June 28, 1966 H. F. IRMEN 3,258,120

METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

Filed Oct. 10, 1963 9 Sheets-Sheet 1

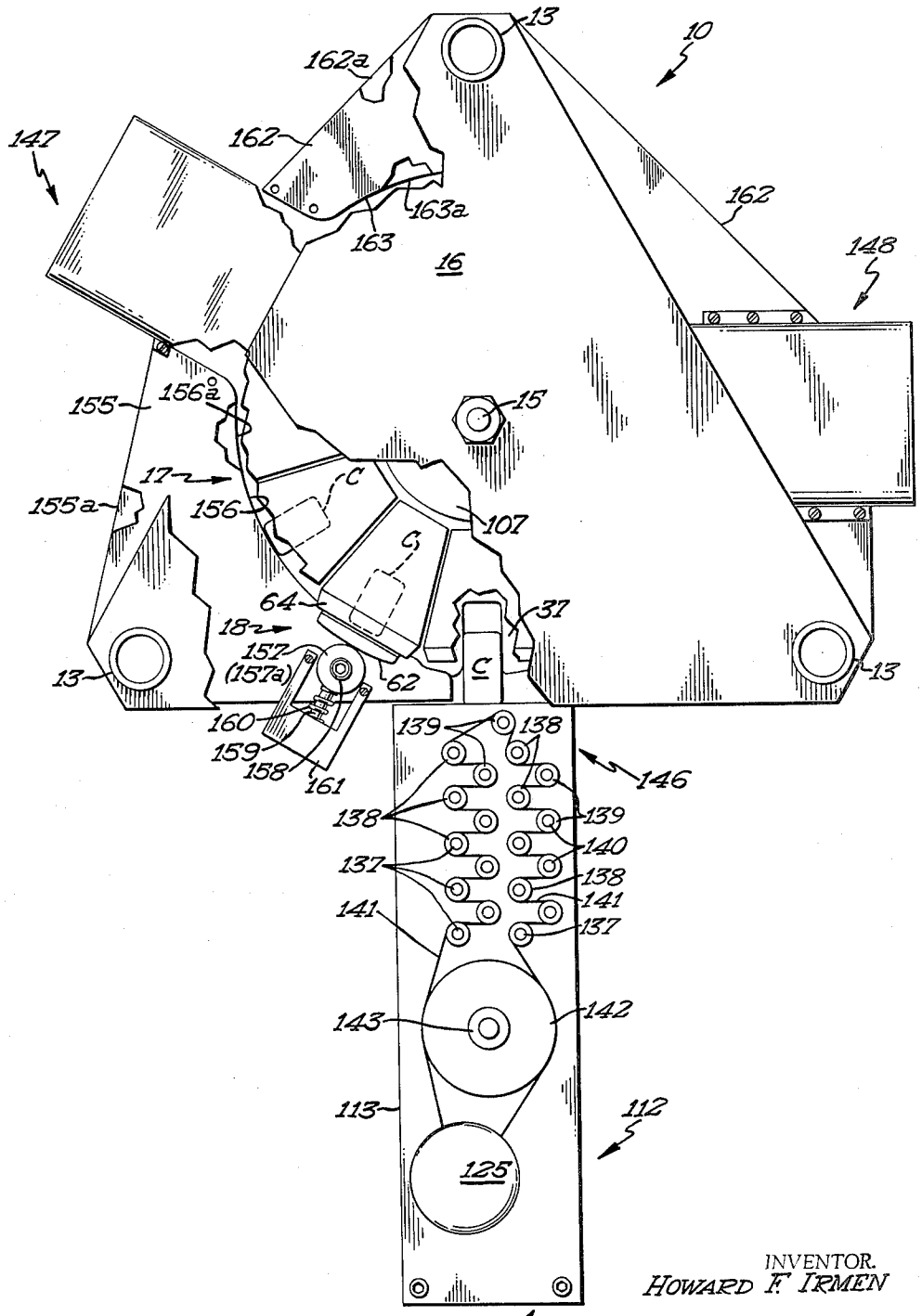


Fig 1

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Filed Oct. 10, 1963 9 Sheets-Sheet 2

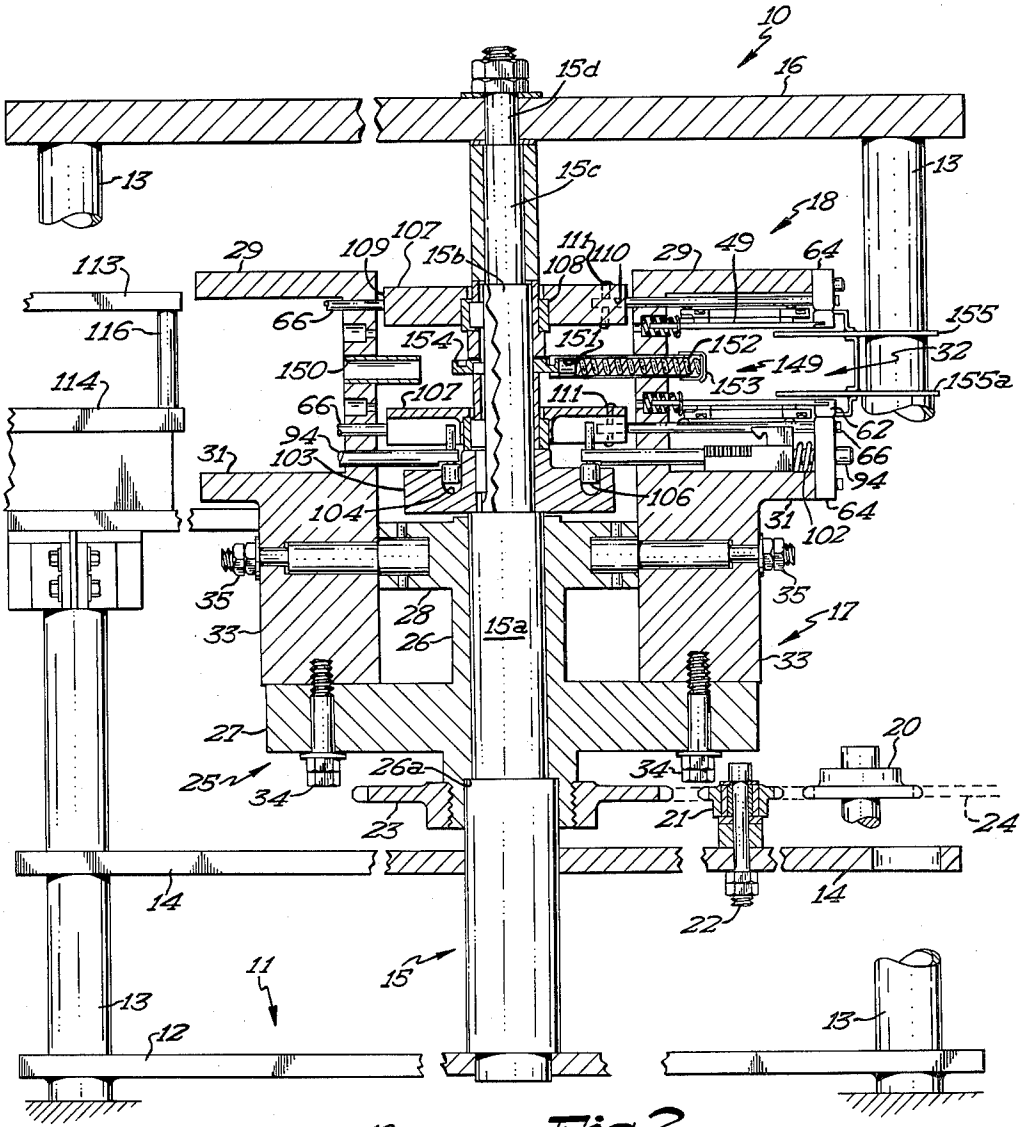


Fig 2

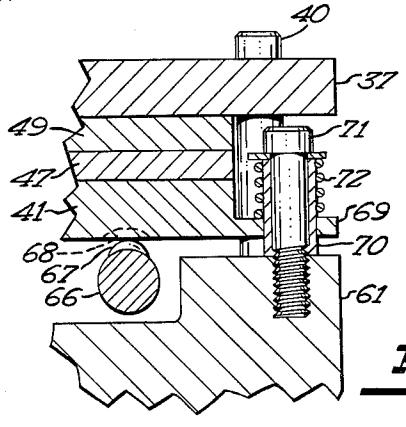


Fig 6

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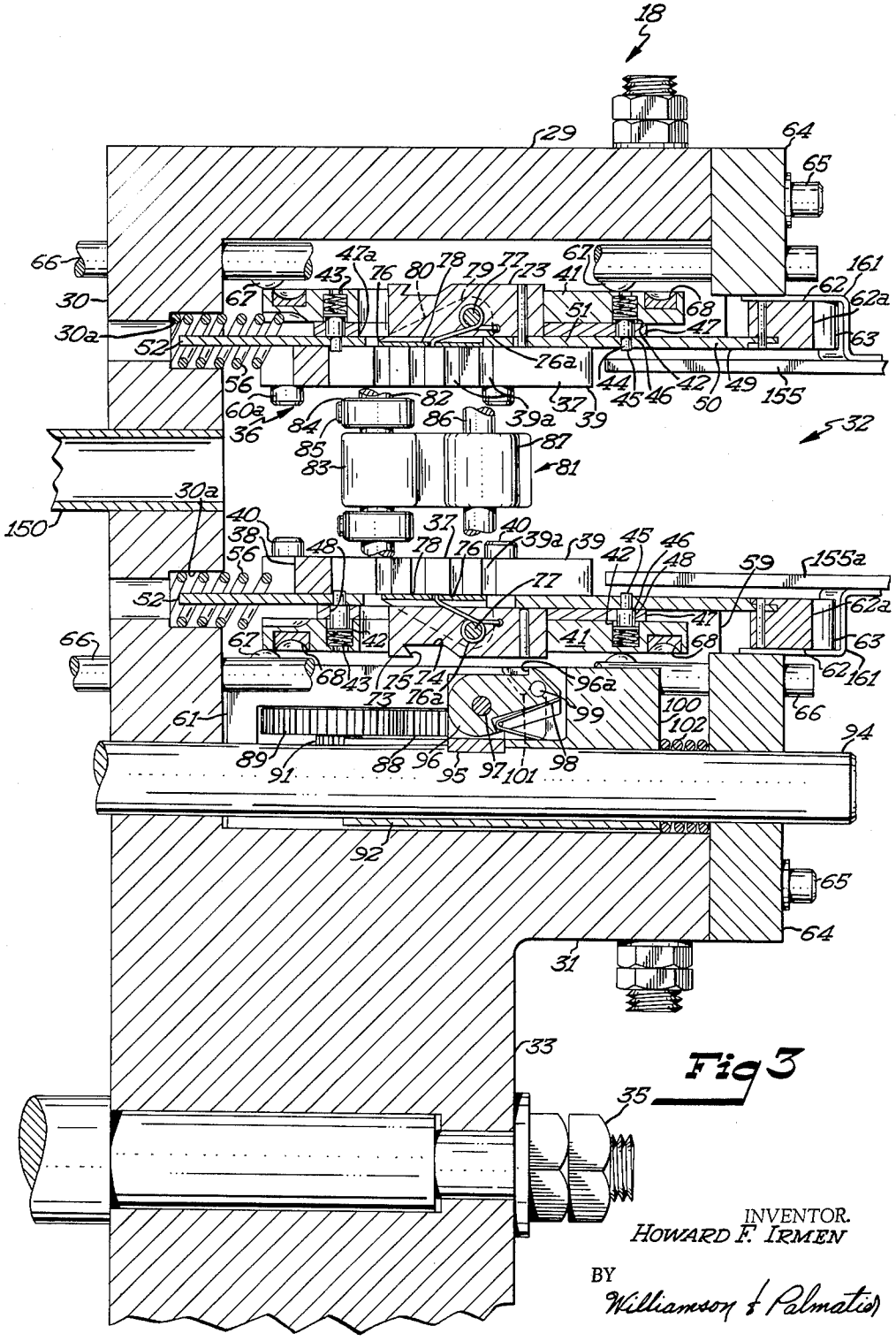


Fig 3

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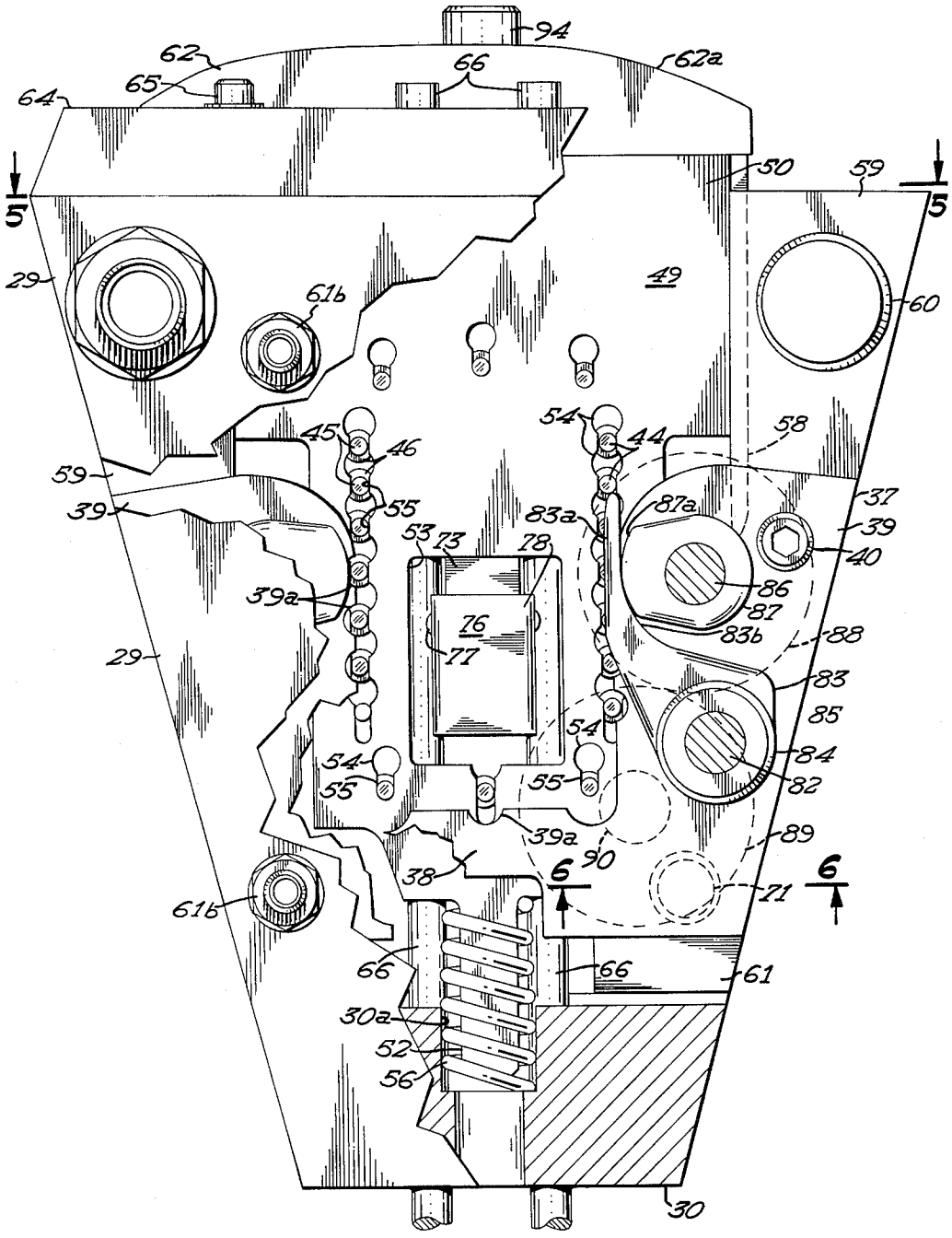


