Feb. 7, 1939. A. G. ROSE 2,146,407

MACHINE FOR FORMING BLANKS INTO CARTONS

Filed Nov. 27, 1937 4 Sheets-Sheet 1

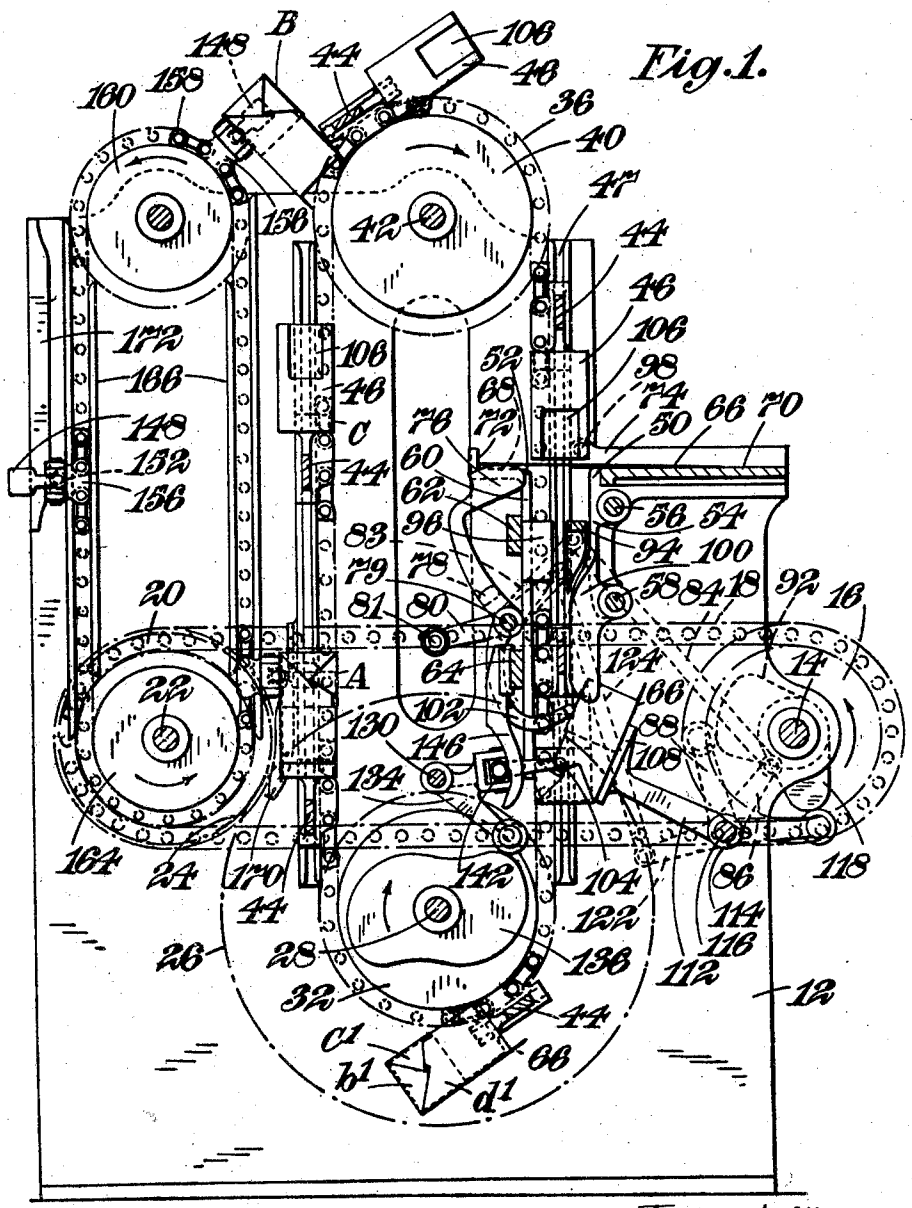

Fig. 1.

