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[54] **LID APPLICATOR**
15 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **156/542,** 156/250, 53/67, 156/521
[51] **Int. Cl.** **B65b 57/02,** B32b 31/20
[50] **Field of Search** ..... 156/69, 253, 254, 250, 263, 230, 264, 54 T, 521, 542, 556, 566; 53/67, 112

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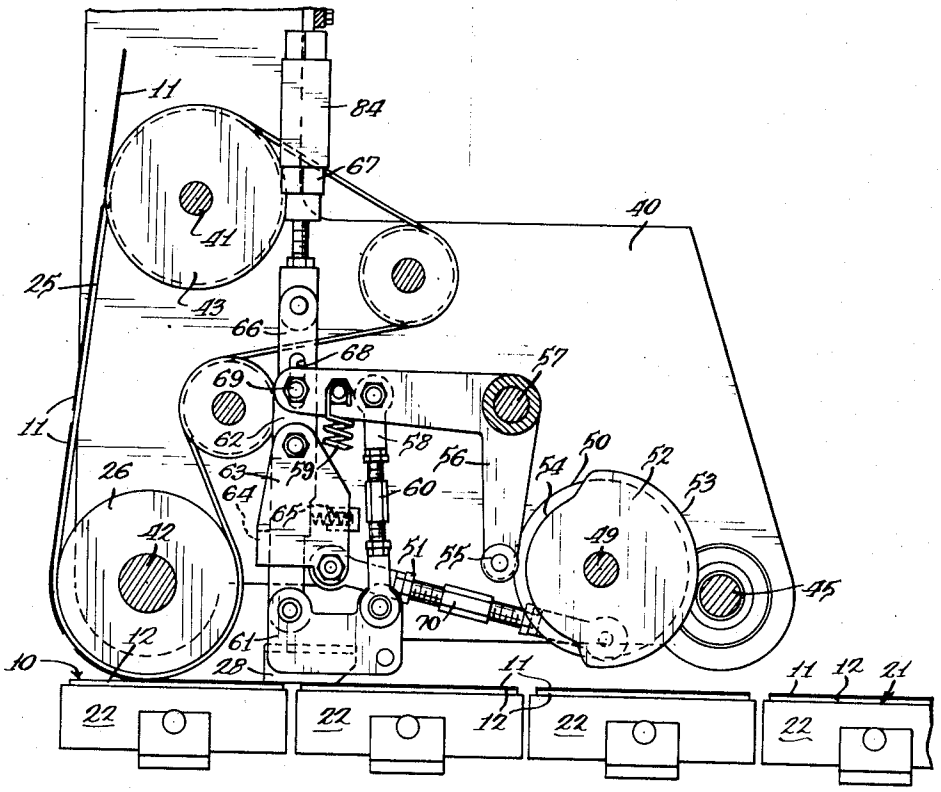
ABSTRACT: Method and apparatus for applying heat-sealable lids to containers characterized by the steps of and means for feeding a strip of lids to a row of containers, separating the individual lids from the strip and laying a lid on each container, pressing each lid to its container and spot tacking it thereto, and thereafter heat sealing the lids onto the containers whereby to expedite production of sealed containers; said tacking means comprising a particular feature of this invention.