Fig 4

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METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

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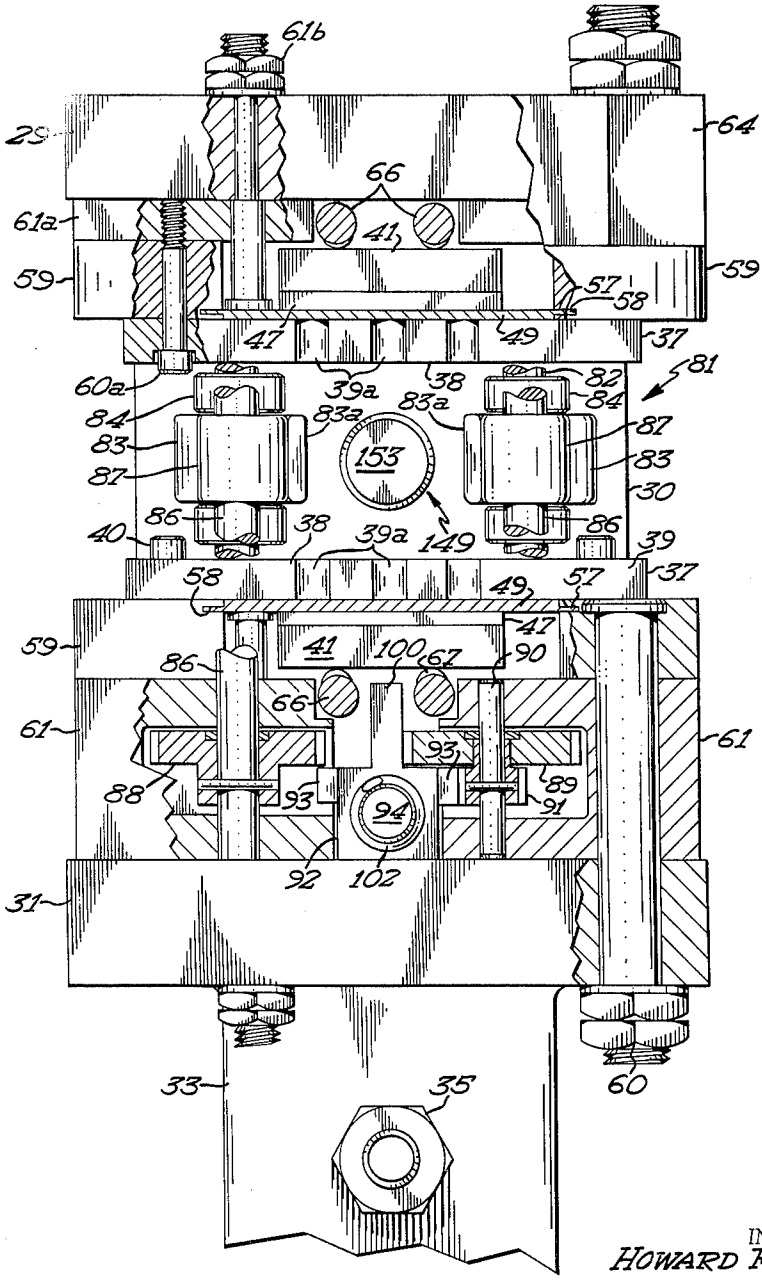


Fig 5

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METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

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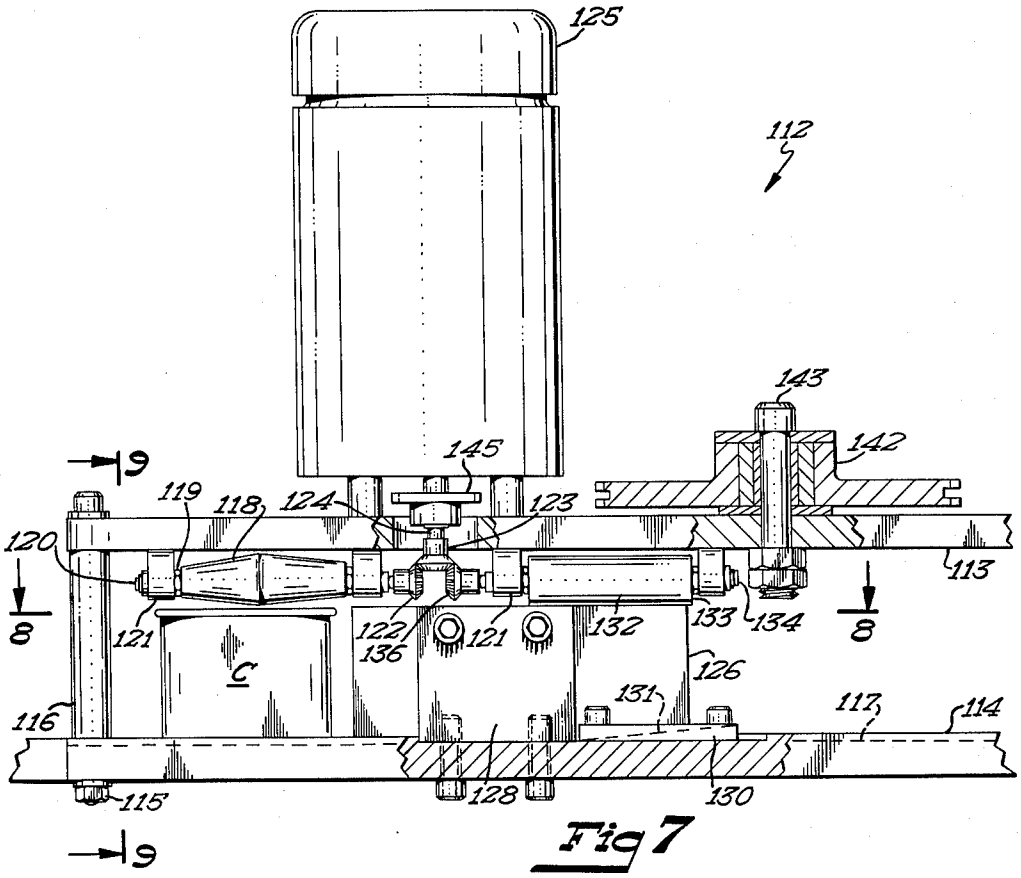


Fig 7

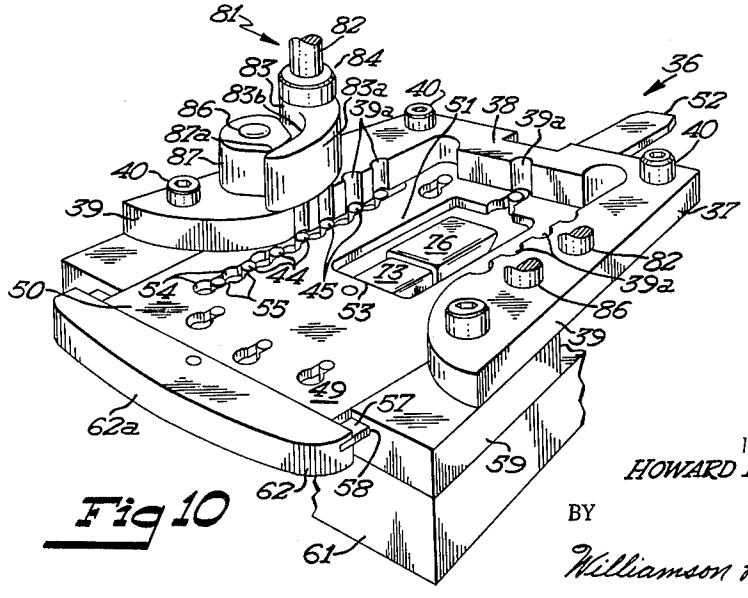


Fig 10

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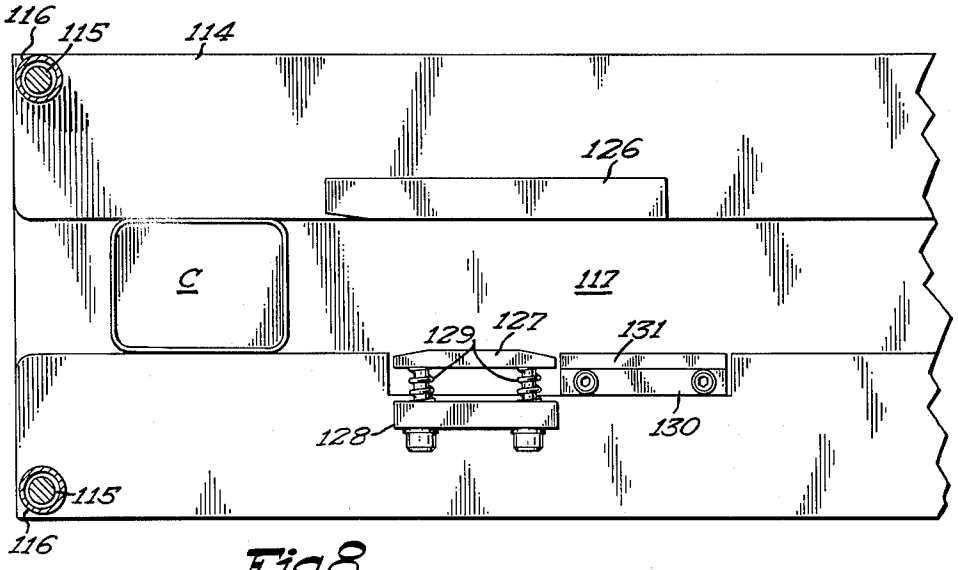


Fig 8

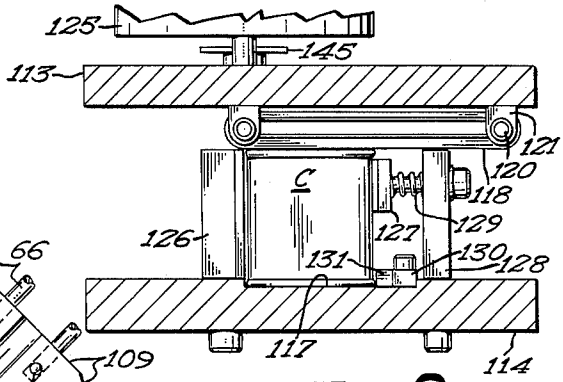


Fig 9

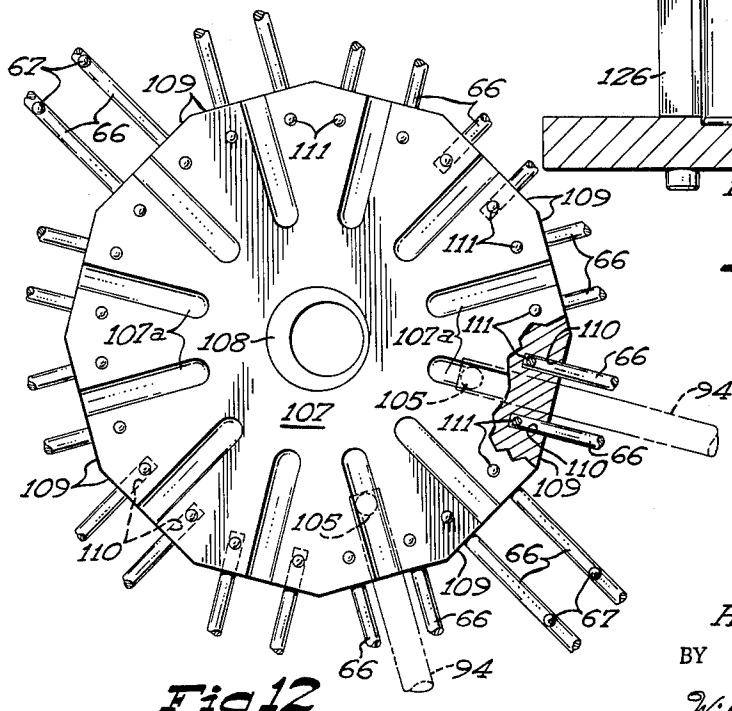


Fig 12

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METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

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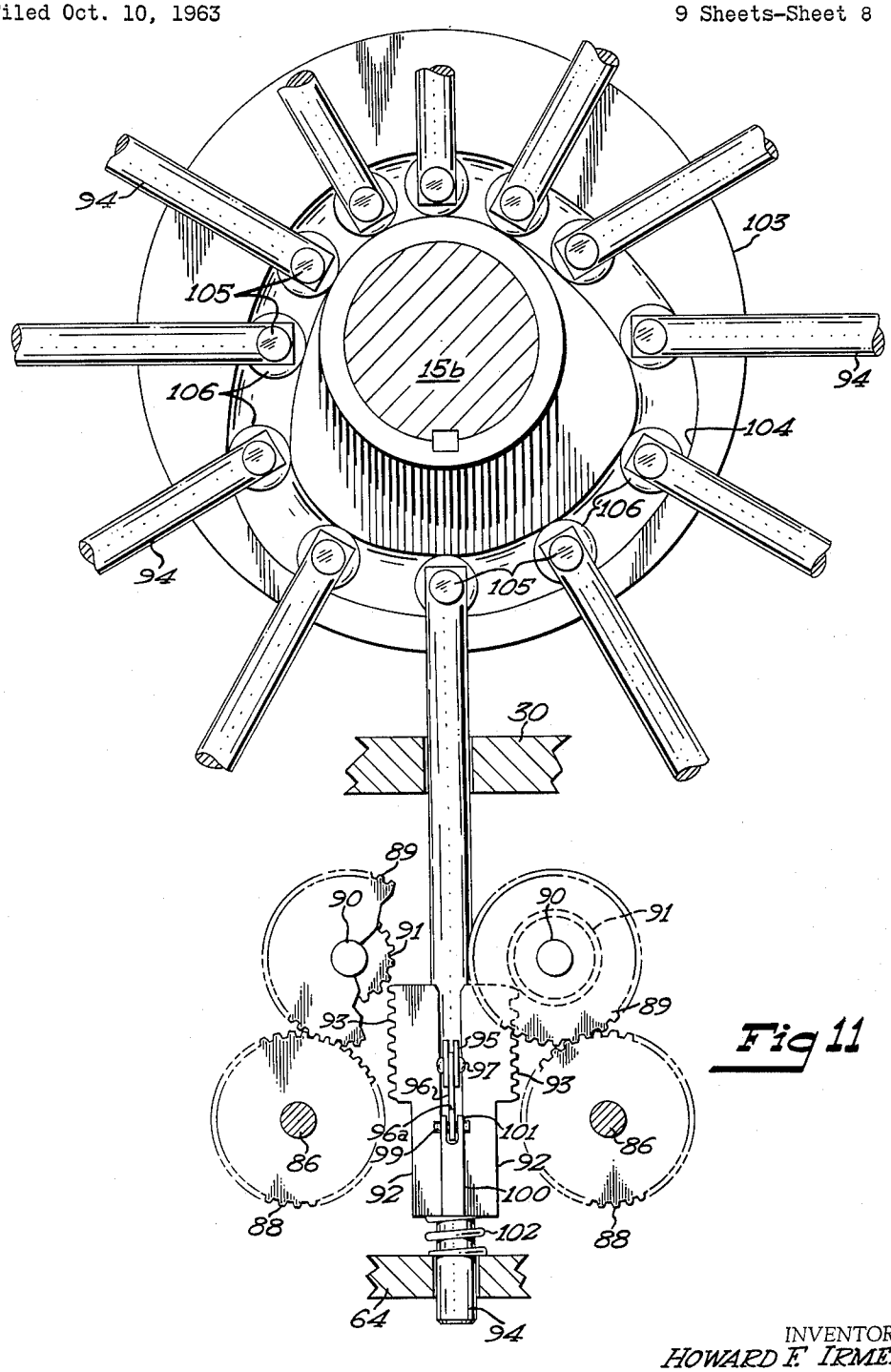


