

May 19, 1942.

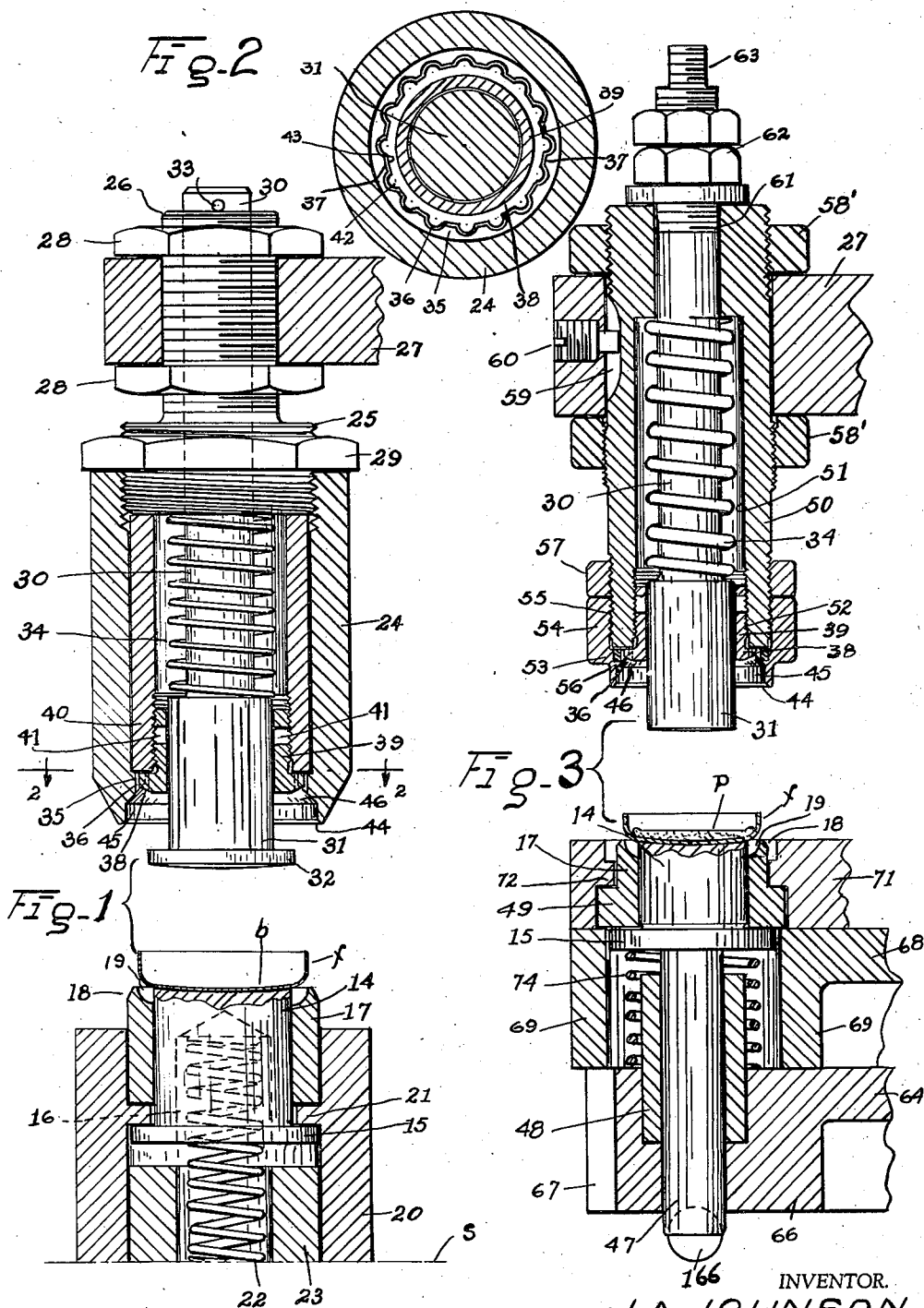
J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 1



BY

INVENTOR.
J. A. JOHNSON
John A. Seifert
ATTORNEY.

May 19, 1942.

J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 2

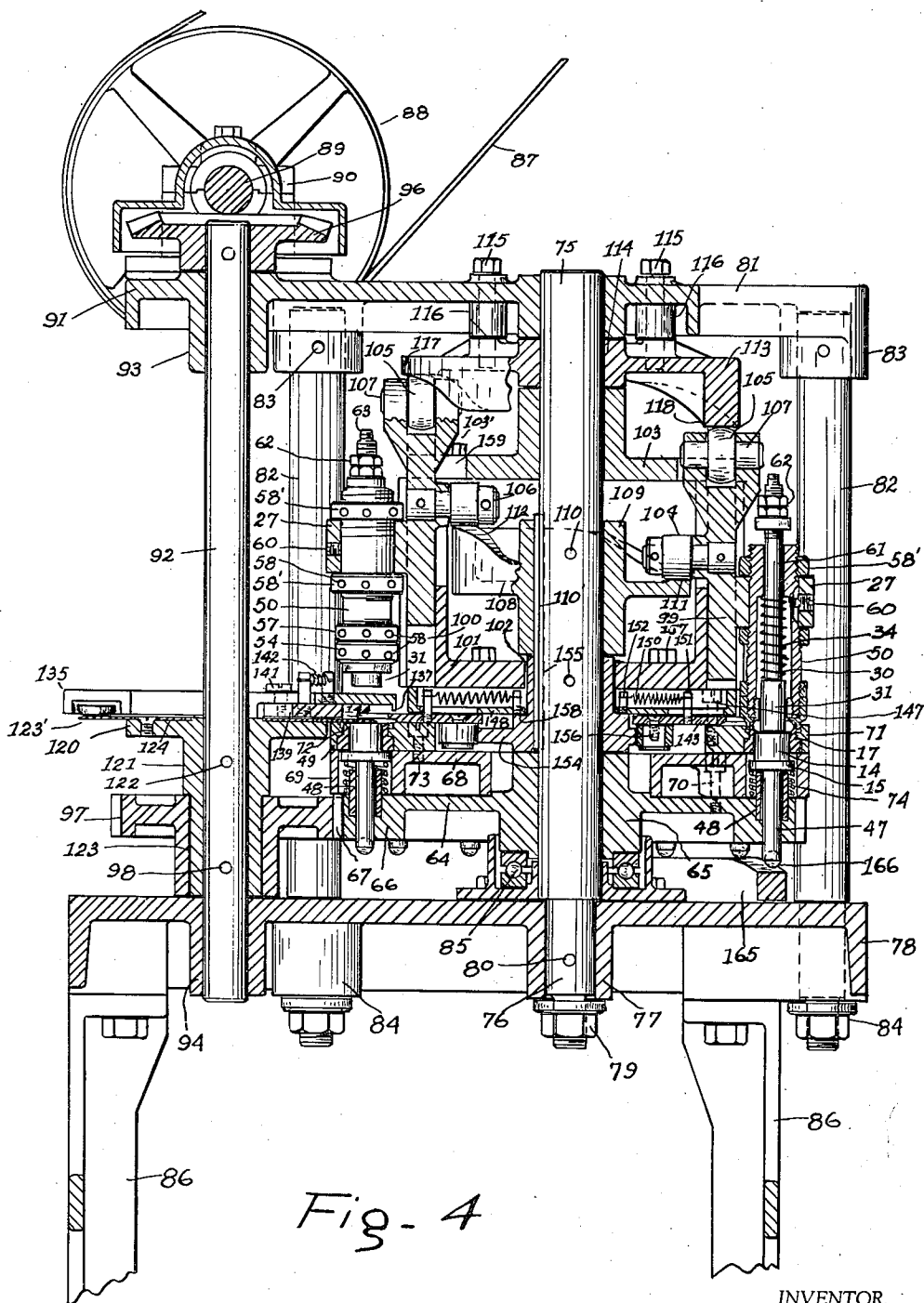


Fig. 4

INVENTOR.
J. A. JOHNSON
BY John A. Seifert
ATTORNEY.

May 19, 1942.

