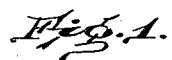


H. A. BARNBY ET AL

APPARATUS FOR VACUUM SEALING CONTAINERS

Filed Aug. 11, 1939

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BY *Rule & Hoge*
ATTORNEYS.

Sept. 2, 1941.

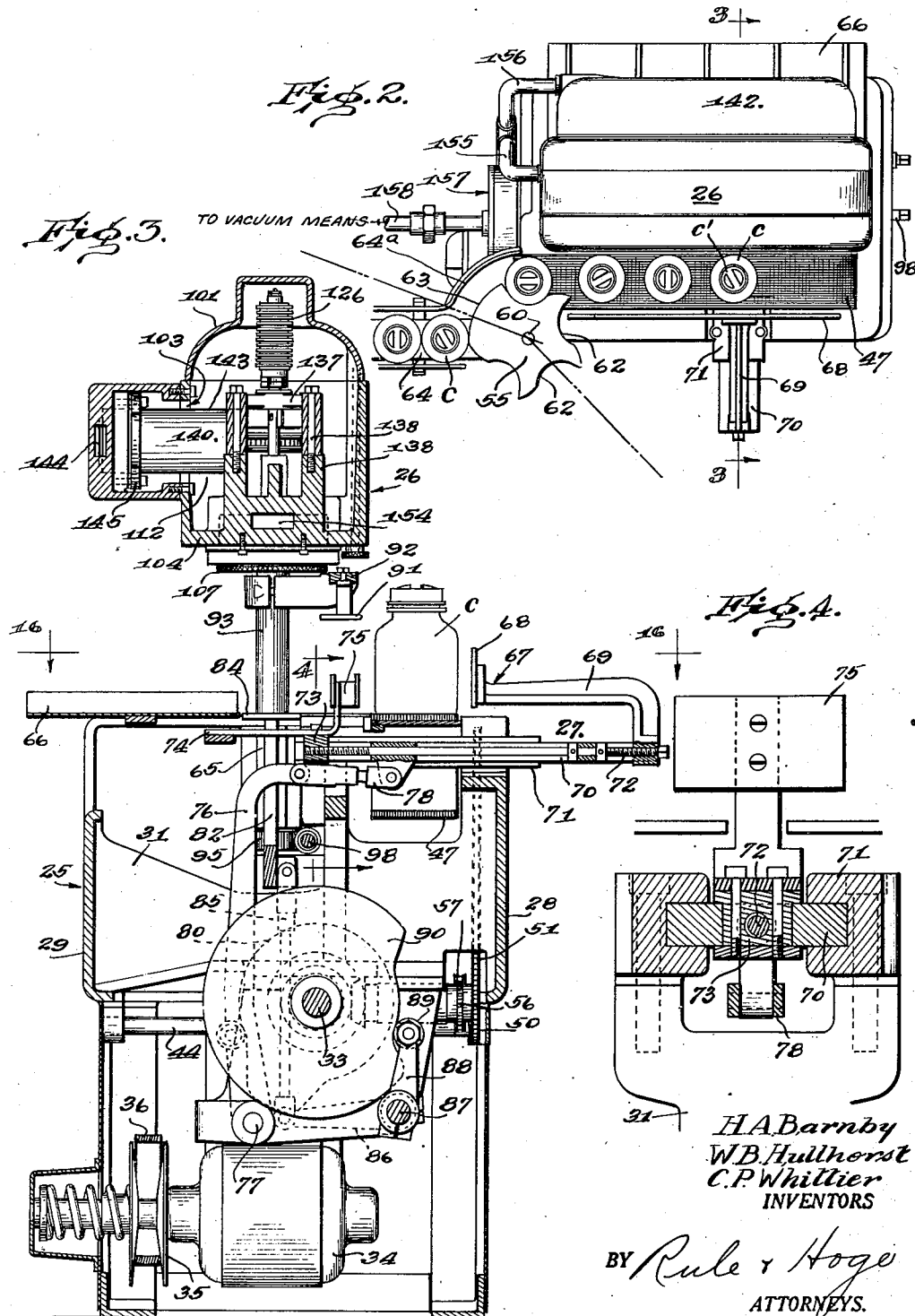
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APPARATUS FOR VACUUM SEALING CONTAINERS

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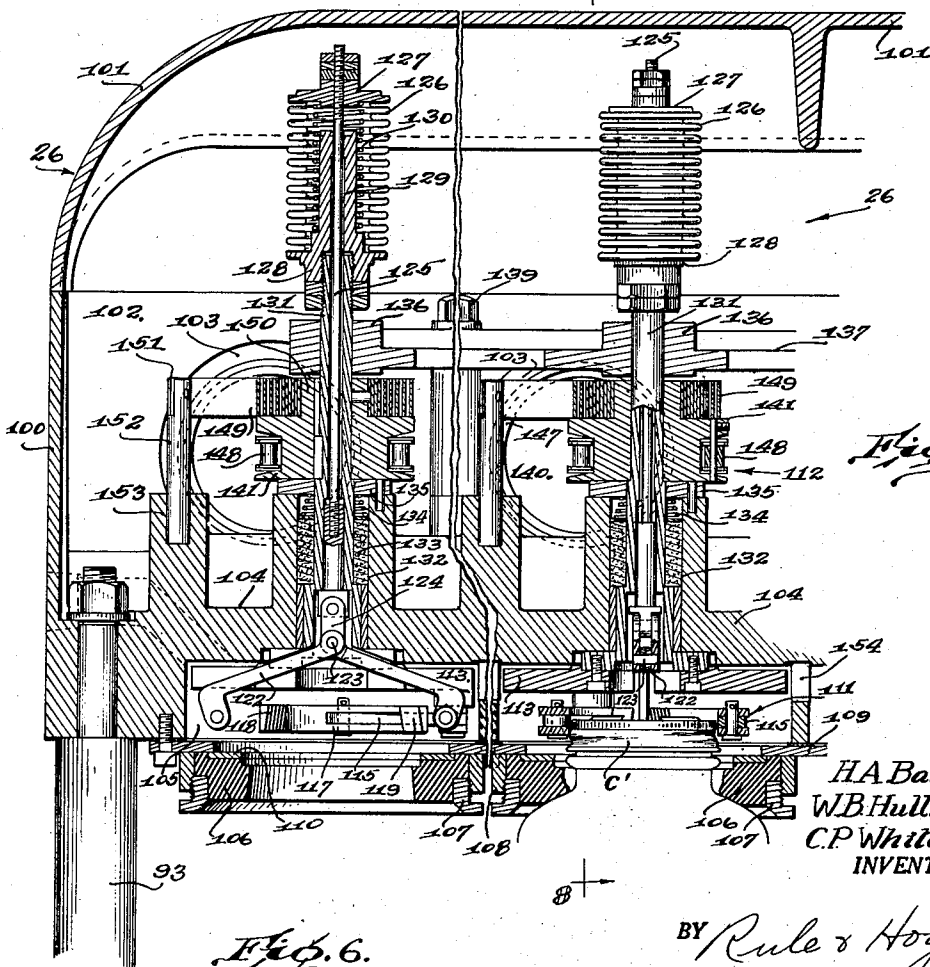
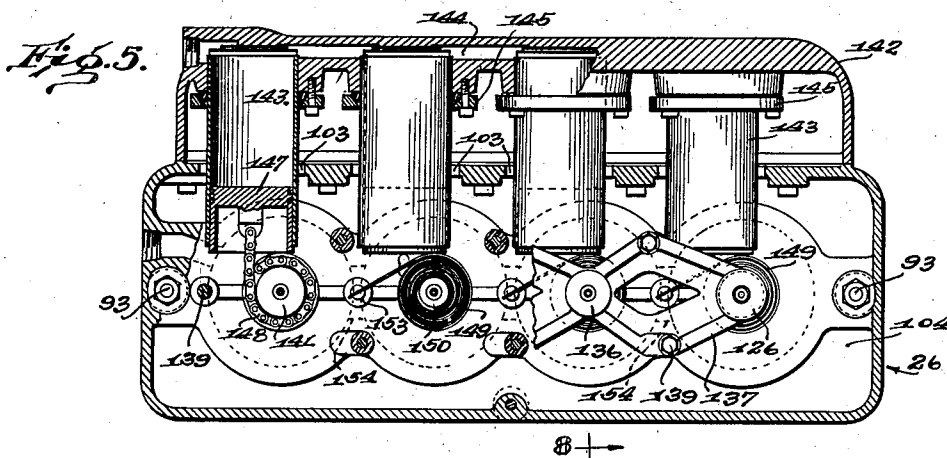
H. A. BARNBY ET AL

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APPARATUS FOR VACUUM SEALING CONTAINERS

