Nov. 16, 1926. 1,607,546

H. E. McCRERY

APPARATUS FOR OPENING SHEET PACKS

Filed August 3, 1925 6 Sheets-Sheet 1

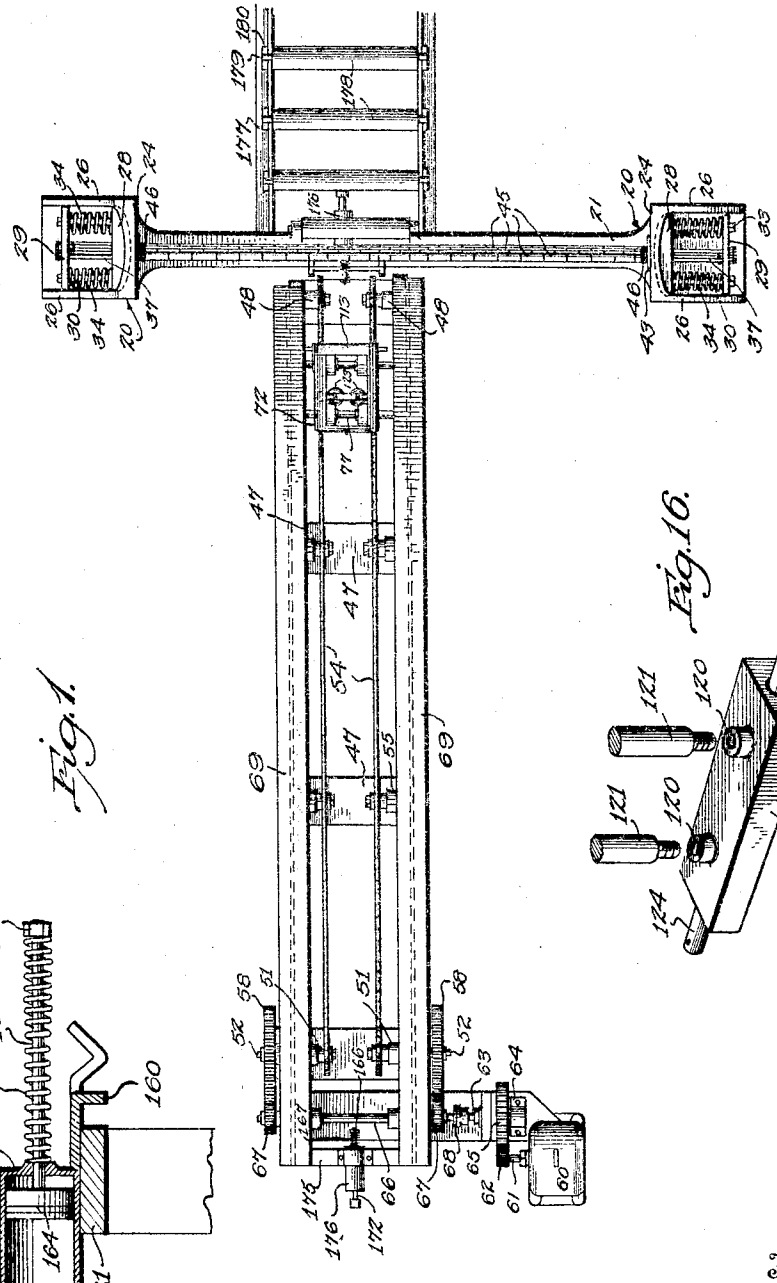


Fig. 1.

Fig. 16.

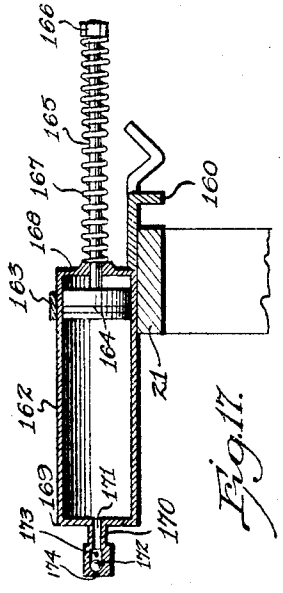


Fig. 17.

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Nov. 16, 1926. **1,607,546**

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APPARATUS FOR OPENING SHEET PACKS

Filed August 3, 1925 6 Sheets-Sheet 2

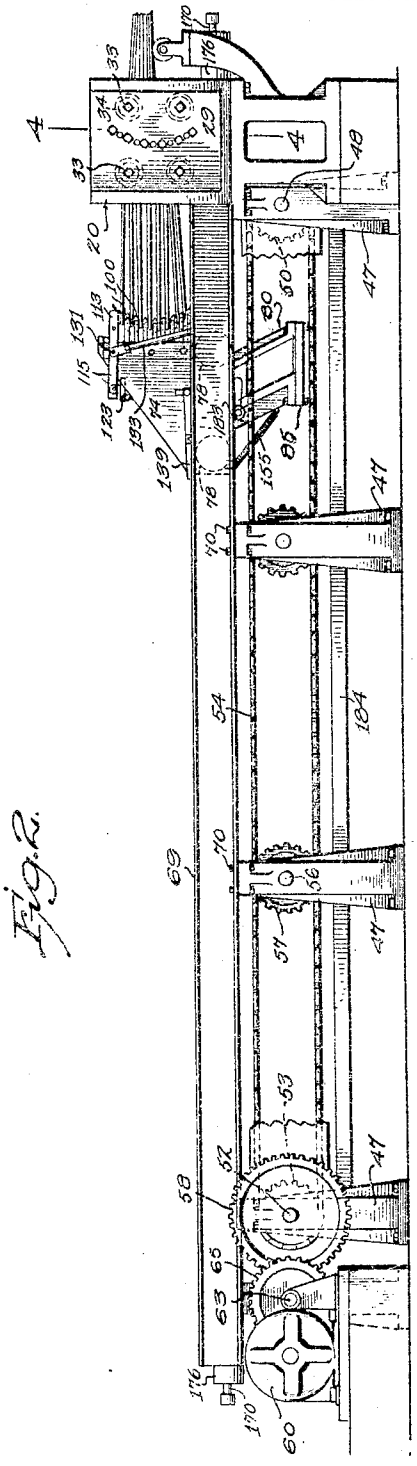


Fig. 2.

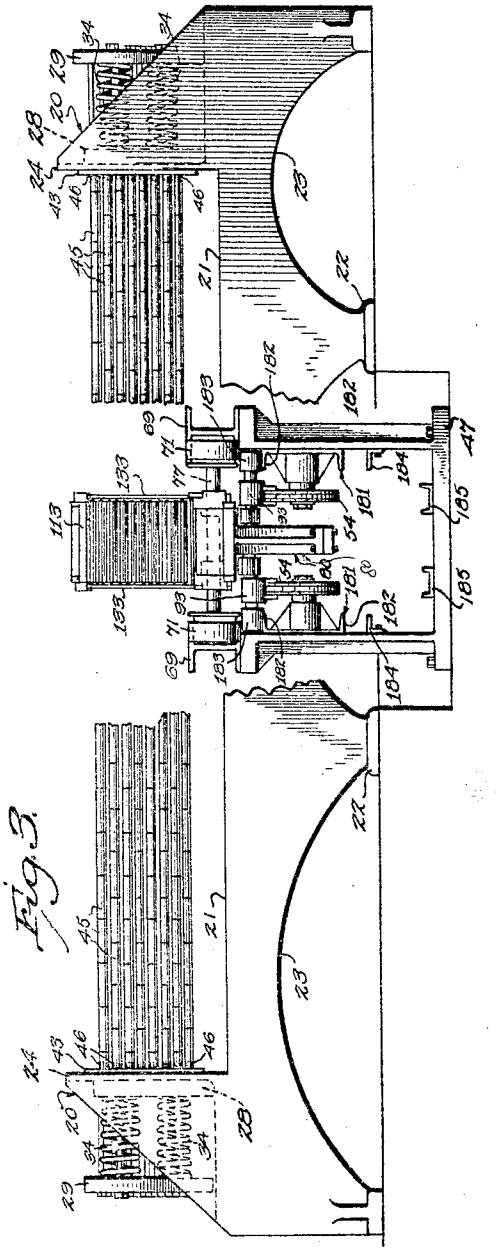


Fig. 3.

