

PATENT SPECIFICATION

(11) 1 234 140

DRAWINGS ATTACHED



1 234 140

- (21) Application No. 51800/69 (22) Filed 22 Oct. 1969
 (31) Convention Application No. 770 021 (32) Filed 23 Oct. 1968 in
 (33) United States of America (US)
 (45) Complete Specification published 3 June 1971
 (51) International Classification B 26 d 7/18
 (52) Index at acceptance
 B4B 5B 5F 5G2 5J2 5M 5P
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(54) APPARATUS FOR REMOVING PIECES FROM SHEET STOCK MATERIAL

(71) We, ILLINOIS TOOL WORKS INC., a corporation organized under the laws of the State of Delaware, United States of America, of 8501 West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a novel apparatus for use in making articles from a strip of sheet stock material.

While it will become apparent that features of the present invention may be utilized in apparatus for making a variety of different workpieces or articles, one embodiment which is specifically disclosed herein is adapted to make a strip of interconnected can carriers from plastics stock material. Such carriers comprise a generally flat body of plastics material having apertures formed therein for receiving end portions of cans and the like and other apertures which may be used as finger gripping holes.

It is an object of the present invention to provide a novel apparatus capable of accurately and effectively separating workpieces such as can carriers from the remainder of a strip of plastics or other suitable sheet stock material.

According to this invention, an apparatus for removing pieces from sheet stock material, which pieces are substantially defined by cut lines, comprises first and second cooperable rolls between which the material can pass, punch means on the first roll comprising a projection engageable with a piece to be removed and a first clamping element adjacent to the projection and engageable with the piece, recess means in the second roll providing clearance for the projection and into which the piece engaged by the projection may be displaced and a second clamping element on the second roll and cooperable with the first clamping element for securing therebetween the piece being engaged by the projection.

[Price 25p]

Further features of the invention which are preferred but not essential will be mentioned in the course of the following description of one example of an apparatus embodying the invention, as shown in the accompanying drawings. In these drawings:—

Figure 1 is a side elevation of the apparatus;

Figure 2 is an enlarged fragmentary plan view showing the condition of a length of stock material as it is progressively processed upon passage through the apparatus from a blank to a finished article such as a can carrier;

Figure 3 is an enlarged partial section of the apparatus, taken generally along the line 3—3 in Figure 4;

Figure 4 is a partial section taken generally along the line 4—4 in Figure 3;

Figure 5 is an enlarged fragmentary section taken generally along the line 5—5 in Figure 3 and showing a portion of knock-out roller means incorporated in the apparatus; and

Figure 6 is a fragmentary section similar to Figure 5, but showing another portion of the knock-out roller means.

The apparatus 10 is shown in Figure 1 installed between a roll 12 of blank strip stock material 14 and a windup reel supporting apparatus 16. The reel supporting apparatus forms no part of the present invention and thus it suffices to state that it is adapted to support reels 18 and 20 on which a continuous workpiece 22 may be wound as it is formed by the apparatus 10 from the strip 14 of stock material.

Figure 2 shows the manner in which the stock material is transformed from a blank strip to the article 22 as it passes through the apparatus 10. In the particular embodiment shown, the finished article 22 comprises interconnected can carriers 24 of known construction, as described and claimed in our British Patent No. 914,202. It suffices to state that each of the carriers comprises two rows of three can receiving

apertures 26. Adjacent ends of the carriers are integrally joined at lines 28 and they are adapted to be separated from each other along these lines when ultimately assembled with cans so as to provide a "six-pack". Finger holes 30 are formed in the carrier body between the rows of apertures 26 for enabling the package to be picked up.

As shown at the left hand end of Figure 2, the strip 14 is blank as it enters the apparatus 10. The strip is then passed through dies which will be described below and which function to cut the strip along lines 34 for defining opposite margins of the article 22. The dies also serve to cut the strip along oval lines 36 for defining pieces 38 which are removed as hereinafter described for producing the apertures 26.

The cutting dies are also provided with elements which form cuts along lines 40 defining pieces 42 which are removed to provide the finger holes. Additional cuts along lines 44 defining pieces 46 are made at intervals located at the connected ends of successive carriers 24. These pieces 46 are subsequently removed for providing the article with openings 48 between ends of adjacent interconnected carriers.