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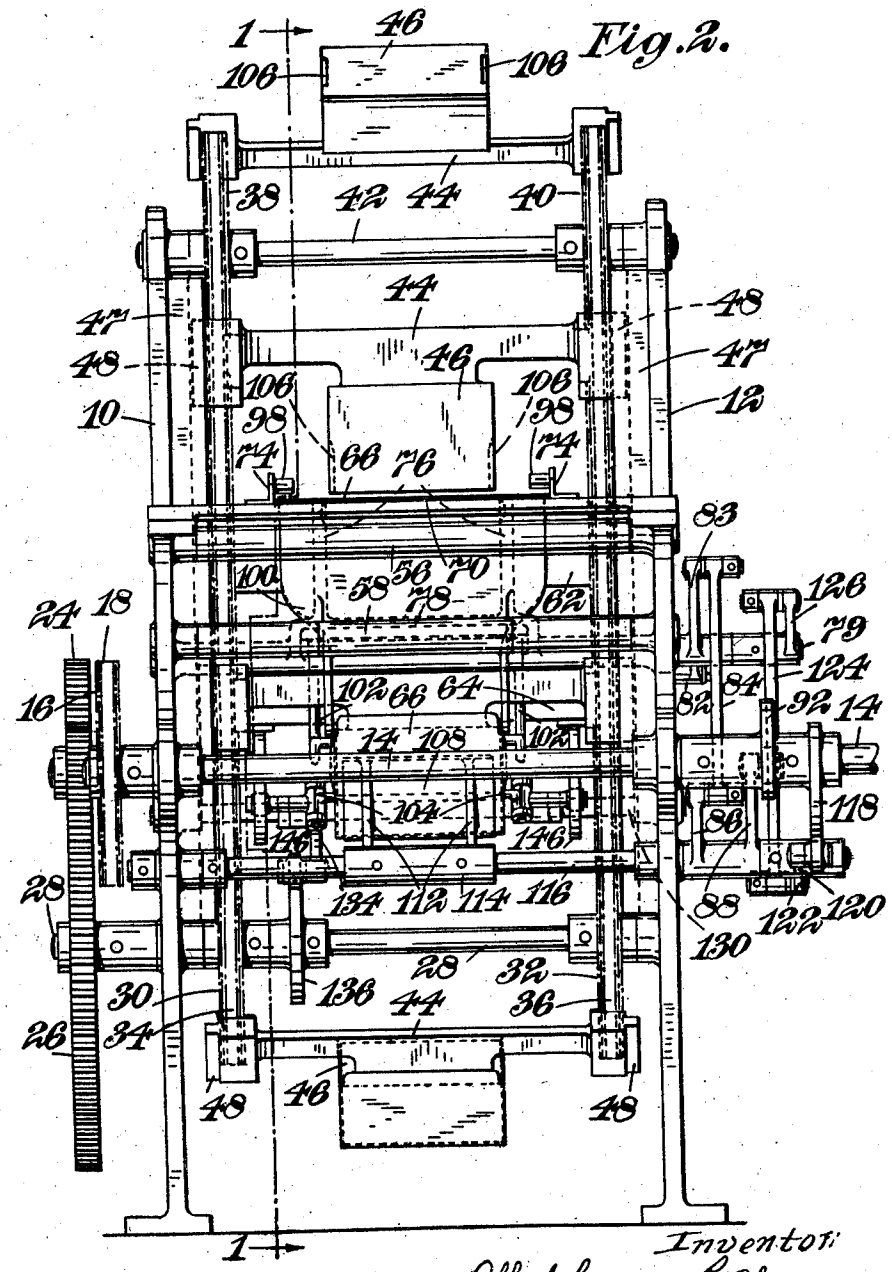
Fig. 2.