Fig 11

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METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

Filed Oct. 10, 1963 9 Sheets-Sheet 9

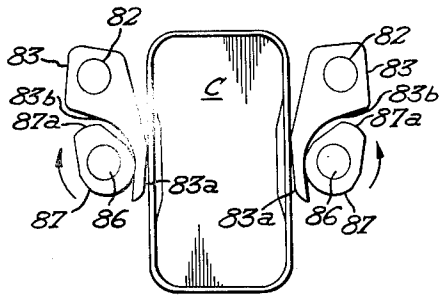


Fig 13

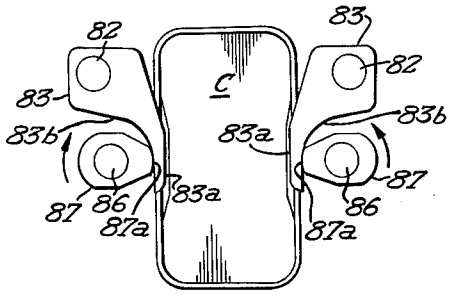


Fig 14

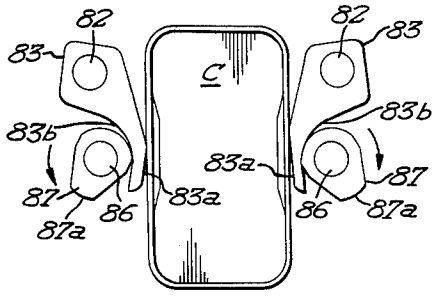


Fig 15

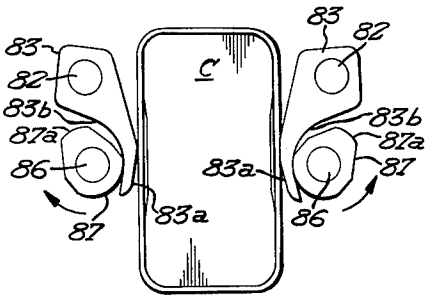


Fig 16

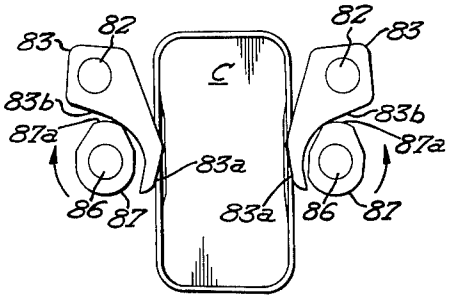


Fig 17

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United States Patent Office 3,258,120 Patented June 28, 1966

3,258,120

METHOD AND APPARATUS FOR INSPECTING VACUUM PACKED RECEPTACLES

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Filed Oct. 10, 1963, Ser. No. 315,247
40 Claims. (Cl. 209—88)

This invention relates to high-capacity method and apparatus for performing multi-mechanical inspection operations on filled receptacles formed of rigid material and containing a vacuum packed product, preferably food stuffs, to determine damage to the receptacle and to also determine if the contents of the receptacle packed therein are packed with sufficient vacuum.

An object of this invention is to provide a novel high-capacity method and apparatus for performing in one cycle of operation, a plurality of inspection steps to determine damage to a receptacle formed of rigid material and containing a vacuum packed product, preferably food stuffs, and to also determine if the contents of the receptacle were packed therein under sufficient vacuum, and to automatically reject unacceptable receptacles.

A more specific object of this invention is to provide a novel method and apparatus for inspecting vacuum packed receptacles and which is especially adapted for continuous line operations in meat packing plants and the like, and wherein the receptacles are successively fed into inspection cells of a multi-celled unit, and mechanically inspected to determine if the contents of the receptacles are packed under sufficient vacuum, each receptacle also having the bead thereof inspected for damage, and wherein acceptable receptacles are directed to a discharge station for further processing, and the imperfect receptacles are retained and rejected at a rejection station.

A further object of this invention is to provide a novel receptacle inspection method and apparatus of the class described with provision of mechanical sensing means interposed along the feed-in conveyor means to remove damaged receptacles from the in-feed line if the damaged receptacles are so deformed that they cannot be received within the inspection cells.

These and other objects and advantages of this 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 diagrammatic top plan view of the apparatus;

FIG. 2 is a vertical cross sectional view of the apparatus taken approximately through the vertical center line thereof;

FIG. 3 is a vertical sectional view on an enlarged scale of a single inspection cell of the apparatus and with certain parts thereof omitted for clarity;

FIG. 4 is a top plan view on an enlarged scale of a single inspection cell with certain parts thereof broken away for clarity and other concealed parts thereof illustrated by dotted line configuration;

FIG. 5 is an elevational view of a single cell on an enlarged scale taken approximately along line **5—5** of FIG. 4 and looking in the direction of the arrows;

FIG. 6 is a detailed view taken approximately along line **6—6** of FIG. 4 and looking in the direction of the arrows;

FIG. 7 is a side elevational view of the in-feed mechanism;

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

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

FIG. 10 is a front perspective view on an enlarged scale of certain of the elements of an inspection cell;

FIG. 11 is a horizontal cross sectional view on an enlarged scale taken approximately along line **11—11** of FIG. 2 and looking in the direction of the arrows;

FIG. 12 is a detailed view of a mask plunger and drive therefor associated with each inspection cell; and

FIGS. 13 through 17 are diagrammatic front elevational views of the vacuum inspection mechanism illustrated in various positions with respect to a receptacle during the inspection cycle.

Referring now to the drawings and more specifically to FIGS. 1 and 2, it will be seen that one embodiment of the apparatus used in carrying out the novel method, is thereshown. It is pointed out that the novel method and apparatus described herein has been found especially adaptable 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 disclosed herein and designated generally by the reference numeral **10**, will be treated under separate headings for clarity.

SUPPORTING STRUCTURE

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

The reduced lower end of a vertically disposed central bearing post **15** is positioned within an aperture in the lower plate **12** and it will be seen that the central bearing post **15** projects upwardly through an aperture in the upper plate **14**. This central bearing post **15** is successively reduced upwardly as at **15***a*, **15***b*, **15***c* and **15***d*, as best seen in FIG. 2, so that annular shoulders are defined at the respective lower ends of each of the diametrically reduced portions. A top plate or cover **16** for the apparatus is positioned upon the shoulder defined between the bearing post portions **15***c* and **15***d* and is also supported by certain of the vertical support posts **13**.

MULTI-CELL INSPECTION UNIT

A multi-cell inspection unit **17** is revolvably mounted on the central bearing post **15** for concentric movement relative thereto. This multi-cell inspection unit **17** includes a plurality of identical inspection cells **18** each opening generally radially outwardly as best seen in FIG. 1. In the embodiment shown, twelve such inspection cells are provided and each individual inspection cell **18** is revolvable from a feed-in station to a discharge station for acceptable receptacles, and thereafter to a discharge station for rejected receptacles and is finally

returned to the feed-in station. In the embodiment shown, this multi-cell inspection unit is revolvable at approximately 13 r.p.m. and is continuously revolved during operation of the apparatus.

The drive mechanism designated generally by the reference numeral **19** for the multi-cell inspection unit **17** includes a drive sprocket **20** which is connectible to a suitable source of rotary power (not shown) such as an electric motor or the like. An idler sprocket **21** is journaled on a shaft **22** for rotation relative thereto, the shaft **22** being mounted on the upper plate **14** as best seen in FIG. 2. A large driven sprocket **23** is threadedly connected to the lower end of the multi-cell inspection unit **17** for rotation therewith. An endless chain **24** is trained around the drive sprocket **20**, the idler **21** and the driven sprocket **23** to thereby supply drive to the multi-cell inspection unit. The power unit or electric motor may be mounted against either the upper or lower surface of the upper plate **14** although no such power unit is illustrated in the drawings.

The multi-cell inspection unit **17** includes a body structure **25** which is comprised of a cylindrical hub portion **26**, the lower end of which is threaded to receive the internal threaded driven sprocket **23**. The body structure **25** of the multi-cell inspection unit **17** is also provided with a relatively large lower annular flange **27** and a smaller upper annular flange **28**. It will be seen from FIG. 2 that the lower annular flange **27** and upper annular flange **28** are integrally formed with the hub portion **26** and each projects concentrically outwardly relative thereto. It will also be noted that the hub portion has an enlarged internal diameter at its lower terminal portion to define a downwardly facing internal annular shoulder **26***a* which is positioned in bearing relation upon the shoulder defined between the lower portion of the central bearing post **15** and the next adjacent reduced portion **15***a* thereof. It will also be seen that the individual inspection cells **18** are mounted upon and releasably secured to the lower annular flange **27** and are also releasably secured to the upper annular flange **18**.

INSPECTION CELLS

Referring now to FIGS. 2, 3, 4 and 5, it will be seen that each of the inspection cells **18** is comprised of a substantially flat top wall **29**, a rear wall **30** and a bottom wall **31** and defining a chamber or cell space therewithin. It will be noted that the top and bottom walls are of trapezoidal configuration and that the bottom wall **31** has a leg **33** integrally formed therewith and projecting downwardly therefrom. The leg **33** is provided with vertically extending threaded taps therein to receive the threaded ends of bolt and nut assemblies **34** and is also provided with transversely extending apertures to receive the nut and bolt assemblies **35** therethrough. It will be seen that the nut and bolt assemblies **34** project through the flange **27** of the body structure **25** while the nut and bolt assemblies **35** secure each cell to the upper flange **28**. It will also be seen that the leg **33** is supported upon the flange **27**, as best seen in FIG. 2, and that each of the cell units **18** has the cell space or chamber **32** opening outwardly.

Each inspection cell includes means for measuring the vacuum of the receptacle to determine if the contents of the receptacles are packed under a sufficient vacuum and each cell also includes the mechanism for inspecting the seam or bead of the receptacle. To this end, it is pointed out that it is contemplated that the particular receptacle to be measured is of generally rectangular configuration as illustrated in FIGS. 1 and 13 through 17. The respective upper and lower peripheries of the can are also provided with the conventional rolled beads or seams. Damage to the beads of such cans in addition to impairing the appearance of the cans quite often results in minute leaks which would permit the escape of fluid such as air into the can or receptacle, the interior of which contains a negative pressure or partial vacuum.

BEAD INSPECTION MECHANISM

The seam or bead inspection means for each cell simultaneously inspects the peripheral bead or seam at both the upper and lower sides of the can and therefore an upper and a lower bead inspection mechanism is provided for each inspection cell. Since the upper and lower inspection mechanisms for each cell are substantially identical, identical reference numerals will be used for each of the corresponding elements and members of the respective upper and lower bead inspection mechanisms. The respective upper and lower bead or seam inspection mechanisms, designated generally by the reference numeral **36**, each includes a generally U-shaped can or receptacle guide member **37** comprised of a transversely extending web portion **38** having legs **39** integrally formed therewith and projecting longitudinally of the associated inspection cell space **32**. The can guide member **37** of each inspection mechanism for each inspection cell is connected to the inner surface of the associated upper or lower wall of the associated inspection cell by suitable bolt assemblies **40**, as best seen in FIGS. 3, 4, 5 and 10. It will also be seen that the inner peripheral surface of the can guide member **37** is provided with a plurality of arcuate recesses **39***a*, the purpose of which will be more clearly set forth hereinbelow.

Each bead or seam inspection mechanism includes a tumbler or pin carriage member **41** which is of generally rectangular configuration and which has a plurality of circular recesses **42** therein. It will be seen that the recesses **42** of the upper bead inspection mechanism **36** face downwardly while the recesses in the lower bead or seam inspection mechanism for each cell face upwardly. These recesses in each of the tumbler carriage member **41** define a generally rectangular pattern corresponding generally to the outline or profile of the respective upper and lower beads of the can to be inspected. Each of the recesses **42** has a small helical spring **43** positioned therein and each recess also accommodates a pin or tumbler element **44** therein. It will be seen that each pin **44** has a reduced upper end portion **45** whereby an annular shoulder **46** is defined intermediate the ends of each pin. Thus it will be seen that the tumblers or pins **45** for the lower carriage member **41** are urged upwardly by the associated helical springs **43** while the pins of the corresponding upper carriage member will be urged downwardly.

Each bead or seam inspection mechanism **36** also includes a relatively flat, generally rectangular shaped guide plate **47** which is disposed in abutting relation with respect to the associated tumbler carriage member **41**. Each guide plate **47** has a plurality of apertures **48** therein corresponding in number to the number of pins **44** and each aperture **48** being of a size corresponding to the enlarged portion of the pins **44**, to permit the pins to project upwardly therethrough. A substantially flat mask plate member **49** is positioned upon the guide plate **47** of each bead inspection mechanism **36** and is shiftable relative thereto. This mask plate member includes an enlarged generally rectangular front portion **50**, a generally rectangular shaped intermediate portion **51**, which is of reduced width, and a tongue or rear terminal portion **52**, as best seen in FIGS. 4 and 10.

The intermediate portion **51** of each mask plate member **49** has a centrally located opening **53** therethrough, the purpose of which will be described more fully hereinbelow. It will also be noted that the mask plate member **49** also has a plurality of apertures **54** therethrough corresponding in number and size to the apertures in the associated guide plate **47**. It will be noted that each aperture has a reduced slot portion **55** communicating therewith, the slots associated with the apertures **54** adjacent the side edges of the mask intercommunicating with adjacent apertures.

The flat portion **55** associated with each of the apertures **54** in the mask plate member **49**, are of a size to permit the pins **44** to project upwardly therethrough but

are of a width to prevent passage of the annular shoulder 46 of each pin upwardly therethrough. Thus when the slot portions associated with each aperture 54 are disposed in registering relation with respect to the axis of each pin, the pins will be retained in their retracted position.

