Sept. 5, 1967 W. E. BOWDEN 3,339,335

METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

Filed June 26, 1964 5 Sheets-Sheet 1

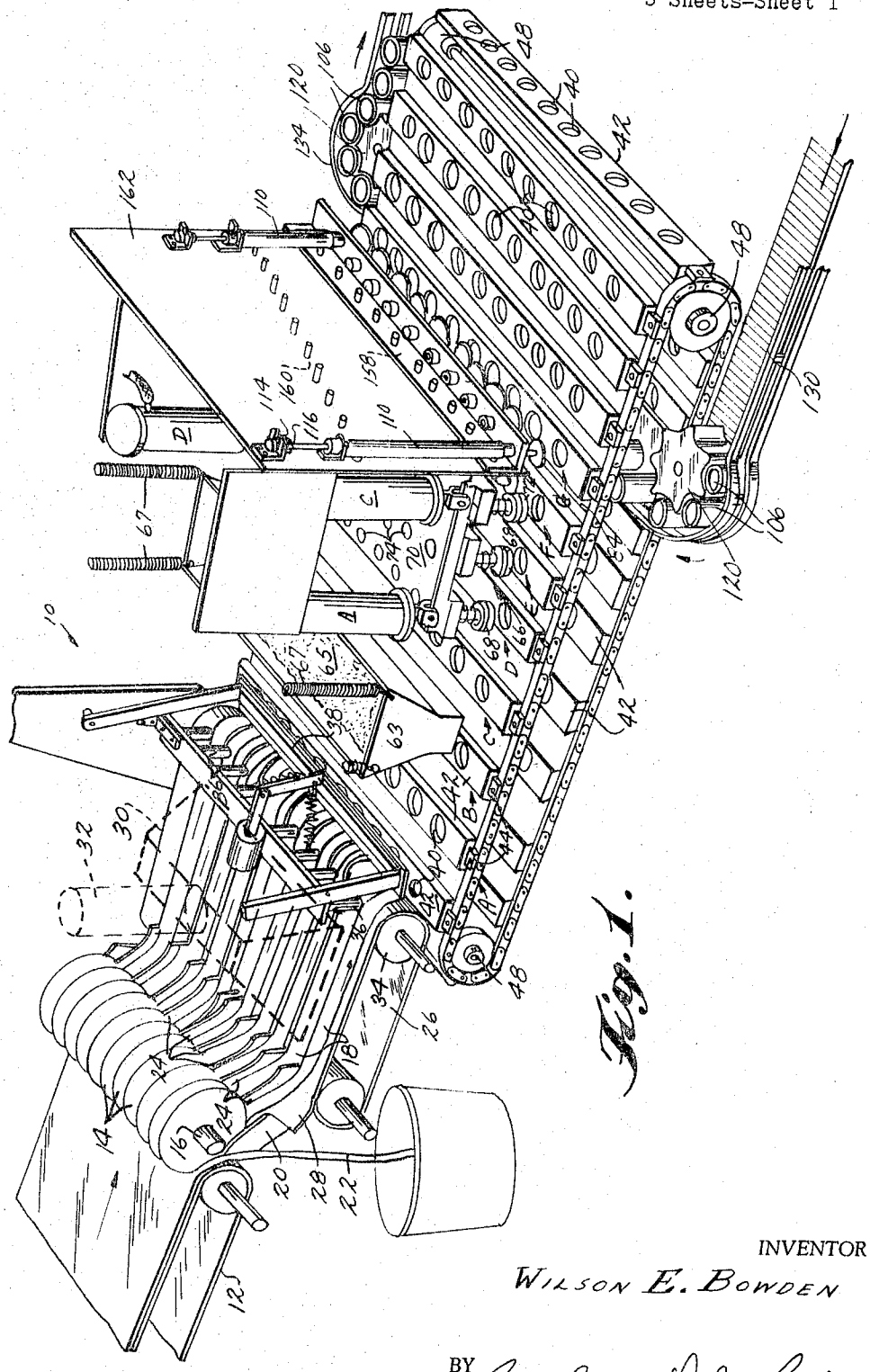


Fig. 1.

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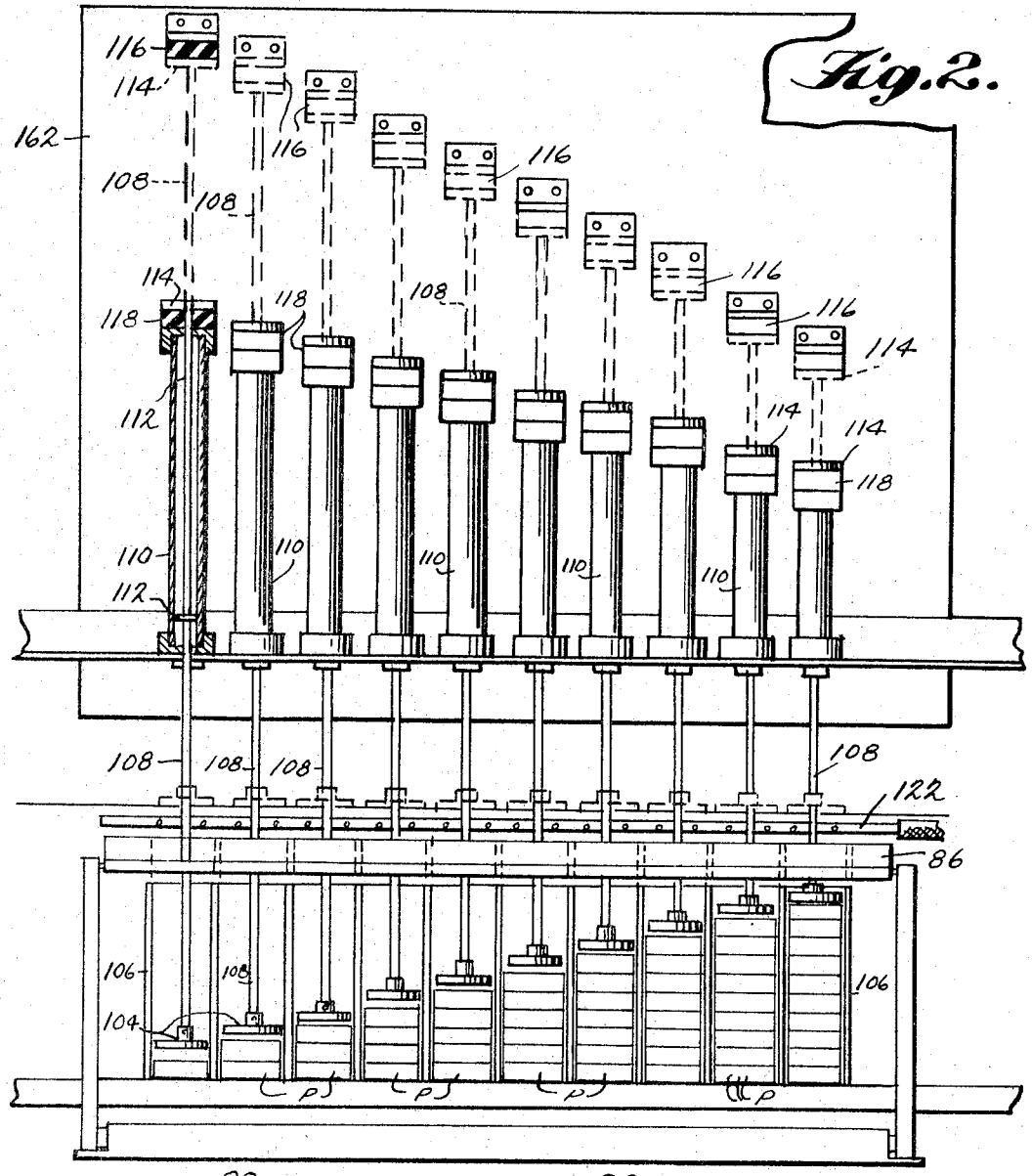
BY Cushman, Darby & Cushman
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METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

Filed June 26, 1964 5 Sheets-Sheet 2

Fig. 2.



