Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 1

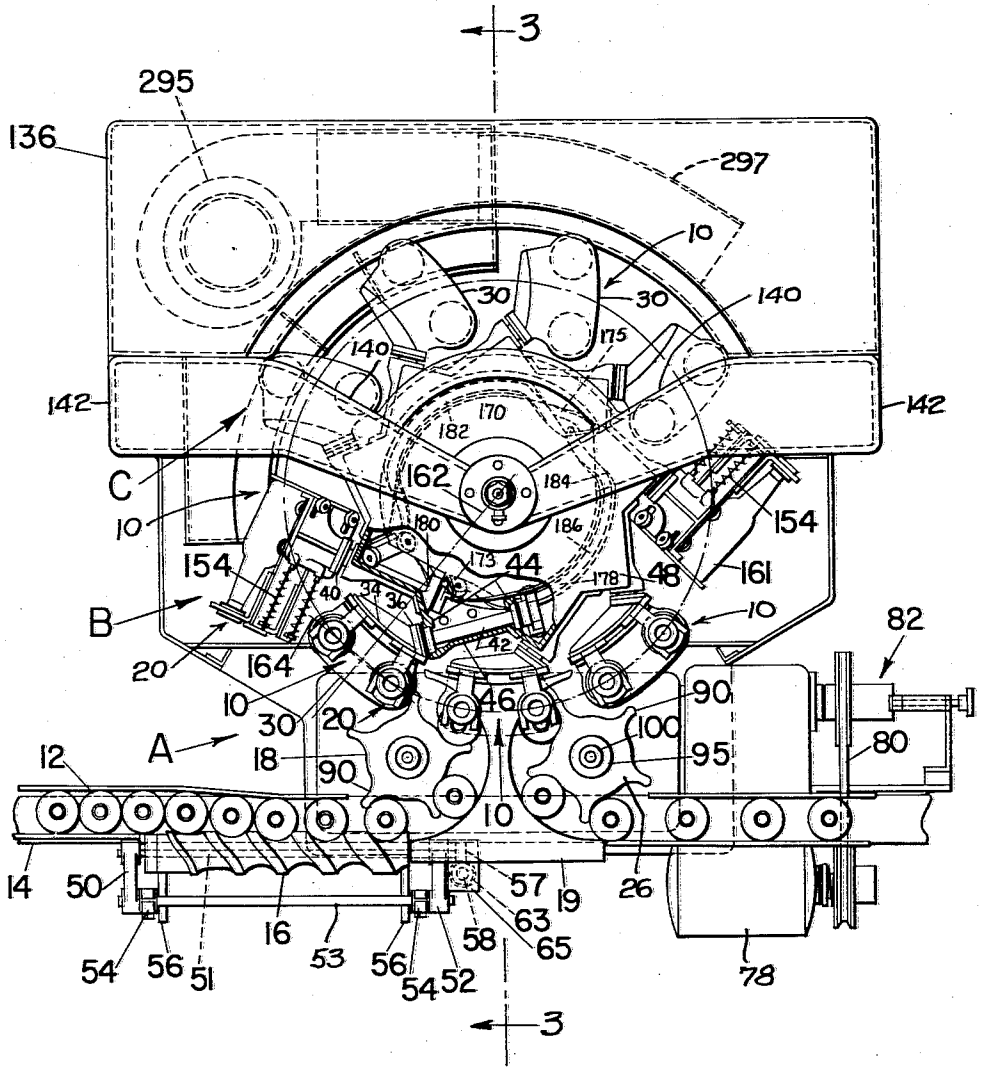


Fig. 1

INVENTOR.
James P. Whelan
BY Robert R. Churchill
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 2

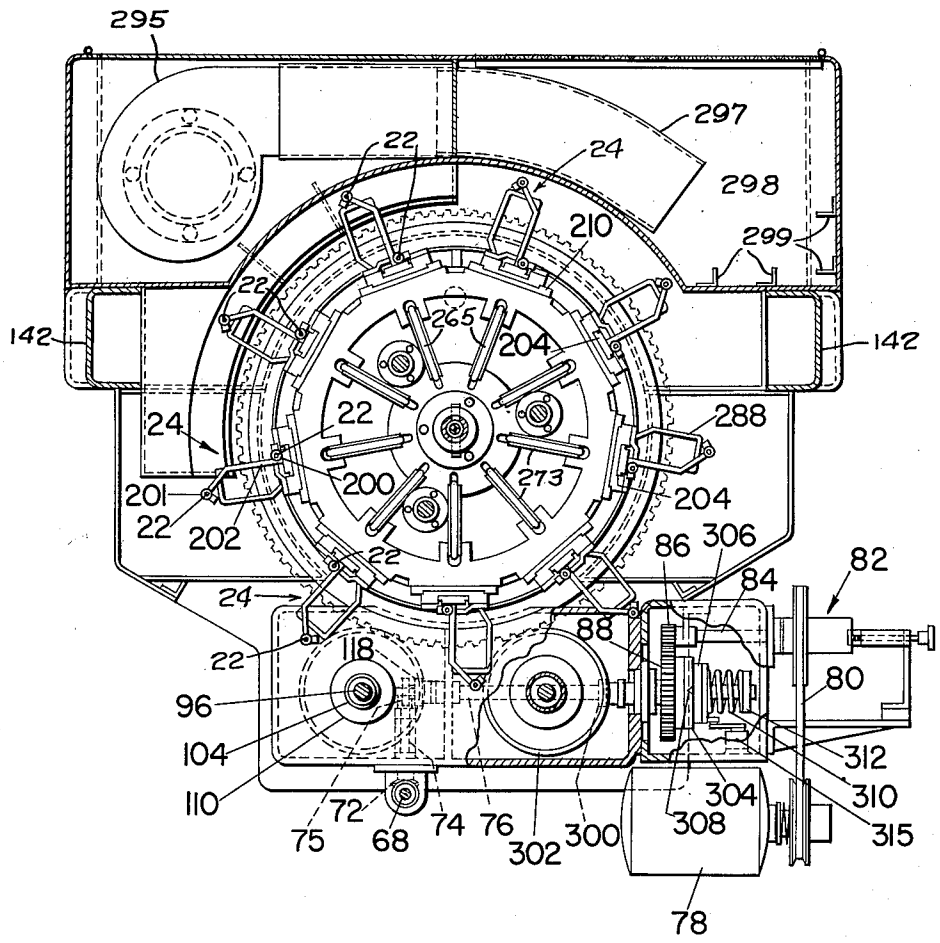


Fig. 2

INVENTOR.
James P. Whelan
BY Robert C. Churchill
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 3

