United States Patent

Klettke

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[54] **APPARATUS FOR AUTOMATICALLY ATTACHING A SLEEVE TO A CYLINDRICAL MEMBER**

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[22] Filed: **Jan. 18, 1971**

[21] Appl. No.: **107,129**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 759,875, Sept. 16, 1968, Pat. No. 3,564,806.

[52] **U.S. Cl.** .....**29/208 B**

[51] **Int. Cl.**.....**B23p 19/04,** B65b 3/10, B65b 31/00

[58] **Field of Search**....29/208 B, 208 R; 53/22 R, 43, 53/37

[56] **References Cited**

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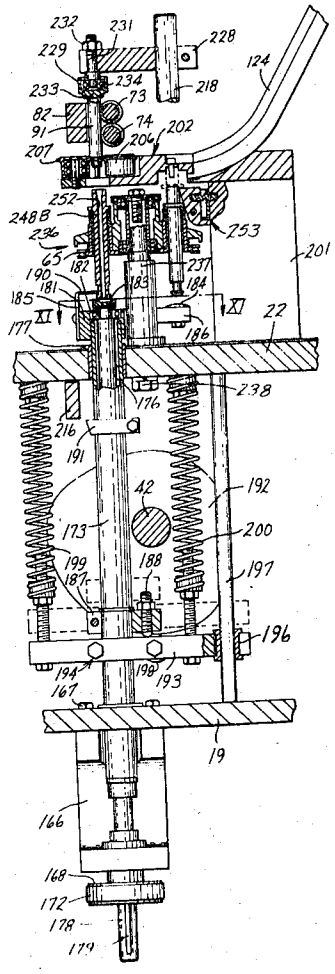
[57] **ABSTRACT**

An apparatus for automatically attaching a malleable cylindrical sleeve or hub to a cylindrical member, such as the neck on a syringe barrel. The syringe barrel is rotatably supported in an upright position axially aligned with and above a hub support which is rotatably mounted upon the frame of the apparatus in axial alignment with the syringe neck. The hub is simultaneously rotated and moved upwardly into engagement with the neck of the syringe barrel, which thereafter rotates with the hub. Deforming rolls engage the upper edge of the hub and rotate with it as they spin the hub onto the hub receiving neck of the syringe barrel. The assembled barrel and hub are then carried away from the apparatus.

8 Claims, 12 Drawing Figures



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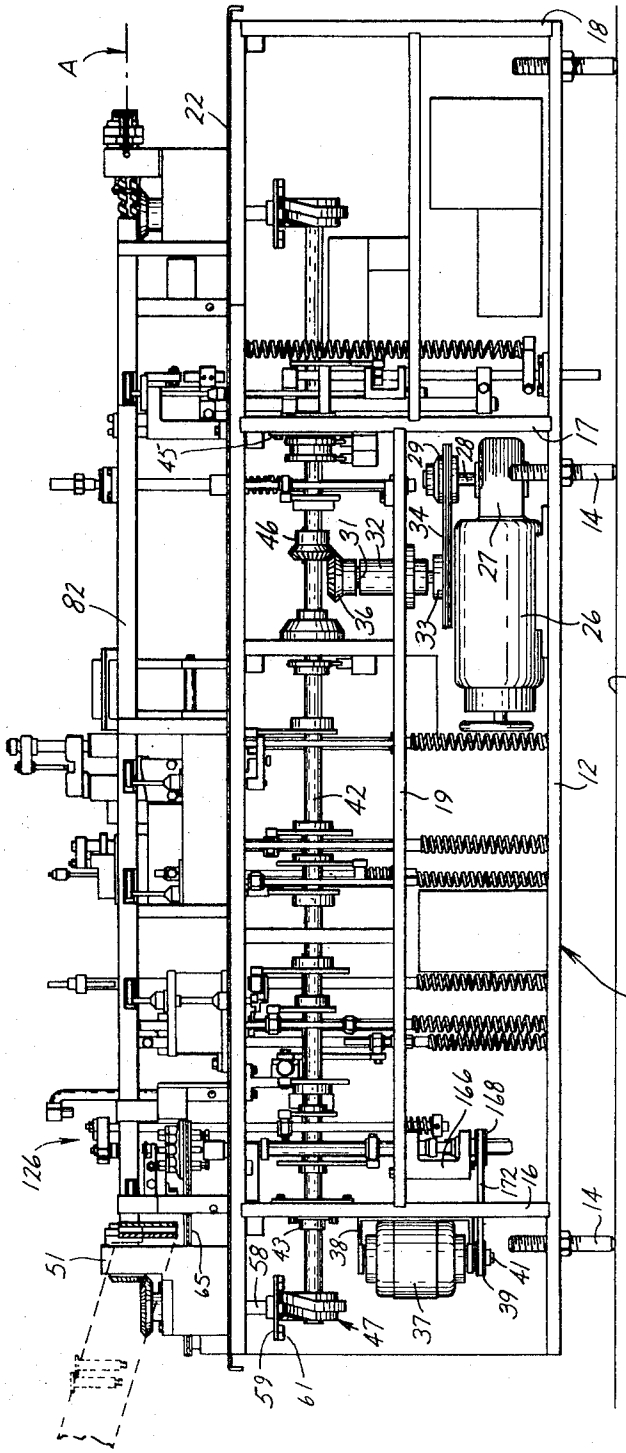

