May 23, 1939. W. H. KOPITKE 2,159,091

APPARATUS FOR DIPPING OBJECTS

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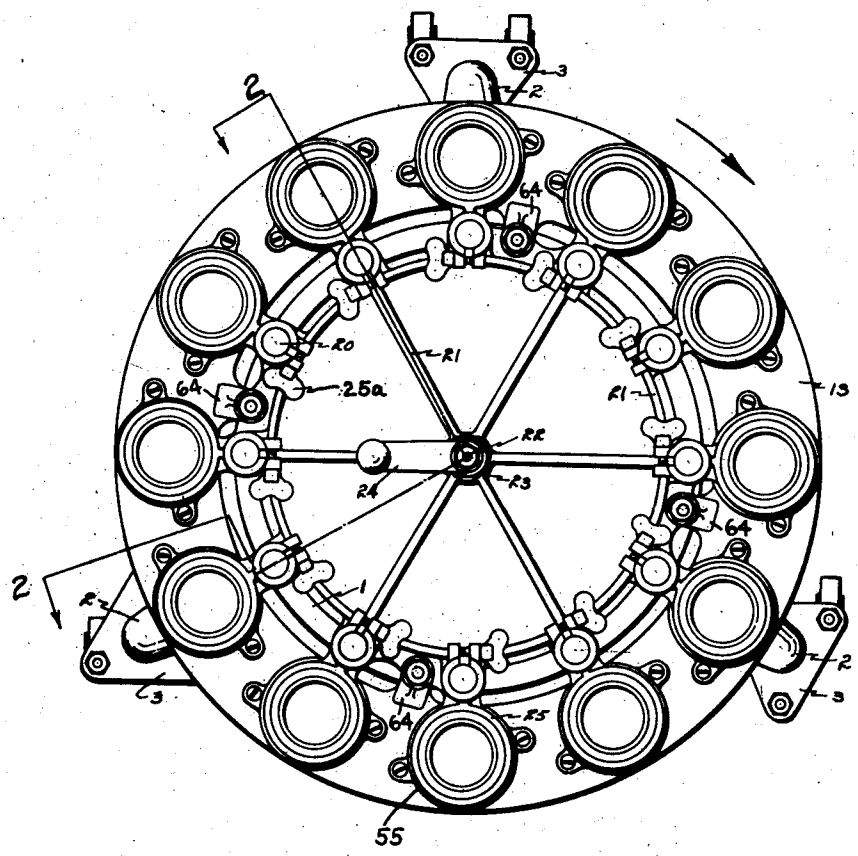


FIG. 1

FIG. 9.

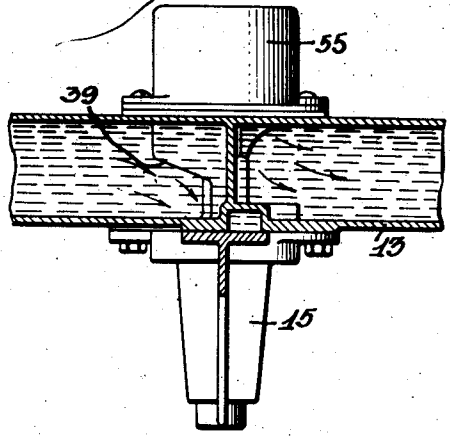
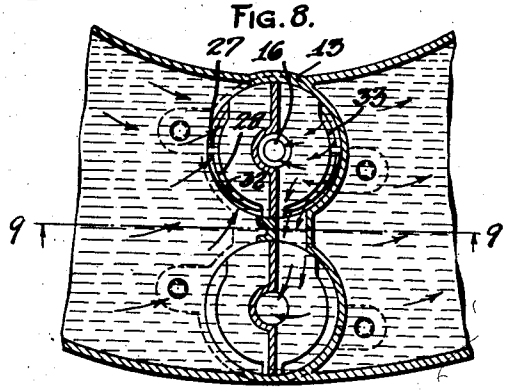


FIG. 8.



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APPARATUS FOR DIPPING OBJECTS

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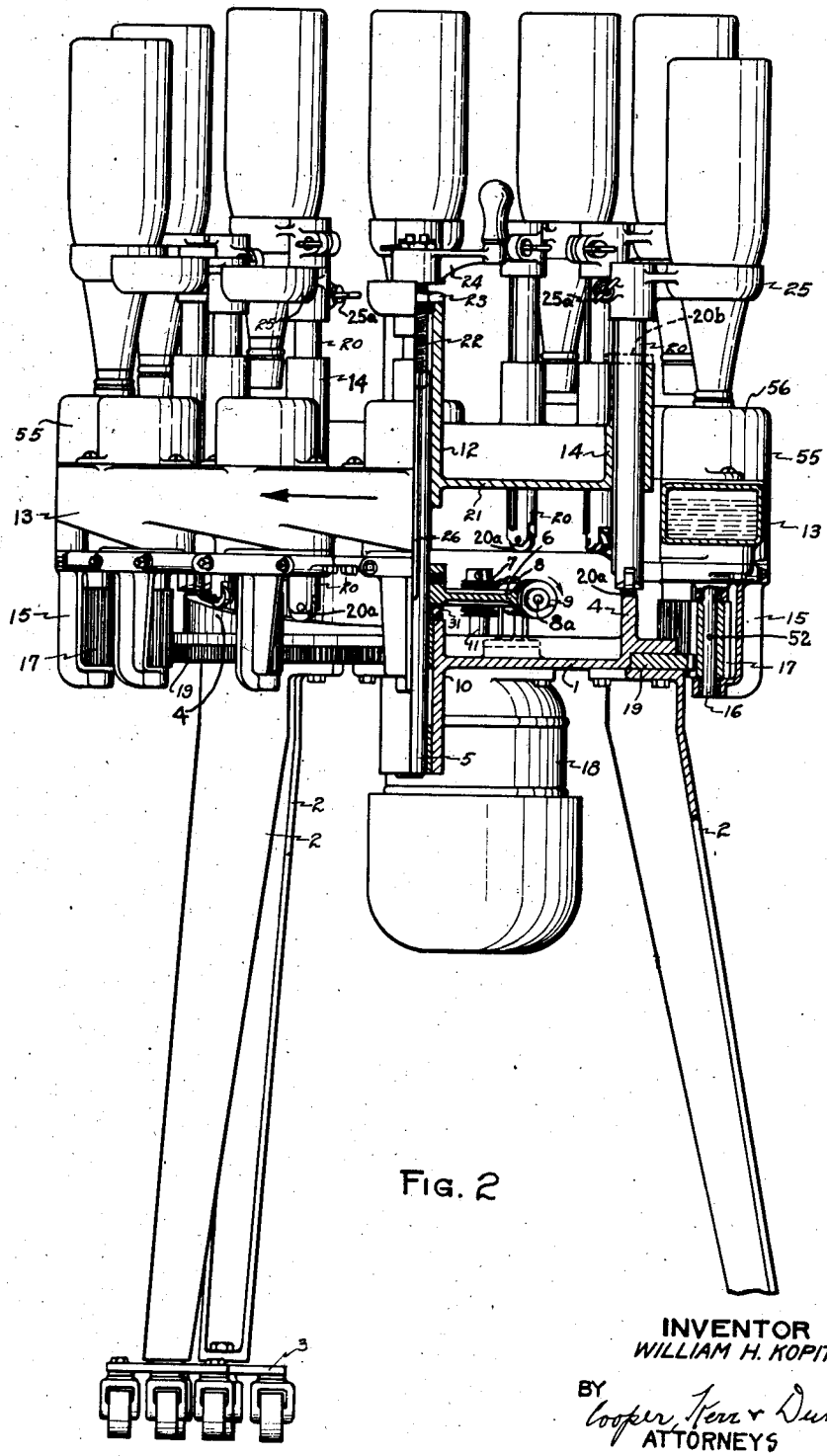


FIG. 2

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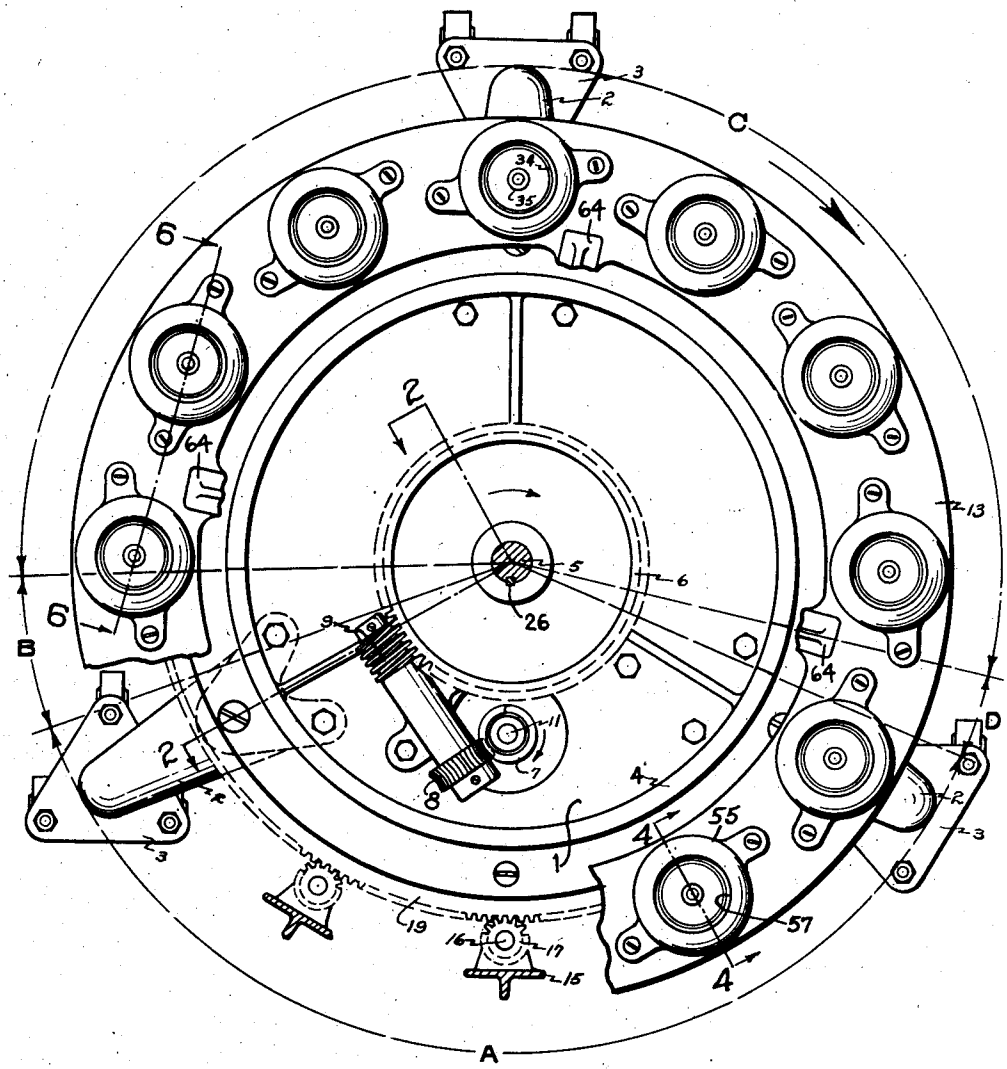


