

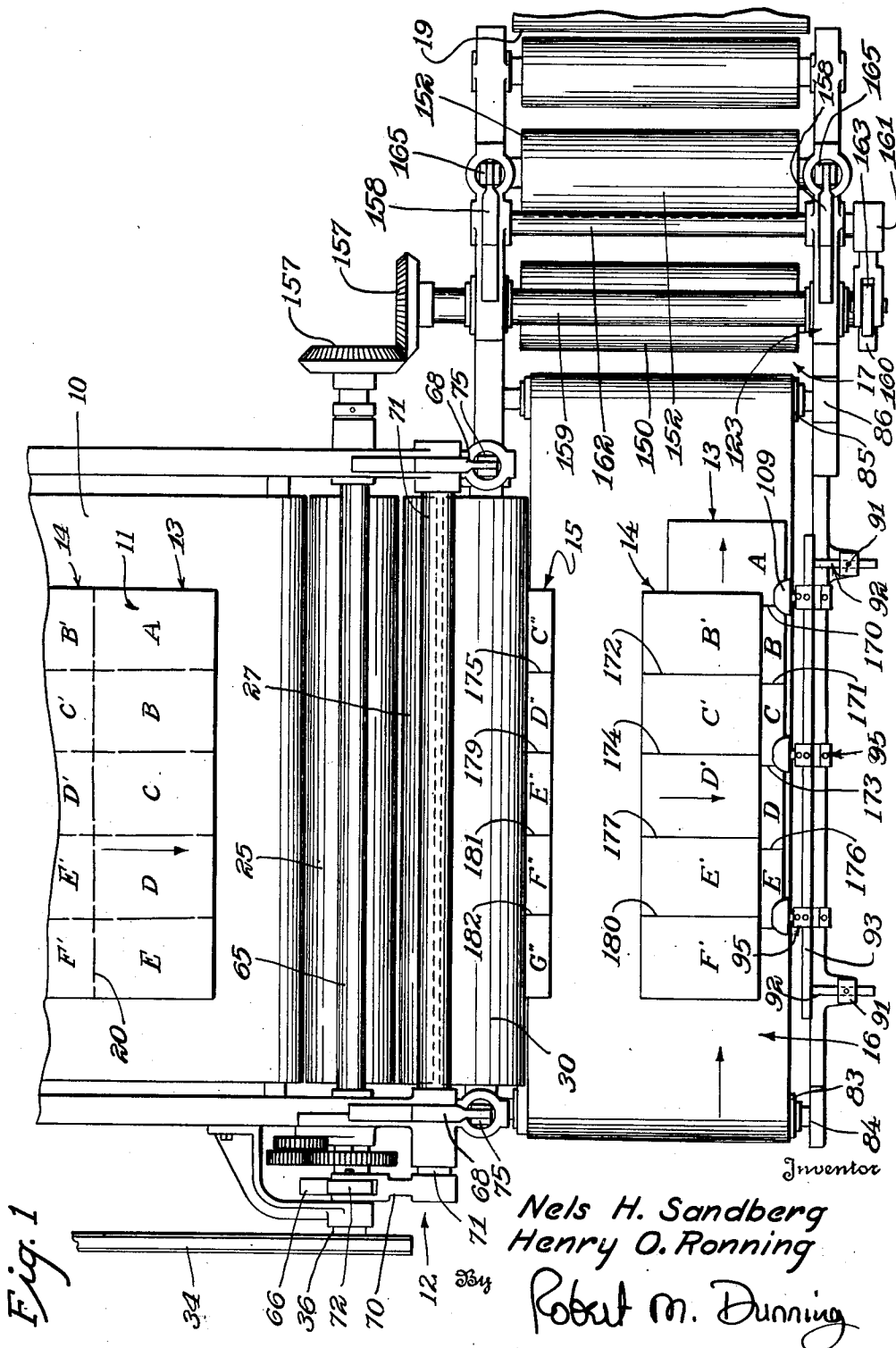
May 26, 1953

N. H. SANDBERG ET AL
SHEET TEARING DEVICE

2,639,772

Filed Feb. 4, 1949

6 Sheets-Sheet 1



May 26, 1953

N. H. SANDBERG ET AL

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SHEET TEARING DEVICE

Filed Feb. 4, 1949

6 Sheets-Sheet 4

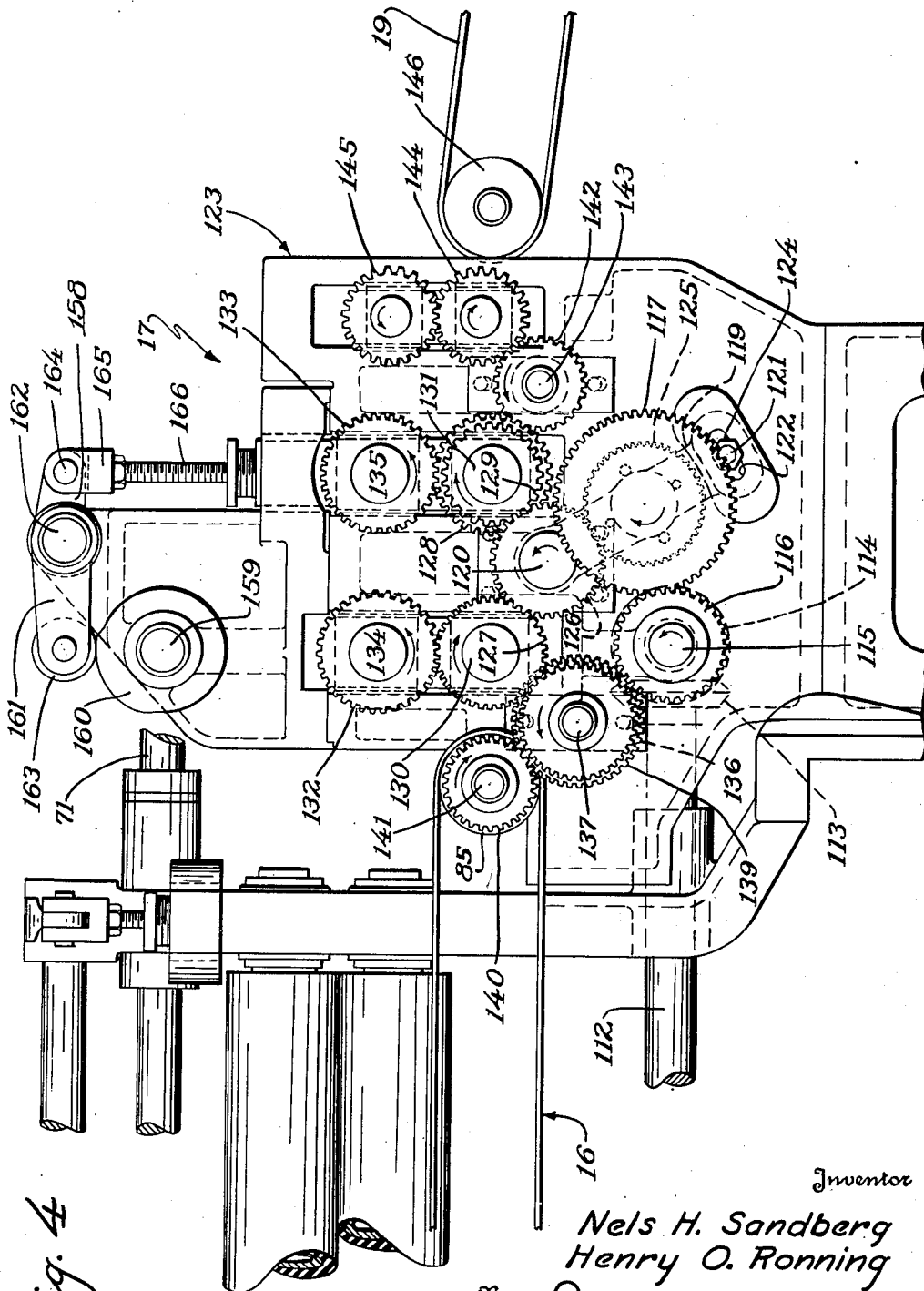


Fig. 4

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6 Sheets-Sheet 5

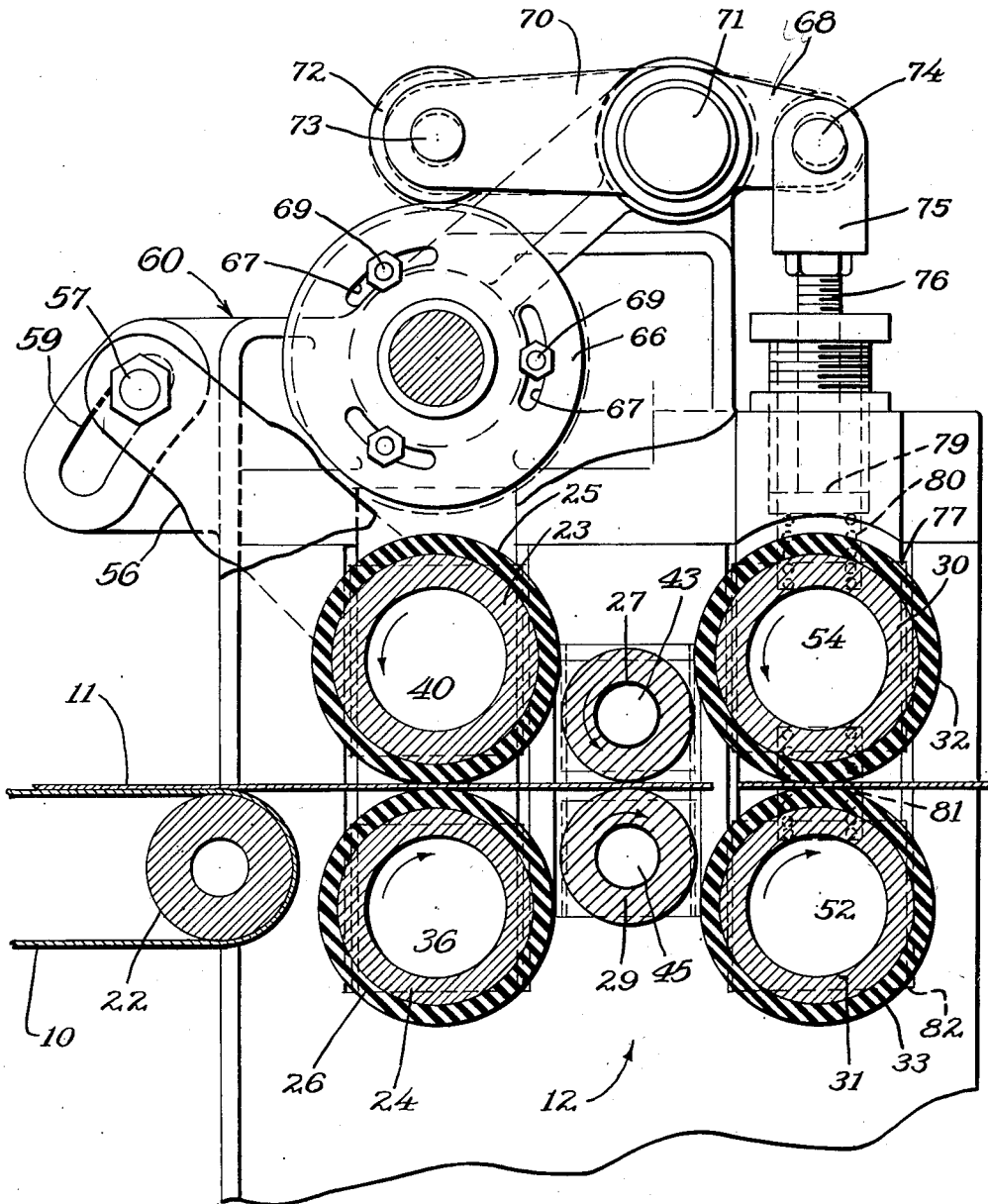


Fig. 5

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6 Sheets-Sheet 6

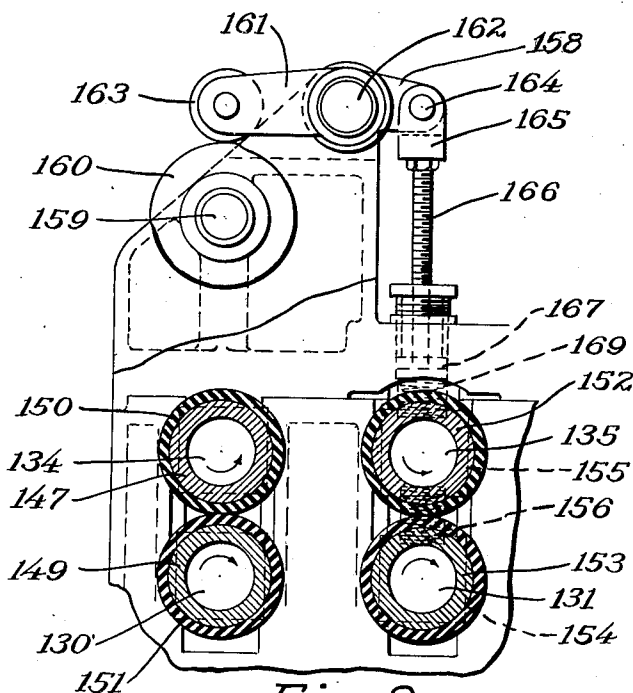


Fig. 9

11					
15	G"	F"	E"	D"	C"
21		182	181	179	175
14	F'	E'	D'	C'	B'
20		182	177	174	172
13	E	D	C	B	A
		176	173	171	170



Fig. 8

Fig. 7

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UNITED STATES PATENT OFFICE

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SHEET TEARING DEVICE

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11 Claims. (Cl. 164—84.5)

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Our invention relates to an improvement in sheet tearing device wherein it is desired to provide a means of separating a printed sheet into a series of smaller units and placing the sheets in a predetermined relationship.

Cartons are often printed in sheets of considerable size and these sheets are later cut to form the individual cartons. In the cutting operation it is usually necessary to have the cartons connected together to a sufficient extent so that the sheet of cartons may be handled as a unit. The sheets are then stacked in superimposed relation and are stripped to remove waste stock from about the cartons and to separate the cartons one from another. If the cartons are cut entirely apart by the cutting apparatus they are difficult to handle and stack.

