Dec. 6, 1960 J. L. LAYTON, JR 2,962,849

PACKAGING MACHINE

Filed Dec. 18, 1958

5 Sheets-Sheet 1

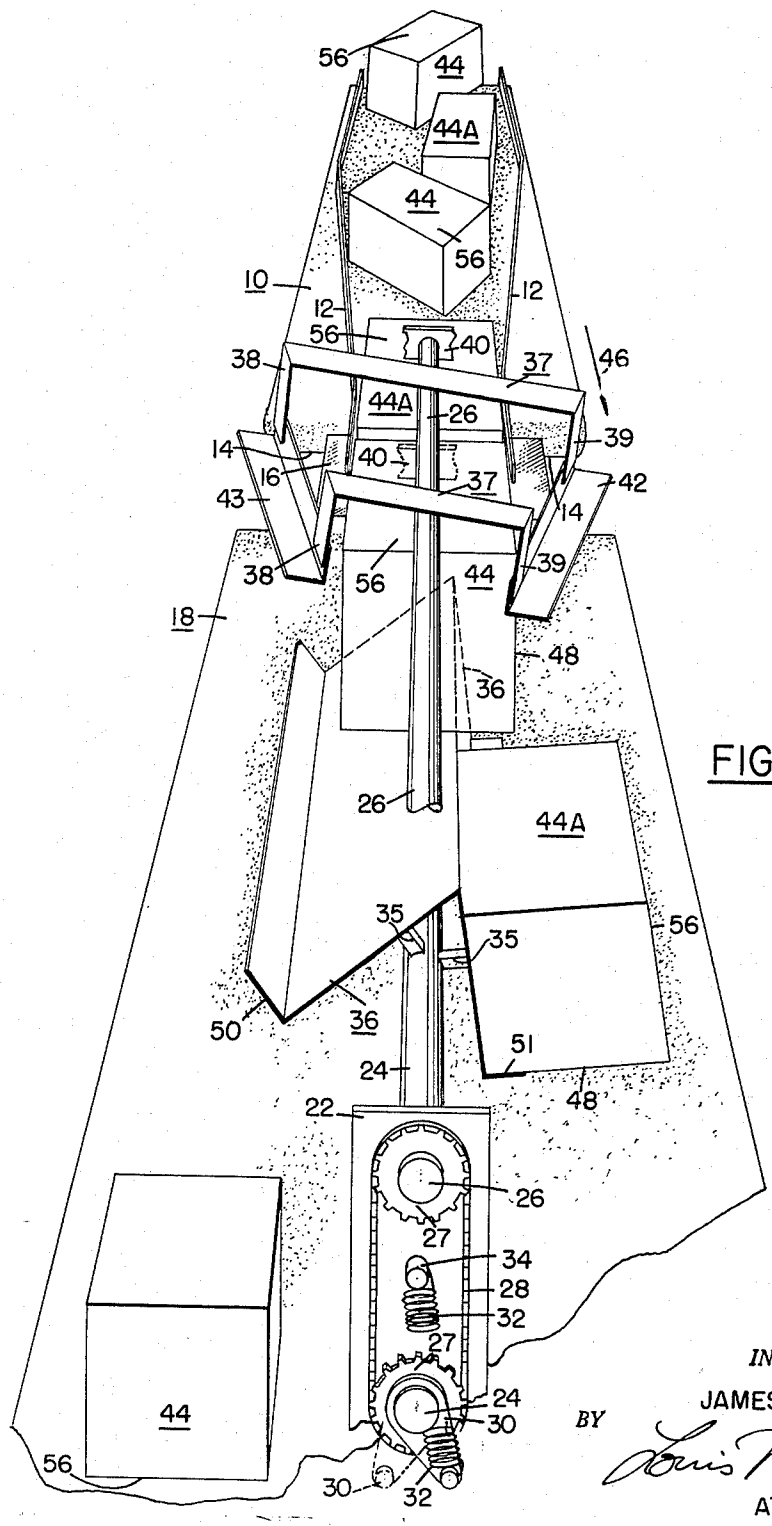

FIG. 1

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