June 12, 1956 F. J. COZZOLI 2,749,688

AUTOMATIC FILLING AND SEALING MACHINE
FOR AMPULS OR OTHER SMALL CONTAINERS

Filed April 18, 1952 4 Sheets-Sheet 1

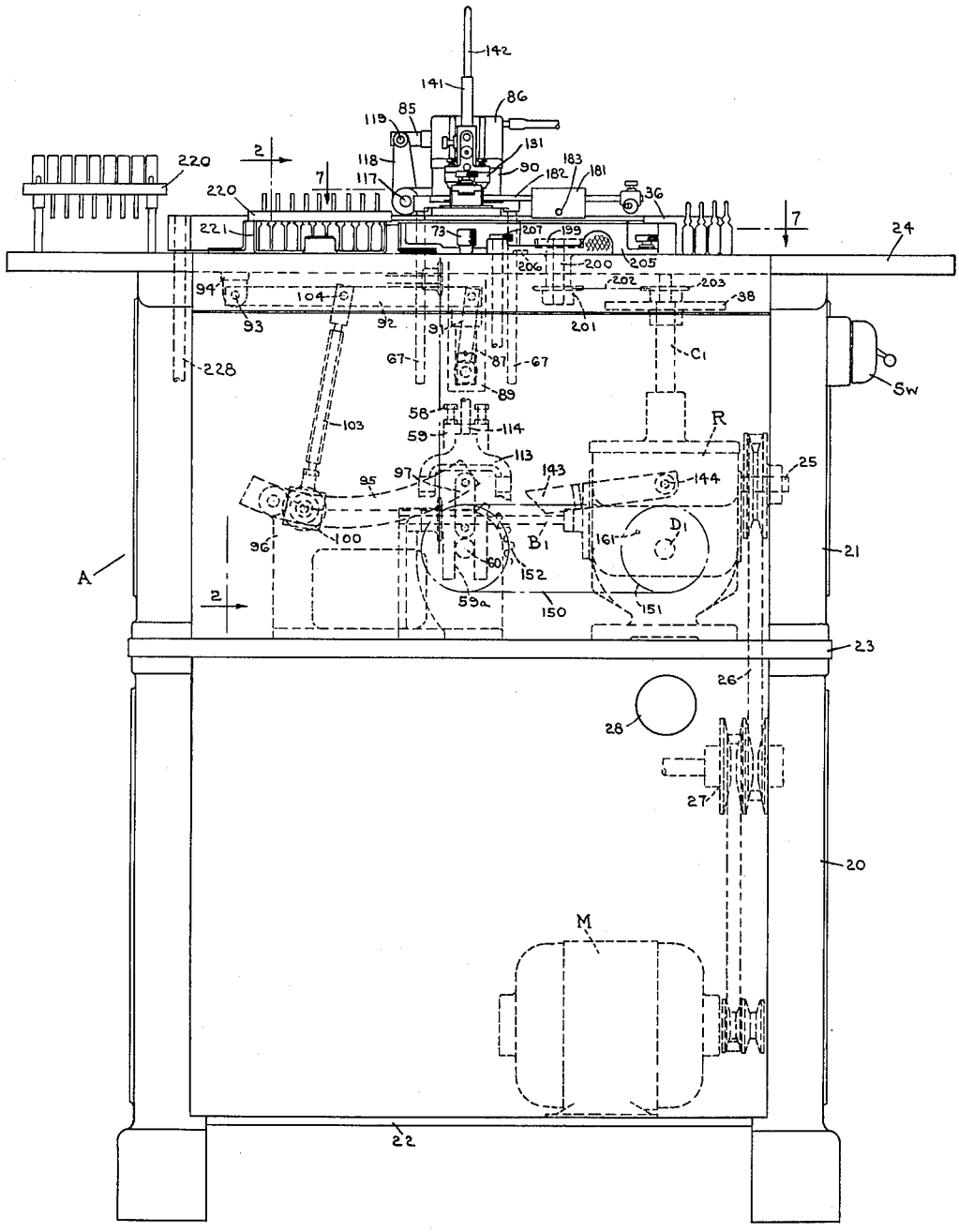


FIG. 1

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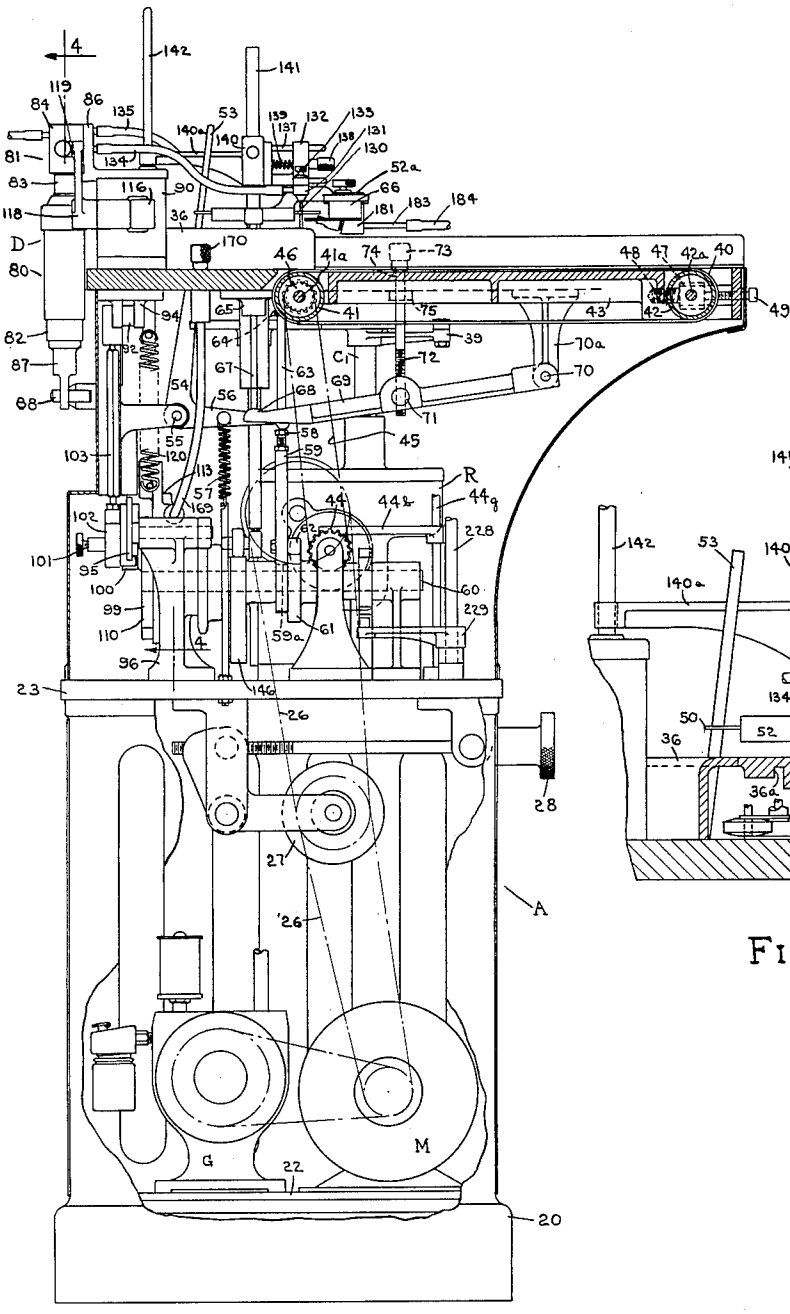


