Jan. 23, 1945. C. T. HALL 2,368,020

MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

Filed Jan. 11, 1943 6 Sheets-Sheet 1

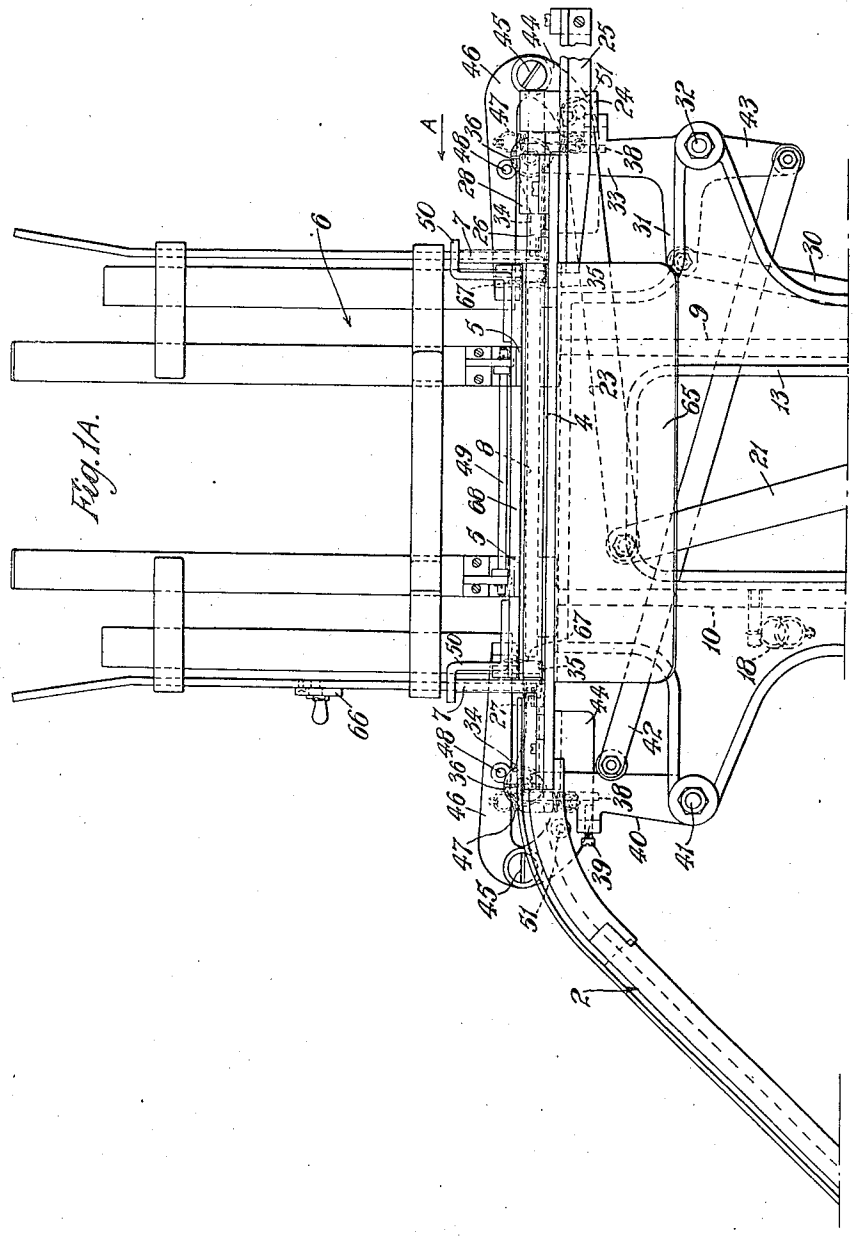


Fig. 1A.

Inventor
C. T. Hall
By Watson, Cole, Grindle & Watson
Attys

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MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

