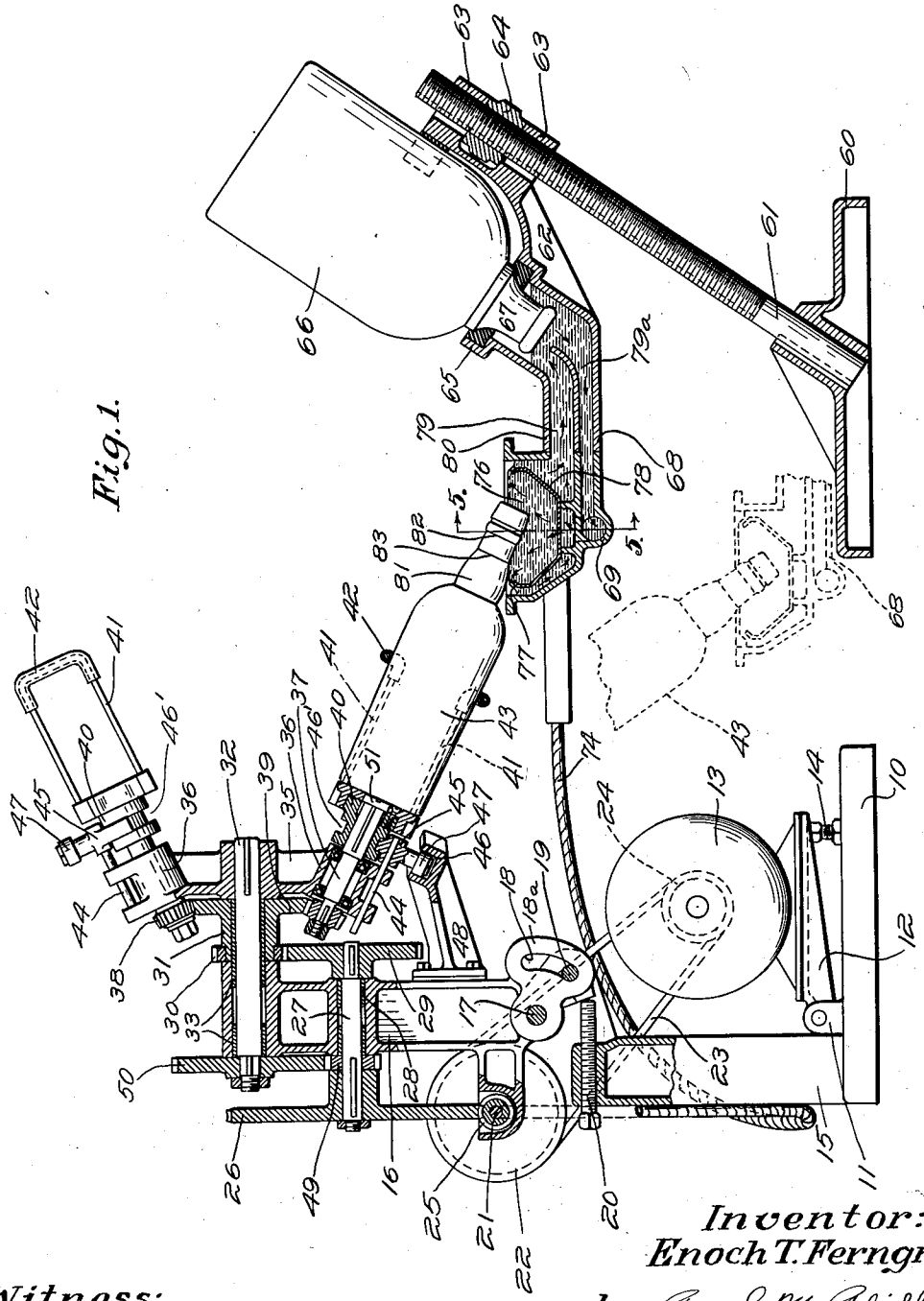
April 2, 1940. E. T. FERNGREN 2,195,670

APPARATUS FOR COATING ARTICLES

Original Filed Sept. 11, 1934 5 Sheets-Sheet 1

Fig. 1.



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APPARATUS FOR COATING ARTICLES

Original Filed Sept. 11, 1934 5 Sheets-Sheet 2

Fig. 2.

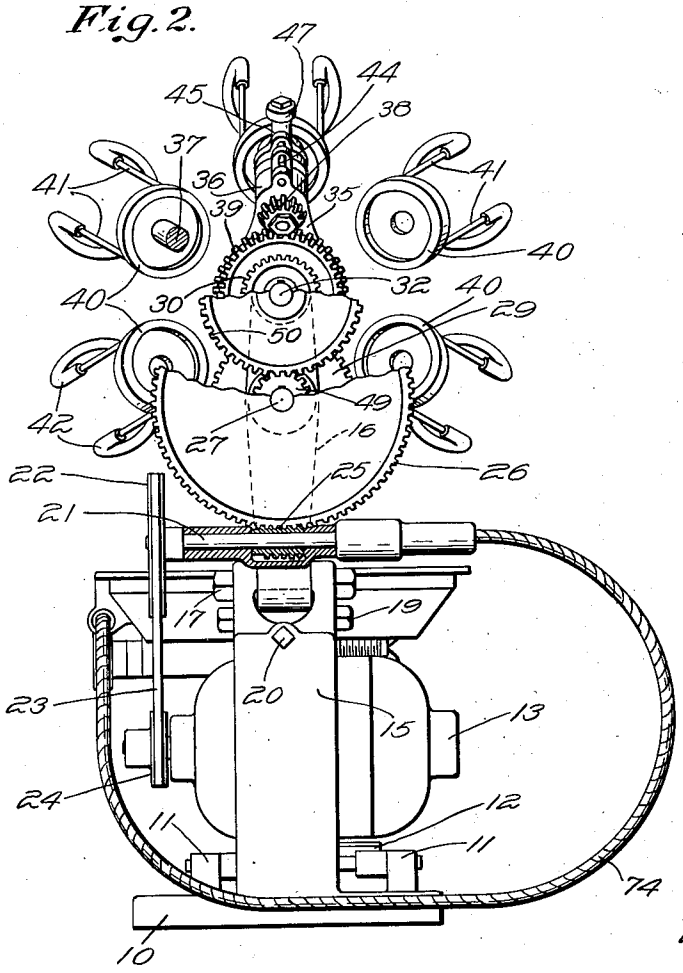


Fig. 3.

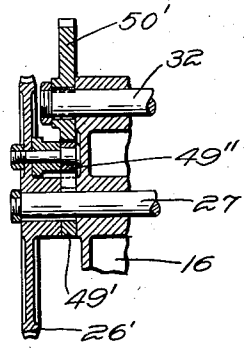


Fig. 4.

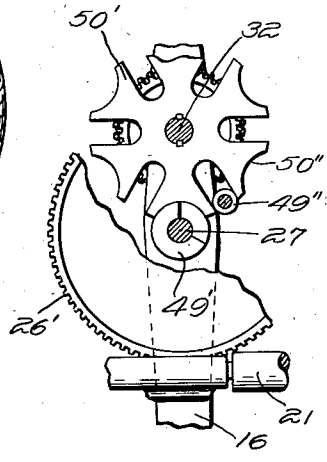
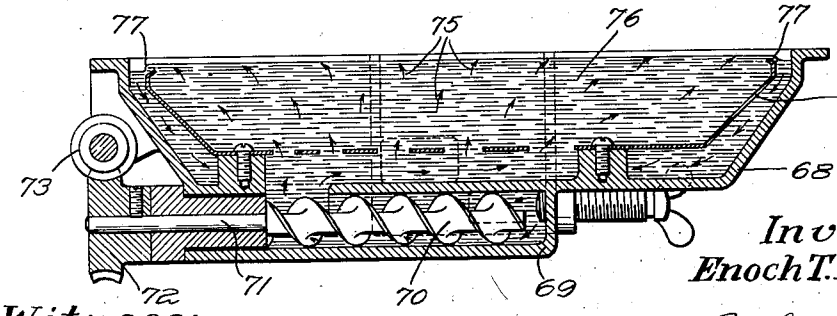


Fig. 5.