FIG. 2

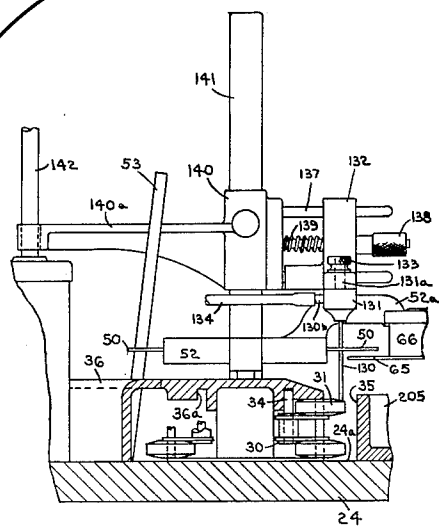


FIG. 8

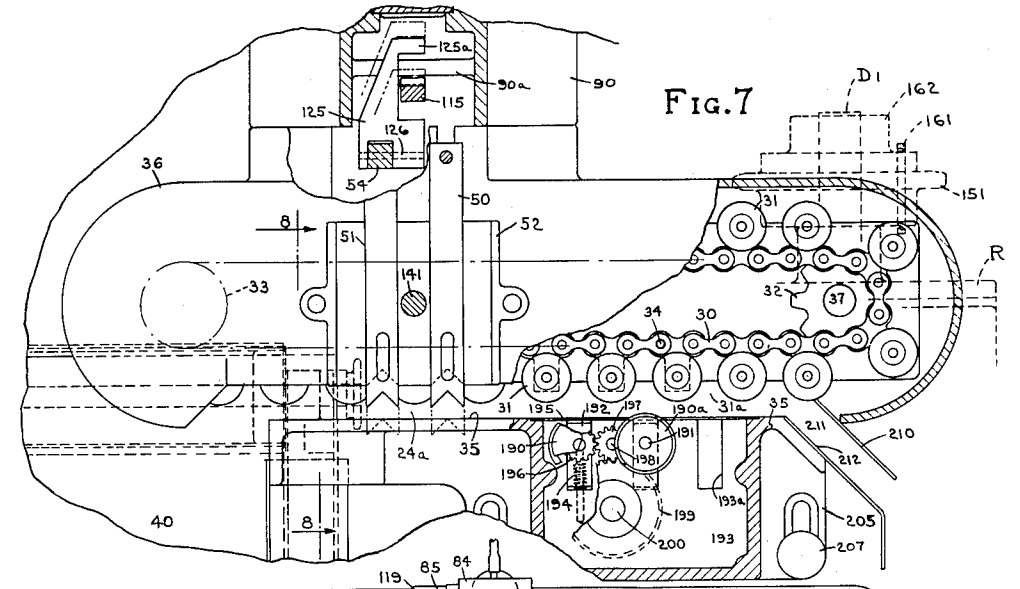
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AUTOMATIC FILLING AND SEALING MACHINE
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FIG. 7



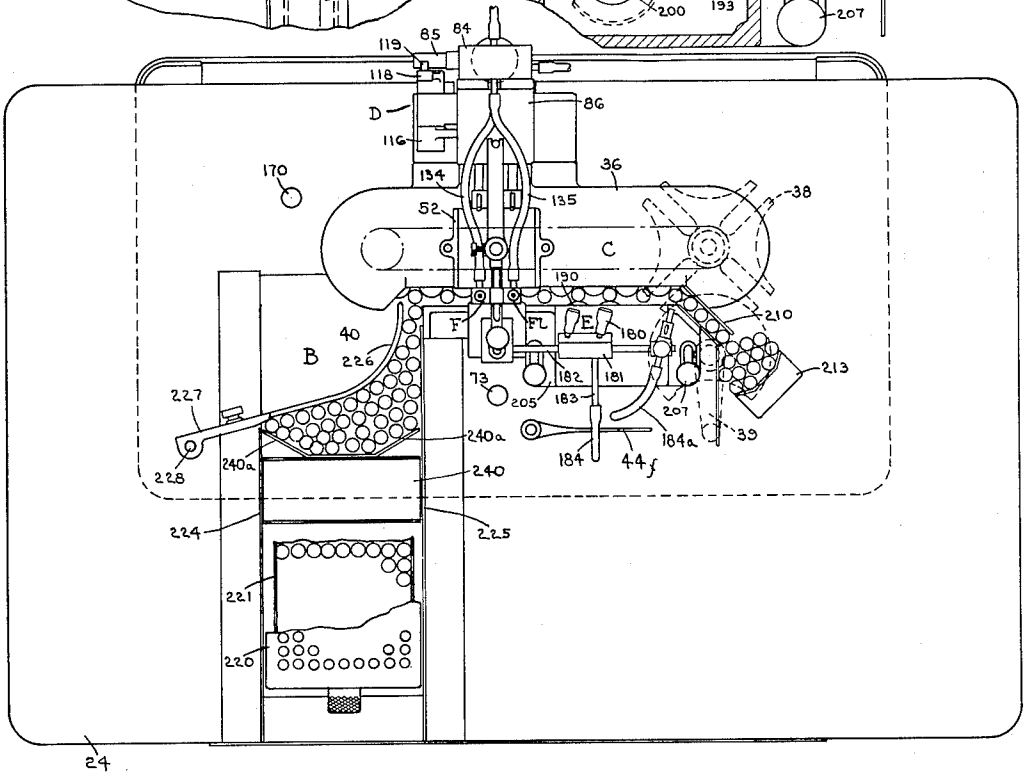


FIG. 3

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June 12, 1956 F. J. COZZOLI 2,749,688

AUTOMATIC FILLING AND SEALING MACHINE
FOR AMPULS OR OTHER SMALL CONTAINERS

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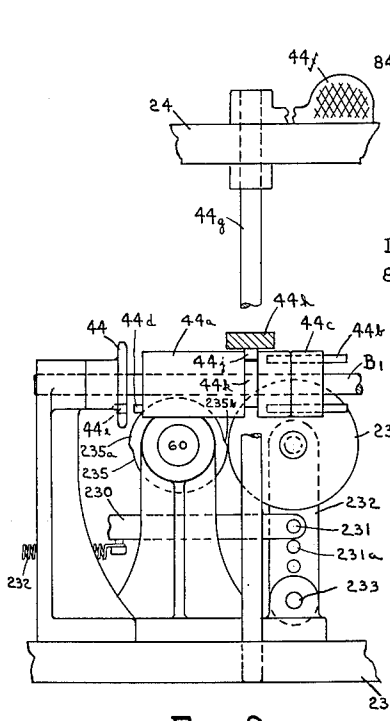


FIG. 9

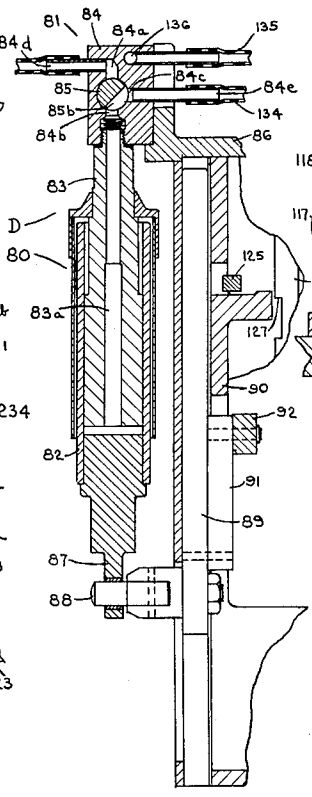


FIG. 5

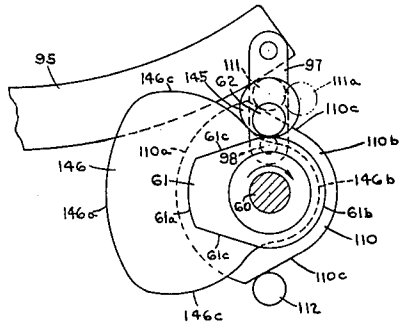


FIG. 6

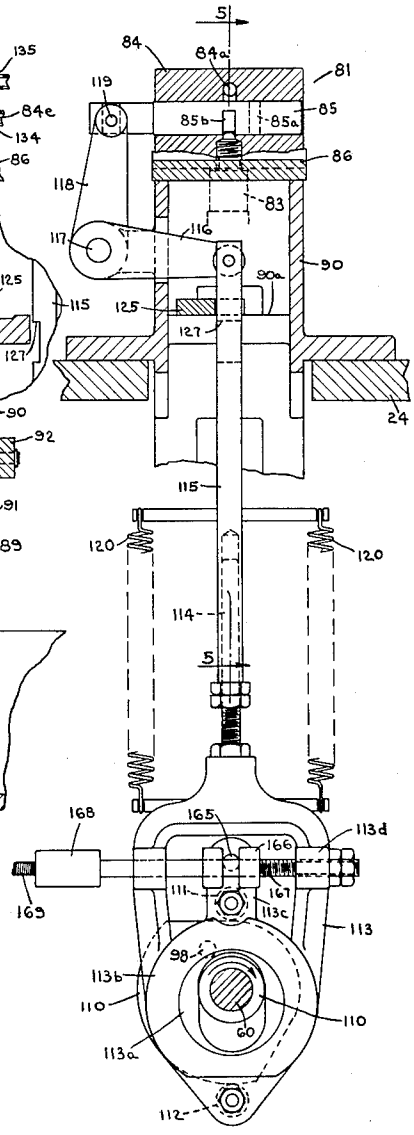


FIG. 4

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United States Patent Office 2,749,688 Patented June 12, 1956

2,749,688

AUTOMATIC FILLING AND SEALING MACHINE FOR AMPULS OR OTHER SMALL CONTAINERS

Frank J. Cozzoli, Plainfield, N. J.