Filed Jan. 11, 1943 6 Sheets-Sheet 2

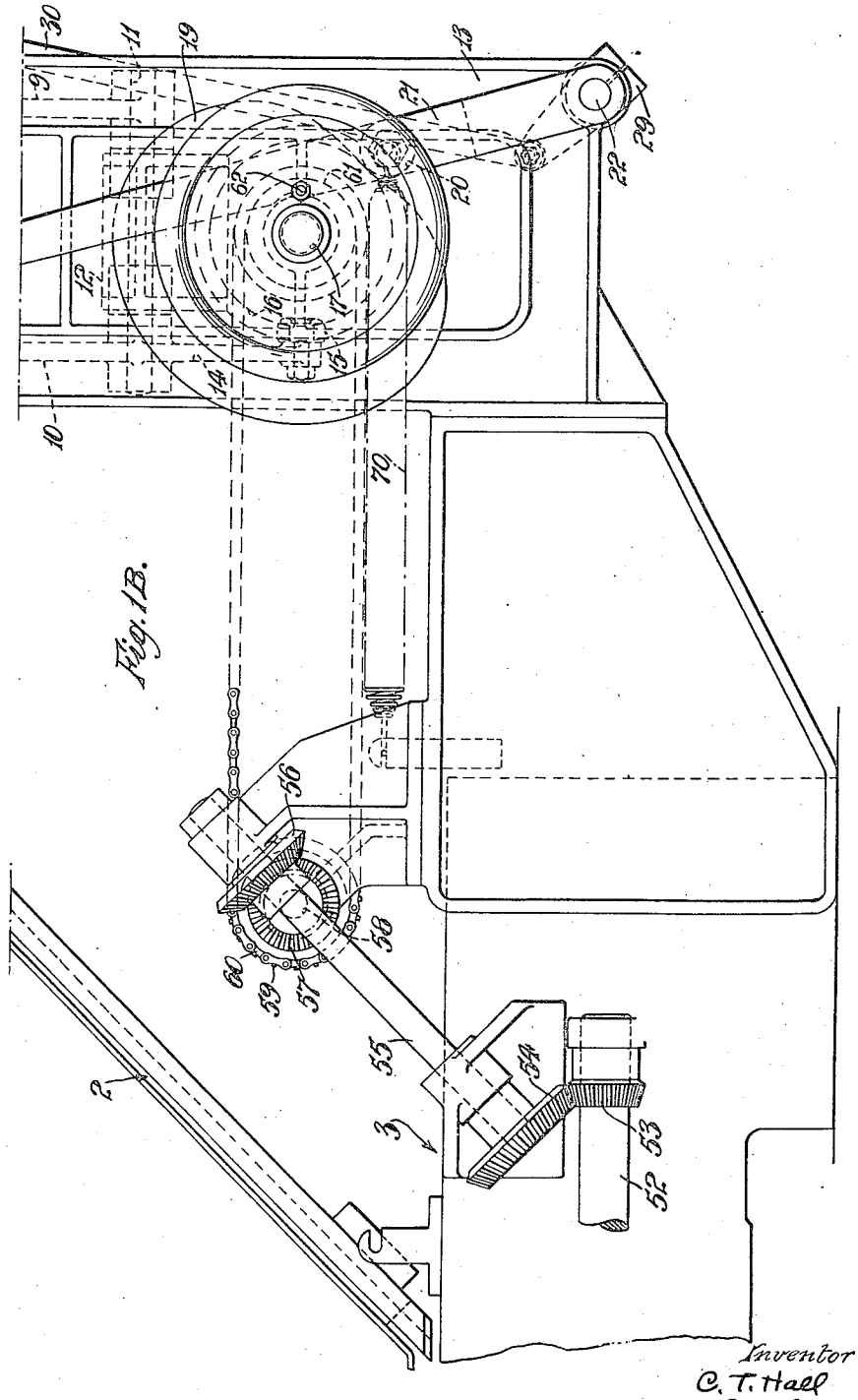


Fig. 1B.

Inventor
C. T. Hall
By Watson, Cole, Grindle & Watson ATTYS

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MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

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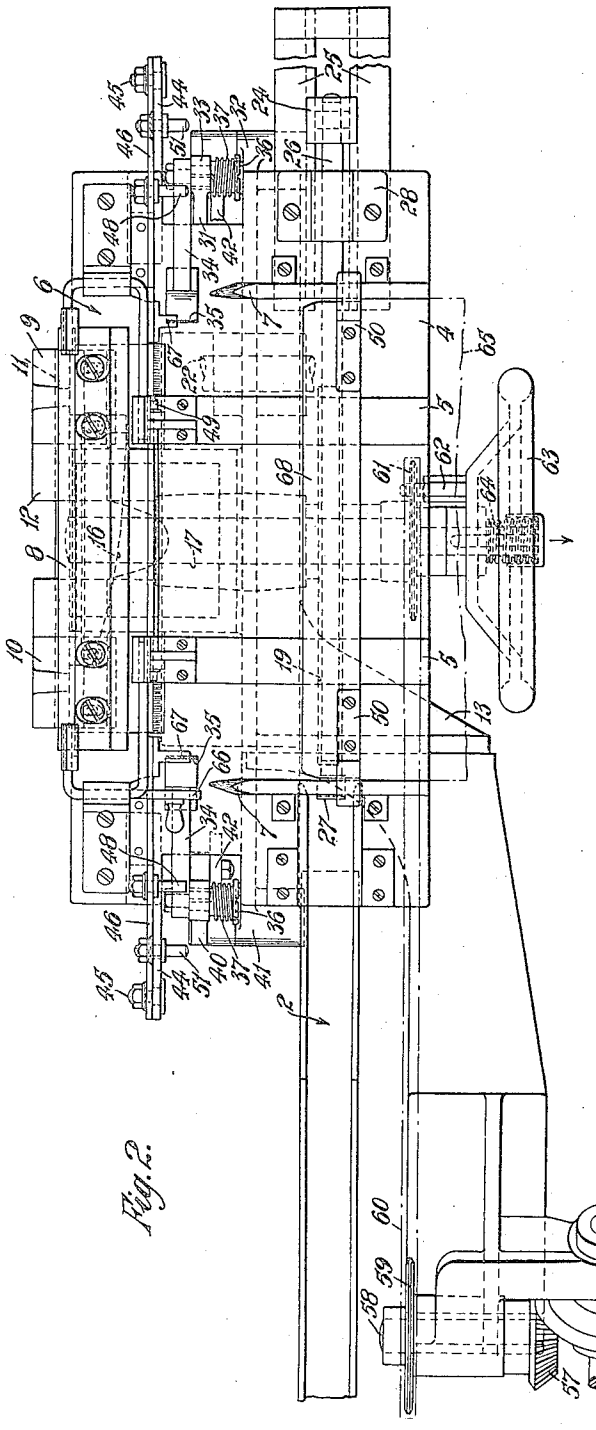


Fig. 2.

