March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 1

Fig. 1

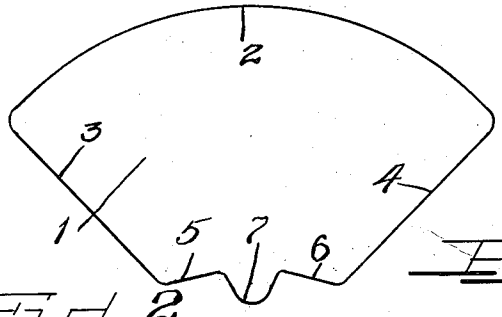


Fig. 2

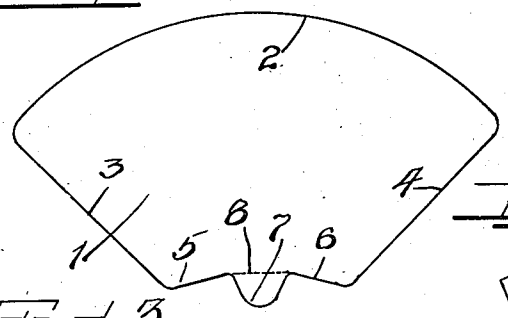


Fig. 3

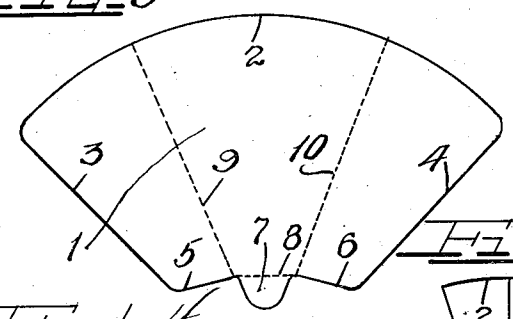


Fig. 4

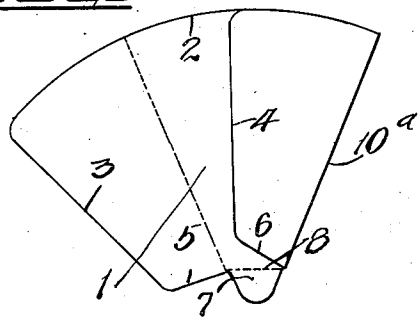


Fig. 5

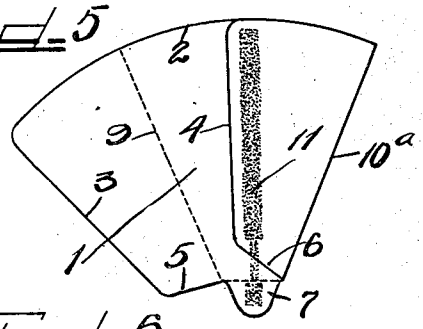


Fig. 6

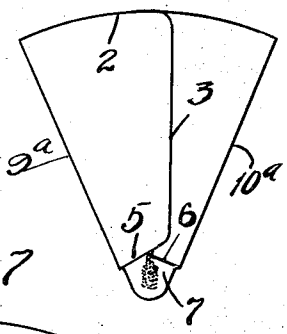


Fig. 7

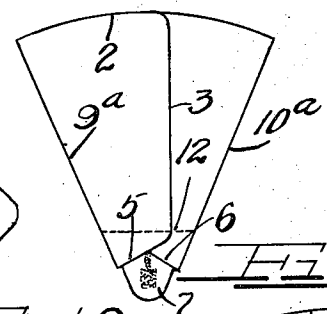


Fig. 8

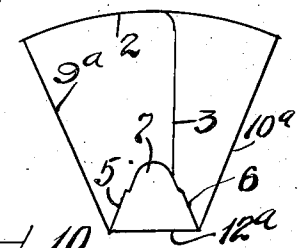


Fig. 9

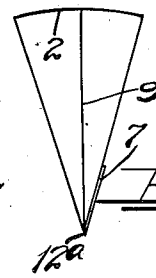
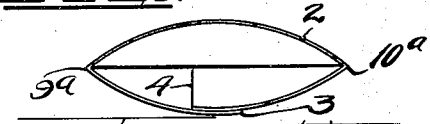


Fig. 10



Inventor

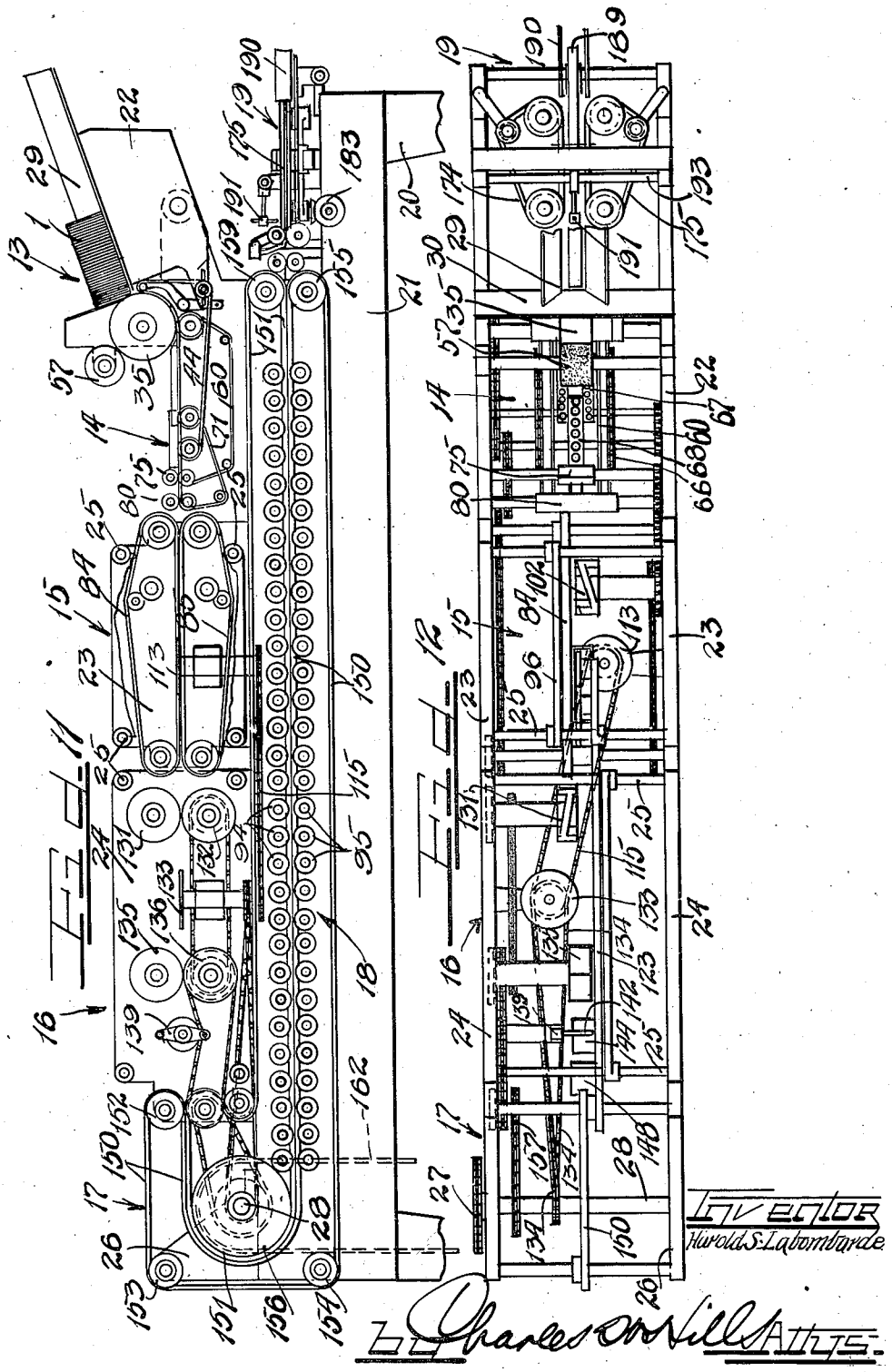
Harold S. Labombarde.

by Charles A. Wells Atty.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 2



Inventor
Harold S. Labombarde
By Charles O. Neill Attys.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 3

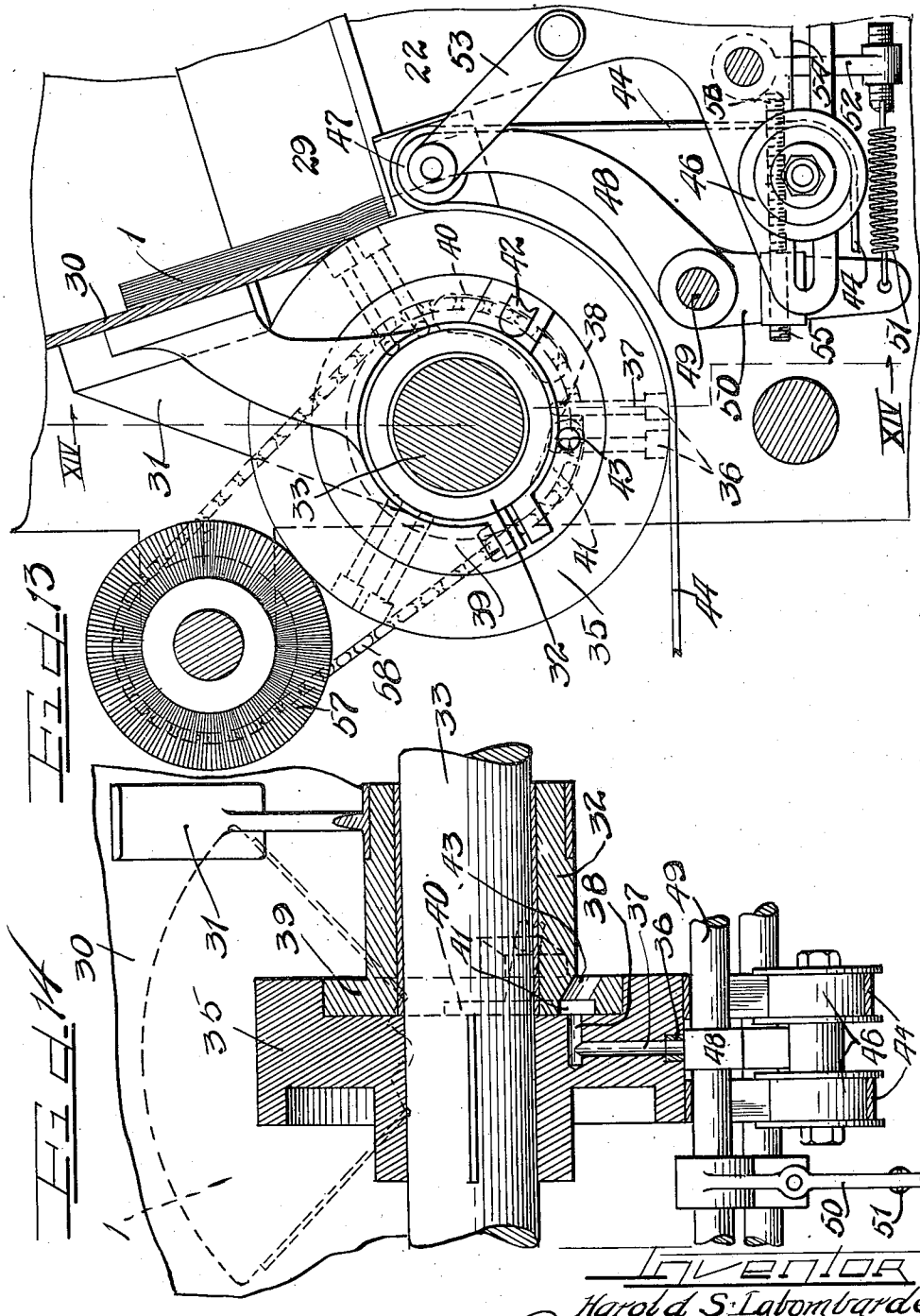


FIG. 13

FIG. 14

Inventor
Harold S. Labombarde
by Charles R. Wilkins
Atty.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 4