The undulating lines shown in Figure 2 are the result of gripping the material as described in our Application No. 43482/68.

Referring now more specifically to Figures 1, 3 and 4, it is seen that the apparatus 10 comprises opposite side frame members 50 and 52. Feed rolls 54 and 56 are mounted on shafts 58 and 60 rotatably supported between the side frame members adjacent to an entering end of the apparatus 10. The strip 14 enters the apparatus between the feed rolls. The shaft 60 of the feed roll 56 is driven by a suitable means interconnected with an adjustable speed reducer unit 62 driven by a motor 64. The speed reducer unit may be of known construction and need not be described in detail. The unit 62 includes output sprocket means 66 indicated in Figure 1 which drives a chain 68 encircling and driving another sprocket 70 on shaft 72. As indicated in Figures 3 and 4, this shaft carries a second sprocket 74 which drives a chain 76 encircling a sprocket 78 on shaft 80. The shaft 80 carries and drives a gear 82 which in turn drives a gear 84 on the feed roll shaft 60.

The strip 14 is directed from the feed roll 56 beneath a guide or idler roll 86 and then upwards between a rotatable cutter roll 88 and a backup roll 90. The rotary cutter roll is provided with cutter elements 92 for severing the strip along the lines 34 mentioned above and cutter elements 94 for making the generally circular cuts 36. Additional cutter elements 96 and 98 are provided for making the finger hole cuts 40 and the cuts 44.

As shown in Figure 3, the cutter roll is provided with two sets of the aforementioned cutter elements so that it is adapted to process a strip 14 having a width sufficient to enable two rows of the elongated articles 22 to be formed in side by side relationship.

The cutter roll 88 is carried by a shaft 100 which is driven from the shaft 72 through gears 102, 104, 106 as shown in Figure 3. The backup roll 90 is rotatably supported on a shaft 108.

The previously mentioned shaft 72 extends between the opposite side frame members and carries another roll 110 which bears against the backup roll 90 and may be used for scoring the strip of stock material as desired.

As the strip 14 passes from the roll 110, all of the desired scoring and cutting steps have been accomplished. The strip is then directed between cooperable rolls 112 and 114 carrying knock-out elements constructed in accordance with features of the present invention for ensuring complete separation of scrap material from the finished article 22. The roll 112 is carried by a shaft 116 driven in timed relationship with the shaft 72 by means of a gear 118 on the shaft 72, an idler gear 120 and a gear 122 on the shaft 116.

The cooperable knock-out roll 114 is supported on a shaft 124 which is driven in timed relationship with the shaft 116 by meshing gears 126 and 128 respectively secured to these shafts.

Difficulties have previously been encountered in removing relatively large cut-outs such as the pieces 38 from a strip, particularly when the strip is formed of a resilient somewhat slippery material, such as polyethylene. Upon the application of localized pressure to such a relatively large cutout, the material may tend to stretch and the piece may slip relative to the pressure-applying element whereby the piece may not be properly removed from the strip. In accordance with a feature of the present invention, the knock-out rolls are provided with cooperable means for overcoming these problems.

As best shown in Figures 3 and 5, the knock-out roll 112 is provided with a plurality of punch members 130 arranged to engage the pieces 38 to be removed from the strip. The roll 114 includes a cylindrical member 132 formed from a tough resilient plastics or rubber-like material and presenting means 134 respectively cooperable with the punch members 130.

In the embodiment shown, the punch member 130 is formed with an annular projection 136 extending radially outwardly of the peripheral surface of the roll 112. The projection 136 has a bevelled outer side 138 joining an inclined inner wall 140 at a crest 130

142. The annular crest 142 has an outline corresponding to the outline of the cut line 36 defining a cutout piece 38 to be removed from the sheet except that it has smaller dimensions, so that the crest is adapted to engage the cutout piece 38 within the cut line 36.