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Nov. 16, 1926. 1,607,546

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APPARATUS FOR OPENING SHEET PACKS

Filed August 3, 1925 6 Sheets-Sheet 3

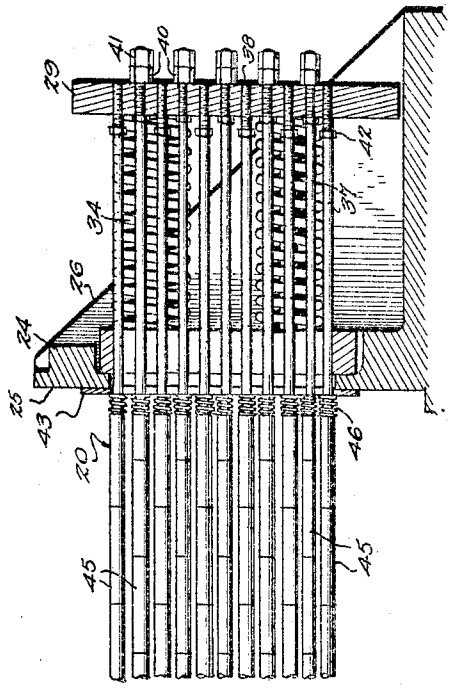


Fig. 4.

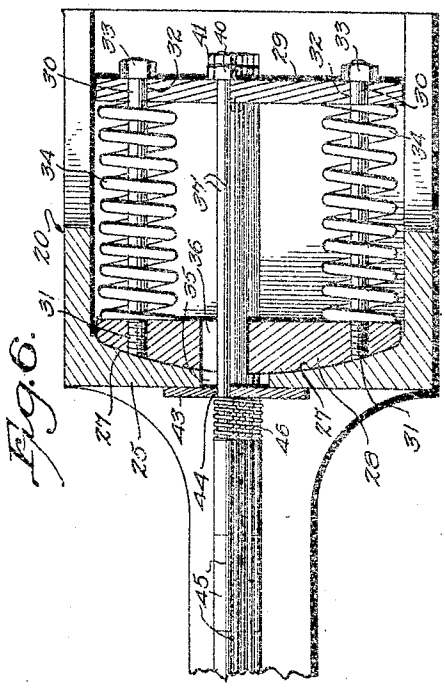


Fig. 6.

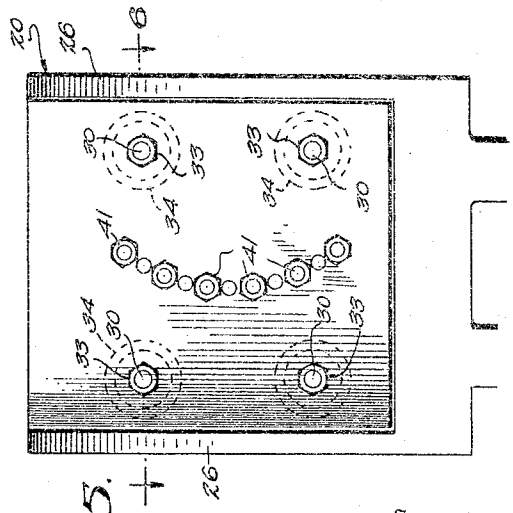


Fig. 5.

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Nov. 16, 1926. **1,607,546**

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APPARATUS FOR OPENING SHEET PACKS

Filed August 5, 1925 6 Sheets-Sheet 4

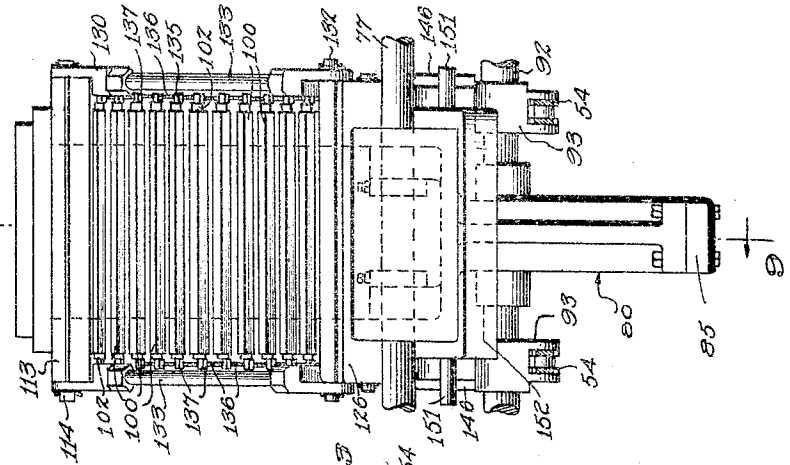


Fig. 8.

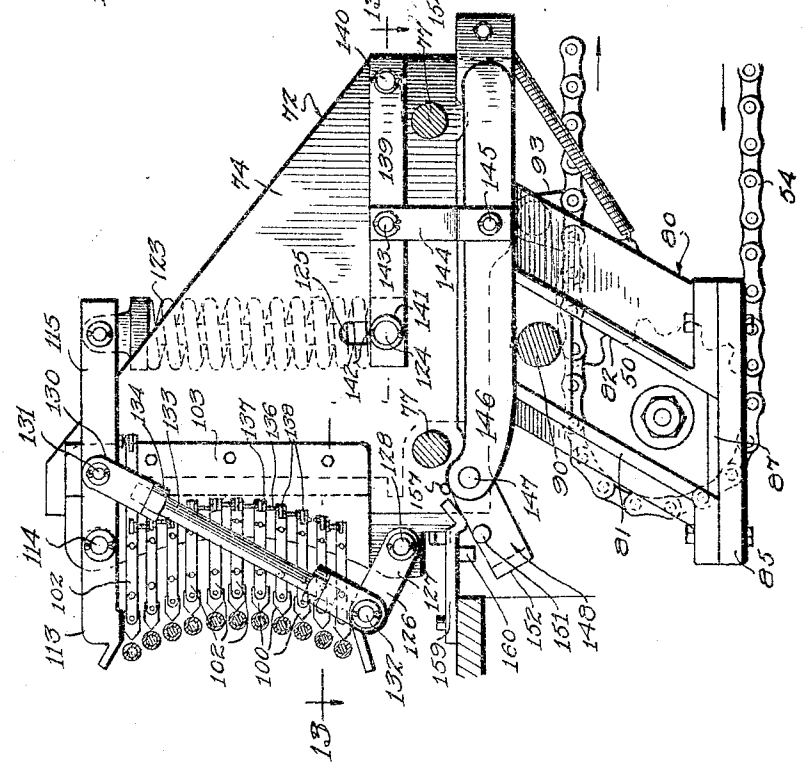


Fig. 7.

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APPARATUS FOR OPENING SHEET PACKS

Filed August 3, 1925 6 Sheets-Sheet 5.

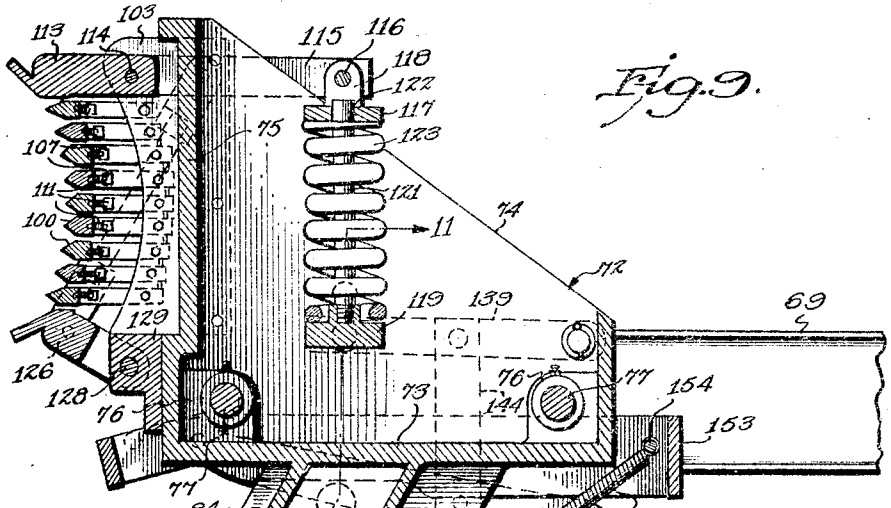


Fig. 9.