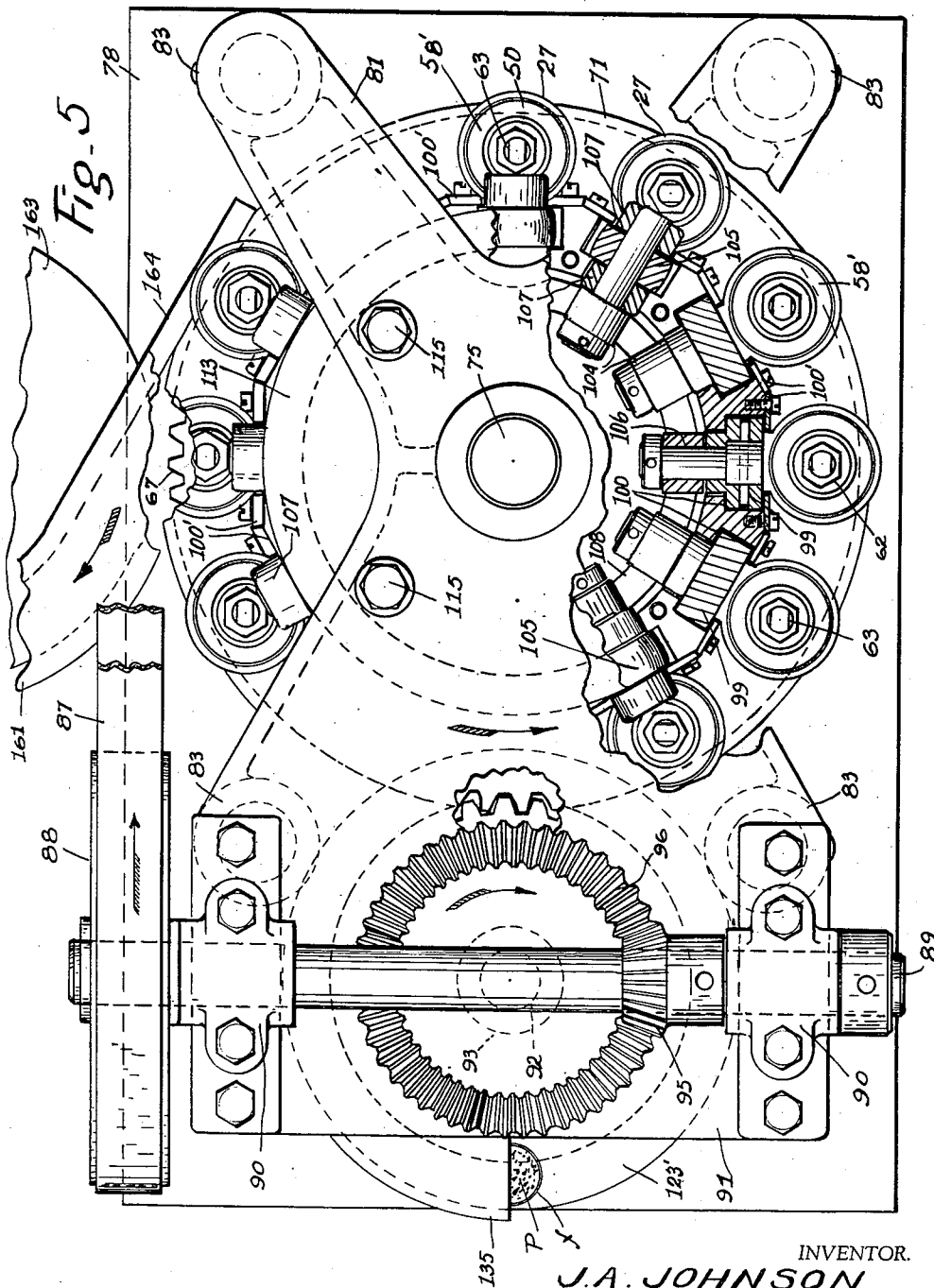
J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 3



INVENTOR.
J. A. JOHNSON
BY *John A. Seifert*
ATTORNEY.

May 19, 1942.

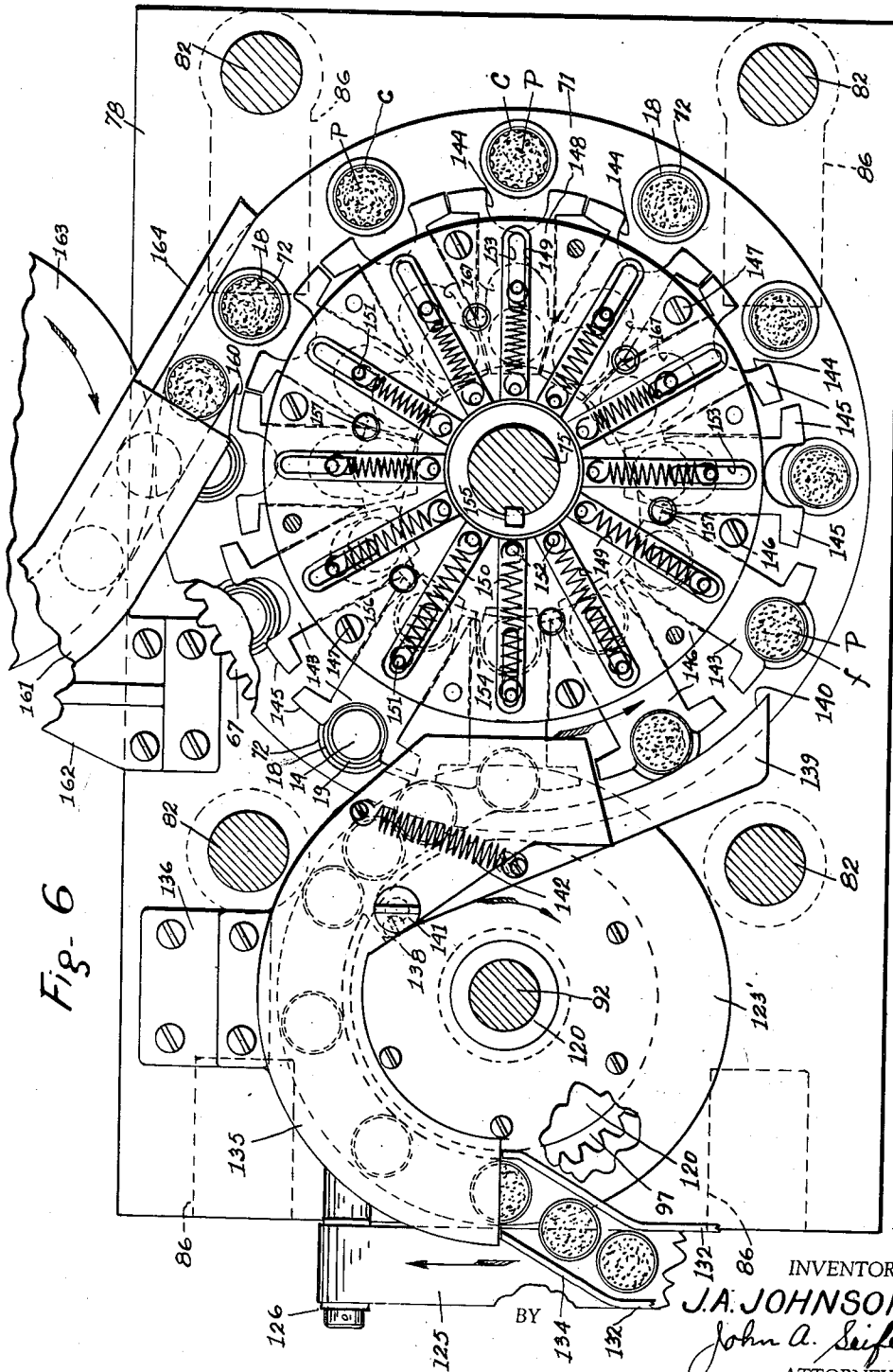
J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 4



May 19, 1942.