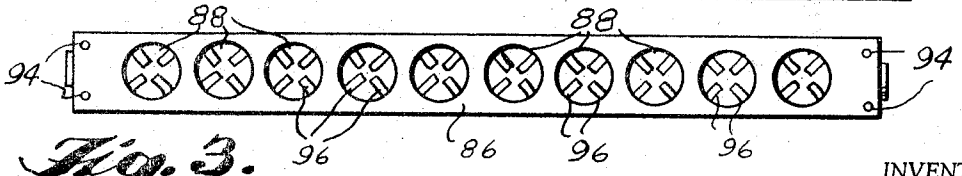


Fig. 3.

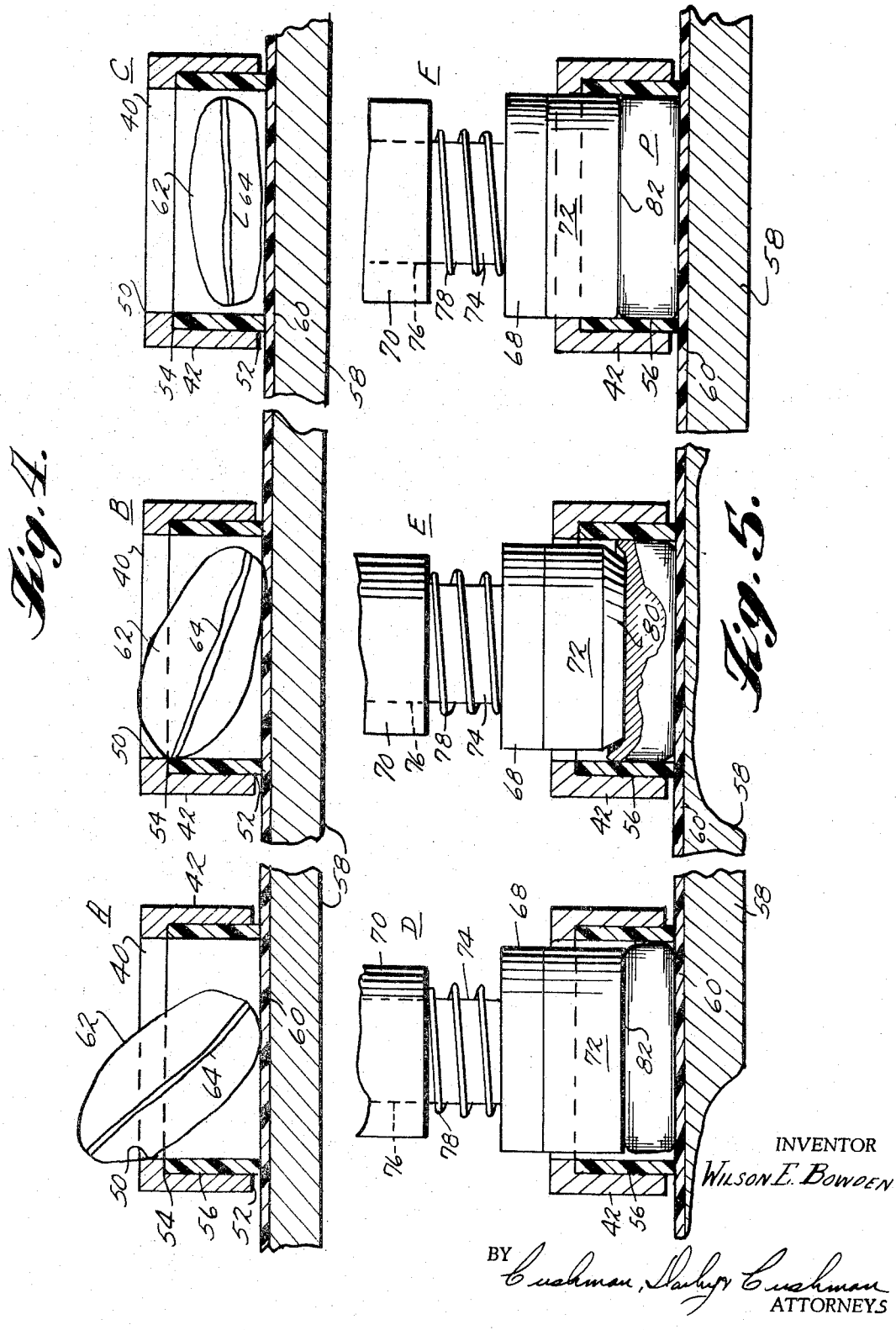
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METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

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METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

Filed June 26, 1964 5 Sheets-Sheet 4

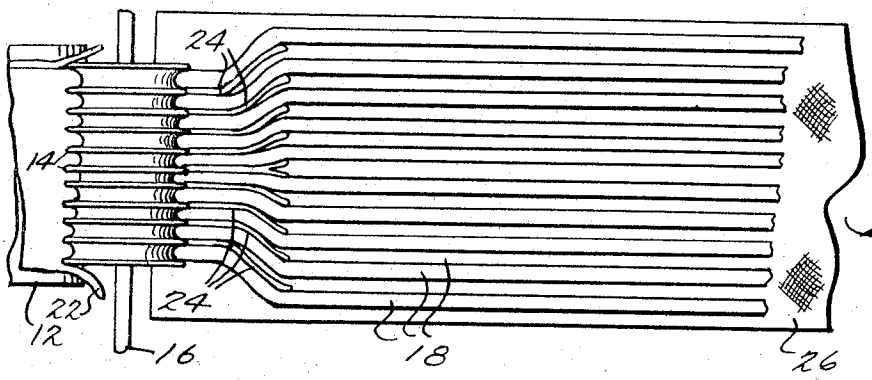


Fig. 6.

Fig. 7.

Fig. 8.

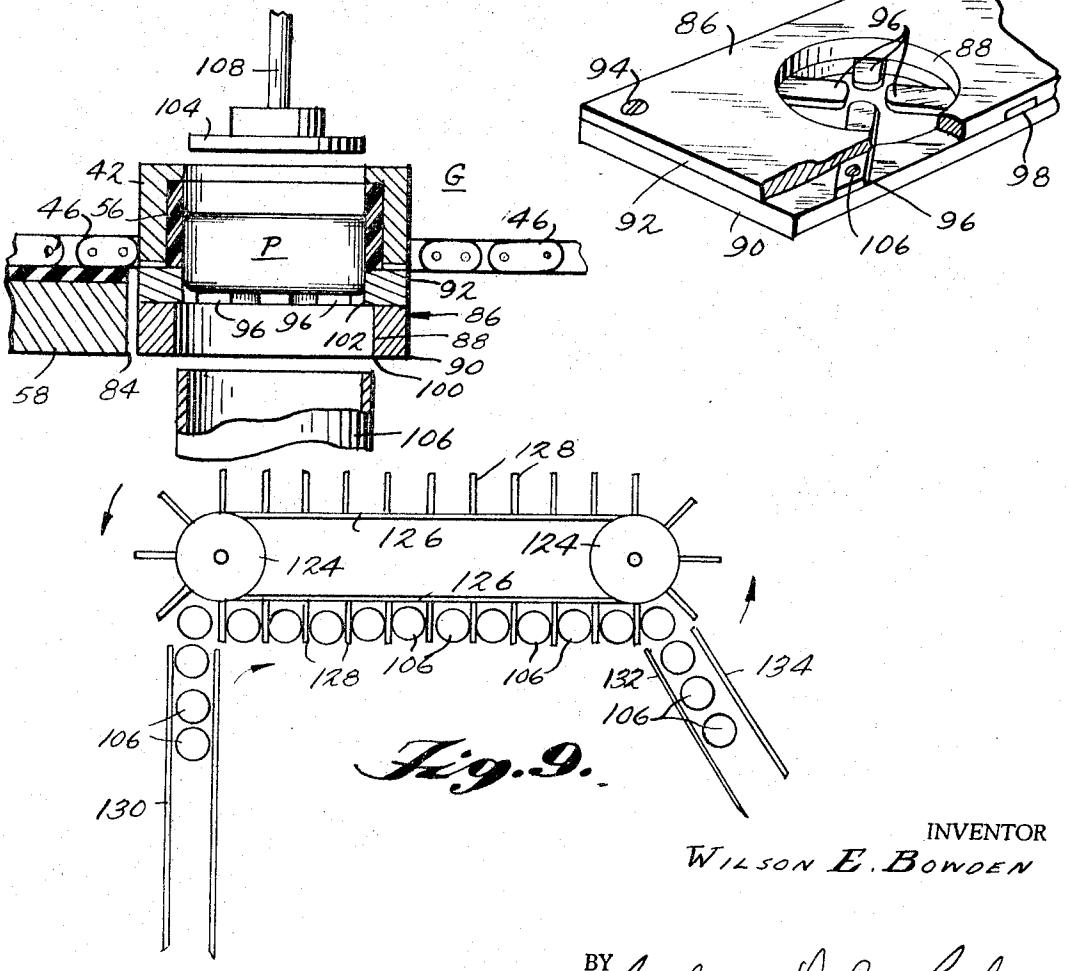


Fig. 9.