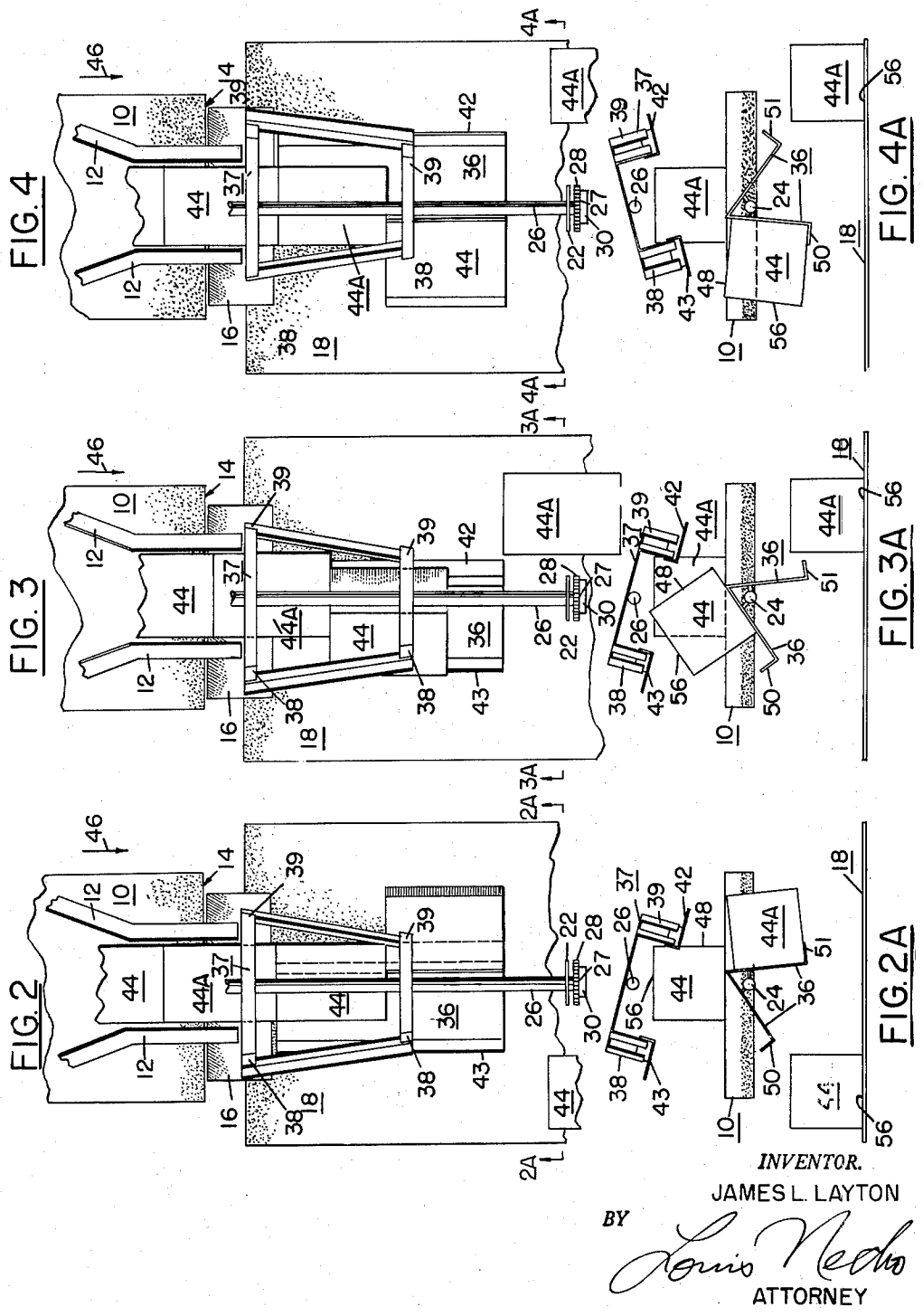

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PACKAGING MACHINE

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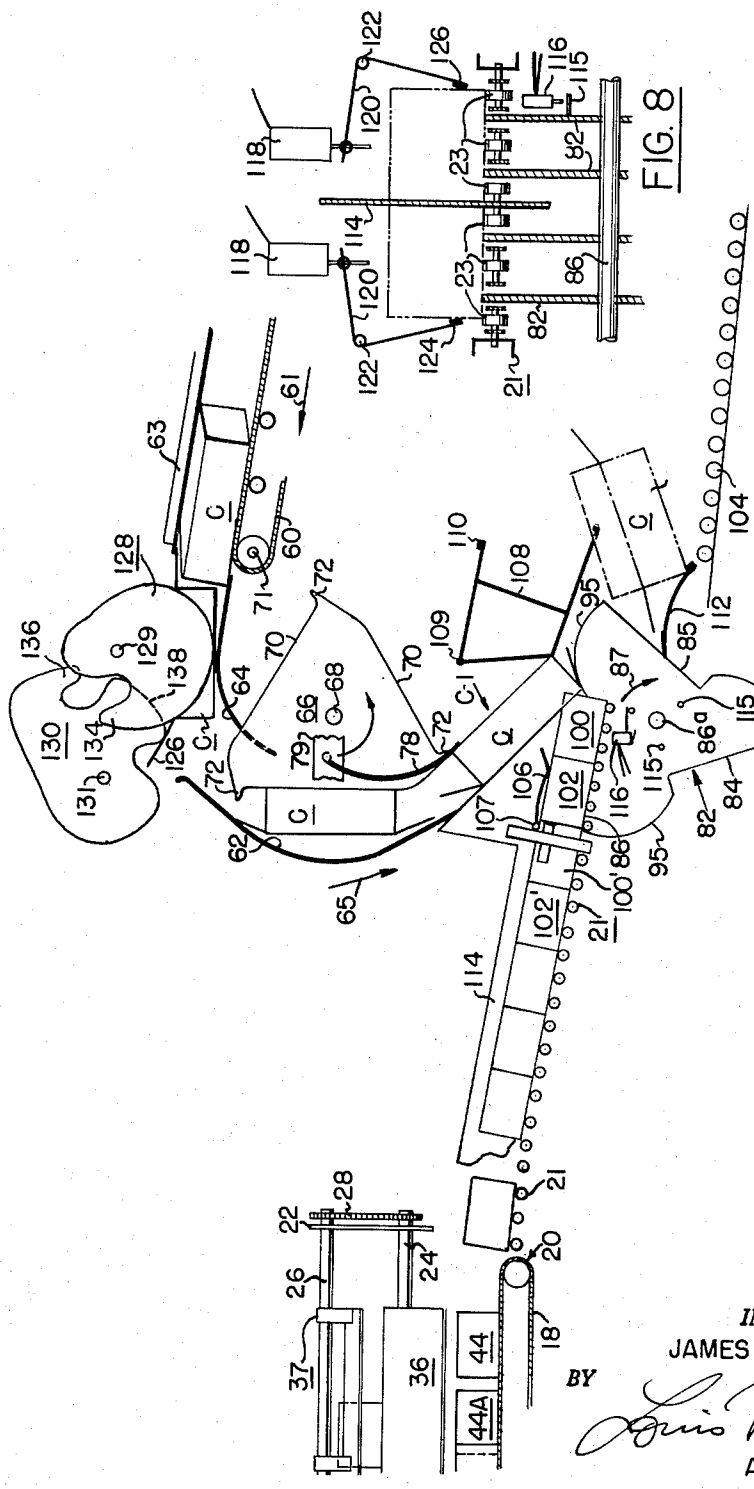

