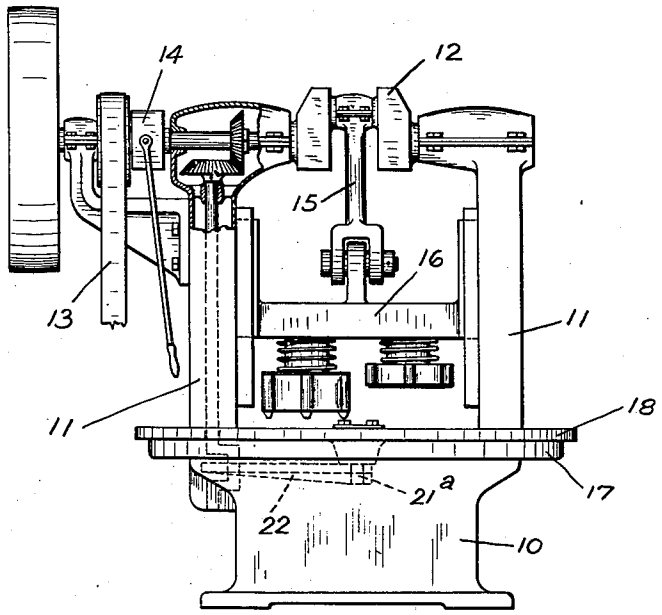
June 2, 1936. W. H. KNOWLES 2,042,851

FORMING MACHINE

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Fig. 1.



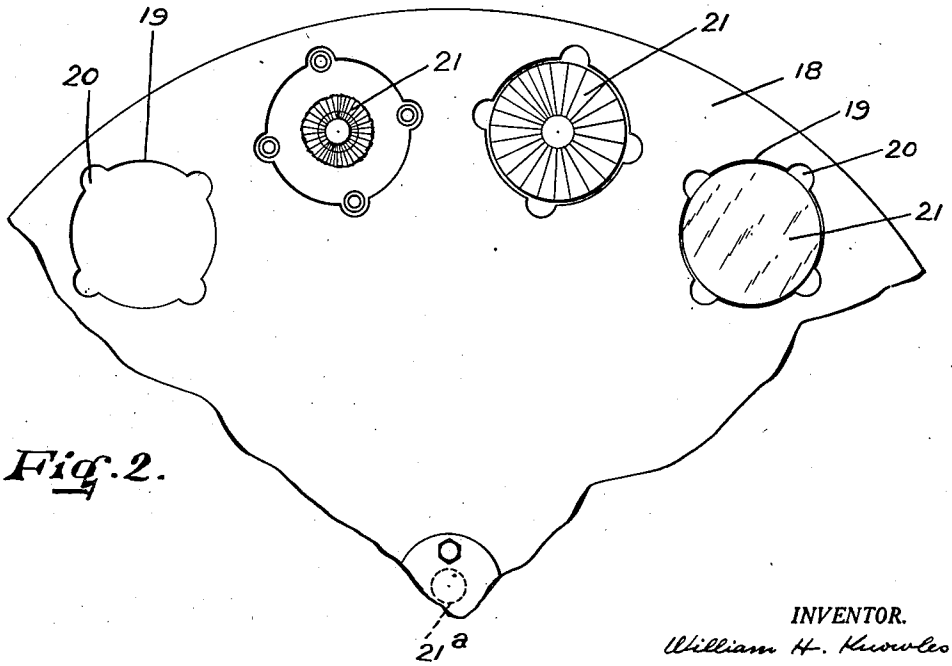


Fig. 2.

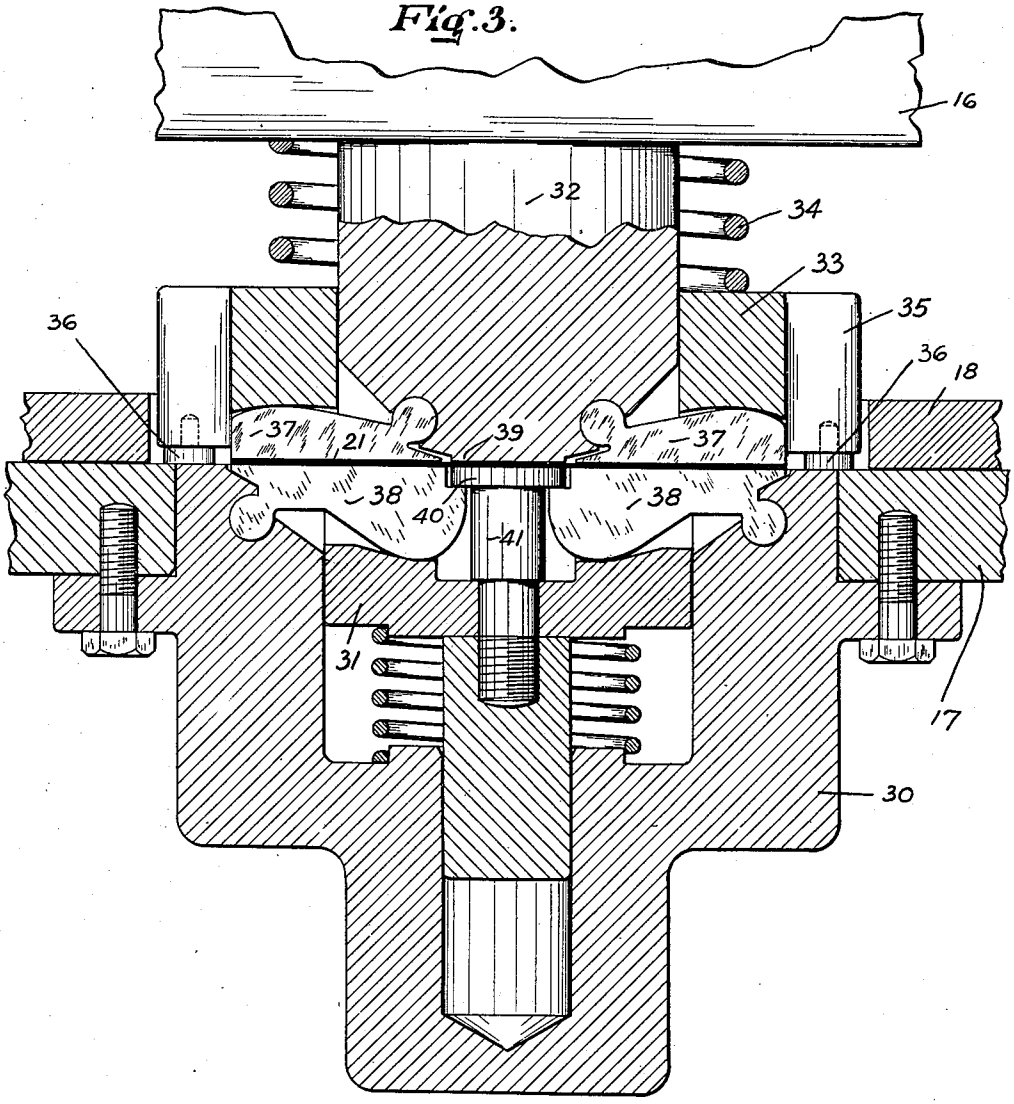
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FORMING MACHINE