Application April 18, 1952, Serial No. 283,070

19 Claims. (Cl. 53—77)

This invention relates to the art of filling and sealing ampuls and has for a primary objective the performance of the filling and sealing operations in an accurate, efficient, and sterile manner without manual handling of the individual ampuls.

A further aim of the invention is to supply sterilized unfilled ampuls to the filling mechanism untouched by the operator, and to perform the filling and sealing automatically to the end of maintaining the sterility of the packaged product and the avoidance of possible contamination incident to manual handling.

Still another objective of the invention is to construct an efficient filling and sealing machine adapted to receive tray lots of ampuls and mechanically to transport them individually and successively to filling, gassing, and sealing stations, for example, and thence to a delivery station where the filled and sealed ampuls may be collected for further processing as may be desired.

Another aim of the invention is to provide a machine capable of filling any one of a wide range of sizes of ampul with an accurately measured quantity of preparation with a high degree of exactitude as to each and every fill, and to achieve the filling without wetting the ampul neck. The invention undertakes, as an additional objective, to provide a variable displacement dispensing mechanism whose volumetric capacity can readily be altered to suit the quantity to be delivered and to incorporate a means, operative over the entire range of delivery settings, effectively to eliminate the final drop that would normally adhere to the needle end, so that an externally "dry" filling needle is caused to enter and leave the restricted throats and stems of the ampuls.

Another aim of the invention is automatically to suspend the filling action of the dispensing unit when and if an ampul fails to be presented at the filling station. As a refinement, this invention proposes a means whereby the blank detector is caused also to function normally as a means for bringing the top end of the ampul into concentric relation with the filling needle so that the needle may enter the ampul without interference or difficulty. While the manufacturers of ampuls make every effort to make the ampuls straight and uniform, variations in size and one or more bent stem in a box lot is not uncommon.

The invention has for a further objective, the construction of a conveyor mechanism having ampul receptacles or pockets therein constructed and arranged so that ampuls may be loaded, conveyed to one or more processing stations and thereafter delivered at a delivery station in upstanding position. The invention further proposes a conveyor mechanism for a filling and sealing machine that may be quickly and easily adapted to different diametered ampuls without need of additional or substitute parts. The invention also comprehends a conveyor in which the containers may be caused to rotate at one or more stations, for example, at the sealing station or stations so that uniform heating and proper sealing of the ends of the ampuls may be effected.

In attaining the objectives of the invention it is proposed to construct a machine with a processing conveyor and a loading conveyor so related that the one feeds containers to the other, and one of which is intermittently movable and the other may be intermittently movable but preferably continuously movable. In the present embodiment, the loading conveyor is continuously driven and is constructed to feed the containers upstanding to the receptacle on the processing conveyor during the dwell periods of the latter. The loading conveyor, in accordance with this invention, is designed and adapted to receive the ampuls in bulk lots and to pass them successively to the processing conveyor without manual handling.

After being positioned in the processing conveyor the ampuls are transported to a filling station whereat each is automatically centered and receives a predetermined measured quantity of the preparation to be packaged. Thereafter the filled ampuls are moved to a succeeding station where if desired they may be flushed with an inert gas to remove remaining air. After the flushing operation, the ampuls are moved to one or more sealing stations where their ends are sealed by fusion, and thereafter brought to a delivery station.

With a machine so arranged the ampuls are received from suitable sterilizers in tray lots and placed upon the loading conveyor, thereafter the loading of the ampuls on the processing conveyor and all processing operations are effected automatically and without manual touching of the ampuls. The various guides, filling needles, centering devices, etc., are preferably constructed of non-corrosive metal capable of removal and periodic sterilization or continuous exposure to sterile lamps to the end of maintaining sterile conditions in and around the ampuls through all of the processing stages, at least all the stages prior to the hermetic sealing.

Other objects and advantages will be in part indicated in the following description and in part rendered apparent therefrom in connection with the annexed drawings.

To enable others skilled in the art so fully to apprehend the underlying features hereof that they may embody the same in the various ways contemplated by this invention, drawings depicting a preferred typical construction have been annexed as a part of this disclosure and, in such drawings, like characters of reference denote corresponding parts throughout all the views, of which:

Figure 1 of the drawings is a front view of an ampul filling and sealing machine embodying this invention.

Figure 2 is a side view of the machine.

Figure 3 is a plan view of the machine.

Figure 4 is a transverse section, viewed from the front of the machine, of portions of the filling transmission.

Figure 5 is a sectional view along line 5—5 of Figure 4 of the measuring unit and valve.

Figure 6 is an end view of the cam shaft illustrating typical phase relations of the various actuating cams.

Figure 7 is a plan view of portions of the processing conveyor and portions of the ampul centering means, blank detector means, and rotating means.

Figure 8 is a detail view along line 8—8 of Figure 7.

Figure 9 is an enlarged view of the loading conveyor clutch and bridge breaker mechanism.

Referring more particularly to Figures 2 and 3 the machine therein illustrated comprises essentially a frame structure A composed of lower leg elements 20, upper panels 21, connected by shelves 22 and 23, and a top plate 24. The machine also includes a loading conveyor B, a processing conveyor C, filling mechanism D, and sealing means E, the moving elements of which derive power from a common source indicated as a motor M. In those instances wherein the sealing method requires a

source of air, provision is made for an air pump G, also to be driven by the motor M. A switch Sw mounted at the side of the machine, controls the motor operations.

With the exception of the air pump drive, the drive power for all of the named mechanisms initiate with a speed reduction unit R, of conventional construction, which is equipped with three output shafts B_1, C_1, D_1, and one input shaft **25**. The input shaft **25** connects with the motor M by means of a pulley and belt system **26** in which there is incorporated a variable speed mechanism **27** controllable with a rate control knob **28** located at the front of the machine. By turning the knob in one direction the speed of the machine is increased and by turning the knob in the other direction the speed is decreased. In this instance. the variable speed mechanism provides infinite changes through a ratio of 4 to 1, and the primary gears of the reduction unit R provide a fixed speed reduction of 40 to 1.

PROCESSING CONVEYOR C

Figures 1, 7, 8

In the present embodiment of the invention the processing conveyor is composed of a chain of links **30**, alternate ones of which carry a laterally off-set pair of rollers **31**. The links of the chain track on spaced sprockets **32** and **33** journaled in a conveyor cover **36** and top plate **24**, and each carries an extended pivot pin **34** that is guided in a slot **36***a* in the cover member **36**. The guide slot **36***a* is provided to keep the pivot pins **34** and thereby the rollers **31**, aligned in the straight run of the chain, particularly along the ampul processing side of the conveyor. As illustrated more clearly in Figure 7, the outer peripheries of adjacent rollers **31** form V-shaped recesses **31***a* that are adapted to receive the ampuls to be processed and to transport them from station to station. The outer side of the recesses **31***a* is closed by a relatively stationary but adjustable guide wall **35** for the major portions of the straight run of the conveyor. The conveyor sprocket **32** is tight on a shaft **37** that extends through the table and carries at the underside thereof a star-wheel **38** which forms part of a four-station Geneva mechanism. The crank member **39** of the Geneva, is mounted on and driven by the reduction output shaft C_1. Each turn of the Geneva crank **39** advances the conveyor a unit distance, this distance in the present embodiment being two conveyor chain pitches or one ampul receptacle.

LOADING CONVEYOR B

The loading conveyor of the embodiment comprises an endless belt **40** arranged to track a drive roll **41** and a driven roll **42**, the latter being adjustable for alignment and to take up stretch, and both being journaled for rotation in a frame member **43**. The frame is detachably secured to the table top **24** and is so constructed that the upper run of the belt lies substantially in the plane of the upper surface of the top **24**. The conveyors B and C are arranged preferably at right angles to each other, and with the delivery end of the loading conveyor passing under the recesses at the receiving end of the processing conveyor in such manner that an ampul standing upon the loading conveyor is urged by the belt into one of the recesses of the processing conveyor and carried by the latter to the processing stations. On each cycle of the processing conveyor a receptacle is brought into position to receive an ampul and it, in turn, is moved laterally off the loading conveyor and into the processing line.