Fig. 3

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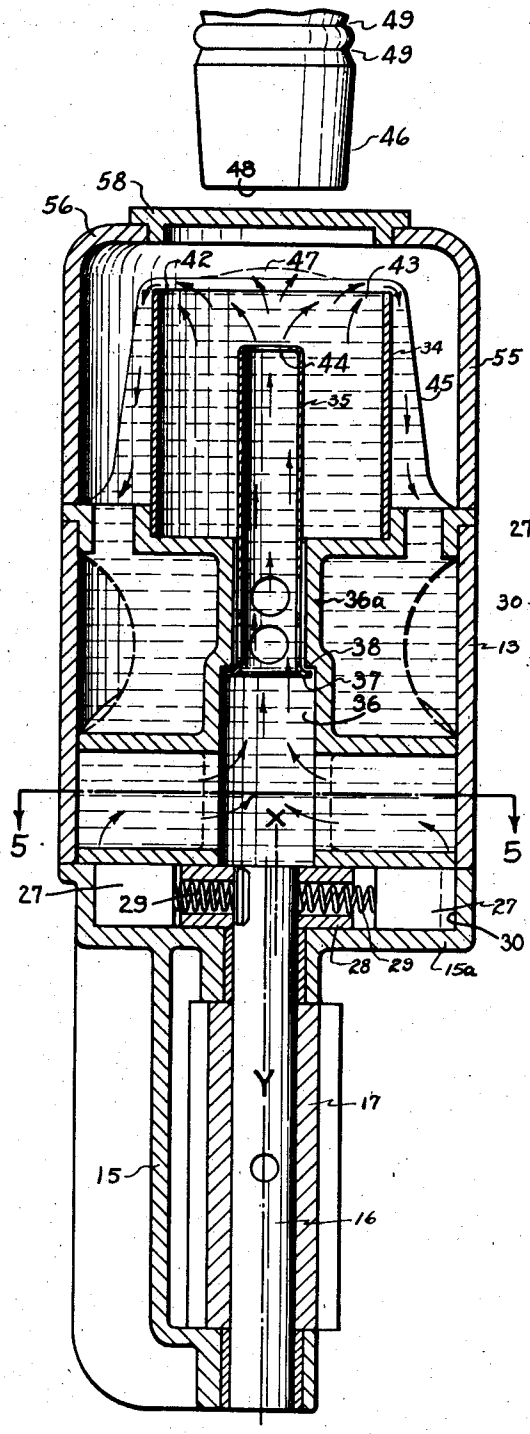


FIG. 4

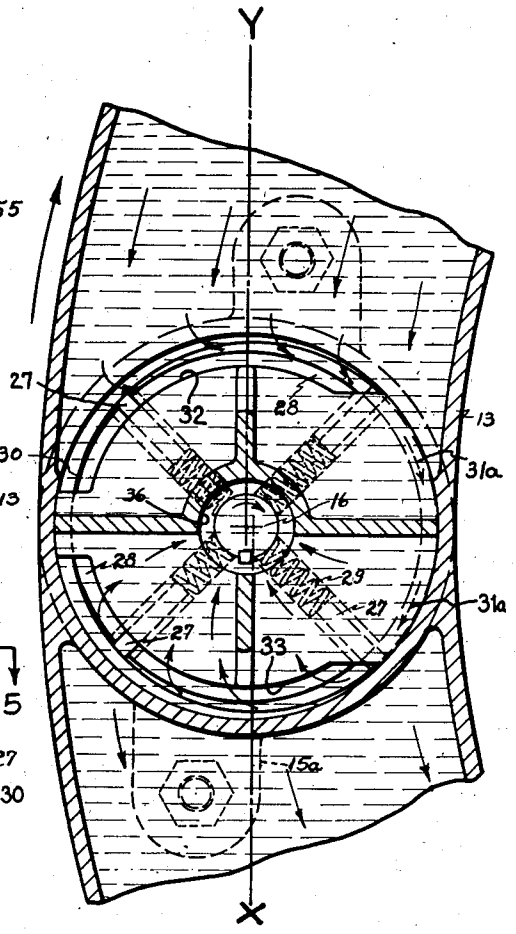


FIG. 5

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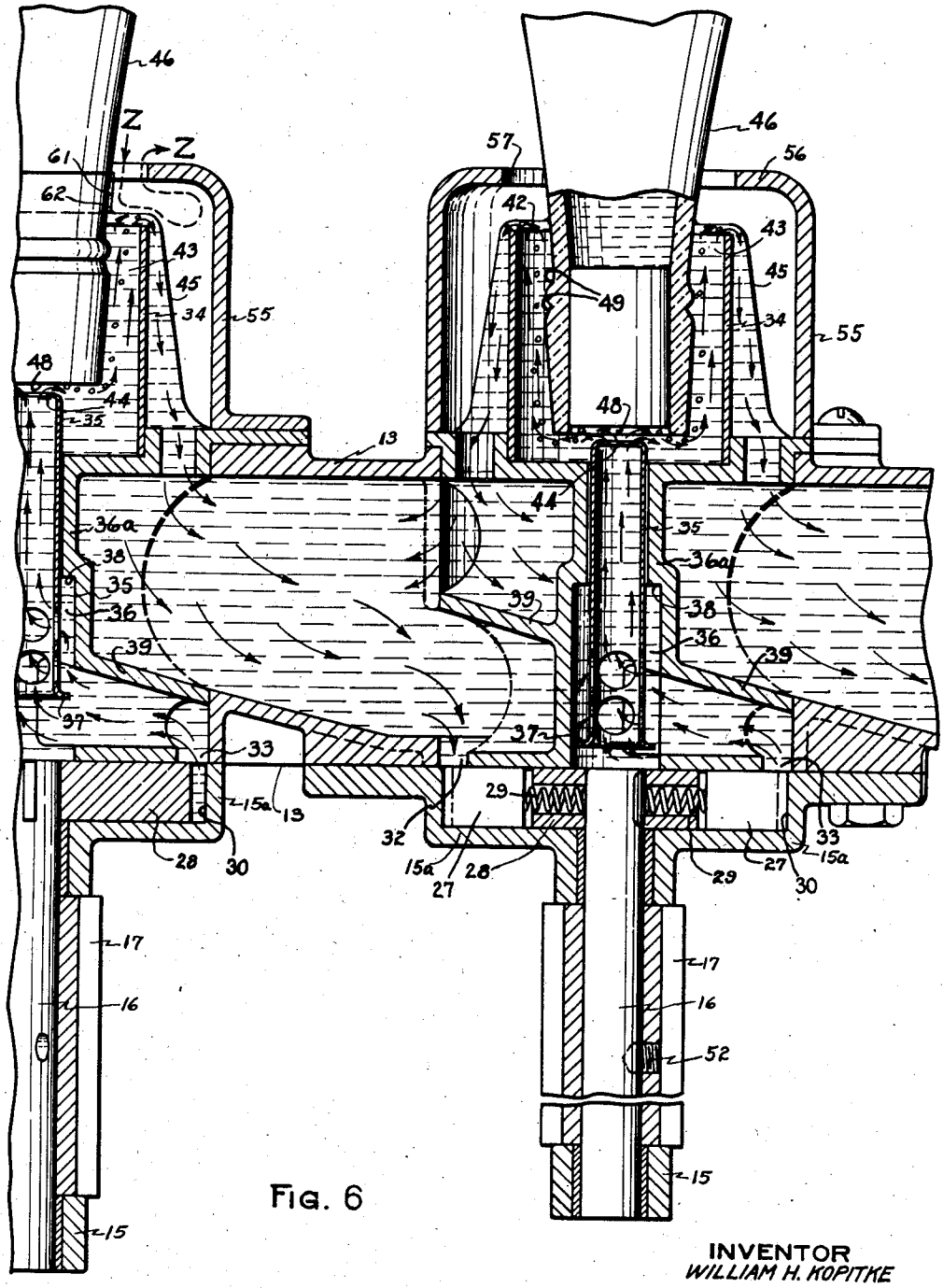


