Oct. 10, 1967 F. M. BROWN ETAL 3,346,112

PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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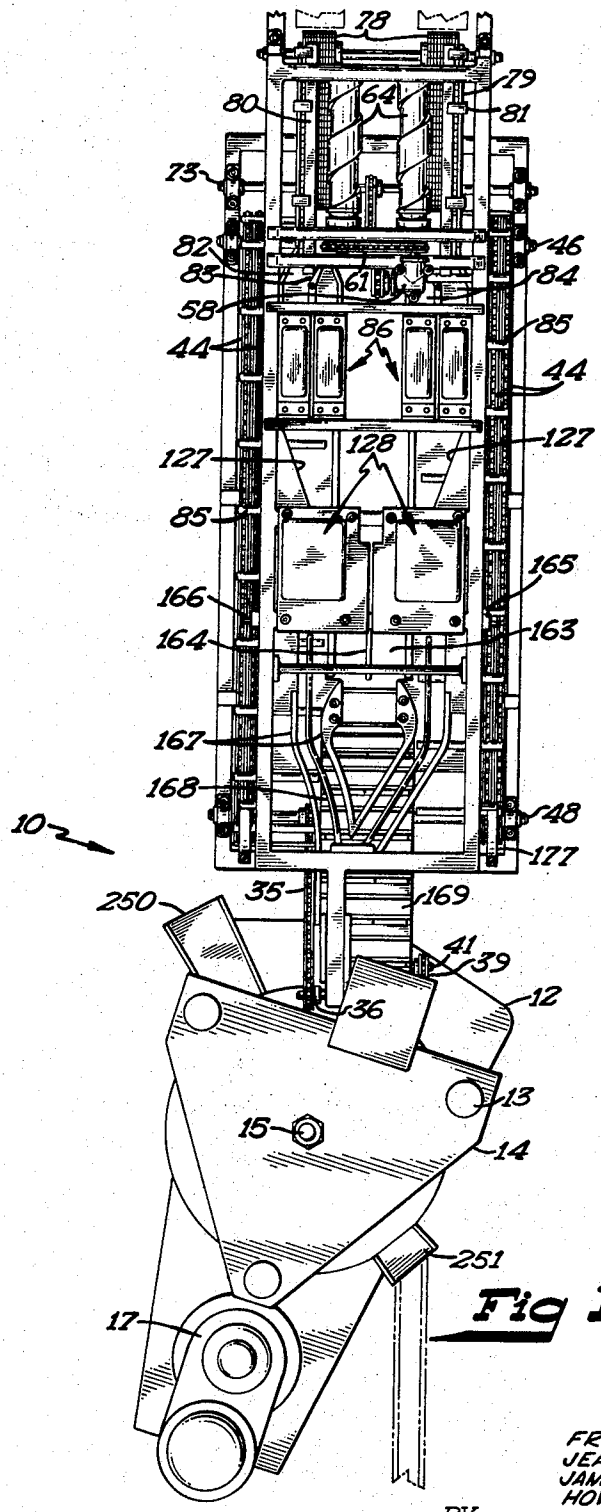


Fig 1

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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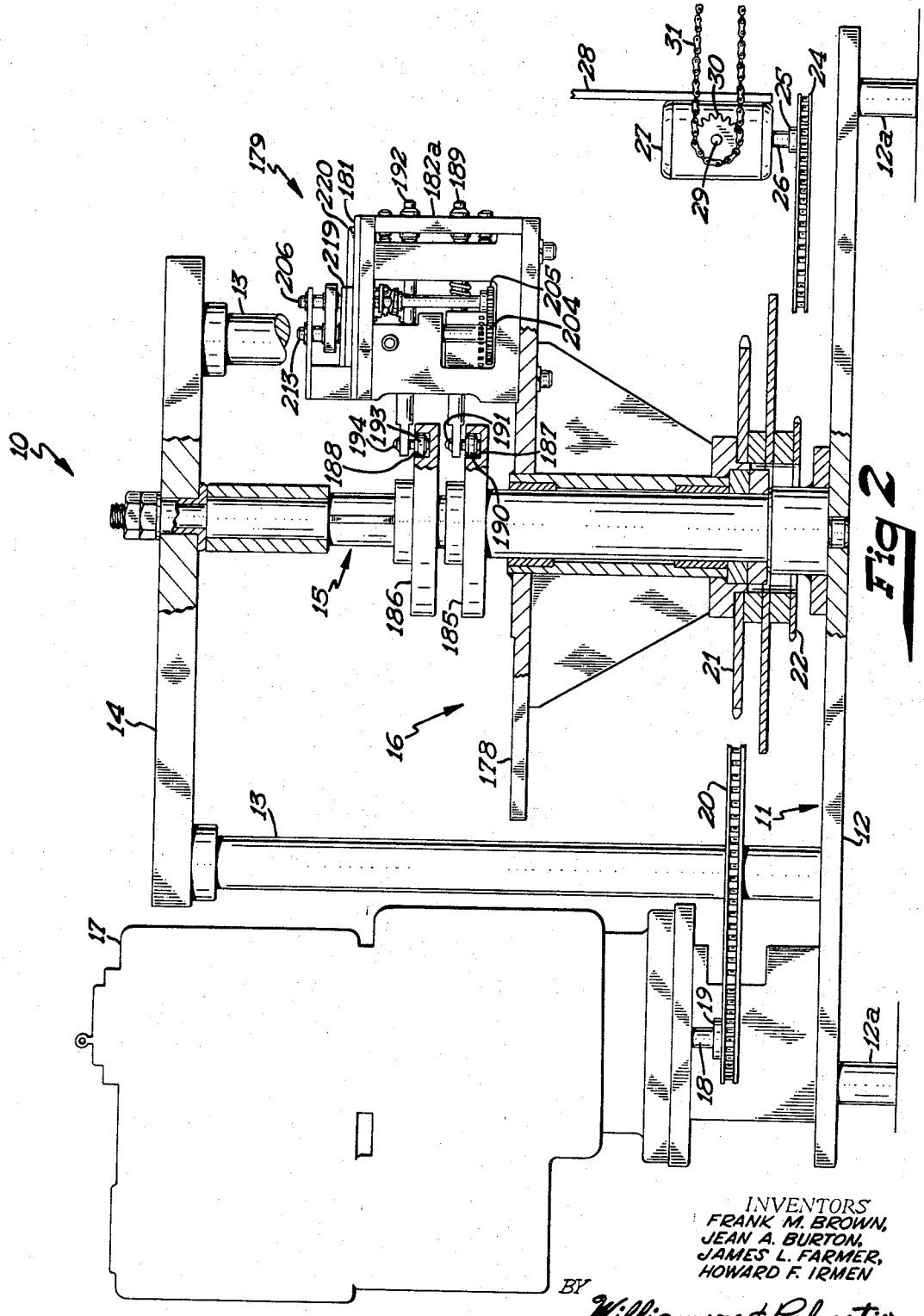


Fig 2

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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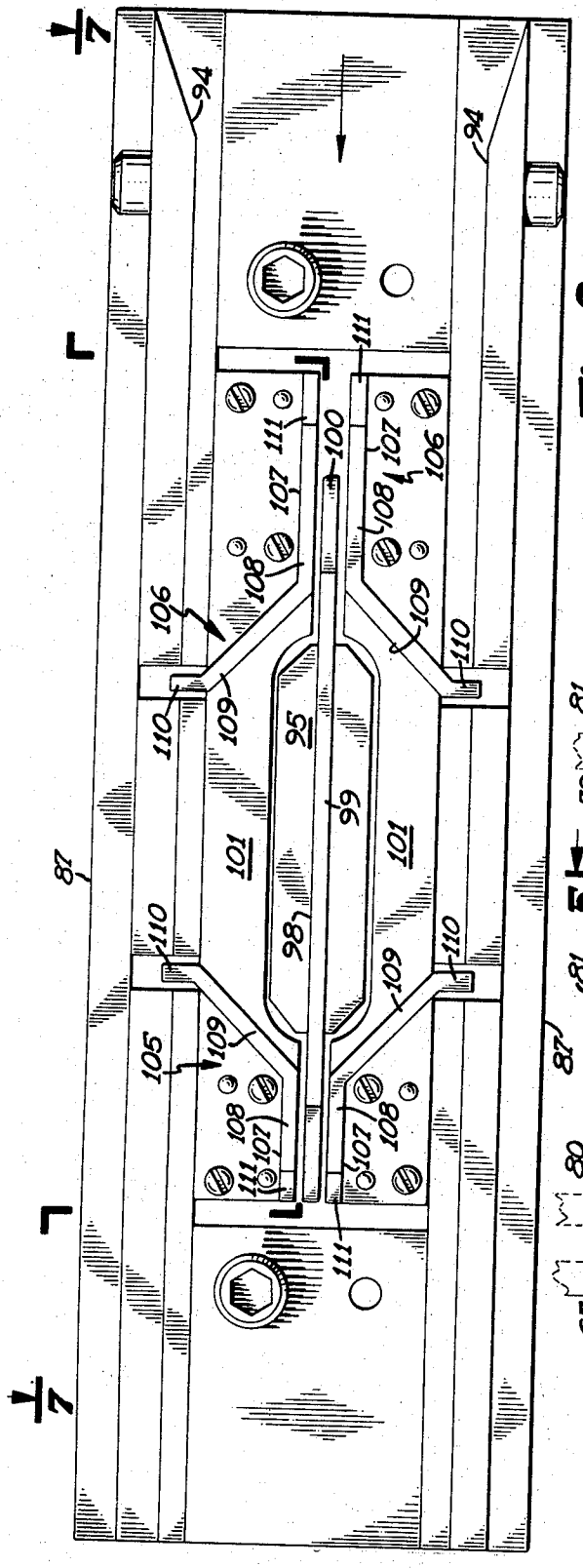


Fig 6

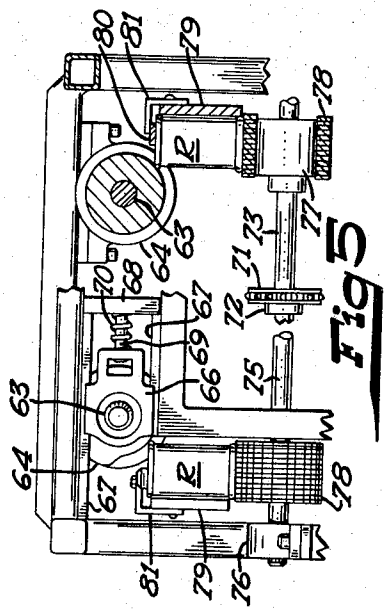


Fig 5

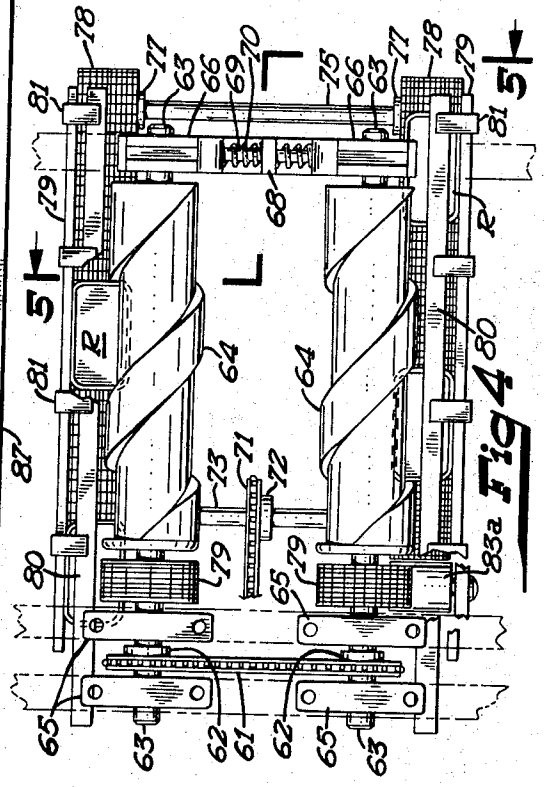


Fig 4

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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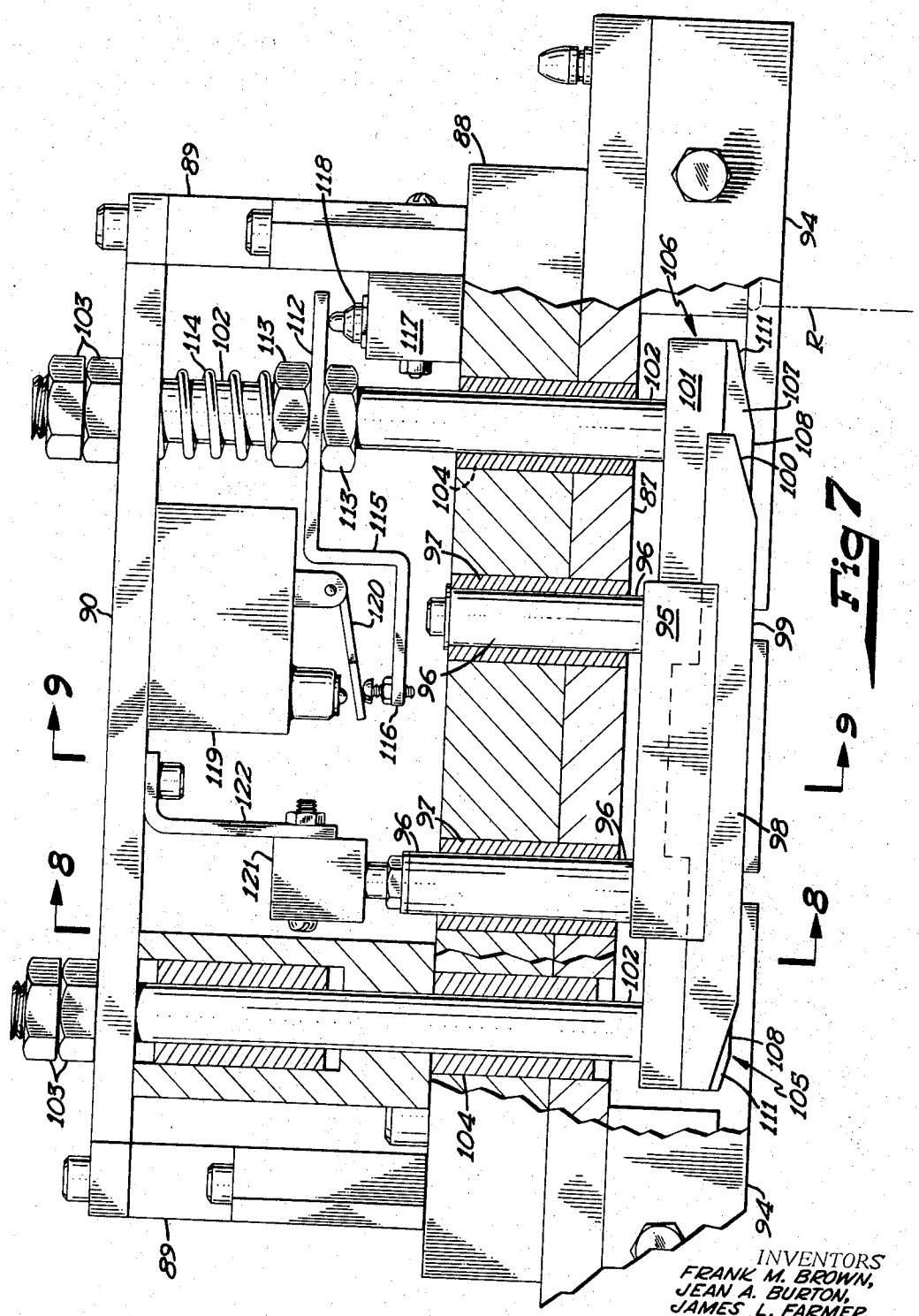