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Fig. 3.



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FORMING MACHINE

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Fig. 5.

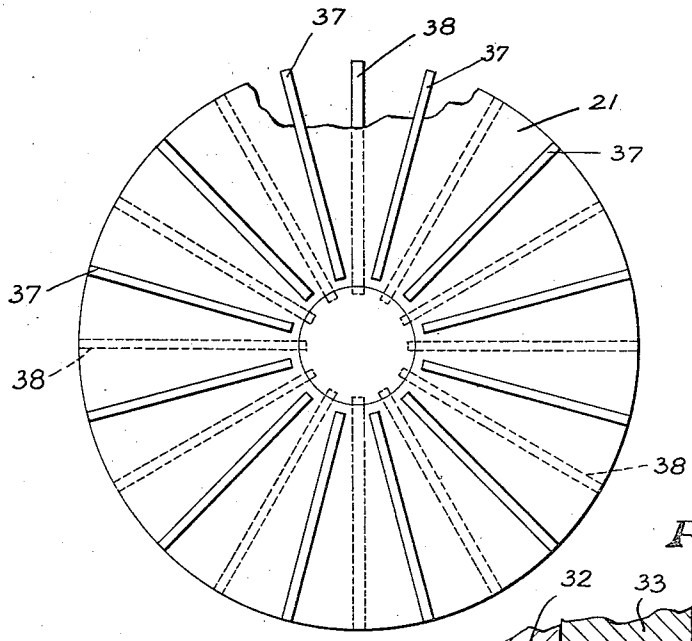


Fig. 4.

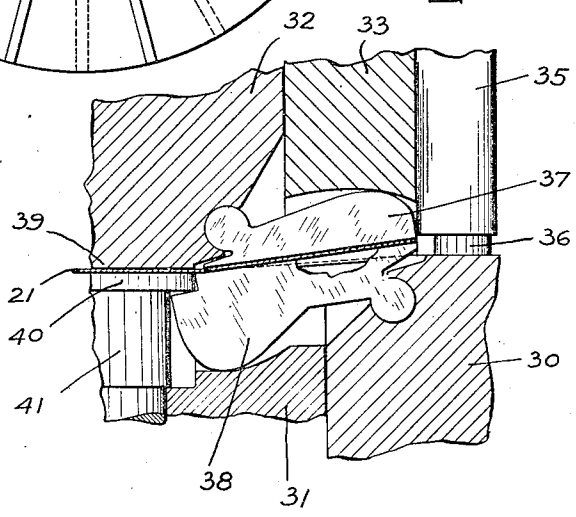
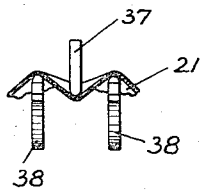


Fig. 6.