As hereinbefore indicated the loading conveyor is normally driven at a reduced speed from the reduction unit R, through the shaft B_1. Shaft B_1 mounts a free running sprocket **44**, which through a chain **45** drives a sprocket **46** that is tight on the conveyor drive roll shaft **41***a*. Shaft B_1 also carries a slidable clutch spool **44***a* which is keyed to the shaft by means of pins **44***b* that slide in matched holes provided in a fixed collar **44***c*. The opposite end of the clutch spool carries one or more pins **44***d* positioned to engage openings **44***e* provided in the free running sprocket **44**. In the position illustrated in Figure 7, the clutch spool is disengaged from the sprocket **44**, and the loading conveyor is idle. When the clutch spool is shifted to the left, the pin **44***d* is caused to enter opening **44***e* in the sprocket **44**, and the loading conveyor is driven. To effect engagement and disengagement of the drive to the loading conveyor, a hand clutch lever **44***f* on the top of the machine is provided. The clutch lever is secured to an oscillatable shaft **44***g* that extends through the table top. Shaft **44***g* carries another radial lever **44***h* that has a pin **44***j* positioned to track in a groove **44***k* in the clutch spool. Thus movement of the hand lever **44***f* from one to the other position causes shifting of the clutch spool and engagement or disengagement of the drive to the loading conveyor. The loading conveyor is normally driven continuously and at a surface speed of the belt such that, within the range of the machine, the distance and ampul will travel in each filling cycle is always greater than the diameter of the ampul that is being loaded on the processing conveyor. This is to insure that when an empty receptacle arrives in loading position, it will receive an ampul with adequate reserve pressure thereon remaining to exert a pocketing pressure on the ampul during the initial portion of its lateral shift.

Belt stretch take-up and alignment may be effected by journaling the shaft **42***a* of the idler roll **42** in adjustable blocks **47**. Each of the blocks is urged outwardly by a spring **48**, and outward movement limited by adjustable screws **49** accessible from the front of the machine.

AMPUL CENTERING MECHANISM

As the ampul is swept off the loading conveyor it is brought into a substantially closed pocket defined by the peripheries of adjacent pairs of conveyor rollers **31** and the guide wall **35**. A bottom wall or track **24***a* is provided by the top surface of the plate **24**. In the instant embodiment, the filling station is located at F, followed by flushing station FL, along the line of travel of the ampuls. After leaving the loading conveyor, an ampul to be filled and sealed is brought in one or more indexing movements to the filling station where it stops during the lock time of the Geneva mechanism. With a four-station Geneva, the lock time is ¾ of a complete cycle and during this time, the neck of the ampul is centered, the filling needle injected, the ampul filled, needle withdrawn and the centering means withdrawn.

The centering means at the filling station comprises a slidable V-plate **50** that is carried in guide ways **51** provided in a vertically adjustable support **52**. The V-plate **50** is provided at its rear end with a hole adapted slidingly to receive an actuating rod **53**. The rod **53** extends downwardly through the table top and forms a part of an L-shaped lever **54** that is pivoted at **55** to a stationary part of the machine. The other arm **56** of the lever **54** extends forward and is urged by a pull spring **57** into engagement with an adjustable screw **58** on a yoke piece **59**. The yoke piece **59** is slotted as at **59***a* at its lower end and straddles a cam shaft **60**. The cam shaft **60** carries a reset cam **61** on which a cam follower **62**, carried by the yoke piece **59**, normally travels. The upper end of the yoke piece **59** carries a pilot bar **63** that is guided in a bearing **64** in a bracket **65** secured to the underside of the table top **24**. The reset cam **61** is formed with a high portion **61***a*, a low portion **61***b*, and intermediate connecting portions **61***c*, so related and of such angular lengths that at least the high portion, reacting through lever **54** will hold the V-plate centering finger **50** withdrawn from the path of ampul travel during the indexing movement thereof, and will allow the finger to advance and center the ampul neck in the V at its end, before the needle descends, and to hold the ampul centered until the filling is completed. The forward movement or centering

operation of the V-plate is performed yieldingly by the action of the pullspring 57 whereby compensation is automatically made for variations in neck size of the ampuls. The tendency of the spring urged V-plate 50 is to tip the ampuls forward, and to prevent this a relatively stationary backstop plate 65 is provided. The plate 65 is carried upon a block 66 that is adjustably mounted to an extension 52*a* of the support 52. As the guide wall 35 is adjusted in or out for body diameter of the ampuls to be filled, likewise is the back-stop plate 65 adjusted in or out to correct for the change in location of the center of the ampul.

In cases wherein it is desired to flush the ampul after filling, the centering mechanism described is duplicated at the flushing station, except that the reset cam 61, and yoke piece 59 may be common to both.

In the event that a blank occurs at the filling station it is desirable that the filling operation be suspended for that cycle, and to effectuate that end the reset cam is formed with its low portion 61*b* sufficiently reduced to provide for considerable over-run or over-travel of the centering V-plate 50, and this movement is utilized to effect a latching of a portion of the filling mechanism, preferably the valve, when a blank occurs. This ampul-detecting valve-latching mechanism will be explained in connection with the filling mechanism. Suffice it for the present to explain that the V-plate support 52 is vertically adjustable to suit different lengths of ampuls, and the no-ampul no-fill feature of this invention operates over the entire range.

To achieve the vertical adjustment, so as to position the centering V-plate reasonably close to the upper open end of the ampul, the supporting platform 52 is provided with a pair of parallel arranged guide rods 67 that extend downwardly through guide bushings in the top 24 and rest upon the end portions 68 of a two armed lever 69. The lever 69 is pivoted as at 70 to a table mounted bracket 70*a* and is provided intermediate its ends with a swivel nut 71. An adjusting screw 72 is threaded through the nut and is arranged to be operated from the upper side of the table 24 by means of the knurled knob 73. A clearance hole 74 is provided in the table top to receive the adjusting screw. The knob 73 above the plate 24 and a collar 75 below the plate, retain the adjusting screw against endwise movement.

FILLING MECHANISM D

The filling mechanism of this invention includes a measuring unit 80 of the piston and cylinder type and a control valve 81 illustrated more clearly in Figures 4 and 5. The measuring unit comprises a reciprocable cylinder member 82 and a cooperating, relatively fixed piston element 83 that is removably secured the valve 81. The valve 81 comprises a body member 84 and a shiftable valve stem 85, the body member being removably secured to a fixed slide-cap 86. The lower end of the cylinder 82 is formed with an eye-piece 87 adapted to fit over a vertically reciprocable pintle 88 carried by a filling slide 89. The piston is formed with an internal bore 83*a* through which the preparation passes in entering and leaving the cylinder.

As illustrated more clearly in Figures 1, 4, and 5, the filling slide is mounted for vertical reciprocation in guides formed in a bracket member 90 secured to the main frame of the machine, and carries at its inner side, a pivoted link member 91 which in turn is pivotally connected to the free end of a pitman lever 92. The opposite end of the lever 92 is pivotally connected as at 93 to a bracket 94 carried by the table 24. Oscillation of lever 92 thus effects a reciprocation of the filling slide 89.

To effect reciprocation of the filling slide different amounts depending upon the unit quantity that is to be dispensed by the filling unit, an adjustable stroke varying means is provided. A preferred form of stroke varying means is illustrated in Figures 1, 2 and 6, and comprises an oscillatable sector arm 95 that is pivoted at one end to a bracket 96. The free end of the sector arm is connected with a connecting rod 97 which in turn connects as at 98 with a rotatable crank member 99. The sector arm 95 carries an adjustable yoke piece 100 that is movable along the arm from a position coincident with the fixed pivot thereof to a selected position outwardly therefrom. The arm may be graduated, if desired, to facilitate adjusting for quantity. The yoke may be clamped to the sector arm in the desired position by a clamp screw 101. The yoke is also constructed to provide a pivot bearing for one end 102 of a connecting rod 103, the upper end of which, is pivotally connected as at 104 with the slide actuating lever 92. In the structure disclosed, the sector arm 95 is caused to oscillate a fixed angular distance, determined by the throw of the crank pin 98, and if the connecting rod yoke 100 is positioned at the pivot point of the arm 95, the response of the connecting rod 103, lever 92, and the filling slide is nil. As the sector yoke is shifted outwardly on the sector arm, the movement of the filling slide is caused to increase in proportion, and consequently the stroke of the reciprocation imparted to the filling unit is altered accordingly. Preferably the parts are constructed and arranged so that the radius of curvative of the sector arm 95 corresponds with the length of the connecting rod 103, and when so arranged there is no change in the position of the cylinder 82 relative to the piston 83 incident to a readjustment of the yoke 100. Also, the preferred construction comprehends that the above indicated position of concentricity corresponds to the empty or discharged position of the piston and cylinder elements of the measuring unit as well as to one of the extremes of throw of the crank pin 98. Accordingly, when making an adjustment for quantity delivered by the measuring unit, the adjustment is effected by lengthening or shortening the length of stroke of the filling unit at one end only, the other end of the stroke, corresponding to the discharged or empty position of the piston and cylinder, remains unvaried.