Fig. 15

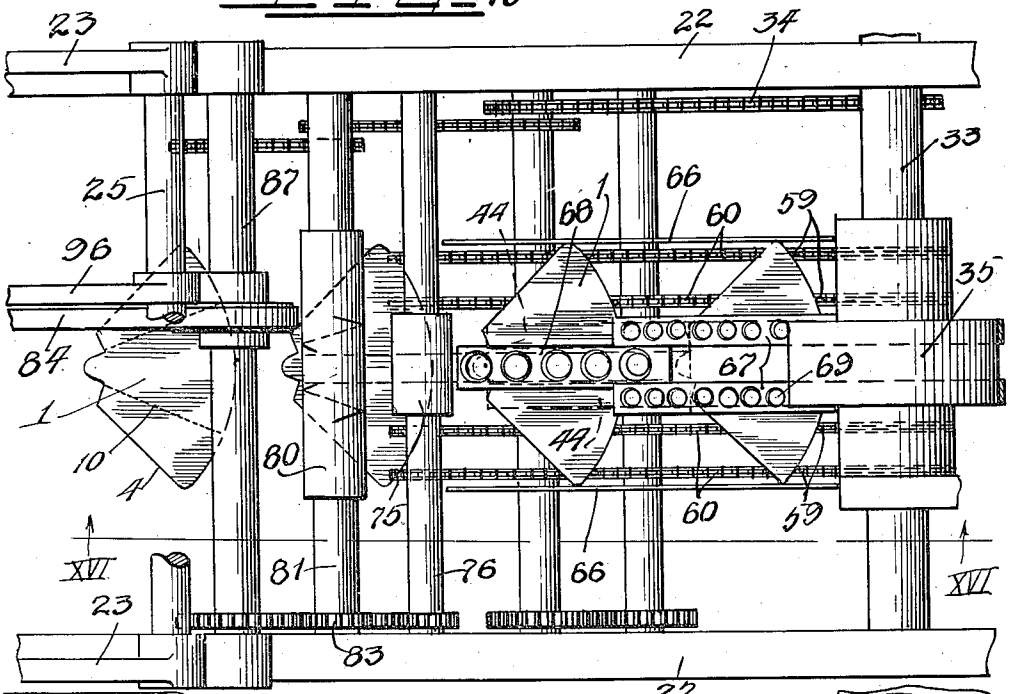
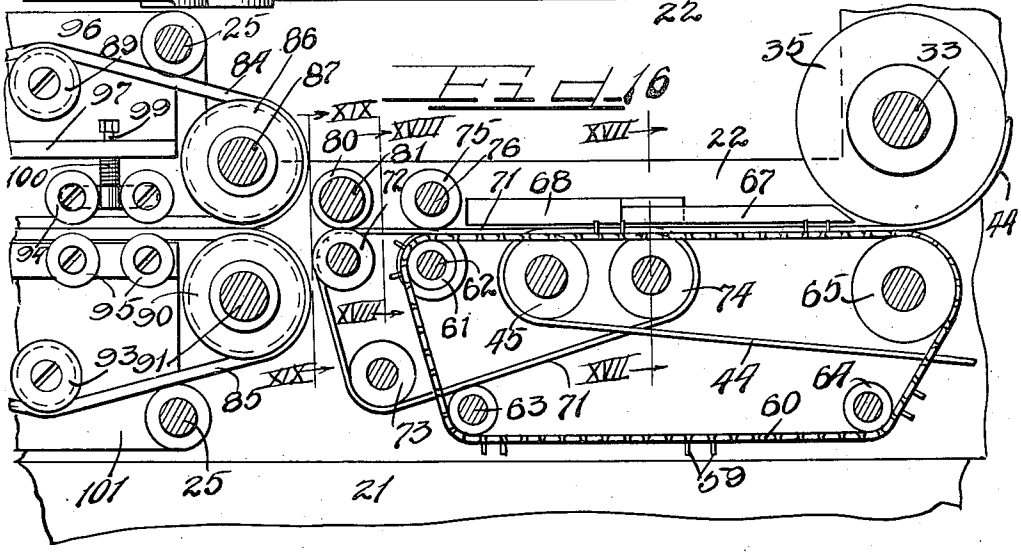


Fig. 16



Inventor

Harold S. Labombarde.

By Charles O. Hill
Attorney.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 5

Fig. 17

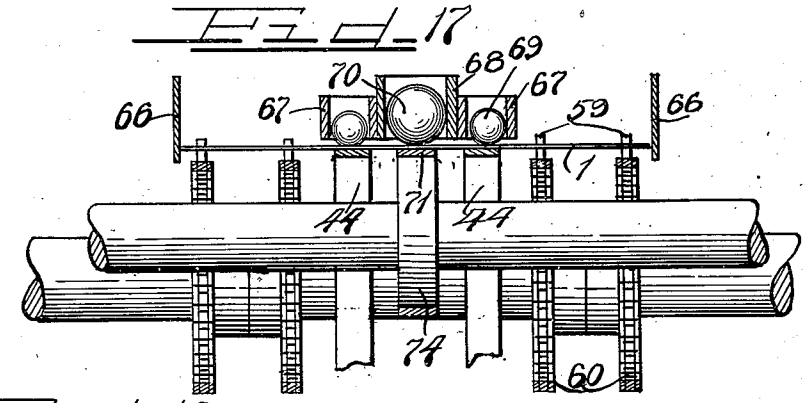


Fig. 18

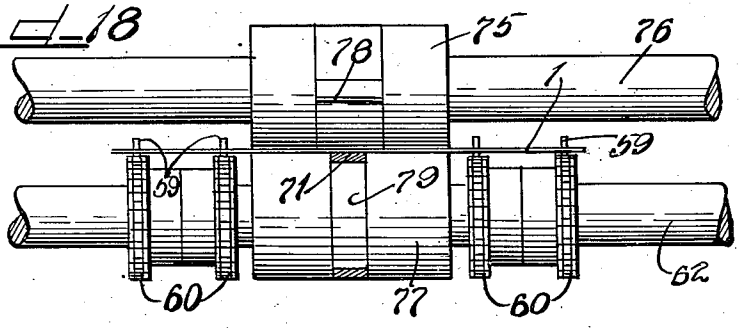
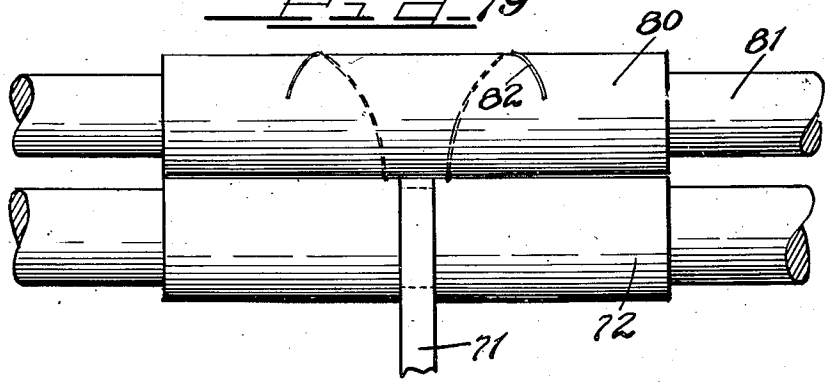


Fig. 19



Inventor
Harold S. Labombarde.

By Charles O. Fellows Attys.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 6

Fig. 20

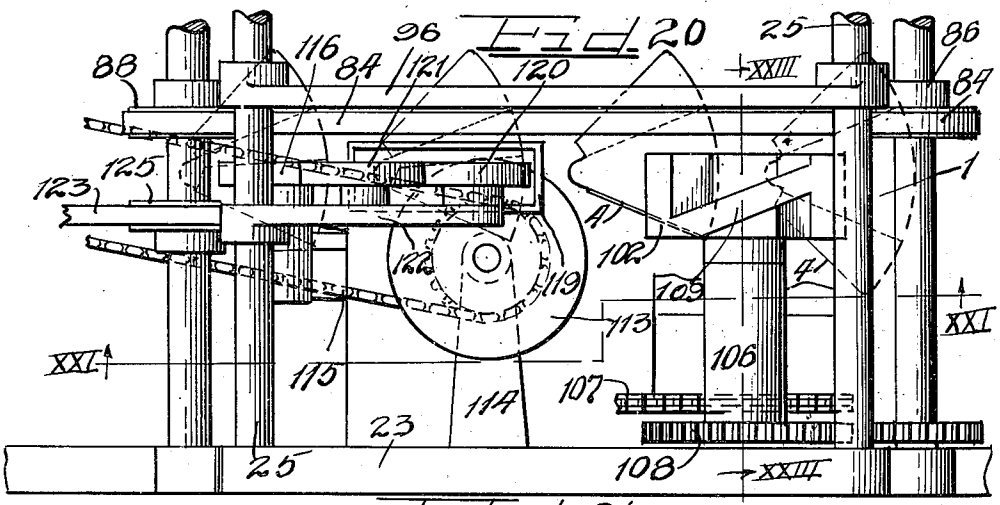
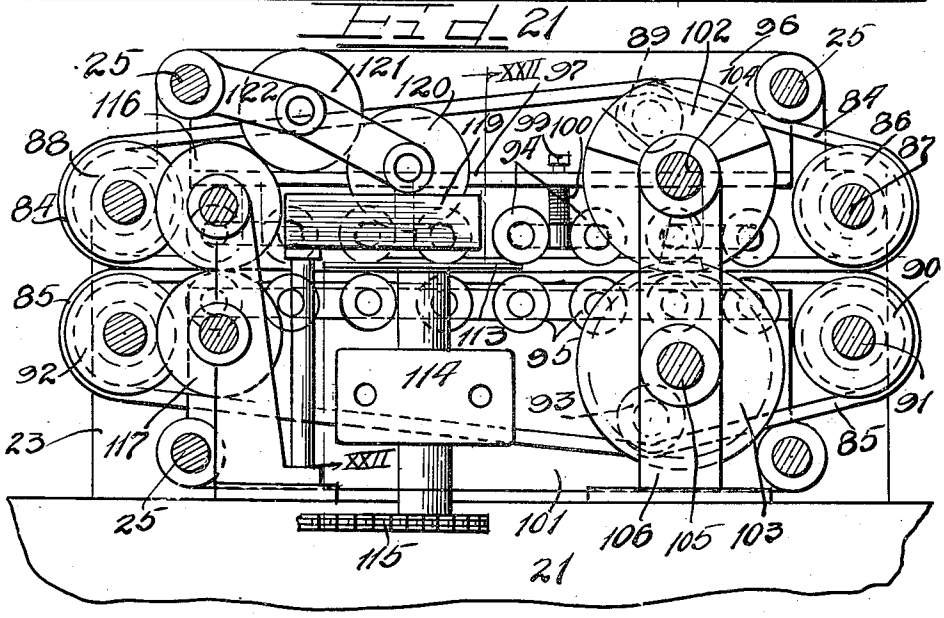


Fig. 21



Inventor
Harold S. Labombarde.
by Charles R. Hubbard
Atty.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 7

Fig. 23.

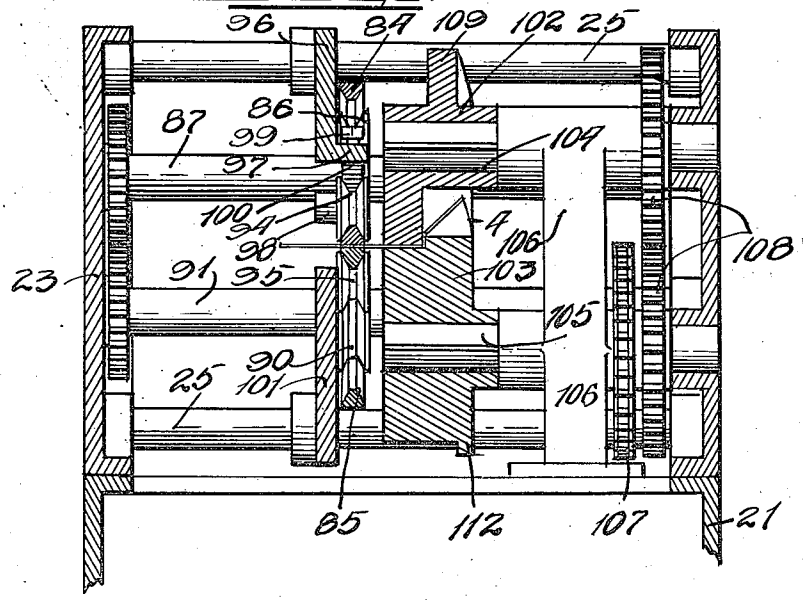
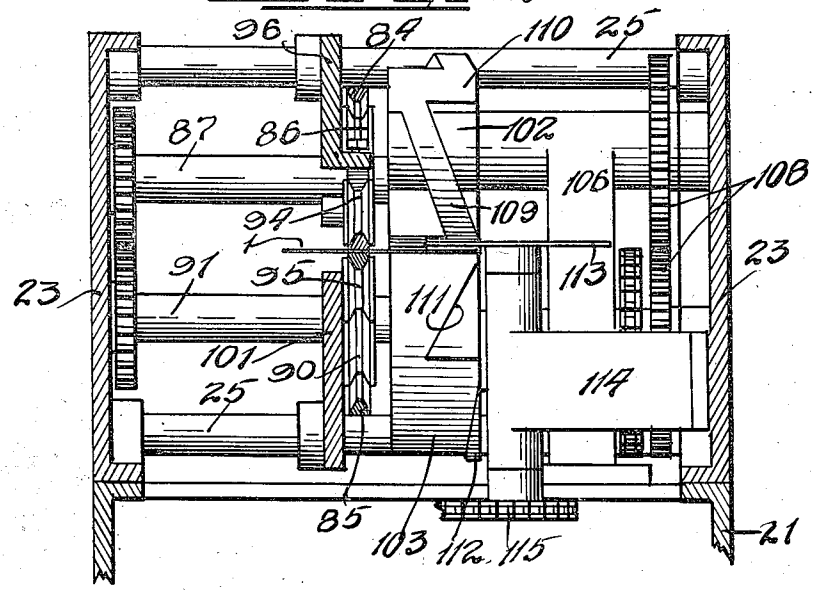