The rear wall 30 of each cell 18 has a pair of recesses 30*a* therein, each recess accommodating one of the tongues or rear terminal portions 52 of each mask plate member 49 therein. Each recess 30*a* also has one end of a helical spring 56 positioned therein, the spring being disposed in embracing relation around the tongue 52 of the associated mask plate member and having its forward end abutting against the intermediate portion of the associated mask plate member. Thus for-and-aft sliding movement of each mask plate member with respect to the associated cell 18 will be effected by the spring 56.

Each mask plate member 49 also has guide elements 57 integrally formed with the respective side edges of the front portion 50 thereof and these guide elements 57 are received within guide slots or recesses 58 in a pair of guide blocks 59. It will be noted that the lower pair of guide blocks 59 are mounted upon spacer elements 61 and are secured to the lower wall 31 of the associated cell by bolt assemblies 60. The upper pair of guide blocks 59 are secured by upper bolt assemblies 60*a* to upper spacer elements 61*a*, the spacer elements 61*a* being secured to the upper wall 29 of the associated cell by bolt assemblies 61*b*, as best seen in FIG. 5. Thus it will be seen that the mask plate member 49 for each of the upper and lower bead inspection mechanisms for each cell 18 are shiftable in a fore-and-aft direction relative to the cell and relative to the associated tumbler carriage member 41 and guide plate 47. It will also be seen that when the mask plate member 49 for each bead inspection mechanism 36 is retracted from the normal extended position, the apertures 54 will be moved into registering relation with respect to the longitudinal axis of the pins 44 and thus permit passage of the enlarged portion of the pins through the apertures 54.

Referring again to FIGS. 3, 4 and 10, it will be seen that each mask plate member 49 has a transversely extending cam element 62 fixedly carried by the front edge of the front portion 50 thereof. This cam element 62 has an arcuate front cam surface 62*a* which is engageable by a cam roller 63 during operation of the apparatus which cam roller causes retractive movement of the associated mask member against the bias of the associated helical spring 56 to permit the bead of the can to be inspected. Therefore, as pointed out above, when the apertures 54 and the mask plate member 49 are disposed in registering relation with respect to the longitudinal axis of the pins 44, the pins 44 will be urged upwardly through these apertures 54 in the mask plate member by the helical spring. When the cam element 62 is disengaged by a cam roller 63 the mask plate member 50 associated therewith will be urged forwardly by the spring 56.

The respective front edges of the upper and lower walls 29 and 31 of each inspection cell 18 are provided with bearing blocks 64 which are respectively secured thereto by means of bolt assemblies 65. It will be noted that the lower bearing block 64 is somewhat larger than the upper bearing block of the associated inspection cell. The upper and lower bearing blocks 64 are each provided with a pair of transversely spaced apertures therein for accommodating the bead inspection mechanism support rods 66 therethrough. It will be seen from FIG. 3 that each pair of the support rods 66 also extend through the rear wall 30 of the associated inspection cell and each pair of support rods 66 is axially shiftable relative to each inspection cell. Each of the support rods 66 has a pair of convex support elements 67 affixed thereto, the lower surface of the associated carriage member being engageable with and supported by the convex support elements of the associated support rods. The lower surface of each of the carriage members 41 also has an arcuate recess 68 formed in the surface thereof disposed adjacent the associated support rod 66, four such recesses being provided for each carriage member 41. The support rods 66 are normally positioned with respect to the associated carriage member 41, as illustrated in FIG. 3, so that the carriage member is supported upon these convex support elements 67. However, upon axial shifting movement of the support rods 66 in a forward direction, as illustrated in FIG. 3, the convex support elements 67 will be moved into registering relation with respect to the arcuate recesses 68, thereby permitting shifting movement of the associated carriage member 41 so that the arcuate recesses are seated upon the convex support elements 67.

In order to assure proper movement of the carriage to cause seating of the arcuate recesses upon the convex support elements 67, reference is made to FIG. 6 wherein it will be seen that each carriage member is provided with a laterally projecting ear 69 adjacent each corner thereof. Each of these ears 69 for each carriage member is suitably apertured and a flanged sleeve 70 projects therethrough. A bolt 71 extends through the sleeve 70 and is threaded into a threaded tap formed in the associated spacer element associated therewith. In FIG. 6, the lower bead inspection mechanism is illustrated, and it will be seen that the bolt 71 is threaded into a tapped recesses in the lower spacer element 61. A coil spring 72 is positioned around the sleeve 70 and bears against the flanged end of the sleeve and against the associated ear 69. Thus it will be seen that the carriage member 41 of the upper bead inspection mechanism is spring loaded upwardly while the carriage member 41 associated with the lower bead inspection mechanism is spring loaded downwardly. Therefore when the support rods 66 for each bead inspection mechanism 36 is shifted axially forwardly, the carriage member will be urged in a direction to seat the arcuate recesses 68 thereof upon the convex support elements 67 of the associated support rod 66.

During the bead inspection operation, the can to be inspected will be positioned in an inspection cell 18 and between the respective upper and lower can guide members 37. The respective upper and lower beads of the can will be positioned upon the pattern or profile defined by the apertures and slots formed in the mask member 50 for each bead inspection mechanism and the mask will be retracted by coaction of the cam roller and cam element 63 and 62 whereby to permit the pins 44 to escape from their retracted position. In the event that either the upper or lower bead of the can or receptacle is deformed, it will be seen that the enlarged portion of the pin 44 located in the vicinity of such deformed portion of the bead will be shifted upwardly to obstruct return of the mask member to the extended position. It will be seen, however, that the locked mask plate member will be allowed to return to its extended position when the support rods 66 therefor are axially shifted to permit the carriage member 41 to have the arcuate recesses 68 thereof seated upon the convex support element 37 of the associated support rod. When this action occurs, the pins 44 which may be obstructing movement of the mask plate member will be shifted out of obstructing relation with respect thereto and permit extension of the mask member to its return position. In the event that the beads of the can being inspected are not damaged, the bead itself will prevent escape of any of the pins into obstructing relation with respect to the associated mask plate member. Thus the mask plate member will be returned to its normal extended position by action of the coil spring 56.

Means are also provided for positively locking the can into the inspection cell during the inspection cycle. To this end, referring again to FIGS. 3, 4 and 10 it will be

seen that the mask plate member **50** of each bead inspection mechanism has a lock supporting member **73** secured thereto for movement therewith. It will be noted that the lock supporting member **73** for the upper bead inspection mechanism is positioned above the associated mask while the lock supporting member for the lower bead inspection mechanism is positioned below the associated mask plate member. It will also be seen that the lock supporting member **73** for each mask plate member has a portion thereof positioned in close proximity and generally in obstructing relation with respect to the central opening **53** in the associated mask plate member. The lower surface of the lower lock supporting member **73** and the upper surface of the upper lock supporting member **73** are each recessed as at **74** to define a hook element **75** adjacent the rearmost end thereof.

Each lock supporting member **73** has a generally U-shaped lock member **76** pivotally secured thereto by means of a pivot pin **77**. It will be noted that each lock member includes a substantially flat web portion **78** having legs **79** integrally formed therewith. The web portion **78** is of a width to permit the legs **79** to be positioned on opposite sides of the lock supporting members **73** and it will be noted that the rear edge of the legs **79** are inclined to define oblique camming surfaces **80**. It will therefore be seen that when the mask plate member **50** is retracted rearwardly, the lock supporting member and the lock member associated therewith are also carried rearwardly thereby.

The carriage member **41** and guide plate **47** for each inspection mechanism are each also provided with a generally centrally located opening therein, as best seen in FIG. 3, and the lock supporting member and lock member for each mask plate member is positioned in the opening of the associated carriage member and guide plate. The rear edge defined by the centrally located opening of each guide plate **47** actually defines a camming edge or surface **47***a* which cooperates with the camming surface **80** on each of the legs **79** for the lock member **76**. Therefore when the lock member **76** is shifted rearwardly with the associated mask plate member, the camming surface **80** of the lock member leg **79** will be urged into engaging relation with the camming edge **47** on the associated guide plate. Thus the lock member **76** will be pivoted by its pivotal axis **77**.

It will be noted that the web portion **78** of the upper lock member **76** has its lower surface disposed in substantially co-planar relation with the lower surface of the associated mask plate member while the lower lock member **76** has the upper surface of the web portion **78** thereof disposed in substantially co-planar relation with respect to the upper surface of the lower mask plate member **50**. However, upon pivoting movement, by the camming action each lock member will be disposed out of co-planar relation and will actually engage the bead of the can to be inspected and will obstruct movement of the can forwardly and outwardly of the inspection cell. Although not shown in the drawings, each of the lock members are provided with spring means to normally urge the lock members into co-planar relation with the associated mask plate member. Thus it will be seen that the upper lock member **76** will be spring loaded upwardly while the lower lock member **76** will be spring loaded downwardly. Therefore upon return of the mask plate member of each bead inspection mechanism to its normal position, the associated lock member **76** will also be returned to its co-planar orientation relative to the associated mask plate member.

VACUUM INSPECTION MECHANISM

In the conventional rectangular shaped cans or receptacles in which food products such as processed meat is packed, the contents of the can are packed while subjected to a partial vacuum so that the interior of the can at the time the can is filled will be subjected to a negative pressure. When the can or receptacle is subjected to a negative pressure, the sides of the can, as best seen in FIGS. 13 through 15, will be collapsed slightly inwardly depending upon the degree of negative pressure. It is desirable to create a sufficient partial vacuum within the packed receptacle or can to minimize any tendency of the contents of the can from spoiling. In the event that there is a leak in the receptacle, the sides of the can will not be retained in the slightly concave collapsed relation and such packed can would be unacceptable for consumer sale. Therefore a vacuum measuring mechanism is provided to determine if a minimum adequate vacuum or negative pressure actually exists within the sealed interior of the can. The cross sectional width of the sealed receptacle generally centrally of the inwardly collapsed side walls thereof are therefore inspected to determine if the sides are collapsed inwardly a predetermined 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.

The vacuum inspecting mechanism for each inspection cell, designated generally by the reference numeral **81**, includes a pair of vertically disposed feeler shafts **82**, each having opposite ends thereof secured in recesses in the adjacent upper and lower legs of the can guide members **36**. Each shaft **82** has a feeler element **83** journaled thereon for rotation relative thereto. Positioning collars **84** secured to the shaft **82** by set screws **85** properly position each feeler element upon the associated shaft **82**. In this connection, it is pointed out that the feeler elements each have arcuate inner feeler surfaces **83***a* which are positioned to be moved towards the inwardly collapsed or concave sides of the receptacle or can to be inspected during the inspection operation. Each of the feeler elements also includes an exterior arcuate cam surface **83***b*, as best seen in FIGS. 13 through 17.

Each vacuum inspection mechanism also includes a pair of vertical cam shafts **86** each having its upper end journaled in a suitable recess in one of the legs **39** of the upper can guide element **36**, the lower end of each shaft **86** projecting downwardly through the leg element **39** of the lower can guide member and below the lower support rods **66** of the lower bead inspection mechanism **36**. It will be seen that each shaft **86** is positioned in relatively close proximity to one of the feeler shafts **82** and substantially parallel thereto. Each cam shaft **86** has a rotary cam **87** keyed thereto for rotation therewith, each rotary cam element **87** having an eccentric peripheral cam surface **87***a* engageable with the camming surface **83***b* of the associated feeler element **83**. Thus it will be seen that when the shaft **86** is revolved, the associated cam **87** will be correspondingly revolved whereby the cam surface **87***a* thereof will contact the cam surface **83***b* of the feeler element **83** to shift the feeler element about its support. Each pair of cam elements **87** are synchronized to be revolved to cause similar synchronized movement of the feeler elements **83**.

Reference again is made to FIGS. 13 through 17 wherein a diagrammatic top plan view of the can to be inspected is illustrated during the vacuum inspection cycle. In FIG. 13, the cams and feelers are in the initial stage of the inspection cycle, and the rotary cam elements **87** will be rotated in the direction of the arrows. It will be seen in FIG. 14 that if a sufficient negative pressure or partial vacuum exists within the interior of the can, the cam elements can make a complete rotation in the inner feeler surfaces **83***a* of the feeler elements and will not be moved into engaging relation with respect to the concave sides of the can. In FIGS. 16 and 17, it will be noted that the respective sides of the can are not collapsed inwardly and the cam elements **87** will revolve until the feeler elements are locked against the sides of the can.

This condition indicates that an insufficient partial vacuum or negative pressure exists within the can and the can is therefore unacceptacle. Therefore the can will be retained within the inspection cell until the multicell inspection unit 17 is rotated to position the particular inspection cell at the rejection discharge station.

Means are provided for driving the rotary cam elements 87 during the inspection cycle and to this end it will be seen that the lower end of each rotary shaft 86 has a driven gear 88 affixed thereto. The driven gear 88 meshes with a drive transmitting gear 89 keyed to a shaft 90, the latter also having a drive gear 91 keyed thereon. It will be seen that each drive gear or pinion 91 meshes with one of a pair of racks 93 carried exteriorly by a drive transmitting sleeve 92, as best seen in FIGS. 3 and 11. The drive transmitting sleeve 92, as best seen in FIG. 3 is concentrically mounted upon a drive shaft 94, one shaft being provided for each inspection cell 18. It will be noted that the drive shaft 94 for each inspection cell extends through the rear wall 30 of each cell and through the lower bearing block 64 as best seen in FIG. 3. It will also be seen that this drive shaft 94 is spaced below the lowermost of the support rods 66 and is axially reciprocable relative to the associated inspection cell.

The drive shaft 94 has a generally U-shaped lock mounting member 95 mounted thereon for movement therewith. A lock member 96 is positioned between and pivotally connected to the legs of the U-shaped mounting member 95 by means of a pivot pin 97, a spring element 98 being interposed between the lower surface of the lock member 96 and the drive transmitting sleeve 92 to normally urge the lock member to pivot in a counterclockwise direction as viewed in FIG. 3. The lock member 96 has a lock element 96*a* formed adjacent the free end thereof and is also provided with a locking pin 99 which extends transversely thereof. It will be seen that since the lock mounting member 95 is affixed to the drive shaft 94 for movement therewith, the lock member 96 will also be moved with the drive shaft 94 during reciprocating movement thereof.

The drive transmitting sleeve 92 has a lock engaging member 100 integrally formed therewith. One end of the lock engaging member 100 is shaped to define a locking element 101 which, as shown in FIG. 3, normally engages the locking pin 99 during the inspection cycle to cause the drive transmitting sleeve 92 to be moved with the drive shaft 94. The spring 98 tends to urge the lock member 96 upwardly so that the locking pin 99 is urged into engagement with the locking element 101. A coil spring element 102 is positioned around the drive shaft and is interposed between the lower bearing block 64 of each inspection cell and the face of the lock engaging member 100. It will therefore be seen that the coil spring 102 resists forward movement of the drive transmitting sleeve 92.

It will be seen that when the shaft 94 is axially reciprocated, the inner locking action of the lock member 96 and the lock engaging member 100 interlock, the drive transmitting sleeve with the drive shaft 94 so that the rectilinear drive is transmitted through the racks 93 and through the gear train to the cam shaft and thereafter to the rotary cam elements.