Fig 7

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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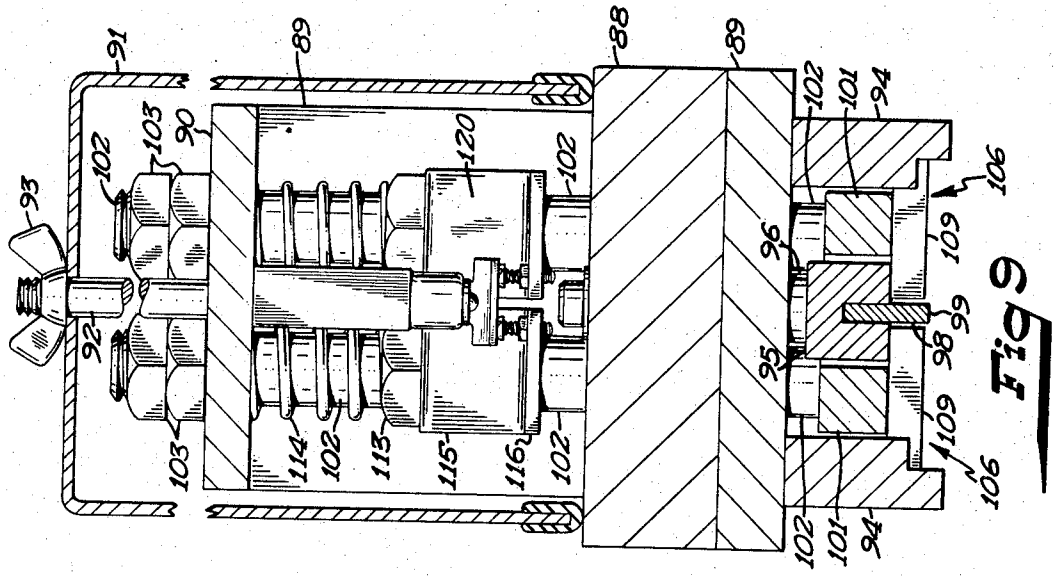


Fig 9

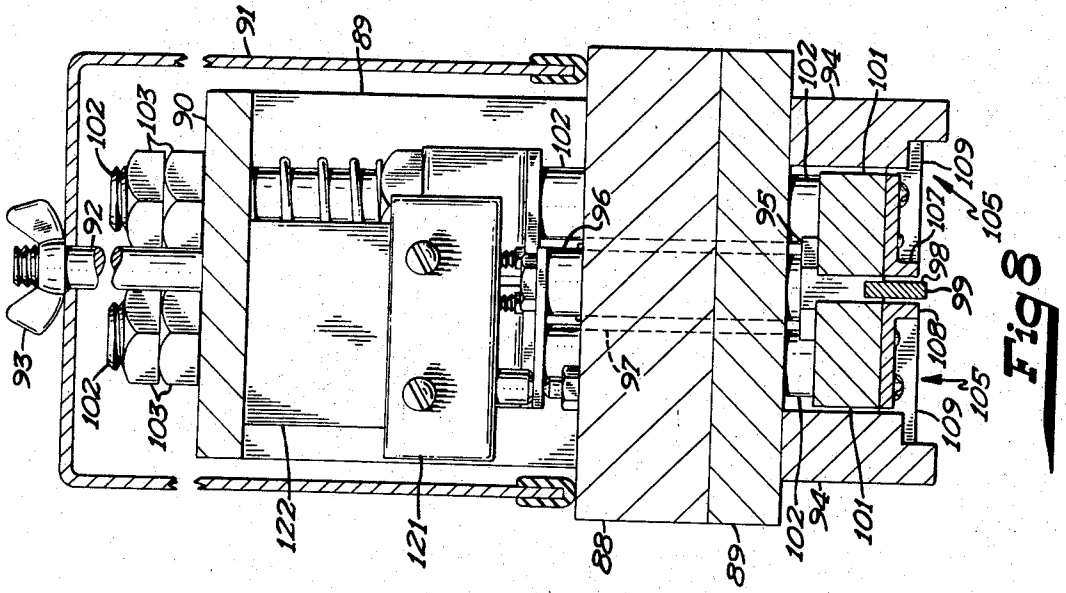


Fig 8

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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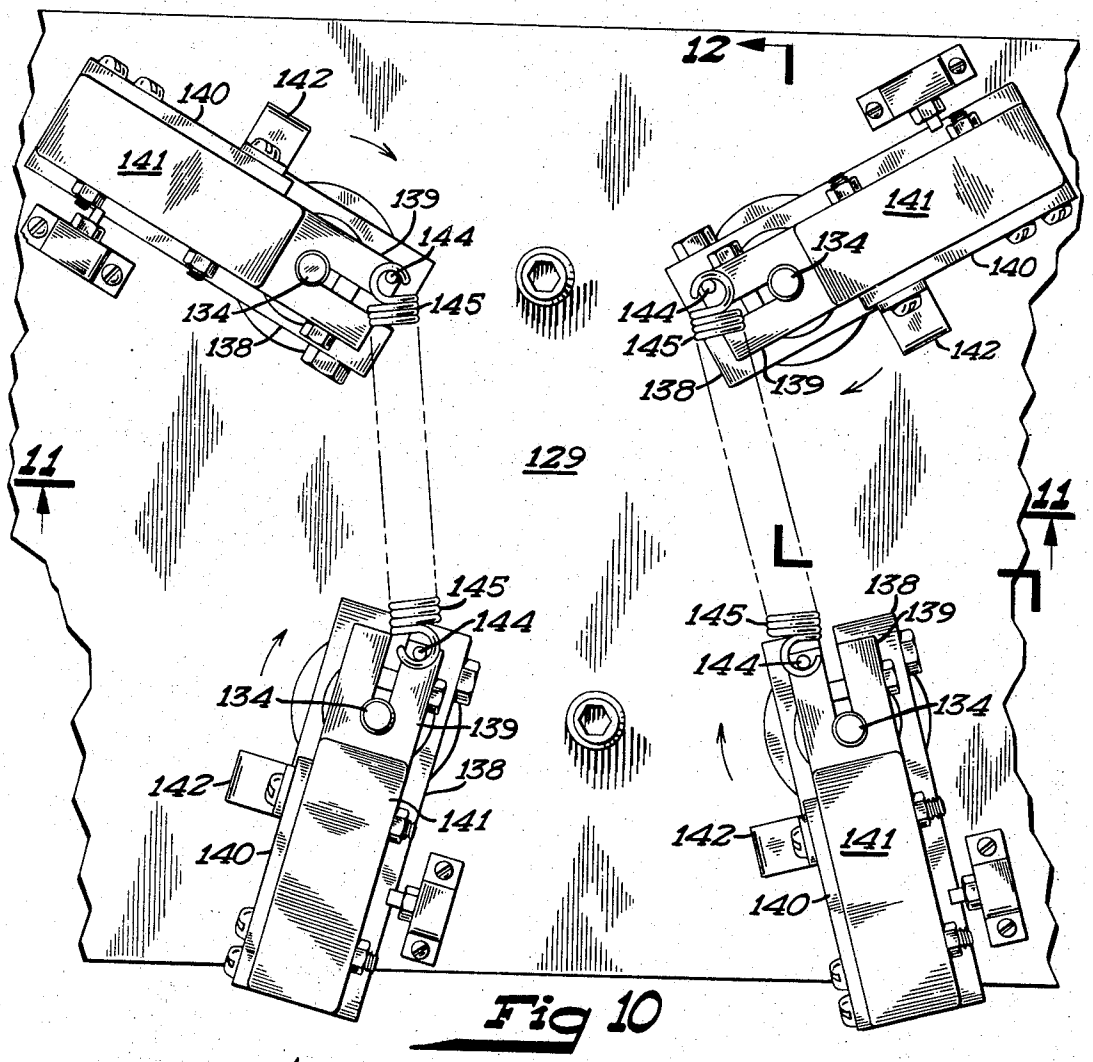


Fig 10

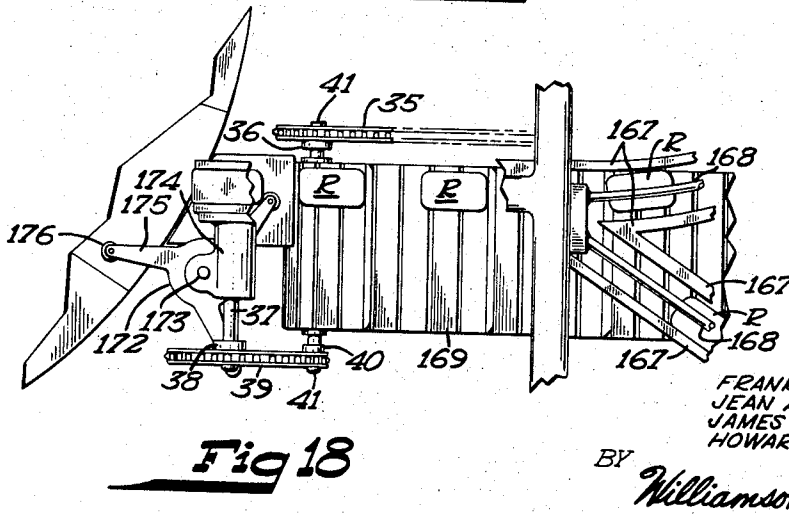


Fig 18

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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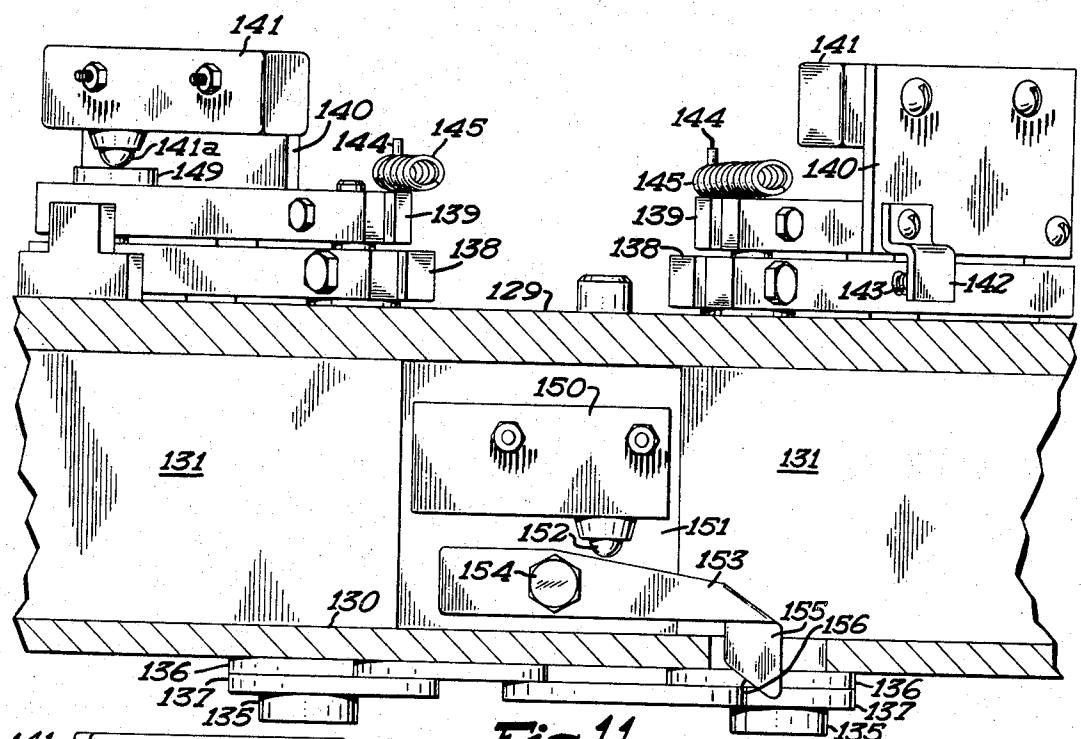