The construction of the valve means 81 is disclosed more clearly in Figures 4 and 5, and in which it will be seen that the valve element 85 is provided with a transverse port 85*a* and a diagonal slot 85*b* longitudinally spaced apart a distance substantially equalling the width of the cross ports. The body 84 has an intake port 84*a*, a syringe or measuring unit port 84*b*, and a delivery port 84*c* provided therein, all intersecting the valve piston bore and lying in the same plane. The intake and delivery ports are equipped with hose nipples 84*d* and 84*e* for receiving flexible hoses, and the syringe port 84*b* is threaded to receive the threaded shank of the measuring piston. When the valve plunger 85 is in the left extreme position, the measuring unit is connected with the source of supply, and when the plunger is in its extreme right position, the measuring unit is connected with the delivery conduit 84*c*. Normally the valve is caused to be shifted from one position to the other in synchronism with the changes in direction of stroke of the measuring unit, and these points of change ordinarily occurring when the filling crank pin 98 reaches its upper and its lower dead center positions.

To effect the valve shifting, a cam 110 secured to the cam shaft 60, is provided. This cam is formed with a high portion 110*a*, a low portion 110*b*, and intermediate connecting portions 110*c*, adapted to actuate cam followers 111 and 112. The follower 112 is secured to a vertically movable slide 113, that is guided on a reduced portion of the hub of the cam 110. The slide has a telescoping connection 114 with a valve operating bar 115, and the latter through the medium of lever 116, pivot pin 117, lever 118, and swivel key 119, connects with the valve plunger 85. Vertical movement imparted to the slide 113 thus causes horizontal shifting move-

ment of the valve plunger **85**. Pull springs **120** anchored to the valve bar **115** and to the valve actuating slide **113** normally constrain the telescoping connection **114** against operation, but permits separation of those elements should the valve be latched.

NO AMPUL, NO FILL

In accordance with this embodiment of this invention latching of the valve is brought about when the processing conveyor is empty or for some reason an ampul fails to be presented in filling position. For this purpose the centering slide actuating lever **54** is constructed to operate a latch plate **125** that extends toward the filling slide and which rests upon a cross rib **90***a* of the filling slide housing **90**. The latch plate is generally L-shaped in plan view and the shorter leg **125***a* is caused to lie behind the valve bar **115**, the longer arm of the latch plate is pivotally connected at **126** with the lever **54**. The rear face of the valve bar is formed with a recess, the upper edge **127** of which, lies slightly above the plane of the upper surface of the latch plate **125** when the valve bar is in its "up" position. The forward movement of the centering V-plate **50** is normally limited by the presence of an ampul and when this condition exists the rear ledge **125***a* of the latch piece **125** is held out of the recess in the valve bar **115** and the latter may descend under the control of the valve cam **110**, the ledge **127** clearing the latch piece by a safe margin. When a blank occurs under the filling needle, the centering V-plate **50** over-runs the normal position and the latch-plate extension **125***a* is caused to enter the recess in the valve bar **115** and blocks the descent thereof. This action locks the valve plunger **85** in syringe intake position and on the succeeding delivery stroke of the pump unit **80**, the entrained fluid is discharged back into the supply.

FILLING NEEDLES

Slender stemmed tubes, such as ampuls, are customarily filled through their stems with a slender tubular needle. The needle must be inserted within the ampul into the body portion so that escaping air may pass the outer side of the needle without carrying the liquid preparation. The inside of the ampul necks should remain dry for proper and acceptable heat sealing. The needles of the present machine are formed of stainless steel tubes **130** pressed into stainless steel hubs **131**. The hubs are formed with extensions **131***a* that may be passed through properly spaced openings in the carrier **132** and clamped by thumb nuts **133**. Two needles have been illustrated in this embodiment, one for filling the ampul and the other for flushing, and each is provided with a hose nipple **130***b*. A flexible hose **134** connects the filling needle with the delivery nipple **84***a* of the valve, and a second hose **135** connects the flushing needle with a source of suitable flushing gas. For convenience, the flushing gas may be brought through ports **136** in the valve body, independently of the filling medium, and the connections provided, if desired, with a separate on-and-off valve.

The needle carrier **132** is mounted for in-and-out adjustment on spaced guide rods **137** under the control and operation of a thumb nut **138** and a compression spring **139**. Compensation for the shift in ampul centers, when changing over from one ampul to another, may thereby be effected.

The guide rods **137** are carried by a normally fixed but vertically adjustable bracket **140** that is secured to a vertically movable needle rod **141**, and to maintain needle alignment, the bracket **140** is provided with an extension **140***a* constructed to straddle a rearwardly located stationary guide post **142**. The needle rod extends downwardly through guide bearings provided in the conveyor cover **36** and in the bracket **64**, and rests upon the free end of a cam actuated lever **143**. The lever **143** is pivoted at one end **144** to a part of the frame, which conveniently may be the side of the reduction unit R, and carries a cam follower **145**. The cam follower **145** is related to track the surface of a rotatable cam **146** also mounted upon the cam shaft **60**. This cam also is formed with a high portion **146***a*, a low portion **146***b*, and intermediate connecting portions **146***c*. Representative shapes, throws, dwell lengths, and phase relations of the centering cam **61**, needle cam **146**, and valve cam **110**, in relation to the crank pin **98** is illustrated in Figure 6.

CAM SHAFT DRIVE

The cam shaft **60** derives its rotary power from the reduction unit R, and to maintain proper timing, the cam shaft **60** is positively driven from the reduction shaft D_1 through the medium of a chain **150** and a pair of sprockets **151** and **152**, the latter being pinned to the cam shaft **60**, and the former being driven through a safety shear pin **161**. A flanged member **162**, pinned to the reduction shaft D_1, carries the shear pin **161**. It will be understood that the shear-pin in the main drive to the cam shaft is proportioned to transmit any normal or reasonable load and will yield and disconnect the drive only if the load is exceeded. For similar reasons, one of the pivot pins in the filling slide actuating link **91** may be proportioned to shear if the load on the measuring unit should become excessive, as by a failure properly to cleanse the unit after a run of fills.

DROP ELIMINATION

It has been mentioned heretofore that proper sealing of an ampul is best attained if the throat thereof has not been wetted by the preparation. A drop of liquid adhering to the needle end when the needle leaves or enters an ampul can wet the side of the stem, and to prevent that from happening this invention proposes a means for effective elimination of the final droplet. Briefly, the solution to the problem, is to pull back the droplet and in accordance with this invention, a preferred method is to cause actuation of the valve of the measuring unit in coincidence with a reversal in the stroke thereof at one end of the stroke, and out of coincidence with the reversal at the other end of the stroke. In other words render valve shifting "on time" at one end of the stroke and "late" at the other end of the stroke. A preferred form of mechanism for accomplishing the desired result is shown more clearly in Figures 4 and 6, in which it will be seen that the valve actuating slide **113** is provided with a circular hub portion **113***a* about which is fitted for angular adjustment a ring shaped follower carrier **113***b*. The carrier **113***b* is formed with an extension **113***c* to which is secured the cam follower **111** previously referred to. The extension **113***c* also carries a pin **165** that is confined between the faces of a pair of fixed collars **166** and a screw shaft **167**. One end of the shaft threads into a boss **113***d* on the slide **113**, and the other end is provided with a fitting **168** to which a flexible shaft **169** is attached. The shaft **169** may be extended to a convenient place on the machine and is equipped with a knurled knob **170** by which the screw shaft **167** may be turned. In the position shown in the drawing, Figure 4, the follower **111** is positioned on the center line directly opposite the fixed follower **112**. When the screw shaft **167** is turned, the follower **111** is caused to advance clockwise, until further turning of the screw is stopped by the fitting **168** abutting the slide **113**. In this figure, the slide **113** is illustrated in its down position which through the levers and connections **114**—**119** places the valve plunger **85** in its extreme right position. When so positioned the rising cam face **110***c* of the valve cam is about to lift the follower **111**, the crank-pin **98** is approaching the top extreme of its stroke, and the measuring cylinder is approaching the end of the delivery stroke. As the crank **98** reaches dead center, the valve will also have been shifted to dead center position when both ports are closed off. An instant later, the valve is caused to crack open on the intake side, and the crank-pin starts downward and fluid

is entrained in the cylinder of the measuring unit. These movements continue until the valve has been shifted all the way over, and is held there by the high portion **110***a* of the valve cam. The intake cycle continues for 180° turn of the crank pin **98**, and as the crank reaches lower dead center, the valve will again have been shifted toward mid-position by reason of the rising portion **110***c* of the cam engaging and shifting the fixed follower **112**. With the followers **111** and **112** directly opposite, as illustrated, valve shifting occurs coincidently and "on time" with reversals of stroke of the measuring unit, at both ends, and when so related there is no drop elimination feature.

