

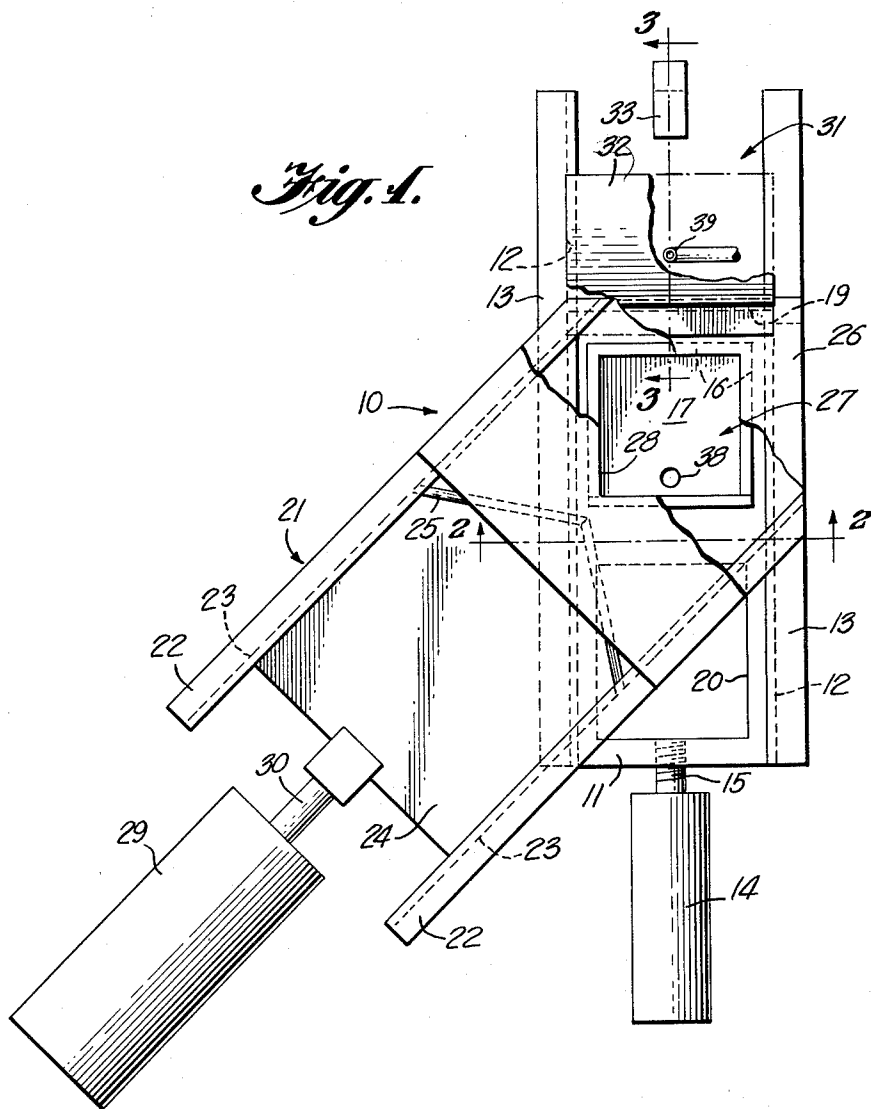
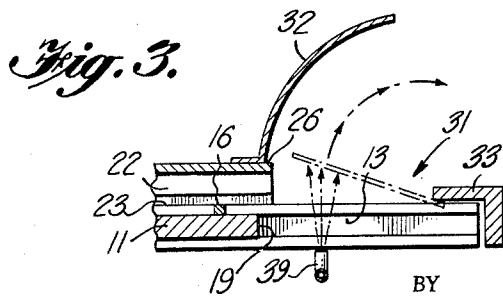
May 16, 1961