Filed Aug. 11, 1939

10 Sheets-Sheet 3



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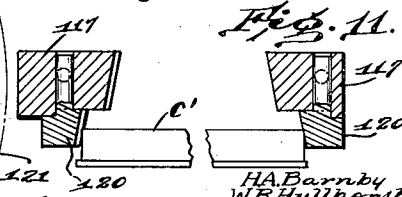
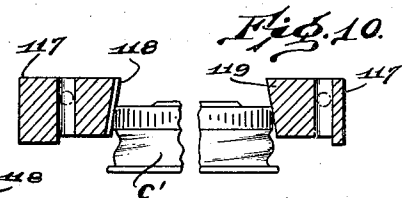
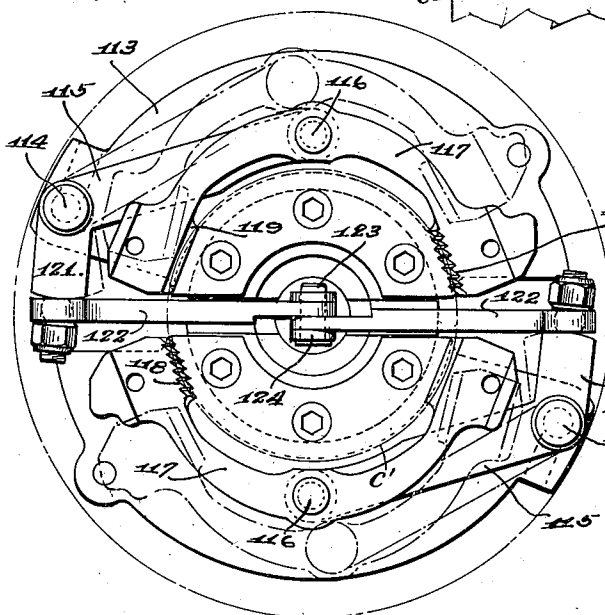
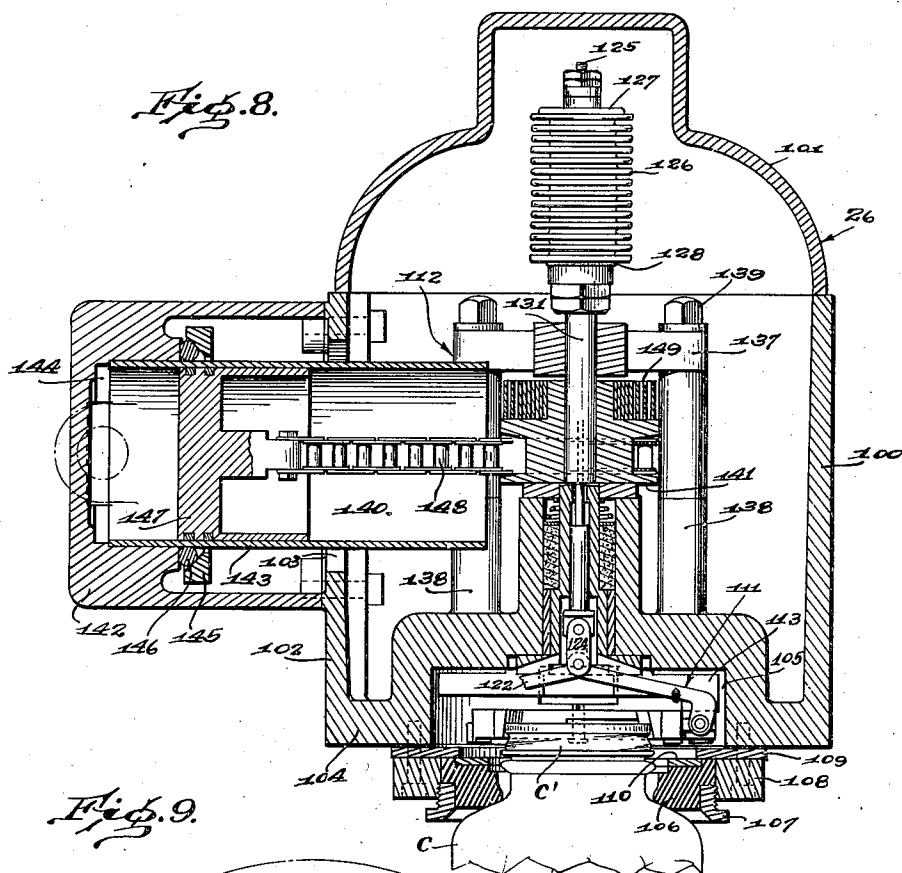
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APPARATUS FOR VACUUM SEALING CONTAINERS

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10 Sheets-Sheet 4



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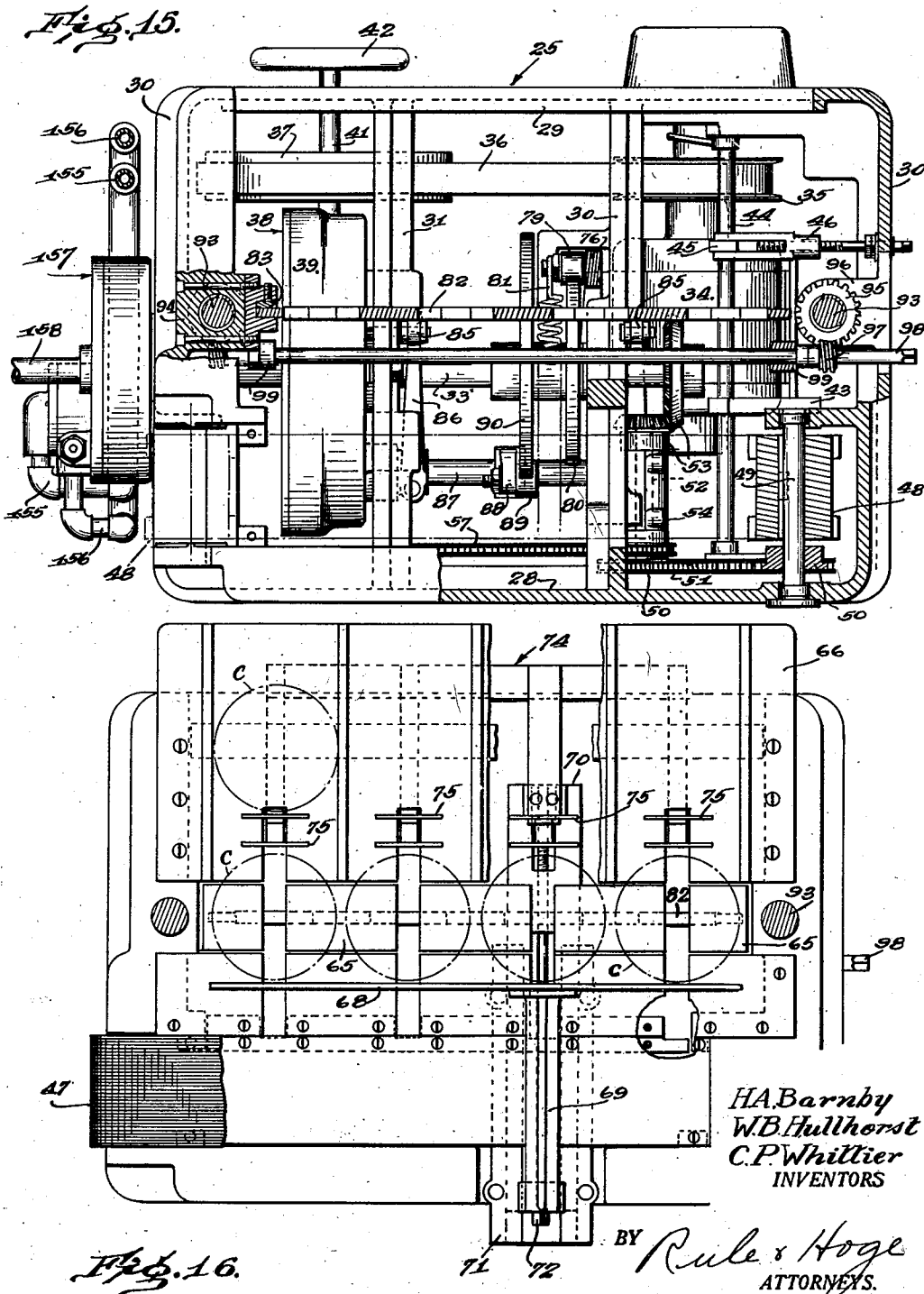
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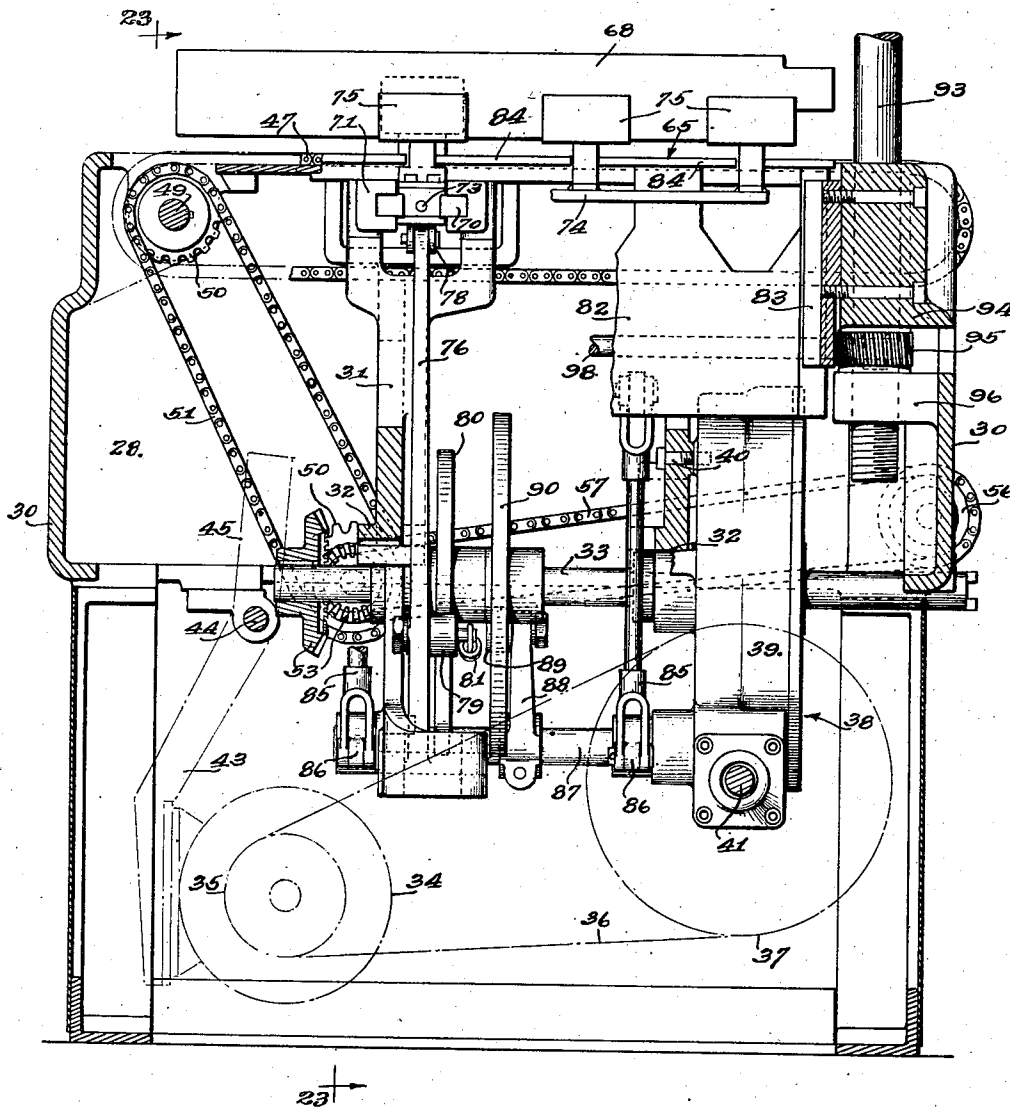