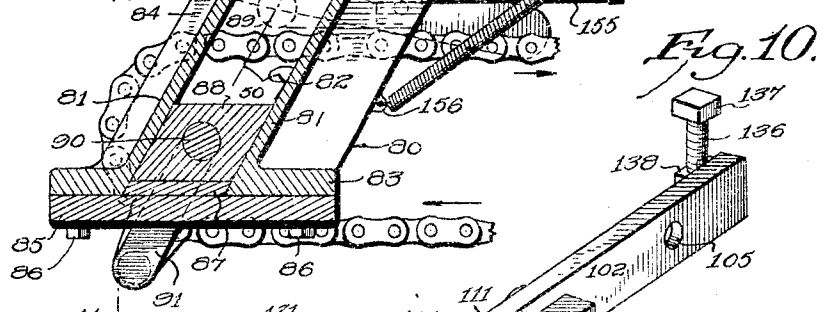


Fig. 10.

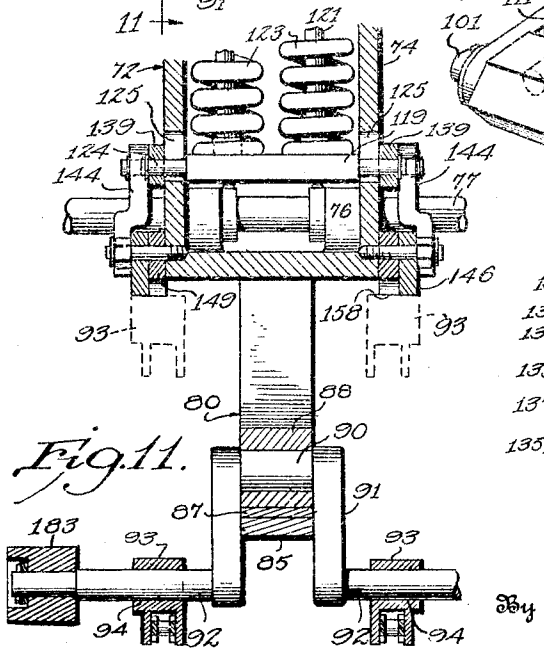


Fig. 11.

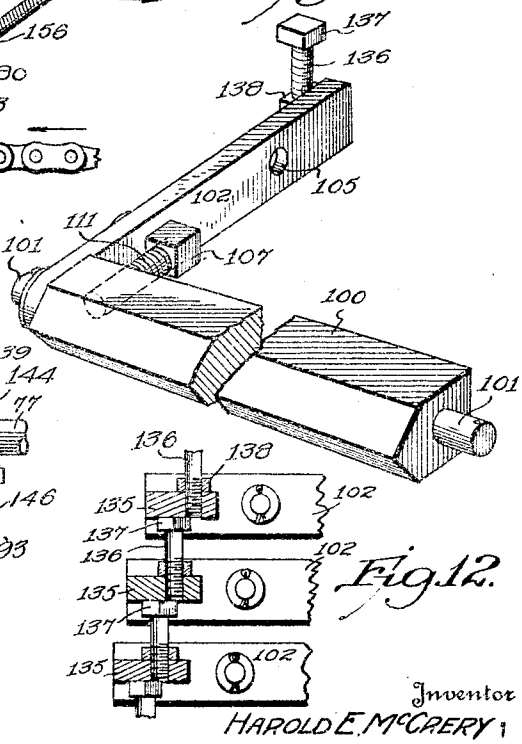


Fig. 12.

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Nov. 16, 1926. 1,607,546

H. E. McCRERY

APPARATUS FOR OPENING SHEET PACKS

Filed August 3, 1925 6 Sheets-Sheet 6

Fig. 13.

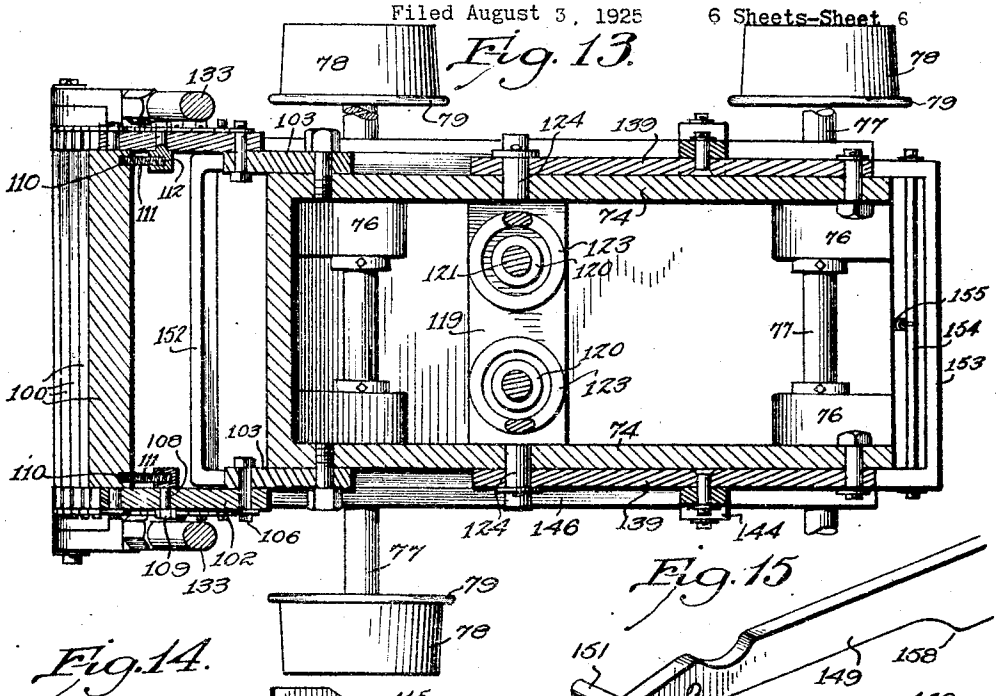


Fig. 14.

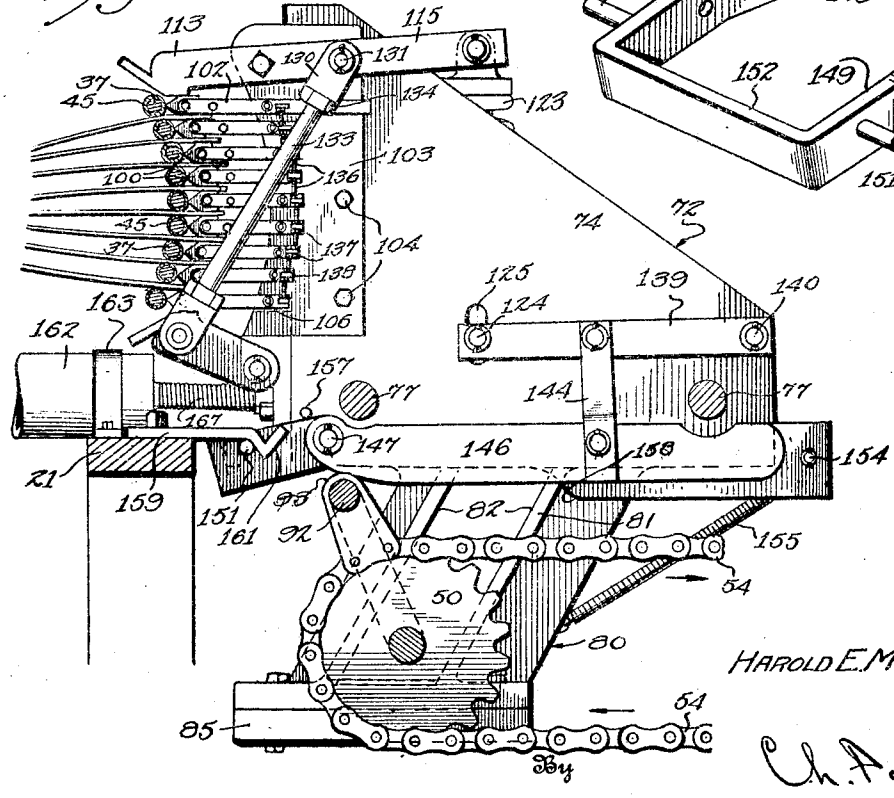
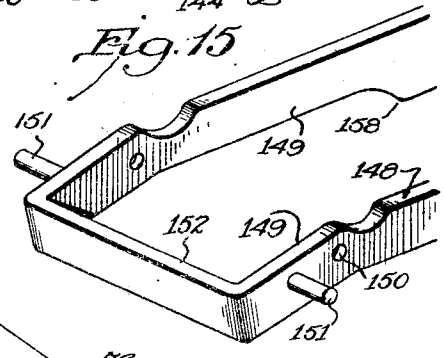


Fig. 15.