During recent years it has been common practice for many concerns to print a series of cartons each having a different design thereupon. For example the cartons may each be printed with a different mask or puzzle to provide amusement after the contents of the carton have been used. In order to provide the necessary variation each of the cartons of a series is different from the other cartons of the series. In order that the cartons when supplied to a dealer include all of the various designs rather than a single one or two designs, it is necessary to sort the cartons so that they will be maintained in series. This mixing or sorting of the various cartons would be extremely difficult if the sheets are stacked and stripped in the usual manner as all of the cartons of each stack would then be similar and it would be necessary to place the cartons in series after they have been stripped.

A feature of the present invention lies in the provision of a cutting press having a means for separating a sheet of cartons into the individual cartons and in grouping the cartons of the sheet together in a predetermined succession so that the various cartons of the series will be in proper consecutive order. Thus when leaving the machine each individual series of cartons will be similarly arranged and the cartons will be stacked in a desired consecutive order.

A feature of the present invention lies in the manner in which the sheet is separated. The sheet of cartons is cut by the cutting press in such a manner that the individual cartons of the sheet are connected together by weakened areas of connection. The sheet passes between a pair of rollers which hold the cartons from relative movement. The forward edge of the sheet then passes between a pair of rollers which are spaced

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apart during a portion of the time and which are drawn together into engagement with the sheet at timed intervals. This second set of rollers is travelling at a speed in excess of the speed of the first named rollers and when in engagement with the sheet tends to pull the forward portion of the sheet from the remainder of the sheet. The first and second series