Fig. 17.

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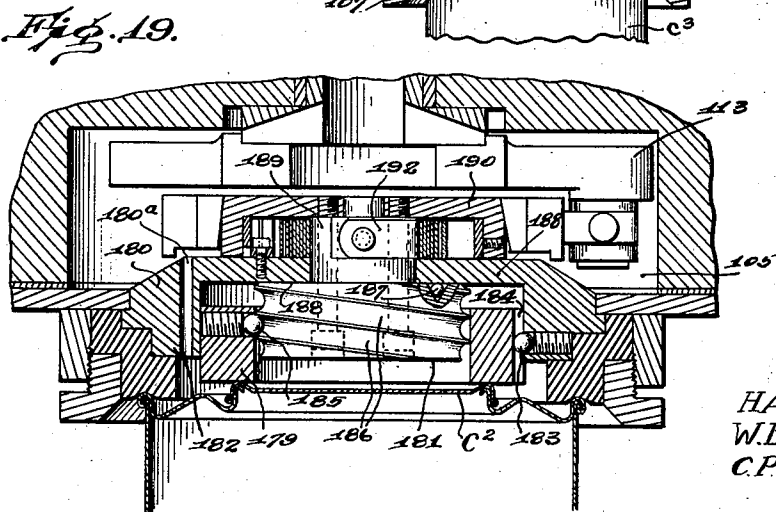
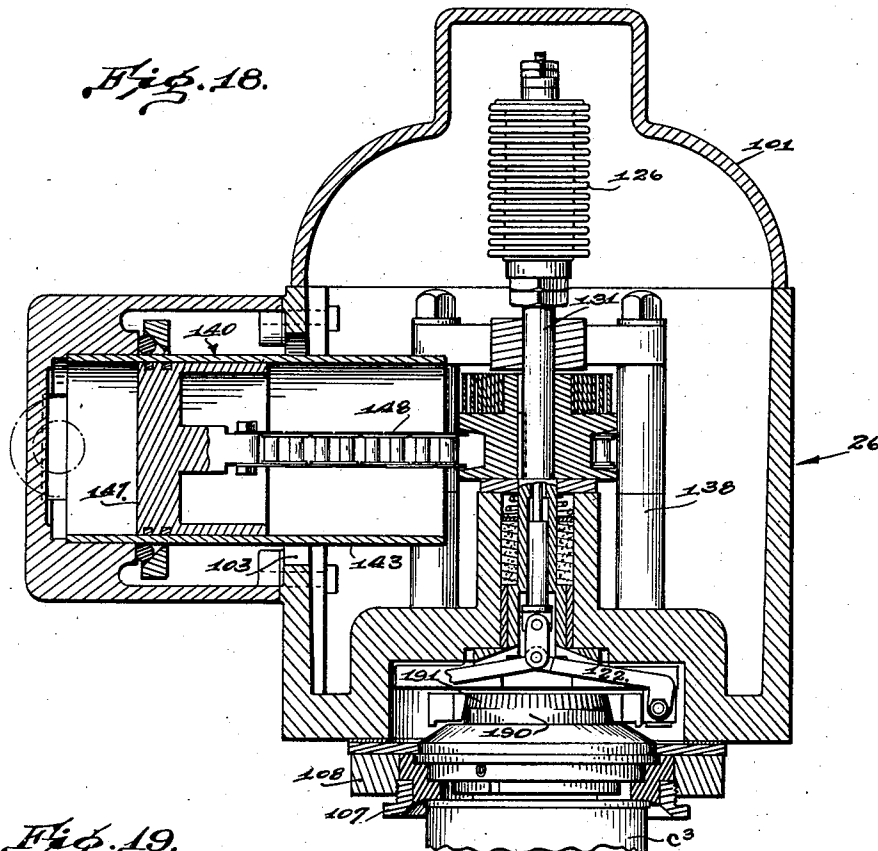
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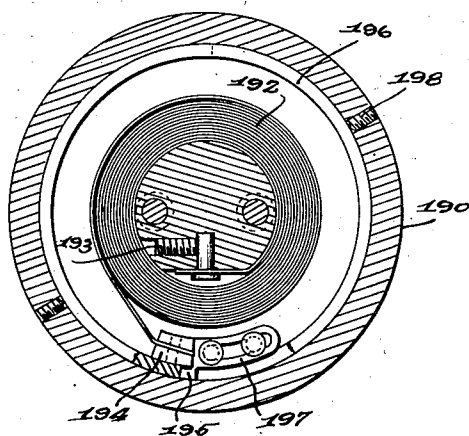
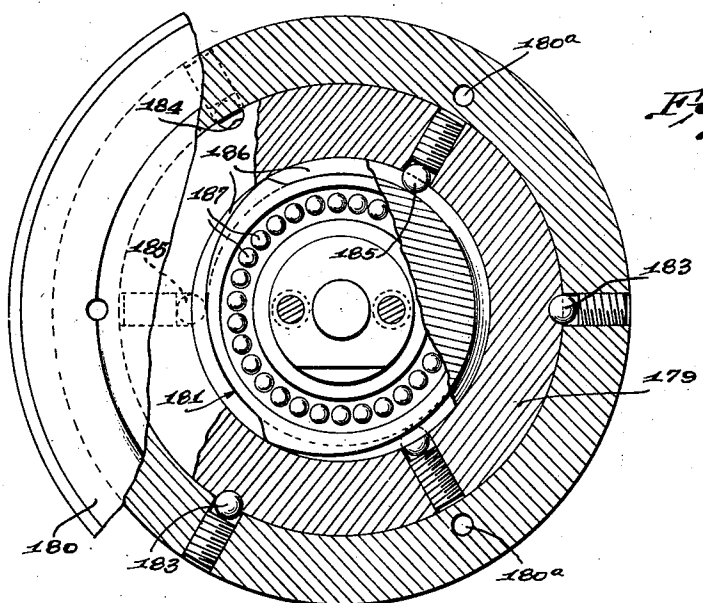
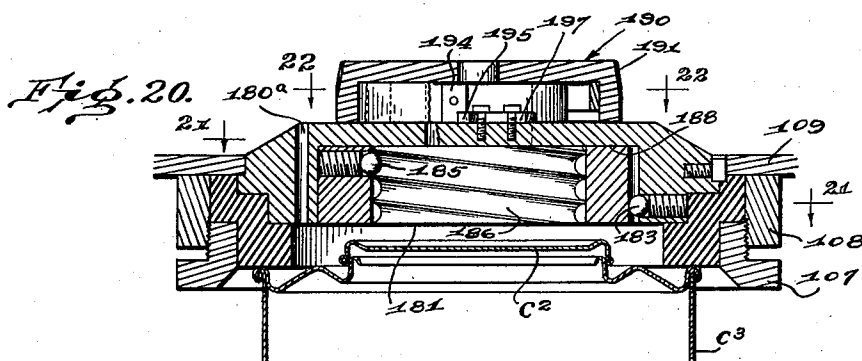
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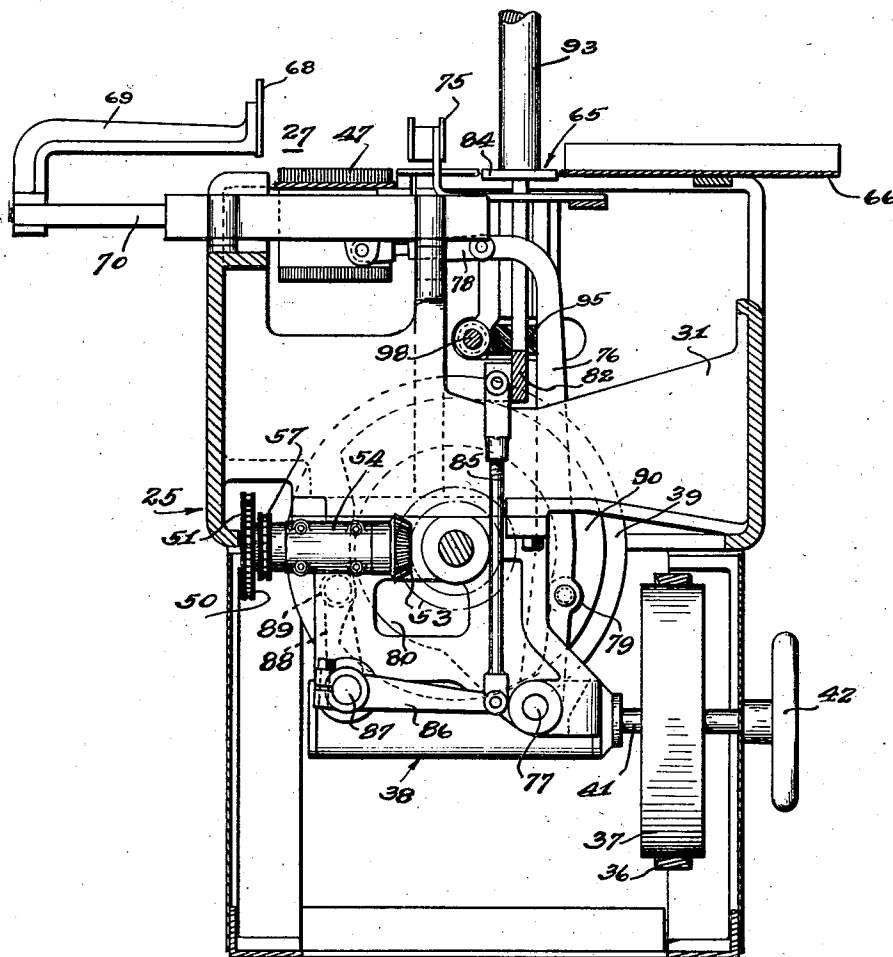


