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Smith et al.

[11] **3,777,886**

[45] **Dec. 11, 1973**

[54] **APPARATUS FOR INSPECTING BODIES FOR THE PRESENCE OF HARD PARTICLES**

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[73] Assignee: **H. J. Heinz Company**, Pittsburgh, Pa.

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[21] Appl. No.: **278,543**

[52] **U.S. Cl.** **209/109**

[51] **Int. Cl.** **B07c**

[58] **Field of Search** ..... 209/109, 88, 82; 99/555, 556; 324/71 NE

[56] **References Cited**

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Primary Examiner—Allen N. Knowles

Attorney—Walter G. Sutcliff

[57] **ABSTRACT**

Apparatus for presenting soft bodies for inspection and detection of the presence of hard particles such as bones or cartilage, within a softer meat body. The apparatus includes automatic handling systems and control means for the handling systems whereby individual soft bodies are sequentially presented at a detection station and thereafter rejected for manual reinspection or advanced to the next food processing station. The control means provide sequence control for the various movable apparatus.

17 Claims, 8 Drawing Figures

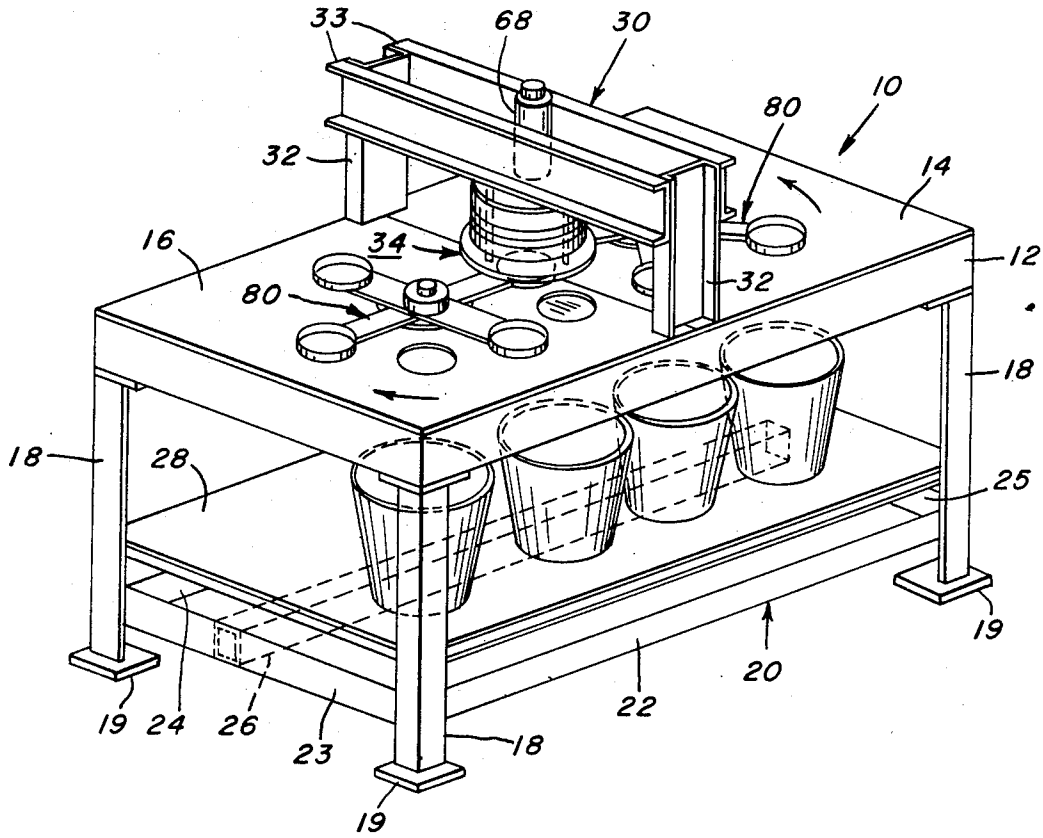
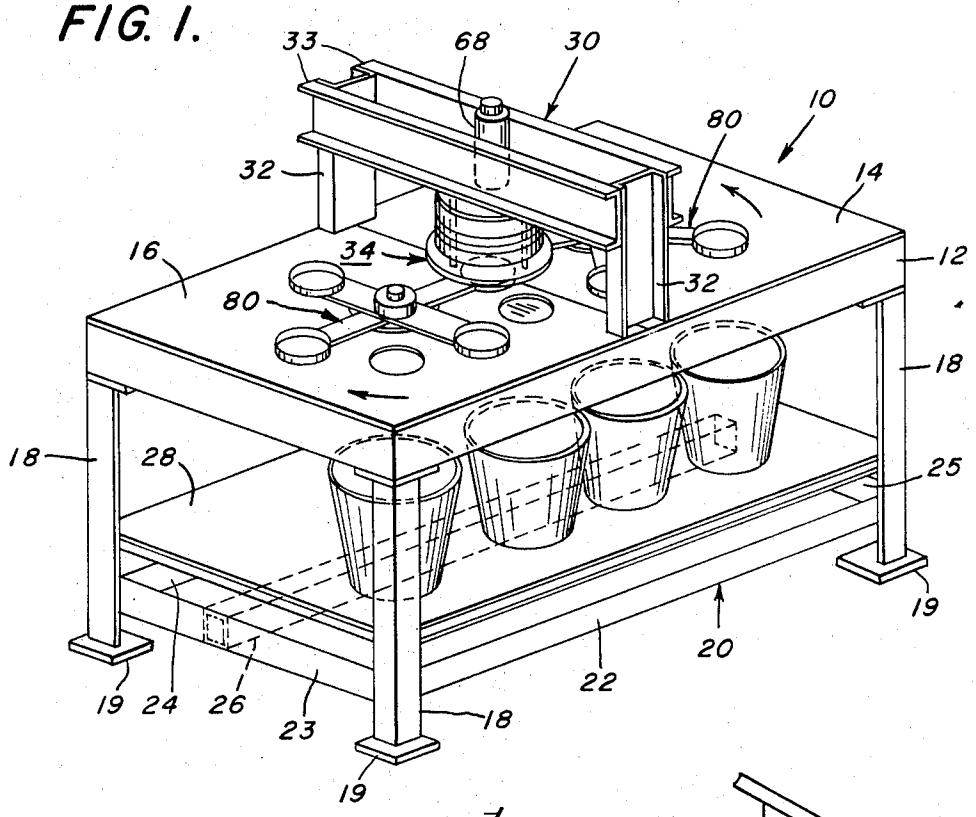


FIG. 1.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68
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80
32
14
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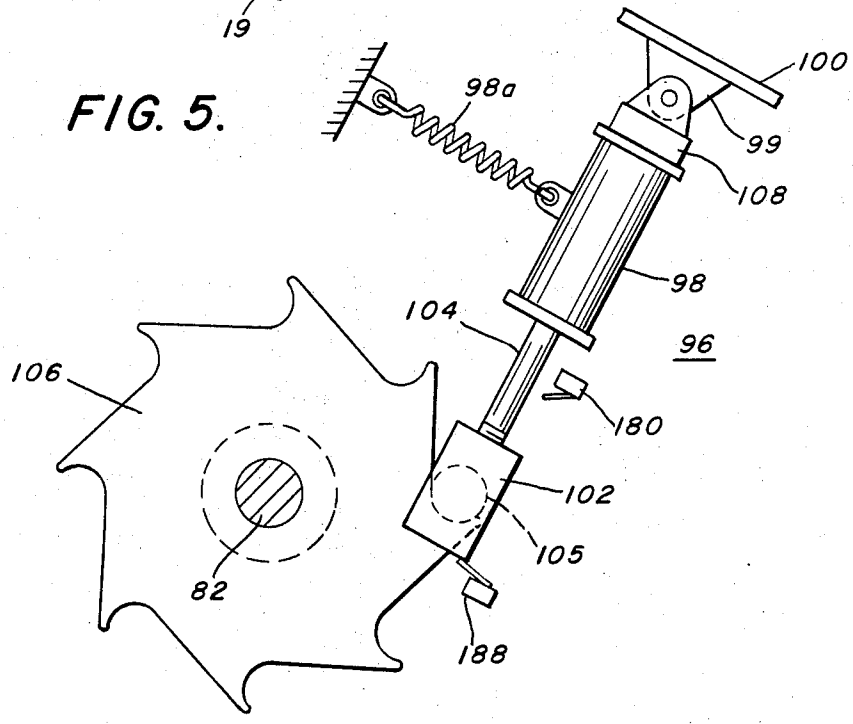
24
26
23
18
19

FIG. 5.