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MACHINE FOR FORMING BLANKS INTO CARTONS

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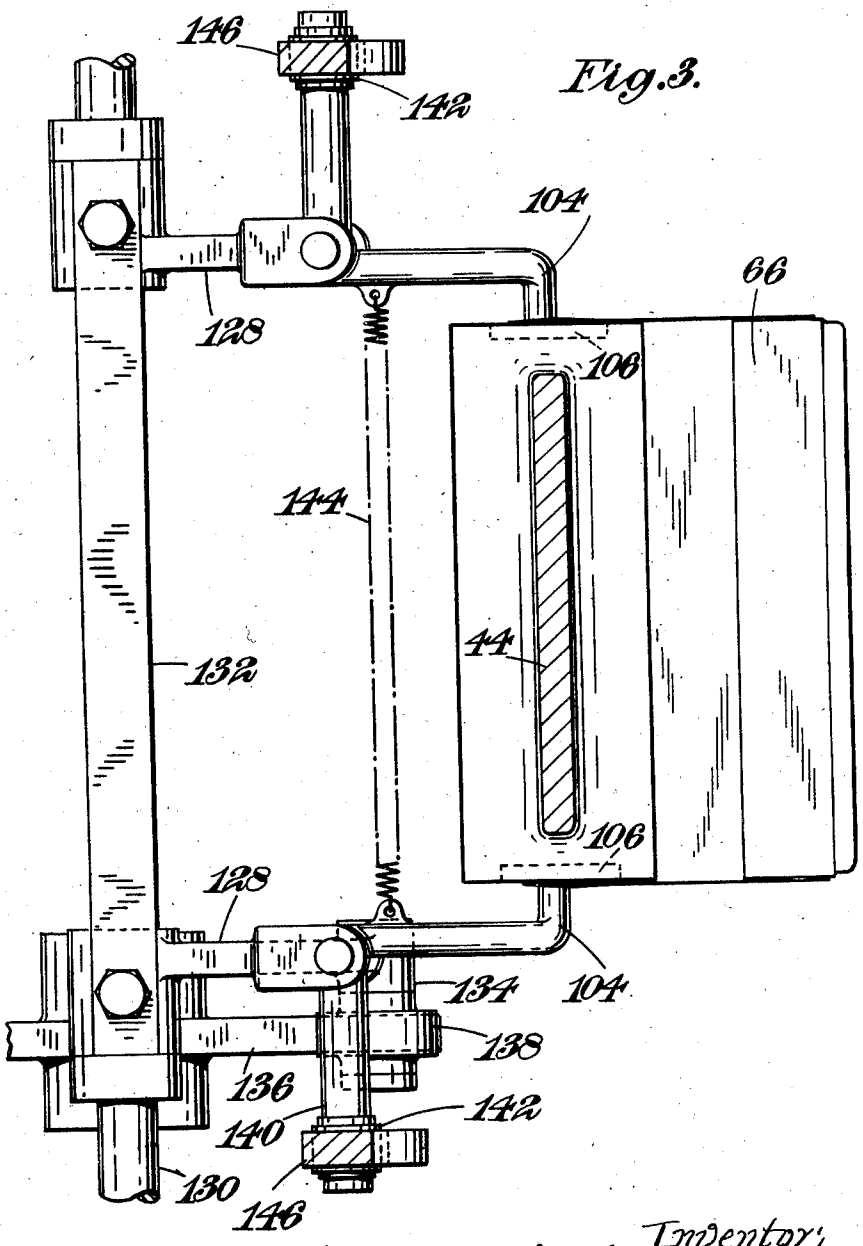

Fig. 3.

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MACHINE FOR FORMING BLANKS INTO CARTONS

Filed Nov. 27, 1937 4 Sheets-Sheet 4

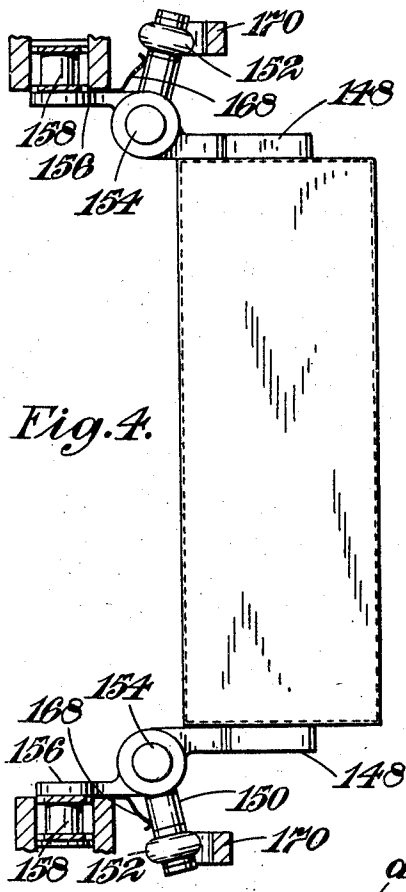

Fig.4.