Fig. 6

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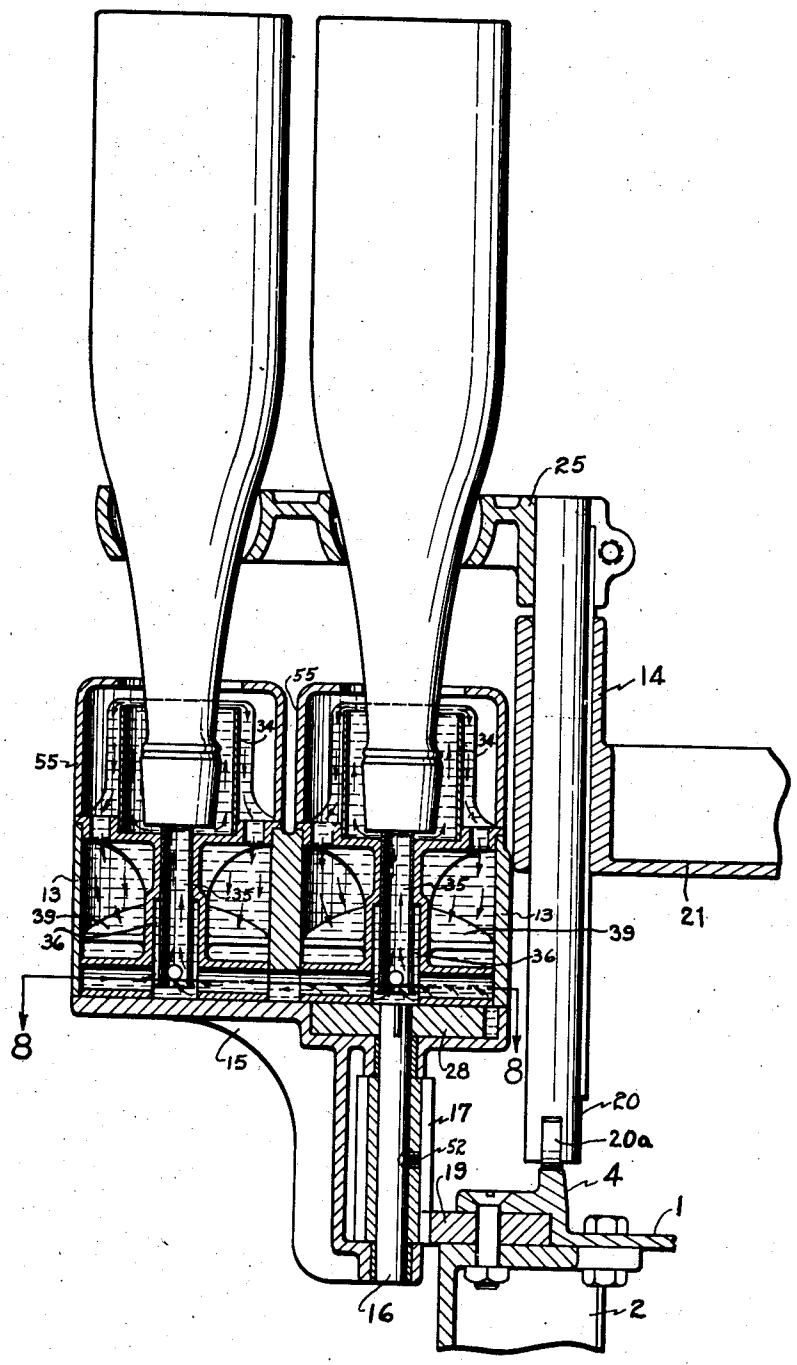


FIG. 7

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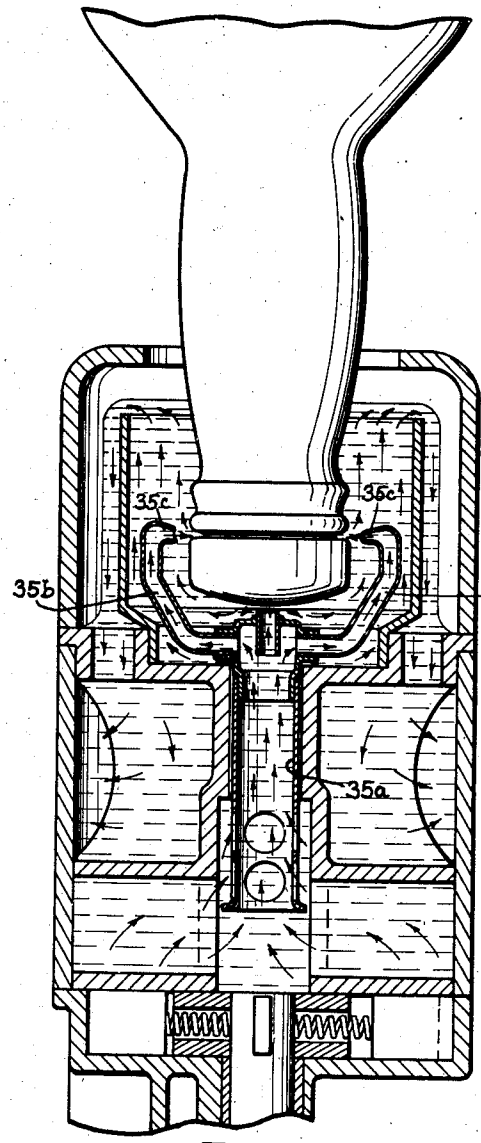


FIG. 10.

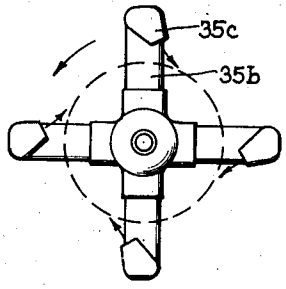


FIG. 11.

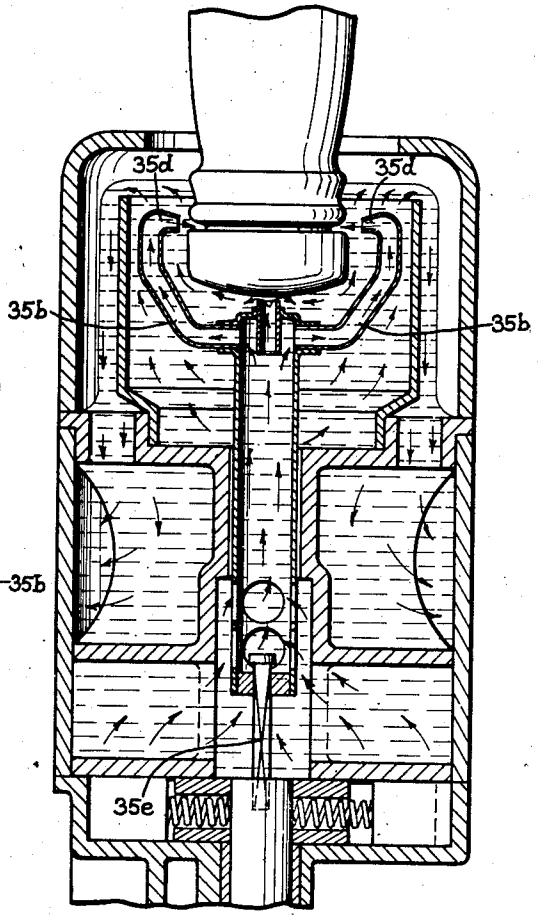


FIG. 12.

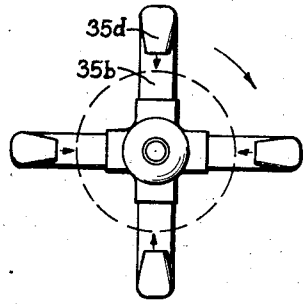


FIG. 13.

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APPARATUS FOR DIPPING OBJECTS

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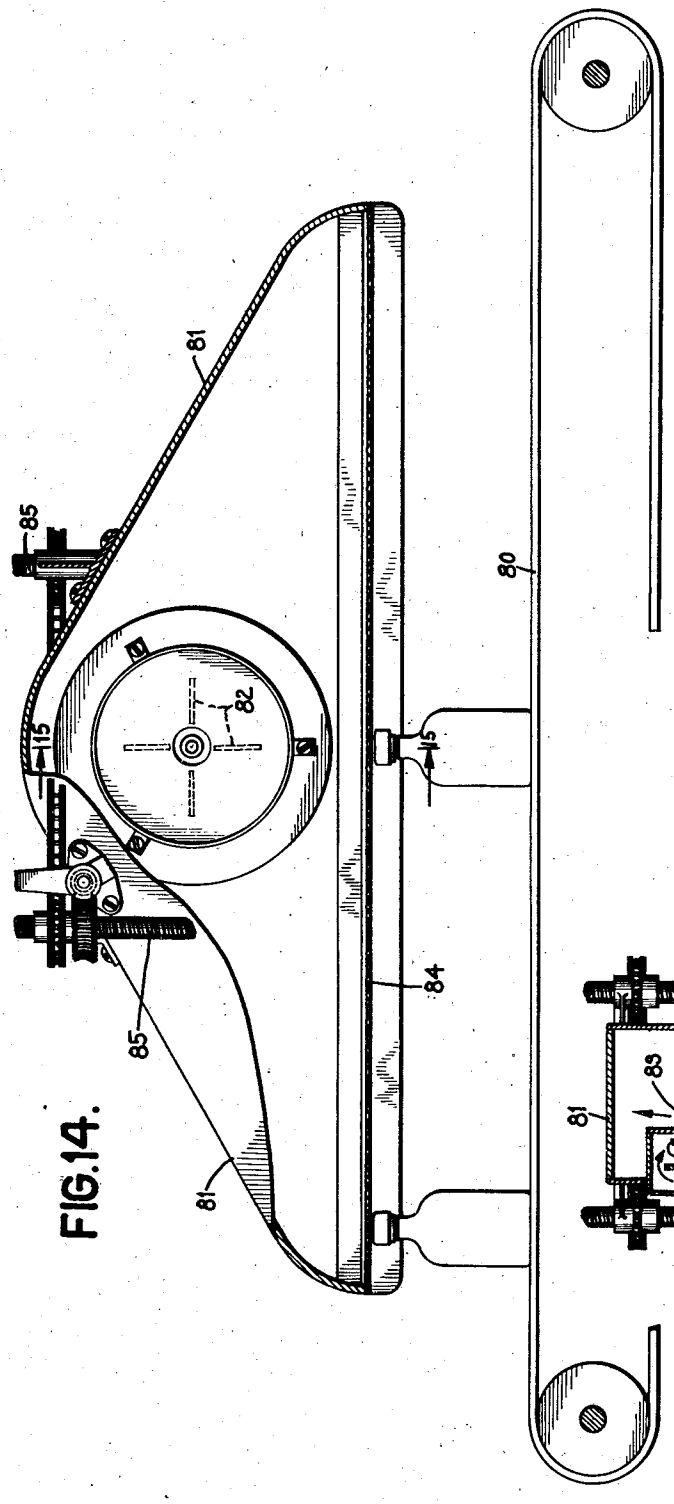


FIG.14.