Fig 11

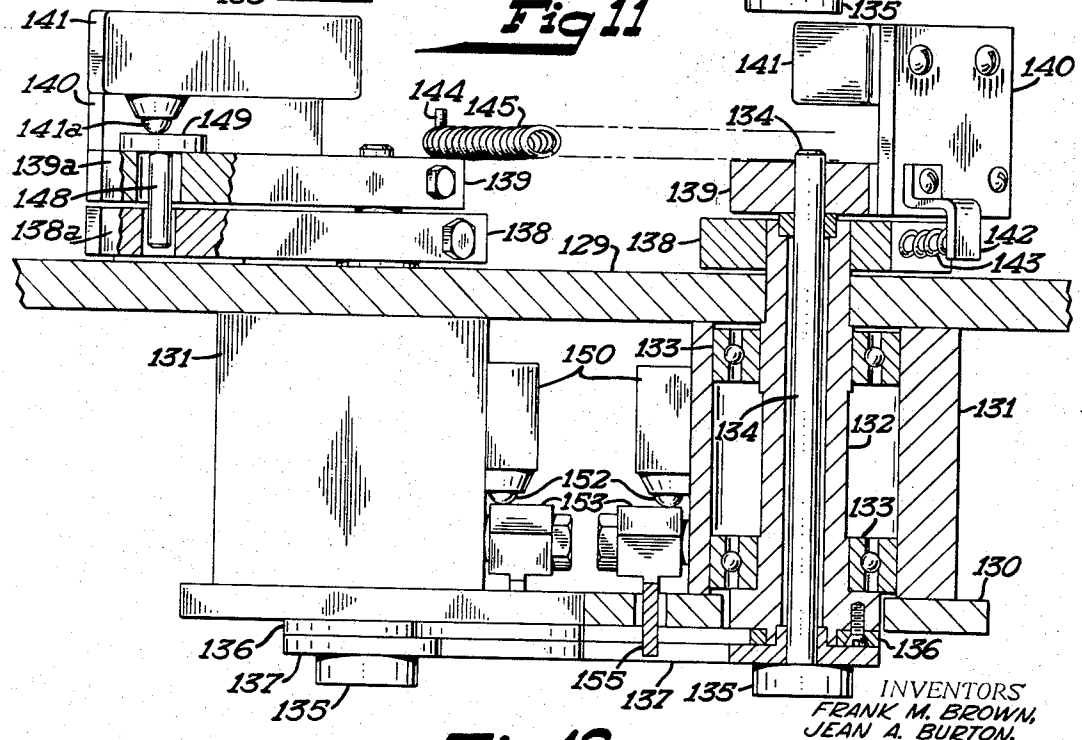


Fig 12

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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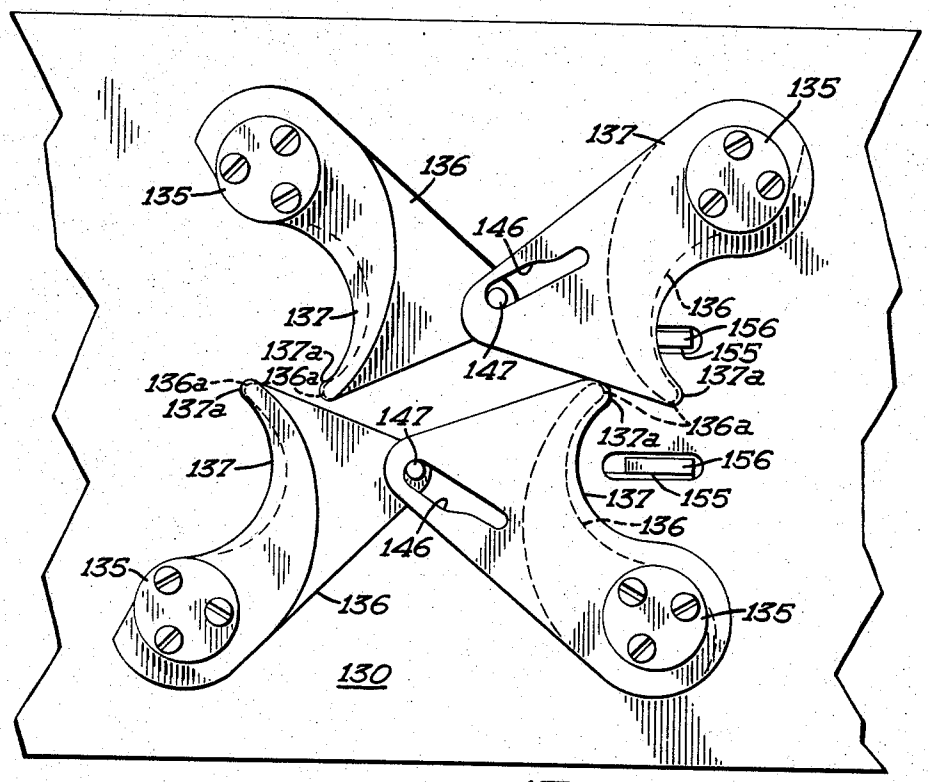


Fig 13

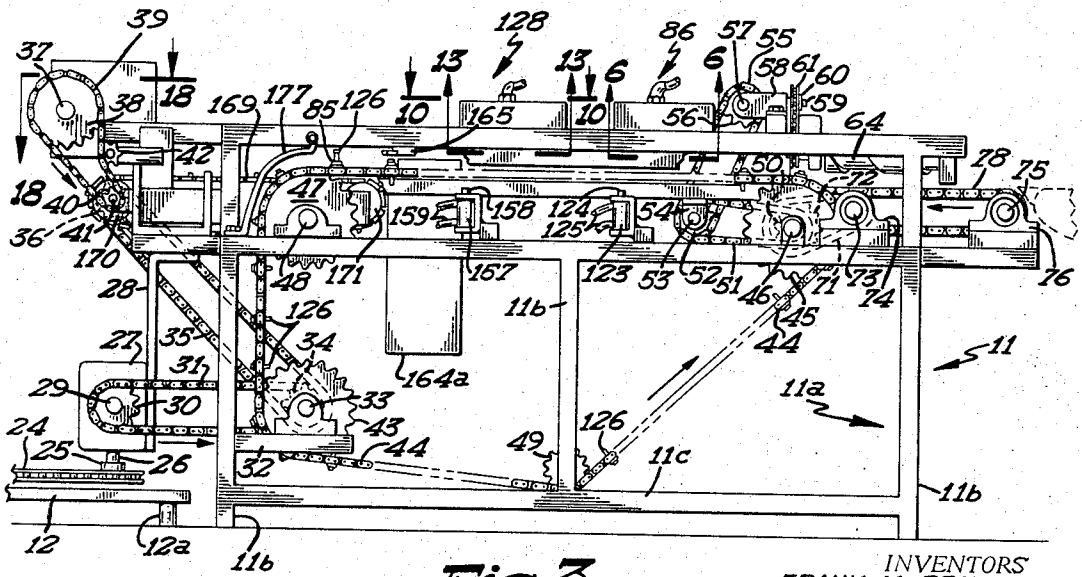


Fig 3

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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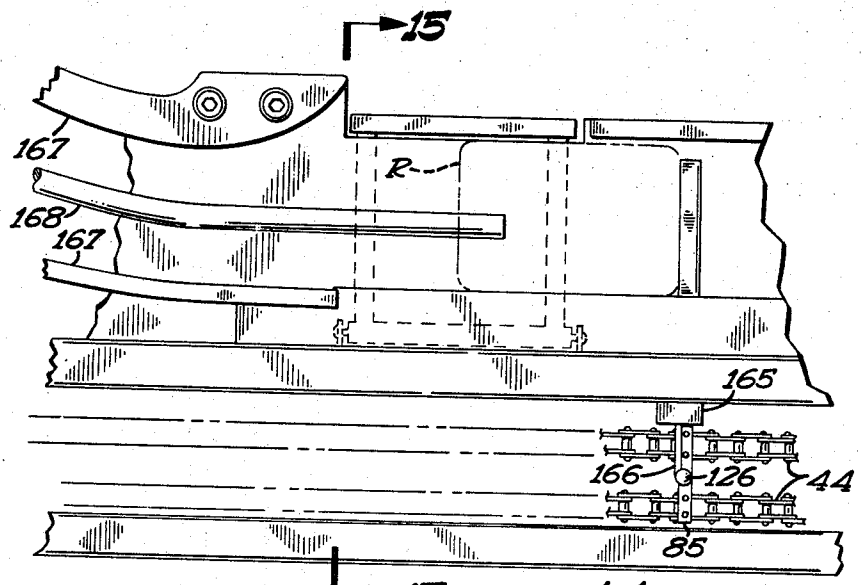


Fig 14

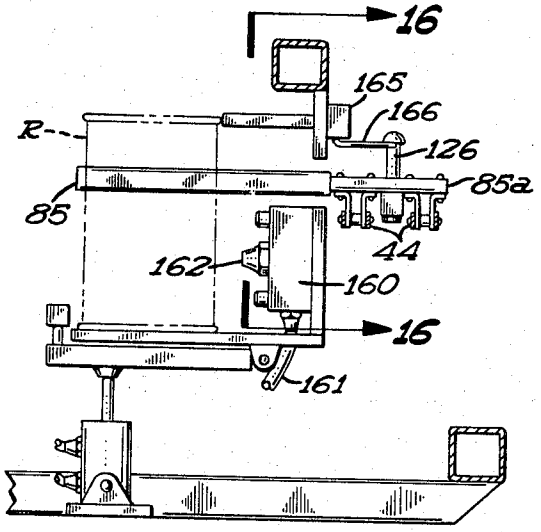


Fig 15

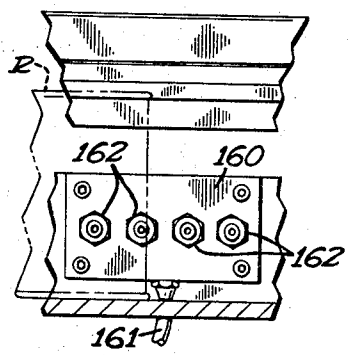


Fig 16

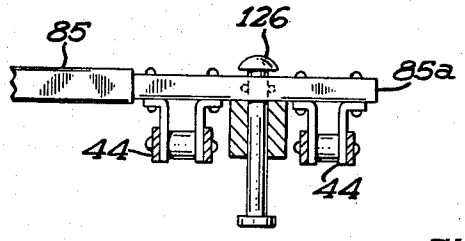


Fig 17

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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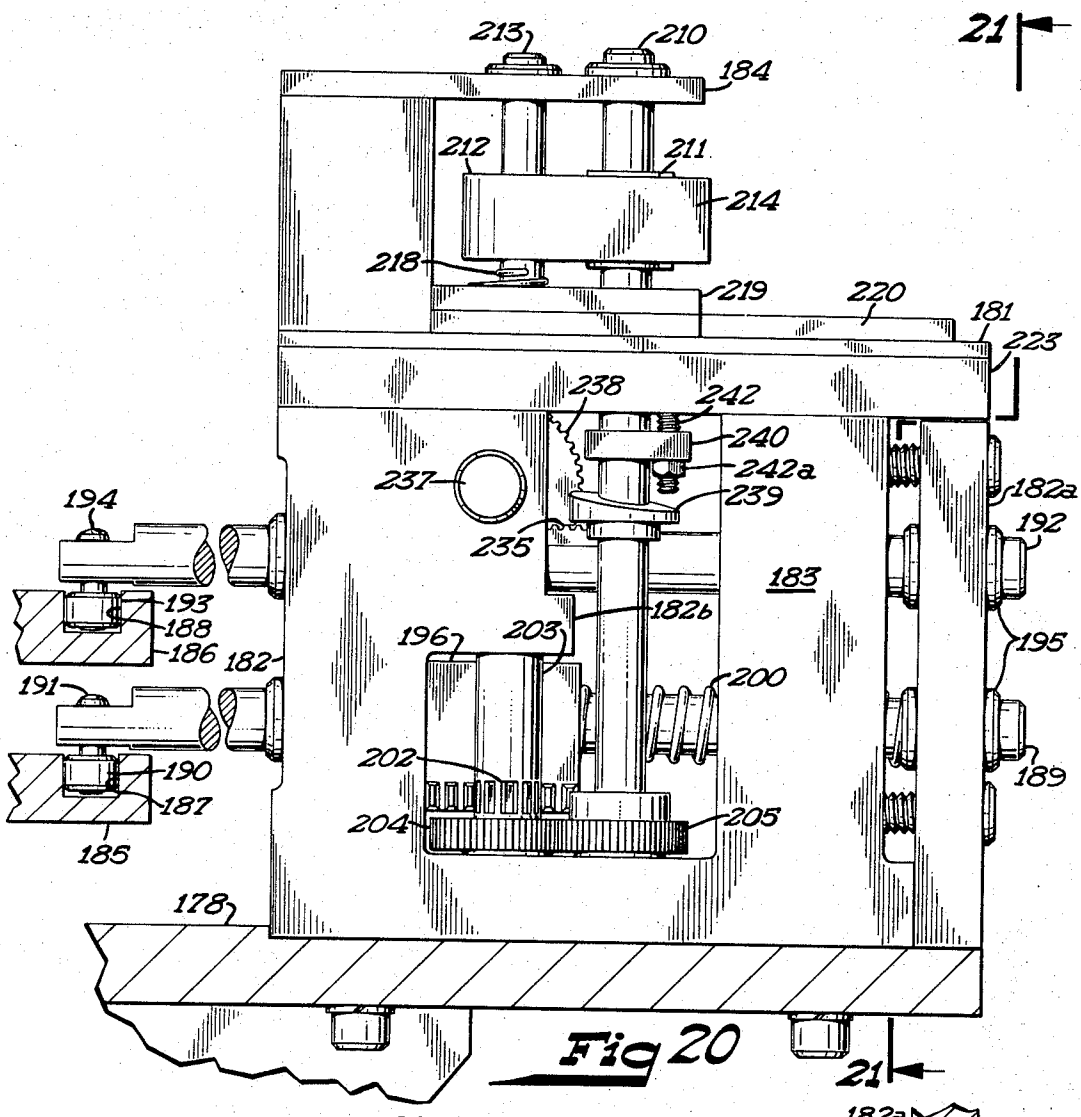