In order to positively lock the can within the inspection cell 18 when such can has an insufficient partial vacuum, the feeler elements 83 will engage the sides of such a can and will prevent further rotation of the rotary cam elements 87. The resistance of the rotary cams towards revolving movement will be transmitted through the gears 88, 89 and 91 and the racks 93 to the drive transmitting sleeve 92. The drive gear or pinion 91 will tend to hold the rack and drive transmitting sleeve 92 against movement with the shaft 94 whereby this resistance will be transmitted to the locking pin 99. Since the spring element 98 is a relatively weak spring, the lock member 96 will become disengaged from the lock engaging member 100 thereby permitting relative movement of the drive transmitting sleeve 92 with respect to the drive shaft 94. When this occurs, the lock element 96 will be urged upwardly and will engage the hook element 75 of the lock supporting member 73. Upon further movement of the shaft 94 in a retractive direction, the lock supporting member 73 and the associated mask element will also be retracted. When this occurs, the lock member 76 will be urged against the camming edge 47*a* of the guide plate 47, therefore shifting the lock member 76 into obstructing relation with respect to the bead of the can being inspected. Thus the can will be retained in the inspection cell until the drive shaft 74 is shifted axially forwardly whereby the lock member 96 will be moved out of interlocked relation with respect to the lock supporting member 73. Thus it will be seen that the lock member 76 not only serves to retain the can within the inspection cell when such a can has a damaged bead, but also is a locking means for retaining the can in the inspection cell in the event that such a can has an insufficient vacuum to collapse the sides inwardly the required predetermined amount.

Referring now to FIGS. 2 and 11 it will be seen that the actuating means for reciprocating the drive shafts 94 for each inspection cell comprises an eccentric generally circular cam plate 103 having a closed cam track or groove 104 formed therein. This cam plate 103 is mounted upon the shoulder defined by the portions 15*b* and 15*a* of the central support post 15. The cam plate is keyed to the central support post and the drive shafts 94 for the inspection cells 18 are moved angularly relative thereto. It will be seen that each drive shaft 94 carries a vertically disposed shaft 105 at its innermost end which is disposed substantially normal to the longitudinal axis of the drive shaft. Actually the shafts 105 constitute cam roller shafts and each has a cam roller 106 affixed to the lower end thereof, the rollers being disposed in the cam track 104. Since the shaft 105 is journaled for rotation in the end of the associated drive shaft 94 the cam rollers will travel very nicely in the cam groove track 104. Because of the eccentric configuration of the cam track 104, the drive shafts 94 will be caused to reciprocate axially during one complete cycle or revolution of the multi-cell inspection unit.

The drive mechanism for reciprocating the support rods 66 for the inspection cell 18 comprises a pair of actuator cam plates 107 each being eccentrically mounted upon the portion 50*b* of the central support post 15 for rotation relative thereto. The uppermost of the actuator cam plates 107 cooperates with the uppermost pair of support rods 66 for the inspection cells 18 while the lowermost of the actuator cam plates 107 cooperates with and actuates the lowermost of the support rods 66 of the inspection cells. It will be noted that each actuator cam plate 107 is mounted upon an eccentric bearing 108 and that the cam plate presents a plurality of substantially flat outer faces 109, each face being positioned in close proximity to the rear wall 30 for one of the inspection cells 18. Each face 109 has a pair of sockets 110 therein for accommodating the innermost ends of the support rods 66 therein. The pair of sockets in each face of the upper actuator cam plate accommodates the inner ends of the upper pair of support rods 66, the inner end of each rod 66 being connected by an adjustable pin element 111 with its associated socket.

It will therefore be seen that during rotation of the inspection cells 18 and the upper and lower actuator cam plates 107, the eccentric movement of the cam plates about the associated eccentric bearings 108 produces rectilinear movement of the support rods 66. These support rods 66 will therefore be moved relative to a tumbler carriage member 41 associated therewith to thereby permit movement of the convex support elements 67 to be

moved into and out of seated relation with respect to the arcuate recesses 68. The speed of movement of the support rods 66 for each cell relative to the drive shaft 94 associated with each inspection cell is such that the lock member 76 will be retained in obstructing relation with respect to a defective can or receptacle within the cell by the lock member 96 during a predetermined distance of movement of the inspection cell 18 which contains the defective receptacle. This action will be described more fully hereinbelow.

Means are also provided for successively supplying each inspection cell 18 with a can or receptacle to be inspected and this in-feed mechanism, designated generally by the reference numeral 112, includes a support structure comprised of a substantially flat, generally rectangular, upper plate 113 and a flat, generally rectangular, lower plate 114 disposed in substantially parallel relation with the upper plate. The upper and lower plates are rigidly connected together by suitable nut and bolt assemblies 115 which extend through suitable spacer sleeves 116, as best seen in FIG. 7. The rear end portion of the in-feed mechanism 112 communicates with the discharge end of the conventional roller type gravity conveyor system used in material handling systems wherein the article to be conveyed travels by gravity over the rollers of the conveyor.

The lower plate member has a substantially straight, longitudinally extending shallow guideway 117 formed therein through which passes the cans or receptacles C to be inspected. The in-feed mechanism 112 also includes means for removing any can or receptacle which is so deformed that the defective receptacle cannot be received within the inspection cells 18. This means includes a first endless skimmer belt member 118 trained about a pair of conical rollers 119, as best seen in FIGS. 7 and 9. The rollers 119 are each provided with a roller shaft 120, the roller shafts being journaled in suitable bearings 121 affixed to the lower surface of the upper plate 113.

It will be seen that one of the roller shafts 120 has a driven gear or pinion 122 affixed thereto for rotation therewith and that this pinion is disposed in meshing relation with respect to another pinion or gear 123 keyed to the shaft 124 of a conventional electric motor unit 125. Thus when the motor 125 is energized to drive the shaft 124, the drive pinion or gear 123 will drive the driven pinion or gear 122 to thereby drive the first skimmer belt 118 to the right as viewed in FIG. 9. The cans or receptacles which are so deformed that the receptacles will pass just below the in-feed side of the lower run of the first skimmer belt 118 will be laterally directed from the guideway 117 and will not pass through the in-feed mechanism 112. It will be seen that the electric motor unit 125 which supplies power to the first skimmer belt 118 is mounted by suitable bolt means upon the upper plate 113.

The in-feed mechanism also includes means for rejecting cans which are slightly deformed to a degree to prevent entry into the inspection cells 18 but which are not deformed to the degree to cause rejection thereof by the first skimmer belt 118. This means detects and removes cans which have been vertically compressed and which as a result of the compression are laterally distended. Referring again to FIGS. 7, 8 and 9 it will be seen that a vertically disposed plate 126 is affixed to the lower plate 114 and is positioned adjacent one longitudinal peripheral edge of the guideway 117 in the bottom plate. A spring urged plate 127 is positioned oppositely of and parallel to the fixed vertical plate 126 and along the other side of the guideway 117, the plate 127 being shiftably mounted by suitable bolt assemblies on a backing support plate 128 and normally urged in a direction towards the fixed vertical plate by resilient spring elements 129. Just forwardly and slightly laterally of the spring urged pressure plate 127, a track member 130 is affixed to the upper surface of the lower plate 114. This track member 130 has an inclined ramp or trackway 131 thereon which is inclined upwardly in a forward direction.

A second endless skimmer belt 132 is trained around a pair of rollers 133 and extends transversely of the guideway 117 and above the fixed plate 126, the spring urged pressure plate 127 and the track element 130, as best seen in FIG. 7. It will be seen that each belt roller 133 is provided with a roller shaft 134 journaled in suitable bearings 135 affixed to and depending from the lower surface of the upper plate 113. It will be seen that one of the roller shafts 134 has a driven pinion or gear 136 keyed thereto which is disposed in driven relation with respect to the drive pinion 123. Therefore when the motor 125 is energized, the skimmer belt 132 is also driven in the same direction as the skimmer belt 118.

When a can which is vertically compressed and laterally distended passes below and beyond the first skimmer belt 118, the can because of its distended width will not be positioned precisely within the relatively shallow guideway 117. The can will pass between the fixed plate 126 and the spring urged pressure plate 127. Since the can is of a width slightly greater than the spacing between the vertical plates 126 and 127 the can will abut against the fixed plate 126 and will urge the pressure plate 127 outwardly. When this condition occurs, the can will be guided positively upon the ramp 131 whereby the can will be tilted so that at least a portion of the upper surface of the can will be engaged by the second skimmer belt 132 and will be laterally ejected. The gear marginal edge portion of the pressure plate 127 is flared slightly outwardly to facilitate entry of a defective can between the plates 126 and 127. It is also pointed out that the rounded peripheral edges of the conventional meat containing receptacles also facilitates entry of the can between the plates 126 and 127.

Means are also provided for accelerating movement of the cans to be inspected after the cans have passed beyond the second skimmer belt 132. This means includes a pair of rows of vertically disposed, generally cylindrically shaped driven accelerator elements 137. These accelerator elements 137 in the embodiment shown, comprise vertically disposed pins preferably covered with a somewhat resilient compressible material such as rubber or the like and extending between the respective upper and lower plates 113 and 114. It will be seen that the rows of accelerator elements 137 are spaced-apart and define a passage therebetween. The upper terminal portion of each accelerator element 137 has a pulley 138 affixed thereto for rotation therewith. It will be seen that a plurality of idler pulley shafts 140 are affixed to the upper plate 113 and project upwardly therefrom. These idler pulley shafts each have an idler pulley 139 journaled thereon for rotation relative thereto. It will be seen that the idler pulleys are arranged in a pair of rows, the pulleys comprising one row being staggered with relation to a pair of the driven pulleys 138.

An elongate endless drive belt 141 is trained around the drive pulleys and idler pulleys in a sinuous fashion and provides drive for the accelerator elements 137. The endless drive belt 141 is also trained around a relatively large pulley member 142, the latter being journaled for rotation around a relatively short pulley shaft 143 which is affixed to the upper plate 113 and projects upwardly therefrom. The output shaft 124 for the electric motor unit 125 also has a drive pulley 145 keyed thereto for rotation therewith and the drive belt 141 is also trained around this drive pulley. It will therefore be seen that when the motor unit 125 is energized, the drive belt and accelerator elements will also be driven whereby cans passing between the accelerator elements will be accelerated towards the multi-cell inspection unit 17. It is pointed out that the spacing between the accelerator elements 137 is such as to snugly and engagingly accommodate the receptacles or containers to be inspected.

Referring now to FIG. 1 it will be seen that the inspection apparatus **10** includes a feed-in station **146**, an acceptance discharge station **147** and a reject discharge station **148**, the stations being circumferentially spaced from each other. The acceptance discharge station is the station wherein the cans which have been inspected and found to be acceptable are discharged for further processing while the reject discharge station **148** is that station wherein the unacceptable cans are discharged.

Referring again to FIGS. 2 and 3, it will be seen that means are provided for normally urging a can from each inspection cell **18** and this means includes a plunger mechanism **149**. This plunger mechanism **149** includes an elongate cylindrical plunger bearing sleeve **150** for each cell, each bearing sleeve **150** being pressed in axially extending relation in a centrally located aperture in each cell rear wall **30**. A plunger sleeve member **151** is slidably positioned within each bearing sleeve **150** and each sleeve member **151** has an elongate coil spring **152** positioned therein. It will be noted that the front end of each sleeve member **151** is opened and that a plunger cap **153** is slidably mounted thereon, the cap projecting outwardly into the associated cell chamber **32**. An actuator cam **154** is affixed to portion **15***b* of the central bearing post **15** and the outer periphery of this cam is maintained in engaging relation with the rear end portion of the associated sleeve member **151**. Although not shown in the drawings, in the embodiment illustrated, the sleeve member **151** will be provided with a cam roller for engagement with the outer peripheral edge of the cam **154** to thereby facilitate camming movement of the sleeve member **151**.

From the description and illustration of the plunger mechanism **149** for each inspection cell, it will be seen that during movement of the multi-cell inspection unit **17**, each plunger member will be shifted axially outwardly by the cooperative action of the cam **154** and the sleeve member **151**. Although not specifically illustrated in the drawings, the cam **154** is constructed to present an outwardly extending camming surface adjacent the reject station **148** so that the spring **152** for each cell will be increasingly loaded at this point. It is also pointed out that when a can is properly seated within each inspection cell **18**, the plunger member including the cap **153** thereof will be under a predetermined tension, the tension being produced by the spring **152**.

Since the receptacles or cans to be inspected are normally urged outwardly of each inspection cell by the plunger mechanism associated therewith during the inspection cycle, means are provided for retaining the receptacle within each cell prior to locking of the receptacle therein as the multi-cell inspection unit **17** is rotated. To this end, the apparatus is provided with an irregularly shaped upper retaining plate **155** and a lower retaining plate **155***a* mounted on certain of the vertical support posts **13** and specifically those vertical support posts located between the feed-in station **146** and the acceptance discharge station **147**. The upper retaining plate **155** and the lower retaining plate **155***a* are of substantially identical shape and are disposed in substantially parallel relation with respect to each other. The spacing between the upper retaining plate **155** and the lower retaining plate **155***a* is less than the height of the cell space or chamber **32** so that the inner marginal portions of the upper and lower retaining plates project inwardly of the individual inspection cells **18** during travel thereof between the feed-in station and the acceptance discharge station.

Referring now to FIG. 3, it will be seen that the respective inner edges of the upper and lower retaining plates **155** and **155***a* respectively are positioned inwardly of a cell space or chamber **32** for each individual cell during predetermined travel thereof so that the inner edge **156** of the upper retaining plate and the inner edge **156***a* of the lower retaining plate actually engage and retain a can to be inspected in seated relation within the can guide members of each inspection cell. It will be noted, however, that these retaining plates **155** and **155***a* terminate adjacent the acceptance discharge station whereby the can inspected will be released thereat unless the inspection mechanism locking means retains the can within the inspection cell.

It will also be seen that the retaining plates **155** and **155***a* carry a pair of cam rollers **157**, one roller being positioned above the upper retaining plate **155** and one roller being positioned below the lower retaining plate **155***a*. The rollers are revolvably mounted on an axle **158**, this axle being spring urged inwardly by a bifurcated plunger **159**. It will be seen that the plunger **159** has a coil spring **160** embracing the same, the coil spring bearing against the bifurcation of the plunger and against the rear wall of a channel bracket **161**. It will also be seen that the bracket **161** is mounted upon the upper and lower retaining plates **155** and **155***a* respectively.

It will also be seen that the peripheral surface of the rollers **157** are positioned rearwardly of the respective inner edges of the upper and lower retaining plates **155** and **155***a*. These rollers are positioned in obstructing relation to the path of travel of the cam elements **62** of each inspection cell **18** so that the cam elements of the inspection cells will be successively engaged by the rollers during rotative movement of the multi-cell inspection unit **17**. Thus when the cam elements **62** for each inspection cell are engaged by the rollers **157**, the cam elements will be shifted inwardly of the cell to initiate the inspection cycle.