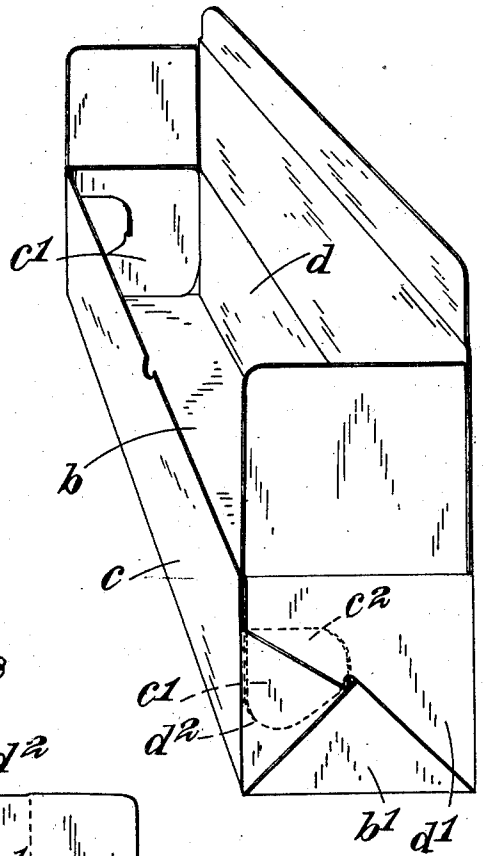

Fig.6.

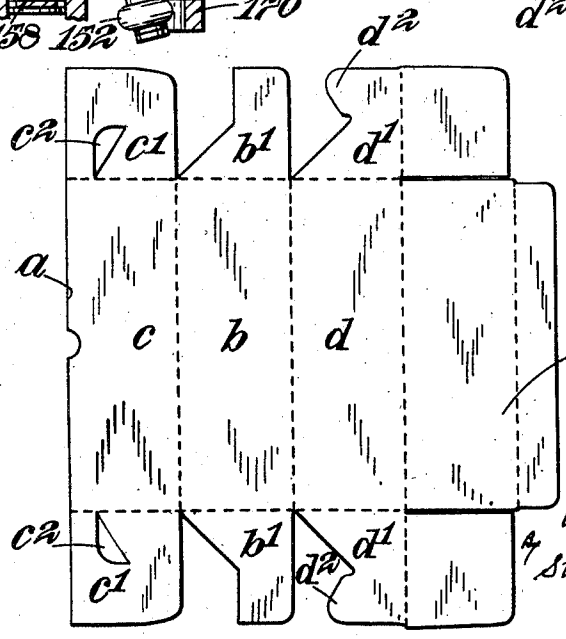

Fig.5.

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UNITED STATES PATENT OFFICE

2,146,407

MACHINE FOR FORMING BLANKS INTO CARTONS

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Application November 27, 1937, Serial No. 176,858
In Great Britain December 5, 1936

5 Claims. (Cl. 93—51.1)

This invention is for improvements in machines for forming blanks into cartons.

An object of the invention is to provide a carton-forming machine which can operate, with efficiency and reliability, at a higher speed than has been found possible with carton-forming machines as heretofore constructed.

In the machine hereinafter described in greater detail as embodying features of the present invention, a series of forming blocks is moved in succession past folding devices by which a cut-and-scored blank is folded into U-shaped formation about three sides of each of the forming blocks. End sections of the blank projecting beyond the ends of the forming block are folded, by other folding devices, one after the other upon the ends of the forming block. Each of the last-folded end sections is then moved in substantially its own plane by a push-back member to bring a tab upon it adjacent a slot formed in the first-folded end section. The last-folded end section is then moved back again by a push-forward device thereby causing the tab to enter the slot and thus lock all three folded end sections in their folded condition. The entry of the tab into the slot is assisted by a pressing finger which, at the appropriate time, bears upon the tab and forces it toward the end of the block, the block having at each of its ends a recess into which the tab can enter. After each blank has been folded upon its forming block, it is carried by the block to a station at which the blank is gripped at its folded ends by an ejecting device. The ejecting device is at this time travelling in the same direction as but faster than the forming block, with the result that the blank gripped by the ejecting device is stripped from off the forming block. Later in the operation of the machine, the ejecting device releases its grip upon the blank which then is received by a conveyor or other device provided for its reception.

