

Dec. 28, 1943.

L. M. WILEY

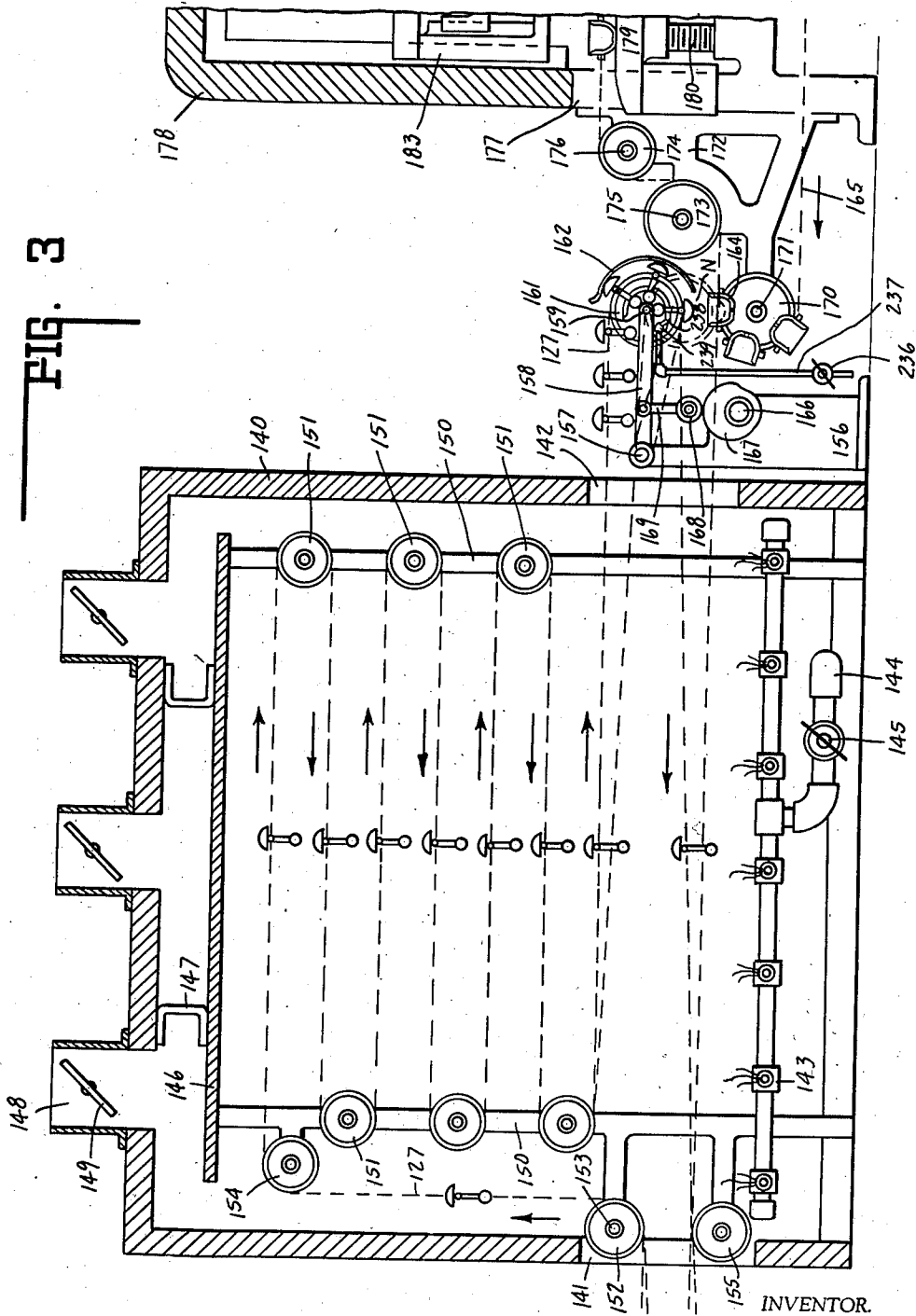
2,337,581

SHEET PULP CONTAINING FORMING APPARATUS

Filed Aug. 4, 1939

8 Sheets-Sheet 1

FIG. 3



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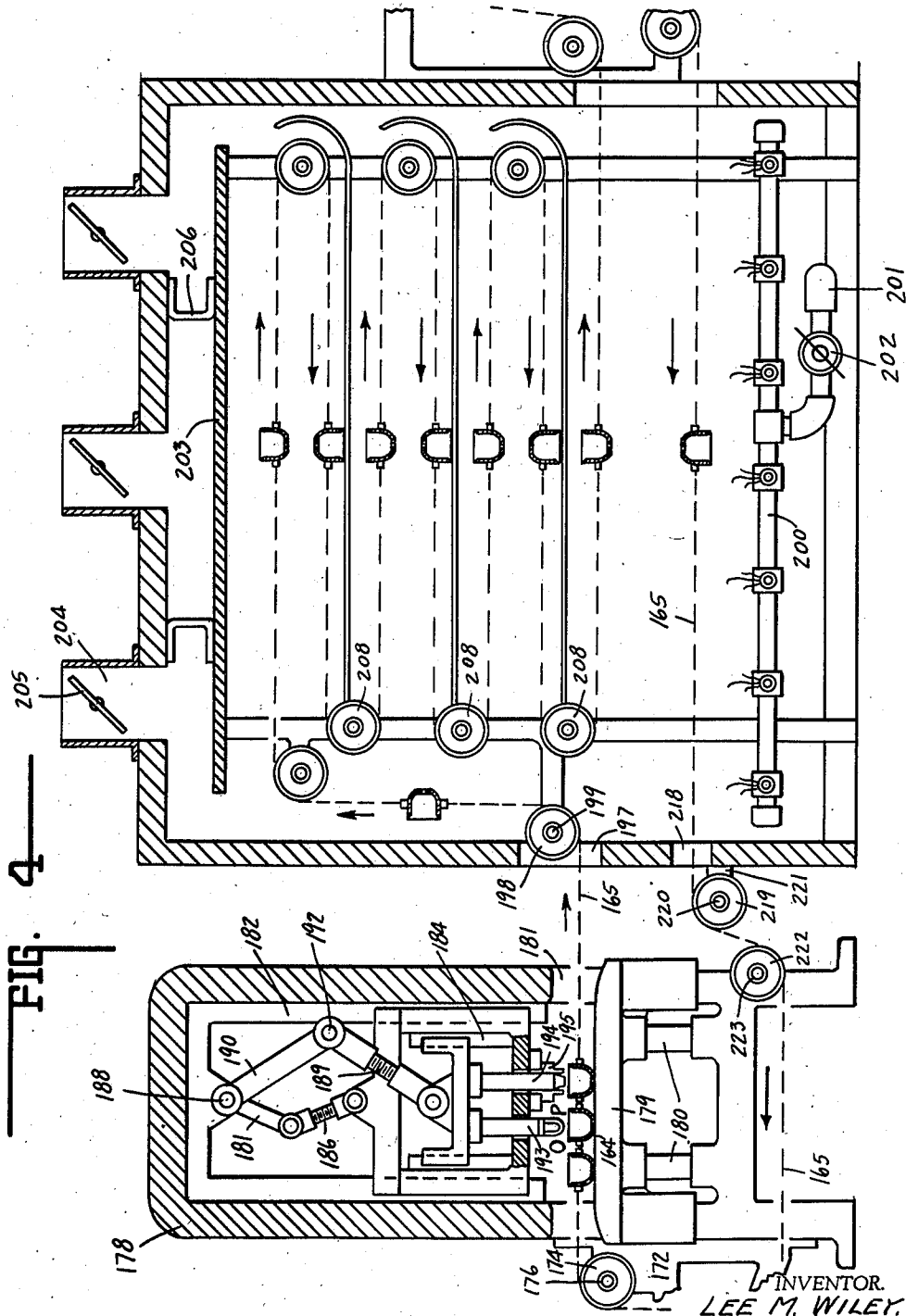
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8 Sheets-Sheet 2



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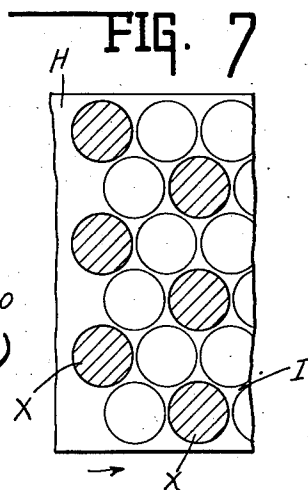
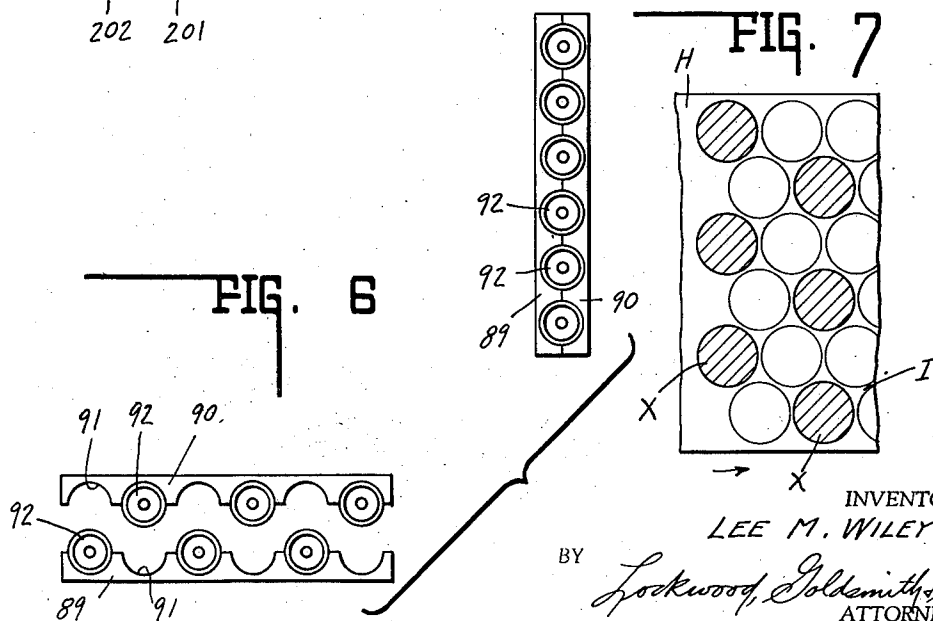
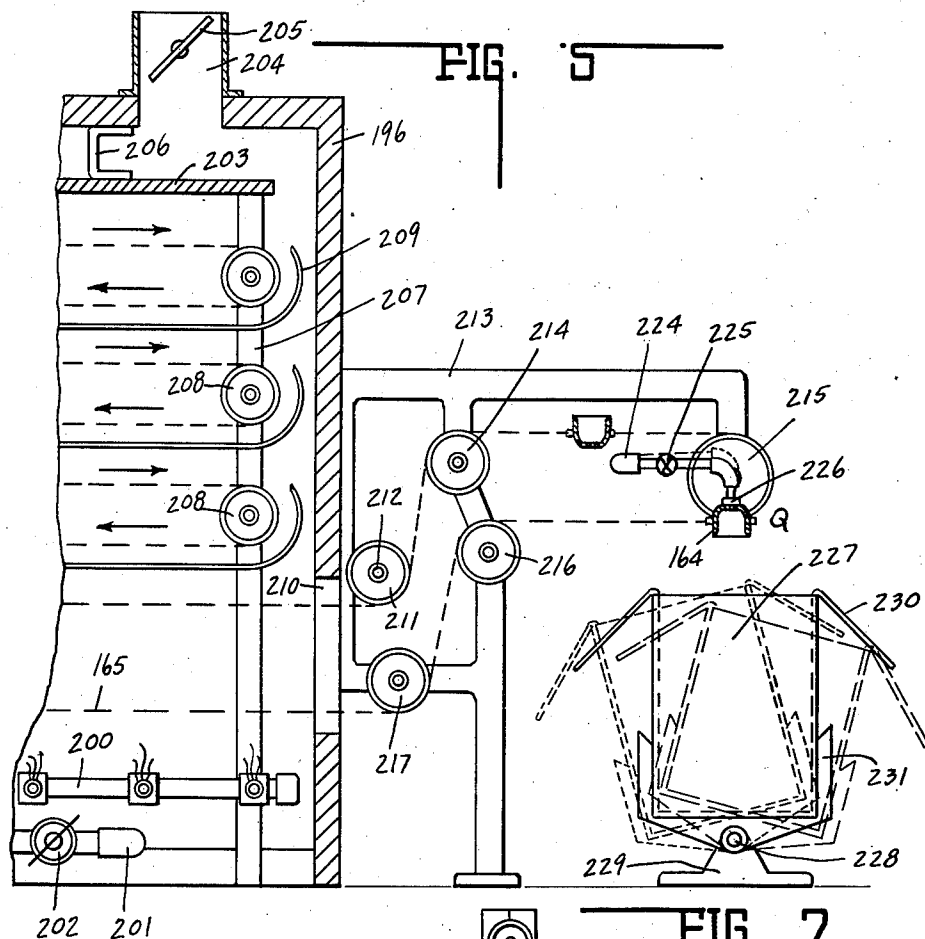
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8 Sheets-Sheet 3