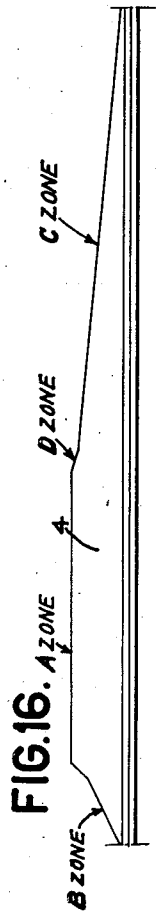


FIG.16.



FIG.17.

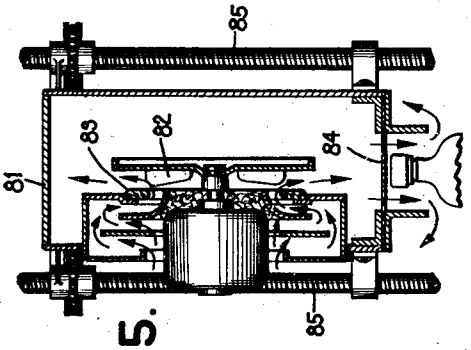


FIG.15.

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Patented May 23, 1939 2,159,091

UNITED STATES PATENT OFFICE

2,159,091

APPARATUS FOR DIPPING OBJECTS

William H. Kopitke, Toledo, Ohio, assignor, by mesne assignments, to Plax Corporation, Hartford, Conn., a corporation of Delaware

Application February 29, 1936, Serial No. 66,399

26 Claims. (Cl. 91—46)

This invention relates to improvements in dipping machines and to an apparatus for coating various objects and forming solid films thereon from various organic plastics or synthetically produced derivatives of organic nature. Such materials may be suitably compounded with plasticizers, resins, coloring materials as dyes, pigments, metallic powders and/or other suitable materials to give the films produced desired colors and other characteristics.

In the application of film coatings to the necks of bottles to form film seals, hood caps, exterior decorative jackets or tamper proof coverings on the outer side of the primary covering, closure, seal-cap or screw cap, at the mouth of a bottle, serious drawbacks or difficulties have always proved a barrier to successful commercial use or exploitation of dipping machines or devices for the application of coatings or films to various closures and necks of bottles or containers. One of the drawbacks has been the long time required to drain off the surplus material after dipping when the dipped objects are withdrawn from the coating solution. Another difficulty has been that in order to overcome the time loss during draining, the solution used had to be compounded so as to have high specific gravity and quick drying characteristics which caused wrinkles to be formed in the skin, film or membrane resulting after the coating had dried on the object dipped and coated.

Another difficulty of a more serious nature has been the inclusion of air in the form of bubbles within or beneath the film coating and uneven surfaces or body thickness of the applied coating, all of which results in more or less unsightly or useless coatings as the bubbles generally will cause the presence of holes in the skin, membrane or film, during or after drying.

Present day needs call for speed, accuracy and economy in the art of producing a seal on a bottle neck by a coating operation and also call for the production of seals which are uniformly alike in appearance and in protective properties, all of which requisites are provided by the present invention, which is in the nature of an improvement to provide industrial users with dipping machines of simple nature capable of more perfectly carrying out certain of the processes and steps heretofore originally disclosed in the application of Enoch T. Ferngren, Serial No. 632,689, which has been refiled October 15, 1936, Serial No. 105,718 and which discloses the moving of the dipping solution and the object to be dipped in the same direction during coating and draining and in the application of Enoch T. Ferngren, Serial No. 38,839, which has been refiled as a joint continuation of this and another application of Ferngren as application, Serial No. 131,736, filed March 18, 1937, and which discloses the use of an upwardly moving stream current of coating material.

Among the objects of the present invention are the improvements in apparatus whereby the coating solution may be handled in such a way as to provide constant circulation thereof, with the coating solution during its advancement directed into a series of submerged spouting streams and where each stream is forcefully directed as a concentrated jet or stream current against the cork, or cap closure at the mouth of a bottle, thereby to utilize the flowing solution itself as a surface cleaning and scavenging agent to the general end that no dust, air pockets or crevices will remain in the final film coating.

Another object is to provide a high velocity stream jet current of and within the solution into which an object is being dipped with the delivery release point of such stream very close to the surface level of a fountain pool of the solution at the point of entrance thereinto of the object or bottle neck which is to be coated, and also to cause such a current to be so directed and controlled that its point of stream release under pressure from a conduit or nozzle will accompany the body of the object which is being dipped downwardly or upwardly, so that, for instance, no matter how deeply an object or a bottle neck is submerged into a pool of coating material, the delivery point and force impact of the washing and cleaning current will always be effective.

Another object is to provide a series of overflow fountain pools to which a coating solution is constantly supplied and advanced in a stream current from a main supply tank, all the pools, the main supply tank, the stream currents and the objects dipped being movable as a unit in the same direction, or as specifically as herein arranged, around a common center while all of the dipping, cleaning and coating operations are constantly carried out on a series of bottles, which are also successively inserted and removed from the machine.

One of the most essential things in a dipping or coating machine is to provide a construction which will allow sufficient time for draining off the surplus coating material which is picked up by and tends to cling to the surface of the dipped article or object as the same is withdrawn from the solution. The loss of time for proper draining is avoided in the present dipping device because of the progressive draining of a series of bottle necks during the same time. For instance, if fifty seconds are consumed for obtaining proper draining during a sixty second period required for moving twelve bottles and twelve dipping fountains three hundred and sixty degrees around a common center, and a coated bottle is removed and a new one inserted every five sec-

onds, each bottle delivered will have had the benefit of a fifty second period for draining, although the output of a dipped or coated bottle will be one every five seconds or ten in fifty seconds.

The number of bottles inserted, neck dipped, drained and removed during a definite period of time, with the same definite draining period, may be greatly increased without reducing the draining time for each bottle by providing a greater number of dipping units, that is, additional holders for the bottles and additional dipping pool fountains, by which expedient any desired number of bottle necks can be dipped-capped during a given time and thus this type of machine can be readily organized to keep step in performance with any existing production speed for filling, corking, capping or labeling successive bottles.

Another object of the invention is to hold the bottle in a vertical position and bring the corked or capped end thereof into contact with the overflow surface of a fountain pool of a coating solution, the central portion of which pool comprises a confined, upwardly, forcibly advanced cylindrical stream of less diameter than the cork in the mouth of the bottle or container. The purpose of this arrangement or relationship is twofold, first to enable straight vertical dipping into a coating solution of any object which may have an inverted cavity in its forward end and to avoid such expedients as tilting the bottle and rotating the bottle neck at an angle in order to avoid bubble effects, and second, positively to insure the ejection of all air from any such cavity during the dipping into the solution or pool, so that an unblemished coating may be had on the dipped object and the air positively dislodged and also positively moved away from the bottle neck or object by means of the strong stream current and the subsequent overflow of the pool.

It is further an object, from the angle of economy, when coating the necks of bottles, to provide a dipping machine which is so organized as to speed of output that one operator or attendant may be able to keep step or pace therewith in a constant manner in placing bottles therein and removing exteriorly sealed, capped bottles therefrom.

It is further an object, where a great output in dip-capped bottles is required, to provide a machine of a type to which the bottles may be supplied quickly and easily by hand or by any desired automatic loading and unloading equipment (not shown). To this end the bottle holders associated with the machine are easily accessible for the loading and unloading of bottles, the bottles being supported by the holders in neck-down position.

A further object of the invention is to provide a device wherein the draining of surplus coating material from the coated surface of a dipped article is facilitated. To this end there is preferably provided a device wherein there is a substantially radial flow of the coating material away from a dipped object, at least during the withdrawal thereof from the dipping pool. One theory which may account for the desired draining characteristics using apparatus of this kind is that the surface tension of the liquid coating material tends to pull surplus coating material downwardly over the adhering coating material from the dipped portion of an object during the withdrawal thereof from the pool, and that this action is assisted by the radial flow of the coating liquid away from the dipped object during such withdrawal. The effect is somewhat as if the object dipped had been covered with an inner adherent coating and an outer non-adherent coating, which latter part of the coating is being drawn downwardly away from the adherent coating.

The practical result of this is to cause a complete and uniform draining accompanied by an almost instant drying of the adherent film coating progressively immediately after it emerges from the pool and as it is freed of the superimposed non-adherent coating substance, so that the coated surface will be substantially dry to the touch at the time the coated object is taken out of the holder of the machine, with the exception that the top end coating on such an object as a corked or capped bottle will still retain some solvent moisture and be soft for a time, which, however, is so slight that the bottle can be taken out of the machine and handled without any danger of dripping of the coating material from its top end or of flow over the bead wall at the mouth of the bottle or over the edge of the cap body thereon.