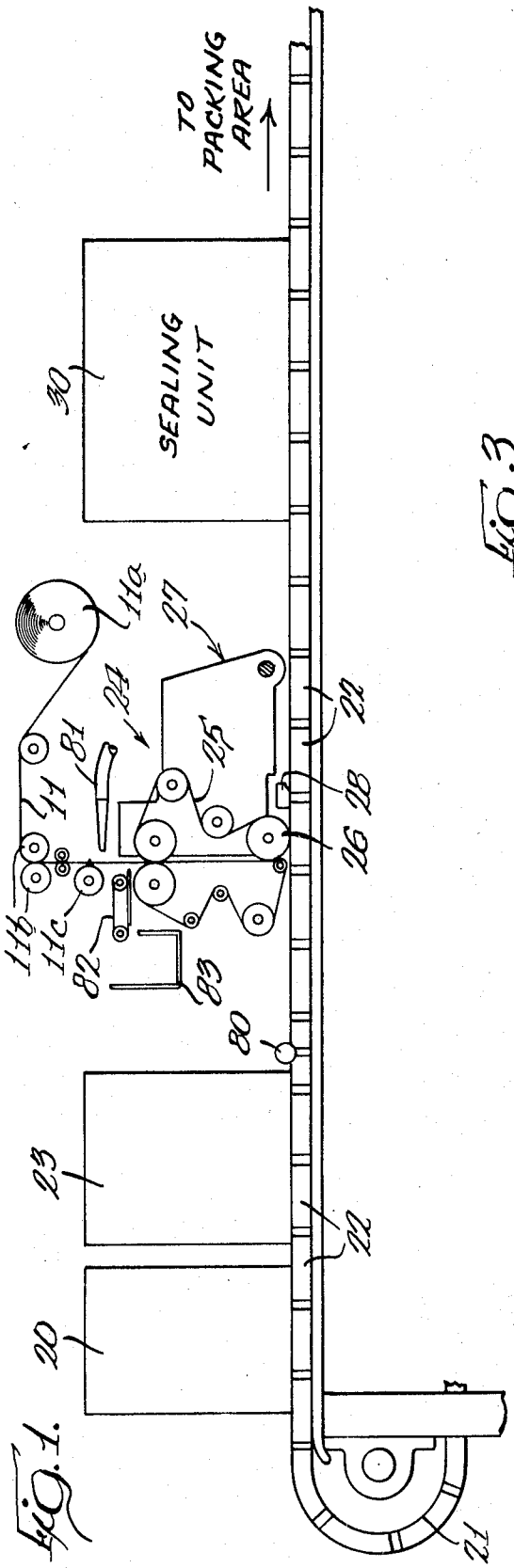


FIG. 1.

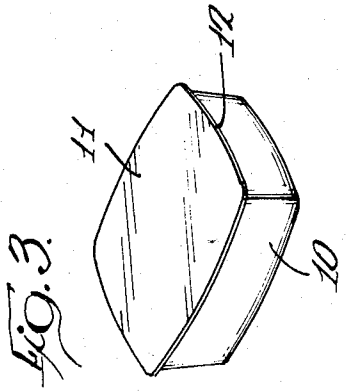


FIG. 3.

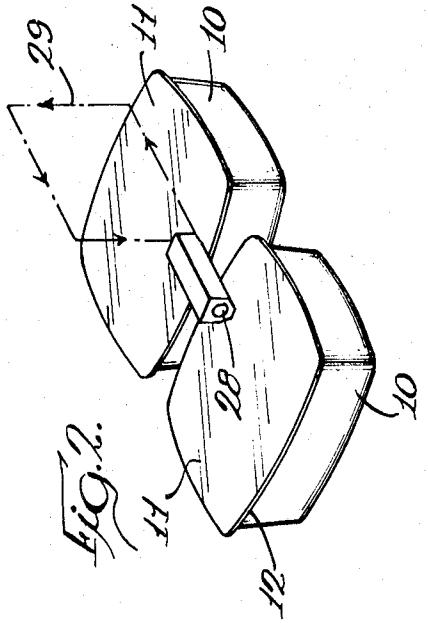


FIG. 2.

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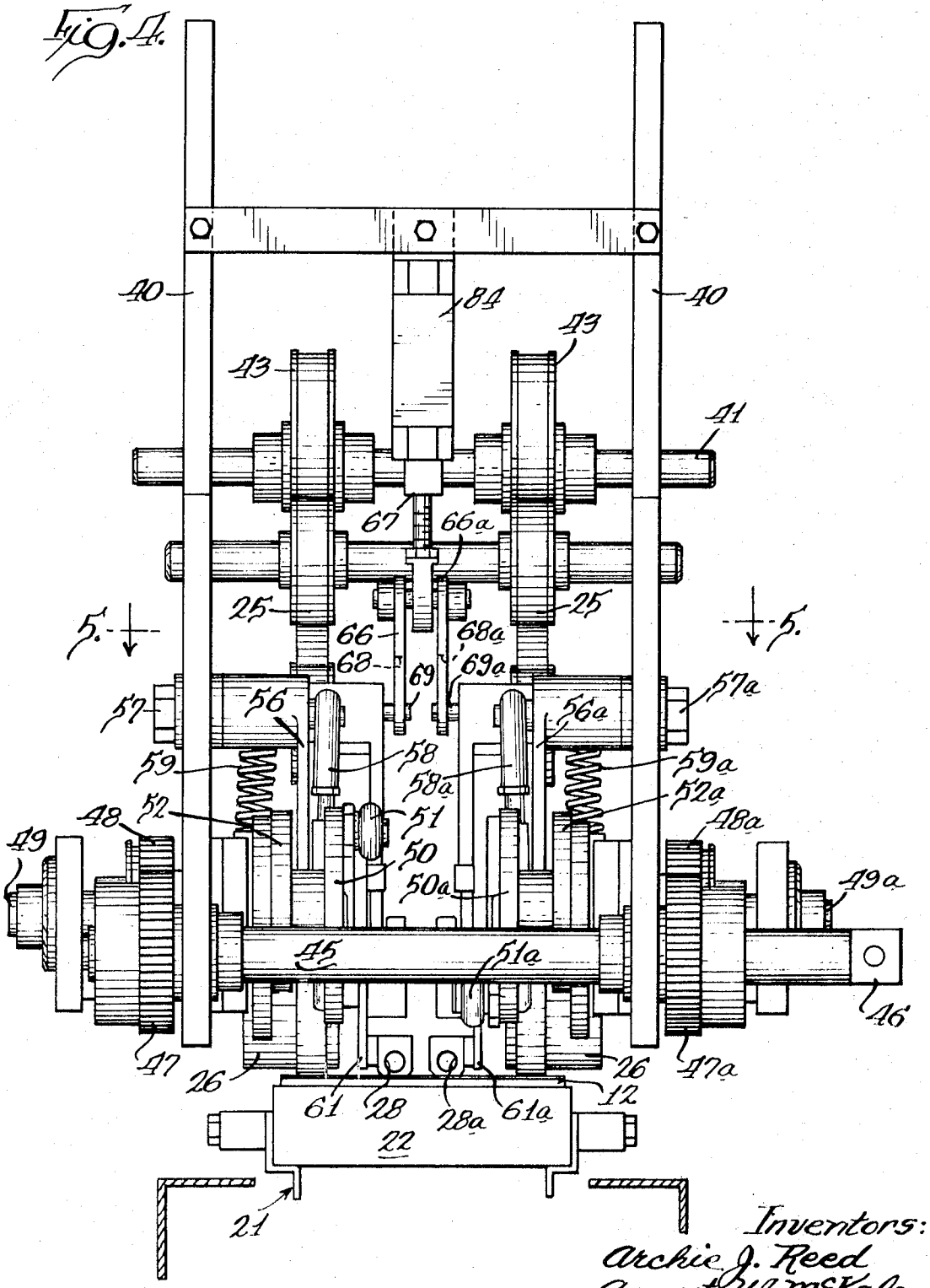
Fig. 4.