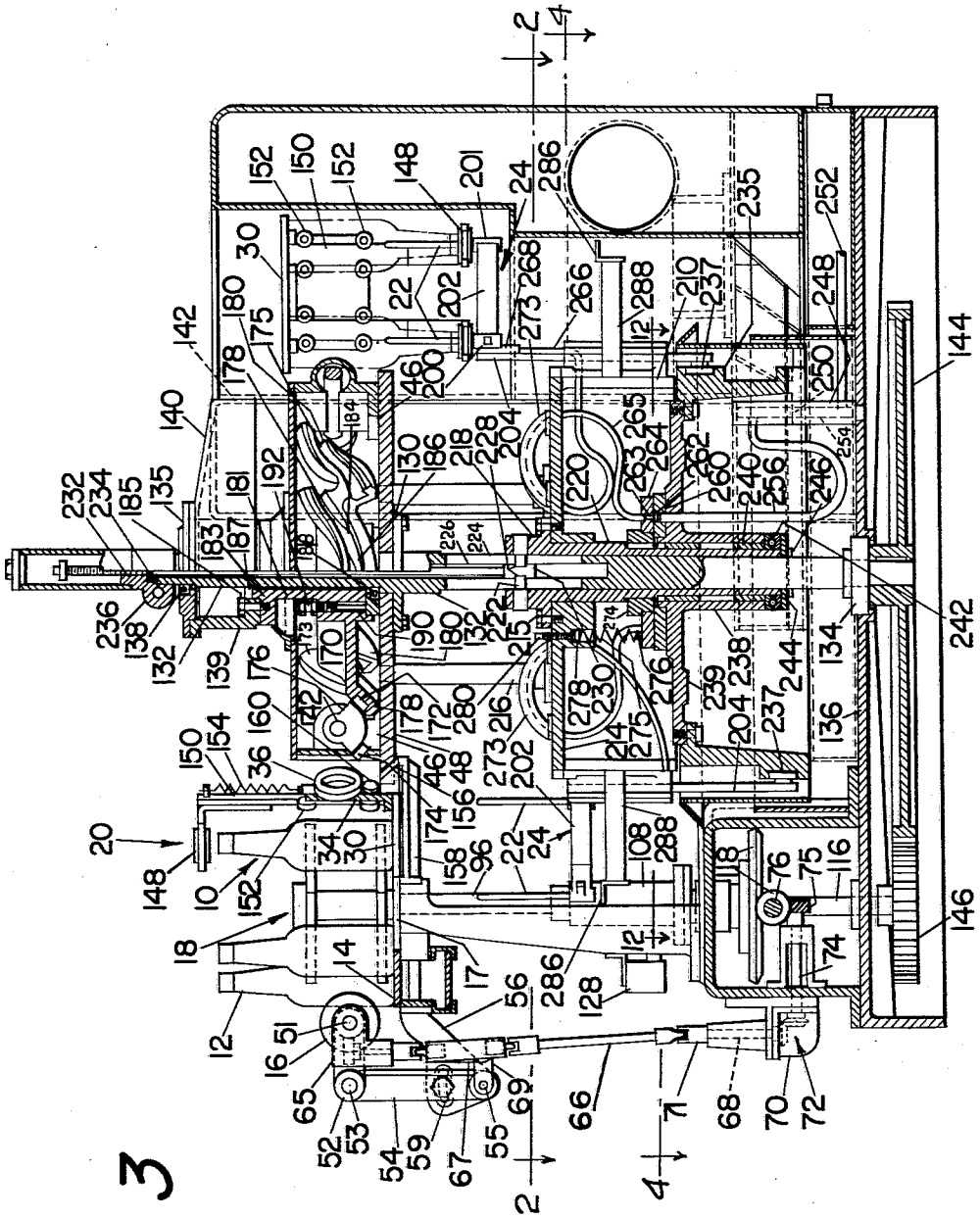


Fig. 3

INVENTOR.
James P. Whelan

BY Robert K. Churchill

ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 4

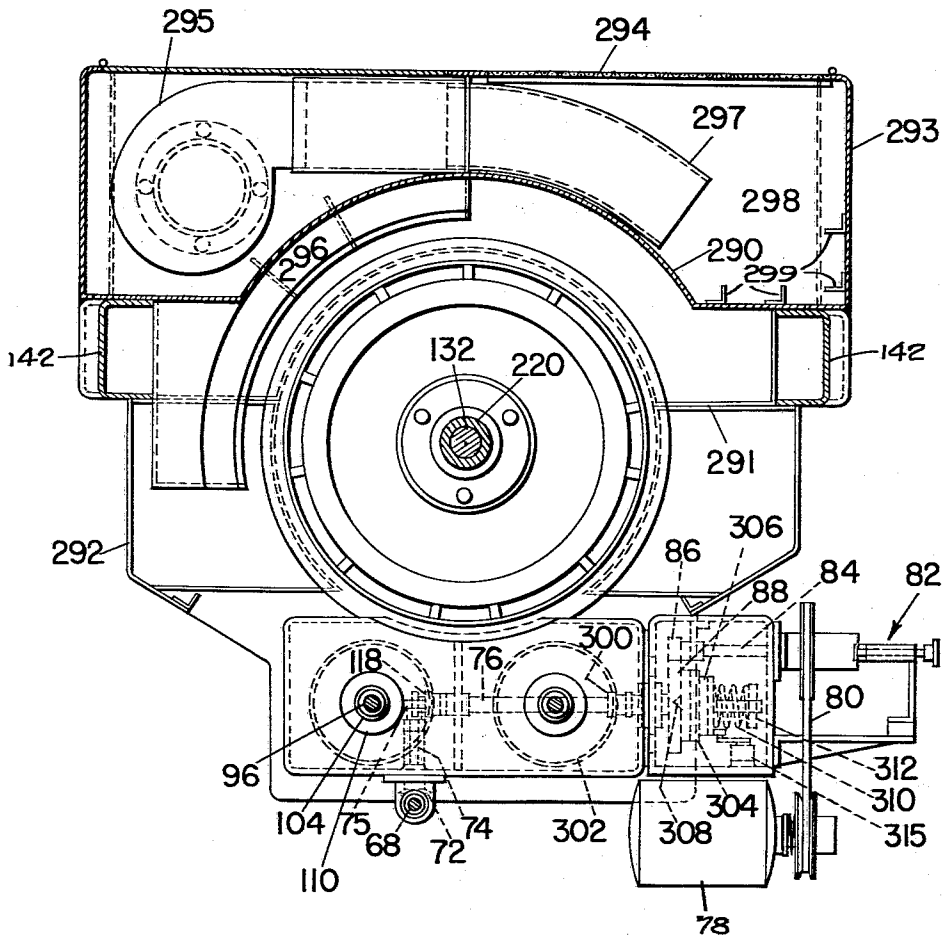


Fig. 4

INVENTOR.
James P. Whelan

BY

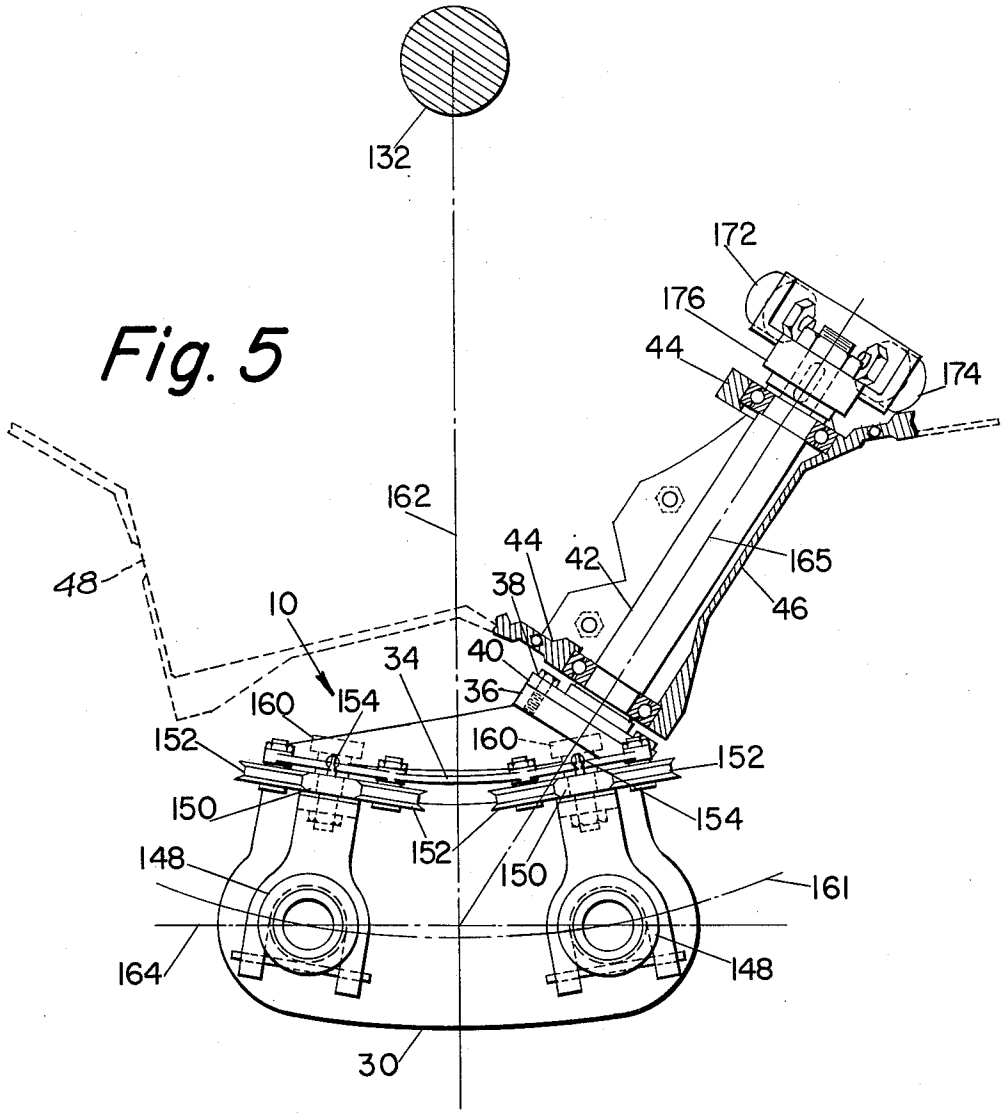
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 5

Fig. 5



INVENTOR.
James P. Whelan

BY
Robert R. Churchill

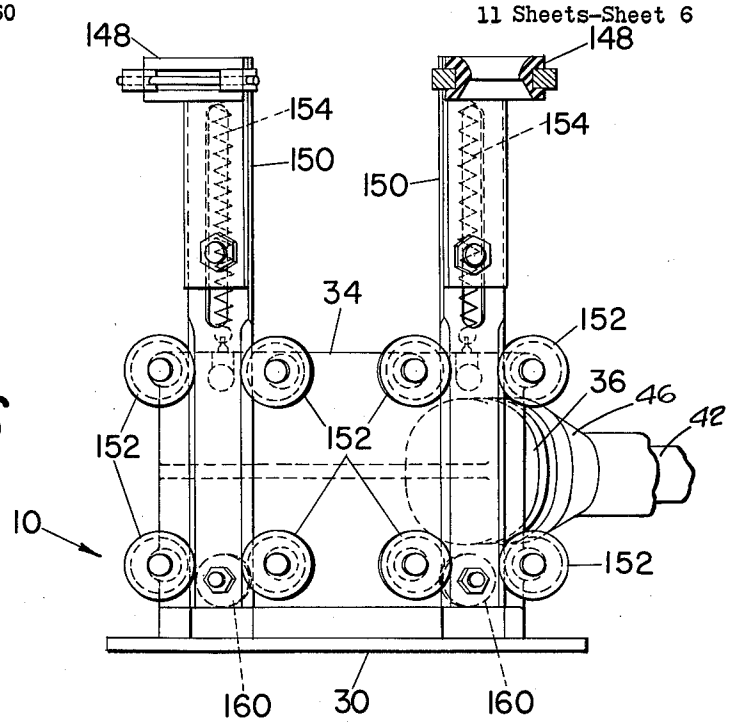
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 6

