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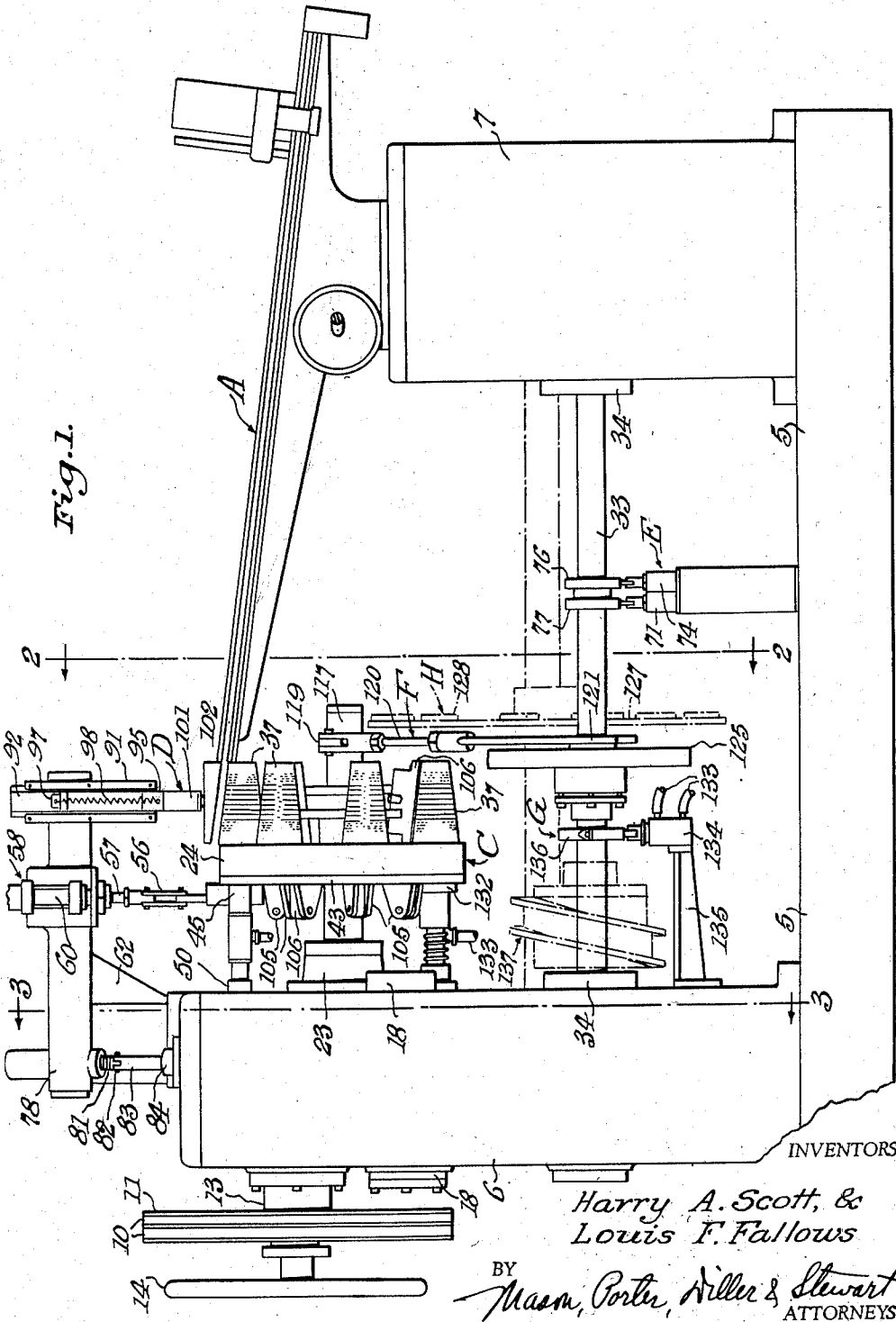
H. A. SCOTT ET AL

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PAPER CUP BODY FORMING APPARATUS

Filed June 9, 1953

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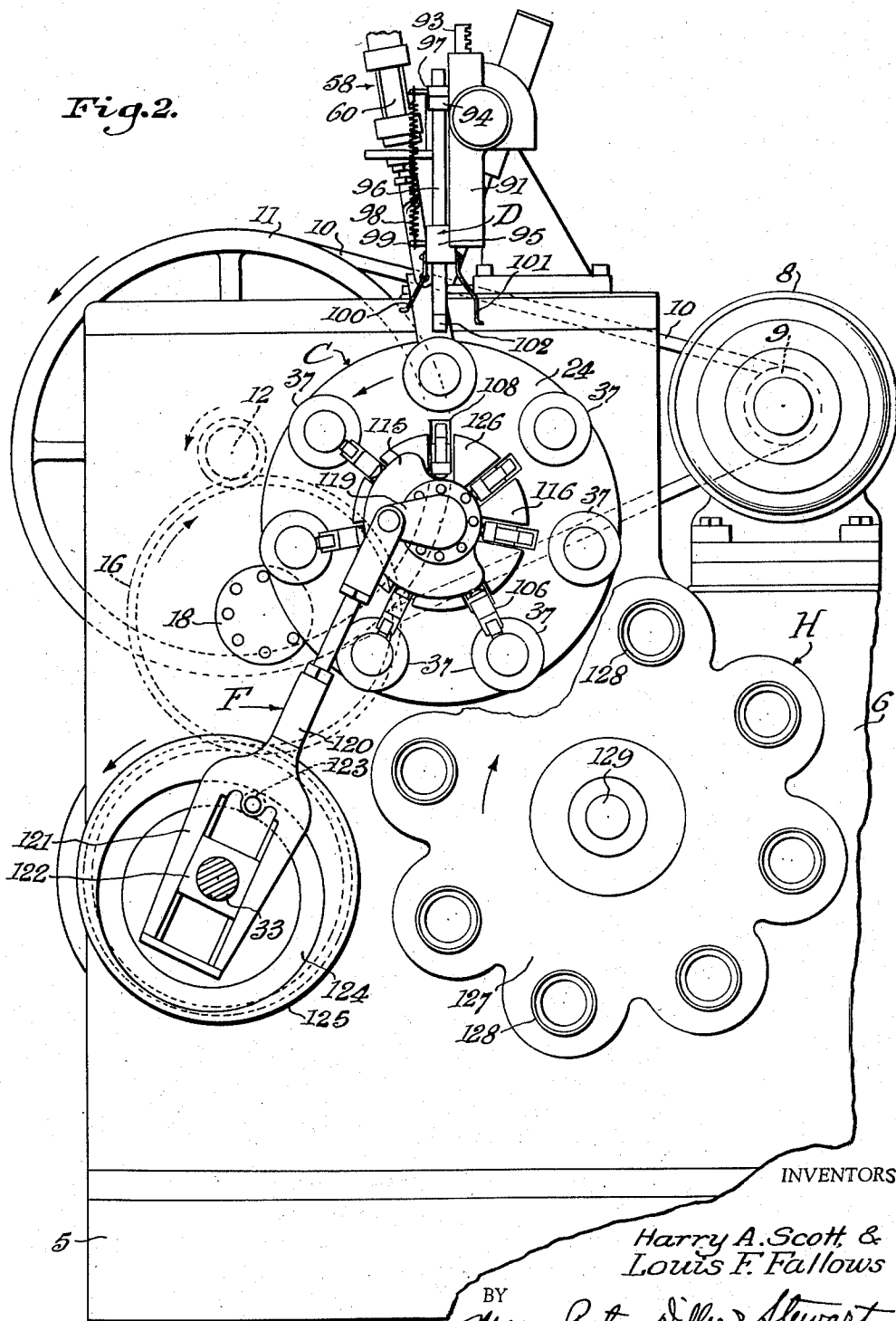
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10 Sheets-Sheet 2

Fig. 2.