Fig 20

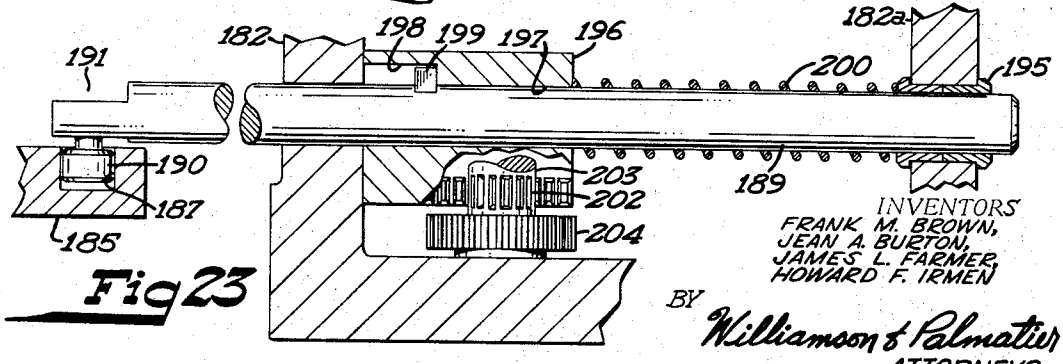


Fig 23

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PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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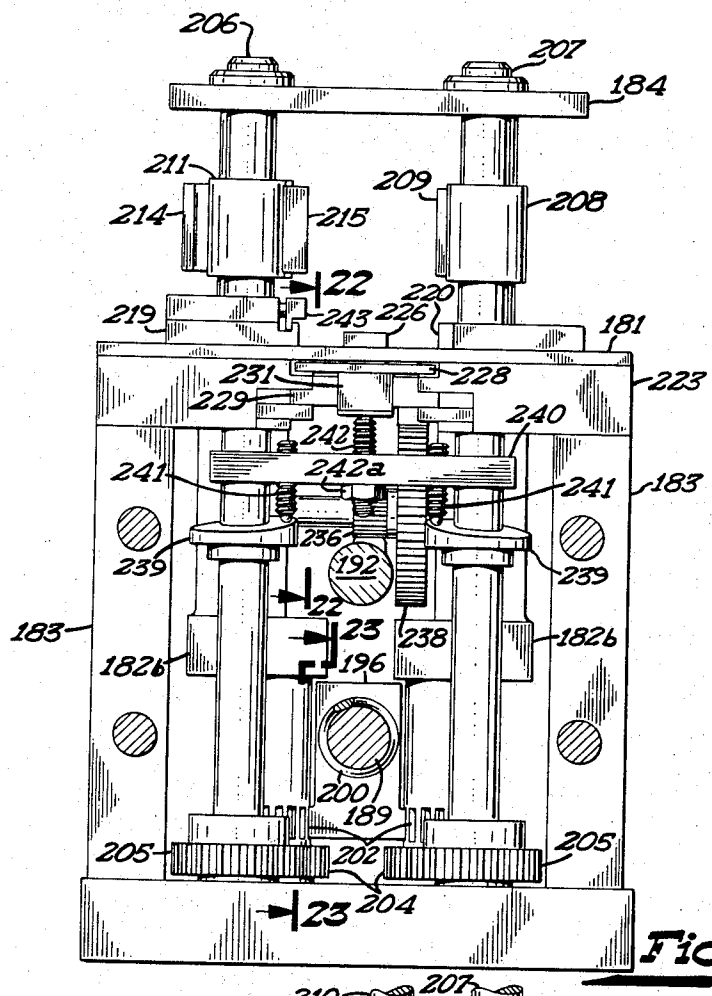


Fig 21

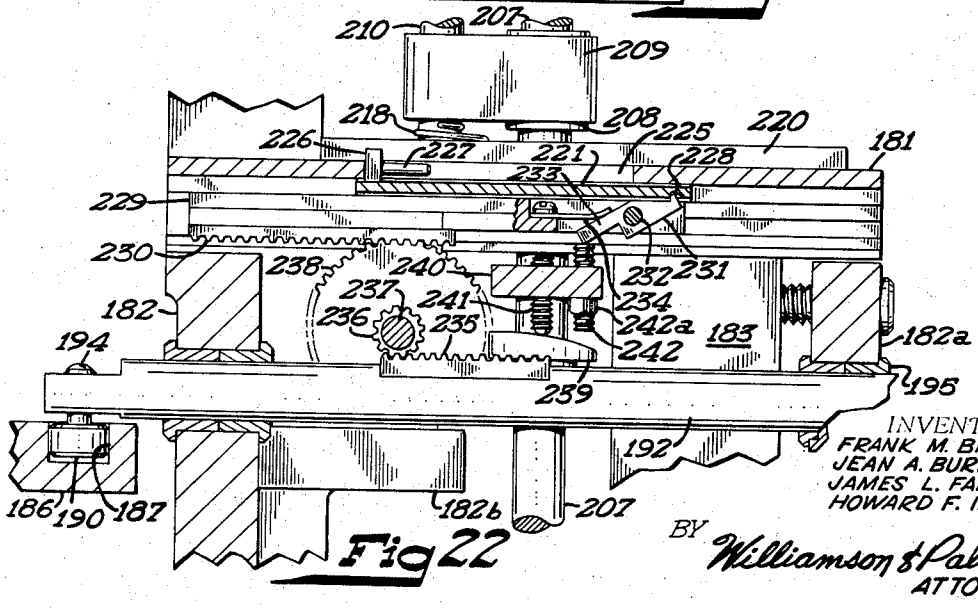


Fig 22

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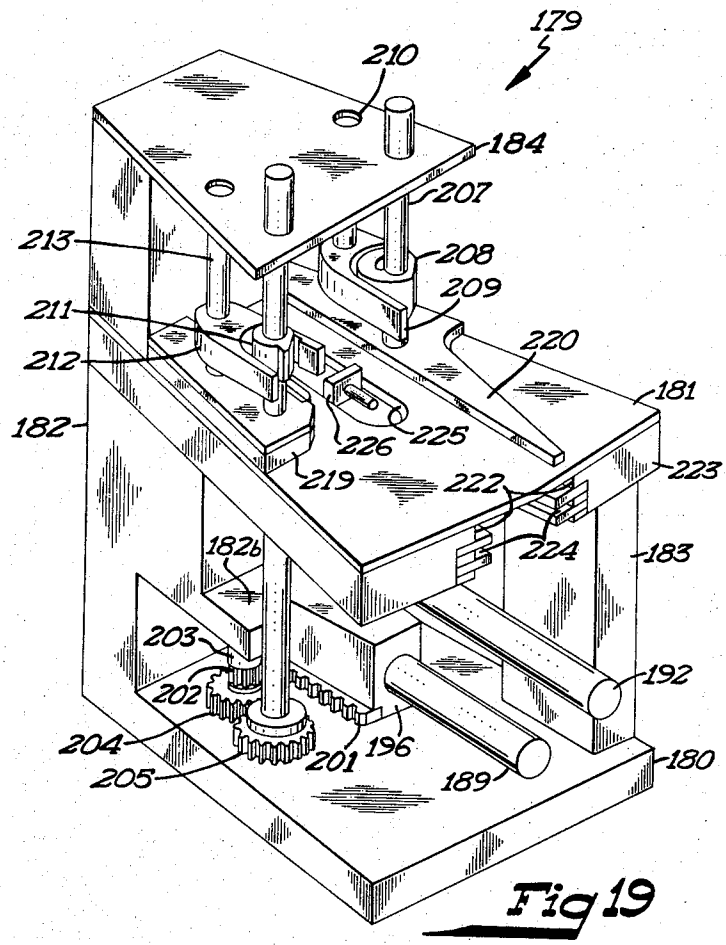


Fig 19

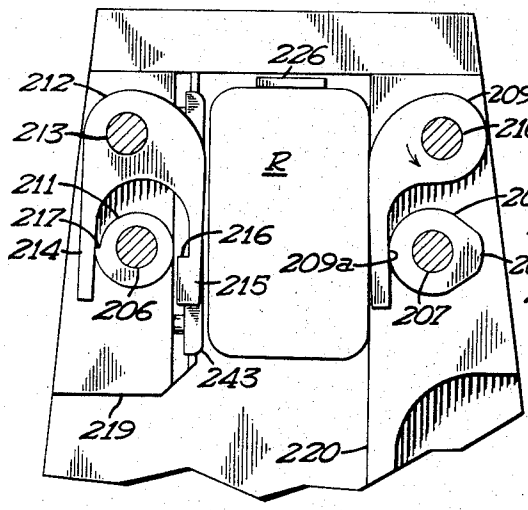


Fig 24

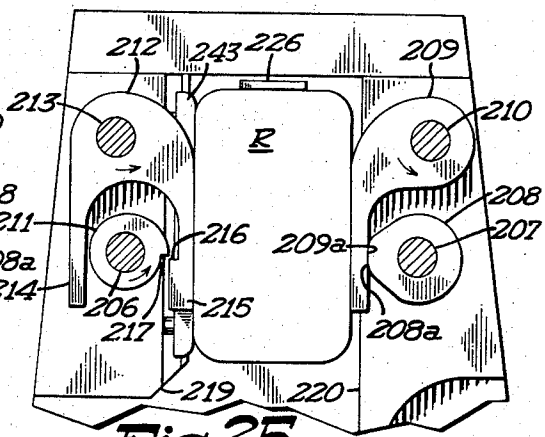


Fig 25

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United States Patent Office 3,346,112 Patented Oct. 10, 1967

3,346,112

PROCESS AND APPARATUS FOR INSPECTING CONTAINERS

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Filed Apr. 19, 1966, Ser. No. 543,702
10 Claims. (Cl. 209—75)

ABSTRACT OF THE DISCLOSURE

A method and apparatus for mechanically inspecting the bead of a sealed vacuum-packed container for damage thereto and measuring the width of the container to determine if the contents therein were packed under sufficient vacuum. A conveyor for moving the container through a first inspection zone wherein the upper surface of the bead is engaged and sensed by a first mechanical sensing device to determine damage thereto, and a second inspection zone wherein the outer marginal portion of the bead is engaged and mechanically sensed by a second sensing device to determine damage to the bead. A revolvable turret having inspection cells therein each including cams engaging the sides of the container at the zone wherein the greatest concavity occurs to measure and determine if the desired minimum predetermined vacuum exists within the container. Impeller means for removing cans or containers having defective beads and ejecting means for ejecting cans in which the contents thereof were packed under insufficient vacuum.

This invention relates to a continuous high capacity method and apparatus for mechanically inspecting product containing sealed receptacles to determine if the content of the receptacles were properly packed therein and also to determine the presence of damage to the receptacle. This application is a continuation-in-part application of co-pending application Ser. No. 315,247.

An object of this invention is to provide a continuous high capacity method and apparatus for sequentially inspecting a sealed receptacle containing a vacuum packed product, preferably food stuffs, to determine if the contents of the receptacle were packed under sufficient vacuum, and to determine the presence of any damage to the bead of the receptacle, with provision being made to automatically reject unacceptable receptacles.

A more specific object of this invention is to provide a novel method and apparatus for use in inspecting vacuum packed receptacles such as those containing process meat products, and is therefore especially adapted for use in a production line operation in meat packing plants, the receptacles being inspected not only to determine if the product was packed therein under a sufficient vacuum, but each receptacle also being mechanically inspected to determine damage to the most susceptible part thereof, the bead of the receptacle, with provision for automatic rejection of unacceptable receptacles.

These and other objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like character references refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a top plan view of the apparatus.

FIG. 2 is a side view partly in section of the vacuum inspection device illustrating a single inspection cell in pratial section and also illustrating the power means for the apparatus.

FIG. 3 is a side elevational view of the bead inspection device and illustrating the drive means therefore.

FIG. 4 is a top plan view on an enlarged scale of the infeed means of the apparatus.

FIG. 5 is a sectional view taken approximately along line 5—5 of FIG. 4 and looking in the direction of the arrows.

FIG. 6 is a bottom plan view on an enlarged scale of the first bead inspection device.

FIG. 7 is a sectional view taken approximately along line 7—7 of FIG. 6 and looking in the direction of the arrows.

FIG. 8 is a sectional view taken approximately along line 8—8 of FIG. 7 and looking in the direction of the arrows.

FIG. 9 is a vertical sectional view taken approximately along line 9—9 of FIG. 7 and looking in the direction of the arrows.

FIG. 10 is a fragmentary top plan view of the second bead inspection device illustrating the motion multiplier switching means.

FIG. 11 is a sectional view taken approximately along line 11—11 of FIG. 10 and looking in the direction of the arrows.

FIG. 12 is a sectional view taken approximately along line 12—12 of FIG. 10 and looking in the direction of the arrows.

FIG. 13 is a bottom elevational view taken approximately along line 13—13 of FIG. 3 and looking in the direction of the arrows.

FIG. 14 is a fragmentary top plan view on an enlarged scale of the reject station of the apparatus.

FIG. 15 is a cross-sectional view taken approximately along line 15—15 of FIG. 14 and looking in the direction of the arrows.

FIG. 16 is a cross-sectional view taken approximately along line 16—16 of FIG. 15 and looking in the direction of the arrows.

FIG. 17 is an enlarged fragmentary detail view of a reject memory pin means.

FIG. 18 is an enlarged fragmentary detail view of the accelerator mechanism for accelerating the cans to be inspected into the inspection cells.

FIG. 19 is a front perspective view of a single vacuum inspection cell.

FIG. 20 is a side elevational view on an enlarged scale of a vacuum inspection cell.

FIG. 21 is a cross-sectional view of an inspection cell taken approximately along line 21—21 of FIG. 20 and looking in the direction of the arrows.