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APPARATUS FOR COATING ARTICLES

Original Filed Sept. 11, 1934 5 Sheets-Sheet 3

Fig. 6.

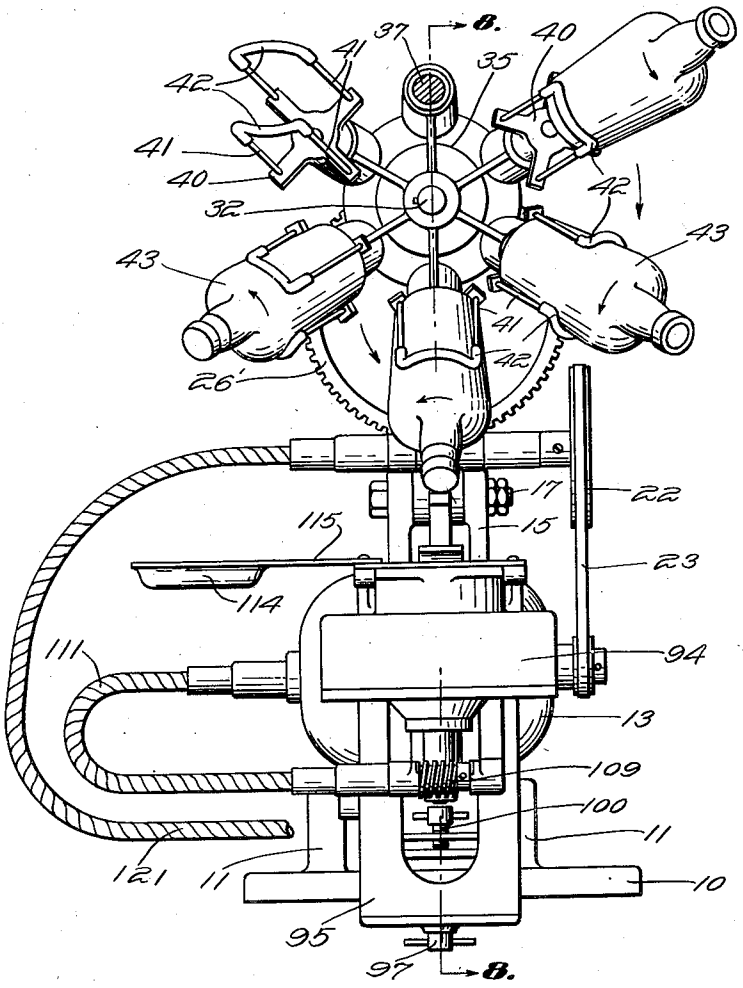
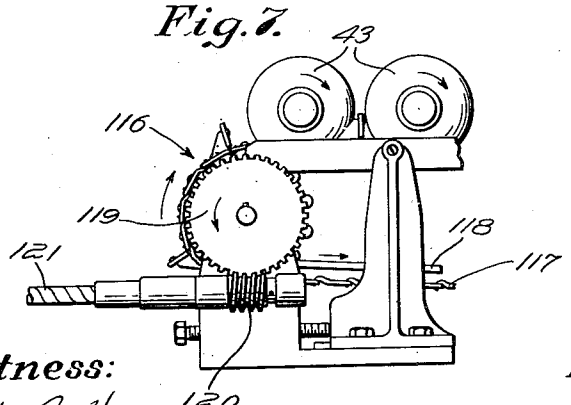


Fig. 7.



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APPARATUS FOR COATING ARTICLES

Original Filed Sept. 11, 1934 5 Sheets-Sheet 4

Fig. 8

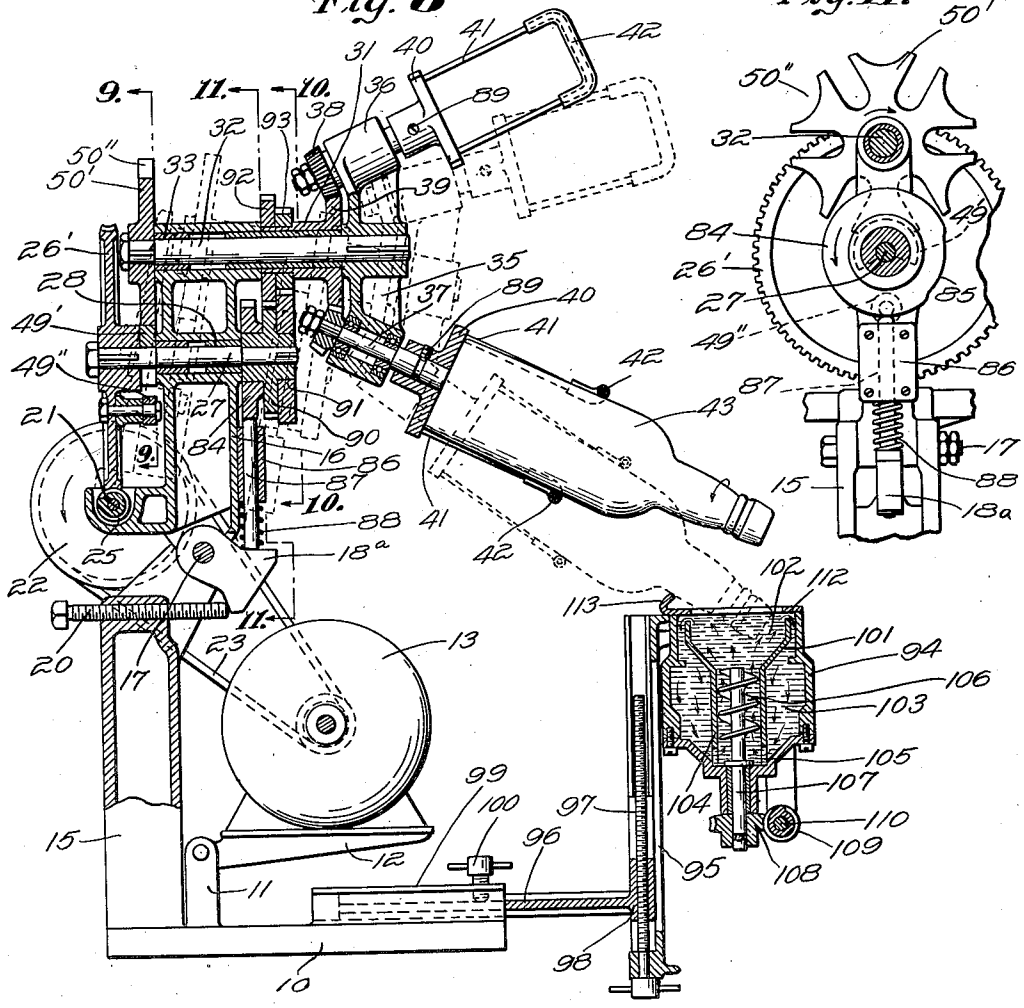


Fig. 11.

Fig. 9.

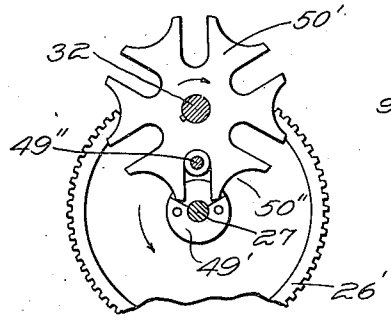
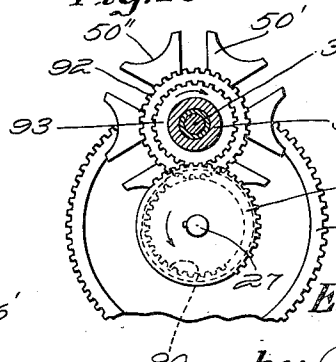


Fig. 10.