Fig. 6



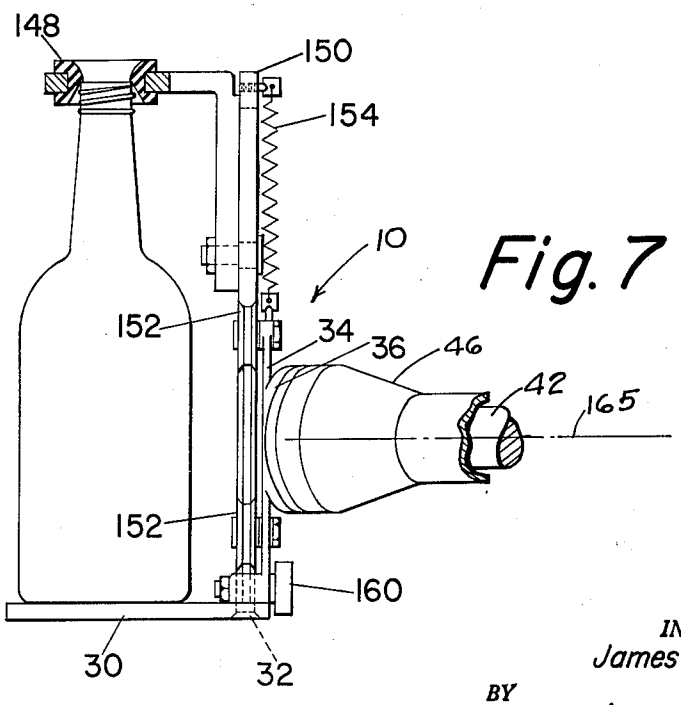


Fig. 7

INVENTOR.
James P. Whelan

BY

Robert R. Churchill

ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 7

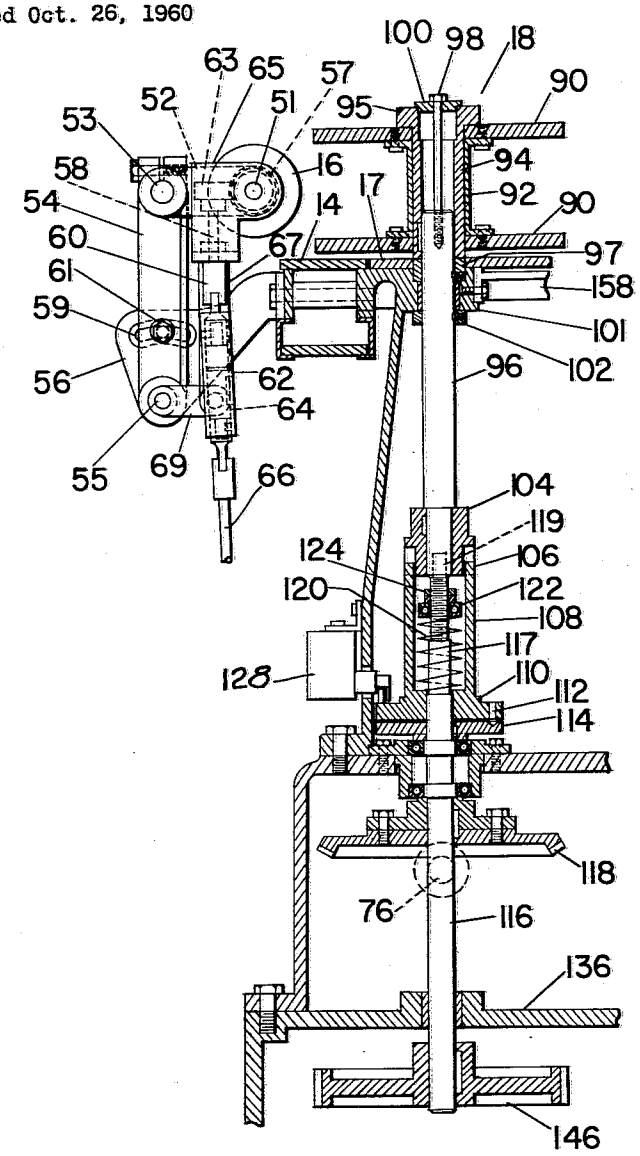


Fig. 8

INVENTOR.
James P. Whelan

BY Robert R. Churchill

ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 8

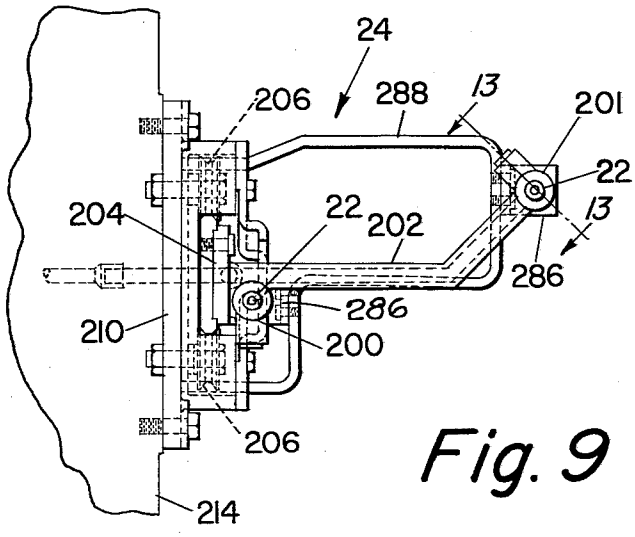


Fig. 9

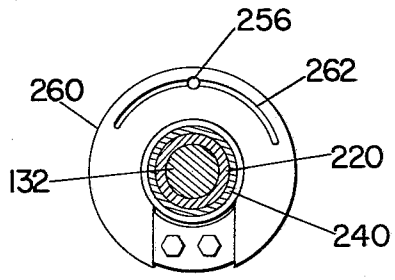


Fig. 12

INVENTOR.
James P. Whelan

BY Robert K. Churchill

ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 9

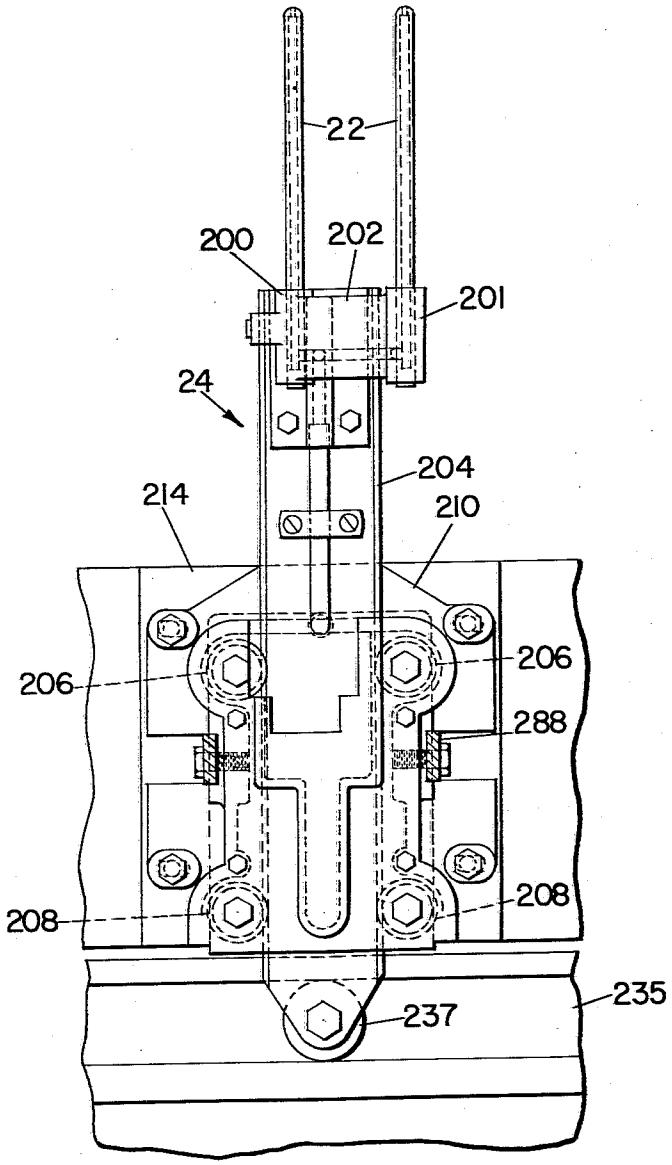


Fig. 10

INVENTOR.
James P. Whelan
BY
Robert K. Quarbill
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 10