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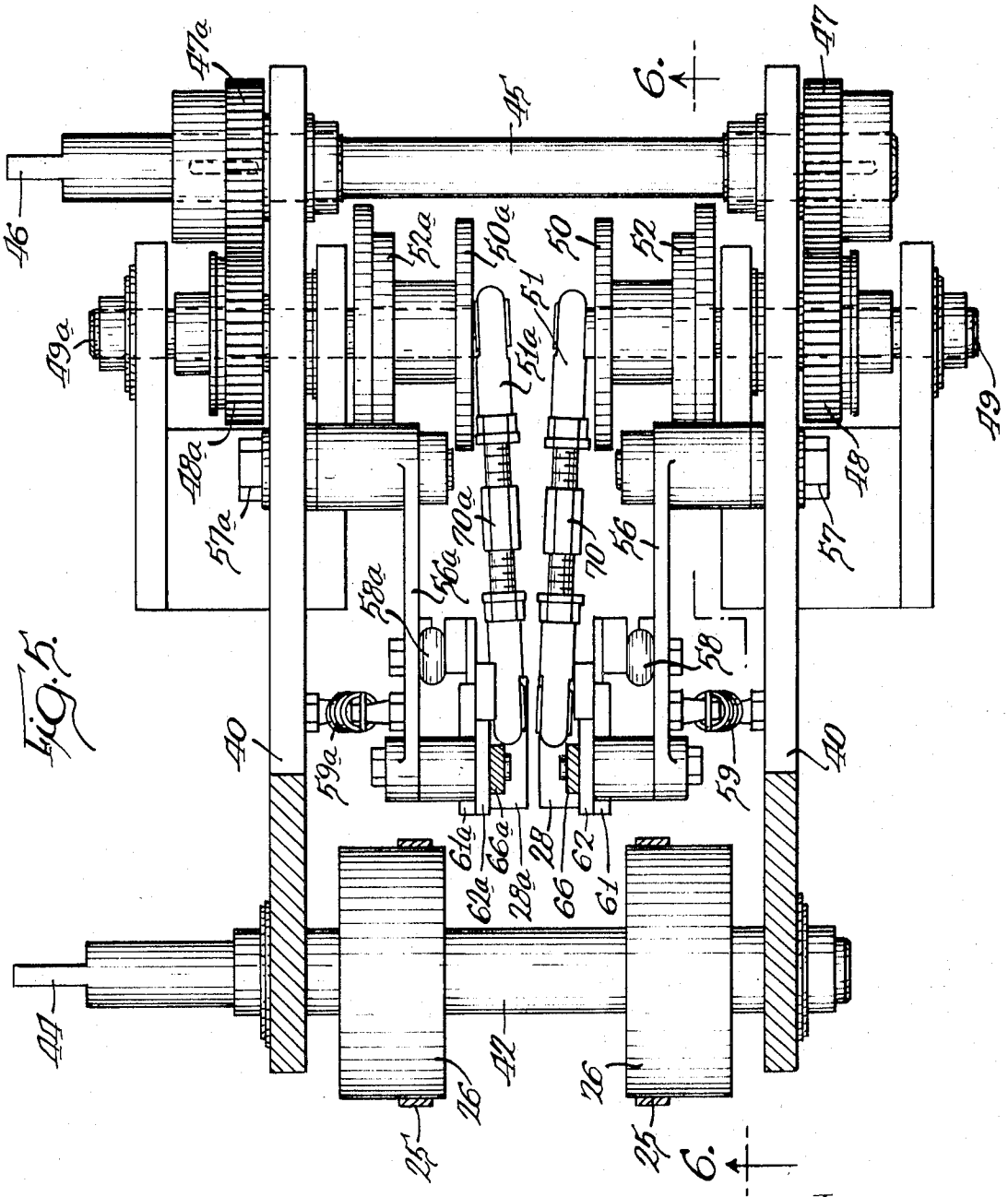

Fig. 5.