of rollers are spaced in such a manner that when the first rollers are engaging the first row of cartons on the sheet, the second rollers are holding the second series of cartons from relative movement. Similarly as the second set of rollers engages the second row of cartons, the first rollers are holding the third set of cartons from relative movement. Similarly as each row of cartons passes between, and is engaged by, the second rollers the next following series of cartons are being held by the first series of rollers so as to separate one series of cartons from the next.

A further feature of the present invention lies in the provision of a conveyor which moves transversely to the movement of the sheet as it leaves the cutting press and conveys the rows of cartons to a second separating means. This conveyor travels at a speed which is so proportioned to the speed of travel of the cartons, leaving the cutting press so that the cartons are stacked one above the other as they move in a transverse direction. As a result the cartons of each row may be separated into individual cartons by a second carton separating means.

A feature of the present invention lies in proportioning the speed of the transverse conveyor and the speed of the cartons leaving the cutting press so that as each row of cartons moves transversely, the distance of movement of the first row of cartons is such as to permit the next row of cartons to coincide in position with certain of the cartons of the first row. In other words, the first row of cartons may be moved a sufficient distance so that the first carton of the second row coincides in position and overlies the second carton of the first row. Similarly the first carton of the third row may coincide with the third carton of the first row and the second carton of the second row. As a result the cartons are arranged one upon the other and therefore may be separated into individual cartons by roller means similar to those previously described.