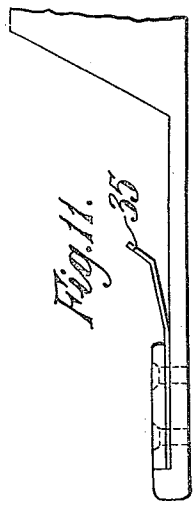


Fig. 11.

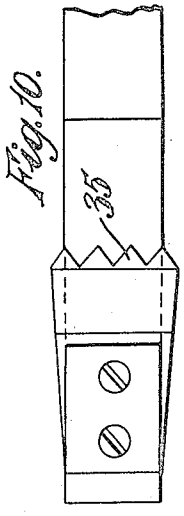


Fig. 10.

Inventor
C. T. Hall
By Watson, Cole, Grindler & Watson
Attys

Jan. 23, 1945. C. T. HALL 2,368,020

MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

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Fig. 3

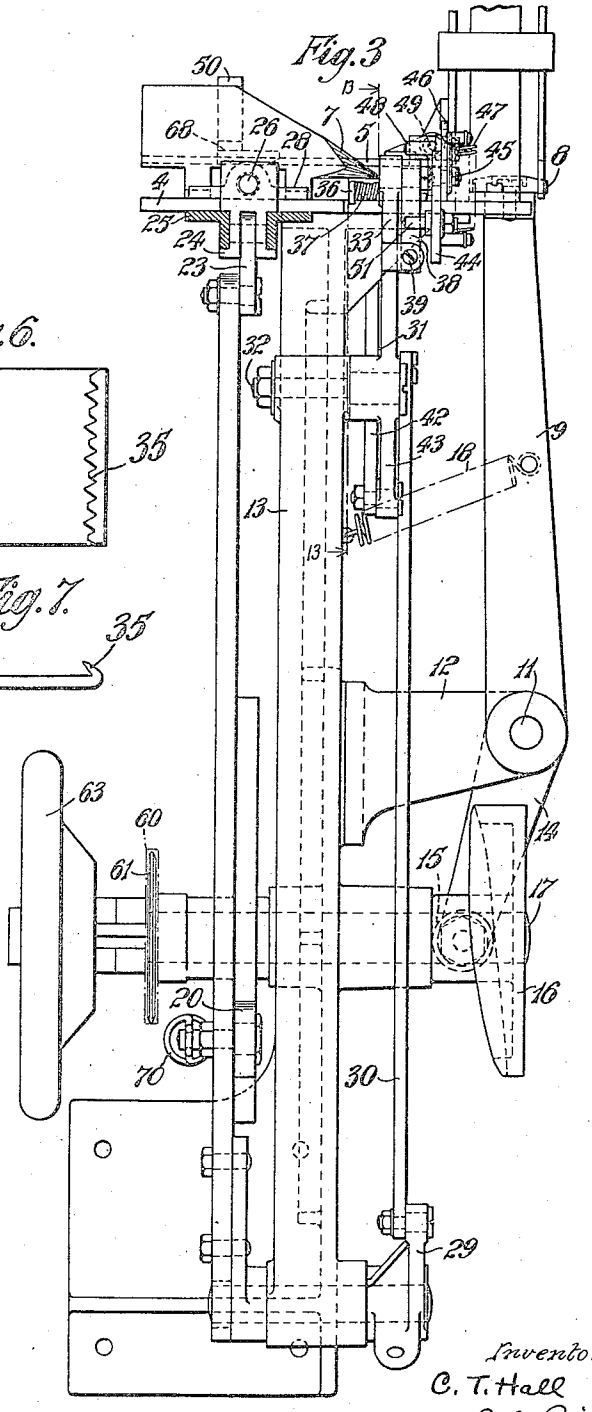


Fig. 6.

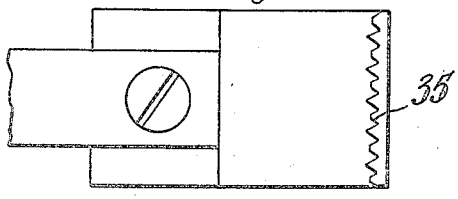
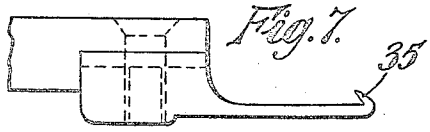


Fig. 7.