FIG. 8

FIG. 5

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PACKAGING MACHINE

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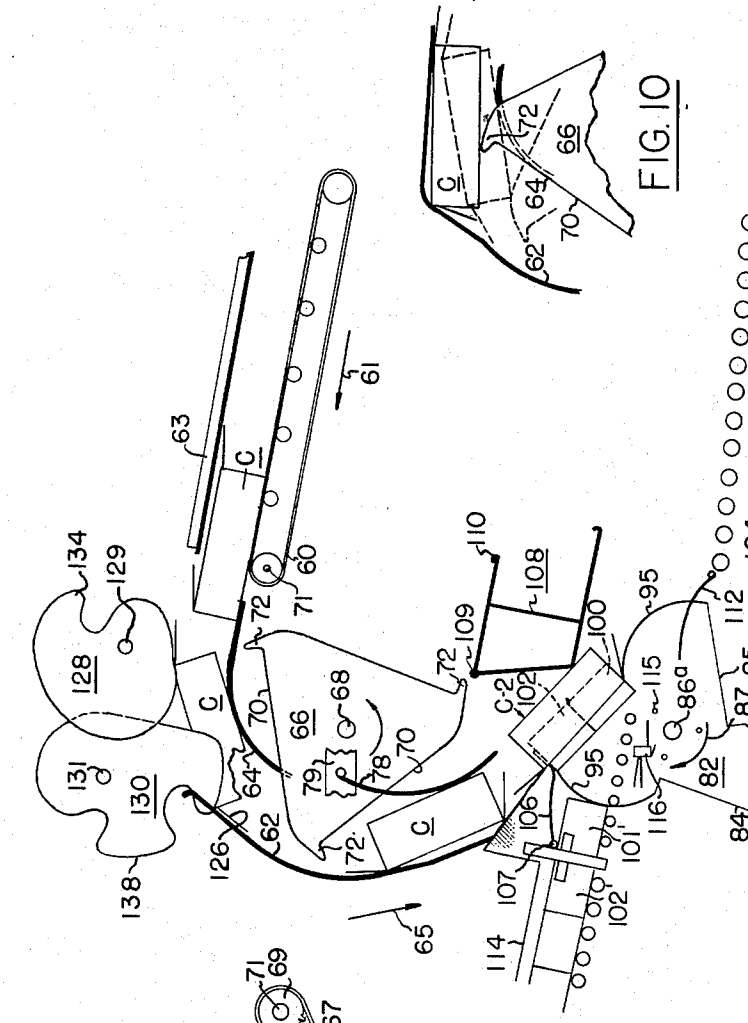