P. J. GARDNER
CAN OPENING APPARATUS

2,984,375

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3 Sheets-Sheet 1



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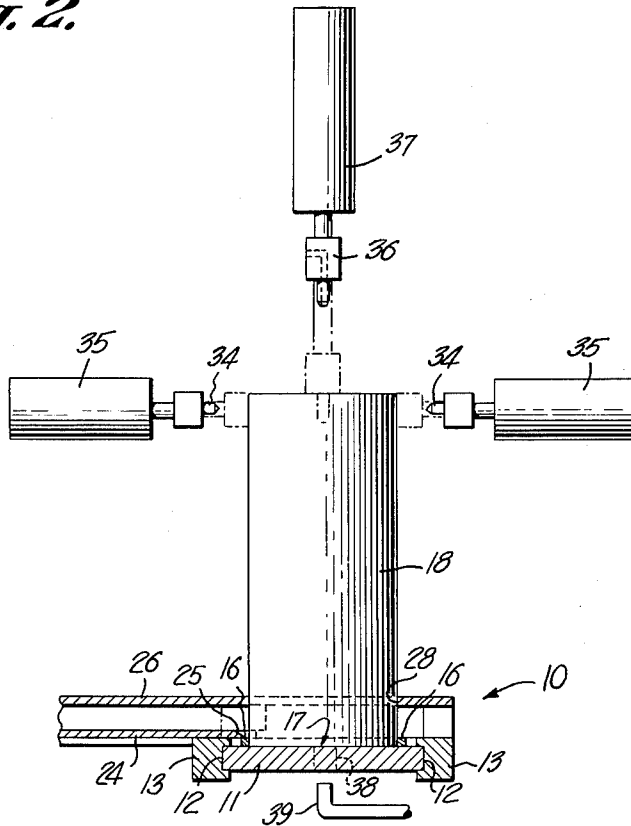
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3 Sheets-Sheet 2

Fig. 2.



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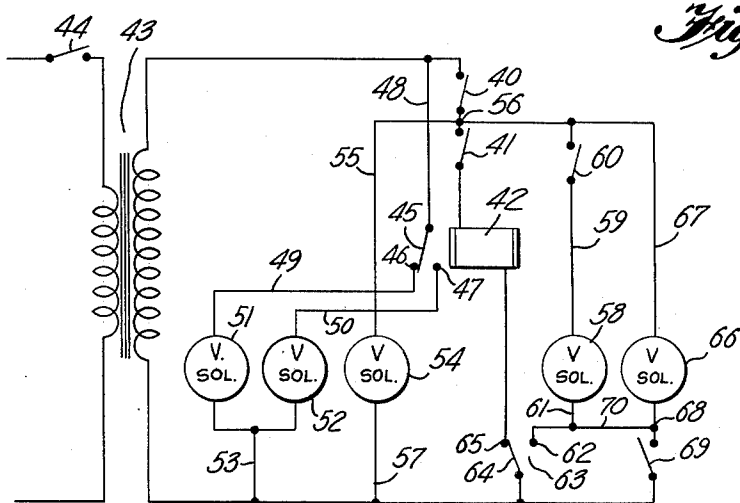
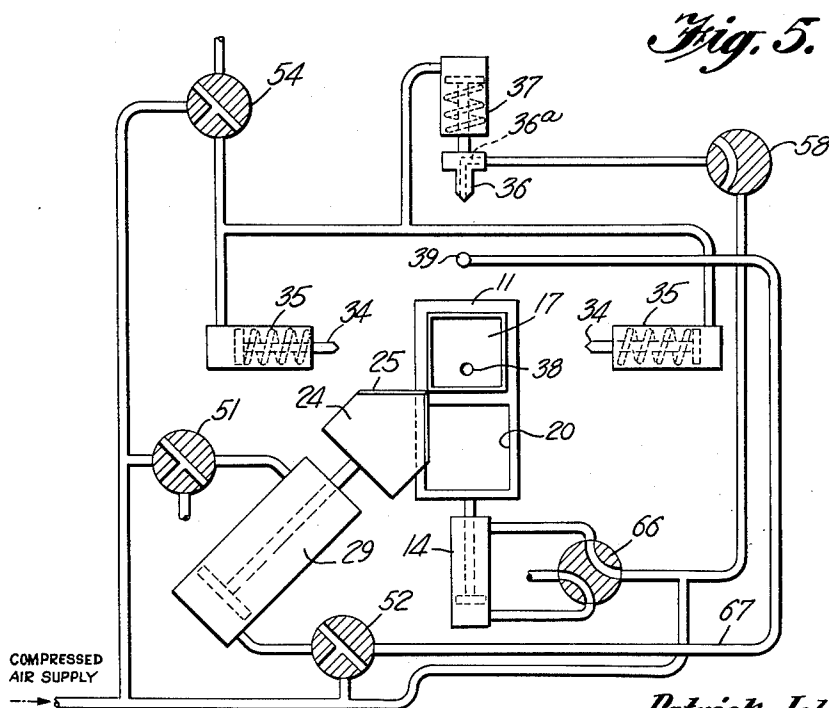
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3 Sheets-Sheet 3



