

July 9, 1963

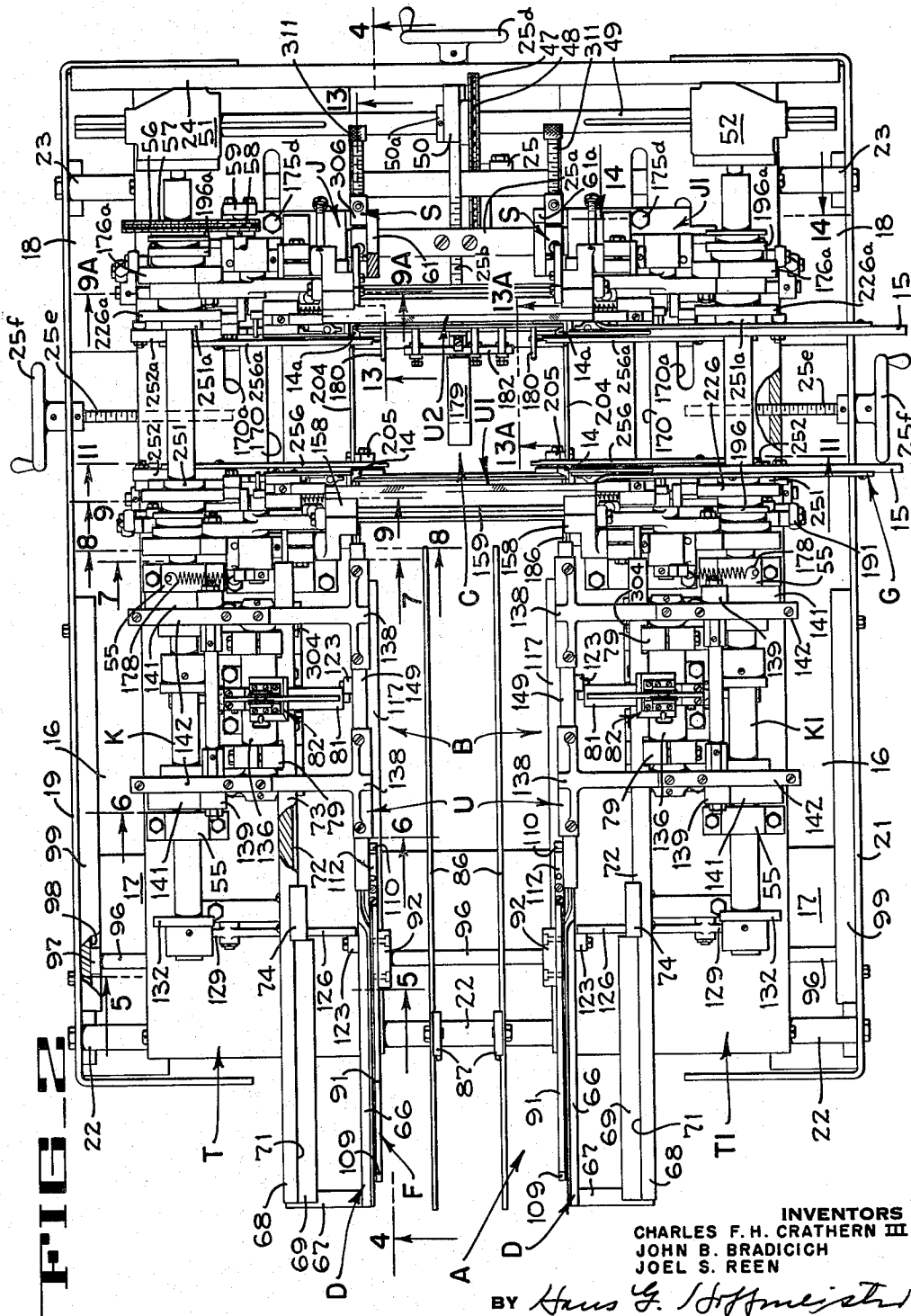
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3,096,692

BOX MAKING MACHINE

Original Filed March 21, 1961

16 Sheets-Sheet 2



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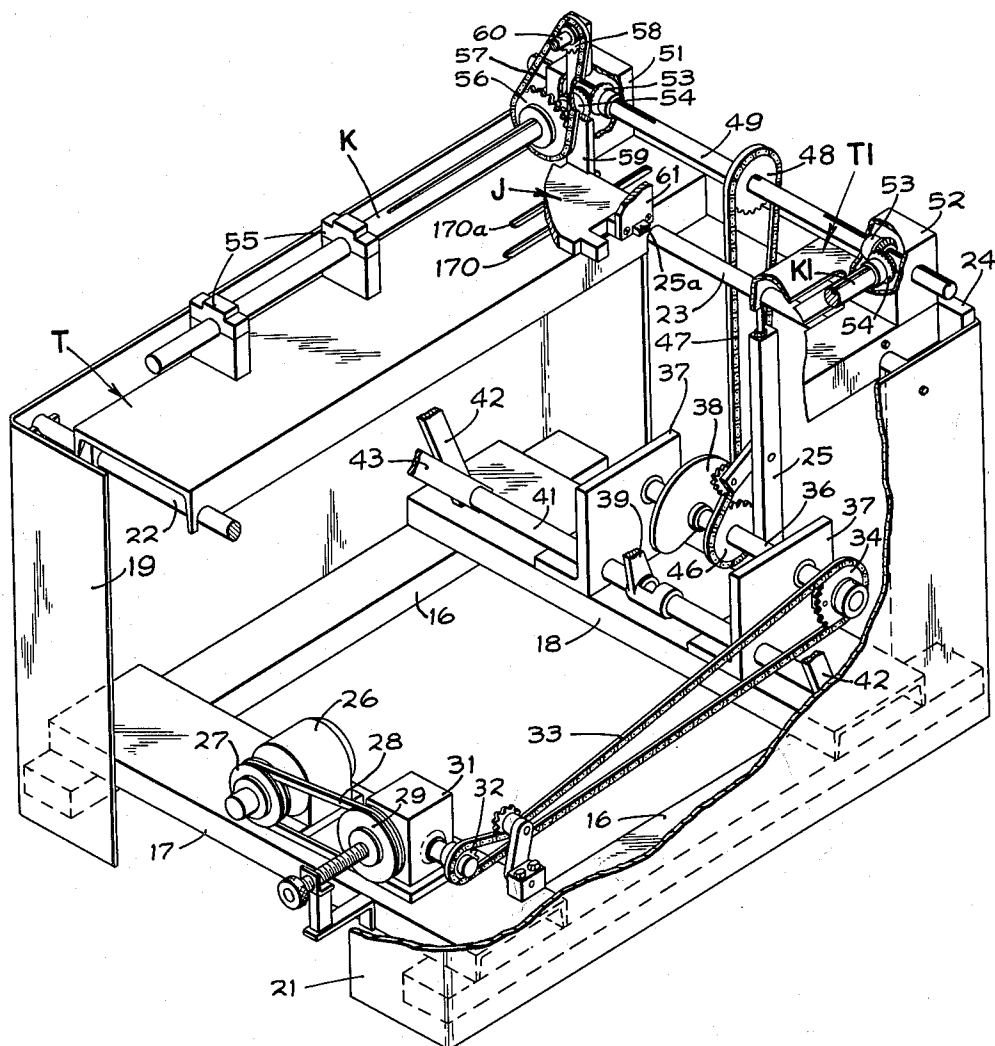
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FIG. 3



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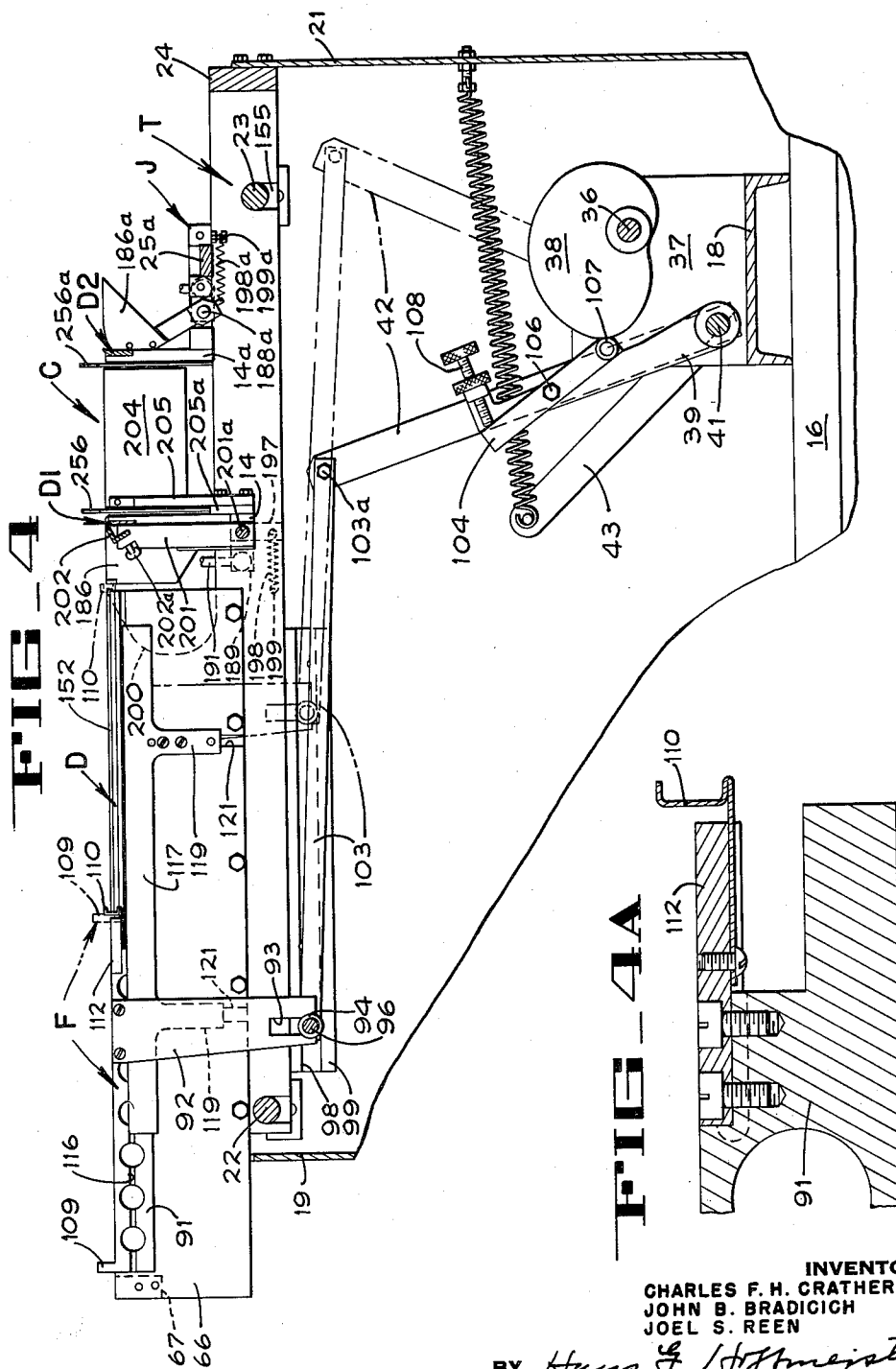
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FIG. 5

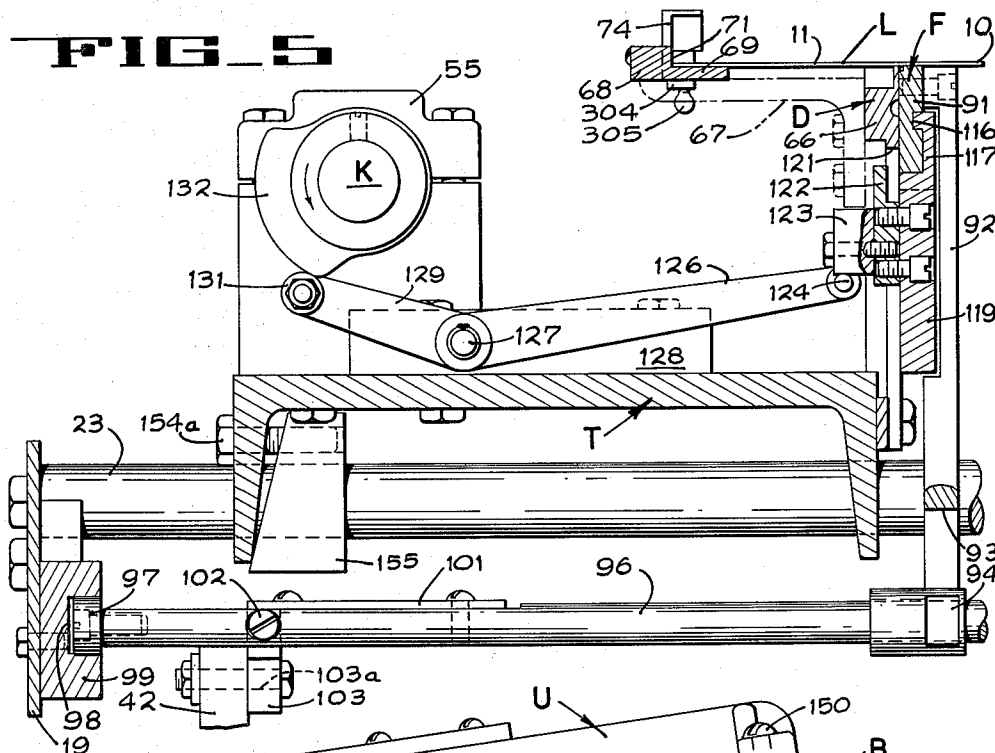
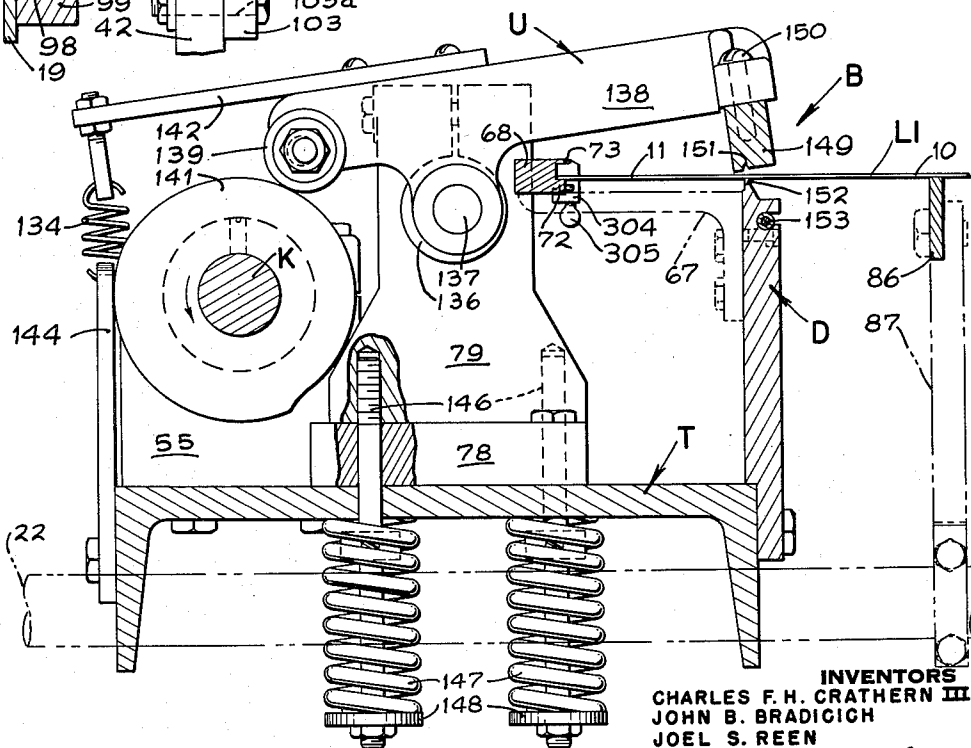