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APPARATUS FOR COATING ARTICLES

Original Filed Sept. 11, 1934 5 Sheets-Sheet 5

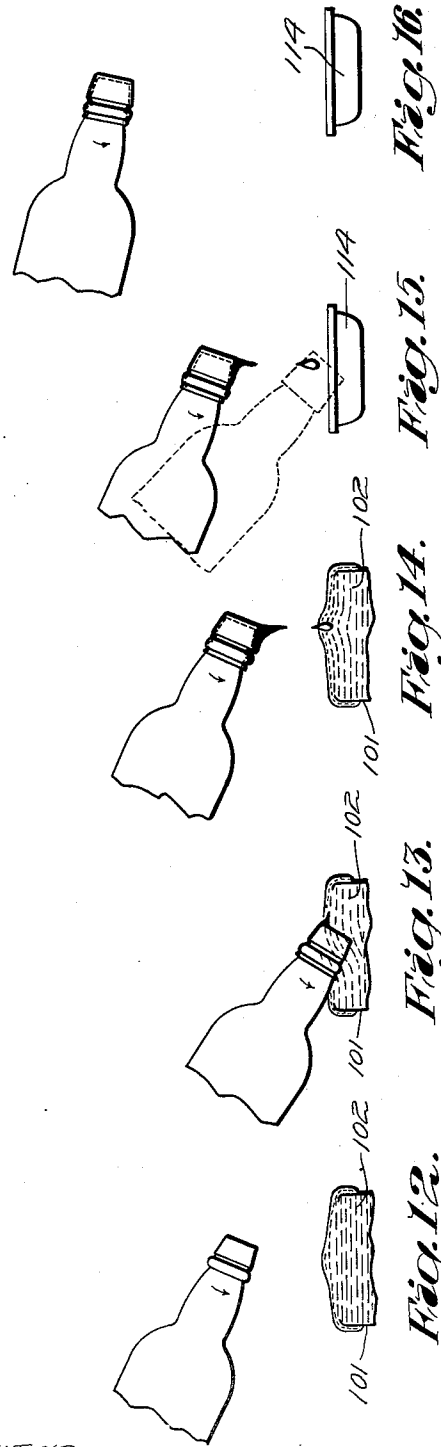


Fig. 16. Fig. 15. Fig. 14. Fig. 13. Fig. 12.

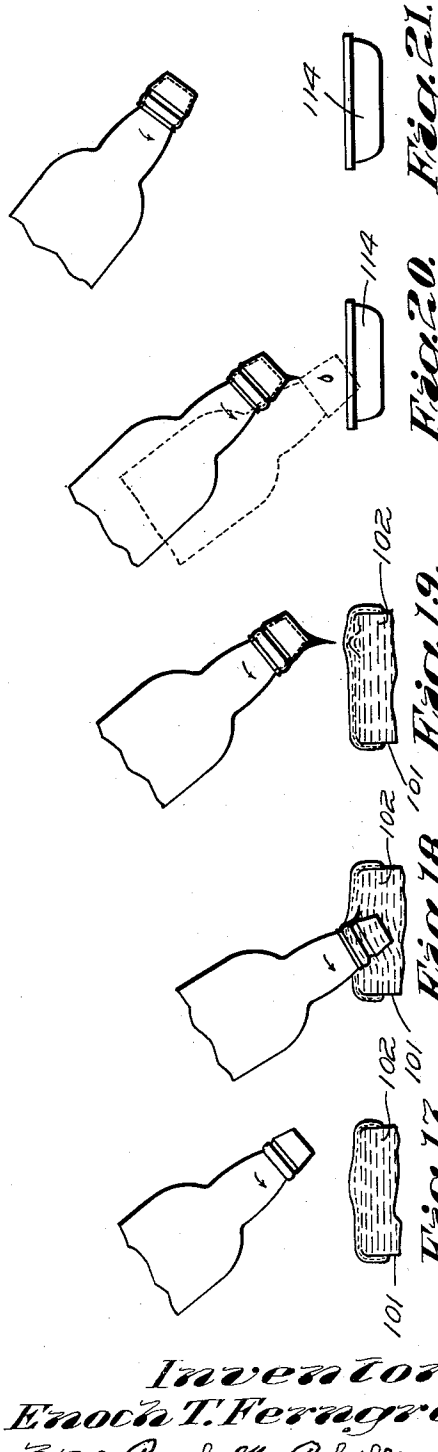


Fig. 21. Fig. 20. Fig. 19. Fig. 18. Fig. 17.

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UNITED STATES PATENT OFFICE

2,195,670

APPARATUS FOR COATING ARTICLES

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Continuation of applications Serial Nos. 743,558, September 11, 1934, and 38,839, August 31, 1935. This application March 18, 1937, Serial No. 131,736

20 Claims. (Cl. 91—46)

This case relates to an apparatus for coating the necks of bottles or analogous articles, which have previously been closed in any suitable manner as by a screw stopper, cork or other closure, for the purpose of providing a tamper-proof and air and liquid-tight seal over the necks of such articles. To the extent that the apparatus herein disclosed is adaptable to the forming of articles on suitable forms by dipping, the invention is to be considered as including such apparatus.

This case is a combined continuation of my copending applications, Serial No. 743,558, filed Sept. 11, 1934, and Serial No. 38,839, filed Aug. 31, 1935. The entire disclosure of this case will be found in one or the other of these two applications. This case is restricted to the apparatus disclosed, the corresponding method being disclosed and claimed in my copending application Serial No. 287,691, filed August 1, 1939.

Many foods and food products, including milk for example, are preferably supplied in containers provided with suitable seals to render them air-tight and liquid-tight in order to preserve their contents and prevent possible contamination thereof. Other types of bottled goods, including liquors, are preferably protected in a suitable manner against the possibility of adulteration or contamination as well as against possible leakage of their contents.

My present invention includes the provision of a suitable automatic means for supplying sealing closures of film type to any and all such articles, specifically the necks of bottles, in order to provide suitable closures for effecting these or other purposes.

Among the objects of the present invention are to provide novel apparatus for applying film-type seals to previously closed bottle necks, or the like, in a manner which will be simple, relatively inexpensive, and such that the seals when made will be uniform and free from blow holes or other imperfections. A specific object of the present invention is to provide apparatus for the forming of seal-caps closures or other films from liquid film-forming material by dipping previously closed bottle necks or suitable forms into a pool of such liquid material while providing within the dipping pool a submerged stream of the film-forming liquid in such direction and velocity as to scavenge from the surface of the neck of a bottle or form dipped thereinto, or from the interstices or depressions open to the surface, all air bubbles which might tend to form blow holes or other imperfections in the film coating or seal formed from the liquid in the pool.

A further and more specific object of the present invention is to provide apparatus for the successive dipping of the necks of a plurality of bottles or other forms, which are held in suitable holders on a rotatable carrier with the necks of the bottles diverging and successively dipped into a pool of a film-forming liquid, and to provide for the rotation of the bottles or forms about their longitudinal axes during the dipping of the necks thereof, and preferably also during the subsequent draining, in order that the necks of the bottles or forms be uniformly dipped and an even film coating applied thereto, and also in order that subsequent to a reasonable draining period, the film-forming liquid adhering to the neck of a bottle or a form will be evenly distributed to form a uniform film.

A further object of the present invention is to provide in conjunction with the apparatus aforesaid suitable adjustments by which the dipping of the articles may be effected at desired angles and/or to a desired degree.

A further specific object of the present invention is to provide apparatus for the rotation of the bottles or forms about their longitudinal axes at different speeds in differents parts of the dipping operation, including for example the relatively rapid rotation of the bottles or forms during the immersion of the neck portions thereof in the dipping pool, the relatively slower roation during the withdrawal of the neck of each bottle from the pool and/or during the initial draining period subsequent to the withdrawal as aforesaid, and the relatively rapid rotation of the bottles or forms during a subsequent portion of the draining period for the purpose of evenly distributing the film-forming liquid about the neck portions thereof.