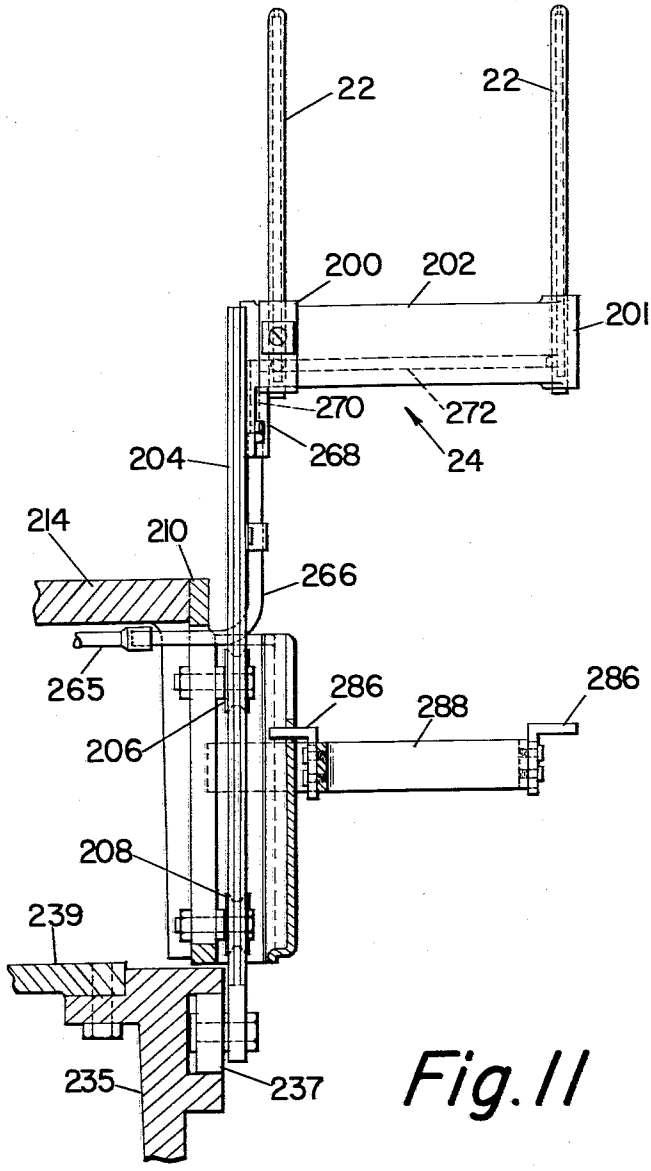


Fig. 11

INVENTOR.
James P. Whelan
BY
Robert C. Churchill
ATTORNEY

Oct. 30, 1962 J. P. WHELAN 3,060,481

CONTAINER CLEANING MACHINE

Filed Oct. 26, 1960 11 Sheets-Sheet 11

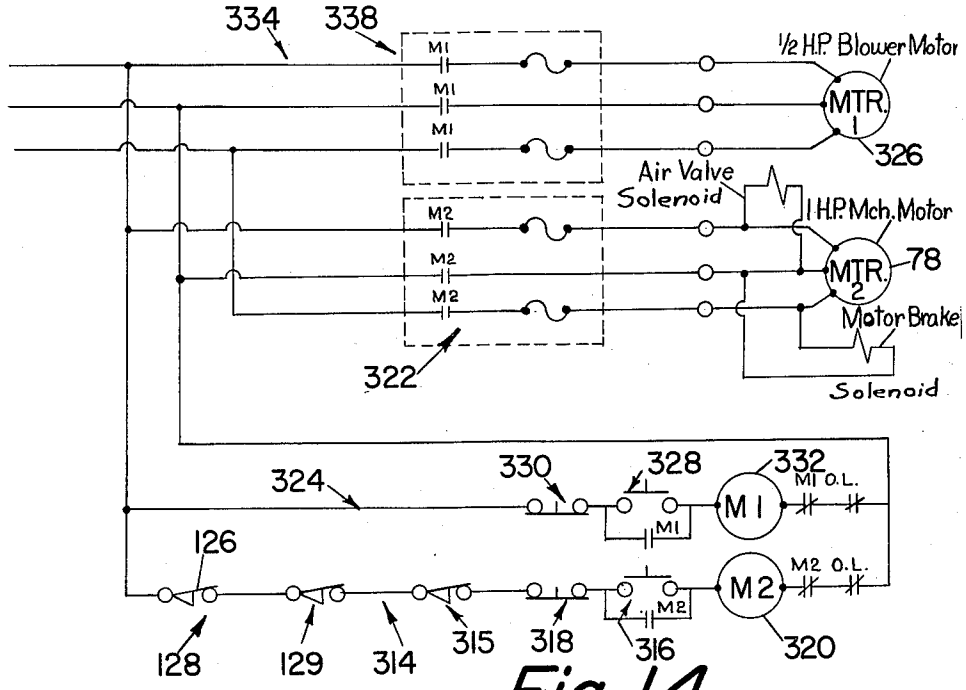


Fig. 14

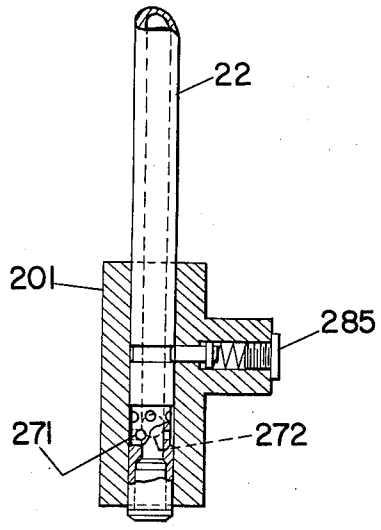


Fig. 13

INVENTOR.
James P. Whelan

BY Robert R. Churchill

ATTORNEY

United States Patent Office 3,060,481 Patented Oct. 30, 1962

3,060,481

CONTAINER CLEANING MACHINE

James P. Whelan, Quincy, Mass., assignor to Pneumatic Scale Corporation, Quincy, Mass., a corporation of Massachusetts

Filed Oct. 26, 1960, Ser. No. 65,190
30 Claims. (Cl. 15—304)

This invention relates to a container cleaning machine.

The invention has for an object to provide a novel and improved container cleaning machine for cleaning containers, particularly bottles, by means of an air stream and which is characterized by structure enabling the bottles to be cleaned in a superior, rapid and economical manner.

With this general object in view and such others as may hereinafter appear, the invention consists in the container cleaning machine and in the various structures, arrangements and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention:

FIG. 1 is a plan view of a bottle cleaning machine embodying the present invention;

FIG. 2 is a horizontal cross section taken on the line 2—2 of FIG. 3;

FIG. 3 is a vertical cross section taken on the line 3—3 of FIG. 1;

FIG. 4 is a horizontal section taken on the line 4—4 of FIG. 3;

FIG. 5 is a plan view detail of a duplex bottle carrier unit;

FIGS. 6 and 7 are detail views in front and side elevation, respectively, of the same;

FIG. 8 is a vertical cross section of the driving mechanism to the intake star wheel;

FIG. 9 is a plan view detail of a duplex nozzle carrier unit;

FIGS. 10 and 11 are detail views in front and side elevations, respectively, of the same;

FIG. 12 is a horizontal section taken on the line 12—12 of FIG. 3;

FIG. 13 is a vertical section of a nozzle supporting unit; and

FIG. 14 is a wiring diagram to be referred to.

In general the present invention contemplates a rotary type bottle cleaning machine, herein shown as having a plurality of duplex bottle carrier units, wherein the bottles are continuously moved through circular paths and wherein successive pairs of bottles delivered to successive duplex carriers in an upright position in one circular path are inverted in a manner such as to present the bottles in two concentric circular paths aligned with successive pairs of air discharge nozzles disposed therebelow and movable therewith arranged to perform the cleaning operation during the continuous movement of the bottles in said two paths. The bottle carrier units are vertically elongated and relatively closely spaced, and the present invention is characterized by a novel mounting of the duplex carrier units whose structure is such as to provide ample clearance to permit inversion of adjacent relatively closely spaced and vertically elongated carrier units without interference one with the other to the end that a greater number of bottles may be inverted and cleaned during their continuous travel in a rotary path of relatively smaller dimensions than would otherwise be possible, the advantage being that a rotary machine of relatively small proportions and dimensions may accommodate a relatively great number of bottles.

One feature of the present invention enabling inversion

of the relatively closely spaced and vertically elongated duplex carrier units without interference resides in the diagonally arranged mounting of the carrier units. Thus, the center line or axis of rotation of each carrier unit is diagonally arranged with respect to a radial line drawn from the center of the rotary supporting disk on which the carrier units are mounted for movement in a circular path. In other words the vertical plane of rotation of a carrier unit being moved in a horizontal circular path is non-tangential to the plane of said horizontal circular path. As a result a vertically elongated carrier unit supporting a pair of relatively long bottles being inverted will avoid adjacent non-inverted and fully inverted carrier units to the end that a greater number of units may be confined and rotated in a horizontal circular path of relatively smaller dimensions than would otherwise be possible. This feature also includes a multitrack cam arrangement adapted to effect rotation of the duplex carrier units in one direction to effect inversion thereof and to effect rotation in an opposite direction to again dispose the carrier units in an upright position. Novel provision is also made for clamping the bottles to the carrier units as will be hereinafter more fully described.

Another structural feature affording clearance to avoid adjacent carriers during inversion of a carrier unit, together with the diagonal mounting above described, resides in disposing the center line of rotation of the carrier supporting and inverting shaft intermediate the length of the bottles supported by the vertically elongated carrier, as distinguished from disposing such center of rotation adjacent the upper or lower ends of the bottles. As a result the extent of the vertical plane of rotation during inversion is substantially reduced, thus enabling reduction in the overall height of the cleaning machine.

The air discharge nozzles are carried by duplex nozzle carrier units disposed below the duplex bottle carrier units, and provision is made for elevating the nozzle carrier units to insert the nozzles into the inverted bottles to perform the cleaning operation. Thereafter, the nozzles are lowered out of the bottles, and the bottle carrier units are returned to their original position presenting the cleaned bottles in an upright position to be removed from the carriers and discharged from the machine. In the illustrated embodiment of the invention successive inverted pairs of bottles arranged in two circular paths are substantially radially arranged with respect to the rotary supporting disk, and the bottles in each inverted path are circumferentially spaced a distance greater than the circumferential spacing of the bottles in the upright path prior to the inverting operation, thus affording ample space for the cleaning mechanism.

In accordance with another feature of the present invention novel provision is made for vertically adjusting the duplex nozzle carrier units relative to the bottle carrier units whereby to accommodate different sizes or lengths of bottles supported by the bottle carriers.

In operation streams of air under pressure are delivered by the air discharge nozzles into the bottles at high velocity while the bottles are in an inverted position whereby to dislodge from the bottles and suspend in the air stream any dust or other foreign matter in the bottles which is discharged through the mouths of the bottles. Suitable suction means is also provided adjacent the discharge area to carry away the dust and other foreign matter removed from the bottles.

Referring now to the drawings, in general the present bottle cleaning machine includes a plurality of duplex bottle carrier units, indicated generally at **10**, mounted to rotate continuously in a circular path. The bottles **12** are delivered to the machine in contiguous engagement on a conveyer **14**, and a spiral feeding screw **16** associated with the conveyer is arranged to engage and space suc-

cessive bottles to present them in timed relation to a continuously rotated intake star wheel **18** arranged to transfer successive bottles onto the continuously moving duplex bottle carrier units **10**. Each carrier unit **10** receives two bottles in spaced relation and in an upright position, the space between the bottles on adjacent carriers being equal to the spacing of the two bottles on a single carrier. Provision is also made for clamping the bottles on the carriers **10** by means engageable with the necks of the bottles as indicated generally at **20**.

Each duplex bottle carrier unit **10** is mounted to be inverted during the continuous movement thereof to dispose the mouths of the inverted bottles in alignment with a pair of air discharge nozzles **22** carried by a continuously rotated and vertically reciprocable duplex nozzle carrier unit indicated generally at **24**, a plurality of which, one for each duplex bottle carrier unit, is also mounted to move in a circular path along with the bottle carrier units.