The machine above-mentioned as embodying features of the present invention will now be described by the aid of the accompanying drawings, and the features of the invention will be pointed out in the appended claims.

In the drawings:—

Figure 1 is a sectional side elevation on the line 1—1 of Figure 2 of the said machine;

Figure 2 is an end elevation of parts seen in Figure 1;

Figure 3 is a detail of pressing fingers hereinafter referred to;

Figure 4 is a detail on a blank-ejecting device of the machine;

Figure 5 shows a cut-and-scored blank, a succession of which is presented to the machine; and

Figure 6 is a perspective view of a carton which has been formed by the machine from a blank such as is shown in Figure 5.

The main frame of the machine illustrated in the drawings comprises two side frame 10 and 12 in which are bearings for a main shaft 14 which is rotated continuously from any convenient source of power. Secured to the main shaft 14 is a sprocket wheel 16 which is connected by a sprocket chain 18 to a sprocket wheel 20 fast upon a shaft 22 rotatable in bearings in the side frames 10, 12. The shaft 22 has fast upon it a gear wheel 24 in mesh with a gear wheel 26 secured to a shaft 28 supported in bearings in the side frames 10, 12. Fast upon the shaft 28 are sprocket wheels 30, 32 connected respectively by sprocket chains 34, 36 with sprocket wheels 38, 40 secured to a shaft 42 carried in bearings at the upper ends of the side frames 10, 12. A number of cross-bars 44 (six in the example illustrated) are attached at their ends to equally-spaced parts of the sprocket chains 34, 36, each of which cross-bars is provided with a forming block 46.

From the foregoing description it will be appreciated that with the main shaft 14 rotating in the direction indicated by the arrow on the sprocket wheel 16 (Figure 1) the forming blocks 46 travel in an endless path, those at the right in Figure 1 moving downwardly. The forming blocks during their vertical movements are guided and steadied by guide channels 47 secured to the side frames 10, 12 within which guide channels are received, parallel-sided projections 48 (Figure 2) located at each end of each of the cross bars 44.

Each forming block 46 during its downward movement passes between a pair of longitudinal folding elements 50, 52 (Figure 1). The rear folding element 50 is constituted by the upper edge of a vertical folding member 54 carried upon cross-bars 56, 58 the ends of which are secured in the side frames 10 and 12, and the front folding element 52 is formed by the edge of a bent-over portion at the upper end of a plate 60 mounted upon cross-bars 62, 64 extending between and secured to the side frames 10 and 12.

A cut-and-scored carton-blank 66, Figure 5 (which will be one of a series of blanks fed in succession to the machine) is fed, by any convenient means, on to a support which comprises a front

ledge 68 (formed by the said bent-over portion of the plate 60) and a rear plate 70 which is secured to the side frames 10 and 12. The blank 66 is correctly positioned in the path of travel of the forming blocks 38 by the aid of an end stop 72 formed by a turned-up part of the ledge 68 and side gauges 74 (Figure 2) mounted upon the plate 70; the blank 66 being correctly positioned when located between the side gauges 74 with its edge a (Figure 5) resting against the end stop 72. During the feed movement of the blank 66, the lateral marginal portions thereof are supported, as the blank crosses the gap between the folding elements 50, 52, by a pair of support members 76, the upper ends of which at that time, are located adjacent said gap, one at each side of the path of travel of the forming blocks 46. The support members 76 have also a folding function as presently will be explained. The support members 76 are arranged upon a rocking frame 78, which is loosely mounted upon a rock-shaft 79 carried in bearings in the side frames 10 and 12. An arm 80 on the frame 78 is rigidly connected by a bolt 81 with one arm 82 (Figure 2) of a two-arm lever the hub of which is loosely mounted upon the rock-shaft 79. The other arm 83 of said two-armed lever is coupled by a link 84 to the arm 86 of a two-armed lever the other arm 88 of which carries a cam roll which, under the action of a spring (not shown), bears against a cam 92 on the main shaft 14.