A further object of the present invention is to provide apparatus for the intermittent rotation of the carrier by which the several bottle or form holders are held, in order that a bottle or form be bodily stationary, while still rotating about its own longitudinal axis, during the dipping thereof.

Further and more detailed objects of the present invention will become apparent from the following description and appended claims, all when taken in connection with the accompanying drawings, in which:

Figure 1 is a view principally in vertical section of one form of bottle dipping apparatus embodying my invention, there being shown in

dotted lines a different adjusted position for certain of the parts;

Fig. 2 is a view in elevation with parts in vertical section and other parts broken away, taken from the left of Fig. 1;

Fig. 3 is a fragmentary detail view in vertical section illustrating a modified form of drive for the carrier of Fig. 1;

Fig. 4 is a fragmentary view, principally in elevation and with parts broken away and in vertical section, of the driving means shown in Fig. 3;

Fig. 5 is a view substantially in vertical section on the line 5—5 of Fig. 1, illustrating the dipping pool and the circulating means therein;

Fig. 6 is a view principally in elevation and similar to Fig. 2 showing a modified form of the invention;

Fig. 7 is a fragmentary view in elevation showing the removal conveyor for articles subsequent to their dipping and draining;

Fig. 8 is a view principally in vertical section on the line 8—8 of Fig. 6, and similar to Fig. 1, showing the detailed construction of this form of the device, the driving means therefor, and the arrangements for producing a submerged upward flow of the film-forming liquid in the dipping pool;

Fig. 9 is a fragmentary view with parts in vertical section on the line 9—9 of Fig. 8, illustrating the Geneva driving means for the carrier;

Fig. 10 is a fragmentary view with parts in vertical section on the line 10—10 of Fig. 8, showing the complementary mutilated gears for applying alternate two-speed rotation to the bottle holders;

Fig. 11 is a fragmentary view with parts in vertical section on the line 11—11 of Fig. 8, illustrating the tilting means for the tilting frame and also the intermittent rotating means for the carrier;

Figs. 12 o 16 inclusive are a series of diagrammatic views, illustrating the dipping and draining of a bottle neck; and

Figs. 17 to 21 inclusive are a series of diagrammatic figures, similar to Figs. 12 to 16, illustrating a bottle being dipped at a different angle and the draining thereof in forming a film around the neck thereof.

The apparatus disclosed in the drawings, Figs. 1 to 5, is the same as that disclosed in my prior application, Serial No. 743,558.

Referring now to Figs. 1 and 2 of the accompanying drawings, the device comprises a base 10 upon which are mounted suitable brackets 11. Pivoted to the brackets 11 is a support 12 carrying an electric motor 13. The support 12 may be angularly adjusted in respect to the brackets 11 and the base 10 by an adjusting bolt 14 for a purpose hereinafter to be described.

Adjacent to the rear of the base 10 there is mounted a suitable standard 15, which supports a frame 16, the later being pivoted to the standard 15 for adjustive movement about the axis of a pintle 17. A slot 18 formed in a portion 18a of the frame 16 has passing therethrough a bolt 19, which is mounted in suitable portions at the upper end of the standard 15. Threaded through another portion of the upper end of the standard 15 is an adjusting screw 20, the right hand end of which, as seen in Fig. 1, bears against a suitable lug formed on the lower end of the portion 18a of the frame 16. Thus, the screw 20 may serve to adjust the angular position of the frame about its pivot 17 in respect to the standard 15. As shown, the frame 16 is adjusted to its highest position.

At the rear of the frame 16, there is journaled a shaft 21, as best shown in Fig. 2. This shaft carries at one end a pulley 22, which is adapted to be continuously driven through a belt 23 from a suitable driving pulley 24 secured to the shaft of the motor 13. Thus, the adjustment of the support 12 by the screw 14, as above set forth, serves not only to adjust the tension of the belt 23, but also to compensate for various positions of the frame 16 as adjusted by the screw 20. The shaft 21 is provided intermediate its bearing in the frame 16 with a worm 25, which meshes with and drives a worm wheel 26 fixed to a shaft 27, which is journaled in suitable bearings 28 in the frame 16. A gear 29 secured to the opposite end of the shaft 27 from the worm wheel 26 is arranged to mesh with and drive a gear 30, which is mounted on a sleeve 31. The sleeve 31 is mounted for free rotation on and with respect to a shaft 32 journaled in bearings 33 in the frame 16 above and parallel with the shaft 27.

At the right hand end of the shaft 32, as seen in Fig. 1, there is secured a carrier 35, which provides a plurality of journal bearings 36 for a corresponding number of shafts 37, these shafts being arranged at oblique angles to the shaft 32 with their outer ends (at the right as seen in Fig. 1) diverging. On the left hand end of each of the shafts 37, as seen in Fig. 1, there is secured a bevel gear 38. All the gears 38 mesh continuously with a bevel gear 39 mounted on or integral with the sleeve 31.

On the right hand end, as seen in Fig. 1, of each of the shafts 37 there is splined a member 40, which supports U-shaped arms 41, provided with suitable means 42 for engaging and holding bottles, one of which is shown at 43, Fig. 1. Arranged parallel to each of the shafts 37 and slidably mounted in suitable apertures in the associated bearing portion 36 is a shaft 44, one end of which is secured to a part collar member 45 engaging in an annular groove 46' formed in the member 40. A cam groove 46 formed in a member 48, which is secured to the frame 16, cooperates with antifriction wheels or rollers 47 respectively mounted on each of the members 45 and serves to control the endwise movement of the members 40 in respect to the shafts 37 to which they are splined.

In the form of the invention shown in Figs. 1 and 2, a spur gear 49 on the shaft 27 meshes with a spur gear 50 secured to the left hand end, as seen in Fig. 1, of the shaft 32, so that the carrier 35, which is also secured to this shaft, is rotated continuously.

Referring now to Figs. 3 and 4 of the accompanying drawings, there is illustrated a means for driving the shaft 32 from the continuously rotating shaft 27 in such manner that the shaft 32 will rotate intermittently, and, hence, will rotate the carrier 35 intermittently, the purpose being to provide a dwell in the rotation of the carrier in timed relation to the immersion and withdrawal of neck portions of bottles in the film-forming liquid as hereinafter set forth. For this purpose, as shown in these figures, a worm wheel 26', which corresponds functionally to the worm wheel 26 of Figs. 1 and 2, carries an eccentric driving roll 49'', which is arranged successively to engage the slots of a Geneva wheel 50' secured to the left hand end, as seen in Fig. 3, of the shaft 32. The shaft 27 or the gear 26' is also provided with a cut-away member 49', which cooperates

successively with the intermediate reentrant portions 50'' of the Geneva wheel 50', thus locking this wheel against rotation during the dwell periods thereof; while the cut-away portion of the member 49' permits the rotative movement of the Geneva wheel.

Referring again to Figs. 1 and 2, each of the shafts 37, which is pivoted in the carrier 35, is provided with a head 51, which limits the outward movement of the member 40 on this shaft.