It will also be seen that a second set of retaining plates are provided which are positioned between the acceptance discharge station **147** and the reject discharge station **148**. The second set of retaining plates includes an upper retaining plate **162** and a lower retaining plate **162***a* suitably mounted on certain of the vertical support posts **13** which are disposed between these stations. It is pointed out that the upper and lower retaining plates **162** and **162***a* are of substantially identical shape and are disposed in substantially parallel relation with the inner edges thereof extending into the inspection cells during movement of the cells between the acceptance discharge station and the reject discharge station. Thus the inner edge **163** of the upper retaining plate **162** and the inner edge **163***a* of the lower retaining plate **162***a* actually constitute means for positively retaining the cans within the cells through movement of the inspection cells between the acceptance discharge station and the reject discharge station.

OPERATION

During operation of the inspection apparatus **10**, the receptacles or containers to be inspected will be fed by conventional gravity feed conveyor means or other conveyor means into the in-feed mechanism **112**. It is pointed out that while the apparatus **10** is specifically designed to inspect generally rectangular shaped containers such as sealed metal cans, it is contemplated that the apparatus and method described herein can be utilized to inspect sealed receptacles or containers having other shapes and configurations.

As the containers or cans designated by the reference character C are successively fed into the in-feed mechanism **112**, those cans which are so deformed that the cans will not pass beneath the first skimmer belt **118** will be immediately impelled laterally by the skimmer belt. However, those cans which are vertically compressed and are laterally distended will pass beneath the first skimmer belt but will be tilted by co-action of the fixed vertical plate **126**, the spring urged pressure plate **127** and the track member **130**, so that this type of deformed can will be engaged and quickly impelled laterally by the second skimmer belt **132**. Those cans or containers which pass below and beyond the second skimmer belt **132** will be impelled by the accelerator elements **137** into the in-

spection cell **18** which has been moved into registering relation with the pathway defined by the in-feed mechanism.

The can or container will then be seated in snug fitting relation with respect to the upper and lower can guide members **37** of the inspection cell and against the bias of the plunger mechanism **149** which will be retracted slightly. The multi-cell inspection unit **17** will be continuously driven during operation of the apparatus by the drive mechanism therefor and the inspection cell will be shifted from the feed-in station **146** towards the acceptance discharge station **147**. The outwardly disposed surface of the can positioned within the inspection cell will be quickly engaged by the respective inner edges of the upper and lower retaining plates **155** and **155***a* respectively so that the can to be inspected will be positively retained within the inspection cell against the bias of the associated plunger mechanism **149**.

As the multi-cellular inspection unit **17** revolves from the feed-in station towards the acceptance discharge station, the rollers **157** engage the cam elements **62** of the upper and lower bead inspection mechanism **36** for each cell and produce retractive movement of the respective upper and lower mask plate members relative to the associated tumbler carriage member and guide plate. When the mask plate member **49** of each bead inspection mechanism is shifted rearwardly, the apertures **54** will be moved into registering relation with the pins **44** in the associated tumbler carriage member. In the event that the container or can to be inspected has no deformities in the upper anad lower beads, upward movement of the tumbler pins **44** will be prevented by the respective upper and lower beads of the container as the same is seated in the inspection cell. Therefore when the cam elements **62** for each cell are moved past the rollers **157**, the spring **56** for each mask plate member **49** will urge the same forwardly to its returned position.

During this bead inspection operation, the lock member **76** will be carried rearwardly by its associated mask plate member and will be cammed by the camming surface **47***a* on the associated guide plate **47** so that the lock member **76** of both the upper and lower bead inspection mechanism will be disposed in obstructing relation with the rear portion of the bead of the receptacle. Upon retraction of the upper and lower mask plate members **49**, the associated lock members will be returned to their retracted position by the associated spring elements which normally urges the lock member into its co-planar relation with its mask plate member.

The drive shaft **94** will also be axially retracted during the bead inspection operation and the rectilinear movement thereof will be transmitted through the racks **93** and through the gear trains to the cam shafts **86** and thereby cause the rotary cam elements to be revolved. Rotation of the rotary cam elements **87** causes swinging movement of the feeler elements **83** whereby the arcuate inner feeler surfaces **83***a* of the feeler elements will be moved through the concavity of the container which occurs when the contents of the container have been packed under a predetremined vacuum. These feeler elements **83** are spaced a predetermined distance so that they will be moved through the zone wherein the greatest degree of concavity occurs if a sufficient minimum predetermined vacuum or negative pressure is present within the can to be inspected. Thus the feeler elements and cam actuators therefor serve to measure the exterior width of the cans at the zone of the opposed walls where the expected greatest concavity will occur in the event that the minimum vacuum exists within the can. If the minimum predetermined vacuum does exist, the cam elements **87** will be allowed to revolve through 360° and the feeler elements will clear the walls of the can in their oscillating movement.

In the event that an insufficient vacuum or negative pressure is present within the can or container to be inspected, the sides of the container will not be collapsed inwardly to the degree to permit clearing of the cam actuated feeler elements **83** during oscillating movement thereof. Thus the cam elements **87** will not be able to revolve through an orbit of 360° and each cam element acting through the associated gear train and rack **93** of the drive transmitting sleeve **92**, will lock the drive transmitting sleeve **92** and permit relative movement thereof with respect to the drive shaft **94**. Therefore upon further retractive movement of the drive shaft **94**, the lock member **96** associated therewith will become disengaged from the lock engaging member **100** on the drive transmitting sleeve **92** and will be urged upwardly into engaging relation with the hook element of the lock supporting member **73**.

When the lock member **96** engages the hook element **75**, the lock supporting member along with the lower mask plate member will also be urged rearwardly to cause the lock member **76** to be cammed upwardly into obstructing relation with respect to the bead of the can being inspected. Therefore even though the upper and lower beads of the can are not damaged, the can will be retained within the inspection cell when an insufficient vacuum exists. The reciprocating movement of the drive shaft **94** is such that the lock member **76** will be locked against the lower surface of the can, in the event that an insufficient vacuum exists therein, during movement of the associated inspection cell as it moves past the acceptance discharge station. It is pointed out that as the inspection cell moves past the acceptance discharge station, the upper and lower retaining plates **155** and **155***a* will no longer be disposed in retaining relation with the can being inspected, and the inspection cell will not have been moved sufficient distance so that the retaining plates **162** and **162***a* retain the can within the cell. Therefore the feeler elements and the lock member **76** serve to retain the can in the inspection cell in the event that such a can has an insufficient negative pressure or partial vacuum therewithin.

During further rotative movement of the multi-cell inspection unit **17**, the drive shaft **94** will be axially extended to its original position thereby allowing the lock member **96** to be interlocked with the lock engaging member **100** and also permitting return of the mask member and lock member **76** associated therewith to their original extended position. The inspection cell in which the defective can is positioned will have been moved in its orbit of rotation to a position wherein the upper and lower retaining plates **162** and **162***a* engage and retain the can within the inspection cell and the lock member **96** when interlocked with the lock engaging member **100** will cooperate therewith to urge the lock mounting member **95** in a retractive direction. This action will revolve the cam elements **87** whereby the feeler elements will be relived from gripped relation with respect to the can being inspected. It will therefore be seen that the upper and lower plates **162** and **162***a* after passage of the inspection cell beyond the acceptance discharge station comprise the sole retaining means of the can within the inspection cell **18**.

In the event that the container or can being inspected has a defective bead at its upper or lower peripheries, one of the pins **44** or tumblers will escape upwardly into the mask plate member adjacent the area formed by the deformed bead. When this occurs, the mask plate member **49** will be prevented from returning to its extended position by the interengagement of the shoulder of the escaped pin **44** with the mask plate member so that the mask plate member is retained in its retracted position. As pointed out above, when the mask plate member is in its retracted position, the lock member **77** will extend upwardly into interlocked or obstructing relation with respect to the can or container being inspected. Thus the container will be locked within the inspection cell by the lock member **76** and the interlocked relation between the pin or pins **44** with respect to the mask plate

member, and the mask plate member 49 will be retracted until the support rods 66 are moved axially outwardly to permit seating of the tumbler carriage member 41 upon the convex support elements 67. The cam plates 107 for the support rods 66 are arranged and constructed so that the support rods will not be axially extended until the associated inspection cell 18 is moved beyond the acceptance discharge station. It will be therefore be seen that as the support rods 66 are extended, the convex support elements will be moved into registering relation with the arcuate recesses 68 in the associated tumbler carriage member 41. The arcuate recesses in the tumbler carriage member 41 will seat upon the convex support elements 67 so that the tumbler carriage member will have moved in a direction away from the associated mask plate member 49. Thus the pins 44 carried by the tumbler carriage member will be moved inwardly and any escaped pin will be moved out of obstructing relation with respect to the the associated mask plate member 49. The mask plate member 49 will then be caused to return to its normal extended position by action of the helical spring 46 and the lock member 76 will be allowed to return to its normal retracted position.

The defective can will then be retained in place in the inspection cell by the respective upper and lower retaining plates 162 and 162*a* respectively since the inspection cell will have moved at this time beyond the acceptance discharge station. The reaining plates 162 and 162*a* will retain the can or container within the inspection cell until the cell is revolved to the reject discharge station 148.

As the inspection cell reaches the reject discharge station, any defective can positioned therein will no longer be retained by the upper and lower retaining plates 162 and 162*a* since the inspection cell will be moved beyond these retaining plates. The sleeve member 151 of the plunger mechanism 149 will co-act with the cam 154 as the inspection cell reaches the reject discharge station to tension the spring 152 whereby the defective cans will be forcibly ejected from the inspection cell. This tensioning of the spring 152 by co-action of the sleeve member 151, the cam 154 is desirable so that any deformed can which might be wedged in seated relation in the can guide members 137 will be ejected therefrom. Continued movement of the multi-cell inspection unit will return the inspection cell to the feed-in station 146 wherein the cycle will begin once again. As pointed out above, the multi-cell inspection unit revolves at approximately thirteen r.p.m. and the containers are continuously inspected and automatically discharged at the acceptance discharge station or automatically discharged at the reject discharge station.

It has been found through experience that containers such as the rectangular shaped metallic cans which contain a food product packed therein under a predetermined vacuum will have their opposed larger sides inwardly collapsed as a result of the presence of such a partial vacuum or negative pressure. It has been found through experience that the external dimension between the walls at the zone wherein the expected greatest degree of concavity will occur should be of a predetermined size. Therefore the sides must have collapsed inwardly a predetermined amount if the desired partial vacuum exists. If the minimum predetermined vacuum is not present then the container or can was ineffectively packed or the can contains a leak. Similarly, damaged beads quite often results in minute leaks thereat and the foregoing apparatus and method permits complete and accurate inspection of such cans to determine damage to the can and to also determine if the minimum desirable predetermined vacuum is present.

From the foregoing, it will be seen that I have provided a novel method and apparatus for simultaneously inspecting containers packed with a product under a partial vacuum, to determine if a desirable predetermined negative pressure exists within the container, and to also determine the presence, if any, of any deformations or damage to the respective beads of the container.

It will also be seen from the preceding paragraphs that the novel method and apparatus is capable of high capacity continuous line operation and is therefore especially adaptable for use in meat packing plants and the like.

Thus it will be seen that I have provided a highly novel method and apparatus for inspecting packed containers, which permits a great saving in both time and labor with respect to conventional container inspection procedures.

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 is claimed is:

1. A method of inspecting sealed symmetrically shaped containers, containing a product packed therein under a partial vacuum, and having upper and lower peripheral beads, to determine if a predetermined partial vacuum exists within the container, and to detect damage or deformation to the beads of the container, said method consisting in

positioning a packed container to be inspected in 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 dimension 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 non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the 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,

simultaneously during said measuring operation inspecting the respective upper and lower beads of the container with mechanical sensing media to detect any deformation thereto,

automatically locking the container within the inspection cell in response to detection of deformation in one of the upper and lower beads of the container, and in response to determination that the measured zone of the container is greater than said predetermined size,

and retaining the defective container in interlocked relation within the inspection cell during travel thereof through the acceptance discharge station and ejecting the defective container at the reject station, but ejecting non-defective containers at the acceptance discharge station.

2. A method of inspecting generally rectangular shaped sealed containers, containing a product packed therein under a partial vacuum, and having upper and lower peripheral beads, to determine if a predetermined partial vacuum exists within the container, and to detect damage or deformation to the beads of the container, said method consisting in

positioning a packed container to be inspected in 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 receptacle between the opposed walls at the zone wherein the greatest degree of concavity occurs when the pre-

determined minimum vacuum exists is of predetermined size,

shifting the inspection cell to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return of the inspection cell to the 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,

simultaneously during said measuring operation inspecting the respective upper and lower beads of the container with mechanical sensing media to detect any deformation thereto,

automatically ejecting non-defective containers at the acceptance discharge station,

automatically locking a defective container within the inspection cell in response to detection of deformation in one of the upper and lower beads of the container, and in response to a determination at the measured zone of the container is greater than said predetermined size,

and retaining the defective container in interlocked relation within the inspection cell during travel thereof through the acceptance discharge station and ejecting the defective container at the reject discharge station.

3. A method of inspecting generally rectangular shaped sealed containers, containing a product packed therein under a partial vacuum, to determine if a predetermined partial vacuum exists within the container, said method consisting in

positioning a packed container to be inspected in 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 dimension 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 non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return of the inspection cell to the 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 interlocked relation within the inspection cell during travel thereof through the acceptance discharge station and ejecting the defective container at the reject discharge station, but permitting ejection of the non-defective conainer at the acceptance discharge station.

4. A method of inspecting sealed symmetrically shaped packed containers having upper and lower continuous peripheral beads, to detect damage or deformation to the beads of the container, said method consisting in

positioning a packed container to be inspected in predetermined orientation within the inspection cell,

shifting the inspection cell to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged and thereafter return to the container receiving station,

during shifting of the inspection cell from the receiver station to the acceptance discharge station, simultaneously inspecting the respective upper and lower beads of the container with mechanical sensing media to detect any deformation thereto,

automatically ejecting non-defective containers at the acceptance discharge station,

automatically locking the container within the inspection cell in response to detection of deformation in one of the upper and lower beads of the container,

and retaining the defective container in interlocked relation within the inspection cell during travel thereof to the acceptance discharge station and ejecting the defective container at the reject discharge station.

5. A method of inspecting in one cycle of operation, a sealed symmetrically shaped container, containing a product packed therein under partial vacuum, and having upper and lower peripheral beads, to determine if a predetermined partial vacuum exists within the container, and to detect damage or deformation to the beads of the container, said method consisting in

positioning a packed container to be inspected in predetermined orientation within the 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 dimension of the container between the opposed walls at the zone of the greatest concavity is of predetermined size,

revolving the cell in one cycle of operation from a container receiving station, wherein the container is received within the cell, to an acceptance discharge station wherein non-defective containers are discharged, then to reject discharge station wherein defective containers are discharged and thereafter return to the container receiver station,

mechanically measuring, during revolving movement of the inspection cell from the receiving station to the acceptance discharge station, 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,

simultaneously during said measuring operation, inspecting the respective upper and lower beads of the container with mechanical sensing media to detect any deformation thereto,

ejecting non-defective containers at the acceptance discharge station,

automatically locking the containers within the inspection cell in response to detection of deformation in one of the upper and lower beads of the container, and in response to a determination that the measured zone of the container is greater than said predetermined size,

and retaining the defective container in interlocked relation within the inspection cell during revolving movement thereof through and beyond the acceptance discharge station and ejecting the defective container at the reject station.