FIG. 6

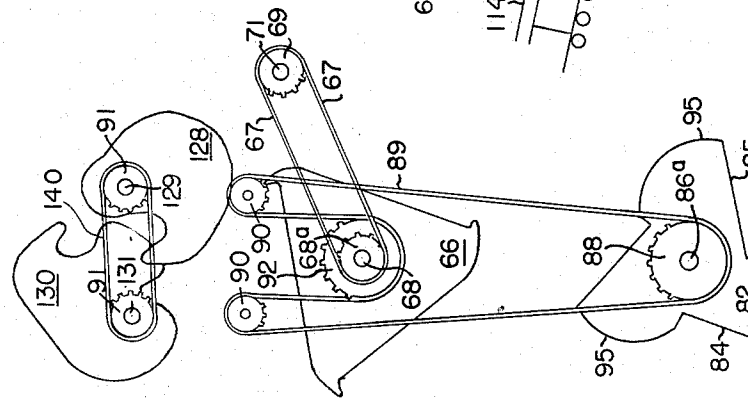

FIG. 9

FIG. 10

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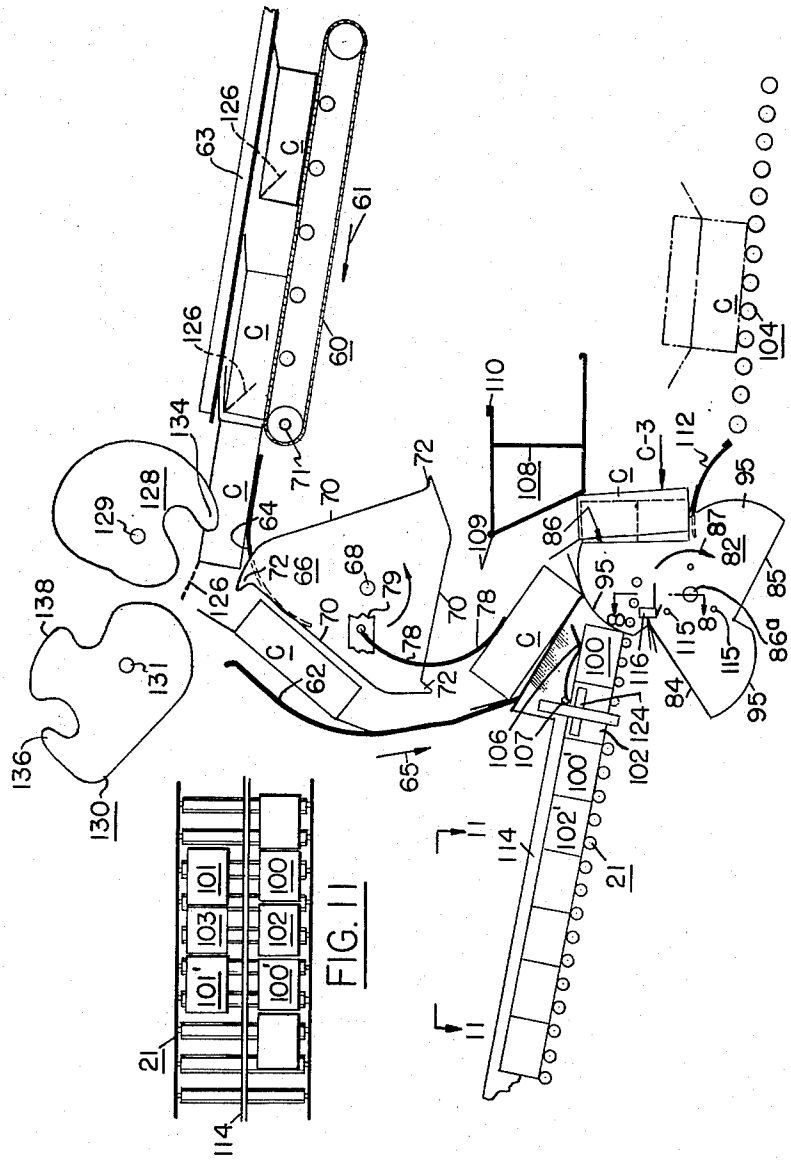

FIG. 7

FIG. 11

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United States Patent Office

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PACKAGING MACHINE

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20 Claims. (Cl. 53—161)

In the brewing industry, for example, six cans of beer are placed in a small package and four such small packages are packed into a large container thus enabling the retailer to sell six cans at a time or a case of twenty-four cans. While reference is made to the brewing industry, it will be understood that the invention is applicable to many other industries.

Since the machine hereinafter described is adapted for use in connection with loose cans or in connection with small packages holding a number of cans, and, in order to avoid repetition, the word unit will be used to designate a single can or a small package containing a number of cans, or other objects.

The object of this invention is to produce a machine which will continuously and automatically receive units from a single source, which will arrange the units into two parallel rows and which will pack a predetermined number of units into a container for storage or for shipping. Again, while reference is made to two rows, it is to be understood that this is by way of illustration and not by way of limitation, and the same is true of the number of units per row, or the total number of units packed in the storing or shipping container.

Generally speaking, the machine illustrated can be said to include two parts, one of which receives the units and arranges them for packing, and the other part of which packs a predetermined number of units in the storing or shipping container. The full nature of the invention will be understood from the following specification and the accompanying drawings in which:

Fig. 1 is a perspective view of the first part of the machine, namely, the part which receives units from a source and inverts and arranges the units into two parallel rolls and delivers them to the second half of the machine.

Fig. 1–A is a fragmentary sectional view taken on line 2—2 on Fig. 1.

Figs. 2, 3 and 4 are plan views showing the successive stations in the operation of the first part of the machine.

Figs. 2–A, 3–A and 4–A are corresponding end elevational views looking in the direction of lines 2–A, 3–A and 4–A on Figs. 2, 3 and 4.

Fig. 5 is a diagrammatic and fragmentary side elevational view of the second part of the machine which packs a number of the units received from the first part of the machine in a carton, this view showing the first step in the operation.

Fig. 6 is similar to Fig. 5, but it shows the second step in the operation.

Fig. 7 is similar to Figs. 5 and 6 and it shows the third step in the operation.

Fig. 8 is an enlarged, diagrammatic view looking in the direction of line 8—8 on Fig. 7.

Fig. 9 is a diagrammatic representation of the manner in which the various parts shown in Figs. 5, 6 and 7 are driven in timed relation to each other.

Fig. 10 is a fragmentary elevational view showing details of structure and operation.

Fig. 11 is a plan view looking in the direction of line 11—11 on Fig. 7.

In as far as possible, the first and second parts of the invention will be described separately.

In Fig. 1 there is shown a feed belt 10 above which are located fixed guides 12 and the delivery end 14 of which is disposed near a fixed plate 16, and a receiving belt 18. The delivery end 20 of belt 18 deposits the units to be packed on a conveyor 21 which will hereinafter be further referred to. Near the delivery end of belt 18 is a vertical plate 22 in which are journalled a lower shaft 24 and an upper shaft 26, the ends of which are provided with sprocket wheels 27, Fig. 1, which are connected by a sprocket chain 28 whereby rotation of one of the shafts will rotate the other. Lower shaft 24 is provided with an overcenter arm 30 which engages one end of a spring 32, the other end of which engages a pin 34 carried by plate 22. This provides a toggle which yieldably keeps the shafts in their respective extreme positions which are shown in solid and in broken lines in Fig. 1. Mounted on lower shaft 24, as by arms 35, is an elongated, inverted V-shaped member 36 and mounted on upper shaft 26 is a yoke formed of cross piece 37 and pendent arms 38 and 39, the lower ends of which are provided with horizontal angles 42 and 43, respectively. It will be seen from Fig. 1–A that inverted member 36 is disposed above receiving belt 18, and that plate 16 bridges the gap between feed belt 10 and inverted member 36.