Mounted in a suitable position adjacent to the base 10, there is a supplementary base 60, which carries secured thereto a screw threaded standard 61. A suitable bracket 62 is splined on the standard 61 and is supported thereby through the provision of a pair of spaced ears 63 on the bracket. Between these ears and threaded on the standard 61 is an adjusting nut 64. Thus, adjustment of the nut 64 will be effective to adjust the position of the bracket 62 and a dipping container 68 rigid therewith along the standard 61, as between the full and dotted line position shown in Fig. 1. The bracket 62 carries rigid or integral therewith the container 68, including a socket portion 65. A bottle or other suitable container 66 for a liquid film-forming material may be associated with the container 68, and in practice may have its neck 67 received in an air-tight manner in the socket portion 65, as shown. The liquid from the receptacle 66 discharges into the container 68. The container 68 is provided in its lower portion with a pump chamber 69, within which is a pump screw 70 mounted upon a shaft 71. The shaft 71 passes through a suitable bearing bushing in the container 68 and is provided on the outside with a worm gear 72, which is arranged to be driven by a worm 73 secured to and driven by a flexible cable 74, which may be arranged to be driven from the end of the shaft 21 above referred to. The liquid film-forming material is adapted to be driven forcibly upwardly by the pump screw, as indicated by the arrows 75, Fig. 5. The functions resulting from this flow within the dipping pool will be more fully discussed hereinafter in discussing the functions of the dipping pool shown in Fig. 8. The dipping pool of film-forming material, which is generally indicated at 76, is segregated within the basin or container 68 by an intermediate partition 78, the liquid entering the bottom of the dipping pool through openings in the partition 78, as shown in Fig. 5, and overflowing at 77 into the intermediate space between the partition 78 and the walls of the container 68. This overflowing liquid moves to the right, as seen in Fig. 1, through a passage indicated at 79, to a point adjacent to the mouth of the receptacle 66, and thence returns to the vicinity of the pump through a bottom passage indicated at 79a. Inasmuch as the fitting of the receptacle 66 in socket 65 is air-tight, there is provided a barometric feed for the dipping material from the receptacle 66, that is, air can only be admitted to the interior of the receptacle 66 above the liquid therein when the level of the liquid in passage 79 is beneath the top wall 80 of this passage. The liquid within the dipping pool is used or dissipated progressively in forming films upon the necks of bottles and also, in the event that a solution of one or more film-forming materials in a solvent is being employed, by the evaporation of the solvent.

As shown in Fig. 1, the bottle 43 has its neck 81 dipping into the liquid material in the pool 76; and as this bottle is being continuously rotated about its longitudinal axis through the train of gears previously described, the liquid material will form a coating 82 on the neck of the bottle up to a line 83.

The operation of the device just described may be summarized as follows: Bottles may be inserted manually or by any suitable automatic mechanism into the holders including the U-shape members 41 and the bottle gripping portions 42, at some position of these holders other than that in which they hold the bottle for dipping into the pool. The shaft 27 is driven continuously, as hereinabove set forth, by the prime mover or motor 13. This shaft drives the sleeve 31 through the gears 29 and 30 and thereby drives gears 38 and the shafts 37 continuously, so that continuous rotation is imparted to all the bottle holders to rotate bottles held therein about their longitudinal axes. Also, the carrier 35 is driven continuously from the shaft 27 through the gears 49 and 50 and serves to move the bottles successively to and through the lowest point in their path of movement at which the necks of the bottles are dipped into the film-forming material in the dipping pool.

While each bottle moves through the lowest zone of its movement in the rotation of the carrier 35, the roller 47 associated therewith enters the cam groove 46, which controls the longitudinal movement of the bottle and is preferably so constructed and arranged as to control this movement to the end that the amount of dipping of a bottle will be constant throughout a material portion of the rotation of the carrier 35, so that the coating will always be applied up to a predetermined line, as shown at 83. For this purpose, the bottle is first thrust outwardly as it approaches its lowest position due to the rotation of the carrier 35, then gradually moves inwardly as it passes through this lowest position, and then is again progressively thrust outwardly as it leaves the lowest position. This outward movement is limited by the head 51, as previously described.

It will be noted that the arrangement of the gears is such that the holder for each bottle is rotated about its axis to rotate the bottle therein about its longitudinal axis in the direction opposite that of the rotation of the carrier 35 about the axis of the shaft 32. This results in the movement of each bottle neck as it passes through the pool as a sort of rolling action over the surface thereof. In this way, the film-forming liquid is applied in the smoothest possible manner to the neck of each article during the immersion thereof. The length of the pool is preferably sufficient so that the neck of each bottle is immersed as previously described and is rotated sufficiently to be completely coated up to the line 83, and then is raised above the pool and any excess film-forming material drained off the bottle neck into the pool before the bottle neck passes beyond the edge of the basin or container 68.

While the application of film coatings may be successfully carried on with suitable liquid film-forming materials, and with the carrier 35 rotating continuously, as is disclosed in Figs. 1 and 2, it is sometimes preferable, particularly with certain types of film-forming materials, to give the bottle neck more time for immersion and/or draining than could be afforded with this construction. For this purpose, the alternative or intermittent drive shown in Figs. 4 and 5, and previously described, may be employed.

With the intermittent type of drive of Figs. 4 and 5, the carrier is preferably stopped in synchronized time relation to the immersion and withdrawal of the neck of a bottle to afford adequate time for draining the coated neck portion.

When the construction of Figs. 1 and 2 is used, the bottles will be rotated about their longitudinal axes at a more rapid rate than that of the rotation of the carrier 35 due to the relative sizes of the several gears 29—30 and 49—50. However, when the intermittent drive of Figs. 4 and 5 is used, resulting in an intermittent rotation of the carrier 35, there is a further relative effect. As the gear 39 is rotated in the same direction as the carrier 35, the resultant motion given to each bottle about its own axis is controlled by the differential between the speeds of rotation of the carrier and of the gear 39. Consequently, when the gear 35 is stationary, at one of its dwell positions, the bottles will be rotated about their own axes at a speed greater than their speed of rotation while the carrier is moving. Thus, the speed of rotation of the bottles may be accelerated at a desired part of the draining period, which serves in practice to spread the film-forming material evenly about the neck of the bottle and results in a superior type of film closure.

The angle of dipping of each article may be adjusted as previously stated by the joint adjustment of the angle of the frame 16 in respect to the standard 15, controlled by the screw 20, and the complementary adjustment required for the level of the dipping pool 68. The latter is shown in two adjusted positions, in full and dotted lines respectively in Fig. 1. In that figure, it will be seen that the inclination of the bottle shown in dotted lines is greater than that of the bottle shown in full lines. The particular angle to be chosen may depend upon the character of the film-forming material being employed, the shape of the bottle, and/or upon other factors. For example, if a bottle has a relatively short neck and a square shoulder, it may be necessary to employ a sharper angle of dip than is required for a bottle of the shape shown in Fig. 1. In such an event, the dotted line position of the parts shown in Fig. 1 would be chosen rather than the full line position.

Thus, from the foregoing, there is provided an apparatus by which a bottle neck may be coated by a rolling motion across a pool of film-forming material, while being dipped to a substantially constant extent in the pool and while making at least one complete revolution about its own axis. This insures the even coating of the neck of the bottle up to a desired line, as indicated at 83. Thereafter, the bottle may be raised while being still maintained at a downwardly directed angle and while excess film-forming material is being drained from the neck. Also, during the draining period, as well as during the dipping period, the bottles may be continuously rotated about their longitudinal axes. This results in a fairly even flow of the excess solution from the neck and mouth of the bottle and provides a substantially uniform coating over the previously closed neck or mouth of the bottle.

In Figs. 6 to 11 inclusive, I have shown another embodiment of my invention, this embodiment being the same as is disclosed in my copending application, Serial No. 38,839. Inasmuch, however, as the device shown in these figures, particularly Figs. 6 and 8, has considerable structural similarity to that shown in Figs. 1 and 2, I am employing the same reference characters for substantially corresponding parts.

Referring now to the drawings, Figs. 6 to 11 inclusive, the device may comprise a base 10 having mounted therein or suitably secured thereto a pair of brackets 11 to which is pivoted a support 12 for a prime mover, such as an electric motor 13. No means are shown corresponding to the adjusting screw 14 of Fig. 1, but obviously such means could be provided if desired. Also, mounted on the base 10 is a suitable standard 15, which has pivoted thereto a frame 16, the frame 16 being pivoted to the standard 15 by a pintle shaft 17. Freely rotatable about the shaft 17 intermediate the bearing portions of both the standard 15 supporting the shaft and the frame 16 is a member 18a, one portion of which is engaged by an adjusting screw 20 operating for the same purpose as the correspondingly numbered screw of Fig. 1. In this form of the invention, however, there is provision, as hereinafter set forth, for relative movement between the frame 16 and the member 18a.