FIG. 6

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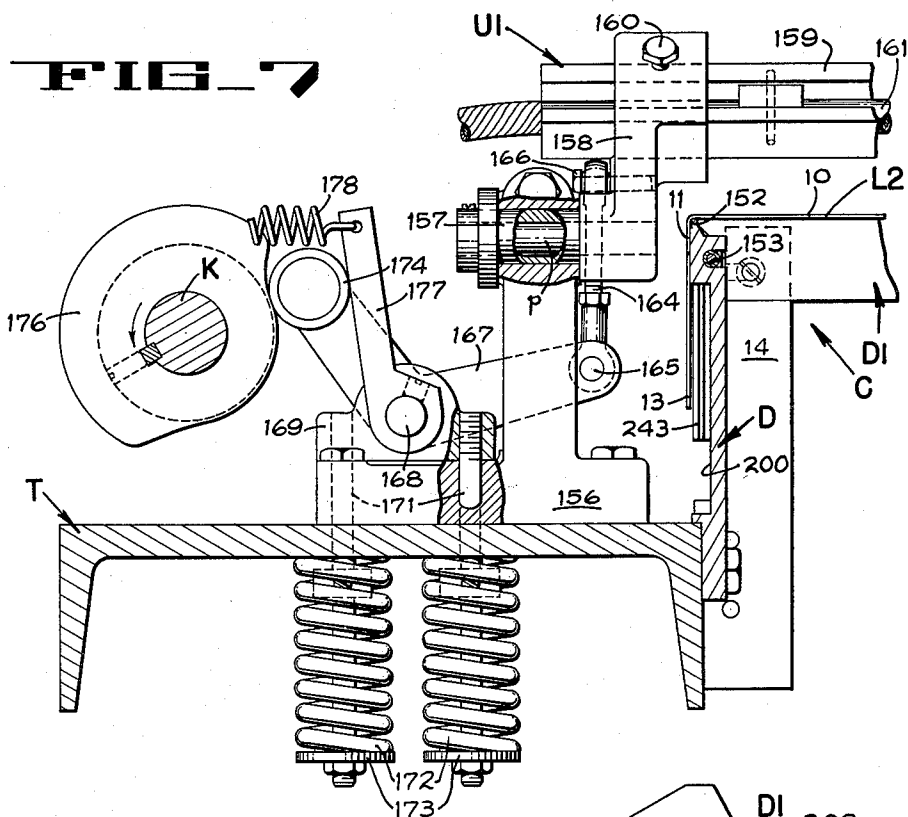
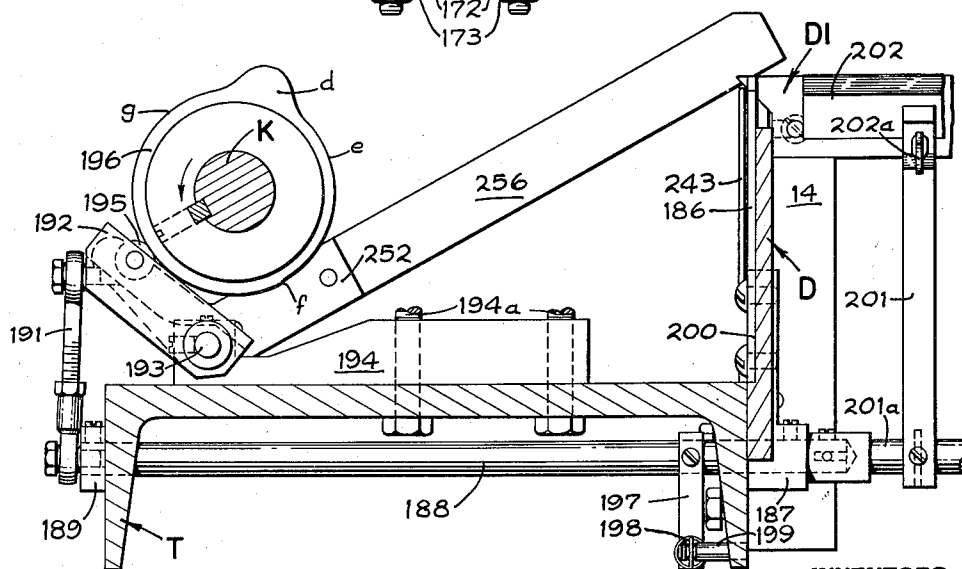
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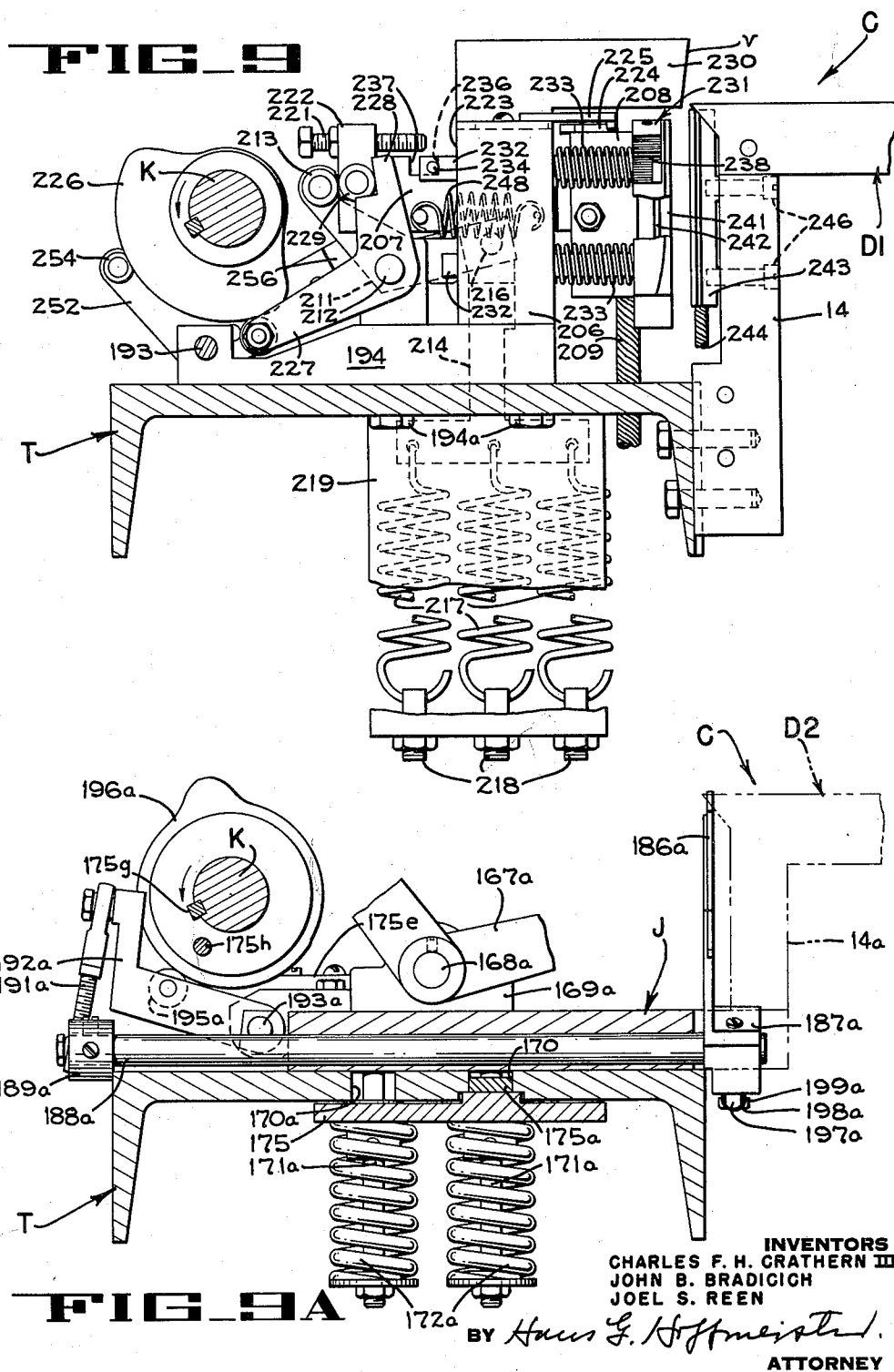


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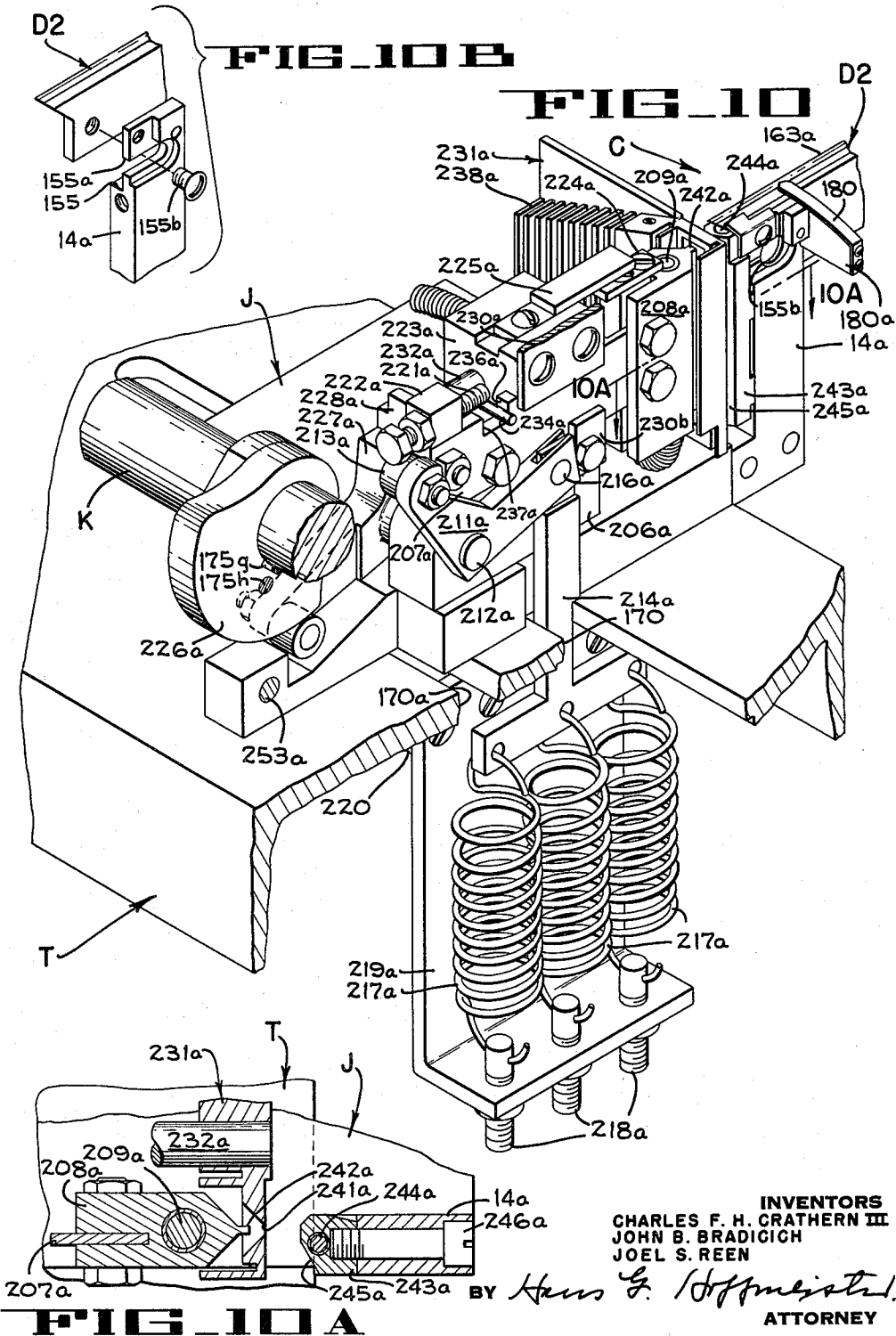
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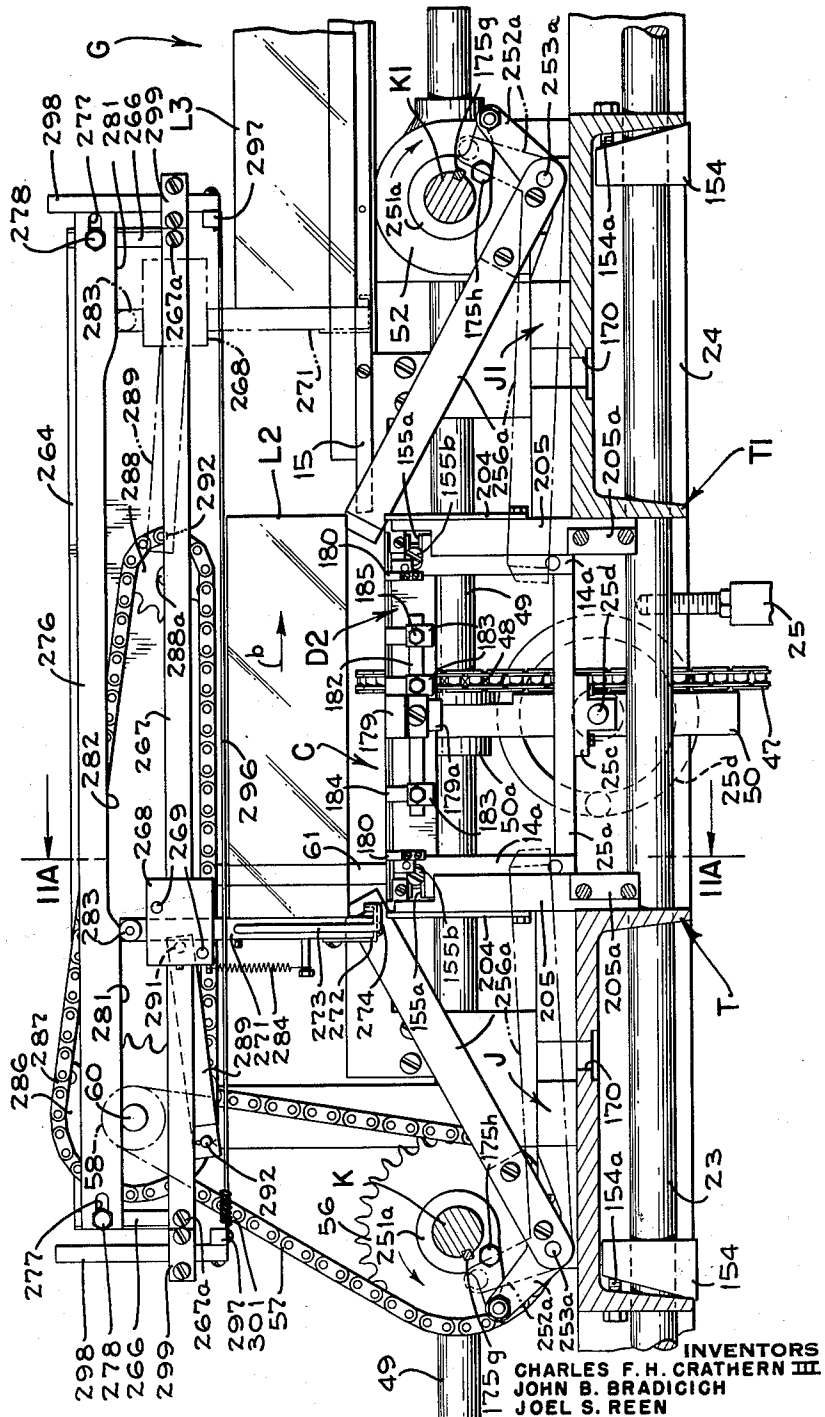
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FIG. 11



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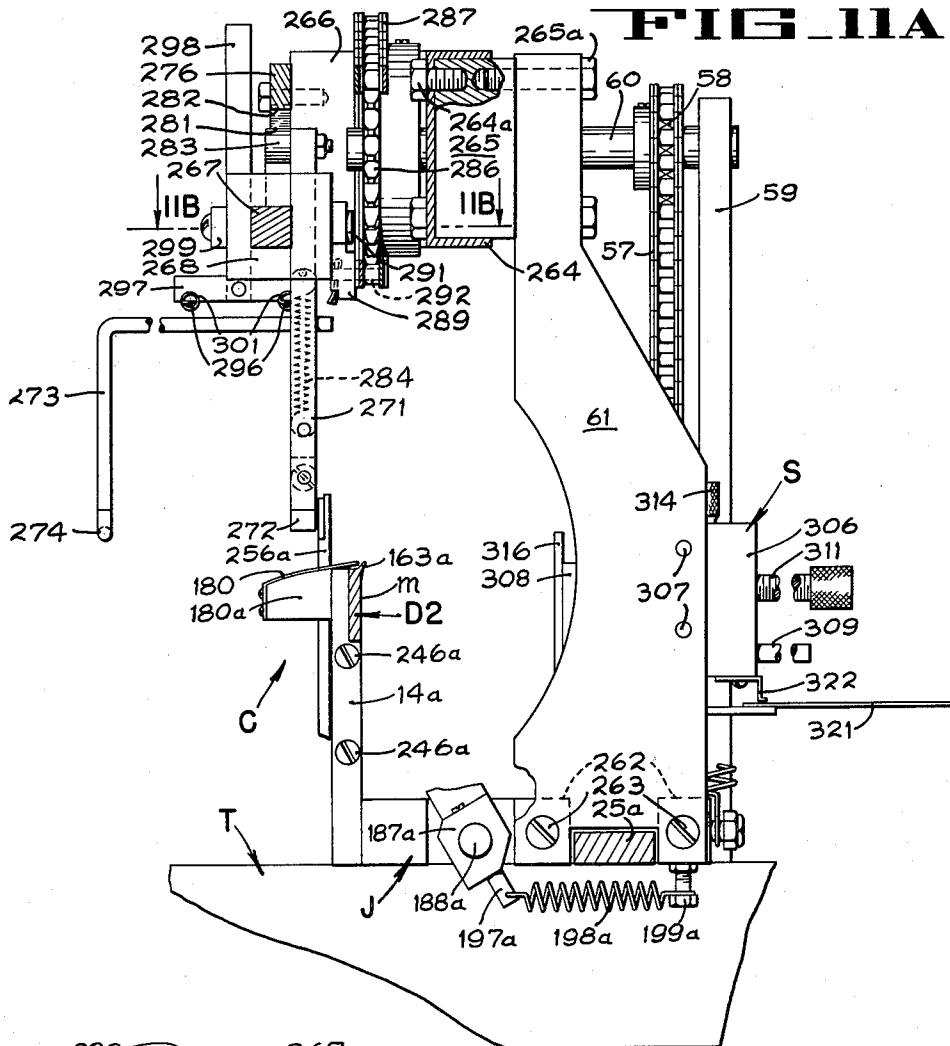
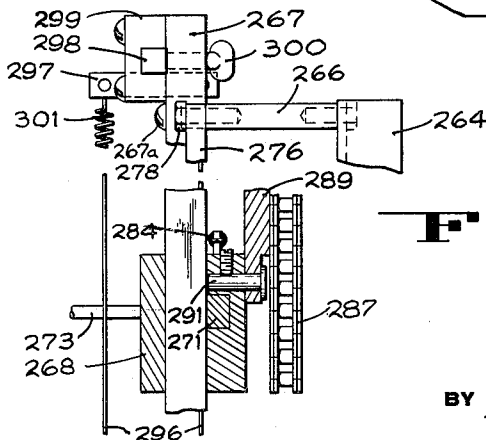
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FIG 13

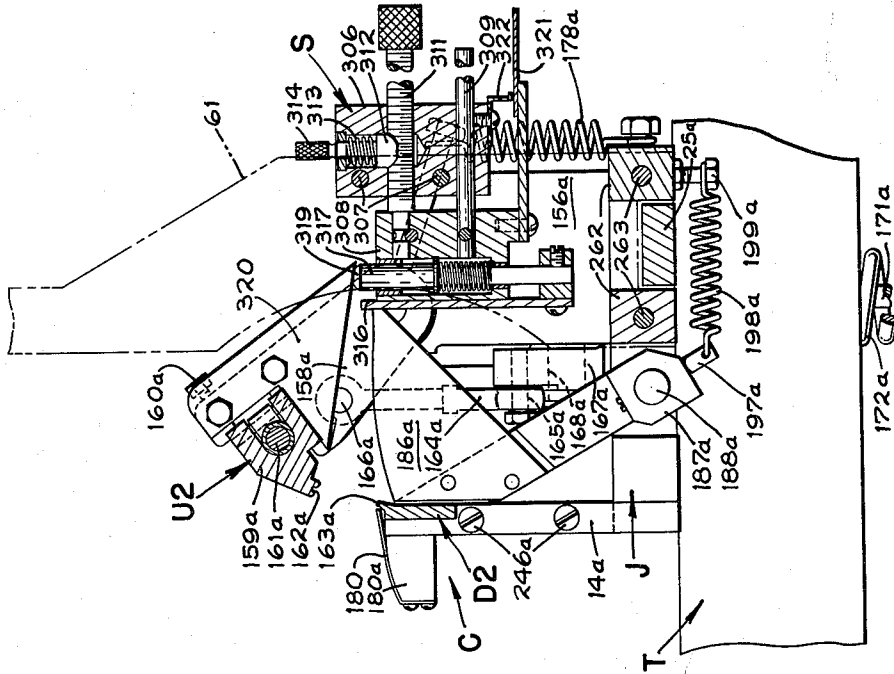
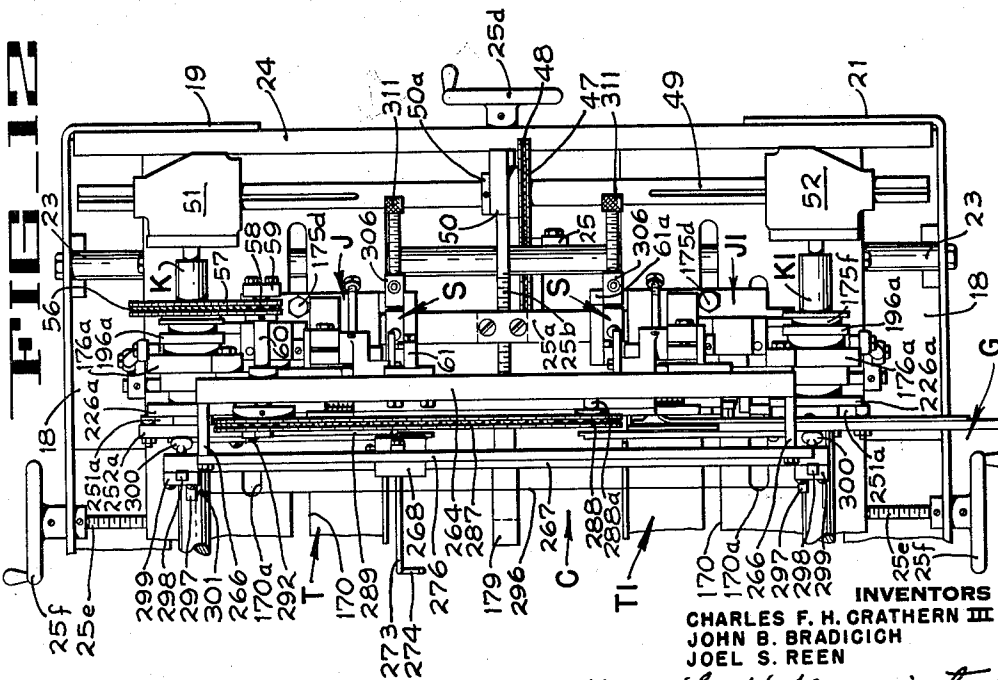