Fig. 22



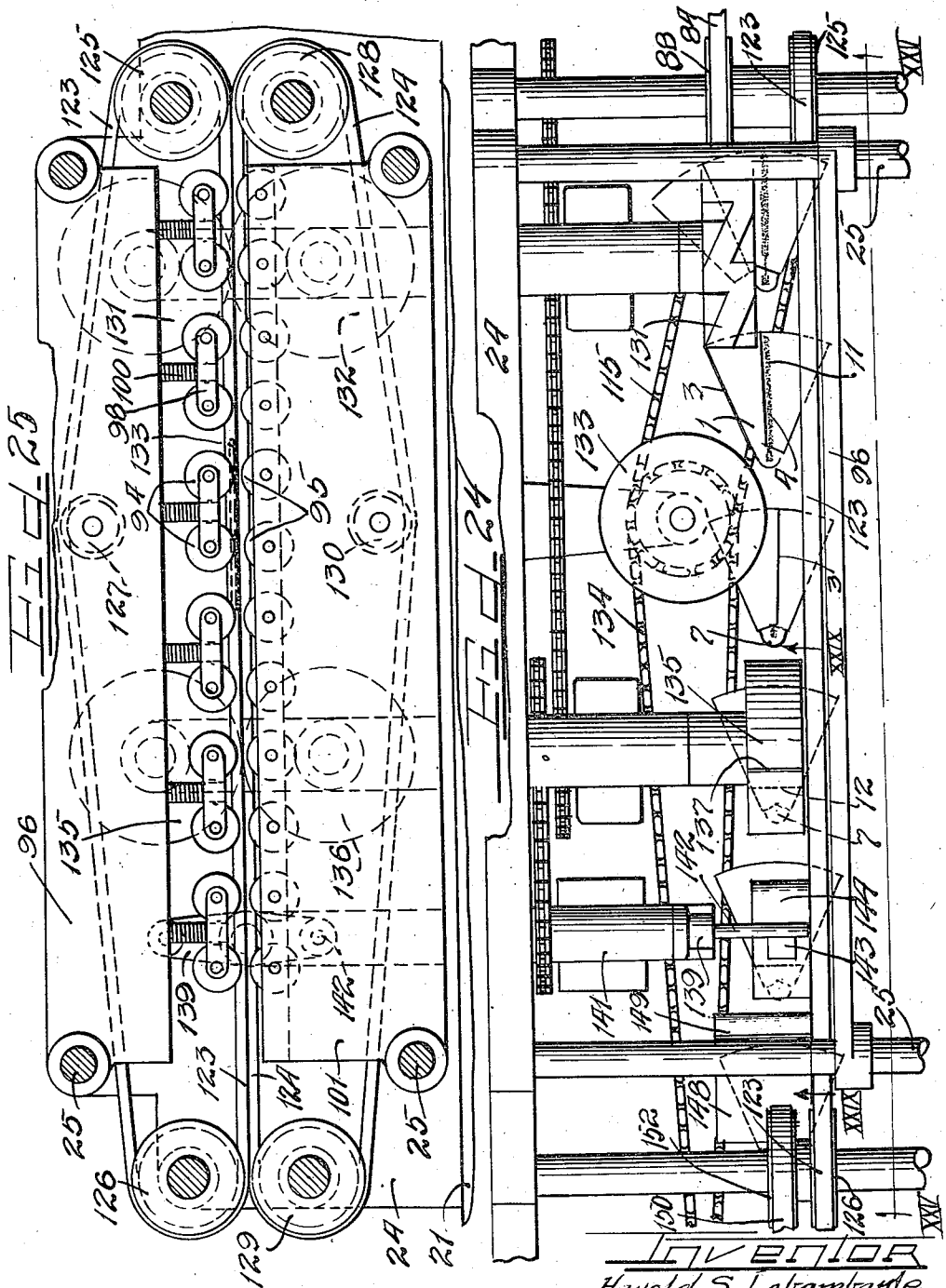
Inventor
Harold S. Labombarde.

By Russell & Williams.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 8



INVENTOR
Harold S. Labombarde
BY Charles O. Gill
ATTY.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 9

Fig. 26

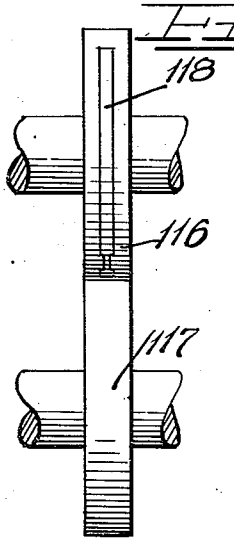


Fig. 28

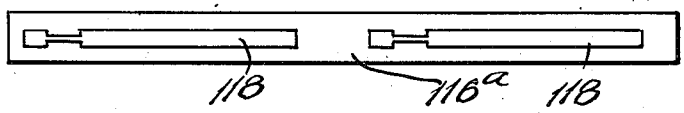


Fig. 27

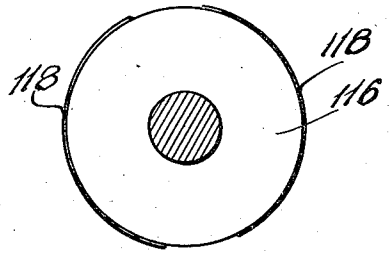
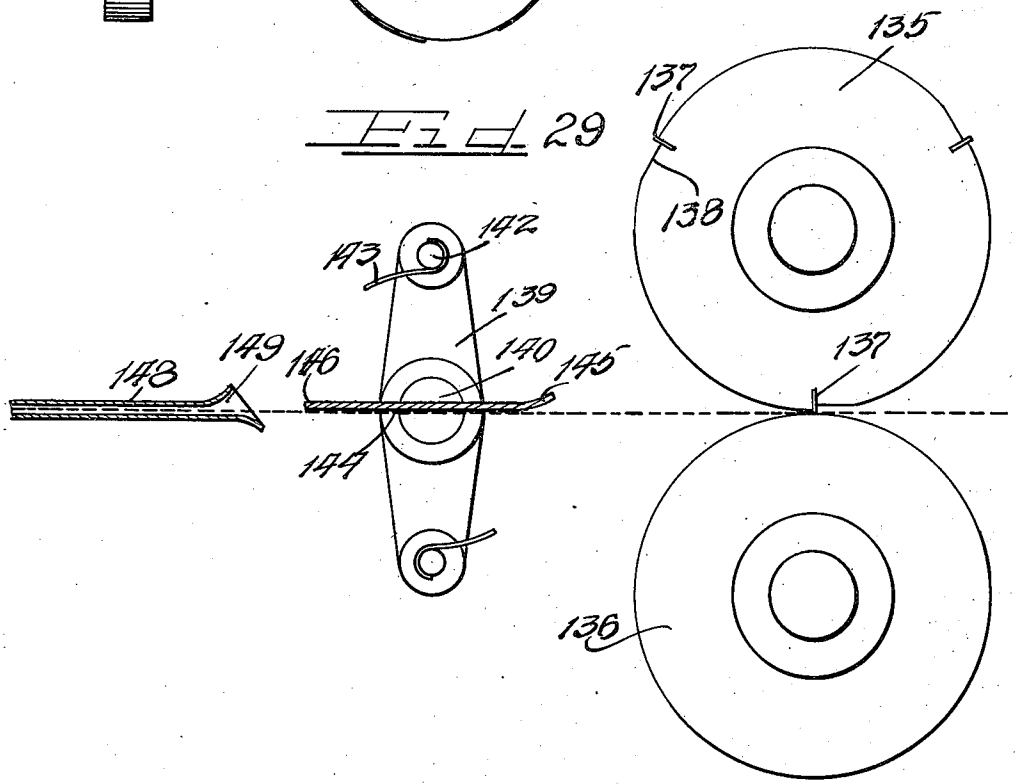


Fig. 29



Inventor

Harold S. Labombarde.

by Charles R. Hubbard

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 10

Fig. 31

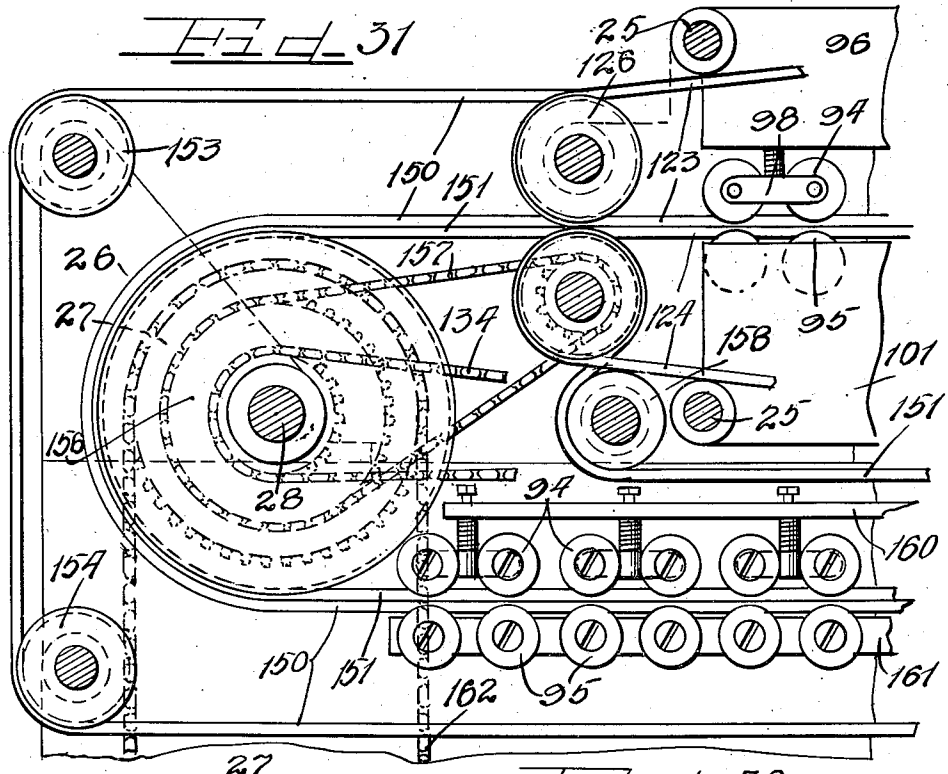
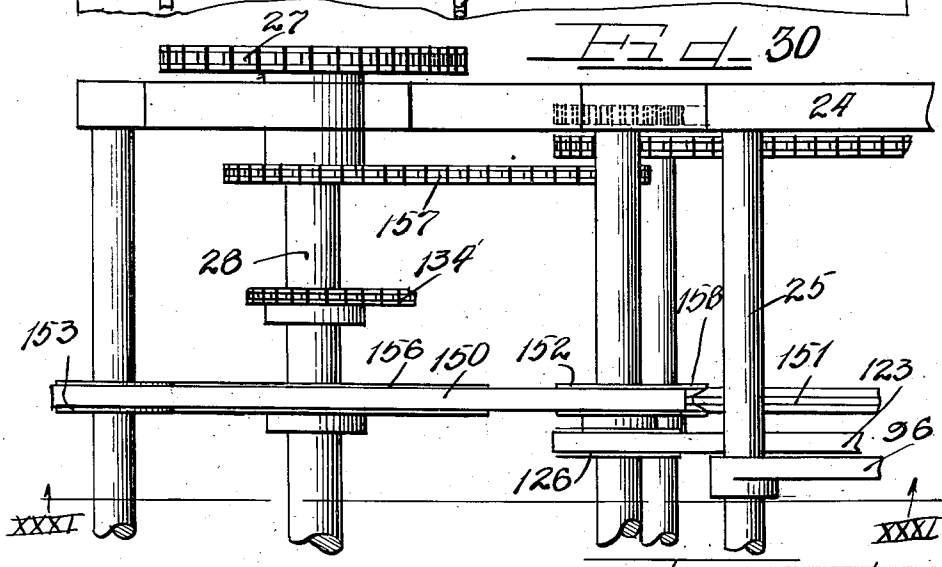


Fig. 30



Inventor
Harold S. Labombarde.

by Charles O. Gill Atty.