FIG. 1

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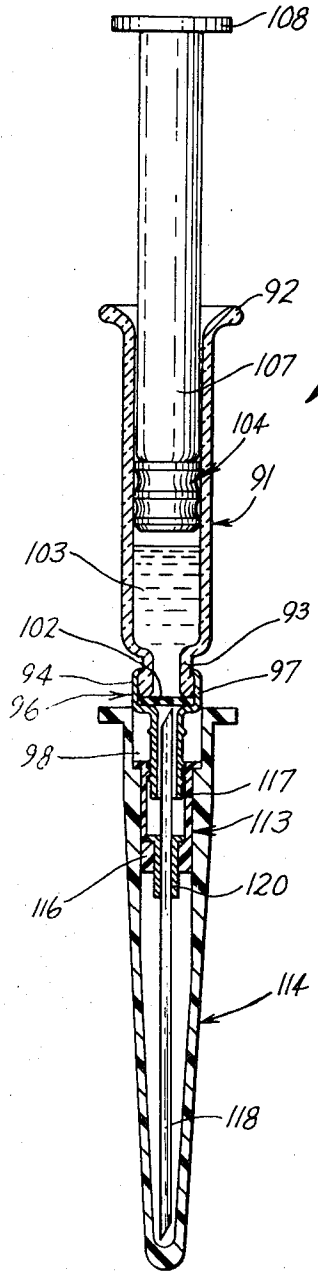

FIG. 2

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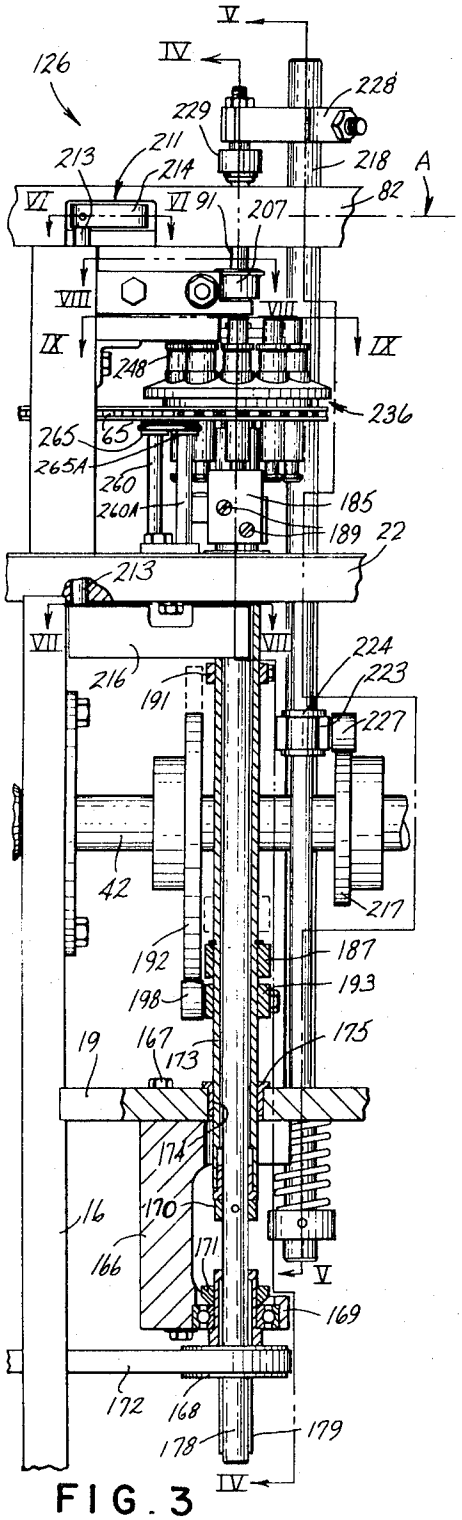

FIG. 3

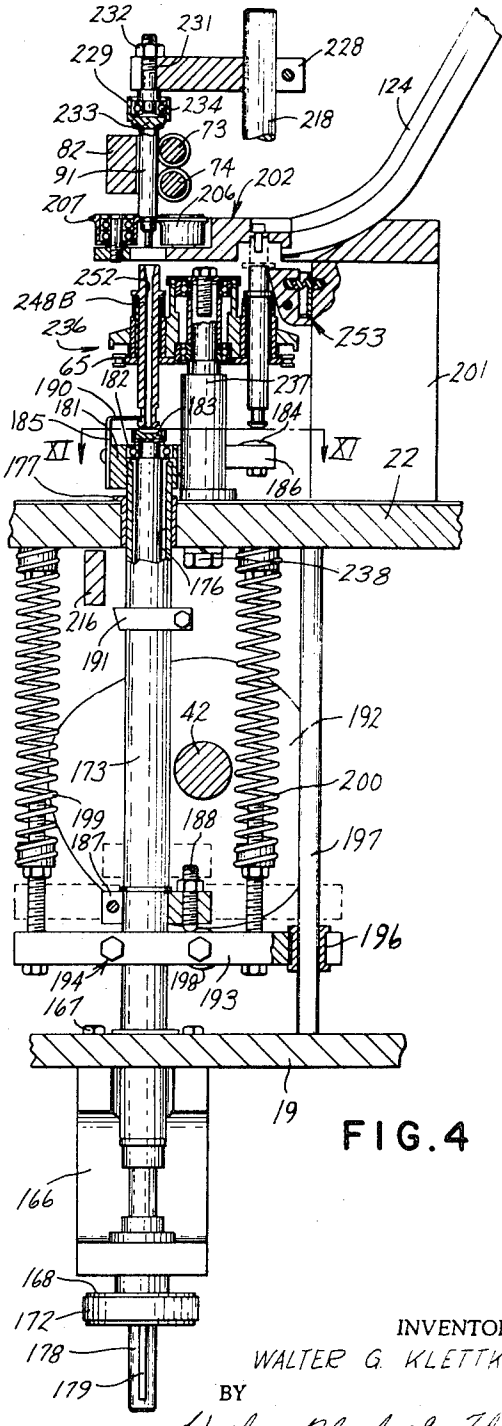

FIG. 4

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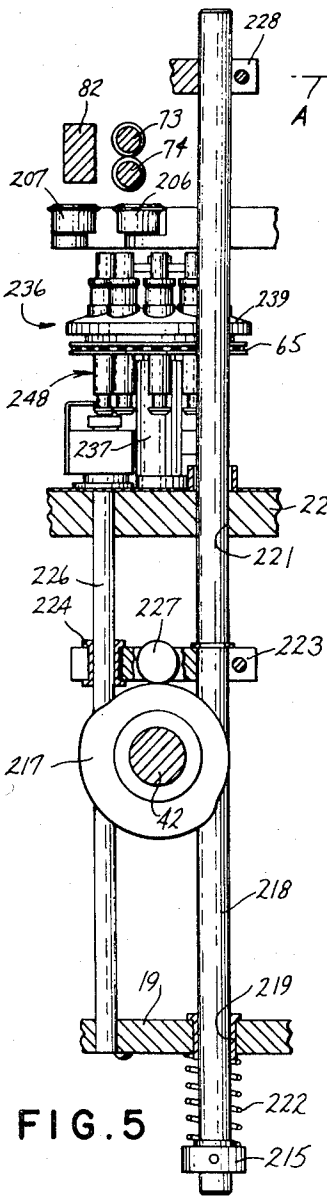