Fig. 23.

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UNITED STATES PATENT OFFICE

2,254,642

APPARATUS FOR VACUUM SEALING
CONTAINERS

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Ohio

Application August 11, 1939, Serial No. 289,692

33 Claims. (Cl. 228—82)

Our invention relates to improvements in apparatus for vacuum sealing containers and more particularly is concerned with improving and automatically mechanizing the handling of containers prior to and following sealing thereof, and the actual vacuumizing and final sealing operations.

An object of our invention is the provision of an apparatus which is especially adapted to the vacuumizing of dry powdered products in containers formed of glass, metal or other materials, such vacuumizing being so effected that the product is not drawn from the containers thereby.

A still further object is the provision of a multiple head vacuum sealing machine wherein the closures, whether screw, slip or friction type, are finally applied to containers by mechanism which functions in response to the creation of a vacuum within a chamber or chambers which receive the neck portions of the containers with closures loosely positioned thereon.

It is also an object of our invention to provide novel automatic mechanism for grouping containers according to the capacity of the vacuum sealing machine, transferring the containers in groups to the machine, positioning the groups for vacuumizing and sealing and finally removing the groups of sealed vacuumized containers from the machine and placing them upon a conveyor.

It is likewise an object to provide novel container transferring mechanism which operates to remove a group of sealed containers from the vacuumizing and sealing machine immediately in advance of placing therein a group of containers which are to be vacuumized and sealed.

Among other important objects is the provision of a vacuum sealing machine wherein vacuumizing of the head space of the containers being sealed functions to bring a closure tightening device into engagement with a closure on the container and wherein the device is then operated by a suction actuated mechanism for effecting final application of the closure.

It is also an object to provide novel means whereby the tightness of the applied closures may be regularly controlled and maintained absolutely uniform.

Above all, the object of our invention is the provision of a compact, efficient machine which automatically performs its functions with a minimum of attention on the part of operators.

Other objects will be in part apparent and in part pointed out hereinafter.

In the accompanying drawings:

Fig. 1 is an end elevational view of the receiving end of our vacuum sealing machine.

Fig. 2 is a top plan view thereof.

Fig. 3 is a central transverse sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3.

Fig. 5 is a sectional plan view taken substantially along the line 5—5 of Fig. 1.

Fig. 6 is a sectional view of one sealing unit of the machine.

Fig. 7 is a view similar to Fig. 6 showing the closure gripping jaws engaging a closure.

Fig. 8 is a detail sectional elevational view taken substantially along the line 8—8 of Fig. 7.

Fig. 9 is a bottom plan view of the closure gripping jaws.

Fig. 10 is a sectional view of the jaws as employed in rotating a screw type closure.

Fig. 11 is a view similar to Fig. 10, but shows adaptors which permit use of the same mechanism in the application of friction closures.

Fig. 12 is an elevational view of the vacuum valve taken along the line 12—12 of Fig. 13.

Fig. 13 is a sectional elevational view taken substantially along the line 13—13 of Fig. 12, excepting only that the rotor has been advanced a few degrees to what is termed the closure tightening position.

Fig. 14 is a vertical sectional view taken along the line 14—14 of Fig. 12.

Fig. 15 is a sectional plan view of the machine.

Fig. 16 is a sectional plan view taken substantially along the line 16—16 of Fig. 3.

Fig. 17 is a rear elevational view with parts broken away to disclose the container transferring and elevating mechanism.

Fig. 18 is a detail sectional view of the mechanism for tightening screw type closures.

Fig. 19 is a sectional view of a modified form of closure applicator.

Fig. 20 is a view similar to Fig. 19 showing the normal inoperative position of the applicator.

Fig. 21 is a sectional plan view taken along the line 21—21 of Fig. 20.

Fig. 22 is a sectional plan view taken along the line 22—22 of Fig. 20.

Fig. 23 is a sectional elevational view taken along the line 23—23 of Fig. 17.

Briefly the apparatus (Figs. 1 and 3) comprises a base 25 which supports a container vacuumizing unit 26, feeding mechanism 27 for delivering containers to the vacuumizing unit and mechanism for elevating containers into operative position with respect to the vacuumizing

unit 26 and other devices for synchronizing operation of the vacuumizing unit, feeding mechanism, and parts thereof.

In more or less general terms the invention as illustrated, includes means for bringing containers C in groups of four to a position in proximity to the vacuumizing unit 26 and automatically transferring the groups one at a time to a station directly beneath the vacuumizing unit. Thereafter the containers are elevated and have their upper ends with closures loosely supported thereon projected into vacuum chambers individual thereto. Mechanism within each vacuum chamber is firmly engaged with the closure, such engagement preferably being effected in response to vacuumizing of the chamber. Following this operation separate mechanism, which may be and preferably is vacuum actuated, operates the closure gripping mechanism for the purpose of threading the closure onto the corresponding container and hermetically sealing the latter. The application of vacuum to the closure applying mechanisms and vacuum chambers is then discontinued and the elevating mechanism lowers the entire group of containers which are then moved laterally away from the vacuumizing unit by a pusher bar which forms a part of the feeding mechanism 27. Simultaneously with removal of one group of containers from the elevating means, a second group is moved onto said elevating means.

The base 25 (Figs. 1, 2, 3, 15 and 17) is of generally rectangular formation and includes front and rear walls 28 and 29 respectively and end walls 30. A pair of longitudinally spaced transverse webs 31 (Figs. 3, 15, 17, and 23) connect the front and rear walls 28 and 29 respectively, and are provided with aligned bearings 32 in which a main drive shaft 33 is journaled. Power for operating the aforementioned feeding and elevating mechanisms is obtained from this shaft which in turn is driven by an electric motor 34 through a conventional Reeves drive 35, a belt 36, pulley 37 and speed reduction unit 38. The speed reduction unit includes a housing 39 which is secured to one of the webs 31 by bolts 40 or like fasteners.