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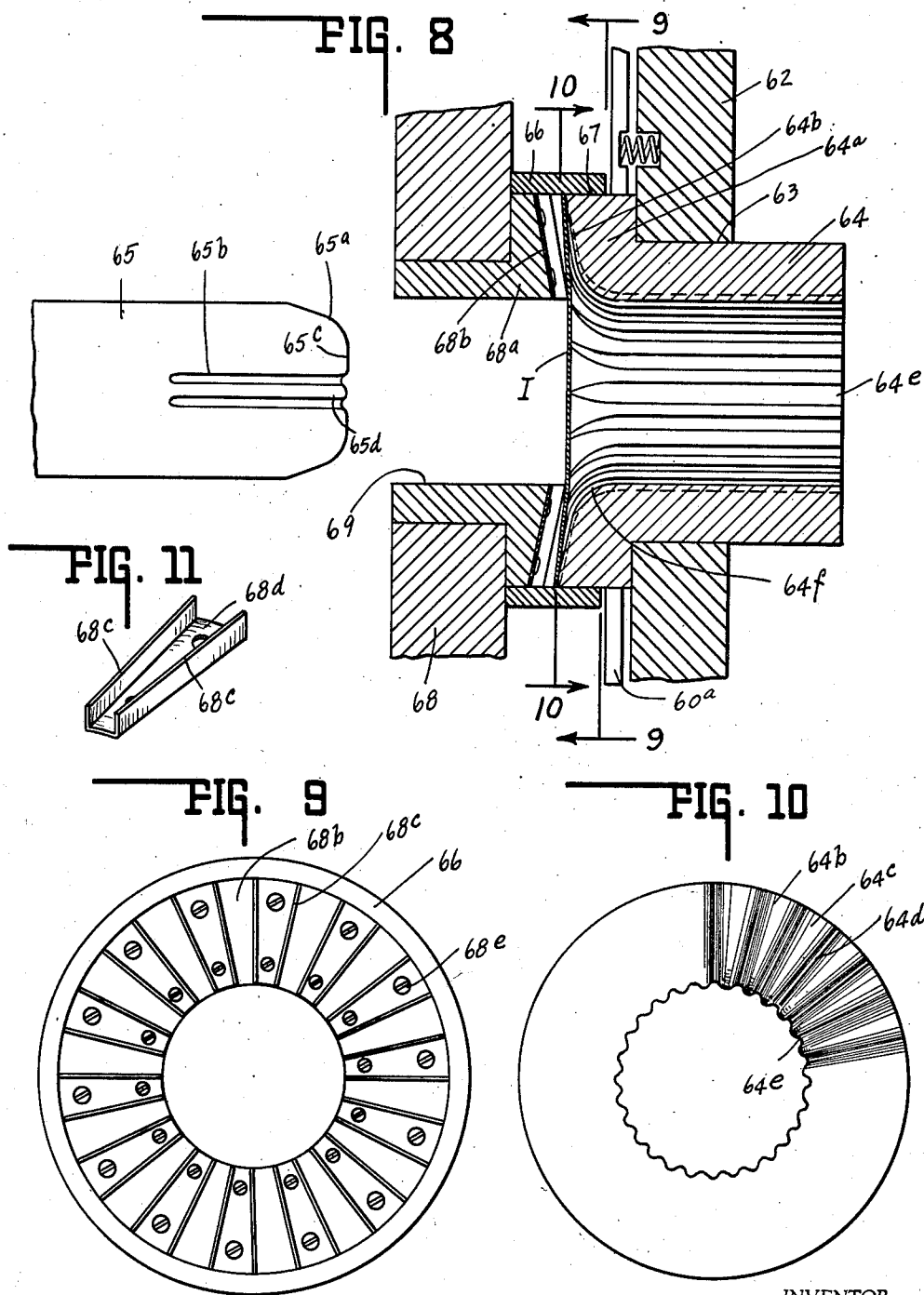
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SHEET PULP CONTAINING FORMING APPARATUS

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8 Sheets-Sheet 4



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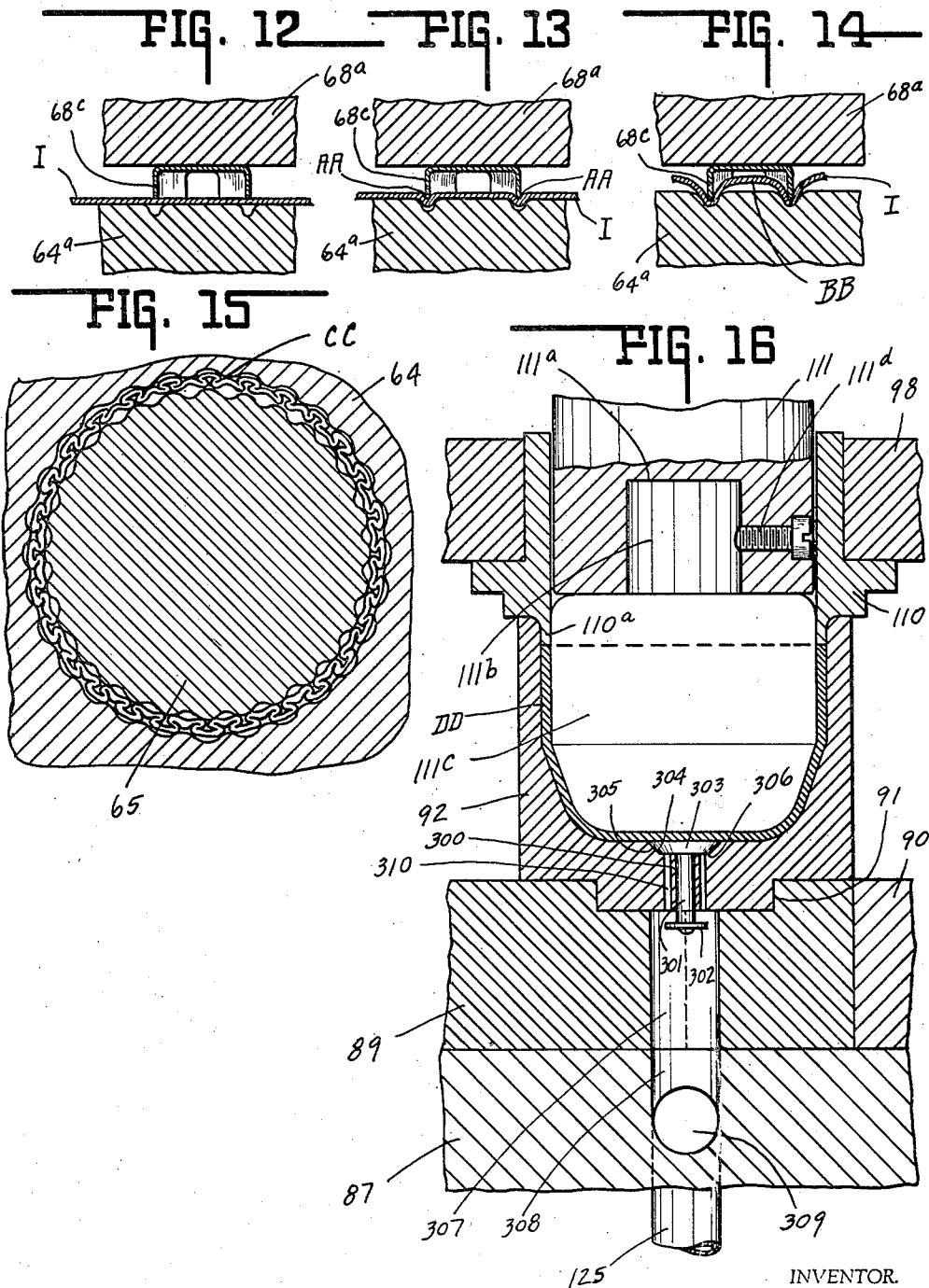
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SHEET PULP CONTAINING FORMING APPARATUS

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8 Sheets-Sheet 5



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SHEET PULP CONTAINING FORMING APPARATUS

Filed Aug. 4, 1939

8 Sheets-Sheet 6

FIG. 17

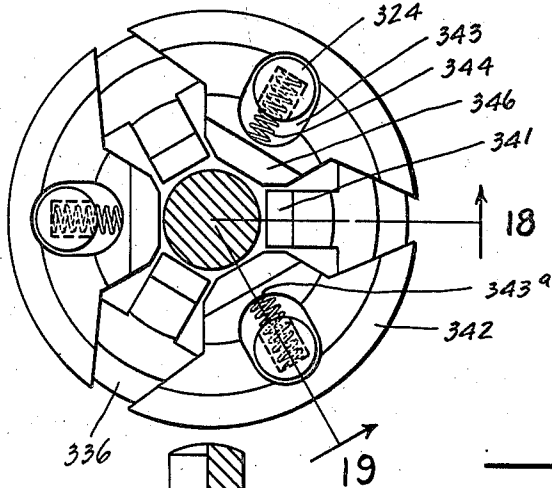


FIG. 18

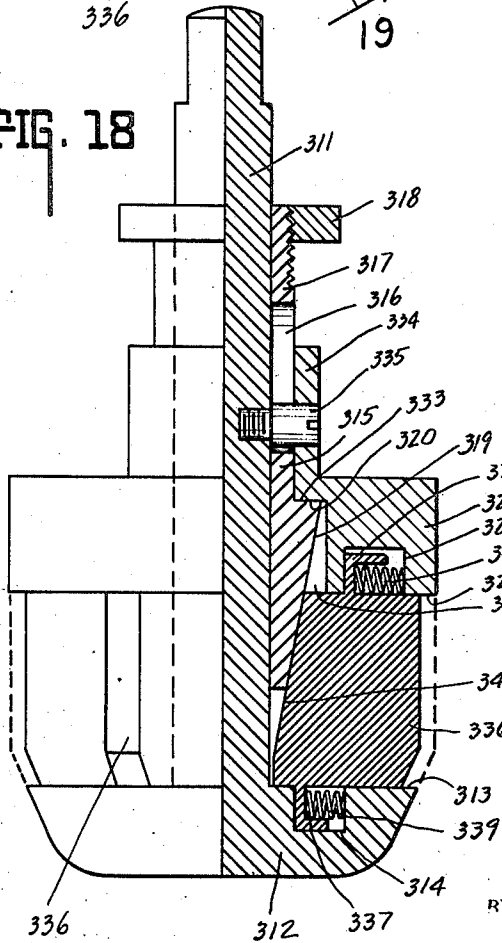
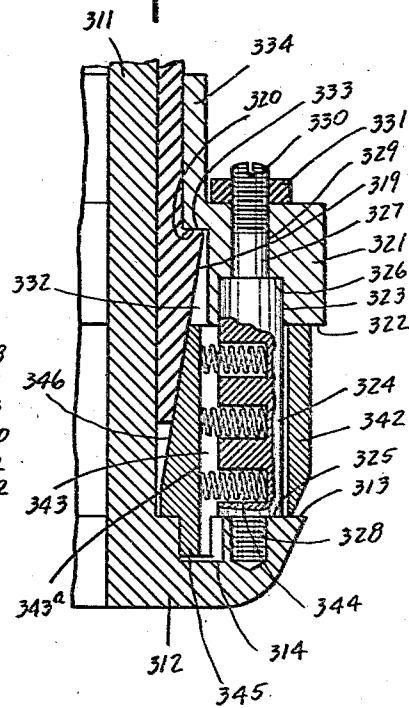