FIG. 5

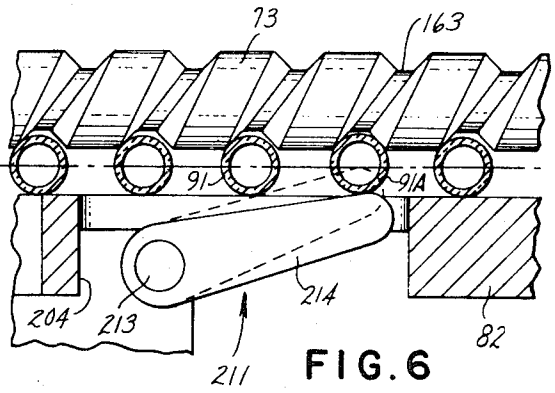

FIG. 6

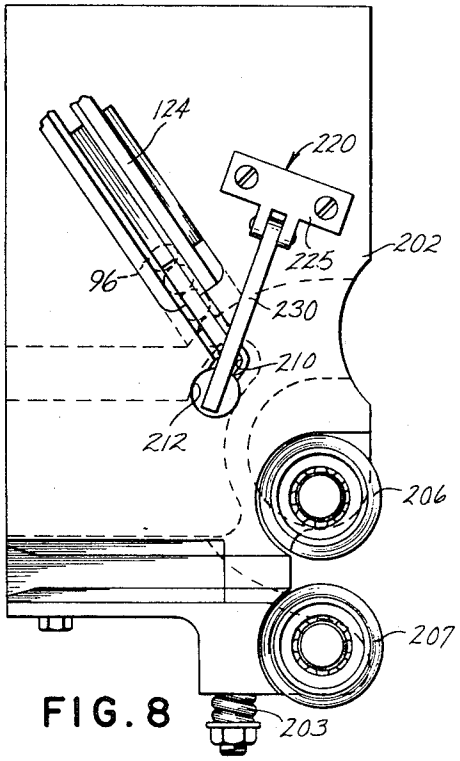

FIG. 8

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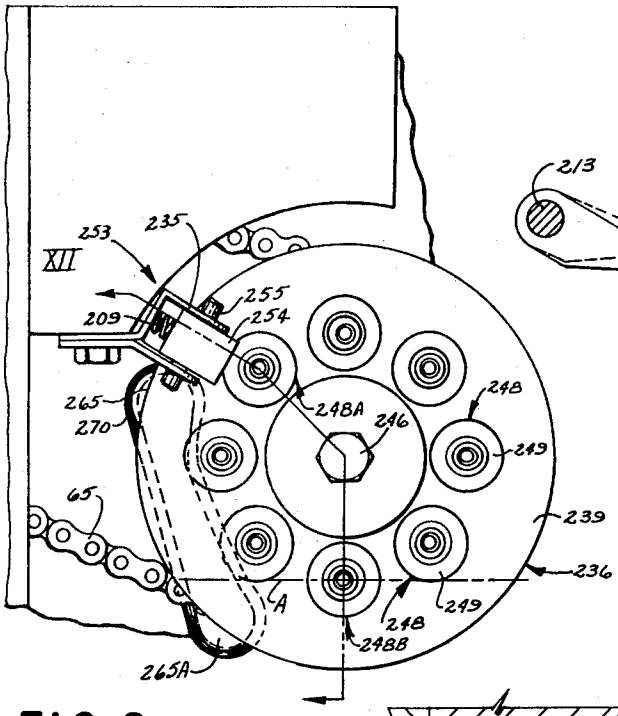