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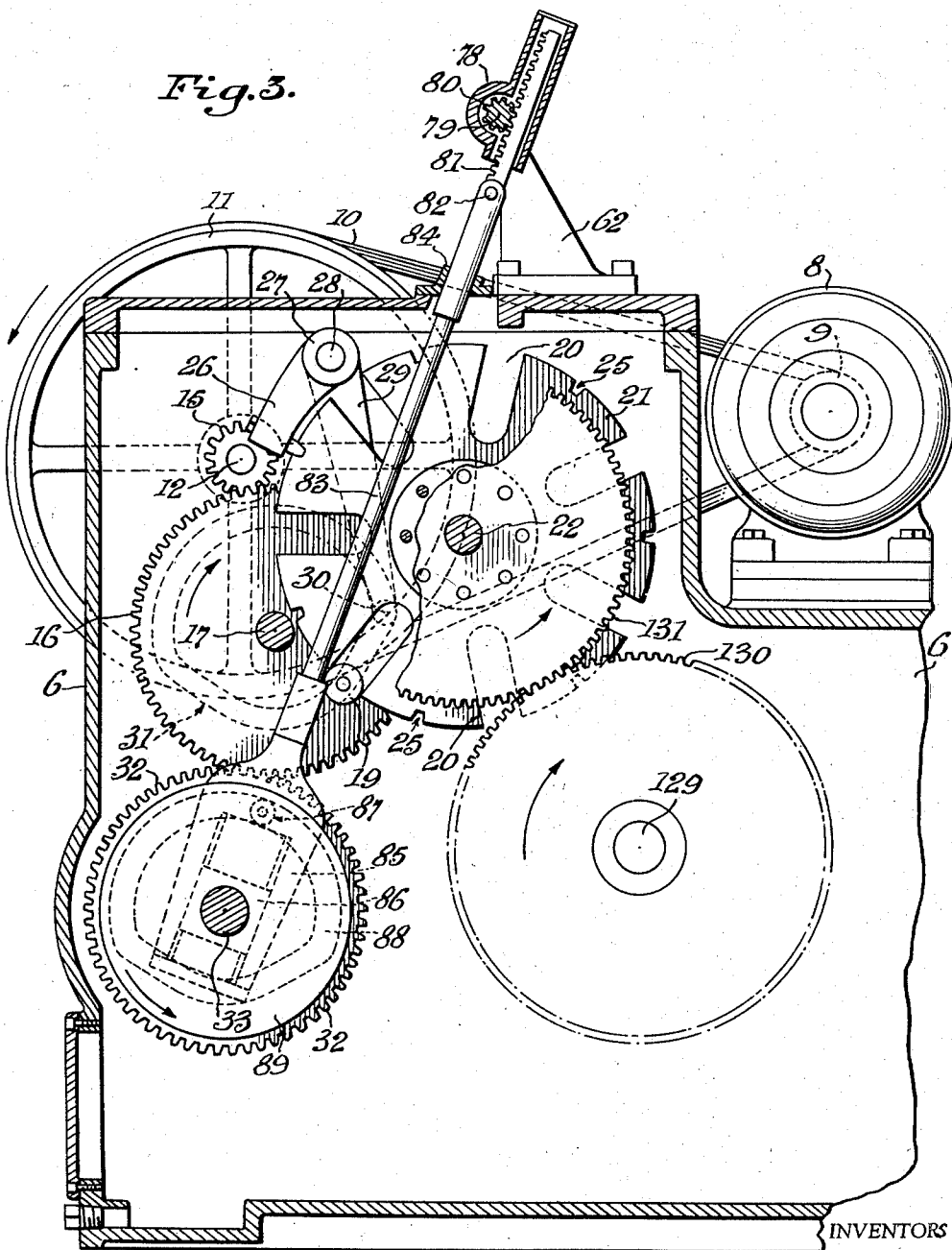
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10 Sheets-Sheet 3



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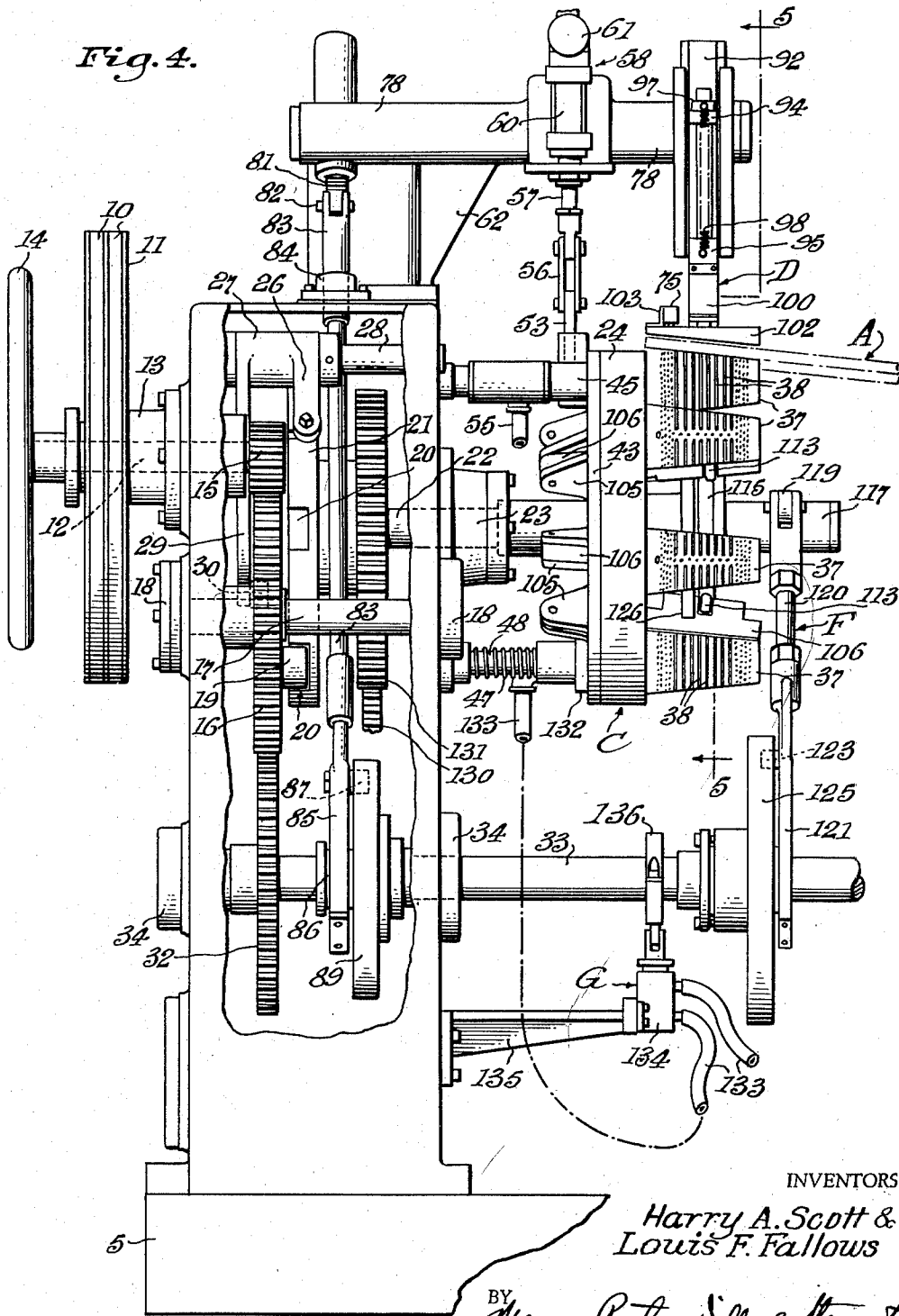
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10 Sheets-Sheet 4



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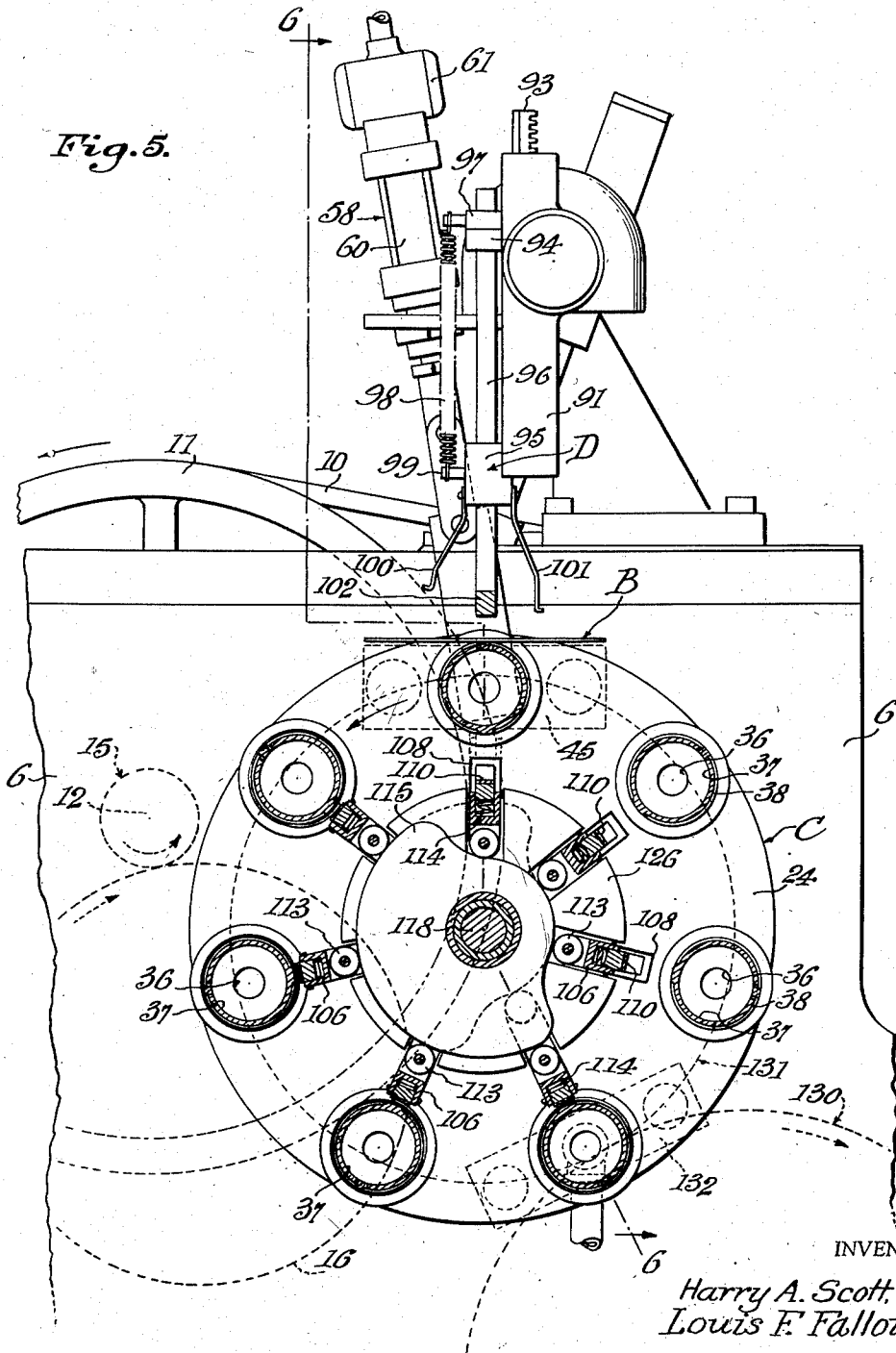
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10 Sheets-Sheet 5