It is a further feature of the present invention to provide a second series of rollers which are so spaced as to enable the individual cartons to be pulled apart from their respective rows. A first pair of rollers is provided for engagement with the cartons as they pass between the same. A second series of rollers is arranged

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in spaced relation to the first series and rotate at a higher rate of speed. This second series of rollers is moved together and apart at timed intervals and the timing is such that as each carton or series of cartons passes between the rollers of this series, these cartons are engaged and moved forwardly at a speed greater than the speed of the preceding cartons held by the rollers of the first series. As a result the first carton or cartons of the rows are torn apart from the next adjacent cartons and this same action continues throughout the length of time the cartons are passing between the rollers.

An added feature of the present invention lies in the ease with which the mechanism may be adjusted to compensate for cartons of various sizes. The rollers of each second series of cartons are geared to travel at a higher rate of speed than the rollers of each first series. The rollers of the second series are moved together and apart by means of a cam. By changing the cam or the gear ratio connecting the cam to the drive mechanism, the frequency of movement of the second series of rollers toward and away from each other may be varied to regulate the frequency at which the second series of rollers engage the sheet.

These and other objects and novel features of our invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of our specification:

Figure 1 is a diagrammatic top plan view of our sorting apparatus showing the construction thereof.

Figure 2 is a side elevational view of the side of the first unit for tearing the sheet into rows of cartons and showing the conveyor for conveying the rows of cartons to the second unit.

Figure 3 is a top plan view showing the connection between the first unit and the second unit.

Figure 4 is a side elevational view of the second unit for tearing the rows of cartons into individual cartons.

Figure 5 is a diagrammatic sectional view through the spaced rollers of the first unit showing the manner of separating the sheets.

Figure 6 is a perspective view of one of the guides used in conjunction with the conveyor for changing the direction of motion of the sheets.

Figure 7 is a diagrammatic view of a sheet showing the arrangement of cartons thereupon.

Figure 8 is a diagrammatic view showing the arrangement of the cartons as they leave the apparatus.

Figure 9 is a diagrammatic sectional view indicating the relative position of the rollers of the second unit.

The sorting apparatus is indicated in general by the numeral 9 and is shown diagrammatically in Figure 1 of the drawings. The cutting press is not shown in detail as this press may be any of a series of types of cutting press which cut sheets into various shapes and crease the sheets. For the purpose of illustration the body of the cutting press has been eliminated and the discharge conveyor 10 of the cutting press is shown.

As shown in this figure the sheets 11 travel upon the conveyor 10 toward a first separating unit indicated in general by the numeral 12. The unit 12 acts to divide the sheet 11 into a

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series of rows of cartons indicated in general by the numerals 13, 14, and 15. These rows of cartons are deposited in overlapping relation upon a conveyor device illustrated generally by the numeral 16. The conveyor 16 delivers the rows of cartons to a second carton separating apparatus indicated in general by the numeral 17. This unit 17 separates the cartons into individual carton blanks and deposits them upon a discharge conveyor 19. For the purpose of explanation the carton sheet is shown in Figure 7 of the drawings. This figure diagrammatically shows the sheet which is partially cut into the carton rows 13, 14 and 15 which are connected by small areas of connection along the separating lines 20 and 21. The sheet 11 is shown as also divided into five rows of cartons longitudinally of the sheet as it moves toward the first separating unit 12. The cartons of the first row are indicated by the letters A, B, C, D, and E respectively. The cartons of the second row are identified by the letters B', C', D', E' and F', respectively. The cartons of the third row 15 are identified by the letters C'', D'', E'', F'' and G''.

The arrangement of the various rollers of the first unit 12 is illustrated in Figure 5 of the drawings. In this figure will be found a conveyor roller or pulley 22 which supports the outer extremity of the discharge conveyor 10 of the cutting press. The conveyor 10 is of the endless belt type and merely carries the sheets 11 from the cutting press to the unit 12. Figure 12 also illustrates a pair of rollers 23 and 24 which engage the top and bottom surfaces respectively of the sheet 11 as the sheet is fed between these rollers by the conveyor 10. One or both of the rollers 23 is provided with a friction surface such as the sleeve of rubber or composition, this sleeve being indicated at 25 on roller 23 and indicated at 26 on roller 24. The rollers 23 and 24 rotates at proper speed so that the surface thereof travels at substantially the same speed as the sheets 11 upon the conveyor 10.

A pair of guide rollers 27 and 29 are provided above and below the sheet 11 as it leaves the rollers 23 and 24, these rollers 27 and 29 being arranged merely to guide the sheet to the second set of rollers indicated at 30 and 31. The rollers 30 and 31 are preferably provided with a friction surface such as the sleeves 32 and 33 of rubber or composition so that these rollers may grip the sheets 11 firmly as they pass between the same. The rollers 27 and 29 are preferably provided with smooth exterior surfaces so that the sheet may slide between the same if the pulling pressure upon the sheet is sufficient.

The means of driving the various rollers is best illustrated in Figure 2 of the drawings. This figure illustrates a drive chain 34 which engages a sprocket 35 upon the roller shaft 36 of roller 24. The drive chain 34 rotates the sprocket 35 in a direction to turn the shaft 36 and the roller 24 in a clockwise direction. A gear 37 on the shaft 36 engages a similar sized gear 39 on the roller shaft 40 of the roller 23, causing rotation of the shaft 40 and roller 23 in a counter-clockwise direction as indicated in Figure 5 of the drawings.