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CAN OPENING APPARATUS

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4 Claims. (Cl. 214—305)

The present invention relates in general to can opening apparatus, and more particularly to electrically and pneumatically operated can opening apparatus for opening sealed cans containing semi-solid products and emptying them of their contents.

An object of the present invention is the provision of novel can opening apparatus wherein a cycle of operation of electrical and pneumatic devices is controlled by actuation of electrical switches to achieve an increase in the rate at which cans containing semi-solid products can be opened and emptied of their contents.

Another object of the present invention is the provision of can opening apparatus wherein a novel cycle of operation of electrically and pneumatically actuated components is automatically established under control of a pair of manually actuated electrical push button switches to facilitate opening of the cans, disposition of the severed lid, and discharge of the canned product.

Another object of the present invention is the provision of novel can opening apparatus for opening cans containing a semi-solid product in a manner minimizing the danger of depositing metal particles from the can on the contents.

Other objects, advantages and capabilities of the present invention will become apparent from the following detail description, taken in conjunction with the accompanying drawings illustrating a preferred embodiment of the invention.

In the drawings:

Figure 1 is a diagrammatic view, with parts shown in top plan and some parts broken away, of can opening apparatus constructed in accordance with the present invention;

Figure 2 is a transverse vertical section view taken along the line 2—2 of Figure 1;

Figure 3 is a longitudinal section view taken along the line 3—3 of Figure 1;

Figure 4 is a schematic diagram of one form of electrical control circuit which may be used with the present invention; and

Figure 5 is a pneumatic circuit diagram showing an exemplary pneumatic circuit for controlling various components of the apparatus, some of the controlled components being indicated schematically.

Referring to the drawings wherein like reference characters designate corresponding parts throughout the several figures, and particularly to the schematic illustrations of the machine in Figures 1, 2 and 3, the can opening apparatus of the present invention, indicated generally by the reference character 10, comprises a generally rectangular, elongated index plate 11 supported for horizontal longitudinal reciprocative movement in the inwardly facing grooves 12 of laterally spaced, fixed guide rails 13. The plate 11 is driven by a pneumatic index cylinder 14 having a piston shaft 15 fixed to one end of the index plate 11. The index plate 11 carries a rectangular framework of frame bars 16 fixed on the upper surface of the index plate 11 and defining a rectangular recess 17 of appropriate dimensions to receive the lower end of a can 18 containing a semi-solid product, such as corn beef and the like. The recess 17 is disposed adjacent the leading edge 19 of the index plate 11 in the advancing direction of movement of the index plate, and a rectangular product discharge opening 20 of slightly larger dimensions than the cross section of the can 18 is provided in the index plate 11 adjacent the trailing edge thereof.

A knife supporting assembly, indicated generally by the reference character 21 is supported on the upper surfaces of the guide rails 13 and comprises a pair of laterally spaced, parallel knife guide bars 22 having grooves 23 in the inner edges thereof slidably supporting a knife 24 for rectilinear reciprocation through a stroke of sufficient length to shift the working edge 25 of the knife entirely across the can receiving recess 17. Supported on and spanning the space between the guide bars 22 is a support plate 26 which overlies the can cutting station, indicated generally at 27 generally coextensive with the can supporting recess 17, the support plate 26 having a rectangular aperture 28 therein of sufficient size to accommodate the cross section of the can 18. The working edge of the knife 25 is pointed as illustrated in Figure 1 and the knife is driven by a pneumatic knife cylinder 29 having a piston shaft 30 which is secured to the edge of the knife 24 remote from the working edge 25.