J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 5

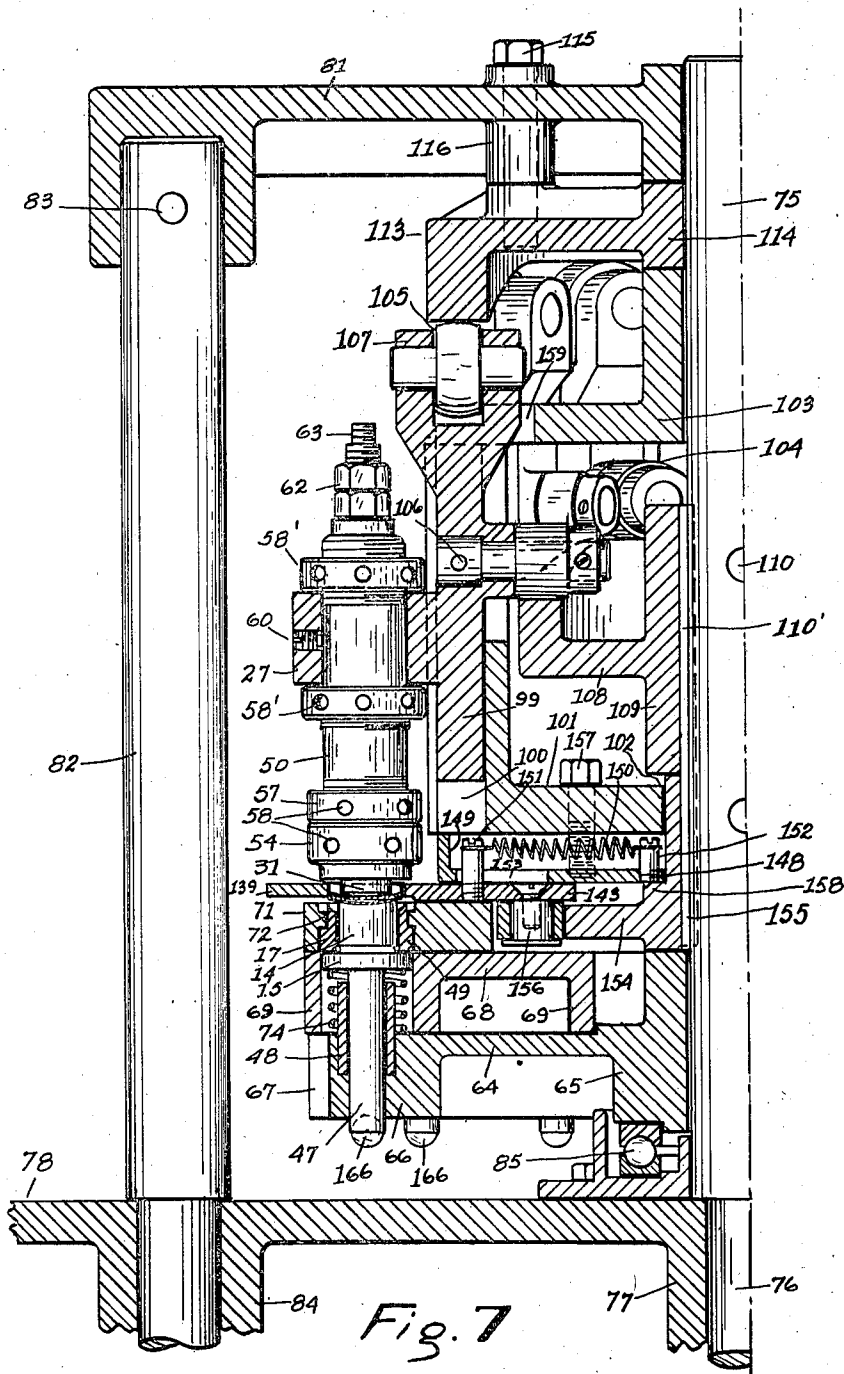


Fig. 7

INVENTOR.

J. A. JOHNSON

BY

John A. Seifert
ATTORNEY.

May 19, 1942.

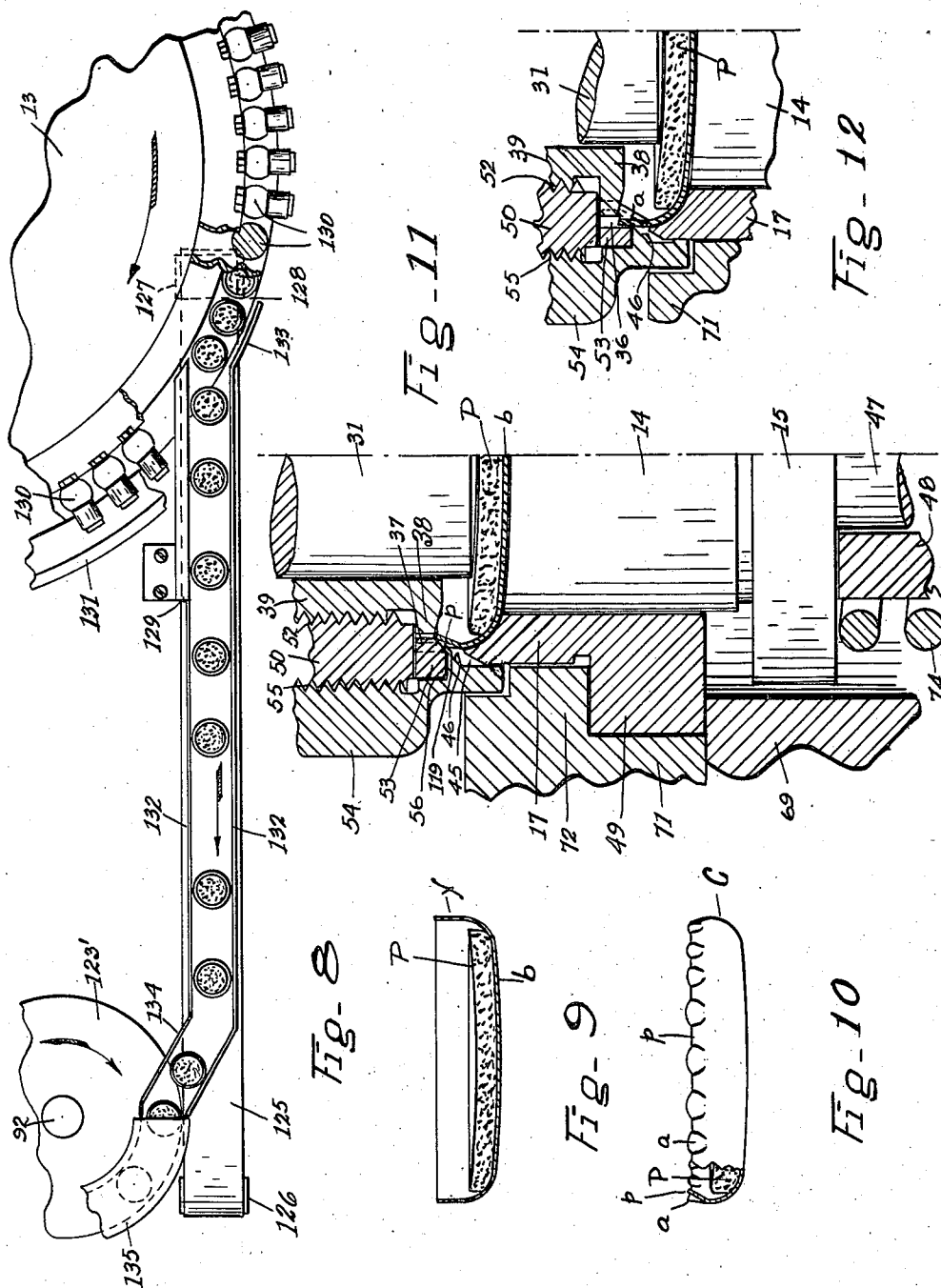
J. A. JOHNSON

2,283,503

MEANS FOR MAKING RECEPTACLE CLOSURE CAPS

Filed Sept. 19, 1938

6 Sheets-Sheet 6



BY

INVENTOR.
J. A. JOHNSON
John A. Seifert
ATTORNEY.

UNITED STATES PATENT OFFICE

2,283,503

MEANS FOR MAKING RECEPTACLE
CLOSURE CAPS

John A. Johnson, Woodhaven, N. Y.

Application September 19, 1938, Serial No. 230,607

11 Claims. (Cl. 153—68)

This invention relates to means for making receptacle closure caps having a corrugated or crimped skirt portion adapted to engage an annular lip or bead of a mouth of a receptacle or bottle to retain the closure cap on the receptacle mouth and hold a sealing pad in the closure cap to the receptacle mouth under compression. The closure cap made by the means forming the embodiment of this invention, is of the "crown" type of closure cap, but requiring less material than the present commercial type of such closure cap and thereby reducing the cost of production thereof, and will more firmly grip the bead of the bottle to retain a greater pressure in the bottle. This application is a continuation in part of my co-pending application Serial No. 165,889, filed September 27, 1937.

It is the principal object of this invention to economically and efficiently crimp the skirt portion of a closure cap from a minimum amount of material and in one operation.

It is another object of the invention to provide means for performing continuous operations whereby a closure cap having a sealing pad assembled therein is produced after the skirt of the closure cap has been crimped or corrugated.

It is another object of this invention to provide a die for corrugating the skirt of a closure cap in which all the parts of the die may readily be replaced when damaged or worn.