FIG 12



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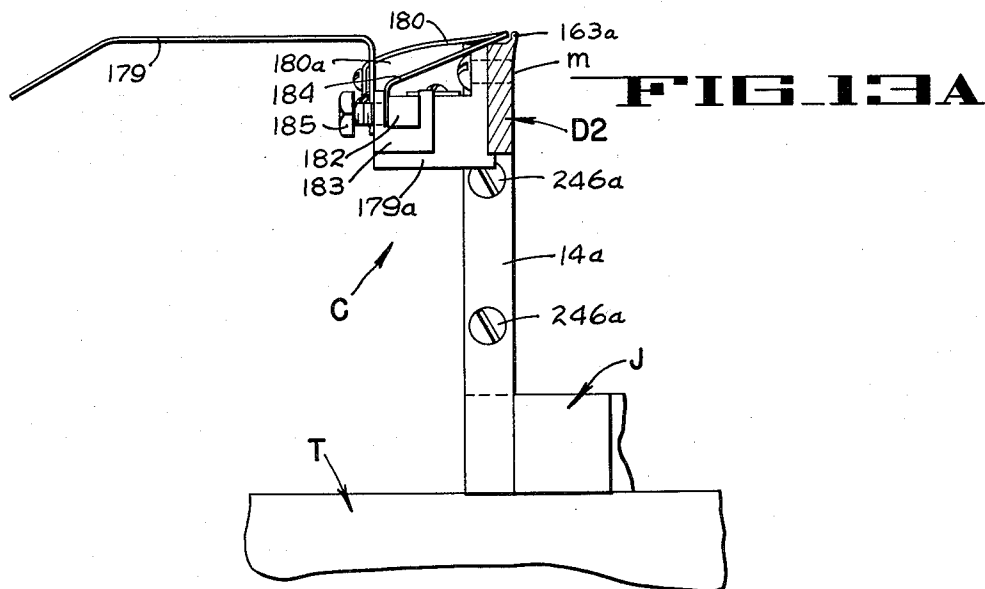
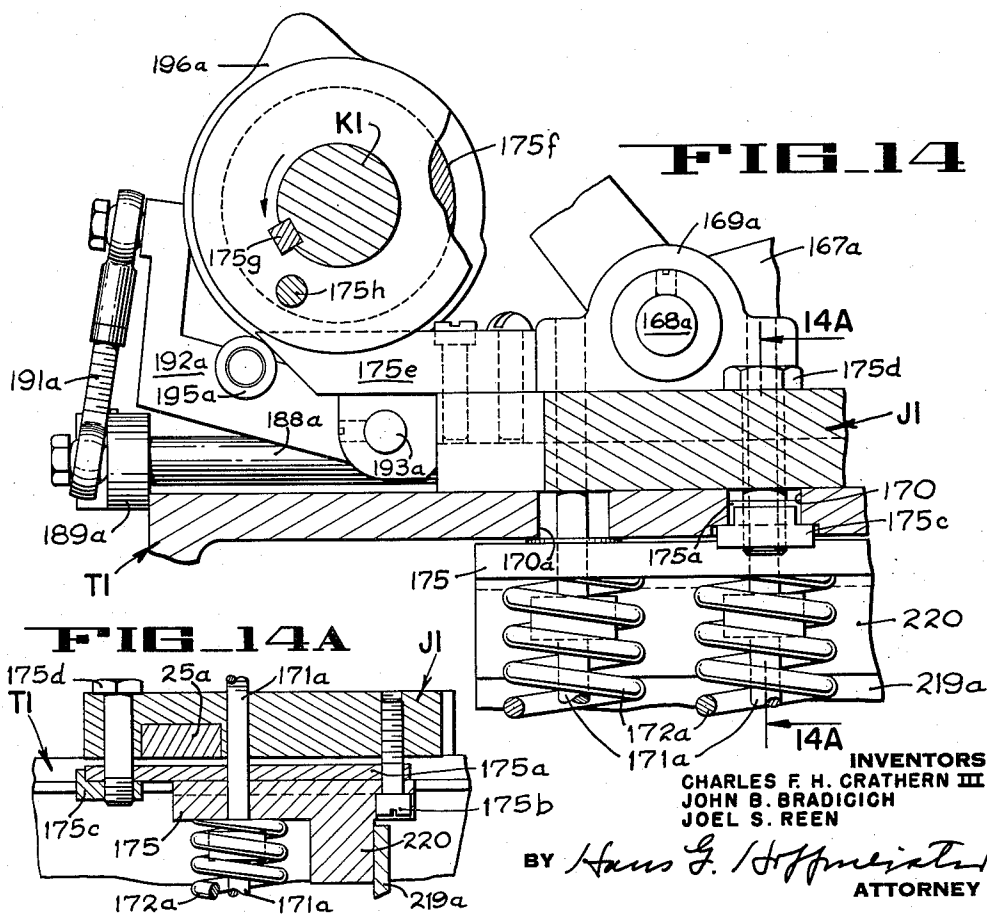
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BOX MAKING MACHINE

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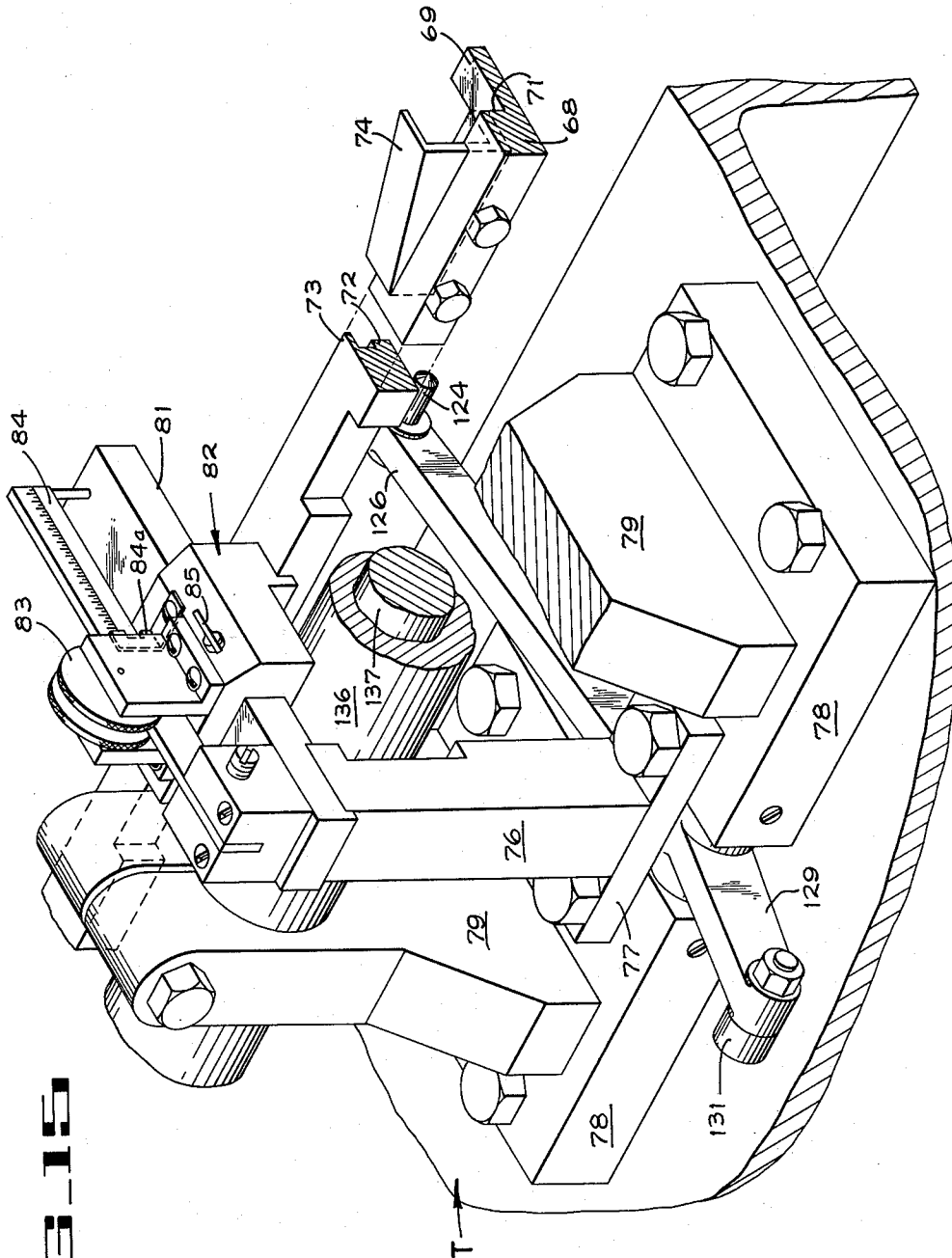


FIG. 15

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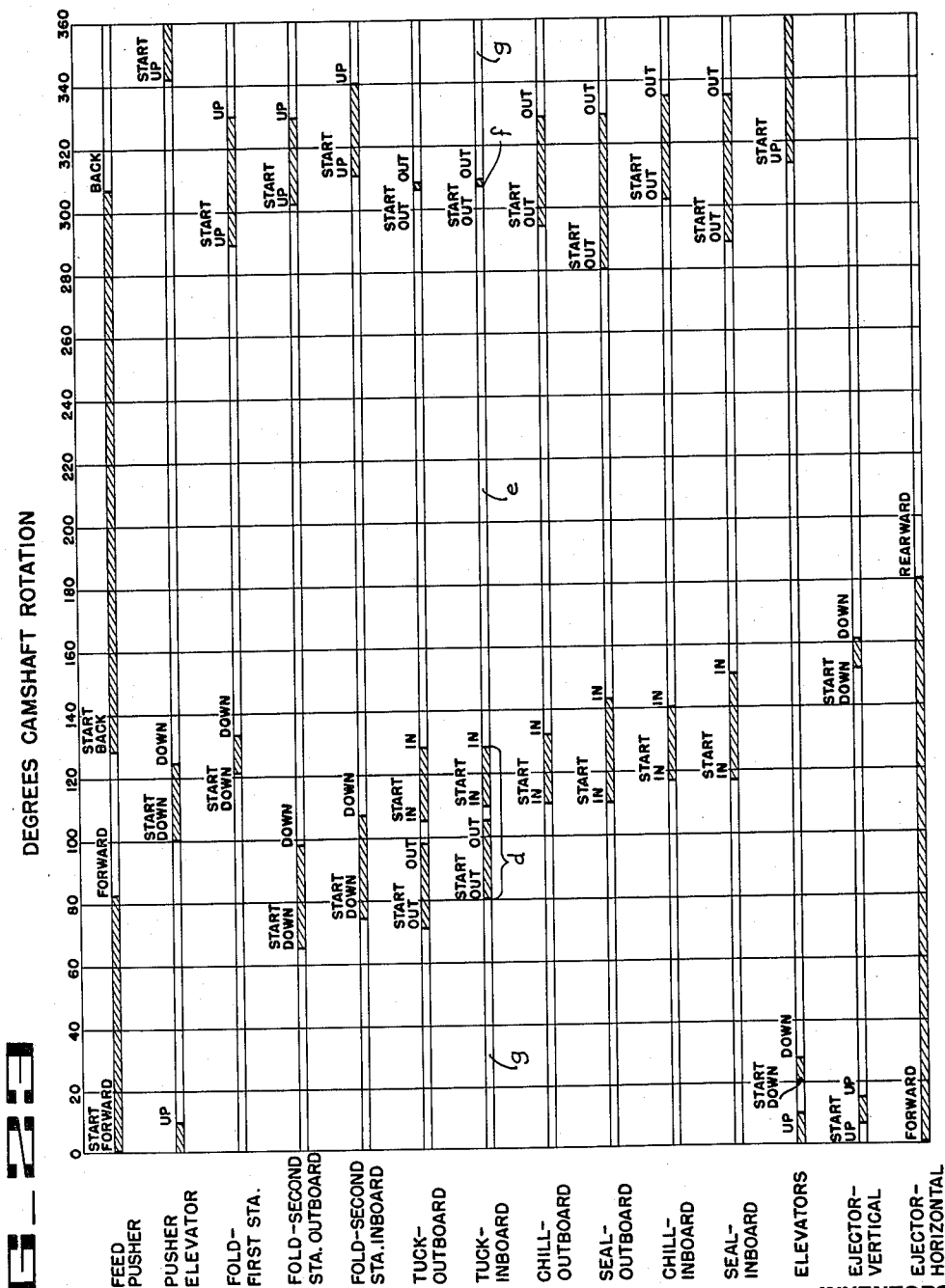
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3,096,692

BOX MAKING MACHINE

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Continuation of application Ser. No. 97,374, Mar. 21, 1961. This application Mar. 16, 1962, Ser. No. 182,156 35 Claims. (Cl. 93—49)

This invention relates to the art of carton or box making and more particularly to the folding up of box or carton components from previously cut blanks. Apparatus of the invention will be described wherein a box lid is folded up and the corners thereof sealed together from a pre-cut blank made of transparent thermoplastic material.

This application is a continuation of application Serial No. 97,374, filed March 21, 1961, now abandoned.

An object of the present invention is to provide apparatus for making rigid, rectangular, set-up type boxes or box lids having a top or bottom panel and side walls or flaps firmly and precisely united at the corners. One of the features of the present invention is that such lids or box sections can be made of thermoplastic or heat sealable material, and such lids will be precisely and accurately made despite the fact that material of this type is somewhat elastic and distortable, and that its finish is readily marred and its appearance can be spoiled by improper handling during manufacture.

Another object of the invention is to provide a machine which is automatic once it has been supplied with a series of blanks. In the size ranges normally employed in this art, the machine of the present invention is easily capable of producing box parts such as lids at a production rate of 1800 parts per hour.

Still another object of the invention is to provide a machine that provides in a simple manner adjustment for box length, box width, and box depth. It is a feature of the present invention that such adjustments can be performed quickly and easily.

Another object of the invention is to provide a box making machine of the character described which does not require forms, which forms must be changed for every size of box or lid manufactured by the machine. In the machine of the present invention only two simple strip dies need be changed to accommodate change in one dimension. Change in the other dimension requires no die changes.

Still another object of the invention is to provide a readily adjustable box forming machine of the type described which is simple and inexpensive in construction and which requires a minimum of floor space. A further object is to provide a construction that places a large majority of the moving parts in a relatively accessible easily reached position so that they can be readily adjusted, maintained and their operation checked from time to time.

Another object of the invention is to provide a box making machine that makes boxes or box lids from pre-cut and corner notched blanks, but which does not require scoring of the blanks.

A further object is to provide a machine of the type described suitable for producing full 90° folds of the sides or flaps and which will precisely maintain the folds during the sealing of the flaps together by means of corner tabs.

Another object is to facilitate transfer of partially folded blanks from a first to a second folding station without permitting the folded down flaps to catch or hang up during transfer.

Still another object is to provide a high production rate machine of the type described that requires but a single operator, who need only perform a very simple feeding

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operation to supply the machine with blanks one by one.

The manner in which these and other objects and advantages of the invention can be attained will be apparent from the following detailed description of the invention with reference to the accompanying drawings:

In the drawings:

FIG. 1 is a simplified perspective diagram showing the sequence of operations performed by the apparatus of the invention.

FIG. 2 is a plan of the apparatus with the ejector mechanism removed for clarity of illustration.

FIG. 3 is a fragmentary perspective showing the basic arrangement of the main frame and table parts and the drive train.

FIG. 4 is a longitudinal section taken on lines 4—4 of FIG. 2 showing the feed mechanism and the inboard and outboard tuck plates. In this figure as in other figures, parts not directly contributing to the operational step being illustrated in the figure have been removed or only parts thereof are shown for clarity.

FIG. 4A is a detail of the outboard pusher finger of the feed mechanism.

FIG. 5 is a transverse section taken on lines 5—5 of FIG. 2 showing mechanism for raising and lowering the feed or blank pusher mechanism.

FIG. 6 is a transverse section taken on lines 6—6 of FIG. 2 showing mechanism for raising and lowering one of the longitudinally extending upper folding dies disposed at the first folding station.

FIG. 7 is a transverse section taken on lines 7—7 of FIG. 2 showing mechanism for raising and lowering the inboard laterally extending upper folding die at the second folding station.

FIG. 8 is a transverse section taken on lines 8—8 of FIG. 2 showing mechanism for operating one of the inboard tuck plates.

FIG. 9 is a section taken on lines 9—9 of FIG. 2 showing an inboard sealing head, chill, and operating mechanism therefor.

FIG. 9A is a transverse section taken on lines 9A—9A of FIG. 2 showing drive mechanism for one outboard tuck plate.

FIG. 10 is a perspective of one of the outboard sealing heads and chills and the operating mechanism therefor.

FIG. 10A is a section taken on lines 10A—10A of FIG. 10 showing the relation of a sealing head and associated chill.

FIG. 10B is an exploded perspective showing mounting of a lateral die.

FIG. 11 is a transverse section of the entire apparatus taken on lines 11—11 of FIG. 2 showing elevator and ejector mechanism for the completed box lid.

FIG. 11A is a longitudinal section taken on lines 11A—11A of FIG. 11 showing the mounting and other parts of the ejector mechanism.

FIG. 11B is a fragmentary horizontal section of the ejector mechanism taken on lines 11B—11B of FIG. 11A.

FIG. 12 is a plan of the rearward end of the apparatus showing the ejector mechanism that has been removed from the plan of FIG. 2.

FIG. 13 is a section taken on lines 13—13 of FIG. 2 showing the outboard die assembly, tuck plate, and blank stop mechanism.

FIG. 13A is a section taken on lines 13A—13A of FIG. 2 showing the outboard lateral die and blank guiding fingers associated therewith.

FIG. 14 is a transverse section taken on lines 14—14 of FIG. 2 showing the cam shifting assembly.

FIG. 14A is a longitudinal section taken on lines 14A—14A of FIG. 14 showing a corner block mounting.

FIG. 15 is a fragmentary perspective showing one ad-

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justable side guide mechanism for the blanks as they are first placed in the machine.

FIG. 16 is a plan of a corner block assembly showing the sealing mechanism and the cam shifting construction.

FIG. 17 is a fragmentary longitudinal section taken on lines 17—17 of FIG. 16 further showing the construction of a corner block assembly.

FIG. 18 is a plan like that of FIG. 17 with the outboard upper die mechanism in place.

FIG. 19 is a fragmentary section through the upper and lower dies at the first folding station closed on a blank.

FIG. 20 is a section showing the corner of a beaded blank free of the first folding dies.

FIG. 21 is a section like FIG. 20 showing a modified set of dies that make unbeaded corners.

FIG. 22 is a section showing the corner of a beaded blank free of the first folding dies.

FIG. 23 is a timing diagram for the apparatus based upon degrees of camshaft rotation.

In the detailed description of the apparatus of the invention that follows, the sequence of operation and the frame and drive train assembly will be discussed in general. There will follow a detailed explanation of the construction and operation of operating units of mechanism at the various stations, the plan of the detailed description being in general that of tracing one blank through the machine. There will then be presented a brief summary of the entire operation, following the same plan, concluding with a recapitulation of the major adjustments for box size.