A gear 41 is in mesh with the gear 39 and acts as an idler gear to rotate a gear 42 on the shaft 43 of the roller 27. A gear 44 on the roller shaft 45 of the roller 29 is in mesh with the gear 42. Counter-clockwise movement of the roller gear 39 rotates the idle gear 41 in clockwise direction and therefore drives the roller shaft 43 in

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a counter-clockwise direction and drives the roller shaft 45 in a clockwise direction. As a result the roller 27 is rotated in a counter-clockwise direction and the roller 29 is rotated in a clockwise direction.

A gear 46 on the roller drive shaft 36 engages an idle gear 47 on a stub shaft 49. A gear 50 rotated with the idle gear 49 engages a cooperable gear 51 on the roller shaft 52 of the roller 31. The gear 51 rotates a similar gear 53 on the roller shaft 54 of the roller 30. The idle gears 47 and 50 are rotated in a clockwise direction, thereby rotating the gear 51 and roller 31 in a clockwise direction for rotating the gear 53 and the roller 30 in a counter-clockwise direction. The gears 51 and 53 are so arranged that the rollers 30 and 31 and the gears 51 and 53 may be moved apart to some extent without disengaging the gears, it being necessary to space the rollers sufficiently so that they do not engage the sheet 11. It will also be noted that an angular adjustment may be made between the idle gears 47 and 50 as indicated by the adjusting members 55.

As indicated in Figure 2 of the drawings the arm 56 is supported for rotation about the axis of the roller shaft 40. A threaded pin 57 on this arm 56 extends through a slot 59 in the side frame 60 of the unit 12 so as to hold the arm 56 in angularly adjusted relationship. The arm 56 supports a bearing 61 for rotatably supporting a gear 62 which is in mesh with the gear 39. A second gear 63 is secured to the gear 62 for rotation in unison therewith and this second gear 63 is in mesh with a gear 64 on a shaft 65. A cam 66 is secured to the gear 64 for rotation in unison therewith. By changing the size of the gear 63 the speed of rotation of the shaft 65 and the cam 66 may be regulated so that the cam will operate in properly timed relation to the speed of the rollers. The cam 66 is preferably adjustable relative to the gear 63 so that the timing of the cam may be regulated. As indicated in Figure 5 of the drawings the cam 66 may be provided with arcuate slots 67 for the accommodation of fastening bolts 69 which may serve to connect the cam to the gear 63 or to a flange connected to this gear 63.

A rocker arm 70 is pivotally supported about a shaft 71 to oscillate about the axis of this shaft. A cam follower roller 72 is pivotally supported at 73 upon one end of the rocker arm 70, this roller 72 following the contour of the cam 66. The ends of a pair of oppositely disposed arms 68 are pivotally connected at 74 to yokes 75 on one end of links 76. The links 76 are either connected to cross heads 77 supporting the bearing for each end of the roller 30 or are connected to pressure plates 79 for compressing a spring 80 against the upper surface of the cross heads 77 to urge the cross heads downwardly. Springs 81 are provided between the cross heads 77 supporting the bearings of the roller shaft 54 of the roller 30 and the relatively fixed bearing 82 supporting each end of the roller shaft 52 at opposite ends of the roller 31. In such an event the operation of the rocker arm 70 relieves tension upon the spring 80 so that the cross head 77 is moved upwardly by the spring 81. This arrangement provides a resilient force compressing the rollers 30 and 31 together in one position of the rocker arm for relieving the pressure therebetween so that they may be separated by the spring 81 in the other extreme position of the rocker arm 70.

With reference now to Figures 1 and 2 of the

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drawings it will be noted that the conveyor belt 16 is supported at one end by a conveyor roller or pulley 83 supported on the mechanism frame by bearings 84 and is supported at its other end by a similar pulley or roller 85 supported by bearings 86. The conveyor 16 moves in a direction at right angles to the direction of movement of the conveyor 10, thereby changing the direction of movement of the rows of carton blanks delivered thereto. The rows of carton blanks are stopped in their forward movement provided by the conveyor 10 and the rollers 23, 24, 30 and 31 by stops best illustrated in Figures 2 and 6 of the drawings. A series of vertically spaced supports 87 are vertically adjustably connected to the frame by brackets 89. Set screws 90 in these brackets 89 hold the vertical supports 87 at the proper elevation. At their upper extremities the supports 87 are provided with transversely extending bearings 91 which are apertured to accommodate arms 92 which support a bar 93 extending longitudinally of the conveyor 16. The bar 93 is adjustable toward or away from the longitudinal center of the conveyor 16 and may be held at the desired location by set screws 94 in the bearings 91 which engage the rods 92. At spaced points throughout the length of the bar 93 we provide brackets 95 which include a base portion 96 extending transversely of the conveyor 16 and having upwardly extending flanges 97 and 99 at opposite ends thereof. The flange 97 engages against one side of the bar 93 and a flange 100 overlies the bar 93. A set screw 101 extends through the flange 100 and against the bar 93 to hold the bracket 95 in adjusted position on the bar 93.

As indicated in Figure 6 of the drawings the base 96 of the bracket 95 is slotted at 102 to accommodate a rocker arm 103. The pivot 104 extends through the rocker arm 103 and through opposite sides of the slot 102 to pivotally support the arm 103 for rocking movement within certain limitations. A spring 105 is provided in the bracket 95 which tends to urge the rocker arm 103 in clockwise direction as viewed in Figures 5 and 6. A strong spring 106 engages against the arm 103 and limits the upward movement of the arm in the opposite direction.

A shaft 107 is provided on the end of the arm 103 for supporting a substantially semi-spherical roller 109. Each roller has its periphery in engagement with the conveyor 16 and is shaped in such a manner that the rows of cartons will not pass entirely between the rollers 109 and the conveyor 16. In other words, these rollers 109 act to stop the movement of the carton rows in one direction and to start the movement thereof in a direction at right angles upon the conveyor 16.