Further objects and advantages of the present invention will be set forth in the detailed description of the embodiment of the invention.

In carrying out the embodiment of the invention, cup shaped blanks are positioned on a yielding support mounted in vertical alinement with a reciprocating member arranged with a die comprising an annular corrugated recess and a spring influenced plunger to engage the center portion of the blank and depress the blank support to abut the blank against an annular support therefor encircling the yielding support. To secure continuous operation and increase production of the closure caps, there are provided a plurality of the blank supports and reciprocatory die members mounted around the periphery of a continuously rotating circular table. The reciprocatory die members are actuated toward and away from the blank supports by a pair of cams fixedly mounted at the center of the table and concentric of each other, the outer cam actuating the die members toward the blank supports and the inner cam actuating the die members from the blank supports. The blanks are fed to the yielding supports on the table by a continuously

rotating disk mounted at a peripheral portion of the table where the die members have been actuated from the blank supports by the inner cam, so that the rotation of the disk and table will transfer the blanks from the disk to the table. The blank feeding disk is arranged with means superposed to the face thereof to guide the blanks in a single row toward the table and arranged to position the blanks into abutment with recesses in members slidably mounted on the table in radial alinement with the blank supports. These slidable recessed members are actuated toward and away from the inner half of the blank supports to position the recesses thereof in registry with the blank supports and in spaced relation to the blank supports to permit crimping of the blanks on the supports by the movement of the die members toward the blank supports. The actuation of the recessed members is accomplished by a cam disk fixed centrally of the table and in predetermined position relative to the die member actuating cams to actuate the recesses of the slidable members in registry with the blank supports when the die members are positioned in spaced relation to the blank supports. The blanks may be supplied to the feeding disk from sealing pad assembling means whereby the blanks have sealing pads assembled therein prior to the formation of the closure caps. Means are provided to actuate the yielding supports to remove the formed closure caps from the annular supports and position said closure caps relative to means to discharge the closure caps from the table.

In the drawings accompanying and forming a part of this application, Figure 1 is a composite view partly in section of yielding and annular supports for a blank and a reciprocating die member, as disclosed in my co-pending application Serial No. 165,889.

Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1 looking in the direction of the arrows.

Figure 3 is a composite view partly in section of the yielding and annular supports and reciprocatory die member showing mechanical changes in the structure thereof to facilitate the manufacture of the same.

Figure 4 is a vertical section of the rotating table carrying the blank supports and reciprocatory die members and the disk for feeding blanks to the supports, and showing the driving connection of said table and disk.

Figure 5 is a plan view, on an enlarged scale, of Figure 4, showing in cross sections taken on

different horizontal planes, the structure of carriers for the die members.

Figure 6 is a plan view of the rotating table and blank feeding disk with the die members, carriers and actuating cams therefor removed to show the slidable recessed members and the positions thereof relative to blank supports, and the manner of discharging formed receptacle caps from the table.

Figure 7 is a fragmentary vertical view in section of the rotating table showing a position of the die members intermediate the positions thereof shown in Figure 4, in which position the spring influenced plunger engages a blank on the yielding support prior to the abutting of the blank with the annular support and the engagement of the die with the marginal portion of the blank.

Figure 8 is a fragmentary plan view of the means for assembling sealing pads in the blank, the blank feeding disk and means for transferring the blanks having sealing pads therein from the pad assembling means to the feeding disk.

Figure 9 is a sectional view of a blank having a sealing pad assembled therein.

Figure 10 is a side view of a closure cap formed by the die embodying the present invention and partly broken away to show a sealing pad assembled therein.

Figure 11 is a fragmentary view in section of a portion of the die for forming an inwardly extending straight protuberance.

Figure 12 is a fragmentary sectional view in cross section of a portion of the die for forming an outwardly extending arcuate protuberance.

The closure caps are formed by the means constituting the embodiment of this invention from cup shaped blanks having a bottom portion *b* of slightly convex form at the exterior and a flange or skirt portion *f* extending from the bottom portion in an arcuate direction and having the free marginal portion extending in a straight vertical plane, as shown in Figure 9.

Sealing pads or disks *P* of cork or other suitable resilient material may be assembled in the blanks before the forming of closure caps by assembling apparatus of the usual type, as illustrated in my Patent No. 2,113,592, issued April 12, 1938, the discharge portion of the pressure applying table of said apparatus being shown at 13 in Figure 8.

The blanks are formed into closure caps by crimping or corrugating the straight marginal portion of the skirt *f* to form alternate series of outwardly extending arcuate protuberances *a* and inwardly extending straight protuberances *p*, both protuberances *a* and *p* extending at an angle inwardly from the original vertical position of the straight marginal portion of the skirt *f* of the closure cap blank, as clearly shown in Figure 10, to cause the arcuate portion of the flange *f* or the sealing pad *P* to intimately embrace the mouth of the receptacle. The inwardly extending straight protuberances *p* constitute lips to be engaged over and below an annular bead around the receptacle mouth, and the outwardly extending protuberances being adapted for the engagement of means to forcibly engage the inwardly extending straight protuberances over the receptacle bead to firmly draw the sealing pad to the mouth of and lock the closure cap onto the receptacle. The outwardly extending protuberances *a* are also adapted for the application of an implement to remove the closure cap from a receptacle.

Figures 1 and 2 disclose the means illustrated

in my copending application Serial No. 165,889 for forming the protuberances *a* and *p* and comprising a support for the blank consisting of a circular member 14 having a concave face at one end of a curvature corresponding to the exterior of the bottom *b* of the blank to centrally support the blank. The opposite end of the supporting member 14 is arranged with an annular laterally extending flange 15, and a recess 16 extended into the member 14 from the flanged end thereof for a purpose to be hereinafter described. The member 14 is slidably mounted in an annular member 17 having the end portion thereof adjacent the concave face of the member 14 tapered inwardly at the outer side, as at 18, and the bore at said end of the annular member 17 provided with an annular enlargement of arcuate form in cross section conforming substantially to the curvature of the juncture of the bottom portion *b* with the skirt *f* of the closure cap blank and constituting a continuation of the concave face of the member 14, as at 19, to support the bottom *b* and the juncture between said bottom and flange *f* of the closure cap blank. The annular member 17 is fixedly supported in a hollow block 20 mounted on a supporting surface *S*, such as a conveyor to be hereinafter described, and said block having an inwardly extending annular shoulder 21 adapted to engage and support the annular member 17 at the end opposite the tapered end. The shoulder 21 is spaced from the upper end of the block a distance less than the length of the member 17 to position the tapered end of said member above the upper end of the block 20. The blank supporting member 14 is of a diameter slightly less than and extends through the opening in the shoulder 21 with the flange 15 positioned below the shoulder 21 to limit the movement of the member 14 outwardly from the annular member 17 and block 20. The length of the blank supporting member 14 will position the concave end thereof substantially even with the edge of the tapered end of the annular member 17 when the flange 15 abuts the shoulder 21, as shown in Figure 1, and the blank supporting member 14 is yieldingly urged to and maintained in this position by a spiral spring 22 having one end portion engaged in a retaining member 23 mounted on the supporting surface *S* within the block 20 and the opposite end portion of the spring engaging in the recess 16 of the blank supporting member 14. The spring retaining member 23 is adapted to be engaged by the flanged end 15 of the blank supporting member 14 by the movement thereof against the force of the spring 22, and said member 23 is of a length to limit the movement of the blank supporting member and position the concave face thereof in line with the arcuate face 19 at the tapered end of the annular member 17 when the flanged end 15 abuts the member 23.

A receptacle closure cap blank positioned on the concave end face of the supporting member 14, as shown in Figure 1, is engaged with the arcuate face 19 of the annular member 17, and the protuberances *a* and *p* are formed on the marginal straight portion of the flange *f* of the blank while the blank is held against movement. This is accomplished by means reciprocatory toward and away from the closure cap blank supporting member 14 and including die mechanism comprising a tubular head 24 internally screw threaded at one end thereof whereby it is releasably and adjustably engaged on an enlarged end 25 of an externally screw threaded tubular

supporting stud 26 loosely engaged in an opening in an arm 27 fixed to and extended laterally from a suitable slide, not shown in Figure 1 but described hereinafter in connection with Figures 4 to 7, inclusive. The stud 26 is releasably and adjustably retained in the opening of the arm 27 by nuts threaded onto the stud at opposite faces of the arm, as shown at 28. The tubular head member 24 is secured in adjusted position on the enlarged end 25 of the stud 26 by a retaining nut screw threaded onto said end to abut the tubular member 24, as at 29.