Sequence of Operations

The schematic diagram of FIG. 1 has been highly simplified, and except for the feed carriages, none of the moving parts of the apparatus have been illustrated in the figure. At the forward, or blank receiving end of the machine, there is a registration station A in which previously notched and tabbed unfolded blanks L are placed one by one by the operator. The feed mechanism, indicated generally at F, advances the unfolded blank L along the pair of longitudinally extending lower folding dies D. As indicated in the figure, the blanks have a top panel 10, it being remembered that the production of a box lid from transparent plastic material is illustrated by way of example. The blank L also has longitudinally extending end sidewalls or flaps 11, and laterally extending sidewalls or flaps 12. Although the illustrated blank orientation is not critical to the present invention, the machine as illustrated is set up to receive blanks in which the longest dimensions of the blank are the lateral dimensions so that as mentioned above the longitudinal flaps or panels 11 may be considered to be the end flaps of the completed box lid. Projecting laterally from the lateral flaps 12, are tabs 13 which form sealing tabs for the corners of the folded box lid.

Blanks fed from the registration station A are delivered to the first folding station, indicated generally at B. A partially folded blank L1 is shown in position at this station, as it appears just after performance of the first folding operation by mechanism not illustrated in the diagram. As seen in FIG. 7, at the conclusion of the first folding operation, the longitudinal flaps 11 and the tabs 13 of the blank have been folded down against the outside walls of the longitudinally extending lower die D.

The same blank feeding mechanism, indicated generally at F, that advances the blank L from the registration station A, to the position of blank L1 at the first folding station D, advances the blank L1 from the first folding station to the position of a blank L2 at a second folding station, indicated generally at C. At the second folding station C are laterally extending lower dies D1 and D2 which will be referred to as inboard and outboard laterally extending lower dies, respectively, and a similar designation will be applied to mechanism associated with these lower dies D1 and D2. At the second folding station C, the lateral flaps or sidewalls 12 are folded down

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by mechanism not shown in the diagram, which brings the tabs 13 against the end flaps 11. After this folding operation of the flaps 12 has been completed, sealing and chill means (not shown) press the tabs 13 against vertical anvils 14 at the inboard lateral die D1, and anvils 14A at the outboard lateral die D2. Heat is applied to heat seal the tabs 13 against the longitudinally extending flaps or panels 11 of the box lid. The completed box lid L2 is lifted vertically by means not illustrated in the diagram, to a position illustrated in broken lines. Ejector mechanism (not shown) then moves the completed box lid L2 laterally of the apparatus to a discharge station G, wherein a completed blank L3 is shown resting on support rails 15. As each completed box lid is moved laterally of the machine by the ejector mechanism, the lid L2 just completed pushes the previously formed box lid L3 clear of the discharge station G and onto a suitable conveyor (not shown) which forms no part of the present invention.

The Frame and Drive Train

Referring primarily to FIGS. 2 and 3, FIG. 3 being a simplified schematic perspective diagram, the frame structure of the apparatus includes a pair of laterally spaced horizontally extending bed plates 16, on which are mounted a front cross plate 17 and a rear cross plate 18 which may be of channel section. Partly enclosing the apparatus are a left sheet metal side plate 19 and a right sheet metal side plate 21, on which plates are mounted a front cross rod 22 and a rear cross rod 23. A rear cross member 24 also connects side plates 19 and 21. There is an intermediate support or jack plate 25 for the rear cross rod 23.

An important feature of the machine are two longitudinally extending channel members, to be referred to as tables T and T1. Table T1 has been almost completely broken away in FIG. 3. These tables mount a large share of the drive and other operating apparatus. The lateral spacing of the tables represents one of the adjustments of the machine for box lid size, box lid or top panel length, in the example given. Mounted adjacent the rear of the machine are corner blocks J and J1, with only the corner block J appearing in the diagram of FIG. 3. These corner blocks are adjustable longitudinally of the machine, and their position on the tables T and T1 determine another dimension of the box lid, the box lid or top panel width in the present example.

The corner blocks J and J1 are connected by a cross bar 25a for simultaneous movement along the tables T and T1. As seen in FIG. 2, there is a corner block adjusting screw 25b threaded into a nut 25c on cross bar 25a. Rotation of a hand wheel 25d mounted on the screw 25b causes the aforesaid longitudinal motion of the corner blocks J and J1, and mechanism mounted thereon that does not appear in the figure. Means are also provided for manually moving the tables T and T1 laterally, in the form of adjusting screws 25e (FIG. 2) threaded onto an outer flange of each table. Screws 25e mount adjusting hand-wheels 25f. As mentioned, the lateral adjustment of the tables determine the box lid or top panel length in the example.

The drive train, the basic elements of which appear in FIG. 3, is quite simple, and except for reciprocation of the blank feeding mechanism, most of the operating parts (not shown in FIG. 3) are mounted on tables T and T1 where they are readily accessible. Referring to FIG. 3, the drive train includes a motor 26 mounted on cross plate 17, the motor driving a V-belt pulley 27, which drives a V-belt 28, that in turn drives an adjustable pulley 29. The pulley 29 is of the conventional type wherein the pulley faces can be relatively adjusted to provide for a limited speed adjustment. The pulley 29 drives into a gear box 31 which in turn drives a sprocket 32, around which is trained a chain 33, that drives a sprocket 34, keyed to a countershaft 36 at the rear of the machine. Countershaft 36 rotates in suitable bearings mounted in

laterally spaced upstanding plates 37, the plates being fixed to the rearward cross plate 18. Keyed to countershaft 36 is a cam 38, which causes longitudinal reciprocation of the feed mechanism. As seen in FIG. 4, the cam 38 operates a crank or lever 39 mounted on a rockshaft 41, and the rockshaft oscillates a pair of feeder operating levers 42 mounted on the ends of the rockshaft 41. The levers 39 and 42 have been broken away in FIG. 3, as has a spring return lever 43, also fixed to rockshaft 41.

In addition to turning cam 38 for reciprocating the feed mechanism by means of rockshaft 41 and associated levers, the countershaft 36 drives the rest of the mechanism of the apparatus. A sprocket 46 (FIG. 3) is mounted on the countershaft 36, and drives a chain 47 trained around a sprocket 48 keyed to an upper countershaft 49. As seen in FIGS. 2 and 11, the countershaft 49 is centrally supported by a bearing block 50 extending forwardly from cross member 24, and the shaft is held from lateral motion by a collar 50a on one side of block 50 and the sprocket 48 on the other side. Countershaft 49 enters and drives a left-hand, right angle gear box 51, and a right-hand, right angle gear box 52, these gear boxes being mounted on tables T and T1, respectively. In each gear box, bevel gears 53 are keyed to the countershaft 49 which bevel gears drive bevel gears 54 keyed to main camshafts K and K1 extending longitudinally along the tables T and T1, respectively. These camshafts are mounted in bearing blocks 55 fastened to the tables T and T1. The cams mounted on the camshafts, and associated mechanisms also mounted on the tables T and T1, have been omitted from FIG. 3 in order to clearly disclose the basic drive train.

In order to remove the completed box lid, ejector mechanism is provided for raising and transporting completed blanks from a position at the second folding station C to the discharge station G, previously described in reference to FIG. 1. The lateral transporting or ejecting mechanism is driven by a sprocket 56 slidably keyed on camshaft K. Sprocket 56 drives a chain 57, which in turn drives a sprocket 58 mounted on a post 59 extending vertically upward from corner block J. The sprocket 58 drives a longitudinally extending shaft 60 which operates the ejector mechanism, as seen in FIG. 11 and in other figures, and to be described later. The shaft 60 has been broken away in FIG. 3 for clarity of illustration. Also shown broken away in FIG. 3, and attached to corner block J, is another upright 61 which, as will be seen, serves to further mount the ejector mechanism. Upright 61 is seen in full in FIG. 11a.

This completes the general description of the operation and basic construction of the apparatus. A detailed description and explanation of the operation of the apparatus at each of the stations previously mentioned will now be presented.

The Registration Station

Elements of the registration station A are seen in FIGS. 2, 4-6, and 15. When the blanks L are initially placed in the machine at the registration station A, the blanks are partially supported by forwardly projecting extensions 66 of the lower dies D. These extensions are also indicated in FIG. 1. Brackets 67 extend laterally outwardly from the forward ends 66 of the lower dies D, to adjustably support blank side guides 68, extending longitudinally of the apparatus. The side guides 68 support the longitudinally extending flaps 11 of the blanks. The side guides 68 have lower blank supporting flanges 69 that slidably rest on the laterally extending brackets 67, as indicated in FIG. 5. The brackets 67 are shown in broken lines in this figure because of the location of the section of the figure. The side guides 68 are formed with blank guiding shoulders 71 which determine the lateral position of the blanks. As seen in FIGS. 6 and 15, the rearward portions of the side guides 68, disposed at the first folding station, are

provided with narrow flanges 72 which serve to releasably support the flaps 11 before they are bent down by the folding mechanism (yet to be described) disposed at the first folding station. Upward bowing of the flaps 11 of the blanks is prevented by upper flanges 73 formed on the side guides. As best illustrated in FIGS. 4-6, and 15, and disposed between the registration station A and the first folding station B, is a blank deflector 74. This deflector insures that blanks will be guided between the lower flange 72 and the upper flange 73 of each side guide 68.

The balance of the mounting structure for one of the side guides 68, which also provides for calibrated adjustment of the side guides for flap width, appears in FIG. 15. The construction at each of the tables T and T1, respectively, of the adjusting mechanism is the same. Post 76 extends upwardly from mounting plate 77, which plate is bolted to plate 78 that mount spaced bearing blocks 79. As will be explained, blocks 79 mount the die mechanism at the first folding station. An arm 81 extends laterally inwardly from post 76, and serves as a track for a carriage 82, fastened by means (not shown) to the side guide 68. The carriage 82 and the associated side guide 68 is moved to a selected position by means of a grooved thumb wheel 83 rotatably mounted in the carriage. The wheel 83 is grooved to frictionally engage a laterally extending scale 84 mounted on the arm 81. A pointer 84a is fixed to the carriage 82, and when the pointer is read against the scale, it indicates the distance of the side guide shoulders 71 from the associated longitudinally extending lower die D, which distance represents the width of end flaps 11. The carriage 82 is locked in position on the arm 81 by a thumb screw 85.

As seen in FIGS. 2 and 6, there are two auxiliary and longitudinally extending blank support rails 86 mounted on posts 87, which posts are adjustably mounted on the forward cross rod 22. The posts 87 are indicated in phantom in FIG. 6. Rails 86 may not be needed in the assembly if the lateral dimension of the box lids being set up is small.

The Feed Mechanism

As previously mentioned, the feed mechanism advances a blank L from the registration station A to the first folding station B, and simultaneously advances a partially folded blank L1 from the first folding station B to the second folding station C. The feed mechanism has two motions, a reciprocating motion for advancing the blanks and for retracting to starting position, and a vertical motion for causing the feed mechanism to lower at the start of the retract stroke so as to not disturb the previously fed blanks, and to rise again at the starting position, ready to feed two blanks at a time.

The reciprocating mechanism of the feed mechanism F will first be described, primarily in connection with FIGS. 4 and 5. Disposed against and just inside of each extension 66 of the lower longitudinal dies D, is a longitudinally extending feed bar 91, which bars will be referred to as carriages. Since the feed mechanism at each lower die D are the same, only the mechanism at one side of the apparatus will be described in detail.

As best seen in FIG. 4, depending from the carriage 91 is a carriage reciprocating arm 92 formed with a vertically extending slot 93. As seen in FIG. 5, a bushing 94 slides in the slot 93 and extending through the bushing is a transverse carriage pusher rod 96 having rollers 97 at each end thereof. The rollers ride in tracks 98 formed in longitudinally extending guide rails 99 fastened to the side panels 19 and 21, respectively. As is also seen in FIG. 5, in order to reciprocate rod 96 and carriages 91, a gusset plate 101 is bolted to the transversely extending pusher rod 96 and to a generally longitudinally extending link 103. The link 103 is notched to receive transverse rod 96, the notch not appearing in FIG. 4. Referring to FIG. 5, the notched link is connected to the

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rod 96 by a screw 102. The link appears in plane in FIG. 4, and as is there seen, the right end of the link 103 pivotally connects, by pivot 103a, to the crank arm 42, previously described as being mounted on the rockshaft 41 in the description of FIG. 3.

In order to adjust the apparatus for the width (depth) of the trailing laterally extending flap 12, the horizontal position of the feed carriages 91 on the lower dies D can be precisely adjusted by mechanism illustrated in FIG. 4. An adjusting lever 104 is pivotally mounted on the arm 39 connected to rockshaft 41, by a pivot 106. Arm 39 is one of those shown broken away in the perspective diagram of FIG. 3. A cam roller 107 is mounted on the lower end of adjusting lever 104, which roller engages the cam 38 that operates feed mechanism, as was previously described in the explanation of the drive train relative to FIG. 3. An adjusting screw 108 is threadably mounted on an upper portion of arm 39 and the end of screw 108 engages the adjusting lever 104. Manipulation of the adjusting screw 108 changes the position of cam follower roller 107 on the lever 104 relative to arm 39 that oscillates rockshaft 41, and hence determines the position of the carriages 91 relative to the inboard lower folding dies D, a critical adjustment because it is important that the blank L2 (FIG. 1) be properly positioned relative to the inboard lateral die D1 by the feed mechanism. This adjustment will be referred to again, later in this description.

The feed cam 38 is shaped to provide a dwell period of the feed carriages 91 at both their retracted and advanced positions. As will be seen, the retraction dwell facilitates insertion of a fresh blank by the operator, and the advance dwell facilitates gripping of the blank before retraction of the feed carriages.

In order to advance blanks L from the registration station A to the first folding station B, each carriage 91 is formed with a blank pushing finger 109 at the forward or feed end of the carriage. Mounted on the rear or leading end of each carriage 91 is a pusher finger 110, best seen in FIG. 4a, which is mounted on a block 112 screwed to the rear end of carriage 91. Pushing fingers 110 advance blanks L1 from the first folding station B to the second folding station C, as previously described. The previously described adjustment of carriage position makes it possible to position fingers 110 relative to inboard lateral die D1 in accordance with the width (depth) of trailing lateral (side) flap 12, so that the fingers 110 stop short of inboard die D1 by a distance equal to the width of the trailing lateral flap 12.

As mentioned briefly, means are provided to lower the carriages 91 and their associated pushing fingers 109 and 110 when the carriages have reached their forward or advanced part of their stroke, and to raise them again when the carriages have returned to their initial position. Referring principally to FIGS. 4 and 5, and with further reference to FIG. 2, a longitudinal slot 116 is formed in each pusher carriage 91. Disposed along the inner face of each carriage is a longitudinally extending carriage supporting rail 117, having a tongue formed thereon, (FIG. 5) that fits in slot 116 in the associated carriage 91. The carriage reciprocating arm 92 extends down and over the inner side of rail 117, and the carriage and arm 117 reciprocate relative to rail 117, which rail can partake of a vertical motion but is horizontally fixed. Depending from each rail 117 are longitudinally spaced fingers 119 and these fingers overlie vertical slots 121 formed in the longitudinally extending lower die D. In order to restrain the rails 117 from horizontal motion while accommodating vertical motion of the rails, blocks 122 are slidably mounted in the vertical slots 121 in the lower die D, and are bolted to fingers 119, depending from the rails, as seen in FIG. 5. In order to raise blocks 122, and the associated rail 117 along with the carriage 91, lugs 123 are bolted to the blocks 122 and these lugs are engaged by lifting pins 124 mounted on

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the end of laterally extending cranks 126. There are two cranks 126 on each table, a forward crank and a rearward crank. As seen in FIG. 5, the forward cranks have pivots 127 that mount them to a block 128 bolted to the tables. The forward cranks 126 each have a crank arm 129 supporting a cam follower roller 131, which is operated by a forward feed mechanism lifting cam 132, mounted on each of the camshafts K and K1.

As seen in FIG. 15, the rearward cranks 126 are pivotally mounted between blocks 78 that mount the bearings 79, previously described in conjunction with the description of the side guide adjusting mechanism. Rearward crank arms 129 also mount rollers 131 that each engage rearward cams 132, not seen in FIG. 15, the rearward cams being identical with forward cams 132. As the camshafts K and K1 rotate, the cam rollers 131 on all four crank arms 129 are depressed, causing the lifting pins 124 on the inner ends of the cranks 126 to lift blocks 123, rails 119, and hence the feeder carriages 91. This lifting mechanism does not interfere with reciprocation of the carriages 91, because of the tongue and slot connection between rails 117 and the carriages. It should be remembered when viewing FIG. 4 the carriage lifting mechanism is mounted on the far side of lower dies D1 and their extensions 66, and so does not appear in that figure. The carriages and associated members move to the lowered position under the force of gravity, after the feeding operation or forward reciprocation of the carriages has been completed.

First Folding Station

As previously mentioned, when the feed carriages 91 advance from their blank receiving positions shown in FIGS. 1 and 4 toward the rear of the machine, pusher fingers 109 move a blank from the registration station A into position at the first folding station B. Here, as seen in FIG. 6, the blank L1 is supported on the longitudinally extending lower folding dies D, the flanges 72 of the side guides 68, and in the case of wide blanks, center support rails 86. Mounted above the lower folding dies D are longitudinally extending upper folding dies U, mounted for motion toward and away from the lower folding dies. The longitudinal extent of the lower dies D and the upper folding dies U is at least as great as that of the widest box that will be formed in the apparatus, as the apparatus is set up in FIG. 1.

As can be seen in FIG. 6, each longitudinally extending upper folding die U is pivotally mounted. The pivot structure is adjustable to provide precise alignment of the upper and lower dies. To this end, a sleeve 136 is clamped in the bearing block 79, previously described, and a pivot pin 137 for the upper dies extends through the sleeve 136 and is eccentric to its periphery, whereby rotation of the sleeve 136 adjusts the position of the upper die relative to the lower dies. Pivoted on the ends of pivot pin 137 (FIG. 2) are rocker arms 138 that mount the upper die proper. Referring to FIG. 6, each rocker arm is operated by a cam follower roller 139 bearing against a cam 141 on camshaft K. FIG. 6 shows the assembly for table T, but the same construction is employed on the other table T1, which mounts camshaft K1. A plate 142 extends laterally outwardly from the rocker arm 138 and mounts a spring 143, the other end of which connects to a spring post 144 extending from the table T. This spring holds the cam follower roller 139 against the cam 141. The position of the axis of the cam follower roller 139 can also be adjusted by means of an eccentric bushing, which adjustment provides a precisely controlled stroke range of the rocker arm and accommodates adjustment for thickness of the material of the blank.

Overload release means are provided to prevent the upper die U from exerting excess pressure against the lower die D. To provide such overload release, studs 146 are threaded into the bearing block 79, and extend

freely through bores in block 78 and through bores in the table T. Compression springs 147 are mounted on the lower portions of the studs and are retained by a nut and washer assembly 148. Thus, the spring mounting assembly can give somewhat, under circumstances wherein excess pressure is developed between the upper and lower dies.

Referring again to FIG. 6, the upper die U actually includes a separate die bar 149 mounted on the arm 138 by screws 150. The undersurface of the bar 149 is grooved as at 151 to cooperate with a bead 152 formed on the lower die D. When the upper die bar 149 is brought down toward the lower die D, the groove 151 on the upper die, in cooperation with the bead 152 on the lower die causes the longitudinal flap 11 and the tabs 13 of the blank L1 to bend downwardly against the outer face of the lower die. When thermoplastic material is employed for the blank, an electric resistance heater 153, mounted in the lower die D, heats the bead 152 of the lower die, and facilitates the bending of the flaps 11, and in this case molds or forms a bead in the blank.