Fig. 5.



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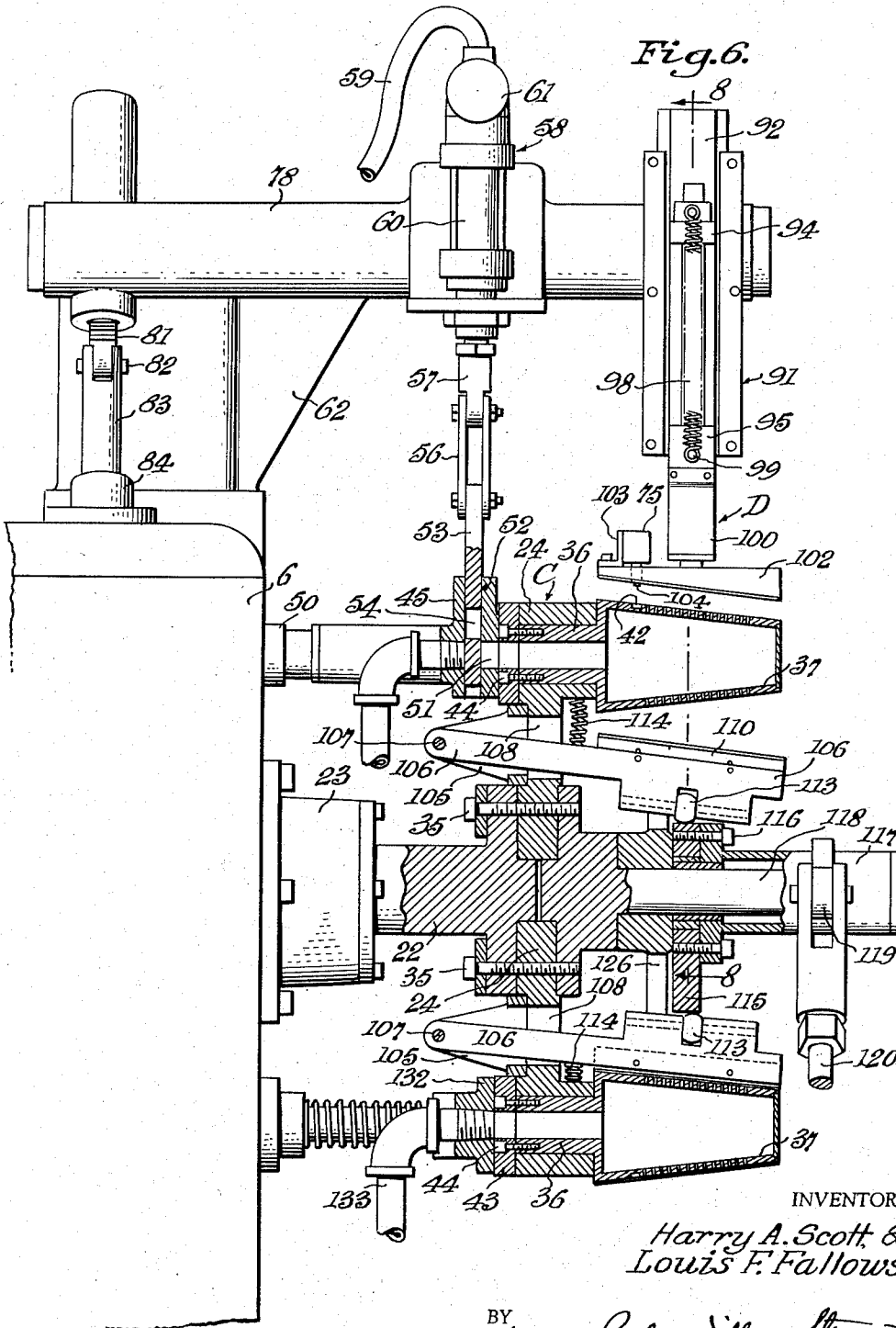


Fig. 6.

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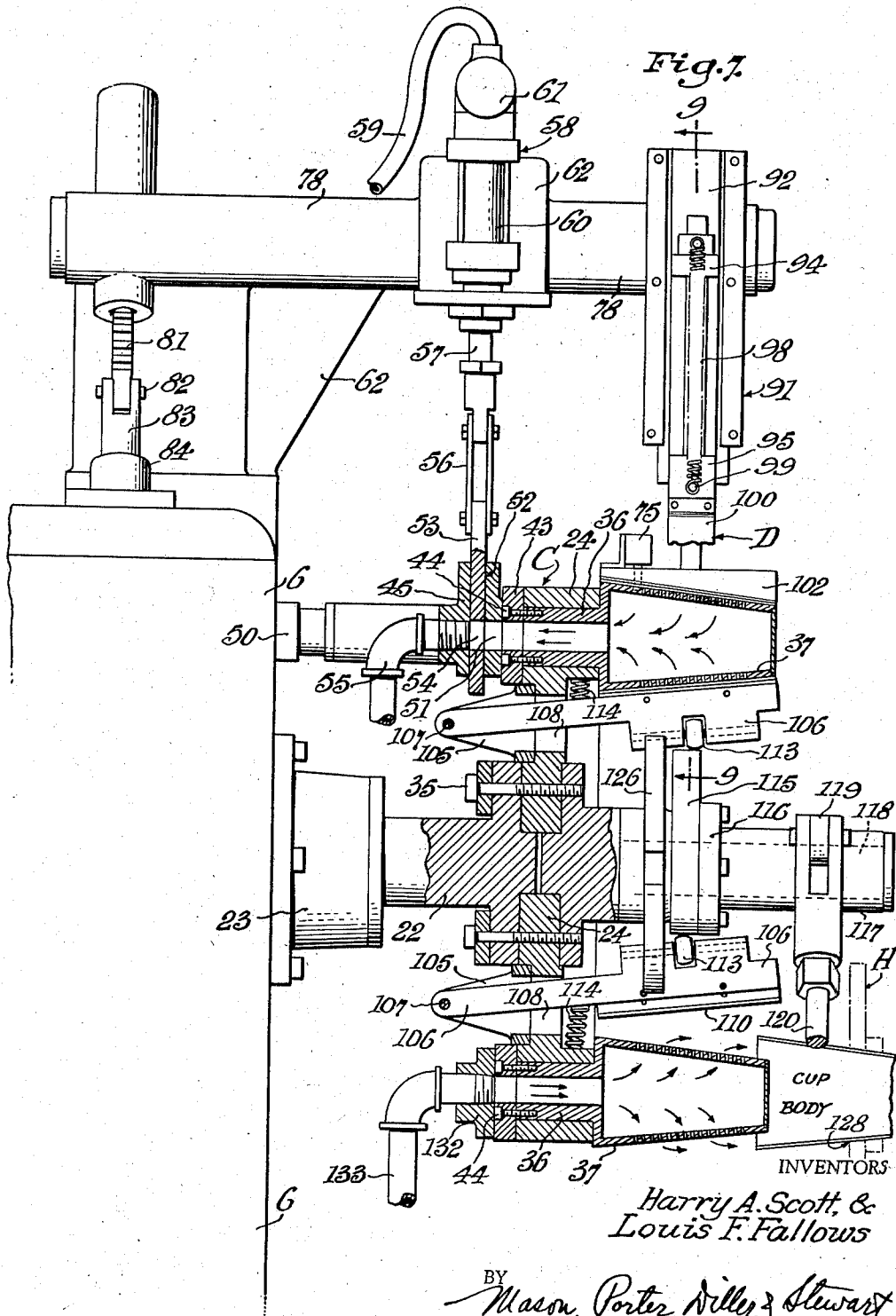
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Fig. 8.