6. The method as defined in claim 5 wherein the containers being inspected are of substantially rectangular configuration.

7. Inspection apparatus for inspecting sealed symmetrically shaped containers, containing a product packed therein under partial vacuum, and having upper and lower peripheral beads, to determine if a desired predetermined partial vacuum exists within the containers, and to detect damage or deformation to the beads of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed walls of a 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 wherein the greatest degree of concavity occurs, when the predetermined minimum vacuum exists, is of a predetermined size,

structure mounting said inspection cell structure for travel from a container receiver station wherein the container is received therein, 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 degree of greatest concavity occurs when the desired minimum predetermined vacuum exists therein,

bead inspection means within said inspection cell structure operable during operation of said measuring means to simultaneously engage the respective upper and lower beads of the container to detect any deformation thereto,

locking means within said inspection cell structure being automatically operable in response to detection of deformation in one of the upper and lower beads of the container, and in response to determination that the measured zone of the container is greater than said predetermined size, to releasably lock the container within the inspection cell structure during travel thereof through the acceptance discharge station, said locking means being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

8. Inspection apparatus for inspecting sealed symetrically shaped containers, containing a product packed therein under partial vacuum, and having upper and lower peripheral beads, to determine if a desired predetermined partial vacuum exists within the container, and to detect damage or deformation to the beads of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed walls of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein so that the exterior dimension of the container between the opposed walls at the zone wherein the greatest degree of concavity occurs when the predetermined minimum vacuum exists is of predetermined size,

means for shifting said cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein each non-defective container is discharged, then to a reject discharge station wherein each defective container is discharged, and thereafter return to the container receiver station,

means within said inspection cell operable during shifting movement of the latter to mechanically measure 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,

upper and lower bead inspection mechanisms within said inspection cell structure, simultaneously operable during operation of said measuring means to simultaneously engage the respective upper and lower beads of the container to detect any deformation thereto,

locking means within said inspection cell structure being automatically operable in response to detection of deformation in one of the upper and lower beads of the container and in response to determination that the measured zone of the container is greater than said predetermined size, to releasably lock the container within the inspection cell structure during travel thereof through and beyond the acceptance discharge station,

said locking means being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject non-defective containers at said acceptance discharge station and to eject the defective containers at the reject discharge station.

9. The apparatus as defined in claim 8 wherein each of said bead inspection mechanisms includes a pair of carriage members mounted at the upper and lower portions of said inspection chamber,

each of said carriage members having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the adjacent bead of the container to be inspected, each of said pins being shiftable from a retracted position to a bead engaging position to engage the adjacent surface portion of the container bead during said inspection operation and for return to said retracted position if the adjacent surface portion of the bead is not deformed, and each pin being shiftable beyond said bead engaging position to an escape position when the adjacent surface portion of the container bead to be engaged is deformed,

and said lock means being operable to lock the defective container within the inspection cell when one of said pins is in the escape position during travel of the inspection cell structure through and beyond the acceptance discharge station and being releasable when said inspection cell structure is shifted to the reject discharge station.

10. The apparatus as defined in claim 8 wherein said measuring means comprises 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 walls 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 the predetermined size,

and actuator means for oscillating said feeler elements during travel of said cell structure.

11. Inspection apparatus for inspecting generally rectangular shaped sealed containers, containing a product packed therein under a predetermined partial vacuum, to determine if the predetermined desired partial vacuum exists within the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving the packed container in predetermined position therein, one 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 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 said cell structure, to a 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 walls 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 cam means for oscillating said feeler elements,

locking mechanism operatively connected with said actuator cam means and including a locking element within said inspection cell structure being shiftable into and out of interlocked relation with respect to the container being inspected, said lock element being shiftable into locked relation with respect to the container in response to engagement of a feeler element with one of the opposed walls of the container being inspected, to thereby lock the container within the cell structure during travel thereof through and beyond the discharge station, said locking means being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

12. The apparatus as defined in claim **11** wherein said feeler elements are oscillatable about substantially vertical axes.

13. Inspection apparatus for inspecting generally rectangular shaped sealed containers, containing a product packed therein under a predetermined partial vacuum, to determine if the desired predetermined partial vacuum exists within the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed walls of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein so that the exterior dimension 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,

means for shifting said cell structure from a container receiving station wherein a container is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station,

means within said inspection cell structure operable during shifting movement of the latter to mechanically measure the exterior dimension of the container between the opposed walls thereof at the zone wherein the greatest degree of concavity occurs when the desired minimum predetermined vacuum exists within the container,

said measuring means comprising a pair of laterally spaced-apart feeler elements mounted within said cell structure for oscillating movement towards and away from each other about substantially vertical axes, said feeler elements having opposed feeler surfaces simultaneously movable during oscillating movement of the feeler elements in orbits through the concave spaces defined by the opposed concave walls of the container when the predetermined partial vacuum exists within the container, said feeler surfaces of said feeler elements engaging the opposed walls of the container when the measured zone thereof is greater than the predetermined size,

a pair of rotary cam elements each being engageable with one of said feeler elements and being revolvable about a substantially vertical axis for oscillating said feeler elements during travel of said inspection cell structure,

locking mechanism operatively connected with said rotary cam element and including a locking element within said inspection cell structure being shiftable into and out of locking relation with respect to the container being inspected, said locking element being shiftable into interlocked relation with respect to the container when one of said feeler elements engages the adjacent wall of the container being inspected to lock the container within the inspection cell structure during travel thereof through and beyond the acceptance discharge station, said locking element being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

14. The apparatus as defined in claim **13** wherein said inspection cell during travel thereof in one cycle of operation is revolvable in a circular orbit through 360°.

15. Inspection apparatus for inspecting generally rectangular shaped sealed containers, containing a product packed therein under predetermined partial vacuum, to determine if the desired predetermined partial vacuum exists within the container, said apparatus comprising

a multi-cell unit including a plurality of substantially identical outwardly opening, juxtaposed inspection cell structures each defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed walls of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein so that the exterior dimension of the container between the opposed wall at the zone wherein the greatest degree of concavity occurs is of predetermined size,

structure revolvably mounting said multi-cell inspection unit which in one complete revolution revolves a given inspection cell structure from a container receiving station wherein a container is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station,

each of said inspection cell structures having means operable during revolving movement thereof to mechanically measure the exterior dimension of the container between the opposed walls thereof at the zone wherein the greatest degree of concavity occurs when the desired minimum predetermined vacuum exists within the container,

said measuring means for each inspection cell structure comprising a pair of laterally spaced-apart feeler elements mounted within each cell structure for oscillating movement towards and away from each other about substantially vertical axes, said feeler elements having opposed feeler surfaces simultaneously mov-

able during oscillating movement of the feeler elements in orbits through the concave spaces defined by the opposed concave walls of the container when the predetermined partial vacuum exists within the container, said feeler surfaces of said feeler elements engaging the opposed walls of the container when the measured zone thereof is greater than the predetermined size,

a pair of rotary cam elements for each inspection cell structure, each cam element being engageable with one of said feeler elements and being revolvable about a substantially vertical axis for causing oscillating movement of the associated feeler elements during revolving movement of said inspection cell structure,

locking mechanism for each inspection cell structure operatively connected with said rotary cam elements and including a locking element within each inspection cell structure being shiftable into and out of locking relation with respect to the container being inspected, said locking element being shiftable into interlocked relation with respect to the container when one of said feeler elements engages the adjacent wall of the container being inspected to lock the container within the inspection cell structure during movement thereof through and beyond the acceptance discharge station, said locking element being automatically releasable when the associated inspection cell structure is shifted to the reject discharge station,

and ejection means for each inspection cell structure operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

16. The apparatus as defined in claim 15 and a pair of immovable container retaining members fixedly mounted adjacent said multi-cell inspection unit, one of said retaining members extending between said container receiver station and said acceptance discharge station, and the other of said members extending between the acceptance discharge station and the reject discharge station.

said one retaining member having a curved surface projecting inwardly of each inspection cell structure during travel of the cell structure between said container receiver station and said acceptance discharge station to engage and retain the container therein,

and said other retaining member having a curved surface projecting inwardly of each inspection cell structure during travel thereof between the acceptance discharge station and the reject discharge station to engage and retain the container therein.

17. Inspection apparatus for inspecting sealed symmetrically shaped containers having a continuous upper and a continuous lower peripheral bead, to detect damage or deformation to the bead of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein,

guide and positioning means within said inspection cell structure to orient the container in predetermined position therein,

means for shifting said inspection cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station.

upper and lower bead inspection mechanisms operatively associated with said inspection cell structure for simultaneously engaging and inspecting the upper and lower beads of the container to detect any deformation thereto,

each of said bead inspection mechanisms including a carriage member having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the adjacent bead of the container to be inspected, each of said pin elements being shiftable from a retracted position to a bead engaging position to engage the adjacent surface portion of the container bead during said inspection operation and for return to said retracted position if the adjacent surface portion of the bead is not deformed, and each pin element being shiftable beyond said bead engaging position to an escape position when the adjacent surface portion of the container bead to be engaged is deformed,

locking mechanism operatively associated with said inspection cell structure and being operatively connected with said bead inspection mechanism and including a locking element within said inspection cell being shiftable into and out of locking relation with respect to the container being inspected, said locking element being shiftable into interlocked relation with respect to the container when one of the pin elements of one of said bead inspection mechanisms is in the escape position during travel of the inspection cell structure through and beyond the acceptance discharge station, said locking element being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

18. Inspection apparatus for inspecting symmetrically shaped containers of the type having a continuous peripheral bead, to detect damage or deformation to the bead of a container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein,

said inspection cell structure having container positioning and guide means therein to orient a container in a predetermined position therein,

means for shifting said cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station where non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station,

a bead inspection mechanism for engaging and inspecting the bead of the container during travel of the inspection cell structure between said container receiver station and said acceptance discharge station,

said bead inspection mechanism including a carriage having a pluarity of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the adjacent bead of the container to be inspected.

each of said pin elements being shiftable from a retracted position to a bead engaging position to engage the adjacent surface portion of the container bead during the inspection operation and for return to said retracted position if the adjacent surface portion of the bead is not deformed, and each pin element being shiftable beyond said bead engaging position to an escape position when the adjacent surface portion of the bead to be engaged is deformed,

locking mechanism operatively connected with said bead inspection mechanism and including a locking element within said inspection cell structure shiftable into and out of locking relation with respect to the container being inspected, said locking element being shiftable into interlocked relation with respect to the container when one of said pin elements is in the escape position during travel of the inspection cell

structure through and beyond said acceptance discharge station and being releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

19. Inspection apparatus for inspecting sealed symmetrically shaped containers and having a continuous peripheral bead, to detect damage or deformation to the bead of the container, said apparatus comprising

inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein,

container positioning and guide means within said inspection cell structure to orient a container in predetermined relation therein,

means for shifting said inspection cell structure from a container receiver station wherein a container to be inspected is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station,

bead inspection mechanism operatively associated with said inspection cell structure and being operable during travel of the inspection cell structure to engage and inspect the bead of the container to detect any deformation or damage thereto,

said bead inspection mechanism including a carriage structure having a pluraliy of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the bead of the container to be inspected, each of said pin elements having a reduced end portion projecting towards the container bead,

means for normally urging said pin elements towards the bead of the container,

a mask member mounted on said pin carriage structure and engaging the bead of the container positioned within the inspection cell structure, and being shiftable relative to the carriage structure between a normally extended position and a retracted bead inspecting position,

said mask member having a plurality of apertures therein arranged to receive the pin elements therethrough, said apertures in said mask member being shaped and contoured whereby the mask member when in the extended position retracts the pin elements out of engaging relation with respect to the bead of the container, and when said mask member is shifted to the retracted bead inspecting position, allowing extension of the pin elements into engaging relation with respect to the bead of the container, each pin element being shiftable beyond said extended position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed,

locking mechanism operatively connected with said mask member and including a locking element within said inspection cell structure being shiftable into and out of locking relation with respect to the container being inspected, said locking element being shiftable into interlocked relation to the container when one of said pin elements is in the escape position to lock the container within the inspection cell structure during travel thereof through and beyond the acceptance discharge station,

lock releasing means interrelated with said locking mechanism and being operable during shifting movement of said inspection cell structure to automatically release said locking element when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

20. The apparatus as defined in claim 19 wherein said locking element is mounted for shifting movement on said mask member.

21. The apparatus as defined in claim 19 and means for shifting said mask member during travel of said cell structure including a pair of cam elements, one of which is mounted on said mask member and the other of which is mounted exteriorly of the inspection cell structure.

22. The apparatus as defined in claim 19 and a pair of immovable container retaining members one of which extends between said container receiver station and said acceptance discharge station and the other of said members extending between the acceptance discharge station and the reject discharge station,

said one retaining member having a surface thereof projecting inwardly of said inspection cell structure during travel thereof between said container receiver station and said acceptance discharge station to engage and retain the container therein,

and said other retaining member having a surface projecting inwardly of said inspection cell structure during travel thereof between the acceptance discharge station and the reject discharge station to engage and retain the container therein.

23. Inspection apparatus for inspecting sealed symmetrically shaped containers having a continuous peripheral bead to detect damage or deformation to the bead of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein,

positioning and guide means within said inspection cell structure to orient a container in predetermined relation therein,

means for shifting said inspection cell structure in one cycle of operation from a container receiver station wherein a container to be inspected is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein the defective containers are discharged, and thereafter return to the container receiver station,

bead inspection mechanism operatively associated with said inspection cell structure and being operable during travel of the inspection cell structure to engage and inspect the bead of the container to detect any deformation or damage thereto,

said bead inspection mechanism including a carriage structure having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the bead of the container to be inspected, each of said pin elements having a reduced end portion projecting towards the container bead,

means for normally urging said pin elements towards the bead of the container,

a mask member mounted on said pin carriage structure and engaging the bead of the container positioned within the inspection cell structure, and being shiftable relative to the carriage structure between a normally extended position and a retracted bead inspecting position,

said mask member having a plurality of apertures therein arranged to receive the pin elements therethrough, said apertures in said mask member each being of a shape and size so that the mask member when in the normally extended position retains each pin element in a retracted position out of engaging relation with respect to the bead of the container, and when said mask member is shifted to the retracted bead inspecting position, allowing extension of the pin elements into engaging relation with re-

spect to the bead of the container, each pin element being shiftable beyond said extended position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed, and to thereby lock the mask member against return to the normally extended position,

locking mechanism for locking a container within the cell structure during said inspection operation and including a locking element carried by said mask member and being shiftable therewith into locking relation with the container when said said mask member is shifted to the retracted bead inspecting position, and being shiftable out of locked relation with the container when said mask member is in the normally extended position, whereby when one of said pin elements is in the escape position, the container will be locked within the inspection cell structure by said locking element during travel of the inspection cell structure through and beyond the acceptance discharge station,

lock releasing means interrelated with said locking mechanism and being operable during shifting movement of said inspection cell structure to cause shifting movement of said pin carriage structure in a direction to return any pin element from the escape position to the retracted position when said inspection cell structure is shifted to the reject discharge station.

and ejection means operable to eject non-defective containers at the acceptance discharge station and being operable to eject defective containers at the reject discharge station.