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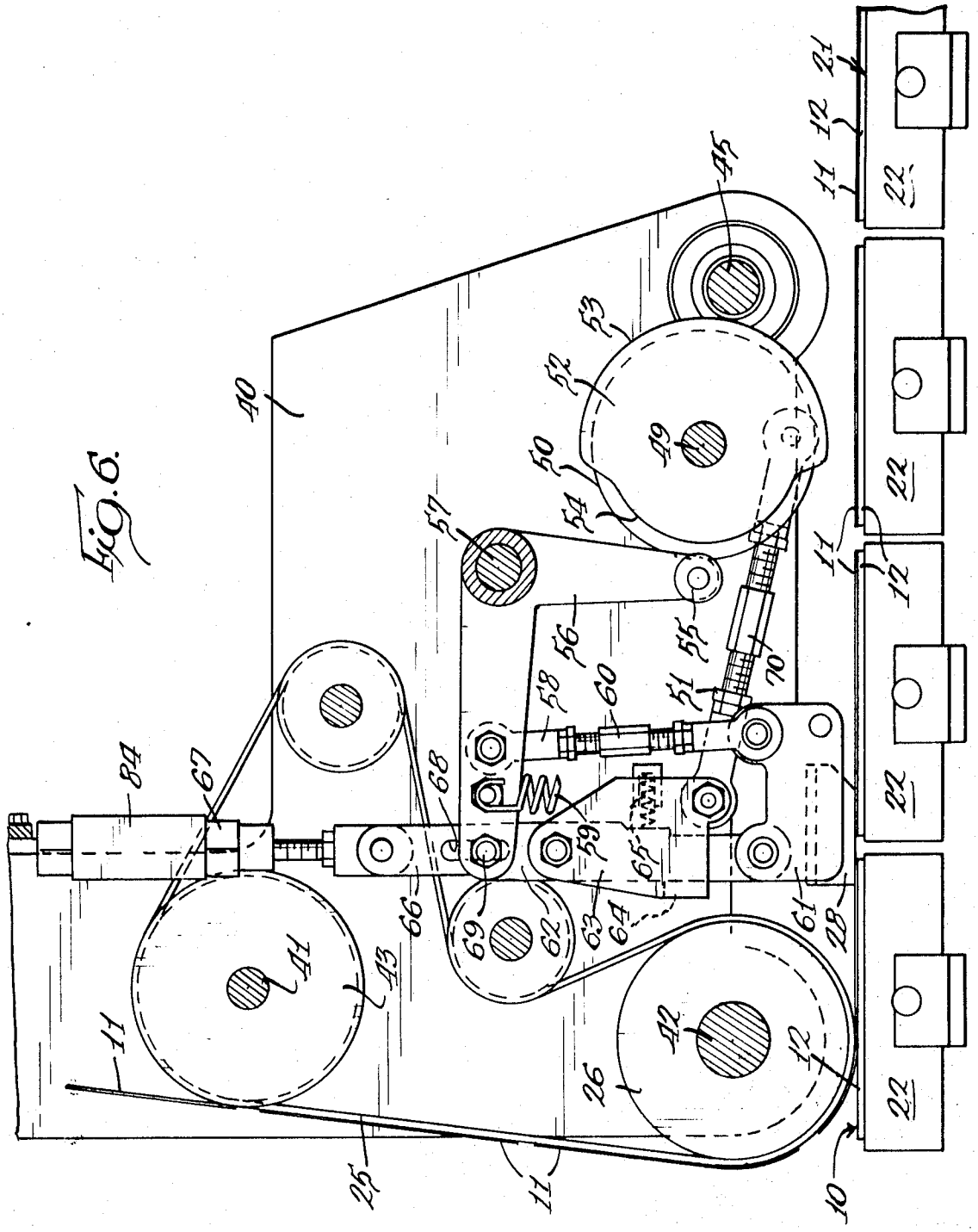

Fig. 6.

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LID APPLICATOR

Other features and advantages will become apparent from the drawings and the following description, which are given to acquaint those skilled in the art with the best mode presently contemplated by us of carrying out our invention.

THE DRAWINGS

FIG. 1 is a schematic side elevation of packaging machinery embodying the principles of this invention;

FIG. 2 is a perspective view of a container and a lid depicting the mode of spot tacking the lid to the container;

FIG. 3 is a perspective view of a completed and fully sealed container;

FIG. 4 is an end elevation, on an enlarged scale, of the tacker;

FIG. 5 is a plan view of the tacker taken substantially on line 5–5 of FIG. 4; and

FIG. 6 is a vertical longitudinal section of the tacker taken substantially on line 6–6 of FIG. 5.

DESCRIPTION

FIG. 1 illustrates the head end of a packaging line for the filling and sealing of individual service bowls of ready-to-eat breakfast cereal. Each bowl, as illustrated in FIG. 3, comprises an economical disposable plastic bowl **10** and a lid **11** heat sealed to a peripheral flange **12** on the top of the bowl. The lid preferably comprises a readily tearable and thus easily removed flexible laminate comprised of an exterior foil and an interior film of heat-sealable material adapted to be heat sealed to the flange **12**. The material of the bowl and the film is such as to seal the contents of the bowl until serving thereof, whereby to maintain the purity and freshness of the container contents. When served, the lid is easily stripped from the bowl and the contents thus exposed for consumption directly from the bowl; i.e., in the case of breakfast cereal, with the addition of milk or cream and sugar if desired.