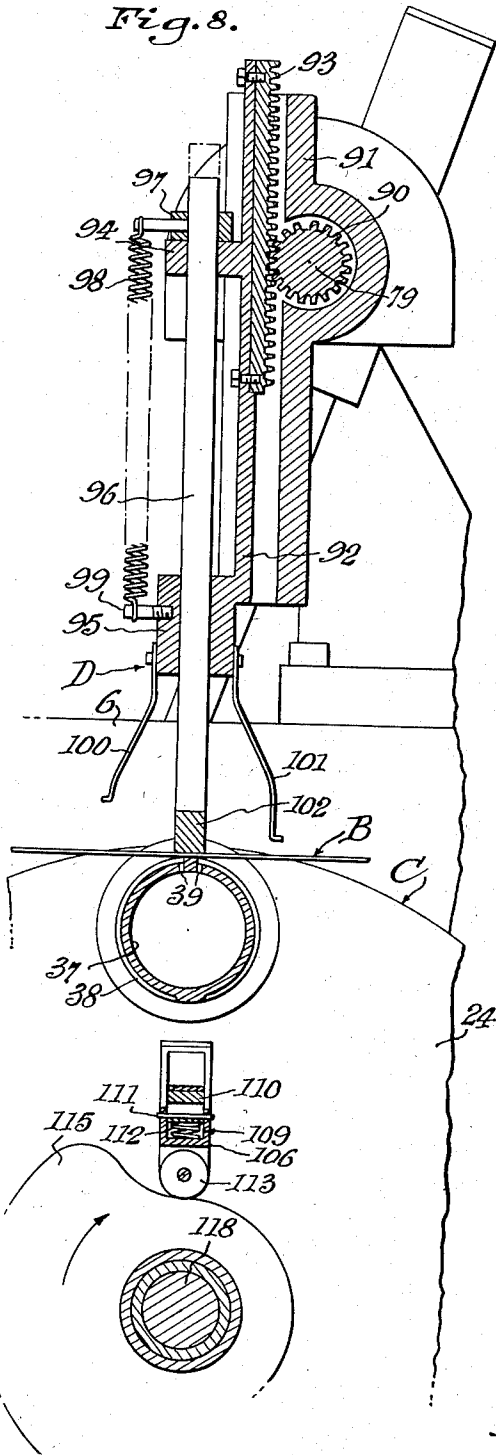
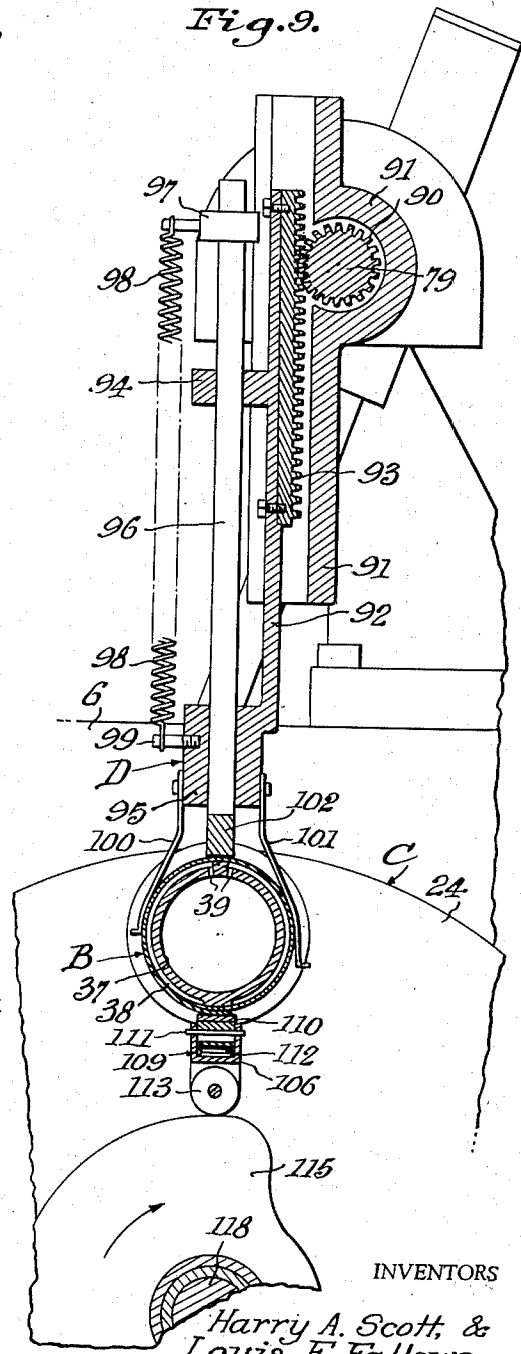


Fig. 9.



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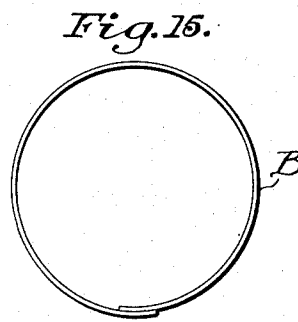
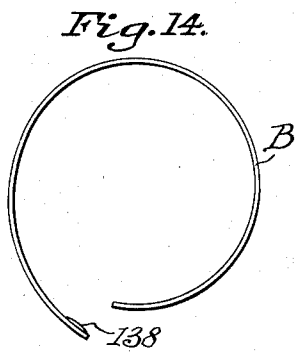
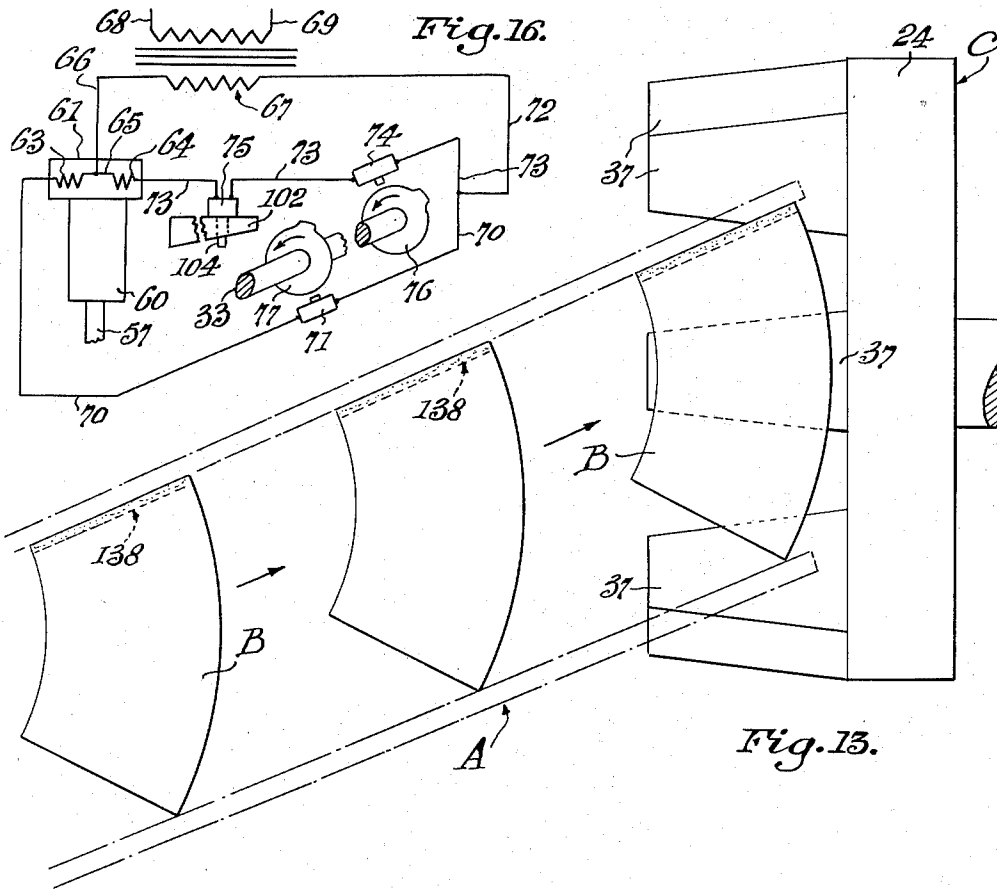
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10 Sheets-Sheet 10



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2,819,659

## PAPER CUP BODY FORMING APPARATUS

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Application June 9, 1953, Serial No. 360,512

27 Claims. (Cl. 93—39.3)

The invention relates generally to the making of paper drinking cups and primarily seeks to provide a novel apparatus for forming the frusto-conical cup bodies.