100
98a
99
108
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104
96
106
180
102
105
82
188

FIG. 2.

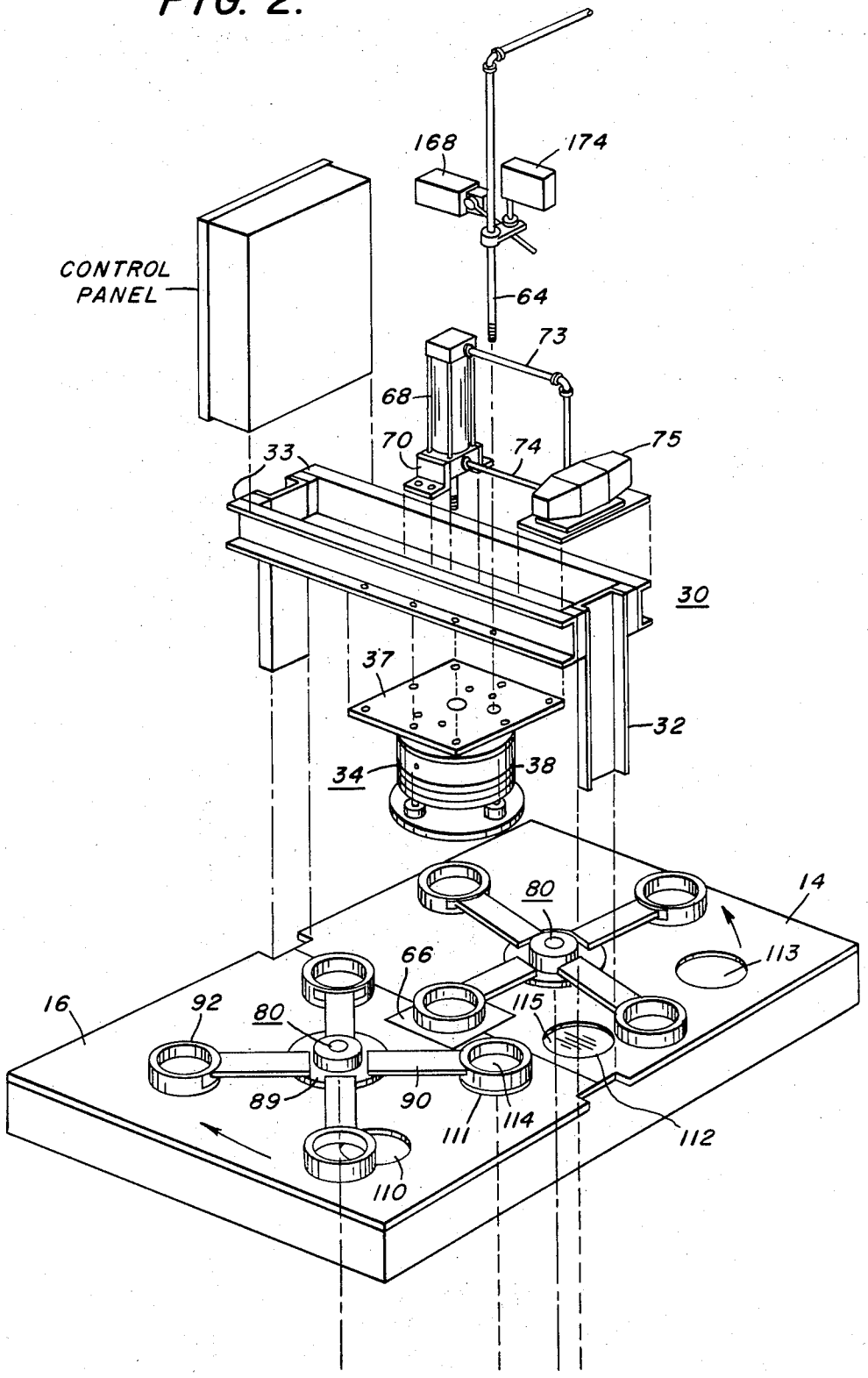
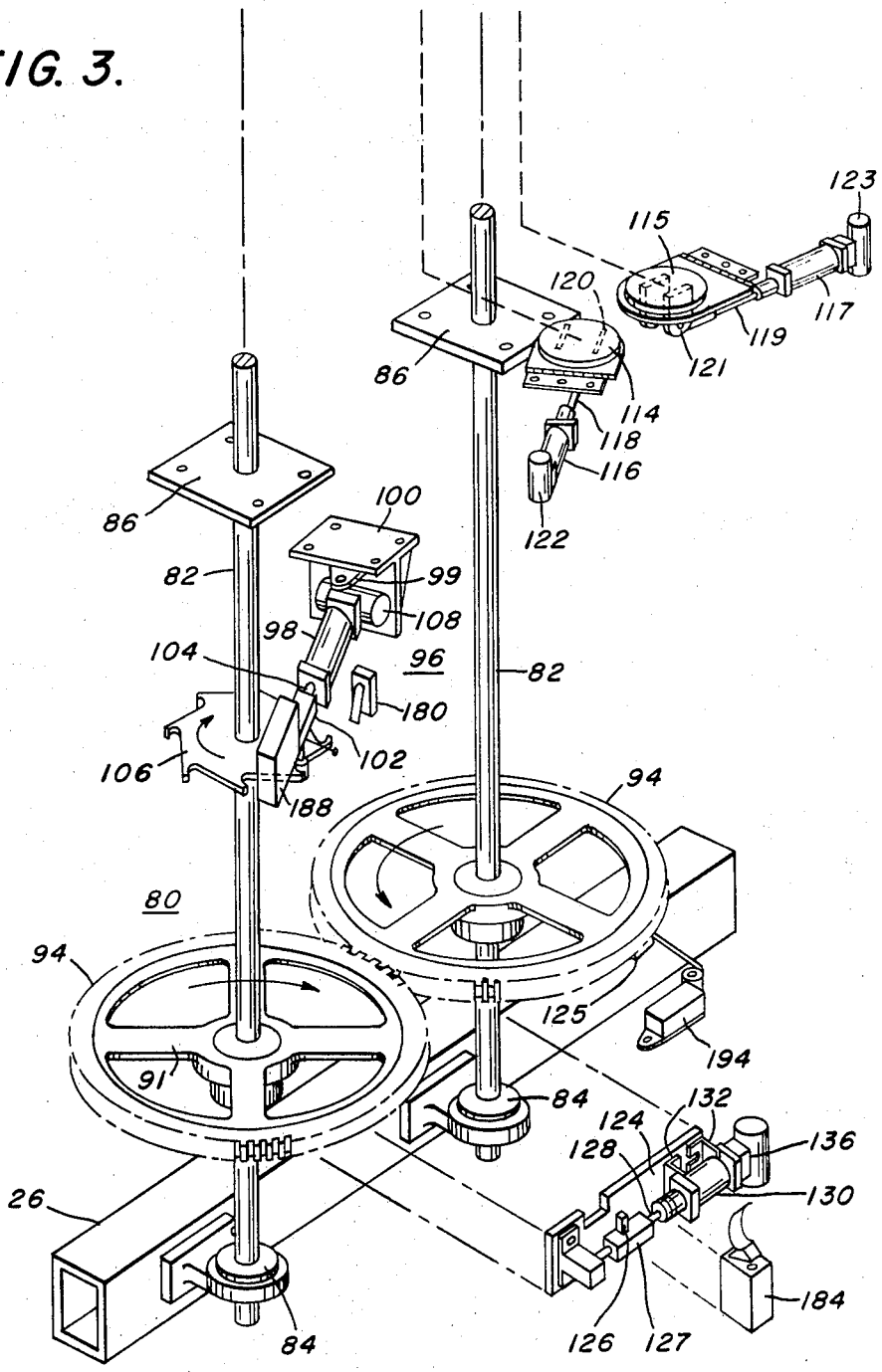

168
174
CONTROL PANEL
64
73
68
70
74
75
33
30
37
32
34
38
80
14
113
66
16
92
80
115
89
90
111
114
112
110

FIG. 3.