FIG. 19



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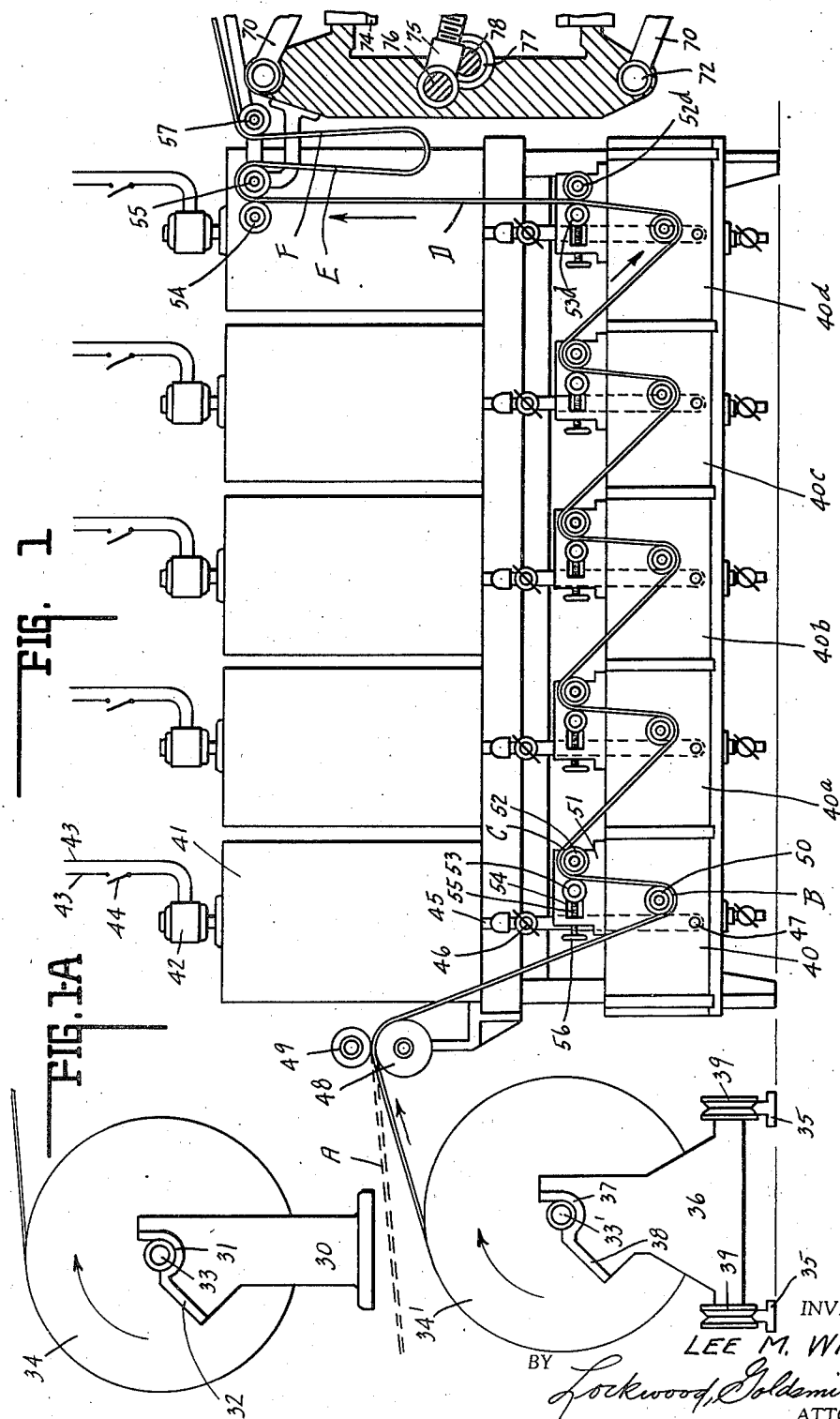
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SHEET PULP CONTAINING FORMING APPARATUS

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8 Sheets-Sheet 7



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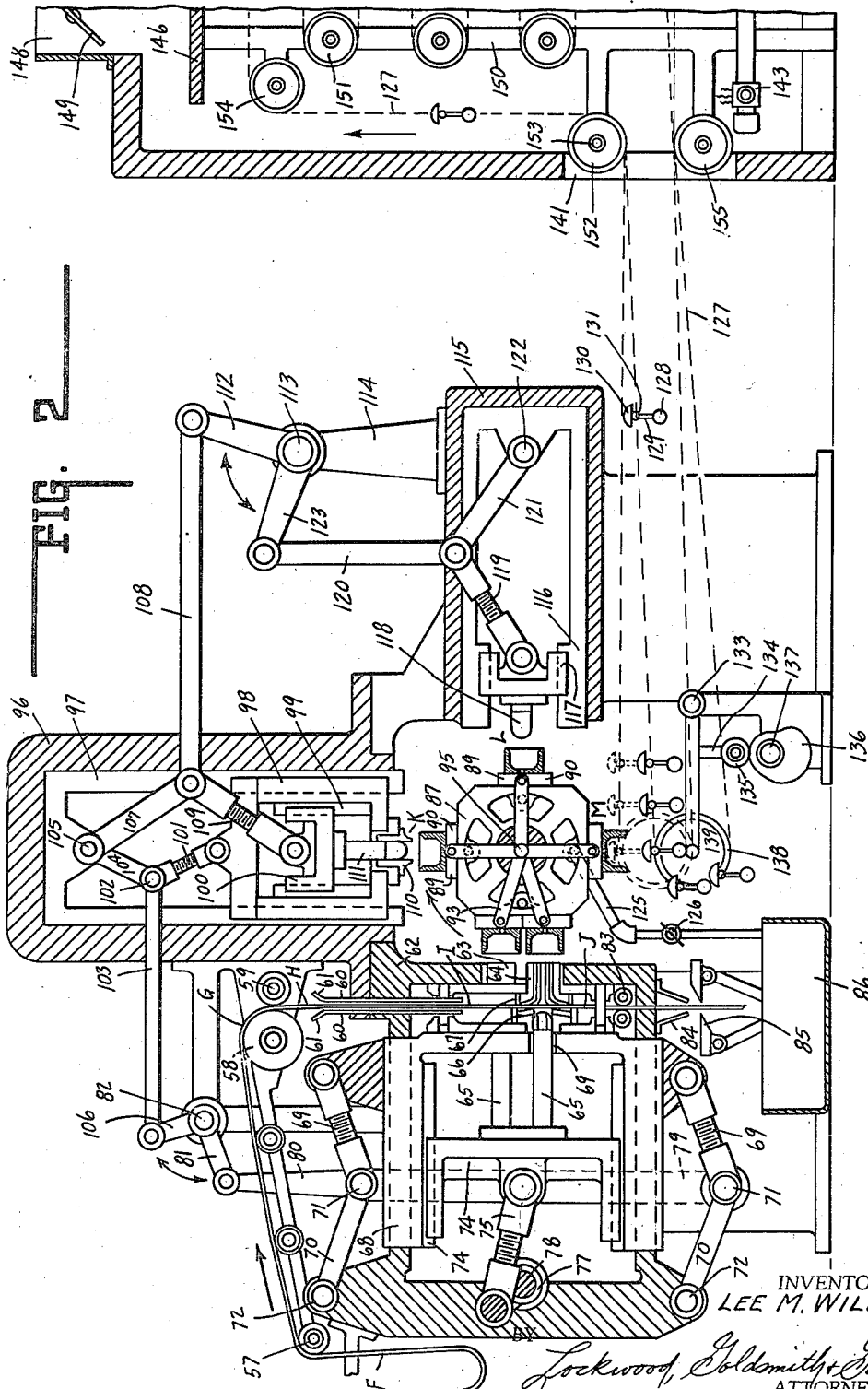
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SHEET PULP CONTAINING FORMING APPARATUS

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8 Sheets-Sheet 8



UNITED STATES PATENT OFFICE

2,337,581

SHEET PULP CONTAINING FORMING
APPARATUS

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Application August 4, 1939, Serial No. 288,343

14 Claims. (Cl. 18—19)

This invention relates to an apparatus for fabricating a relatively deep seamless container, or the like, from prime sheet pulp. The articles comparable thereto are such as core plugs for wrapping paper rolls, flower pots, food containers, drinking cups, and other objects suitable for industrial and commercial uses.

Heretofore the industry has formed by other methods from pulp material containers and the like at the container mill located near the source of use—in other words, at the centers of population. The pulp supplied to such mills has required shipment of the pulp material to the mill in tank cars since it contains more than 90% water. The result is the cost of the pulp material at the container mill is greatly increased by reason of the transportation charges between the pulp factory and the container mill and more especially upon the water content of the pulp material.

One solution to this problem is to locate the container manufacturing plant immediately adjacent the pulp mill and supply the pulp material through flumes, and the like, as it is produced. This has two disadvantages. The first is that the pulp mill production in this situation must be regulated to the commercial program of production of the container manufacturing plant unless additional storage capacity be provided. The second objection is the containers when fabricated usually have a relatively large bulk for small weight and, therefore, transportation charges upon the shipment of such containers from the plant located immediately adjacent the pulp mill and to the source of use or purchaser are exceedingly excessive.

The present invention, therefore, is directed to a solution which has neither of these objections of the last mentioned problem nor the objection of the first mentioned problem. This invention primarily is directed to the formation of useful articles adjacent the source of consumption and from prime sheet pulp which may be readily fabricated by the pulp mill into rolls and which can be readily shipped from the pulp factory to the container factory.

In the production of prime pulp, the fibers and the like are supplied to the screen and this pulp is then sheeted and dried to a reasonable dryness and as the sheet comes off of the screen and drier, it is formed into rolls or may be formed into sheets. Herein the invention is illustrated as utilizing this pulp in sheet form but arranged in roll formation. Thus the pulp material may be continuously manufactured by the pulp fac-

tory, made up into rolls of prime sheet pulp material and readily stored or shipped as and when required. This sheet pulp material, therefore, contains but little moisture so that the transportation charges on the primary material are relatively small compared to the transportation charges on an equivalent amount of liquid pulp material.

Also this material may be stored either at the pulp mill or the container factory for a relatively nominal expense and thus the container manufacturer can during the maximum pulp production season purchase the prime sheet material more economically in the event the commercial demand for containers and the like does not coincide with the seasonal production of the pulp material.

All of the foregoing, therefore, constitutes advantages which are available to the container manufacturer provided the prime pulp material can be fashioned into containers which heretofore has been impossible but which by means of the present invention is accomplished, although it is to be observed that this intermediate production of the prime sheet pulp does of necessity require a fuel cost for sheet drying purposes after the major portion of the water has drained from the pulp fibre in the formation of the sheet material on the paper screen and drier rolls in the pulp plant.

More economical advantages will be noted by operating such a unit herein described as vertical integration in the pulp mill. In this manner of operation along with the fact that all solutions such as for sizing, for water repellency, acid repellency, heat resisting and colors being added to the fibres in the pulp heaters the pulp sheet can be handled directly from the mill driers in a more moistened state, which is a saving on drying energy in the mill and all web waste from this unit can be returned immediately to the beaters and again formed into the pulp sheet thereby eliminating all web waste. This method of operation will also eliminate freight charges on the pulp sheets and all solutions in tanks on the form moulding equipment.

As previously mentioned, this invention is directed to the utilization of this type of sheet material for the formation of relatively deep seamless products and which products when formed have a finished appearance substantially free from wrinkles and the like, and which may be made to substantially any desired shape and dimension and held to that dimension and which when made will retain that dimension and shape

and which may be suitably treated for the specific industrial purposes to which the container is directed.