To remove the final drop from the needle the movable follower **111** is advanced in the direction of rotation of the cam **110** and crank-pin **98**, a predetermined amount. Assuming that the follower is advanced 10°, to the dotted line position **111***a* shown in Figure 6, the crank pin **98** will have reached and passed upper dead center before the rising portion **110***c* of the cam has engaged and lifted the follower **111** to a mid-position. The consequence of the delaying of the closing off of the delivery port of the valve, is that the fluid entrained in the cylinder during the initial portion of the intake stroke must come from the delivery conduit and the filling needle. Therefore, the fluid in the needle at the end of the delivery cycle is drawn back and in drawing back this fluid, any droplet adhering to the needle end is drawn within the needle.

In using filling machines of this character and for this specialized purpose it is not desired to pull back the liquid from the needle end too great a distance for the danger of entraining air in the system presents itself. It has been found that a pull-back of fluid from the needle end a distance approximately three-eights of an inch is more than adequate to remove the final drop and avoids air entrainment. For this reason the pull-back cam follower **111** is mounted for angular adjustment circumferentially of the cam **110** so that the "lateness" of the valve action and the extent of pull-back can be varied at will. Also, it will be appreciated that the volume contained within a tubular needle varies with the diameter of the needle and the pull-back setting for a needle of a given size is incorrect for a needle of another size. Furthermore, with a variable stroke measuring unit of the character disclosed in which a crank-actuated sector arm is employed to actuate the measuring unit through selectively different displacement strokes, the volumetric quantity of liquid pulled back from the needle end is a percentage value of the stroke setting, and the circumferential adjustment of the movable follower **111** should be changed whenever the stroke is changed so that the pull-back on a given piston stroke and in a given size needle remains tolerable. For example, if the sector arm yoke **100** is set outward on the arm **95** to obtain the maximum stroke, the cam follower **111**, should be set relatively close to the dead center position so that its response to the action of the cam in shifting the valve occurs before the crank pin **98** has moved very far off its dead center position. A small movement of the crank, in an intake direction, imparts a greater displacement movement of the piston relative to the cylinder of the measuring unit on a large stroke setting than does the same movement of the crank when the sector arm yoke is set for a small stroke and operating near the fixed pivot of the sector arm. Percentagewise the movement is comparable, but quantitively the results are very different. Hence, the pull-back follower-roll **111** should be readjusted when the delivery stroke is changed in order to obtain a pull-back of a given quantity over the entire range of delivery settings, and with due regard to the needle size.

After the ampul has been filled and the needle withdrawn, it is carried by the processing conveyor to the flushing station, if one is used, and receives a charge of flushing gas in a manner similar to the manner of filling. The ampul is centered and then entered by the flushing needle as previously expained in connection with the filling operation.

SEALING MECHANISM

After the flushing operation, the filled ampul passes to the sealing means indicated generally at E. One or two or more sealing stations may be provided according to the requirements. At each of the sealing stations, means are provided to heat the neck of the ampul and to rotate the ampul during heating thereof. The heating means comprises preferably a burner tip **180** of the appropriate character for the kind of fuel to be used, which is carried by a burner block **181**. The block **181** is angularly and axially adjustable on a stub shaft **182**, carried by the back-stop guide block **66** of the ampul centering mechanism. The burner block is also bored and fitted with a hose nipple **183** by which a gaseous fuel from a supply line hose **184** is conducted to the burner tip **180**. By tilting the burner block upon the supporting shaft **182** or shifting it along the shaft, the angle of the fire and its point or zone of concentration may be adjusted to suit requirements. When such adjustments have been made the assembly may be moved in or out, together with the back-stop plate **65**, previously described, to suit the ampul size. Likewise, when the centering slides and supporting bracket **52** is raised or lowered in accordance with the height of the ampul, the burner fire, or fires are also raised or lowered so that correct relations, once established, are maintained over the range of sizes without independently readjusting the several mechanisms.

In the instant disclosure, two sealing stations are illustrated, each equipped with a burner tip **180** directed toward the ampul stem. When the nature of the seal requires, an annealing fire, indicated by the burner **180***a* may be provided. This burner may be carried upon an extension of the supporting shaft **182** and be supplied with fuel from line **184***a*. Best annealing results are obtained if the annealing fire is positioned one or more stations away from the final sealing station so that the ampul tip has an opportunity to cool slightly before entering the annealing zone.

The ampul rotating mechanism at each station comprises a drive roll **190** that is caused to rotate about a shaft **191** carried in a yieldable slide block **192**. The block **192** is guided in a slot **193***a* formed in a supporting plate **193** and is tensioned by a spring **194** toward the ampul receptacle formed by the slides of adjacent pair of the conveyor rolls **31**. Movement of the drive roll block is limited in one direction by the end wall of the slot **193***a* and in the other direction by a retaining plate **195** that extends across the open end of the slot. Normally a portion of the drive roll **190** extends into the path of travel of the ampul, and when the latter arrives in position the drive roll **190** presses on the ampul and retains it and rotates it in a three-sided pocket formed by two of the rollers **31** and the roll **190**.

Rotation of the drive roll **190** is effected, in the present embodiment, by a gear train that derives its power from the reduction unit R. This train includes a gear **196** that is secured to the drive rolls **190**, and a gear **197** that is jounaled on a stub shaft **198** carried by the plate **193**, and a drive gear **199** on a shaft **200**. The shaft **200** is rotatably supported in the plate **193**, extends below the top plate **24** and carries a sprocket **201**, the latter being driven by a chain **202** from a sprocket **203** mounted upon the reduction shaft C_1. When desired, a second sealing station may be provided by adding a second burner and a second drive roll indicated at **190***a* and additional stations added by adding additional gears and drive rolls. As the construction and operation is the same as the parts just described, a repetition of the description is deemed unnecessary. Suffice it to say that the ampuls to be sealed enter and leave the respective sealing stations, the drive rolls **190**, **190***a* are caused to yield more or less according to the ampul size and the drive gear under each moves along its pitch line relative to the fixed intermediate gear or gears **197**.

As illustrated in the drawings the ampul rotating mechanism is preferably mounted in a covered housing **205**, of which plate **193** as well as the guide fence **35** may form a part, and the entire assembly mounted on the table top **24** for in-and-out adjustment relative to the processing conveyor roller receptacles to accommodate different sizes of ampuls. For this purpose a key guide **206** and clamp screws **207** that pass through slots in the housing member are provided.

It will be understood that the processing conveyor transports the ampuls from station to station and if more than one sealing station is provided, the first may be used as a pre-heating station, the second a fusing station, the third a finishing station, etc., and the respective fires adjusted according to the purpose.

DELIVERY

After sealing, the ampuls are brought successively to a delivery station where they are discharged from the conveyor. Delivery, in this instance, is effected by interposing a tongued guide **210** into the path of ampul travel. The leading end of the guide is preferably bifurcated to permit passage of the rollers **31**, and when positioned at an angle to the line of travel of the ampuls each in succession engages and is displaced laterally out of the V-pockets of the conveyor rolls and into a delivery channel **211**. This channel may be defined by the guide **210** on one side, and a wall **212** on the other. The wall **212** may, if desired, be a part of the housing **205** and be adjustable therewith. Also, the channel **211** may, if desired, have a flaring outlet so that successive ampuls may move laterally as well as forwardly. Should ampuls at the outer margins of the group tend to fall over before they are removed by the operator, a yieldable back-wall **213** may be provided. This back-wall **213** may comprise simply a movable lever or any such device that will function to provide an ever enlarging pocket-like enclosure for receiving and supporting the ampuls.

BULK LOADING

As herein above indicated the containers are to be loaded preferably in bulk lots on the upper run of the loading conveyor belt **50**, though they may be placed on the belt individually by hand if desired. For bulk loading of ampuls a convenient means comprises a perforated rack-plate **220** and an open-ended tray **221**. The perforations in the plate are larger than the ampul necks but smaller than their body parts. Ampuls may be received from a sterilizer in inverted position in such perforated plates and the open-ended tray **221** placed upon the inverted ampuls and both tray and plate inverted in space and placed upon the conveyor belt **40** with the open end of the tray directed toward the processing conveyor C. After being positioned in this manner, the tray is slid from beneath thte ampuls, which are still confined in the perforations of the rack-plate, thus bringing the bottoms of the ampuls into engagement with the belt. The ampuls move forward with the moving belt **40**, while being steadied by the rack-plate **220**, until they reach the remaining ampuls of the preceding lot at which time the rack-plate is lifted off the stem ends. Until the attendant has become skilled in the loading operation, movement of the loading conveyor may be stopped by means of clutch lever **44***f* during the actual loading.