Inventor:
C. T. Hall
By Watson, Cole, Grindle & Watson
ATTYS

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MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

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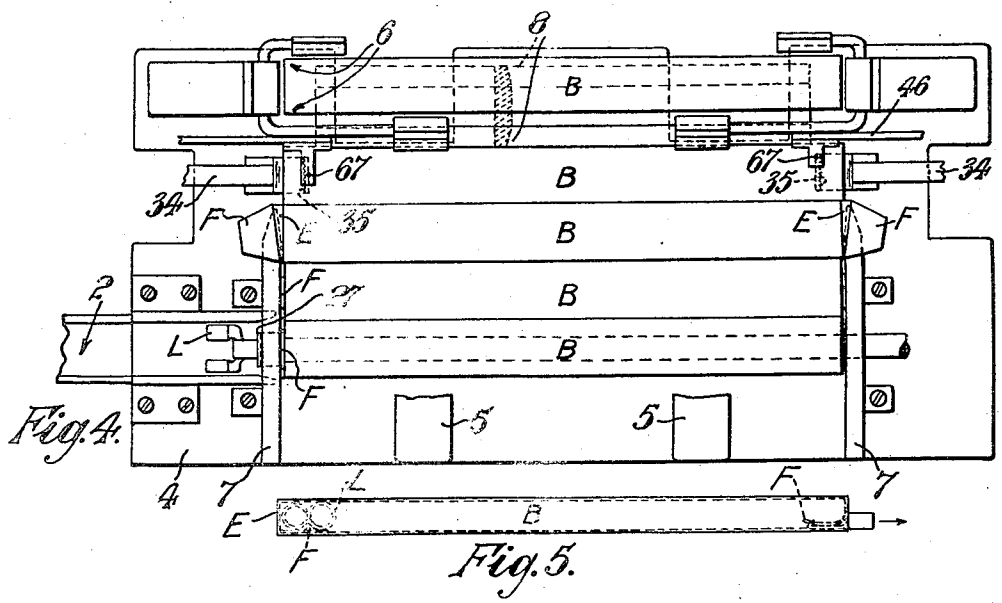


Fig. 4.

Fig. 5.

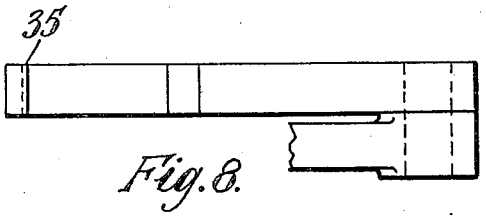


Fig. 8.

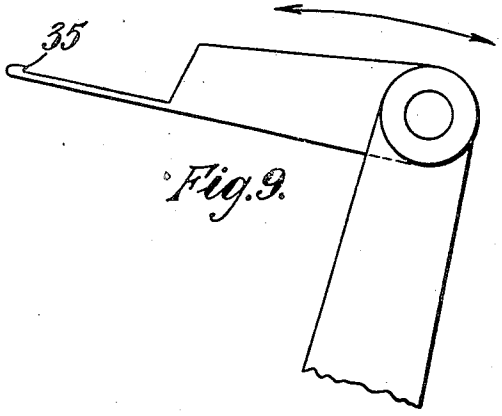


Fig. 9.

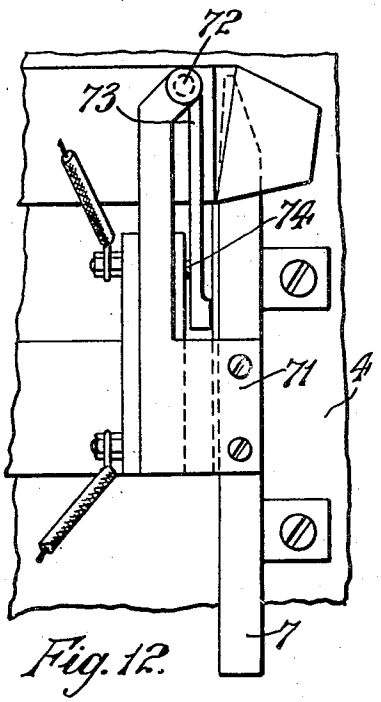


Fig. 12.