Briefly, the process contemplates first the proper preliminary treatment of the sheet pulp as it is derived from the "Jumbo" roll and in successive stages, which treatment essentially consists of immersing the sheet in a reservoir or tank which due to the absorbent character of the sheet readily picks up the impregnating liquid and after it has been passed through this liquid, the sheet is passed through a wringer structure so that excess liquid material is removed from the sheet. Any desired number of immersions may be employed and these may be of like character or of dissimilar character.

Solutions can be put in the beater at the pulp mill before sheet of pulp is formed on the wire as explained on page 1 for vertical integration.

The various liquids, in solution, may be for the purpose of adding strength and rigidity to the final product, making the product heat resisting, acid resisting, water repellent and/or for coloring same. The sheet material is positively passed through the several reservoirs and then is supplied to the initial forming device which has a certain time sequence arrangement of its various parts so that while the sheet previously has been continuously fed, the sheet now is intermittently fed, as will be hereinafter more fully pointed out.

Interposed between the intermittent feeding thereof and the continuous feeding thereof, the sheet is looped or forms a festoon so that the intermittent feeding of the sheet is not carried back into the continuously fed portion of the sheet, thereby insuring proper impregnation by the respective impregnating liquids. As stated, the working portion of the sheet is intermittently fed and in a vertical direction operable so that the impregnating material thereon does not accumulate in the initial forming machine, and which vertical direction of feeding the sheet material does eliminate all tendencies of friction between the surface of the sheet and the machine parts thereby allowing for a lower minimum of web loss as the sheet travels by gravity through the die area and no pull is exerted on the narrow web sections, which permits these web sections to be made more narrow.

The sheet is presented to a blanking structure and from the same the desired size of blank is cut from the sheet. Previously these blank providing areas are so positioned in the sheet that when removed therefrom there will be a minimum waste of stock. The resulting web following the blank formation then may be suitably handled by cutting into small pieces and collecting the same as a waste which may be sold.

The apparatus hereinafter to be described is arranged so that it simultaneously forms a plurality of blanks and the blank formation is of staggered character at each blanking operation for speed and economy.

Upon the formation of the blanks, each is initially deformed into a container like shape similar to the final shape desired. In this shaping operation, however, there is initially formed in the outer portions of the blank, reference being had to its flat form, inwardly and outwardly directed corrugations, or the like. These corrugated walled articles then are brought together and arranged in transverse alignment and are handled in a single row transverse alignment thereafter. Accordingly, while two rows of blanks are initially formed in one blanking operation, the

subsequent operations, except initial formation, are directed solely to a single transverse row of structures and, therefore, reference will be had hereinafter to but a single article.

In the initial forming of the outer portions of the blank, referred to above as inwardly and outwardly directed corrugations, or the like, which are set up or formed in the outer portions of the blank by a specific mechanical arrangement of thin fins in the blanking punch which are in alignment with and enter grooves in the drawing die of equidistant spacing. These fins are constructed with sufficient depth or height as to allow for the accumulation of the surplus stock in the outer portions of the blank as it is drawn toward and into the center opening of the drawing die. In actual practice the edges of the fins in the blanking die exert a pressure on the blank forcing it into the grooves of the forming die, causing inverted creases, flutes, corrugations, or the like, to be formed in the blank equally spaced around the outward portion of the blank. After the initial formation of these creases, flutes, corrugations, or the like between the edges of the fins on the blanking die and the grooves in the drawing die, the blanking die is withdrawn, retarded or receded slightly, to relieve the pressure exerted by the fins on the blank so that the friction on the surface of the blank is reduced to a minimum as the blank is drawn through the opening in the center of the drawing die and changes its shape from a flat to a corrugated walled article.

After initial blank formation and subsequent initial container like formation, including a pre-formed corrugated wall formation, the corrugated wall product and top edge is subjected to a forming process which reduces the corrugations to a substantially continuous solid mass of annular or peripheral outline in cross section and primarily to ultimate size. Thereafter the resulting article is expanded to almost the final size. It is then subjected to a drying operation which evaporates the external moisture and sets the various impregnating liquids included in the article so that the article then is in semi-finished form. It is then subjected to an expansion operation and upsetting operation on the top edge wherein it assumes substantially its final form and then it is finally finished and subjected to a final drying operation.

It is to be understood, however, that the process hereinbefore thus briefly described, is a continuous one, although of intermittent character. For example, the blanking and corrugating formation of a second article takes place simultaneously with the initial preliminary formation of a similar previous article and this takes place simultaneously with the third forming operation previously mentioned.

The sheet is fed to the blanking dies during the interval that these formations do not occur and the feeding of the sheet to the blanking die is stopped during the blanking and the other forming operations. The articles are handled individually and are suitably conveyed from one stage of operation to another, that is, initial drying, final finishing and final drying by suitable conveying means so that the desired degree of drying and the proper finishing will be effected.

The article if subjected to an impregnating liquid that is substantially colorless and which does not change color on the application of heat thereto, in its finished form will have a remarkably natural appearance and look like wood with-

out a grain and will be practically as hard as wood and since it has substantially no grain, will not have a tendency to split or crack. The resulting article also by reason of the inclusion of the intentionally formed corrugations will be substantially free from wrinkles and the like, and it is to be understood that in the formation of such article, the surplus stock resulting from the corrugations is distributed uniformly throughout the article, as will be hereinafter pointed out.

Having thus described the process portion of this invention, reference now will be had to apparatus whereby the aforesaid process is accomplished.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

In the drawings,

Fig. 1 is a side elevational view, more or less diagrammatic in form of the positive feed portion of apparatus for handling sheet pulp material from the roll and which feeding sheet is shown immersed in a plurality of reservoirs or tanks for impregnation, said figure also illustrating in a like manner the wringing operation to which the sheet is subjected for removal of surplus impregnating material.

Fig. 1A is similar to Fig. 1 but constitutes an extension of the same when the apparatus is arranged to accommodate two "Jumbo" rolls so that immediately upon the exhaustion of one roll the second roll may be fed therethrough and without interrupting the operation of the machine.

Fig. 2 is a vertical sectional view through the blanking and corrugating portion of the apparatus, the initial forming portion of the apparatus, and the intermediate portion of the apparatus as well as a turret structure associated with all of the aforesaid and a conveyor structure for receiving turret discharged articles.

Fig. 3 is a vertical sectional view of the last mentioned conveyor structure and the first mentioned drier structure as well as the conveyor associated article discharging means and a conveyor supported article receiving means for receiving the articles previously dried and discharged from the first mentioned conveyor.

Fig. 4 is a central sectional view through the finishing press and associated conveyor supporting article arrangement last mentioned and the final drier arrangement.

Fig. 5 illustrates the last mentioned conveyor arrangement, an article discharging means and an article receiving structure which receives the finished article from said conveyor.

Fig. 6 is an enlarged plan view of two separable forms carried by the rotatable turret, one being shown in open position and the other in closed position. While illustrated herein as in a common plane at 90° apart, it is to be understood they are faced to planes 90° apart.

Fig. 7 is a plan view of the sheet with areas for present blanking purposes, and openings formed by previous blankings suitably illustrated therein.

Fig. 8 is a vertical sectional view of a blanking and initial forming and drawing die structure.

Fig. 9 is an elevational view of the corrugating punch and blanking die shown in Fig. 8 and is taken on broken lines 9-9 of Fig. 8 and in the direction of the arrows.

Fig. 10 is an elevational view of the corrugat-

ing female die and is taken on line 10-10 of Fig. 8 and in the direction of the arrows.

Fig. 11 is a perspective view of one of the male corrugating or fluting segments.

Fig. 12 is a diagrammatic section of the punch and die after blank formation and prior to flute formation.

Fig. 13 is a similar view with the blank in fluted condition.

Fig. 14 is a similar view illustrating the bowing of the fluted section when the blank edge is drawn about half the distance between the inner and outer peripheries of the punch shown in Fig. 9.

Fig. 15 is a transverse section of the initial corrugating forming structure with the intentionally fluted or corrugated blank therein.

Fig. 16 is a central sectional view of the rubber expanding punch, cooperating mold or receiver and the article ejector and with the formed article in position prior ejection.

Fig. 17 is a transverse view of a portion of the mechanical punch, expander and former.

Fig. 18 is an elevational view thereof with part in vertical section.

Fig. 19 is a fragmentary vertical section thereof taken in another plane.

In order that a more complete understanding of the process previously described may be obtained, certain explanations will be incorporated in the following description of the apparatus suitable for performing said process.

In Fig. 1A there is illustrated a support structure 30 which is of roll width and in the upper portion of each of the two spaced portions, there is provided an open bearing 31 with an inclined ledge portion 32 leading thereto. Rotatably supported therein is a shaft 33 which in turn supports a "Jumbo" roll 34 of prime sheet pulp material. The shaft 33 may be included in the roll in its initial formation at the pulp mill or shaft receiving sleeves may be provided in opposite ends of the roll for subsequent shaft reception at the container factory.

The roll support 30 is spaced from the impregnating portion of the apparatus and therebetween is provided a plurality of spaced rails 35 upon which is rollably mounted a carriage structure 36 which has two portions extending upwardly and provided with open bearings 37 and inclined portions 38 to receive shaft 33' of another "Jumbo" roll structure 34'.

The roll support 36 is provided with track co-operating rolls or wheels 39 which permits this roller support to be moved laterally below the feeding sheet portion A so that the roll 34' will be available instantly for use upon exhaustion of roll 34. Of course, when roll 34 is exhausted and the machine is being fed from roll 34', the shaft 33 is removed from the left hand roll support 30 and another roll and supporting shaft applied thereto. Therefore, upon exhaustion of roll 34' the new roll 34 then will be immediately available for use.

Suitable brake means may be associated with these roll support arrangements so as to prevent overrunning of the roll if the same have that tendency.

In Fig. 1 there is illustrated a frame arrangement which in its lower portion is shown provided with five tanks 40, 40a, 40c and 40d. Associated with each of said tanks is other mechanism individual thereto and consequently a description of one tank 40 and its associated mecha-

nism will suffice for an understanding of them all.

Herein above the tank 40 is a reservoir or vat 41. Mounted therein is an agitator, not shown, and which is operable by an individual motor 42 supplied by lines 43 including a switch 44. The discharge 45 from the reservoir or vat to the tank is controlled by a regulating valve 46 and the immediate end 47 of said discharge 45 is positioned near the bottom of the tank 40. The operator is merely required to observe the level of the liquid in the tank 40 and see that it does not fall below that which the sheet in its lowermost position occupies in said tank.

The sheet A is fed from the roll by means of power driven so-called booster rollers 48 and 49, the drive therefor being omitted herein for clearness. Thus the sheet A is positively withdrawn from the roll. The sheet A as at B passes under a roller 50 which may float thereon or which may occupy a fixed position in a tank 40 and which may or may not be positively driven as desired or required.

Positioned above the tank 40 and suitably supported at opposite ends thereof in supports 51, is the positively driven roll 52 and cooperating therewith is a pressure roll 53 which is slidably supported at each end in an aperture 54 and associated therewith is a compression structure 55 including the adjusting member 56. This constitutes a wringer structure and the sheet portion B passes upwardly from beneath the roll 50 between the two wringer rolls 52 and 53. These rollers remove the surplus impregnating liquid and the same drains downwardly either on to the sheet B or into the tank 40. These rollers also force the impregnating liquid into the sheet and as stated, since the sheet is of fibrous character, it absorbs a predetermined amount of impregnating liquid and this is continuously supplied to the tank 40 by means of the controlled discharge 45, 46, 47 from the reservoir or vat 41.

In a like manner the sheet portion C leaving the wringer roll structure passes into the next tank 40a and thence in succession into tanks 40b, 40c and 40d where it is subjected to impregnating material of the desired character, as previously set forth, or subjected to no material, if no further impregnation is desired. The sheet portion D leaves the last wringer roller structure indicated by 52a and 53d and passes upwardly to a pair of rollers 54 and 55, both of which preferably are power driven and constitute a booster roll arrangement. Rollers 48 and 49, and 54 and 55 have the same linear velocity so that the sheet is positively fed through the impregnating portion of the apparatus and is pulled from the Jumbo roll.