123
115
120
117
119
121
86
114
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122
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86
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99
108
98
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180
102
106
188
94
80
94
125
194
91
84
132
124
128
136
130
26
184
84
126
127

FIG. 4.

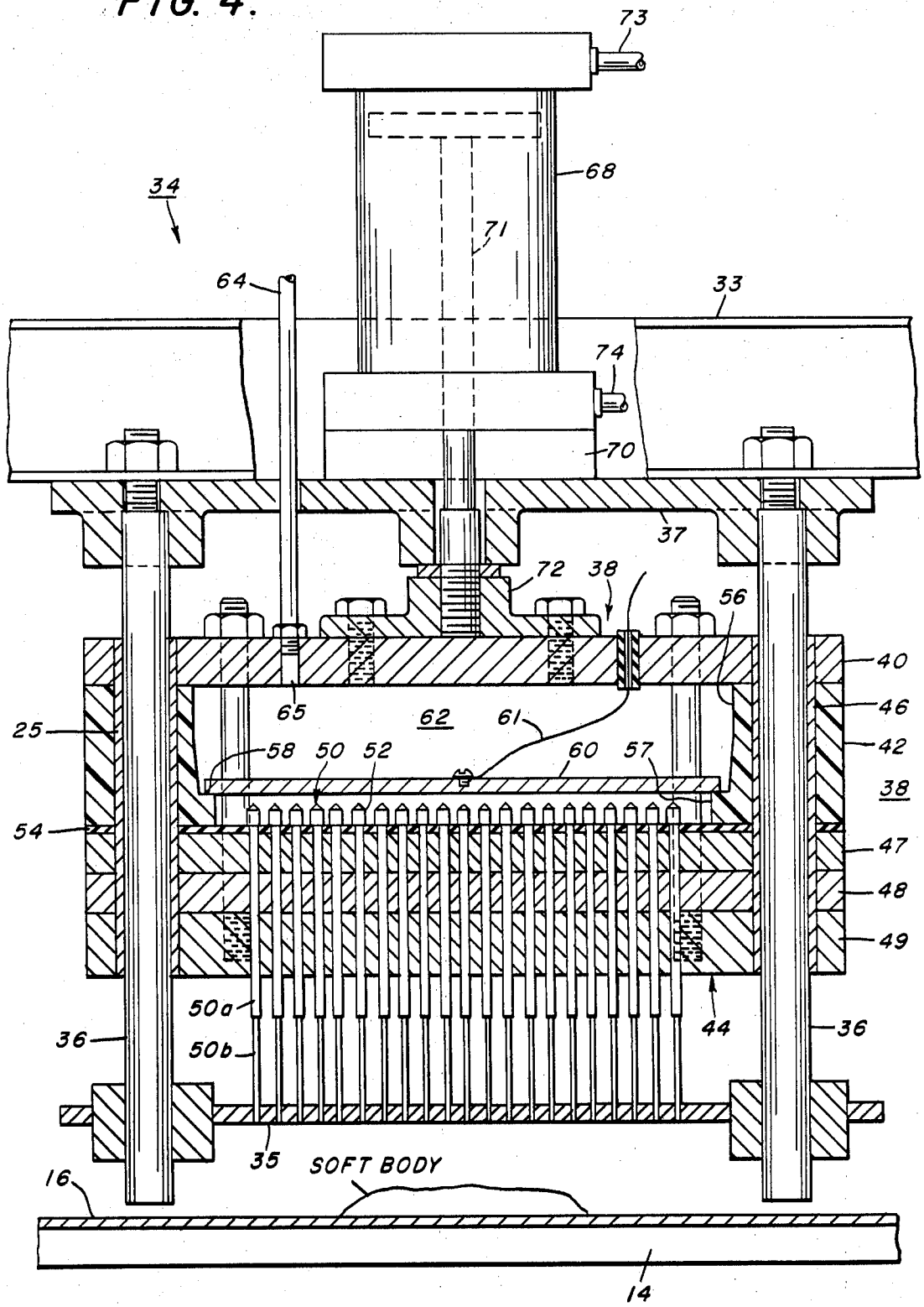

73
68
34
71
64
33
74
70
37
72
38
56
40
46
25
65
62
61
58
50
52
60
57
42
38
54
47
48
49
50a
36
50b
44
36
35
SOFT BODY
16
14

FIG. 6.

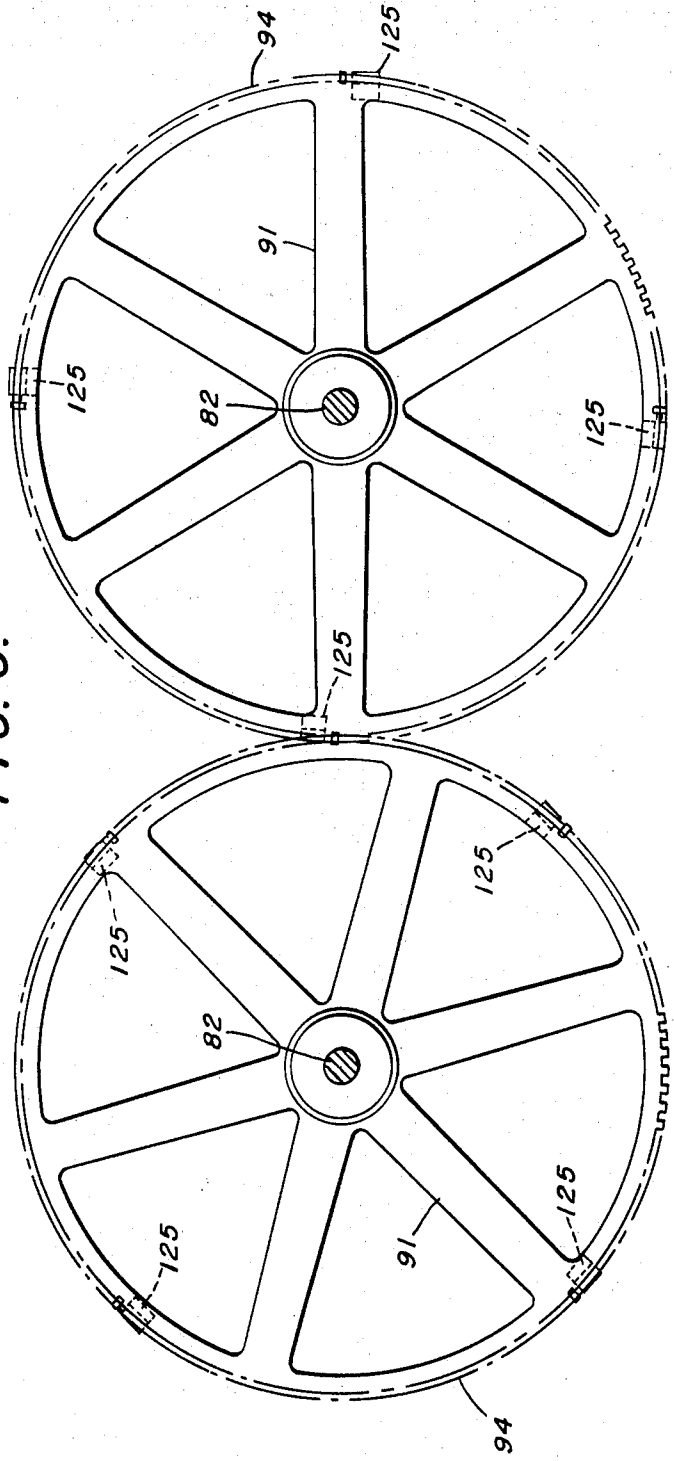

94
125
91
82
125
125
125
125
125
125
82
91
125
125
94

FIG. 7.