FIG. 9

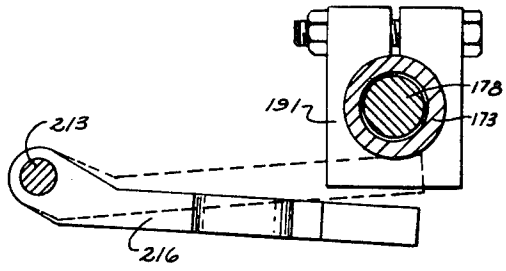

FIG. 7

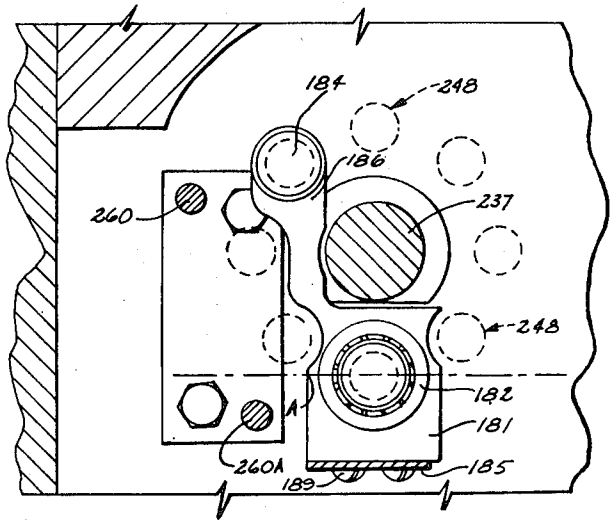

FIG. 11

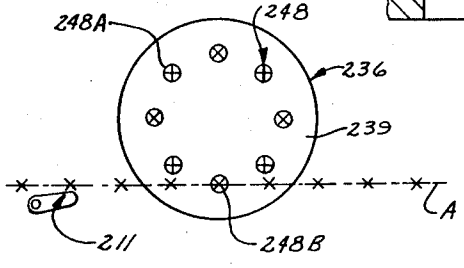

FIG. 10

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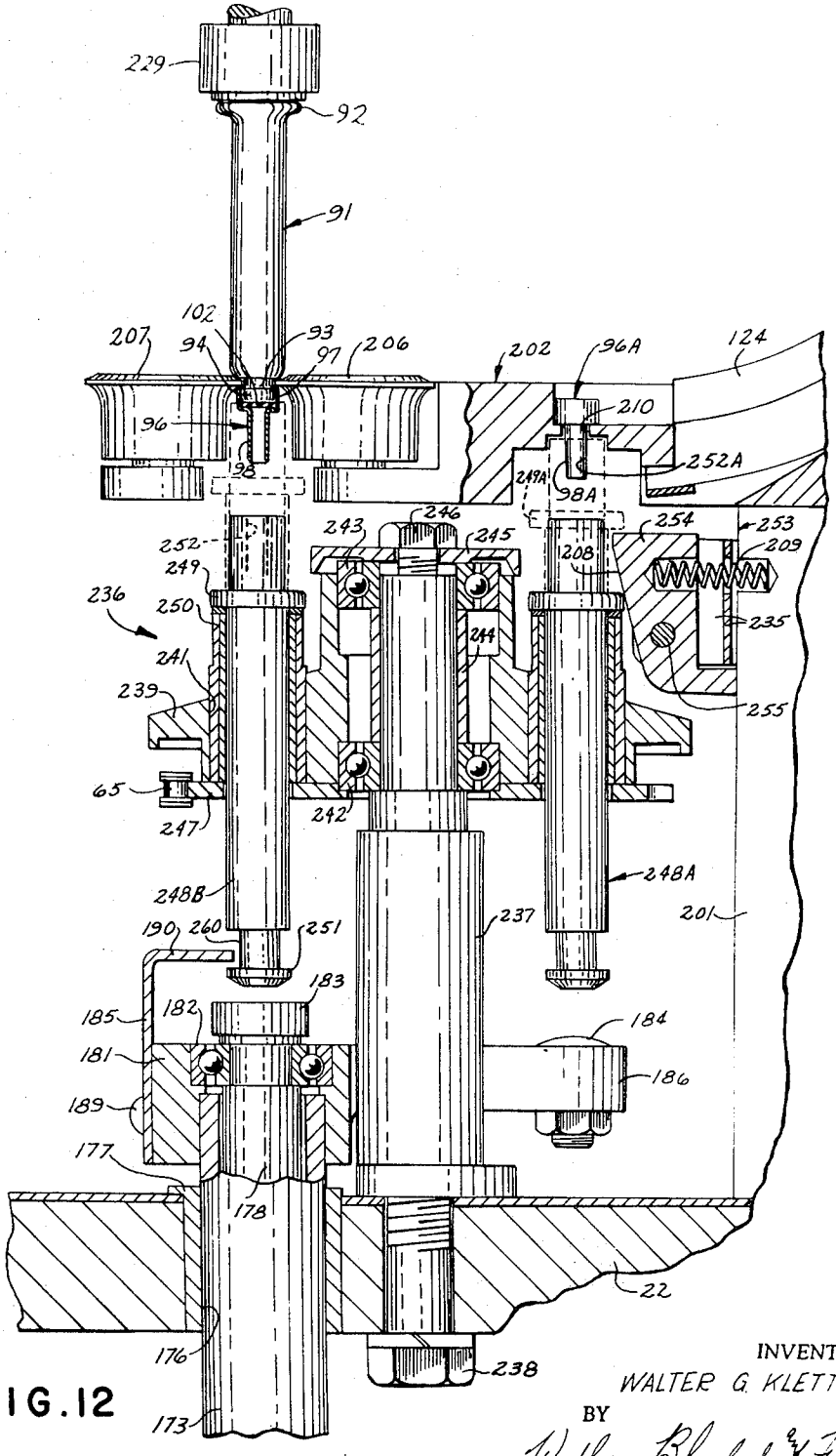

FIG. 12

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APPARATUS FOR AUTOMATICALLY ATTACHING A SLEEVE TO A CYLINDRICAL MEMBER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part application of my copending application Ser. No. 759 875, filed Sept. 16, 1968, now U.S. Pat. No. 3,564,806, Pat. Feb. 23, 1971.

FIELD OF THE INVENTION

This invention relates to an apparatus for attaching one cylindrical member to another and, more particularly, for spinning a hub onto one end of a syringe barrel in the process of assembling and filling a complete syringe, as shown in said copending application Ser. No. 759 875.

BACKGROUND OF THE INVENTION

While the need for relatively inexpensive disposable syringes has been readily recognized, it has been impossible to satisfy this need inasmuch as it has been too costly to assemble such syringes by hand and under sterile conditions. One of the more important obstacles to the automatic assembly and filling of disposable syringes has been the lack of suitable apparatus for attaching the hub, which supports the cannula, to the syringe barrel.

More specifically, previous mechanisms for securing the hub to the syringe barrel have not been capable of holding the syringe barrel in an upright, upwardly opening position so that a liquid can be automatically poured into the open upper end of the barrel immediately after it is attached to the hub which has means for sealing the lower end of the barrel. This arrangement is essential to accurate, high speed assembly of the syringes and to uncontaminated filling thereof.

Therefore, it is a primary object of the present invention to provide an automatic hub assembling apparatus for use in an automated syringe assembling machine, whereby the hub is attached to the neck at the lower end of the upright syringe barrel.

It is a further object of the present invention to provide a hub assembling apparatus, as aforesaid, which is easily cleaned, thereby reducing the downtime of the assembling machine of which it is a part, and which can be quickly restored to a condition of operability after the machine is stopped for some reason.

Other objects and purposes of this invention will become apparent to persons acquainted with apparatus of this general type upon reading the following specification and inspecting the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of a syringe assembling and filling machine having a hub attaching apparatus.