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Patented Nov. 16, 1926. 1,607,546

UNITED STATES PATENT OFFICE.

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APPARATUS FOR OPENING SHEET PACKS.

Application filed August 3, 1925. Serial No. 47,903.

This invention relates to an apparatus for opening sheet packs and is an improvement over the apparatus shown in my copending application Serial No. 748,777, filed November 8, 1924.

As stated in the copending application above identified, the last steps employed in the manufacture of iron and steel sheets consist in introducing a pack of sheets into what is known as a "sheet furnace" where the sheets of the pack are heated. The pack is then rolled as a unit between heated rolls where the sheets are brought out to the required length. The pack then is usually sheared to the desired dimensions and it is necessary to employ skilled labor to separate the sheets of the pack due to the fact that the sheets adhere to each other in spots.

In my copending application I have shown an apparatus which comprises generally a plurality of spaced relatively small bars through which the corners of the sheets of a pack are introduced after having been initially opened by suitable corner separating means. Associated with the separating bars there is shown and described a gripping device comprising a plurality of pivoted fingers between which the corners of the sheets are adapted to be clamped and the gripping device is moved away from the separating bars through the medium of a suitable source of power to draw the sheets completely through the bars whereby they will be separated.

An important object of the present invention is to provide an apparatus generally similar to the apparatus shown in my copending aplication wherein the gripping means and other elements of the apparatus are in an improved form and adapted more efficiently to carry out the operation of the machine.

A further object is to provide a movable carriage provided with gripping fingers adapted to be moved toward and away from the separating means, a novel drive means being employed whereby the carriage will remain at rest with the fingers adjacent the separating bars while the fingers are being clamped against the inserted corners of the sheets.

A further object is to provide novel means for locking the carriage referred to with the gripping fingers thereof arranged adjacent the separating bars while the gripping action is taking place, the locking means then being released to permit movement of the carriage away from the separating bars with the corners of the sheets gripped between the fingers of the carriage.

A still further object is to provide means associated with the separating bars for minimizing shearing stresses adjacent the ends of the bars, means being provided whereby such stresses are distributed to a number of the bars when one of them encounters a pair of sheets which adhere tightly.

A still further object is to provide adjustable means associated with the gripping fingers of the carriage for maintaining the fingers in spaced relation while the sheets are being inserted therebetween.

A still further object is to provide means for absorbing shocks incident to bringing the carriage to a stationary position at opposite ends of its reciprocating movement.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown one embodiment of the invention. In this showing:

Figure 1 is a plan view of the apparatus,

Figure 2 is a side elevation, parts being broken away,

Figure 3 is an end elevation, parts being broken away,

Figure 4 is a section taken substantially on line 4—4 of Figure 2,

Figure 5 is a detail end elevation of the separating device,

Figure 6 is a section substantially on line 6—6 of Figure 5,

Figure 7 is a side elevation of the movable carriage and associated elements, parts being shown in section,

Figure 8 is an end view of the movable carriage,

Figure 9 is a section on line 9—9 of Figure 8,

Figure 10 is a fragmentary perspective of one of the gripping fingers,

Figure 11 is a detail sectional view on line 11—11 of Figure 9,

Figure 12 is a detail sectional view showing the rear ends of several of the gripping fingers,

Figure 13 is a section on line 13—13 of Figure 7,

Figure 14 is a side elevation of the mov-

able carriage and associated elements showing the fingers of the carriage initially gripping the corners of the sheets,

Figure 15 is a fragmentary perspective of a portion of the locking mechanism for the carriage,

Figure 16 is a detail perspective of the gripping finger actuating plate and associated elements, and,

Figure 17 is a detail sectional view through one of the shock absorbing devices.

Referring to Figures 1 to 6 inclusive, the numeral 20 designates the sheet separating apparatus as a whole. This apparatus comprises a relatively narrow elevated base 21 supported on legs 22 connected by arches 23, as shown in Figure 3. The base 21 is provided near opposite ends with upstanding supports 24 each of which is provided with a vertical inner face 25, as shown in Figure 4. The walls 24 are preferably formed integral with the base 21 and are connected thereto at their sides by inclined webs 26. Each of the walls 24 is provided in its outer face with an arcuate pocket 27 as shown in Figure 6, within which is arranged a plate 28 having its inner face corresponding in curvature to that of the pocket 27. A supporting plate 29 is arranged outwardly of and spaced from each of the plates 28 and heavy bolts 30 are connected between these plates. The bolts are preferably arranged adjacent the corners of the plates as shown in Figure 5 and their inner ends are threaded as at 31 for reception within threaded openings formed in the plate 28. The outer ends of the bolts are slidable within openings 32 formed in the plates 29 and nuts 33 are arranged on the outer ends of the bolts. Heavy coil springs 34 surround the bolts 30 as shown, and contact with the inner faces of the plates 28 and 29. The walls 24 and plates 28 are provided with alined arcuate slots 35 and 36 respectively for a purpose to be described. Separating bars 37 extend through the slots 35 and 36 as shown in Figure 4. One end of each of the bars is threaded as at 38 for reception in a threaded opening in one of the plates 29 while the opposite end of the bar extends through an opening in the opposite plate 29 and is provided against the inner and outer face thereof with nuts 39 and 40. A lock nut is preferably arranged against each of the nuts 40 as shown in Figure 4. Each of the bars adjacent its threaded end 38 is provided with a nut 42 for a purpose to be described. As shown in Figure 6 the slots 35 and 36 are materially wider than the bars 37 to permit free movement of the latter in the slots. A supplemental plate 43 is arranged against the inner face of each of the walls 24 and is provided with a slot 44 of substantially the same width as the bars 37. Between the plates 43, each of the bars is surrounded by a plurality of collars 45 arranged in end to end relation as shown in Figure 4. The collars of adjacent bars are staggered as shown and springs 46 are arranged between the ends of the outer collars and plates 43 to maintain the ends of the collars of each rod in contact with each other. The rods 37 are preferably formed of untempered chrome nickel steel whereby they are adapted to withstand shocks of considerable intensity without fracturing while the collars 45 are preferably formed of hardened steel whereby their surfaces are not subject to excessive wear. It will be obvious that the collars of each bar are spaced from the collars of the next adjacent bar whereby corners of the sheets of a pack previously separated may be inserted therebetween and it will be apparent that the bars are permitted to partake of limited movement toward and away from each other.

A plurality of substantially U-shaped supports 47 are arranged in alinement with each other substantially at right angles to and centrally of the separating means, as shown in Figure 1. A pair of bearings 48 are carried by the supports nearest the separating apparatus, as shown in Figure 1 and these bearings are provided with stub-shafts 49 having sprockets 50 mounted on their inner ends within the arms of the support. The U-shaped support furthest removed from the separating apparatus is similarly provided with bearings 51 in which are arranged stub-shafts 52 provided at their inner ends with sprockets 53. Endless chains 54 pass about the sprockets 50 and 53 as shown in Figure 2. The intermediate supports 47 also may be provided with bearings 55 to support shafts 56 which have sprockets 57 mounted on their inner ends in alinement with the sprockets 50 and 53. The chains 54 also engage the sprockets 57 to be supported thereby, the sprockets 57 acting as idlers, as will be obvious.