March 17, 1942. H. S. LABOMBARDE 2,276,318

CUP MAKING MACHINE

Filed June 22, 1938 11 Sheets-Sheet 11

Fig. 32

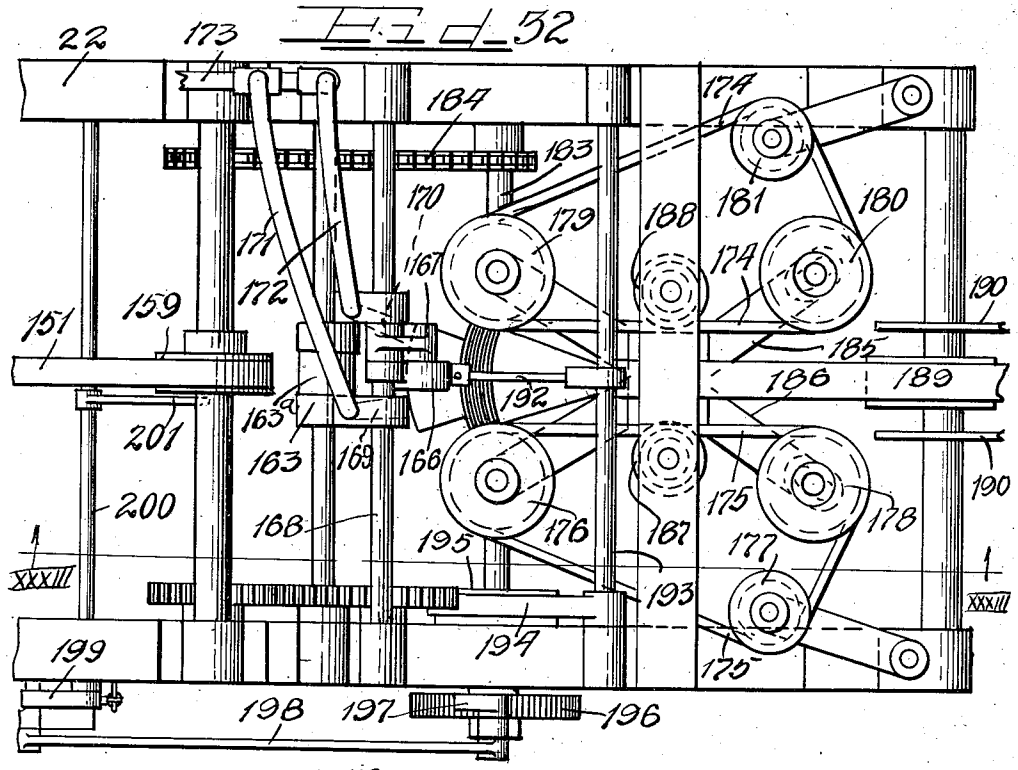
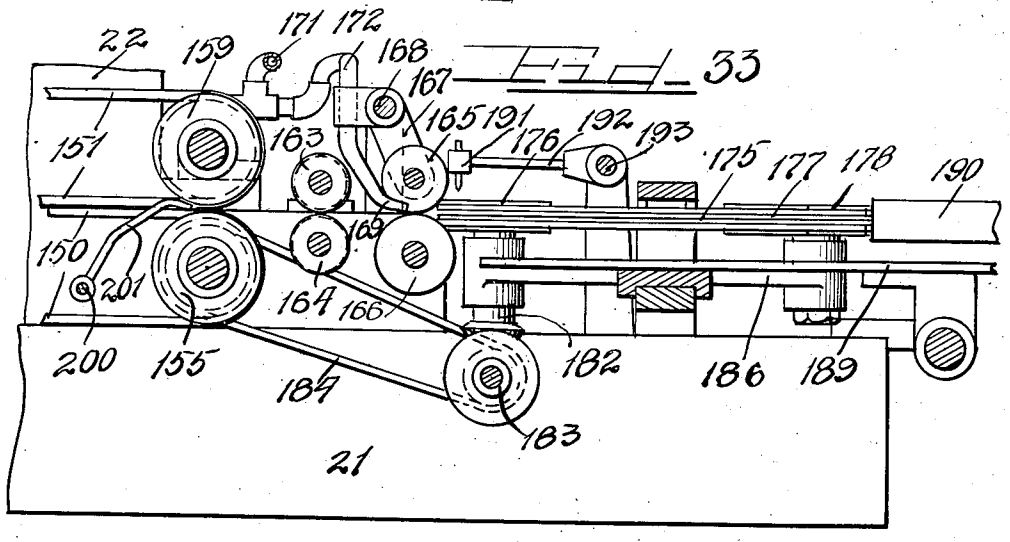


Fig. 33



Inventor
Harold S. Labombarde
By Charles O. Hill Attys.

Patented Mar. 17, 1942

2,276,318

UNITED STATES PATENT OFFICE

2,276,318

CUP MAKING MACHINE

Harold S. Labombarde, Nashua, N. H., assignor to Dixie-Vortex Company, Chicago, Ill., a corporation of Delaware

Application June 22, 1938, Serial No. 215,123

31 Claims. (Cl. 93—36.05)

This invention relates to improvements in a cup making machine, highly desirable for the manufacture of paper cups of the character used for drinking, ice cream packaging, etc., of such economical character as to usually be discarded after a single usage, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

The present invention embodies divisional subject matter from the invention set forth and described in my copending application for patent entitled "Method and machine for making tapered cups," filed June 29, 1936, Serial No. 87,628, and this application is a continuation in part of my aforesaid copending application.

In the manufacture of paper containers of the character of drinking and ice cream cups which are usually discarded after a single usage, economy of production is an essential. Economy of production is determined to a considerable extent by the ease, facility, and rapidity with which the paper stock may be handled and formed into paper cups. Rapidity is a very important factor. Heretofore, in the manufacture of paper cups, it has been customary to use what may be termed a forming mandrel around which the paper is shaped into a cup, and then the cup is either discharged or stripped from the mandrel. With the use of such a mandrel, the rapidity of manufacture is necessarily delayed both by the fact that the paper must be shaped around and on the mandrel and then must be taken off the mandrel in some manner. With paper cups of a substantially wedge-shape, that is, sloping in all directions towards a transverse seam defining a bottom fold-up, which seam is in the nature of a line, the shaping of a paper blank around and on a mandrel results in much slower production than is desired.

In connection with machines for manufacturing paper cups as known heretofore, particularly wedge-shaped cups, the handling of the blank also resulted in too slow a production. It is desirable to keep a blank moving continuously throughout its formation and also to have a plurality of cups undergoing formation at the same time, although in different stages of completion.

With the foregoing in mind, it is an important object of the present invention to provide a machine for manufacturing paper cups with greatly increased speed, the machine being approximately five or six times as fast in production as machines known heretofore.

Another object of the invention is to provide a machine for making containers such as paper cups or the like, in which the main and various forming mechanisms are rotary as distinguished from any reciprocatory movement, thereby adding to the rapidity of manufacture.

A further object of the invention is the provision of a machine for making containers, directed towards speed and economy of production without sacrifice of efficiency and stability of the finished product, and in which all driven parts are preferably under continuous operation.

Also an object of the invention is the provision of a machine for making paper cups in which the blanks undergoing formation follow one another in single file through the machine with a plurality of blanks undergoing formation at the same time, although the blanks will be at different stages of completion.

It is also a feature of the present machine to form a blank of stock into a paper cup without the use of a mandrel or any means around or on which the paper blank is formed. In other words, the blank is shaped without anything being disposed within the cup undergoing formation.

Another feature of the invention is the provision of a machine for making paper cups embodying forming means entirely exteriorly of the blank undergoing formation, and which act on the blank only, folding parts of the blank upon itself to shape the blank into a cup.

Another object of the invention is the provision of a machine for forming paper cups, in which machine a blank is caused to continuously follow a predetermined path, with forming means entirely exteriorly of the blank acting on the blank as it passes by, the forming and shaping members being either entirely stationary or, if moving, fixed in location relatively to the path of travel of the blank.

Also a feature of the invention is the provision of a paper cup machine, in which separate forming units are positioned each to shape a different part of a blank as the blank passes by the respective units, and conveying means for the blank arranged to grip the blank and carry it by said units, the conveying means being further arranged to vary the locations of the grip on the blank from time to time to permit proper operation upon the blank by the respective forming units.

Still another object of the invention is the provision of a paper cup machine embodying feeding or conveying means arranged in a series of units staggered relatively to a predetermined path of travel of a blank undergoing formation, and forming means also staggered relatively to

said path of travel but oppositely to the feeding and conveying means.

A further feature of the invention resides in the provision of a paper cup making machine embodying forming elements each arranged to act on a plurality of blanks following each other in rapid order before the forming elements assume their original positions.

Still a further feature of the invention is the provision of a paper cup making machine in which continuously rotating forming means are utilized, the forming means being disposed in spaced locations to act upon a blank as it is carried thereby.

An added feature of my invention resides in the fact that the blanks are formed in flat condition and held under pressure in flat condition until the adhesive uniting the overlapping marginal portions has set sufficiently for a distending and nesting of the completed cup. Preferably the forming and drying operations are at continuous rotary high speed. From the time the blanks are put in motion by the feeder until they come to rest in the nesting device or receiver, they travel preferably at one continuous high speed. All the registering, scoring, folding, gluing and drying operations are rotary as distinguished from plunger or other reciprocatory operations. All of these operations, such as folding, gluing and nesting in the receiving mechanism are performed while the blank undergoing formation travels forward constantly at a continuous uniform speed along a predetermined path.

It will, of course, be apparent that the disclosure of the invention herein includes a novel method of making paper cups which is more fully set forth and claimed in my aforesaid copending application, as well as novel receiving mechanism and novel feeding or conveying mechanism, which respective mechanisms are each more fully set forth and claimed in two other copending applications.

While some of the more salient features, characteristics and advantages of the present invention have been above pointed out, others will become apparent from the following disclosures taken in conjunction with the accompanying drawings, in which:

Figure 1 is a plan view of a cut blank prior to any forming operation;

Figure 2 is a plan view of the same blank after the first scoring line has been put thereupon;

Figure 3 is a plan view of the blank after another operation in which added scorelines are provided;

Figure 4 is a plan view of the blank after the first side fold has been made;

Figure 5 is a plan view of the structure of Figure 4 illustrating the application of glue or other adhesive to the blank;

Figure 6 is a plan view of the blank after the second side fold has been made;

Figure 7 is a plan view of the structure of Figure 6 after a score line for the bottom fold-up has been provided;

Figure 8 is a plan view of the blank of Figure 7 after the bottom fold-up has been completed, this figure being also a plan or elevational view of the finished cup;

Figure 9 is a side elevational view of the finished cup;

Figure 10 is a view of the finished cup looking into the open end thereof;

Figure 11 is a fragmentary side elevational view of the machine, the side walls and side frame structures being removed for the purpose of clarity, indicating diagrammatically the location of the salient parts of the machine;

Figure 12 is a fragmentary diagrammatic plan view of the structure of Figure 11, with parts broken away;

Figure 13 is an enlarged fragmentary vertical sectional view of the structure at the upper right hand portion of Figure 11, illustrating the mechanism for removing a blank from the hopper;

Figure 14 is a fragmentary vertical sectional view taken substantially as indicated by the staggered line XIV—XIV of Figure 13 looking in the direction of the arrows;

Figure 15 is an enlarged fragmentary plan view of the structure seen in the right central portion of Figure 11;

Figure 16 is a fragmentary vertical sectional view taken substantially as indicated by the line XVI—XVI of Figure 15;

Figure 17 is a further enlarged fragmentary sectional view, with parts in elevation and parts omitted, taken substantially as indicated by the line XVII—XVII of Figure 16;

Figure 18 is an enlarged fragmentary vertical sectional view, with parts omitted, taken substantially as indicated by the line XVIII—XVIII of Figure 16;

Figure 19 is an enlarged fragmentary elevational view of the main scoring roller taken substantially as indicated by the line XIX—XIX of Figure 16;

Figure 20 is an enlarged fragmentary plan view of the structure seen in the central portion of Figure 11;

Figure 21 is a fragmentary vertical sectional view taken substantially as indicated by the line XXI—XXI of Figure 20, with parts omitted;

Figure 22 is a fragmentary transverse vertical sectional view taken substantially as indicated by the line XXII—XXII of Figure 21;

Figure 23 is a fragmentary transverse vertical sectional view, with parts in elevation, taken substantially as indicated by the line XXIII—XXIII of Figure 20;

Figure 24 is a fragmentary plan view of the structure seen in the left central portion of Figure 11;

Figure 25 is a fragmentary vertical sectional view taken substantially as indicated by the line XXV—XXV of Figure 24;

Figure 26 is a fragmentary elevational view of the glue applying roller and backing roller therefor;

Figure 27 is a vertical sectional view showing the glue applying roller in elevation;

Figure 28 is a plan development of the circumference of the glue applying roller;

Figure 29 is an enlarged fragmentary vertical sectional view, with parts omitted, taken substantially as indicated by the line XXIX—XXIX of Figure 24;

Figure 30 is a fragmentary plan view of the structure seen in the left hand portion of Figure 11;

Figure 31 is a fragmentary vertical sectional view taken substantially as indicated by the line XXXI—XXXI of Figure 30;

Figure 32 is a fragmentary plan view of the receiving mechanism seen in the lower right hand portion of Figure 11; and

Figure 33 is a fragmentary vertical sectional view, with parts shown in elevation, taken substantially as indicated by the line XXXIII—XXXIII of Figure 32.