It can be seen in FIG. 6 that when the table T is moved laterally along its supporting rods 22 and 23, both the upper and lower die assemblies move together so that the alignment of the upper die with the lower die is not affected by lateral adjustment of the tables. FIG. 5, which appears on the same sheet with FIG. 6, shows a clamp block 154 and a clamp bolt 154a which causes the clamp block to be wedged against the cross rod 23 to hold the table in its laterally adjusted position. The same clamping assembly is supplied for both tables T and T1, as shown in FIG. 11.

Second Folding Station

After the longitudinally extending flaps 11 and the tabs 13 have been folded down against the outer faces of the lower dies D, the blank L1 is advanced by the pusher fingers 110 to the second folding station, indicated generally at C. Here the laterally extending flaps 12 are folded down through an angle of 90°, to bring the tabs 13 in overlapping relation with the ends of longitudinal extending flaps 11. As previously described, the second folding station includes laterally extending inboard and outboard lower dies D1 and D2, mounted respectively on upwardly projecting anvils 14 and 14a. Laterally extending die D1 and anvils 14 are at the inboard folding assembly at the second folding station, and laterally extending die D2 and anvils 14a are at the outboard folding station.

The mounting of the laterally extending dies D1 and D2 on their respective anvils is best seen in FIG. 10B wherein the mounting of the outboard die D2 on anvil 14a is shown in a fragmentary perspective. As seen in FIG. 10B, anvil 14a is notched at 155 to receive the upper die D2. The anvil has a specially formed lateral slot 155a for receiving a mounting screw 155b. At this point it should be stated that when the tables T and T1 are laterally adjusted for box lid size, the laterally extending lower dies D1 and D2 are replaced with a new set of dies cut to the proper length, and this is the only replacement part needed when size adjustment is made. The slots 155a in the anvils 14 and 14a provide for a fine adjustment of table spacing in case the dies D1 and D2 are not exactly of the desired length.

The mechanism for operating the inboard upper die U1, is seen in FIGS. 2 and 7. This mechanism is the same as that operating the outboard upper die U2, which mechanism appears in FIGS. 16-18. Referring to FIG. 7, a bearing block 156 is bolted to tables T and T1, that for table T appearing in FIG. 7. The structure that operates the inboard upper dies U1 is the same on both tables T and T1, so that the same reference numerals are applied to the various elements of such structure for both tables. As seen in FIG. 7, an eccentric sleeve 157 is

adjustably clamped in bearing block 156. A crank 158 mounts the upper die U1 at each table, the crank having a crankpin P rotatable in eccentric sleeve 157. The upper die U1 includes a die bar 159 that is slidably mounted through a suitable aperture in the crank 158, and the die bar 159 is clamped to the crank 158 by a set screw 160 threaded in the crank. With this construction, when the tables are laterally adjusted the set screws need only be loosened one at a time so that the die bar 159 is free to slide through the crank 158 of the table being adjusted. The die bar of upper die U1 is grooved in the manner of the die bars 149 of the longitudinally extending dies U. The groove cooperates with a bead formed on the lower die D1. The groove and bead referred to do not appear in FIG. 7, but in FIG. 13 the corresponding groove 162a formed in the outboard lateral die U2, and the bead 163a which cooperates with the groove in the upper die, are to be seen. Heaters 161, 161a are mounted in die bars 159, 159a.

Referring again to FIG. 7, in order to lower or raise the upper die U1, an adjustable link 164 is pivotally connected to each crank 158 by means of a pin 166, hidden in that figure. The lower end of each link 164 connects to a bell crank 167 by means of a pin 165. Bell crank 167 is mounted by means of a pivot pin 168 on a bearing block 169. Studs 171 are threaded into bearing block 169 and extend freely through the base of bearing block 156 and through the associated table, table T in FIG. 7. Below the table T, as seen in FIG. 7, are springs 172 retained on the studs 171 by nut and washer assemblies 173. This mounting assembly of the operating mechanism for the upper die U1 provides an overload relief like that of the mounting assembly for the longitudinal upper dies U, previously described.

A cam follower roller 174 is mounted on the outer end of bell crank 167 and engages the upper die operating cam 176, mounted on cam shaft K. A cam of the same construction is also mounted on cam shaft K1 on table T1. The cam follower roller 174 is urged against the cam 176 by a construction involving a spring arm 177 fastened to the pivot shaft 168 of bell crank 167, to which arm is connected a laterally extending spring 178 the other end of which is connected to bearing block 55 as seen in FIG. 2. Thus it can be seen that upon rotation of the camshafts K and K1, cams 176 cause the inboard laterally extending upper die U1 to descend towards the lower die D1, dwell to perform the bending operation on the laterally extending flaps 12 of the blank L2, and spring 178 lifts the upper die from the lower die.

The Outboard Lateral Die Assembly, the Corner Block Mounting and Cam Shifter

The outboard lateral die assembly is functionally the same as the inboard lateral die assembly but it is somewhat more complicated because it is mounted on the corner blocks J and J1 on tables T and T1 respectively, in order to provide for longitudinal adjustment of the outboard lateral die assembly U2, D2 relative to the inboard lateral die assembly U1, D1. As seen in FIGS. 2, 3, and other Figures, the tables T and T1 are formed with longitudinally extending slots 170 and 170a. The purpose of these slots is to accommodate longitudinal motion of the mounting means provided for corner blocks J and J1 along their respective tables, to adjust for the width of the box lid being made. The shifting of the corner blocks J and J1 by means of hand wheel 25d (FIG. 2) has been previously described.

The adjustable mountings for the corner blocks J and J1 will now be described with reference to FIGS. 9A, 14, 14A and 17. The mounting of both corner blocks is the same, but it will be noted that the assemblies shown in FIGS. 9A and 17 include corner block J on table T, whereas those of FIGS. 14 and 14A include corner block J1 on table T1. In FIGS. 9A and 14 the bell cranks 167a for operating the outboard lateral upper die U2, and the

bearing blocks 169a that mount the bell cranks 167a appear, although the bell cranks are broken away. The bearing blocks 169a form part of the mounting for the corner blocks J and J1. The bearing blocks 169a are mounted for overload release by means of studs 171a and springs 172a in the manner described for the bearing blocks 169 of the corresponding inboard assembly. The studs 171a extend through the slots 170 and 170a formed in the tables T and T1. There is a block 175 below each table through which the studs 171a just described freely extend. A key 175a fits in the slot 170, and as seen in FIG. 14A, a bolt 175b connects plate 175 with the overlying corner block J1. A specially shaped clamp nut 175c, and a clamp bolt 175d, best seen in FIG. 14A, are also part of the assembly, and as seen in FIGS. 14 and 14A the specially formed clamp nut 175c is drawn against a shoulder on the table by the clamp bolt 175d to lock the corner block J1 in its adjusted position on the table.

At this point means mounted on the corner blocks for moving a set of cams associated with mechanism on the corner blocks will be referred to. The cam shifting structure is best seen in FIGS. 14, 16, and 17. A laterally outwardly projecting finger 175e is mounted on its associated corner block, corner block J1 in FIG. 14, and corner block J in FIGS. 16 and 17. A groove 175f is formed in the hub of a cam 196a, the function of which cam will be explained presently. The groove receives the cam set shifting finger 175e. The set of cams associated with each corner block, some of which have not been described in detail, comprise the cam 176a that operates the outboard upper folding dies U2, a cam 196a that operates an outboard tuck plate to be described presently, a cam 226a that operates an outboard sealing mechanism to be described presently, and a cam 251a that operates a completed box lid elevator lever to be described presently. Each set of four cams is keyed to the camshafts K or K1, as the case may be, by keys 175g (FIGS. 9A and 14). The cams of each set are held together for simultaneous movement by a longitudinal bolt 175h extending through all of the cams. The bolt is shown sectioned in FIGS. 9A and 14, and its length appears in dotted lines in FIG. 16.

The structure and operation of the mechanism for raising and lowering the outboard laterally extending upper die U2 is like that previously described for operating the corresponding inboard die U1, so that the reference characters employed for the inboard assembly have been applied to the outboard assembly with the suffix "a" added. The cam 176a that operates the outboard lateral die U2 appears in FIGS. 16-18. The cell crank 167a operated by the cam 176a has been broken away in FIGS. 9A and 14 but appears in full in FIG. 18.

When thermoplastic is employed as the material of the box lid, as in the present example, such material can be stretched and distorted if attempts are made to perform two bends at once, and so requires careful handling. For this reason, the timing of the inboard and outboard upper fold dies U1 and U2, respectively, is such that one die makes its fold slightly ahead of the other die. Thus any drawing or creeping of the material that takes place on the first lateral fold does not interfere with the formation of the second lateral fold. Furthermore, the die that first descends upon the material remains down while the other die descends upon the material to initiate and complete its fold which, provides precise location of the blank during the first lateral fold. In the present apparatus it is the outboard lateral die U2 that descends and makes its fold before the inboard die descends. As can be seen from the timing diagram of FIG. 23 the feed mechanism does not start its back or retract stroke until the outboard die U2 has engaged the blank. Thus the feed mechanism can be lowered to clear the inboard laterally extending die U1, before the latter die reaches its lowermost position, and such lowering and clearing of the

pusher finger 110 from the blank will not upset the placement of the blank on the lateral dies U1 and U2 because the blank is held by the previously lowered outboard die U2, which grips the blank before retraction of the pusher finger 110 from the blank occurs.

Blank Guide Mechanisms at the Outboard Lower Die

As seen in FIGS. 2, 11, 13 and 13A, guide means are provided to prevent the blank from catching on the outboard lower die during the feed operation of the blank to the second folding station C. As best seen in FIGS. 2 and 13A, near the center of the machine is a relatively long finger 179 that projects forwardly from adjacent the lower die D2 to guide the center of the blank, which might be sagging, to the final blank guiding means. Near the ends of the lower die D2, spring fingers 180 are mounted on blocks 180a screwed to the anvil 14a, and such fingers insure that the edge of the blank will not catch on the bead 163a of the die D2. The spring fingers can be deflected by the upper die and thus will not interfere with the folding operation. When relatively wide blanks are used, additional adjustable guide means are provided in the intermediate zone of the machine. Block 179a that mounts the relatively long spring finger 179 previously described, is formed with a notch in which a cross bar 182 is fitted and suitably retained. A suitable number of C-clamps 183 are adjustably positioned along the cross bar 182, and carry spring guide fingers 184 for additionally insuring that the leading edge of the blank will not catch on the bead 163a of the die before it rides over the bead. The C-clamps can be locked in place by lock screws 185, and can be removed if not required. In FIG. 11, three C-clamps 183 and their springs 184 are shown in place.

Inboard Tuck Plate

The longitudinal extending lower dies D must be spaced from the laterally extending lower die D1 at the second folding station to prevent interference with the trailing flap 12 of the blank L2 as it is folded down over the inboard laterally extending lower folding die D1. To bridge the gap between dies D and D1 during feed, inboard movable tuck plates are provided which can be retracted to clear the trailing flap 12 as it is folded. These tuck plates further serve to prevent the previously folded flaps 11 from buckling inward, and they are also operated to press the associated lateral flap 12 of the blank against the anvils 14 during the sealing operation. Outboard tuck plate assemblies are also provided which serve to initially guide the leading flap 12 during feed, and which also provides a holding action of leading flap 12 against anvils 14a during sealing of the tabs 13 to the longitudinal flaps 11.

The mechanism for operating one of the inboard tuck plates 186 appears in FIGS. 2, 4 and 8. The tuck plate itself is a thin vertical plate, which in its advanced position, shown best in FIG. 4, has an upper edge that is in alignment with the upper edges of dies D and D1. The tuck plate is mounted on a bracket 187 fastened to a rock shaft 188 (FIG. 8) that extends across the associated table T or T1, as the case may be, and turns in the flanges of the associated table. On the laterally outer end of the rockshaft 188 is a crank arm 189, whose counterpart on the outboard assembly appears clearly in FIG. 17. Extending upwardly from the outer end of the crank arm 189 (FIG. 8) is an adjustable link 191 which is pivoted at its upper end to a cam follower arm 192. The cam follower arm 192 is mounted on a pivot 193 fixed in a support block 194 fastened to the table T. Throughout this discussion of the inboard tuck plate mechanism, it should be understood that the mechanisms on both tables T and T1 are the same and only one will be described. Block 194 is retained on the associated table by bolts 194a which have been broken away in FIG. 8, but which are threaded into another block to be described presently as forming part of the sealing mechanism. Near the outer

end of cam follower arm 192 is a roller 195 that engages a cam 196 for operating the tuck plate mechanism in the proper timed relation. In order to hold the cam roller 195 against the associated cam, a spring arm 197 (FIGS. 4 and 8) is attached to the rockshaft 188 and a spring 198 connects between arm 197 on rockshaft 188 and a spring post 199 mounted on the table T. As indicated in dotted lines in FIG. 4, and as seen in FIG. 8, the outer face of each die D is recessed at 200 to receive the tuck plate 186 in its retracted position.

The tuck plate cam 196 is a three stage cam. Referring to FIG. 8, when the nose *d* of the cam is over the cam follower roller 195, the tuck plate 186 is retracted to clear flap 12 of the blank (not seen in the FIGURE) for the folding operation at the die set U1, D1. When the cam surface *e* is over the roller, the tuck plate is raised and presses flap 12 against the anvil 14. The small hump *f* of the cam then passes over the roller, and when the cam surface *g* is over the roller the tuck plate is retracted slightly to clear the work. It stays in this slightly retracted position while serving as a guide during feeding of the next blank.

Retractable means are provided to guide the mid-portion of the blank as it passes from the longitudinal lower dies D to the inboard lateral lower die D1. As seen in FIGS. 4 and 8, at each inboard tuck mechanism is a vertical arm 201 extending upward from an extension 201a fastened to the inner end of rockshaft 188 that operates the tuck mechanism. Connected across the upper ends of arms 201 is a blank deflecting strip 202, which is in its upper position when the tuck plates are in their upper guiding position, and which are retracted with the tuck plates 186 to clear the trailing flap 12 during the folding operation. Strip 202 is clamped to arms 201 by clamp 202a in order to provide for lateral adjustment of the tables.

To additionally guide blanks and their flaps as the leading edges move from lower die D1 to lower die D2, side plates 204 are provided between the lateral ends of these dies, these plates appearing in FIGS. 2, 4, and 11. Side plates 204 are spaced from anvils 14 and 14a to clear elevator levers 256 and 256a to be described presently, as seen in FIG. 4. The side plates are mounted on posts 205 spaced from anvils 14 by blocks 205a to clear levers 256. The plates 204 stop short of outboard anvils 14a. The plates 204 also prevent the previously folded longitudinal flaps 11 from buckling inward and hanging up on other parts. When the outboard dies are adjusted for lid width, a new set of plates 204 of the proper length is installed.

The operation and timing of the inboard tuck plates 186 can best be described more completely after the operation of the sealing and ejecting mechanism has been explained.

Outboard Tuck Plates

A pair of outboard tuck plates 186a is provided which plates generally serve the same function as that of the inboard tuck plates 186, but which are mounted on the outboard side of lower dies D2. The outboard tuck plates 186a appear in FIGS. 4, 9A and 13. The outboard tuck plate assemblies are mounted on the corner blocks J and J1 at each side of the apparatus, and the linkage for the plates is such as to pivot them in the opposite direction from that of the inboard plates. However, the function and mode of operation of the mechanism for operating the outboard plates is functionally like that described in connection with the inboard tuck plates, and therefore the corresponding parts have the same reference numerals as those applied to the inboard mechanism with the suffix "a" added to the reference numerals applied to the parts of the outboard tuck plate mechanism. The major difference, aside from the direction of motion of the outboard tuck plates 186a, is that the cross-shafts 188a, as best seen in FIG. 9A, are journaled in the associated

corner blocks J or J1, so that they move with the corner blocks upon adjustment of the outboard dies D2 and U2 for box lid size. Also the mounting of the springs that press the tuck plates against the flaps 12 is somewhat modified in the outboard unit.

The Tab Seal and Chill Mechanism

There is an inboard tab seal and chill mechanism associated with inboard lateral die D1, and an outboard mechanism of the same general construction mounted on the corner blocks J and J1 and operating in conjunction with the outboard lateral die D2. The inboard mechanism is seen in side elevation in FIG. 9 whereas the outboard mechanism is seen in FIGS. 10, 10A and 16. Since the construction and mode of operation of both the inboard and outboard mechanisms chill and seal are the same, the reference character that are applied to the inboard mechanism will be applied to the outboard mechanism with the suffix "a" added. Since the mechanisms are the same, the following description on the details thereof refers to reference characters of the inboard mechanism, although several of the figures (as previously mentioned) show the outboard mechanism and hence have the suffix "a" appended to the corresponding reference numeral. It will be noted that the inboard and outboard mechanisms on the same table are reversed, right to left.

The mechanism operates in two stages, there is a chill that presses the tabs 13 against the flaps 11 at the anvils 14 and 14a, and a heated sealing head that thereupon advances toward a heated anvil shoe to effect the seal in the thermoplastic material of the box lid under fabrication. Referring to FIG. 9, which shows the inboard mechanism, there is a mounting block 206 bolted to block 194 (previously described in the description of FIG. 8) by bolts 194a, also previously described. The corresponding mounting block 206a on the outboard mechanism, as seen in FIG. 10, is mounted on the corner block J, and its mate on the other outboard assembly is mounted on the corner block J1. The mounting block 206 is notched to receive a shank 207 that is slidably mounted in the notch and that carries a sealing head 208. A heating element 209 of the resistance type is mounted in the sealing head 208.

The sealing head 208 is spring advanced to perform its sealing function as it approaches a heated shoe portion of the anvil 14 or 14a, as the case may be. To advance the sealing head 208, there is a bell crank 211 pivotally mounted on block 206 by a pivot 212. One end of the bell crank 211 carries a roller 213 that engages the end of the shank 207 of the sealing head. The other end of the bell crank 211 is pinned to a T bar 214 by means of a pivot 216, and the T bar is urged downwardly by a set of coil springs 217 connected to the T bar and to a set of spring posts 218 which are adjustably mounted in a spring bracket 219. The T bar for the outboard mechanism is seen in full in FIG. 10. The spring bracket 219 for the inboard assembly is mounted, by means not shown in FIG. 9, directly on the tables T and T1 at each side of the machine. The spring brackets 219a for the outboard assemblies are, as shown in FIGS. 10 and 17, mounted on a flange 220 which depends downwardly from the plate 175, previously described, that forms part of the mounting structure for corner blocks J and J1. This mounting of the spring plate 219a on the flange 220 associated with the corner blocks J and J1 is for the purpose of causing the spring plate to move with the corner blocks as the corner blocks are adjusted on their respective tables.

The forward or heat sealing position of the sealing head 208 is determined by a stop bolt 221 adjustably mounted in a block 222, bolted to the sealing head shank 207. When the sealing head is in its forward position, the inner end of bolt 221 strikes a member 223 projecting upwardly from the main mounting block 206 for the sealing head assembly. Additional stop plates 224 and

225 are mounted on the sealing head 208 and on the extension 223 of the sealing block 206, respectively, for limiting the motion of the sealing heads in case bolt 221 is removed.