A shaft 41 which is directly connected to the pulley 37, extends outwardly from the base 25 and carries a hand wheel 42 through which the drive shaft 33 may be manually rotated thereby facilitating adjustment and timing of the various mechanisms prior to starting a commercial run of the machine. The variable speed incident to the use of the aforementioned Reeves drive, is obtained by mounting the motor 34 upon a pivoted frame 43 which depends from a horizontal shaft 44 extending transversely of the machine proper. An arm 45 connected to the frame 43 is in turn connected to an adjusting device 46 (Figs. 15 and 17) by means of which said frame 43 may be rocked. Thus, the spaced relationship between the motor shaft and the aforementioned shaft 41 of the speed reduction unit 38 is varied with the result that the Reeves drive unit 35 operates to increase or decrease the speed of said shaft 41. The speed of rotation of the main shaft 33 is thereby regulably controlled.

The feeding mechanism 27 by means of which containers are placed in groups of four in proximity to the vacuumizing unit 26, and later moved successively to positions directly beneath and beyond said unit, is driven by the aforementioned shaft 33. This mechanism includes a horizontal endless cross conveyor 47 which is trained over

sprockets 48 or rolls (Fig. 15), the latter being mounted upon shafts 49 which are journaled in bearings in the base 25. One of these shafts (Fig. 15) has driving connection to the main drive shaft 33 through sprockets 50, a sprocket chain 51, a shaft 52, and meshing bevel gears 53, one of which is keyed to the inner end of the main drive shaft 33. The shaft 52 which carries the lower sprocket 50 and one of the bevel gears 53, is journaled in a bearing 54. Power for operating a star wheel 55, by means of which containers are delivered to the cross conveyor 47, is obtained from the above mentioned shaft 52 through means including a sprocket 56 on the shaft 52, a sprocket chain 57 meshing with said sprocket 56 and with a sprocket 58 which is positioned near the opposite end of the machine and is directly connected to meshing bevel gears 59, one of which is keyed to a vertical shaft 60. This shaft 60 is journaled in a vertical bearing 61 and at its upper end is rigidly connected to the star wheel. The star wheel as shown is formed with four pockets 62 and a blank space 63 in its periphery. Thus, rotation of the star wheel together with continuous feeding of containers C thereto along the feed conveyor 64, results in the delivery of four containers to the cross conveyor 47 and then an interruption in the delivery of the containers to the latter conveyor due to the blank space 63 in the star wheel. During this interruption, or pause, the four containers on the cross conveyor 47 are moved onto a container elevating mechanism 65, preparatory to being operatively positioned for the vacuumizing and sealing operations. Immediately upon movement of the group of four containers from the cross conveyor 47, the star wheel brings the first of another group of containers onto the receiving end of said conveyor.

Removal of the groups of containers from the cross conveyor 47 onto the elevating mechanism 65 and from said elevating mechanism onto a platform 66, is obtained by pusher mechanism 67. This mechanism (Figs. 1 and 3) comprises a horizontal pusher bar 68 which is attached to the inner end of a supporting arm 69, the outer end of the latter being turned downwardly and adjustably connected to the front end of a horizontal slide 70 which is mounted in slideways 71, the latter positioned between the upper and lower reaches of the cross conveyor 47. The adjustable connection between the arm 69 and slide 70 may well include an adjusting screw 72 which has threaded connection with the lower portion of said downward extension of the arm 69. This screw 72 extends the full length of the slide 70 in which it is rotatively supported and at its extreme inner end, is threaded through a slide block 73 which carries a frame 74 upon which four pusher bars 75 are mounted. By adjusting the screw 72, the front pusher bar 68 and the four individual pusher bars 75 are adjusted as a unit, the degree of adjustment being determined entirely by the diameter of the containers being handled. Thus, if containers of relatively small diameter are being vacuumized, the pusher bars (Fig. 3) will be adjusted inwardly so that the containers when placed upon the elevating mechanism 65, will be accurately aligned or in register with the vacuumizing unit 26.

Reciprocation of the slide 70 for the purpose of imparting movement to the pusher bars is obtained by the motion of a rocker arm 76 (Figs. 3, 17 and 23) which is pivoted at its lower end

to a hinge pin 77 carried by the lower portion of one of the webs 31 and at its upper end is connected through a link 78 to the lower side of the aforementioned slide 70. A cam roller 79, which is mounted upon the rocker arm in proximity to its fulcrum point, rides upon a continuously rotating cam 80 which cam is mounted upon and for rotation with the main drive shaft 33. A coil spring 81 yieldingly holds the cam roller 79 in contact with the face of the rotary cam 80 and thereby insures the transmission of uniform motion to the rocker arm 76. The contour of the cam 80 is such, with respect to the diameter and shape of the star wheel, that it operates immediately upon the placing of four containers centrally upon the cross conveyor 47, to move the slide 70 inwardly whereby to transfer the four containers to the elevating mechanism 65 and simultaneously and by the same stroke, remove four containers from the latter to the aforementioned platform 66.

This elevating mechanism 65 includes a vertically disposed carrier plate 82 which has its vertical end portions slidingly mounted in guide-ways 83 and at its upper end supports a series of lifter plates 84 or pads, upon which the containers C are positioned for elevation into operative relationship to the vacuumizing unit 26. It will be noted that the upper margin of the carrier plate 82 is bifurcated or notched, this obviously being necessary in order to avoid interference with movement of the frame 74 and pusher plate 75 carried thereby. The carrier plate 82 is connected through push rods 85 to the outer end of a pair of rocker arms 86 which in turn are mounted upon a horizontal rock shaft 87. Upon this rock shaft 87 there is mounted a rocker arm 88 carrying a roller 89 which rides upon a rotary cam 90, the latter being fixed to the aforementioned main drive shaft 33. This cam 90 is so shaped and positioned relative to the cam 80 which actuates the pusher bars, that containers placed upon the pads 84 are moved upwardly immediately upon retraction of the pusher bars and again move downwardly to their lowermost position slightly in advance of the initiation of the loading movement of said pusher bars.

Accurate final positioning of the containers upon the elevating mechanism 65 is definitely assured by means of rearwardly converging guide arms 91 or deflectors which are arranged in pairs individual to the chambers of the vacuumizing unit 26 and supported upon a cross bar 92, the latter being mounted at its ends upon a pair of vertical posts 93, or uprights, which support the vacuumizing unit 26 in spaced relation to the previously described mechanisms. These posts 93 are vertically adjustable in guides 94 provided in the end walls 30 of the base 25 in order to permit vertical adjustment of the vacuumizing unit 26 and thereby compensate for variations in the height of containers being handled. For the purpose of adjusting these posts and consequently the elevation of the unit 26, a worm gear 95 is threaded upon each post between said guide 94 and a boss 96 and runs in mesh with a worm 97. The worms 97 are fixed upon an adjusting rod 98 which extends longitudinally of the machine and is journaled in bearings 99.

The vacuumizing unit 26 (Figs. 3, and 5 to 8 inclusive) comprises an elongated box-like housing 100 secured to the upper end of the posts 93, the upper side of which housing is closed by a dome-like cap 101 or cover. The rear wall

102 of the housing is provided with four longitudinally spaced openings 103 which accommodate a portion of mechanisms for applying closures as will appear hereinafter. The lower wall

5 104 or bottom of the housing is provided with four longitudinally spaced downwardly facing recesses 105 or chambers, which are intended to accommodate portions of closure applying means and the upper portion of containers with closures thereon as will be apparent presently. Inasmuch as the mechanisms for vacuumizing the containers and applying the closures thereto, are identical in construction, and operation, the following detail description will largely be directed to only one of the vacuumizing heads which make up the vacuumizing unit 26.

Each chamber 105 is provided at its lower open end with a resilient sealing ring 106 which is designed for airtight sealing engagement with the shoulder or other portion of the container being sealed and vacuumized. This sealing ring is removably held in place by a metal locking ring 107, or follower, which is threaded into a collar 108, the latter together with a gasket 109, being bolted, or otherwise detachably secured to the lower wall 104 of the housing 100. A backing ring 110 is positioned in engagement with the inner surface of the sealing ring 106, for the purpose of supporting it against the distorting influence of vacuum which is created in the chamber 105.

Application of the closures C' to the containers C is obtained by mechanism including a closure gripping device 111 and a closure tightening device 112, the operation of which devices is synchronized with the step of vacuumizing the chambers 105 so that the containers are sufficiently vacuumized prior to final application and tightening of the closures thereon.

40 Each of the closure gripping devices comprises a divided rotary carrier plate 113 (Figs. 6 to 9) which is positioned in the upper area of the chamber 105 and, on its lower side, at diametrically opposed points, carries a pair of depending hinge pins 114 to which a pair of bell crank levers 115 is pivoted. The longer arms of these two levers extend in opposite directions and at their outer ends, which are positioned diametrically opposite each other, are pivoted through hinge pins 116 to the medial point of a pair of jaws 117. Each jaw is of substantially semi-circular form and on its inner surface near one end thereof, is provided with serrations or teeth 118 and at a corresponding point at the other end, with an upwardly inwardly tapered face 119. The teeth 118 are formed to bite into or interlock with the usual corrugations on a closure, upon movement in one direction and to slide freely over the surface of the closures when moved in the reverse direction. Both the teeth 118 and smooth surface 119 are tapered inwardly and upwardly for the purpose of holding to a minimum, the area of contact between the jaws and closure and definitely avoiding any contact of the jaws with the threaded area of the closures. Moreover, such tapering permits the jaws to accommodate closures varying in diameter. In Fig. 11 we have shown adaptors 120 which may be attached to the lower side of the jaws in order to accommodate closures of unusually large diameter.