THE BLANK, CUP, AND METHOD IN GENERAL

The illustrated embodiment of the present invention is in the nature of a machine to form wedge-shaped paper cups from pre-cut blanks of stock. The stock may be any suitable paper, such as is commonly used for the forming of paper drinking cups, preferably of the so-called dry wax type, which paper is impregnated with a waterproofing medium and yet the medium is not visible on the surface of the paper.

The blanks are successively drawn from a hopper and carried through the machine continuously along a predetermined path which, in this instance, is in a substantially straight line along the upper deck, a turn at one end of the machine, and a return trip along a straight line on the lower deck. The blank travels through the machine, small end first, and the various formations upon the blank are accomplished by forming means as the blank passes thereby in its continuous travel. Nothing is placed on the blank or within the blank around which the blank is formed, the blank being folded entirely upon itself, thereby resulting in the elimination of the customary mandrel and also the elimination of the operation of removing the blank from a mandrel.

During its course of travel, the conveying means firmly hold the blank, but the grip of the conveying means upon the blank is periodically shifted from one location to another to leave free the corresponding portion of the blank upon which a forming element is to act at a particular time and location during the travel of the blank.

For the purpose of clarity, the general steps in the making of the container, without reference to the mechanism embodied in the machine, will first be described in connection with Figures 1 to 11, inclusive.

In Figure 1, a blank 1 is illustrated just as it is withdrawn from the hopper and about to begin its travel through the machine. The blank 1 is generally of the shape of a sector and includes an arcuate edge 2, the trailing edge during the travel of the blank, and which edge defines the mouth of the finished cup. The blank also embodies a pair of converging side edges 3 and 4 leading from opposite ends of the arcuate edge 2 to a pair of transverse edge portions 5 and 6 respectively which terminate in an outwardly extending centrally disposed tab 7. The axis of the blank extends centrally through the tab 7 and both halves of the blank are symmetrical.

After the blank is drawn from the hopper, it is next centered relatively to the conveying means so that it will be disposed in its proper position and thus meet the various forming mechanisms at the proper time in their operation, it being recalled that the forming mechanisms preferably move continuously. After being centered, the blank is carried forward by the conveying mechanism and is next provided with a score line 8 (Figure 2) which extends transversely across the base of the tab 7. This score line weakens the tab 7 so that the tab will not tend to spring away from the body of the blank when it is folded and glued thereagainst. Immediately following the application of the score line 8, the blank is next provided with a pair of spaced score lines 9 and 10 emanating from opposite ends of the score line 8 and diverging towards the arcuate edge 2 (Figure 3). The score lines 9 and 10 define side tabs adjacent the edges 3 and 4 respectively to be folded over the central portion of the blank.

After the initial scoring has thus been completed, the tab defined by the edge 4 is folded inwardly over the body of the blank forming a crease 10a coinciding with the score line 10. With reference to Figure 5, it will be seen that the next operation is the application of a stripe of glue on the outer face of the folded side flap adjacent the edge 4, this stripe of glue extending downwardly beyond the edge portion 6 and onto the inner face of the tab 7. Then the other side flap adjacent the edge 3 is folded over so that the margin thereof overlies the glue stripe 11, and this flap is pressed firmly into position forming a crease 9a coinciding with the score line 9.

With reference to Figure 7, it will be seen that the next operation is the provision of a transverse score line 12 across the end portions of the folded flaps to define a line of fold-up for the bottom closure flap. The bottom portion of the vessel is next folded up to form a bottom 12a for the cup coinciding with the score line 12, the adhesive on the inner face of the tab 7 securing this bottom fold-up to the body portion of the cup. With the pressing into place of the bottom fold-up, the forming operations are completed. It is then only necessary to hold the cup firmly gripped over the glued parts until the glue has had a reasonable time to set, when the container may be expanded and stacked in nested relationship with other containers in the receiving mechanism.

THE MACHINE IN GENERAL

For the purpose of clarity herein, the different portions of the machine will be described separately and in the order in which each portion acts upon a blank traveling through the machine. Of course, it is understood that the machine is not actually divided up into separate portions, it being a complete machine arranged for continuous operation and continuous movement of a blank once it starts until it is discharged in the form of a finished cup.

Sectionalizing the machine, therefore, for the purpose of clarity only, with reference to Figure 11, it will be seen that in the first portion of the machine generally indicated by numeral 13, blanks are removed in successive order from a hopper by a suitable combing roll operating in association with a friction applying construction. In the next portion, generally indicated by numeral 14, the blank is taken by the initial feeding means, properly registered or centered in respect to the feeding means so that the blanks will each subsequently reach the forming means at the proper time, and the first scoring operations are performed upon the blank.

In the next portion of the machine, generally indicated by numeral 15, each blank is positively gripped by the feeding means to one side of the center line of the blank and carried along with the feeding means. In this part of the machine, the side flap adjacent the edge 4 is folded inwardly, the crease 10a made, and the stripe of glue 11 applied to the blank. The next section of the machine is generally indicated by numeral 16, and in this section, the other side flap adjacent the edge 3 is folded over on top of the previously folded side flap, the crease 9a formed, the score line 12 placed upon the blank, and the bottom fold-up part of the blank is kicked upwardly ready for the bottom fold-up to be se-

cured in the next section of the machine. All this occurs, of course, while the blank travels continuously, but in this portion of the machine the grip by the feeding means upon the blank has been changed to the opposite side of the center line of the blank.

In that section of the machine generally indicated by numeral 17, the securing of the bottom fold-up is completed and the gripping action of the feeding means has been transferred to the exact central portion of the blank, so that the gripping is concentrated directly over the glued parts of the now formed cup, and the cup is started on its way back to that end of the machine from which it began its journey.

The cup returns to the starting end of the machine on a lower deck or level beneath its previous course of travel in the opposite direction. All the way along this lower deck portion, generally indicated by numeral 18, the cup is held gripped by the conveying means, and the gripping action is concentrated over the glued portions of the cup, so that the glue has sufficient opportunity to set.

Underneath the first described portion of the machine 13 is the final portion generally indicated by numeral 19. This is the receiving mechanism in which the cup is partially expanded, stacked in nested relationship with previously received cups, and the cups are counted as they are stacked.

The machine is provided with a suitable supporting frame 20 upon which is disposed a bed plate 21. Mounted on the bed plate 21 at the head end of the machine is a pair of opposite side members 22 shaped to support the structure in the portion of the machine generally indicated by numerals 13 and 14. In the portions 15 and 16 of the machine, other side plates 23 and 24 are disposed on the bed plate on each side of the mechanism. These side plates are connected near the top and lower portions thereof by fixed cross rods 25. At the opposite end of the machine, a pair of side frame members in the form of wings 26 are provided. It will be appreciated that the various shafts are journaled in any suitable manner in the respective frame members, with the exception of certain shafts to be later described, and further details as to the frame construction and the journaling of various shafts need not be provided herein, since such construction will be understood by one skilled in the art and the particular frame members will be shaped regularly or irregularly as will be most feasible to carry the structure with which they are associated.

It will also not be necessary herein to specifically describe the driving mechanism, it being sufficient to point out various chain drives and gear trains hereinafter so arranged and so proportioned to drive each particular shaft at its proper speed in synchronism with the other operating parts of the machine. The entire machine is preferably driven from a drive wheel 27 carried by a main drive shaft 28 seen in the left hand portion of Figure 12. The drive wheel 27 may be connected to any suitable source of power, such as an electric motor or equivalent means. Diagrammatically illustrated in Figure 12 are a plurality of chain drives and gear trains, by which each operating shaft of the machine may be driven at the proper speed directly from some other shaft, and indirectly from the drive shaft 28. It will be further understood that where rolls are arranged in pairs, such as the scoring roller and the backing roller, a pair of forming rollers, feeding rollers and the like, one of these rolls is preferably driven from the other by suitable like gears at the ends of the respective shafts, so that the rolls will be operated in unison and at the same speed, but in opposite directions.

Blank pulling mechanism

With reference now to Figures 13 and 14, it will be seen that the blanks 1 are initially banked in the sloping hopper 29, any suitable means being used if so desired to urge the blanks forwardly against the front wall 30 of the hopper. The wall 30 is spaced above the bottom of the hopper 29 so as to leave a portion of the forwardmost blank exposed for contact by the combing roller. A bracket 31 supports the hopper wall 30 and is carried by a fixed non-rotatable sleeve 32 in turn supported by a shaft 33 which is rotatable relatively to the sleeve. With reference to Figure 15, it will be seen that the shaft 33 is driven by a suitable chain drive 34.

Rotatable with the shaft 33 is a combing roll 35 provided with a plurality of pairs of friction or suction plugs 36, the plugs in each pair being circumferentially spaced apart a short distance. In this instance, the combing roll carries three pairs of such plugs, which are made of rubber or any other suitable material, and so with each revolution of the combing roll, three separate blanks will be withdrawn from the hopper 29. The plugs 36 are hollow and each connects through a radial passage 37 and a transverse passage 38 with the outer side face of the combing roll, the combing roll being recessed on this face to receive a flange 39 integral with the aforesaid fixed sleeve 32. The transverse passages 38 terminate adjacent the flange 39 so that they are in successive communication with a pair of spaced hollows 40 and 41 in the flange. The hollow or recess 40 is in direct connection with a conduit 42 leading to any suitable source of suction. The hollow or recess 41 is in direct communication with the atmosphere through a suitable port 43.

It is therefore apparent that as the combing roll 35 rotates towards the magazine 29, each pair of circumferentially spaced suction plugs may contact the first blank beneath the front wall 30. Substantially at the time both plugs are in contact with the blank, the horizontal passages 38 successively communicate with the aforesaid recess 40, thus creating a suction through the plugs 36 to hold the lower portion of the blank firmly attached to the roll. The combing roll pulls the blank downwardy out of the magazine between itself and a pair of adjacent belts 44—44 which travel along in keeping with the circumference of the combing roll. When the blank is carried sufficiently for the passages 38 to coincide with the recess 41, which is open to the atmosphere, the suction is automatically broken and the blank is released upon the belts 44 to be carried along therewith.

It will thus be seen that one blank only is removed from the hopper 29 at a time, but that during a single rotation of the combing roll, three successive blanks are removed from the hopper in properly spaced order for single file travel through the machine.

The belts 44 are preferably endless and are trained over a pair of driven pulleys 45 (Figures 15 and 16), a pair of adjustably positionable pulleys 46—46, and a pair of higher pulleys 47 (Figure 13) positioned so that the belts will be in contact with the face of the combing roll 35 for

a portion of its revolution. The upper pulleys 47 are supported on the free end of a crank arm 48 fixed on a shaft 49. Another crank arm 50 also fixed to this shaft and depending therefrom is urged rearwardly by a tension spring 51 adjustably connected to an arm 52. The pulleys 47, together with the belts 44, are thus constantly urged towards the combing roll 35, forming in effect a friction gauge, and any wear of any part is automatically compensated for.

One or more links 53, suitably connected to a frame part of the machine, aid in maintaining the pulleys 45 in proper position. The lower part of the frame portion is slotted, as indicated at 54, to permit adjustment of the pulleys 46—46, these pulleys being positionable at any desired point along the slot 54. An elongated set screw 55 is adjustably positioned in the crank arm 50, abuts a stop 56 on the arm 52, and may be used, together with the adjustable attachment of the spring 51, to regulate the pressure of the belts 44 against the combing roll 35.