FIG. 22 is a cros-sectional view taken approximately along line 22—22 of FIG. 21 and looking in the direction of the arrows.

FIG. 23 is a cross-sectional view taken approximately along line 23—23 of FIG. 21 and looking in the direction of the arrows.

FIGS. 24 and 25 are diagrammatic front elevational views illustrating certain elements of the vacuum inspection means coacting with a receptacle being inspected.

Referring now to the drawings and more specifically to FIG. 1, it will be seen that one embodiment of the apparatus used in carrying out the novel method is thereshown. In the embodiment shown, the apparatus is adapted for use in inspecting generally rectangular metal receptacles containing food stuffs such as meat and the like, although the apparatus may be used to inspect other types of receptacles or containers.

The apparatus **10** comprises a supporting structure, designated generally by the reference numeral **11**, which includes a horizontally oriented lower plate **12** spaced above the floor of the building by legs **12***a*. An upper plate **14** is spaced above and substantially parallel to the lower plate **12** and is supported by suitable vertical support post **13**.

The lower reduced end of a vertically disposed central bearing post **15** is positioned within an opening in the lower plate **12** and it will be seen that the post **15** projects upwardly through an aperture in the upper plate **14** and is locked against movement relative thereto by suitable lock nuts as shown. A revolvable turret **16** is journalled on the central bearing post **15** for revolving movement relative thereto and it is pointed out that the turret **16** supports the inspection cells (to be described hereinbelow) which inspects the various receptacles to determine if the contents thereof have been packed therein under a sufficient vacuum.

Referring now to FIG. 3 it will be seen that the support structure also includes a support frame **11***a* which supports the remaining components of the apparatus **10**. The support frame **11***a* includes a plurality of vertical support elements **11***b* interconnected by a plurality of transversely extending and longitudinally extending horizontal frame elements **11***c*.

Drive means are also provided for driving the various components of the inspection apparatus and reference again is made to FIG. 2 wherein the power means includes a relatively large electric motor **17** which is supported upon the plate **12** and which is provided with suitable gear reduction means having an output shaft **18**. A drive sprocket **19** is keyed to the shaft **18** and a drive chain **20** is trained therearound and also around a sprocket **21** affixed to the turret **16** whereby when the motor **17** is energized, the turret **16** will be revolved. It will also be noted that a relatively small sprocket **22** is also secured to the lower end of the turret **16** for movement therewith. A drive chain **24** is trained around the sprocket **22** and is also trained around a sprocket **25** which is keyed to an input shaft **26** of a gear box **27** that is suspended by a bracket **28** from the support frame **11***a*. The gear box **27** is provided with an output shaft **29** having a sprocket **30** keyed thereto and about which is trained an endless drive chain **31**.

A support member or bracket **32** which is mounted on the support frame **11***a* has suitable bearings thereon (not shown) in which is journalled a shaft **33** having a sprocket thereon (not shown) about which is trained the drive chain **31**. A sprocket **34** is keyed to shaft **33** for rotation therewith and an endless chain **35** is trained around the sprocket **34** to be driven thereby.

The drive chain **35** is also trained around a sprocket **36** that is keyed to a shaft **41** that is journalled in suitable bearings (not shown), carried by the support frame **11***a*. The shaft **41** also has a smaller sprocket **40** keyed to one end thereof spaced from sprocket **36** and a drive chain **39** is trained around the sprocket **40** and around a larger sprocket **38** which is fixed or otherwise keyed to a shaft **37** journalled in suitable bearings (not shown) also carried by the support frame **11***a*. It will be noted that the shaft **41** is disposed below and slightly rearwardly of the shaft **37** but above and forwardly of the shaft **33**. It will also be noted that the sprocket **40** is substantially smaller than the sprocket **38** and idler sprocket **42** engages the drive chain **39** to maintain the same in tightened relationship with respect to the sprockets **38** and **40**.

The shaft **33** has two pairs of relatively large identical sprockets **43** affixed to opposite sides thereof for rotation therewith an deach sprocket **43** has a drive chain **44** trained thereover as best seen in FIG. 3. Each drive chain **44** is also trained about one of a pair of identical larger sprockets **45**, each pair of which is keyed to opposite end portions of a shaft **46** which is journalled in suitable bearings (not shown) carried by the frame **11***a*. Each chain **44** is also trained about one of a pair of identical sprockets **47** which are keyed to a shaft **48** also journalled in suitable bearings carried by the frame **11***a*. Each chain is also chained about one of a pair of idler sprockets **49** revolvably mounted adjacent the lower mid-portion of the support frame **11***a*.

The shaft **46** also has a sprocket **50** keyed thereto for rotation therewith and a chain **51** is trained around the sprocket **50** and also around another sprocket **52** keyed to a shaft **53** supported in suitable bearings **54** carried by the support frame **11***a*. A chain **55** is trained around a sprocket (not shown) on shaft **53** and also trained around another sprocket **56** which is keyed to a shaft **57** of a gear box **58**. It is pointed out that the gear box **58** has beveled gears therein which drive an output shaft **59**, the latter having a sprocket **60** keyed thereto and about which is trained a chain **61**.

Referring now to FIG. 4 is will be seen that chain **61** is also trained about a pair of laterally spaced apart sprockets **62** each being keyed to one of a pair of shafts **63** that are disposed in substantially parallel relation adjacent the rear of the apparatus **10**.

It will be seen that each of the shafts **63** have a helical conveyor member affixed thereto for rotation therewith. The respective front ends of the shafts **63** are each journalled in suitable axially spaced apart pillow bearings **65** which are carried by the support frame **11***a*. The rear end portion of each shaft **63** is journalled in a movable bearing block **66** having lateral slots therein (not shown) which slide upon suitable guide ways **67** located on a pair of vertically spaced apart horizontal frame elements **11***c* of the support frame **11***a*. A bracket **68** extends between the horizontal frame elements on which each pair of guide ways **67** are located and each bracket **68** is provided with a laterally projecting stud **69** rigidly connected therewith and projecting through an aperture formed in the associated slide block bearing **66**. A pair of helical springs **70** are each disposed around one of the studs **69** and each spring has its respective ends bearing against the bracket **68** and against one of the slide block bearings **66** to normally urge the associated end of each shaft **63** outwardly away from the generally longitudinal center line plane of the apparatus **10**. It will therefore be seen that each of the helical conveyor members **64** is not only mounted for revolving movement but is also capable of lateral shifting adjacent its rearmost end to accommodate variations in the receptacles being inspected.

Referring again to FIG. 3 it is pointed out that the shaft **46** also has a centrally located sprocket (not shown) keyed thereto and a chain **71** is trained about this sprocket and also about a sprocket **72** which is keyed to a shaft **73** supported in laterally spaced apart bearings **74** mounted on the support frame **11***a*. A shaft **75** is spaced rearwardly of the shaft **73** and disposed in substantially horizonal coplanar relation therewith and is revolvably journalled in suitable bearings **76** also carried by the support frame **11***a*. Each of the shafts **73** and **75** has a pair of enlarged generally cylindrically shaped conveyor engaging roll members **77** keyed thereon for rotation therewith so that each pair of roll members on shaft **73** and **75** are disposed in longitudinally aligned relationship. Each pair of longitudinally aligned roll members **77** has an endless chain type conveyor **78** trained therearound and it will be noted, as best seen in FIGS. 4 and 5, each chain type conveyor **78** is positioned below and slightly outwardly of one of the screw conveyor members **64**.

Since the rear end of each shaft **63** may shift laterally to accommodate variances in the receptacles being inspected, the forward end portion of each shaft **63** is actually constructed of two axially spaced apart shaft portions that are interconnected by a flexible coupling **79** preferably formed of a yieldable flexible material and thereby permitting this front end of the shaft **63** to flex in response to any sidewise yielding movement of the rear end portion of the shaft.

It will be noted that the receptacles to be inspected are supported upon the chain type conveyor **78** and are engaged by the screw conveyor members **64** so that these receptacles are urged positively in a forward direction. Elongate substantially flat vertical guide rails **79** are provided and each is supported from the support frame **11***a*

and each projects upwardly from and adjacent one side of the upper run of one of the chain conveyors **78** as best seen in FIG. 5. An elongate substantially flat horizontally disposed guide rail **80** is supported from the vertical guide rail **79** by suitable brackets **81** and it will be seen that guide rail **80** prevents vertical displacement of the receptacles R while guide rails **79** prevent lateral displacement of the receptacles.

Referring now to FIG. 1, it will be seen that the receptacles to be inspected are conveyed as two lines by the cooperative action of the chain and screw conveyor mechanisms and are discharged upon the floor **82** of the support frame **11***a*. A pair of directional control mechanisms are provided (not shown) and includes a pair of rubber rollers (not shown), each being actuated by each can as it is discharged from engagement with the screw and chain conveyors. A cam (not shown) located on shaft **53** actuates the swingable arm **83** which is pivotal about a vertical axis to direct the cans of each line alternately to one of a pair of longitudinally extending passageways **84** located on opposite sides of the machine. It will therefore be seen that the two lines of cans that are fed into the apparatus **10** are then diverted into four lines for inspection of the bead of the can by the first bead inspection device.

It will be noted that each pair of chains **44** located adjacent one of the longitudinal sides of the support frame **11** has a pair of elongate transversely extending fingers **85** affixed thereto for movement therewith. These conveyor fingers **85** project inwardly of the support frame **11***a* and engage the rear surface of each receptacle R as the latter is discharged by each cooperating pair of screw and chain conveyors to move the receptacles along the passageways **84**. Again it is pointed out that the receptacles to be inspected are alternatively directed into one of the passageways **84** each being operable to inspect the upper surface of the upper bead of the receptacle to be inspected. To this end it is pointed out that the type of receptacles which are to be inspected are preferably made of a metallic material and may have any symmetrical shape such as parallelopiped, as illustrated by the receptacles R in the drawings. These cans also have a beaded seam S located at the top and bottom wherein the respective top and bottom closure plates are applied to the peripheral wall of the receptacle. When the product is packed into the receptacles R, the top plate is then applied to the receptacle in sealing relation therewith and the beaded seam is then formed. The present apparatus is not only operable to inspect the receptacle to determine if the contents thereof was packed under a proper vacuum but is also operable to very carefully and accurately inspect the beaded seam and specifically the upper beaded seam to determine the presence of any damage to this seam. Since the manufacturer of the cans normally applies the bottom wall of the can to the peripheral wall to form the seam along the lower peripheral edge of the receptacle then the manufacturer therefore normally inspects this lower bead or seam for damage. Therefore the present machine is adapted to inspect the upper only although the machine many be modified for inspecting both the upper and lower bead of such a can or receptacle.

As pointed out above, the first bead inspection device **86** is comprised of four identical inspection mechanisms each being disposed over one of the passageways **84** for inspecting the receptable which passes therebelow. Each of these bead inspection devices **86** includes a substantially flat generally rectangular shaped horizontally disposed base plate **87** which is mounted on the frame and spaced above the floor **82** of one of the passageways **84**. A rectangular shaped bearing block **88** is positioned upon the base plate **87** and is secured thereto. A pair of end plates **89** project upwardly from the bearing block **88** and are secured thereto by suitable bolt means. An elongate substantially flat generally rectangular shaped top plate **90** extends between and is secured to the end plates

89 and is secured thereto by any conventional securing means such as bolts and the like. A substantially generally rectangular shaped cover member **91** is secured to the top plate **90** and suitable stud elements **92** which project through the cover member **91** are secured thereto by wing nuts **93** as best seen in FIGS. 8 and 9.

Each inspection device **86** has a pair of vertically disposed longitudinally extending guide plates **94** secured to the base plate **87** and depending therefrom as best seen in FIGS. 8 and 9. A cam supporting block **95** is positioned substantially centrally between the guide plates **94** and is suspended from the bearing block **88** by a pair of vertical support pins **96** that are slidable in sleeve bearings **97** carried by the bearing block **88**. To this end it is pointed out that the bearings **97** are positioned in bores formed in the base plate and bearing block and permit vertical translation of the pins **96**. The cam support block **95** is provided with a central slot and a set-up cam bar **98** is pressed into the slot. The cam bar **98** has a substantially horizontally disposed lower cam surface **99**, the respective leading and trailing ends **100** thereof being upwardly inclined. When a receptacle to be inspected is moved along one of the passageways **84**, the cam bar **98** is disposed in obstructing relation with respect to the upper surface of the bead of the can and will be engaged thereby to produce vertical translation of the cam **98** and the pins **96** associated therewith.

Each inspection device **86** is also provided with a pair of elongate cam blocks **101** positioned between the guides **94** on opposite sides of the cam supporting block **95**. Opposite ends of each of these cam blocks **101** is suspended from the top plate **90** by elongate vertically extending pins **102**, the pins being threaded at their upper ends and having suitable lock means such as nuts **103** secured thereto. These pins project through sleeve bearings **104** carried by the bearing block **88** and base plate **87** to permit vertical translation thereof.

Referring now to FIG. 6 it will be seen that each cam block **101** has a front cam **105** and a rear cam **106** secured thereto. Each of these cams are similar in construction and are mirror images of each other. Each is formed of a plate which is bent to form an irregular shaped cam bar **107**. It will be noted that the cam bar **107** for each front and rear pair of cams has a substantially straight longitudinally extending lower cam surface **108**, an oblique surface **109** continuous therewith, and terminating in a transverse surface **110**, disposed substantially normal to the surface **108**. It will be noted that while the respective surfaces **108**, **109** and **110** of each front and rear cam are disposed in the same horizontal plane, the leading edge of the rear cam **106** and the trailing edge of the cam **106** are oppositely upwardly inclined, these inclined edge surfaces being designated by the reference numeral **111**.