In the operation of the machine, the support members 76 are moved by the cam 92 to the position indicated in Figure 1 after the blank 66 has been fed into position across the gap between the folding elements 50, 52. A forming block 46 in its downward movement then engages the blank 66 and by the aid of the folding elements 50, 52 folds the bottom longitudinal section b (Figure 5), the forward longitudinal section c and the rearward longitudinal section d of the blank into U-shaped formation on the bottom and corresponding sides of the forming block. At this time in the operation, the end sections b', c', d' of the corresponding longitudinal sections, b, c, d project beyond the respectively adjacent ends of the forming block. Later in the operation, the end sections b', c', d' are folded over upon the ends of the downwardly moving forming block in the manner now to be explained.

The end sections c' are first folded over the respectively adjacent ends of the forming block by the support members 76 which for this purpose are moved rearwardly under the action of the cam 92. The end sections b', by the downward movement of the forming block, are next folded upwardly over upon the end sections c' by stationary folders 94, 96 secured respectively to the folding member 54 and the cross-bar 62. While the end sections b', c' are being thus folded, the end sections d' are prevented from moving forwardly and thus colliding with the sections b', c' by means of a pair of fingers 98 which are mounted upon the side gauges 74 and project towards each other, in position to engage the sections d'. Continued downward movement of the forming block 46, brings the end sections d' into engagement with a pair of stationary curved folders 100 which are formed integral with and one at each side of the folding member 54. These folders 100, as the forming block moves down past them turn the end sections d' inwardly and fold them upon the already folded end sections b', c'. As shown in Figure 5, the end sections d' are each provided with a tab-shaped portion d^2. This tab portion d^2 is adapted to enter a slot c^2 formed in the associated end section c' thereby to lock the end sections c', d', in their folded condition and also to lock, in that condition, the associated end section b' which lies between the end sections c' and d'. In order to cause the tabs d^2 to enter the slots c^2, the end sections d', together with the longitudinal section d, are pushed back, as shown in Figure 1, by a pair of push-back members 102 until the ends of the tabs d^2 are over the slots c^2, the ends of the tabs d^2 are next pressed into the slots c^2 by a pair of pressing fingers 104, the forming block 46 having a recess 106 in each of its end portions to facilitate this operation, and finally the end sections d^2, together with the longitudinal section d, are pushed forward again, by a push-forward device 108, thus causing the tabs d^2 to enter fully into the slots c^2 and lock the end sections together as shown in Figure 6. It will be noted from an inspection of Figure 1, that while the end sections d^1 are pushed back as above described their upper ends are still engaged by and under control of the lower ends of the curved folders 100. If desired, the plate 60 against which the longitudinal sections c bear during the downward movement of the forming blocks 46, may be provided where necessary with side plates arranged to support the end sections c' in folded condition while the push-forward device 108 advances to cause the tabs d^2 to enter the slot c^2 in the sections c^1.

The push-forward device 108 consists of a plate supported upon arms 112 projecting from a hub 114 which is fast upon a shaft 116 carried in bearings in the side frames 10 and 12. The push-back members 102 are fast upon the shaft 79. Both of the shafts 79 and 116 are rocked to give the necessary movements to the parts they support, by means of a cam 118 fast upon the main shaft 14. The cam 118 actuates a two-arm lever 120—122 which is secured to the shaft 116, one arm 120 of which lever carries a roll which engages the cam 118 under action of a spring (not shown) while the other arm 122 is connected by a link 124 with an arm 126 fast upon the shaft 79.