An ejector station 31 is provided at the projected or upper end of the path of movement of the index plate 11, as viewed in Figure 1, there being provided an upwardly and forwardly curving lid deflector 32 which may be fixed at one end to the support plate 26, and a stationary lid catch 33 disposed in the path of movement of the index plate 11 to abut the leading edge of the index plate when the index plate is fully projected toward the can ejector station.

A pair of axially reciprocative can holding needles 34 are slidably supported in laterally flanking relation to the position to be occupied by the can 18 when the can is at the can cutting station 27 to be projected against the opposite sides of the can 18 and hold the same in position, the can holding needles 34 being driven by pneumatic can holding cylinders 35. Additionally a can puncture needle 36 having a bore 36a therein is driven by a can puncture cylinder 37 and supported above the can cutting station 27 for vertical axially reciprocative movement such that the lower tip of the can puncture needle 36 can be driven through the top of the can 18 when the can is placed at the can cutting station 27.

The portion of the index plate 11 forming the base of the can receiving recess 17 is also provided with an aperture 38 positioned to register with a compressed air nozzle or conduit exit orifice 39 when the recess portion 17 of the index plate 11 is advanced to the ejector station 31.

Referring now to the electrical and pneumatic operation of the can opening apparatus, with particular reference to Figure 4 illustrating an exemplary form of an electrical control circuit which may be used with the can opener, and Figure 5 illustrating one exemplary form of pneumatic circuit, a pair of manual push buttons 40 and 41 are disposed in series circuit relation with a relay coil 42 across an approximately 6.3 volt A.C. supply obtained for example across the secondary winding of a step-down transformer 43 whose primary winding is coupled to a 110 volt A.C. supply through a main control switch 44 which may be a single pole, single throw toggle switch. The relay coil 42 controls a single pole, double throw contact formed by a movable contact arm 45 coacting with a pair of stationary contacts 46, 47. The movable contact arm 45 is connected by the lead 48 to the upper end of the secondary winding of transformer 43 and is normally contacting the stationary contact 46,

The stationary contacts 46 and 47 are connected by leads 49 and 50 to a terminal of normally closed three-way solenoid valves 51 and 52, respectively, and the other terminals of valves 51 and 52 are connected through lead 53 to the lower end of the transformer secondary winding. The three-way solenoid valves 51 and 52 respectively activate the knife cylinder 29 to withdraw the knife 24 from the can cutting station 27 and project the knife 24 through the can cutting station.

A three-way solenoid valve 54 is connected through lead 55 to the lead extending between the two push button switches 40 and 41 at the juncture 56 and by lead 57 to the lower end of the transformer secondary winding so that the three-way solenoid valve 54 is in series circuit relation with and responsive to actuation of the push button switch 40. The three-way solenoid valve 54 is normally closed and supplies pneumatic pressure to the can holding cylinders 35 to project the can holding needles 34 into abutment with the can at the can cutting station 27 when the valve 54 is opened.

A two-way solenoid valve 58 is connected through lead 59 and a normally closed knife position switch 60 to the juncture 56 and through the lead 61 to the normally open stationary contact 62 of a single pole double throw index plate switch 63. The index plate switch 63 includes a movable contact arm 64 which is normally contacting a stationary contact 65 and forms a normally closed switch in the return lead from the relay coil 42 connecting the return terminal of the relay coil 42 with the lower end of the secondary winding of transformer 43. The two-way solenoid valve 58, when open, completes the compressed air supply to the bore 36a in the can puncture needle 36.

The knife position switch 60 is a normally open switch having an actuator positioned to be engaged by the knife 24 or a projection from the piston shaft 30 when the knife reaches fully retracted or initial position to close the switch. The index plate switch 63 may be in two sections located near the initial and projected positions of the index plate to respond to index plate position and cause the circuit through stationary contact 65 to be closed (as schematically indicated by the position of contact arm 64) when the index plate is in its initial position and cause contact 62 to be closed when the plate 11 reaches fully projected position.