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FORMING MACHINE

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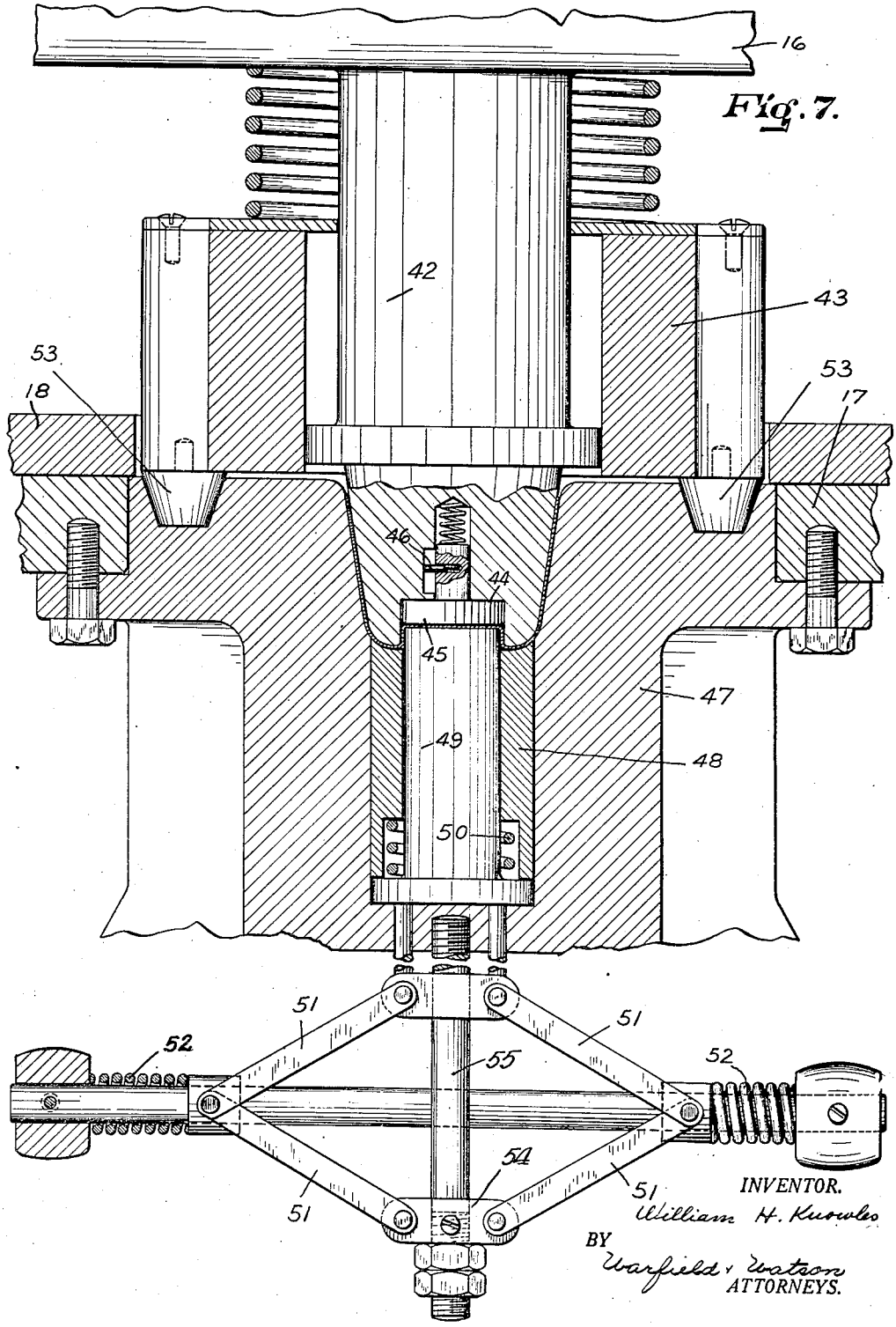


Fig. 7.

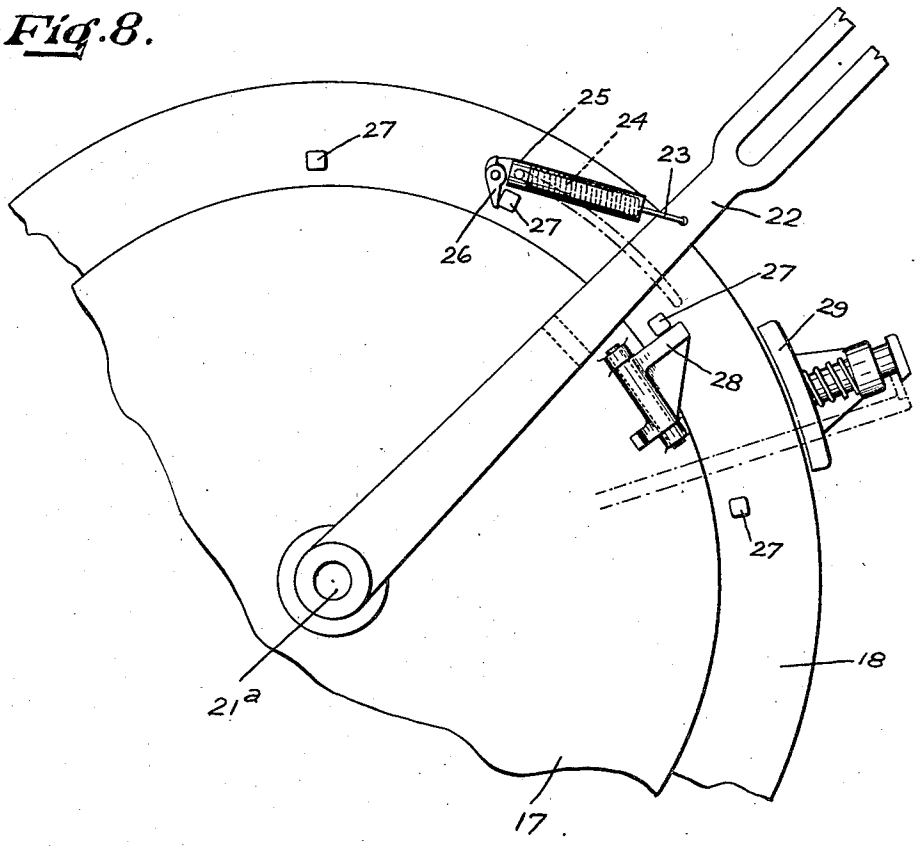
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FORMING MACHINE

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Fig. 8.



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Patented June 2, 1936 2,042,851

UNITED STATES PATENT OFFICE

2,042,851

FORMING MACHINE

William H. Knowles, Indianapolis, Ind., assignor, by mesne assignments, to General Cap Co. Inc., New York, N. Y., a corporation of Delaware

Application November 27, 1929, Serial No. 410,025

51 Claims. (Cl. 93—1)

This invention relates to a functionally and structurally improved forming machine capable of use in numerous different associations and of operating efficiently with various types of materials. However, the present invention is primarily directed to an apparatus and method by means of which caps of paper or similar material, and suitable for milk bottles or other receptacles, may be formed and which caps will efficiently serve to seal the pouring orifice of such a receptacle.

An object of the invention is that of providing a method and machine as afore outlined, and which machine will be capable of manufacturing sealing members having integral stopper portions, as well as sealing members of more conventional construction.

A further object is that of providing a forming method and machine which will cooperate efficiently and automatically with varying thicknesses of paper or other material to produce a large number of articles each perfect and similarly formed, this production being accomplished with a minimum of manual attendance and at relatively small cost.