The portion of the sheet which leaves the booster roller structure 54 and 55 drops downwardly as at E and forms a festoon or loop because the portion F extends upwardly and over a roller type conveyor structure, including a stationary frame arrangement 56 in which is mounted in spaced relation a suitable number of free running rollers 57.

At the remote end of this conveyor arrangement reference being had to the booster rollers 54 and 55, the sheet portion G passes between the end rollers 58 and 59 which are positively driven and which are also mounted in the support or frame structures 56 at opposite ends. These rollers discharge the sheet downwardly and substantially vertically as at H and between

a guide arrangement 60 provided with oppositely directed mouth or lip portions 61, as shown in Fig. 2.

In Fig. 2 there is illustrated a blank forming arrangement to which the sheet portion H is supplied through the guide 60. In this portion of the machine the body portion 62 includes an aperture 63, the purpose of which will be hereinafter set forth. Mounted in said aperture are the corrugating or drawing female dies 64, to which reference will be had more fully hereinafter. Axially and herein horizontally aligned therewith, are the male corrugating or drawing punches 65, there being one male punch for each female die. As shown clearly in Fig. 2, there are two die arrangements, one above the other and preferably these are offset in a certain relationship as will hereinafter be pointed out and preferably there are a plurality of dies in each horizontal row and same are spaced a predetermined distance apart and in noninterfering relation to the other row of horizontal dies but in what may be said to be an interfitting, or staggered relation.

Coaxial as it were, with each male corrugating or drawing punch structure 65, there is a blanking die 66 and said blanking die is adapted to cooperate with the peripheral edge 67 of the female die 64 to form the die receivable blank.

Slidably supported on the body portion 62 is a carriage or cross head construction 68 and the same is suitably apertured as at 69 for male die reception and mounts on its face confronting the female corrugating and drawing die 64 the blanking dies 66. This carriage or cross head structure is provided with links 69 and 70, pivotally connected together as at 71 and pivotally mounted at 72 upon the structure 62. When the parallel arranged toggle link structure 69-70 is extended from the position shown in Fig. 2, the blanking die will be forced to the right so as to sever the blanks from the sheet portion.

After the blanks are severed from the sheet portion I, the blanking die 66 travels on in a horizontal line to the right until the inner surface portion of the blanking die 66—see Fig. 9—with the thin fins, presses the outer portion of the blank into the series of grooves around the surface of corrugating and drawing female die 64. When this action has proceeded to the position that corrugations of sufficient depth have been formed in the blank, the action of links 69 and 70 is reversed, to withdraw the blanking die 66 with the attached fins to relieve the pressure exerted upon the blank by the fins in initially corrugating the blank.

When this withdrawal is accomplished to just a slight extent or sufficient to allow clearance between the edges of the fins on the blanking die 66 and the grooves in the corrugating and drawing female die 64—see Fig. 10—the links 69 and 70 pause or dwell in a fixed position. This is immediately followed by the forward or right hand movement of the male drawing punch 65—see Fig. 8—so that the blanks thus formed are received by the female die in alignment therewith and are formed into crude receptacle shape with preformed convolutions or corrugations therein, as will be more fully set forth hereinafter.

These male drawing punches 65—see Fig. 2—are carried by a cross head 73 which is slidably mounted as at 74 upon the cross head 58. The cross head 73 is connected by one or more link arrangements 75 to an eccentric portion 76 of a

crank construction 77 rotatable by shaft 78. This shaft 78 is operable in timed relation with the power application to the toggle link structures, previously described. Herein the links 69 are shown of adjustable character. Also, the link 75 is shown adjustable. This is to insure the proper operation of the respective die structures when they are caused to move from final position to the right, which is the operative position.

The toggle linkage, previously described, is connected by a link 79 at the connected points 71 and this link 79 is connected by a link 83 to one end of a bellcrank having the arm 81 and oscillatable by rockshaft 82 suitably operated in predetermined timed relation. It will be apparent that rollers 58—59 do not feed the sheet portion G, H and I, to the blanking and initial forming dies while said dies are in operative position.

Immediately upon the formation of the blanks and the initial formation of the container article with the corrugated wall arrangement therein and upon retraction of the respective dies causing the aforesaid, the rollers 58—59 advance the sheet a predetermined amount so that additional blanks may be cut therefrom and these blanks similarly operated upon.

The web, indicated at J in Fig. 2, passes between the positively driven feeding rolls 83 and thence through the guide members 84. The depending end of the web is in timed relation, severed by a pair of cooperating cutter structures 85 into small pieces that are received by a waste receptacle 86. This waste stock, if not impregnated with materials that are unacceptable, may be sold as waste and pulp stock suitable for use in paper and like formations or may be returned to the pulp beaters and be disintegrated and formed into sheet pulp again, providing this process is operated as vertical integration in the pulp mill.

Adjacent the blanking and initial dieing station is a turret structure, indicated by the numeral 87, and carried by the rotatable shaft like member 88. This turret is provided with four faces and each face is provided with a receiver arrangement. Since these are identical, a description of one will suffice for all.

It will be remembered that two horizontal series of blanking dies are utilized and by referring to Fig. 7, it will be noted that the sheet H has been previously blanked and upon the next blanking operation, two spaced blanks indicated by X are formed therefrom, leaving the web portion I therebetween.

The receiver structure is shown in Fig. 6 and this figure shows two receivers each of which is of partable or expansible character, the left hand receiver being shown expanded or parted, which corresponds to the position of the receiver parts when it is in alignment with or registering with the blanking station. Fig. 6 also shows the right hand receiver in closed position which is the position each receiver parts assume when at all other stations assumed in the intermittent rotation of the turret. Herein one-half of the receiver structure is indicated by the numeral 89 and the other half by the numeral 90. Each receiver "plate" includes a plurality of cutout portions 91 and a plurality of well portions 92. These are aligned transversely in portions 89—90, one with the other so that each cutout portion is opposite a well portion and vice versa and in each portion

89 and 90, the recess and well portions are alternated, as illustrated.

From a comparison of Fig. 7 and a comparison of the left hand portion of Fig. 6, it will be apparent that the three right hand blanks X will be received by the three upper well portions 92 in the portion 90 and the three left hand blanks X in Fig. 7 will be received by the three lower well portions 92 of portion 89 after the blanks X have been formed and have been forced through the female corrugating die by means of the cooperating male punch.

These two portions 89 and 90—see Fig. 2—are herein shown conventionally associated together by means of links 93 and 94 which are connected together as at 95 coaxially with the power or source of turret rotation. Any suitable means, such as a cam or the like, may be arranged to effect movement of said links towards and away from each other at the desired position. In other words, when any particular receiver structure 89—90 is positioned adjacent the blanking station, the two links are then separated and are retained in separated relation until the turret indexes. Upon such indexing movement, the two links are caused to move toward each other and register with each other, as shown, thereby bringing the two complementary halves of the receiver 89—90 together to form the complete receiver, such as shown in the right hand portion of Fig. 6. This position in this partable receiver is retained throughout the turret movement subsequent thereto until this particular receiver is again caused to move into registration with the blanking station at the end of one cycle of turret movement for that receiver. Of course, the other three receiver structures are similarly constructed and similarly operable.

Reference now will be had to the central upper portion of Fig. 2. Herein numeral 96 indicates a stationary portion of the turret enclosing or enveloping apparatus. It is provided with interior ways 97 upon which is slidably mounted a cross head 98 in turn provided with ways 99 that slidably supports a cross head 100. The cross head 98 is pivotally connected to a link 101 in turn pivotally connected at 102 to a link 103 and to another link 104, the latter being pivoted as at 105 on the portion 96. Links 101 and 104 constitute a toggle and link 103, the operating member therefor. The other end of link 103 is connected to the other arm 106 of the bell crank lever carried by the rock shaft 82 having the arm 81, previously referred to.

Also pivotally connected at 105 for convenience is a link 107 that is connected at its opposite end to a link 108 and to a link 109, the latter being connected to the cross head 109. The cross head 98 supports a die structure 110 and the cross head 100 supports a die 111. As previously set forth, there are six dies 110 and six plungers 111 carried by these two cross heads, and these are arranged in spaced and transverse row relation and alignment, respectively.

The link 108 is connected to one arm 112 of a bell crank operable by a rock shaft 113 suitably supported as at 114. Toggle links 101 and 109 each, are of adjustable character for die adjusting purposes. At this station designated by the letter K, the receiver structure 89—90 has been closed up or collapsed and as stated, assumes the position and appearance in plan as illustrated at the right hand portion of Fig. 6.

To the right of the turret structure in the portion 115 of the machine, there are provided

the ways 116 in which is slidably mounted cross head 117 carrying an expanding punch or die, indicated by the numeral 118. A link 119 is pivotally connected to a link 120 at one end and to the cross head 117 at the opposite end. It is also connected at the first mentioned end to a link 121 pivoted at 122 to portion 115. The link 120 at its opposite end is pivotally connected to the arm 123 of the bell crank having the other arm 112, previously referred to. Thus, the plungers 111 and 118 are operable simultaneously. Also, the blanking die and the die 110 are operable simultaneously. The punch 65, however, operates after the blanking die has operated and may operate at the same time and for the same interval of operation as the plunger punches 111 and 118. The expanding punch operates upon the blanks that are carried by the receiver structure and which are then positioned at the station L.

When the plunger punches have all been retracted from the material and are clear of the receivers 89—90, the turret is again indexed and the receiver moves to the station M. At this point or station, the receiver structure registers with an air supply arrangement through the openings 124—see Fig. 6. This air structure is supplied with air under pressure by line 125—see Fig. 2—controlled by valve 126. This valve regulates the amount of air pressure applied. The air pressure for operation is applied intermittently, that is, each time a receiver 89—90 registers at the station M, air pressure is supplied to the conduit 125 and when that is done, the regulated discharge of air discharges the article from the receiver 89—90. The air may continue to discharge during the entire time that the turret remains stationary or the intermittently operable control (not shown) for the air supply may be so regulated that the interval of air application is only that sufficient to eject the articles from the receiver 89—90. Following article ejection the turret again indexes and the receiver moves to the blanking position and in that movement, the parts of the receiver separate, as shown in Figs. 2 and 6 so that they receive the corrugated partially formed blanks for a second cycle of operation.

The details of the construction and operation of the plungers 111 and 118 and structure 110 will be set forth more fully hereinafter in referring to Figs. 16 to 19, inclusive. Also, the details of the construction and more specific description of the operation of the initial punch, plunger and dies, as shown in Figs. 8 to 15, will be set forth more fully hereinafter.

Positioned beneath the station M is an endless conveyor of suitable character and indicated more or less diagrammatically in Figs. 2 and 3 by the numeral 127. This conveyor includes a plurality of spaced, transverse rows of article receivers, including the weight portions 128, stem portions 129 and the article supporting portions 130. The weights always maintain the article supporting portion 130 uppermost. This is because these receivers are pivoted as at 131 to the conveyor structure. This conveyor structure is of open-work character. It will be obvious, since the runs are spaced sufficiently apart, that the desired constant positioning, previously referred to, can be maintained. The details of such a construction are intentionally omitted herefrom for simplicity.

It may suffice, however, to state the conveyor may include a pair of sprocket chains connected

at suitable intervals by rods which support the portions 130 of the transverse row aligned receivers, these being retained in the rod against lateral or longitudinal rod displacement so that these receivers can always tilt thereon to hold the head or article supporting portion upward and, the weight downwardly irrespective of the position of the run of the endless conveyor any particular receiver may then occupy.