Both ends of the rollers forming a part of the unit 12 operate in a similar manner, although it is not essential that both ends of the rollers be equipped with all of the gears described. The shaft 65 on which the cam 66 is mounted may extend from one side to the other of the unit 12 so that a cam 66 may be provided at each side of the unit. Both sides of the unit are provided with rocker arms 70 for the associated mechanism so that the rollers 30 may be moved upwardly and downwardly simultaneously.

A drive chain 110 connects a sprocket on the drive shaft 36 to the cooperable sprocket 111 on one end of a shaft 112 extending from one side of the unit 12 to the opposite side thereof. As indicated in Figure 4 of the drawings the shaft

112 is provided with a bevel gear 113 which meshes with a cooperating bevel gear 114 on a shaft 115 extending at right angles to the shaft 112. The shaft 115 extends from one side of the unit 17 to the opposite side thereof and acts as a drive shaft for the various rollers of the unit 17.

A gear 116 on the shaft 115 is engageable with an idle gear 117 mounted upon an arm 119 rotatable about a transverse pivot 120. The arm 119 is pivotal to accommodate idle gears 117 of varying size to compensate for various speeds of rotation.

A pin 121 on the arm 119 extends through a slot 122 in the frame 123 of unit 17 and is secured in adjusted relation by a nut 124. The drive shaft 115 normally rotates in a counterclockwise direction, thus driving the idle gear 117 in a clockwise direction.

A gear 125 is rotatable in unison with the gear 117 and engages a gear 126 on the shaft 120 to rotate this gear 126 in a counter-clockwise direction. The gear 126 is engageable with gears 127 and 129 mounted upon roller shafts 130 and 131 respectively. Both the shafts 130 and 131 are rotated in a clockwise direction. The gear 127 and a gear 128 secured to the gear 129 are engaged with similar gears 132 and 133 which comprise upper roller gears. The gears 132 and 133 and their roller shafts 134 and 135 respectively are rotatable in a counterclockwise direction.

A gear 136 is mounted upon a vertically adjustable shaft 137 and a gear 139 connected to the gear 136 is engageable with a gear 140 on the conveyor shaft 141 of roller or pulley 85. Thus the conveyor 16 is rotated by the drive shaft 115 and rotates at a selected speed so that the speed of movement of the belt surface and of the rollers which engage the conveyed carton rows is equal.

An idle gear 142 is mounted upon a vertically adjustable shaft 143 and acts to connect the gear 128 with a gear 144 forming a guide roller gear. A second guide roller gear 145 meshes with the gear 144. The cartons are engaged between the rollers connected to the gears 144 and 145 as they leave the unit 17. It will be noted that the gears 144 and 145 are supported in such a manner that they may move together or apart to accommodate for varying thicknesses of material between the rollers. The discharge conveyor 19 is supported at one end by a roller or pulley 146 which is positioned in such a way that the cartons passing between the rollers driven by the gears 144 and 145 are deposited thereupon. The conveyor 19 may travel at a relatively slow rate of speed so that the cartons are overlapped as they leave the unit 17. In Figure 9 of the drawings I disclose a pair of rollers 147 and 149 which are mounted upon the roller shafts 134 and 130 respectively. The rollers 147 and 149 are preferably provided with sleeves 150 and 151 of material such as rubber or composition. The rollers 147 and 149 are positioned to receive the carton rows as they leave the conveyor 16, the carton rows passing between these rollers.

A second set of rollers 152 and 153 are supported in spaced relation to the rollers 147 and 149 and are mounted upon the roller shafts 135 and 131 and are driven thereby. The roller shaft 131 is preferably mounted at opposite ends in bearings 154 which are relatively fixed in position. The roller shaft 135 is mounted at opposite ends upon a vertically movable cross head 155 supported in the frame 123 for vertical movement. A spring 156 is preferably provided be-

tween the bearing 154 and the cross head 155 to urge the cross head 155 upwardly.

The cam shaft 71 of the unit 12 is provided with bevel gears 157 which connect this cam shaft to the right angularly extending cam shaft 159 of unit 17. The cam shaft 159 extends transversely of the unit 17 and is provided near each extremity with a cam 160. A rocker arm 161 is pivotally supported to shaft 162 and is provided at one end with a cam follower roller 163 which is designed to follow the contour of the cam 160. A pair of oppositely disposed arms 158 mounted on the shaft 162 are pivotally connected at 164 to yokes 165 forming a part of links 166 which may either be connected to the cross heads 155 to operate the same or may be provided with pressure plates 167 designed to increase or decrease the compression upon springs 169 interposed between the pressure plate 167 and the cross head 155. When the arms 158 are in one extreme position the springs 169 are compressed urging the cross heads 155 downwardly and urging the rollers 152 and 153 together. When the arms 158 are in their other extreme position compression of the spring 169 is released permitting the spring 156 to urge the cross head 155 upwardly and thereby spacing the rollers 152 and 153.

The operation of our separating and sorting device can readily be understood from the foregoing description. The sheets 11 are cut into the proper shape and outline and the various cartons are mostly separated but are held together by relatively narrow points of connection so that the sheet can be handled as a unit. As the forward edge of the sheet 11 passes between the rollers 23 and 24, these rollers grip the surface of the sheet and guide the same between the guide rollers 27 and 29 and over the roller 31. At the time the forward end of the sheet is fed between the rollers 30 and 31, the rocker arm 70 is in engagement with a low portion of the cam 66 and the rollers 30 and 31 are spaced sufficiently so that they will not grip the sheet passing therebetween.