The operation of the first part of the machine is as follows:

The units 44 and 44–A to be packed, which in this case are small packages containing six cans each, are delivered in a continuous stream, from a source, not shown, to the receiving end of feed belt 10, with their tops facing upwardly. As the units advance in the direction of arrow 46, they are directed, by guide plates 12, onto slide 16 from which they pass, in single file, onto the apex of inverted V-shaped member 36. Since inverted member 36 is always in one or the other of the extreme positions best shown in Figs. 2–A, 3–A and 4–A, it follows that a unit coming to rest on inverted member 36, must, if unrestrained, fall to one side or the other of the center of gravity of the unit which depends on the position of member 36. For example, if a unit, or a package 44, is placed on inverted member 36 when said member is in the position of Fig. 2–A, the unit will fall to the left, as shown in Fig. 3–A and, if the inverted member is in the position of Fig. 4–A, the unit will fall to the other side. It will be noted that, in Fig. 2–A pendent arm 39 pushes a unit 44 to the left and that, in Fig. 4–A, arm 38 pushes unit 44*a* to the right. This alternate action is effected by the weight of the unit. For example, when a unit falls off member 36 in the position of Fig. 2–A, it lands on ledge 50 of member 36 and rotates it from the position of 2–A to the position of Fig. 4–A and the reverse action takes place when a unit falls off member 36 onto ledge 51 of this member. By this arrangement, one unit will fall on one side of belt 18 and the next unit will fall on the other side to form a double row, as shown in Fig. 11. It will be noted that, when each unit first comes to rest on inverted member 36, its top 56 will be facing upwardly and that, as each unit falls onto ledge 50 or 51, and onto belt 18 it will be turned upside down, as shown at 56 in Figs. 3–A and 4–A. In other words, the single stream of units reaching feed belt 10, right side up, is divided into two parallel rows of upside down, or inverted, units which are delivered to conveyor 21 of the second part of the machine which will next be described.

The second part of the machine includes an upper conveyor 60 which moves endlessly in the direction of arrow 61 to bring a continuous supply of empty containers C

from a source, not shown. The containers move along, right side up, with their end and side flaps bearing against the underside of a guard **63**. Conveyor **60** delivers the containers to a curved guide plate **64** which, in cooperation with guide **62** begins to invert the containers as they move in the direction of arrow **65**. Near, and below, guide plate **64** is a feed timing wheel **66** which is driven by shaft **68** which will be hereinafter referred to. It is sufficient, at this point, to say that for each one third of one rotation of the feed timing wheel **66**, conveyor **60** moves through a distance slightly greater than the length of a container. In other words, the movement of the containers is thus roughly timed in relation to the rotation of feed wheel **66**. If, however, a container arrives at guide plate **64** too early to coincide fully with one of flat surfaces **70** on feed timing wheel **66**, the containers well be wedged by a finger **72** of the timing wheel **66** against guard **62**, as diagrammatically shown in Fig. 10, so that the container will only move further when it is free of finger **72** and is pushed by the container behind it onto a flat surface **70** of the packing wheel. If, when a container approaches the position of Fig. 6, it does not fall on an approaching flat surface **70** by gravity, the approaching finger **76** of timing wheel **66** will push the container so that, in any event, the containers will move in the desired order for the subsequent operations.

Co-acting with feed wheel **66** are spring arms **78** which are pivoted to a fixed frame portion **79** and yielding press against the bottoms of the containers as they move through the positions of Figs. 7 and 6 and to the packing position of Fig. 5. The desired number of units are packed into a container C by a set of packing wheels **82** which are interdigitated with the rollers **23** of conveyor **21**, as best shown in Fig. 8, and each of which has three flat surfaces **84**, **85** and **86**. Packing wheels **82** operate as a unit and are, therefore, collectively referred to as the packing wheel. The packing wheel **82** is mounted below the delivery end of conveyor **21** and is driven by shaft **86***a* in the direction of arrow **87**. Shaft **86***a* is driven by a motor, not shown. Shaft **86***a* also drives sprocket **88** which is engaged by sprocket chain **89** which passes over idler sprockets **90** and drives sprocket **92** on shaft **68**. Shaft **68** also carries sprocket wheel **68**–*a* which is engaged by sprocket chain **67** which drives sprocket wheel **69** on shaft **71** which drives conveyor **60** above referred to. By this arrangement, packing wheel **82**, feed timing wheel **66** and conveyor **60** are driven in timed relation and the timing is such that, as a container C reaches position C–1, packing wheel **82** rotates from the starting position shown in Fig. 5 to the intermediate position of Fig. 6, in which it has raised units **100**, **101**, **102** and **103** and pushed them into an inverted container at position C–2. It will be seen from Figs. 6 and 7 that cam **95** on the periphery of packing wheel **82** abuts the lead edges of the approaching units **100'** and **101'** to hold them back and control their entry in reasonably uniform linear forward motion, as distinguished from intermittent, motion while units **100** to **103** are being pushed into a container after position C–1. To facilitate entry of the units **100** to **103** into the container between positions C–1 and C–2, I provide a thin, flexible guide **106** which is hinged at **107** and which enters the container with units **100** to **103** and which withdraws from the container as it approaches and passes the position shown in Fig. 6. In other words, arm **106** operates much the same as a shoe horn does when a tight shoe is put on. In order to keep container C pressed against a flat **84**, **85** or **86** of packing wheel **82** while it moves from the position of Fig. 5 to the position of Fig. 7, I provide hold-down arms **108** which are pivoted at **109** and which are heavy enough, or are weighted as at **110**, so as to bear first against the bottom and then against the top of the container as it rotates from its inverted to its up-ended position prior to falling onto conveyor **104**, as shown immediately to the right of the packing wheel in Fig. 5. In order to cushion the fall of the container from the packing wheel **82** to conveyor **104**, I provide guide arms **112** on which the container slides, as shown in Figs. 5 and 7.