In order to insure that the circumferential surface of the combing roll as well as the plugs 36 are kept in a clean condition, a rotary brush 57 or the equivalent rides upon the surface of the combing roll, as seen best in Figure 13. This brush may be driven by any suitable means, such as a chain drive 58, from a suitable sprocket carried by the combing roll shaft 33.

The registering mechanism and primary scoring means

After the combing roll 35 releases a blank, it is carried along on the twin belts 44—44 in position to have its trailing arcuate edge 2 engaged by a plurality of pins 59 protruding from several similar chains 60, as best seen in Figures 15 and 16. In this instance, there are four such chains 60, and the pins on the inner pair of chains are offset out of alignment with the pins 59 on the outer two chains in keeping with the curvature of the edge 2 of the blank. All four chains are similarly driven and each is trained in quadrilateral formation over a similar set of four sprockets, including a sprocket 61 carried by a driven shaft 62, and three sprockets 63, 64 and 65, respectively, each mounted upon a free shaft, as seen in Figure 16.

It will be noted that the chains 60 are disposed below the belts 44, with the pins projecting above the belts, so that the blanks ride in successive order over the belts being moved forwardly by the pins. The blanks move along between a pair of suitable side guide rails 66—66. In order to expedite rapid production, the pins 59 are spaced along the chains 60 at various intervals, so that more than one blank may be moved along by the pins at one time. It is, therefore, necessary to center or position a blank properly relatively to a transverse series of pins 59, so that each blank will be carried through the machine so as to reach each forming or shaping mechanism at the proper time.

In this instance, the centering or registering means are in the form of retarding elements to cause a blank to drag on the moving belts 44 until the blank is positively engaged and moved forwardly by the pins 59. The retarding mechanism includes a pair of outside channels 67—67 and an inner channel 68 extending forwardly beyond the outer channels. The outer channels 67 are preferably disposed directly over the twin belts 44, and the inner channel 68 is disposed between these belts and over a belt to be later described. Each of the channels is provided with a series of apertures in the bottom thereof, and in each aperture a metallic ball is disposed, the ball being of less size than its respective aperture so that it may ride freely on the blank 1.

With reference to Figures 15 and 17, it will be seen that the outer channels carry a series of balls 69 and the inner channel carries a series of balls 70, the balls in the inner channel being preferably larger than the balls in the outer channels. These balls 69 and 70, riding upon the blank, will retard the blank regardless of the movement of the belts 44 until the blank is positively engaged by the pins 59 and thereafter advanced uniformly by the pins.

The forward pulley 45 associated with the belts 44 is disposed beneath the center channel 68 so that these belts are in overlapping relationship with a centrally disposed belt 71 trained over a series of pulleys, including a driven pulley 72 and a pair of pulleys 73 and 74 each mounted on a free shaft. The upper end of the belt 71 is on the same level with the belts 44, and after the blank is passed beyond the belts 44, it is carried over the belt 71 by the pins 59 until the leading portion of the blank is taken by gripping conveying means to be later described.

The blank next passes between a scoring roller 75 on a driven shaft 76 and a backing roll 77 on the aforesaid shaft 62, which latter shaft is driven by a suitable gear connection from the shaft 76. With reference to Figure 18, it will be seen that the scoring roller 76 is provided with an outstanding edge portion 78 designed to provide the score line 8 on the blank as seen in Figure 2. The backing roll 77 may have a depression opposite the die part 78, and the backing roll is further provided with a central circumferential recess 79 to accommodate the aforesaid belt 71.

As the blank passes from beneath the scoring roller 75, it passes between another scoring roller 80 on a driven shaft 81 and the aforesaid pulley 72, which pulley is elongated to form a backing for the scoring roller 80 as seen best in Figure 19. The pulley 72 is centrally recessed so that the belt 71 will ride over the pulley flush with the face of the pulley. The scoring roller 80 is provided with a die portion 82 shaped to provide the score lines 9 and 10 (Figure 3) on the blank to define the lines of fold for the side flaps of the blank, and the pulley 72 may be accordingly recessed if so desired. The shaft of the pulley 72 is preferably driven by a suitable gear in mesh with a gear 83 carried by the shaft 81, and the gear 83 in turn meshes with another gear carried by another shaft and is also trained to actuate the shaft 76, so that the drive of one shaft by another is had either through a gear train or through chain and sprocket connections as above mentioned.

Such a method of drive is embodied throughout the entire machine, and wherever rolls are disposed in superposed position, the two shafts of the rolls are preferably gear connected at one end so that one roll is driven by the other, as seen in Figures 22 and 23, for example. While such drives are shown for the respective shafts in the drawings, they will not be specifically described hereinafter for the purpose of avoiding prolixity.

The first folding mechanism and gluing means

The mechanism which initially folds the side flaps of the blank into position and also the gluing means are embodied in that portion of the

machine designated in general by numeral 15 in Figure 11.

With reference to Figures 16, 20 and 21, it will be seen that as the blank leaves the belt 71 and the scoring roller 80, it enters between a pair of conveying belts 84 and 85 arranged to provide confronting horizontally traveling portions for receiving the blank therebetween, the belts being located to one side of the center line of the blank so as to permit free action for the folding of the side flap adjacent the edge 4 on the score line 10 (Figure 15). The upper belt 84 is trained over a pulley 86 of a driven shaft 87, a pulley 88 on a free shaft, and a free rider roll 89 keeps the belt under proper tension. Likewise, the lower belt 85 is trained over a pulley 90 on a driven shaft 91, driven from the shaft 87, a pulley 92 on a free shaft, and a rider roll 93 maintains this belt under proper tension.

The confronting horizontal tracts of the belts 84 and 85 are held in tight confronting relationship under pressure by means of a series of upper rollers 94 bearing on the belt 84 and a series of lower rollers 95 bearing on the belt 85 inside the horizontal portions of the respective belts. With reference more particularly to Figures 22 and 23, it will be seen that the upper rollers are grouped in pairs and supported on a bracket 96 depending from adjacent frame rods 25, the bracket having a horizontally extending shelf portion 97 which carries the upper series of rollers. Each pair of rollers is held upon a yoke member 98 carried on a bolt 99 having a smooth shank portion extending freely through the shelf 97. A suitable spring 100 is disposed between the shelf and the yoke 98 to constantly urge the respective pair of rollers 94 downwardly against the horizontal tract of the belt 84.

The bottom series of rollers 95 are individually carried each on a stub shaft engaged in an upwardly extending supporting bracket 101 carried by adjacent lower frame bars 25.

From the showing in Figure 21, it is apparent that the upper and lower rollers 94 and 95 are sufficiently numerous and disposed so closely together as to maintain a fairly even compression of the horizontal tracts of the belts 84 and 85 so that these portions of the belts provide a firm and positive gripping action upon the blank moving along therewith. With reference to Figure 16, it will be seen that the belts 84 and 85 take a gripping hold of the blank before it is entirely released by the scoring roller 80 and the backing pulley 72, so that the blank has no chance to get out of alignment. No pressure is necessary on the bottom series of rollers 95, because each pair of upper rollers is urged downwardly against the upper belt by one of the springs 100.

As the blank is carried along by the belts 84 and 85, the free portion of the blank passes between a pair of folding rolls 102 and 103 which elevate the side flap of the blank adjacent the edge 4 to the position seen in the central portion of Figure 20. With reference to Figures 22 and 23, it will be seen that the folding rollers 102 and 103 are mounted upon a pair of stub shafts 104 and 105, respectively, both journaled in a frame bracket 106. The lower shaft 105 is driven by a suitable sprocket chain 107, and the upper shaft is driven by the lower shaft by virtue of a pair of like gears 108.

The folding rollers are, of course, complemental in nature, and each is preferably arranged with similar half circumferential portions, so that the folding rollers may act upon two separate blanks, one following the other, on each complete revolution of a folding roller. The rollers are preferably continuously rotating.

From Figures 22 and 23, it will be noted that the upper folding roller 102 is provided on each side thereof with an outstanding die portion 109 extending obliquely across the roller and a pair of transverse die parts 110 connecting the ends of the portions 109. The lower roller 103 is recessed on opposite sides, as indicated at 111, and is also provided with certain outstanding die parts 112. As seen best in Figure 23, when the blank is received between the folding rollers, one of the parts 109 of the upper roller forces the blank into a recess 111 in the lower roller, causing the blank to be bent at right angles and thus elevating a flap of the blank. The oblique disposition of the element 109 in the upper roller, in its association with the complemental portions of the lower roller, causes the elevated portion of the blank to be continued in an upward direction until the entire side flap of the blank has been elevated to the position seen in Figure 20 along the score line 10.

After being so elevated by the folding rollers, the blank next passes beneath a horizontally disposed continuously rotating plate 113 which presses the side flap of the blank downwardly over the body portion of the blank to the position seen in Figure 4. This plate is carried on the upper end of a vertical shaft journaled in a bracket 114 carried by the frame of the machine and is driven by means of a suitable chain drive 115 from the shaft of a similar plate to be later described. As the blank is forced beneath the plate, the side flap is creased along the score line 10 to provide the side crease 10*a* seen in Figure 4.

Immediately after being so creased, the blank passes between a glue applying roller 116 and a suitable backing roller 117 when the glue stripe 11 seen in Figure 5 is applied to the blank. With reference to Figures 26, 27 and 28, it will be seen that the gluing roller 116 is provided with a pair of outstanding die portions 118 which function as glue applicators. In Figure 28, the circumference 116*a* of the glue applying roller is shown developed in the flat. With this construction, noting that the die portions 118 are spaced apart, a stripe of adhesive 11 is applied to each of two successive blanks in one revolution of the glue roll. The backing roller 117 is preferably merely a smooth surfaced roller.

The preferable form of each die part 118 is such as to put a stripe of glue along the edge 4 of the blank, a spot on the projection 7, with a narrow portion connecting them. Such an application of glue permits rapid drying, facilitating manufacture at high speed. In order to make the cup water-tight, it is preferable to subsequently apply metal to metal pressure over the end fold, as will more fully later appear. Consequently, only a comparatively little amount of glue need be applied at and adjacent the projection 7, so that none will be squeezed out when the pressure is applied to the several thicknesses of stock adjacent the end fold. The glue applied by the sequential glue wheel 116 is of such an amount as to spread properly under pressure but not squeeze out or form a substantially visible spot when dry.

Glue is supplied to the roller 116 from a glue pot 119 (Figures 20 and 21) in which a pick-up roller 120 extends, this roller carrying glue on

the circumference thereof and transferring it to an intermediate roller 121, which in turn transfers glue to the die portions 118 on the roller 116. Both the rollers 120 and 121 are journaled in a fixed arm 122 carried by one of the frame bars 25.

The second side flap folding means, final scoring means, and end folding means

This mechanism is all contained in that portion of the machine generally indicated by numeral 16 in Figure 11. It is best seen with reference to Figures 24, 25 and 29.

Before the remaining side flap of the blank can be folded inwardly over the glued margin of the first folded side flap, it is necessary to transfer the gripping action of the conveying means to the opposite side of the median line of the blank. To this end, the blank is next taken by a pair of belts 123 and 124 similar in character to the previously described belts 84 and 85 but located so as to grip the opposite or previously folded portion of the blank. With reference to Figures 20 and 24, it will be seen that the belts 123 and 124 are in overlapping relationship with the belts 84 and 85, so that the blank is positively engaged between the belts 123 and 124 prior to its ultimate release from between the belts 84 and 85. Thus, the blank is never released while traveling through the machine, but the grip upon the blank by the conveying means is shifted in accordance with the operations to be performed upon the blank.

The upper belt 123 is trained over a pulley 125 on the same shaft as the aforesaid pulley 88, a pulley 126, and a free rider roll 127 maintains the proper tension. Likewise, the lower belt 124 is trained over a pulley 128, a pulley 129, and a free rider roll 130 maintains proper tension on the belt. The confronting horizontal tracks of these belts are maintained in compressed association by means of a series of spring-pressed upper rollers 94 and a series of lower rollers 95 of the exact nature as those previously described. The upper rollers are supported on a bracket 96, the lower rollers on a bracket 101, and each series of rollers rides the inside part of the respective belts, just as previously described.

As the blank is carried along between the belts 123 and 124, it passes between a pair of folding rollers 131 and 132 of the same general character and construction as the forming rollers 102 and 103 previously described, but of course of opposite disposition, since the folding rollers 131 and 132 elevate the opposite flap of the blank, namely, the side flap adjacent the edge 3, as seen in Figure 24. After the elevation of this side flap, the blank passes beneath a horizontally disposed rotating plate 133 mounted on the upper end of the shaft driven by a suitable chain drive 134 from parts to be later described. The plate 133 is of the same nature and function as the previously described plate 113. Upon passing beneath the plate 133, the second side flap of the blank is pressed down into position over the glued margin of the first side flap, providing the side crease 9a along the score line 9, and the blank is then in the form seen in Figure 6.