Shortly after the cut line 20 separating the cartons from the first row 13 and from the second row 14 passes between the rollers 23 and 24, the cam 66 oscillates the rocker arm 70 so as to bring together the rollers 30 and 31. It will be noted that the rollers 30 and 31 rotate at a higher rate of speed than the rollers 23 and 24. The gear 46 connecting the drive shaft 36 of the roller 24 is of greater diameter than the idle gear 47 and the gear 50 which rotates with the gear 47 is larger than the gear 51. As a result the rollers 30 and 31 act to pull the row of cartons 13 away from the remainder of the sheet 11, the sheet separating along the weakened line 20 and the remainder of the sheet being held by the rollers 23 and 24. Thus the row 13 of cartons passes between the rollers 30 and 31 and is propelled over the conveyor 16 engaging beneath the rollers 109 which tend to change the direction of this row 13 so that the row 13 moves with the conveyor 16 at right angles to its former direction of travel.

Before the rollers 30 and 31 come into contact with the forward edge of the carton row 14, the cam 66 rotates sufficiently to move the rocker arm 70 in a counter-clockwise direction, raising the roller 30 away from the rocker 31 and allowing the forward edge of the carton row 14 to pass between the rollers and to move at a slower speed than the peripheral speed of these rollers. Shortly after the weakened line of separation 21

between the carton rows 14 and 15 passes between the slower rollers 23 and 24, the rollers 30 and 31 are moved together by the cam 66 and these rollers which travel at a higher rate of speed are engaged with the carton row 14. As a result the carton row 14 is pulled away from the carton row 15 which is held at constant speed by the rollers 23 and 24 and the carton row 14 is embedded over the conveyor 16 to overlap the carton row 13 previously directed upon this conveyor.

As indicated in Figure 1 of the drawings, by the time the carton row 14 is propelled against the rollers 109 the conveyor 16 has moved the carton row 13 a distance equal to the width of one or more of the cartons of row 13. In the particular instance illustrated when the row 14 comes to rest upon the carton row 13, the carton B' lies over the carton B and both of the cartons are approximately in registry. It is important that one carton lie substantially over another as the superimposed cartons are later pulled apart along the weakened lines of separation separating the individual cartons of the row.

As the carton row 15 passes between the rollers 30 and 31, it is in turn propelled against the conveyor rollers 109 and by the time this third row 15 is deposited upon the carton rows 13 and 14, the carton C'' of the carton row 15 substantially registers with the cartons C and C'. It is important that the speed of travel of the conveyor 16 be synchronized with the speed of the rollers 30 and 31 so that the carton rows are carried a distance equal to one or more complete cartons before the next carton row is deposited thereupon.

With reference now to Figure 9 of the drawings, as the carton A travels between the rollers 147 and 149 and is fed between the rollers 152 and 153, these latter rollers are spaced apart by the rocker arms 161 and the cams 160 until the juncture or weakened line of separation 170 between carton A and carton B passes the rollers 147 and 149. The cam 160 then urges the rollers 152 and 153 together, clamping the carton A therebetween.

As noted in Figure 4 of the drawings, the gear 126 driven by the gear 127 of the roller shaft 130 of roller 149 is larger than the gear 129 rotated thereby. As a result the rollers 152 and 153 which are geared together by gears 128 and 133 travel at a higher rate of speed than the rollers 147 and 149. As a result the carton A is pulled away from the carton B and delivered by guide rollers 144 and 145 to the discharge conveyor 19.

As the cartons B and B' pass between the rollers 152 and 153 these rollers are spaced apart by the cam 160 until the line of separation 171 between cartons B and C and the corresponding weakened line of separation 172 between cartons B' and C' has passed the rollers 147 and 149. At this point the cam 160 pivots the rocker arm 161 to urge the rollers 152 and 153 together. This action pulls the cartons B and B' away from the adjacent cartons C and C'. Similarly as the cartons C, C' and C'' pass in superimposed relation between the rollers 152 and 153, the rollers are separated until the weakened lines of separation 173, 174, and 175, respectively, connecting the cartons C, C' and C'' to their adjacent cartons D, D' and D'' pass the rollers 147 and 149. At this point the rollers 152 and 153 are moved together and act to pull the cartons C, C' and C'' from the next adjacent cartons D, D' and D''.

In a similar manner the cartons D, D' and D'' are separated along their weakened lines of con-

nection 176, 177 and 179 from the adjacent cartons E, E' and E''. This completely separates the cartons of row 13.

In the next operation the cartons E' and E'' are separated along their weakened lines of separation 180 and 181 from the cartons F' and F''. This completely separates the cartons of row 14. In the final separating operation the carton F'' is separated from the carton G'' along the weakened line of separation 182. This completely separates the cartons and deposits them upon the conveyor 19.

In Figure 8 of the drawings we disclose diagrammatically the order in which the cartons are deposited upon the discharge conveyor 19. This discharge conveyor preferably travels at a relatively slow rate of speed so that the cartons are stacked in the order mentioned in overlapping relationship and in proper sequence.

The cartons after removal from the conveyor 19 may be stripped of waste stock if desired and may be stored in stacks pending the gluing operation. The stacks of cartons are fed into the gluing machine in the same order in which they are delivered from the cutting machine, thereby maintaining the glued cartons in proper sequence. The glued cartons when delivered to the filling and sealing equipment are also maintained in the same sequence and the cartons as they leave the filling and sealing equipment are placed into shipping containers. As a result shipping containers contain cartons of each type, rather than cartons of similar design. In the present arrangement the sheet 15 is divided into fifteen cartons all of which may be of different design if desired. The cartons are sealed and placed into shipping containers. If each shipping container holds fifteen cartons, each of the cartons are of different design. This feature is of importance as it is essential that the various designs be distributed in equal quantities to the storekeeper.

It will be seen that our separating and sorting arrangement is of considerable value in placing the cartons in proper sequence. As the order in which the cartons are deposited upon the conveyor 19 may be readily determined, it is possible that if the cartons are produced with five different designs instead of fifteen, the three plates of similar type which are employed may be properly located in the form so that the sequence remains the same. For example in the particular arrangement illustrated it is possible that each fifth carton might be of similar design, in which case the cartons A, C' and E' would be of similar design in order that the sequence of cartons repeat itself at relative intervals.