Another new and useful embodiment in coating devices set forth herein is the provision of a small confining dipping tank or fountain cup which is close fitting relative to the objects which are to be dipped therein, so that a coating material which is driven upwardly into the cup by a positive impeller will induce considerable friction between the coating material and the surfaces of the object dipped, which friction effect is useful in displacing and carrying away air from the recesses or grooves in the side portions of a dipped object. Furthermore, a narrow space around the object results in a greater speed of upward flow of the coating liquid which is effective for quickly removing air bubbles and for securing good coverage at all points.

Further objects of the present invention will be hereinafter set forth in the accompanying specification and claims and shown in the drawings, which show by way of illustration a preferred embodiment of my invention and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention employing the same or equivalent principles may be used and structural changes made as desired by those skilled in the art without departing from the present invention and within the spirit of the appended claims.

In the drawings:

Figure 1 is a plan view of a bottle dipping machine having twelve bottle holders;

Fig. 2 is a view in side elevation and partly in section of the dipping machine, the section being taken on the line 2—2 of Figs. 1 and 3;

Fig. 3 is a plan view of the machine with the bottle holders and parts of the dipping tank removed to show the driving and operating mechanisms, some parts being broken away and shown in horizontal section;

Fig. 4 is a detail view in vertical section taken on the line 4—4 of Fig. 3, showing the interior relations of the parts in the dipping fountain prior to the entrance of a bottle neck therein;

Fig. 5 is a fragmentary view in horizontal section taken on the line 5—5 of Fig. 4 showing the rotor pump and the movements of the fluent coating material;

Fig. 6 is a fragmentary view in vertical section taken on the line 6—6 of Fig. 3, showing the position of the stream ejecting nozzle during the coating period;

Fig. 7 is a fragmentary view in vertical section showing a double bottle holder and a multiple fountain dipping arrangement;

Fig. 8 is a fragmentary view in horizontal section taken on line 8—8 of Fig. 7, showing the movement of the coating material from a tank basin toward the dipping fountains;

Fig. 9 is a fragmentary view partly in vertical section taken on the line 9—9 of Fig. 8 and partly in elevation, illustrating the flow of coating material toward the pump and away from the dipping fountain;

Fig. 10 is a fragmentary view in vertical section similar to Fig. 4, but showing a modified form of floating nozzle;

Fig. 11 is a detailed view substantially in plan of the nozzle of Fig. 10;

Figs. 12 and 13 are views similar to Figs. 10 and 11 respectively showing another modified form of nozzle and a positive rotating drive therefor;

Fig. 14 is a view partly in elevation and partly in vertical section of a conveying and drying arrangement;

Fig. 15 is a view in transverse vertical section taken on the line 15—15 of Fig. 14; and

Figs. 16 and 17 show diagrammatically developments of two alternatively usable main cams for controlling the submerging and emerging of the bottle necks.

The construction illustrated in the drawings provides coordinated means for progressively, simultaneously and in consecutive order applying uniform film coatings from a series of pools to the heads and necks of a series of bottles, thereby to provide exterior film seals around the necks and the primary closures, which sealing films prevent inward penetration by air or water, and also prevent evaporation or leaking of liquid contents from bottles in the case of imperfect corks or caps.

The work of applying these film seals in the form of a liquid coating which will dry after it has been applied is performed automatically as the bottles are successively placed in a series of single or multiple bottle holders, which are successively actuated to lower the corked or capped ends of the bottles into a pool of film forming solution and thereafter successively to lift the bottles while the bottles and the pools of the film forming materials conjointly are carried around a common center, the mechanism being progressive in operation so that upon each revolution it completes the applications of exterior seals on a predetermined series of bottle necks. As the bottles approach the starting point they are successively taken out and replaced by others.

Broadly the machine comprises a substantially circular rotatable tank section provided with a plurality of receptacles for coating material and affording a plurality of dipping pools. Means are provided for circulating liquid from the tank to a receptacle and then back to the tank to another receptacle and so on in a continuous path around the tank. Rotatable with the tank section is a bottle carrier section provided with a plurality of bottle carriers so arranged to support each bottle substantially concentrically over a dipping pool. Means are also provided successively to lower the bottles from their raised or loading positions to lower positions in which the bottle necks are submerged in the coating medium in the dipping pools. After a period of maintained submergence and during further movement of the carriers, the bottles are gradually elevated so that the necks are gradually withdrawn from the dipping pools. If desired, the withdrawing movement may be varied in rate, preferably slow, terminating in a rather rapid upward final movement after the bottle neck is clear of the coating medium.

With bottles provided with screw caps, push caps or the like, provision may be made for causing the neck to be submerged to such an extent as to allow the coating material to run in over the peripheral terminating edge of the cap and to permit the air to escape. Thereafter an upward movement may be effected to dislodge air and fill the voids around the caps with coating material. Thereafter there may be a re-submerging movement followed by final withdrawal. Accordingly, provision is made for affording one or several additional withdrawing and re-submerging movements prior to final withdrawal to dislodge any bubbles on the neck, cap or closure.

Provision is also made for directing coating medium in a stream substantially endwise with respect to an overlying bottle neck and closure in order to scavenge out air and dust particles in proximity to the closure. Provision is also made to utilize the radial flow of the coating medium outwardly away from the bottle neck for improving the characteristics of the final coating. In particular, the action of the flowing radial stream of coating medium tends to draw down excess coating material from the coated neck as such neck is being withdrawn from the coating medium and thereby to avoid an excess of coating medium upon the bottle neck.

Referring to Fig. 2, the machine comprises a fixed base plate 1 mounted on legs 2, the legs being provided with casters 3 to permit moving the machine from place to place. The base plate 1 has a hub extension 10 which provides a bearing for a vertical shaft 5 (see also Fig. 3). Shaft 5 has fixedly secured thereto a worm wheel 6, which is driven from a motor 18 by the train of driving connections including a motor shaft 11, worm gears 7 and 8, a shaft 8a, and a worm 9 (see Fig. 3). A slide key 26 on the shaft 5 cooperates with a hub 12 of a frame 21 and rotates such frame while permitting vertical adjustment of said frame with respect to the shaft 5. The frame 21 also is provided wtih a series of hubs 14 affording support for bottle carrier lifter rods 20. A supply tank basin 13, which is in the form of an annular body and which holds the coating solution (see Figs. 1 and 2), is rigidly connected to the structure 21 by means of the lugs or ears 64 (Fig. 1), which are bolted or otherwise secured to the rotating frame 21.

When the shaft 5 is rotated by the motor drive previously described, the structure 21, the tank 13 and the hubs 14 rotate as a unit. Fixed to the base 1 of the machine in any desired manner is a circular cam 4 (Fig. 2). Cooperating with this cam are follower rollers 20a disposed on the lower ends of the lifter rods 20. The upper ends of the lifter rods receive bottle carriers 25 which carriers may be clamped to the lifter rods by wing nuts 25a. The lifter rods 20 are preferably keyed so as to be prevented from rotating in the supporting hubs 14.

By the foregoing arrangement the rotational movement of the frame 21 will provide progressive and successive lifting and lowering movements of the bottle carriers 25 as the followers 20a travel along the cam track.

Various desired configurations can be provided for the cam track. The configuration of this

track may be such that the bottle carriers travel for a period in extreme elevated position. Thereafter the carriers descend quite rapidly to effect submersion of the bottle necks in the dipping pools. Thereafter may be a gradual elevation of the carrier gradually to withdraw the bottle necks from the coating medium. The final withdrawing movement may be a rapid one to bring the carriers back to their extreme upper position (Fig. 16).

Another embodiment of the cam track is shown in Fig. 17 at 4a and may comprise an intermediate hump portion to elevate the carriers after complete submersion of the bottle necks has been effected and then lower the carriers again to resubmerge the bottle necks in the coating medium. Following the second submersion, the carriers may be gradually elevated gradually to withdraw the bottle necks.

With special caps, submerging, removing and re-submerging operations may be varied to suit different shapes and relationships of caps or closures and necks.

Inasmuch as the rotating parts are comparatively heavy, a suitable thrust bearing 31 may be provided disposed in the relation shown in Fig. 2 below the worm wheel 6 and cooperating with the upper end of the hub 10.

In order that the depth of submersion of bottle necks into the dipping pools may be varied and in order to provide for variation in types of bottles which the machine is adapted to handle, particularly with regard to the lengths of the necks of such bottles, provision is made for providing a vertical adjustment for the rotating parts with respect to the fixed base 1. This adjustment is secured by means of a crank 24 (Fig. 2), which has fixedly secured thereto a screw 22, the lower end of this screw rotating in a socket in the upper part of shaft 5. A nut 23 is securely screwed into the top of hub 12 and has internal threads to receive the screw 22. Accordingly, by turning the crank 24, the hub 12 may be raised or lowered with respect to the shaft 5. Another adjustment can be secured by unclamping a wing nut 25a and raising or lowering the bottle carrier with respect to the lifter rod 20 and then re-clamping it in a desired position.

By the foregoing adjustments bottles having different length necks can be handled and dipped by the machine and the depth of immersion in the coating solution may be varied. It may be explained that the lifter rods 20 are slidable in the hubs 14 and thus will not be affected by any vertical adjustment of other parts including the hubs 14. Accordingly, when the structure 21, which carries the tank 13, is adjusted upwardly with respect to the shaft 5, the bottle necks will be immersed deeper into the coating solution and when the adjustment of parts 21 and 13 is downward with respect to shaft 5, the top level of the dipping solution will be a greater distance away from the bottle necks at their uppermost positions, which will result in a lesser depth of submersion and a less length of coating on the bottle necks.