FIG. 2 is a central, cross-sectional view of an assembled syringe.

FIG. 3 is a broken and enlarged fragment of FIG. 1 which illustrates the hub attaching apparatus.

FIG. 4 is a sectional view taken along the line IV—IV in FIG. 3.

FIG. 5 is a broken sectional view substantially as taken along the line V—V in FIG. 3.

FIG. 6 is a sectional view taken along the line VI—VI in FIG. 3.

FIG. 7 is a sectional view taken along the line VII—VII in FIG. 3.

FIG. 8 is a sectional view taken along the line VIII—VIII in FIG. 3.

FIG. 9 is a sectional view taken along the line IX—IX in FIG. 3.

FIG. 10 is a schematic illustration of the hub assembly station.

FIG. 11 is a sectional view taken along the line XI—XI in FIG. 4.

FIG. 12 is a sectional view taken along the line XII—XII in FIG. 9.

For convenience in reference, the words "up," "down," "left," "right," "front," and "rear" will have reference to the apparatus in its normal position of operation, as appearing in FIG. 1, which shows the front of the assembling machine. The words "inward" and "outward" will refer to the geometric center of the apparatus and designated parts thereof. Such terminology will include the words above mentioned, derivatives thereof and words of similar import.

SUMMARY OF THE INVENTION

The objects and purposes of the invention have been met by providing an apparatus for attaching a hub to the neck at the lower end of a syringe barrel held in an upright position. The cylindrical syringe barrel is rotatably supported in axial alignment with and above hub carrying means which rotatably supports the hub for axial movement toward the hub neck of the syringe barrel. Engagement of the rotating hub with the syringe barrel effects rotation of the syringe barrel. Deforming rolls are provided for engaging the hub adjacent the upper edge thereof and spinning the hub onto the neck during the rotation thereof to secure the hub to the syringe barrel.

DETAILED DESCRIPTION

The hub attaching apparatus described hereinafter may be adapted for use in many different applications. However, for convenience of discussion, said apparatus will be described with reference to its use in a syringe assembling machine, the specific details of which are disclosed in my aforementioned copending application Ser. No. 759,875.

Briefly the syringe assembly machine 10 illustrated in FIG. 1 has a frame 11 which comprises a lower or base plate member 12 supported in an elevated position parallel to and spaced from the floor 13 by a plurality of vertically adjustable legs 14. A plurality of walls 16, 17 and 18 project upwardly from the lower plate 12 and are secured in any convenient manner thereto. An intermediate plate member 19 is located above and preferably parallel to the lower plate member 12 and is secured to the walls 16 and 17 by convenient means, such as welding. A cover plate 22 is secured to the upper ends of the walls 16, 17 and 18 and constitutes a platform on which the syringe assembling elements discussed hereinafter are secured.

A drive motor 26 is mounted on the lower base member 12 and has a gear type speed reducer 27 secured thereto with an output shaft 28. A sprocket 29 is secured to the shaft 28.

A bearing housing 32 extends through and is secured to the intermediate plate 19 in any convenient manner and rotatably supports a shaft 31. A sprocket 33 is secured to the lower end of the shaft 31 and is coplanar with the sprocket 29 secured to the shaft 28. An endless chain 34 interconnects the sprockets 29 and 33. A beveled gear 36 is secured to the upper end of the shaft 31 and is rotatable therewith.

A motor 37 is secured to a bracket 38 which in turn is mounted on the left side of the wall 16 and has a pulley 39 secured to the output shaft 41 thereof.

An elongated cam shaft 42 is located between the top wall 22 and the intermediate plate members 19 and 21 and is rotatably supported by bearings 43 and 45 supported on the walls 16 and 17 by any convenient means. A beveled gear 46 is secured to the shaft 42 and is in driving engagement with the beveled gear 36. In this particular embodiment, the gear 46 and shaft 42 are continuously driven by the gear 36 and motor 26. It is recognized, however, that other forms of this invention could utilize an intermittently driven shaft 42.

A cam member 47 is secured to the left end of the shaft 42. The cam 47 is preferably cylindrical in shape and has a pair of annular and axially spaced cam surfaces 48 and 49 facing each other.

A pillow-type block 51 is secured on the upper surface of the top wall 22 in any convenient manner and a shaft 58 extends vertically through the block 51. A plate 59 is secured to the lower end of the shaft 58 and a plurality of cam followers 61 are mounted on the underside thereof. The cam followers 61 are positioned so that they are engaged, one after another, by the cam member 47 to cause the plate 59 to rotate intermittently a predetermined number of degrees with a selected, such as 360°, rotation of the shaft 42 and cam member 47. In this particular embodiment, there are eight cam followers 61 and the plate 59 is rotated 45 degrees with 360 degrees rotation of the shaft 42. The chain 65 is engaged by a sprocket (not shown) which is mounted upon and rotated by the shaft 58.

The hollow, cylindrical barrel 91 (fig. 2) of syringe 89 has a radially outwardly projecting flange 92 at the upper end thereof. A neck 93 is located on the lower end and has a diameter less than that of the barrel 91. A radially outwardly projecting and annular ridge 94 is located on the free end of the neck 93 and has a diameter greater than the neck portion 93 but less than the diameter of the barrel 91.

The syringe 89 includes a malleable hub 96 preferably made of aluminum and having a cylindrical sleeve 97 into which the neck 93 is slideably and snugly received after which said sleeve is spun on the rib 94. A hollow portion 98, having a diameter less than that of the cylindrical sleeve 97, is integral with said sleeve and provides the lower end of the hub 96. A seal 102 is provided within the cylindrical sleeve 97 and is sealingly held between the neck 93 and the shoulder created in the hub 96 by the hollow portion 98 to prevent the flow of fluid through the hub 96. The number 103 represents the fluid which is inserted into the barrel.

A resilient piston 104 is adapted to be slidably and snugly received into the barrel 91 for urging the fluid 103 through needle 118 after the needle penetrates the seal 102. The piston rod 107 may be cylindrical in shape and has a radially outwardly projecting flange 108 located at the upper end thereof.