The sealing head is spring advanced as described, and is mechanically retracted against the force of springs 217. To retract the sealing head, cams 226 mounted on shafts K and K1 respectively, are employed for the inboard assembly. As previously indicated, cams 226a are employed for the outboard assembly. It will be recalled that cams 226a slide along their shafts K and K1, along with the others of the set of cams associated with the corner blocks J and J1. In order to retract each sealing head against the force of springs 217, a bell crank 227 is provided, the bell crank 227 having a roller engaging the cam 226. The bell crank is pivoted in block 206 by the same pivot pin 212 that mounts the bell crank 211, provided for spring advancing of the sealing head. At the end of the retract bell crank 227 that is opposite from the end that mounts the cam roller, a finger 228 is provided, best seen in FIG. 9, and the finger engages a roller 229 mounted on block 222 previously described as being attached to the shank 207 of the sealing head. The roller 229 is hidden in FIG. 10 of the outboard assembly.

The shank 207 of the sealing head is retained in place by an upper retaining plate 230 bolted to the extension 223 of the primary mounting block 206. A lower retaining plate 230b is also provided. As seen in FIG. 9, upper retaining plate 230 has a lateral extension formed with a generally vertical guide surface "v" for guiding the completed box lid when it is being lifted from the second folding station. The corresponding plate 230a of the outboard assembly has been broken off in FIG. 10.

Associated with the sealing head assembly 208 is a chill indicated generally at 231. The chill is mounted on rods 232 which slide in mounting block 206. The chill is urged forwardly, or towards the anvil 14, by springs 233 seen in FIG. 9 of the inboard assembly. The forward motion of the chill is controlled by a pin 234 extending laterally from the upper rod 232, which pin is spring urged into engagement with an edge 236 of a notch 237 formed in the shank 207 of the sealing head. Each chill 231 has a finned heat radiating or dissipating portion 238, best seen as portion 238a in FIGS. 10 and 16. As seen in FIG. 10A of the outboard assembly, a vertical slot 241a is formed in the chill, the slot receiving a sealing nose 242a of the sealing head 208. The chill 231 has been partially broken away in FIG. 9 to show the same structure on the inboard assembly.

Detachable anvil shoes 243 and 243a are provided on the anvils 14 and 14a respectively. In this description, shoes 243 and 243a are considered to form and be part of their respective anvils. FIG. 10A shows the anvil shoe 243a on an outboard assembly and FIG. 9 shows the anvil shoe 243 on the inboard anvil 14. The anvil shoes 243 and 243a are heated by resistance heating elements 244, the element 244a for the outboard assembly being best seen in FIG. 10A. The anvil shoes 243 are beveled at 245a (outboard anvil) to help guide flaps 11 over the anvils, and to reduce the contact area of the heated anvils with the box lid, and the shoes are mounted on their respective anvils by bolts 246. The bolts 246a for the outboard assembly appear clearly in FIG. 10A.

In addition to the main springs 217 that urge the sealing head 208 to its forward position, an auxiliary spring 248, shown in FIG. 9, is connected between the mounting block 206 and the shank 207 on the sealing head to provide additional actuating force on the sealing head.

As the cam 226 retracts from under the roller on bell crank 227, the nose 228 of the bell crank is retracted from the roller 229 mounted on the shank 207 of the sealing head, and permits the springs previously described

to advance the sealing head toward its anvil. The springs 233 also urge the chill 231 to move with the sealing head. The motion of the chill is made possible by the advance of the surface 236 of the notch 237 in the shank of the sealing head. As the surface 236 moves forward, the pin 234 on the chill assembly follows, and the chill moves forward with the shank of the sealing head. This action continues until the chill engages the blank and presses the tabs 13 and flap 11 against the anvil 14 to hold the blank in place for the sealing operation. When the chill engages the blank, the sealing head 208 has not yet reached the blank, but its forward motion continues under the force of the springs 217, until the sealing nose 242 of the sealing head engages the blank with sufficient force to perform the heat sealing operation. At this point it will be noted that care has been taken to avoid stating whether the tabs 13 underlie or overlie the flaps 11, because the apparatus can fold up the blank either way, and either way is satisfactory. The heated sealing nose is prevented from digging into the tab or flap material of the box lid being formed by proper adjustment of the stop bolt 221 which strikes surface 223 of the mounting block for the sealing head at precisely the proper time.

At the proper time in the cycle, first the sealing head and then the chill are mechanically retracted from the work. As the high section of cam 226 moves over the roller on bell crank 227, the finger 228 on the bell crank forces roller 229 to the left, as these parts appear in FIG. 9, and the sealing head 208 is retracted against the force of springs 217 and 248. The face 236 of the notch 237 formed in the shank of the sealing head is soon brought to bear against the pin 234 projecting laterally from rod 232 on the chill. When this occurs, further retraction of the sealing head by cam 226 causes retraction of the chill, which soon clears the completed box lid for removal from the second folding station.

The Ejector Mechanism

As previously described in connection with the schematic diagram of FIG. 1, the ejector mechanism has two functions that are separately performed. The mechanism first elevates a completed box lid over the top of the lower dies at the second folding station C, then transports the completed lid laterally in the machine to the discharge station G. The elevator mechanism which lifts or elevates the blanks will be described first.

There are actually four individual elevator mechanisms in the apparatus as there are four sealing head mechanisms. Although all perform the same function, the inboard units are fixed on the tables T and T1 respectively, and the outboard units are mounted on the corner blocks J and J1 respectively. In the description that follows, since the outboard units are like the inboard units, the corresponding elements of the outboard units have the suffix "a" added to the applicable reference numeral. The cams for operating the inboard units are indicated at 251 and the cams for the outboard units are indicated at 251a. The outboard cams are clearly seen in FIGS. 11, 16 and 17, whereas the inboard cams 251 appear at small scale in FIG. 2. It will be recalled that cams 251a form part of a set of cams that are slidable on their respective camshafts K or K1 during adjustment of the corner blocks J or J1.

In order to raise the completed box lid from the second folding station, in response to the motion the inboard and outboard cams 251, 251a on each table, four elevator bell cranks are provided, there being an inboard bell crank 252, and an outboard bell crank 252a, on each table. The inboard bell cranks 252 are pivotally mounted on block 194 (FIG. 9) on the same pivot shaft 193 that mounts the cam follower arm 192 (FIG. 8) for the inboard tuck mechanism. The inboard elevator bell crank 252 also appears in FIG. 9 but it has been broken away in that figure. The outboard elevator bell cranks 252a are mounted on separate pivot pins 253a project-

ing from corner blocks J and J1, FIGS. 11 and 17. Cam rollers 254 and 254a mounted on arms 252 and 252a engage the respective cams 251 and 251a. This is best seen in FIGS. 16 and 17 for the outboard assemblies. Extending laterally inward from the pivots 193 for the inboard elevator bell cranks 252, and the pivots 253a for the outboard elevator bell cranks 252a are box lid lifting arms 256 and 256a, respectively. Arms 256a of the outboard elevator assembly appear clearly in FIG. 11, and as seen in FIG. 11A, the elevator arms 256a are disposed just inside of anvils 14a, the arm 256a appearing in FIG. 11A having been broken off. As indicated in FIG. 4, the inboard elevator arms 256 are likewise disposed just inside of their associated anvils 14.

After the sealing and chill mechanisms previously described have retracted from the completed box lid L2 at the second folding station C, the elevator arms 256 and 256a just described are lifted by the cams 251 and 251a to raise the inner ends of the elevator arms and lift the completed box lid L2 clear of the lower dies D1 and D2. After this occurs, the lateral transport or blank ejector mechanism to be described below is operated to move the completed box lid L2 laterally of the apparatus and to the discharge station. Soon after the ejector mechanism takes control of the completed lid, the elevator cams permit the elevator arms to drop by their own weight.

The Lateral Transport Mechanism

The mechanism appears in plan, but on a small scale, in FIG. 12, in side elevation on a larger scale in FIG. 11, and details thereof also appear in FIGS. 11A and 11B, to which figures reference is made for the following description. A primary support for the mechanism is the upright 61, previously referred to in the description of FIG. 3. The upright is mounted on corner block J by means of spacer blocks 262 and bolts 263. The spacer blocks 262 also appear clearly in FIG. 16, wherein the upright support 61 has been broken away, but the blocks appear in plan. A channel 264 extending laterally of the apparatus forms a major support for the balance of the apparatus. This channel is fastened by bolts 264a to filler blocks 265 bolted to the upright 61 by bolts 265a (FIG. 11A).

In order to support other parts of the mechanism from channel 264, thin blocks 266 are bolted to and extend forwardly from each end of channel 264, and a laterally extending track 267 is mounted on the lower end of each block 266 by means of bolts 267a, appearing in FIG. 11. A traveling block 268 slides along the track 267. The block is made in two halves that are bolted together by bolts 269 (FIG. 11). Slidably mounted for vertical motion in the traveling block 268 is a transport leg 271, and attached to the lower end of the transport leg is a support foot 272, which supports the trailing end of the finished box lid at the outboard lateral die D2 early in the ejection cycle. In order to support the same end of the box lid at the inboard lateral die D1, a wire extension member 273 is mounted on the transport leg 271 and has a foot 274 bent up from the lower end of the wire member. The wire support member 273 is horizontally adjustable in the leg 271 to adjust for box lid width.

In order to control the vertical motion of the sliding leg 271, a cam bar 276 is mounted above the track 267. As best seen in FIG. 11, the ends of the cam bar 276 are slotted at 277 and bolts 278 pass through the slots and are threaded into the narrow end blocks 266 extending outwardly from the channel 264. This mounting of the cam bar 276 also appears in plan in FIG. 11B, wherein the major part of the cam bar 276 has been broken away. As seen in FIG. 11, the cam bar 276 has a lower cam or track face 281 and an upper cam or track face 282, the upper face 282 extending over the majority of the effective length of the cam bar. A roller 283 is mounted on the upper end of transport leg 271 and is

urged against the cam faces just described by a spring 284 that connects between a spring post on the leg 271 and a spring post on the traveling block 268.

Means are provided to reciprocate the transport leg 271 in order to remove completed box lids from the apparatus and return the leg to a lid pickup position. A sprocket 286 is keyed to shaft 60, and as previously described with respect to FIG. 3, and as seen in FIG. 11, shaft 60 is driven from the cam shaft K by sprocket 58 chain 57 and a sprocket 56 on the camshaft. Trained around sprocket 286, and best seen in FIG. 11, is a generally horizontally extending chain 287, the other end of which passes around an idler sprocket 288 mounted on a stub shaft 288a that is supported by means (not shown) on the channel 264. A generally horizontal link 289 is pivoted at its one end to the traveling block 268 by a pin 291 (FIG. 11B). As best seen in FIG. 11, the other end of the link 289 is pivotally connected to the chain 287 by a pin 292, the pin also appearing in dotted lines in FIG. 11A.

Means are provided to guide the upper end of a box being ejected by the apparatus. A pair of wires 296 extend parallel to the channel 264, the wires being mounted on cross bars 297 adjacent each end of the channel. The cross bars 297 are screwed to vertically sliding legs 298 mounted in blocks 299 and retained in their adjusted position in the blocks by a thumb screw 300, as shown in FIG. 11B. The wires 296 are maintained under tension by a spring section 301 adjacent one end of each wire. The vertical position of wires 296 is adjusted for box lid depth.

In FIG. 11, a completed box lid L2 is shown supported by elevator arms 256a, and the transport leg 271 has been brought up against the end of the lid. The leg 271 and feet 272, 274 are in their lowered position. However, further rotation of the camshaft K will cause the lower run of chain 287 to move to the right, or in the direction of the arrow b, as seen in FIG. 11. This will impart a compound motion to the leg 271. The leg will be moved to the right by link 289 and traveling block 268 and at the same time, the roller 283 on the upper end of the leg will move from under the lower cam face 281 along the transmittal slope, and onto the upper cam face 282, so that the spring 284 will lift the leg 271. During this process the box is moved along the upper ends of elevator arms 256a, but before the box leaves the arms, the feet 272 and 274 will be in a position to support the lower trailing end of the box lid. The leading end of the box lid soon rides over the support rails 15 previously described, and the elevator arms 256a now drop clear of the lid. The leading end of the box lid is now supported on rails 15 and the other end is being supported and advanced by the leg 271. Toward the end of the travel of the leg 271, the roller 283 thereon passes from the upper cam face 282 to the lower cam face 281, thereby lowering the leg 271, as shown in broken lines to the right of FIG. 11. The leg then deposits the box lid completely on the rails 15, and the leg imparts a final lateral pushing motion to the lid when the leg is in its lowered position.

In the position of the leg shown in phantom at the right of FIG. 11, the pin 292 that connects the link 289 to the chain 287 has reached the end of its forward travel, and the pin 292 on the chain will now start to pass along the upper run of the chain to retract the leg 271 from its advanced position. At the completion of the retraction stroke the pin 292 will have passed around one quarter of sprocket 286, with which the leg 271 will be at a position somewhat to the left of the position shown in solid lines in FIG. 11. Upon further rotation of sprocket 286, the pin 292 connecting the link 289 to the chain 287 merely passes around the other quarter of sprocket 286, bringing leg 271 back to the position shown in full lines in FIG. 11. Before the leg 271 again reaches the position shown in full to the left of FIG. 11,

a new box lid will have been elevated to a position in front of leg 271 by elevator arms 256 and 256a, ready to be picked up by the leg.

Blank Stops

Stop means are provided for the leading edges of end flaps 11 of the blank at the first folding station D. These stops are in the form of small blocks 304 (FIGS. 2 and 6), slidably mounted on the narrow flanges 72 of side guides 68 and held in place by thumb screws 305 (FIG. 6). The thumb screws deform the blocks to grip the side guides. These stops prevent overfeed by pusher fingers 109. Also, where the box lids are narrow, that is, have a short longitudinal dimension in the machine, these stops will square the blank in case the side guides 68 have not maintained perfect blank orientation.

Stops are also provided for the leading edge of leading side flap 12 at the rear of the machine. These stops appear in FIGS. 2 and 13 and are constructed so as to be readily adjustable for the width of the leading lateral flap 12. The stops are self clearing as the movable upper die U2 descends to bend down box lids having narrow lateral flaps. These adjustable blank stop assemblies are indicated at S in FIGS. 2 and 13. One of the assemblies is mounted on upright 61, previously described as mounting the ejector mechanism. The other stop assembly S is mounted on a similar upright 61a also shown in FIG. 2, which upright differs from upright 61 only in that it is shorter, and has no support function for the ejector mechanism. The stop assemblies S are mounted by blocks 306 on the uprights 61 and 61a. Upright 61 being shown in broken lines in FIG. 13. Bolts 307 mount the blocks 306 in their respective uprights. A carrier 308 is movably mounted in each block 306. The carrier 308 has a lower rod 309 slidable in the block 306, and the carrier also rotatably mounts an adjusting screw 311 which is also slidable in the block 306. A quick release nut 312 is slidably mounted in the block 306 and is urged against the adjusting screw 311 by a spring 313. For quick adjustment of the stop, the quick release nut is lifted by a knob 314, with which the carrier can be rapidly positioned. The fine adjustment is made by releasing the knob 314 and rotating the adjusting screw 311. The blank stop plate itself is indicated at 316, and is mounted for vertical sliding motion in the carrier 308 by means of a plunger 317 attached to the lower end of the stop plate 316. The upper end of the plunger 317 has a rounded nose 319 that is urged upwardly against the lower face of a cam 320 mounted on the crank arm 158a for the outboard upper die U2. In the position of the parts shown in FIG. 13, the stop plate 316 projects above the outboard tuck plate 186a so that the tuck plate will guide the flap 12 of the blank toward the stop plate 316, which plate prevents overshoot of the blank during feed. There would be no interference between the die bar 159a and the stop plate 316 in the illustrated position of the parts. Also, the stop plate 316 clears the cam 320 laterally. However, if the stop plate 316 is moved to the left, as seen in FIG. 13, to receive a narrow flap 12 of a blank, if it were not for cam 320, the outboard die bar 159a would strike the stop plate 316 as that die bar descends against the lower die D2. However, before this can occur, the cam face of cam 320 will engage the plunger and depress the stop plate 316, so as to clear the descending outboard die bar 159a.

In order to facilitate adjustment of the stop plate, a scale 321 is mounted on the carrier 308 and is read against a pointer 322 mounted on the block 306. The scale is calibrated in terms of the width of the leading lateral flap 12, which represents the depth of the completed box lid.

Die Details

As has been mentioned, the apparatus previously described has die sets formed for producing box lids of thermoplastic material such as cellulose acetate or the like,

having beaded corners. Reference is made to FIGS. 19 and 20 for some details relative to the lower longitudinal dies D and the movable upper longitudinal dies U at the first folding station. It has been mentioned that the die bar 149 of each movable upper die U is formed with a groove 151 which cooperates with a bead 152 formed on the upper edge of the lower longitudinal die D, in order to both bend the blank and to form a beaded corner of the blank. As seen in FIGS. 19 and 20 these die parts cooperate to bend down the longitudinally extending end flaps 11 of the blank L1. After this folding operation is completed the blank L1 is pushed longitudinally along the apparatus to the second folding station, and the bent down flaps 11 must clear the inboard tuck plates and the shoes 243 and 243a of the anvils 14 and 14a. For this reason, although perfect 90° corner beads are formed at the first folding station, the bent down side flaps are not permitted to come to a perfectly vertical position. Referring to FIGS. 19 and 20, it will be seen that the bead 152 of the lower die D has an outer face 326 that is inwardly offset from the outer face 327 of the die body. With the construction, although the bead 328 of the blank L1 (FIG. 20) is perfectly formed and will make a 90° corner, the longitudinal end flap 11 at each die assembly cannot assume a fully vertical position, but forms an angle with the top panel 10 that somewhat exceeds 90°. This insures that the flap 11 will not catch or hang up during the transfer of the blank from the first to the second folding station. It also prevents the heated lower dies D from distorting the plastic. Before sealing takes place, the chills positively bring flaps 11 against their anvils.

FIGS. 21 and 22 illustrate a die set which does not form beaded corners but forms conventional, or plain corners. To obtain this result, instead of being formed with a groove 151, the die bar 149' of the modified upper horizontal die assembly U' is formed with a lip or shoulder 151'. This lip or shoulder cooperates with the bead 152 on the lower die D to bend the flap 11 down as indicated in FIGS. 21 and 22.

Since there is no horizontal transfer problem at the second folding station C, wherein the lateral flaps 12 are folded down against the anvils 14 and 14a, the die construction of the inboard and outboard lower dies D1 and D2 is somewhat different. Referring to the die construction of die D2 shown in FIGS. 11A and 13A, it will be seen here that the bead 163a on the die projects slightly past the main face *m* of the lower die D2. With this construction, the lateral flaps 12 (not shown in these figures) will be brought to a substantially vertical position by the folding operation, and after retraction of the heated upper die U2, the flap 12 will remain in a vertical position, so that tabs 13 are properly positioned for heat sealing with flaps 11. Even so, during corner sealing, the tuck plates insure that flaps 12 are against their anvils. The construction at the inboard die D1 is the same, with the same results.

Resumé of Operation

The operation performed at the various stations, the mechanism at those stations, and the operation of the various mechanisms themselves have been individually described in detail so that the entire operation of the apparatus has been explained. However, no attempt has been made to relate the sequence of all operations. The following resumé of operation will be made in general terms, without referring to mechanical details of the various operating elements of the units or mechanisms at the various stations.

In the description of the sequence of operation that follows, a single blank will be followed through the machine, and reference will be made to the timing diagram of FIG. 23 relative to that blank. If it is desired to compare the timing of any one of the individual units with respect to any other, such relative timing can be

readily obtained directly from the timing diagram of FIG. 23, wherein the positions of all units are referred to degrees of camshaft rotation.