The jaws 117 which are similar in construction and operation to the well known alligator jaws constituting a part of ordinary pipe wrenches, are opened and closed by mechanism which is

connected to the short arms 121 of the levers 115. This operating mechanism comprises a pair of radially disposed links 122, the outer ends of which are connected to the short arms 121 of the levers 115 and the inner ends of which are connected through a pivot pin 123 and a pair of relatively short vertical links 124 to the lower end of a push rod 125 which extends vertically upwardly into the interior of the dome-like cap 101 of the vacuumizing unit where it is connected to metal bellows 126. This bellows 126 includes upper and lower end plates 127 and 128 respectively, the latter carrying an elongated guide sleeve 129 which extends into the bellows and surrounds a major portion of the push rod 125 within said bellows. A coil spring 130 within the bellows normally exerts an expanding tension thereon and opposes downward compression thereof which is necessary in bringing the jaws into gripping engagement with a closure. In this connection it is to be understood that the step of exhausting air from the chamber 105, likewise operates to compress the bellows and through the push rod 125 and links heretofore described, brings the jaws into firm gripping engagement with the closure which has been loosely positioned upon the container. Such application of vacuum to the bellows simultaneously with the removal of air from the chamber 105, is obtained by a structure including a tubular housing 131 which encloses a major portion of the push rod 125 and is sufficiently oversize to provide a passageway between the rod and housing through which air can be exhausted from the bellows simultaneously with vacuumization of the chamber 105. The lower end of this housing is bolted or otherwise attached to the divided carrier plate 113, so that rotation of said housing in a manner to be described presently, will effect threading of a closure upon a container.

An airtight seal between the lower portion of the tubular housing 131 and the opening 132 and the corresponding chamber 105, is obtained by means of a packing material 133 which is placed around the housing and held under compression by a coil spring 134, the latter being held in place by a plate 135. The upper end of the aforementioned tubular housing has threaded connection with the lower end plate 128 of the bellows and is rotatably fitted into a guide 136 which is carried by a frame 137. This frame, as indicated in Figs. 3 and 5 to 8, is attached to bosses 138 on the bottom wall 104 of the housing by means of bolts 139 or like fastening devices. From the above it is understood that the jaws can be brought into engagement with the closure and move the latter downward into firm engagement with a container until both the chamber and container have been vacuumized to a point which is controlled by the tension of the spring 130. At such time as the desired degree of vacuumization has been obtained, and the tension of the spring is overcome thereby, the bellows collapse downwardly, and the jaws are then brought into firm engagement with the closure. Thus the closure is moved downwardly into firm contact with the sealing surface of the container.

The closure tightening device 112 (Figs. 3 and 6 to 8) which imparts rotary motion to the closure gripping device 111, comprises a vacuum operated piston motor 140 which is connected to a spool 141, or collar, the latter being keyed or otherwise rigidly secured to the tubular housing 131. The

piston motor includes a housing 142 which is positioned in register with the opening 103 in the rear wall 102 of the elongated box-like housing 100. A horizontal cylinder 143 is mounted in the housing 142, the outer end of said cylinder being in communication with a manifold 144 which extends lengthwise of the housings 100 and 142 and provides for the simultaneous application of vacuum to the several cylinders. The inner end of the cylinder 143 terminates in proximity to the aforementioned spool 141. The cylinder 143 is held in place by a locking ring 145, the latter also holding under compression, a sealing ring 146 which prevents loss of vacuum such as would occur from the seepage of air into the outer end of the cylinder from the interior of the housings 100 and 142. A piston 147 within the cylinder 143, is connected by means of a sprocket chain 148 or any other flexible connecting element to the spool 141. Thus, it is apparent that by the simple step of exhausting air from the outer end of the cylinder 143, the piston 147 is moved outwardly and thereby operates through the sprocket chain 148 and spool 141 to impart rotary motion to the tubular housing 131 and jaws 117 connected thereto. Return of the piston 147 and the jaws 117 to their starting or initial positions, is obtained by a spring 149 which is anchored at one end to a hub 150 on said spool, is wound upon said hub under tension and has its other end 151 secured to a pin 152, the latter being supported in a boss 153 rising from the wall 104.

The air is exhausted from the several chambers 105, (which communicate with each other through ports 154) and the piston motor cylinders 143, by way of pipes 155 and 156 respectively, which pipes lead to a vacuum distributor 157 or valve, the latter being connected to a main vacuum supply pipe 158 and to the aforementioned main drive shaft 33 which actuates the distributor or valve plate. This distributor functions to time the application of vacuum to the several chambers 105 with respect to operation of the closure tightening mechanism and in addition, periodically interrupts application of vacuum to both the chambers and tightening devices so that a group of hermetically sealed jars may be removed from the vacuumizing unit and a group to be sealed, brought into position for vacuumizing and sealing.

This distributor or valve (Figs. 1 and 12 to 15) consists of a drum-like housing including a removable face plate 159, which at its axis, is connected to the aforementioned supply pipe 158. The inner surface of this plate is engaged with a rotor 160 or valve plate, the latter having separable connection to the main drive shaft 33, said connection including a coil spring 161 which operates to maintain the meeting surfaces of said rotor and face plate in snug sealing contact with each other.

Communication between the vacuum pipes 155 and 156 one at a time, with the supply pipe 158 and at regular time intervals with the atmosphere is obtained by means of a series of ports and a distributing chamber or manifold, all of which are provided in the aforementioned rotor 160 or valve plate. In order to avoid withdrawal of any of the contents of the containers being vacuumized and sealed, the degree of vacuum applied to the chamber 105 by way of the pipe 155 is progressively and gradually increased from zero to the maximum desired. This is accomplished by a structure substantially as follows. The dis-

tributor chamber 162 (Figs. 12, 13, and 14) communicates at all times with the supply pipe 158 and through a series of ports 163 with an opening 164, the latter opening directly into the adjacent end of said pipe 155. The ports 163 communicate with arcuate channels 165 and in some instances with circular recesses 166, which determine the manner in which vacuum may be applied to the chamber 105. By reference to Fig. 12 in which the exact contour of the distributing chamber 162 may be ascertained, it is clear that inasmuch as the rotor 160 revolves in a clockwise direction, and the ports 163 progressively increase in area in a counter-clockwise direction, the degree of vacuum applied to the pipe 155 and therefore to the chamber 105, will gradually increase as stated heretofore. Spaced circumferentially from the series of ports 166 and counter-clockwise from the opening 164 a short distance, is an exhaust port 167 (Figs. 12 and 14) which upon being brought into register with the opening 164 permits breaking of the vacuum in the pipe 155 and vacuumizing chambers 105. This port 167 (Fig. 14) communicates with the atmosphere by way of an opening 168 which surrounds the adjacent end of the main drive shaft 33. As brought out heretofore, the step of exhausting air from the chamber 105, also brings the jaws 117 into firm gripping engagement with a closure. This is followed by actuation of the tightening device, which is also vacuum operated.

The application of vacuum to the pipe 156 and thence to the piston motors 140 is obtained through the provision of a port 169 (Figs. 12 and 13) in the rotor 160, said port opening into an elongated channel 170 in the outer face of the rotor. The port and channel communicate directly with the distributing chamber 162 or manifold and at regular intervals, connect it with a port 171 or opening which leads to the adjacent end of the vacuum pipe 156. Spaced counter-clockwise from the inlet port 169 is an exhaust port 172, which, at regular time intervals, establishes communication between the pipe 156 and the atmosphere by way of the aforementioned opening 168, thereby breaking the vacuum in the piston motors 140 and permitting the spring devices to return the tighteners to their starting position.

In order that all closures applied by our vacuumizing unit may be applied with a uniform degree of tightness which incidentally can be regularly controlled, a valved vent 173 or bleeder valve (Fig. 13) is provided in the conduit 174 which connects the port 171 and the aforementioned pipe 156. This valved vent comprises a ball valve 175 which is held closed upon a seat 176 by means of a spring 177. The seat 176 is provided at the inner end of a threaded tube 178 which is adjustable to regularly control the effective tension of the spring 177 upon the valve and thereby predetermine the degree of vacuum that will unseat the valve and permit entry of outside air into the vacuum line. In this manner it is obvious that the motors 140 will uniformly tighten the closures upon the containers and that the degree of tightness may be regulated with ease.