The syringe 89 also includes a needle or cannula assembly 113 and a needle sheath 114. An elongated needle 118 projects coaxially through an opening in the bottom wall 116 of a cup-shaped shell 117 and is secured in said opening by a sleeve member 120. The upper portion of needle 118 is spaced radially from and projects axially beyond the open end of the cup-shaped shell 117. The shell 117 is telescoped upon the lower end of the neck 98 on hub 96.

A C-shaped support member 166 (FIG. 3) is secured to the underside of the frame plate 19 of the machine frame by a plurality of bolts 167. The hub of a pulley 168 is mounted on the leg 169 of the support member 166 by a nut 171 and is rotatable with respect thereto. The pulley 168 is driven for rotation by an endless belt 172 which is connected to the pulley 39 (FIG. 1) on the output shaft 41 of the motor 37.

An elongated tubular member 173 (FIG. 3) is located above and coaxial with the pulley 168 and is slidably vertically disposed in the opening 174 in the bushing 175 held by the frame plate 19. The tubular member 173 also extends through the opening 176 (FIG. 4) in the bushing 177 in the top plate 22.

A shaft 178 is slidably secured to the pulley 168 and held against rotation by an elongated key 179. The shaft 178 is permitted to slide axially of the pulley 168 for purposes which will become apparent hereinbelow.

The shaft 178 extends upwardly through the tubular member 173 and is rotatable with respect thereto, but held against relative axial movement with respect thereto by any convenient means including the collar 170.

A collar 191 (FIGS. 3 and 7) is secured to the elongated tubular member 173 and is, in this embodiment, spaced below the top plate 22 of the machine frame.

An L-shaped arm 181 (FIGS. 4, 11 and 12) is secured to the upper end of the tubular member 173 and houses a bearing 182 which rotatably supports the upper end of the shaft 178. A socket member 183 is secured to the upper end of the shaft 178 and is rotatable therewith. A cushion 184 is secured on top of the rearward end of the leg 186. An L-shaped bracket 185 is secured to the arm 181 by screws 189 and has a leg 190 extending rearwardly therefrom.

A disk cam 192 (FIGS. 3 and 4) is secured to the shaft 42 adjacent the left side of the tubular member 173 and is rotatable therewith. An arm 193 (FIG. 4) is held on the tubular member 173 by a bolt and clamp arrangement 194. A bushing 196 is secured in one end of the arm and slidably receives a guide rod 197 which is secured to and extends between the middle plate 19 and the top plate 22, and is parallel to the elongated tubular member 173. A cam follower 198 is rotatably supported on the side of the arm 193 between the ends thereof and is radially aligned with the disk cam 192. In this particular embodiment, a pair of springs 199 and 200 are secured to and extend between the underside of the top plate 22 and the arm 193 to resiliently urge the cam follower 198 upwardly against the radially lower surface of the cam 192.

An arm 187 is secured to the tubular member 173 above the arm 193 and has an adjustment screw 188 threadedly engaging the arm 187 and abutting against the upper surface of the arm 193. Thus, by moving the adjustment screw 188 relative to the arm 187, the spacing between the arm 187 and the arm 193 can be

changed, thereby adjusting the limit of the upward movement of the tubular member 173.

A turret 236 (FIGS. 3, 4 and 12) is rotatably supported on a spindle 237 secured to the top plate 22 by a bolt 238. The turret 236 comprises a wheel 239 (FIG. 12) having a plurality of openings 241 uniformly spaced circumferentially around the perimeter. The wheel 239 is rotatably supported on the spindle 237 by a pair of vertically spaced bearings 242 and 243 separated by a spacer sleeve 244. A bearing retainer cap 245 is secured to the upper end of the spindle 237 by a bolt 246. The turret assembly 236 also includes a sprocket 247 which is secured to the lower side of the wheel 239 and is engaged by the endless chain 65.

A plurality of arbors 248 are slideably disposed in the openings 241. Each arbor is cylindrically shaped and has a flange 249 projecting radially outwardly therefrom adjacent but spaced downwardly from the upper end thereof. Bushing elements 250 are provided in the opening 241 and engage the underside of the flange 249 to support the arbors 248.

A flange 251 is secured to the lower end of each arbor 248 and is axially aligned with the socket 183 on the shaft 178. The diameter of the flange 251 is no greater than the diameter of the opening in the bushing elements 250 so that the arbors 248 can be removed from the wheel 239 for sterilization purposes. The arbor 248 has an annular groove 260 just above the flange 251 into which the leg 190 of the bracket 185 is received when the arbor is axially aligned with the socket 183. An opening 252 extends through the center of the arbor 248 and diverges upwardly at the upper end for receiving the neck 98 on the hub 96.

A latch mechanism 253 (FIGS. 9 and 12) comprises a frame 235 secured to the block 201 supported on plate 22 and has a latch member 254 pivotally supported on frame 235 by a pin 255. The latch member 254 has a cam surface 208 which is engageable with, and is biased into the path of, the flange 249 on the arbor 248 by a spring 209.

A pair of rod members 260 and 260A (FIGS. 3 and 11) are secured in any convenient manner to the upper surface of the top plate 22 and extend upwardly therefrom adjacent a theoretical circle defined by the radially outermost edges of the arbors 248 in the turret assembly 236. A pair of circular flanges 265 and 265A are secured to the upper ends of the rods 260 and 260A, as best illustrated in FIG. 9. The flanges 265 and 265A support a rubber ring 270 which engages the arbors 248 along the radially outermost surfaces thereof.

A horizontally oriented mounting plate 202 (FIG. 4) is secured to the upper surface of the mounting block 201 and projects frontwardly beyond the turret 236. The mounting plate 202 rotatably supports a pair of spaced and axially parallel rollers 206 and 207. The peripheries of the rollers 206 and 207 are spaced a distance slightly greater than the diameter of the neck portion 93 on the barrel 91 and said rollers are located so that a line connecting the centers thereof intersects the extended axis of the shaft 178. The roller 207 is urged by the spring 203 (FIG. 8) into a resilient contact with a neck 93 of a barrel 91 as it passes thereby to accommodate variations in the diameter of the necks.