Also, mounted in the frame 16 is a shaft 21 arranged to be continuously rotated. For this purpose, this shaft is provided on one end with a suitable pulley 22, which is driven through a belt 23 from the motor 13. The shaft 21 carries a worm 25 arranged to drive a worm wheel 26', in the same way as previously described for Figs. 1 and 4. The worm wheel 26' is provided with a Geneva driving roll 49'' arranged successively to engage the slots of a Geneva driving wheel 50'. The worm wheel 26' is mounted on a shaft 27, which is journaled in suitable bearings 28 in the frame 16. The Geneva wheel 50' is carried by one end of a shaft 32, which journaled in suitable bearings 33 in the frame 16 parallel to the shaft 27. The shaft 27 will be continuously driven from the motor 13 and the shaft 32 will be intermittently driven through the Geneva drive above described and illustrated in Figs. 8 to 11. The shaft 27 is also provided with a suitable cut-out locking member 49' arranged to engage re-entrant portions 50'' of the Geneva wheel 50' intermediate the slots therein in order to lock the shaft 32 at the several dwell positions thereof. The arrangement of these parts is illustrated in Figs. 8, 9 and 11.

Means are provided for intermittently tilting the frame 16 bodily, in order to dip the bottles successively into the dipping pool, later to be described. This means is depended upon for the dipping in place of the rotating means of Fig. 1, combined with the means shown in that figure for moving the bottles axially of the shafts 37. As shown in Figs. 8 and 11, the shaft 27 has secured thereto a cam 84, which is provided with a reduced diameter portion 85 (Fig. 11). In alignment with this cam and freely slidable in a bearing 86 secured to the frame 16 is a push rod 87, the lower end of which bears against a shoulder on the member 18a. Surrounding the push rod 87 and extending between the lower end of the bearing 86 and the upper face of the member 18a is a compression spring 88.

In operation, the member 18a is normally stationary, but its position may be adjusted by the screw 20. The push rod 87 bears at all times against the member 18a and is arranged for sliding movement in the bearing 86. Thus, when the high portion of the cam 84 is in alignment with the push rod, the frame 16 and the parts carried thereby will be in the full line position shown in Fig. 8. When, however, the low portion 85 of

the cam 84 comes into alignment with the push rod 87, the frame 16 will tilt forwardly, due to the unbalanced arrangement of the weight thereof and of the parts and bottles carried thereby, and will bring the parts to the position shown in dotted lines in Fig. 8. Movement to this forwardly tilted position, however, is cushioned by the compression spring 88. The movement back to the full line position from the dotted line position is a positive one, under control of the cam 84 acting on the push rod 87. The cam 84 rotates continuously and in the direction of the arrow in Fig. 11. Inasmuch as this cam is secured to the shaft 27 and as the arrangement for driving shaft 32 from shaft 27 includes a single action Geneva drive, the frame 16 will be tilted forwardly once for every dwell of the rotation of the shaft 32 and in synchronized time relation therewith. Furthermore, the cam 84 will cause the tilting of the frame 16 through a predetermined range. The location of this range, however, may be adjusted by adjusting the screw 20, which, in turn, adjusts the position of the member 18a, this to compensate for different types of bottles as discussed above in the description of Figs. 1 and 2.

On the right hand end of the shaft 32, as seen in Fig. 8, is a carrier 35, which is provided with a plurality of bearing portions 36, as described for the first embodiment of the invention. In each of these bearing portions, there is journaled a rotatable shaft 37 carrying a member 40 at its outer end, to which is secured a pair of U-shaped members 41 having bottle-engaging portions 42, a bottle 43 being shown in one of the bottle holders as thus formed in Fig. 8. In this form of the invention, however, the members 40 are rigidly secured to the shafts 37 by set screws, as shown at 89; and there is no relative longitudinal movement between the bottles or the holders and the shafts 37.

Each of the shafts 37 is provided with a bevel gear 38, all of which gears mesh with a bevel gear 39 mounted on a suitable sleeve 31, which is mounted concentrically with and freely rotatable about the shaft 32. The drive for the sleeve 31 in this case, however, is different from that previously described for the first embodiment of the invention.

In this embodiment of the invention, it is desired that there be provided two speeds of rotation for the bottles about their longitudinal axes, these two speeds being applied alternately so that each bottle is rotated continuously about its longitudinal axis, but the speed of rotation is alternately changed between a high and a low speed. For this purpose, the shaft 27 is provided with complementarily arranged mutilated gears 90 and 91. These gears mesh respectively with ordinary spur gears 92 and 93 respectively, which are secured to the sleeve 31. The portion of the gear 90 provided with teeth is opposite a plain portion of the gear 91, while the portion of the gear 91 provided with teeth is opposite a plain portion of the gear 90. Inasmuch as the gear 90 is of less diameter than is gear 91, and the gear 92 of greater diameter than gear 93, there will be a higher speed of rotation for the bottle holders and the bottles therein when the gear 91 is driving the gear 93 than when the gear 90 is driving the gear 92. The construction just described and illustrated in the drawings of Figs. 8 and 10 thus provides for a continuous drive of the bottles in the bottle holders about their longitudinal axes alternately at two different speeds. The timing of the changes in speed in the rotation of the bottles will be described hereinafter in describing the operation of the device.

Mounted adjacent to the path of movement of the bottles in the bottle holders of the device of Figs. 6 and 8 is a container, generally indicated at 94, for a pool of a film-forming liquid. The container 94 is supported upon a vertically adjustable slide 95, which is carried by and arranged for vertical adjustive movement in respect to a bracket 96 by the provision of an adjusting screw 97 carried by the slide 95 and threaded through a suitable portion 98 of the bracket 96. The bracket 96 is horizontally adjustable in respect to the base 10 and is carried thereby. For this purpose, this bracket is received in a suitable horizontal guideway, generally indicated at 99, on the base 10 and may be secured in any desired adjusted relation thereto by a set screw 100.

The container 94 is provided with an intermediate partition 101 providing a central dipping pool, generally indicated at 102, and an overflow space shown as an annular chamber 103. The partition 101 is provided at its lower end with a cylindrical portion 104 having apertures 105 therein communicating between the interior of the cylindrical portion and the annular chamber 103. Arranged for rotation about a vertical axis in the cylindrical portion 104 is a pump screw 106, which is mounted upon a vertical shaft 107 journaled in a suitable bearing in the base of the container 94. The shaft 107 is provided below the container 94 with a worm wheel 108, which is arranged to be driven by a worm 109 carried by a shaft 110. The shaft 110 is driven from a suitable source of power, here shown as the motor 13, through a flexible shaft 111. The fluid within the dipping pool is circulated in the direction of the arrows, as shown, overflowing the edge of the partition 101 to flow down into the annular chamber 103 and thence through the openings 105 to be recirculated by the pump.

While I have not shown any particular means in Fig. 8 for supplying film-forming liquid to the dipping pool continuously or intermittently, it will be understood that any suitable means, including, for example, the means shown in Fig. 1, may be employed for this purpose.

The container 94 is provided with a suitable cover member 112 having an aperture therein of the desired shape and size to permit the introduction of a portion of an article, such as the neck of a bottle, to be coated. This cover may also be provided with a bottle rest 113 rigid or integral therewith serving to steady an article during the dipping thereof and thereby to predetermine the extent to which it is dipped into the pool, as shown in Fig. 8. When film-forming material, including a volatile solvent is employed, it is desirable that the free space open to the atmosphere above the dipping pool be minimized in order to minimize volatilization of the solvent and maintain the film-forming material in proper condition for use.