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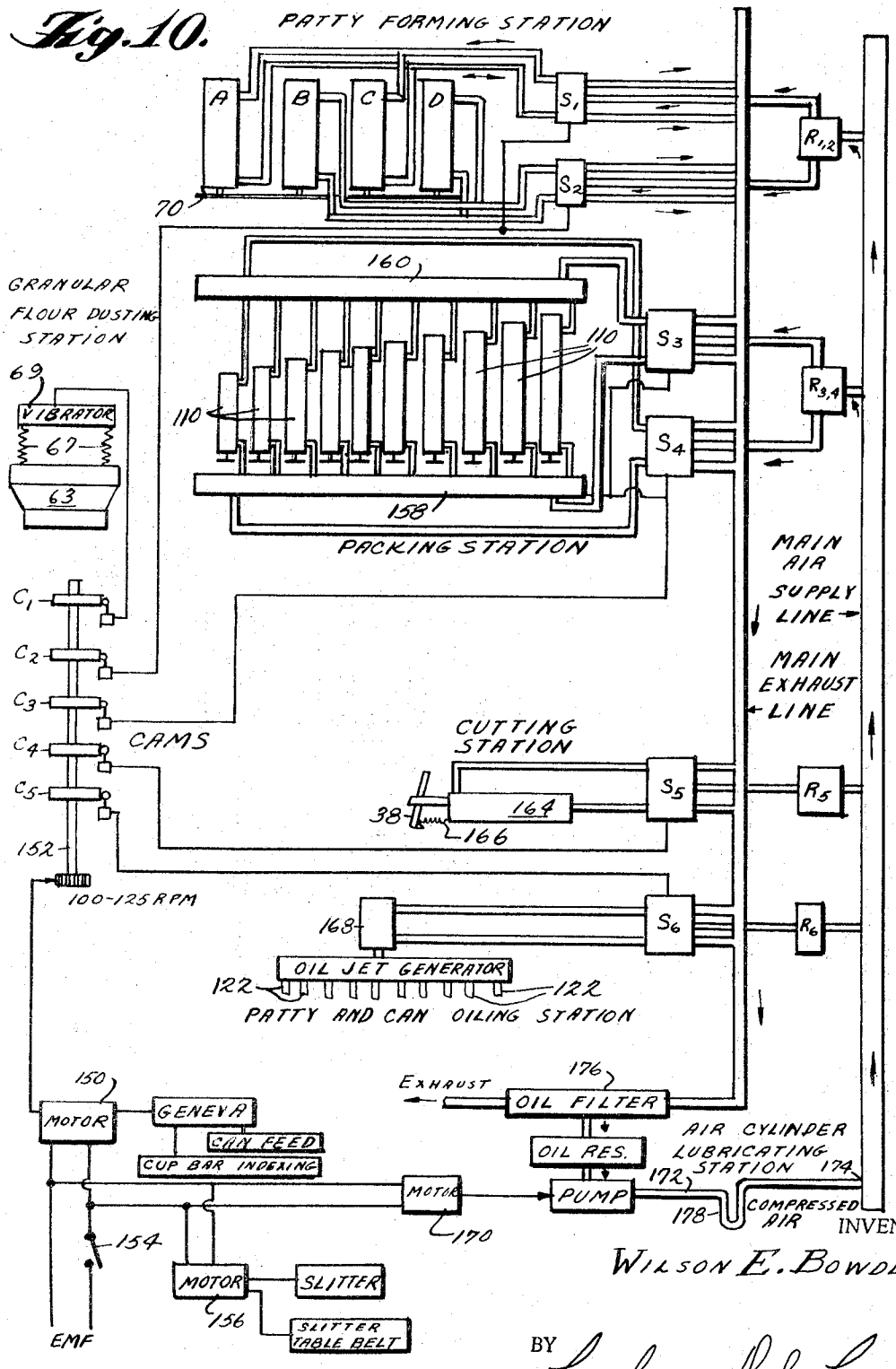
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METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

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Fig. 10.



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3,339,335

METHOD AND APPARATUS FOR FORMING AND PACKAGING BISCUIT PATTIES

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Filed June 26, 1964, Ser. No. 382,434
52 Claims. (Cl. 53—123)

The present invention relates to dough packaging and more particularly to apparatus for automatically forming and packaging a plurality of disk shaped biscuit patties in vertically stacked orientation in cans suitable for shipping and sale under refrigeration.

The invention provides apparatus which is simple and efficient and reliable in operation resulting in the providing of biscuits having improved appearance and physical characteristics. Many devices have been provided in the prior art, for instance U.S. Patent 3,065,584, for packaging biscuit dough patties in cans. But because of the nature of the biscuit dough, there are several problems inherent in the packaging of such dough patties that have not heretofore been successfully and efficiently solved and as a result many similar devices of the prior art have proven to be inefficient inasmuch as they cause dough wastage and because they are susceptible of early mechanical failure that requires a large amount of expensive down time for repairs.

Additionally, because of the nature of dough, it has heretofore been difficult to assure that each biscuit patty will be properly oriented as it is brought into position in a can. Improper orientation results not only in a mis-shaping of the patty so that a biscuit baked therefrom will not have an attractive appearance, but because the rough unrolled edges of improperly oriented biscuit patties are not sealed by contact with the can wall, leavening gases will be lost from such biscuits during storage and upon opening of the can so that such biscuit patties will not rise as they bake but will have an unattractive texture.

Accordingly, the apparatus provided by the present invention is capable of efficient operation requiring low maintenance, being able to place biscuit patties in cans with the proper orientation and without mis-shaping the patties.

More specifically, it is an object of the present invention to provide apparatus of the type described capable of forming a sheet of dough into a plurality of longitudinally elongated strips, cutting these strips of dough into biscuit blanks, forming the blanks in properly oriented positions into uniformly shaped biscuit patties and positively displacing each biscuit patty thus formed into a biscuit can in the desired horizontally extending vertically superimposed relationship with similar biscuit patties being placed in the can.

It is a further object of the invention to provide novel flexible finger means for supporting biscuit patties over biscuit cans immediately prior to displacement of the biscuit patties into the cans.

It is a further object of the invention to provide means for lubricating the biscuit patties to facilitate the proper orientation of biscuits in the cans and assist their easy removal for baking.

Another object of the present invention is the provision of an integrated system for precisely controlling the cyclic operation of the apparatus.

Yet another object of the invention is to provide compressed fluid operated piston means for displacing the biscuits into the cans at a speed faster than they would fall by gravity.

A further object of this invention is the provision of

novel means for the lubrication of the fluid operated pistons.

These and other objects of the invention will become more apparent during the following detailed explanation of a preferred illustrative embodiment of the invention, specific reference being made to the attached drawings wherein the embodiment is shown.

In the drawings:

FIGURE 1 is a fragmentary schematic perspective view of apparatus provided according to the principles of the present invention;

FIGURE 2 is a front elevation view of the packing station of the apparatus of FIGURE 1, partially in section to show details thereof otherwise hidden from view;

FIGURE 3 is a plan view of the resilient finger bar of the packing station;

FIGURE 4 is a sectional view of a portion of the apparatus taken substantially along lines **4**—**4** of FIGURE 1 and illustrating the successive movement of a dough patty into the die cup of a former bar during indexing movement of the bar along the former table;

FIGURE 5 is a fragmentary sectional view taken along the lines **5**—**5** of FIGURE 1 illustrating the successive forming of a biscuit slug into a disk-shaped biscuit patty;

FIGURE 6 is a plan view of the dough slitting and strip separating stations of the apparatus shown in FIGURE 1;

FIGURE 7 is a sectional view taken substantially along lines **7**—**7** of FIGURE 1 showing a biscuit patty supported on the resilient fingers and about to be displaced into a can;

FIGURE 8 is a fragmentary perspective view partially broken away to show a preferred orientation of the resilient fingers;

FIGURE 9 is a plan view of alternate means for indexing biscuit receiving cans transversely with respect to the biscuit packaging station; and

FIGURE 10 is a schematic view of the air cylinder, lubrication and electrical systems of the apparatus.