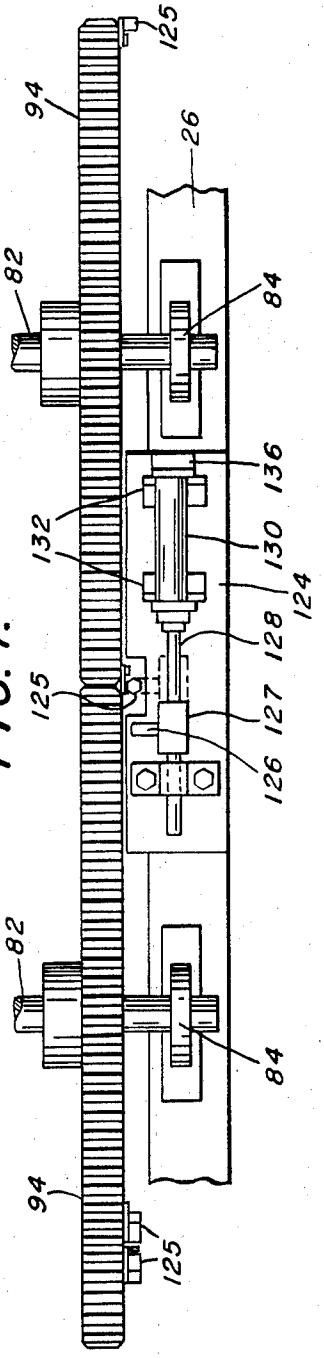
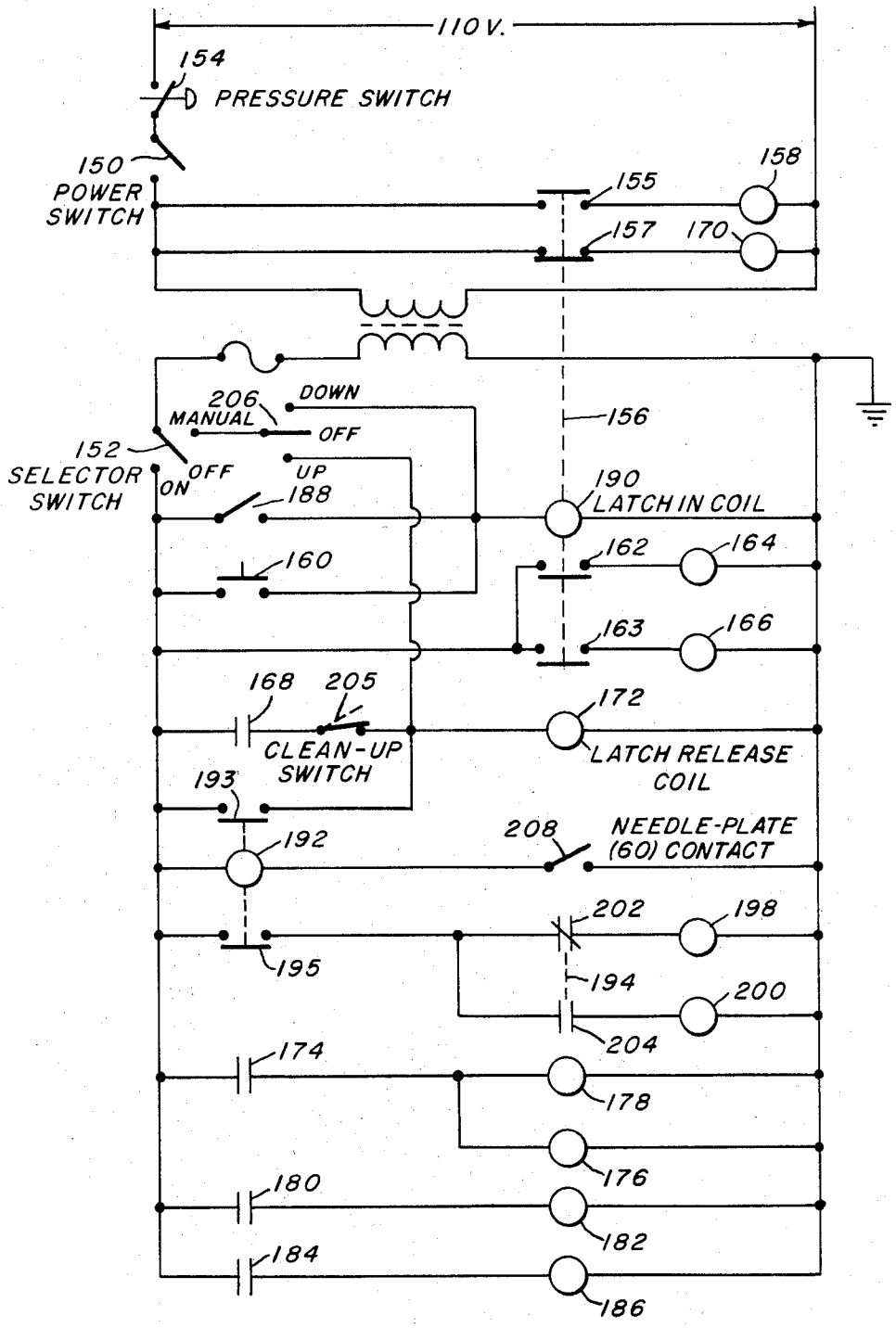

125
94
26
82
84
136
132
130
124
128
125
127
126
82
84
94
125

FIG. 8.


110 V.
154
PRESSURE SWITCH
150
POWER SWITCH
155
158
157
170
206
MANUAL
DOWN
OFF
152
SELECTOR SWITCH
ON
OFF
UP
188
156
190
LATCH IN COIL
160
162
164
163
166
168
205
CLEAN-UP SWITCH
172
LATCH RELEASE COIL
193
192
208
NEEDLE-PLATE (60) CONTACT
202
198
195
194
200
204
174
178
176
180
182
184
186

APPARATUS FOR INSPECTING BODIES FOR THE PRESENCE OF HARD PARTICLES

BACKGROUND OF THE INVENTION

This invention relates to an apparatus for inspecting bodies for the presence of foreign objects such as hard particles in soft bodies, as for example the presence of bone, gristle, or cartilage fragments in chicken flesh.

In many processes there is a need for removing small hard particles from a body of softer material. In the food processing industry, for example, one such need is the removal of small bone fragments and other hard matter such as gristle and cartilage from chicken. The usual procedure followed in removing the hard matter is to first have sorters or inspectors positioned at long tables to inspect chicken pieces by feeling with their fingers and then to remove any detected particles. This method has proven to be inadequate, especially in detecting and removing very small (viz. one-eighth inch) particles. Oftentimes many small bone fragments remain in the chicken and end up in the final product. We have invented a particular penetration apparatus for detecting small particles in a body, which apparatus overcomes the problems of ineffective detection inherent in using human hands. Our penetration apparatus is fully disclosed in our copending U.S. Pat. application, Ser. No. 106,043 filed Jan. 13, 1971 issued May 29, 1973 as U.S. Pat. No. 3,736,583, and assigned to the assignee of the present invention and application.