The shafts 52 project through the supports as shown in Figure 1, and are provided at their outer ends with gears 58. A support 59 is arranged outwardly of the gears 58 and an electric motor 60 is mounted on this support. The motor is provided with a shaft 61 to which is secured a pinion 62. A shaft 63 is supported on the support 59 and is mounted in bearings 64. The shaft 63 is provided with a gear 65 meshing with the pinion 62 to be driven thereby. A transverse shaft 66 is arranged parallel to the shafts 52 in alinement with the shaft 63, and is provided adjacent opposite ends with pinions 67 adapted to mesh with the gears 58 as will be apparent. A suitable clutch 68 is adapted to connect the shafts 63 and 66. It will be obvious that operation of the motor 60 is adapted to drive the chains 54 through the gearing just described.

A pair of rails 69 are supported on the up-

per ends of the supports 47 as shown in Figures 1 and 2. The rails are preferably in the form of I-beams and are secured to the upper ends of the supports by bolts 70. The ends of the rails adjacent the separating apparatus may be provided with curved end plates 71.

A carriage 72 is mounted to reciprocate on the rails 69. The carriage comprises a base 73, side walls 74 and a front wall 75 as shown in Figures 9 and 13. The base and side walls of the carriage are provided near their front and rear portions with inwardly extending bearings 76 which support transverse axles 77. The axles 77 are provided at their outer ends with wheels 78 having flanges 79 at their inner edges. It will be apparent that the wheels 78 are adapted to travel on the lower bases of the rails 69 whereby the carriage may be moved toward and away from the sheet separating apparatus previously described.

The carriage 72 is provided with a depending portion 80 as shown in Figure 9. This depending portion includes parallel inclined flanges 81 forming an inclined slot 82. The depending portion is further provided with a base 83 and reinforcing webs 84. A plate 85 is adapted to be bolted as at 86 to the base 83 of the depending portion and this plate is adapted to support a block 87 arranged in the lower end of the slot 82 and preferably formed of wood for a purpose to be described. A cross-head 88 is slidably arranged between the flanges 81, as shown in Figure 9. The cross-head is provided with a central transverse bearing opening 89 in which is mounted a crank shaft 90. The center of the shaft 90 coincides with the centers of the sprockets 50 when the carriage is in its forward position, as indicated in Figure 9. The shaft 90 is provided outwardly of the depending portion 84 with crank arms 91 having alined outwardly extending stub-shafts 92 at their outer ends. One link of each of the chains 54 is provided with an outwardly extending block 93 and these blocks are provided with bearing openings 94 adapted to receive the outer ends of the stub-shafts 92.

Means are associated with the carriage 72 for gripping the corners of sheets inserted between the collars 45. As shown in Figures 7 and 10, the numeral 100 designates a plurality of gripping fingers arranged one above the other and corresponding in curvature to the arrangement of the bars 37. These fingers are adapted to be moved in close proximity to the bars, as clearly shown in Figure 14, when the carriage reaches the forward limit of its movement. Each of the fingers is provided at each end with stub-shafts 101 arranged in openings formed in the forward ends of side arms 102. As shown in Figure 13, the side arms 102 are adapted to be arranged outwardly of the side walls 74 of the carriage. A plate 103 is secured against each of the side walls 74 of the carriage near the forward end thereof and these plates are secured by means of bolts 104. The arms 102 are provided near their rear ends with openings 105 to receive bolts or the like 106 by means of which the arms are pivotally supported by the plates 103. Each of the arms is provided against its inner face with a block 107 having a bolt 108 connected thereto and extending through the arm 102. Nuts 109 are arranged on the outer ends of the bolts 108 as shown in Figure 13. Each of the fingers 100 is provided adjacent opposite ends with apertures 110 to receive the forward ends of coil springs 111. The rear ends of these springs extend into apertures 112 formed in the blocks 107. The stub-shafts 101 are pivotally supported in the forward ends of the arms 102 and the springs 111 normally maintain the fingers in horizontal position, as will be obvious, but the fingers may partake of limited swinging movement against the tension of the springs 111. for a purpose to be described.

Means are provided for clamping the fingers 100 against the faces of the corners of sheets inserted between the separating bars. As shown in Figures 7, 8, 9 and 14, an upper clamping head 113 is arranged above the uppermost clamping finger 100. The head 113 is provided with a portion extending inwardly between the plates 103 and is pivotally connected therewith by a transverse shaft 114. The head is further provided with a pair of rearwardly extending arms 115 through which the shaft 114 also extends. A transverse shaft 116 connects the rearward ends of the arms 115 which are arranged wholly above the upper edge of the side walls 74 of the carriage. A plate 117 is arranged transversely of the carriage within the side walls thereof, and this plate is provided adjacent opposite ends with upwardly extending ears 118 which pivotally receive the shaft 116. A second transverse plate 119 is arranged transversely between the walls 74 at a point spaced below the plate 117. The plate 119 is provided adjacent opposite ends with internally threaded bosses 120 adapted to receive the lower threaded ends of upstanding rods 121 (see Figure 16). The upper ends of the rods 121 extend through openings 122 in the plate 117 and are slidable therein to permit movement of the plates 117 and 119 toward and away from each other. Relatively heavy coil springs 123 surround the rods 121 as shown. The plate 119 is provided at opposite ends with trunnions 124 which extend through substantially vertical slots 125 formed in the side walls 74 of the carriage. As shown in Figures 7 and 9, a lower clamping head 126 is provided below the lower-

most clamping finger 100. The head 126 is provided at opposite ends with rearwardly extending arms 127 pivotally connected as at 128 to a cross member 129 preferably formed integral with the side plates 103. The numeral 130 designates a link pivotally connected at its upper end as at 131 to each of the arms 115 and the lower end of each link is pivotally connected as at 132 with the lower clamping head 126. The link includes a central circular rod portion 133 threaded into the ends of the link and secured thereto by lock nuts 134. The threaded connection of the rod portion of the link permits adjustment of the length thereof to properly position the clamping heads with respect to each other. As clearly shown in Figure 9, the upper ends of the links are pivotally connected to the arms 115 rearwardly of the shaft 114 while the lower ends of the links are pivotally connected to the lower head 126 forwardly of the pivot 128 thereof. It will be obvious that upward movement of the rear ends of the arms 115 will move the head 113 downwardly while the link connection will cause the head 126 simultaneously to move upwardly.

As shown in Figure 7 of the drawings the arms 102 of the uppermost clamping finger extend rearwardly a materially greater distance than the arms of the other clamping fingers. Each of the arms of the clamping fingers is provided with a lug 135 secured against its outer face near the rear end thereof. Each of the lugs 135 is internally threaded to receive a vertically extending bolt 136 as shown in detail in Figures 10 and 12 of the drawings. The bolts are provided at their upper ends with polygonal heads 137 and lock nuts 138 are threaded on the bolts and adapted to engage the upper surfaces of the lugs 135, as will be apparent. As shown in Figure 12 the heads 137 of all the bolts 136 except those of the upper arms are adapted to contact with the lugs carried by the arms thereabove. The heads of the bolts 136 which are carried by the uppermost arms 102 are adapted to contact with the arms 115, as shown in Figure 7. It will be apparent that downward movement of the uppermost finger 100 will be limited by the contact of the upper heads 137 against the arms 115 and similarly, downward movement of the remaining fingers will be limited by the contacts between the nut 137 and lugs 135. Thus when the fingers are in inoperative position, the fingers 100 will be spaced to permit the corners of the pack to be received therebetween.