The individual service bowls of cereal are of course given principally by way of example, the invention being equally applicable to other forms of containers and other contents to be packaged. However, the cereal bowls do serve to exemplify the invention.

Referring to FIG. 1, a device **20** of known construction and operation is provided at the head end of an endless conveyor **21** for feeding bowls one by one in an upright position onto the conveyor to form a row of bowls in contiguous relation. The conveyor preferably comprises a series of cuplike holders **22** pivotally interconnected in link fashion, each link or holder being complemental to the bowls each to receive an individual bowl. The conveyor thus carries the bowls seriatim beneath a filling machine **23** of known construction which deposits a predetermined quantity of cereal into each bowl. The the bowls are conveyed to a lid-applying means **24**.

The lids **11** are conventionally supplied in elongate strips in roll form, as indicated by the roll **11***a*. In the machine **24**, the lid strip **11** is pulled from the supply roll **11***a* by two rubber feed rolls **11***b*. The peripheral speed of these rolls corresponds to the product of lid length and machine speed, and they feed the lid strip at proper speed through the two guide rolls into a rotary knife **11***c* which cuts the strip into individual lids mated to the bowls **10**. From the rotary knife, each lid is picked up by a pair of feed tapes **25** which convey each lid to and lay it on a respective bowl. The speed of these tapes is the product of bowl spacing on the conveyor and machine speed, so that as the lids are cut, they are spaced from one another and carried by the feed tapes into register with the bowl spacings of the conveyor holders **22**. Thus, lids **11** are fed seriatim downwardly under a roller or guide means **26** in such timed manner that a lid **11** is automatically brought into overlying relation to each container or bowl **10**. Each assembly of lid and bowl, while held in place by the roller **26**, is then engaged by a tacker, indicated generally at **27**, which by means of a heated shoe tacks the lid to the bowl.

A spot tacking shoe and its mode of operation are depicted schematically in FIG. 2 wherein a shoe is indicated at **28** and its path of movement is depicted by phantom line **29**. As illustrated, the shoe **28** moves forwardly (opposite to the direction of travel of the bowls) in upwardly spaced relation to the bowls and lids, then downwardly to contact the trailing edge of one bowl **10** and its lid **11** and the leading edge of the next bowl and lid, then rearwardly simultaneously with the two bowls to apply thereto sufficient heat for a sufficient period of time to cause each lid to be heat sealed to the flange **12** of its bowl at the spot or area contacted by the shoe **28**, and then the shoe moves upwardly away from the bowls to repeat its operation on a succeeding pair of bowls in the line, while the bowls with fixedly tacked lids thereon move down the line to the next operation.

The next operation is performed by a lid-sealing device **30** of known construction which acts simultaneously on a plurality of the bowls to effect complete sealing of each of the lids over the full area of the flange **12** of the respective bowl **10**.

Prior to the advent of this invention, considerable difficulty had been occasioned in the latter operation due to accidental displacement of the lids relative to the bowls. A lid might slip slightly forward or backward, or to one side or the other, with the result that it was not aligned with the bowl flange during the heat-sealing operation and the bowl would issue from the sealer with its lid askew and the bowl contents exposed. While the contents might be salvaged, the bowl and lid were wasted and production was severely restricted.

By virtue of this invention, the lids are laid and held onto the bowls while under complete control of the lid-applying mechanism where they are relatively easy to handle and properly align with the bowl. The lids are the immediately tacked in place so that they cannot become askew, and thus pass into the sealing mechanism **30** properly oriented to the bowls. The result is substantially decreased waste and substantially increased production of the finished product.

Also, the invention facilitates continuous mass production of the filled and sealed bowls, there being no interruption of bowl or conveyor movement necessitated thereby. Consequently, a continuous stream of the completed product moves down the conveyor to a suitable packing area to the right of FIG. 1.

Referring now to FIGS. 4 to 6, the lid feeder **24** and tacker **27** provided by this invention are shown as mounted on a pair of spaced parallel side frames **40** which are supported above the conveyor **21** in parallel and centered relation thereto. Journaled in the upstream end of the frames are a pair of vertically spaced cross-shafts **41** and **42**, the upper one **41** of which carries a pair of spool-type guide rollers **43** for guiding a pair of flexible belts which comprise the lid feeding belt means **25**, and the lower one **42** of which carries a pair of belt-driving rollers comprising the previously mentioned roller or guide means **26**, the belts being reaved over the two sets of rollers and adapted to be driven by the shaft **42**. For the purpose, the shaft **42** includes a clutch tongue **44** adapted to be engaged with a driven element of the machine for rotating the rolls **26** at such speed as to align a lid **11** with each of the bowls **12**.

At the downstream end of the frames **40**, a similar transverse drive shaft **45** equipped with a clutch part **46** is journaled in the frames for driving the heat-sealing shoe means **28** of the tacker in timed relation to the movement of the conveyor **21**.