Now with more particular reference to the figures, the biscuit patty forming and packaging machine **10** provided by the present invention includes an endless dough sheet transporting belt **12** carrying dough from a conventional sheeter or the like (not shown) into the path of a plurality of laterally spaced vertically directed cutter disk knives **14** mounted on a continuously rotating shaft **16**. As the dough sheet passes beneath the disk knives, it is severed into a plurality of laterally adjacent longitudinally elongated dough strips **18**. Deflectors **20** mounted on either side of the bank of disk knives deflect the uneven transverse edge portions **22** of the dough sheet into suitable collecting means such as cans from which it can periodically be returned to the dough sheeter.

The dough strips **18** are led from the disk knives downwardly between a plurality of downwardly and forwardly diverging spreader plates **24** which separate the strips laterally from one another. The separated strips are then moved forwardly on a slitter table belt **26**. It should be noted that between the cutter disk knives and the slitter table belt the dough strips, as they are separated from one another, slide downwardly on the support **28** on which the spreader plates are mounted. This downwardly, forward sliding motion has been found to aid considerably in the efficient separation of the strips.

A laterally elongated downwardly facing hood **30** is shown in FIGURE 1 located immediately above the separated strips as they are guided forward on the slitter table belt. The conduit **32** communicated to the hood is also connected to a suitable source of vacuum (not shown). Accordingly, fine wheat flour or the like which has earlier been dusted onto the dough sheet in order to facilitate the rolling out of the sheet and prevent its stick-

ing to the rollers of the sheeting mechanism and to the cutter knives is vacuumed from the strips.

At the forward end of the slitter table, the belt **26** begins to move downwardly over the forward roller **34** and the dough strips pass between separators **36**. A reciprocating cutting knife **38** is carried on supports for rotation about a generally horizontal axis parallel to the axis of the roller **34** and arranged to intermittently swing forwardly to sever a generally square pillow of dough from each of the strips. Due to the precise timing of the cycle of the apparatus, as set forth more fully hereinafter, each pillow as it is cut falls into a die cup **40** of a former bar. As shown in FIGURE 1, there are ten strips **18** so that the ten pillows fall into an equal number of laterally spaced die cups **40** in the same former bar **42**. A plurality of such former bars are longitudinally spaced in the path of the movement of the dough through the apparatus as shown in FIGURE 1. Each former bar has an ear **44** at each end thereof by which it is secured to an endless drive chain **46**. The drive chains **46** are suitably carried on sprockets **48**, the forward set of which is preferably coupled to a conventional Geneva drive mechanism (not shown). The drive mechanism is attached to index the chain-carried former bars one position forwardly several times per minute as will be discussed hereinafter.

As best shown in FIGURE 4, the die cups **40** of each bar **42** are defined by vertically directed through-bores **50** through the bars and a counter bore **52** passing upwardly from the bottom of each through bore and defining a downwardly facing annular shoulder **54** in each opening. An annular sleeve **56** preferably having the same width as the shoulder **54** but a slightly longer length than the cutter bore is frictionally received in each opening so that the upper end thereof abuts the shoulder.

A former table **58** is located immediately subjacent the former bars. According to the preferred embodiment shown in FIGURE 1, the upper surface of the former table is covered with a sheet **60** of self-lubicating thermoplastic material such as polytetrafluroethylene or the like and the table itself is cylindrically bowed slightly upwardly in the central portion thereof. Because of this last mentioned feature, the former bars are urged into a more intimate contact with the former table.

The annular inserts **56** are also preferably comprised of a self lubricating thermoplastic material such as polytetrafluoroethylene or the like so that as the chains pull the former bars across the table, the only portions of bars and table which come into contact with one another are the lower edges of the thermoplastic inserts **56** and the upper thermoplastic surface **60** of the table. Accordingly, any flour or dough scraps which might find their way onto the surface of the table slide past the former bars rather than being carried along by them toward the packing station which in such a case might result in the displacing of some of these scraps into the biscuit cans.

The forward indexing of the former bars in the first three positions A, B and C thereof serve to increasingly collectively unite the severed pillows **62** into lie-flat positions in the die cups **40** so that the cut or raw edge **64** of each pillow which has not been rolled is positioned vertically as best illustrated in FIGURE 4.

At the station C, a vertical reciprocable sifter **63** containing granular rice or corn flour **65** is positioned over the forming table as by springs **67** connected to a vibrating mechanism **69** generally illustrated in FIGURE 10 whose period of motion is controlled by the main controlling system of the apparatus depicted therein. Accordingly, each time a former bar is indexed into position beneath the sifter **63** the vibrator mechanism vertically reciprocating the sifter causes a predeterminable quantity of granular flour to be displaced onto the upper surface of each biscuit pillow. Thus, during succeeding forming operations, the biscuit being formed is prevented from sticking to the apparatus and after packaging in a biscuit receiving can each biscuit is effectively prevented from sticking to adjacent biscuits.

Further forward indexing of the former bars brings them successively to the three positions D, E, F of the forming station shown in FIGURE 5. In the forming station, a battery **66** of patting plungers **68** are arrayed on a vertically moving carrier **70**. Immediately subsequent to each forward indexing of the former bars **42**, the battery **66** of patting plungers is lowered so that the plungers **68** thereon slidingly contact the pillows **62** located in the three former bars **42** beneath the array. As shown each generally cylindrical patting plunger **68** carries an upwardly cup-like sleeve **72** thereon formed from a flexible thermoplastic material such as polytetrafluoroethylene or the like. Each of the plungers **68** is carried on a shaft **74** slidably received in the sleeve **76** of the carrier **70**. A coil spring **78** is mounted circumferentially surrounding each shaft **74** between each plunger **68** and the carrier **70**. Accordingly, a measured amount of resiliency is incorporated into the operation of each patting plunger in order to prevent the plunger from over-compressing the pillow and driving leavening gas therefrom. Suitable means such as a snap ring collar or the like retains each shaft in its respective sleeve.

As novelty provided by the present invention, the middle group of plungers at E is chamfered at the lower outer edge **80** of each. The plungers in the forward and rearward group of plungers at D and F are each generally cylindrically curved so that each has a disk-like bottom **82** approximating the size of the sleeve **56** carried in each die cup. Therefore, the first gentle pat each biscuit receives at the station D tends to radially expand the pillow into a general conformance of the die cup in which it is located. The second pat received from the chamfered plunger at the station E tends to displace an annular body of dough adjacent the upper portion of each dough pillow into the die sleeve and the third pat received by each biscuit finishes its molding into a generally pill-like flat-ended cylindrical patty P. As a biscuit patty carrying former bar located in a position F is brought to a position G as shown in FIGURE 7 this bar is brought past the forward end **84** of the former table **58** to a position overlying a resilient finger bar **86** having a plurality of laterally shaped generally vertically directed cylindrical openings **88** and each of which is arranged to coaxially underlie an opening in the former bar.

The finger bar **86** is preferably comprised by a lower bar element **90** and a thinner upper bar element **92** secured thereto by means of set screws **94** or the like. A plurality of flat elongated resilient fingers **96** comprised of a flexible material such as rubber or synthetic thermoplastic material are received in grooves **98** defined between the upper and lower elements **90**, **92** so that they project laterally toward the center of each opening through the finger bar. As best seen in FIGURES 3 and 8, each resilient finger is preferably shaped somewhat like a tongue depressor. Preferably, four such fingers **96** are mounted adjacent each opening so that they extend at approximately 45° to the longitudinal and transverse axes of the finger bar and lie in a generally horizontal plane.