The ampuls are guided toward the processing conveyor by means of side guides **224** and **225** and a throat guide **226**. The guide **225** is positioned so that at least its forward end guides the leading ampul approximately central to the receiving cavity between rolls of the processing conveyor. The opposite side wall, particularly the throat region **226** thereof may be constructed to prevent the ampuls from bridging and failing to feed. One form of device for accomplishing the purpose is to construct and mount the throat guide piece **226** so as to be capable of movement to enlarge and decrease the throat opening with a frequency at least equal to the indexing cycle of the processing conveyor and preferably at a faster rate. To this end the throat piece **226**, which in effect forms a continuation of the guide wall **224**, is adjustably secured to an oscillable arm **227**. Arm **227** is fastened to a shaft **228** journaled in bearings provided by the table top **24** and shelf **23**. Shaft **228** carries another arm **229** at a point below the table top, and the arm pivotally connects with a cross bar **230**. Bar **230** is also pivotally connected as at **231** with an upstanding lever **232**, and the latter is pivoted as at 233 to a fixed part of the machine. The free end of lever **232** carries a cam follower roll **234** positioned to track the periphery of a lobed cam **235** mounted on the cam shaft **60**. As indicated in Figure 9, the cam **235** is provided with two progressively increasing high portions **235***a* and two relatively sharp descending portions **235***b*. The follower roller is spring tensioned, by pull spring **236**, against the cam, and responds to the contour thereof as the cam revolves, slowly in one direction and rapidly in the other. These motions are transmitted, through the linkages **230**, **229**, **228**, **227** to the throat guide **226** and causes the latter to move toward the standing ampuls slowly and away from the ampuls quickly. These repeated jarrings of the ampuls in co-operation with the forward movements brought about by the movement of the conveyor has been found sufficient to break the tendency of the ampuls to bank up or bridge in the throat region leading to the processing conveyor. A continued flow of ampuls to the receptacles of the processing conveyor may, in this manner, be assured. The magnitude of the oscillation imparted to the guide **226** may be varied to suit requirements by shifting the location of link pivot **231** on the lever **230**. For this purpose the lever **230** is provided with a series of pivot pin openings **231***a*.

For the smaller sizes of ampuls especially, a follow block **240**, may to advantage be employed. As herein illustrated the follow-block may comprise a member provided with extending arms **240***a* positioned so as to group the ampuls and thereby promote their travel as a group. The arms **240***a* also function to back-up the ampuls so that the outer ones do not fall over. It will be understood also that the follow-block **240** is relatively light in weight so that it cannot, by reason of the drag of the conveyor belt **40** thereon, exert too great a pressure upon the bank of ampuls. When reloading the conveyor, the follow-block is removed and replaced behind the new bank of ampuls.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various utilizations by retaining one or more of the features that, from the standpoint of the prior art, fairly constitute essential characteristics of either the generic or specific aspects of this invention and, therefore, such adaptations should be, and are intended to be, comprehended within the meaning and range of equivalency of the following claims.

Having thus revealed this invention, I claim as new and desire to secure the following combinations and elements, or equivalents thereof, by Letters Patent of the United States:

1. In an ampul filling and sealing machine having ampul filling means at one station and ampul sealing means at another station a conveyor means operative to transport ampuls upstanding successively into filling relation with the filling means and thereafter into sealing relation with the sealing means comprising a chain mechanism having a series of closely spaced rollers carried thereby each two rollers forming between their peripheries an open sided ampul-receiving recess, a relatively stationary guide fence positioned opposite the recesses in the chain, said guide fence forming a third side to the ampul-receiving recesses effective to retain the ampuls in the recesses during their lateral movement incident to the operation of the conveyor, track means underlying the recesses in the conveyor on which the ampuls may

stand during the filling and sealing thereof and during the movement thereof by the conveyor means stationed in the path of travel of the ampuls and beyond the filling and sealing means to displace the ampuls laterally from the recesses in upstanding position, and means for driving the conveyor intermittently whereby to bring the recesses successively to the filling station and to the sealing station with a dwell at each of said stations.

2. In a machine for sealing ampuls or the like, combining a sealing station and means thereat for sealing an ampul, conveyor means cooperatively positioned in relation to the sealing station and operative to transport an ampul into sealing relation with the sealing means comprising a chain mechanism having pairs of rollers carried thereby, each pair of rollers providing an open sided ampul-receiving notch between their peripheries, a relatively stationary guide fence positioned opposite the rollers in at least one run of the chain, said guide fence forming a third side of the ampul-receiving notches effective to retain the ampuls within the notches during the lateral shift of the ampul incident to the operation of the conveyor, means at the sealing station and positioned along the path of movement of the confined ampuls frictionally to engage and rotate the ampuls within selected notches, said pairs of rollers that form the notches being frictionally rotated by the driven ampuls during dwell periods of the conveyor, and means for imparting an intermittent movement to the conveyor whereby to bring the ampuls confined in the recesses successively into the sealing station.

3. The method of filling and sealing ampuls without individual manual handling which consists in manually placing a group of ampuls in the upstanding position onto a movable flat-top conveyor, moving the conveyor slowly and simultaneously guiding the upstanding ampuls successively into open-sided recesses in a second conveyor, moving the second conveyor in a direction transverse the direction of movement of the ampuls during the loading operation whereby to sweep the recessed ampuls off the moving flat conveyor and simultaneously confining the successive ampuls in the open-sided recesses of the conveyor, filling the ampuls successively while confined in the recesses of said second conveyor and thereafter rotating and heat sealing the ampuls while still so confined in the recesses of the second conveyor, and then moving the sealed ampuls away from the rotating and sealing means and to a region whereat they are no longer confined in the recesses of the second conveyor and then removing the sealed ampuls in upstanding relation laterally out of the recesses and out of the path of travel thereof.

4. In a filling machine of the character described a variable displacement measuring unit of the piston and cylinder type, valve means operative to connect the interior of the cylinder of the measuring unit with a source of supply and with the delivery needle in alternation, a delivery needle connected with the measuring unit, means to reciprocate the piston of the measuring unit through a normally fixed stroke whereby to effect entrainment and discharge of a predetermined quantity of the preparation, stroke varying means for the measuring unit, and means to operate the valve means in timed relation with the operation of the means to reciprocate the piston comprising a rotatable cam element, a normally fixed cam follower operatively related to the cam, a relatively movable cam follower also operatively related to the cam and positioned substantially diametrically opposite the said fixed cam follower, a common carrier member for said cam followers and connections therefrom to the said valve, and means mounting the relatively movable cam follower on the carrier for adjustment circumferentially of the cam to thereby vary the time of valve shift relative to the time of change of the piston stroke from a delivery direction to intake direction, the timing of valve shifting being invariable relative to the time of change of piston stroke from an intake direction to a delivery direction, said movable cam follower being capable of adjustment from a zero position opposite the fixed follower to a position circumferentially ahead of zero whereby to delay the time of valve shift from a delivery position to an intake position in amounts inversely proportionate to the stroke imparted to the piston of the measuring unit to thereby effect a substantially quantitatively constant pull-back of fluid from the delivery end of the needle at all stroke settings of the measuring unit.

5. In a filling machine of the character described, a variable displacement measuring unit of the piston and cylinder type, valve means operative to connect the interior of the cylinder of the measuring unit with a source of supply and with the delivery needle in alternation, a delivery needle connected with the measuring unit, means to reciprocate the piston of the measuring unit to effect entrainment and discharge of a predetermined quantity of the preparation, means to operate the valve means normally in coincidence with changes in the reciprocatory movements imparted to the piston of the measuring unit comprising a rotatable cam element, a normally fixed cam follower operatively related to the cam, a relatively movable cam follower also operatively related to the cam and positioned substantially diametrically opposite the said fixed cam follower, a common carrier member for said cam followers and connections therefrom to the said valve, and means mounting the relatively movable cam follower for adjustment circumferentially of the cam to thereby effect valve shifting out of coincidence with a change in direction of movement of the piston with respect to one end of the stroke only, said normally fixed cam follower being continuously operative to effect valve shifting coincidentally with a change in direction of piston movement at the other end of the stroke thereof, said movable cam follower being capable of adjustment from its position of coincidence opposite the fixed follower to a position circumferentially ahead thereof whereby to delay the time of valve shift from a delivery position to an intake position a selected amount whereby to effect a pull-back of fluid from the delivery end of the needle at the end of a delivery stroke.