Each pair of front cams **105** are oppositely arranged and constructed as are each pair of rear cams **106**. It will further be noted that the longitudinal cam surfaces **108** of each pair of front cams are disposed in spaced apart parallel relation on opposite sides of the cam bar **98** as are the longitudinal portions **108** of the rear cams **106**. Similarly the oblique portions **109** of the front pair of cams converge with respect to the direction of travel of the receptacle to be inspected while the oblique portions **109** of the rear pair of cams diverge with respect to each other. Each front and rear pair of cams are spaced apart with respect to each other and each is adapted to be engaged by the upper surface of the upper bead of the receptacle as the same is moved through one of the passageways **84**. It will further be noted that the respective trailing inclined edges **111** of the front pair cams **105** are positioned forwardly of the inclined trailing edge surface **100** of the cam bar **98**. Similarly, the inclined leading edge surfaces **111** of the rear cams **106** project beyond the corresponding inclined edge of the set up cam bar **98**. The cam surface **99** of the cam bar **98**, however, is dis-

posed in a lower horizontal plane than the horizontal cam surfaces of the front and rear pairs of cams **105** and **106**.

Switch actuating means in the form of a substantially flat plate **112** suitably apertured to receive the support pins **102** associated with the front pair of cams **105** is mounted on the front pair of pins **102** by collars or nuts **113**. Each of the front pair of pins **102** has a helical spring **114** positioned therearound which bears against the lower surface of the top plate **90** and against the uppermost collar **113** to thereby normally urge the plate **112** in a downward direction.

The actuator plate **112** is downwardly offset as at **115** and terminates in a substantially flat second actuating portion **116**. A low profile switch **117** having an actuator button **118** is mounted on an end plate **89** and below the plate **112**. A high profile switch **119** having an actuator arm **120** is mounted on the upper plate **90**, the actuator arm **120** being swingable between an open and closed position and being positioned above the actuator portion **116**. Movement of the arm **120** in an upward swinging direction closes the switch **119** and conversely, the switch **119** is in the open condition when the switch arm **120** is in the position illustrated in FIG. 7. A set up switch **121** also having an actuator button is mounted from the top plate **90** by bracket **122** and it will be seen that the switch **121** is actuated by the rearmost pin **96** which supports the cam bar **98**. Upward movement of the pin **96** closes the switch **121** and this switch is in a normally open condition when the cam bar is in the position as illustrated in FIG. 7.

It is pointed out that when a receptacle is passed through one of the first bead inspection devices **86**, the upper peripheral surface of the receptacle will engage the incline edge surface of the front pair of cams **106** to produce vertical translation of the cams and vertical translation of the front and rear pair of pins **102** associated therewith. If the receptacle has an upper bead surface which projects upwardly beyond the acceptable limits which is evidence of damage thereof, the actuator plate **112** will be moved upwardly to cause sufficient movement of the actuator portion **116** of the plate **112** to urge the arm **120** of switch **119** upwardly to close switch **119**. Further movement of the receptacle in a forward or downstream direction will result in the upper surface of the bead engaging the cam bar **98** to produce vertical translation thereof and to close the switch **121**. The set up switch **121** is interposed in controlling relation with respect to the circuits of switches **119** and **117** and switch **121** must therefore be closed before the circuit can be energized. Therefore, when switch **119** is closed and switch **121** is thereafter closed the circuit of switch **119** will be energized and the mechanism associated with rejecting unacceptable cans will be actuated. It is pointed out that each rear cam **106** is capable of movement independently of the other rear cam, while the front cams **105** can move independently of each other. However, each front and rear cam positioned on the same side of the cam bar **98** are interconnected together for common movement.

Similarly, if a can or receptacle to be inspected is damaged so that the upper surface of the bead is disposed below the acceptable profile surface, the bead of the can will engage the front and rear pairs of cams **105** and **106** to produce some upward vertical translation of the front and rear pair of pins **102** but an insufficient amount to move the actuator plate out of engaging relation with the actuator button **118** of the low profile switch **117**. Therefore, this normally closed switch **117** will remain closed and when the cam bar **98** is urged upwardly by the upper surface of the receptacle bead, the switch **121** will be closed and the circuit of switch **117** will be energized to actuate the reject mechanism associated with unacceptable cans.

Referring now to FIG. 3, it will be seen that the support frame **11***a* is provided with a pair of rear air operator piston and cylinder units **123** each being mounted adjacent one side of the support frame **11***a* and adjacent the zone occupied by the first set of bead inspection devices **86**. The piston rod **124** of these units is vertically oriented and is positioned below one pair of the conveyor chains **44**. Conduits **125** supply air under pressure to the cylinder of the unit and these conduits are also connected by suitable valving to a source of air under pressure. The valves (not shown) which are interposed in flow controlling relation with respect to the air cylinder unit **123** are controlled by the circuits of the low profile switch **117** and the high profile switch **119**. Therefore, when the circuits for these respective switches are energized, air will be supplied to the cylinder of the unit and the piston rod **124** will be extended upwardly.

Referring now to FIGS. 3, 14 and 17 it will be seen that the attachment portion **85***a* of each conveyor finger **85** has an aperture therein and a switch actuator pin **126** is positioned within the aperture of each finger attachment portion **85***a* and is moveable therein. To this end, it is pointed out that the actuator pins **126** are normally positioned as illustrated in FIG. 17 so that the major length of the pin projects below the upper run of the associated pair of conveyor chains **44**. However, when the piston rod **124** of the unit **123** is extended it will strike the large lower portion of the actuator pin **126** of the conveyor finger just forwardly of the can or receptacle which has caused the circuit of the low profile switch or high profile switch to be energized and the pin **126** associated therewith will be urged upwardly.

Referring again to FIG. 1 it will be seen that while a pair of passageways are provided for the cans to be inspected as the same are passed through the first feed or seam inspection devices **86**, each pair of rows of receptacles adjacent each side of the apparatus **10** is urged into single file order by suitable oblique guides **127**. Therefore, a pair of second bead inspection devices **128** are positioned to inspect the sides and lower surface of the upper bead of the receptacle by the devices **128**.

Referring now to FIGS. 1, 3, 10, 11, 12 and 13 it will be seen that each inspection device **128** includes an upper plate **129** and a lower plate **130** which are secured to the support frame **11***a* in vertically spaced apart horizontal relationship. The lower plate **130** is spaced above the floor of the apparatus that defines the passageways below the respective pair of inspection devices **128**. Two pairs of generally rectangular shaped housings **131** extend between and are secured to the upper plate **129** and the lower plate **130**, and these housings are arranged in front and rear pairs. Each housing **131** has an elongate vertically disposed sleeve shaft **132** positioned therein and this sleeve shaft is journalled for rotation in suitable ball bearings **133** interposed betwen the associated housing and the sleeve shaft. An elongate rod shaft **134** having an enlarged head **135** at its lowermost end is associated with and projects through each sleeve shaft **132** for rotation relative thereto. Each sleeve shaft **132** projects below the lower plate **130** and has a sensing finger **136** secured thereto for movement therewith. Similarly, each rod shaft **135** has a sensing finger **137** secured thereto for movement therewith. The sensing fingers **136** and **137** associated with each concentrically arranged pair of rod and sleeve shafts are similar in shape, and each is provided with a cam engaging sensing surface which engages the upper bead of the can to be inspected. Thus each sensing finger **136** has a sensing surface **136***a* for engagement with the outer exterior or side surface of the upper bead of the receptacle while sensing finger **137** has a sensing finger **137***a* for engagement with the lower surface of the upper bead and for engagement with the upper marginal vertical surface of the receptacle.

The upper end portion of each sleeve shaft **132** projects upwardly beyond the upper plate **129** and an upper generally rectangular shaped block **138** is affixed thereto

for movement therewith. Each rod shaft **134** also projects upwardly beyond the upper plate **129** and beyond the block **138** associated with the sleeve shaft **132**. This upper end portion of each rod shaft **134** has a pivot block **139** keyed thereto for movement therewith. Each pivot block **139** has a bracket **140** secured to one side thereof and projecting upwardly therefrom and each bracket **140** has an electrical switch **141** mounted thereon.

It will also be noted that each bracket **140** has a smaller bracket **142** secured to the lower edge portion thereof and which projects outwardly and downwardly therefrom. A small positioning stud is affixed to the side of pivot block **138** and a helical spring **143** is positioned around the stud and bears against the inner surface of the bracket **142** and against one longitudinal edge of the lower pivot block **138**. Each spring member **43** tends to urge relative pivoting movement betwen each pair of blocks **139** and **138** in a predetermined direction.

The outer or free end of each upper pivot block **138** has a vertically extending spring engaging pin **144** affixed thereto and projecting upwardly therefrom. Opposite ends of a helical spring **145** engage the pins **144** associated with each front and rear pair of upper pivot blocks **139**. Thus as best seen in FIG. 10 one coil spring **145** extends between and interconnects the forward pair of upper pivot blocks **139** and the other spring interconnects the rear pair of upper pivot blocks **139** and these springs tend to return these pivot blocks to the position illustrated in FIG. 10. These springs **145** cooperate with the springs **143** to return each pair of lower and upper pivot blocks **138** and **139** respectively to the position illustrated in FIG. 10 and to align each upper and lower pair of pivot blocks with respect to each other. Thus not only is relative movement between each associated pair of upper pivot blocks **139** yieldably resisted but relative movement between each upper and lower pair of pivot blocks is also yieldably resisted.

Referring now to FIGS. 11, 12 and 13 it will be seen that the rearmost pair of fingers **137** are provided with forward extensions that are slotted as at **146** while the forwardmost pair of upper fingers **136** are provided with rearward extensions having a depending pin **147** secured thereto. It will be seen that the pin **147** on each forward pair of upper sensing fingers **136** is positioned within the slot **146** of one of the rear pair of lower fingers **137** located on the same side thereof. It will therefore be seen that not only are the sensing fingers interconnected transversely by yieldable means, but the lower sensing finger of each rear pair is interconnected by a slot and pin connection with the upper sensing finger of one of the front pair of sensing fingers.

Referring now to FIGS. 11 and 12 it will be seen that each lower piovt block **138** has a vertically extending opening **138***a* therein adjacent its free end and that each upper pivot block **139** also has an opening **139***a* therein which is normally disposed in registering relation with respect to the recess **138** of the associated lower pivot block. An elongate pin **148** is loosely disposed within the registering recesses **138***a* and **139***a* of each pair of upper and lower pivot blocks and each pin has an enlarged flat disc shaped head **149**. Each switch **141** has an actuating button **141***a* which is disposed in engaging relation with respect to the upper surface of the associated head **149** of the actuator pin **148**. It will therefore be seen that any relative pivotally movement between each upper and lower pair of pivot blocks will cause the head of the pin **149** to be tilted or cocked which condition results in closing the actuating button **141***a* of the switch **141**.

Referring again to FIGS. 11 and 12 it will be seen that a pair of circuit swtiching switches **150** are each mounted on one of a pair of laterally spaced apart substantially parallel vertical plates **131** which extend between and are interconnected to the upper and lower plates **129** and **130** of each inspection device **128**. Each switch **150** has an actuator button **152** which is disposed in close proximity to the upper surface of an elongate actuator arm **153** which is pivoted by pivot **154** to one of the plates **131**. Each actuator arm **153** has a depending cam **155** integrally formed therewith, each cam **155** having a downwardly and rearwardly inclined cam surface **156** which is seen in disposed in obstructing relation with respect to the upper portion of the can to be inspected. Each of the circuit-switching switches **150** serves to de-energize the circuit to one of front switches **141** while simultaneously energizing the associated rear switch **141**, and it is pointed out that the switches **150** are normally in a neutral or open condition when the actuator arm **153** is in the position illustrated in FIGS. 11 and 12. However, when the upper surface of the can to be inspected engages the inclined surfaces of the actuator arms of each pair of circuit switching switches **150**, the circuit switching switches will de-energize one of the front switches **141** and will simultaneously energize one of the rear pair of switches **141**. The rear end of the arm **153** will be urged upwardly about its pivot **154** thus closing the switches. When this occurs, the reject circuit associated with each inspection device **128** will be energized in the event that any of the switches **141** are closed.

Closing of the switches **141** occurs when one of the upper or lower pair of sensing fingers **136** and **137** respectively associated with each switch **141** moves over an irregularity in the upper seam or bead of the receptacle to be inspected thus producing relative pivoting movement between each associated pair of upper and lower pivot blocks **138** and **139**. The displacement of one of the sensing fingers by such an irregularity, even though small, will be transmitted through either the associated sleeve shaft or rod shaft to one of the upper or lower pivot blocks wherein this motion is multiplied because of the length of the respective lever arms of each pivot block. Tilting of the pin and associated head **149** will close the switch **141** associated therewith and the reject circuit operatively associated with the inspection device **128** will be energized.

Referring again to FIG. 3 it will be seen that another pair of air cylinder and piston units **157** are mounted on opposite sides of the supporting frame **11***a* forwardly of the units **123** and adjacent the inspection devices **128**. Each of these units includes a piston rod **158** which is vertically disposed and when extended, adapted to engage one of the actuator pins **126** to urge the same upwardly. It will also be noted that each unit is connected by suitable conduits **159** to a source of air under pressure (not shown) and functions in the manner of the units **123**. Therefore, when the reject circuit of anyone of the four switches **141** is closed, the piston rod **158** will be projected upwardly to strike the actuator pin **126** carried by the conveyor finger **85** located just forwardly of the can being inspected and the actuator pin **126** will be held in its upward position by its frictional coaction with the attachment portion **85***a*. It will therefore be seen that if the upper surface of the upper bead of the receptacle being inspected is damaged or if the side or lower surface of the bead is damaged, both of the inspection devices are operative to cause one of the pins **126** to be shifted vertically upwardly.

The reject mechanism includes a pair of air blast heads **160** each being connected by suitable conduits **161** to a source of air under pressure and each being mounted upon the support frame **11***a* just forwardly of the inspection devices **128**. Each air blast head **160** is provided with a plurality of nozzles **162**, as best seen in FIG. 16, these nozzles having their orifices facing inwardly towards the center of the frame and directed against the exterior surface of the can being inspected. It will therefore be seen that when air is supplied to the air blast head **160**, the receptacles will be blown inwardly into a recess **163** formed in the floor of the support frame **11***a* as best seen in FIG. 1. A vertically disposed baffle plate **164** is provided to limit inward movement of each receptacle as it is discharged.