The operator of the machine places a previously notched and tabbed blank L in the machine at the registration station A, with the end flaps 11 resting on the side guides 68 (FIG. 1), and with the trailing side flap in position to be picked up by the pushers 109 of the feed carriages 91. When the blank is in place at the registration station, the carriages 91, which have a dwell in their upper retracted position, start forward and pusher fingers 109 are lifted to a position behind the blank L, whereupon they move the blank from the registration station A, along the side guides and lower die extensions, to the first fold station B. The stroke of the feed mechanism is constant, and since the length of the longitudinal dies at the first fold station exceeds that of the maximum width blank that will be formed in the machine, the position of the blank at the first fold station is not critical. When the blank reaches the first folding station, the pusher elevator permits the feed carriages 91 to move down, and soon thereafter the longitudinal upper dies U at the first folding station also start down toward the lower dies D. Before the upper dies U are fully down, the feed carriages 91 will be fully down and will have started back toward their initial position. The dies U and D at the first fold station complete their fold soon after the lower feed carriages 91 begin their return stroke, and the upper dies remain down for some time, so that the heaters in the lower dies can soften and mold the blank material to fold down flaps 11 and form the corner bead.

After the feed carriages 91 have fully retracted to their starting position, the elevator mechanism for the feed carriages lifts them and returns them to their upper position illustrated in FIG. 1. The blank L1 (FIG. 1) has now been formed at the first fold station B with the longitudinally extending end flaps 11 and the tabs 13 folded down against the longitudinally extending lower dies D.

Feed carriages 91 are now advanced as before, except on this stroke the blank being followed, which is now blank L1 as seen in FIG. 1, is advanced by the pusher fingers 110 at the leading ends of the feed carriages 91. This second reciprocation of the feed mechanism slides the blank L1 along the lower dies D, across the inboard tuck plates, across the anvils 14, along the side plates 204 mounted between the anvils 14 and 14a, over the outboard lower die D2, along the outboard tuck plates, and against the end stops S. The position of the feed carriages will have been adjusted so that fingers 110 stop short of the inboard lower dies D1 by a distance equal to the width of lateral side flaps 12. Toward the end of the feeding operation of the blank L1 from the first to the second folding station, first the outboard, and then the inboard upper dies U2 and U1, respectively, start their downward stroke. First, the outboard, and then the inboard tuck plates also start to retract, to clear the lateral flaps 12 for folding. Soon after completion of the forward feed stroke, the outboard lateral die U2 reaches its folding position at the lower die D2, and bends down the outboard side flap 12 as previously described. After the outboard side flap 12 has been folded down, the pusher elevator starts to lower the feed carriages and this lowering of the carriages will not disturb the blank, because it is being firmly held by the outboard die set U2, D2. Since the blank is only constrained by the outboard die set, any creeping of the material during the folding and bead forming operation that might take place, takes place freely and the blank is neither stretched nor distorted.

After the leading pusher fingers 110 on the carriages 91 have cleared the blank, the inboard upper die U1 is lowered to its folding position at lower die D1, and folds the inboard side flap 12 downwardly. Thus even though the blank is gripped by the outboard die set dur-

ing operation of the inboard die set, only one fold and bead are made at a time, and distortion or stretching of the blank material is minimized. The inboard and outboard tuck plates, which were in blank guiding position during the feeding operation, will have been fully retracted to clear the lateral flaps 12 on both sides of the box lid during the folding operation.

As mentioned above, with this sequential timing of the outboard and inboard lateral dies U1 and U2, distortion and drawing of material during the folding operations presents no problem, nor will retraction of the feed carriages shift the blank, because the blank is firmly held by the outboard die set U2, D2 before the feed carriages retract. The inboard and outboard upper folding dies U1 and U2 remain in their down position while the tuck plates are again advanced toward their respective anvils to their fully advanced, or tuck position, to press against the lateral side flaps 12 and hold them in place ready for the sealing operation. The dies U1 and U2 remain down long enough so that the heaters in the die bars soften the plastic material to form a clean, permanent corner.

As the tuck plates are moving toward their fully advanced or tuck position just described, the outboard and inboard chill and seal mechanisms are advancing toward their respective anvils. Soon after the outboard tuck plate reaches its tuck position against the blank, the outboard chills reach their advanced position to press the tabs 13 and the end flaps 11 together against the associated heated shoes forming part of the outboard anvils 14a. The outboard sealing heads, which have been moving with the outboard chills, continue their forward motion until the heated sealing nose of each sealing head presses the material of the blank against the heated shoes and effects a heat seal or weld between the tabs and the end flaps.

The inboard chill and seal unit perform the same operation but they are timed to slightly lag the outboard chill and seal units. Both units engage the blank for the same length of time. The inboard and outboard tuck plates remain in their tuck position against the blank and, the upper lateral folding dies U1 and U2 are both in their down position during the aforesaid heat and pressure sealing or welding operation.

With the second station inboard and outboard upper folding dies still in their down position, and after sufficient time has elapsed to heat seal the tabs 13 to the end flaps 11 and to form the corner beads, the outboard sealing heads begin to retract, the chills temporarily remaining in position against the now completed box lid in order that the outboard sealing heads can retract without distorting the completed work. Soon after the outboard sealing head has cleared the work, the chill retracts automatically, because of the notch and pin construction that places the chill under control of the sealing head as previously described in the detailed description of the chill and seal mechanisms. The inboard chills and sealing heads follow the same cycle except that their retract strokes start slightly after those of the outboard mechanisms.

When both the inboard and outboard sealing heads and chills have retracted sufficiently to clear the completed box lid, the tuck plates are retracted slightly to clear the box lids. This occurs as the slight hump *f* of the tuck plate cams (FIGS. 8 and 23) passes over the cam follower rollers, as previously described. The tuck plates then remain in their semi-advanced position, to serve as guides for the next blank. After the tuck plates have retracted slightly to clear the work as described above, upper dies U1 and U2 are raised, the blank elevator arms are raised by their cam mechanisms, to lift the completed box lid L2 (FIGS. 1 and 11) to its elevated position.

As the elevators are raising the completed box lid L2 to its upper position, the transport leg on the ejector mechanism is moving forward toward the trailing end of the completed lid. While the elevators are fully raised, and

when the ejector leg reaches the box lid, the ejector leg both advances the box and begins to rise. The ejector leg reaches its uppermost position before the elevator arms start down. The ejector leg now supports its end of the completed box lid and moves it laterally in the apparatus. The other end of the lid is supported on the guide rails 15. The ejector leg moves to its lower position before it has completed its forward box discharging motion, but before the ejector leg reaches its lower position, the box is fully supported on the guide rails 15 at the discharge station G.

This completes the brief resume of the cycle of operation referring to a single blank as it moves through the machine. As previously mentioned, the timing diagram of FIG. 23 also shows the relationship between operations occurring at any given station, it being understood that normally two blanks are being folded substantially simultaneously. The various degrees of overlapping in the operation at the various stations, can best be understood from direct examination of the timing diagram of FIG. 23.

Lid Size Adjustment Summary

This adjustment summary is prepared for a set-up wherein the long dimension of the box lid extends laterally of the machine, so that the ends of the box lid extend longitudinally of the machine, and are formed by longitudinally extending flaps 11 (FIG. 1), and the sides of the lid extend laterally of the machine, and are formed by laterally extending flaps 12. The various principal adjustments for box lid size are listed below:

Lid Length

Lateral spacing of tables T and T1 and associated dies D and U. Made by loosening clamps 154, FIG. 11, and turning handwheels 25f, FIG. 2.

Cut new lower dies D and D1 to length from strip material.

Loosen set screws 160 and 160a so that cranks of upper lateral dies U1 and U2 can slide along their respective die bars, FIGS. 7 and 18.

Loosen clamp screws 202a for mounting deflector strip 202 on posts 201, FIG. 8. Replace strip 202 if too long or too short.

Lid Width

Longitudinal spacing of outboard die D2 from inboard die D1. Made by moving corner blocks J and J1 with handwheel 25d, FIG. 2.

Plates 204 replaced, FIG. 4. Adjust wire foot 274 on discharge leg 271, FIG. 11A.

Width (depth) of End Flaps 11

Lateral spacing of side guides 68 from lower dies D. Made by turning thumb wheels 83 on side guide mountings, FIG. 15.

Width (depth) of Trailing Side Flap 12

Spacing of forward position of pusher shoes 110 from inboard lateral die D. Made by adjusting thumbscrew 108 on feed rocker arm, FIG. 4.

Width (depth) of Leading Side Flap 12

Made by adjusting end stops S at outboard lateral dies, FIG. 13.

Lid Depth Adjustment at Discharge Station

Adjust spacing of wires 296 above discharge rails 15. Made by adjusting wire mounting legs 298, FIG. 11.

Having completed a detailed description of the invention it can be seen that the apparatus of the invention is capable of manufacturing box components such as lids by means of apparatus that is accessible, simple and easily adjustable for lid size. The drive train is made up of simple parts.

The lids can be manufactured from material that is relatively fragile or distortable such as thermoplastic,

transparent or translucent material such as cellulose acetate or the like, and the apparatus will nevertheless produce perfectly formed and true finished parts. The machine is capable of maintaining a high production rate and requires but a single operator who need only supply blanks to the registration station.

Only a pair of side plates need be changed for adjusting the machine for different dimensions or widths of box parts in a direction longitudinal of the machine, and these need only be replaced for major changes. When adjusting the machine laterally for different box lengths, the lower laterally extending dies need be replaced. These are easily cut to the proper length from strip material.

The invention having thus been described, that which is claimed to be new and which is desired to be protected by Letters Patent is:

We claim:

1. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies mounted on said tables at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, and blank feed means for progressively and simultaneously advancing blanks from station to station.

2. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies supported on said tables for receiving blanks from said first folding station, longitudinally extending upper dies movably mounted on said tables at said first folding station and laterally extending upper dies movably mounted on said tables at said second folding station for motion toward and away from their respective lower dies, a right angle gear box mounted on each table adjacent opposed ends thereof, a cross shaft for driving said gear boxes, means for driving said cross shaft, longitudinally extending cam shafts mounted on said tables and driven by said gear boxes, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, and blank feed means for progressively and simultaneously advancing blanks from station to station.

3. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, means mounting said tables for lateral adjustment on said frame, a blank registration station at the forward end of the apparatus including means adjustably mounted on said tables for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending inboard and outboard lower dies for receiving blanks from said first folding sta-

tion, means mounting the inboard laterally extending lower die in a fixed longitudinal position on said tables, means mounting the outboard laterally extending lower die for longitudinal adjustment on said tables, longitudinally extending upper dies movably mounted on said tables at said first folding station for motion toward and away from the longitudinal extending lower dies, laterally extending inboard and outboard upper dies at said second folding station, means mounting the inboard laterally extending upper die on said tables for motion toward and away from the laterally extending inboard lower die, means mounting the outboard laterally extending upper die for longitudinal adjustment on said tables and for motion toward and away from the laterally extending outboard lower die, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, and blank feed means for simultaneously advancing blanks from the registration station to the first folding station, and from the first folding station to the second folding station.

4. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, means mounting said tables for lateral adjustment on said frame, a blank registration station at the forward end of the apparatus including means adjustably mounted on said tables for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending inboard and outboard lower dies for receiving blanks from said first folding station, means mounting the inboard laterally extending lower die in a fixed longitudinal position on said tables, means mounting the outboard laterally extending lower die for longitudinal adjustment on said tables, longitudinally extending upper dies movably mounted on said tables at said first folding station for motion toward and away from the longitudinal extending lower dies, laterally extending inboard and outboard upper dies at said second folding station, means mounting the inboard laterally extending upper die on said tables for motion toward and away from the laterally extending inboard lower die, means mounting the outboard laterally extending upper die for longitudinal adjustment on said tables and for motion toward and away from the laterally extending outboard lower die, drive means for lowering and raising both sets of upper dies, and blank feed means for simultaneously advancing blanks from the registration station to the first folding station, and from the first folding station to the second folding station, means for adjusting the longitudinal position of said blank feed means on said frame relative to said inboard laterally extending die, and means for longitudinally reciprocating said feed means over a fixed stroke.

5. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies mounted on said tables at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, and folded blank delivery means at said

second station comprising elevators for lifting the folded blank from the lower dies of said second folding station, and a laterally reciprocable ejector foot for pushing a folded blank clear of said second folding station in a lateral direction.

6. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, anvils mounting said laterally extending lower dies on said tables, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies mounted on said tables at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable heated tab sealing means at said anvils, means for reciprocating said tab sealing means by said cam shaft, tab chill means at said tab sealing means, means for reciprocating said chill means for bringing the chill means against the blank before the tab sealing means engages the work and for retracting said chill means from the work after said sealing means is withdrawn from the work, means for driving said tab sealing and chill means by said camshafts, and folded blank delivery means at said second station comprising elevators for lifting the folded blank from the lower dies of said second folding station, and a laterally reciprocable ejector foot for pushing a folded blank clear of said second folding station in a lateral direction.

7. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, anvils mounting said laterally extending lower dies on said tables, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies mounted on said tables at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable tab sealing means at said anvils, means for reciprocating said tab sealing means by said cam shaft, tab chill means at said tab sealing means, means for reciprocating said chill means for bringing the chill means against the blank before the tab sealing means engages the blank and for retracting said chill means from the blank after said sealing means is withdrawn from the blank, tuck plates reciprocable longitudinally of the apparatus for holding the corners of the blank against said anvils during operation of said sealing and chill means, means for retracting said tuck plates while the upper dies at said second folding station are performing their folding operation, and folded blank delivery means at said second station comprising elevators for lifting the folded blank from the lower dies of said second folding station, and a laterally reciprocable

ejector foot for pushing a folded blank clear of said second folding station.

8. Apparatus for forming container parts from corner notched and tabbed blanks comprising a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, anvils for supporting said laterally extending lower dies, longitudinally and laterally extending upper dies mounted at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means for lowering and raising both sets of upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable tab sealing means at said anvils, means for reciprocating said tab sealing means, tab chill means at said tab sealing means, means for reciprocating said chill means for bringing the chill means against the blank before the tab sealing means engages the blank and for retracting said chill means from the blank after said sealing means is withdrawn from the blank, means for driving said tab sealing and chill means, tuck plates reciprocable longitudinally of the apparatus for holding the corners of the blank against said anvils during operation of said sealing and chill means, and means for retracting said tuck plates while the upper dies at said second folding station are performing their folding operation.

9. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising a laterally extending inboard lower die, anvils mounting said inboard lower die on said tables, corner blocks adjustably mounted for movement along said tables, an outboard laterally extending lower die, anvils mounting said outboard die on said corner blocks, longitudinally and laterally extending upper dies mounted on said tables at said first folding station and at the inboard lower die of said second folding station, a laterally extending upper die mounted on said corner blocks at the outboard lower die of said second folding station, said upper dies being mounted for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable inboard and outboard tab sealing means at said anvils, means mounting said inboard and outboard sealing means on said tables and corner blocks respectively, means for reciprocating said tab sealing means by said camshaft, tab chill means at said tab sealing means, means for reciprocating said chill means for bringing the chill means against the blank before the tab sealing means engages the blank and for retracting said chill means from the blank after said sealing means is withdrawn from the blank, inboard and outboard tuck plates mounted on said tables and corner blocks respectively and reciprocable longitudinally of the apparatus for holding the corners of the blank against said anvils during operation of said sealing and chill means, means for operating said tuck plates by said camshaft including means for retracting said tuck plates to clear the flaps being folded while the upper dies at said second folding station

are performing their folding operation, and folded blank delivery means mounted on one of said corner blocks comprising elevators for lifting the completed container part from the lower dies of said second folding station, and a laterally reciprocable ejector foot for pushing a folding blank clear of said second folding station.

10. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising a laterally extending inboard lower die, anvils mounting said inboard lower die on said tables, corner blocks adjustably mounted for movement along said tables, an outboard laterally extending lower die, anvils mounting said outboard die on said corner blocks, longitudinally and laterally extending upper dies mounted on said tables at said first folding station and at the inboard die of said folding station, a laterally extending upper die mounted on said corner blocks at said second folding station, said upper dies being mounted for motion toward and away from the corresponding lower dies, drive means for both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable inboard and outboard tab sealing means at said anvils, means mounting said inboard and outboard sealing means on said tables and corner blocks, respectively, and means for reciprocating said tab sealing means.

11. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, longitudinally extending camshafts mounted on said tables, a cam set fixed on each camshaft, means for driving said camshaft, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising a laterally extending inboard lower die, anvils mounting said inboard lower die on said tables, corner blocks adjustably mounted for movement along said tables, a cam set slideable on each camshaft, means on said corner blocks for moving said cam set with the corner blocks, an outboard laterally extending lower die, anvils mounting said outboard die on said corner blocks, longitudinally and laterally extending upper dies mounted on said tables at said first folding station and at the inboard lower die of said second folding station, a laterally extending upper die mounted on said corner blocks at the outboard lower die of said second folding station, said upper dies being mounted for motion toward and away from the corresponding lower dies, drive means between said fixed cam sets, the upper dies at said first holding station, and the inboard upper die at said second folding station, drive means between said slidable cam sets and the outboard upper die, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable inboard and outboard tab sealing means at said anvils, means mounting said inboard and outboard sealing means on said tables and said corner blocks respectively, means for reciprocating said inboard and outboard tab sealing means by said fixed and sliding cam sets respectively, tab chill means at said tab sealing means, means for reciprocating said chill means for bringing the chill means against the blank before the tab sealing means engages the blank and for retracting said chill means from the blank after said sealing means is withdrawn from the blank, inboard and outboard tuck plates

mounted on said tables and said corner blocks respectively, and reciprocable longitudinally of the apparatus for holding the corners of the blank against said anvils during operation of said sealing and chill means, means for operating said inboard and outboard tuck plates by said inboard and outboard cam set respectively, including means for retracting said tuck plates to clear the flaps being folded while the upper dies at said second folding station are performing their folding operation, and folded blank delivery means mounted on one of said corner blocks comprising elevators operated by said sliding cam set for lifting the completed container part from the lower dies of said second folding station, and a laterally reciprocable ejector foot for pushing a folded blank clear of said second folding station.

12. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, longitudinally extending camshafts mounted on said tables, a cam set fixed on each camshaft, means for driving said camshafts, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising a laterally extending inboard lower die, anvils mounting said inboard lower die on said tables, corner blocks adjustably mounted for movement along said tables, a cam set slidable on each camshaft, means on said corner blocks for moving said cam set with the corner blocks, an outboard laterally extending lower die, anvils mounting said outboard die on said corner blocks, longitudinally and laterally extending upper dies mounted on said tables at said first folding station and at the inboard lower die of said second folding station, a laterally extending upper die mounted on said corner blocks at the outboard lower die of said second folding station, said upper die being mounted for motion toward and away from the corresponding lower dies, drive means between said fixed cam sets, the upper dies at said first folding station, and the inboard die at said second folding station, drive means between said slidable cam sets and the outboard upper die, blank feed means for progressively and simultaneously advancing blanks from station to station, laterally reciprocable inboard and outboard tab sealing means at said anvils, means mounting said inboard and outboard sealing means on said tables and said corner blocks respectively, and means for reciprocating said inboard and outboard tab sealing means by said fixed and sliding cam sets respectively.

13. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies mounted on said tables at said first and second folding stations for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, anvils mounted on said tables at the ends of the lower dies of said second folding station, laterally reciprocable tab sealing means at said anvils, and means for reciprocating said tab sealing means by said camshafts.

14. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies movably mounted on said table at said first and second folding stations respectively for motion toward and away from the corresponding lower dies, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, and blank feed means for progressively and simultaneously advancing blanks from station to station, the drive means for the upper dies at said second folding station operating said upper dies consecutively to minimize stretching of the material by the later operating laterally extending upper die.