Inasmuch as the opening **100** through the lower element **90** of the finger bar has a slightly larger diameter than the opening **102** through the upper element **92** thereof as shown in FIGURE 7 and because there is always a biscuit patty between the bottom of a knockout plunger **104** and the rubber fingers **96** as the knockout plungers are displaced downwardly as to be more fully discussed, it has been found that the rubber fingers in practice do not break off during the downward can packing stroke of the plungers, but rather during the upward stroke thereof. Accordingly, any worn out fingers which may break off will be drawn upwardly away from the apparatus and thus will not be carried into a biscuit receiving can. A broken finger can be replaced simply by loosening the set screw **106** which secures the finger to the bar through the lower side thereof, displacing the remaining finger portion from the slot through a transverse edge of

the bar and inserting a new finger. The new finger is then fastened into place using the set screw. Because of the novel angular positioning of the resilient fingers, it can be seen that it is possible to replace any of the fingers as they break without undue dismantling of the apparatus.

At the packing station, according to the apparatus of the invention as best seen in FIGURES 1, 2, and 7, a biscuit receiving can **106** is positioned immediately subjacent each finger bar opening **88** and a knockout plunger **104** is positioned immediately above each opening for displacement into and through the finger bar openings. During the operation of the apparatus when the former bars **42** are indexed forwardly so that a former bar **42** carrying biscuit patties P is brought onto the rubber finger bar **86**, the biscuit patties P move downwardly onto the upper surface of the resilient fingers **96** (FIGURE 7). Immediately thereafter the knockout plungers **104** lower at a speed faster than gravity contacting the upper surface of each biscuit and displacing it downwardly into a biscuit receiving can **106** (FIGURE 2). As shown, each knockout plunger **104** is arranged to enter the biscuit receiving can positioned therebeneath to a point above the resting place of the biscuit patty being displaced into the can by a distance less than the diameter of a biscuit patty and preferably by about one inch. The knockout plungers are carried at the lower end of shafts **108** received in vertically directed laterally spaced cylinders **110** mounted on a support frame. As shown in FIGURE 2, each shaft carries a piston **112** thereon within each cylinder and each cylinder includes means for communicating pressure to the space above and below the piston in order to drive the piston upwardly and downwardly. Each shaft **108** also extends upwardly beyond the upper end of the associated cylinder and carries an enlarged collar **114** thereon at the upper end thereof.

A pair of vertically spaced resilient stops **116, 118** are positioned above each cylinder in the reciprocating path of the collar. Each lower resilient stop pad **118** is centrally apertured and receives the shaft **108** so that the collar is positioned between the stops. Accordingly, as the piston is driven upwardly and downwardly, the resilient stops limit the travel of each knockout plunger between a first upper position wherein each plunger is located in the same horizontal plane as shown in dashed lines in FIGURE 2 and a second position wherein each knockout plunger is approximately one inch above the biscuit that it has just displaced into a biscuit receiving can. As shown, both the length of the pistons and their length of travel between the upper and lower resilient stops are graduated on an empirically derived scale so that although the knockout plunger at the left of the array must travel a greater distance, for instance about 5½ inches further, than the plunger at the right of the array, all of the plungers **104** will reach their lower position and the upper substantially together.

In the embodiment shown the distance between the resilient stops at the leftmost plunger of the array is seven and one-half inches and the distance between the resilient stops at the rightmost plunger of the array is three and one-half inches.

Immediately prior to the displacing of each biscuit into a biscuit receiving can a mist of vegetable oil or similar eatable lubricating material is directed into each biscuit receiving can, for instance by a tube **122** adjacent the mouth of each can which is connected to an oil mist generator as shown in FIGURE 10.

It has been found advantageous to dispense a lubricated oil mist into each biscuit patty receiving package at this point for several reasons. Firstly, the oil coacts with the granular flour earlier dispensed by the sifter mechanism **63** to prevent the sticking of adjacent biscuit patties to one another within each can, the oil also forms a film on the side walls of each can substantially eliminating the frictional contact with the biscuit patty being downwardly displaced into the can so that each biscuit patty will retain its highly desirable flat ended cylindrical shape rather than being distorted into a substantially concave shape due to friction of the raw side edges of the biscuits with the side wall during its downward displacement. Additionally that portion of the dispensed oil which is rubbed onto the raw vertical edge of each biscuit during its descent into the can aids in the prevention of the escape of leavening gas from the biscuits by at least partially sealing such edges.

In the operation of the apparatus according to the invention after each knockout plunger has been brought to its upper, rest position, the star wheels **120** shown in FIGURE 1 index one unit forwardly so that each of the cans is displaced to a position one can to the right of its former position as shown by the arrows.

A modified means for indexing biscuit receiving cans transversely beneath the knockout plungers is illustrated in FIGURE 9. In this modification, two transversely spaced sprockets **124** are mounted onto generally vertically directed shafts one of which is coupled to the Geneva drive mechanism (not shown). An endless flexible belt **126** is carried around each of the sprockets a plurality of vertically directed vanes **128** of sheet material or similar thin rigid material are positioned on the outside of the belt and spaced from one another thereon by an amount such that a biscuit receiving can **106** can be positioned between each adjacent pair of vanes. A conveyor **130** is provided to supply empty cans through a guide to the vane adjacent one of the sprockets. The foremost can in the line of empty cans is engaged by a vane as it passes around the sprocket and brought into position between two adjacent vanes. The cans so received are carried by successive indexing movements of the belt **126** beneath the packing station to a pair of spaced guides **132, 134**. The outermost guide contacts the sealed can and removes it from its position between two adjacent vanes and the engagement of this can with successive sealed cans so removes the can toward the capping station (not shown).

It should now be seen that during successive operations of the knockout plungers biscuit patties are successively placed in each biscuit receiving can until each can as it reaches the rightmost position beneath the rightmost knockout plunger receives its tenth and final biscuit. The filled biscuit cans indexed beyond the packing station by the star wheels **120** or sprocket driven vaned belt **126** are moved to the capping station. Thereafter the sealed biscuit cans are stored at a controlled temperature in order to cause partial rising of the biscuits within the cans so that the raw vertical edge of each biscuit closely embraces the side wall of each can.

A preferred embodiment of the packing apparatus operates as follows. A sheet of dough enters the apparatus from the slitter table conveyor cut in ten strips each of which is spaced from one another so that they are 2$\frac{9}{32}$ inches center to center and are aligned with the die cups in the former bars. Excess flour is vacuumed from the strips and a reciprocating knife successively cuts generally square dough pillows from the forward ends of the strips and drops one pillow into each die cup of the former bar at this station. When the dough pillow has reached the cup in the former bar the chain belt indexes and moves all the former bars one position forward. Each position is about 4½ inches forward of the last. At station C a predeterminable quantity of granular flour is sifted onto each pillow by the vibrating sifter. The forming plungers operated by air cylinders in two pairs at the diagonals of the carrier to minimize the effect of malfunctioning of either pair raise and lower the forming plungers at stations D, E and F forming the slugs or pillows of dough into patties of biscuit size. From there the biscuit patties are moved in the former bars to the finger bar where they are positioned over the biscuit cans. An oil mist is directed into each can and air cylinders at the packing station then operate to lower the knockout

plungers displacing the biscuit patties into the cans at a speed faster than gravity to preclude tumbling of the biscuits during their descent. These cylinders operate again lifting the knockout plungers and the biscuit cans are indexed one can to the right as shown in FIGURE 1. An efficient operating range of this novel apparatus has been found to be 100–125 cycles per minute. The cycling of the various elements discussed herein is preferably precisely controlled by means such as are now to be explained with reference to FIGURE 10.

As illustrated in FIGURE 10, the main drive motor **150** is connected to a suitable source of electrical power preferably 220 v. AC. The motor **150** drives the cam shaft **152** at, for instance, 100 revolutions per minute through suitable transmission means (not shown) which may be adapted to vary the speed of revolution of the cam shaft. The cam shaft **152** carries a plurality of spaced cam disks **C1, C2, C3, C4,** and **C5** thereon each having a radially outer cam track which includes a recessed portion extending along part of the length of the cam track.