A further object of the invention is that of providing a machine which comprises comparatively few parts, each individually rugged and simple in construction, these parts cooperating efficiently to achieve the desired results.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating one practical embodiment of the invention and in which:

Fig. 1 is a front elevation of a forming machine;

Fig. 2 is a fragmentary plan view of the turn table thereof;

Fig. 3 is a fragmentary sectional view of the parts which serve to provide for initial forming of the blank;

Fig. 4 is a fragmentary view of certain of these parts in a slightly different position from that illustrated in Fig. 3;

Figs. 5 and 6 are somewhat diagrammatic views of certain of these parts;

Fig. 7 is a sectional side view of the mechanism by means of which the final shaping or forming operation is achieved, and

Fig. 8 is a bottom plan view of the turn table.

As afore brought out, the apparatus of the present invention is to be employed primarily for the shaping of such articles as bottle seals and specifically seals or caps similar to that shown in U. S. Letters Patent #1,712,274, issued May 7, 1929, although it and the method may be advantageously employed in connection with the manufacture of paper—or similar material—caps, and which differ in construction from the cap illustrated in such patent.

Thus, in the foregoing views, the numeral 10 indicates the base supporting standards 11 which mount a crank shaft 12. This shaft may be operatively coupled to a drive 13 by means of any suitable form of clutch 14, and a pitman 15 is provided which serves to reciprocate a head 16 between the standards 11 as the shaft is rotated.

Supported upon the deck 17 of the base is a turn table 18 which is formed with a series of openings 19 having recesses 20, the purpose of which will be hereinafter brought out. The turn table may be shifted to progressively present openings at positions underlying the head 16. This shifting may be achieved in a number of different manners but is preferably accomplished by mechanism somewhat similar to that diagrammatically illustrated.

In this connection, it will be observed that the shaft 21a supporting the turn table also mounts an arm 22. This arm may carry a rod 23 cooperating with a spring 24 to potentialize the latter. This spring is conveniently housed within a casing 25, the end of which terminates in a pawl 26 for engagement sequentially with a series of ratchet teeth 27 extending from the underside of the turn table. These teeth may serve the further purpose of locking dogs, in that a latch member 28 cooperates therewith and is released by being engaged by the arm 22. Moreover, a brake 29 may cooperate with the periphery of the turn table in order to slow-down the movement thereof, the action of this brake being suitably and automatically controlled. The operation of these parts will be apparent in that the arm will primarily move with the pawl 26 in engagement with one of the ratchet teeth. Due to the fact that the latch 28 prevents movement of the turn table under these circumstances, the spring 24 will merely be potentialized until the latch is released whereupon the turn table will move and it will be appreciated that this movement will, incident to the tensioning of the spring, be such that the turn table will move forward with constantly accelerated speed to a degree at which its periphery is moving at a higher rate of speed than the movements of the arm 22, thus resulting in the ratchet tooth 27 moving away from the pawl 26. Thereupon the brake shoe 29 will be tripped to move into engagement with the periphery of the disk and to

slow down the parts to such an extent that there will be no sudden strain upon the latch 28 engaging the next tooth or stop element.

The mechanism just described may be varied in structural details in many particulars but it is preferred, according to the present invention, that the sequence of functions achieved thereby be adhered to. It will, moreover, be understood that mechanism is provided for delivering automatically one disk 21 to each of the turn table openings as well as removing the formed articles from such opening. This mechanism has not been illustrated in the present application nor has the mechanism for forming and preparing the blanks been herein illustrated.

In any event, the disks or blanks come to lie one within each of the turn table openings and incident to the movement of this turn table are brought primarily to a position underlying one side of the head 16. At this point and as has been particularly shown in Figs. 3 to 6, the deck 17 is formed with an opening which receives a member 30 carrying a spring pressed plate 31. The head at this point supports a plunger 32 slidably mounting a collar 33 which is pressed downwardly by a spring 34. This collar carries arms 35 terminating in spacer pins 36, the arms and pins extending into the recesses 20 and the outer ends of the pins contact with the deck 17 or adjacent portions to prevent a clamping engagement between certain of the parts hereinafter referred to. An annular series of radially extending arms 37 are rockingly secured to the plunger 32 and the member 30 likewise carries a similar series of arms 38 which lie within the well-portion of this member and the lower edges of which are engaged by the plate 31. At this time, it will be observed that the plunger 32 terminates in what might be termed a contact or clamping portion 39 for cooperation with a similar portion 40 forming a part of a pin 41 extending from the plate 31.

Now presuming that a disk 21 is in position within the turn table opening and that the latter is at a point underlying the head and in line with the plunger 32, it will be apparent primarily, that the disk is resting upon a series of arms or blades 38 and in such position it is maintained accurately centered incident to the fact that the opening of the turn table is just adequate to accommodate this. As the plunger 32 descends, the center of the disk will be clamped against movement between the parts 39 and 40, but no clamping contact will be effected between the series of blades 37—38 and the disk for the reason that the spacer pins or portions 36 will preclude this occurrence. These parts will also serve to prevent portions of the collar 33 from effecting a binding or clamping contact, conceding that the latter are extended to a point between the series of blades 37 where such an action might be possible. The individual blades of different series are arranged in staggered relationship and as shown for example in Fig. 6, the edges thereof may be rounded to prevent any possibility of tearing.

In conjunction with both Figs. 5 and 6, it will be appreciated that for the purpose of illustration, the spacing between the blades has been somewhat exaggerated. However, as the plunger continues its descent, the blades 37 will be forced downwardly and this movement will be resisted by the spring associated with the plate 31. Due to the fact that ample space is provided for the blades 38 to pivot and incident to the fact that as shown, the two different series of blades lie on different radii, these blades will come to extend between each other as shown in Figs. 4 and 6, consequently corrugating the disk 21 from the central portion towards the periphery thereof, and these corrugations will increase in depth in this direction. As afore brought out, due to the fact that clamping contact between the disk and the base is at all times avoided, a tearing of the disk will be precluded and thus an article will be formed which may have—according to the embodiment illustrated—a flat central portion and a corrugated body or skirt. As the plunger ascends, the parts will reestablish their initial position and in fact, under the action of the spring pressed plate, the lower series of blades will act to deliver the formed blank from within the well of the member 30.