Tank construction, dipping pool, receptacles, etc.

In cooperation with the tank 13 are a series of pool receptacles 34 (Fig. 6). Provision is made for supplying the coating medium from each one to the next of these dipping receptacles entirely around the circular series thereof. The means for effecting such supply of coating medium will now be described.

Referring to Fig. 2, a ring gear 19 is fixedly secured to the base 1. Cooperating with this ring gear are a series of elongated pinions 17 which are fixedly secured to pump shafts 16 by set screws 52 (Fig. 6). The pump shafts 16 are rotatably held in the bracket extensions 15 which are secured to the tank structure 13 at equally spaced points therearound. The pinions 17 are in maintained engagement with the ring gear 19 and being elongated, will permit relative vertical adjustment between the pinions and the ring gear 19 with maintained engagement of the pinions. Disposed at the upper ends of the shafts 16 are pump rotors 28 (see Fig. 6) in pump housings 15a, which are provided at the upper end of the brackets 15. Each rotor is provided with a series of radially disposed and movable partition blades 27, which are mounted in radial slots in the pump rotor and forced outward to bear against the inner wall 30 of the housing 15a by springs 29 which are mounted in the rotor. The housing in which each pump rotor and pump blades operate is eccentric to or located off-center with respect to the location of the pump shaft as indicated by the broken line X—Y (Figs. 4 and 5). Referring to Fig. 5, the intersection of the line Y with the radial line is the center of the pump rotor; while the intersection of the line X with the same radial line is the center of the pump casing surface 30. This eccentricity causes the rotor 28 to meet the wall 30 on one side of the cylindrical housing 15a and to leave a gap or space at the opposite sides. As the rotor revolves in the direction of the arrows 31a (Fig. 5), the coating material in the basin tank 13 is drawn in from the intake port 32 of the pump (Fig. 6) and forced to the outgoing passage 33 and then upwardly to a well 36. From this well the coating material flows into and through a floating nozzle 35, which loosely fits in the wall portion 36a of the well 36, then into the fountain cup 34 and then over the upper edge of the fountain cup, the coating material thereafter returning to the basin tank 13 and to the intake 32 of another pump.

Supplies of coating material may be introduced into the basin tank through any one or more of the fountain cups 34. As shown in Fig. 6, a partition wall 39 is provided to direct returned coating material received from one cup receptacle to the intake point 32 of the pump for the succeeding coating receptacle.

By the foregoing pumping devices the coating material is withdrawn from the supply tank, then forced into a cup, flowing radially outward over the edge of the cup; and the material is thereafter returned to the tank, which is inwardly partitioned so that the returned material from one coating receptacle flows to the intake point of the pumping means for the succeeding coating receptacle.

The floating nozzle 35, which is loosely received by the walls 36a, is relatively light and formed with thin walls of non-corrosive material. It is so shaped and proportioned that it is adapted to be carried upwardly and projected into the cup fountain 34 under the influence of the flow velocity of the coating material. Such upward projection of the floating nozzle is limited by a flange 37, which is adapted to cooperate with a shoulder 38 in well 36. Fig. 4 shows the nozzle 35 in its extreme upper position. The floating nozzle is adapted to deliver a stream of the coating material at a submerged point below the surface level 42 of the pool of coating material in the cup 34. The upper opening 44 of the nozzle

35 is less in diameter than the nozzle, so that the stream velocity at the point of delivery from the nozzle will be increased and cause the formation of an upwardly moving well defined cylindrical stream body 47 within the otherwise normally slowing, upwardly moving sub-strata of the pool of coating material. By this arrangement the flow at the surface of the pool is substantially radially outward. Radial flow is accentuated by the gravity pull of the overflowed material 45. The coating material is relatively viscous in nature.

When an object, such as a corked bottle neck 46 with a cavity in its lowermost end is submerged into the pool 43, the nozzle 35 will immediately recede from the position shown in Fig. 4 to substantially the position shown at the right in Fig. 6. During submersion of a bottle neck the pressure of the coating fluid against the side and bottom surfaces of the bottle neck is greatly increased due to the sudden displacement of the fluid from the lower to the upper portion of the fountain cup 34. Such pressure is supplemented by the strong impact pressure of the stream emerging from the opening 44 of the nozzle. This effect provides for the dislodging of air from the cavity 48 at the inverted top end of the bottle neck. The dislodgement of air from grooves 49 around the side wall of the bottle neck is effected by proper speed of submergence.

During withdrawal of a bottle neck the floating nozzle follows up, so to speak, the receding closure or end of the neck and so at all times directs the scavenging stream of coating material into the receptacle at a point which is in maintained proximity to the receding closure. In this way scavenging operations at the end of the neck are maintained during the withdrawal phase.

It will be understood that the machine may be constructed with fountains or pool receptacles 34 which are deeper than that shown and that with deeper receptacles for longer seals or for providing for complete or almost complete submergence of an article corresponding changes in the cam track of cam 4 should be made.

As explained before, if desired, provision may be made for withdrawing a bottle neck after it is initially submerged and re-submerging it before final gradual withdrawal. Such multiple submerging operation also facilitates the removal of remaining bubbles.

The cam track may also be of such shape as to afford the desired variations in rate of submergence, time of submergence and emergence for screw caps, crimp caps, pushed on caps or the like. Figs. 16 and 17 show diagrammatically developments of several suitable cam tracks for different operations and closures. The developed cam track 4 of Fig. 16 is suitable for bottle necks provided with corks and that of Fig. 17, numbered 4a, is suitable for dipping operations with screw-cap bottles and the like. By proper design of the cam track additional material may be applied or removed where and when needed so that bubbles, etc., may be dislodged. Also modifications in the submerging action may be effected by limiting the descent of the bottle carriers. This may be effected in various ways as by providing washers on the rods 20, see 20b (Fig. 2). Or if desired, the lower hub 14 may be upwardly extended or the carrier hub may be downwardly extended.

As explained before the partitioning means of the tank afford means for constantly directing the circulation of the coating material from fountain to fountain. This is desirable to prevent settling out of the pigments and/or other suspended material from the coating solution.

Referring further to Fig. 6, each fountain 34 is provided with an opening 57 which is slightly larger in diameter than the diameter of the bottle neck 46. Removable covers 58 (Fig. 4) may be provided for closing the openings 57 for keeping air out of the apparatus when the machine is idle or not in use thereby to prevent evaporation or loss of low boiling point solvents.

In order to obviate fire hazards attendant upon the use of certain plastic material coating compositions that contain nitro-cellulose, it is advantageous to use cellulose acetate for the dipping solutions to be used for film coatings or films. The following is a typical formula and method for compounding a cellulose acetate coating solution to be used in the dipping machine. For a clear transparent coating the following formula may be compounded in any desired quantity and will give satisfactory films for such objects as bottle necks and the like.

	Pounds
Cellulose acetate	1
Phenol-formaldehyde resin soluble in acetone and compatible with other constituents	¼
Ortho and para toluene ethyl sulphonamid	¼
Acetone	6 to 8

In the foregoing formula the resin is utilized for building up the body of the film to increase its solid material content and cohesiveness and for obtaining better lustre and ready release of solvents during the draining period. The quantity of resin may be increased up to ¾ lb. or more for heavier or thicker film coatings. Ortho and para toluene ethyl sulphonamid serves as a plasticizer, provides a glossy surface in the film coatings and aids in quick drying. The quantity of the plasticizer may be increased up to ½ lb. or more for obtaining gloss with certain pigments. In place of the above plasticizer, another plasticizer, methyl phthalyl ethyl glycolate may be used in the same or a slightly larger quantity.

To the foregoing may be added solid materials such as pigments, dyes, metallic powders, pearl essence and the like if opaque, colored or lustrous effects are desired. Other solvents may also be added for use as thinners.

If it is desired that the film coating produced on a bottle neck or other article should be made more resistant to moisture or softer, or tougher and extensible or impressible in the sense of being capable of taking good impressions under hot or cold pressing with dies, a material such as methyl ortho benzoyl benzoate is added to the above formula in the proportion of ½ to 3 ozs. by weight.

A coating solution made according to the above formula will provide a coating composition with proper wetting, cohesiveness, adhering, elasticity, surface tension and viscosity characteristics for coating bottle necks and the like and will provide for the speeding up of the drying of the coating on the neck as the adhering coating is exposed to the atmosphere. The viscosity may be somewhat varied depending upon the amount of acetone or other solvent or diluent which is added. A suitable viscosity has been found to be from ten to twenty seconds according to the standard A. S. M. E. falling ball scale or test. Preferably dipping operations are best effected at normal room temperatures at about 70 degrees Fahrenheit. The material should be of such character that a final coating is provided which dries rapidly and which does not include an undesired excess of coating

material. Suitable coating materials may be produced from numerous materials and in compounding, the compounder should take into consideration the practical results obtained from the use of resins, plasticizers, solvents and softeners and should take into account the relation of such ingredients to the performances of the coating solution during the coating of objects such as bottle necks as herein described.

Preferably all metal parts of the machine that come into contact with the coating solution should be of chromium or nickel or alloys thereof or such alloy as Monel metal (60% nickel and 40% copper). Alternatively surface treatments or compositions can be used to avoid rust, corrosion, and chemical action with resulting chemical changes in the coating material.

The tank and fountains herein described can be used with many different kinds of coating material and solutions with or without cellulose acetates and other esters or ethers. If desired, heated solutions or materials can be used, in which case the tank **13** is preferably electrically heated. The temperatures of the tank under such conditions need not exceed 375 degrees Fahrenheit for most purposes where organic plastics are used. Many materials including waxes and resins are fluid at much lower temperatures, so that heating of the tank is much more feasible.