24. The apparatus as defined in claim **23** wherein the apertures in said mask member are of generally key-hole configuration.

25. The apparatus as defined in claim **23** wherein said inspection cell structure during travel thereof in one cycle of operation is revolvable in a generally circular orbit of 360°.

26. Inspection apparatus for inspecting symmetrically shaped sealed containers of the type having a continuous peripheral bead, to detect damage or deformation to the bead of the container, said apparatus comprising

a multi-cell unit including a plurality of substantially identical outwardly opening, generally circularly arranged inspection cell structures each defining an inspection chamber therewithin for receiving a container to be inspected therein,

structure revolvably mounting said multi-cell inspection unit about a substantially vertical axis and wherein in one complete revolution revolves a given inspection cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein a non-defective container is discharged, then to a reject discharge station wherein a defective container is discharged, and thereafter return to the container receiver station,

each of said inspection cell structures having positioning and guide means therein to orient a container in predetermined relation within the cell structure chamber,

each inspection cell structure having a bead inspection mechanism for engaging and inspecting the bead of the container during travel of the cell structure between said container receiver station and said acceptance discharge station,

each of said bead inspection mechanisms including a carriage having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the adjacent bead of the container to be inspected,

means for normally urging said pin elements towards the bead of the container,

means mounted on each of said carriage structures and engaging the bead of the container positioned within the associated inspection cell structure and being shiftable relative to the carriage structure between a normally extended position and a retracted inspecting position,

said last mentioned means when in a normally extended position being arranged and constructed to retain the pin elements in a retracted position out of engaging relation with respect to the bead of the container, and when in the retracted bead inspecting position, allowing extension of the pin elements into engaging relation with respect to the bead of the container, each pin element being shiftable beyond said extended bead engaging position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed, to thereby retain said last mentioned means in the retracted bead inspecting position,

locking mechanism for each inspection cell structure operatively connected with the associated bead inspection mechanism and including a locking element within the associated inspection cell structure being shiftable into and out of locking relation with respect to the container being inspected, said locking element being retained in interlocked relation with respect to the container when one of said pin elements is in the escape position to retain the container within the inspection cell structure during travel thereof through and beyond the acceptance discharge station,

lock releasing means for each of said inspection cell structures interrelated with the associated locking mechanism thereof and being operable during shifting movement of each inspection cell structure to automatically release the associated locking element when said inspection cell structure is shifted to the reject discharge station,

and ejection means for each inspection cell structure operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

27. The apparatus as defined in claim **26** and a pair of immovable container retaining members fixedly mounted adjacent said multi-cell inspection unit, one of said retaining members extending between said container receiver station and said acceptance discharge station, and the other of said members extending between the acceptance discharge station and the reject discharge station,

said one retaining member having a curved surface projecting inwardly of each inspection cell structure during travel of the cell structure between said container receiver station and said acceptance discharge station to engage and retain the container therein,

and said other retaining member having a curved surface projecting inwardly of each inspection cell structure during travel thereof between the acceptance discharge station and the reject discharge station to engage and retain the container therein.

28. Inspection apparatus for inspecting symmetrically shaped sealed containers having a continuous upper and a continuous lower peripheral bead, to detect damage or deformation to the bead of the container, said apparatus comprising

a multi-cell unit including a plurality of substantially identical outwardly opening, generally circularly arranged inspection cell structures, each defining an inspection chamber therewithin for receiving a container to be inspected therein,

structure revolvably mounting said multi-cell inspection unit about a substantially vertical axis which in one complete revolution revolves a given inspection cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein non-defective containers are discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter to the container receiver station,

each inspection cell structure having an upper and a lower bead inspection mechanism for simultaneously engaging and inspecting the respective upper and lower beads of the container to detect any deformation thereto during travel of the inspection cell structure between the acceptance discharge station and the reject discharge station,

each of said bead inspection mechanisms for each inspection cell structure including a carriage structure having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the bead of the container to be inspected,

means for normally urging the pin elements for each carriage structure towards the bead of the container,

each carriage structure having a mask member mounted thereon engaging the bead of the container positioned within the inspection cell structure and being shiftable relative to the carriage structure between a normally exended position and a retracted bead inspecting position, and when in said normally extended position retaining the pins of the associated carriage structure in a retracted position out of engaging relation with respect to the bead of a container,

said mask member having a plurality of apertures therein shaped and sized to permit the passage of the pin elements of the associated carriage structure therethrough from the retracted position to an extended position when the mask member is shifted to said retracted bead inspecting position wherein the pin elements engage the adjacent bead of the container, each pin element being shiftable beyond said extended position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed,

each mask member having a locking element carried thereby, each locking element being shiftable into and out of locking relation with respect to a container being inspected, and being retained in interlocked relation with the container when one of the pins of the associated carriage structure is in the escape position to lock the container within the inspection cell structure during travel thereof through and beyond the acceptance discharge station,

lock releasing means interrelated with each of said locking elements and being operable during shifting movement of each inspection cell structure to automatically release each locking element when the associated inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

29. Inspection apparatus for inspecting sealed symmetrically shaped containers, containing a product packed therein under partial vacuum and having a continuous peripheral bead, to determine if the desired predetermined partial vacuum exists within the container, and to detect damage or deformation to the bead of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein,

one pair of opposed wall portions of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein so that the exterior dimension of the container between the opposed wall portions at the zone wherein the greatest degree of concavity occurs, is of predetermined size,

means for shifting said cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein each non-defective container is discharged, and then to a reject discharge station wherein each defective container is discharged, and thereafter return to the container receiver station,

means within the inspection cell structure operable during shifting movement of the latter from the container receiver station to the acceptance discharge station to mechanically measure the exterior dimension of the container between the opposed wall portions thereof at the zone wherein the greatest degree of concavity occurs when the desired minimum predetermined vacuum exists therein,

a bead inspection mechanism simultaneously operable during operation of said measuring means to engage and inspect the bead of the container to detect any deformation or damage thereto,

said bead inspection mechanism including a carriage structure having a plurality of pin elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the bead of the container being inspected,

means for normally urging said pin elements towards the bead of the container,

means mounted on said carriage structure and engaging the bead of the container positioned within the inspection cell structure and being shiftable relative to the carriage structure between a normally extended position and a retracted inspecting position,

said last mentioned means when in the normally extended position being arranged and constructed to retain the pin elements in a retracted position out of engaging relation with respect to the bead of the container, and when in the retracted bead inspecting position, allowing extension of the pin elements into engaging relation with respect to the bead of the container, each pin element being shiftable beyond said extended position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed, to thereby retain said last mentioned means in the retracted bead inspecting position,

locking mechanism operatively connected with said measuring means and said bead inspection mechanism and including a locking element within said inspection cell structure and being shiftable into and out of locking relation with respect to the container being inspected, said locking element being retained in interlocked relation with the container when one of said pin elements is in the escape position,

means operatively connected with said measuring means and said locking element to retain said locking element in interlocked relation with the container when the measured zone thereof is greater than said predetermined size,

lock releasing means interrelated with said locking mechanism and being operable during shifting movement of said inspection cell structure to automatically release said locking element when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

30. Inspection apparatus for inspecting sealed symmetrically shaped containers, containing a product packed therein under a partial vacuum, and having a continuous peripheral bead, to determine if the desired predetermined partial vacuum exists within the container, and to detect damage or deformation to the bead of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed wall portions of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists within the container so that the exterior dimension of the container between the opposed wall portions at the zone wherein the great-

est degree of concavity occurs is of predetermined size,

means for shifting said inspection cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein each non-defective container is discharged, then to a reject discharge station wherein defective containers are discharged, and thereafter return to the container receiver station,

means within said inspection cell structure operable during shifting movement of the latter from the container receiver station to the acceptance discharge station to mechanically measure the exterior dimensions of the container between the opposed wall portions thereof at the zone wherein the greatest degree of 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 portions 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 of greater than said predetermined size,

actuator cam means for oscillating said feeler elements,

bead inspection mechanism including a carriage structure having a plurality of bead engaging elements shiftably mounted thereon and arranged in a pattern corresponding generally to the configuration of the bead of the container to be inspected,

means for urging said bead engaging elements towards the bead of the container,

a mask member shiftably mounted on said carriage structure and engaging the bead of the container positioned within the inspection cell structure, said mask member being shiftable relative to the carriage structure between a normally extended position and a retracted bead inspecting position, and when in said normally extended position retaining the bead engaging elements in a retracted position out of engaging relation with the bead of the container.

said mask member having a plurality of apertures permitting passage of said bead engaging elements therethrough from their retracted position to an extended position into engaging relation with respect to the bead of the container when said mask member is shifted into the retracted bead inspecting position, each bead engaging element being shiftable beyond said extended position to an escape position when the adjacent portion of the bead to be engaged thereby is deformed, and to thereby lock the mask member against return to the normally extended position,

locking mechanism for locking a container within the cell structure during said inspection and measuring operation including a locking element shiftable into and out of interlocked relation with a container within the cell structure during travel thereof between said container receiver station and said acceptance discharge station, said locking element being retained in interlocked relation with the container when said mask member is locked in the retracted bead inspecting position by one of said bead engaging elements,

means for retaining said locking element in interlocked relation with respect to the container when said feeler elements engage the opposed wall portions of the container,

lock releasing means interrelated with said locking mechanism and being operable during shifting movement of said inspection cell structure to automatically release the locking element from interlocked relation with the container when said inspection cell structure is shifted to the reject discharge station,

and ejection means for each inspection cell structure operable to eject the non-defective containers at the acceptance discharge station and being operable to eject the defective containers at the reject discharge station.

31. The apparatus as defined in claim **30** and means for shifting said mask member during travel of said cell structure between said container receiver station and said acceptance discharge station,

said mask member shifting means including a pair of cooperating cam elements, one of which is mounted on said mask member and the other of which is mounted exteriorly of the inspection cell structure.

32. The apparatus as defined in claim **30** and a pair of container retaining members fixedly mounted adjacent the path of travel of said inspection cell structure, one of said retaining members extending between said container receiver station and said acceptance discharge station, and the other of said members extending between the acceptance discharge station and the reject discharge station,

said one retaining member having the surface thereof projecting inwardly of said inspection cell structure during travel thereof between said container receiver station and said acceptance discharge station to engage and retain the container therein,

and said other retaining member having a surface thereof projecting inwardly of said inspection cell structure during travel thereof between the acceptance discharge station and the reject discharge station to engage and retain the container therein.

33. Inspection apparatus for inspecting sealed symmetrically shaped containers, containing a product packed therein under partial vacuum, and having a peripheral bead, to determine if a desired predetermined partial vacuum exists within the container and to detect damage or deformation to the bead of the container, said apparatus comprising

an inspection cell structure defining an inspection chamber therewithin for receiving a container to be inspected therein, one pair of opposed wall portions of the container normally presenting concave external surfaces when the desired minimum predetermined vacuum exists therein, so that the exterior dimension of the container between the opposed wall portions at the zone wherein the greatest degree of concavity occurs is of predetermined size,

means for shifting said cell structure from a container receiver station wherein a container is received therein, to an acceptance discharge station wherein each non-defective container is discharged, then to a reject discharge station wherein each defective container is discharged, and thereafter return to the container receiver station,

means for conveying containers to said container receiver station,

means for removing badly deformed containers from said conveyor means comprising a first impeller mechanism positioned transversely above said conveyor means and being disposed in obstructing relation to containers having a vertical dimension exceeding a predetermined size whereby vertically distended containers will be engaged and impelled laterally from the guideway by said first impeller mechanism,

a second impeller mechanism positioned transversely of said conveyor means and spaced from said first impeller mechanism and being operable to first tilt and thereafter laterally impel from the conveyor means deformed containers which are laterally distended,

means within said inspection cell operable during shifting movement of the latter to mechanically measure the exterior dimension of the container when the opposed walls thereof at the zone wherein the greatest degree of concavity occurs when the desired minimum predetermined vacuum exists therein,

bead inspection mechanism simultaneously operable during operation of said measuring means to engage the beads of the container to detect any deformation thereto,

locking means within said inspection cell structure being automatically operable in response to detection of deformation in the bead of the container and selectively in response to determination that the measured zone of the container is greater than the predetermined size, to releasably lock the container within the inspection cell during travel thereof through and beyond the acceptance discharge station,

said locking means being automatically releasable when said inspection cell structure is shifted to the reject discharge station,

and ejection means operable to eject non-defective containers at said acceptance discharge station and to eject defective containers at the reject discharge station.

34. The apparatus as defined in claim **33** wherein each of said impeller mechanisms includes an endless drive belt member.

35. The apparatus as defined in claim **33** wherein said measuring means comprises a pair of spaced-apart feeler elements mounted within said cell structure for oscillating movement towards and away from each other through the concave spaces defined by the opposed concave walls of the container when a 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 the predetermined size,

and actuator means for oscillating said feeler elements during travel of said cell structure between said container receiver station and said acceptance discharge station.

36. The apparatus as defined in claim **33** and an accelerator mechanism interposed between said second impeller mechanism and said container receiver station operable to accelerate movement of non-deformed containers towards said container receiver station.

37. The apparatus as defined in claim **33** wherein said inspection cell structure is revolvable during one complete cycle of operation from the receiver station and return thereto through a circular orbit.

38. A device for removing defective containers from an in-feed conveyor system used to convey containers to a processing station,

said device comprising an elongate passage defining structure having a fore-and-aft extending elongate guideway therein, the rear end of said guideway communicating with a conveyor system to receive containers therefrom, and the forward end of said guideway communicating with said process station whereby containers are conveyed along said guideway towards said process station,

a first impeller mechanism positioned transversely above said guideway adjacent said forward end and being disposed in obstructing relation to containers having a vertical dimension exceeding a predetermined size whereby vertically distended containers will be engaged and impelled laterally from the guideway by said first impeller mechanism,

a second impeller mechanism positioned transversely above said guideway adjacent said forward end thereof,

a pair of vertical plate members disposed on opposite sides of said guideway adjacent said second impeller mechanism, one of which is fixedly mounted on said passage defining structure and the other of said plate members being laterally shiftable from a normal gauging position to a retractive position,

a forwardly inclined track element positioned forwardly of said shiftable plate member and laterally thereof when the latter is in the normal gauging position,

said shiftable plate member being shiftable from said normal gauging position to the retracted position when a container passes therebetween having a width dimension exceeding a predetermined size, whereby laterally distended containers are guided upon said track element and laterally tilted into engaging relation with said second impeller mechanism to be laterally impelled from the guideway.

39. The device as defined in claim **38** wherein each of said first and second impeller mechanisms includes a driven endless belt member.

40. The device as defined in claim **38** wherein said first impeller mechanism comprises an elongate driven endless belt member, having a lower run transversely inclined toward the forward end of said guideway.

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