Paper cups are extensively manufactured today, and the present invention has reference to machine structures wherein paper cups of the frusto-conical body type are formed, such cups having a bottom insert or closure therein, and an edge smoothing and strengthening curl at the upper ends thereof. The bodies of these cups are formed by wrapping flat paper blanks about frusto-coniform shaping mandrels, said blanks having converging side edges, a convexly curved top edge and a concavely curved bottom edge so as to provide the desired frusto-conical sleeve shape when the side edges are brought together and bonded in overlapping relation. In the apparatus covered herein the blanks are received on and shaped about frusto-coniform mandrels equidistantly spaced about a turret which is indexed about a horizontal axis, the mandrels being disposed with their axes parallel the axis about which the turret is indexed, novel means being provided for presenting the blanks flatwise over the mandrels, for starting the shaping of each blank over a mandrel by mechanical pressure contact, and for completing said shaping by vacuum action, and means also being included for securely clamping each blank to the shaping mandrel as it is presented thereover and prior to said shaping, and also for clamping each side seam formed by overlapping of blank side edges, thereby to secure an adhesive bonding of the side seams. In the machine structure as a whole, of which the herein disclosed apparatus forms a part, novel means for feeding the blanks to the mandrels, and also novel means for providing the edge smoothing and strengthening body curls are included, but these individual apparatuses are not covered herein but rather in separate applications for Letters Patent of the United States filed on May 22, 1953 by Orville L. Dellinger and Franklin D. Scott, Serial Number 356,792 relating to the Blank Feeding Mechanism, and on June 23, 1953 by Harry A. Scott and Charles A. Uncapher, Serial Number 363,528 and relating to the Paper Cup Edge Curling Means.

In its more detailed nature the invention seeks to provide a novel paper cup body forming apparatus wherein are included a turret rotatable about a horizontal axis and having a plurality of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes paralleling the axis of rotation of the turret, a body blank receiving station, a shaped body discharging station, means for indexing the turret to serially present the mandrels at the receiving station and later at the discharging station, means at the receiving station for clamping a blank against each mandrel presented thereat with a portion of the blank extending beyond each side of the mandrel, means also at said receiving station for engaging said extended portions of the blank and shaping them partially about the mandrel, means for completing the shaping of the blank about the mandrel by vacuum action to provide a shaped body having a lapped side seam, means for clamp-

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ing the side seams immediately after the shaping of each body and holding the same until each body is presented at the discharging station so as to assure the provision of a securely bonded side seam, and means at the discharging station for discharging the thus formed cup body sleeve.

An object of the invention is to provide an apparatus of the character stated wherein the means for partially shaping the blanks includes a carrier reciprocable radially with relation to the turret and having a fork-like member with arms of uneven length engageable with blank portions extending to either side of a mandrel, the longer arm serving to advance the partial wrapping of one extended side of the blank about the mandrel ahead of the partial wrapping of the other side so that when the wrapping of the blank is completed by the vacuum means the first mentioned partially wrapped side portion will underlie the other side portion in the lapped side seam.

Another object of the invention is to provide an apparatus of the character stated wherein the means for completing the shaping of the blanks by vacuum action includes hollow mandrels having circumferential grooves in their peripheries and orifices opening outwardly into the grooves approximately at the position at which the blanks are initially clamped on the mandrels, means being included for controlling evacuation of the interiors of the mandrels in timed relation to the applying and releasing of the clamping devices.

Another object of the invention is to provide an apparatus of the character stated wherein the initially effective blank clamping means and the fork-like member with arms of uneven length are mounted on a common carrier on which the clamping means is supported for independent yielding movement so that it can come against and clamp a blank while the fork-like member partakes of an over travel to contact the partially shape the clamped blank.

Another object of the invention is to provide an apparatus of the character stated wherein the body side seam clamping means includes a clamping member movable radially outwardly against each mandrel, and a cam means oscillatable back and forth for applying each said clamping member at the receiving station and releasing the same at the discharging station, and including a dwell portion for holding the clamping members against the body side seams while they are being indexed from the receiving station to the discharging station.

Another object of the invention is to provide an apparatus of the character stated wherein the means for controlling evacuation of the interior of the mandrels includes means for preventing evacuation of any mandrel whereon no blank has been applied.

Another object of the invention is to provide an apparatus of the character stated wherein the means for preventing evacuation of a mandrel when no blank has been applied thereon includes a control switch movable with the body blank clamping means.

Another object of the invention is to provide an apparatus of the character stated wherein there are included a pocketed turret and means for controlling the position thereof to place a pocket thereof opposite each mandrel as it is presented at the body discharging station, and means for discharging each formed cup body from the mandrel about which it has been shaped and depositing it in the opposing turret pocket.

Another object of the invention is to provide an apparatus of the character stated wherein the formed cup discharging means comprises means for directing air under pressure through each mandrel presented at the discharging station to blow the shaped cup body off the mandrel and into the opposing turret pocket.

Another object of the invention is to provide an apparatus of the character stated wherein each hollow man-

drel includes outwardly directed orifices over which the bodies are shaped and comprising part of the pressure discharging means, said last named means also including a pressure source and cam operated valve means for controlling introduction of body discharging pressure into the mandrels at the discharging station.

A still further object of the invention is to provide an apparatus of the character stated wherein the mandrel evacuation control includes a vacuum source, a spring pressed shoe engaged with the mandrel carrying turret and having a port connected with the vacuum source and communicating with each mandrel as it is presented at the blank receiving station, and cam controlled valve means for opening the port to bring about an evacuation of a mandrel presented at the receiving station to complete shaping of a blank thereabout, and foreclosing said port and closing off the vacuum source before the mandrel is indexed from said station.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation illustrating a machine structure embodying the invention.

Figure 2 is a vertical cross section taken on the line 2—2 on Figure 1.

Figure 3 is a fragmentary vertical cross section taken on the line 3—3 on Figure 1.

Figure 4 is an enlarged fragmentary side elevation, parts of the housing structure being broken away to illustrate portions of the drive mechanism.

Figure 5 is a fragmentary vertical cross section taken on the line 5—5 on Figure 4, a body blank being illustrated as presented at the receiving station prior to the application of the clamp for holding the same against the mandrel at said station, the seam clamping devices being shown as released at the receiving station and applied at the discharging station and at all positions intermediate said receiving and discharging stations.

Figure 6 is an enlarged fragmentary vertical longitudinal section taken on the line 6—6 on Figure 5, the mandrel evacuation controlling valve being shown in the closed position.

Figure 7 is a view similar to Figure 6, the clamps being shown applied at the receiving station, the mandrel evacuation controlling valve being shown open at the receiving station, the clamp being shown released and a shaped cup body being shown in the process of being discharged from the mandrel by a blast of air at the discharging station.

Figure 8 is an enlarged fragmentary sectional view illustrating the blank clamping and preshaping means at the receiving station.

Figure 9 is a view similar to Figure 8, the section being taken on the line 9—9 on Figure 7 and the completed shaping of the blank and the clamping of the side seam of the formed body being illustrated.

Figure 10 is an enlarged fragmentary horizontal section illustrating a mandrel presented at the receiving station, the mandrel evacuating port equipped shoe and one of the spring presser equipments being shown in part section.

Figure 11 is a detail cross section taken on the line 11—11 on Figure 10.

Figure 12 is a detail cross section taken on the line 12—12 on Figure 10.

Figure 13 is a somewhat diagrammatic fragmentary plan view illustrating the manner in which the blanks are fed to and placed over the mandrels as they are serially presented at the receiving station.

Figure 14 is a somewhat diagrammatic view illustrating the manner in which the side of the blank first contacted by the mechanical shaping means is completed by vacuum action in advance of the completion of wrapping or shap-

ing of the other side so as to assure proper overlapping at the side seam.

Figure 15 is a view similar to Figure 14 showing the completion of the shaping or wrapping of a cup body.

Figure 16 is a diagrammatic view illustrating one acceptable manner of mechanically and electrically controlling the operation of the mandrel evacuating valve so that the mandrels will be evacuated only when body blanks are applied thereon.

In the example disclosure of cup making machine structure herein shown as embodying the invention, A generally designates a somewhat diagrammatic showing of the blank feeding means which is being covered in the beforementioned Dellinger and Scott application. The blanks B are fed in processional order to the mandrels on the turret C in the manner indicated in Figures 1 and 13. Means for clamping the blanks on a mandrel presented at the blank receiving station and for starting the shaping of the blank about the mandrel is generally designated D, the on and off control for effecting the completion of the body shaping by vacuum action is generally designated E, the control for the body seam clamping device is generally designated F, the shaped cup body blow-off control is generally designated G, and the receiver turret into a pocket of which each shaped cup body is blown to receive its bottom and have its upper edge curled is generally designated H. See Figures 1, 2, 4 and 13.