As will be seen from Fig. 11, conveyor **21** is divided longitudinally by a partition **114** so that the units approach the packing wheel in two parallel rows. As shown, four units are packed into each carton, but this is not controlling as the number of small units packed in a carton depends on the size of the units and on the size of the container.

Ideally, and when the packing units have accurate sizes and smooth exteriors, the timing of the parts thus far described is sufficient to assure continuous and uninterrupted operation. However, when the units to be packed into a container vary slightly, in size, or if their exteriors are rough, it may be necessary to retard the flow of units to create a small gap between units **100'**, **101'**, and units **102** and **103**, so that there will be no possibility of entanglement between successive pairs of units at the instant that the packing wheel leaves the position of Fig. 5. In order momentarily to retard the flow of units on conveyor **21**, I provide the exterior of packing wheel **82** with three pins **115** which are so arranged as successively to engage and close a normally open limit switch **116** which energizes solenoids **118**. When energized, the solenoids raise arms **120** which are pivoted at **122** to cause brake shoes **124** and **126** to press against the sides of units **100'** to **103'** immediately following units **100** to **103**. When the packing wheel leaves the position of Fig. 5, the solenoids are de-energized.

The timing effected by feed timing wheel **66** is sufficient for all practical purposes. But, sometimes in practice, re-shipping containers are fed to the machine with the lead end flap **126** closed or in the position shown in solid lines in Fig. 7. In order to "open" flap **126**, that is, to move it to the broken line position in Fig. 7, the second part of the machine may also include cam **128** which is carried by shaft **129** and which makes one complete revolution with the passage of each container thereunder. Cam **128** has a finger **134** which, with each rotation of the cam, enters a carton therebelow to engage end flap **126** and move to the open position, as shown in broken line in Fig. 7. As cam **128** rotates further, it engages the bottom and the ends of the container in the manner shown in Fig. 5 in which the cam accurately indexes the container, by retarding its motion, or by pushing it ahead, as may be required. In addition, the machine may include another cam **130** which is carried by shaft **131** and which also makes one complete rotation with the passage of each container thereunder. Cam **130** has a finger **136** which, if necessary, will engage the leading end of a container and propel it forward further to guarantee the proper positioning of the container in reference to feed wheel **66**. Cam **130** also has a surface **138** which is adapted to engage flap **126** and depress it from the broken line position so as to insure that the end flap will engage the inner side of guard **62**, as shown in Fig. 5.

From the foregoing, it will be seen that, by my invention, a stream of units is continuously deposited on the feed belt at one end of the machine, with the units right side up, that the units are automatically inverted and arranged in parallel rows; that a continuous stream of containers is delivered to a conveyor at the other side of the machine, right side up; that the containers are inverted to meet the inverted units, and that the packing wheel packs four units into each container and deposits the containers right side up on a take-away conveyor. It will also be seen that by synchronizing the movement of the cartons with the movement of the packing wheel, the machine operates automatically and continuously with, or without, cams **128** and **130** which open the end flaps and index the containers to insure their proper engagement with feed wheel **66**.

When cams **128** and **130** are used, guard **62** is interrupted, as shown in Fig. 7. When cams **128** and **130**

are omitted, guard 62 will be continuous as shown at 139 in Fig. 10 and timing wheel 66 will be depended upon for indexing the containers. In Fig. 10 a situation is illustrated in which a container C has moved faster than it should have and has been engaged by a finger 72 of the timing wheel and delayed until a flat surface comes into registration with the container.

As will be seen from Fig. 9, cams 128 and 130 are driven jointly by chain 140 which engage sprockets 91 on shafts 129 and 131, one of which is driven in any suitable manner synchronously with the timing wheel 66 and packing wheel 82.

In connection with the introduction of the units to be packed into a container at position C–1, is pointed out that, as shown in Fig. 5, finger 72 on feed wheel 66 moves the container to a position such that the leading edge of the container will be slightly in advance of units 100, 101, whereby further rotation of the packing wheel will move the units into the container near one end thereof and the insertion of guide arm 106 near the opposite end of the container, cooperate to produce a shoe-horn effect at the opposite ends of the container which will pull the container forward or backward, as needed, to adjust the position of the container. This happens only in the rare event that all the indexing devices previously mentioned may not have succeeded in exactly indexing the container to perfection.