The barrel detecting device 211 (FIG. 6) has a rod 213 rotatably journaled in the top plate 22 and extending upwardly into a notch 204 in the guide 82 adjacent the row of barrels 91 supported in the assembly line A by the conveyor screws 73 and 74 (FIG. 4). An arm 214 is secured to the upper end of the rod 213 and is movable into the path of the barrels 91 in the assembly line A as illustrated in broken lines in FIG. 4. The arm 214 is disposed in the notch 204 and is preferably positioned to engage the barrel 91A (FIG. 6) located in the third root 163 of said screws 73 and 74 behind (or leftwardly of) the axis of shaft 178 where it intersects said assembly line A. For convenience, each pair of vertically aligned roots on the screws 73 and 74 may be referred to hereinafter as an index position along the assembly line A.

An arm 216 (FIGS. 3, 4, and 7) is secured to the lower end of the rod 213, is rotatable therewith, and is movable into and out of engagement with the collar 191 fixed to the tubular member 173. That is, when a barrel 91 is in position 91A (FIG. 6) in the assembly line A, the arm 214 will be held thereby in the solid line position, thereby holding the arm 216 in the solid line position illustrated in FIG. 7, contrary to the urging of resilient means not shown.

A disk cam 217 (FIGS. 3 and 5) is secured to the shaft 42 rightwardly of the cam 192 and is rotatable therewith. A vertically oriented rod 218 is slideable axially through a bushing 219 in the middle plate 19 and an opening 221 in the top plate 22. A spring 222 is held under compression between the underside of the middle plate 19 and a collar 215 fixed to the lower end of the rod 218 to urge the rod 218 in a downward direction. An arm 223 is secured to the rod 218 intermediate the ends in any convenient manner and extends transversely above the axis of the shaft 42. A bushing 224 is located in the outer end of the arm 223 to slideably receive a guide rod 226 which is secured to and extends between the middle plate 19 and the top plate 22. A cam follower 227 is rotatably supported on the arm 223 by convenient means between the rods 218 and 226 and is radially aligned with the cam 217. Thus, the spring 222 resiliently urges the cam follower 227 against the periphery of the cam 217.

An arm 228 (FIGS. 3 and 4) is secured to the upper end of the rod 218 and extends transversely therefrom. A barrel holddown device 229 is secured to the free end of the arm 228 by means of a stud 231 and a nut 232. A pressure pad 233 is rotatably supported on the lower end of the stud 231 by a bearing 234, and said pad 233 engages the flange 92 on the barrel 91 to prevent upward movement of the barrel when the hub is attached thereto.

A track 124 (FIGS. 4 and 8), for delivering hubs 96 to the hub assembly station 126, is supported on the plate 202 secured to the mounting block 201. The lower end of the track 124 (FIG. 8) terminates in a right angle turn 210 which communicates with an opening 212 in plate 202. A keeper mechanism 220 comprises a base member 225 which is secured to the plate 202 and has an arm 230 pivotally connected thereto. The outermost end of the arm 230 projects into the opening 212 to block the end of the track 124. The keeper mechanism 220 serves to limit the flow of hubs 96 into opening 212.

The center of the opening 212 is vertically aligned with the circle defined by the axes of the arbors 248 on

the turret assembly 236. Also, the center line of the turn 210 in the track 124 is also vertically aligned with the circle of the axes of the arbors 248.

OPERATION

The operation of the above-described machine embodying the invention will be apparent to skilled persons examining such description and the drawings. Thus, the operation will be summarized hereinafter primarily for convenience.

Upon the energization of the motor 26 the gear 36 (FIG. 1) is rotated to drive gear 46 and effect the continuous rotation of the shaft 42. The cam 47 is rotatably driven by the shaft 42 and causes a rotational movement of the plate 59 through engagement of the cam followers 61 with the cam member 47. Accordingly, the shaft 58 is intermittently rotated 45° during each revolution of the cam member 47.

The barrels 91 are advanced rightwardly (FIGS. 1, 6, and 10) one index station at a time along the assembly line A by the intermittent rotation of the screws 73 and 74. When a barrel 91 (FIG. 6) moves into the position adjacent the arm 214 of the barrel detecting mechanism 211, the arm 214 will move from the dotted line position to the solid line position illustrated in FIG. 6. Thus, the arm 216 (FIG. 7) is moved from the dotted line position to the solid line position wherein the arm 216 is out of position for blocking engagement with the collar 191.

Simultaneously with the movement of a barrel into engagement with the arm 214 of the barrel detecting mechanism 211, a hub 96 is moved into the right angled turn 210 (FIGS. 8 and 12) and in vertical alignment with an arbor 248A (FIGS. 9, 10, and 12). Furthermore, the center line of another arbor 248B will move into vertical alignment with the assembly line A, as illustrated in FIGS. 10 and 12.

Rotation of the cam wheel 217 (FIG. 5) will result in a downward movement of the arm 223 and shaft 218 under the urgence of the spring 222 to cause the holding device 229 (FIG. 4) to come into engagement with and guide the upper end of a barrel 91. The wheels 206 and 207 prevent the barrel from being moved upwardly.

The shaft 178 (FIG. 4) is driven by a belt 172 interconnecting the pulleys 39 and 168 (FIG. 1). Rotation of the shaft 178 (FIG. 4) also causes a rotation of the socket 183 (FIG. 12) secured to the upper end thereof.