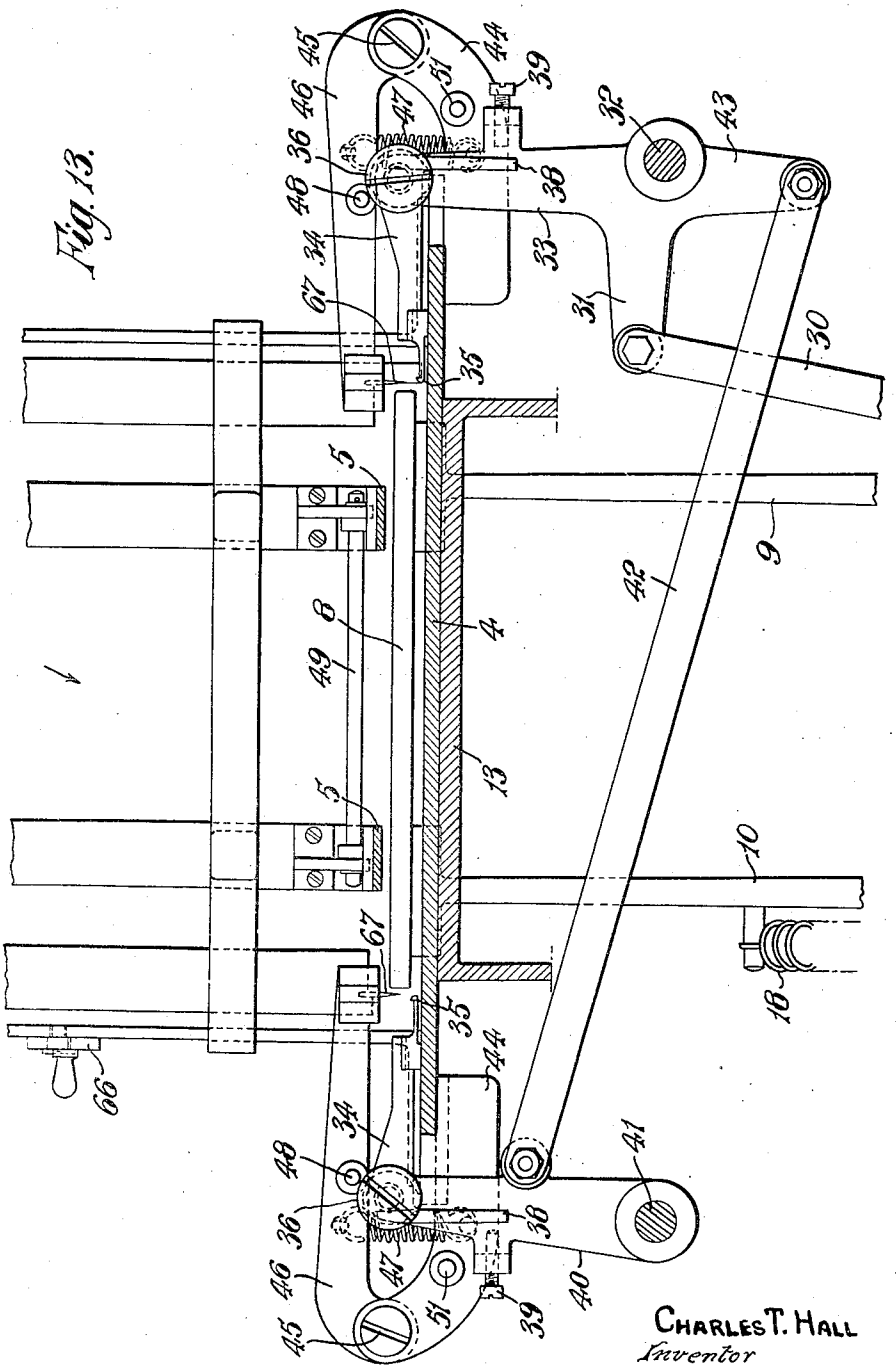
Inventor
C. T. Hall
By Walton, Cole, Grindle & Watson
ATTYS

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MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

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Fig. 13.



CHARLES T. HALL
Inventor

Watson, Cole, Grindle & Watson
Attorneys

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UNITED STATES PATENT OFFICE

2,368,020

MECHANISM FOR OPENING AND EJECTING THE CONTENTS OF BOXES

Charles Thomas Hall, Deptford, London, England, assignor to Molins Machine Company, Limited, London, England

Application January 11, 1943, Serial No. 472,088
In Great Britain January 12, 1942

8 Claims. (Cl. 214—1.1)

This invention concerns improvements in or relating to mechanism for opening and ejecting the contents of boxes. The boxes with which the invention is concerned are of the kind which comprises a tube made of cardboard or like material, in which one end at least is closed by a flap having a portion folded so as to lie within and against the tube. Such boxes will be referred to as "boxes of the kind described."

The object of the invention is to provide an improved mechanism whereby boxes of the kind described may be opened and their contents ejected endwise.

According to the present invention there is provided mechanism for opening boxes of the kind described, wherein an element having a claw, barb or other like projection is arranged to be inserted into and withdrawn from an end of the box having a closure flap, the claw or the like projection being moved into the box (e. g. beyond the end of the folded portion of the flap), and caused to engage the flap (e. g. the edge of the folded portion of the flap), whereby on withdrawal of the element the claw or like projection withdraws the flap.

Further according to the invention there is provided mechanism for opening and ejecting the contents of boxes of the kind described, wherein the tube has a flap as aforesaid at each end, comprising in combination means to feed boxes in succession from a supply, means to withdraw the end flaps from engagement with a box, guide members to raise the withdrawn end flaps as the box is moved laterally and to hold said flaps clear of the open ends of the box, and a pushing member arranged to enter the box at one end and eject the contents endwise through the opposite end.

A machine made in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figures 1A and 1B together comprise a front elevation of the machine.

Figure 2 is a plan of the machine.

Figure 3 is a side elevation looking in the direction of the arrow A, Figure 1A.

Figure 4 is a diagrammatic plan of the upper part of Figure 2 and only shows the essential elements of the box feeding and opening devices.

Figure 5 is a side elevation of a box showing an opening element engaging a closure flap.

Figures 6 and 7 are a plan and elevation respectively of an opening element drawn to a larger scale.

Figures 8 and 9 are a plan and elevation respectively of a different kind of opening element.

Figures 10 and 11 are a plan and elevation respectively of a still further kind of opening element.

Figure 12 shows a device for causing the machine to stop if a box flap fails to open.

Figure 13 is a section of Figure 3 on the line 13—13.

Referring to the drawings, the machine illustrated is intended for opening cardboard boxes of the kind described, the boxes B, Figure 4, having closure flaps at each end and containing links L, Figures 4 and 5, for machine-gun cartridge belts. The closure flap consists of two parts, an end wall for the box marked E and a tuck-in flap marked F. The machine is arranged to feed the links into a chute 2 from which they are to be delivered to a further machine, part of which is indicated at 3, Figure 1B, in which they are to be assembled with cartridges to form a belt. This machine may be of the kind shown in British Patent Specification No. 539,184. The boxes contain, for example, ten links, which are packed in such a manner that they are suitably aligned for delivery to such further machine.