SUMMARY OF THE INVENTION

The present invention relates to an apparatus which provides for the automatic transporting and inspecting of bodies for the presence of particles, whereby a detection apparatus such as the penetration apparatus described in said Patent Application, is used for timed automatic inspection of bodies transported into position beneath the penetration apparatus. In addition, the present invention provides means whereby bodies having detected particles are automatically positioned in one area so that such bodies may be further handled for removal of the particles, and further where bodies not containing any detected particles are automatically positioned in another area where they may be removed for further processing. More particularly the inspecting apparatus of the present invention preferably comprises: a main support member such as a table having a generally flat upper surface; detection means, such as our apparatus described in said Patent Application but not limited thereto, for detecting the presence of hard solid particles in bodies of softer substance, the detection means being supported by the support member such that a spaced relationship exists between the upper surface of the support members and the underside of the detection means; product transporting means for transporting bodies to and from a position beneath the detection means; means for effecting relative movement between the detection means and at least that portion of the support member beneath the detection means such that bodies to be inspected will be positioned to be tested by the detection means; and control means operative with the detection means and the product transporting means for effecting the operation of the transporting means to move bodies sequentially to and from beneath the detection means. The preferred embodiment of this invention includes a pair of pocket wheel assemblies arranged in spaced relation to each other, one on each side of the detection means, and wherein each assembly comprises a plurality of arcuately spaced arms which having a product carrying pocket at the outer end thereof. The arms of each pocket wheel assembly are mounted on a shaft, with the shaft of each assembly being driven by a common drive unit such that the assemblies are rotated in timed sequence for moving a pocket of one assembly beneath the detection means followed by a pocket of the other assembly. The preferred embodiment of this invention further provides that the control means is operative with the pocket wheel assemblies to move bodies having detected particles therein to a first area on the support table where those bodies will be automatically discharged to another station, and to move bodies which have no detectable particles therein to another area on the support table where those bodies will likewise be automatically discharged to another station.

Other details and advantages of this invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings we have shown a present preferred embodiment of this invention in which:

FIG. **1** is a perspective view of an apparatus for inspecting soft bodies for the presence of hard particles embodying the present invention and with certain parts removed and cut away to show details of construction;

FIG. **2** is an exploded perspective view of the portion of the apparatus mounted above the support table.

FIG. **3** is an exploded perspective view of the apparatus which is below the support table and is aligned with and connected to the apparatus of FIG. **2.**

FIG. **4** is an enlarged elevation view of the penetration apparatus used as the detecting means with the present invention, and showing the probing unit in its upper position;

FIG. **5** is a plan view of the ratchet drive assembly which rotates the pocket assemblies;

FIG. **6** is an enlarged view of the intermeshing ring gears;

FIG. **7** is an enlarged side elevation view of the ring gears shown in FIG. **6** and the stop pin assembly;

FIG. **8** is a schematic representation of a control circuitry for use in the automatic operation of the inspecting apparatus of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference numerals refer to like parts throughout the various views, FIG. **1** shows a perspective view of an apparatus, generally represented by the numeral **10,** for inspecting soft bodies for the presence of hard particles, such as bones, gristle and cartilage in chicken flesh. The apparatus **10** is not, however, limited to use for inspecting just chicken flesh, which has been and will be referred to only by way of example, but may be used in inspecting any other soft bodies where the need exists for finding and removing particles of hard material. The inspection apparatus **10** includes a main support member or table **12** having an elongated top plate **14** with an upper flat surface **16,** the plate being supported by four vertical legs **18** having pads **19** fixed to the lower ends thereof for resting on a floor surface. The legs **18** also support a frame **20** formed of structural members **22,**

23, 24, and 25 connected at their respective ends to form a box or rectangular shape with another structural member 26 extending longitudinally of the frame and having its respective ends fixed to mid portions of the members 23 and 25. The frame 20 functions to support a drive mechanism and other equipment which will be described in more detail hereinafter. Frame 20 also supports a platform 28 formed of three sections each of which is selectively removable from the frame for access to the members and equipment disposed beneath the platform.

An upright support assembly 30 is arranged to extend transversely of top plate 14, and includes two vertical upwardly extending legs 32 one each arranged on and fixed to opposite sides of the top plate 14. Cross-members 33 are fixed at their respective outer ends to the upper section of the legs 32, whereby an open space is defined between the cross-members. The support assembly 30 functions to support a detection apparatus 34 and other equipment to be described later. The detection apparatus 34 is used for actually inspecting the chicken pieces to detect the presence of hard particles therein. The detection apparatus 34 may be of any construction such as a probing device, ultrasonic tester, or x-ray machine for performing the intended purpose and does not per se form part of the present application. A typical detection apparatus 34, as stated earlier, which is a penetration detection device, is disclosed and claimed in our copending U.S. Pat. application Ser. No. 106,043 filed Jan. 13, 1971, now U.S. Pat. No. 3736583, and assigned to the assignee of this application. Penetration apparatus 34 will be briefly described to the extent necessary to relate the elements thereof to the control circuitry forming part of this application. A more detailed description of the penetration apparatus 34 may be had by referring to said copending U.S. Patent Application.

Penetration apparatus 34 as shown in greater detail in FIG. 4 includes a disc-shaped stripper plate 35 to which is secured four vertically extending support rods 36 arranged in a generally square pattern. The upper ends of the support rods 36 are secured to a generally square-shaped plate 37. A probing unit 38 is arranged for reciprocal vertical movement with respect to the support rods 36. The probing unit 38 includes an upper cover plate 40, a housing 42 disposed in abuttment with the lower surface of plate 40, and a probe assembly 44 arranged in abuttment with the lower surface of housing 42. Plate 40, housing 42, and probe assembly 44 are all provided with communicating similarly spaced and sized openings to be registered with bushings 46 which are slidably arranged on support rods 36.

Probe assembly 44 includes three electrically conductive abutting plates 47, 48, 49 secured to each other and provided with closely-spaced axial holes therethrough, the three plates 47, 48, 49 provide a housing or matrix for receiving penetrating rod-shaped probes 50. Each probe 50 includes an upper terminal portion 50*a* having an outer diameter slightly smaller than the diameter of the holes through plates 47, 48, 49, whereby the probes are slidable with respect to the plates. The lower portions of the probe 50 are slender needles 50*b*, the lengths of the needles being generally uniform whereby their free lower ends are in substantially the same horizontal plane. The needles 50*b* extend in a slidable relationship through openings provided through stripper plate 35. The stripper plate 35 insures that the soft body being inspected is not carried upwardly with the probes 50.

Each probe 50 is provided with a sleeve 52 fixed around an upper section of the terminal portion 50*a* and disposed to have its lower end abut the upper surface of a sealing gasket 54 secured to the top plate 47. The sleeve 52 serves as a stop to limit the relative downward movement of the probe 50 with respect to the plates 47, 48, 49.

Housing 42 formed of a non-conductive material has an upper portion 56 and a reduced diameter lower portion 57 whereby an annular shoulder 58 is defined between the upper and lower portions. A solid electrically conductive plate 60 connected by an electrical lead 61 to the control circuitry of this invention rests freely on shoulder 58 and serves as the sensing element for the upward movement of the probes 50, as will be more fully explained hereinafter. The interior of housing 42, the lower surface of cover plate 40, and the upper surface of plate 47 and gasket 54 define a pressure chamber 62 into which regulated pressurized fluid such as filtered air, is supplied from a suitable source, not shown, through tubing 64 which includes a length of flexible tubing connected with opening 65 in cover plate 40. When chamber 62 is pressurized a constant pressure is maintained on probes 50 forcing them downward, with the force on the probes 50 being sufficient to cause them to penetrate the soft body of meat, yet not sufficient to cause penetration of any hard solid particles in the meat.

As clearly shown in FIGS. 1 thru 4, the penetration apparatus 34 is supported by the support assembly 30 by removably securing the plate 37 as with nuts and bolts to a generally central position of both cross-members 33. The penetration apparatus 34 is so arranged on support assembly 30 that the horizontal plane including the lower ends of the needles 50b of the probes 50 when the probes are fully retracted is spaced above a base plate 66 fixed to the upper surface 16 of top plate 14. The spacing between the base plate 66 and the plane of the ends of the retracted needles 50*b* is of such magnitude that cut up pieces of chicken flesh may be placed on the base plate in anticipation of being probed by the needles. When the probes 50 are fully extended as when the probing unit 38 is lowered the ends of the needles 50*b* will extend to a position slightly above the base plate 66 thus insuring that the body to be inspected will be virtually completely penetrated.