Means are provided for automatically raising the plate 119 and operating the clamping fingers when the latter reach a position in proximity to the bars 37. As shown in Figure 7 of the drawings, a lever 139 is arranged against the outer face of each of the walls 74. The rear ends of the levers are pivotally connected to the walls 74 as at 140 and extend forwardly of their pivots. The forward ends of the levers are apertured to receive the trunnions 124 of the plate 119, and washers 141 and cotter pins 142 secure the forward ends of the levers to the trunnions as will be obvious. Intermediate its ends, each of the levers 139 is provided with an outwardly extending stub-shaft 143 which is pivotally connected with the upper end of a link 144. The lower ends of the levers 144 are pivotally connected to stub-shafts 145 carried by levers 146 arranged substantially parallel to the side walls of the carriage. These levers are pivotally connected at their forward ends to the carriage as at 147 and the rear ends of the levers extend rearwardly beyond the pivots 145, as shown. The levers 146 are arranged in the path of travel of the blocks 93 shown in Figure 11 of the drawings and are adapted to be raised thereby when the blocks pass about the pulley 50, as will be explained. It will be obvious that the raising of the levers 146 will move the clamping heads 113 and 126 toward each other, clamping the fingers 100 against opposite faces of the corners of sheets projecting between the bars 37.

The operation of the crank shaft 90 and its connection with the chains 54 is such that the carriage 72 is permitted to remain stationary an appreciable period of time when it reaches a point where the clamping fingers come in proximity to the rods 37 as will be explained. Means are provided for positively locking the carriage in its stationary position while the clamping fingers are being brought into engagement with the sheets of the pack. As shown in Figures 7, 9, 11, 13, 14 and 15, a locking member 148 surrounds the lower portion of the carriage 72. This locking member is substantially rectangular in shape and includes side arms 149 preferably arranged between the side walls 74 and the levers 146. Near their forward ends the side arms 149 are apertured as at 150 to receive the pivot pins 147 previously described. The side arms 149 are further provided forwardly of the apertures 150 with outwardly projecting alined pins 151 for a purpose to be described. Forwardly of the pins 151 the side arms 149 are connected by a preferably integral cross-bar 152. Rearwardly of the carriage the locking member is provided with a transverse portion 153 within which is arranged a cross-bar 154 secured at its opposite end to the side arms 149. A spring 155 is connected at one end to the bar 154 and at its opposite end to a lip 156 carried by the web 84 as shown in Figure 9. It will be obvious that the spring is adapted to normally urge the rear end of the locking member downwardly and the forward

end upwardly. Upward movement of the forward end of the locking member is limited by a suitable pin 157 as shown in Figure 14. The side arms 149 of the locking member are provided with cams 158 as shown in Figures 14 and 15, and these cams are also adapted to be engaged by the blocks 93 shown in Figure 11, as these blocks pass about the sprockets 50 and start rearwardly on the upper runs of the chains 54. The base 21 of the sheet opening device is provided with a coacting locking member 159 as shown in Figures 7 and 14. This locking device is provided intermediate its ends and within the side arms 149 of the locking member 148 with a downturned lip 160 and, in alinement with the pins 151, the locking member 150 is provided with cams 161. It will be obvious that the pins 151 are adapted to contact with the cam 161 to move the forward end of the locking member 148 downwardly as the carriage approaches its forward position. This downward movement permits the cross-bar 152 to pass below the lip 160 and to move upwardly behind the lip when the pins 151 pass beyond the cams 161 as will be apparent.

Means are provided for absorbing the shocks incident to bringing the carriage to a standstill at opposite ends of its travel. As shown, a cylinder 162 is arranged transversely of the base 21 in alinement with the travel of the carriage 72. The cylinder 162 is adapted to be secured to the base 21 by a strap 163 as shown in Figures 14 and 17. A plunger 164 is mounted to reciprocate in the cylinder and is provided with a rod 165 having a head 166 thereon adapted to contact with the forward end of the carriage as the latter approaches the sheet opening apparatus. A spring 167 surrounds the rod 165 and contacts at one end with the head 166 and at its opposite end with the cylinder head 168. The opposite end of the cylinder is closed by a head 169 having an axial extension 170 thereon provided with an opening 171. A check valve 172 is arranged in the outer end of the extension 170 and inward movement thereof is limited by a pin 173. The outer end of the extension is provided with a restricted opening 174. It will be obvious that rearward movement of the plunger 164 wll be opposed by the pressure of air within the cylinder 162 due to the closing of the check valve 172, while the spring 167 is adapted to return the plunger to normal position. The rear ends of the rails 69 are connected by a cross-plate 175 upon which is mounted a shock absorbing member 176. This member is similar to the shock absorbing means previously described and need not be described in detail.

The apparatus is provided forwardly of the sheet opening device with a pair of rails 177 between which are arranged rollers 178 having stub-shafts 179 journalled in bearings 180. These rollers are adapted to assist in the feeding of sheet packs to the opening means as will be obvious.

Means are provided for supporting the crank arms 91 between the sprockets of the chain. As shown in Figures 2 and 3, I provide rails 181 having upper and lower bases 182. These bases are arranged equadistantly above and below the centers of the sprockets and are adapted to support wheels 183 rotatably mounted on the outer ends of the shafts 92 as shown in Figures 3 and 11. When the blocks 93 are travelling in the lower run of the chain, the wheels 183 will pass below the lower bases 182 and will be supported on lower rails 184 spaced from the lower rails 182, as shown in Figure 3. Channels 185 are supported upon the bases of the supports 47 and extend parallel to the chains 54. These rails are not essential but may be provided if desired to form sliding surfaces for the chains if the lower runs thereof should break to prevent the chains from becoming entangled with the bases of the supports 47.

The operation of the apparatus is as follows:

One corner of a sheet pack is opened by employing any suitable means for separating the sheets such as is shown in my copending application above identified. The means employed preferably is adapted to separate the corners of the sheets a distance substantially equal to the distances between the bars 37. The pack is then placed upon the rollers 178 shown in Figure 1 of the drawings. These rollers are provided merely for convenience in feeding the pack to the separating means. The pack is moved toward the bars 37 and the corners of the sheets inserted between the bars as shown in Figure 14. It will be obvious that the initial separating of the corners of the sheets will cause the extreme corners to be arranged substantially in an arc of a circle.

Each corner of the pack is inserted in the space between the rollers of adjacent bars 37 and allowed to project therethrough a slight distance, as shown in Figure 14. Assuming the motor 60 to be in operation and driving the chains 54 in the direction indicated by the arrows in Figures 7, 9 and 14, it will be obvious that the block 93 will be carried by the chain and through its connection with the carriage 72, the latter will be moved toward the separating means when the block 93 is in the lower run of the chain 54. The movement of the carriage will continue until the block 93 is arranged substantially in the position shown in Figure 9 of the drawings. As a practical matter, the center of the crank shaft 90 will not coincide with the centers of the sprockets 50 when the

block 93 reaches the position shown in Figure 9 due partly to slight slack in the chain, and due also to the action of the shock absorbing means. It will be apparent that the carriage and elements carried thereby will be relatively heavy and it is desired to eliminate the delivery of shocks to the crank shaft 90 when the carriage approaches each limit of its travel. Accordingly the forward end of the carriage will contact with the head 166 as the carriage approaches the separating means and air will be compressed in the cylinder 162 to retard the movement of the carriage. As the blocks 93 pass about the sprockets 50, the carriage will be positively drawn to a position where the center of the crank shaft 90 will coincide with the centers of the sprockets 50. This position will be reached when the crank arms reach a horizontal position when passing about the sprockets. With the carriage 72 in the position illustrated in Figure 7, with the gripping fingers released, it will be apparent that the corners of the sheet pack will be received between the gripping fingers. As the crank arms 91 turn upwardly from a horizontal position it will be apparent that there will be no movement of the carriage. It is desirable that the carriage be maintained at rest until the gripping fingers may be brought positively into engagement with the inserted corners of the sheet pack and it also is desirable to lock the carriage against movement while the gripping action is taking place. It will be obvious that as the carriage approaches its forward limit the pins 151 will engage the cam faces 161 and tilt the forward end of the locking device 148 downwardly about its pivot 147. Thus the cross-bar 152 of the locking member will be depressed to pass beneath the lip 160 whereupon the pin 151 will pass beyond the cam faces 161 and the rear end of the locking member will be moved downwardly by the spring 155. This action will place the cross bar 152 forwardly of the lip 160 and thus prevent rearward movement of the carriage.