Adjacent the station M is a pair of spaced arms 132 which are pivotally supported as at 133 upon a portion of the machine. An arm 134 depending from the arm 133 mounts a roller 135 that bears on a cam 136 carried by shaft 137. The chains or side portions of the conveyor are associated with the adjacent sprocket wheels, pulleys or the like, 138, carried by the shaft 139 in turn carried by the end of the arms 132. As the shaft 137 is rotated in timed relation to the previous operation, the arms 132 will be raised and lowered. As each row of receivers is presented to the station M, the high point of the cam 136 by engaging the roller 138 causes the adjacent end of the conveyor structure to elevate so that when the air pressure is supplied to the receiver 89—90 at station M, the article will be discharged so as to envelope and seat or nest the head portion 130 of that adjacent receiver. Promptly thereafter due to gravity, or spring means may be provided, if desired, the cam 136 having moved so that its lower point then is adjacent the roller 135, the arms 132 lower to the full line position shown in Fig. 2 so that the article and the receiver 128—129—130 then are not located within the receiver 89—90. Thus, the receiver clearance necessary is provided for so that upon subsequent turret rotation the discharging receiver may readily move from station M to the blanking station or initial position.

Reference now will be had more especially to Fig. 3. Herein the numeral 140 indicates a drying oven housing having an inlet opening 141 confronting the previously described blank forming mechanism and having a discharge opposite opening 142. Near the bottom of this housing a suitable source of heat is provided. Herein the same includes a plurality of gas burners 143, the flames of which are directed upwardly and which are supplied by a master line 144 controlled by a valve 145. This heat supply is continuous. The products of combustion rise upwardly through the housing or chamber and impinge upon the baffle plate 146 in spaced relation to the top of the housing which supports the same, as indicated at 147. The gases pass laterally around the plate 146 and thence outwardly through the control flues 148 controlled by valve 149.

Mounted within the housing 140 is a suitable frame work 150 which supports suitable pulleys, sprockets or the like, 151. The conveyor 127 passes inwardly into the housing 140 at the aperture 141 and the chain portion thereof is engaged by a sprocket gear 152 carried by shaft 153 which is positively driven. All of the wheels 151 may be sprocket or gear wheels, if desired.

The conveyor 127 thence passes upwardly and over the wheel 154 and thence across to the discharge side of the drying oven, thence back and forth from the entrance side to the discharge side and finally the conveyor leaves the housing through the discharge aperture 142. Following removal of the article from the receivers or supports of the conveyor, the conveyor reenters the housing 140 through the aperture

142 and then leaves the housing 140 through the aperture 141 and passes to the wheel 138. Where the lower run of the conveyor leaves the housing, there is provided a wheel 155. This also may be of sprocket character and positively driven. The wheels 138 may be of sprocket character and positively driven.

Immediately adjacent the aperture 142 in the oven 140 is a support arrangement 156 which pivotally supports at 157 a pair of arms 158 in turn rotatably supporting as by the shaft 159 spaced wheels 160 similar to wheels 138.

Immediately adjacent the aperture 142 in the oven 140 is a support arrangement 156 which pivotally supports at 157 a pair of arms 158 in turn rotatably supporting as by the shaft 159 spaced wheels 160 similar to wheels 138. A U-shaped guard 161 is suitably carried by the arms 158 and is positioned in spaced relation to the conveyor 127, as shown.

Suitably supported by means, not shown, and omitted for simplicity, but carried by the arms 158, is another guard 162 and this has an outwardly directed lip portion 164 which is adapted to be engaged by the articles carried by the conveyor 127 so that said articles in the travel of the conveyor 127 adjacent the guard are caused to be retained upon said receivers until the receiver and the article reaches the station designated by the letter N in Fig. 3.

A third receiver arrangement which is of the external type in that it may be said to be of cup form, is at this station adapted to receive the discharged articles which have been partially formed and partially dried. Herein numeral 164 designates such a receiver structure and a corresponding number of receivers are arranged in transverse rows and are suitably connected together to form an endless conveyor structure 165.

Rotatably supported in the support 156 is the shaft 166 which mounts cams 167 immediately adjacent the rollers 168 carried by the depending arms 169 in turn carried by the arms 158. The shafts 137 and 166 are similarly operable so that the high point of the cam 166 and the low point of the cam 167 are operable or effective at the same time so that the entire discharge structure is lowered at the station N at the same time as the receiving structure is elevated at the station M so that as the articles are discharged at the station N, the similar articles but not dried, are received at the station M.

The movement of the conveyor through the oven naturally is of intermittent character and this is because the conveyor could not move without interference when the mushroom type receivers are nested within the partable receivers at station M or the mushroom type receivers are nested within the cup shaped receivers 164 at the station N.

Adjacent station N, see Fig. 3, is a transverse header 239, having six nozzles 239, supplied by line 237 controlled by valve 238. This line is arranged to have intermittently supplied thereto, in the manner previously described, relative to line 125, and simultaneously therewith (and intermittently) air pressure to facilitate or effect separation of the article from its mushroom support, and its ejection into and seating in the adjacent receivers 164 (at station N) carried by conveyor 165.

As previously set forth, the successive transverse rows of receivers, cup-shaped in character and indicated by the numeral 164, are suitably

connected together or supported by a conveyor structure 165. This conveyor structure is associated with a wheel arrangement 170 carried by shaft 171 mounted in brackets 172 and these wheels 170 may be positively rotated but such rotation is of intermittent character for the reasons previously assigned. The brackets also support the successive wheels 173 and 174 carried by shafts 175 and 176, respectively. These also may be positively driven, if desired, the conveyor passing under wheel 173 and over wheel 174 and from thence passing inwardly through an aperture 177 of a housing 178 in the lower part of which is mounted a bed plate 179, the position of which may be adjusted as indicated at 180. These receivers and the connecting conveyor structure leave this housing at the aperture 181.

This conveyor structure may also be of sprocket chain type and the wheels associated therewith may be of sprocket gear type.

Within the housing 178 above the bed plate 179 there is provided a way structure 182 which slidably supports a crosshead 183 provided in turn with ways 184 which slidably support crosshead 185. The crosshead 183 is connected by link 186 to another link 187 pivoted at 188 to the interior of the housing 178. The crosshead 185 is pivoted by a link 189 to a link 190 also pivoted at 188.

The several links last mentioned constitute toggle structures and means for moving the same are associated with the midpoints 191 and 192 thereof but herein in view of equivalent disclosure of toggle operating mechanism shown in Fig. 2, these toggle operating mechanisms herein have intentionally been omitted for clearness.

The conveyor positions the cup-like receiver 164 beneath a plunger 193 at the station O and this plunger 193 is carried by the crosshead 185. This crosshead 185 also carries plunger 194 at the station P. The crosshead 183 carries the die structure 195 cooperating with the plunger die 194. The last mentioned triple die structure constitutes the finishing dies and illustrates two successive stages of finishing operation.

Plunger 193 is of the mechanical expander type whereas plunger 194 is of the pressure expandable type. The mechanical and pressure expanding plunger finish the interior of the article to size, eliminating all wrinkles et cetera, therein, both internally and externally. The die 195 forms the finished head or outer edge of the article between these operations and holds said edge in finished position and formation during final finishing, sizing, et cetera. Since the equivalent structures appear at 110-111 and 112 and same as illustrated in Figs. 16 to 19, inclusive, and will be described hereinafter more fully, no further description will be given here.

In an article of $3\frac{1}{2}$ " in diameter, it is finished or stretched, for example, to $\frac{1}{8}$ " greater diameter and in the second drying operation, the heat tempering causes uniform shrinkage, the stock springing back uniformly to final size and being finally set at the final size.

For exceptionally smooth finished walls of articles another or second finishing unit press of two stages may be operated between the second drying oven and the discharging station Q of the second conveyor 165.

It will be obvious that when the conveyor 165 is stationary, that is during the interval required to eject or discharge the articles from the mushroom shaped receivers, the plungers 193 and 194

are effective as well as the die 195 and that when the conveyor is moved, all the dies are free and clear and positioned above the cup-shaped receivers 164. Thus, the conveyor 165 is intermittently operable in timed relation necessary to secure this time sequence and clearance relationship.

The conveyor 165 enters a second drying oven or housing 198 through aperture 197. Adjacent said aperture 197 is a wheel structure 198 which is suitably supported at 199. This wheel structure may be of sprocket character and the connections at the ends of the transverse rows of cup receivers may be of sprocket chain character.

Within the housing 196 which is substantially similar to the housing or oven 140, there is provided the heating means 200 supplied with fuel as at 201 and controlled as at 202. The products of combustion are baffled by plate 203 and flow laterally to the sides of the housing and thence upwardly to the discharge or venting flues 204, each of which preferably is valve controlled as at 205. The baffle structure 203 is suitably supported from the roof as at 206.

Within the housing 196 is the frame structure 207 which supports adjacent each opposite side wall of the housing a plurality of wheels 208. Herein the mechanism differs from that previously described for the first drying oven, in that there is provided the guide and article retaining shields 209, these being provided, so that the articles in the inverted runs, as it were, of the conveyor structure 165, to prevent accidental loss of article from the cup type receiver. The last and lowermost run of the conveyor with the articles included therein leaves the housing 196 through the aperture 210 and immediately engages a wheel structure 211 carried by a shaft 212 in turn supported by a bracket structure 213 carried by the housing 196. After passing under wheel 211, the conveyor passes over a similarly supported wheel 214 and thence passes approximately half way around a wheel 215 carried by the free end of the bracket 213. The conveyor or receivers after passing this discharge station Q pass over a similar wheel structure 216 similarly carried by the frame 213 and under another wheel 217 also similarly supported and adjacent the discharge aperture 210. The lower run of the conveyor 165 thence passes through the housing 196, leaving the same through the aperture 218 and passing over the wheel 219 carried by shaft 220, in turn carried by bracket 221 also carried by housing 196. The conveyor 165 thence passes under wheel 222 mounted as at 223 upon the finishing press arrangement and thence passes directly to the wheel 170.

Any or all of the respective wheels may be positively driven as necessary or required, although it is to be understood this conveyor travel is, of necessity, of intermittent character but progressive or successive in character, the stationary intervals being necessary for article reception by the cup-shaped receivers and the die operations.

At the station Q, there is provided an air pressure supply line 224 controlled by valve 225 and having an outlet arrangement 226 of header character and having discharge ports adapted to register with ports in the bottom of the cup-shaped receivers 164 so that when the conveyor is stationary and the receivers at the station Q register with this header 226 and air is supplied for a

predetermined interval under pressure to line 224, said air pressure will discharge the finished article from the cup-shaped receiver 164 into a suitable container 227 therebeneath, which herein is shown pivoted as at 228 upon a base 229. This receiver may tilt back and forth so that the articles are discharged in regular sequence across and back in the container so that when the container is full of articles, the covers 230 may be closed and sealed and the container removed from its cradle 231 pivoted at 228. An empty container may then be supplied to the cradle and the packaging, therefore, is continuous. Mechanism for tilting cradle 231 in accordance with the foregoing herein is intentionally omitted for clearness.

Whenever it is desired to further decorate or surface finish the articles, in lieu of the container arrangement, there may be provided a second conveyor structure similar to conveyor 127 and provided with mushroom receivers 130. This second conveyor adjacent station Q would be mounted and operated as illustrated at the left hand end of conveyor 127—see Fig. 2. Each mushroom receiver might include a small pinion on the tail portion—see stem or tail 129—which in the travel of the conveyor would engage a rack or like, that would rotate said receiver so that an inner, an outer, or inner and outer directional spray device would coat the interior, exterior or both surfaces of the article in the desired manner. In this manner a lacquer color coat can be applied. Of course, the sprays would not discharge while the conveyor was not moving. Ejection of coated articles from these modified mushroom receivers could be effected as illustrated at the right hand end of conveyor 127—see Fig. 3—after passing through a drier similar to that illustrated in Fig. 3, if desired or required. Such ejected articles then could be collected as illustrated in the right hand portion of Fig. 5.

Whenever intermittent conveyor movement is not desirable or cannot be utilized, the elevating mechanism for the conveyor would not be utilized but each article would be pressure ejected at station Q into a chute which would guide the article to a registering mushroom receiver therebeneath, the chute being relieved to permit receiver movement into chute registration, travel therethrough and article and receiver passage therefrom all without interference.