Cam wheel 192 is continuously driven by the shaft 42. As a result, the cam follower 198, resiliently biased into engagement with wheel 192, by the springs 199 and 200, follows the cam wheel and results in an up and down movement of the tubular member 173 and the shaft 178. A sliding engagement between the shaft 178 and the pulley 168 permits an upward movement of the shaft 178. When the tubular member 173 is caused to move upwardly, the collar member 191 moves upwardly therewith. Since a barrel 91 in the position of the barrel detecting mechanism 211 has moved the arm 214 to the solid line position in FIG. 6, the arm 216 (FIG. 7) has been moved out of the path of the collar member 191. If no barrel had been in place at the position indicated in FIGS. 3, 4 and 6, the arm 216 would have blocked the upward movement of the collar 191 as well as the upward movement of the tubular member 173 and shaft 178. The cam wheel 192 would continue to rotate with the shaft 42 and would result in no structural damage to the machine components.

As the tubular member 173 and the shaft 178 are moved upwardly, two things happen simultaneously. Referring to FIG. 12, the arbor 248A will come into engagement with the pad 184 on the arm 186 of the L-shaped arm 181. Further upward movement of the arm 181 will cause the arbor 248A to move upwardly therewith so that the flange 249A thereon will come into engagement with the surface 208 on the latch member 254. The latch member 254 will pivot about the axis of the pin 255 against the urgence of the spring 209 until the flange 294A reaches the position illustrated by the dotted lines in FIG. 12. In this position, the latch member 254 will snap into the position illustrated below the flange 249A to hold the arbor 248A in the position illustrated in dotted lines. In this position, the opening 252A will receive the neck 98A of the hub 96A.

Secondly, the flange 251 will come into engagement with the rotating socket member 183 and due to engagement therebetween, the arbor 248B will be rotatably driven thereby. Further upward movement of the shaft 178 and tubular member 173 will cause the arbor 248B carrying a hub member 96 to move to the dotted line position illustrated in FIG. 12. Since the arbor 248B is rotating, the hub 96 will be spun into engagement with the rollers 206 and 207 causing same to be curled over the ridge 94 as illustrated in FIG. 12 for a rigid securement.

Further rotation of the cam wheel 192 will cause the arm 193, tubular member 173 and shaft 178 to be moved downwardly away from the barrel 91 and the assembled hub 96. As a result, the arbor 248B will move downwardly with the socket member 183 under the influence of its own weight. However, should the arbor 248B remain in the position shown in dotted lines in FIG. 12, the leg 191 of the bracket 185 will engage the upper surface of the flange 251 and pull same downwardly therewith. On the other hand, the arbor 248A will not move downwardly with the pad 184 and arm 186. Instead, the arbor 248A will remain supported on the upper surface of the latch member 254.

At the completion of the downward movement of the arm 181, the screws 73 and 74 will be intermittently driven again to advance the barrels along the assembly line A to the next index station. Simultaneously therewith, the turret assembly 236 will be driven one index station counterclockwise as viewed in FIGS. 9 and 10. As a result of this movement, the flange 249A on the arbor 248A will move off from the upper surface of the latch member 254 carrying therewith a hub 96A. Simultaneously with the releasement of the flange 249A on the arbor 248A from the upper surface of the latch member 254, the radially outermost surface of the arbor 248A will come into frictional engagement with the rubber ring 270 which resists the downward movement of the arbor 248A. The arbor 248A is urged downwardly until the flange 249A thereof engages the upper surface of the bushing elements 250. The downward movement of the arbor 248A is slowed by the ring 270 so that the hub 96 will not bounce out of the opening 252A due to a sudden engagement of the flange 249A with the upper surface of the bushing ele-

ments 250. At the completion of an indexing movement of the turret assembly 236, the hub assembling operation is repeated as set forth above.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for automatically attaching a malleable cylindrical sleeve onto the lower end of a cylindrical member, comprising:

frame means;

means on said frame means for rotatably supporting said cylindrical member in an axially upright position;

holding means rotatably supported on said frame means and adapted to hold said sleeve in axial alignment with said cylindrical member, said holding means being axially movable toward and away from said supporting means;

means effecting simultaneous rotation and axial movement of said holding means with a sleeve thereon, whereby a sleeve is moved upwardly and telescoped onto said lower end of a cylindrical member held by said supporting means, the engagement of said sleeve with said cylindrical member inducing rotation of said cylindrical member;

roll means adapted to engage, and deform against said cylindrical member, the upper edge of said sleeve during said rotation, thereby to secure said sleeve to said cylindrical member.

2. The attaching apparatus according to claim 1, wherein said cylindrical member is a syringe barrel having a neck at said lower end, said neck being of reduced diameter; and

wherein said roll means spins said upper edge of said sleeve onto said neck.

3. The attaching apparatus according to claim 2, wherein said neck has an annular, outwardly projecting ridge adjacent its lower end, and said upper edge of said sleeve is above said ridge.

4. The attaching apparatus according to claim 2, wherein said roll means comprises a pair of spaced rollers each having an annular rib projecting radially outwardly therefrom and in radial alignment with said neck on said syringe barrel, the spacing between the annular ribs on said roller elements being greater than the diameter of said neck but less than the diameter of said annular ridge; and

wherein said barrel supporting means includes conveyor means adapted to move said syringe into a position with said neck between said annular ribs before said sleeve is telescoped onto said neck.

5. The attaching apparatus according to claim 2, including means controlling and effecting the engagement of a sleeve with said sleeve holding means prior to movement of a syringe barrel into axial alignment with said sleeve holding means.

6. The attaching apparatus according to claim 5, wherein said controlling and effecting means includes a multi-station turret, each station having means adapted to engage a sleeve and move same into engagement with said lower end of said syringe barrel.

7. The attaching apparatus according to claim 2, wherein said holding means includes plural holding members each adapted to engage a sleeve, and mechanism for moving said holding members sequentially into an attaching position where each sleeve is in axial alignment with a syringe barrel, said mechanism thereafter moving each sleeve into engagement with a syringe barrel; and

including feed means adapted to supply a sleeve to each of said holding members before it reaches said attaching position.

8. The attaching apparatus according to claim 7, including conveyor means adapted to move syringe barrels sequentially into a position of alignment with a said sleeve; and

including control means for preventing a sleeve from moving into engagement with a selected holding member which will not be aligned with a syringe barrel when said selected holding member reaches said attaching position.

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