After the above described folding operation, the blank is next provided with a transverse score line 12 defining the bottom fold-up seen in Figure 7. This is accomplished when the blank passes between a scoring roll 135 and a suitable backing roll 136. With reference to Figure 29, it will be seen that the scoring roll 135 is provided with a plurality of inserted transverse die elements 137, in this instance three, so that three successive blanks are scored during one complete revolution of this roll. The scoring roll is preferably recessed as indicated at 138 adjacent the trailing side of each die element 137, so that each element may readily provide a clean score line 12 on the blank. The next operation is the provision of the bottom fold-up along the score line 12.

To this end, a continuously rotating folding arm 139 is provided, the arm being attached at its center to the end of a stub shaft 140 journaled in a suitable bearing bracket 141. The arm itself is disposed to one side of the path of the blank, and from each end of the arm a pin 142 extends horizontally over the path of the blank, each pin being equipped with a trailing wiper 143. The arm is of such length that one of the pins 142 may contact the leading end of the continuously traveling blank, elevate this end, while the other pin 142 misses the trailing edge 2 of the blank. For each revolution of the arm 139, a fold-up is made on each of two successive blanks.

To insure a clean bottom fold of the blank along the score line 12, a fixed plate 144 having an upturned end 145 is disposed opposite the shaft 140. After leaving the scoring roller 135, the blank passes beneath this plate 144, and when the score line 12 coincides with the edge 146 of the plate, the leading end portion of the blank is struck upwardly by one of the pins or bars 142, and the blank is folded against the edge 146 of the plate. The wiper 143 carried by the pin 142 maintains the end portion of the blank in elevated position until the line of fold 12a has entered a flat chute 148 which is equipped with a flaring mouth 149 to facilitate the entry of the folded portion of the blank. The chute is disposed to one side of the conveying belts 123 and 124, so that the end fold-up portion of the blank must pass through the chute and the bottom fold-up is thereby laid flatly against the body of the cup, the formed blank being then in the position seen in Figure 8.

It will be noted that when the blank has been so folded, owing to the first score line 8 illustrated in Figure 2, the projecting tab 7 is so weakened that it will not tend to spring away from the body of the cup, and the adhesive on the inner face of this tab will adhere to the body of the cup to firmly join the parts.

The final portion of the conveying means

In order to insure the proper setting of the adhesive and the positive union of the overlapped portions of the blank, the blank is next taken by another section of the conveying means and gripped firmly directly over the adhesived areas. The final conveying means are located in that portion of the machine generally indicated by numerals 17 and 18 in Figure 11. This mechanism is best seen in Figures 11, 30 and 31.

Before the belts 123 and 124 release their grip upon the blank, it is gripped between another pair of belts 150 and 151, adjacent ends of which are in overlapped relationship with the adjacent ends of the belts 123 and 124. The belts 150 and 151 are very long belts and extend from the termination of the belts 123 and 124 all along the lower deck of the machine to substantially the opposite end of the machine.

The belt 150 is trained over a pulley 152 on the same shaft as the pulley 126, a free pulley 153, a free pulley 154, and a pulley 155 adjacent the

opposite end of the machine, as seen in Figure 11. In traveling from the upper deck to the lower deck, the operative portions of the belt 150 rides the belt 151 over a large pulley 156 carried by the aforesaid drive shaft 28. A suitable chain drive 157 from the shaft 28 operates the shaft bearing the pulleys 126 and 152.

The belt 151 is trained over the large pulley 156, a pulley disposed on the same shaft as the pulley 129 directly beneath the pulley 152, a pulley 158 around a portion of which the flat side of the belt rides, and a pulley 159 at the opposite end of the machine. The belts track together and exercise a gripping action upon the blank from the pulley 152, over the large pulley 156, and all along the under deck of the machine to the pulleys 155 and 159. The belts are so located as to directly overlie the central portion of the blank and bear upon all the adhesived areas of the formed blank. Thus, the blank, formed into a cup, travels from the pulley 152 to the opposite end of the machine, during which time the glued portions are tightly pressed together and the glue has sufficient time to set.

During the lengthy travel along the lower deck of the machine beneath the mechanism previously described, the belts 150 and 151 are pressed tightly together by a series of spring-pressed upper rollers 94 and a series of lower rollers 95 exactly the same as above described. The upper rollers are carried on a suitable frame bar 160, and the lower series of rollers by a suitable frame bar 161.

With reference to Figure 31, it will be seen that a suitable chain 162 may connect the drive wheel 27 on the drive shaft 28 with any suitable source of power, such as an electric motor. The entire machine is preferably driven from this drive shaft 28.

The cup expanding and receiving mechanism

The receiving and nesting mechanism is that portion of the machine indicated in general by numeral 19 in Figure 11 and is best seen with reference to Figures 32 and 33.

The cup is delivered by the belts 150 and 151 to a pair of feed rollers 163 and 164. These rollers are preferably metallic and aid in insuring that the resultant cup, in the case of drinking cups and the like, becomes water-tight if it is not already so by the time it reaches these rollers. It is desired that the rollers 163 and 164 apply relatively heavy pressure across the end fold, but afterwards shift the pressure or carrying contact to portions of the cup outside of the glued areas. To this end, one or both of these rollers may be segmental as shown in the drawings, with the central part of a roller of slightly less diameter, as indicated at 163*a*, than the adjacent outer part on each side. The drop in diameter of the part 163*a* is of such amount that firm pressure will be applied to the multi-thicknesses of stock in the end fold, but when the end fold passes from between the rollers, the pressure on the cup is then applied on each side of the glued areas.

The rollers 163 and 164 deliver the cups in successive order to another pair of rollers 165 and 166. The roller 165 is a comparatively narrow roller of substantially the same width as the belt 151 and overrides the central or adhesived portions of the cup. This roller is carried on the free end of a pivotal crank arm 167, the other end of which is pivotally supported on a cross bar 168. The narrowness of the roller 166 provides room for a pair of air nozzles 169 and 170 disposed on either side of the roller. These nozzles are connected through conduits 171 and 172, respectively, to a line 173 which may lead from any suitable source of compressed air. With the central portion of the cup held compressed between the rollers 165 and 166, the blast of air from the nozzles 169 and 170 expands the side portions of the mouth end of the cup, and as soon as the cup is released by the rollers 165 and 166, the air blast further expands the mouth end of the cup and forcibly lodges the cup between a pair of continuously traveling similar belts 174 and 175, each of which is provided with a longitudinal V-shaped groove on the side facing the received cup. At the time the cup is received by the traveling belts 174 and 175, it is also automatically nested within previously received cups and held in its partially expanded condition by the belts which are sufficiently close together to maintain the cup expanded to the position seen in Figures 9 and 10.

The belt 175 is trained over a driven pulley 176, a free rider roll 177, and a pulley 178. In like manner, the belt 174 is trained over a pulley 179, a pulley 180, and a free rider roll 181. The pulley 176 is disposed upon a vertical shaft having a bevel gear 182 at the lower end which connects with a similar gear on a shaft 183 driven from the shaft carrying the pulley 155 by a suitable chain drive 184. The pulley 179 for the belt 174 is similarly mounted and similarly driven.

The pulleys 180 and 178 are carried on the outer ends of a pair of arms 185 and 186 respectively. As indicated by dotted lines in Figure 32, these arms are provided with slots for receiving the pulley bearings, so that the pulleys 178 and 180 may be adjusted towards the path of the cups to make the cup receiving tracts of the belts converge and thus cause a greater expansion of the cup, if so desired. The driven pulleys 176 and 179 are mounted on arms of similar nature but without adjustment slots. A pair of free riders rolls 187 and 188, carried on a suitable cross frame structure, maintains the confronting cup-receiving tracts of the belts in proper alignment.

The nested cups are moved along by the belts 174 and 175 over a bottom member 189 and discharged by the belts onto this bottom member between a pair of side guards 190—190, from which structure the cups may be removed and placed in cartons for shipment.

It may be desirable, for convenience in packaging the cups, to employ a counting mechanism, so that the cups are counted as they are delivered to the receiving mechanism, and every predetermined cup, such as each two-hundredth or each two-hundred and fiftieth one, is visibly marked. To this end, a suitable marking implement 191 which, for example, may be a spur or a pencil, is carried on the free end of an arm 192 fixed to rotate with a shaft 193. This shaft 193 is periodically rotated a fraction of a revolution sufficient to bring the point of the marking implement into contact with the cup then disposed therebeneath between the belts 174 and 175, by an arm 194, the free end of which periodically falls into a groove or notch in the surface of a cam wheel 195 floating on the aforesaid shaft 183 (Figure 32).

The cam 195 is connected to rotate with a ratchet wheel 196, intermittently rotated by a pawl 197 through the medium of a link 198. The ratchet wheel is also floating on the shaft 183 and is rotated preferably one tooth at a time by the

pawl. The ratchet wheel contains a predetermined number of teeth in accordance with the number of the cups to be marked. For example, if every two hundredth cup is to be marked by the implement 191, then the ratchet wheel embodies two-hundred teeth.

The mechanism for periodically operating the link 198 is not visible in the drawings, but the operation thereof is responsive to a latch member 199 fixed to a shaft 200 which is rotated by a tripper 201, the free end of which extends upwardly into the path of a traveling cup, as seen best in Figure 33. With the passage of each cup, the tripper 201 is knocked down, releasing the latch 199 and permitting a movement of the ratchet wheel 196. In the event a cup fails to pass by the tripper 201, the tripper is not moved and the latch 199 prevents actuation of the ratchet wheel.

The receiving and counting mechanisms just above described are more fully set forth and described, as well as claimed, in my aforesaid copending application, Serial No. 215,125, filed June 22, 1938.

The Operation

The operation of the constituent parts of the machine has been hereinbefore set forth with the description of such parts to such an extent that it will only be necessary herein to briefly summarize the operation of the machine as a whole. It will be remembered that preferably all movable parts of the machine operate continuously, with the exception of the intermittently operable parts of the counting mechanism.

Referring to Figures 1 to 12, inclusive, the blanks are banked in the hopper 29, with the projecting tab 7 of each blank downward. The blanks are successively removed from the hopper in proper sequence by the combing roll 35 between itself and the traveling twin belts 44—44. When released from the combing roll, each blank travels along the twin belts 44—44, is retarded by the balls 69 and 70 in the channels 67 and 68, until it is properly registered and picked up by the pins 59 projecting from the traveling chains 60. The blank is then moved forward over the belts 44 and the belt 71 beneath the scoring roller 75 which provides the score line 8, and then beneath the scoring roller 80 which provides the score lines 9 and 10. The blank is next firmly gripped and carried along by the belts 84 and 85, by the folding rollers 102 and 103 which elevate the side flap adjacent the edge 4, and beneath the rotating plate 113 which creases the side flap into position. While still engaged by the belts 84 and 85, the blank passes beneath the glue applying roller 116 which provides the stripe of adhesive 11 upon the partially folded blank.

After the application of adhesive, the blank is engaged prior to its ultimate release by the belts 84 and 85, by another pair of traveling belts 123 and 124 which grips the blank on the opposite side of the median line to permit the other side flap of the blank adjacent the edge 3 to be elevated by folding rollers 131 and 132, and this flap is pressed into position by a rotating plate 133. Still carried by the belts 123 and 124, the blank next passes beneath a scoring roller 135 which provides the score line 12, seen in Figure 7, and immediately thereafter passes under the fixed plate 144 and the bottom portion is kicked up by one of the bars 142 on the folding arm 139. Passing through the chute 148, to insure the proper bottom fold-up, the blank is then centrally engaged by the belts 150 and 151, these belts gripping the now formed blank directly over the adhesived portions thereof.

The formed cup is carried by the belts 150 and 151 over the large pulley wheel 156 and returned along the lower deck of the machine, with the adhesived portions tightly held, so that the adhesive may properly set. These belts deliver the cup to the receiving mechanism, where it is partially expanded by compressed air and so forcibly lodged between the traveling belts 174 and 175 which may further expand the cup or maintain the expansion it already has, depending upon the adjustment of the pulleys 178 and 180. The belts also maintain the cup in nested relationship with previously received cups, transferring the stacked nested cups to a position for ultimate removal and packaging in a carton. As the cups are fed to the receiving means, they are counted and each predetermined cup is visibly marked by the element 191, so that it is a simple expedient to remove a portion of the stack of cups embodying the proper number of cups for a single carton.