The turn table will now be advanced in the manner afore described and accordingly the formed disk will come to underlie the head at a point at which the finishing operation is to be accomplished. At this point, the head carries a plunger 42 which is preferably encircled by a spring pressed collar 43. It is intended that at this station of the machine, a completely formed article is to be produced and if this article is to embody a stopper portion—as has been shown in the patent previously referred to—the machine, according to the present invention, should make provision for this forming operation preferably at this station.

With this in mind, the plunger is conveniently recessed as at 44 to accommodate a spring-pressed plate 45, displacement of which may be prevented by a stop-pin 46. The deck 17 mounts a sleeve 47 at this point which has a bore accommodating a tube 48 through which extends a rod or plunger 49. A spring 50 may be provided to normally maintain the upper edge of the tube substantially flush with respect to the plunger 49 and the deck 17. The plunger 49 is supported by two pairs of interconnected links 51, the links of each pair, at their point of juncture, being preferably acted upon by a resisting element such as springs 52.

It will be appreciated that the disk has had its diameter reduced at the corrugating station incident to the operation which has occurred at this point and thus, provision should be made to assure a centering of the disc with respect to the opening of the turn table accommodating the same. With this in mind, the collar 43 may carry center pins or members 53 which, as the plunger is projected downwardly, come to extend into the recesses 20 and gradually into the area of the opening 19 to a point where they finally engage the disk and center the same. Lost motion will now occur between the latter and the plunger 42 and the plate 45 will move into contact with the central portion of the blank and in conjunction with the plunger or rod 49 will retain the same against shifting. Continued movement will tend to force the central portion of the disk into the wall of the member 47, it being observed that clamping contact between the ring 43 and the disk is prevented by virtue of the centering elements 53 which also serve the function of spacing members. The resistance of the parts to such movement will be relatively great for the reason that the toggle provided by the pairs of links 51 will be extended. Consequently, the initial function will be that of forcing the central portion of the disk into the recess 44 and against the action of the plate 45;

this being achieved by the plunger 49. During this operation, the tube 48 will be moving downwardly with respect to the plunger 49, thus providing portions which in the present exemplification serve to overlap the pouring-lip of a receptacle to which the cap is subsequently applied.

Continued downward movement of the plunger 42 will result in the central or stopper portion of the blank being completely formed and the plunger 49 together with the sleeve 48 will thereupon move as one unit within the bore of the member 47 until finally the flared end portion or ramp of the plunger 42 clamps the skirt of the disk between it and the correspondingly formed portion of the member 47, thus flattening the corrugations and providing a completed article.

It will be appreciated that the tube 48 and plunger 49 in their normal position, are both elevated so that their upper edges occupy substantially the same plane as the upper faces of the sleeve 47 and deck 17. Resistance to depression by the plunger 49 is material in view of the manner in which this element is supported. The tube 48 offers comparatively little resistance to movement, due to the fact that it is only lightly supported by the spring 50. Thus, the paper may be drawn across the top edge of the tube without danger of being torn. Obviously, upward movement of the tube 48 and plunger 49 beyond their proper projected positions is limited in any desired manner. The tube 48 serves effectively to strip the stopper portion from plunger 49. It also serves to properly close the gap between the plunger and the sleeve 47. Thus, the cap folds are held lightly while the stopper is being drawn, and a substantially smooth and unbroken surface is provided upon which the finished cap can be moved from its position between the forming dies.

At this time, it will be understood that the resistance to movement offered by the plunger 49 may be varied in any desirable manner, as for example, by adjusting the upper and lower elements 54 of the link assemblage along the rod 55 which forms a part of the plunger or rod 49 and that any other desired adjustments might be provided throughout the machine. As the plunger 42 now moves upwardly, the disk will be maintained in contact with the ramp portion thereof to a point at which this plunger moves out of contact with the rod or plunger 49 and the tube 48. Thereupon, the plate 45 will act to automatically detach the disk from the plunger and the turn table will now shift and the disk will subsequently be removed therefrom.

It will be understood that in certain instances the disks and resultant caps might stick. Also, if these elements are to retain fluid within a receptacle, it is desirable that they embody moisture proof characteristics. With this in mind, the present invention also contemplates that the stock from which the disks are formed be impregnated with paraffine or other suitable material. Thus, in addition to having the finished article embody moisture proof characteristics, a certain lubricating action is set up during the operations on the article which prevents any tendency of the latter to stick to the machine parts.

In operation a plain disk is delivered to the turntable and the latter shifts to a point where finally this disk underlies the plunger 32. Downward movement of this member will result in the entire blank with the exception of its central portion being formed with even corrugations. The disk will now be shifted to the next station at which the central or stopper portion thereof is formed (conceding that it is desired to impart such a construction to this blank) and the corrugations will be flattened out throughout what might be termed the pouring-lip portion of the blank and to a very material extent throughout the skirt portion thereof.

This flattening will cause the existing corrugations or folds to change their shape to an extent depending upon the amount of pressure applied and the closeness with which opposite faces of the several parts of the cap being formed are pressed by the forming means. The fit of the parts may be such that the skirt portion is pressed lightly so that upon constriction around a bottle neck the folds may easily further change their form to permit the skirt to closely embrace the bottle, the portion connecting the stopper to the skirt may be heavily pressed to flatten the folds in that area to such an extent that they are almost undiscernible upon casual inspection, but it should be understood that the parts which press upon the walls of the stopper portion, acting in cooperation with the ring 43, not only flatten the corrugations within the stopper walls, but causes them to change in form and number.