The inner wall 140 of the lip of projection 136 defines a recess 144 into which a centre post 146 on the member 130 projects. In the embodiment shown, the centre post comprises the head of a screw 148 which serves to detachably secure the member 130 to the roll 112. The means 134 comprises an annular recess 150 formed in the member 132. This recess has the same general annular configuration as the projection 136 and provides sufficient clearance to prevent the projection from interfering with the roll 114. The annular recess 150 is defined by an outer wall 160 and an inner wall 162. The inner wall in turn defines a centre post 164 which projects radially sufficiently for interfering engagement with the centre post 146 of the punch member 130. As previously indicated, the member 132 on the roll 114 is formed from a tough resilient material so that the centre post 164 is adapted to yield slightly when engaged by the centre post 146 as shown in Figure 5.

The manner in which a cutout piece 38 is removed from the strip is clearly shown in Figure 5. More specifically, as the strip advances between the rolls 112 and 114, the projection 136 of the member 130 engages an annular portion of the piece 38 within the cut line 36 and deflects the piece 38 into the recess 150. The action of the projection serves to deflect the engaged annular portion of the piece 38 out of the plane of the strip so that the peripheral edge of the piece 38 is pulled away from the strip 14 along the cut line 36. As the strip passes through the nip between the rolls, this action takes place progressively, starting at the leading end of the oval cut line 36, and proceeding around both sides towards the trailing end. As the strip and the separated piece 38 emerge from between the rolls 112 and 114, the scrap material falls onto a chute 166 indicated in Figure 1 and is discharged into a box or container 168 from which it may be removed by any suitable means. The commencement of separation is assisted to some extent by the fact that the strip, as shown in Figure 5, immediately after passing through the nip between the rolls, is guided in a curved path around part of the circumference of the roll 112, by the positioning of a following guide roll 178.

The pulling action of the projection 136 is assisted, and total separation of the piece 38 from the strip is ensured, by the presence of the clamping elements constituted by the posts 146 and 164. As these posts pass

through the nip between the rolls, they securely clamp the piece 38 between them, with the post 164 yielding sufficiently to accommodate the thickness of the material. Figure 5 shows the post 164 at its greatest state of compression. When unstressed, its free end is flat.

Thus the piece 38 is secured against slippage relative to the member 130, and the pulling action of the member 130 is able to have its full intended effect at each place in turn around the cut line 36.

The rolls 112 and 114 also carry co-operable elements for removing the cutout pieces 42 and 46 from the strip. Elements such as the previously described complementary punch and recess means 130 and 134 may be used except for modification as to size and shape. However, since the cutout pieces 42 and 46 are relatively small, the problem of stretching and slippage of the material is greatly reduced. Thus, simple punch elements 170 are secured to the roll 112 and co-operable elements 172 are formed in the roll member 132 for displacing the cutout pieces 42 as shown in Figures 3 and 6. Similar, but appropriately shaped co-operable punch and recess elements 174 and 176 are provided for removing the pieces 46.

The strip 14 emerging from between the knock-out rolls is directed around guide rolls 178 and 180 as shown best in Figure 4. Then the strip passes between feed rolls 182 and 184 respectively carried by shafts 186 and 188. The shaft 186 is driven in timed relationship with the rotary cutting rolls and knock-out rolls by suitable means including a chain 189 extending from the speed reducer unit 62.

As the strip emerges from between the rolls 182 and 184, the finished article portion 22 is directed towards one of the reels on the apparatus 16. As indicated in Figure 2, opposite marginal portions 190 of the strip 14 are removed from the articles 22. This is accomplished by passing these opposite marginal portions or waste strips downwards between the roll 184 and a cooperating roll 192 and then between feed rolls 194 and 196. Meshing gears 198 and 200 are on the roll shafts 186 and 188 for driving the roll 184, and a suitable drive chain 202 extends around sprocket means on the roll shaft 188 and additional sprocket means on a shaft 204 supporting the roll 194 for driving the roll 194.

The clamping elements need not be located in the centre of the shape outlined by the cut. There may be advantage in having the clamping elements nearer the trailing part of the cut, to ensure completion of separation. There may be more than one pair of clamping elements per piece to be separated, especially if the length of the 130

piece in the direction of travel is equal to a substantial arc of the circumferences of the knock-out rolls.

5 Preferably, as shown, the apparatus operates continuously, but it is possible to operate in a step-by-step manner.

The projection need not exactly match the shape of the cut outlining the piece. In particular the projection need not be circumferentially continuous, but may be a series of studs.