Provision is made for elevating the nozzle carrier units **24** to present the nozzles into the mouths of the bottles and to discharge streams of air through the nozzles into the bottles and out of the mouths thereof to effect the cleaning operations, as above defined. The nozzle carrying units are then lowered to remove the nozzles from the bottles whereupon the bottle carrier units **10** are returned to their original upright position. Provision is made for controlling the air discharge to coincide with the time the nozzles are in operative engagement with the bottles, and provision is also made for removing the air by vacuum from the area into which the dust-laden air is discharged from the bottles. The cleaned bottles **12**, supported on the upright carrier units **10**, are then removed from the carriers and transferred back onto the conveyer **14** by a discharge star wheel **26** to be delivered to a bottle filling machine or other delivery point.

As illustrated in FIG. 3 and in detail in FIGS. 5, 6 and 7, each duplex bottle carrier unit **10** includes an arcuate bottle supporting plate **30** secured by screws **32** to the lower end of a vertical bracket **34**. The bracket **34** is provided with an angularly disposed flange **36** at one end thereof which is connected by bolts **38** to a flange member **40** fast on the outer end of an angularly arranged rocker shaft **42** mounted in bearings **44** formed in a bracket **46** secured to a continuously rotated spider or supporting disk **48**. The rocker shaft **42** comprises the supporting and inverting shaft for its carrier unit **10** as will be hereinafter described.

The conveyer **14** which delivers the bottles to the machine at the intake point and also receives the cleaned bottles at the discharge point may be continuously driven in any usual or preferred manner and may be conveniently driven through connections from a bottle filling machine or other machine, not shown, associated with the present cleaning machine. The feeding screw **16** is arranged to engage and space successive bottles delivered by the conveyer **14**. As herein shown, the feeding screw **16** is carried by a horizontal shaft **51** mounted to rotate in bearings formed in the ends of spaced horizontally extended arms **50**, **52** which are secured at their other ends to an elongated supporting shaft **53**. The shaft **53** is clamped to the upper ends of spaced vertical arms **54**, and each arm **54** is pivotally mounted on a stud **55** carried by spaced brackets **56** secured to and extended from a side rail of the conveyer **14**. Each bracket **56** is provided with an arcuate slot **59** through which a bolt **61** is extended and engaged with a threaded opening in its adjacent vertical arm **54**. With this construction it will be seen that the feeding screw **16** may be adjusted laterally of the conveyer **14** to accommodate different diameter bottles by rocking the arms in the required direction and then tightening the bolts **61**.

As illustrated in FIG. 8, one end of the horizontal feeding screw shaft **51** is provided with a helical gear **57** in mesh with a helical gear **63** fast on the upper end of a short shaft **58**. The shaft **58** is journaled in a gear housing **65** having a portion thereof fitted over and supported by the shaft **51**. The gear housing **65** is prevented from rotation with the shaft **51** by a bracket **67** secured to and depending from the lower end of the housing and by a link **69** connected between the bracket **67** and the adjacent pivot stud **55**. The lower end of the shaft **58** is connected by a universal joint **60** to a depending tubular extension **62** into which the upper end of a rod **64** forming a part of a second universal joint is telescopically fitted and keyed in a manner such as to permit movement of the rod longitudinally relative to the extension **62** when the screw feeder is adjusted laterally. The second universal joint is connected to a shaft **66** which in turn is connected by a third universal joint **71** to the upper end of a short shaft **68** journaled in a bracket **70** secured to the machine frame. The lower end of the shaft **68** is connected by bevel gears **72** to a horizontal shaft **74** which in turn is connected by helical gears **75** to a main driving shaft **76**.

The main driving shaft **76** is arranged to be continuously rotated through connections from an electric motor **78** which is connected by a belt **80** and speed selector driving mechanism indicated generally at **82** to a shaft **84** provided with a pinion **86**. The pinion **86** meshes with a gear **88** fast on the main drive shaft **76**.

In operation, rotation of the feeding screw **16** effects spacing of the bottles **12** and advancement of successive bottles to be received in timed relation between the arms **90** of the intake star wheel **18** which is continuously rotated in timed relation to the continuous movement of the rotary carrier units **10**. As shown in FIG. 8, the intake star wheel **18** includes upper and lower wheels provided with arms **90** and which are secured in spaced relation to the flanged ends of a spool-like member **92** fitted on a hollow shaft **94** having a flange **95** at its upper end. The upper end of a vertical shaft **96** is fitted into and keyed to the hollow shaft **94**. A bolt **98** extended through a washer **100** supported by the flange **95** is threadedly engaged with the upper end of the shaft **96**. The lower end of the hollow shaft **94** bears against a collar **97** secured to the shaft **96** and supported in a bearing portion **101** of the machine frame. The intake star wheel unit **18** is thus detachably clamped to the upper end of the shaft **96** to permit interchange of the star wheel unit for a unit arranged to accommodate different size bottles. A second collar **102** secured to the shaft **96** engages the underside of the bearing portion **101** to prevent vertical displacement and to support the shaft for rotation in the bearing portion **101**.

The lower end of the shaft **96** is keyed to a connecting member **104** having longitudinally extended grooves arranged to receive in telescopic driving relation upstanding fingers **106** formed in a hollow cylindrical member **108**. The member **108** forms the driven member of a separable driving connection arranged to yield upwardly to effect disengagement of the driving connection in the event that the intake star wheel **18** becomes jammed by a defective bottle or is otherwise inadvertently forcibly stopped from rotating. As herein illustrated, the driven member **108** is provided at its lower end with a flange **110** which carries a plurality of circumferentially spaced pins **112** having conical heads extended from the lower face of the flange for cooperation with correspondingly shaped openings in the upper face of a driving disk **114**. The disk **114** is secured to a shaft **116** rotatably mounted in the machine frame and connected by bevel gears **118** to the main driving shaft **76**. The shaft **116** has an upper portion **117** which extends upwardly from the disk **114** into the hollow portion of the driven member **108**, and a reduced diameter portion **119** at the upper end of the portion **117** is engaged in an opening in the lower end of the driven shaft **96** for relative rotation therein whereby to maintain vertical alignment of the parts. A spring **120** coiled about the extended end **117** of the

shaft 116 is interposed between a portion of the driven member 108 and a thrust bearing 122 adjustably maintained in a position to compress the spring by nuts 124 engageable with a threaded portion of the shaft.

With this construction it will be seen that the spring 120 resiliently maintains the conical heads of the pins 112 in driving engagement with the conical openings in the disk 114, and when the intake star wheel 18 is held stationary, as by a jammed bottle, the conical openings in the continuously rotated driving disk 114 cause the conical heads of the pins 112 to ride up out of the openings and to elevate the driven member 108 a short distance. Such slight separation of the driven member 108 from the driving member 114 is arranged to rock a switch arm to open a switch 128 in the motor circuit and terminate operation of the machine to thus prevent damage to the operating parts and permit the operator to clear the jammed parts.

From the description thus far it will be seen that successive bottles 12 delivered to the machine are spaced and transferred to successive duplex bottle carrier units 10 mounted on the continuously rotated supporting disk 48. As illustrated in FIG. 3, the supporting disk 48 is bolted to a flange 130 which may be secured, as by welding, to a central drive shaft 132. The central drive shaft is supported for rotation at its lower end in a bearing 134 carried by the base 136 of the frame, and at its upper end in a ball bearing 138 supported in a cap member 135 secured to the upper end of a hollow hub 139 forming a part of a cantilever bracket 140 mounted on uprights 142 upstanding from the base of the machine. The lower end of the central shaft 132 is provided with a large diameter gear 144 which meshes with a gear 146 fast on the lower end of the intake star wheel drive shaft 116 to drive the rotary supporting member 48. Thus, the duplex carrier units 10 are rotated in timed relation to the intake star wheel 18 so as to receive two bottles in spaced relation on the supporting plate 30 of successive carrier units 10. It will be seen that the bottles are transferred from the conveyer 14 to the carrier plate 30 across a bridge plate 17 and are guided between the intake star wheel 18 and a guide plate 19.

Provision is made for aligning and retaining the bottles on their supporting plate 30 during inversion and cleaning thereof. As herein shown (see FIGS. 5, 6 and 7), a bottle clamping and aligning member 148 is provided for engagement with the neck of each bottle to clamp the bottle against its supporting plate 30. Each clamping member is provided with a conical opening to guide and align the mouth of its bottle for subsequent registration with their respective air discharge nozzles 22. Each clamping member is mounted for vertical adjustment on an upright member 150 guided for vertical reciprocation between opposed pairs of upper and lower rollers 152 carried by the bracket 34. A spring 154 connected between the upper end of the member 150 and the bracket 34 tends to urge the member 148 downwardly into clamping engagement with the neck of its bottle, and a stationary cam piece 156 supported by a bracket 158 attached to the machine frame is arranged to cooperate with a cam roll 160 carried by the lower end of the vertically reciprocable member 150. The cam piece 156 is designed to maintain the clamping members 148 in an elevated position until a bottle is transferred and guided onto its supporting plate 30 by the intake star wheel 18 whereupon the clamping member is lowered into engagement with the top of the bottle.

As diagrammatically illustrated in FIG. 5, when a duplex bottle carrier unit 10 is arranged in an upright position the bottles 12 are arranged in spaced relation on a circumferential center line 161, and a pair of bottles carried by the supporting plate 30 are equally spaced on either side of a radial center line 162 through the plate 30. A line 164 drawn between the centers of the two bottles on the plate intersects the radial line 162 at right angles thereto. The diagonal mounting for each carrier unit 10 is arranged to effect inversion of the carrier plate 30 from such radially and circumferentially arranged position to a position wherein the two bottles are arranged in two different concentric circular paths, such different circular paths being substantially equally spaced radially on either side of said circumferential center line 161 to dispose the inverted bottles in alignment with the nozzles 22 of the nozzle carrier unit 24. It will be observed that a pair of inverted bottles in said different paths are arranged substantially radially with respect to the rotary supporting disk 48.