It will be appreciated that once the blanks leave the hopper 29, they are in continuous motion until they emerge from the receiving means in the form of stacked nested cups. The blanks cannot get out of alignment at any time during the passage through the machine because, while the locations of the gripping holds upon the blank are shifted from time to time to permit various forming operations, the grippings on the various portions are so overlapped that the blank is never at any time released. It will be further appreciated that with substantially all of the forming elements of the machine arranged to operate on a plurality of blanks following each other other in single file during a single revolution of each respective forming element, the travel of the blank through the machine is exceedingly rapid and the blanks may be disposed quite closely together.

From the foregoing, it is apparent that I have provided a machine for making paper cups, particularly cups substantially wedge-shaped, in which a blank has portions thereof folded directly upon itself in the flat to form it into a cup, there being nothing around which the blank is folded in order to shape it into a cup. It is further apparent that the machine, being continuously operable and maintaining each blank in continuous motion, produces paper cups at an exceedingly rapid rate, thus materially economizing production. Further, the machine is relatively simple in construction, highly efficient in operation, very durable, and may be economically operated.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than is necessitated by the prior art.

I claim as my invention:

1. In a machine of the character described, forming elements arranged to act upon a flat paper blank and fold portions of the blank on other portions thereof to form the blank into a flat envelope type drinking cup, said forming elements being entirely exterior of the blank, conveying means arranged to carry a plurality of blanks simultaneously and in successive order past said forming elements, means to deliver blanks in spaced successive order to said conveying means, retarding means arranged to insure

the delivery of a blank to the conveying means at a predetermined time, receiving mechanism for completed cups, and means to partially expand each cup as it enters the receiving mechanism and nest it in previously received cups.

2. In a machine of the character described, forming elements arranged to act upon a flat paper blank and fold portions of the blank on other portions thereof to form the blank into a flat envelope type drinking cup, said forming elements being entirely exterior of the blank, conveying means arranged to carry a plurality of blanks simultaneously and in successive order past said forming elements, means to deliver blanks in spaced successive order to said conveying means, retarding means arranged to insure the delivery of a blank to the conveying means at a predetermined time, receiving mechanism for completed cups, and means to partially expand each cup as it enters the receiving mechanism and nest it in previously received cups, said receiving means being continuously in motion and arranged to hold the delivered cups partially expanded and carry a stack of them along therewith.

3. In a machine for making paper cups from blanks of stock, conveying means arranged to grip a blank and carry it along a predetermined path, a pair of forming units disposed on opposite sides of said path to act on the blank as it passes thereby, and said conveying means being arranged to shift its grip on the blank to a different location between said forming units, and a gluing unit disposed between said forming units, said conveying means changing its grip on the blank to directly hold the glued parts of the blank after the blank has passed said forming units.

4. In a machine for making paper cups from blanks of stock, conveying means arranged to grip a blank and carry it along a predetermined path, forming means arranged to fold the blank to provide overlapping portions as the blank passes thereby, gluing means to apply adhesive to the blank to join said overlapping portions, and said conveying means being arranged to grip the blank to one side of the gluing means and later transfer the grip directly over the adhesive seam holding together overlapping portions of the blank.

5. In a machine for making paper cups from blanks of stock, conveying means arranged to grip a blank and carry it along a predetermined path, a pair of forming units each arranged to fold a side flap of the blank inwardly over the central part of the blank, said conveying means being arranged to periodically shift the location of its hold on the blank in keeping with the operation of said forming units, and said forming units operating continuously and each being arranged to act on a plurality of successive blanks before assuming its original position.

6. In a machine for making paper cups from blanks of stock, conveying means arranged to grip a blank and carry it along a predetermined path, scoring means to provide oblique lines of fold on the blank extending generally lengthwise of the blank, and rotating forming units disposed on opposite sides of said path to fold the blank along said oblique lines as the blank passes thereby.

7. In a machine for making paper cups from blanks of stock, conveying means arranged to grip a blank and carry it along a predetermined path, forming means to shape the blank, gluing means to apply adhesive to the blank, and said conveying means being arranged to grip the blank in one location until said forming means and said gluing means have acted and then ultimately grip the shaped blank directly over the glued parts thereof and hold the blanks a material length of time while the glue is setting.

8. In a machine for making paper cups from blanks of stock, conveying means for carrying a blank along a predetermined path, folding members in the nature of superposed rollers complementally shaped to elevate a side flap of the blank as it passes thereby, and a flat rotating plate under which the blank is carried to press down the elevated side flap over the body part of the blank.

9. In a machine for making paper cups from blanks of stock, conveying means for carrying a blank along a predetermined path, folding members in the nature of superposed rollers complementally shaped to elevate a side flap of the blank as it passes thereby, a flat rotating plate under which the blank is carried to press down the elevated side flap over the body part of the blank, gluing means to apply adhesive to the folded side flap, and similar folding members and a similar plate to fold the opposite side flap of the blank over the applied adhesive.

10. In a machine for making paper cups from blanks of stock, conveying means for carrying a blank along a predetermined path, folding members in the nature of superposed rollers complementally shaped to elevate a side flap of the blank as it passes thereby, a flat rotating plate under which the blank is carried to press down the elevated side flap over the body part of the blank, gluing means to apply adhesive along the margins of the folded side flap and the end portion of the blank, similar folding members and a similar plate to fold the opposite side flap over the applied adhesive, and means to fold up the end portion of the blank to provide a bottom closure.

11. In a machine for making paper cups from blanks of stock, conveying means for carrying a blank along a predetermined path, folding members in the nature of superposed rollers complementally shaped to elevate a side flap of the blank as it passes thereby, a flat rotating plate under which the blank is carried to press down the elevated side flap over the body part of the blank, gluing means to apply adhesive along the margins of the folded side flap and the end portion of the blank, similar folding members and a similar plate to fold the opposite side flap over the applied adhesive, and means to fold up the end portion of the blank to provide a bottom closure, said conveying means being arranged to grip the blank and periodically shift the location of the grip upon the blank to permit operation of the folding members.

12. In a machine for making paper cups from a blank by folding side flaps inwardly and turning up a bottom fold, conveying means for advancing a blank along a predetermined path, folding means arranged to fold inwardly side flaps of the blank, and a continuously rotating arm adjacent said path and having means extending therefrom over said path and arranged to kick up the bottom portion of the folded blank as the blank passes thereby.

13. In a machine for making paper cups each having a bottom fold-up portion, conveying means for advancing a partially formed blank, a plate under which said blank passes, and a

continuously movable folding arm arranged to strike up the end portion of the blank when said portion extends a predetermined distance beyond the edge of said plate during its travel.

14. In a machine for making paper cups each having a bottom fold-up portion, conveying means for advancing a partially formed blank, a plate under which said blank passes, a movable folding arm arranged to strike up the end portion of the blank when said portion extends a predetermined distance beyond the edge of said plate, and a chute having a flaring mouth into which said blank enters to lay the struck-up end portion over the body of the blank.

15. In a machine for making paper cups each having a bottom fold-up portion, conveying means for advancing a partially formed blank, a plate under which said blank passes, a movable folding arm arranged to strike up the end portion of the blank when said portion extends a predetermined distance beyond the edge of said plate, and a chute having a flaring mouth into which said blank enters to lay the struck-up end portion over the body of the blank, said folding arm having a trailing wiper thereon to hold the struck-up portion in position until the blank enters said chute.

16. In a machine for making paper cups each having a bottom fold-up, conveying means arranged to continuously advance a plurality of blanks in successive order along a predetermined path with the portion to be folded up leading, and a rotating folding arm adjacent said path and having a pin at each end thereof projecting over said path to cause said arm to act on two successive blanks in each revolution.

17. In a machine for making paper cups each having a bottom fold-up, conveying means arranged to continuously advance a plurality of blanks in successive order along a predetermined path with the portion to be folded up leading, and a rotating folding arm adjacent said path and having a plurality of elements extending therefrom over said path, said elements being spaced apart and each being arranged to strike up the leading portion of a blank.

18. A machine for making tapered cups comprising means to glue blanks and fold them into complete tapered cups in flat form, and means to conduct air under pressure into the flat cups to open them and also to move them into nested position.

19. A machine for making tapered cups comprising means to glue blanks and fold them into complete tapered cups in flat form, means to conduct air under pressure into the flat cups to partially open them while a portion of each cup is held against opening, and means acting when the cup is free of said holding to complete the opening of the cups and coincidentally with said complete opening to nest the cups.

20. A machine for making tapered cups comprising means for registering, scoring, folding, gluing and nesting blanks, and means to feed each blank during said operation and up to the position of nesting at a continuous uniform speed in a defined path.

21. In a machine for making a paper cup from a blank having side flaps to be folded inwardly and a projection to be turned up in a bottom fold, means for folding inwardly one of the side flaps, and glue applying means arranged to apply a varying amount of glue along the folded side flap and on the projection, said glue being of such amount as to remain within the confines of the overlapped parts of the cup when pressure is applied to the seams.

22. In a machine for making a paper cup from a blank having side flaps to be folded inwardly and a projection to be turned up in a bottom fold, means for folding inwardly one of the side flaps, and glue applying means arranged to apply a varying amount of glue along the folded side flap and on the projection, said amount of glue including an area on the folded side flap, an area on the projection, and a narrow area connecting the first said areas.

23. In a machine for making a paper cup from a blank having side flaps to be folded inwardly and a projection to be turned up in a bottom fold, means for folding inwardly one of the side flaps, and glue applying means arranged to apply a varying amount of glue along the folded side flap and on the projection, said glue being in the nature of a stripe on the folded side flap, and a spot on the projection with a connecting stripe of less width.

24. In a machine for making wedge-shaped paper cups, feeding means to carry a blank along a defined path, scoring means arranged to provide diverging score lines extending substantially the full length of the blank and disposed obliquely to the axis of the blank to define side tabs to be folded over the blank part therebetween, rotary folding elements adjacent said path arranged to fold the side tabs inwardly into overlapping relationship along the oblique score lines as the blank passes by, and means to turn up the leading portion of the partly folded blank and fold it back on the body portion to provide a bottom closure.

25. In a machine for making wedge-shaped paper cups, feeding means to carry a blank along a defined path, scoring means arranged to provide diverging score lines extending substantially the full length of the blank and disposed obliquely to the axis of the blank to define side tabs to be folded over the blank part therebetween, folding means to fold inwardly one of said side flaps along the oblique score line thereadjacent, means to apply an area of glue on the folded side flap, folding means to fold over the opposite side flap along its oblique score line with a margin overlying said glue area, and means for turning up the forward portion of the partly folded blank to provide a bottom closure for the cup.

26. A machine for making paper containers from blanks, including conveying means operating along two courses of travel in opposite directions, forming means to form a blank into a container disposed along one course, the formed container being returned by said conveying means along the other course to be discharged at the same end of the machine from which the blank started, and a traveling receiver arranged to both expand a received container and carry it along.

27. In a machine for making flat paper cups, conveying means to carry a blank through the machine, forming means along the path of travel of the blank to shape the blank into a flat container, and traveling receiving means arranged to both expand the container and carry it along therewith.

28. In a machine for forming paper cups from a blank of sheet material, a folding mechanism comprising a plurality of pairs of rolls for creasing said blank, means for folding the same into a completed cup, and cup supporting means adapted to receive and support the said cups in a position wherein they are nested one partly

within the other as they are delivered from the machine.

29. In a machine for making wedge shaped paper cups having overlapping portions adhesively held together, conveying mechanism for carrying a blank in the direction of its longitudinal axis continuously through the machine at a uniform speed, forming means arranged to completely form a blank into a cup as the blank is carried thereby, and a part of said conveying mechanism being arranged to grip the formed blank directly over the adhesively held parts and carry it along while the adhesive is setting.

30. In a machine for making wedge shaped paper cups having overlapped portions adhesively held together, conveying mechanism to grip a blank and carry it along therewith, folding means spaced on opposite sides of the path of travel of the blank arranged to successively lay over side flaps into overlapping relationship with each other over the central portion of the blank as the blank passes by the folding means, said conveying means changing the location of its grip on the blank during the action of the folding means, gluing means to apply adhesive to the first folded side flap and the end portion of the blank and further folding means to fold the end portion of the blank back over the seam between the side flaps, said conveying means again changing its grip on the blank to a new location directly over the folded end portion and seam between the side flaps.

31. In a machine for making wedge shaped paper cups, conveying means for gripping and carrying a blank through the machine during forming without once releasing the blank, forming means to shape the blank into a paper cup as the blank passes by the forming means, traveling receiving means capable of both expanding a cup and carrying along a stack of expanded and nested cups, and transfer means to move the formed blank from said conveying means and seat it in said traveling receiving means in nested relationship with previously received cups.

HAROLD S. LABOMBARDE.