The major difficulty in a machine of this type resides in perfectly indexing each container at position C–1 in which objects, having a surface area only slightly less than the area of the mouth of the container, must be pushed into the container at the highest possible speed and with unfailing regularity. Failing perfect operation, a machine of this type will not be practical because of the time waster in extricating a jammed container and because of the damage which can occur if solid objects, such as beer cans, or the like, get wedged between moving parts. Accordingly, I have provided for synchronizing the movement of conveyor 60 and timing wheel 66 with the rotation of packing wheel 82, and I provided cams 128 and cam 130 which serves to open the leading flap 126 of a container as well as to index a container passing therebeneath.

From the foregoing, it will be seen that my improved machine is capable of accurate operation at high speed which is due to the accurate synchronization of the co-acting parts and to the continuous, uniform forward flow of units and the receiving containers and the rotary, instead of intermittent motion of said parts.

It will be noted that as soon as a flat surface, such as surface 86 beings to leave the position of Fig. 5 in which it is co-planar with conveyor 21, the high point of its trailing cam 95 will be in the path of movement of units 100′ and 101′ and will control their movement to the right as veiwed in Figs. 6 and 7. This, however, is imperceptable because the packing wheel is moving continuously and, therefore, the high point of cam 95 might be said to have a wiping relation to the leading edges of the approaching units 100′ and 101′. But, as the packing wheel rotates, progressively lower portions of cam 95 are presented to the units moving down on conveyor 21 so that by riding on cam 95 the units will be perfectly indexed with flat surface 84, or in the position of units 100, 102 which is shown in Fig. 5 from which the units are lifted into the next container by the continued rotation of said flat surface and so on. It is this feature which makes continuous, as distinguished from intermittent operation, possible.

It will also be seen that the high point of cam 95 which trails flat surface 86 first engages the bottom corner of a box approaching position C–1 and that, as the packing wheel rotates, the container will be supported by progressively lower portions of the cam. In other words, the registering cam 95 regulates the downward movement of the carton and indexes it with reference to the movement of the approaching flat surface.

What I claim is:

1. An apparatus for automatically and continuously packing a predetermined number of units into a container, said apparatus including a rotary packing wheel having a plurality of flat peripheral surfaces each of which is adapted to receive said predetermined number of units, a first delivery means for delivering a continuous stream of said units toward said wheel, a second delivery means for moving a continuous stream of containers to be packed toward said packing wheel, means for moving said containers successively into the path of movement of said flat surfaces in a substantially semi inverted position, and means for continuously rotating said packing wheel to insert the units on one of said flat surfaces into a corresponding container and to move said container out of the path of movement of said packing wheel.

2. The structure recited in claim 1 in which said first delivery means includes means for receiving units in single file and right end up, and means for inverting said units and delivering them in parallel rows successively to said flat surfaces.

3. The structure recited in claim 1 in which said second delivery means includes means for indexing said containers to insure accurate registration of each container with one of said flat surfaces of said packing wheel.

4. The structure recited in claim 1 and means for delaying the flow of units from said first delivery means to a succeeding flat surface until the preceding flat surface has moved out of its units receiving position.

5. The structure recited in claim 1 and a guide arm insertable into the trailing ends of the successive containers simultaneously with the movement of said units into said container to insure proper alignment of the units on successive flat surfaces with successive containers, said guide arm being retracted from said container upon movement of said container away from its unit receiving position.

6. The structure recited in claim 1 in which said first delivery means includes a conveyor, and a unit-receiving member above said conveyor, means mounting said member for limited, reciprocal rotation about an axis parallel to the plane of said conveyor, means for delivering the units to be packed, right side up and single file, to said member, and means movable with said member and engageable with said units as they are successively deposited on said member to drop said units alternately on opposite sides of said member and simultaneously to invert said units.

7. The structure recited in claim 1 in which said second delivery mechanism includes another conveyor for delivering a supply of containers, right side up, and a timing wheel having a number of flat surfaces, each of which is adapted to engage the bottom of a right side up container, said timing wheel being rotated synchronously with, but in a direction opposite to the direction of rotation of, said packing wheel to move said containers to substantially a semi inverted position and to place successive containers in a position to receive the units carried by successive flat surfaces of said packing wheel.

8. The structure recited in claim 7 and yielding means pressing against the bottoms of containers during the packing of said units thereinto.

9. The structure recited in claim 7 and a rotary indexing cam above said other conveyor and engageable with successive container accurately to position the containers with reference to said timing wheel.

10. The structure recited in claim 7 and a rotary cam above said other conveyor and engageable with the lead end of a container therebelow, said cam including a finger which enters successive containers as they move therebelow with each rotation of said cam to move said containers as may be indicated by their positions relative to said finger.

11. An apparatus for automatically and continuously packing predetermined numbers of units into successive

containers, said apparatus including a rotary packing wheel having spaced flat surfaces, a first conveyor for moving the units towards said packing wheel, means continuously rotating said packing wheel to bring said flat surfaces successively to a position in which each of said flat surfaces underlies a predetermined number of units on the adjacent end of said first conveyor, a second conveyor for moving containers, right side up, for receiving said predetermined number of units, a feed timing wheel between said second conveyor and said packing wheel and engageable with successive containers, and means synchronously rotating said timing and packing wheels to time the movement of said containers in relation to the movement of said flat surfaces, and guide means co-acting with said timing wheel progressively to invert each successive container as it approaches a second position above said packing wheel to present said containers to said flat surface at an angle which on further rotation of said packing wheel, causes the units on successive flat surfaces to be inserted into said successive containers, said flat surfaces, said containers and the units inserted therein, being moved by still further rotation of said packing wheel, out of the path of movement of succeeding flat surfaces of said packing wheel.