It is obvious that the ring 43 preferably is spaced from the surface upon which the disk is mounted a distance sufficient to permit the corrugations to increase in depth as much as may be required incident to the decrease in effective circumference of the disk as portions are drawn into the stopper forming device, but not enough to permit individual corrugations to increase unduly and other corrugations not to increase or to increase little. Ring 43, therefore, provides for maintaining the relative angular positions of the corrugations and thereby prevents bunching and consequent tearing of the material as it is drawn into the closely spaced parts of the forming device. Even spacing of the corrugations is especially necessary to insure even distribution of material being drawn into the stopper walls, and the need increases rapidly as the area of the material beyond the stopper walls is increased.

It is also to be understood that the portions of the evenly spaced corrugations being drawn into the stopper wall forming device tend to increase in depth incident to the decreasing effective circumference of the stopper wall area, but, unlike other portions of the corrugations, they are still relatively shallow when met by opposing faces of the forming means and thereby prevented from continuing to develop. Pressure upon these slightly formed corrugations obliterates them and in so doing applies circumferential pressure upon the annular stopper wall causing each original corrugation to become a number of smaller corrugations of somewhat different form, and provides a stopper wall presenting a substantially smooth and unchanneled surface.

The paraffined stock employed, which must be of rather heavy, strong material, also functions advantageously in that it tends to make the material more moldable, that is, to prevent cracks or tears during formation and to insure a setting or shape-holding after formation.

It is to be understood that the fit between the several parts at this point is made with sufficient tolerance to accommodate varying thicknesses of paper so that any difficulties in this connection are avoided.

The turn table now shifts to a point at which the cap is discharged from the machine and the formed member now preferably moves to a mechanism by means of which it will be automatically stacked or otherwise stored.

Thus it will be appreciated that the skirt and stopper wall areas are first corrugated and thereafter the stopper is formed by means which changes the form and number of folds in the stopper wall area. Aided by the spaced presser plate, the folds in the skirt permit the latter to draw in evenly without causing harmful angular displacement of any of the material from which the stopper wall is formed.

From the foregoing, it will be understood that among others, the several objects of the invention as specifically afore stated are achieved. It will be additionally understood that numerous changes in the method steps and the construction and arrangement of the machine parts might be resorted to without departing from the spirit of the invention as defined by the claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A cap forming machine including, in combination, means operating upon a layer of fibrous material to form a cup portion, and means acting subsequently upon the base of said cup portion to form a stopper portion without rupture of said layer of fibrous material.

2. A cap forming machine including, in combination, means for corrugating a disk of material at points remote from the central area thereof to provide a constrictable skirt and means for subsequently forming said central area to provide a depressed stopper portion to serve as a stopper.

3. A cap forming machine including, in combination, means operating upon a disk of material to corrugate the same, means for extending the corrugated portion at an angle to the central area of the disk to provide a cup shaped member, and means for subsequently forming a circular depressed portion in the base of said member.

4. A cap forming machine including, in combination, means for corrugating a disk of material and to one side of the central area thereof, means for extending the corrugated portion of said disk at an angle to the central area to provide side walls, and means for subsequently forming in the substantially uncorrugated portion of said disk an inwardly extending bulged portion serving as a stopper.

5. A cap forming machine including, in combination, means for receiving a disk of material, means acting to corrugate portions of said disk, means for subsequently forming a stopper portion as an integral part of said disk and comprising portions of the previously corrugated area, and means for extending the disk adjacent the edge portion of the latter at an angle with respect to the central disk portion whereby to provide a cup shaped member with the stopper portion extending from the base thereof.

6. A cap forming machine including a receiving member formed with an opening to accommodate a disk of material, means coacting with a disk disposed within said opening to corrugate the former and decrease the effective circumference thereof, means for maintaining said disk centered within said opening, and means for subsequently forming a stopper portion within said disk.

7. A cap forming machine including, in combination, a receiving member formed with an opening to accommodate a disk of material, means for corrugating portions of said disk, means for extending said corrugated portions to project at an angle to the central portion of said disk, and means for changing the form and number of said corrugations to cause the area within which such change has occured to extend as a thickened portion forming a part of said disk.

8. A cap forming machine including, in combination, a receiving member formed with an opening to accommodate a disk of material, means for corrugating portions of said disk, means for extending said corrugated portions to project at an angle to the central portion of said disk, means for changing the form and number of said corrugations to cause the area within which such change has occurred to extend as a thickened portion forming a part of said disk, said disk presenting an effectively diminishing circumference throughout said operations, and means for maintaining said disk centered throughout said operations and with regard to said means.

9. A cap forming machine including, in combination, a receiving member formed with an opening to accommodate a disk of material, means for corrugating portions of said disk, means for extending said corrugated portions to project at an angle to the central portion of said disk, means for flattening certain of said corrugations to extend as a thickened portion forming a part of said disk, and means acting to prevent a shearing effect upon said disk and during the cooperation therewith of said several means.

10. A cap forming machine including means to receive a disk of material, means acting to one side of the central area of said disk to form increasingly deepening corrugations toward the edge thereof, means for extending the corrugated disk portions at an angle to the central area of said disk to form a cup shaped member, and means for changing the form and number of said corrugations to cause the area within which such change has occurred to present in effect a thickened area forming a part of said disk.

11. A cap forming machine including means to receive a disk of material, means acting to one side of the central area of said disk to form increasingly deepening corrugations toward the edge thereof, means for extending the corrugated disk portions at an angle to the central area of said disk to form a cup shaped member, and means subsequently acting upon the base of said member to provide an inwardly extending stopper portion in said disk.

12. A method of forming a cap which includes utilizing a disk of material, forming the same with increasingly deepening corrugations, extending the side area of said disk to project at an angle to the central portion thereof to form a cup shaped member, and in subsequently forming the disk adjacent the center thereof with a stopper portion projecting inwardly with respect to the body of the resultant member.

13. A method of forming a cap which includes utilizing a disk of material, corrugating said disk to one side of the central area thereof, extending the corrugated portions to project at an angle to the central portion and thus form a cup shaped member, and subsequently forming a stopper por-

tion in said disk and within the central area thereof.