In operation, the containers with closures loosely positioned thereupon, are automatically moved along the conveyor 64 (Fig. 2) to the star wheel 55, which, together with curved plate 64^a, direct the containers in group of four to the cross conveyor 47. Obviously, the unit may be con-

structed to accommodate any desired number of containers. Upon completion of the transfer of four containers to the cross conveyor, the blank space 63 in the star wheel interrupts delivery of any additional containers to the cross conveyor until the four already placed thereupon have been moved into position beneath the vacuum chambers 105. This movement of the four containers as a group is accomplished by the pusher bar 68 (Fig. 3) which is set to bring about accurate register of the containers with the opening of the vacuum chambers 105. The aforementioned guide fingers or bars 91 assist in effecting accurate positioning of the containers beneath said chambers. The elevating mechanism then is operated to bring the shoulder portion of the containers into tight sealing contact with the rubber rings 106. The elevating mechanism continues to support the containers with the neck portions and closures within the vacuum chambers during the vacuumizing and closure-tightening operations. While the containers are supported in the elevated position (Fig. 1) the pusher mechanism is retracted to the position shown in Fig. 3. The air is exhausted from the vacuum chambers in the manner just described and upon the creation of a sufficient degree of vacuum, the jaws 117 firmly grip the closures. The vacuum distributor valve then seals off the chambers from the source of vacuum and almost immediately thereafter, vacuum is applied to the several motors 140 which impart rotary motion to the jaws and thereby thread the closures upon the containers. This latter operation places the springs 149 under tension so that upon breaking of the vacuum in both the chambers 105 and piston motors 140, the jaws will be returned to their original position by said springs. Preferably the vacuum is broken simultaneously in the several motors 140 and vacuum chambers 105.

In Figs. 18 to 22 both inclusive, we have illustrated a slightly modified form of our invention which is especially designed for the application of friction or slip type covers wherein the application thereof is effected solely by top pressure. For the greater part, the same actuating devices are employed as heretofore. The structural changes reside largely in placing an adaptor unit within each of the vacuum chambers 105, which unit is engaged by the gripping jaws 117 and in turn operates to apply top pressure to the closure C², the latter in this instance being a friction type metal cap adapted to be slipped over the neck of a tin can C³. The specific form of adaptor illustrated, comprises a pressing ring 179 or collar which is non-rotatively supported in a carrier 180 and intended for vertical movement under the influence of a rotary head 181 which has threaded engagement with the interior of said pressing ring 179. The carrier 180 which has vertical ports 180^a through which air is exhausted from the container to the chamber above said adaptor, includes a depending flange 182 which through the medium of an annular series of anti-friction balls 183 running in vertical channels 184 in the periphery of the pressing ring 179, secures the latter against rotation. An annular series of anti-friction balls 185 carried by said pressing ring 179 and running in helical ways 186 in the periphery of the rotary head 181, provide means whereby the said pressing ring is held assembled with the other units. Moreover, as is obvious, rotation of the head 181 in one direction will lower the ring into

engagement with the closure C² while rotation in the reverse direction elevates said ring. The driving head 181 carries a series of anti-friction balls 187 in a raceway in its upper face, which bear against the lower face of the upper wall 188 of said carrier 180. A hub 189 carried by said driving head 181 extends upwardly through said wall 188 of the carrier and at a point spaced above the latter, is connected to a hollow cup-like driving ring 190. The exterior surface of this driving ring 190 is tapered and provided with serrations 191, or teeth, which are designed for gripping engagement with the jaws 117, which jaws operate to rotate the ring 190 and driving head 181 as a unit. Thus, the pressing ring 179 is moved into and out of engagement with the closure C². Return of the several parts to their initial, or starting position, is obtained by a spring 192, one end of which is secured to the hub by means of a screw 193 and the other end of which is anchored to a block 194. Retraction of the pressing ring following each closure-applying operation is limited by a stop 195 on the block 194 engaging an end of a ring 196 which is secured to the inner vertical wall of the driving ring 190. This ring is the full height of said wall throughout approximately 180°, the remainder having its lower portion cut away to clear the attaching plate 197 of the block 194 when said ring and connected parts are subjected to clockwise rotation during the application of a closure. Set screws 198 secure the ring in position.

In operation, a container is positioned as shown in Fig. 20 with a closure loosely positioned thereupon. The air is exhausted from the container and space 105 above the adaptor in the same manner as in the previously described form of our invention. Such exhausting of air causes the jaws 117 to grip the driving ring 190. Immediately, thereafter, the piston motor 140 operates to rotate the jaws and ring. Thus the threaded head 181 is rotated and the pressing ring 179 moved downwardly whereby to force the closure onto the container.

The spring 192 is placed under additional tension by such rotation of the head 181 and upon breaking of the vacuum in the chamber 105 and stopping operation of the motor 140, returns the head 181 to its uppermost or starting position.

Modifications may be resorted to within the spirit and scope of the appended claims.

We claim:

1. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a screw type closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, releasable jaws for gripping the closure, suction operated mechanism for effecting engagement of the jaws with the closure, means for exhausting the air from said chamber and thereby actuating said mechanism, and means for rotating the jaws and thereby threading the closure onto the container.

2. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, suction operated mechanism for actuating said jaws, and suction operated mechanism for imparting rotary motion to the jaws while engaged with the closure.

3. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, suction

operated mechanism for actuating said jaws, suction operated mechanism for imparting rotary motion to the jaws while engaged with the closure, and a spring device adapted to be placed under tension by said rotary motion of the jaws and operating to return the jaws to their initial position upon completion of the closure tightening operation.

4. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, a holder for the jaws, suction operated mechanism for actuating said jaws, and suction operated mechanism for imparting rotary motion to the jaws while engaged with the closure, said last named mechanism including an open-end cylinder, a piston therein, and means connecting the piston and holder.

5. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, means for effecting gripping engagement of the jaws with a closure, a rotary holder for said jaws, suction operated mechanism for imparting rotary motion to said holder, and means for regulably controlling the amount of suction applied to said last named mechanism to thereby control the degree of tightness of the closures on the containers.

6. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, means for effecting gripping engagement of the jaws with a closure, a rotary holder for said jaws, suction operated mechanism for imparting rotary motion to said holder, and means for regulably controlling the amount of suction applied to said last named mechanism to thereby control the degree of tightness of the closures on the containers, said last named means comprising a valved vent for admitting air into a vacuum supply line for said cylinder.

7. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, means for effecting gripping engagement of the jaws with a closure, a rotary holder for said jaws, suction operated mechanism for imparting rotary motion to said holder, and means for regulably controlling the amount of suction applied to said last named mechanism to thereby control the degree of tightness of the closures on the containers, said last named means comprising a valved vent for admitting air into a vacuum supply line for said cylinder, said valved vent including a spring pressed ball valve and means for regulably controlling the effective tension of the spring.

8. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, means for effecting gripping engagement of the jaws with a closure, a rotary holder for said jaws, and suction operated mechanism for rotating the jaw holder in one direction and a spring device for rotating said holder in the opposite direction.

9. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, suction operated mechanism for actuating said jaws, suction operated mechanism for imparting rotary motion to the jaws while engaged with the closure, and means for regulably controlling the

effectiveness of the suction operated mechanism whereby to predetermine the degree of tightening pressure applied thereby to a closure.

10. Mechanism for tightening screw type closures upon containers comprising a container holder, jaws engageable with a closure, suction operated mechanism for actuating said jaws, suction operated mechanism for imparting rotary motion to the jaws while engaged with the closure, and an adjustable bleeder valve for regularly controlling the effectiveness of said suction operated mechanism and thereby predetermining the degree of tightening pressure applied to a closure.

11. In apparatus for applying a threaded closure to a container having a threaded neck, a closure gripping device, vacuum operated mechanism for rotating the device, and spring means for reversing the direction of operation of said mechanism upon completion of the closure applying operation.

12. In apparatus for applying a threaded closure to a container having a threaded neck, a closure gripping device, vacuum operated mechanism for rotating the device, and an adjustable bleeder valve for regularly controlling the effectiveness of said mechanism and thereby predetermining the tightness of closures applied thereby.

13. In apparatus for applying a closure to a container, closure engaging means, vacuum operated mechanism for actuating said means and causing the latter to attach the closure to a container, a spring device opposing operation of said mechanism and functioning upon completion of the closure applying operation to reverse said mechanism, a vacuum chamber enclosing a portion of the container, the closure, closure engaging means and at least a portion of said mechanism, and means for exhausting the air from said chamber.

14. In apparatus for applying a threaded closure to a container having a threaded neck, a closure gripping device, vacuum operated mechanism for rotating the device, spring means for reversing the direction of operation of said mechanism upon completion of the closure applying operation, a vacuum chamber enclosing a portion of the container, the closure, closure engaging means and at least a portion of said mechanism, and means for exhausting the air from said chamber.

15. In apparatus of the character described, closure gripping and rotating means comprising a pair of pivoted arms mounted for oscillation in a horizontal plane, jaws pivoted to said arms and engageable with a closure, said jaws also movable in a horizontal plane, each jaw including a toothed area and a smooth surface engageable with the periphery of the closure at circumferentially spaced points, said toothed area and smooth surface being tapered upwardly and inwardly toward the axis of the closure, and means for moving said arms to thereby bring the jaws into engagement with the closure.

16. In apparatus of the character described, closure gripping and rotating means comprising a pair of pivoted arms mounted for oscillation in a horizontal plane, jaws pivoted to said arms and engageable with a closure, said jaws also movable in a horizontal plane, each jaw including a toothed area and a smooth surface engageable with the periphery of the closure at circumferentially spaced points, said toothed area and smooth surface being tapered upwardly and in-

wardly toward the axis of the closure, means for moving said arms to thereby bring the jaws into engagement with the closure, and vacuum controlled means for rotating the arms and jaws as a unit about the axis of a closure.