10 In the example, the free end of the centre post 146 is substantially in the plane of the annular crest of the projection 136, but this is not necessarily so. The clamping element may extend further or less far than the projection.

The invention is not confined in its use to handling of plastics, but may be applied to any sheet material which presents problems of slippage and stretching.

WHAT WE CLAIM IS:—

1. An apparatus for making an article from sheet stock material comprising a first pair of cooperable rolls including means thereon for forming cuts in the material passing therebetween to define pieces to be removed from the material, a second pair of cooperable rolls adjacent to the first pair of rolls for removing the pieces from the material passing therebetween, one of the second pair of rolls including punch means comprising a projection engageable with a piece to be removed and a first clamping element adjacent to the projection, the other of the second pair of rolls including recess means providing clearance for the projection into which the piece engaged by the projection is displaced and a second clamping element cooperable with the first clamping element for securing therebetween the piece being engaged by the projection, and a means for driving the rolls in timed relationship.

2. An apparatus, as defined in claim 1, wherein the clamping elements project radially of their respective rolls for interfering engagement with each other, one of the clamping elements being yieldable.

3. An apparatus, as defined in claim 1 or claim 2, wherein the means for forming cuts has a substantially annular outline, for forming substantially annular cuts, and the projection has a crest having a substantially annular outline with dimensions smaller than the outline of the means for forming the cuts.

4. An apparatus, as defined in claim 3, wherein the means for forming substantially annular cuts comprises a plurality of generally annular cutting elements arranged on

one of the first pair of rolls in a pattern, and the rolls of the second pair respectively include a plurality of the punch means, recess means and clamping elements arranged in a pattern corresponding to that pattern.

5. An apparatus, as defined in any of claims 1 to 4, wherein the other roll of the second pair includes a peripheral portion formed from tough resilient material, the recess means and the second clamping element being integral with that portion.

6. An apparatus for removing pieces from sheet stock material, which pieces are substantially defined by cut lines, comprising first and second cooperable rolls between which the material can pass, punch means on the first roll comprising a projection engageable with a piece to be removed and a first clamping element adjacent to the projection and engageable with the piece, recess means in the second roll providing clearance for the projection and into which the piece engaged by the projection may be displaced and a second clamping element on the second roll and cooperable with the first clamping element for securing therebetween the piece being engaged by the projection.

7. An apparatus, as defined in claim 6, wherein the projection is substantially annular, the first clamping element being disposed within the annular projection, the recess means being substantially annular for receiving the annular projection, and the second clamping element being disposed within the recess means.

8. An apparatus, as defined in claim 7, wherein the punch means comprises a member including the projection detachably secured to the first roll and a fastener securing the member to the first roll, a head portion of the fastener providing the first clamping element.

9. An apparatus, as defined in claim 8, wherein the second roll comprises a peripheral portion formed of tough resilient material, the recess means and the second clamping element being formed integrally with the peripheral portion.

10. An apparatus according to claim 1, substantially as described with reference to the accompanying drawings.

11. An apparatus according to claim 6, substantially as described with reference to Figures 5 and 6 of the accompanying drawings.

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The projection need not exactly match the shape of the cut outlining the piece. In particular the projection need not be circumferentially continuous, but may be a series of studs.

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one of the first pair of rolls in a pattern, and the rolls of the second pair respectively include a plurality of the punch means, recess means and clamping elements arranged in a pattern corresponding to that pattern.

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7. An apparatus, as defined in claim 6, wherein the projection is substantially annular, the first clamping element being disposed within the annular projection, the recess means being substantially annular for receiving the annular projection, and the second clamping element being disposed within the recess means.

8. An apparatus, as defined in claim 7, wherein the punch means comprises a member including the projection detachably secured to the first roll and a fastener securing the member to the first roll, a head portion of the fastener providing the first clamping element.

9. An apparatus, as defined in claim 8, wherein the second roll comprises a peripheral portion formed of tough resilient material, the recess means and the second clamping element being formed integrally with the peripheral portion.

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11. An apparatus according to claim 6, substantially as described with reference to Figures 5 and 6 of the accompanying drawings.

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