In its preferred embodiment, the tacker embodies a pair of the heat-sealing shoes, indicated respectively at **28** and **28***a*, and an independent drive mechanism for each shoe. Accordingly, the drive shaft **45** (which is engaged in known manner with an element of the machine) carries a pair of drive gears **47** and **47***a* each of which is engaged with a respective gear **48–48***a* each of which is secured to a respective shoe operation shaft **49–49***a*.

Inasmuch as the shoe-operating mechanisms are identical, except for being 180° out of phase as will subsequently be described, one of the mechanisms will be described in con-

junction with whole reference numerals and the corresponding parts of the other mechanism will be designated in the drawings by the same numerals with the suffix "*a*."

As shown, the shoe-operating shaft **49** of each mechanism is equipped with an eccentric **50** to which a horizontal link **51** is pivotally connected for reciprocatory movement in a generally horizontal direction. Also, the shaft **49** carries a cam **52** having a peripheral surface divided into an outer lobe or cam surface **53** of approximately 180° arcuate extent, an inner lobe or cam surface **54** of a somewhat lesser arcuate extend, and intervening transition surfaces. Said surfaces are engaged by a follower **55** mounted on one end of a bellcrank lever **56** which is pivoted intermediate its ends on the frame by a pivot pin or bolt **57**. Adjacent its opposite end, the bellcrank pivotally mounts a vertical link **58** for reciprocatory movement in a generally vertical direction in response to the cam-induced movements of the bellcrank; the outer end of the bellcrank being biased downwardly and the inner end thereof rearwardly toward the cam by a tension spring **59** extended between the bellcrank and the adjacent side frame **40**.

The vertical link **58** is longitudinally adjustable by virtue of a built-in turnbuckle **60** and is thereby adjustably and pivotally connected to the rear of a carrier **61** for the heat-sealing shoe **28**. The forward end of the carrier is pivotally connected to a vertical link **62** which generally parallels the link **58** and is pivotally connected to the forward or outer end of the bellcrank, whereby the carrier is mounted on and retained in an essentially horizontal position by a parallelogram linkage.

Associated with this linkage is a bracket **63** that is pivotally connected to the vertical link **62** and to the horizontal link **51** and which serves as a safety link or lost motion connection between the links **51** and **62**. To this end, the bracket **63** includes a crossmember **64** that normally engages the front side of the linkage **62** and a compression spring **65** disposed between the opposite side of the link **62** and a rearward extension of the bracket, whereby the bracket is normally biased into the position shown in FIG. **6**. Consequently, when horizontal link **51** is moved rearwardly (i.e., to the right in FIG. **6**) it will pull the bracket **63** and thus the link **62** and the shoe **28** rearwardly with it. However, when the horizontal link **51** is moving forwardly under the driving action of the eccentric **50**, should the link **62** become jammed or reach its end position before completion of the forward stroke of movement of the link **51**, the bracket **63** can swing forwardly against the bias of spring **65** to prevent further forward movement of and damage to the parallelogram linkage and the sealing shoe, thereby providing a safety factor in the operation of the linkage.

As will thus be appreciated, the horizontal link **51** is reciprocated by the eccentric **50** to impart horizontal swinging movement to the links **58** and **62**, whereby to reciprocate the shoe **28** horizontally.

The links **58** and **62** in turn serve to retain the shoe horizontal and the bellcrank **56** serves to raise and lower the same. Specifically, the parallelogram linkage is adapted to be moved upwardly by the outer cam surface **53** of the cam **52** to dispose the shoe **28** in upwardly spaced relation to the conveyor **21** and the bowls **10** and lids **11**, and is adapted to be biased downwardly by the spring **59** when the bellcrank is released for downward movement by the inner cam surface **54**. The cam surface **54** is so located that when the same becomes aligned with the follower **55** the shoe **28** is in position to bridge over or span between two of the carriers **22**. Consequently the spring **59** will move the shoe **28** downwardly until it engages the trailing edge and the leading edge respectively of the lids **11** and flanges **12** of the two containers therebelow, and will then maintain a predetermined spring pressure thereon to facilitate the lid-tacking operation.

To prevent excessive downward movement of the shoe in the event of malfunction of the machinery, a safety link **66** is associated with the bellcrank **56** and the parallelogram **58–62**. This link is pivotally and adjustably suspended from a turnbuckle **67** mounted on the tacker frame and includes a lost motion connection with the bellcrank comprising a slot **68** within which a pin **69** on the bellcrank comprising a slot **68** within which a pin **69** on the bellcrank is free to move. The bottom margin of the slot defines the lower limit of bellcrank and linkage movement, and the slot itself accommodates up and down movement of the bellcrank within its normal operating range.