A double acting hydraulic cylinder 68 is provided for effecting the downward and upward movement of the probing unit 38. A bracket 70 fixed to the lower outer portion of cylinder 68 is removably secured as by bolts to the upper surface of plate 37. The rod 71 of cylinder 68 is threaded into mounting fixture 72 which is bolted to the upper surface of cover plate 40. By extending rod 71 the probing unit 38 will be urged toward base plate 66 where the needle portions 50*b* of probes 50 will pass through stripper plate 35 to encounter and penetrate a piece of chicken flesh disposed on the base plate. Pressurized fluid is provided to the cylinder 68 by tubing 73 and 74 connected to openings in the cylinder located at the rod and cylinder sides, respectively, of the piston. The tubing 73 and 74 are connected through a solenoid valve 75 to a source of pressurized hydraulic fluid, not shown. The solenoid 75 in turn is connected with circuitry which controls the overall

operation of the inspecting apparatus **10**, details of the control circuitry to be described later.

Transporting means for moving chicken pieces across the upper surface of top plate **14** are provided in the form of pocket wheel assemblies **80**. There are two pocket wheel assemblies **80** both of which are essentially the same in structure. The pocket wheel assemblies **80** include generally vertical drive shafts **82** which are parallel to each other and are disposed to intersect the longitudinal centerline of top plate **14** at points equidistant from the centerpoint of base plate **66**. The lower ends of the drive shafts **82** are supported for rotation in bearings **84** secured to one side of structural member **26**. Bearing plates **86** are disposed at an upper region of the drive shafts **82**, the plates being bolted to the underside of the top plate **14** to provide additional support for the drive shafts. The upper ends of the drive shafts **82** extend through the top plate **14** to engage and support product pocket wheel assembly **80**. Each product pocket wheel assembly **80** includes a hub **89** which is removably secured to a drive shaft **82**, and four radially extending arms **90** spaced 90° apart. A product carrying pocket **92** in the form of a ring is fixed to the free end of each arm **90**. Each pocket **92** is sized to receive a piece of chicken of a size specified or determined by the user of the apparatus. The drive shafts **82** are so spaced and the product pocket wheel assemblies **80** so sized that when the pocket wheel assemblies are rotated, a product carrying pocket **92** passes centrally of base plate **66**, thus enabling a chicken piece to be positioned on the base plate for eventual probing by the penetration apparatus **34**. The product carrying pockets **92** mesh together at the base plate **66** as each pocket wheel assembly **80** is rotated. Ring gears **92** having four radial spokes **91** spaced 90° apart are fixed to an intermediate position of the drive shafts **82** at a location above structural member **26**. The ring gears **94** are identical and are sized to mesh with each other. Thus, when the drive shafts **82** are driven one will rotate clockwise and the other counterclockwise. Since the drive shafts **82** are coupled through the ring gears **94**, only one drive shaft need be rotated. As shown in FIGS. **3** and **5** power means **96** is arranged to provide motive force to the drive shaft **82** located on the left of the drawing of the Figures. Power means **96** includes a double acting air cylinder **98** having the rear end thereof pivotally mounted between ears **99** fixed to a bracket **100** which in turn is detachably secured as by bolts to the underside of top plate **14**. As clearly shown in FIG. **5**, a block **102** is screwed onto the end of the piston rod **104** with a rotatable disc-shaped cam follower **105** arranged on the lower side of the block. The cylinder **98** is arranged such that the cam follower **105** is disposed to engage the outer cam surfaces of cam ratchet wheel **106** secured to left drive shaft **82**. Thus, when piston rod **104** is extended the follower **105** will engage the extensions of the cam ratchet wheel **106** to rotate the wheel in turn rotating left drive shaft **82** which causes right shaft **82** to rotate by virtue of the intermeshing of ring gears **94**. When the piston rod **104** is retracted the follower **105** will roll along the cam surfaces of the cam ratchet wheel **106** without causing ratchet wheel **106** to rotate, thus to be repositioned again for engaging the cam surface to rotate the ratchet wheel. The pivotal connection of the cylinder **98** permits the follower **105** to track in the ratchet wheel **106** upon extension and retraction of rod **104** with limit switch **188** being actuated upon extension and limit switch **180** being actuated upon retraction of rod **104**. A biasing spring **98***a* is shown attached to the cylinder **98** to further ensure that follower **105** tracks in the ratchet wheel **106** particularly upon retraction when the follower **105** rolls to clear the next succeeding ratchet projection and then is urged into engagement with the ratchet projection. There are eight ratchet projections on ratchet wheel **106** to provide for 45° incremental movements for the ratchet wheel **106** and connected drive shafts **82**. Pressurized air is supplied to the respective rod and cylinder ends of cylinder **98** from a source of air, not shown, through double acting solenoid valve **108** which is caused to be actuated in response to control signals to be more fully elaborated upon later.

Referring again to FIGS. **2** thru **4** top plate **14** is provided with four longitudinally spaced openings **110**, **111**, **112** adn **113** arranged along one side of the top plate, and having a diameter approximately the same as that of the product carrying pockets **92**. The openings **110–113** are also located along the rotary path traversed by the product carrying pockets **92** such that the pockets and openings will be coaxial at certain times during rotation of the pocket wheel assemblies **80**. The center points of openings **111** and **112** are approximately 45° from the longitudinal centerline of base plate **66** which passes through drive shafts **82**, and the center points of openings **110** and **113** are approximately 135° from the longitudinal centerline of the base plate. The openings **110** and **113** define zones for receiving chicken pieces which have no detectable hard particles found therein while openings **111** and **112** define zones for receiving those chicken pieces which have hard particles detected therein. Thus, when penetration apparatus **34** senses that a chicken piece is without a hard particle, the pocket wheel assemblies **80** move that piece in three 45° incremental movements over opening **110** or **113** where the chicken piece will discharge through the opening to be received by a bucket or a moving conveyor belt arranged on platform **28**. On the other hand, if penetration apparatus **34** senses a hard particle in a chicken piece it will cause a signal to activate and open the normally closed closure or reject plates **114** or **115** which are hingedly mounted to the underside of top plate **14**, and the pocket wheel assemblies **80** will move that piece onto opening **111** or **112** to discharge the piece to a bucket or conveyor arranged on platform **28**. As is clearly shown in FIG. **3** with respect to reject plate **114**, both reject plates **114** and **115** are swung towards and away from openings **111** and **112** be means of double acting cylinders **116** and **117**, the piston rods **118** and **119** of which are pivotally secured between the furcations of clevises **120** and **121** fixed to the underside of the closure plates **114** and **115**. Pressurized air is supplied to the rod and cylinder ends of each cylinder **116** and **117** from a source of air, not shown, through double acting solenoid valves **122** and **123** and are coupled to the control circuitry for the entire inspection apparatus **10**. The ends of cylinders **116** and **117** proximate the solenoid valves **122** and **123** are pivotally mounted from the underside of top plate **14**.

While the ratchet wheel **106** is designed to rotate the pocket wheel assemblies **80** in **45** degree incremental steps, additional means are provided for positively stopping the pocket wheel assemblies **80** every 45° dur-

ing the rotation thereof by the power means **96.** As clearly shown in FIGS. **6** and **7** four symmetrically spaced downwardly extending lugs **125** are fixed as by bolting to the bottom of each ring gear **94.** Each lug **125** is arranged to engage the upwardly extending pin **126** fixed to a block **127** attached to the end of the piston rod **128** of double acting air cylinder **130** when the air cylinder **130** has been actuated to retract rod **128** and position pin **126** in position to engage the lugs. The air cylinder **130** is secured by a bracket **132** to a mounting plate **124** which in turn is removable secured as by bolts to the side of structural member **26.** The upwardly extending pin **126** is positioned so that with rod **128** retracted pin **126** intersects lugs **125** along a line through the intersection of ring gears **94.** The actuation of air cylinder **130** moves the rod **128** and pin **126** out of line so as to permit the lugs **125** to freely pass as the ring gears **94** are rotated. Pressurized air from a source, not shown, is provided to the rod and cylinder ends of air cylinder **130** through solenoid valve **136** which is coupled with the control circuitry for operating the overall inspection apparatus **10.** When the piston of cylinder **130** is caused to be retracted the pocket wheel assemblies **80** will be locked in position ready for downward movement of the probing unit **38** of penetration apparatus **34.** With the lugs **125** being spaced 90° apart on each ring gear **94** the limit of rotation of the pocket wheel assemblies **80** will be controlled to 45° incremental movements due to the lugs on the ring gear being spaced 45 ° from the lugs on the other ring gear.