14. A cap forming machine including means to receive a disk of material, means supporting said disk and offering decreasing resistance to movement, means coacting with the central area of said disk to form a stopper portion therein by clamping said disk against said supporting means and moving the latter and said disk to conform to the surfaces of said supporting means, and means for causing the side portions of said disks to extend at an angle to the central disk portion.

15. A cap forming machine including means to receive a disk of material, means to corrugate said disk to one side of the central area thereof, means supporting said disk and offering decreasing resistance to movement, means coacting with the central area of said disk to form a stopper portion therein by clamping said disk against said supporting means and moving the latter and said disk to conform to the surfaces of said supporting means, and means for causing the side portions of said disks to extend at an angle to the central disk portion.

16. A method of forming a cap which includes utilizing a disk of material, primarily forming the same with corrugations to one side of the central area thereof, thereupon forming a stopper portion in the central part of said disk and with the base of said stopper comprising substantially the entire uncorrugated area, and the walls of said stopper including a portion of the primarily corrugated area, and in finally bending the portions of said disk beyond said stopper portion to form a cup shaped member.

17. A method of forming a cap which includes utilizing a disk of material, primarily forming the same with corrugations to one side of the central area thereof, thereupon forming a stopper portion in the central part of said disk and with the base of said stopper comprising substantially the entire uncorrugated area and the walls of said stopper including a portion of the primarily corrugated area, and flattening the corrugations in said disk.

18. The method of forming skirted milk bottle caps, which includes impregnating relatively heavy stock material with a substance both moisture-resistant and moldable under pressure, thereupon forming said material by pressure to provide a marginal, corrugated skirt portion and subsequently forming a stopper portion in said material and extending the corrugated parts thereof beyond said stopper portion to provide a cup-shaped member.

19. The method of forming skirted milk bottle caps, which includes impregnating relatively heavy stock material with a substance both moisture-resistant and moldable under pressure, thereupon forming said material by pressure to provide a marginal, corrugated skirt portion and in finally flattening the corrugations of said skirt portion.

20. A method of forming a cap which includes utilizing a disk of material, forming the same with corrugations to one side of the central area thereof and simultaneously causing the corrugated area to extend at an angle with respect to the central area, causing the said corrugated area to stand at a lesser angle with respect to said central area, and thereupon and subsequently changing the angle at which such areas extend with respect to each other to form a cup-shaped cap.

21. A method of forming a cap which includes utilizing a disk of material, forming the same with corrugations to one side of the central area thereof and simultaneously causing the corrugated area to extend at an angle with respect to the central area, causing the said corrugated area to stand at a lesser angle with respect to the said central area, thereupon subsequently changing the angle at which such areas extend with respect to each other to form a cup-shaped cap and in flattening the corrugations within said corrugated area.

22. A forming machine including means to receive a disk of material, means cooperating with said receiving means to corrugate said disk at points beyond the central area thereof and further means subsequently cooperating with said receiving means to form a stopper portion in said central area and to extend the corrugated area of said disk at an angle with respect to said stopper portion.

23. A forming machine including means to receive a disk of material, means cooperating with said receiving means to corrugate said disk at points beyond the central area thereof, means engaging said central area during said corrugating to maintain the same against displacement with respect to said corrugating means and further means separate and remote from said corrugating means subsequently cooperating with said receiving means to form a stopper portion in said central area and to extend the corrugated area of said disk at an angle with respect to said stopper portion.

24. A forming machine including means to receive a disk of material, means cooperating with said receiving means to corrugate said disk at points beyond the central area thereof and further means subsequently cooperating with said receiving means and the corrugated area of said disk to cause the form and number of some portions of said corrugations to be changed.

25. A forming machine including means to receive a disk of material, means cooperating with said receiving means to corrugate said disk at points beyond the central area thereof, means engaging said central area during said corrugating to maintain the same against displacement with respect to said corrugating means, means cooperating with said receiving means and disk to form a stopper portion in the central area thereof, and means cooperating with the corrugated area of said disk to change the form of such corrugations.

26. A forming machine including means cooperating with a disk of material to corrugate the same, shaping means cooperating with the corrugated disk to form a stopper portion in the base thereof said stopper portion including portions of the corrugations produced by said first named means and to extend portions of the corrugated area of said disk in the form of cap side walls and means for successively presenting a disk to said corrugating and shaping means.

27. A forming machine including means to corrugate a disk of material, shaping means cooperating with the corrugated disk to change the form and number of portions of the corrugations thereof and to extend other portions of the corrugated area of said disk to provide side walls and means for successively presenting said disk to said corrugating and shaping means.

28. A cap forming machine including a head, a deck disposed adjacent thereto, means to position a disk of material in the plane of said deck and

below said head, an annular series of radially extending blades, means for rockingly supporting said blades with reference to said deck and in a position underlying said disk, a second annular series of blades rockingly mounted by said head and to cooperate with said disk, said second series of blades being disposed in staggered relationship with respect to said first named series, means whereby upon head projection occurring, portions of blades of one series are caused to extend between the blades of the second series and means connected to said head and deck respectively for clamping portions of said disk against movement with respect to said head and during such projection.

29. A cap forming machine including a head, a deck disposed adjacent thereto, means to position a disk of material in the plane of said deck and below said head, an annular series of radially extending blades, means for rockingly supporting said blades with reference to said deck and in a position underlying said disk, a second annular series of blades rockingly mounted by said head and to cooperate with said disk, said second series of blades being disposed in staggered relationship with respect to said first named series, means whereby upon head projection occurring, portions of blades of one series are caused to extend between the blades of the second series, said last named means including means connected to said first blade series and contacting with one of the disk faces and means connected to said second blade series and contacting with the central portion of the opposite disk face to maintain the same against movement with respect to said head during said blade movement.

30. A forming machine including means for corrugating a disk, means engaging the central portion of said disk to cause the corrugated area thereof to extend angularly with respect to said central portion and means cooperating with said disk to maintain the relative position of the corrugations thereof substantially simultaneously with the angular extension of such disk area with respect to the central portion thereof.