A horizontal table 4, over which the boxes B, Figure 4, are to be moved laterally, is provided with horizontal top guides 5 arranged at a distance from the table just sufficient to permit the boxes to move between the top guides and the bed. At one side of the bed vertical side guides are provided, forming a receptacle or magazine 6 for a vertical stack of boxes. In Figure 13 the lower end of the left-hand rear rail of the magazine is broken away, as these lower ends are in line with the other parts, but the shape is similar to that of the right-hand rail which is fully shown. A pair of sloping guides or unfolding devices 7 is provided, one being fixed near each end of the table, for the purpose of engaging the flaps E and F of the box after they have been withdrawn and holding them clear of the open ends of the box.

A pusher member 8 is adjustably fixed on the upper ends of a pair of levers 9 and 10 which are pivoted at 11 in a bracket 12 attached to the frame 13 of the machine. The lower end of the lever 10 has an extension 14 carrying a roller 15 which engages with the surface of a crown cam 16 fixed on the main shaft 17 of the machine. The upper ends of the levers 9 and 10 are urged to move inwardly by a spring 18 attached to the frame of the machine, and are moved outwardly by the crown cam 16. The

pusher member 8 moves into and out of the lower part of the magazine for the stack of boxes.

The main shaft 17 carries a further cam 19 whose edge engages a roller 20 attached to a lever 21 which is fixed at its lower end to a spindle 22 pivoted in the frame, its upper end being connected by a link 23 to a slide 24 slidable in guides 25 fixed to the table 4. A rod 26 is fixed to the slide and has a pusher 27 at its other end. The rod passes through a guide bracket 28 fixed on the table. A spring 70 effects the return movement of the lever 21. As the cam-operated lever 21 is oscillated, the plunger is moved to and fro along the table in a direction transverse to the direction in which the boxes are moved over the table.

A further lever 29 is fixed to the spindle 22 and is connected by a link 30 to an arm 31 of a three-armed lever pivoted at 32 on a pin fixed in the frame of the machine. The uppermost arm 33 of this three-armed lever has pivotally mounted on it a bell-crank lever, one arm 34 of which is arranged to move to and fro over the table. The arm 34 has at its free end a claw or barb 35 in the form of a projection on its upper surface which claw is shown more clearly in Figures 6 and 7. In these views it will be seen that the claw is serrated or toothed and alternate serrations are sharp and blunt. The sharp points enter the material of the box flap and the blunt parts form stops or registers to limit the penetration.

The bell-crank lever is pivoted to the arm 33 by a pin 36 surrounded by a torsion spring 37 which is arranged to urge the arm 34 towards the table surface. The other arm 38 of the bell-crank depends from the pivot and when the arm 33 moves outwardly the arm 38, as will be more fully described later, is engaged by an adjusting screw 39 located in the arm 33. The screw in question is omitted from Figure 1A, but a similar screw bearing the reference 39 is shown at the left of the figure.

A similar claw member is provided at the opposite end of the bed and moved in the opposite direction to that of the first claw member. This second claw member is operated by a lever 40 pivoted to the frame at 41 and connected by a link 42 with the lowermost arm 43 of the above-mentioned three-armed lever. The other parts of the device which are similar to those previously described bear similar references.

A bracket 44 is fixed at each end of the table 4 and to each bracket there is pivotally attached at 45 a lever 46 which is pulled downwards by a spring 47. A pin 48 is fixed to the lever 46 and at times this pin is engaged by the upper part of the bell-crank lever. Thus the free end of the lever 46 is caused to rise and fall at predetermined intervals. At the free end there is fixed a needle 67. On each bracket 44 there is also fixed a pin 51.

The guides 5 are joined by a bar 68 and the whole structure is hinged at 49 so that it can swing upwards about said hinge. Brackets 50 fixed to the bar 68 engage the tops of the parts 7 and locate the structure in the working position.

As shown, the machine is driven from the cartridge belt assembling machine, see Figure 1B. The mainshaft 52 of this machine has a bevel gear wheel 53 fixed on it which engages another bevel gear wheel 54 fixed on an inclined shaft 55 journalled in brackets as shown. A further bevel gear wheel 56 on said shaft transmits the drive to another bevel gear wheel 57 on a stub shaft 58. A sprocket 59 is also fixed to said shaft and a chain 60 tranmits the drive to a sprocket 61 on the main shaft 17. This last sprocket is not fixed to the shaft but has a number of holes in it spaced apart around a circle concentric with the shaft axis. A pin 62 fixed on a handwheel 63 is normally located in one of the holes and as the handwheel is coupled to the shaft by a key the drive is transmitted to the shaft through the pin. If the handwheel is pulled outwards, that is, in the direction of the arrow Figure 2, and against the resistance of the spring 64, the pin is disengaged from the sprocket and the machine is stopped.

The operation of the machine is as follows, and is best followed by reference to Figure 4. Boxes filled with links are placed in the magazine 6 one on top of another to form a vertical stack. On rotation of the main shaft, the crown cam 16 and spring 18 cause the pusher 8 to move to and fro, and thus the pusher member moves into contact with the side of the lowermost box of the stack and pushes it laterally across the bed into a position in which it lies directly between and in line with the two claw members, which at this stage are drawn back beyond the edges of the table. On further rotation of the shaft, the pusher member 8 is drawn back and when it is clear of the magazine the stack of boxes moves downwardly so that the lowermost box of the stack becomes in turn supported on the table. At the same time the two claw members move inwardly toward each other to the position indicated in Figure 4, the movements being more fully described later.