The pressing fingers 104 (see Figure 3) are each pivoted between the tines of the forked end of a lever 128, each of which levers is loosely mounted upon a shaft 130 secured in the side frames 10 and 12. The two levers 128 are coupled together, so as to rock as one, by a bar 132 which is bolted to the hubs of these levers. One of the levers 128 has an arm 134 carrying a cam roll 138 which, under the action of a spring (not shown), engages a cam 136 fastened to the shaft 28. A roll 142 bounted upon an arm 140 projecting from the hub of each pressing finger 104, is maintained by means of a spring 144 against a stationary cam 146, each of which cams is carried by the cross-bar 64. It will be appreciated that the cam 136 on the shaft 28 and each of the stationary cams 146 are so shaped and arranged that as the forming block 46 descends the ends of the pressing fingers 104 under action of the cam 136 move downwardly with the forming block and remain in the neighbourhood of the slots c^2 in the sections c^1 of the carton blank, and also that the pressing fingers are moved inwardly towards the forming block by the cams 146 at the appropriate time to tuck the tabs d^2 into the slots c^2.

The machine is provided with an ejecting device for removing the folded cartons from the forming blocks. This device comprises a pair of gripping members arranged to grip a carton

66 which has been folded by the machine, at its folded ends and by moving in the same direction as but faster than the forming block to remove the carton from the block. Each gripping member is constituted by one arm 148 (Figure 4) of an elbow lever, the other arm 150 of which carries a cam roll 152, the purpose of which will presently be explained. Each elbow lever 148—150, is pivoted at 154 upon a support 156 attached to a sprocket chain 158. Each sprocket chain 158 passes respectively over one of a pair of sprocket wheels 160 (only one of which is shown in Figure 1) carried upon a shaft 162 extending between the side frames 10 and 12. The two chains 158 also pass, respectively, about two sprocket wheels 164 (only one of which is shown) which are secured to the shaft 22. The driving mechanism for the chains 158 and for the chains 34, 36, which support the forming blocks, is so arranged that the chains 158 travel faster than the chains 34, 36. Stationary guide channels 166 serve to guide and steady the chains 158 in their movements in a vertical direction. In the example illustrated herein, there are three sets of gripping members 148 which are spaced equally along the chains 158, with their path of upward movement adjacent the path of upward movement of the forming blocks upon which the cartons have been folded. Moreover, the timing of the parts is such that when a folded carton on its forming block arrives in or about the position marked A in Figure 1, it is gripped by one of the sets of gripping members 148, which thereupon, by reason of the fact that the set is travelling faster than the forming block, withdraws the carton from the forming block and completely removes it therefrom before the said set of gripping members and the block arrive in the positions marked B and C respectively in Figure 1.

The gripping members 148 are separated against the action of springs 168 (Figure 4) to straddle a carton on its forming block and then released to the action of said springs to grip the carton, by means of stationary cams 170 which are secured to a convenient part of the machine frame (see Figure 1) in a position in which the rolls 152 associated with the gripping members 148 travel over said cams as the gripping members approach and arrive at position A of Figure 1. After a carton has been withdrawn from its forming block, and has been carried over the shaft 162 at the top of the machine, another pair of stationary cams, one of which is indicated at 172 in Figure 1, engage the rolls 152 and cause the gripping members 148 to release the carton 66 which then falls—open side uppermost—upon a convenient receptacle (not shown), such as a travelling conveyor, which is provided for its reception.

Each of the carton blanks may be accompanied by an inner liner of waxed paper or similar material, which liner and its associated blank will be folded simultaneously by the folding devices of the machine.

I claim:

1. A machine for folding blanks into cartons, comprising a forming block, folding elements cooperating with said forming block for folding the portions of a blank which are to constitute the bottom and two sides of the carton against corresponding surfaces of the forming block, means for imparting relative movement between the forming block and folding elements to effect such folding operation, folding devices for folding in succession against another surface of said forming block the side end sections and the bottom end section of the blank, means for imparting relative movement between the forming block and said folding devices to effect such end folding operation, means for engaging a locking element on the outermost of said folded end sections of the blank with a co-operating locking element on the innermost of said folded end sections thereby to lock all said end sections of the blank in folded condition, a retaining element for engaging an end section of the blank, before the folding operation thereon and preventing it from colliding with the other end sections during the folding operation upon these sections, and means for imparting relative movement between said retaining element and the forming block to cause said element to release said non-folded end section for the folding operation thereon by the said folding devices.