A main switch **154** is interposed in the main electrical line to allow the operation of the entire biscuit patty forming and packaging apparatus to be interrupted. Also controlled by the switch **154** is a motor **156** suitably drivingly connected to the shaft **16** on which the slitting knives **14** are mounted for continuously rotating the shaft and knife disks thereon. The motor **156** also continuously drives the slitter table belt **26.**

The main drive motor **150** also powers the Geneva drive which provides the indexing movement of the cup bars **42** by drivingly engaging at least one of the sprocket arrangements **48** on which the chains **42** to which the cup bars are secured are carried. The Geneva drive is also arranged to index the star wheels **120** or sprockets **124** of the alternate can feeds shown in FIGURES 1 and 9.

A limit switch riding on the cam track of cam C_1 is wired to the vibrator **69** of the sifter **63** at the granular dusting station and arranged to operate so that as the switch arm rides into the cam depression the vibrator **69** is actuated to vertically reciprocate the sifter a single time whereupon the switch is opened by continued revolution of the cam C_1.

The cam C_2 has a similar limit switch having an arm riding on the cam track thereon. The cam C_2 is connected to commercially available solenoid valves S_1 and S_2 at the biscuit patty forming station D, E, F of FIGURE 1. The solenoid valves S_1, S_2 are each connected both to the cam exhaust line and through regulator $R_{1,2}$ to the main compressed air supply line. Each of the solenoid valves S_1, S_2 also has two outlet ports each of which are communicated through the valve to either the main exhaust line or the main air supply line as determined by the electrically induced movement of the valve bodies within the valves (not illustrated) controlled by cam C_2. The two outlet ports of the solenoid operated valve S_1 are connected to the diagonally opposed air cylinders A and B of the patting plunger arrangement shown in FIGURE 1. As shown, one of the outlet lines is connected to the cylinders A and B below the point where a piston located within each of the cylinders is located and the other outlet line is connected to the space above the piston location within each of the cylinders A and B. Accordingly, compressed air admitted to the line connected above the pistons drives the pistons and therefore the assembly **70** downwardly while at the same time allowing the air previously admitted to the spaces within the cylinders A and B below the pistons received therein to escape to the main exhaust line through the outlet line communicated to the cylinders A and B below the pistons received therein. Upon the reversing of the position of the valve position within the solenoid operated valve S_1 air is admitted beneath the pistons through the lower line and air previously admitted is exhausted from the space above the pistons through the upper line thus raising the pistons and the carriage arrangement **70** connected thereto.

The diagonally opposed air cylinder pair C, D is similarly connected to the carriage **70** and is operated to raise and lower the carriage **70** in conjunction with the cylinders A, B by the solenoid valve S_2 connected to these cylinders in an identical manner to that just described in connection with the solenoid operated valve S_1 and the air cylinders A, B.

The cam C_3 is electrically connected to the solenoid operated valves S_3 and S_4 which are similar in construction to the solenoid valves S_1 and S_2 just described. The solenoid operated valves S_3 and S_4 are connected to the main exhaust line and are both connected to the main compressed air supply line through a pressure regulator $R_{3,4}$. The outlet sides of the solenoid operated valves S_3 and S_4 are connected to two air manifolds **158, 160** one of which is communicated to each of the ten knockout plunger air cylinders in the space below the pistons received therein and the other of which is communicated to each of the ten knockout plunger air cylinders **110** in the space above the pistons **112** received therein (see also FIGURES 1 and 2). The manifolds **158, 160** may be conveniently mounted on the opposite side of the knockout plunger mounting board **162** from the cylinders **110.** The parallel operation of the air system provided through the solenoid operated valve S_3 and through the solenoid operated valve S_4 is provided firstly to negate the effect of a temporary malfunctioning of either branch, for instance by the blockage of one of the air lines or sticking of one of the valves, and secondly to allow a greater volume of air to be admitted and exhausted from the ten cylinders **110** of the packing station knockout plungers. Upon admission of compressed air to the upper air manifold **160** each of the knockout plungers is driven downwardly from its raised position wherein the plungers **104** are in horizontal alignment and positioned above the biscuit receiving means as shown in dashed lines in FIGURE 2, to their lower position wherein the plungers **104** are no longer in horizontal alignment but are stepped as illustrated in full lines in FIGURE 2, each having driven a biscuit patty downwardly into a biscuit receiving can at a speed faster than the biscuit would have fallen under the influence of gravity alone and have stopped a short distance above the resting place of the biscuit within the can. The driving of the biscuit patties downwardly at a speed faster than gravity assures that the patties will not tilt or tumble as they are displaced into the cans. The controlling of the movement of each biscuit patty by engagement with a plunger **104** until the biscuit patty has almost arrived at its resting place assures that the biscuit patty will not become improperly oriented during the remaining short portion of its descent and also assures that the plungers will not compact or compress the biscuit patties already received within the cans and squeeze the desirably retained leavening gases therefrom.

The admission of compressed air to the lower manifold **158** drives the plungers upwardly to their rest position ready to displace another finger bar-load of biscuit patties into biscuit receiving cans. The solenoid valves S_3 and S_4 operate to exhaust air from the opposite manifold from that to which compressed air is being admitted during each half cycle. The cams C_2 and C_3 and their associated switches and solenoid operated valves shown in FIGURE 10 operate to both raise and lower the associated plunger pistons received in the cylinders **112,** A, B, C, D, thereof during each cycle.

The cam C_4 has a limit switch operating arm carried thereon which is connected to a solenoid operated valve S_5 similar to solenoid valves S_1–S_4. The solenoid operated valve S_5 as shown is communicated to the main exhaust line and also to the main air supply line through a pressure regulator R_5. This valve's output lines are communicated to an air cylinder **164** having a piston received therein communicated to the reciprocable cutter bar **38** as shown in FIGURE 1. Air admitted to one side of the cylinder retracts the piston and rod connected thereto

pulling the knife **38** into cutting engagement with the dough strips **18**. The admission of air to the other side of the piston within the cylinder **164** extends the rod and moves the knife blade out from the dough strips **18** after it has cut generally square pillow-like dough forms from each strip as discussed more fully hereinbefore.

The action of the knife first described is preferably assisted by resilient spring means **166** secured between the knife and the support arrangement including dividers **36** so that the cutting action of the blade is more positive and quite rapid.

The cam R_5 has a limit switch having its operating arm operatively engaged therewith and which is connected to a solenoid operated valve S_6 similar to solenoid valves S_1–S_5 previously described. The last-mentioned solenoid operated valve S_6 is also connected to the main exhaust line and also to the main air supply line through a pressure regulator R_6. The solenoid valve S_6 is connected to the reciprocable air cylinder means **168** of an oil mist generator which is adapted to produce oil mist from an oil supply during each cycle of operation and conduct the mist through the individual conduits **122** to points just above each of the biscuit receiving cans **106** which are just about to receive a biscuit. This oil mist settles both on the walls of the biscuit cans and on top of the biscuit patty received during the prior cycle of operation of the apparatus in each of the cans.

An auxiliary motor **170** also controlled by the main electrical switch **154** of the apparatus is arranged to drive a pump connected to an oil reservoir so as to push oil through a line **172** in which a sight glass is interposed, to a point **174** where a line connects with the main air supply line. This point is prior to the connection of any of the air utilizing stations just discussed to the main air supply line. The speed at which the pump is driven is such that a supply of oil is maintained at the juncture between the oil line and the main compressed air supply line so that oil is continuously aspirated into the compressed air line by the passage of the compressed air thereby. The oil laden air thus produced serves to lubricate all of the rapidly operated pistons received within the air cylinders of the various stations discussed.

This continuous lubrication is necessary because of the rapid operation, for instance 200 strokes or more per minute to prevent undue wear on the pistons and cylinders and the generation of an unacceptable amount of heat by friction.

Inasmuch as the air associated from the air cylinders of each of the stations is collected in a main exhaust line, the oil collected in the exhausting air is collectible, for instance, by the interposition of an oil filter **176** in the main exhaust line which can be connected to the oil reservoir as shown. Accordingly, the air cylinder lubricating fluid collected from the exhaust line can be circulated in the system continuously during the operation of the apparatus. Beside eatable vegetable oils, alternate lubricating means such as glycerin have been found to be advantageously usable in this air cylinder lubricating system. The oil line sight glass **178** may be conveniently positioned, for instance, on the mounting board **162** of the knockout plunger air cylinders shown in FIGURES 1 and 2 so as to be easily observable by personnel responsible for the operation of the apparatus so that the presence of a sufficient supply of lubricating means within the air cylinder lubricating system just discussed can be monitored.