31. A forming machine including means for corrugating a disk, means engaging the central portion of said disk to cause the corrugated area thereof to extend angularly with respect to said central portion and means in contact with said disk and cooperating therewith to maintain the relative position of the corrugations thereof and means whereby said last named means is maintained out of clamping contact with said corrugated disk area.

32. A cap forming machine including, in combination, a receiving member formed with an opening to accommodate a disk of material, means for corrugating portions of said disk, means for extending said corrugated portions to project at an angle to the central portion of said disk, means for subsequently forming a stopper portion in the central part of said disk, and for changing the form and number of portions of said corrugations to cause the zone within which such change has occurred to present a thickened area forming a part of said stopper portion.

33. A cap forming machine including means to receive a disk of material, means acting to one side of the central area of said disk to form increasingly deepening corrugations toward the edge thereof, means for extending the corrugated disk portions at an angle to the central area of said disk to form a cup-shaped member, means subsequently acting upon the base of said member to provide an inwardly extending stopper portion in said disk, and for changing the form and number of portions of said corrugations to cause the zone in which such change has occurred to present in effect a thickened area forming a part of said stopper portion.

34. A method of forming a cap which includes utilizing a disk of material, forming the same with increasingly deepening corrugations, extending the side area of said disk to project at an angle to the central portion thereof to form a cup-shaped member, and changing the form and number of the corrugations within an area remote from the periphery of said disk to cause the zone within which such change has occurred to present in effect a thickened area forming an integral part of said disk.

35. A cap forming machine including, in combination, means operating upon a disk of material to form a cup portion, and means separate and remote from said first named means acting upon the base of said cup portion to form a stopper portion.

36. A cap forming machine including means for forming in a disk of material an annular series of corrugations increasingly deep toward the edge of said disk, means for simultaneously cupping said disk to thereby decrease the angular spacing of said corrugations and means to control the depth of said corrugations throughout substantially their entire extent so that none of said corrugations exceeds a predetermined depth.

37. A cap forming machine including corrugating members to corrugate a disk of material, means co-operating therewith for causing said disk to assume a cup-shaped form, and for subsequently flattening the corrugations and disk thereby returning said disk to substantially its original form.

38. A cap forming machine including means operating upon a disk of material to corrugate the same, and subsequently acting means separate and remote therefrom to form a stopper portion within said disk.

39. A cap forming machine including means for corrugating a disk of material, and means for forming a stopper portion in said disk, said stopper portion embracing portions of the corrugated area of said disk.

40. A cap forming machine including means for corrugating a disk of material and means for subsequently forming a stopper portion in said disk, and for forming side walls for said stopper portion from portions of the corrugated area of said disk.

41. A cap forming machine including a head, an annular series of radially extending blades rockingly attached to said head, a support, a second annular series of blades rockingly attached to said support and adjacent said head to cooperate with said first series of blades and with a disk of material disposed between the said two series of blades, means connected with one series of blades and contacting the central area of one face of said disk, and means connected with the other series of blades and contacting the central area of the opposite face of said disk to cause the blades of one series to rock responsive to the projection of said head.

42. A cap forming machine including a head, an annular series of radially extending blades rockingly attached to said head, a second annular series of blades cooperating with said first

series and with a disk of material disposed therebetween, a support adjacent said head, said second series of blades being disposed in staggered relationship with respect to said first series of blades and being rockingly attached to said support, means responsive to projection of said head portion, to extend the blades of one series between the blades of the other series and to rock the blades of both series in controlled relationship with respect to each other and means for preventing the control of said relationship depending upon cooperation of said disk and said blades.

43. A cap forming machine including a head, an annular series of radially extending blades rockingly attached to said head, a support, a second annular series of blades rockingly attached to said support adjacent said head and cooperating with said first series of blades and a disk of material disposed between the two series of blades, means whereby said several series of blades are caused to corrugate portions of said disk, means for maintaining said blades in corrugating relationship, and further means forming a part of said machine and causing the disk contacting surfaces of all of said blades to be moved in controlled relationship with respect to each other and said disk.

44. A cap forming machine including means comprising movable blades acting upon opposite faces of a disk of material to corrugate the same, and means supporting the blades acting upon one face of said disk of material and acting to cause the blades acting upon both faces of said disk to move in controlled relationship with respect to each other and to said disk, the movements of said blades being unaffected by pressure of said disk upon said blades.

45. A method of forming a cap which includes utilizing a disk impregnated with a substance resistant to moisture, corrugating portions of said disk and subsequently forming a stopper portion in said disk and including within said stopper portion parts of the disk area previously corrugated.

46. A cap forming machine including means for corrugating a disk, means separate and remote from said corrugating means and not agreeing in outline with the corrugations of said disk to cause corrugated portions thereof to extend at an angle with respect to other portions thereof, and means acting simultaneously with said second named means to maintain the relative size and angular positions of said corrugations.

47. A cap forming machine including means acting upon a disk of material to form a saucer-shaped member, and means separate and remote from said first named means for changing the angle at which the disk portions adjacent the edge of said saucer-shaped member extend with respect to the central portion thereof.

48. A cap forming machine including means to receive a disk of material, means supporting said disk and adjustable to offer either unchanging, increasing or decreasing resistance to movement, and means coacting with said second named means and with said disk to modify the shape of the latter by causing said disk to conform to the surface of said supporting means.

49. A method of forming a cap which includes utilizing a layer of material, forming the same with corrugations and subsequently changing the form and number of said corrugations.

50. A method of forming a cap which includes utilizing a disk of material, forming the same with corrugations to one side of the central area thereof and subsequently changing the form and number of portions only of said corrugations.

51. A cap forming machine including corrugating means to corrugate a disk of material, and control means to control the depth of the corrugations formed thereby throughout the entire extent of said corrugations independently of the resistance offered to said corrugating means by said disk of material.

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