6. In an ampul filling and sealing machine drive means comprising a main power shaft, a first set of speed reducing gears and a second shaft driven from said main shaft, a second set of speed reducing gears and a third shaft driven from said first shaft, a branch transmission driven from said second shaft, an indexible ampul carrier, an ampul filling means operatively associated with the indexible carrier ampul sealing means also operatively associated with the indexible carrier; power transmitting connections between said second shaft and the indexible carrier, and between said third shaft and said filling means, and between said branch transmission and said sealing means for driving same, and safety means in the power transmitting connections between the said third shaft and said filling means operative to suspend operation of the filling means in the event of an overload, said other named power transmitting connections remaining effective to operate the conveyor and the sealing means whereby to effect sealing of previously filled ampuls.

7. A machine for filling and sealing a container with a measured quantity of a pharmaceutical preparation said machine having a container-filling station and a container-sealing station, combining a movable processing conveyor adapted to transport the container from the said filling station to the said sealing station, said conveyor comprising in part a pair of closely-spaced rotatable rollers whose adjacent peripheries form a V-shaped pocket for the reception of the container, means at the filling station operative normally to inhibit rotation of the container confined in the said pocket, means at the sealing station operative normally to effect rotation of the container during the sealing thereof comprising a yieldably-mounted rotatable driving roller at the sealing station operative when the container is at the sealing station to form a

third side to the aforesaid V-shaped pocket formed by said pair of rollers and to press upon the container confined therein, means to rotate said driving roller thereby to effect rotation of the container by its engagement therewith within the pocket formed by the said pair of rollers and the said driving roller, and means to move said conveyor intermittently whereby the container is stationary while at the filling station and rotated while it is at the sealing station.

8. A filling machine combining a continuously operating measuring pump adapted cyclically to receive a pharmaceutical preparation from a bulk supply and to discharge a measured quantity of the preparation into a container, said pump including a supply conduit adapted to be connected with a bulk supply of preparation, a filling spout through which the preparation is discharged into the container and valve means connected between the supply conduit and the pump and between the pump and the filling spout operative normally to connect the bulk supply with the pump on an intake cycle of the latter and thereafter to connect the pump with the filling spout on a discharge cycle of the pump, means for actuating said valve means normally in phase with the operation of the pump to effect pumping action including a continuously operating valve actuator and a yieldable connection between said continuously operating actuator and the valve, a conveyor mechanism operative normally to position containers successively in filling relation with the said filling spout, blank detecting means positioned at the filling station and operatively associated with said valve responsive to the presence of a container in filling relation with the spout to render said valve means operative to direct the preparation entrained in the pump through the filling spout and into the container and operative in the absence of a container in filling relation with the spout to connect the pump with the supply conduit so that the preparation entrained by the pump discharges back to the bulk supply.

9. The combination of claim 8 in which said blank detecting means includes a movable member cooperatively associated with said valve means to latch the valve means in its said pump-intake position during a normal delivery cycle of the pump in the absence of a container in filling relation with the filling spout.

10. A machine for filling small vials, ampuls or the like with a pharmaceutical preparation comprising a measuring unit, a fluid intake conduit and a fluid discharge conduit connected with said unit, valve means between said conduits and said unit operative normally to connect said unit with said intake conduit and with said discharge conduit in alternation, said valve means having an intake position and a discharge position, continuously operating means for actuating said measuring unit, means for actuating said valve means to its effective positions normally in synchronism with the actuation of said measuring unit whereby a quantity of fluid is entrained by the unit from the said supply conduit and thereafter discharged by the unit through the said discharge conduit, said valve actuating means including a movable cam element and connections responsive to the movement of the cam for actuating said valve comprising a carrier element having a cam-follower fixed thereto and responsive to movement of the cam to actuate the valve to its said intake position and another cam-follower adjustably fixed to the carrier and responsive to the movement of the cam to actuate the valve to its said discharge position, said two cam-followers being normally positioned relative to the cam 180° apart time-wise so that valve actuation normally occurs at the change in the intake and discharge cycles of operation of the measuring unit, and means connected with said adjustable cam-follower to shift the position of the adjustable cam-follower relative to the cam in a direction such that said valve means is caused to be actuated from its said discharge position to its said intake position slightly later than the change in the actuation of said measuring unit from its discharge cycle to its intake cycle so that said discharge conduit remains connected with the measuring unit during a portion of the intake cycle.

11. The combination of claim 10 in which said connections between the cam element and the valve also includes a normally positive but yieldable connector, and additional means operable selectively to latch the valve in one of its effective positions, said normally positive connector yielding in response to the continued operation of the cam during a valve latched condition.

12. In a machine of the character described the combination of a relatively fixed ampul-loading station and a relatively fixed ampul-processing station distantly located from the loading station, a processing conveyor extending between said stations adapted to transport ampuls from the loading station to the processing station for the performance of a processing operation at said last-named station, said processing conveyor comprising a series of uniformly and closely-spaced rollers arranged single file so that the peripheries of adjacent rollers form uniformly-spaced open-sided recesses adapted to receive ampuls, means for moving the processing conveyor intermittently through distances equalling the spacing of the open-sided recesses of the conveyor to bring the recesses successively from the said loading station to the said filling station with dwell periods between such movements for effecting loading of an ampul into one recess and for effecting a processing operation at the ampul-processing station on an ampul in a preceding recess, an ampul-loading conveyor at the said loading station adapted to receive a bulk supply of ampuls and to place them one-by-one successively in the recesses of the processing conveyor, comprising a plane surface movable toward the open sides of said recesses and substantially at right angles to the path of movement of the recesses, means for moving the loading conveyor toward the said processing conveyor at a speed greater than the diameter of an ampul during a dwell period of the processing conveyor so that an ampul is moved into an open-sided recess while the latter is stationary and retained therein by the movement of the loading conveyor until the processing conveyor moves the recess-confined ampul laterally away from the loading station, and means operative after the ampul is moved away from the loading station to confine the ampul to its respective open-sided recess in the processing conveyor for the performance of the processing operation.

13. The combination of claim 12 including guide means having a throat portion operatively associated with the loading conveyor for guiding the ampuls to the recesses in said transporting conveyor.

14. The combination of claim 13 in which the said guide means includes a movable member at the throat portion, and means to actuate said movable member repeatedly whereby effectively to disturb ampuls that tend to bridge at the throat of the guide means.

15. In a machine for filling ampuls or like containers with a charge of liquid preparation the combination of, a continuously-operating positive-displacement liquid dispenser, a supply conduit for conducting liquid from a bulk supply to the dispenser and a delivery conduit for conducting a charge of dispensed liquid into the container, valve means including a shiftable element for controlling the flow of liquid from the bulk supply to the dispenser and from the dispenser to the delivery conduit, the said shiftable element of said valve means having a dispenser-intake effective position when in one shifted position and a dispenser-discharge effective position when in another shifted position, power means connected with the valve means for shifting the shiftable element thereof normally cyclically from one of its effective positions to its other effective position in phase with the operation of said dispenser to cause the dispenser to receive and discharge unit quantities of the liquid preparation, means for positioning the open ends of ampuls successively in filling

relation with said delivery conduit to receive the liquid discharged by the dispenser, and means operative normally to engage the open end of the ampul and operatively connected with said shiftable element of the valve means for rendering said power means ineffective to shift said valve element to its dispenser-discharge position in the absence of an ampul in filling relation with the said delivery conduit whereby liquid entrained by the dispenser is caused to be discharged thereby back into said supply conduit.

16. In a machine for processing ampuls, a processing conveyor adapted to transport the ampuls from a loading station to a processing station, means at the loading station for loading the processing conveyor comprising an endless conveyor having a relatively flat upper run on which ampuls may be placed in upstanding position, guide means associated with the endless conveyor for guiding the ampuls, said guide means comprising relatively stationary side guide members and a relatively movable guide member positioned at an angle to the path of travel of the ampuls operative to effect movement of the ampuls laterally as they are advanced between said side guide members, said relatively movable guide member terminating adjacent the loading station of processing conveyor whereby the ampuls are fed successively thereto, and means coacting with said relatively movable guide member for actuating the member in an ampul-compacting and an ampul-releasing direction repeatedly so as to dislodge ampuls that tend to bridge.

17. The combination of claim 16 including a removable follow block member adapted to be positioned on the endless conveyor at the rear of the ampuls, said follow block being frictionally urged in ampul supporting position by the drag of the conveyor.

18. The combination of claim 17 in which the follow block is formd with flaring leading surface operative to group the ampuls and to effect propulsion thereof as a group toward the loading station.

19. The combination of claim 16 including a drive train for effecting movement of the processing conveyor and a drive train for effecting movement of the endless conveyor, and clutch means in one of the said drive trains operative at will to suspend operation of one of the conveyors independently of the other.

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