The tubular head 24 is mounted in vertical alinement with the blank supporting members 14, 17, and the reciprocation of said head by the arm 27 toward the supporting members will move the blank on the member 14 into engagement with the arcuate face 19 of the annular member 17 against the force of the spring 22. This is accomplished by a plunger having an end portion 30 of reduced diameter slidably mounted in the bore of the tubular stud 26 and a portion 31 of increased diameter at the opposite end of the plunger arranged with a disk like head 32 at the outer end of the portion 31 having an outer convex face complementary to the concave face of the supporting member 14. The plunger is retained in the stud 26 by a pin fixed in and extending laterally from a portion of the plunger portion 30 projecting above the upper end of the stud 26, and said pin engaging the upper end of the stud, as shown at 33 in Figure 1. The plunger is normally positioned with the head 32 projecting from the tubular head 24 by a spring 34 coiled around the plunger portion 30 and compressed between the enlarged portion 25 of the stud 26 and the plunger portion 31. The movement of the plunger head 32 from the tubular head 24 is limited by the pin 33 engaging the stud 26. By the movement of the plunger carrying head 24 toward the blank supporting members 14, 17, the plunger head 32 will first engage in the blank positioned on the supporting member 14 and clamp the blank to said supporting member. By the continued movement of the tubular head 24 toward the blank supporting members 14, 17, the force of the spring 34 will move the blank with its supporting member 14 against the force of the spring 22 until the flanged end 15 of the supporting member 14 abuts the spring retaining member 23 when the arcuate base portion of the flange *f* of the closure cap blank will engage the arcuate face 19 of the annular supporting member 17.

By the continued movement of the tubular head 24 relative to the closure cap blank supporting members and while the blank is held against horizontal and vertical displacement on the supporting members by the plunger head 32, the straight marginal portion of the flange *f* of the closure cap blank extending from the arcuate face 19 of the member 17 is crimped to simultaneously form the protuberances *a* and *p*. This crimping or corrugating operation is effected by a die arranged in the free end of the tubular head 24 concentrically of the plunger and shown in the form of an annular corrugated recess extending in a plane parallel of the longitudinal axis of the head. This corrugated recess is formed by an annular series of corrugations or serrations arranged in the lateral face of an annular shoulder 35 integral with and projecting from the inner wall of the tubular head 24 adjacent the free end thereof. The corrugations in the shoulder 35 comprise alternate series of

arcuate shaped grooves 36 and alternate series of ridges having a straight or flat vertex, as shown at 37 in Figure 2. The corrugations 36, 37 in the shoulder 35 constitute the outer wall of the corrugated recess in the head 24. The inner wall of said corrugated recess is formed by an annular series of corrugations or serrations in the outer face of an annular flange 38 extending laterally from an end of a tubular member 39 externally screw threaded for releasable engagement with screw threads on the interior wall of a sleeve 40 engaged in the tubular head 24 and supported therein by the lower end of the sleeve abutting the shoulder 35 of the head 24. The corrugated flange 38 is juxtaposed to the end of the sleeve 40 and the corrugations thereof positioned in opposed spaced relation to the corrugations 36, 37, by the upper end of the sleeve 40 engaging the enlarged end portion 25 of the stud 26 and the opposite end of the sleeve abutting the shoulder 35 by screwing the tubular head 24 onto the enlarged end portion 25 of the stud 26. The tubular member 39 is arranged with openings 41 for the application of a pin wrench to facilitate the mounting of the member 39 in the sleeve 40 with the flange 38 abutting the end of the sleeve. The bore of the tubular member 39 serves to guide the portion 31 of the plunger in its movements in the head 24 and prevents canting of the plunger. The corrugations in the flange 38 of the tubular member 39 comprise alternate series of arcuate shaped ridges 42 positioned in opposed spaced relation to the arcuate grooves 36 of the corrugations in the shoulder 35 of the head 24, and alternate series of grooves 43 positioned in opposed spaced relation to the ridges 37 of the corrugations in the shoulder 35 and having a straight or flat vertex, whereby a corrugated or uniform sinuous recess is formed between the portions 36, 37 of the corrugations in the shoulder 35 of the head 24 and the portions 42, 43 of the corrugations in the flange 38 of the tubular member 39, as shown in Figure 2.

To facilitate the engagement of the corrugated recess in the head 24 with the straight marginal portion of the flange *f* of the blank held against the concave face of the supporting member 14 and arcuate face 19 by the plunger head 32, the outer end of the head 24 is arranged with a mouth portion consisting of an annular bevelled edge 44 extending from the outer end of the head to a vertical annular wall portion 45 and a tapered or conical portion 46 extending from said vertical wall portion and constituting the bottom wall of the shoulder 35 of the head 24. The bevelled edge 44 is adapted to engage the tapered portion 18 of the annular member 17 and guide the head 24 centrally of the annular member 17. The vertical wall portion 45 of the head 24 will engage the outer vertical wall of the annular member 17 and maintain the head 24 and the corrugated die recess thereof in alinement with the straight marginal portion of the flange *f* of the closure cap blank and the support 14, 17 therefor.

Figure 3 shows a modified form of closure cap support and die member embodying improvements in manufacture without changing the function of the parts and the shape of the die shown in Figures 1 and 2. The blank support and die member illustrated in Figure 3 is shown in Figures 4 to 7, inclusive, in conjunction with apparatus for continuously forming closure caps and thereby increase production of the same. It

should be understood that the structure shown in Figures 1 and 2 can be used with the structure shown in Figures 4 to 7, inclusive.

In Figure 3, there is shown a slidable support for the blank corresponding to the member 14 of Figure 1 and similar in structure having the circular body 14 and flange 15, and a stem 47 extending from the flanged end of the body to slidably support said end in a bearing sleeve 48. The annular support for the blank is also the same as that shown at 17, 18 and 19 in Figure 1, with the body 17 having a laterally extending flange 49 to facilitate the securing of the annular member in a carrier thereof shown in Figures 4 to 7, inclusive. The die member shown in Figure 3 comprises a tubular member 50 having an enlarged bore at the die end, as at 51, arranged with screw threads for the releasable mounting of the tubular die portion 38, 39, 42, 43, as at 52. The other die portion 35 of the Figures 1 and 2 structure is in the form of an annular member 53 having the corrugations 36, 37 and a bevelled face below said corrugations, as at 119 in Figure 11, and clamped to the end of the enlarged bore portion 51 in opposed spaced relation to the corrugations 42, 43 of the member 38, 39 by a collar having an enlarged portion 54 internally screw threaded for removable engagement with screw threads on the exterior of the end portion of the tubular member 50 arranged with the enlarged bore 51, as at 55. An intermediate portion of the collar is arranged with an annular seat for the mounting of the annular die member 53 in abutting relation with the end edge of the tubular member 50, as at 56, and the end of the collar opposite the enlarged portion 54 is arranged with the bevelled edge 44, vertical wall portion 45 and tapered or conical portion 46, in the same manner and for the same purposes as the free end of the head 24 of the Figure 1 structure. The bevelled face 119 of the member 53 is a continuation of the conical portion 46. The collar 54 is retained in position by a locking nut 57 screw threaded on the tubular member 50, both the collar 54 and locking nut 57 being arranged with spaced holes for the application of a pin wrench, as shown at 58 in Figures 4 and 7. The use of the annular die member 53 will reduce the cost of the die head, as in the structure of Figure 1, the entire head 24 has to be of tool steel, whereas in the Figure 3 structure, only the annular member 53 is of tool steel. The tubular member 50 is directly mounted on the slide arm 27 by being engaged in an opening in said arm and retained in said opening by nuts screw threaded on the member 50 at the opposite faces of the arm, as at 58'. The nuts 58' are also arranged with spaced holes for the engagement of a pin wrench, which are similar to the holes 58 in the collar 54 and nut 57. To facilitate adjusting and retaining of the tubular member 50 in the arm 27, the tubular member is arranged with a recess 59 in the side thereof for the engagement of a set screw mounted in the end of the arm, as at 60. The blank retaining plunger has the reduced portion 30 and the portion 31 of increased diameter, but the portion 31 is not arranged with a head 32. The portion 30 is slidable in an end portion of the bore of the tubular member 50 of reduced diameter, as at 61, and the portion 31 is slidable in the die member 39. The plunger portion 31 is yieldingly urged beyond the collar portion 44 by the spring 34 coiled around the plunger portion 30 in the bore portion 51 of the member 50

and compressed between the shoulder formed at the juncture between the bore portions 51 and 61, and the plunger portion 31. The plunger is retained in the member 50 by nuts and a washer engaged on a screw threaded section of the portion 30 projecting beyond the member 50, as at 62, and to facilitate the adjustment of the plunger portion 31 relative to the collar portion 44, the end of the plunger projecting from the retaining nuts is arranged for the application of a suitable tool, as shown at 63.