The means for controlling each of the air blast heads **160** to reject a defected can comprises a pair of microswitches **165** each having a normally open switch arm **166** disposed in obstructing relation with respect to any of the actuator pins **126** that are disposed in the upward position as best seen in FIG. 15. Each microswitch **165** is connected in controlling relation to the circuit that controls the valve (not shown) that is disposed in flow controlling relation with respect to the conduit **161**. Thus when the circuit to the valve is energized, the valve will be opened supplying air to the air blast head **160** and air discharged through the nozzles **162** will impel the cams laterally inwardly and through the discharge opening **163**. A chute **164***a* is provided to collect the cans as they are discharged through the opening **163** as best seen in FIG. 3.

Referring now to FIGS. 1 and 14 it will be seen that guide means are provided for directing the two rows of receptacles into a single row for movement into the turret **16**. This guide means includes two sets of guide rails **167**, each set communicating at its rear end with one of the passageways associated with one of the inspection devices **128**. It will be noted that each side of guide rails directs the can moving therebetween inwardly towards the longitudinal center line of the supporting frame **11** whereby the sets of guide rails converge towards each other in the direction of travel of the receptacles. Each set is provided with a horizontally disposed upper retaining member **168** which prevents vertical displacement of the receptacles being inspected.

The receptacles to be inspected are conveyed in supported relation towards a turret by suitable endless conveyor belt **169** which is trained around a roller **170** at is forward end, the roller **170** being keyed or fixed to the shaft **41** for rotation therewith. The conveyor belt **169** is also trained about a rear roller **171** provided wtih a shaft that is journalled in suitable bearings carried by the support frame **11***a*. It will, therefore, be seen that the converging rows of the cans are moved towards the conveyor belt **169** by the conveyor fingers and are then moved by the conveyor belt **169** to an impeller device which impels the receptacles into the turret **16**.

The impeller mechanism includes a rotary impeller member **172** which is revolvably mounted on the shaft **173** as best seen in FIG. 18. The shaft **173** which is vertically disposed is interconnected by suitable gearing of a gear box **174** to the shaft **37** as best seen in FIG. 18. The gear box **174** is mounted upon the support frame **11***a* by a bracket **175**. The impeller member **172** is provided with a plurality of outwardly projecting impelled arms **175** each having a roller **176** revolvably mounted at its free end. Referring again to FIG. 18 it will be seen that as the impeller member **172** is revolved, the impeller arms **175** will engage and impel the receptacles R into each inspection cell of the turret **16**.

Referring again to FIG. 3 it will be seen that means are provided for returning the actuator pins **126** to their downwardly disposed normal position as the conveyor chains **44** located at opposite sides of the frame **11***a* begin their downward run. This means includes a pair of elongate curved cam members **177** each being secured by suitable bolt means to the support frame **11***a* and each presenting a rearwardly and downwardly facing curved cam surface disposed in obstructing relation with respect to any of the actuating pins that are disposed in an upward or operative position. Therefore, any of these actuating pins that are disposed in an upwardly operative position will engage the cam member **177** associated therewith and will be cammed downwardly as best seen in FIG. 3.

Referring now to FIGS. 1, 2 and 19–25 it will be seen that the turret **16** is comprised of a plurality of the inspection cells designated generally by the reference numeral **179** and each being adapted to inspect the vacuum packed receptacle R to determine if the receptacle has been packed under a suitable vacuum.

To this end, it is pointed out that in the conventional rectangular shaped cans or receptacles in which food products such as processed meat are packed, the contents of the can are packed while subjected to a partial vacuum so that the interior of the can or receptacle at the time the receptacle is filled will be subjected to a negative pressure. When the receptacle is subjected to a negative pressure, the sides of the receptacle will be collapsed slightly inwardly to form concavities at opposite side surfaces of the cans. It is desirable to create a sufficient partial vacuum within the packed receptacle to minimize any tendency of spoilage of the contents of the receptacle. In the event that there is a leak in the receptacle, or in the event that an insufficient negative pressure is used, the sides of the receptacle will not have the pair of concave collapsed sides then such a packed can would be unacceptable for consumer sale. Therefore, the vacuum measuring cells are adapted to determine if a minimum adequate vacuum or negative pressure actually exists within the seal interior of the container. Thus the cross-sectional width of the sealed receptacle in the zone of the concavities are inspected to determine if the sides are collapsed inwardly a sufficient amount to indicate the presence of an adequate partial vacuum. If an insufficient partial vacuum or negative pressure exists within the interior of the can, the sides of the can will not be collapsed inwardly the desired predetermined amount.

Referring now to FIG. 2 it will be seen that the turret **16** includes a revolvable base plate **178** upon which are mounted the plurality of outwardly facing inspecting cells **179**. Each inspection cell **179** includes a base plate **180** which is mounted on the support plate **178** by suitable bolt means or the like. Each inspection cell also includes a lower plate **181** which is rigidly connected with the base plate by a rear wall **182** and upstanding walls **183**. The rear wall of each inspection cell projects upwardly beyond the floor plate **181** and is provided at its upper end with a top plate **184** as best seen in FIG. 19.

Referring again to FIG. 2 it will be seen that the turret **16** is also provided with a lower cam plate **185** and an upper cam plate **186** for revolving movement therewith. The lower cam plate **185** is provided with a continuous upwardly facing eccentric cam track or groove **187** therein adjacent the periphery thereof and the upper cam plate **186** is also provided with an upwardly facing continuous eccentric cam track or groove **188** therein adjacent the periphery thereof. The cam tracks **187** and **188** are of different configuration with cam track **187** having one low spot thereon (not shown) while cam track **188** has low spots thereon (not shown).

Each inspection cell **179** has a lower elongate horizontally disposed thrust rod **189** mounted for inward and outward shifting movement reltaive to the cell **179** and projecting through the rear wall **182** as best seen in FIG. 23. A cam roller **190** is revolvably mounted on a shaft **191** carried by the inner end of each lower shaft **189**. Each inspection cell **179** also includes an upper thrust rod **192** disposed above and parallel to the lower thrust rod **189** and this upper rod also projects through the rear plate **182**. The inner end of the upper rod **192** is provided with a cam roller **193** which is revolvably mounted on a shaft **194** carried by the upper rod **192**. It will be seen that inward and outward movement of the lower thrust rod **189** is in response to the coaction of the roller **190** with the cam groove or track **187** and similarly, the movement of the upper thrust rod **192** is in response to the coaction of its associated roller with the cam track or groove **188**.

Each inspection cell **179** is also provided with a front plate **182***a* and it will be seen from FIGS. 20 and 23 is provided with suitable apertures each having slide bearings **195** therein for receiving the forward end portions of the thrust rods **189** and **192** therethrough. A slide block **196** having a bore **197** therethrough is slidably

mounted upon the lower thrust rod **189** as best seen in FIG. 23 and this slide block **196** has a keyway **198** therein into which projects a key **199** carried by the lower thrust rod **189**. A helical spring **200** is interposed between the slide block **196** and the slide bearing **195** associated with the lower thrust rod **189**.

The slide block **196** has a pair of similar gear racks **201** integrally formed with the lower opposite longitudinal edges thereof as best seen in FIGS. 19 and 21 and each rack is disposed in meshing engagement with the circumferentially arranged gear teeth **202** formed on one of a pair of vertical idler shafts **203**. It will be noted that the idler shafts **203** are journalled in the base plate **180** and also journalled in shoulders **182***b* integrally formed with the rear plate **182**. Each idler shaft **203** has a gear **204** keyed thereto for rotation therewith and each gear **204** is disposed in meshing engagement with one of a pair of gears **205** each being carried by one of a pair of drive shafts **206** and **207**. It will be seen that shafts **206** and **207** are vertically disposed each being journalled in the base plate **180** and projecting upwardly through the floor plate **181** and the top plate **184**.

Shaft **207** has a rotary cam **208** affixed thereto for rotation therewith and cam **208** engages the cam face of a sensing finger **209** which is revolvably mounted on a shaft **210** that extends between the floor plate **181** and the top plate **184**. Referring now to FIG. 25 it will be seen that the cam **208** has a cam surface **208***a* which engages the cam surface **209***a* of sensing finger **209** when revolved to urge the finger **209** in a clockwise direction as viewed in FIG. 25. It is pointed out that the sensing finger **209** is provided with spring biasing means (not shown) which normally urge the finger in a counterclockwise direction as viewed in FIG. 25.

Shaft **206** is also provided with a rotary cam **211** which is affixed thereto for rotation therewith. This cam **211** coacts with a sensing finger member **212** which is journalled on a shaft **213** that extends between the floor plate **181** and the top plate **184**. It will be noted that the sensing finger member **212** is of generally U-shaped configuration and includes an outer finger **214** and an inner finger **215**. The terminal end portion of the inner finger **215** is enlarged and defines a shoulder **216** as best seen in FIGS. 24 and 25. It will also be noted that at least a portion of the camming surface of the cam **211** is of volute configuration to define a shoulder **217**. Referring now to FIG. 22 it will be seen that a small coil spring **218** is positioned around the shaft **213** and has one end projecting into an aperture therein and has the other end hooked over the guide plate **219** to normally urge the shaft and sensing finger **212** in a counterclockwise direction as viewed in FIGS. 24 and 25. Thus it will be seen that the sensing finger member **212** is normally urged towards the respective concave surface of the can or receptacle to be inspected. A guide member **219** is affixed to the floor plate **181** and it will also be seen that another guide plate **220** is also affixed to the floor plate and is spaced laterally from the guide member **219**. Thus a receptacle or can to be inspected will be urged inwardly between the guide members **219** and **220** and will be supported upon the floor plate **181**. A spring urged pressure plate **243** is shiftably mounted on the guide plate **219** and serves to aid in the proper positioning of the receptacle between the sensing fingers.

When a receptacle or can is inspected within each inspection cell **179**, the can will be impelled inwardly between the guide members **219** and **220** and the yieldable pressure plate will cooperate with these guide members to properly align the can. As the turret is revolved, the upper and lower thrust rods **192** and **189** respectively will be urged outwardly by coaction of the thrust rod rollers with the cam grooves in the upper and lower cam plate. These thrust rods will be moved outwardly or in a direction away from the center of the turret and it will be seen when the lower thrust rod is extended outwardly, the slide block **196** will also be moved outwardly. Movement of the slide block **196** revolves the shafts **206** and **207**. To this end it is pointed out that revolving movement of the shaft **207** revolves the cam **208** associated therewith and this cam **208** swings the sensing finger **209** inwardly against one concave surface of the cam to shift the same against the inner finger **215**. Since the sensing finger member **212** is normally urged inwardly towards the adjacent concave surface of the can, the finger **215** will be disposed into engaging relation with the concave surface of the can.

The cam **211** will then be rotated in a counterclockwise direction as viewed in FIG. 24 upon outward movement of the slide block **96** to the position illustrated in FIG. 25. If the contents of the receptacle were packed under a sufficient vacuum, the inner finger **215** which is held into engaging relation with the concave side of the can will have its shoulder **216** disposed out of obstructing relation with respect to the shoulder **217** on the cam **211**. Thereafter the return of the slide block **196** which results from retraction of the lower thrust rod **189** and the biasing effect of the spring **200** will result in the cam **211** being rotated in the opposite direction. The acceptable can would then be ready to be released at the station for acceptable cans.

However, in the event that there is an insufficient vacuum in the can or receptacle, the inner finger **215** will not be urged inwardly a sufficient distance to permit clearance of the cam shoulder **217** with the shoulder **216** thereon.

The ejection mechanism for ejecting an acceptable can from each inspection cell comprises a slide ejector plate member **221** which is slidably mounted in grooves **222** formed by suitable track members **223** secured to the underside of the floor plate **181**. To this end, it will be noted that the track member **223** also define a second pair of grooves **224** which are disposed below the grooves **222**. It will be noted that the floor plate **181** has a central elongate opening **225** therein and the ejector plate **221** has a can engaging element **226** integrally formed with the slide plate **221** and projecting upwardly therefrom through the opening **225**. The receptacle engaging element **226** is provided with a small pin **227** which limits forward movement of the slide plate **221** with respect to the lower plate **181**. Referring now to FIG. 22 it will be seen that the ejector slide plate **221** is provided with a locking notch **228** adjacent the lower forward surface thereof.

An ejector rack plate **229** is slidably positioned within the grooves **224** for sliding movement therein and this rack plate has a downwardly facing elongate rack bar **230** integrally formed therewith and depending centrally therefrom. The forward end of the rack plate **229** has a recess and a latch element **231** is pivotally connected thereto by pivot **232** as best seen in FIG. 22. This latch element **231** has a rearwardly projecting actuating portion **233** integrally formed therewith which is engaged by a small leaf spring **234** also carried by the rack plate for normally urging the latch element **231** in a counterclockwise direction as viewed in FIG. 22.

The upper thrust **192** has a small rack **235** integrally formed therewith which engages a small pinion **236** carried by a shaft **237** which extends between and is journalled in a pair of forwardly projecting support elements carried by the rear plate **182**. The shaft **237** has a relatively large gear **238** keyed thereto for rotation therewith and gear **238** is disposed in meshing relation with the rack **230**. It will therefore be seen that when the upper thrust rod **192** is moved outwardly, the gear **238** will be rotated to shift the rack bar **230** in its track grooves **224** in a rearward direction in opposite or inward retraction of the rod **192** causes outward movement of the rack bar.