A four-way solenoid valve 66 is also connected by a lead 67 with the junction 56 and by lead 68 through normally open knife position switch 69 to the lower end of the transformer secondary winding, and a branch lead 70 extends from the lead 68 between the switch 69 and solenoid valve 66 to the stationary terminal 62 of the index plate switch 63. The knife position switch 69 is controlled by an actuator disposed to be contacted by the knife 24 or a projection on the shaft 30 when the knife reaches fully projected position at the outer end of its stroke and close the switch 69. The four-way solenoid valve 66 controls the supply to the index cylinder 14 to project and retract the index plate 11 in accordance with the position of the valve 66.

In the operation of the apparatus, a can as indicated by the reference character 18, containing a semi-solid product, is positioned in the apparatus by dropping the lower end of the can through the opening 28 in the support plate 26 and into the recess 17 formed by the frame bars 16 on the index plate 11. The machine operator initiates the cycle of operation by depressing and holding the two push button switches 40 and 41. When the push button switches 40 and 41 are closed, the relay coil 42 is energized through the push button switches and through the normally closed index plate switch contact 65 and contact arm 64. Also, the normally closed three-way solenoid valve 54 is energized through the push button switch 40, opening the valve 54 and admitting pneumatic pressure to the can holding cylinders 35 to project the pointed ends of the can holding needles 34 into hold-

ing relation with the can 18 and admitting pressure to the can puncture cylinder 37 to drive the can puncture needle 36 downwardly through the top of the can. The energizing of the relay coil 42 causes the movable contact arm 45 to open circuit the stationary contact 46 and engage the stationary contact 47. This deenergizes the three-way solenoid valve 51 and energizes the three-way solenoid valve 52 to admit pneumatic pressure to the knife cylinder 29 in a direction to project the knife 24 through its full stroke toward the can 18 occupying the can cutting station 27. The knife edge 24 will thus cut through the sides of the can 18 in a horizontal plane spaced above the bottom of the can a distance corresponding to the height of the frame bars 16.

When the knife cylinder 29 comes to the end of its stroke, the normally open knife position switch 69 is closed, thus energizing the four-way solenoid valve 66 to admit pneumatic pressure to the index cylinder 14 in a direction to project the index plate 11 toward the ejector station 31. It will be noted that the three-way solenoid valve 58 is not energized at this time because the normally open knife position switch 60 is still open. When the index plate cylinder 14 comes to the end of its projection stroke, the index plate switch 63 is actuated to shift the movable contact arm 64 into contact with the stationary contact 62. This deenergizes the relay coil 42, causing the spring biased movable contact arm 45 to open circuit the stationary contact 47 and engage the stationary contact 46. The transfer of power from the contact 47 to the contact 46 deenergizes the three-way valve 52 and energizes the three-way valve 51 controlling pneumatic pressure to the knife cylinder 29 to withdraw the knife 24 away from the can cutting edge 27 to its initial position. As the knife 24 starts to move back to its original position, the knife position switch 69 opens, but the four-way solenoid valve 66 is not thus deenergized because a branch circuit has been completed through the lead 70 and index plate switch 63 by-passing the knife position switch 69.

The position assumed by the valve 52 when deenergized communicates the rear of the knife cylinder through conduit 67 to the nozzle 39, over which the opening 38 in the index plate 11 is now disposed, so that the compressed air behind the piston of knife cylinder 29 is exhausted through the nozzle 39 to blow the severed bottom of the can upwardly out of the recess 17. The severed bottom, in going upward, strikes the deflector 32, causing the severed bottom to be thrown onward away from the apparatus. The lid catch 33 insures that the severed bottom strikes the deflector 32 in the proper manner.

When the knife 24 has returned to its original position, the knife position switch 60 is closed in response to the knife position, energizing the two-way solenoid valve 58, which causes compressed air to be admitted to the bore 36a of the puncture needle 36. This compressed air enters the can 18 through the puncture made by the needle 36 and pushes the contents of the can 18 through the product discharge opening 20 of the index plate 11 which is now in registry with the upper portion of the can 18 and into a suitable container disposed below the can. It will be noted that the projecting movement of the index plate 11 did not disturb the position of the can 18 which was held at the can cutting station 27 by the can holding needles 34 and can puncture needle 36, although the severed bottom of the can was carried to the can ejector station by the frame bars 16.