The machine structure includes suitable framing and housing structures of which the base 5, the main drive housing 6 and the feeder means drive housing 7 form parts.

A driving motor 8 is supported on the housing 6, and on its drive shaft is secured a driver pulley 9. See Figures 2, 3 and 4. A belt means 10 passes over the pulley 9 and over a large pulley 11 secured on a driver shaft 12 which is rotatable in a housing supported bearing 13. Without the housing 6 the shaft 12 is equipped with an inching hand wheel 14, and within said housing the shaft has a pinion 15 fixed thereon. The pinion 15 meshes with and drives a large gear 16 on a shaft 17 which is rotatable in housing supported bearings 18, and said gear has an indexing roller 19 thereon which is engageable in the radial slots 20 provided in the rotor 21 which is secured on the turret shaft 22, the latter being rotatable in bearing means 23. It will be apparent that as the gear 16 is rotated, the indexing roller 19 thereof will engage in the turret rotor slots 20 in the well known manner for indexing said rotor forming a part of the turret structure generally designated C. The turret shaft 22 carries the mandrel supporting rotor 24 of the turret structure.

The turret structure rotor 21 also is provided with peripherally presented stop lock notches 25 which are engageable by the stop arm 26 of a bell crank 27 which is rockably supported at 28 in the housing 6. See Figures 3 and 4. The other arm 29 of the bell crank is equipped with a follower roller 30 engaged in a control cam groove 31 in a face of the gear 16, the cam groove being so shaped as to lift the stop arm 26 and free the rotor 21 each time an indexing of the turret structure is to be started, and to lower the arm 26 into engagement with one of the notches 25 after each completion of an indexing movement of the turret structure.

The gear 16 also meshes with and drives a large gear 32 fixed on the control cam shaft 33 which is rotatable in bearings 34 and which extends into the feeder drive housing 7 in the manner clearly illustrated in Figures 1, 3 and 4.

The turret rotor 24 is removably secured at 35 on the shaft 22 and has seven mounting bores therein paralleling the turret axis and in which to removably receive the reduced hollow extensions 36 of the hollow frusto-coniform mandrels 37. See Figures 2, 5, 6 and 7. It will be noted that each of the mandrels is closed at its smaller or cup bottom end and has its cup body shaping or frusto-coniform surface provided with a plurality of circum-

ferential grooves 38, arranged in parallel spaced relation. It will be apparent by reference to Figures 10, 11 and 12 that the grooves 38 extend about one-half way around the mandrel at each side, connecting with the longitudinal central row of suction orifices 39 which is centrally and upwardly disposed when the respective mandrel is presented at the blank receiving station, and terminating at the inner longitudinal seam opposing rib 40 of the mandrel. See Figure 11. Each mandrel also includes an annular row of orifices 41 completely surrounding the same endwise of the grooves 38 toward each end of the mandrel, and each mandrel also includes a switch plunger receiving clearance 42, the purpose of which will become apparent as this description progresses.

A hardened ring 43 is secured at 44 to the mandrel extensions 36, and this manner of securing the ring serves not only to removably position the ring, but also the mandrels 37. At the position of the blank receiving station, shown in Figures 1, 4, 6, 7 and 10, the ring 43 is opposed by a longitudinal shoe or valve plate 45 which is held tight against the ring by abutments 46 which are yieldably pressed by compression springs 47. The springs 47 surround pins 48 on which the shoe is slidably mounted as at 49, and said pins project from a support 50 secured on the housing 6. A suction port 51 extends through the center of the shoe 45 in position for registering with the hollow interior of each mandrel as it is presented at the blank receiving station in the manner clearly illustrated in Figures 6 and 7. The shoe also includes a valve slideway 52 in which a valve member 53 is slidable, said valve member having a cross port 54 therein. The port 54 is effective to open communication through the shoe into the interior of a mandrel positioned at the blank receiving station when the valve member is in its lowered position shown in Figure 7, and such communication will be closed off when the valve member is raised as indicated in Figure 6. The shoe port 51 is connected through nipple and duct means 55 with a suction source (not shown).

The valve 53 is link connected as at 56 to the reciprocable plunger 57 of a Bellows electrically controlled air powered valve actuator generally designated 58. These actuator devices are well known structures purchased on the open market and detailed illustration and description thereof is deemed unnecessary herein. An example disclosure is to be found in Figure 6 of the copending application for U. S. Letters Patent, filed by Lawrence F. Glowen and Joseph J. Sennello on June 29, 1951, entitled, Magnetically Operated No-Can No-Feed Control, and identified by Serial Number 234,306. In this actuator and control device pressure fluid from the source duct 59 is alternately directed to opposite ends of the cylinder 60 under control of the electrical control head 61 wherein the shiftable control valve is shifted from one end to the other by the energizing of the coils of magnets at the opposite ends of the control head 61. In this example illustration, the valve actuator generally designated 58 is supported on a bracket 62 mounted on the housing 6.

In the diagrammatic illustration of an acceptable control arrangement illustrated in Figure 16 the coils of the magnets which bring about the control shifting of the pressure fluid directing valve are diagrammatically indicated at 63 and 64, and it is to be understood that coil 63 on the left controls the lifting or closing of the vacuum control valve (Figure 6), and the coil 64 on the right controls the lowering or opening of said valve (Figure 7). The magnet coils are connected at their proximate ends at 65, and the connection 65 is in turn connected by a conductor 66 with the step-down transformer generally designated 67 and which is connected with the power input lines 68 and 69. This transformer serves to reduce the service current to eight volts for use in this particular control system. The coil 63 is connected through

a conductor 70, the switch 71 and the conductor 72 with the transformer, and the other coil 64 is connected by conductors 73, the switch 74 and said conductor 72 with the transformer, a second switch 75 being connected in series with the switch 74 for a purpose to be described hereinafter. The normally open switches 74 and 71 are actuated or closed by cams 76 and 77 mounted on the cam shaft 33, the closing of the valve opening switch 74 serving to bring about evacuation of a mandrel presented at the blank receiving station, and the closing of the switch 71 following a proper interval of time after the closing of the switch 74 and serving to close the evacuating valve 53 and discontinue the evacuation of said mandrel.

Additional to supporting the electrically controlled head 58 the bracket 62 provides a rotary bearing 78 for a shaft 79 having a pinion 80 thereon. See Figures 4, 6, 8 and 9. The pinion 80 is engaged by a rack 81 which is pivotally connected at 82 to a pitman 83 which is slide guided at 84. The pitman is provided at its lower end with a fork 85 which straddles a slide block 86 on the shaft 33 and is equipped with a follower roller 87 which is engaged in an actuator groove 88 in a plate cam 89 secured on the shaft 33. It will be apparent that as the shaft 33 is rotated, the pitman 83 will be reciprocated, and its reciprocatory movement will be transmitted in the form of rotary movement back and forth to the shaft 79 through the rack and pinion connections 81 and 80.

The shaft 79 also has a pinion 90 at its other end within the housing 91 supported on the bearing 78 and in which a carrier 92 is vertically slidable. See Figures 5, 6, 8 and 9. The carrier is equipped with a rack 93 enmeshed with the pinion 90 so that the back and forth rotation of said pinion will serve to lift and lower the carrier 92. The carrier has an upper guide 94 and a lower guide 95 in which a clamp slide bar 96 is vertically slidable. A collar 97 is fixed on the bar and serve as an abutment engageable with the upper guide 94 in the manner illustrated in Figure 8 to limit downward movement of the bar. A retractile spring 98 attached at its upper end to the collar 97 and anchored at its lower end at 99 on the lower guide 95 of the carrier constantly tends to move the bar 96 to its fully lowered position.

The lower guide 95 forms a fork-like member with the arms 100 and 101 secured thereon, the latter being somewhat longer than the arm 100. The slide 96 carries a body blank clamp 102 on which the beforementioned switch 75 is mounted as at 103 so that its button 104 extends downwardly below the clamping face of the member 102 for engagement with paper body blanks over the mandrel recesses 42.

It is to be understood that as each cup body blank B is presented over a mandrel at the receiving station as illustrated in Figure 8, the carrier 92 and the slide bar 96 will be spaced slightly above the position illustrated in Figure 8 so that the clamp 102 will clear the blank. On the first movement downwardly of the carrier and slide the clamp 102 will first engage and press the blank against the top surface of the mandrel along the central row of orifices 39, and as downward movement of the carrier 92 is continued after this blank clamping contact, said carrier will slide downwardly relative to the now stationary clamp slide 96 in the manner illustrated in Figure 9, the long arm 101 first engaging the blank side extending to the right of the mandrel as viewed in Figure 8, and starting the shaping thereof about the mandrel, after which the shorter arm 100 will engage the blank and start the shaping of the other side thereof. This progressive contacting of the arms 101 and 100 assure the overlapping of the first engaged side under the last engaged side of the blank when the shaping of the body is completed by vacuum action.