12. The structure recited in claim 11 and an arm yieldably pressing against the bottom of each container as it moves against said guide towards said second position.

13. The structure recited in claim 11 and an arm yieldably pressing against the bottom of a container to resist the thrust incident to the insertion of said units into a container, said arm also engaging said container for a predetermined length of time after the insertion of said units into said container.

14. An apparatus for automatically and continuously packing predetermined number of units into successive containers, said apparatus including a rotary packing wheel having spaced flat surfaces and cams between said flat surfaces, a first conveyor for moving a continuous stream of units to be packed in a container towards said packing wheel, means continuously rotating said packing wheel to bring said flat surfaces successively to a unit receiving position in which each of said surfaces underlies a predetermined number of said units on the adjacent end of said first conveyor, a second conveyor for propelling containers, right side up, toward said packing wheel for receiving said predetermined number of units, a feed timing wheel between said second conveyor and said packing wheel and engageable with successive containers partly to invert each container as it nears said packing wheel and to place said container in unit receiving position relative to an approaching flat surface, means for yieldably retaining each of said containers in its unit receiving position, and means synchronously rotating said feed timing and said packing wheels to time the movement of said flat surfaces and said containers whereby, as each of said containers approaches its unit receiving position, at least one of said units on said approaching flat surface is inserted into the leading end of said container, moves said container as may be indicated to insure its registration with the remaining units on said approaching flat surface.

15. The structure recited in claim 14 in which the cam trailing a flat surface which has left its unit receiving position engages the leading units approaching said packing wheel and regulates the movement of said units toward the first position to coincide with the arrival of a trailing flat surface to its unit receiving position.

16. An apparatus for automatically and continuously packing predetermined numbers of units into successive containers having haphazardly disposed closure flaps, said apparatus including a rotary packing wheel having spaced flat surfaces, a first conveyor for moving the units towards said packing wheel, means continuously rotating said packing wheel to bring said flat surfaces successively to a unit receiving position in which each of said surfaces underlies a predetermined number of units on the adjacent end of said first conveyor, a second conveyor for propelling containers, right side up, a conveyor continuously moving said containers toward said flat surfaces, means positioning said container for receiving the units on an approaching flat surface, an index cam above, and rotatable in the direction of movement of said containers, said cam being engageable with leading edges of successive containers and operable to open the end flaps of successive containers, means rotating said index cam and said packing wheel synchronously with each other and with the movement of said conveyor, and means positioning each container in unit receiving position relative to an approaching flat surface.

17. The structure recited in claim 16 and a second index cam above, and rotatable in the direction of movement of said container, said second index cam being engageable with the open side of a container passing therebeneath to flatten the closure flaps of a container prior to its arrival at said packing wheel, and means synchronously rotating said second index cam and said packing wheel.

18. An apparatus for automatically and continuously packing predetermined numbers of units into successive containers, said apparatus including a rotary packing wheel having spaced flat surfaces, a first conveyor for moving the units towards said packing wheel, means continuously rotating said packing wheel to bring said flat surfaces successively to a first position in which each of said surfaces underlies a predetermined number of units on the adjacent end of said first conveyor, a second conveyor for propelling containers, right side up, a feed timing wheel between said second conveyor and said packing wheel, means rotating said timing wheel synchronously with said packing wheel to time the movement of said containers in relation to the movement of said flat surfaces, guide means co-acting with said timing wheel progressively to invert successive containers whereby said containers approach a second position at an angle which corresponds to the angle of a flat surface approaching said second position whereby further rotation of said packing wheel causes the units on said flat surface to be inserted into said container, said container and the units inserted therein being moved, by further rotation of said wheel, off said flat surface and out of the path of movement of succeeding flat surfaces, a third conveyor adapted to receive and remove packed containers as they fall off their respective flat surfaces, and means located between said third conveyor and the path of movement of said packing wheel to cushion the drop of a container off its flat surface and to guide in onto said third conveyor.

19. Apparatus for automatically and continuously packing predetermined numbers of units into successive containers, said apparatus including a packing wheel having spaced flat members for receiving a predetermined number of units, a first conveyor for propelling units toward said packing wheel, means rotating said wheel, said first conveyor having an opening therein through which said flat members successively pass on rotation of said wheel into engagement with successive units on the adjacent portion of said conveyor, means for moving successive unit-receiving containers toward said packing wheel, and indexing means for positioning each successive container in the path of rotation of successive flat members whereby the units on each flat member will be inserted into a container while said flat member and said container are in motion, said indexing means including cams carried by said packing wheel intermediate said flat members, the high point of each cam being near the trailing edge of one flat member and the low point of each cam being near the leading edge of a following flat member, means for moving successive containers in substantially semi-inverted condition into engagement with the high point of a cam therebeneath whereby, rotation of

said packing wheel brings successively lower portions of said cam into engagement with said container, the surface of said cam and the rotation of said packing wheel being so related that said container rides off said cam just as the units on the following flat member enter said container.

20. The structure recited in claim 19 and means yieldably urging each container in a direction opposite the direction of rotation of said wheel, to resist the thrust incident to the insertion of units into said container.

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