To continuously form the closure caps, a plurality of the blank support and die member of the structure shown in either Figure 1 or Figure 3, are mounted on a continuously travelling conveyor in the form of a circular table comprising a circular member 64 having a center hub portion 65 extending from the opposite faces thereof and a ridge portion 66 extending from a face and around the periphery thereof and arranged with gear teeth 67 around the peripheral edge. An annular member 68 having a series of annular ribs 69 extending from a face thereof, a pair of said ribs being at the periphery and a rib at the opening to encircle the hub 65, is mounted on the member 64 with the ribs abutting the face of the member 64 opposite the face arranged with the ridge 66 and secured to said member 64 by bolts, as shown at 70 in Figure 4. A ring member 71 having a series of equidistantly spaced openings arranged with a shoulder for the engagement of the shoulders 49 of the annular blank supports 17, as at 72 in Figure 3, is secured to the annular member 68 by bolts 73, as shown in Figure 4, with the blank supports 17 in alignment with the space between the pair of peripheral ribs 69 of member 68 and the ridge portion 66 of member 64. The diameters of the openings in the ring member 71 and the flange 49 of the supports 17 are greater than the space between the pair of peripheral ribs 69, so that the supports 17 are secured between the shoulders 72 and member 68, as shown in Figure 3. The pair of peripheral ribs 69 may be in the form of equidistantly spaced bosses, as indicated in Figure 3. The ridge 66 of the member 64 is arranged with equidistantly spaced recesses in the level face of said member in vertical alignment with the blank supports 17 for the mounting of the bearing sleeves 48, as shown in Figures 3, 4 and 7. The bearing sleeves 48 will project into the space between the peripheral ribs or bosses 69 and act as a centering support for a spiral spring 74 compressed between the flanges 15 of the blank supports 14 and the member 64 to yieldingly urge flanges 15 against the blank supports 17 and position the concave faces of the blank supports 14 above the arcuate faces 19 of the blank supports 17, as shown in Figure 3. The composite table comprising members 64, 68 and 71 is rotatably supported on a shaft 75 having one end of reduced diameter and screw threaded, as indicated at 76. The shaft 75 is supported at the opposite ends by fixing the reduced end 76 in a boss 77 of a table 78 by means of a washer and nut engaged on the screw threaded end of the shaft, as shown at 79, with the washer abutting the boss 77 and the shoulder of the shaft formed by the reduced end abutting the face of the table 78, and by a pin engaged in the boss and reduced end of the shaft, as at 80 in Figure 4. The opposite end of the shaft 75 is engaged in a boss of a spider plate 81 supported in spaced relation to the table 78 by pillars 82 fixed at one end in sockets

at ends of the spider plate by pins, as at 83, and the opposite ends being reduced and retained in bosses of the table by a washer and nut engaged on the reduced end, as at 84. The table 64, 68, 71 is antifrictionally supported on the table 78 by ball bearings enclosed in a cup shaped member fixed to the table, as at 85. The table 78 is supported in elevated position by standards 86 fixed to the corners of the table.

The table 64, 68, 71 is continuously rotated from a source of power, such as an electric motor, not shown, by a belt 87 engaged around a pulley on the motor shaft, not shown, and a pulley 88 fixed on a horizontal shaft 89 rotatably mounted in bearings 90 mounted on an extension of the spider plate, as at 91 in Figures 4 and 5. A vertical shaft 92 is rotatably supported at opposite ends in a boss 93 in the spider extension 91 and a boss 94 in the table 78, and driven from the horizontal shaft 89 by a bevel pinion 95 fixed on the horizontal shaft 89 and meshing with a bevel gear 96 fixed on an end of the vertical shaft 92 projecting from the spider extension 91. The vertical shaft 92 is operatively connected to the table 64, 68, 71 through a pinion 97 fixed to the shaft by a pin 98 and meshing with the gear teeth 67 of the table member 64.

The tubular die carrying members 50 are mounted in vertical alinement with the blank supports 14, 17 by the arms 27 of slides 99 slidably mounted in slideways 100 arranged on the annular side wall of a cup shaped member 101 having an opening in the bottom to encircle the shaft 75, as at 102. A plate 103 having a hub loosely engaging the shaft 75 is mounted on the open end of the member 101 and fixed thereto by bolts 103' as shown in Figure 4. The slides are retained in the slideways 100 by gibs 100' fixed to the member 101, and said slides are arranged with a pair of cam engaging rollers 104, 105, rollers 104 being rotatably mounted on studs fixed in bosses of the slides intermediate the ends thereof, as at 106, and rollers 105 rotatably mounted in bifurcations 107 at the upper ends of the slides. The rollers 104 are arranged to engage a cam arranged on the edge of a cup shaped member 108 arranged with a hub 109 fixed on the shaft 75 by a pin 110 and key-way 110'. The cam of member 108 is arranged with a low portion 111 and a high portion 112 to raise the dies 53, 38 and plunger portions 31 in spaced relation to the blank supports 14, 17 and permit positioning of blanks on the supports 14, as shown in Figure 3 and the left hand portion of Figure 4. The rollers 105 are adapted to engage a cam arranged on the edge of a cup shaped member 113 of greater diameter than the diameter of the cam member 108 having a hub engaged on the shaft 75 between the hub of plate 103 and the boss of the spider plate 81, as at 114, and supported from the spider plate by bolts 115 passed through bosses 116 arranged in the plate 81 and screw threaded into the bottom of the member 113, the bosses 116 spacing the cam member 113 from the spider plate 81. The cam edge of member 113 faces the cam edge of member 108 to engage the rollers 105 and actuate the die carrying members 50 toward the blank supports 14, 17. The cam edge of member 113 has a low portion 117 positioned relative to the high portion 112 of the cam edge of member 108 to permit actuating of the die carrying members 50 from the blank supports 14, 17 by the high portion 112, and has a high portion

118 to actuate the die carrying members 50 toward the blank supports 14, 17 and positioned relative to the low portion 111 of the cam edge of member 108, so that there will be no interference with the actuation of the die carrying members toward the blank supports. The cam edges of both members 108 and 113 are graduated from the high to the low portions to progressively actuate the die carrying members to first to engage the plunger portions 31 with the blanks on the supports 14, then depress the blanks and supports 14 to abut the arcuate portions of the flanges *f* of the blanks with the arcuate faces 19 of the annular blank supports 17, and then engage the dies 38, 53 with the straight portions of the flanges *f* of the blanks. The cup shaped member 101 and disk 103 are arranged with equidistantly spaced cut-away portions at the slideways 100, as at 159, to permit movement of the rollers 104, 105.

The movement of the dies 38, 53 toward the blanks on the supports 14, 17 will engage the conical faces 46 of the collar portions 54 with the straight edge portions of the flanges *f* of the blanks which engagement will bend and guide the flanges *f* relative to the corrugations 36, 37 and 42, 43 to form the protuberances *a* and *p* inclining toward the centers of the blanks by the continued downward movement of the members 50. The protuberances *p* are bent to a greater extent than the protuberances *a*, as the portions of the bevelled walls 46, 119 forming the bottom walls of the ridge portions 37 extend further toward the center of the members 50, as shown in Figure 11. The angle of the bevelled wall portions 46, 119 will determine the force with which the straight portions of the protuberances *p* will grip the beads of the receptacle mouths, the protuberance *a* being the tensioning or compression means for the protuberances *p* to retain the closure caps on the receptacles. The protuberances *a* are only slightly curved inwardly by the bevelled wall 46, as said protuberances are formed by the grooves 36 having radii slightly less than the radii of the flanges *f*, as shown in Figure 12, and therefore, the inward curvature of the protuberances *a* is chiefly caused by the bending in of the protuberances *p* by the portions of the bevelled walls 46, 119 forming the bottoms of the ridges 37.