The switch opening recessed portions of the cam tracks of cams C_1–C_5 are preferably configured so that the granular flour vibrating sifter of the dusting station, the knockout plungers of the packing station and the air cylinders operating the plungers of the patty forming station all operate simultaneously and are slightly preceded by the operation of the pillow cutting knife of the cutting station and slightly succeeded by the operation of the oil mist generator of the patty and can oiling station.

The cam operated stations are actuated during the pauses between the advancement of the cup bars and can feed provided by the Geneva drive mechanism.

It has been found that the efficient operation provided by the control system discussed with reference to FIGURE 10 is far superior to that provided by prior art biscuit packing apparatus utilizing primarily mechanical station actuation, primarily because the rapidity with which, for instance, the knockout plungers, biscuit support releasing means and patty forming plungers must operate on such apparatus, in order to produce a sufficient volume of biscuits to make the operation of the apparatus sufficiently profitable as to be economically feasible, exceeds the practical limit of durability of the mechanical station actuating means. For instance, the rapid operation of such apparatus results in an unacceptable amount of high amplitude vibration, much frictional heat and such excessive wear on the mechanical actuators that the failure of individual mechanical parts of the actuators takes place with highly unacceptable frequency.

In contrast, the compressed air cylinder knockout plunger and resilient finger bar arrangement of the packing station provided by the apparatus of the present invention as described herein is operable at high speeds in excess of 100 cycles per minute without the production of equipment destroying high amplitude vibrations and without the excessive wear incumbent in the high speed operation of essentially mechanical packing stations of prior art devices. Additionally, the resilient finger bar arrangement eliminates the necessity of independent means for coordinating the retraction of support from the biscuit patties and the lowering of the packing station plungers into engagement with the patties and therefore malfunctioning of the apparatus which could be caused by such improper coordination as is possible in prior art apparatus is effectively eliminated in the instant apparatus.

It should now be clear that the novel apparatus for forming and packing biscuit patties explained in detail above efficiently accomplishes all of the objects of the invention set forth and provides many important practical advantages over prior art apparatus for the automatic forming and packaging of biscuit patties. Because the specific embodiments of the apparatus which are described herein are intended to facilitate the understanding of the principles of the invention rather than limits its scope, and inasmuch as the embodiments shown can be modified without departing from these principles, the invention should be understood as encompassing all such modifications as lie within the spirit and scope of the following claims.

I claim:

1. Apparatus for continuously forming and packaging substantially uniformly shaped biscuit patties comprising: conveyor means for continuously advancing a sheet of dough forwardly, a slitting station having means for continuously slitting the advancing dough sheet into a plurality of longitudinally directed strips; means transversely separating said strips and means continuously advancing the separated dough strips forwardly; a cutting station including cutting knife means mounted for cutting transversely of said strips, means intermittently indexing said knife means into and from a cutting position wherein a pillow-like slug of dough is severed from each of said strips; a generally horizontal table positioned forwardly and downwardly from said cutting station; a plurality of generally horizontal, laterally extending cup bars having means defining a plurality of laterally spaced, upwardly opening cups in each cup bar and extending through each cup bar; means securing each of said bars to endless conveyor means said conveyor means being arranged to intermittently index said bars forwardly along the upper surface of said table, and return the bars; means coordinating the cup bar indexing and the cutter knife indexing whereby the pillow-like dough slugs severed from said dough strips upon each movement of the knife means to its cut-

ting position each fall into the die cups of a cup bar and are thereafter indexed forwardly within the die cups; means defining a biscuit patty forming station comprising at least one laterally extending row of patting plungers arranged for intermittent contact with the upper surface of the dough slugs in the cups of at least one cup bar indexed to said station to thereby form said slugs into patties conforming with the cups, patting plungers and table upper surface; a packing station including means defining a resilient finger bar positioned forwardly of said table; means defining a plurality of laterally spaced vertically directed openings through said resilient finger bar, said openings corresponding in spacing to that of the die cups in each die cup bar; means defining a plurality of resilient fingers mounted on said finger bar and extending generally laterally from the periphery of each finger bar opening to the central region of each opening; said die cup bars each being indexable to a position wherein each patty carrying die cup in the die cup bar overlies a resilient finger bar opening and the patties rest on the resilient fingers; means positioning a biscuit can beneath each resilient finger bar opening; a vertically reciprocable knockout plunger positioned coaxially with each resilient finger bar opening, air cylinder received piston means operatively carrying said knockout plungers, said air cylinder piston means being adapted to intermittently lower said plungers into engagement with the upper surface of the biscuit patties resting on said resilient fingers and drive said biscuits downwardly through said resilient finger bar and into position within said biscuit cans at a speed faster than gravity thereby preventing tumbling action of said biscuits during the downward movement thereof.

2. Apparatus as set forth in claim 1 including means indexing the biscuit cans one can position laterally subsequent to each displacement of a biscuit patty into each can.

3. Apparatus as set forth in claim 2 wherein said can indexing means includes first and second laterally spaced star wheels positioned subjacent said resilient finger bar and connected to a source of indexing motion; means defining a conveyor supplying empty biscuit cans to one of said star wheels and means defining a conveyor accepting filled biscuit cans from the second of said star wheels.

4. Apparatus as set forth in claim 2 wherein said can indexing means includes an intermittently driven sprocket and an idler sprocket laterally spaced therefrom subjacent the resilient finger bar; a flexible endless conveyor belt carried on said sprockets, a plurality of vertically directed vanes secured to said belt and spaced therealong sufficiently to define a snug can receiving pocket between each pair of adjacent vanes.

5. Apparatus as set forth in claim 1 including deflector means mounted laterally outwardly from said slitting station for continuously deflecting uneven dough sheet lateral edge portions into holdup means for dough reclamation.

6. Apparatus as set forth in claim 1 wherein the continuous dough sheet slitting means of the slitting station comprises a plurality of vertically directed laterally spaced knife disks mounted on a laterally extending rotatable shaft.

7. Apparatus as set forth in claim 1 wherein the dough strip laterally separating means comprises a forwardly and downwardly directed slide-like support having a plurality of laterally spaced forwardly diverging separating elements positioned thereon.

8. Apparatus as set forth in claim 1 additionally comprising a vacuuming hood positioned over the transversely separated dough strips to remove excess dust-like flour therefrom.

9. Apparatus as set forth in claim 1 wherein the cutting knife of the cutting station is intermittently brought to is cutting position by a compressed air cylinder having a piston mounted therein and a piston rod linked to said cutting knife.

10. Apparatus as set forth in claim 9 wherein the means for continuously advancing the transversely separated dough strips comprises an endless belt carried on spaced rotatable members so that at its forward extent the belt curves downwardly, the cutting knife being positioned to reciprocate toward and away from the curved forward extent of the belt and cut said strips in this curved region of the belt.

11. Apparatus as set forth in claim 9 wherein the cutting action of said cutting knife is assisted by a tensioned spring secured to said knife and arranged to urge it toward said strips.

12. Apparatus as set forth in claim 1 additionally including means for dispensing a predeterminable amount of granular flour onto each dough slug between the cutting station and the biscuit patty forming station.

13. Apparatus as set forth in claim 12 wherein said granular flour dispensing means includes a flour hopper suspended above said table.

14. Apparatus as set forth in claim 13 wherein the hopper is a sifter suspended on spring means from a vibrator.

15. Apparatus as set forth in claim 14 wherein the vibrator is actuated by a compressed air cylinder operated to dispense granular flour once from said sifter after each forward indexing of a cup bar into location subjacent the sifter.

16. Apparatus as set forth in claim 1 wherein the cup bar conveyor means comprises a pair of endless chains secured at each lateral end of the cup bars and carried on forward and rearward sprockets.

17. Apparatus as set forth in claim 1 wherein each cup bar die cup includes a vertical throughbore through the bar and a counterbore coaxial with said bore extending from the bottom of the bar upwardly, defining a downwardly facing annular shoulder at the juncture of the bore and counterbore.