A typical control circuit for use in the operation of the inspection apparatus **10** is shown schematically in FIG. **8.** When it is desired to operate inspection apparatus **10** the air supplies for the penetration apparatus **34,** air cylinder **98** used for driving the pocket wheel assemblies **80,** cylinders **116** and **117** used for operating the reject plates **114** and **115,** and cylinder **130** for actuating the stop pin **126** are turned on as is the hydraulic pump, not shown, for supplying hydraulic fluid to cylinder **68** for powering the probing unit **38** of the penetration apparatus. The power switch **150** is turned on and selector switch **152** is turned from off to automatic which sends power to all points of the control system provided there is at least 85 psi of air in the high pressure supply tank, not shown, to close the contacts in pressure switch **154.** A latching relay **156** is provided having latch in coil **190** and latch release coil **172.** Also associated with latching relay **156** are normally open contact **155,** normally closed contact **157,** and normally open contacts **162** and **163.** A latching relay has two coils, so that when the latch in coil is energized the normally open contacts close and the normally closed contacts open. The armature is mechanically latched in this position even though the latch in coil is de-energized. When the latch release coil is energized the contacts return to their normal positions. The latch in coil **190** of relay **156** is pulled in by pushing a start button **160** to close contact **155** with the coil **158** associated with solenoid valve **75** being energized to open solenoid valve **75** for directing hydraulic fluid to the cylinder side of hydraulic cylinder **68** to move the probing unit **38** downwardly towards base plate **66,** whereby the probes **50** penetrate a piece of chicken flesh. Contacts **157** are opened to de-energize coil **170** of solenoid valve **75** permitting the valve to divert hydraulic fluid to the cylinder side of hydraulic cylinder **68.** Pulling in the latch in coil **190** also results in contacts **162, 163** closing to energize coils **164** and **166** to actuate solenoid valves **122** and **123** to permit pressurized air to flow to the cylinder side of cylinders **116** and **117** to urge reject plates **114** and **115** into closed relationships with openings **111** and **112** in top plate **14.** A time delay switch **168** is mounted from cross member **33** of support assemply **30** and is disposed to be engaged and actuated by the movement of tubing **64** which moves as unit **38** is reciprocated to the full downward extent. When probing unit **38** is fully down tubing **64** engages time delay switch **168** at the bottom of its stroke, closing switch **168** after a delay which ensures that probing unit **38** does reach the full down position, and thereby actuating latch release coil **172** through normally closed cleanup switch **205.** The contact **157** of relay **156** is thus returned to closed which actuates coil **170** associated with solenoid valve **75** for directing hydraulic fluid to the rod side of cylinder **68** whereby probing unit **38** will be raised upwardly. When probing unit **38** reaches its upper limit the tubing **64** is again used to contact and actuate one-way momentary switch **174** whereby stop pin air cylinder solenoid coil **176** is energized to open the solenoid valve **136** to direct pressurized air to the rod side of air cylinder **130** to extend the piston so that the pocket wheel assemblies **80** are free to be rotated. At the same time coil **178** is energized to open solenoid valve **108** to direct pressurized air to the rod side of air cylinder **98** which causes the piston therein to be retracted. As the piston of air cylinder **98** retracts it engages switch **180** which closes to thereby energize coil **182** which opens solenoid valve **108** to direct pressurized air to the cylinder side of air cylinder **98,** which causes the piston therein to be extended whereby the cam follower **105** engages ratchet wheel **106** to rotate the left drive shaft **82** which in turn causes right drive shaft **82** to rotate simultaneously through the intermeshing gears **94.** The pocket wheel assemblies **80** are thus caused to move **45** degrees to thereby position a product carrying pocket **92** on base plate **66** where a piece of chicken flesh is ready to be inspected by penetration apparatus **34.** During rotation of the pocket wheel assemblies **80** lugs **125** on the ring gears **94** engage limit switch **184** which is positioned proximate the stop pin position so as to be contacted and actuated by the lug which is rotated from the stop pin position. The closing of switch **184** energizes coil **186** to actuate solenoid valve **136** which causes pressurized air to be directed to the rod side of air cylinder **130** whereby the piston thereof is retracted to position stop pin **126** to be engaged by the succeeding lug **125** on the other ring gear which is rotated to be stopped by pin **126.** When the piston of the ratchet air cylinder **98** is fully extended it momentarily engages one way momentary contact switch **188** which energizes latch in coil **190** of latching relay **156** to close contact **155** energizing coil **158** to open solenoid valve **75** to direct hydraulic fluid into the cylinder side of cylinder **68** to move probing unit **38** downwardly towards base plate **66** to engage a piece of chicken flesh. At the same time contacts **157** are opened to de-energize coil **170** of solenoid **75** to permit the valve to divert hydraulic fluid to the cylinder side of hydraulic cylinder **68.** Actuation of latching relay **156** also results in contacts **162** and **163** closing to energize coils **164** and **166** to actuate solenoid valves **122** and **123** to permit pressurized air to flow into cylinders **116** and **117** to urge reject plates **114** and **115** into their closed position. So long as no

hard particles are detected in the pieces of chicken the pieces will be transported on the upper surface **16** of top plate **14** with the closure plates **114** and **115** in their closed positions and thence through openings **110** and **113.**

When the penetration apparatus **34** senses a hard particle in a piece of chicken the control circuitry will react to cause that piece of chicken to be discharged through either opening **111** or **112.** When a probe **50** is caused to be urged upwardly due to engaging a hard particle, conductor plate **60** is contacted which is represented in FIG. **8** by the closing of switch **208** which causes relay coil **192** to be energized closing contacts **193** and **195** and actuating latch release coil **172** thereby closing contacts **157** to energize coil **170** which opens solenoid valve **75** to direct hydraulic fluid to the rod side of cylinder **68** causing the probing unit **38** of penetration apparatus **34** to be raised. Switch **194** contains one normally closed contact **202** and one normally open contact **204.** When any one of the four gear lugs **125** on right ring gear **94** are in contact with switch **194,** this lug position indicates that chicken is being tested in a pocket of the right pocket wheel **80.** The lug **125** when in contact with switch **194** causes normally closed contact **202** to open and normally open contact **204** to close. When ring gears **94** move 45° for the next test cycle, a pocket of the left pocket wheel assembly **80** will be in position for testing, and switch **194** will be deactivated, contact **202** will return to normally closed. The energizing of relay **192** as a result of a probe striking a hard particle results in contact **195** being closed and thereby completing a circuit through either contact **202** or **204** of switch **194.** The circuit is completed through whichever of the contacts **202** or **204** are closed, which depends upon whether the left or right pocket wheel has presented material beneath the detection device as just explained. Thus, either coil **198** or coil **200** are energized, whereby solenoid valves **122** or **123** will be opened to direct air to the rod side of cylinder **116** or **117** to retract the piston therein and thus open the proper reject closure plate **114** or **115.**

The ratchet cylinder **98** is then actuated as already explained, and the pocket wheels rotated **45** degrees permitting the examined soft body to be dropped through opening **111** or **112** if a hard particle has been detected, or to be supported by closure plates **114** or **115** if no hard particle has been detected while the next pocket wheel is beneath the detection device. Successive actuation of the probing unit **38** is achieved as follows. The pocket wheels are rotated in **45** degree increments. When the limit switch **188** is engaged upon extension of the piston of ratchet air cylinder **98** latch in coil **190** is energized to close contacts **155** energizing coil **158** to open solenoid valve **75** to direct hydraulic fluid into cylinder **68** to thereby move probing unit **38** downwardly as already explained. Energizing latch in coil **190** causes contacts **162** and **163** to close to energize coils **164** or **166** to open either solenoid valve **122** or **123** to direct air to cylinder **116** and **117** to close either reject plate **114** or **115,** whichever the case may be if either be open.