In the illustrated embodiment of the invention each bottle carrier unit 10 is connected to its supporting and inverting shaft 42 at a point adjacent one corner of the supporting plate 30 with the center line or axis of rotation 165 of the shaft 42 arranged diagonally at an angle of about 35° on one side of said radial line 162 from the point of intersection of the line 162 with the line 164 as shown. As illustrated in side elevation (see FIG. 7), the center line or axis of rotation 165 of the shaft 42 occurs in a horizontal plane intermediate the ends of the bottles.

With this construction it will be seen that when the rocker shaft 42 is rotated through 180° in a clockwise direction facing the outer end of the shaft, the duplex bottle carrier unit 10 will be rotated in a diagonal plane relative to the radial line 162 from the center of rotation of the shaft 132 and will be moved from the upright and radially aligned position indicated at A, through a halfway or 90° position indicated at B, and then to a completely inverted or 180° position indicated at C without interference one with the other of adjacent closely spaced and continuously moving duplex bottle carrier units.

As herein illustrated, such rotation is effected by a stationary multitrack barrel cam indicated at 170 which is arranged to cooperate with two cam rolls 172, 174 carried by an arcuate member 176 fast on the inner end of each rocker shaft 42. The cam rolls 172, 174 are radially extended from the rocker shaft and are circumferentially spaced 90° apart. The stationary cam 170 is provided with two separate cam tracks, one track 178 cooperating with the roll 172 which follows an upward path 173 to effect 90° of rotation of the shaft 42 in a clockwise direction whereby to dispose the carrier unit 10 in its halfway position indicated at B. At this time, during the continuous movement of the bottle carriers, the cam roll 172 leaves the trailing end of the track 178, and the second cam roll 174, which has been rotated through 90° during the first 90° movement of the carrier unit, enters the leading end of the second cam track 180 which is provided with an upward path arranged to effect rotation of the shaft 42 through another 90° in a clockwise direction whereby to complete inversion of the duplex bottle carrier unit 10 to the position indicated at C. The cam track 180 has an idle portion 182 for maintaining the carrier unit in its inverted position during the air cleaning operation, and at the end of the cleaning operation the cam roll 174 follows a downward path 175 to rotate the shaft 42 in a reverse direction through 90° of the return movement of the bottle carrier unit. The second roll 174 then leaves the trailing end of the second track 180, and the roll 172, which has been rotated through 90° during such return movement, enters the leading end of the first track 178 which has a downward path 184 arranged to effect rotation of the shaft 42 through the remaining 90° to return the bottle carrying unit 10 to its upright position. The first track 178 has an idle portion 186 for maintaining the unit 10 in an upright position during removal and discharge of the cleaned bottles from the supporting plate 30 and during transfer of a new pair of bottles to be cleaned onto the supporting plate in readiness to start a succeeding cleaning cycle.

The stationary cam 170 is provided with an elongated hub 181 having a flange 183 at its upper end which is connected by bolts 185 to a flange 187 at the lower end of the hollow hub 139 forming a part of the cantilever bracket

140 as shown. The central opening in the hub 181 provides a clearance for the continuously rotating shaft 132, and a roller bearing 188 is provided between the lower end of the hub 181 and the rotary supporting member 48. One element of the roller bearing is secured to rotate with the shaft 132, and a plurality of circumferentially arranged friction plugs 190 carried by the hub are arranged to bear against the stationary element of the roller bearing. The friction plugs are adjustably held against the stationary element by set screws 192 to support the cam 170 in concentric relation to the shaft 132 and in a fixed position for cooperation with the cam rolls 172, 174.

The inverted bottles 12 are disposed in vertical alignment with their respective air discharge nozzles 22 carried by the vertically reciprocable and rotatably mounted nozzle carrier units 24 which are arranged to be elevated to present the nozzles into the mouths of the bottles to perform the cleaning operation. As shown in FIG. 9, each nozzle carrier unit 24 is provided with two nozzles 22 mounted in offset elongated hub portions 200, 201 carried by a radially extended arm 202 adjustably secured to an upright slide member 204 mounted for vertical movement between upper and lower pairs of guide rolls 206, 208 respectively. The guide rolls are carried by a bracket 210 secured to and depending from the outer edge of a rotary supporting member 214 arranged to be rotated along with the supporting disk 48 by connections including a plurality of circumferentially spaced drive pins 216 secured to and depending from the disk 48 as shown in FIG. 3. The pins 216 extend into openings formed in the rotary member 214 and are of a length such as to permit vertical adjustment of the member 214 relative to the bottle carrier supporting disk 48 to accommodate bottles of different heights.

The rotary member 214 is connected by bolts 215 to a flange 218 secured to an elognated sleeve 220 mounted for rotation with and longitudinal adjustment on the central drive shaft 132. As herein illustrated, the upper end of the sleeve 220 is provided with opposed inwardly extended blocks 222 which extend through opposed slotted openings 224 formed in the side walls of a central longitudinal bore 226 in the upper portion of the drive shaft 132. The inner ends of the blocks 222 engage opposed grooved portions 228 formed at the lower end of an elongated adjusting rod 230 extended through the bore 226. The upper threaded end of the elongated rod 230 cooperates with an adjusting nut 232 which bears against the upper end of the central shaft 132 through the medium of a ball bearing 234. The adjusting rod 230 is held from rotation relative to the shaft 132 by the blocks 222 engaging the grooved portions 228 so that upon rotation of the nut 232 in one direction the supporting member 214 is elevated relative to the shaft 132 and the disk 48 carried thereby, and conversely, rotation of the nut in the opposite direction will lower the supporting member 214 relative to the shaft 132. The nut 232 is maintained in its adjusted position by a clamp structure 236 which forms a part of the nut as shown. Thus, in operation the nut 232 and the adjusting rod 230 rotate as a unit with the shaft 132 and sleeve 220.

From the description thus far it will be seen that the elongated sleeve 220 and the rotary nozzle unit supporting member 214 carried thereby are suspended from the end of the adjusting rod 230 by virtue of the blocks 222 engageable with the lower end thereof in a manner such as to permit adjustment vertically with relation to the central shaft 132 and thus effect adjustment of the nozzle carrier units 24 relative to the bottle carrier units 10 to accommodate bottles of different heights.

The nozzle carrier units 24 mounted on the vertically reciprocable members 204 are arranged to be reciprocated during their movement through a circular path by a stationary barrel cam 235 arranged to cooperate with a cam roll 237 carried at the lower end of each vertically reciprocable member 204. The stationary barrel cam 235 is connected to a supporting disk 239 mounted on the lower end of the rotating sleeve 220 in a manner such as to permit rotation of the sleeve therein and to permit vertical adjustment of the stationary cam as a unit along with the nozzle carrier supporting member 214. As herein shown, a depending hub 238 of the supporting disk 239 is provided with bushings 240 to permit rotation of the sleeve 220 within the hub, and the lower end of the hub bears against a ball bearing 242 supported on the sleeve by an annular retaining plate 244 secured to the end of the sleeve by bolts 246. The barrel cam 235 is held from rotation with the sleeve by an upstanding stop member 248 secured to the base 136 and which is engageable between projections 250 extending inwardly from the inner periphery of the barrel cam, as shown, so as to permit vertical adjustment of the cam along with the sleeve 220.

Provision is made for supplying air under pressure to the air discharge cleaning nozzles 22 and for controlling the admission of air to the nozzles to correspond to the portion of the cycle of operation during which the containers are inverted. Air under pressure may be supplied from a regulated source, not shown, to a supply conduit 252 which is connected to the lower end of a passageway 254 formed in the upstanding stop member 248. The upper end of the passageway 254 is connected by a flexible conduit 256 to a stationary annular member 260 secured to the upper face of the stationary disk 239. As herein shown (see FIGS. 3 and 12), the conduit 256 extends through an opening in the stationary cam supporting disk 239 and communicates with an arcuate groove 262 formed in the upper surface of the annular member 260. A second annular member or ring 264 is mounted to rotate with the sleeve 220 and with its undersurface in contiguous and airtight engagement with the upper surface of the member 260. A plurality of circumferentially spaced ports 263 provided in the upper surface of the movable ring 264 are arranged to communicate with the arcuate groove 262 during the air cleaning operation, and each port is connected by a flexible conduit 265 to its individual nozzle carrier unit 24. As herein shown (see FIG. 11), each flexible conduit 265 is connected to the lower end of a right angle pipe 266 secured to and movable with the vertically reciprocable member 204. The upper end of the pipe 266 is connected to a depending portion 268 of the nozzle supporting arm 202 and communicates with a vertical passageway 270 formed therein. A communicating horizontal passageway 272 formed in the arm 202 and in the offset hub portions 200, 201 leads to the nozzles 22 as shown. Each flexible conduit 265 may be looped, as shown in FIG. 3, and an arcuate guide 273 attached to the rotary supporting member 214 may be provided to confine the loop during reciprocation of the nozzle carrier unit.

As illustrated in FIG. 3, the ring 264 is connected to rotate with a flange 274 keyed to the sleeve 220 in a manner such as to permit slight vertical movement relative to the sleeve, and provision is made for resiliently maintaining the ring 264 in airtight engagement with the upper surface of the annular member 260. For this purpose a plurality of circumferentially spaced compression springs 275 are provided, each spring being interposed between a spring positioning stud 276 seated in the upper surface of the ring 264, and a washer 278 mounted on the lower end of an adjusting stud 280. Each stud 280 is carried by the rotary supporting member 214 and extends into a bored portion formed in the underside of the member 214 and within which the upper end of the spring 275 extends as shown. The arcuate groove 262 in the upper surface of the annular member 260 forms with the upper cooperating ring 264 a rotary valve with which the ports 263 cooperate. In the illustrated embodiment of the invention the arcuate groove 262 extends through an arc of about 136° which defines the period in the cycle during which the cleaning operation is performed. In practice a port 263 arrives in com-

munication with the groove 262 immediately prior to insertion of the nozzles into the bottle, and the port is cut off immediately after withdrawal of the nozzles.