It will be seen that the shafts **206** and **207** are each provided with rotary cams **239** thereon for rotation therewith. A latch actuating bar **240** is also suitably apertured

and is slidably mounted on the shafts **206** and **207** for vertical translation relative thereto. This latch bar **204** has a pair of threaded apertures therein each receiving one of a pair of threaded bolts **241** to permit adjustment of the bolts relative to the latch bar. The latch bar **240** also has a centrally located threaded aperture therein for receiving a latch actuator bolt **242** therethrough, the latter being vertically adjustable and provision for locking the same in place by means of a suitable lock nut **242***a*. It will be seen, as noted in FIGS. 21 and 22, that rotation of the shafts **206** and **207** causes rotation of the rotary cams **239**. The upper surfaces of these cams define the cam faces thereof which are engaged by the bolts **241**. Therefore, rotation of the rotary cams **239** produces vertical translation of the latch bar **240**. This vertical translation of the latch bar causes pivotal movement of the latch element **231** since the actuating portion **233** thereof is engaged by the latch actuator bolt **242**. To this end it will be noted that when the latch bar **240** is shifted upwardly, the latch element **231** will be urge out of engaging relation with respect to the notch **228** in the ejector slide plate **221** and will thereby permit relative movement between the slide plate and the rack plate.

During the inspection operation, the receptacles to be inspected will be fed by any suitable conventional conveying means such as belt or chain conveyors into the infeed mechanism, illustrated on the right of FIG. 1. In the embodiment shown, two continuous lines of receptacles will be fed into the infeed mechanism and each receptacle R will be moved in supporting relation upon one of the chain conveyors **78** and will be engaged at its upper inner longitudinal edge portion by one of the screw or helical conveyor members **64** and urged outwardly against the guide rail **79**. Each can will therefore be positively fed towards the first set of bead inspection devices **86**.

It is pointed out above, the receptacles will be directed into one of four passageways **84**, each passageway being positioned below and associated with one of the first bead inspection devices **86**. As each receptacle is moved below each inspection device **86**, it will be seen that two closely spaced apart upper surface portions of the bead will be engaged by the leading edge **111** of the rear cams **106** and continued movement of the can or receptacle will result in the entire continuous upper surface of the continuous generally rectangular shaped upper bead to be progressively engaged by the respective surfaces of the front and rear cams. Thus the entire continuous generally rectangular upper surface of the upper bead of the receptacle is engaged and sensed by the front and rear cams to detect any deformation thereto.

If the receptacle has an upper bead surface which projects upwardly beyond the acceptable limits, this deformation will be sensed by the cams and the actuator plate **112** will be moved out of contact with the switch actuator button **118** to open the switch and to also cause sufficient movement of the actuator portion **116** of the plate **112** and to urge the arm **120** of the switch **119** upwardly to close the switch **119**. It will be noted that movement of the receptacle in this forward direction will result in the cam bar **98** being engaged by the bead of the receptacle to cause vertical movement of the cam bar in vertical translation of the pins **96** to close the switch **121** so that the circuit of switch **119** will be energized.

Conversely when a receptacle has a bead deformed downwardly, one of the front or rear cams located on one longitudinal side of the cam bar **98** will drop downwardly thus causing switch **117** to be closed by the actuator member **112** and when switch **121** is closed, the circuit of switch **117** will be energized. When this occurs, or when the circuit of switch **119** is energized, one of the air pistons and cylinder units located on opposite sides of the support frame **11***a* will be actuated to move one of the actuator pins **126** upwardly into position for actuating the microswitch that controls the ejector mechanism.

The receptacles are thereafter moved through the second set of inspection devices **128** and as each receptacle is moved along the passageway associated with one of the inspection devices **128** each upper and lower pair of sensing fingers will engage the outer exterior or side surface of the upper bead. As the receptacle is moved between the four sets of sensing fingers, any irregularity or deformation along the outer or side surface of the upper bead or along the lower surface thereof will result in relative pivoting movement between a pair of the sensing fingers and the associated upper and lower pivot blocks thereof. This results in tilting of the pin **148** and closure of the switch thereof. When this occurs, one of the air cylinder and piston units **157** will be actuated to move an actuator pin upwardly into a position for closing the micro-switch associated with the air blast heads. It will therefore be seen that in the event that there is any deformation or damage to any of the continuous surfaces of the upper bead, this damage will be sensed and detected by one of the inspection devices to move a pin **126** into position for ejecting the unacceptable can. This ejection action of the unacceptable cans will be located at a point remote from the inspection device and will be in response to a determination of damage to the bead of the receptacle. These defective receptacles will be impelled by the air blast heads out of their predetermined path of travel and those cans or receptacles which have no damage to the beads thereof will be continued in their predetermined path of travel towards the turret **16**.

It will be noted as the receptacles approach the turret **16**, the two respective lines will be directed into a single row for movement into the turret **16**. The impeller mechanism impels each can or receptacle into one of the inspection cells **189** whereby the receptacle is inspected to determine if the contents therein have been packed under a sufficient vacuum. As each receptacle is urged into one of the inspection cells, the receptacle will engage the receptacle or cam engaging element **226** which is integrally formed with the slide plate **221** and will cause the slide plate to be moved inwardly. As the turret is revolved, the upper and lower thrust rods **192** and **189** respectively will be urged outwardly. It will be seen that this causes rotation of shafts **206** and **207** whereby the receptacle will be engaged by the sensing fingers **209** and **212**.

In the event that the contents of the receptacle have been packed therein under a sufficient vacuum, the sides of the receptacle which are engaged by the sensing fingers will have been collapsed inwardly a sufficient distance to permit movement of the shoulder **217** of the cam **211** by the shoulder **216** on the finger **215**. Thereafter upon retraction of the rods **189** and **192**, the shafts **206** and **207** will be rotated in the return direction which results in retraction of the slide block **196**. The latch bar **240** will also be lowered whereby the latch element **231** of the ejector rack plate **229** will be urged into engaging relation with the slide plate member **221**. As the rod **192** is retracted, it will be seen that the ejector rack plate will be urged outwardly and since the slide plate member **221** is latched thereto, this plate will also be moved in an outward direction and the engaging element **226** thereof will urge the receptacle outwardly at the acceptance station.

In the event that the interior of the receptacle has not been subjected to a sufficient negative pressure, the cross-sectional dimension through the sides of the receptacle that are normally concave will be of a sufficient magnitude to cause the shoulder **217** of the cam **211** to engage the shoulder **216** on the finger **215**. Therefore, when the rod **189** retracts, the slide block **196** will be locked into engagement with respect to the shafts **206** and **207**. The receptacle will be retained in the inspection cell and will be revolved beyond the acceptance station. As the rod **192** is retracted, the latch bar **240** will be in the upward position to urge the latch element **231** out of locking engagement with respect to the locking notch of slide plate member **221**. The ejector rack plate **229** will therefore be

free to move outwardly relative to the stationary plate member **221**.

As the rods **189** and **192** are urged again outwardly, the ejector plate member will be returned and the latch element will lock into engagement with the slide plate member **221**. Thereafter, upon the return stroke of the rod **192**, the latch element **233** will be urged downwardly and the can engaging element **226** will exert a sufficient force to overcome the pressure applied against the sides of the receptacles by the fingers **209** and **215**. To this end, it will be noted that while the finger **209** is held against the side of the can, the finger **215** is capable of some lateral yielding so that the force exerted by the element **226** is sufficient to urge the can outwardly at the reject station. Referring again to FIG. 1, it is pointed out that the acceptable receptacles are discharged from the inspection cell at the acceptance station designated at **250** while the unacceptable receptacles are retained in the inspection cell until the turret is revolved approximately 270 degrees where the reject station **251** is located.

From the foregoing description it will be seen that the inspection process and apparatus is capable of a highly efficient continuous operation for very accurately inspecting receptacles which are packed under a vacuum to determine damage to that portion of the receptacle, the bead, to determine the presence of damage thereto. The apparatus and method is also capable of determining whether the contents of the receptacle have been packed under a sufficient vaccum. Although the electrical circuitry for permitting the various operations of the apparatus and process have been illustrated, it is pointed out that such circuitry is of conventional arrangement for operating the various electrical components of the apparatus. Thus, it is felt unnecessary for the instant application to illustrate such circuitry by the diagrammatic illustrations. It will, therefore, be seen that this apparatus and process is capable of functioning in a more efficient manner than any heretofore known comparable apparatus and process.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What we claim is:

1. The method of inspecting symmetrically shaped containers having at least one continuous peripheral bead thereon to detect damage or deformation to the bead, said method comprising, moving a container to be inspected in a predetermined path of travel through a first inspection zone, and during travel through said first inspection zone, preventing rotation of a container while simultaneously engaging different parts of a continuous surface portion of the bead with mechanical sensing media to detect any deformation thereto, continuing movement of the container in said predetermined path of travel through a second inspection zone, and during travel through said second inspection zone preventing rotation of said container while simultaneously engaging different parts of other continuous surface portions of the bead of the container with mechanical sensing media to detect any deformation thereto, continuing movement of the container in said predetermine path of travel and automatically impelling any defective receptacle from said path of travel at a point spaced from said inspection zones, in response to a determination of deformation to the bead of the container.

2. The method as defined in claim **1** wherein the bead of the container to be inspected is located on the upper portion of the container, and wherein the mechanical sensing media in said first inspection zone engages and senses the upper continuous surface of the bead of the container, and wherein the mechanical sensing media at said second inspection zone engages and senses the outer continuous side and the lower surfaces of the bead of the container.

3. The method as defined in claim **1** and moving each container having undamaged beads into predetermined orientation within an inspection cell, a pair of opposed walls of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein so that the exterior dimensions of the container between the opposed walls at the zone of greatest concavity is of predetermined size, shifting the inspection cell to an acceptance discharge station wherein the containers which are packed under sufficient vacuum are discharged, then to the reject discharge station wherein the receptacles having an insufficient vacuum therein are discharged, and thereafter return of the inspection cell to a container receiver station, during shifting of the inspection cell from the receiver station to the acceptance discharge station, mechanically measuring the exterior dimension of the container between the opposed walls thereof at the zone wherein the degree of greatest concavity occurs when the desired minimum predetermined vacuum exists therein, automatically locking the container within the inspection cell in response to determination that the measured zone of the container is greater than said predetermined size, and retaining the inspected container in interlock relation within the inspection cell during travel thereof through the accepted discharge station and ejecting the defective receptacle at the reject discharge station, but permitting ejection of the non-defective container at the acceptance discharge station.

4. The method as defined in claim **3** wherein each inspection cell is revolved in one cycle of operation from the container receiving station to the acceptance discharge station and thereafter return to the receiver station.

5. Inspection apparatus for inspecting sealed symmetrically shaped containers, containing a product packed therein under a predetermined partial vacuum, said apparatus comprising conveyor means for moving containers to be inspected in a predetermined path of travel, a first bead inspection device interposed in said path of travel, and having a pair of mechanical sensing members thereon simultaneously engaging opposite parts of a continuous surface portion of the bead of a container to detect any deformation thereto as a container is moved in said predetermined path of travel, a second bead inspection device interposed in said path of travel and having a pair of mechanical sensing members thereon simultaneously engaging opposite parts of another continuous surface portion of the bead of the container during movement of the latter in said predetermined path of travel to detect any deformation to the bead, impeller mechanisms spaced from said bead inspection devices and being operable when actuated to impel a container from said predetermined path of travel, impeller actuator means being operable by said bead inspection devices in response to a determination of deformation to the bead of the container to actuate said impeller mechanism whereby defective containers will be impelled from said predetermined path of travel.

6. The inspection apparatus as defined in claim **5** wherein the bead of the container to be inspected is located on the upper surface portion of the container, and said mechanical sensing members of said first bead inspection device comprises cams for engaging the upper continuous surface portion of the bead of the container and being operable to detect any deformation to the upper surface of the bead of the container.

7. The inspection apparatus as defined in claim **5** wherein the bead of the container to be inspected is located at the upper surface portion of the container, and said bead engaging members of said second bead inspection device comprise a plurality of pairs of cams which simultaneously engage the outer side and lower surfaces of the bead of the container during movement of the latter in said predetermined path of travel to detect any deformation to the surface portions of the bead.

8. The inspection apparatus as defined in claim **5** and an inspection cell structure interposed in said path of

travel and defining an inspection chamber there within for receiving a container in predetermined position therein, one pair of opposed walls of the container normally presenting concave external surface when the desired minimum predetermined vacuum exists therein so that the exterior dimensions of the container between the opposed walls at the zone wherein the greatest degree of concavity occurs when the predetermined vacuum exists, is of predetermined size, structure mounting said inspection cell for travel from a container receiver station wherein a container is received within the cell structure, to an acceptance discharge station wherein non-defective containers are ejected, then to a reject discharge station wherein defective containers are discharged, and thereafter return to said container receiver station, means within said inspection cell operable during shifting movement of the latter from said container receiver station to said acceptance discharge station to mechanically measure the exterior dimension of the container between the opposed walls thereof at the zone wherein the greatest concavity occurs when the desired minimum predetermined vacuum exists therein, said means comprising a pair of spaced apart feeler elements mounted within said cell structure for oscillating movement towards and away from each other and through the concave spaces defined by the opposed concave wall of the container when the predetermined partial vacuum exists within the container, said feeler elements engaging the opposed walls of the container when the measured zone thereof is greater than said predetermined size, actuator means for oscillating said feeler elements, said feeler elements being operable in response to engagement thereof with the opposed concave walls of the container being inspected to lock the container within the cell structure during travel thereof through and beyond the acceptance discharge station, and ejection means operable to eject the non-defective container at the acceptance discharge station and being operable to eject the effective containers at the reject discharge station.

9. The apparatus as defined in claim 8 wherein said mechanical sensing members in said first bead inspection device and said second bead inspection device respectively comprise cams.

10. The inspection apparatus as defined in claim 8 wherein said inspection cell structure comprises one of a plurality of substantially identical outwardly opening, juxtaposed inspection cell structures each defining an inspecting chamber and each being mounted upon a revolvable turret which is rotatable through a circular orbit of 360 degrees.

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