As shown in Figures 7 and 14, the levers 146 are provided with lower edges which curve downwardly from the pivots 147 thus providing cam faces which will be engaged by the blocks 93 as these members pass upwardly around the sprockets 50. This action is clearly illustrated in Figure 14 of the drawings where the blocks 93 are shown as initially raising the levers 146. When these levers are moved upwardly the links 144 will be raised to lift the forward ends of the levers 139 which action lifts the plate 119 and rods 121. The spring 123 is thus lifted upwardly to raise the upper plate 117 which in turn raises the rear ends of the arms 115 to depress the clamping head 113. It also will be apparent that the links 130 will lift the lower clamping head, and these heads cooperate with the clamping fingers to grip them securely against opposite faces of the sheets of the pack. After the lever 146 is initially raised, the blocks 93 are moved rearwardly along the lower edges of these levers and the latter will be maintained in raised position. After the blocks pass beyond the upper end of the slot 82 of the depending member 80, it will be obvious that the block 88 will start to move upwardly in the slot 82. This action however, will not cause any movement of the carriage, as will be apparent. As the block 88 approaches the upper end of the slot 82, the blocks 93 will contact with the cams 158 of the locking member 148, and the rear ends of this member accordingly will be lifted thus depressing the forward end thereof and releasing the cross-bar 152 from the lip 160. When the block 88 reaches the upper end of the slot 82, the blocks 93 will assume the position shown in Figure 7 of the drawings and will maintain the rear ends of the locking member 148 and levers 146 in elevated position. It will be apparent that the spring 123 will provide a compensating movement between the upper and lower heads 117 and 119 whereby sheets of different thicknesses may be clamped between the gripping fingers and clamping heads.

It will be obvious that continued movement of the chains 54 after the blocks 93 reach the position shown in Figure 7 will cause the carriage 72 to be moved rearwardly away from the separating apparatus. With the corners of the sheets securely clamped between the gripping fingers and clamping heads, the sheets will be drawn rearwardly and the collars 45 will be forced between the sheets to separate them. This action has been found efficiently to separate the sheets without warping thereof and the entire action may be carried out in a short space of time. When the carriage 72 approaches the rear end of its travel, it will be apparent that the shock absorbing member 176 will retard its movement. When the blocks 93 start to pass around the rear sprockets 53, it will be apparent that the carriage again will remain stationary until these blocks pass completely around the sprocket and the blocks reach their lowermost position. Obviously, as the blocks pass around the sprockets, they will release the rear ends of the levers 146 thus permitting the clamping fingers to be separated whereupon the operator may remove the separated sheets from the upper faces of the rails 69. It will be apparent that the locking member 148 also will be released when the blocks 93 pass around the sprockets 53 and will assume a position ready for the pins 151 to contact with the cam faces 161 when the carriage again approaches the forward limit of its movement.

When the gripping fingers are released at the rear end of the carriage travel, it will be apparent that the upper clamping head 113 will be raised. This action will release the clamping fingers, and the nuts 137 carried by the upper clamping finger will contact with the lower faces of the arms 115, thus maintaining the upper clamping finger in proper position spaced from the lower face of the upper clamping head. Similarly, the nuts 137 of the other clamping fingers will limit the movement of these members downwardly away from each other so that all of them will be maintained in proper spaced relation to permit insertion of the sheets. This separating action, together with the fact that the forward ends of the fingers are tapered as clearly shown in Figure 10, permits the sheets to be readily received between the clamping fingers. The apparatus is adapted to be used in connection with packs of sheets of varying thicknesses, and it is desired that the adjacent faces of the clamping fingers firmly engage the faces of the sheets. Accordingly, I provide the springs 111 shown in Figure 10 which permits a pivoting action whereby the fingers are adapted to engage flat against the surfaces of the sheets.

As previously stated, some portions of adjacent sheets of a pack occasionally adhere very tightly and there is thus present a sufficient adhesion to require considerable force to separate the sheets. Accordingly, it will be obvious that rearward movement of the carriage 72 will exert considerable lateral stress against the rods 37. It is accordingly desired to use a very tough material in manufacturing these rods, such as untempered chrome nickel steel and it also is desired to minimize shearing stresses adjacent the ends of the rods. It will be apparent that the provision of the springs 34 will permit the outer plates 29 to be drawn inwardly as the rods tend to bend, and slight turning movement of the plate 28 is permitted by virtue of its arcuate inner face to accommodate the rod supporting means to varying positions of the rods. The nuts 42 carried by the rods are provided to prevent the ends of the rods from being completely pulled through the plate 43 if breakage should occur adjacent the ends of the rods. As also previously stated, the slots 44 in the plates 43 are substantially equal in width to the diameter of the rods 37. Accordingly it will be seen that if only two sheets of a pack adhere tightly, great stress will be delivered to one of the rods 37 and it is desired to distribute this stress to minimize the danger of breakage of the rod. When this action occurs, it will be apparent that the plates 43 will move laterally with the rod due to the snug fitting of the latter in the slots 44, and movement of the plates will cause movement of the other bars thus distributing the stresses delivered to any one particular rod. It will be apparent that the provision of the springs 46 will maintain the adjacent ends of the collars 45 in contact with each other to present smooth continuous surfaces to the surfaces of the sheets being separated. The collars 45 are adapted to partake of rotation about the rods so that they may shift themselves according to the particular conditions under which they operate and accordingly new surfaces constantly will be presented to the sheets being separated to distribute surface wear on the collars.

It is to be understood that the form of my invention herewith shown and described is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. Apparatus of the character described comprising a member adapted to be received between corners of sheets arranged to one side thereof, and means arranged on the opposite side of said member for gripping the corners of the sheets, said member and said gripping means being movable toward and away from each other to move said member between the sheets and being adapted to remain stationary when in proximity to each other while the gripping action is taking place.

2. Apparatus of the character described comprising a member adapted to be received between corners of sheets arranged to one side thereof, means arranged on the opposite side of said member for gripping the corners of the sheets, and means for moving said member and said gripping means toward each other to grip the corners of the sheets and away from each other to move said member between the sheets, said gripping means and said member being adapted to remain relatively stationary when in proximity to each other while the gripping action is taking place.

3. Apparatus of the character described comprising a member adapted to be received between corners of sheets arranged to one side thereof, a carriage, means for moving said carriage toward and away from said member, and means carried by said carriage and adapted to grip the corners of the sheets while said carriage is moving away from said member, said carriage being adapted to remain stationary when in proximity to said member while the gripping action is taking place.

4. A device constructed in accordance with claim 1 provided with means for positively preventing relative movement between said

separating member and said gripping means while the gripping action is taking place.

5. A device constructed in accordance with claim 2 provided with means for positively preventing relative movement between said member and said gripping means while the gripping action is taking place, and means associated with said moving means for releasing said member and said gripping means to permit relative movement therebetween after the gripping means has been brought into operation.

6. A device constructed in accordance with claim 3 provided with means for locking said carriage against movement while the gripping action is taking place.

7. Apparatus of the character described comprising a plurality of separating members adapted to be received between corners of the sheets of a pack inserted from one side thereof, a carriage movable toward and away from the opposite side of said separating members, and means carried by said carriage for gripping the inserted corners of the sheets while said carriage is moving away from said separating members, said carriage being adapted to remain stationary while the gripping action is taking place.

8. Apparatus of the character described comprising a plurality of separating members adapted to be received between the corners of the sheets of a pack inserted from one side thereof, a carriage, means for intermittently moving said carriage toward and away from said separating members whereby it will remain stationary momentarily when in proximity to said separating members, and means carried by said carriage for gripping the inserted corners of the sheets while said carriage is moving away from said separating members, said gripping means being adapted to be initially actuated while said carriage is stationary.

9. Apparatus of the character described comprising a plurality of separating members adapted to be received between the corners of the sheets of a pack inserted from one side thereof, a carriage movable toward and away from the opposite side of said separating members, means carried by said carriage for gripping the inserted corners of the sheets while said carriage is moving away from said separating members, constantly moving drive means for actuating said carriage, and means connected between said drive means and said carriage whereby the latter will remain stationary momentarily when in proximity to said separating members while the gripping action is taking place.