The blanks are positioned on the supports 14 when the die carrying members 50 are actuated in spaced relation to the supports 14, as shown at the left hand side of Figure 4, by a continuously rotating disk 120 having an elongated hub 121 extending from one face of the disk and fixedly engaged on the shaft 92 by the pin 98 and a pin 122. The free end portion of the hub 121 is reduced in diameter for engagement within the hub of pinion 97, as shown at 123 in Figure 4. The diameter of the disk 120 is such to position the periphery of the disk adjacent to the periphery of the table member 71 and the hub 121 is of a length to position the upper surface of the disk even with the horizontal face of the member 71. The die carrying members 50 are actuated from the supports 14 in the path of travel of the table 64, 68, 71 where the peripheries of the table member 71 and disk 120 are adjacent to each other by positioning the high portion 112 of the cam member 108 in line with and between the shafts 75 and 92. To position the blanks onto the supports 14, the disk 120 is arranged with a peripheral thin platform in the form of an annular plate 123' fixed in a peripheral groove

in the upper surface of the disk 120, as at 124 in Figure 4. The peripheral portion of the plate 123' will extend partly over the supports 14.

The blanks are fed onto a peripheral portion of the plate 123' diametrically opposite the peripheral portion extending over the supports 14 by an endless conveyer belt 125 supported by a pulley 126 rotatably mounted on an end portion of the table 78 adjacent to the disk 120 and a pulley 127 rotatably mounted adjacent the discharge portion 13 of the pressure applying table of a sealing pad assembling apparatus, either of said pulleys being driven by suitable means. The pulleys are mounted to position the upper stretch of the conveyer belt in the planes of the annular plate 123' and blank supporting shelf 128 of the pressure applying table, so that the blanks having sealing pads assembled therein are discharged from the shelf 128 onto the conveyer belt 125 and removed from the belt onto the plate 123'. The assembled blanks are discharged from the shelf 128 onto the conveyer belt 125 by an abutment 129 mounted at one end with the opposite end projecting over the shelf 128 at the point of travel of the pressure applying table where the pressure applying plungers 130 have been raised from the blanks by a cam rail 131. The conveyer belt is propelled in a direction from the sealing pad assembling apparatus to the annular plate 123', as indicated by the arrow in Figure 8, and during the travel of the assembled blanks on the conveyer belt, said blanks are maintained on the belt by guide rails 132 extending along the margins of the belt on the upper surface of the upper stretch thereof with the abutment 129 extending as a continuation of the inner guide rail. The end of the outer guide rail adjacent the shelf 128 extends in an arcuate direction conforming to the periphery of the shelf to maintain the assembled blanks on the shelf when they engage the abutment 129, as at 133 in Figure 8, and the opposite ends of both guide plates extend obliquely from the conveyer belt to the peripheral portion of the annular plate 123' to direct the assembled blanks onto said plate, as at 134. The assembled blanks deposited on the rotating plate 123' are guided around the periphery thereof in a single row by an arcuate member 135 of channelled shape in cross section mounted in inverted position over the path of travel of the peripheral portion of plate 123' extending from the oblique portions 134 of the guide rails 132 to the portion of the plate 123' positioned over the supports 14. The member 135 is supported in position by a bracket 136 fixed to the top of table 78, as shown in Figure 6. The channel of the member 135 has the outer wall cut-away at the portion above the seats 14, as at 137 in Figure 4, and the opposite inner wall cut-away, as at 138 in Figure 6, for the pivotal mounting of an arm 139 having at the free end an arcuate edge corresponding to the curvature of the table member 71, as at 140. The arm 139 is pivoted to the bottom portion of the member 135 by a headed pin loosely engaged in the member 135 and screw threaded in the arm, as at 141 in Figure 4. The arm is yieldingly urged into engagement with the assembled blanks on the plate 123' by a spring 142 fixed at the opposite ends to the exterior of member 135 and an intermediate portion of arm 139, as shown in Figures 4 and 6.

To properly position and maintain the blanks on the supports 14 during the travel of the blanks on the rotating table 64, 68, 71 from the annular plate 123' to the point in the travel of said

table where the die carrying members 50 are actuated toward the supports 14 to engage the plunger portions 31 with the sealing pads P in or the bottom portions *b* of the blanks and subsequently engage the dies 38, 53 with the flanges *f* of the blanks, there is provided a plurality of slidable members 143 equal in number to the number of supports 14 and having at one end an arcuate recess 144 corresponding to the curvature of the blank flanges *f* and ears 145 extending laterally from opposite sides of the recesses, as shown in Figure 6. The members 143 are slidable on the table member 71 in guideways formed by triangular plates 146 having the base of arcuate shape and fixed to the table member 71 by screws 147. The triangular plates 146 are spaced from each other a distance slightly greater than the width of the slidable members 143 and shape of the plates 146 will slidably mount the members 143 radially of the table 64, 68, 71. The members 143 are retained in the slideways or guideways formed by the plates 146 by an annular plate 148 engaged on the plates 146 in superposed relation to the slidable members 143 and to encircle the shaft 75. The upper face of the annular plate 148 is arranged with a radial series of elongated recesses 149 extending centrally of the slidable members 143 for the purpose of mounting springs 150 fixed at one end to posts 151 mounted in the slidable members 143 and the opposite ends being fixed to posts 152 mounted in the recesses 149. The posts 151 are extended into the recesses 149 through slots 153 in the bottom of the recesses 149 which slots will permit sliding movement of the members 143 and limit said movement by the ends of the slots abutting the posts 151. The springs 150 will yieldingly urge the members 143 toward the shaft 75 and said members are positively actuated toward the supports 14 by a cam face arranged on the periphery of a disk 154 having a hub fixedly mounted on the shaft 75, as at 155. The cam disk 154 is adapted to engage rollers rotatably mounted on pins fixed to the under surface of the slidable members 143 at the inner ends thereof, as at 156. The high point in the cam disk 154 extends centrally of and in opposed relation to the portion in the path of travel of the table 64, 68, 71 where the blank feeding plate 123' extends over the periphery of said table, so that the slidable members 143 are actuated against the force of the springs 150 to position the arcuate recesses 144 juxtaposed to the supports 14 to engage and position the blanks being delivered by the rotating disk 120, 123' and arm 139 onto the supports 14, as shown in Figure 6. The arcuate path of travel of the supports 14 in an anticlockwise direction and the blanks in a clockwise direction in the guide member 135, as indicated by the arrows in Figure 6, will permit the engagement of the blanks on the supports 14 within the recesses 144 under the influence of arm 139. The ears 145 will guide the blanks onto the supports 14 and prevent the forward movement of the following blank on the plate 123' until the succeeding support 14 and its accompanying member 143 is positioned relative to said following blank, as shown in Figure 6. The blanks are retained on the supports 14 by the members 143 and the arcuate edge 140 of arm 139 until the blanks are clamped to the supports 14 by the plungers 30, 31, as shown in Figure 7. The cam face is arranged on the disk 154, so that the recesses 144 are engaged with the blank flanges *f* while the blank bottoms *b* are impinged against the sup-

ports 14 by the plungers 30, 31, and the recessed ends of the members 143 are progressively withdrawn from the blank flanges *f* by the springs 150 during the downward movement of the dies 38, 53 into engagement with the blank flanges *f*, as shown at the bottom section of the table 64, 68, 71 in Figure 6. The members 143 are fully withdrawn from the blanks and supports during the crimping operation of the dies 38, 53, as shown in the right hand sections of Figures 4 and 6. The inner edge of the table member 71 is serrated by arcuate recesses, as shown in dotted lines at 167 in Figure 6, to accommodate the movement of the rollers 156.

The retaining plate 148 for the slidable members 143 is secured to the table member 71 by the screws 147 for the securing of the guideway plates 146 with the heads of the screws countersunk in the retaining plate 148, as shown at the right side of Figure 4.

The slideway member 101 is supported by the retaining plate 148 and secured thereto by bolts 157 engaged in the bottom of the member 101 and screw threaded in the plate 148, as shown in Figures 4 and 7. By this arrangement of parts, the table 64, 68, 71, members 143, plates 146, 148, members 101, 103, slides 99 and die carrying members 50 are rotatable as a unit about the shaft 75.

The hub of the cam disk 154 is elongated from the upper face thereof with a shoulder adjacent the disk 154 for the supporting engagement of the center portion of the retaining plate 148, as at 158, and the upper end of the hub acts as a bearing for the opening 102 of the slideway member 101, as shown in Figure 7.