The inner cam surface **54** and the horizontal link **51** are so related to one another on the shaft **49** as to impart an essentially rectangular path of movement to the shoe **28**, as depicted at **29** and described in conjunction with FIG. **2**. The turnbuckle **60** in the vertical link **58** and a similar turnbuckle **70** in the horizontal link **51** are adjustable to accommodate reasonable adjustments to be made in the path of shoe movement. For the same purpose, the cam **52** may be adjustably mounted on the shaft **49**. Usually, as shown in FIG. **6**, the horizontal link **51** is connected to the eccentric **50** at a location adjacent and preferably slightly ahead of the initial portion of the inner cam surface **54** in the direction of rotation of the shaft **49**. Consequently, with the parts positioned as illustrated in FIG. **6**, continued rotation of the cam and eccentric in the indicated direction will cause the shoe **28** to be moved rearwardly until the point of connection between the eccentric **50** and the link **51** approaches a position corresponding to roughly **4** o'clock, at which time the rate of horizontal movement of the link **51** starts to diminish.

At this time, the cam **52** has rotated to a position wherein the outer cam lobe **53** becomes engaged with the follower **55** whereupon the bellcrank **56**, the parallelogram linkage **58–62** and the shoe **28** are raised upwardly to release the shoe from the particular bowls that it had engaged. The shoe is then retained elevated by the outer cam surface **53** during something more than 180° of shaft rotation.

During the 180° plus rotation in which the shoe is elevated, the eccentric **50** is rotated through the null point at 30'clock, the link **51** is moved forwardly to swing the parallelogram linkage and the shoe forwardly, and the eccentric **50** is rotated through the null point at the 90'clock position, whereupon the linkage starts on its rearward stroke of movement. As the latter occurs, the cam again presents its inner cam lobe **54** to the follower **55**, whereupon the shoe is lowered onto the trailing and leading edges respectively of the lids and flanges of the two bowls now positioned therebelow, which edges are twice removed respectively from those first engaged by the shoe **28**. (In other words, the shoe **28** engages the trailing edges of alternate bowls, and the leading edges of the bowls intervening between said alternate bowls, not both edges of every bowl.) The link **51** is then moves the shoe **28** horizontally rearward in synchronism with the horizontal movement of the bowls engaged thereby, whereupon the shoe **28** (which is preferably electrically heated in known manner) spot tacks the trailing edge of one lid and the leading edge of the next lid to the flanges of their respective bowls.

During this horizontal movement, the shoe moves in a perfectly horizontal path inasmuch as the spring **59** and the slot **68** in the safety link **66** accommodate the necessary fluctuations or variations in what would otherwise be an arcuate swinging of the lower ends of the links **58** and **62**.

Thus, the sealing shoe **28** efficiently and expeditiously physically presses each lid **11** to the flange **12** of the respective bowl **10**, and thereafter fixedly tacks the lid to the bowl to ensure proper orientation of the lid and the bowl when they arrive at the final sealing mechanism **30**.

As above explained, the shoe **28** spans only alternate ones of the gaps or junctions between the carriers **22**. To effect tacking of the lid edges contiguous to the intervening gaps or junctions, the second tacking shoe **28***a*and its operating mechanism have been provided. This shoe and mechanism are identical to that above described with the single exception that the eccentric **50***a*and cam **52***a* thereof are positioned 180° out of phase with the eccentric **50** and the cam **52**. Consequently the *a* unit or assembly will automatically tack lids onto the bowl edges adjacent the intervening carrier's junction. Thus,

each bowl in the line will have a lid tacked thereto at both its leading and trailing edges as the bowls pass through the lid applicator and tacker structure. Thus, a lid is pressed and tacked to and properly oriented on each bowl or container as the containers travel to the sealing mechanism **30**.

In this manner, the row of containers may travel continuously through the machinery depicted schematically in FIG. **1** without pause, hesitation or interruption of movement, each container will have a lid tacked thereto in properly oriented position, and the sealing mechanism **30** will properly perform its function in respect of all of the containers whereby to afford high-speed and efficient production of filled and sealed containers.

Occasionally in the operation of the machine, a bowl may not be fed into a holder **22** by the mechanism **20**, or a bowl may be improperly filled with product by the mechanism **23** whereupon that mechanism causes the bowl to be ejected. Thus, an occasional open holder in the conveyor will appear at the lid applicator. If a lid were applied to the open holder, the lid would be sealed to the holder with no way to remove it and operation of he machine would be impaired.

To obviate this problem, an empty holder detector **80** (FIG. **1**) is provided adjacent the conveyor **21** at a location upstream from the lid applicator correlated to the distance of the cutter **11***c* from the conveyor and a lid rejecting air jet **81** is provided just below the cutter. When the detector **80** senses an empty holder, it causes actuation of the air jet **81** whereupon the next succeeding one of the lids **11** (the lid corresponding to or intended for the empty holder **22**) is forced to follow the rotary knife and is blown onto a reject conveyor **82** and dropped into a reject box or receptacle **83**. Thus, the lid that otherwise would have been fed to the empty holder is rejected and the stream of lids will have an empty space matching the empty holder.

At the time when the empty conveyor pocket passes under the tacking shoes **28**, it is also preferable to render the shoes inoperative to prevent damage to the shoes and/or the conveyor. For this purpose, an air cylinder **84** under the control of the detector **80** is preferably associated with the turnbuckle **67** of the shoe operation linkage to raise the linkage to an inoperative or upwardly spaced position during passage of the empty holder.

Thus, proper and continuous operation of the machine is assured.