17. In apparatus of the character described, a vacuum chamber for receiving the neck end of a container and a closure loosely resting thereupon, closure gripping means at least in part located within said chamber, means for exhausting the air simultaneously from said chamber and container, a vacuum operated bellows actuated in response to a predetermined degree of vacuumization of said container and chamber for bringing the gripping means into engagement with the closure, and mechanism for rotating said gripping means and thereby sealing the closure upon a container.

18. In apparatus of the character described, a vacuum chamber for receiving the neck end of a container and a closure loosely resting thereupon, closure gripping means at least in part located within said chamber, means for exhausting the air simultaneously from said chamber and container, a vacuum operated bellows actuated in response to a predetermined degree of vacuumization of said container and chamber for bringing the gripping means into engagement with the closure, and mechanism including a suction operated piston motor for rotating said gripping means and thereby sealing the closure upon a container.

19. In apparatus of the character described, a vacuumizing unit including a plurality of downwardly opening chambers arranged side by side in a straight line, container elevating mechanism positioned beneath the chambers and operable to position the neck end of containers with closures loosely positioned thereupon in said chambers during vacuumizing of the containers and final attachment of the closures thereto, means for actuating the elevating mechanism, means for exhausting the air from the chambers simultaneously, closure gripping mechanism at least in part located within each of said chambers and operable in response to the creation of a predetermined degree of vacuum in said chambers to grip the closures, means for rotating the closure gripping mechanism, and means for loading and unloading the container elevating mechanism.

20. In apparatus of the character described, a vacuumizing unit including a plurality of downwardly opening chambers arranged side by side in a straight line, container elevating mechanism positioned beneath the chambers and operable to position the neck end of containers with closures loosely positioned thereupon in said chambers during vacuumizing of the containers and final attachment of the closures thereto, means for actuating the elevating mechanism, means for exhausting the air from the chambers simultaneously, closure gripping mechanism at least in part located within each of said chambers and operable in response to the creation of a predetermined degree of vacuum in said chambers to grip the closures, vacuum operated means for rotating the closure gripping mechanism, means for loading and unloading the container elevating mechanism, and a rotary vacuum distributing valve for timing operation of the said closure gripping mechanism.

21. In apparatus of the character described, a vacuumizing unit including a plurality of downwardly opening chambers arranged side by side

in a straight line, container elevating mechanism positioned beneath the chambers and operable to position the neck end of containers with closures loosely positioned thereupon in said chambers during vacuumizing of the containers and final attachment of the closures thereto, means for actuating the elevating mechanism, means for exhausting the air from the chambers simultaneously, closure gripping mechanism at least in part located within each of said chambers and operable in response to the creation of a predetermined degree of vacuum in said chambers to grip the closures, means for rotating the closure gripping mechanism, means for delivering groups of containers to the elevating mechanism including a cross conveyor positioned parallel to an imaginary line connecting the centers of said chambers, automatic means for placing containers upon the cross conveyor in uniform spaced relationship, and mechanism for transferring containers in groups from the cross conveyor to the elevating mechanism.

22. In apparatus of the character described, a vacuumizing unit including a plurality of downwardly opening chambers arranged side by side in a straight line, container elevating mechanism positioned beneath the chambers and operable to position the neck end of containers with closures loosely positioned thereupon in said chambers during vacuumizing of the containers and final attachment of the closures thereto, means for actuating the elevating mechanism, means for exhausting the air from the chambers simultaneously, closure gripping mechanism at least in part located within each of said chambers and operable in response to the creation of a predetermined degree of vacuum in said chambers to grip the closures, means for rotating the closure gripping mechanism, means for delivering groups of containers to the elevating mechanism including a cross conveyor positioned parallel to an imaginary line connecting the centers of said chambers, automatic means for placing containers upon the cross conveyor in uniform spaced relationship, mechanism for transferring containers in groups from the cross conveyor to the elevating mechanism, and means actuated by said transferring mechanism for removing sealed containers from the elevating mechanism in advance of the transfer of containers to be sealed, from said cross conveyor.

23. In apparatus of the character described, a vacuumizing head having a downwardly opening vacuum chamber, a resilient sealing ring at the lower margin of the wall of the chamber, closure gripping means within the chamber including a divided carrier plate mounted for rotation about a vertical axis coincident with the axis of said chamber, a pair of levers pivoted to the lower side of said plate at diametrically opposed points, closure gripping jaws carried by said levers, mechanism operable in response to the creation of a vacuum in said chamber for swinging said levers and thereby contracting the jaws about a closure, and means for imparting rotary motion to said carrier.

24. In apparatus of the character described, a vacuumizing head having a downwardly opening vacuum chamber, a resilient sealing ring at the lower margin of the wall of the chamber, closure gripping means within the chamber including a divided carrier plate mounted for rotation about a vertical axis coincident with the axis of said chamber, a pair of levers pivoted to the lower side of said plate at diametrically

opposed points, closure gripping jaws carried by said levers, mechanism operable in response to the creation of a vacuum in said chamber for swinging said levers and thereby contracting the jaws about a closure, mechanism for positively rotating the carrier plate in one direction, and spring means opposing such rotation and operable to reverse the direction of rotation upon completion of the closure applying operation.

25. In apparatus of the character described, a vacuumizing head having a downwardly opening vacuum chamber, a resilient sealing ring at the lower margin of the wall of the chamber, closure gripping means within the chamber including a divided carrier plate mounted for rotation about a vertical axis coincident with the axis of said chamber, a pair of levers pivoted to the lower side of said plate at diametrically opposed points, closure gripping jaws carried by said levers, mechanism operable in response to the creation of a vacuum in said chamber for swinging said levers and thereby contracting the jaws about a closure, mechanism for rotating said carrier plate including a piston motor, means operatively connecting the motor and carrier, and means for applying suction to said motor at regular time intervals.

26. In apparatus of the character described, a vacuumizing head having a downwardly opening vacuum chamber, a resilient sealing ring at the lower margin of the wall of the chamber, closure gripping means within the chamber including a divided carrier plate mounted for rotation about a vertical axis coincident with the axis of said chamber, a pair of levers pivoted to the lower side of said plate at diametrically opposed points, closure gripping jaws carried by said levers, mechanism operable in response to the creation of a vacuum in said chamber for swinging said levers and thereby contracting the jaws about a closure, mechanism for rotating said carrier plate including a piston motor, a tubular housing connected to said carrier, sprocket and sprocket chain mechanism connecting said housing and the piston motor, and means for applying suction to the said motor at regular time intervals.

27. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure gripping mechanism at least in part disposed within the chamber, means including a vacuum operated piston motor for rotating the closure gripping means, a source of supply of vacuum, individual pipes communicating with said vacuumizing chamber and piston motor, and a rotary timing valve providing communication between the source of vacuum supply and said pipes.

28. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure gripping mechanism at least in part disposed within the chamber, means including a vacuum operated piston motor for rotating the closure gripping means, a source of supply of vacuum, individual pipes communicating with said vacuumizing chamber and piston motor, a rotary timing valve providing communication between the source of vacuum supply

and said pipes, and a bleeder valve in the pipe leading to the piston motor.

29. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure applying mechanism at least in part disposed in said chamber and including a vertically movable pressing ring, a guide for said ring, and a rotary driving head having threaded engagement with the ring and operable upon rotation to impart vertical movement to the latter.

30. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure applying mechanism at least in part disposed in said chamber and including a vertically movable pressing ring, a guide for said ring, a rotary driving head having threaded engagement with the ring and operable upon rotation to impart vertical movement to the latter, means for rotating said driving head including a driving ring secured to the head, and vacuum operated means for rotating said driving ring.

31. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure applying mechanism at least in part disposed in said chamber and including a vertically movable pressing ring, a guide for said ring, a rotary driving head having threaded engagement with the ring and operable upon rotation to impart vertical movement to the latter, means for rotating said driving head including a driving ring secured to the head, releasable devices for gripping said driving ring, means for vacuumizing the chamber and there-

by actuating said devices, and means for imparting rotary motion to said gripping devices.

32. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure applying mechanism at least in part disposed in said chamber and including a vertically movable pressing ring, a guide for said ring, a rotary driving head having threaded engagement with the ring and operable upon rotation to impart vertical movement to the latter, means for rotating said driving head including a driving ring secured to the head, releasable devices for gripping said driving ring, means for vacuumizing the chamber and thereby actuating said devices, and means including a vacuum operated piston motor for imparting rotary motion to said ring gripping devices.

33. Apparatus of the character described comprising a chamber having an opening to admit the neck of a container and a closure loosely positioned thereupon, means for effecting an airtight seal between the wall of said opening and an adjacent exterior surface of the container below said neck, closure applying mechanism at least in part disposed in said chamber and including a vertically movable pressing ring, a guide for said ring, a rotary driving head having threaded engagement with the ring and operable upon rotation to impart vertical movement to the latter, means for rotating said driving head including a driving ring secured to the head, releasable devices for gripping said driving ring, means for vacuumizing the chamber and thereby actuating said devices, means for imparting rotary motion to said gripping devices, and spring means interconnecting said driving ring and guide and operating upon complete application of a closure to reverse the direction of rotation of said ring gripping devices.

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