In accordance with the patent statutes, we have described the principles of construction and operation of our sheet separating and sorting device, and while we have endeavored to set forth the best embodiment thereof, we desire to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of our invention.

We claim:

1. A carton separating apparatus including for use in conjunction with a sheet of cartons including a plurality of rows of cartons with a plurality of cartons in each row, said cartons and rows being separated along weakened lines of separation, the apparatus including a pair of rollers between which said sheet is guided, said rollers gripping said sheet and moving the same, a second set of rollers in spaced relation to the first set thereof, means operating said second set of rollers

at a higher rate of speed than said first set of rollers, means for moving said second set of rollers into and out of engagement with the sheet and operable upon engagement with the sheet to separate one row of cartons from another row thereof, means arranged in properly timed relation with said rollers for moving the rows of cartons one above the other in overlapping relation at right angles to the direction of movement thereof between said rollers, a third set of rollers between which the cartons of each row extend, a fourth set of rollers in spaced parallel relation to said third set of rollers, means for driving said fourth set of rollers at a greater rate of speed than said third set of rollers, means for moving the rollers of said fourth set toward and away from each other, said fourth set of rollers acting upon engagement with cartons passing therebetween to separate the overlapped individual cartons of each row one from another.

2. The structure described in claim 1 in which the means for moving the cartons at right angles comprises a conveyor belt supported on axes at substantially right angles to the axis of said first named rollers.

3. A carton separating apparatus for use in conjunction with a sheet of cartons arranged in a plurality of rows both longitudinally and transversely of the sheet, the cartons being separated by weakened lines of separation, the apparatus including a pair of rollers between which the sheet extends, said rollers gripping the sheet, a second set of rollers in parallel spaced relation to the first set, means for moving the rollers of the second set into and out of engagement with the carton rows extending therebetween, means for rotating the rollers of said second set in a speed in excess of the speed of the rollers of the first set, continuously operable means for changing the direction of travel of the rows of cartons separated so that the individual cartons of each row follow consecutively, timing means connecting said continuously operable means and said rollers, said continuously operable means moving at a speed to overlap said rows of cartons an amount equal to substantially equal multiples of the individual carton width, a pair of holding rollers between which the cartons of each row extend, a second set of rollers between which the carton rows extend, said last named second set of rollers travelling at a speed in excess of the speed of the rollers of the last mentioned first set, means for moving the rollers of said last named second set into and out of engagement with the cartons, said last named rollers of the second set acting to separate the individual cartons of each row.

4. A carton separating apparatus for use in conjunction with a sheet of cartons having a series of carton rows and a series of individual cartons in each row, said cartons and rows being separated by weakened lines of separation, the apparatus including two right angularly related sets of holding rollers arranged in spaced relation, a set of separating rollers in spaced adjacent relation to each set of holding rollers, means for rotating said holding rollers and separating rollers to apply tension to the sheet therebetween and means for directing the sheet through the first set of holding and separating rollers to tear the sheets along parallel of said weakened lines of separation and thereby to separate the sheet into a series of rows, said directing means delivering said rows in overlapped relation, and means for directing the carton rows in a right angular

relation with the cartons in consecutive order and the rows overlapped to the second set of holding and separating rollers to tear the rows along the remaining weakened lines of separation and thereby to separate the individual cartons of each row, and timing means connecting said last named directing means to said first set of rollers.

5. The structure described in claim 4 in which the carton rows moving between the first set of holding and separating rollers to the second set thereof individually change direction to move at right angles.

6. The structure described in claim 4 and including a conveyor onto which the carton rows are deposited for movement toward the second set of clamping and holding rollers.

7. A sheet separating and sorting apparatus for use with a sheet divided into a series of sections arranged in a plurality of right angularly arranged rows connected along weakened lines of separation, the apparatus including a pair of separating units arranged in right angular relationship, each unit including a pair of holding rollers between which the sheet extends and a pair of separating rollers between which the sheet extends, the separating rollers of each unit being arranged to apply a tension to the sheet to tear apart the sections passing therebetween along weakened lines of separation between the separating rollers and the holding rollers, and a continuously movable conveyor for conveying the rows of sections from the first unit to the second unit, said conveyor moving in a direction at right angles to the direction of movement of the sections through said first unit, timing means connecting said rollers and said conveyor for moving said conveyor at proper speed so that said rows of cartons are deposited thereupon in overlapping relation with the overlapped sections being substantially one above the other.

8. The structure described in claim 7 in which the conveyor moves the sections substantially the width of one section before the next row of sections is deposited thereupon.

9. The structure described in claim 7 in which a superimposed series of sections are simultaneously separated from next adjacent sections upon movement through said second unit.

10. A carton separating apparatus for use in conjunction with a sheet of cartons having a series of carton rows and a series of individual cartons in each row, said cartons and rows being separated by weakened lines of separation, the apparatus including a first tension applying separating means, a drive means for moving the sheet of cartons past said separating means, said separating means applying tension to the sheet along parallel of said weakened lines to separate the sheet by tearing into a series of rows, a conveying means onto which said rows of cartons are delivered by said drive means, timing means connecting said conveying means in timed relation to said drive means to move said carton rows a distance substantially equal to an equal multiple of carton widths between the time adjacent rows of cartons are separated from the sheet by said separating means, said drive means thereby depositing said carton rows in overlapped relation on said conveyor, and a second tension applying carton separating means in the path of movement of the overlapped rows of cartons on said conveyor, said second carton separating means engaging the overlapped rows of cartons on opposite sides of the remaining weakened

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lines of separation and separating them by tearing into individual cartons.

11. The structure described in claim 10 and including a second drive means for driving the cartons past said second separating means.

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