While we have shown and described what we regard to be the preferred embodiment of our invention for applying a particular lid to a particular container, it is to be appreciated that the invention is equally applicable to other lids and containers and that for this and similar purposes changes, rearrangements and modifications may be made in the apparatus without departing from the scope of the invention, as defined by the appended claims.

We claim:

1. Apparatus for spot tacking lids to continuously traveling containers comprising a lid-pressing and tacking shoe, means movably supporting said shoe for movement toward and away from the containers and for reciprocation along the axis of container travel, means for moving said shoe toward and away from the containers, means for reciprocating said shoe along said axis, and means for driving said shoe moving means and said shoe reciprocating means in timed relationship to one another for imparting a generally rectangular movement to said shoe from a starting position toward the containers, parallel to the path and in the direction of container travel, away from the containers and in parallel but spaced relation to the path of container travel and in direction opposite thereto back to the starting point, whereby the shoe may be engaged with a lid and container and travel along with them to spot tack the lid onto the container and thereafter be retracted from the container and returned to its starting position for subsequent engagement with a succeeding lid and container.

2. The apparatus of claim **1** wherein the lids are heat-sealable to the containers and said shoe has a heated surface of limited area engageable with a portion of the lid and a complementary portion of the container.

3. The apparatus of claim **1** wherein said shoe supporting means comprises a parallelogram linkage for retaining said shoe in a predetermined attitude relative to the lids and containers.

4. The apparatus of claim **1** wherein said shoe-moving means comprises a cam having a inner lobe portion and an outer lobe portion, and a lever connected to said shoe supporting means and having a follower engageable with said cam, said outer lobe portion being longer than said inner lobe portion for causing said level to retract said shoe from the containers throughout the shoe-returning stroke and the null points at the opposite ends of reciprocatory movement of said shoe, said inner lobe portion accommodating engagement of said shoe with a lid and container solely during movement of the shoe in the direction of container travel.

5. The apparatus of claim **4** including resilient means for biasing said shoe toward the containers; said resilient means, said supporting means, said lever and the inner lobe of said cam accommodating variable displacement of said shoe in the direction toward the containers and said resilient means causing said shoe to exert a uniform pressure on the lid and container.

6. The apparatus of claim **4** wherein said shoe reciprocating means comprises an eccentric and a connecting link between said eccentric and said shoe, said eccentric and said cam being mounted on a common shaft and comprising therewith said driving means.

7. The apparatus of claim **6** wherein said common shaft is coupled to and operated in timed relationship with means for effecting continuous travel of the containers whereby said shoe engages a predetermined spot on each lid and container and travels synchronously therewith while engaged thereto.

8. The apparatus of claim **1** wherein said shoe reciprocating means comprises an eccentric and a connecting link between said eccentric and said shoe.

9. The apparatus of claim **8** wherein said connecting link includes a spring-biased safety coupling.

10. The apparatus of claim **1** comprising a plurality of shoes; and supporting, moving, reciprocating and driving means for each of said shoes; said driving means being arrayed in predetermined phase relationship with one another for causing each shoe to engage respective ones of the lids and containers in the row; said drive means being so arrayed and said shoes being of such number as to engage each lid and its container.

11. The apparatus of claim **10** wherein each shoe engages the trailing edge of one container and the leading edge of the next succeeding container.

12. Apparatus for applying lids to containers comprising lid-feeding means for laying a lid onto each container in a continuously traveling row of containers wherein said lid-feeding means comprises means for feeding lids seriatim to the traveling row of containers, a detector upstream of said feeding means for detecting the absence of containers in said row, and means actuated by said detector for ejecting the respective lid in the series intended for the absent container in the row; pressing and tacking means engageable with each lid substantially at the time the lid is laid on the respective container, means for engaging said pressing and tacking means with a lid and its container at said time, for then moving said means synchronously with the respective lid and container during a portion of the travel of the container for effecting spot tacking of the lid to the container without interrupting container travel, and for thereafter returning said pressing and tacking means for engagement with a succeeding lid and container; and means for completing securing of the tacked lids to their containers.

13. The apparatus of claim **12** wherein said lid-feeding means includes means for feeding a continuous strip of lids, means for cutting individual lids from said strip and means for feeding the individual lids seriatim from said cutting means to

said row of containers, and wherein said lid-ejecting means is located between said cutting means and the last-named feeding means and said detector is spaced upstream from the point of application of lids to the containers by a distance substantially equal to the spacing between said ejecting means and said point.

14. The apparatus of claim **12** including means actuated by said detector for rendering said pressing and tacking means inoperative during the time the absent container and the ejected lid would otherwise have been engaged thereby.

15. A method of applying lids to containers comprising the steps of laying a lid onto each container in a continuously traveling row of containers and substantially simultaneously pressing each lid to the respective container, spot tacking each lid to the respective container while the lid is so pressed by moving lid pressing and tacking means synchronously with the container through a portion of its travel thereby fixedly to orient each lid to its container, and thereafter securing the lids to the containers; detecting a lack of continuity in the row of containers, ejecting the lid that would otherwise have been laid on the row at the point of discontinuity, and rendering the pressing and tacking means inoperative at the point of discontinuity.

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