The device here shown, and preferably also the dipping pool arrangement shown in Fig. 5 of the present drawings, is such as to cause a submerged upward movement of the dipping liquid in a direction to impinge upon the neck of a bottle or other article being dipped into the pool thereof with such velocity and direction as to scavenge from the surface of the dipped article any bubbles adhering thereto, and also any bubbles of gas which might be enclosed or trapped beneath

a film formed by the process in interstices or depressions in or about the neck portion of an article. Such interstices may occur, for example, in uneven portions at or adjacent to the neck of an article itself and also intermediate an article and closure thereof, for example, a screw-cap type of closure. It also happens in some instances that bottles having cork stoppers therein pushed down below the top level of the bottle (when the bottle is standing upright) are to be capped by my process. Under these circumstances, air may be trapped in the reentrant portion at the end of the cork of the bottle. If this air were permitted to remain, it might contract during the volatilization of a volatile solvent from the drying film, for example, and cause a blow hole in the film. Also, bubbles of air if permitted to remain on or about the surface of an article being dipped tend to cause unsightly blemishes in the film formed on the article. By the use of a submerged current of the dipping liquid impinging on the article with a sufficient velocity, I am enabled to scavenge such bubbles of air from the surface so as to provide for the production of uniform films and effectively prevent the production of blow holes and other imperfections in the films.

The circulation of the dipping liquid has another and incidental effect in that it serves to keep the film-forming liquid uniform and homogeneous, which is important where a liquid is employed having some one or more constituents which might tend to settle out to leave a non-homogeneous liquid in the dipping pool.

I contemplate that when using a device, substantially as shown in Figs. 6 and 8, a bottle will be brought to its lowermost position in the rotation of the carrier **35**, which will be a dwell position for the carrier, and then the frame **16** tilted to dip the neck of the bottle into the pool, as shown in Figs. 8, 12, 13, 17 and 18. At the time an article is being dipped into the pool, it will be rotated relatively rapidly, due to gears **91** and **93** being in driving engagement at this time. When the article is emerging from the pool, which preferably takes place relatively slowly, the bottle is rotated about its longitudinal axis and at its relatively slow rate, due to the gears **90** and **92** being in driving engagement. Subsequent to the dipping and the formation of a film on the end of the article, it drains over the dipping pool, as shown in Figs. 14 and 19 for a short period, the rotation being continued at the slow rate. The bottle is then moved by the next intermittent rotative step of the carrier **35** to the next dwell position, which is clockwise of the dipping position as seen in Fig. 6. At this position, the bottle is again tipped downwardly by the tilting of the frame **16** to dip the next succeeding bottle, Figs. 15 and 20. The draining, however, has been substantially completed at this point with the possible exception of a single drop. There is provided, however, a drip catching pan **114** beneath this position of the bottle, which pan may be carried by a suitable bracket **115** extending from the container **94**. Here again, the speed of rotation of the article is increased, which is effective to produce an even distribution of the film-forming liquid about the end of the neck and mouth of the bottle, so as to produce a uniform film. This rapid speed of rotation takes place at the same time that the succeeding article is being dipped into the pool at the high speed as aforesaid. Subsequently, the bottle may be suitably removed and the film dried or hardened in any suitable manner, including air drying by leaving it exposed in open air for a desired period.

I have shown in Fig. 7 a removal conveying means, including a chain conveyor generally indicated at **116**, by which a bottle may be continuously rotated while being moved away to a desired delivery point. The bottle is conveyed toward the delivery point by means of a link chain **117**, the links of which are sufficiently large so that the bottom portions of the bottles extend therethrough, the bottles being thus bodily moved by the chain **117**. Below and in frictional driving relation to the bottom portions of the bottles being bodily conveyed by the chain **117** is a reversely moving belt **118** causing rotation of the bottles, as indicated by the arrows, while they are being conveyed away, the whole conveyor operating to give a sort of a rolling action to the bottles during their travel. The conveyor **116** may be arranged suitably to be driven by a driving gear **119**, shown as a worm gear driven from a worm **120**, power for which is supplied through a flexible cable **121**, which, as shown in Fig. 6, may be driven from one end of the shaft **21**.

I do not wish to be limited to any particular type of film-forming liquid for use in either form of my device, but contemplate that any suitable material may be employed, for example, solutions of cellulose acetate dissolved in a suitable solvent, such as acetone, alone or mixed with suitable plasticisers, resins, etc. However, inasmuch as the particular composition of the film-forming liquid forms no part of my present invention, it will not be further described.

While the drawings and the specific disclosure of this application relate to an apparatus for dipping bottle necks to coat the previously closed ends thereof, it is obvious that the invention may be equally well applied to the dipping of suitable forms to form coatings thereon from the film-forming material in the dipping pool. Such coatings may thereafter be stripped from the forms in any way known to the art and used either in that condition or after being subjected to other manufacturing or shaping operations. The bottle holders particularly disclosed in the present application could be used for holding suitable forms either as shown or with such modification as would normally occur to those skilled in the art, in order to adapt them to a desired use. The appended claims are to be construed to include the dipping of forms to the same extent as the coating of bottle necks in so far as the apparatus features of the claims are adaptable to such use.

While I have shown but two principal embodiments of my invention, I contemplate that many changes and variations may be made therein and individual features thereof may be used in other combinations. I do not wish to be limited therefore except by the scope of the appended claims, which are to be construed as broadly as the state of the prior art permits.

I claim:

1. Apparatus for coating selected portions of articles, comprising a frame tiltable about a horizontal axis, a carrier mounted on said frame and rotatable about an axis in a plane perpendicular to the axis of the frame, a plurality of article holders mounted in an annular series on said carrier, means providing a pool of a coating liquid in the path of the portions of articles to be coated as they are moved by said carrier, means to rotate the articles while said portions thereof are dipped in the liquid and in a direction opposite

to the direction of rotation of said carrier, and cam means controlling the depth to which said portions of the articles are dipped into the pool.

2. Apparatus for coating selected portions of articles, comprising a rotatable carrier, a plurality of article holders mounted in an annular series on said carrier, said holders holding articles selected portions of which are to be coated at an angle to the axis of said carrier and with said portions diverging, means providing a pool of a coating liquid in the path of said portions of the articles as they are moved by said carrier, and means to adjust the axis of rotation of said carrier and thereby to adjust the depth to which the articles are dipped into the liquid in the pool.

3. Apparatus for coating selected portions of articles, comprising a rotatable carrier, means to adjust the axis of rotation of said carrier with respect to the horizontal, a plurality of article holders mounted in an annular series on said carrier, said holders holding articles at an angle to the axis of said carrier and with the portions thereof to be coated diverging, means providing a pool of a coating liquid in the path of said portions of the articles as they are moved by said carrier, and means to adjust the height of the pool.

4. Apparatus for coating selected portions of articles, comprising a frame, a carrier mounted on said frame for rotation in respect thereto about a substantially horizontal axis, a plurality of article holders mounted in an annular series on said carrier, means for rotating said carrier, means for rotating said article holders in respect to said carrier, means providing a pool of a coating liquid in the path of the portions of the articles held in said holders which are to be coated as they are moved by said carrier, and means for controlling and varying the position of the article holders in respect to the carrier in addition to their rotation in respect thereto and operable during the dipping of each article to compensate for the rotation of said carrier and to control the extent to which said portions of the articles are dipped into said pool in such manner that said portions will be dipped to a substantially constant extent during a substantial portion of the rotation of said carrier.

5. Apparatus for coating selected portions of articles, comprising a frame, a carrier mounted on said frame for rotation in respect thereto about a substantially horizontal axis, means for imparting intermittent rotation to said carrier about said axis, a plurality of article holders mounted in an annular series on said carrier, means providing a pool of a coating liquid in the path of the portions of the articles to be coated as they are moved by said carrier, and means to rotate the articles in said holders about their longitudinal axes in respect to said carrier while said portions are being dipped in the coating liquid in the pool and also subsequent to the emergence of said portions of the articles from said pool, the last named means being so constructed and arranged as to impart a higher speed of rotation to the articles in respect to said carrier during the dwells of the carrier rotation than during the movement of said carrier about its axis in respect to said frame.