15. Apparatus for forming container parts from corner notched and tabbed blanks comprising a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending inboard and outboard lower dies for receiving blanks from said first folding station, longitudinally and laterally extending upper dies movably mounted at said first and second folding stations respectively for motion toward and away from the corresponding lower dies, drive means for both sets of upper dies for lowering and raising the upper dies, and blank feed means for simultaneously advancing blanks from said registration station to said first folding station and from said first folding station to said second folding station, means for retracting said feed means, the drive means for the upper dies at said second folding station lowering said outboard upper die before said inboard upper die is lowered, to grip the blank while said blank feed means is retracting clear of said inboard upper die, and to perform a square fold at said outboard lower die without distorting the blank material.

16. Apparatus for forming container parts from corner notched blanks having longitudinally extending unfolded flaps and laterally extending unfolded flaps with said latter flaps having unfolded tabs projecting laterally therefrom, said apparatus comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including laterally spaced longitudinally side guides for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, anvils mounting said laterally extending lower dies on said tables, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally extending upper dies mounted on said tables at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, laterally extending upper dies mounted on said tables at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank and bringing the previously folded tabs

into overlapping relation with the longitudinally extending flaps, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means for progressively and simultaneously advancing blanks from station to station, tab sealing means mounted for lateral reciprocation at said anvils, means for reciprocating said tab sealing means by said camshafts, tuck plates reciprocable longitudinally of the apparatus for holding the corners of the laterally extending folded down flaps of the blank against said anvils while said tab sealing means advance laterally toward said anvils, and means driven by said camshafts for operating said tuck plates.

17. Apparatus for forming container parts from corner notched blanks having longitudinally extending unfolded flaps and laterally extending unfolded flaps with said latter flaps having unfolded tabs projecting laterally therefrom, said apparatus comprising a first folding station having laterally spaced longitudinally extending lower dies, a second folding station having longitudinally spaced laterally extending lower die for receiving blanks from said first folding station, longitudinally extending upper dies at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, laterally extending upper dies at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank and bringing the previously folded tabs into overlapping relation with the longitudinally extending flaps, drive means for both sets of upper dies for lowering and raising the upper dies, blank feed means for advancing blanks from said first folding station to said second folding station, anvils mounted adjacent the ends of the lower dies of said second folding station, tab sealing means mounted for lateral reciprocation at said anvils, means for reciprocating said tab sealing means, tuck plates reciprocable longitudinally of the apparatus for holding the corners of the laterally extending folded down flaps of the blank against said anvils while said tab sealing means advance laterally toward said anvils, and drive means for operating said tuck plates.

18. Apparatus for forming container parts from corner notched blanks having longitudinally extending unfolded flaps and laterally extending unfolded flaps with said latter flaps having unfolded tabs projecting laterally therefrom; said apparatus comprising a first folding station having laterally spaced longitudinally extending lower dies, a second folding station having longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending upper dies mounted on said tables at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, drive means for said longitudinally extending upper dies, laterally extending upper dies mounted on said tables at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank and bringing the previously folded tabs into overlapping relation with the longitudinally extending flaps, drive means for said laterally extending upper dies, said latter drive means operating said upper dies consecutively to insure that the later operating upper die does not distort the blank material and makes a square bend, blank feed means for advancing blanks from said first folding station to said second folding station, anvils mounted adjacent the ends of the lower dies of said second folding station, tab sealing means mounted for lateral reciprocation at said anvils, means for reciprocating said tab sealing means, tuck plates reciprocable longitudinally of the apparatus for holding the corners of the laterally extending folded down flaps of the blank

against said anvils while said tab sealing means advance laterally toward said anvils, and drive means for operating said tuck plates.

19. Apparatus for forming container parts from corner notched blanks having longitudinally extending unfolded flaps and laterally extending unfolded flaps with said latter flaps having unfolded tabs projecting laterally therefrom, said apparatus comprising a first folding station having laterally spaced longitudinally extending lower dies, a second folding station having longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending upper dies mounted on said tables at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, drive means for said longitudinally extending upper dies, laterally extending upper dies mounted on said tables at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank and bringing the previously folded tabs into overlapping relation with the longitudinally extending flaps, drive means for laterally extending upper dies, said latter drive means operating said upper dies consecutively to insure that the later operating upper die does not distort the blank material and makes a square bend, blank feed means for advancing blanks from said first folding station, anvils mounted adjacent the ends of the lower dies of said second folding station, tab sealing means mounted for lateral reciprocation at said anvils, and means for reciprocating said tab sealing means.

20. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally extending camshafts mounted on said tables, means for driving said camshafts, longitudinally and laterally extending upper dies movably mounted on said table at said first and second folding stations, respectively, drive means between said camshafts and both sets of upper dies for lowering and raising the upper dies, blank feed means reciprocable longitudinally of said apparatus and having longitudinally spaced pushers for progressively and simultaneously advancing blanks from station to station, means for reciprocating said blank feed means, and means operated by said camshafts for raising said blank feed means to engage blanks for feeding and for lowering said blank feed means to clear blanks on a retract stroke.

21. Apparatus for forming container parts from corner notched and tabbed blanks comprising a blank registration station at the forward end of the apparatus including means for guiding the longitudinally extending edges of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies for receiving blanks from said registration station, a second folding station comprising longitudinally spaced laterally extending lower dies for receiving blanks from said first folding station, longitudinally and laterally extending upper dies movably mounted at said first and second folding station respectively, drive means for lowering and raising the longitudinally extending upper dies at said first folding station, drive means for lowering and raising the laterally extending upper dies at said second folding station, said drive means operating said upper dies consecutively to insure that the later descending upper die makes a right angle bend without distorting the blank material, and blank feed means for progressively and simultaneously advancing blanks from station to station.

22. Apparatus for forming a container part having a main panel and sidewalls, said container part being formed from corner notched blanks forming the main panel, unfolded longitudinally extending sidewall flaps, and laterally extending unfolded sidewall flaps having unfolded tabs projecting laterally therefrom; said apparatus comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including laterally spaced longitudinally side guides for the edges of the longitudinally extending flaps of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, means for adjusting the lateral spacing of said tables and hence the spacing of said longitudinally extending lower dies for accommodating one panel dimension, means for adjusting the lateral spacing of said side guides from said lower dies for accommodating the width of the longitudinally extending flaps, a second folding station comprising longitudinally spaced laterally extending inboard and outboard lower dies for receiving blanks from said first folding station, means mounting the inboard lower die in a normally longitudinally fixed position on said tables, means mounting the outboard lower die for longitudinal adjustment on said tables for accommodating the other panel dimension, longitudinally extending upper dies mounted on said tables at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, laterally extending upper dies at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank while bringing the previously folded tabs coextensive with the ends of the longitudinally extending flaps, drive means for lowering and raising both sets of upper dies, blank feed means for simultaneously advancing blanks from the registration station to the first folding station and from the first folding station to the second folding station, means for reciprocating said blank feed means over a fixed stroke, means for adjusting the longitudinal position of said blank feed means relative to said inboard lower die to accommodate the width of the trailing laterally extending flap, outboard blank stop means disposed rearwardly of said outboard lower die, means for adjusting the longitudinal spacing of said outboard stop means from said outboard lower die to accommodate the width of the leading laterally extending flap, and means at the ends of said laterally extending lower dies for joining the lateral flap tabs to the longitudinally extending flaps.

23. Apparatus for forming a container part having a main panel and sidewalls, said container part being formed from corner notched blanks forming the main panel, unfolded longitudinally extending sidewall flaps, and laterally extending unfolded sidewall flaps having unfolded tabs projecting laterally therefrom; said apparatus comprising a frame, a pair of laterally spaced tables extending longitudinally of said frame, a blank registration station at the forward end of the apparatus including laterally spaced longitudinally side guides for the edges of the longitudinally extending flaps of the blanks, a first folding station comprising laterally spaced longitudinally extending lower dies supported on said tables for receiving blanks from said registration station, means for adjusting the lateral spacing of said tables and hence the spacing of said longitudinally extending lower dies for accommodating one panel dimension, means for adjusting the lateral spacing of said side guides from said lower dies for accommodating the width of the longitudinally extending flaps, a second folding station comprising longitudinally spaced laterally extending inboard and outboard lower dies for receiving blanks from said first fold-

ing station, means mounting the inboard lower die in a normally longitudinally fixed position on said tables, means mounting the outboard lower die for longitudinal adjustment on said tables for accommodating the other panel dimension, longitudinally extending upper dies mounted on said tables at said first folding station and movable toward and away from said longitudinally extending lower dies for folding down both the longitudinally extending flaps and the tabs on the laterally extending flaps of the blank, laterally extending upper dies at said second folding station and movable toward and away from said laterally extending lower dies for folding down the laterally extending flaps of the blank while bringing the previously folded tabs coextensive with the ends of the longitudinally extending flaps, drive means for lowering and raising both sets of upper dies, blank feed means for simultaneously advancing blanks from the registration station to the first folding station and from the first folding station to the second folding station, means for reciprocating said blank feed means over a fixed stroke, means for adjusting the longitudinal position of said blank feed means relative to said inboard lower die to accommodate the width of the trailing laterally extending flap, and means at the ends of said laterally extending lower dies for joining the blank tabs to the longitudinally extending flaps.

24. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame; a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending lower dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, longitudinally spaced, laterally extending lower dies mounted on said die support means for receiving blanks from said first folding station; longitudinally and laterally extending upper dies movably mounted on the die support means at said first and second folding stations respectively; drive means for lowering and raising said upper dies to form flaps that depend from the base of the blank; blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; and means for sealing the tabs of the flaps at said second folding station; the laterally extending lower dies at said second folding station being detachably mounted on the associated die support means, said laterally extending lower dies, when mounted, being no longer than the lateral spacing of said longitudinally extending dies at said first folding station, in order to insure that the descending upper dies at said second folding station can fold down flaps at right angles to the base of the blank without interfering with the longitudinally extending flaps previously formed at said first folding station.

25. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame; a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending fixed dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, longitudinally spaced, laterally extending fixed dies mounted on said die support means for receiving blanks from said first folding station; longitudinally and laterally extending flap folding dies movably mounted on the die support means at said first and second folding stations respectively; drive means for moving said movable dies toward and away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blank; blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; and means for sealing the tabs of the flaps at said second folding station; the laterally extending fixed dies at said second folding station being detachably mounted on the associated die support means,

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said laterally extending fixed dies, when mounted, being no longer than the lateral spacing of said longitudinally extending fixed dies at said first folding station, in order to insure that the movable die at said second folding station can fold flaps at right angles to the base of the blank without interfering with the longitudinally extending flaps previously formed at said first folding station.

26. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame; a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending fixed dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, longitudinally spaced, laterally extending fixed dies mounted on said die support means for receiving blanks from said first folding station; longitudinally and laterally extending flap folding dies movably mounted on the die support means at said first and second folding stations respectively; drive means for moving said movable dies toward and away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blanks; said drive means operating the laterally extending dies at the second folding station consecutively to prevent distortion of the blank; blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; and reciprocating means for sealing the tabs of the flaps at said second folding station, said reciprocating sealing means being synchronized with the associated movable lateral die.

27. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame; a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending fixed dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, fixed dies mounted on said die support means for receiving blanks from said first folding station; flap folding dies movably mounted on the die support means at said first and second folding station respectively; drive means for moving said movable dies toward and away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blank; said drive means operating the dies at the second folding station consecutively to prevent distortion of the blank during forming of the flaps at said folding station; blank feed means for progressively and simultaneously advancing blanks from station to station; and reciprocating means for sealing the tabs of the flaps at said second folding station, said reciprocating sealing means being synchronized with the associated movable lateral die.

28. Apparatus for forming container parts from corner notched and tabbed blanks including heat sealable material, comprising a frame, a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending fixed dies mounted on said die support means for receiving blanks; a second folding station comprising die support means, on said frame, said die support means including vertical corner anvils, fixed dies mounted on said anvils for receiving blanks from said first folding station; flap folding dies movably mounted on the die support means at said first and second folding station respectively; drive means for moving said movable dies toward and away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blank; blank feed means for progressively and simultaneously advancing blanks from station to station; reciprocating sealing heads for sealing the tabs of the flaps while backed up by said anvils at the second folding station, and means for heating said sealing heads and anvils.

29. Apparatus for forming container parts from corner

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notched and tabbed blanks comprising a frame, a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending lower dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, longitudinally spaced, laterally extending lower dies mounted on said die support means for receiving blanks from said first folding station; longitudinally and laterally extending upper dies movably mounted on the die support means at said first and second folding station respectively; drive means for lowering and raising said upper dies to form flaps that depend from the base of the blank; longitudinally extending guide means forming continuations of said longitudinally extending lower dies, and blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; the longitudinal flaps formed at said first folding station cooperating with said guide means to maintain said blank orientation during transfer.

30. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a first folding station comprising die support means on said frame, laterally spaced, longitudinally extending lower dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame, longitudinally spaced, laterally extending lower dies mounted on said die support means for receiving blanks from said first folding station; longitudinally and laterally extending upper dies movably mounted on the die support means at said first and second folding stations respectively; drive means for lowering and raising said upper dies to form flaps that depend from the base of the blank; and blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; the longitudinal flaps formed at said first folding station cooperating with longitudinally extending lower dies to maintain said blank orientation during initial blank transfer.

31. Apparatus for forming container parts from corner notched and tabbed blanks comprising a frame, a first folding station comprising die support means on said frame, fixed spaced dies mounted on said die support means for receiving blanks; a second folding station comprising die support means on said frame fixed spaced dies mounted on said die support means for receiving blanks from said first folding station; flap folding dies movably mounted on the die support means at said first and second folding stations respectively; drive means for moving said movable dies toward and away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blank; and blank feed means for progressively and simultaneously advancing blanks from station to station while maintaining the orientation of the blank relative to said frame; the fixed dies at said second folding station being detachably mounted on the associated die support means, said latter fixed dies, when mounted, being no longer than the spacing of the fixed dies at said first folding station, in order to insure that the movable dies at said second folding station can fold flaps at right angles to the base of the blank without interfering with the flaps previously formed at said first folding station; said fixed dies at the second folding station each comprising a body portion having a vertical outer face, and a bead forming edge portion that is thinner than said body portion, said bead forming edge portion of the die being offset outwardly from the vertical outer face of the body portion to insure the formation of permanent right angle folds.

32. Apparatus for folding down flaps from container blanks comprising a frame, die support means on said frame, spaced fixed dies mounted on said die support means for receiving blanks; flap folding dies movably mounted on said die support means at said fixed dies; drive means for moving said movable dies toward and

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away from said fixed dies to form flaps that form an angle of substantially 90° with the base of the blank; said fixed dies being detachably mounted on said die support means, said fixed dies comprising a body portion having a vertical outer face, and a bead forming edge portion that is thinner than said body portion, said bead forming edge portion being offset outwardly from the vertical outer face of said body portion to insure the formation of permanent right angle folds.

33. A machine adjustable to produce, from corner notched sheet material blanks of appropriate size, open rectangular boxes having edge dimensions within given ranges, said machine comprising: longitudinally extending and laterally spaced blank guides for the registration and guiding of said blanks from the front toward the rear of the machine, longitudinally extending and laterally spaced first fold die sets for receiving the registered blanks and for folding a first pair of flaps from the plane of the blanks, a pair of laterally extending and longitudinally spaced second fold die sets arranged to receive first folded blanks and adapted to fold the second pair of flaps from the plane of the blank, blank feed means for moving each blank successively along said guides to said first fold die sets, from said first fold die sets to said second fold die sets and from said second fold die sets, and machine adjustment means for adjusting the spacing of the first fold die sets with respect to one another, the blank guides with respect to one another, the second fold die sets with respect to one another, and the blank feed means according to the blank and box size.

34. A machine adjustable to produce, from corner notched and tabbed sheet material blanks of appropriate size, open rectangular boxes having edge dimensions within given ranges, said machine comprising a frame; a pair of longitudinally extending tables mounted on said frame; a set of cooperating longitudinally extending first fold dies fixedly mounted on each table intermediate of said table ends; a longitudinally extending blank guide mounted on each table outwardly of the corresponding first fold die set and extending rearward from the front of each table; an inboard anvil fixed to each table to the rear of and in longitudinal alignment with the corresponding first fold die set; an outboard anvil mounted on each table to the rear of the corresponding inboard anvil and in longitudinal alignment with the corresponding first fold die set; a set of laterally extending second fold inboard dies fixedly associated with respect to and extending between the inboard anvils; a set of laterally extending second fold outboard dies fixedly located with respect to and extending between the outboard anvils; tab sealing means associated with each anvil for clamping the adjacent tab and flap between said means and the anvil to secure said tab and flap together; blank feed means for progressively advancing blanks along said blank guides to said first fold die sets and from first fold die sets to said anvils and said second fold die sets; box ejector means for ejecting a completed box from said anvils and moving said completed box from the machine in timed relation with said feed means; means for adjusting the lateral spacing of the blank guide with respect to the first fold die set on each table and for adjusting said blank feed means to effect an adjustment for box depth; means for adjusting the lateral

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spacing of tables with respect to one another to correspondingly adjust the lateral spacing of the first fold die sets with respect to one another and thereby to effect an adjustment for one of the remaining box dimensions; and means for adjusting the longitudinal spacing of the outboard and inboard anvils on each table to effect an adjustment of the other remaining box dimension; at least one inboard and one outboard die of each set being replaceable to permit said table adjustment and to provide fold edges between said inboard anvils and said outboard anvils.

35. A machine adjustable to produce from sheet material blanks of appropriate size, open rectangular boxes having edge dimensions within given ranges, each blank being corner notched to provide a first pair of opposite flaps, a second pair of opposite flaps, and a pair of opposite sided tabs on each of said second flaps, said machine comprising: a frame; a pair of longitudinally extending tables mounted by said frame for lateral adjustment with respect thereto; a set of cooperating longitudinally extending first fold dies fixedly mounted on each table intermediate of said table ends for folding said first pair of flaps and said tabs through substantially 90° from the plane of the blank; a longitudinally extending blank guide mounted on each table outwardly of, and for lateral adjustment with respect to, the corresponding first fold die set and extending rearward from the front of each table to guide the flat blanks to the first fold die sets; an inboard anvil fixed to each table to the rear of and in longitudinal alignment with the corresponding first fold die set; a set of laterally extending longitudinally spaced second fold inboard dies fixedly located with respect to and extending between the inboard anvils; an outboard anvil mounted for longitudinal adjustment on each table to the rear of the corresponding inboard anvil and in longitudinal alignment with the corresponding first fold die set; a set of second fold outboard dies extending laterally between the outboard anvils and adapted to be longitudinally adjustable with said anvils, the sets of second fold dies thereby being adapted to fold said second pair of flaps through substantially 90° from the plane of the blank; blank feed means for intermittently, progressively and simultaneously advancing blanks along said blank guides to said first fold die sets and from said first fold die sets to said anvils and said second fold die sets, said feed means being adjustable to locate each blank correctly with respect to said inboard die set; tab sealing means associated with each anvil for pressing and sealing the associated tab against the adjacent first flap to complete the box; and box ejector means for ejecting a completed box from said anvils and moving said completed box from the machine in timed relation with said feed means; the lateral adjustment of the tables being determined by the lateral width of the box, the lateral adjustment of each blank guide with respect to the corresponding first die set and the adjustment of the blank feed means being determined by the depth of the box, and the longitudinal adjustment of the inboard dies and anvils with respect to the outboard dies and anvils being determined by the longitudinal box dimension.

No references cited.