In beginning the operation of the machine the motor **18** is set into operation, which causes motion of the various movable parts. Assuming that the tank **13** is filled with the coating material, the pumps **28** will immediately send streams of the material through the nozzles **35** into the fountain cups **34**. After a few minutes all of the coating material will be in a thoroughly mixed condition ready for application as a film coating to the necks of a multiplicity of bottles. The bottles are now progressively loaded, neck foremost, into the holders **25** in proximity to the zone marked "A" in Fig. 3. As each holder with a bottle arrives at the zone marked "B", the rods **20**, which travel on the cam track **4**, are quickly lowered, thereby causing the bottle neck to be dipped the entire required distance into the pool **43** as shown at the right in Fig. 6. During this action there is a complete coverage of the bottle neck with the coating solution and there is also a displacement and release of air from cavities and grooves of the bottle neck. It will be noted that the nozzle **35** in Fig. 6 (at the right) is elevated to a point in which it is nearly in contact with the sealing cork in the bottle neck.

The machine operation proceeds and the bottle necks and fountain cups **34** are caused to move the entire distance over the C zone. This C zone represents the draining period, during which the neck of each bottle is gradually drawn upwardly through the surface stratum **42** of its related pool **43**. As a bottle is drawn upwardly the nozzle **35** tends to follow the bottle (note Fig. 6, at the left). Such following action of the nozzle tends to maintain a scavenging action to clear out air in and around the closure of the neck. During the withdrawal of a bottle through the upper stratum of the liquid in the coating pool, the radial flow of the liquid in the upper stratum of the pool improves the character of the coating and the performance and efficiency of operations generally. At the surface **42** of such pool, such radial stream flow to the overflow periphery of the pool (which is partially induced by the downward drag of the overflowing coating medium **45**) produces a very marked drag or draw down of the surface coating upon the emerging neck or upon the previously coated and withdrawn portion of the neck. In Fig. 6 at the left the final coating on the withdrawn portion of a bottle is shown at **61** and surplus coating is indicated at **62**. The effect of the radial stream flow action is to set up effects, which in cooperation with the cohesive surface characteristics of the top substratum coating material tend and act to prevent surplus material from being drawn up with a bottle neck as such bottle is being withdrawn. Such surplus and other possible surplus upon the previously withdrawn portion of the neck is drawn downwardly and thence outwardly in the radial streams. The ultimate result is that the coating **61** is relatively thin and free from surplus material. Such final coating **61** is of such character that it quickly loses its solvents in the outside air and becomes substantially non-fluent as it reaches a short distance above the surface of the coating pool. Even if it remains fluent, there is no excess upon the seal and it may be readily and rapidly dried.

As the bottles arrive at the zone marked "D" in Fig. 3, each bottle carrier is quickly elevated so that the bottle neck is quickly elevated above the surface **42** of the pool. When arriving at the zone marked "A", the lower end surface of the neck, stopper or cork is drained off and the bottle is ready for removal. The bottles are progressively removed from the holders **25** and new bottles continually inserted and operations repeated.

Certain advantageous features of the present invention may now be set forth. The delivering of the coating material as a stream under pressure directly from a floating nozzle **35** across a short space to impact with the surface of an object which is being submerged and with said object during withdrawal is an extremely effective method for removing air, dust, water and other foreign substances from the necks of bottles, so that a uniform film free from air bubbles and other defects may be provided. The provision of a small diameter cup for the dipping pool whereby much of the material comprising the pool is crowded out therefrom when the object or article is submerged therein is advantageous and produces useful results since by such construction the force and friction of the upwardly delivered stream of coating material becomes effective not only at the lower end of the object, but also along the side surfaces thereof as the object is submerged in the pool, whereby air and other foreign substances may be removed which would hinder the making of a satisfactory film cap.

Third, the provision of radial overflow of the coating material in comparatively large volume is effective in reducing to a minimum the quantity of material going into each coating and it also reduces the subsequent drying time of the coating remaining upon the neck. A large volume of radial overflow is provided for by using a fountain cup of relatively small diameter and by the provision of proper pumping means.

According to the present invention the rate of withdrawal of a bottle neck is relatively slow as compared to the speed of the radially flowing coating medium in the surface stratum of each dipping pool. A typical withdrawal rate is one-sixteenth of an inch per second and the stream rate is many times this rate. With such correlation and with proper viscosity, the withdrawing forces are more powerful than the adhering resistance of excess quantities of coating material on the emerging bottle necks.

Fourth, the arrangement of mechanism where-

in each one of the holders **25** is in maintained alignment with an individual fountain **34** during the entire cycle of operation which occurs during one revolution provides an efficient construction so that the objects can be removed and inserted without loss of time and in continuous sequence. While manual removal and loading of the bottles is shown, automatic loading and removing means can be provided if desired. Such a construction provides for a very large output of dipped objects with a machine which is inexpensive in original cost and upkeep. The plan lends itself to expansion inasmuch as by doubling up the holders and fountains as shown in Figs. 7, 8 and 9, a greater output can be secured. As illustrative of possible output:—with a machine having carriers for twelve bottles and with a two inch coating on each bottle neck the output may be 780 per hour. Such output may be increased to 1560 per hour with double holders.

The purpose of the hooded cover or housing **55** is mainly to protect the coating solutions from the loss of solvents. Such housing **55** also minimizes loss of heat when heated coating solutions are used. The opening **57** in the wall portions **56** of the housing **55** is relatively larger than the neck of the bottle in order that outside air can enter and circulate above the heavy solvent vapors which blanket the surface **42** and surround the overflowing body **45**. As a bottle neck **46** is gradually being withdrawn upwardly through the housing **55** air flows in next to the bottle neck and air and solvent vapor flow out at the upper edge of the opening **57**. This constant movement of outside air downward along the coating **61**, promotes evaporation of solvents and is a factor in quick drying and in producing a condition of cohesiveness. The direction of inward air flow and outward flow of air and solvent vapors is indicated by the arrows Z in Fig. 6.

The cohesiveness of the top stratum of coating material in the pools is further enhanced by the removal of solvents from the top surface induced by the circulation of air adjacent the top surface. This increased cohesiveness acts as a deterrent against excessive pickup of material upon the object being withdrawn and cooperates with the outward radial stream flow of the top stratum away from the object and improves the characteristic of the final coating and the drying and setting of the material upon the necks so that sightly seals are provided.

Alternative forms of floating jet may also be used (see Figs. 10 to 13 inclusive). In some cases with certain bottles and with certain kinds of necks or with certain forms of closures on the necks, it may be desirable in addition to the structure above disclosed to provide a stream or streams of coating material impinging tangentially upon the side periphery of the neck and closure. Such modified floating nozzle may include one or more supplemental duct portion or portions terminating in a tangential direction or directions and if desired, disposed above the lowermost level reached by a submerged bottle. Such a nozzle arrangement will impart a whirling movement of the coating medium circumferentially around the side periphery of the submerged neck or closure and may be used with the previously described longitudinal stream nozzle arrangement. Such stream jets will promote efficient and complete covering. With such a nozzle the flow in the surface stratum of the pool will be in a spiral path with a radial component of flow toward the overflow periphery of the pool.

With the floating nozzle arrangement shown in Figs. 10 and 11, branch ducts **35***b* extend upward from the main floating nozzle **35***a* and direct streams of coating material tangentially upon the side of the bottle neck. Note the angular disposition of the nozzles **35***c* in Fig. 11. With this arrangement the floating nozzle will not only float up and down, but will rotate as the coating medium is pumped therethrough.

According to the arrangement shown in Fig. 12, the branch ducts **35***b* are provided as before but the terminating nozzle portions **35***d* extend directly radially inward. With this construction, provision is made for mechanically rotating the floating nozzle **35***a* with ducts **35***b* and nozzles **35***d* from the driven pump shaft. A suitable driving connection **35***e* is provided for this purpose.

The arrangements shown in Figs. 10 and 12 are particularly adapted to dislodge air from crevices or the gap between a cap and a shoulder upon the bottle neck. If the streams emerging from the nozzles **35***c* and **35***d* are directed slightly downwardly, air will be removed from pockets in the ordinary crimped or crown cap, thus insuring the applying of a smooth film in and over such pockets. The nozzle arrangement can be utilized in lieu of or in connection with the supplemental bump or projection upon the cam track **4***a* of Fig. 17 to facilitate the inflow of the coating material into crevices upon the bottle neck and to dislodge clinging air bubbles from such cracks and crevices.

In Fig. 16, one development of a cam track is shown with the zones marked thereon to correspond with Fig. 3 previously described.

In Fig. 17, an alternative form of cam track is disclosed with supplemental bump portions E to elevate and then lower a neck during the operation carried out upon the C zone. If desired, several of such supplemental elevating or lowering cam means may be provided as indicated by the dotted lines at E—1 and/or E—2. The shapes of such cam portions may be varied as desired. The cam portion E—2 is particularly useful in increasing the thickness and strength of the coating.

The method or process of the present invention may also include the step of effecting final drying and setting of the films by passing the dipped bottles after the removal from the carrier to a conveyor which carries the bottles through a housing through which heated air is circulated. In this way, final quick drying may be effected. Any suitable structure may be provided for this purpose.

In Figs. 14 and 15 a suitable combined conveyor and dryer is shown. In these figures, **80** represents the conveyor which may be of any suitable type. Over the conveyor there is a hood **81**. A fan **82** is provided in the side of the hood which draws in air and forces the air over an electric heater **83**. The heated air then flows downwardly and passes out of the hood in proximity to the necks of the bottles which are carried by the conveyor. The hood is somewhat restricted adjacent to the bottle necks as shown in the sectional view, Fig. 15. The hood may be provided with a screen **84** adjacent to the restricted portion, the openings through the screen being preferably varied along the length of the hood to equalize the outflow of heated air therefrom.