2. A machine for folding blanks into cartons, comprising a forming block, folding elements cooperating with said block for folding the portions of a blank which are to constitute the bottom and two sides of the carton against three corresponding surfaces of the block, means for imparting relative movement between the forming block and the folding elements to effect such folding operation, folding devices for each end of the carton for folding against another surface of the block first a side end section of the blank, next a bottom end section of the blank, and finally another side end section of the blank, means for imparting relative movement between the forming block and said folding devices to effect such end folding operation, means for each end of the carton for engaging a locking element on one of said side end sections of the blank with a co-operating locking element on the other side end section of the blank thereby to lock the side end sections in folded condition with the folded bottom end section located between the side end sections, retaining elements for engaging the said side end sections which are folded finally before the folding operation thereon and preventing them from colliding with the other end sections during the folding operation upon these sections, and means for imparting relative movement between said retaining elements and the forming block to cause said elements to release said non-folded end sections for the folding operation thereon by the said folding devices.

3. A machine for folding blanks into cartons comprising a plurality of spaced forming blocks, a pair of folding elements, means for moving the forming blocks in succession between said folding elements to fold the portions of a blank which are to constitute the bottom and two sides of the carton against corresponding surfaces of each forming block as it moves between the elements, folding devices for folding in succession the side end sections and the bottom end sections of each of the said blanks, in overlying relation against the forming block, means for causing said folding devices to perform said end folding operation, means for engaging a locking element on the outermost of said folded end sections of each blank with a co-operating locking element on the innermost of said folded end sections thereby to lock all the end sections at each end of each carton in their overlying folded condition, and for each end of the carton a retaining element for engaging an end section of the blank, before the folding operation thereon and preventing it from colliding with the other end sections

during the folding operation upon these sections, and means for imparting relative movement between said retaining element and the forming block to cause said element to release said non-folded end section for the folding operation thereon by the said folding devices.

4. A machine for folding blanks into cartons comprising a plurality of spaced forming blocks, a pair of stationary folding elements, means for moving the forming blocks in succession between the folding elements to fold the portions of a blank which are to constitute the bottom and two sides of the carton against the corresponding surfaces of each block as it moves between the elements, a movable folding device, means for moving said device to cause it to fold at each end of the carton a side end section of the blank against an end surface of the forming block, stationary folding devices, spaced along the path of movement of the forming block, and operating by reason of movement of the forming block past them next to fold first the bottom end section and finally another side section against the end surface of the forming block upon which the first-named side end section has been folded, retaining elements for engaging the said side end sections which are folded finally before the folding operation thereon and preventing them from colliding with the other end sections during the folding operation upon these sections, and means for imparting relative movement between said retaining elements and the forming block to cause said elements to release said non-folded end sections for the folding operation thereon by the said folding devices.

5. A machine for folding blanks into cartons, comprising a forming block, folding elements co-operating with said forming block for folding the portions of a blank which are to constitute the bottom and two sides of the carton against corresponding surfaces of the forming block, means for imparting relative movement between the forming block and folding elements to effect such folding operation, folding devices for folding in succession against another surface of said forming block the side end sections and the bottom end section of the blank, means for imparting relative movement between the forming block and said folding devices to effect such end folding operation, means for engaging a locking element on the outermost of said folded end sections of the blank with a co-operating locking element on the innermost of said folded end sections thereby to lock all said end sections of the blank in folded condition, a retaining element for engaging an end section of the blank, before the folding operation thereon and preventing it from colliding with the other end sections during the folding operation upon these sections, means for imparting relative movement between said retaining element and the forming block to cause said element to release said non-folded end section for the folding operation thereon by the said folding devices, an ejecting device for removing formed cartons from the forming block comprising a pair of gripping members for gripping between them the carton by its folded end faces, means to cause said gripping members to approach each other thus to grip between them the end faces of the carton, means to move said members while gripping the carton away from the forming block to remove the carton therefrom and means acting thereafter to separate said gripping members to release the carton.

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