The air discharge nozzles 22 comprise tubular members mounted for sliding movement in openings in the hub portions 200, 201 and are normally retained in their upwardly extended operative positions by a spring pressed friction device indicated generally at 285 in FIG. 13 which cooperates with a grooved portion of the nozzle. The nozzles are closed at their lower ends and are provided with openings 271 in a grooved portion of their side walls for communication with the air passageway 272. The sliding and frictionally retained mounting for the nozzles comprises a safety to avoid damage to a nozzle in the event that the upper end of the nozzle strikes an obstruction such as the edge of the mouth or a closed mouth of an imperfect bottle during the elevating movement of the nozzle. When such condition occurs, the nozzle is free to slide downwardly in its supporting hub against the force of the friction retaining means 285. Thereafter, the displaced nozzle is returned to its operative position by a stop plate 286 during the lowering movement of the nozzle carrier unit. As herein shown, two stop plates 286, one for each nozzle, are mounted for vertical adjustment on a loop shaped bracket 288 secured to and extended from the side edges of the bracket 210 as shown.

As illustrated in FIG. 4, provision is made for removing the dust and other foreign matter discharged from the bottles during the cleaning operation. As therein shown, the open area at the lower portion of the machine is enclosed by suitable sheet metal guards 290, 291, 292, 293 to confine the suspended material therein, and a continuously operated motor driven suction fan 295 mounted on an extended portion of the base 136 and in communication with the enclosed area through an inlet 296 is arranged to remove the suspended material and deliver the same through curved conduit 297 into a storage chamber 298. The dust blown into the chamber strikes baffle members 299 secured to the walls of the chamber. A door 394 provided in one wall of the chamber may be provided with a fine mesh screen to relieve any pressure built up in the chamber. The bottoms of the enclosed areas and the storage chamber 298 may be provided with suitable pans which may be removed to clean out the accumulated dust.

Upon completion of the cleaning operation the nozzle carrier units 24 are lowered to remove the nozzles from the bottles whereupon the bottle carrier units 10 are rotated 180° in a reverse direction through two 90° steps by the cams 180, 178, as previously described, to return the carrier units 10 to their initial upright position. The cleaned bottles carried by the upright units 10 are then released by lifting of the bottle clamping and aligning members 148 when the cam roll 160 engages the leading end of the stationary cam piece 156. The released bottles are then guided off the supporting plate 30 by engagement with a curved portion of the guide member 19 arranged in the path thereof which positions the bottles between the arms of the discharge star wheel 26 by which the bottles are transferred back onto the conveyer 14 for delivery to a subsequent machine in the line such as a bottle filling machine. It will be understood that the cam piece 156 maintains the clamping members 148 in an elevated position until new bottles to be cleaned are transferred to the supporting plate 30 by the intake star wheel 18.

As illustrated in FIG. 2, the discharge star wheel 26 may also be driven through connections from the main drive shaft 76 which include a bevel pinion 300 and gear 302, and a separable driving connection similar to that illustrated and described for the intake star wheel 18. The separable driving connection for the discharge star wheel 26 is also arranged to open a switch 129 similar to the switch 128 in the motor circuit, as diagrammatically illustrated in FIG. 14, when rotation of the wheel is inadvertently stopped by a jammed bottle, or otherwise, to discontinue operation of the machine and thus prevent damage to the operating parts.

Provision is also made for discontinuing operation of the machine in the event of any obstruction in the path of the rotary carriers or in the event of any undue strain on other portions of the machine such as to stop movement thereof. As illustrated in FIG. 2, the main driving mechanism includes a separable driving connection comprising a driving element 304 and a driven element 306 associated with the main drive shaft 76. The driven element 306 fast on the shaft 76 is provided with circumferentially spaced conical studs 308 extending therefrom which are urged into engagement with conical depressions formed in the driving element 304 by a coil spring 310 interposed between the driven element 306 and a collar 312 fast on the outer end of the shaft 76. In operation when inadvertent stoppage of the driven mechanism occurs, the conical studs 308 carried by the driven element 306 will ride out of the conical depressions to move the driven element outwardly against the pressure of the spring 310. The driven element thus urged outwardly is arranged to open a switch 315 to open the circuit to the driving motor 78 and discontinue operation of the machine.

As illustrated in FIG. 14, the circuit to the driving motor 78 is indicated generally at 314 and includes a manual starting switch 316 and stop switch 318. When the starting switch is closed a relay 320 is energized to close the contacts of circuit breaker 322 to start the motor 78. Manual operation of the stop switch 318 will effect separation of the contacts of the circuit breaker 322 to discontinue operation of the motor. Also, opening of the circuit 314 at any one of the safety switches 128, 129 or 315 will also effect deenergization of the relay 320 to discontinue operation of the driving motor 78.

The wiring diagram, FIG. 14, also includes a circuit 324 to the blower motor 326 for removing the dust from the cleaning area. The circuit 324 is also provided with manual start and stop switches 328, 330, respectively, for actuating a relay 332 to start or stop operation of the motor 326 through a circuit breaker 338.

From the above description it will be seen that the present rotary inverted bottle cleaner is capable of continuous operation to air clean inverted bottles in a rapid and efficient manner, and wherein the provision of duplex bottle carriers mounted to move in a circular path and to be inverted in a diagonal plane such as to avoid interference with adjacent carriers renders the machine capable of handling and cleaning a relatively great number of bottles in a relatively small space.

While the preferred embodiment of the invention is herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. In a rotary bottle cleaning machine, in combination, means for supporting and moving in a circular path a plurality of bottles in spaced relation, means disposed below the bottle supporting means for supporting and moving a plurality of vertically reciprocable air discharge nozzles in two spaced circular paths and means for inverting successive pairs of bottles in said first path through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said first circular path to present the mouths thereof in vertical alignment with their respective nozzles in said two paths.

2. In a rotary bottle cleaning machine, in combination, means for supporting and continuously moving in a circular path a plurality of bottles in spaced relation, means disposed therebelow for supporting and continuously moving a plurality of vertically reciprocable air discharge nozzles in two spaced circular paths concentric with the

axis of rotation of said bottle supporting means, and means for inverting successive pairs of bottles in said first circular path through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said one circular path to present the mouths thereof in vertical alignment with their respective nozzles in said two circular paths.

3. In a rotary bottle cleaning machine, in combination, a plurality of duplex bottle carrier units for supporting and moving continuously in a circular path a plurality of bottles in circumferentially spaced relation, a plurality of duplex nozzle carrier units disposed therebelow for supporting and moving continuously a plurality of vertically reciprocable air discharge nozzles in two radially spaced circular paths concentric with the axis of rotation of said bottle carrier units, and means for inverting successive duplex bottle carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said one circular path to present the mouths of the two circumferentially spaced bottles carried thereby in vertical alignment with their respective radially spaced nozzles in said two paths.

4. In a rotary bottle cleaning machine, in combination, a plurality of duplex bottle carrier units for supporting and moving a plurality of bottles in circumferentially spaced relation in one circular path, bottle cleaning means disposed below said bottle carrier units, and means for inverting successive duplex bottle carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said one circular path to present the bottles carried thereby in two radially spaced circular paths in operative relation to said bottle cleaning means.

5. In a rotary bottle cleaning machine, in combination, a conveyer for transporting bottles into and from the machine in an upright condition, a plurality of duplex bottle carrier units for supporting and moving in a circular path a plurality of bottles in circumferentially spaced relation, means for transferring successive bottles from the conveyer onto successive duplex bottle carrier units, means for clamping successive pairs of bottles to their respective carrier units, a plurality of duplex nozzle carrier units disposed below and movable with said bottle carrier units for supporting and moving a plurality of vertically reciprocable air discharge nozzles in two radially spaced circular paths concentric with the axis of rotation of said bottle supporting units, means for inverting successive bottle carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said one circular path to present the inverted bottles in vertical alignment with their respective radially spaced nozzles, and means for reciprocating successive nozzle carrier units to present the air discharge nozzles into and out of the inverted bottles to perform the cleaning operation.

6. In a rotary bottle cleaning machine, in combination, a conveyer for transporting bottles into and from the machine in an upright condition, a plurality of duplex bottle carrier units for supporting and moving in a circular path a plurality of bottles in circumferentially spaced relation, means for transferring successive bottles from the conveyer onto successive duplex bottle carrier units, means for clamping successive pairs of bottles to their respective carrier units, a plurality of duplex nozzle carrier units disposed below and movable with said bottle carrier units for supporting and moving a plurality of vertically reciprocable air discharge nozzles in two radially spaced circular paths concentric with the axis of rotation of said bottle supporting units, means for inverting successive bottle carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said one circular path to present the inverted bottles in vertical alignment with their respective radially spaced nozzles, means for reciprocating successive nozzle carrier units to present the air discharge nozzles into and out of the inverted bottles to perform the cleaning operation, means for thereafter righting successive bottle carrier units to return the bottles to an upright position, means for unclamping the bottles, and means for transferring the cleaned bottles from their carriers back onto said conveyer.

7. A rotary bottle cleaning machine as defined in claim 6 which includes an enclosed area for receiving the dust and other foreign matter removed from the inverted bottles and suspended in said area, a dust storage chamber, and suction means communicating with said enclosed area for removing the suspended dust and depositing the same in said storage chamber.

8. A rotary bottle cleaning machine as defined in claim 6 which includes means for supplying air under pressure to said air discharge nozzles, and means for controlling the supply of air thereto.