Each box is disposed with the folded-in portions F of its end flaps in contact with the lower side wall of the box. As the claw members move inwardly, the leading edges of the claw members come into contact with the flaps E of the boxes, and on continued movement pass between the flaps F and the lower side wall of the box. At about the end of this inward movement the barbs reach a position where a link is located and the resistance offered thereby is sufficient to cause the barbs to enter the material of the flaps F, since the insertion of the claws causes the flaps to be pressed against the links. By this action the flaps will be withdrawn when the claw members move outwardly.

The claws are supported as previously mentioned on the bell-crank levers which are pivoted to the three-armed lever, and the lever 40 respectively. The torsion springs tend to press the bases of the claw members towards the table 4 as they move over the latter but as the claws move off the table they swing through an arc about the pivots 32 and 41 as soon as the stop screws 39 contact the arms 38 of the bell-cranks, and all the parts move as one. Later in the outward movement the arms 38 strike against the fixed pins 51 and then the bell-cranks execute a slight rotation on their pivots 36. Thus as the claws move inwards again these movements are reversed and they swing downwards with an arcuate movement as they approach the flaps E. Owing to the arcuate movement of the claw members as they move inwardly, their leading edges, as they pass between the end flaps and the lower side wall of the box, have a downward component of movement until they engage the lower side wall, whereupon the claw members turn slightly on their pivots 36 against the action of the springs 37, and the leading end of the claw

members slide inwardly along the lower side wall of the box. On the withdrawal movement, the ends of the claw members slide back along the lower side wall of the box until such time as the stops 39, and later the pins 51, are again engaged by the bell-cranks upon which the claw members move upward and outward and complete the withdrawal of the end flaps.

When the claw members have been withdrawn, the pusher member 3 again moves inwardly and pushes the lowermost box of the stack laterally across the bed into position between the claws. The box on which the claw members have just operated is thus moved still further across the table by the oncoming box into a position nearer into line with the reciprocating pusher 27. As this box is thus moved laterally, the withdrawn end flaps are engaged by the lower portions of the sloping guides, the flaps being raised thereby and held clear of the open ends of the box.

The feeding of two further boxes brings the box first mentioned into line with the pusher 27 and when a box arrives in this position the pusher 27 moves inwardly and enters the open end of the box, ejecting the links through the opposite end. At the same time, owing to the connection between the levers operating the pusher 27 and the claw members, the claw members move inwardly and commence to operate on the box now in the opening position in the manner described above, the inward movement of the claws coinciding with that of the pusher 27. When the pusher is withdrawn from the first box the claw members are likewise withdrawn from the box being opened.

The pusher member 3 again moves inwardly and a further box is moved across the bed, with the result that the first box, which is now empty, is pushed off the bed down a plate 65 while another box is moved into position in line with the pusher 27.

The links as they are ejected from a box move by gravity down the chute 2 which forms a continuation of the surface of the table, and thence are fed by any suitable means to the assembling machine.

As the links are loose in a box, it may happen, particularly in the case of boxes containing small links, that the entry of the claws and withdrawal of the flaps tends to displace or pull out a link. To prevent this the needles 67 are provided and are caused to penetrate the material of the top of the box and project through sufficiently far to prevent a link from moving out. These needles are raised by the bell-cranks as they swing upwards on the outward movement of the claws, the arms 34 engaging the pins 43 on the levers 46. As a fresh box comes into the opening position the levers 46 are pulled down by the springs 47 as soon as the arms 34 have moved in again sufficiently to allow this.

In boxes of the kind described, the folded portion which lies within and against the tube has to be of a certain minimum length in order that it may retain the end flap in position and consequently in a thin box of this kind (e. g. the box shown in Figures 4 and 5) the folded portion has to be nearly as long as in the case of a thicker box, for example a box half an inch thick has a folded portion equal in length to that of a box one inch thick. It will be seen that where articles such as links are contained in such a thin box, the claw members would have to move into the box a distance equal to that occupied by several links in order to engage the end of the flap F, and this tends to disturb the contents of the box and hinders the rapid and accurate opening of the end flaps. For this reason the claw members are constructed and operate as above described. Where the shape of the box permits the claw members may be constructed with ends as shown in Figures 8 and 9, and then operated to move through arcs as shown until they contact with the flaps E of the boxes and on continued movement pass between the flaps F and the lower side wall until at the end of the movement the extreme edges of the flaps F are engaged by the claws so that when the movement reverses the flaps are pulled out.

Figures 10 and 11 show another kind of opening device in which the claw is made of resilient material such as spring steel and clamped as shown to the opening arms.