18. Apparatus as set forth in claim 17 additionally including an annular sleeve received in said counterbore abutting said shoulder, said sleeve being composed of thermoplastic material having as a primary characteristic a poor adhesion to biscuit dough.

19. Apparatus as set forth in claim 18 wherein said sleeve is essentially composed of polytetrafluoroethylene.

20. Apparatus as set forth in claim 18 wherein the inner surface of said sleeve is substantially flush with said die cup throughbore.

21. Apparatus as set forth in claim 18 wherein said sleeve depends beneath said cup bar whereby the sleeves in the die cups of the cup bars ride on the upper surface of the table and maintain the lower surface of the cup bars above the table facilitating the bypassing of crumbs on the table by the bars without carrying the crumbs forwardly.

22. Apparatus as set forth in claim 21 wherein the upper surface of said table comprises a layer of thermoplastic material having as a primary characteristic a poor adhesion to biscuit dough.

23. Apparatus as set forth in claim 22 wherein the thermoplastic material essentially includes polytetrafluoroethylene.

24. Apparatus as set forth in claim 1 wherein the table top is covered with a layer of thermoplastic material essentially including polytetrafluoroethylene.

25. Apparatus as set forth in claim 1 wherein the table is curved slightly convexly upwardly about a laterally directed axis to increase the contact pressure between the cup bars and the table.

26. Apparatus as set forth in claim 1 wherein each patting plunger comprises a generally cylindrical body mounted on an upwardly extending rod; the patty forming station additionally including a plunger carrier having a plurality of sockets therein slidably receiving the

patting plunger mounting rods and means retaining said rods in said sockets for limited axial movement of the rods therein.

27. Apparatus as set forth in claim **26** additionally including resilient means extending between said plungers and said carrier urging said plungers away from the carrier whereby a predeterminable amount of resiliency is inherent in the patting of the dough slugs by the patting plungers to reduce the driving of desirable leavening gasses from the slugs during patty forming.

28. Apparatus as set forth in claim **27** wherein the resilient means comprises a coil spring surrounding each of said plunger mounting rods.

29. Apparatus as set forth in claim **26** wherein the lower region of each patting plunger cylindrical body includes a covering of thermoplastic material having as a primary characteristic poor adhesion to biscuit dough.

30. Apparatus as set forth in claim **29** wherein said thermoplastic material essentially includes polytetrafluoroethylene.

31. Apparatus as set forth in claim **26** wherein the carrier includes three longitudinally spaced, laterally extending rows of patting plungers, the space between adjacent plunger rows substantially equalling the space between adjacent die cup bars and space between adjacent patting plungers in each row substantially equalling the spacing between adjacent die cups in each die cup bar.

32. Apparatus as set forth in claim **30** wherein the body portion of each patting plunger in the central row of patting plungers is chamfered at the lower edge thereof whereby the central row of plungers is adapted to primarily pat the central region of dough slugs thus forcing the peripheral region of such slugs radially outwardly and somewhat upwardly into contact with the die cup sidewalls.

33. Apparatus as set forth in claim **1** wherein the patting plungers are resiliently mounted in a carrier and the patty forming station additionally includes means for generally vertically reciprocating said carrier.

34. Apparatus as set forth in claim **32** wherein the carrier reciprocating means comprises at least a pair of compressed air operated, piston carrying cylinders from which the carrier is suspended.

35. Apparatus as set forth in claim **33** wherein the carrier is suspended from four diagonally paired compressed air operated piston carrying cylinders, each pair being independently actuable thereby reducing the effect of the temporary failure of any individual cylinder or pair of cylinders to actuate.

36. Apparatus as set forth in claim **1** wherein said resilient finger bar includes four evenly spaced generally equally spaced resilient fingers extending from the periphery of each resilient finger bar opening toward the central region of each of said openings.

37. Apparatus as set forth in claim **35** wherein each resilient finger is generally horizontal; the longitudinal axis of each finger lying between the longitudinal and lateral axes of the resilient finger bar, each finger terminating adjacent a transverse edge of the bar.

38. Apparatus as set forth in claim **36** wherein the resilient finger bar comprises an upper bar member removably secured to a lower bar member and means defining resilient finger receiving channels between said upper and lower members.

39. Apparatus as set forth in claim **37** wherein said resilient fingers are slidably removable and insertable in said channels through the transverse edges of the bar; and additionally including means in said lower bar member removably securing said fingers in said channels.

40. Apparatus as set forth in claim **37** wherein the vertical openings through the resilient finger bar each include a smaller vertically directed opening through the upper bar member vertically superimposed upon a larger vertically directed opening through the lower bar member.

41. Apparatus as set forth in claim **35** wherein the ends of the resilient fingers presented centrally of the finger bar openings are rounded.

42. Apparatus as set forth in claim **1** including means defining a gap between the table and the resilient finger bar equal to substantially less than the width of the biscuit patties whereby dough carried forwardly by the cup bars can fall through the gap while the biscuit patties are carried past the gap and onto the resilient finger bar.

43. Apparatus as set forth in claim **1** including means for intermittently dispensing a mist of lubricating fluid into each biscuit receiving can prior to each displacement of a biscuit into each can.

44. Apparatus as set forth in claim **42** wherein the dispensing means includes a compressed air powered mist generator and conduit means from said generator to points adjacent the open upper ends of said biscuit receiving cans positioned beneath the resilient finger bar openings.

45. In a biscuit patty forming and packaging machine having means for successively forming longitudinally spaced laterally extending rows of biscuit patties the subcombination of a packaging station comprising: a laterally extending bar having a means defining a plurality of laterally spaced generally vertically directed openings therethrough; means defining a plurality of resilient fingers mounted on said bar adjacent the periphery of the openings and extending generally radially from the periphery of each opening and terminating in the central region thereof; means for successively bringing rows of biscuit patties into supported relationship with the resilient fingers; means positioning a biscuit can subjacent each opening and means for successively displacing each row of biscuits downwardly past said fingers and through said bar into said cans at a speed faster than gravity.

46. The subcombination of claim **45** additionally comprising means for indexing the biscuit cans one can position laterally subsequent to each displacement of a row of biscuit patties into the cans, the cans being thereby successively intermittently filled as they move laterally.

47. The subcombination of claim **45** additionally comprising means dispensing a lubricating mist into each can prior to each displacement of a row of biscuit patties into the cans.

48. The subcombination of claim **45** wherein the means for successively displacing the rows of biscuits into the intermittently indexed cans includes a row of knockout plungers positioned coaxially with said resilient finger bar openings; means for vertically reciprocating each knockout plunger between a first position wherein each knockout plunger is above the finger bar and a second position wherein each knockout plunger has contacted the upper surface of a biscuit patty supported on resilient fingers of the resilient finger bar and driven it downwardly through one of said bar openings into one of said biscuit cans to a point located above the resting place of the upper surface of said biscuit patty by an amount less than the width of said patty.

49. The subcombination of claim **48** wherein the plunger reciprocating means includes an elongated rod secured to each plunger; a piston mounted on each rod; cylinder means encasing and slidably receiving each piston; means including a solenoid operated valve alternately communicating and exhausting compressed air to the portions of said cylinder which contain the opposite ends of said piston to reciprocate the piston within the cylinder; a rotatable cam, a limit switch operated by said cam and operatively connected to said solenoid valve; and stop means adjacent engageable with said plunger reciprocating means to delimit the first and second positions of the plungers.

50. The subcombination of claim **48** wherein the stop means comprises a collar on each elongated rod and a pair of longitudinally spaced resilient pads fixedly positioned adjacent each rod for alternate contact with said collar.

51. The subcombination of claim **48** wherein said

plungers are all in substantial horizontal alignment in their first position and progressively stepped with respect to one another in their second position corresponding to the progressively increased number of biscuit patties in the cans positioned beneath the resilient finger bar.

52. The subcombination of claim 48 wherein the plunger reciprocating means includes an elongated rod secured to each plunger; a piston mounted on each rod; cylinder means encasing and slidably receiving each piston; and means alternately communicating and exhausting compressed air to the portion of said cylinder which

contain the opposite ends of said piston to reciprocate the piston within the cylinder.

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