Adjustment means may be provided such as the screw threaded posts **85** to permit raising

and lowering of the hood with respect to the conveyor so that different heights of bottles may be accommodated.

The supplemental dryer is particularly useful and advantageous with metal screw caps and other caps which are good conductors of heat. With such caps upon evaporation of the solvent, chilling effects are induced which bring about contraction of the air in the threads and adjacent parts of the caps which contraction tends to draw and rupture the film at at least one point before the film is properly set. The heat of the air in the dryer and the radiation of heat from the walls of the dryer provide means to counteract the undesired effects caused by such chilling.

What I claim is:

1. A dipping machine comprising a series of travelling receptacles affording a series of individual pools containing coating medium into which bottle necks or like articles may be successively dipped, travelling article carrying means movable with the pools, means for causing relative approach of successive article carriers and successive individual associated pools to successively submerge the article necks of articles carried by the carriers therein and for thereafter causing opposite relative movement so that the article necks are successively gradually withdrawn from submergence in the pools and means including a tank and pumping means to circulate the coating medium successively and continuously from the tank to a pool back to the tank and then to another pool in succession.

2. The invention set forth in claim 1 in which means is provided for so directing the streams of circulating coating medium leaving the pools so that the emerging streams from the pools coact to avoid surplus in the applied coatings.

3. The invention set forth in claim 1 wherein means is provided for directing an entering stream of coating liquid into each pool in such direction as impinge upon a neck of a submerged article and scavenge entrapped air and the like therefrom whereby complete coating of the neck is effected.

4. The invention set forth in claim 1 wherein a floating shiftable nozzle jet is provided for each pool adapted to receive incoming coating liquid and to maintain the stream of such liquid emerging from such jet in close proximity to an article neck during submergence and withdrawal of the article neck from the pool.

5. The invention set forth in claim 1 wherein each travelling receptacle comprises a cup overflowing at its top periphery and thereby providing for stream flow of the coating medium radially outward from a submerged article neck for the purpose described.

6. A dipping machine comprising a rotatable support, a series of coating material receptacles arranged about said support, means for circulating the coating material through each of said receptacles and to the next receptacle of said series, a series of rotatable article carriers which rotate in unison with said receptacles and which are individually endwise displaceable with respect to the said receptacles so that articles carried thereby may be successively submerged in the coating material, maintained therein and withdrawn therefrom, and means for controlling and timing the aforesaid endwise movements of the carriers for the purpose described.

7. The invention set forth in claim 6 wherein a common means is provided for simultaneously adjusting the relative position of the carriers in elevated and submerged positions with respect to the coating material receptacles for the purpose described.

8. A tank and receptacle structure for a continuous dipping machine, including an annular tank, a plurality of receptacles thereover receiving liquid from the tank and returning overflow liquid thereto, pumping means for pumping the liquid from the tank into the individual receptacles and partitioning means in the tank to successively direct the coating liquid from receptacle to receptacle in succession.

9. The invention set forth in claim 8 in which each receptacle is of annular form discharging overflow liquid at its upper periphery.

10. The invention set forth in claim 8 in which means comprising a floating nozzle is provided for supplying coating material substantially centrally and upwardly in each receptacle.

11. A machine for dip sealing closed bottle necks and the like, comprising tank means providing a plurality of receptacles and affording and defining a plurality of dipping pools, means for circulating a coating medium from pool to pool, means for continuously rotating the aforesaid tank means, bottle carrying means rotating in unison with the aforesaid tank means, means for causing a series of bottles or the like advanced by the carrier means to be caused to be partially submerged successively into the pools and to be thereafter withdrawn successively therefrom by imparting relative vertical movement between the pools and bottle carrier means in timed succession.

12. A dipping machine comprising a rotatable series of receptacles affording dipping pools through which coating material is circulated from pool to pool, a correlated series of rotatable article carriers, means for concurrently rotating the receptacles and article carriers and means for individually and in succession causing individual raising and individual lowering of the individual carriers to cause articles carried thereby to be dipped into the pools to be retained therein for a time and then to be gradually withdrawn therefrom at a rate coordinated to the effects induced by the coating medium at the surface of the pools to cause the retention at such surfaces of downwardly flowing coating material flowing off the articles, which material may be picked up by each article and which material comprises excess coating material.

13. The invention set forth in claim 12 in which a tank is provided with which the receptacles are associated and including means to circulate and direct the coating material from the tank to a receptacle, thence back to the tank and so on through other receptacles in succession.

14. The invention set forth in claim 12 in which a tank is provided with which the receptacles are associated and including means to circulate and direct the coating material from the tank to a receptacle, thence back to the tank and so on through the other receptacles in succession and including means to direct overflow material for return to the tank in a stream flow which radially overflows the periphery of each receptacle for the purpose described.

15. A machine for forming seals upon bottle necks provided with closures, wherein means is provided for dipping a bottle neck provided with a closure into a pool of seal-forming coating composition and for removing the neck therefrom and including in combination means effective during

the submersion of the bottle neck in the composition for directing a scavenging stream of the coating composition toward the neck, and means associated with said last mentioned means for directing the flow of said stream laterally towards the submerged neck in proximity to the terminating upper end of the closure for the purpose described.

16. Apparatus for coating articles by dipping, comprising a receptacle for a pool of a coating material, means for relatively moving said receptacle and an article to immerse a portion of the latter in the pool of the coating material in said receptacle and to withdraw it therefrom, means to cause an upwardly moving submerged current of the coating material in the pool in said receptacle directed at the portion of the article immersed in the pool to scavenge bubbles therefrom, and a vertically movable nozzle through which the upwardly moving current passes for directing such current onto a selected part of the article to be coated.

17. Apparatus according to claim 16 wherein the nozzle through which the current passes and by which it is directed onto a selected part of the article to be coated is freely floating in the coating material and is unattached to any part of said receptacle.

18. Apparatus according to claim 16 wherein said nozzle is freely floating in the coating material and unattached to adjacent parts of the receptacle, and wherein said nozzle has an entrance passage of greater cross sectional area than the exit therefrom so as to be moved upwardly by the flow velocity of the stream of coating material passing therethrough.

19. Apparatus according to claim 16 wherein said nozzle is so constructed and arranged as to move automatically during the immersion and withdrawal of an article into and from the pool so as to keep the point of emission of the stream of coating material flowing through and from the nozzle at a substantially constant distance from the adjacent portion of the article against which the stream flowing through said nozzle impinges.

20. Apparatus for forming seals on containers to which closures have previously been applied, comprising a receptacle for a pool of a coating material, means for relatively moving said receptacle and container to immerse a portion of the latter into the pool of coating material in said receptacle and to withdraw it therefrom, a supply chamber for coating material associated with said receptacle, means for pumping coating material from said supply chamber axially upwardly in said receptacle, means for directing an overflow from said receptacle back to said supply chamber, a nozzle member in said receptacle mounted for free vertical movement for directing the upwardly moving current in said receptacle at a selected portion of a container to be coated so as to scavenge bubbles of gas from the surface thereof, said nozzle member having constricted portions therein so arranged that the flow velocity of the current of coating material passing therethrough will tend to keep said nozzle member at a substantially constant distance below the adjacent part of a container immersed in the pool in said receptacle throughout the immersion and withdrawal of the container into and from the pool.

21. Apparatus for forming film coatings on articles having annular depressions or grooves therearound spaced from the ends thereof, comprising a receptacle for a pool of a coating material, means for relatively moving the receptacle and an article to immerse the end of the latter into the pool in said receptacle and to withdraw it therefrom, means to establish and maintain and upwardly moving submerged current of the coating material in said pool, a vertically movable nozzle member through which said current is caused to flow for directing a portion of it substantially axially onto the end of the article, and means associated with said nozzle member and including at least one branch pipe and a nozzle thereon for directing another portion of the submerged current of material in said pool laterally into the annular groove or depression around the article immersed in the pool to scavenge bubbles therefrom.

22. Apparatus according to claim 21 wherein said nozzle member is mounted in said receptacle for free vertical movement in response to the velocity effect of the flow current of coating material passing therethrough and is constructed and arranged so as to maintain the portion of the flow current of coating material passing from the branch of the nozzle in a lateral direction substantially level with an annular recess around the end of an article submerged in the pool during a substantial part at least of the immersion and withdrawal of such article into and from the pool.

23. Apparatus according to claim 21 wherein said nozzle member is provided with a plurality of lateral arms for directing submerged jets of the coating material passing therethrough in generally tangential directions so as to rotate said nozzle member and also to provide a swirling movement to the coating material in the pool.

24. Apparatus according to claim 21 wherein said nozzle member has a plurality of arms on the ends of which are laterally directed nozzles for projecting submerged streams of the coating material in directions each having at least a component radially inwardly from the point of emission of the stream, and wherein said nozzle member is so constructed and arranged as to be rotated during the operation of the apparatus.

25. Apparatus according to claim 21 wherein said nozzle member has a plurality of arms on the ends of which are laterally directed nozzles for projecting submerged streams of the coating material in directions each having at least a component radially inwardly from the point of emission thereof, and means for positively rotating said nozzle member effective throughout the vertical movement thereof as aforesaid.

26. Apparatus according to claim 21 wherein said nozzle member has a plurality of arms on the ends of which are laterally directed nozzles for projecting submerged streams of the coating material in directions each having at least a component radially inwardly from the point of emission thereof, and wherein the means for establishing and maintaining the flow current of the coating material in said pool comprises a rotary pump below and arranged substantially concentrically with said pool, and means connected to and driven from said pump to rotate said nozzle member while permitting the free vertical movement thereof.

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