Apparatus suitable for effecting such additional operations is intentionally not illustrated herein for the same may assume, as is obvious from the foregoing, several different types or forms and such apparatus utilized for individually supporting and transporting articles for subsequent coating by spraying and the like, as well as drying same, when desired or required.

However, the foregoing constitutes a disclosure of subsequent ornamentation of formed articles, and is a part of a process for forming ornamented articles of the character described and from prime sheet pulp material and in the manner described and claimed.

Having thus briefly described the major portions of the apparatus suitable for performing the complete process previously described, reference now will be had to the detailed description of the initial corrugating and blank operating die structures, including the male and female portions thereof, the die structure illustrated at station K, the plunger die structure indicated at

station L, and the die structures illustrated at station O and P, respectively.

Reference will now be had more particularly to Figs. 8 to 14 inclusive. As previously described, the stock material is fed in sheet form and between the guides 60. As previously set forth, in the body 62 there is formed an aperture 63 in which is mounted the female corrugating or drawing die 64. Now, the outer peripheral edge of said die as indicated at 67 is engaged by the blanking die 66 carried by the crosshead 68. This forms a circular blank from the sheet which remains stationary during the subsequent operation at this station.

Now, with the sheet severed from the blank, there results a circular blank between the forming die 62a and the flared portion 64a of the tubular die 64. As shown in Fig. 8, the two confronting faces 62b of these two structures are tapered or inclined toward the tubularity in the female corrugating die 64.

As shown in Fig. 10, the face 64b is corrugated, as indicated at 64c. These corrugations are radially arranged and in spaced relation and are equidistant. The corrugations are formed by the grooves 64d in said face which grooves merge into the linear grooves 64e in the tubular portion of the female die 64, the merging portions being indicated by the numeral 64f.

There is suitably secured to the confronting face 62b of the die 62a a plurality of corrugating fins 62c. These are preferably formed in pairs, as illustrated in Fig. 11, a pair of said fins being connected together as indicated at 62d and being suitably secured to the face 62b, as indicated at 62e. The resulting construction is that there is provided an annular series of radially arranged fluting fins, each of which is adapted to register with a fluting groove 64d. As previously described, the initial movement of the crosshead 68 forms the blank by severing the same from the sheet stock I and then continued movement of the crosshead 68 toward the female corrugating die forms in the blank the creases indicated by AA in Fig. 13. After this formation occurs, as previously described, the crosshead 68 backs away from the corrugating female die an amount sufficient to relieve the clamping action of said dies on the radially creased circular blank. This return movement, however, is not sufficient to clear the cutting die 66 from cooperative position or association with the cutting surface or periphery 67, but so that the blank I remains trapped between the two corrugating dies.

Thereafter, as previously described, the male plunger 65, having the substantially conoidal end 65a, is caused to advance and it enters the aperture 63 in the corrugating die 62a. The periphery and point, as it were, of this plunger 65 is longitudinally fluted as at 65b and the fluting extends into the front face 65c as indicated at 65d. The positioning of these flutings are such and the spacings are such that they correspond with and are complementary to the flutings or grooves 64e in the female corrugating die 64. Upon the face 65c engaging the blank I after the die 62a has been retracted to blank releasing position continued forward movement (movement to the right—see Fig. 8) serves to draw the blank stock into the tubular portion of the tubular female corrugating die. In so doing, the previously radially grooved rim portion of the stock follows the groovings and is partially confined by the ribs 62c so that said

stock includes a bulging, buckling or bowing position as indicated at BB in Fig. 14. Fig. 14 illustrates what might be said to be the edge of the blank after having been drawn toward the central hole in the female die and to an extent where said edge is midway between the outer peripheral edge of the die and the inner tube forming edge of said die. This action results in, first, the formation of preformed flutes and then the formation of preformed corrugations between the fluted portions by reason of the aforesaid action. These corrugations are compressed in the movement of the blank into the tubular portion of the female die 64 so that when the blank is finally drawn into semi-article formation, as illustrated in Fig. 15, there is provided at the upper edge thereof a reversely corrugated formation in the stock, the same being indicated by the letters CC. This means that the stock or material from the bottom or side wall immediately adjacent the bottom to its upper or outer free edge is progressively corrugated and, therefore, is progressively thickened in the initial formation.

Fig. 15 illustrates the stock held in position with the male plunger seated in the female corrugated die just prior to the final forward movement of the plunger to eject the partially formed article from the blanking, corrugating and initial forming station and into the registering well structure 92 carried by the adjacent portion of the partable receiver 89—90. Following discharge of this partially formed article, the plunger is fully retracted to its initial position to the left, see Fig. 2, and the corrugating forming die and the blank cutting die 66 are similarly retracted. A web stripper 60a, see Fig. 8, may be employed if desired. It frees the web from die 64 when die 66 has cleared the forward end of blanking edge 67.

Then the sheet is advanced the required amount as previously described so that new blanks may be cut therefrom and new articles may be formed therefrom. Simultaneously therewith receivers are closed and the turret carrying the same and the receiving wells is indexed from the blanking station to the station K. No further description of the specific blanking and initial forming die structures, or their operation, is believed necessary. The foregoing arrangement, therefore, provides a very uniform, predetermined wrinkle in the blank and by reason of the backing off arrangement of the indenting or creasing die the friction of the surfaces upon the blank is reduced to a minimum and the subsequent formation of the blank into partial article form is thereby expedited.

Reference will now be had to Figs. 2 and 16. It will be remembered that in Fig. 2, numeral 111 indicated a plunger and this is a rubber expanding punch. Numeral 110 is the top edge forming collar which is locked in place by the mechanical pressure exerted by reason of the toggle structure associated with the crosshead 93 and it is locked in place on the receiver 89—90 in which is mounted the several wells 92, the interior thereof serving as an exterior form for the resulting article.

In Fig. 16, the same numerals are employed. The article is indicated by the letters DD. The plunger includes the main supporting member 111 which is apertured at 111a to receive the stem 111b of a rubber or resilient plunger structure 111c, the stem and member 111 being suitably locked together by means of a set screw 111d.

For a further description of the rubber plunger 111c, it is to be understood that owing to the nil compressing characteristics of rubber that this plunger in its normal state (without applied pressure) is somewhat smaller in diameter than the inside diameter of the resulting article and longer in its normal state than the depth of the resulting article. This proportion is essential so that plunger 111c can thereby enter or be withdrawn from the resulting article in its normal state, which is smaller in diameter and thereby allows for the proper clearance. Upon encountering axial resistance, the rubber expands outwardly or transversely and substantially equally.

As the crosshead 98 moves down toward the receiver 92, it initially has its central projecting portion 110a enter said well and this forces downwardly the stock of the article DD so that a substantially uniform, even and true upper edge is formed on the article. After the ring structure 110 is seated on the well, the plunger 111 advances and serves to force downwardly and transversely the excess stock and thus the thicker stock portions at the upper edge of the article DD are caused to flow into the thinner portions of the article until when the plunger 111 is fully seated within the well structure as shown in Fig. 16. The resultant article included between the well and the punch 111—111c is substantially of uniform thickness throughout. This appreciably removes all wrinkle formations and major deformations. In the third stage formation, as has been previously described, the punch 118 is of substantially similar or identical character to that indicated by the numeral 111 in Fig. 2 and illustrated in detail in Fig. 16, or on resulting articles where an exceptionally smooth finish is desired on the interior surface of the side walls a solid metal punch or an expanding mechanical punch referred to as 193 may be used.

Further referring to Fig. 16, for convenience only, the lower portion of said figure is shown as the same appears at station M in Fig. 2, it being understood that when at this station the crosshead 98 and the forming die 110 and plunger 111 are not associated with the article DD or the well 92 so that for the following description it is assumed that these parts are not present in the bottom half of the disclosure found in Fig. 16.

It will be remembered that a series of six wells is supported, three by one of the receiver elements 89 and three by one of the receiver elements 90, and when the two are associated together the six wells are in alignment and in predetermined spaced relation. The bottom of each well is herein shown provided with a bore 300 and slidably supported therein is a valve stem 301 mounted on one end of which is a retainer 302 and on the opposite end of which is mounted a valve 303 with a tapered face 304 that cooperates with the corresponding tapered face 305 of a frusto conical recess 306. The interior exposed face of this valve member 303 is flush with the bottom of the well structure. Each portion 83 and 90 is provided with a plurality of registering bores 307 that extend therethrough and communicate with similar bores 308 in the turret structure 87. These latter bores all communicate with a central passage 309 which in turn, at station M, registers with the air pressure supplying conduit 125 as diagrammatically illustrated in Fig. 2 and Fig. 16.

Each well is provided with a plurality of ducts 75

310 positioned about the stem receiving bore 300. When the pressure is supplied to the header structure 309, air pressure elevates the valve member 303 to open the same permitting the air to escape from said ducts and between the article and the well structure so that the air effects the release. This also is assisted by the action of the plunger type valve 303 by the force of gravity acting on said valve. Thus, each article is positively assured of ejection from its well structure at station M following initial formation at the blanking station and subsequent stations K and L.

Reference will now be had to Figs. 17 to 19 inclusive, as well as Fig. 4—the latter representing stations O and P following the drying of the article after initial formation and discharge from the well at station M.

In said Fig. 4, the punch 193 is of mechanical expanding type and one form of the same is illustrated in Figs. 17 to 19 inclusive. The plunger 194 constitutes the finish sizing punch and it may be of mechanical type or of the rubber pressure type as desired. If of the latter type, it may be substantially the same as that previously described and illustrated more particularly in Fig. 16. In any event, associated with the latter is the finishing collar or top edge forming die 195. As previously set forth, the receivers 164 are made a trifle larger in diameter than the wells 92 so as to allow the stretch previously mentioned in the side walls to take place in the mechanical expansion at this station O and to permit the article to relieve all stresses and strains therein so that the article will dry out to uniform size without any stresses or strains included therein that would subsequently be found in the second operation. It, of course, is to be understood that the finish punch 194 may also be of mechanical type, if desired.

In Figs. 17 to 19 inclusive numerals beginning with 211 are employed without regard to whether other numerals in other figures have been applied to the mechanical expanding punch designated more especially in Fig. 4 by the numeral 193.

Herein the punch structure is shown of six-segment character, as it were.

The central stem of the mechanical expander or punch is indicated by numeral 311 and mounts at its lower end the base or article bottom forming portion 312 which projects laterally therefrom and its upper face 313 is annularly grooved as at 314.

Slidably mounted on stem 311 is sleeve 315 including a longitudinally directed elongated slot 316 therethrough. The upper end of the sleeve 315 is threaded as at 317 to receive an adjustable stop member (nut) 318. The lower end of the sleeve 315 is frusto-polygonal in character having six tapered faces 319, and a shouldered portion 320.

A head structure 321 has its lower face 322 annularly grooved as at 323. Three spacing members 324 having shoulders 325 and 326 serve to space the head lower face 322 a predetermined distance from the base upper face 313 so that the six cooperating expanding segments may freely move radially therebetween. The ends 327 are threaded at 328 into the base 312 and the opposite threaded exposed ends 330 extend through bores 329 in the head mount and clamping nuts 331.

The head 321 is relieved as at 332 to form a chamber having shoulder 333 engageable by

shoulder 320 of the frusto-polygonal wedge 327. The head 321 includes an upwardly directed tubular extension 334 spaced from stem 311 and providing an annular channel for sleeve 315. A bolt 335 connects the stem and head together and rides in slot 316 of sleeve 315 and prevents relative rotation between the wedge and the expanding segments or the head and base.

The six expanding segments are of two kinds and alternated. One segment is shown clearly in Fig. 18 in side elevation. The other segment is shown clearly in Figs. 17 and 19 and in central section in the latter figure.

Each of the first mentioned segments 336 includes oppositely directed ears 337 and 338 which register with channels 314 and 323 respectively and associated with said ears are springs 339 and 340 which normally constrain segments 336 inwardly into wedge engagement. Herein the inner face of the segment 336 has an inclined face 341 complementary to the wedge inclination.