9. A rotary bottle cleaning machine as defined in claim 6 which includes means for vertically adjusting said nozzle carrier units relative to the bottle carrier units to accommodate bottles of different heights.

10. A rotary bottle cleaning machine as defined in claim 6 wherein the nozzles are mounted in their carrier units to permit longitudinal sliding movement when the nozzles meet an obstruction during elevation into the bottles, and means for resetting the nozzles to their normal position during subsequent lowering of the nozzle carrier units.

11. In a rotary bottle cleaning machine, in combination, a supporting member mounted to rotate in a horizontal plane, a plurality of vertically elongated duplex bottle carrier units arranged in relatively closely spaced relation secured to and movable with said rotary supporting member, each bottle carrier unit being arranged to support a pair of elongated bottles in an upright position for movement in a circular path, a plurality of vertically reciprocable air discharge nozzles arranged in two radially spaced circular paths disposed below and movable with said rotary supporting member, and means for inverting successive duplex carrier units through a vertical plane having an axis of rotation arranged diagonally with respect to said rotary supporting member whereby to provide clearance so as to avoid interference one with the other of adjacent elongated and relatively closely spaced bottle carrier units during the inverting operation and to present the inverted bottles in vertical alignment with their respective radially spaced air discharge nozzles arranged in said two circular paths.

12. A rotary bottle cleaning machine as defined in claim 11 wherein said diagonally arranged axis of rotation is disposed in a horizontal plane at a point intermediate the upper and lower ends of its vertically elongated bottle carrier unit.

13. A rotary bottle cleaning machine as defined in claim 11 wherein said diagonally arranged axis of rotation intersects a point formed by the intersection of a radial line drawn intermediate a pair of bottles with a line drawn between the centers of said bottles, the line of said axis of rotation occurring at an angle of about 35° with respect to said radial line whereby the circumferentially spaced upright bottles in one circular path will assume radially spaced positions in two circular paths when inverted.

14. In a rotary bottle cleaning machine, in combination, a plurality of duplex carrier units each supporting and moving a pair of circumferentially spaced bottles in a circular path, bottle cleaning means disposed below and movable with said bottle carrier units, and means for inverting successive duplex bottle carrier units to present the pair of bottles carried by each unit in two radially spaced circular paths in operative relation to said bottle cleaning means, said inverting means comprising a cam operated rocker shaft operatively connected to each duplex carrier unit, said rocker shaft having its axis of rotation arranged diagonally with respect to a radial line

extended medially of a pair of circumferentially spaced bottles disposed on said carrier unit when in an upright position.

15. A rotary bottle cleaning machine as defined in claim 14 wherein each bottle carrier unit is substantially rectangular in shape and is bounded by four corners and wherein said rocker shaft extends diagonally from one corner of the bottle carrier unit.

16. A rotary bottle cleaning machine as defined in claim 14 wherein the circumferential spacing of the inverted bottles in each of said two paths is greater than the circumferential spacing of the upright bottles in said one path.

17. In a bottle cleaning machine, in combination, means for supporting and moving in a predetermined path a plurality of bottles in spaced relation and in successive groups, bottle cleaning means disposed below the bottle supporting means, and means for inverting successive groups of bottles in said predetermined path through a vertical plane arranged diagonally with respect to said path adapted to present the bottles in the group in a plurality of different parallel paths and in operative relation to said cleaning means.

18. In a rotary bottle cleaning machine, in combination, a rotary supporting member, a plurality of bottle carrier units arranged in relatively closely spaced relation secured to and movable with said rotary supporting member, bottle cleaning means disposed below said carrier units, and means for inverting said bottle carrier units through a vertical plane arranged diagonally with respect to the rotary path of said units to present the bottles in operative relation to said cleaning means.

19. In a rotary bottle cleaning machine, in combination, a rotary supporting member, a plurality of vertically elongated bottle carrier units arranged in relatively closely spaced relation secured to and movable with said rotary supporting member, bottle cleaning means disposed below said carrier units, and means for inverting said bottle carrier units through a vertical plane to present the bottles in operative relation to said cleaning means, said vertical plane having an axis of rotation diagonally arranged with respect to a radial line drawn from the center of said rotary supporting member whereby to avoid interference one with the other of said vertically elongated and relatively closely spaced bottle carrier units during inversion thereof.

20. In a rotary bottle cleaning machine, in combination, a plurality of duplex carrier units each supporting and moving a pair of circumferentially spaced bottles in a circular path, bottle cleaning means disposed below and movable with said bottle carrier units, and means for inverting successive duplex bottle carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said circular path to present the pair of bottles carried by each unit in two radially spaced circular paths in operative relation to said bottle cleaning means, said inverting means having an axis of rotation comprising a rocker shaft extended diagonally with respect to said radial line and operatively connected to each duplex carrier unit, and cam operated means for rocking said shaft in one direction to effect the inverting operation and for thereafter reversing the direction of rotation of the shaft to return the carrier unit to its upright position.

21. A rotary bottle cleaning machine as defined in claim 20 wherein the cam operated means includes a multitrack stationary cam, each rocker shaft having a pair of radially extended rollers spaced 90° apart for cooperation with their respective cam tracks and arranged to effect the inverting operation in two 90° steps and to return successive carrier units to their upright position in two 90° steps.

22. A rotary bottle cleaning machine as defined in claim 21 wherein the stationary cam is provided with two cam tracks, each having a leading and trailing end, and wherein a roller is presented into the leading end of its track when the other roller is leaving the trailing end of its track.

23. In a rotary bottle cleaning machine, in combination, a rotary supporting member movable in a horizontal plane, a plurality of vertically elongated duplex bottle carrier units arranged in relatively closely spaced relation secured to and movable with said rotary member, each carrier supporting and moving a pair of bottles in a circular path in spaced relation, a plurality of duplex nozzle carrier units disposed below and movable with said bottle carrier units, each nozzle carrier unit provided with two radially spaced and vertically extended air discharge nozzles, means for inverting successive bottle carrier units through a vertical plane to present their bottles in alignment with their respective radially spaced nozzles, said vertical plane having an axis of rotation arranged diagonally with respect to a radial line extended medially of a pair of circumferentially spaced bottles disposed on a bottle carrier unit, said axis of rotation occurring intermediate the upper and lower ends of said vertically elongated carrier unit in a horizontal plane, whereby to avoid interference one with the other of said vertically elongated and relatively closely spaced bottle carrier units during inversion thereof.

24. In a rotary bottle cleaning machine, in combination, a rotary supporting member movable in a horizontal plane, a plurality of vertically elongated duplex bottle carrier units arranged in relatively closely spaced relation secured to and movable with said rotary member, each carrier supporting and moving a pair of bottles in a circular path in spaced relation, a plurality of duplex nozzle carrier units disposed below and movable with said bottle carrier units, each nozzle carrier unit provided with two radially spaced and vertically extended air discharge nozzles, means for inverting successive bottle carrier units through a vertical plane to present their bottles in alignment with their respective radially spaced nozzles, said vertical plane having an axis of rotation arranged diagonally with respect to a radial line extended medially of a pair of circumferentially spaced bottles disposed on a bottle carrier unit, said axis of rotation occurring intermediate the upper and lower ends of said vertically elongated carrier unit in a horizontal plane, whereby to avoid interference one with the other of said vertically elongated and relatively closely spaced bottle carrier units during inversion thereof, and means for vertically reciprocating said air discharge nozzles to present the same into and out of the mouths of the inverted bottles to perform the cleaning operation.

25. A rotary bottle cleaning machine as defined in claim 24 wherein provision is made for vertically adjusting said nozzle carrier units and said reciprocating means as a unit relative to said bottle carrier units to accommodate bottles of different heights.

26. In a rotary bottle cleaning machine, in combination, a plurality of bottle carrier units each supporting and moving a pair of circumferentially spaced bottles in a circular path, each carrier unit including a supporting plate and a pair of clamping units engageable with the tops of successive bottles for clamping the same to said plate, a bottle supply conveyer, a rotary intake spider for transferring successive bottles from the supply conveyer onto successive bottle carrier units, a helical feed screw associated with the conveyer for advancing and spacing the bottles in timed relation to said rotary intake spider, means for inverting successive carrier units through a vertical plane diagonally arranged with respect to a radial line extending from the center of rotation of said circular path to present the bottles into operative relation to be cleaned and for again righting the carriers, and a rotary discharge spider for removing and transferring successive cleaned bottles from the supporting plates back onto said conveyer.

27. A rotary bottle cleaning machine as defined in

claim 26 wherein the clamping units include a stationary cam cooperating with successive clamping units to effect clamping of successive bottles on their plates when delivered thereto by said intake spider and to effect release of successive bottles prior to engagement by said discharge spider.

28. A rotary bottle cleaning machine as defined in claim 26 which includes an adjustable mounting for said helical feed screw arranged to effect lateral adjustment of the same relative to said conveyer.

29. A rotary bottle cleaning machine as defined in claim 26 which includes an electrical circuit and a motor in said circuit for driving the machine, a separable driving connection associated with said motor arranged to be disengaged in the event of a jam, and a normally closed switch in said circuit arranged to be opened when said separable driving connection is disengaged to discontinue operation of the machine.

30. A rotary bottle cleaning machine as defined in

claim 29 wherein each transfer spider is provided with separable driving connection and normally closed switches in said motor circuit responsive to disengagement of their driving connections in the event of a jam to discontinue operation of the machine.

References Cited in the file of this patent

UNITED STATES PATENTS

1,260,329	Chilton	Mar. 26, 1918
1,730,381	Pennock	Oct. 8, 1929
2,172,509	Howard	Sept. 12, 1939
2,282,474	Howard	May 12, 1942
2,298,475	Fechheimer	Oct. 13, 1942
2,665,697	Hohl et al.	Jan. 12, 1954
2,967,321	Whelan	Jan. 10, 1961

FOREIGN PATENTS

619,609	Germany	Oct. 4, 1935