When the contents have been discharged from the can 18, the operator releases push button switch 41, and then grasps the can 18 with one hand and releases the push button switch 40. The release of the push button switch 40 deenergizes the two-way solenoid valve 58, the three-way solenoid valve 54, and the four-way solenoid valve 60. This causes the pneumatic pressure to be withdrawn from the puncture needle bore 36a and from the

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solenoids 35 and 37 and permits their spring return to initial position, and activates the index cylinder 14 to retract the index plate 11 to initial position. When the can holding needles 34 and puncture needle 36 are withdrawn, the can can then be manually withdrawn from the machine, and the machine is ready for application of another can and a repeat of the cycle of operation.

It will be appreciated that cans of other cross-sectional configuration than the square can herein described can be used with appropriate modification of the position and pattern of the frame members 16 and opening 28 and 20.

While but one preferred example of the present invention has been particularly shown and described, it is apparent that various modifications may be made therein within the spirit and scope of the invention, and it is desired, therefore, that only such limitations be placed on the invention as are imposed by the prior art and set forth in the appended claims.

What is claimed is:

1. Apparatus for opening cans of semi-solid products comprising a can cutting station and a lid ejector station spaced along a selected horizontal axis of movement, an elongated index plate supported for longitudinal reciprocative movement in a horizontal plane along said axis from a retracted position, said index plate having a recess normally registering with said can cutting station when said index plate is in retracted position to accommodate the lower end portion of a product containing can and support the bottom of the can a selected distance below a horizontal cutting plane and a product discharging aperture extending through the index plate and spaced rearwardly from said recess, driving means for advancing said index plate to a projected position wherein said recess is shifted into registry with said lid ejector station and said product ejector aperture registers with said can cutting station and for returning said index plate to retracted position, a knife supported for reciprocative movement in said cutting plane along an axis extending laterally of the index plate, driving means for projecting said knife through a stroke traversing said recess at said can cutting station, a plurality of axially reciprocative holding needles disposed at said can cutting station above said recess to engage opposite side portions and the top of a can seated in said recess, means for shifting said needles into engagement with the can including means for driving the needle at the top of the can into the can, means for activating the said index plate driving means to shift said index plate through a stroke moving said recess and a severed can bottom therein to said ejector station when said knife has been driven through the can, compressed air means at said ejector station to dislodge the severed bottom in said recess and eject the same from said recess, and means for admitting compressed air through the needle projected through the top of the can to force the contents of the can downwardly through said product discharging aperture when the latter is in registry with the can at the can cutting station and the knife has been withdrawn from the can cutting station.

2. Apparatus for opening cans of semi-solid products comprising a can cutting station and a lid ejector station spaced along a selected horizontal axis of movement, an elongated index plate supported for longitudinal reciprocative movement in a horizontal plane along said axis from a retracted position, said index plate having a recess normally registering with said can cutting station when said index plate is in retracted position to accommodate the lower end portion of a product containing can and support the bottom of the can a selected distance below a horizontal cutting plane and a product discharging aperture extending through the index plate and spaced rearwardly from said recess, fluid pressure means for advancing said index plate to a projected position wherein said recess is shifted into registry with said lid ejector station and said product ejector aperture registers

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with said can cutting station and for returning said index plate to retracted position, a knife supported for reciprocative movement in said cutting plane along an axis extending laterally of the index plate, fluid pressure means for projecting said knife through a stroke traversing said recess at said can cutting station, a plurality of axially reciprocative holding needles disposed at said can cutting station above said recess to engage opposite side portions and the top of a can seated in said recess, means for shifting said needles into engagement with the can including means for driving the needle at the top of the can into the can, timing means for activating said fluid pressure means for said index plate and said knife in selected timed relation to advance said knife through a can seated in said recess, shift said index plate to said projected position while said knife overlies said recess to advance said recess and a severed can lid therein to said lid ejector station, and withdraw said knife from said can cutting station, compressed air means at said ejector station to dislodge the severed bottom in said recess and eject the same from said recess, and means for admitting compressed air through the needle projected through the top of the can to force the contents of the can downwardly through said product discharging aperture when the latter is in registry with the can at the can cutting station and the knife has been withdrawn from the can cutting station.