The cams 108, 113 and 154 are arranged and the speed of rotation of the table 64, 68, 71 is regulated; so that the protuberances *a* and *p* are formed on the blank flanges *f* when the supports 14 are positioned diametrically opposite the position thereof for receiving blanks from the feeding disk 120, 123', as shown in Figure 6. After the protuberances are shaped to form closure caps C from the blanks, the die carrying members 50 are actuated from the supports 14 by the cam 108 with the slidable members 143 being retained in withdrawn or retracted position by the springs 150, and when the plunger portions 31 are free of the crimped skirts of the closure caps, the closure caps are removed from the supports 14 by a pointed abutment 160 forming a side wall of an inverted channel member 161 mounted on the table 78 by a bracket 162 to extend over a peripheral portion of the table 64, 68, 71 and a revolving discharge disk, partially shown at 163. The side wall of the channel member 161 opposite the side wall having the abutment 160 is extended beyond the abutment and across a peripheral portion of the table member 71, as at 164, to maintain the closure caps C on the supports 14 after the plunger heads 31 are removed from the caps and prior to the engagement of the caps by the abutment 160. The table 64, 68, 71 is rotated in an anti-clockwise direction, and the disk 163 is rotated in a clockwise direction, as indicated by the arrows in Figure 6, whereby the closure caps are removed from the supports 14 and transferred from the table 64, 68, 71 to the disk 163 by the rotation of said table and disk and guided in a single row during said transfer by the channel member 161.

The protuberances *a* and *p* of the closure caps C are removed from the dies 38, 53 during the actuation of the die carrying members 50 from

the supports 14 by the plungers 30, 31 under the force of the springs 34, and the closure caps are lifted from the arcuate faces 19 of the annular supporting members 17 and positioned level with the face of table member 71 by the supports 14 under the influence of the springs 74. To positively assure the positioning of the closure caps level with the face of the table member 71, the supports 14 are actuated in an upward direction by a cam rail 165 mounted on the table 78 below and in vertical alignment with the path of travel of the stems 47 of the supports 14 to engage balls 166 mounted in the free ends of said stems, as shown in Figure 4. It is only necessary to have the cam rail 165 extend along the path of travel of the table 64, 68, 71 subsequently to the forming of the closure caps with the high portion thereof extending along the path of travel of said table where the plungers 30, 31 are removed from the closure caps and the springs 74 are actuating the supports 14 in an upward direction.

The disk 163 for discharging closure caps from the apparatus may be actuated from the table 64, 68, 71 or by other suitable means, and said disk may be adapted to deliver the closure caps to a conveyer traveling to a machine for applying the closure caps to receptacles, or to a suitable depository, or to apparatus for assembling sealing pads in the closure caps should the blanks be without sealing pads, as shown in Figure 1.

It should be understood that the parts disclosed for forming the closure caps C would not be changed if it is desirable to form the closure caps without the sealing pads P assembled in the blanks. The only change that it is necessary to make in this event, is that the conveyer belt 125 would travel from a source of supply of the blanks instead of traveling from the sealing pad assembling apparatus 13.

Having thus described my invention, I claim:

1. In apparatus for making receptacle closure caps from a cup shaped blank having a skirt connected to the bottom by an arcuate portion, a support for the blank comprising a fixedly mounted annular member having an arcuate face to support the arcuate portion of the blank and a member slidable in the annular member, and having a face to support the bottom of the blank, a head reciprocatory toward and away from the support and arranged with a die to engage the marginal portion of the blank on the support and form a circumferential series of inwardly and outwardly extending protuberances therein during the reciprocation of the head toward the support, and a plunger slidably mounted in the head and arranged to co-operate with the slidable member of the support to hold the blank against movement on the annular member during the forming of the protuberances.

2. In apparatus for making receptacle closure caps as claimed in claim 1, wherein the slidable member of the support and the plunger are yieldingly urged in a direction toward each other, and means to limit the movements of the slidable member of the support and normally position the supporting face of the slidable member to extend above the supporting face of the annular member and position the supporting face of the slidable member in line with the supporting face of the annular member during the formation of the protuberances by the die, whereby the arcuate portion of the blank is supported by the annular member and the bottom of the blank is supported by the slidable member during the formation of the protuberances.

3. In apparatus for making receptacle closure caps, a conveyer arranged with a series of annular seats for closure cap blanks, yielding supports for the closure cap blanks slidable in the annular seats, members slidably mounted to have movement toward and away from a marginal portion of the seats and having an arcuate recessed portion conforming to the curvature of said seats, means mounted relative to the path of travel of the conveyer and arranged to position the arcuate recessed portion of the slidable members in registry with the seats for a predetermined part of the travel of the conveyer and in spaced relation to the seats for another predetermined part of the travel of the conveyer and progressively actuate said slidable members from and to said positions of the arcuate recessed portions, means mounted relative to the part of the path of travel of the conveyer where the arcuate recessed portions of the slidable members are in registry with seats and adapted to feed closure cap blanks to the supports in abutting relation with the recessed portions, members slidably mounted in alignment with the seats and supports and having dies to crimp the marginal portions of the blanks on the supports and form closure caps thereof, and means to reciprocate the die members toward and away from the seats and supports and arranged to position the dies in spaced relation to the seats and supports during the travel of the conveyer past the blank feeding means and engage the dies with the marginal portions of the blanks when the recessed portions of the slidable members are positioned in spaced relation to the seats.

4. Apparatus for making receptacle closure caps as claimed in claim 3, wherein the die member reciprocatory means is adapted to reciprocate the die members toward the blank seats and supports in synchronism with the actuation of the slidable members from the blank seats and reciprocate the die members from the blank seats and supports prior to the actuation of the slidable members toward the blank seats.

5. Apparatus for making receptacle closure caps as claimed in claim 3, wherein the conveyer comprises a circular table having the series of annular seats arranged about the periphery of the table.

6. Apparatus for making receptacle closure caps as claimed in claim 3, wherein the means for positioning and actuating the slidable members comprises a cam, and the slidable members are yieldingly urged from the blank seats into engagement with the cam.

7. In apparatus for making receptacle closure caps as claimed in claim 3, means mounted relative to the path of travel of the conveyer where the recessed portions of the slidable members are positioned from the blank seats and the die members are positioned from the blank seats and supports, and adapted to remove formed closure caps from the conveyer.

8. In apparatus for making receptacle closure caps, a circular table rotatably mounted and having a series of annular seats around the pe-

riphery thereof arranged to support the marginal portions of closure cap blanks, members slidably mounted in the table in vertical alignment with the seats and having a head yieldingly positioned beyond the seats and arranged to support the center portions of the blanks, a series of slideways mounted on the table in radial alignment with the seats and slidable members, tubular members slidably mounted in the slideways extending in vertical alignment with the seats and slidable members and arranged with a die adapted to crimp the marginal portions of the blanks on the seats and slidable members, a plunger slidably mounted in the tubular members and having a head yieldingly positioned beyond the dies to engage and clamp the blanks on the slidable members, and a pair of annular cams fixed centrally of the table and concentrically of each other, one cam being arranged to actuate the tubular members toward the blank seats and slidable supporting members to engage the plungers with the blanks supported on the slidable blank supporting members, depress the heads of the slidable blank supporting members and engage the blanks with the seats, and then engage the dies with the marginal portions of the blanks to crimp said marginal portions and form closure caps, and the other cam arranged to actuate the tubular members from the crimped blanks and permit the slidable blank supporting members to move the closure caps from the seats.

9. In apparatus for making receptacle closure caps as claimed in claim 8, means mounted relative to the travel of the table to engage and positively actuate the slidable blank supporting members to move the closure caps from the seats.

10. Apparatus for making receptacle closure caps as claimed in claim 3, wherein the means to feed closure cap blanks to the yielding closure cap blank supports comprises a disk rotatable in a plane to extend over and position the blanks relative to the supports, and an arm pivotally mounted above the disk and yieldingly urged to move the closure cap blanks from the disk onto the yielding supports and in abutting relation with the recessed portions of the slidable members.

11. Apparatus for making receptacle closure caps as claimed in claim 3, wherein the means to feed closure cap blanks to the yielding closure cap blank supports comprises a disk rotatable in a plane above the supports, a channel shaped member mounted to extend over a peripheral portion of the disk to guide closure cap blanks on the disk relative to the supports, and an arm pivotally mounted to extend between the channel shaped member and disk and yieldingly urged to move the closure cap blanks from the disk onto the supports and into abutting relation with the recessed portions of the slidable members and the end portion of the arm extending along the conveyer to engage and maintain the closure cap blanks in abutting relation with the recessed portions of the slidable members.

JOHN A. JOHNSON.