6. Apparatus for coating selected portions of articles, comprising a supporting frame, a carrier mounted on said frame for rotation in respect thereto about a substantially horizontal axis, a plurality of article holders mounted in an annular series on said carrier and arranged for both rotative and axial movement in respect thereto, a continuously rotating shaft arranged to rotate said carrier in respect to said frame, means driven by the rotation of said shaft for rotating said article holders in respect to said carrier, and other means responsive to the rotation of said carrier for controlling the axial movement of said article holders in respect to said carrier.

7. Apparatus for coating selected portions of articles, comprising a supporting frame, a carrier mounted on said frame for rotation in respect thereto about a substantially horizontal axis, a plurality of article holders mounted in an annular series on said carrier and arranged for both rotative and axial movement in respect thereto, a continuously rotating shaft, gearing arranged to impart continuous rotation from said shaft to said carrier, other gearing arranged to impart continuous rotation from said shaft to said article holders for rotating them in respect to said carrier independently of their axial movement in respect to the carrier, and cam means operating in response to the rotation of the carrier for controlling the axial movement of each of said article holders in respect to said carrier, whereby selected portions of the articles may be dipped to a substantially constant extent in a stationary pool of a coating liquid throughout a substantial portion of the rotation of said carrier.

8. Apparatus fo coating selected portions of articles, comprising a supporting frame, a carrier mounted on said frame for rotation in respect thereto a'out a substantially horizontal axis, a plurality of article holders mounted in an annular series on said carrier, a continuously rotating shaft, Geneva driving means interposed between said shaft and said carrier for imparting intermittent rotative movement to said carrier in response to continuous rotation of said shaft, and other means driven by said shaft for rotating said article holders, the last named means being constructed and arranged to rotate said holders independently of the rotation or dwell of said carrier.

9. Apparatus for coating selected portions of articles, comprising a supporting frame, a carrier mounted on said frame for rotation in respect thereto about a substantially horizontal axis, a plurality of article holders mounted in an annular series on said carrier and arranged for both rotative and axial movement in respect thereto, a continuously rotating shaft, Geneva driving means interposed between said shaft and said carrier for imparting intermittent rotative movement to said carrier in response to the continuous rotation of said shaft, gearing interposed between said shaft and said article holders for rotating said holders continuously by power derived from said shaft irrespective of the movement and dwells in the rotation of the carrier, and cam means operating in response to the rotation of said carrier for moving said holders axially in respect thereto.

10. Apparatus for coating selected portions of articles with a film-forming liquid, comprising a container for a pool of film-forming liquid, a rotatable carrier, a plurality of article holders thereon, means for rotating said holders in respect to said carrier at different speeds, means for periodically raising and lowering said holders and the articles held therein relative to the surface of the pool of film-forming liquid for dipping selected portions of the articles therein,

means for adjusting the position of said container to predetermine the portions of the articles to be coated during the dipping thereof, and means for periodically arresting the movement of said rotatable carrier.

11. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame movably mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders mounted on said carrier, means for rotating said carrier, and means for tilting said frame to dip the portions of the articles in said holders to be coated successively into the pool of film-forming liquid in said container.

12. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame movably mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders mounted on and for rotation with respect to said carrier, means for rotating said carrier, means for rotating said article holders with respect to said carrier, and means for tilting said frame to dip the portions of the articles in said holders to be coated successively into the pool of film-forming liquid in said container.

13. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders mounted on said carrier, means for rotating said carrier, means for automatically tilting said frame to dip the portions of articles in said holders to be coated successively into the pool of film-forming liquid in said container, and means for manually adjusting the range of tilting movement of said frame.

14. Apparatus for applying film coatings to selected positions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame movably mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders each rotatably mounted on said carrier, and a common operating means for tilting said frame, rotating said carrier with respect to said frame, and rotating said article holders with respect to said carrier to effect the successive dipping of selected portions of the articles in said holders in the pool of film-forming liquid in said container.

15. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders mounted on said carrier, means for intermittently rotating said carrier, and means for tilting said frame to dip the selected portions of the articles in said holders to be coated successively into the pool of film-forming liquid in said container, the last two means being so constructed and arranged that the articles will be dipped by the tilting of said frame into the pool of film-forming liquid during the dwell periods in the rotation of said carrier.

16. Apparatus for applying film coatings to selected portions of articles, comprising a frame, a container for a pool of a film-forming liquid mounted adjacent to said frame, a carrier rotatably mounted on said frame, a plurality of article holders each rotatably mounted on said carrier, means for rotating said carrier, and means for rotating said article holders to rotate articles held therein about their longitudinal axes alternately at two different speeds, the last named means being so constructed and arranged that each article is rotated at one speed during one portion of the dipping of the selected portion thereof in the pool of film-forming liquid in said container and at its other speed during another portion of such dipping.

17. Apparatus for applying film coatings to selected portions of articles, comprising a frame, a container for a pool of a film-forming liquid mounted adjacent to said frame, a carrier rotatably mounted on said frame, a plurality of article holders each rotatably mounted on said carrier, means for rotating said carrier, a driving shaft arranged for continuous rotation, a driven rotatable member arranged to rotate said article holders, and gearing including a complementary pair of mutilated gears arranged continuously to impart rotative movement from said driving shaft to said driven member for imparting continuous rotation alternately at two different speeds to said article holders.

18. Apparatus for applying film coatings to selected portions of articles, comprising a frame, a container for a pool of a film-forming liquid mounted adjacent to said frame, a carrier rotatably mounted on said frame, a plurality of article holders each rotatably mounted on said carrier, a continuous rotating shaft journaled in said frame, Geneva driving means interposed between said shaft and said carrier for imparting intermittent rotation to said carrier, and other driving means including a complementary pair of mutilated gears for imparting continuous rotation alternately at two different speeds to said article holders from said continuously rotating shaft, the last named means being constructed and arranged to change the speed of rotation of the article holders and articles held therein in synchronism with the movement and dwells of the rotation of said carrier.

19. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tiltable frame movably mounted on said support, a carrier rotatably mounted on said frame, a plurality of article holders each mounted for rotation on said carrier, means for rotating said carrier, cam means responsive to the rotation of said carrier for tilting said frame to dip articles in said holders successively into the pool of film-forming liquid in said container, and means operating in synchronized time relation to the rotation of said carrier for imparting continuous rotation alternately at two different speeds to said article holders, the last named means being so constructed and arranged as to rotate the articles at a relatively high speed during the immersion of the portions thereof to be coated in the pool of film-forming liquid in said container and to rotate the articles at a relatively low speed during the withdrawal thereof from the pool.

20. Apparatus for applying film coatings to selected portions of articles, comprising a support, a container for a pool of a film-forming liquid mounted adjacent to said support, a tilting frame pivotally mounted on said support on

a horizontal axis, a carrier rotatably mounted on said frame, a plurality of article holders each mounted for rotation on and with respect to said carrier, a continuously rotating shaft, means for rotating said shaft, Geneva gearing interposed between said shaft and said carrier for imparting intermittent rotation to said carrier, a train of gearing interposed between said shaft and said article holders including a pair of complementary mutilated gears constructed and arranged to impart continuous rotation alternately at two different speeds from said continuously rotating shaft to said article holders, cam means responsive to the rotation of said carrier for tilting said frame to dip articles in said article holders successively ino the pool of film-forming liquid in said container, and pump means associated with said container and arranged to direct a submerged stream of the liquid against said selected portions of the articles dipped thereinto with such force and direction as to scavenge air bubbles on and open to the surface of the said portions of the articles, the article rotating and carrier rotating means above recited being so constructed and arranged that each article will be rotated relatively rapidly about its longitudinal axis as the portions thereof to be coated are immersed in the pool of film-forming liquid, the articles will be rotated at a relatively slower speed during the withdrawal of the immersed portions thereof from the film-forming liquid, the carrier will be at a dwell position during the immersion of each article in the pool, and each article will be rotated again at a relatively rapid speed subsequent to a draining period and for the purpose of distributing film-forming liquid uniformly about the coated portions thereof.

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