In stopping the operation of the inspection apparatus **10,** the selector switch **152** is turned to the off position when the probing unit **38** is moving upwardly. When cleaning the apparatus the clean up switch **205** is turned off and the selector switch **152** is put into the manual position. The manual probe unit operating switch **206** is then moved to the down or up position as needed to permit spraying cleaning liquid on the probes **50,** stripper plate **35,** etc. If it is desired to cause the pocket wheel assemblies **80** to rotate for purposes of cleaning, switch **206** should be moved to the up position then to the off position, turn on switch **205,** the selector switch **152** should be moved to automatic, and switch **160** pushed to the start operation position. After cleaning is completed the selector switch **152** should be turned to the off position as the probing unit **38** is just starting its upward movement.

While we have shown and described a present preferred embodiment of this invention it is to be distinctly understood that the invention is not limited thereto but may also be otherwise variously embodied within the scope of the following claims.

We claim:

1. Apparatus for inspecting soft bodies for the presence of hard particles, comprising:

a main support member having a generally flat upper surface;

detection means for detecting the presence of hard particles in bodies of softer substance, and supported by said support member such that a spaced relationship exists between the upper surface of the support member and the underside of the detection means;

product transporting means supported by said support member for transporting bodies on said support member to and from a position beneath said detection means;

means for effecting relative movement between said detection means and at least that portion of said support member beneath said detection means such that bodies to be inspected will be positioned to be tested by said detection means; and

control means electrically operative with said detection means and said product transporting means for effecting the operation of said transporting means to move bodies sequentially to and from beneath said detection means.

2. Apparatus as set forth in claim **1** wherein said detection means is a penetration means which includes a probing unit having a matrix of spaced probes slidably arranged for reciprocal movement with respect to each other, pressure means for maintaining pressure on each of said probes such that a force sufficient to penetrate the body to be inspected is exerted on each probe but not enough to penetrate the hard solid particles sought to be detected, and sensing means for sensing the movement of the probes when such probes are moved when a hard solid particle is engaged.

3. Apparatus as set forth in claim **2** wherein said penetration means is constructed and arranged such that it moves towards and away from said support member to engage and disengage a body to be inspected.

4. Apparatus as set forth in claim **1** wherein said tranporting means includes a pocket wheel assembly comprising a plurality of arcuately spaced arms each having a product carrying member at the outer ends thereof, a drive shaft rotatably supported by said support member and fixed to said arms for rotating said arms as a unit, and drive means coupled to said drive shaft for providing the motive power thereto; and wherein said pocket wheel assembly is constructed and arranged such that bodies to be inspected are transported in said

product carrying members to and from a position beneath said detecton means.

5. Apparatus as set forth in claim 1 including product separation means on said support member defining a first zone along the path of travel of said product transporting means for receiving bodies which have solid particles detected therein and a second zone along said path of travel for receiving those bodies which have no detectable solid particles therein.

6. Apparatus as set forth in claim 5 wherein said control means is operative with said detection means and said product transporting means for effecting the operation of said transporting means to move bodies to and from beneath said detection means and for positioning bodies having solid particles detected therein at said first zone and for positioning bodies which have no detectable solid particles therein at said second zone in response to the operation of said detection means in testing the bodies for detecting particles.

7. Apparatus as set forth in claim 5 wherein said first and second zones include means defining openings through the upper surface of said support member, and selectively movable closure means closing at least one of said openings during movement of said product transporting means, whereby said closure means may be operated to open the said openings with which it is associated, zones as bodies are received on the openings such that the bodies will be deposited beneath said support member.

8. Apparatus as set forth in claim 7 wherein said control means is operative with said detection means, said product transporting means, and said closure means for effecting the operation of said transporting means to move bodies to and from beneath said detection means and for positioning bodies having particles detected therein at said first zone and for positioning bodies which have no detectable particles therein at said second zone and further for actuating said closure means to discharge bodies to a position beneath said support member, said control means responding to the operation of said detection means in engaging the bodies for detecting particles.

9. Apparatus as set forth in claim 7 including product receiving means supported by said support member and arranged beneath said first and second zones, respectively, for receiving bodies as they are discharged through the first and second zones.

10. Apparatus as set forth in claim 4 wherein said transporting means includes a pair of pocket wheel assemblies arranged in spaced relation to each other, each of the pocket wheel assemblies being further arranged on one side of said penetration means; wherein both of said pocket wheel assemblies further include a common drive means coupled to the drive shafts thereof; and wherein said control means is further operative with said pocket wheel assemblies to drive each of the assemblies in timed sequence for moving a said product carrying member of one assembly into position beneath said penetration means followed by a product carrying member of the other assembly.

11. Apparatus for inspecting soft bodies for the presence of hard particles, comprising:

a main support member having a generally flat upper surface;

detection means for detecting the presence of hard solid particles in bodies of softer substance, and supported by said support member such that a spaced relationship exists between the upper surface of the support member and the underside of the detection means;

product transporting means supported by said support member for transporting bodies on said support member to and from a position beneath said detection means;

means for effecting relative movement between said detection means and at least that portion of said support member beneath said detection means such that bodies to be inspected will be engaged by said detection means;

product separation means on said support member defining a first zone along the path of travel of said product transporting means for receiving bodies which have solid particles detected therein and a second zone along said path of travel for receiving those bodies which have no detectable solid particles therein;

product discharge means operative with said product separation means for discharging bodies from said first and second zones in accordance with whichever of said zones has bodies positioned thereon; and

control means operative with said detection means and said product transporting means for effecting the operation of said transporting means to move bodies sequentially to and from beneath said detection means and for positioning bodies having solid particles detected therein at said first zone and for positioning bodies which have no detectable solid particles therein at said second zone in response to the operation of said detection means in engaging the bodies for detecting solid particles.

12. Apparatus as set forth in claim 11 wherein said control means is further operative with said product discharge means for effecting operation of said discharge means in response to the operation of said detection means.

13. Apparatus as set forth in claim 11 wherein at least one of said first and second zones include means defining openings through the upper surface of said support member; and wherein said discharge means includes selectively movable closure means closing said openings during movement of said product transporting means, whereby said closure means may be operated to open said openings of such that the bodies will be discharged to an area beneath said support member.

14. Apparatus as set forth in claim 13 including product receiving means supported by said support member and arranged beneath said first and second zones, respectively, for receiving bodies as they are discharged through the first and second zones.

15. Apparatus as set forth in claim 13 wherein said transporting means includes a pocket wheel assembly comprising a plurality of arcuately spaced arms each having a product carrying member at the outer ends thereof, a drive shaft rotatably supported by said support member and fixed to said arms for rotating said arms as a unit, and drive means coupled to said drive shaft for providing the motive power thereto; and wherein said pocket wheel assembly is constructed and arranged such that bodies to be inspected are transported in said product carrying members to and from a position beneath said detection means.

16. Apparatus as set forthinn claim 15 wherein said transporting means includes a pair of pocket wheel as-

semblies arranged in spaced relation to each other, each of the pocket wheel assemblies being further arranged on one side of said detection means; wherein both of said pocket wheel assemblies further include a common drive means coupled to the drive shafts thereof; and wherein said control means is further operative with said pocket wheel assemblies to drive each of the assemblies in timed sequence for moving a said product carrying member of one assembly into position beneath said detection means followed by a product carrying member of the other assembly.

17. Apparatus as set forth in claim 11 wherein said detection means is a penetration means which includes a probing unit having a matrix of spaced probes slidably arranged for reciprocal movement with respect to each other, pressure means for maintaining pressure on each of said probes such that a force sufficient to penetrate the body to be inspected is exerted on each probe but not enough to penetrate the hard solid particles sought to be detected, and sensing means for sensing the movement of the probes when such probes are moved when a hard solid particle is engaged.

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