10. An apparatus constructed in accordance with claim 7 provided with means for positively locking said carriage in proximity to said separating members while the action of said gripping means is taking place.

11. An apparatus constructed in accordance with claim 8 provided with means for momentarily positively locking said carriage in proximity to said separating members while said gripping means is being initially actuated, and means controlled by said moving means for releasing said locking means.

12. An apparatus constructed in accordance with claim 9 provided with means for momentarily positively locking said carriage in proximity to said separating members while said gripping means is being initially actuated, said locking means having a movable portion supported by said carriage and adapted to be actuated by said carriage actuating means for releasing said locking means.

13. Apparatus of the character described comprising a plurality of separating members adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a support arranged on the opposite side of said separating members, means for moving said support and said separating members toward and away from each other, and means carried by said support and initially operable when the latter is in proximity to said separating members for gripping the inserted corners of the sheets while said support and said separating members are moving away from each other, said support being adapted to remain stationary momentarily while said gripping action is initially taking place.

14. An apparatus constructed in accordance with claim 13 wherein the means for moving said support and said separating members is provided with means for operating said gripping means.

15. An apparatus constructed in accordance with claim 13 provided with means for positively locking said support against movement away from said separating members when said support is in stationary position.

16. An apparatus constructed in accordance with claim 13 wherein the means for moving said support and said separating members is provided with means for operating said gripping means, and means for positively locking said support and said separating members against relative movement while the action of said gripping means is initially taking place.

17. Apparatus of the character described comprising a plurality of separating members adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a carriage arranged on the opposite side of said separating members, an endless chain, means for driving said chain, means connected between said chain and said carriage for moving the latter toward and away from said separating members, and gripping fingers carried by said

carriage and operative to grip the inserted corners of the sheets when said carriage is in proximity to said separating members and to remain in the gripping position while said carriage is moving away from said separating members, said carriage being adapted to remain stationary momentarily while in proximity to said separating members.

18. An apparatus constructed in accordance with claim 17 provided with means actuated by said chain for operating said fingers.

19. An apparatus constructed in accordance with claim 17 provided with means for momentarily locking said carriage in stationary position while said fingers are being actuated, and means for releasing said locking means after said fingers have gripped the corners of the sheets.

20. Apparatus of the character described comprising a plurality of separating members adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a carriage arranged on the opposite side of said separating members, an endless chain arranged substantially at right angles to said separating members, said carriage being provided with a slot arranged at an angle to said chain, a slidable member arranged in said slot, an actuating member provided with offset ends pivotally connected to said chain and said slidable member respectively, and gripping members carried by said carriage and adapted to be actuated while said carriage is in proximity to said separating members to grip the inserted corners of the sheets while said carriage is moving away from said separating members.

21. An apparatus constructed in accordance with claim 20 provided with means for momentarily locking said carriage against movement while said actuating member is adjacent its limit of movement toward said separating members.

22. An apparatus constructed in accordance with claim 20 provided with means connected between said actuating member and said gripping members for operating the latter.

23. Apparatus of the character described comprising a plurality of parallel separating members arranged one above the other and adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a carriage arranged on the opposite side of said separating members, an endless chain arranged substantially at right angles to said separating members, said carriage being provided with a slot arranged at an angle to said chain, a slidable member arranged in said slot, an actuating member provided with offset ends pivotally connected respectively with said chain and said slidable member, a plurality of gripping fingers carried by said carriage and adapted to receive therebetween corners of the sheets inserted in said separating members, and means for moving said gripping members to operative position including a movable member arranged in the path of travel of a portion of said chain adjacent said actuating member to be operated thereby.

24. Apparatus of the character described comprising a plurality of substantially parallel separating members arranged one above the other and adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a carriage arranged on the opposite side of said separating members, a vertically arranged sprocket arranged adjacent said separating members, a second vertical sprocket arranged at a point remote from said separating members, an endless chain passing around said sprockets, said carriage being provided with a depending slot arranged adjacent said chain, a slidable member arranged in said slot, a block carried by said chain, a crank shaft having offset ends pivotally connected to said slidable member and said block respectively, a plurality of gripping fingers carried by said carriage and adapted to receive therebetween corners of the sheets inserted through said separating members, and means for moving said gripping members to operative position including a movable member having a cam face arranged in the path of travel of said block and adapted to be actuated thereby.

25. An apparatus constructed in accordance with claim 24 provided with means for positively locking said carriage against movement momentarily while said gripping members are being initially actuated.

26. Apparatus of the character described comprising a plurality of separating members adapted to receive therebetween corners of the sheets of a pack inserted from one side thereof, a carriage arranged on the opposite side of said separating members, means for supporting said carriage for movement toward and away from said separating members, a vertical sprocket arranged adjacent said separating members, a second sprocket arranged in alinement with said first named sprocket remote from said separating members, an endless chain passing around said sprocket, a block carried by said chain, a crank shaft having offset parallel crank arms pivotally connected respectively to said block and said carriage, a plurality of gripping fingers carried by said carriage and adapted to be arranged in proximity to said separating members when said block is passing around said first named sprocket, and means for operating said fingers to grip the inserted portions of the sheets therebetween, said means having a portion arranged in the path of travel of

said block as it passes around said first named sprocket and being adapted to be maintained in operative position by said block throughout the movement of said carriage away from said separating members.

27. An apparatus constructed in accordance with claim 26 provided with means for positively locking said carriage against movement momentarily while said block is operating said gripping means.

28. An apparatus constructed in accordance with claim 26 provided with means for positively locking said carriage against movement momentarily while said block is initially operating said gripping means, said locking means having a portion arranged in the path of travel of said block and adapted to be actuated thereby to release said locking means after said gripping members have been brought into operation.

29. An apparatus constructed in accordance with claim 26 provided with a stationary locking lip arranged adjacent said separating members, a cam associated with said lip, and a pivoted locking member carried by said carriage, said locking member having a portion adapted to be engaged by said cam to swing said locking member to locking position, said block being adapted to contact with said locking member to release it from said lip after said gripping members have been initially actuated.

30. A gripping device comprising a plurality of substantially parallel cross arms, a longitudinal arm pivotally connected at one end to each end of each of said cross arms, means for pivotally supporting said longitudinal arms at points spaced from said cross arms, and resilient means normally opposing relative movement of said cross arms with respect to said longitudinal arms.

31. A gripping device comprising a plurality of parallel fingers provided at their ends with projecting pins, a plurality of supporting arms each provided in one end with an opening to pivotally receive one of said pins, means for pivotally supporting said arms at points remote from said pins, a block carried by each of said arms against its inner face, and a spring connected between said fingers and each of said blocks.

32. An apparatus for separating sheets of a pack comprising a plurality of spaced parallel rods adapted to receive the corners of the sheets inserted from one side thereof, means on the opposite side of said rods for gripping the sheets and drawing them therethrough, and means associated with said rods for distributing lateral stresses to all of said rods.

33. An apparatus for separating sheets of a pack comprising a plurality of spaced parallel rods adapted to receive the corners of the sheets inserted from one side thereof, means on the opposite side of said rods for gripping the inserted portions of the sheets and drawing them through said rods, means for supporting the outer ends of said rods, and a pair of plates spaced from each other and from said supporting means, each of said plates having a slot through which said rods pass, said slots being substantially equal in width to the diameter of said rods.

34. An apparatus for separating sheets of a pack comprising a pair of spaced standards provided with relatively wide slots, a plurality of spaced parallel rods arranged in said slots and extending therebeyond, plates secured to the outer ends of said rods, compression springs arranged between said standards and said plates, and a plate arranged adjacent the inner face of each of said standards, each of said last named plates being provided with slots substantially equal in width to the diameter of said rods, said rods extending through said last named slots.

35. An apparatus constructed in accordance with claim 34 provided with collars arranged in contacting end to end relation surrounding said rods, and coil springs surrounding said rods between the outer ends of the outer collars and said second named plates.

In testimony whereof I affix my signature.

HAROLD E. McCRERY.