3. Apparatus for opening cans of semi-solid products comprising a can cutting station and a lid ejector station spaced along a selected horizontal axis of movement, an elongated index plate supported for longitudinal reciprocative movement in a horizontal plane along said axis from a retracted position, said index plate having a recess normally registering with said can cutting station when said index plate is in retracted position to accommodate the lower end portion of a product containing can and support the bottom of the can a selected distance below a horizontal cutting plane and a product discharging aperture extending through the index plate and spaced rearwardly from said recess, pneumatic cylinder means for advancing said index plate to a projected position wherein said recess is shifted into registry with said lid ejector station and said product ejector aperture registers with said can cutting station and for returning said index plate to retracted position, a knife supported for reciprocative movement in said cutting plane along an axis inclined laterally to the axis of movement of the index plate, pneumatic cylinder means for projecting said knife through a stroke traversing said recess at said can cutting station at a level immediately above the bottom of the can to a projected position wherein the knife wholly overlies the recess, a plurality of horizontally axially reciprocative holding needles disposed at said can cutting station above said recess, a pneumatic cylinder means for axially projecting said needles into engagement with opposite sides of the can at said can cutting station, a bored can puncturing needle supported for axial reciprocation vertically above the can at said can cutting station, pneumatic cylinder means for projecting said puncturing needle through the top of the can, means for activating the cylinder for said index plate to shift said index plate through a stroke moving said recess and a severed can bottom therein to said ejector station when said knife has been driven through the can, said index plate including an opening extending through the bottom of said recess, compressed air nozzle means disposed below said index plate at said ejector station to direct forced air upwardly through said opening against the severed bottom in said recess to eject the severed bottom from said recess, and means for admitting compressed air to said bored puncture needle to force the contents of the can downwardly through said product discharging aperture when the latter is in registry with the can at the can cutting station and the knife has been withdrawn from the can cutting station.

4. Apparatus for opening cans of semi-solid products comprising a can cutting station and a lid ejector station spaced along a selected horizontal axis of movement, an elongated index plate supported for longitudinal reciprocative movement in a horizontal plane along said axis from a retracted position, said index plate having a recess normally registering with said can cutting station when said index plate is in retracted position to accommodate the lower end portion of a product containing can and support the bottom of the can a selected distance below a horizontal cutting plane and a product discharging aperture extending through the index plate and spaced rearwardly from said recess, pneumatic cylinder means for advancing said index plate to a projected position wherein said recess is shifted into registry with said lid ejector station and said product ejector aperture registers with said can cutting station and for returning said index plate to retracted position, a knife supported for reciprocative movement in said cutting plane along an axis inclined laterally to the axis of movement of the index plate, pneumatic cylinder means for projecting said knife through a stroke traversing said recess at said can cutting station at a level immediately above the bottom of the can to a projected position wherein the knife wholly overlies the recess, a plurality of horizontally axially reciprocative holding needles disposed at said can cutting

station above said recess, a pneumatic cylinder means for axially projecting said needles into engagement with opposite sides of the can at said can cutting station, a bored can puncturing needle supported for axial reciprocation vertically above the can at said can cutting station, pneumatic cylinder means for projecting said puncturing needle through the top of the can, and timing means for activating said pneumatic cylinder means for said index plate and said knife in selected timed relation to advance said knife through a can seated in said recess, shift said index plate to said projected position of said index plate while said knife overlies said recess to advance said recess and a severed can lid therein to said lid ejector station, withdraw said knife from said can cutting station, admit compressed air to said bored puncture needle to force the contents of the can downwardly through said product discharging aperture, admit compressed air to said nozzle means to eject the severed can bottom from said recess, and withdraw said index plate to retracted position.

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