Each of the other three segments 342 is slotted as at 343 to embrace the spacing studs 324. This slot is of sufficient radial width, as illustrated, to permit the segment to move radially between the base and head. Springs 344 seated in recesses 345 in the stud 324 bear on face 343a of the slot 343 and normally constrain the segment 342 into wedge engagement. An ear 345 on said segment also seats in base slot 314. The wedge engaging face 345 of this segment is inclined and complementary to the inclination of the wedge.

The adjacent faces of adjacent segments are complementary as shown in Fig. 17 so that as the segments move outwardly and radially the summation resulting outer periphery is substantially complete and merges at the top and bottom with the adjacent outer surfaces of the head and base respectively as shown by the dotted lines in Fig. 18.

It will be obvious that bodily movement of stem 311 merely positions the mechanical expanding punch as desired. However, application of pressure to collar or nut 312 forces wedge 315 downwardly thereby simultaneously and to a corresponding degree forcing all segments radially outward. Final outward movement may be limited by the lower end of slot 316, the lower limit of travel of the member engaging the nut 312 or by ears 337 and/or ears 345 engaging annular slot 314, as desired or required.

It is also to be noted that the rubber plunger shown and described may be pneumatic character instead of substantially solid character. When of pneumatic type, it would be inflated by a regulated pressure before or during seating movement or when seated as desired or required. Such inflation naturally would be properly timed.

While the invention has been illustrated and described in great detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In a container forming machine, means at one station adapted to simultaneously supply blanks to a pair of spaced, movable, elongated members, means for moving said members laterally into abutting relation and away from each other, at least one blank receiver carried by each elongated member, each receiver having a por-

tion projecting laterally from one side face of its elongated member and toward the confronting side face of the other elongated member, each blank receiver having a blank receiving cavity therein, the blank receivers being spaced apart lengthwise of the elongated members when the same are in substantially abutting relation, each of the confronting faces of the elongated members having a recess therein to laterally nest the laterally projecting portion of the receiver carried by the other elongated member when the members abut each other, the blank receivers, when so nested, being in alignment with each other, a plurality of aligned blank working means at a second station spaced from said one station, said blank working means having a spacing therebetween and alignment corresponding to the spacing between and alignment of said receivers when said receivers are at said second station and said members are in abutting relation, means for moving the receivers from the one station to the second station, and means for moving the blank working means into blank engagement for working thereon when the blank receivers are at said second station.

2. In a container forming machine, the combination of an indexable turret, means for intermittently rotating said turret, a plurality of pairs of spaced, movable, elongated members carried by said turret, means at one station adapted to simultaneously supply blanks to a pair of said members, means for moving each pair of members laterally into abutting relation and away from each other, at least one blank receiver carried by each elongated member, each receiver having a portion projecting laterally from the side face of its elongated member and toward the confronting side face of the other elongated member, each blank receiver having a blank receiving cavity therein, the blank receivers of each pair of elongated members being spaced apart lengthwise of the elongated members, each member having a confronting face recess adapted when the members abut each other to nest the laterally projecting portion of the blank receiver carried by the other of said elongated members, the blank receivers, when so nested, being in alignment with each other, a plurality of aligned blank working means at a second station spaced from said one station, said blank working means having a spacing therebetween and alignment corresponding to the spacing between and alignment of said receivers when said receivers are at said second station and said members are in abutting relation, the axis of turret rotation and the alignments of the receivers of the pairs of elongated members being parallel, the several pairs of turret carried elongated members having arcuate spacing therebetween for successive registration of each pair of members at said one and said second stations, the receivers at said one station registering with the blank supplying means and then with the blank working means at said second station, the means for moving each pair of elongated members towards and away from each other being operable prior to and following turret presentation of each pair of elongated members to the blank supplying means.

3. In a forming machine including a centrally apertured creasing member having ribbing at one end directed outwardly from the aperture, a plunger movable longitudinally in the aperture thereof, a tubular, interiorly corrugated, die

member, means for relatively moving said creasing member and said die member, a ribbed face on the die member at the end closest to the creasing member, the face ribbing being complementary to the creasing member ribbing for creasing a blank therebetween, said plunger having corrugations thereon complementary to the tubular die member corrugations, means for moving the plunger, following blank creasing, toward, into, and through the tubular die member with the previously creased blank between the die member and the plunger, to force the creased blank entirely through the die member, and a substantially closed end receiver mold immediately adjacent the blank discharging end of the tubular die member for simultaneous reception of the blank and the plunger, the plunger seating in said receiver mold and against the closed end thereof for uniform distribution of the blank stock.

4. A fibre stock forming machine, as defined by claim 3, wherein the ribbing of the centrally apertured member comprises a plurality of fin-like blades, each with an anchoring base portion, and means detachably securing the base portions to said centrally apertured member with the blades projecting therefrom and toward the tubular die member.

5. A fibre stock forming machine, as defined by claim 3, wherein the ribbing of the centrally apertured member comprises a plurality of fin-like blades, each with an anchoring base portion, and means detachably securing the base portions to said centrally apertured member with the blades projecting therefrom and toward the tubular die member, the blades being arranged in pairs and the base portions of each pair being integral, said base securing means being positioned between the integral base portion connected blades.

6. In a container forming machine, the combination with an intermittently movable endless conveyor, movable a predetermined distance at each movement thereof, a plurality of successively arranged cup-shaped receiver molds carried by said endless conveyor with a spacing therebetween substantially equal to the aforesaid predetermined distance, a stationary frame, a substantially stationary platen supported thereby and across which said conveyor passes for platen backing of the receiver molds, a pair of spaced plungers movably supported by the frame and simultaneously movable into a pair of platen backed adjacent receiver molds for expansion of the articles therein, said spaced plungers successively cooperating with each receiver mold, apertured ring means movably supported by the frame and adapted for engagement with a receiver mold for article retention therein and subsequent article top edge formation, one of the plungers being longitudinally movable in the ring means aperture and relative to the ring means for pressure surfacing and top edging of the retained article, means for selectively moving the ring means and the plungers toward and away from the then platen backed, plunger registering, receiver molds whereby the ring means is initially engaged with one of said platen backed receiver molds prior to the plunger nesting therein, said ring means moving means retaining the ring means in engagement with the ring engaged receiver mold until the ring means associated plunger is disengaged therefrom.

7. In a container forming apparatus having a plurality of article transfer stations, the combi-

nation of an endless conveyor intermittently movable between two stations, a plurality of cup-shaped article receivers, means for successively presenting each receiver, with a cup-shaped article therein, to one station, a second plurality of cup-shaped article receivers, means for successively presenting each of the second cup-shaped article receivers to a subsequent station, a plurality of article supports carried by said conveyor, successive article supports being successively registrable with and nestable in successive first cup-shaped receivers and then with successive second cup-shaped receivers, the conveyor being stationary during the nesting of the supports in the registering receivers, successive article supports having a spacing therebetween upon said conveyor whereby two article supports simultaneously register with one each of the different cup-shaped receivers, and means at each of the two stations for nesting the conveyor supported article support at that station within the adjacent cup-shaped receiver then registering therewith for article transference and then denesting of the same for conveyor and support travel clearance, operation of the last mentioned means only occurring when the conveyor is stationary.

8. A container forming apparatus as defined by claim 7 wherein the conveyor supported article supports at the transfer stations are oppositely directed relative to each other.

9. A container forming apparatus as defined by claim 7 wherein there is provided at each station intermittently operable fluid pressure means for facilitating transference of the article between the receiver and support then registering at that station and only operable when the conveyor is stationary and after the nesting means at the station has effected the nesting relationship between said registering receiver and support at that station, said fluid pressure means being inoperative when denesting has been effected for conveyor travel.

10. In a container forming apparatus having a plurality of article transfer stations, the combination of a plurality of parallel series of cup-shaped receivers, each series including a plurality of said receivers having like spacing therebetween, means for simultaneously presenting to one station, one receiver of each series, a second plurality of parallel series of cup-shaped receivers, each series thereof including a plurality of said second mentioned receivers having like spacing therebetween, means for simultaneously presenting to another station one receiver of each second mentioned series, an endless conveyor intermittently movable between the two aforesaid stations, a third plurality of parallel series of article supports on said conveyor, each series thereof including a plurality of said article supports having like spacing therebetween, the number of all parallel series being identical, the successive series being in alignment, the support spacing upon said conveyor simultaneously registering a support with one of the first mentioned cup-shaped receivers at the one station and another support in the same series with a second mentioned receiver of said another station, and means at each of the stations for moving the conveyor portions adjacent thereto toward and away from the adjacent cup-shaped receivers then at the stations to effect nesting and denesting between the then registering cup-shaped receivers and article supports.

11. A container forming apparatus as defined by claim 10 wherein the first mentioned present-

ing means comprises an intermittently rotatable turret upon which is mounted the first mentioned cup-shaped receivers, article transference occurring while the turret is stationary, and a plurality of reciprocable plunger die means in juxtaposition to the turret and movable toward and away from the latter, there being as many plunger die means as there are parallel series of cup-shaped receivers upon the turret, the plunger die means having an alignment parallel to the turret axis of rotation and spaced apart identical to the spacing between the parallel series on the turret, the plunger die means reciprocation occurring while the turret is stationary.

12. A fibre stock container forming apparatus as defined by claim 10 wherein the second mentioned presenting means comprises an intermittently movable conveyor upon which is mounted the second mentioned cup-shaped receivers, a stationary frame, a platen carried thereby over which the second mentioned presenting means conveyor passes, at least one of each receiver of each series of said last mentioned conveyor supported receivers being platen backed, the said one receivers having an alignment transverse to the parallelism of the series, and a plurality of similarly aligned plunger means reciprocable on the frame toward and away from the platen and into said platen backed receivers when the platen associated conveyor is stationary and the plunger means are in registration with the conveyor supported cup-shaped receivers on the platen.

13. A fibre stock container forming apparatus as defined by claim 10 wherein the second mentioned presenting means comprises an intermittently movable conveyor upon which is mounted the second mentioned cup-shaped receivers, a stationary frame, a platen carried thereby over which the second mentioned presenting means conveyor passes, at least one of each receiver of each series of said last mentioned conveyor supported receivers being platen backed, the said one receivers having an alignment transverse to the parallelism of the series, and a plurality of similarly aligned plunger means reciprocable on the frame toward and away from the platen and into said platen backed receivers when the platen associated conveyor is stationary and the plunger means are in registration with the conveyor supported cup-shaped receivers on the platen, and a

second plurality of plunger die means parallel to the first plurality of plunger die means, and similarly and simultaneously movable upon the frame, the spacing between the two pluralities of plunger die means being that between successive conveyor supported cup-shaped receivers, the platen simultaneously backing two successive conveyor supported cup-shaped receivers of each parallel series thereof, and a plurality of apertured ring means reciprocable on said frame and in each of which one of said plunger die means is mounted, each of the latter being relatively movable therein, the ring means engaging the platen backed receivers prior to plunger die means nesting therein, and ring means separation occurring subsequent to plunger die means denesting.

14. A container forming apparatus as defined by claim 10 wherein the first mentioned presenting means comprises an intermittently rotatable turret upon which is mounted the first mentioned cup-shaped receivers, article transference occurring while the turret is stationary, and a plurality of reciprocable plunger die means in juxtaposition to the turret and movable toward and away from the latter, there being as many plunger die means as there are parallel series of cup-shaped receivers upon the turret, the plunger die means having an alignment parallel to the turret axis of rotation and spaced apart identical to the spacing between the parallel series on the turret, the plunger die means reciprocation occurring while the turret is stationary, the second mentioned presenting means comprising an intermittently movable conveyor upon which is mounted the second mentioned cup-shaped receivers, a stationary frame, a platen carried thereby over which the second mentioned presenting means conveyor passes, at least one of each receiver of each series of said last mentioned conveyor supported receivers being platen backed, the said one receivers having an alignment transverse to the parallelism of the series, and a plurality of similarly aligned plunger means reciprocable on the frame toward and away from the platen and into said platen backed receivers when the platen associated conveyor is stationary and the plunger means are in registration with the conveyor supported cup-shaped receivers on the platen.

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