As the mechanism herein described is intended for attachment to another machine, such for example as the machine referred to for assembling bullets for automatic guns, it is important that the continuous supply of the articles contained in the boxes shall be maintained, and sometimes boxes are inadequately filled or for some other reasons the supply of links is temporarily interrupted. For instance if a flap fails to open the box may jam. In order to compensate for such defects, means is provided for advancing feeding of the present mechanism relatively to the other machine. This is effected by driving the present mechanism from said machine by the means described which is operated in the following manner:

If a box jams it may be cleared by lifting the guides 5 about the hinge, a latch 66 being provided for holding the guides up while the box is removed. Meanwhile the machine may be stopped by pulling the handwheel in the direction of the arrow as previously described. Then the guides may be lowered and the handwheel may be rotated to advance the machine until the chute 2 is once more filled with links to normal capacity and the handwheel can then be released and the pin 62 will engage the nearest hole in the sprocket 61 whereupon the mechanical driving is resumed.

In some cases it may not be convenient to permit the machine to jam if a box flap fails to open. For instance if the material of the box is comparatively stiff or rigid the jamming of the box may be sufficiently severe to cause injury to the machine. To overcome this objection a device, such as is shown in Figure 12, may be associated with each of the unfolding devices 7. The device consists of a bracket 71 screwed on to the member 7, and having its free end formed as a pivot at 72. A lever 73 is attached to the pivot and its free end is normally in engagement with a flap which has just been opened by the device 7 and therefore standing upright between the device 7 and the lever 73.

The lever 73 presses against the stud of a switch 74 which is of the kind known as a "Microswitch." These switches, although of small size and requiring only a slight movement of the stud to operate them, are fit for use in an ordinary power circuit and the connections from the switch, which are indicated by wires in the figure, lead to the motor which drives the machine, and normally the stud is pressed inwards by the flaps of the boxes, and under these conditions the motor is running. If, however, a box flap fails to open, there will be no flap between the lever 73 and the surface of the member 7, and the spring pressure of the switch stud will move the

lever towards the right and the switch will move into the "off" position, and the motor will stop.

What I claim as my invention and desire to secure by Letters Patent is:

1. Mechanism for opening tubular cardboard boxes having a closure flap at at least one end, said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, an element having a claw-like projection, means arranged to insert said element into and to withdraw it from an end of a box having a closure flap when said box is on said support, said means being so arranged that the claw-like projection is moved into the box and caused to engage the flap, whereby on withdrawal of the element the claw-like projection withdraws the flap, a pointed element adapted to penetrate a wall of a box and prevent any of the contents from being withdrawn by said opening element, and means movable in timed relationship with the claw-like element to cause the pointed element to hold the contents against withdrawal during the opening of the flap.

2. Mechanism for opening tubular cardboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed said mechanism comprising a support for a box, feeding means to feed boxes in succession from a supply to said support, elements having claw-like projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box to engage the flaps, whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box and a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite end of the box.

3. Mechanism for opening tubular cardboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, feeding means to feed boxes in succession from a supply to said support, elements having claw-like projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box to engage the flaps whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box, a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite end of the box, and means movable in timed relationship with the pointed elements and claw-like elements to cause said elements to hold the contents from being withdrawn during the opening of the flaps.

4. Mechanism for opening tubular cardboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, feeding means to feed boxes in succession from a supply to said support, elements having clawlike projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box beyond the end of the folded portion of the flap and caused to engage the edge of the folded portion, whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box, and a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite end of the box.

5. Mechanism for opening tubular cardboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, feeding means to feed boxes in succession from a supply to said support, elements having claw-like projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box beyond the end of the folded portion of the flap and caused to engage the edge of the folded portion, whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box, a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite ends of the box, and means movable in timed relationship with the pointed elements and claw-like elements to cause said elements to hold the contents from being withdrawn during the opening of the flaps.

6. Mechanism for opening tubular carboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, feeding means to feed boxes in succession from a supply to said support, elements having claw-like projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box to engage the flaps, whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box, a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite end of the box, and an electric switch detector device adapted to cooperate with the opened flaps and operable to stop the mechanism if a closure flap is not opened.

7. Mechanism for opening tubular cardboard boxes having a closure flap at each end, each said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, feeding means to feed boxes in succession from a

supply to said support, elements having claw-like projections, means to insert said elements into and withdraw them from the respective ends of a box when said box is on said support, said means being so arranged that the claw-like elements are moved into the box to engage the flaps, whereby on withdrawal the claw-like elements withdraw the flaps, means to move a box laterally from said support after the flaps have been withdrawn, guide members to engage the withdrawn end flaps as the box moves laterally and to hold said flaps clear of the open ends of the box, a pusher member arranged to enter the box at one end and eject the contents endwise through the opposite end of the box, means movable in timed relationship with the pointed elements and claw-like elements to cause said elements to hold the contents from being withdrawn during the opening of the flaps, and an electric switch detector device adapted to co-operate with the opened flaps and operable to stop the mechanism if a closure flap is not opened.

8. Mechanism for opening tubular cardboard boxes having a closure flap at at least one end, said flap having a portion folded so as to lie within and against the tube when closed, said mechanism comprising a support for a box, an element having a claw-like projection, means arranged to insert said element into and to withdraw it from an end of a box having a closure flap when said box is on said support, said means being so arranged that the claw-like projection is moved into the box and caused to engage the flap, whereby on withdrawal of the element the claw-like projection withdraws the flap, and an electric switch detector device adapted to co-operate with the opened flap and operable to stop the mechanism if the closure flap is not opened.

CHARLES THOMAS HALL.