It is to be understood that just as the arms 101 and 100 are pre-shaping or starting the shaping of the blank in

the manner above described, the cam 76 will close the switch 74 and energize the magnet coil 64 to bring about a shifting of the vacuum control valve to the open position illustrated in Figure 7, assuming of course that the blank on the mandrel has been engaged by the descending button 104 of the series connected switch 75. Had there been no blank presented over the mandrel at the receiving station, the switch 75 would not be closed and the control circuit through the switch 74, conductors 72, 73 and 66 and the coil 64 would not be completed. The evacuation of the mandrel causes air to run in through the orifices 39 and about the annular grooves 38 in a manner for causing the free ends of the blank to rapidly and progressively complete the shaping about the mandrel to the final, seam forming condition illustrated in Figures 9 and 15. After a suitable interval of evacuation of the mandrel for the purpose stated, the cam 77 functions to close the switch 71 and complete a circuit through the conductors 66, 70, 72 and the coil 63 effective to bring about a closing of the vacuum control valve 53 or a shifting thereof to the raised position illustrated in Figure 6.

At the position of each mandrel, the turret is equipped with a pair of mounting ears 105, and between each pair of ears a seam clamp arm 106 is pivotally mounted as at 107. Each arm 106 extends through an aperture 108 in the turret body and is swingable in a radial plane toward and from one of the mandrels. At its face opposed to the mandrel, each clamp arm 106 has a recess 109 in which a clamp bar 110 is mounted on slot and pin retainers 111, compression spring means 112 serving constantly to tend to displace the bars from their mounting recesses. Each arm 106 also has a follower roller 113 and is urged outwardly by a spring means 114 to hold said roller against the periphery of a seam clamp operating cam 115. The cam is secured at 116 on a sleeve 117 which is oscillatable about a shaft 118 secured to the shaft 22 with the turret plate 24. See Figures 2, 4 and 6. A crank 119 projecting from the sleeve 117 is connected with a pitman 120 having a fork 121 straddling a slide block 122 on the cam shaft 33. The fork is equipped with a roller 123 which is engaged in an actuator groove 124 in a plate cam 125 secured on the shaft 33. In their radial movements toward and from the opposing surfaces of the mandrels 37 the clamp arms 106 are guided in radial slots provided in the guide plate 126 which is rotatable with the turret structure.

The cup body receiving turret H is best shown in Figure 2 and includes a plate-like body 127 which is equipped with equidistantly spaced cup body receiving pockets 128 and mounted on a shaft 129 which is rotatable in suitable frame bearings. The shaft 129 has a gear 130 fixed thereon, the same being enmeshed with and driven by the gear 131 secured on the turret shaft 22. See Figure 3.

A blow-off pressure supply shoe 132 engages the turret ring 43 at the cup body discharging station as shown in Figures 4 through 7, said shoe being supported and spring pressed in the same manner as the previously described shoe 45 at the blank receiving, mandrel evacuating station. It will be noted by reference to Figures 2 and 5 that one of the sockets 128 of the receiving turret H is registered with one of the mandrels of the main turret structure at the conclusion of each indexing movement, the indexing means, the ratio of the gears 131, 130 and the spacing of the mandrels and said pockets assuring this perfect registering. The shoe 132 has nipple and duct connection at 133 with a pressure source (not shown) through a control valve 134 which is supported at 135 on the housing 6 and controlled by a cam 136 mounted on the shaft 33.

In Figure 1 a cam 137 is illustrated in dot and dash line phantom on the cam shaft 33, but it is to be understood that this cam forms a part of the actuating mechanism in the paper cup edge curling means forming a part of the machine structure as a whole and which is not covered

herein, but rather in the separate application of Scott and Uncather previously referred to herein.

#### Operation

It will be apparent by reference to Figures 1 and 13 that the feedway over which the body blanks B are fed in processional order is upwardly inclined, the degree of inclination being the same or approximately the same as the degree of inclination of the top surface of a mandrel 37 presented at the blank receiving station. The feedway also is disposed in angular relation to the axis of the mandrel disposed to receive a blank, and this angle is selected so that when a blank is presented over the mandrel it will not only lie at the inclination of the top surface of the mandrel but will be directly centered in the manner clearly illustrated in Figure 13 with its lateral edge portions spaced approximately like distances to either side of the mandrel axis and converging toward intersection at a point directly over or along said axis. It is to be understood that adhesive is applied to the underside of each blank along one marginal edge thereof as indicated at 138. The parts are so timed that immediately after the presentation of a blank in the manner stated, the carrier 9 will be lowered to first press the clamp member 102 against the blank and secure it on the mandrel in the manner illustrated in Figure 8, and then said carrier will overtravel with relation to the clamp bar 96 and cause the arms 101 and 100 to engage first at one side and then at the other side of the blank to start the shaping thereof about the mandrel with one side preceding the other so as to assure the desired overlapping at the side seam in the manner illustrated in Figure 9. As before stated, the controls diagrammatically illustrated in Figure 16 will function to bring about an evacuation of the mandrel as the pre-shaping thereof by the arms 101 and 100 is in progress, the vacuum action serving to quickly and progressively complete the shaping of the blank. No evacuation of the mandrel will take place if no blank B is clamped thereover, because the button 104 of the switch 75, descending with the clamp 102, will enter the mandrel recess 42 without closing to complete the evacuation control circuit. Following a normal mandrel evacuating interval the cam 77 will function to close the switch 71 and bring about a lifting or closing of the evacuation control valve 53 in the manner previously described.

As soon as the shaping of a blank about a mandrel is completed in the manner above described, the cam 115 will be shifted from the position illustrated in Figures 2 and 5 to the position illustrated in dot and dash lines in Figure 5. This shifting of the cam 115 will serve to apply the seam clamp against the side seam of the body which has just been shaped at the receiving station shown at the top in Figure 5, and the shifting of the cam will simultaneously release the seam clamp on the mandrel presented at the discharging station shown at the lower right in Figure 5 or at the bottom in Figures 6 and 7. It will be apparent that the dwell portion of the cam 115 extends over four mandrel positions so as to simultaneously hold four seam clamps and release three such clamps. This multi-station holding of the seam clamps assures the efficient adhesive bonding of the cup body side seams.

Immediately after the releasing of each side seam clamp at the discharging station, the cam 136 will act to open the valve 134 and direct a charge of air under pressure into the mandrel at said station in the manner clearly illustrated in Figure 7, and this air, discharging through the orifices 41 and 39 serves to discharge the completed cup body and deliver the same into the registering pocket 128 of the receiving turret H.

As the indexing of the turrets is continued the operations briefly described hereinabove will be repeated.

While an example structure has been disclosed herein, it is to be understood that the cooperating parts may be variously changed without departing from the spirit and scope of the invention as defined in the appended claims.

## We claim:

1. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel having at least one ring of orifices extending completely thereabout and composed of a plurality of rows of small closely spaced orifices opening outwardly from the hollow interior through the outer surface of the mandrel, means for placing a blank flatwise over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel solely by suction through the mandrel and with the marginal side edge of the side first partially shaped underlying the marginal side edge of the other side to form a side seam, and means for applying pressure to the side seam to form a secure adhesive bond.

2. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel, means for placing a blank over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, said mandrel having a longitudinal row of orifices opening outwardly from the hollow interior and extending therealong adjacent the area over which the longitudinal center of the blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row at least approximately half-way about the mandrel and each communicating with one said orifice, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel with the marginal side edge of the side first partially shaped underlying the marginal side edge of the other side to form a side seam, and means for applying pressure to the side seam to form a secure adhesive bond.

3. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel having at least one ring of orifices extending completely thereabout and composed of a plurality of rows of small closely spaced orifices opening outwardly from the hollow interior through the outer surface of the mandrel, means for placing a blank flatwise over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel with the marginal side edge of the side first partially shaped underlying the marginal side edge of the other side to form a side seam, means for applying pressure to the side seam to form a secure adhesive bond, and means operable after the bonding of the side seam for directing air under pressure into the mandrel and out through said orifices against the interior of the side wall of the cup body to blow said cup body from the mandrel.

4. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel, means for placing a

blank over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, said mandrel having a longitudinal row of orifices opening outwardly from the hollow interior and extending therealong adjacent the area over which the longitudinal center of the blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row at least approximately half-way about the mandrel and each communicating with one said orifice, said mandrel also having a ring of orifices opening outwardly from the hollow interior endwise of each end terminus of the plurality of parallel grooves, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel with the marginal side edge of the side first partially shaped underlying the marginal side edge of the other side to form a side seam, and means for applying pressure to the side seam to form a secure adhesive bond.

5. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-conical mandrel, means for placing a blank over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, said mandrel having a longitudinal row of orifices opening outwardly from the hollow interior and extending therealong adjacent the area over which the longitudinal center of the blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row at least approximately half-way about the mandrel and each communicating with one said orifice, said mandrel also having a ring of orifices opening outwardly from the hollow interior endwise of each end terminus of the plurality of parallel grooves, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel with the marginal side edge of the side flat partially shaped underlying the marginal side edge of the other side to form a side seam, means for applying pressure to the side seam to form a secure adhesive bond, and means operable after the bonding of the side seam for directing air under pressure into the mandrel to blow the cup body therefrom.

6. Apparatus as defined in claim 2 in which the means for placing the blank includes a clamp bar and means for reciprocating it to alternately press a blank against the mandrel and then withdraw out of contact therewith, and wherein the means for bringing about evacuation of the mandrel includes an electrically controlled valve and a switch movable with the clamp bar and having an actuator button extending beyond the blank engaging face of the clamp bar to be displaceable by contact with a blank, said mandrel having a recess therein disposed for being covered by a blank on the mandrel but effective when no blank is present to receive the switch button without effectively displacing the same, thereby to prevent evacuation of the mandrel when no blank is present thereon.

7. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel, means for placing a blank over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, and means for performing another operation in said apparatus, said means for placing the blank including a clamp bar and means for reciprocating

it to alternately press a blank against the mandrel and then withdraw out of contact therewith, and said means for performing said other operation being at least in part electrically controlled and including a switch mounted on and movable with the clamp bar and having an actuating button extending beyond the blank engaging face of the clamp bar to be displaceable upon each contact with a blank on the mandrel for actuating the switch, said mandrel having a recess therein disposed for being covered by a blank on the mandrel and in line with the path of movement of the switch button toward the mandrel so as to be effective when no blank is present to receive the switch button without engaging and effectively displacing the switch button and actuating the switch, thereby to prevent performance of said other operation when no blank is present on the mandrel.

8. Apparatus as defined in claim 2 in which the means for partially shaping the blank about the mandrel includes a fork-like member with fork arms of unequal length one disposed at each side of the center of the mandrel, and means for reciprocating the fork-like member toward and from the mandrel to cause the longer arm to first engage and start a shaping of one side of the blank about the mandrel and then the shorter arm to engage and start a shaping of the other side of the blank about the mandrel, thereby to assure a proper overlapping of the blank side edges in side seam formation as the shaping of the blank about the mandrel is completed by vacuum action.

9. Apparatus as defined in claim 2 in which the means for partially shaping the blank about the mandrel includes a fork-like member with fork arms of unequal length one disposed at each side of the center of the mandrel, and means for reciprocating the fork-like member toward and from the mandrel to cause the longer arm to first engage and start a shaping of one side of the blank about the mandrel and then the shorter arm to engage and start a shaping of the other side of the blank about the mandrel, thereby to assure a proper overlapping of the blank side edges in side seam formation as the shaping of the blank about the mandrel is completed by vacuum action, and wherein the means for placing the blank includes a clamp bar movable with the fork-like member and slidably mounted for movement relative thereto so that the fork-like member can over travel after the clamp bar has engaged a blank on the mandrel and perform its blank shaping function.

10. Apparatus as defined in claim 2 in which the means for partially shaping the blank about the mandrel includes a fork-like member with fork arms of unequal length one disposed at each side of the center of the mandrel, and means for reciprocating the fork-like member toward and from the mandrel to cause the longer arm to first engage and start a shaping of one side of the blank about the mandrel and then the shorter arm to engage and start a shaping of the other side of the blank about the mandrel, thereby to assure a proper overlapping of the blank sides edges in side seam formation as the shaping of the blank about the mandrel is completed by vacuum action, and wherein the means for placing the blank includes a clamp bar movable with the fork-like member and slidably mounted for movement relative thereto so that the fork-like member can overtravel after the clamp bar has engaged a blank on the mandrel and perform its blank shaping function, and also wherein the means for bringing about evacuation of the mandrel includes an electrically controlled valve and a switch movable with the clamp bar and having an actuator button extending beyond the blank engaging face of the clamp bar to be displaceable by contact with a blank, said mandrel having a recess therein disposed for being covered by a blank on the mandrel but effective when no blank is present to receive the switch button without effectively displacing the same, thereby to prevent evacua-

tion of the mandrel when no blank is present thereon.

11. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank, and an adhesive extending along one said edge, said apparatus including a turret having a plurality of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes disposed generally horizontally and parallel each other and the turret axis, means for indexing the turret for serially presenting the mandrels at a plurality of stations including a blank receiving station and a cup body discharging station, means for placing a blank over and in contact with a mandrel at the receiving station with its longitudinal center line overlying and extending along the axis of the mandrel, means operable for shaping the blank about the mandrel at the receiving station with the blank edges overlapping in a side seam over an inwardly directed part of the mandrel, clamp means mounted on the turret opposite the inwardly directed portion of each mandrel over which a side seam is formed, an oscillatable cam engageable with all said clamps and including a clamp holding dwell extending over a plurality of mandrel positions and a clamp releasing recess, means for first moving the cam counter to the direction of travel of the turret and thereafter in the direction of indexing movement and during indexing movement of the turret, said cam dwell and release recess being so proportioned as to be effective to apply the seam clamp at the receiving station and simultaneously release the seam clamp at the discharging station while holding all seam clamps from the receiving station around to the discharging station in the direction of turret travel when the cam is moved in said counter direction, and effective when so moved in the direction of turret indexing movement, to retain the application of the seam clamp on the last formed cup body and to retain the seam clamp holding at the discharging station until the next counter movement of the cam, and means operable at the discharging station for discharging the cup body thereat when the seam clamp opposing the particular mandrel is released.

12. Apparatus as defined in claim 11 wherein each mandrel is hollow and has orifices opening outwardly from the hollow interior thereof through the outer wall about which cup bodies are shaped, and wherein the means for discharging the cup bodies at the discharging station includes means for directing a blast of air into the mandrel at said station and outwardly through its orifices against the side walls of the cup body on the mandrel to blow the shaped cup body off the mandrel.

13. Apparatus as defined in claim 11 wherein each seam clamp comprises an arm disposed in generally parallel relation to the turret axis and pivotally supported on the turret for swinging movement toward and from one of the mandrels in a radial plane and having a follower roller thereon engaged by the periphery of the oscillatable cam, and wherein spring means are included for holding the clamp arms against said cam, said arms being pivotally mounted on the side of the turret remote from the mandrels and extending through apertures in the turret into position at the opposite side of the turret for opposing the mandrels, and radial guide slot means being included and disposed directly inwardly of the mandrels for radially guiding movement of said arms.

14. Apparatus as defined in claim 11 wherein each seam clamp comprises an arm disposed in generally parallel relation to the turret axis and pivotally supported on the turret for swinging movement toward and from one of the mandrels in a radial plane and having a follower roller thereon engaged by the periphery of the oscillatable cam, and wherein spring means are included for holding the clamp arms against said cam, said arms being pivotally mounted on the side of the turret remote from the mandrels and extending through apertures in the turret into position at the opposite side of the turret for opposing



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the mandrels, and radial guide slot means being included and disposed directly inwardly of the mandrels for radially guiding movement of said arms and each said arm having a U-shaped recess therein opposed to the respective mandrel, a clamp bar slidably mounted in the recess to project therefrom toward the opposed mandrel, means for limiting movement of the bar toward the opposed mandrel, and spring means constantly tending to displace the bar from its mounting recess.

15. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one side edge, said apparatus including a hollow frusto-coniform mandrel, means for placing a blank over and in contact with the mandrel with its longitudinal center line overlying and extending along the axis of the mandrel, said mandrel having a longitudinal row of orifices opening outwardly from the hollow interior and extending therealong adjacent the area over which the longitudinal center of the blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row a distance slightly less than half-way around the mandrel to provide a continuous side seam opposing rib diametrically opposed to the position of the longitudinal row of orifices, means for partially shaping one side of the blank about the mandrel, means for bringing about an evacuation of the mandrel to complete the shaping of the blank about the mandrel with the marginal side edge of the side first partially shaped underlying the marginal side edge of the other side to form a side seam, and means for applying pressure to the side seam to form a secure adhesive bond.

16. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank, and an adhesive extending along one said edge, said apparatus including a turret having a plurality of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes disposed generally horizontally and parallel each other and the turret axis, means for indexing the turret for serially presenting the mandrels at a plurality of stations including a blank receiving station and a cup body discharging station, means for placing a blank over and in contact with a mandrel at the receiving station with its longitudinal center line overlying and extending along the axis of the mandrel, means operable for shaping the blank about the mandrel at the receiving station with the blank edges overlapping in a side seam over an inwardly directed part of the mandrel, clamp means mounted on the turret opposite the inwardly directed portion of each mandrel over which a side seam is formed, means for actuating the seam clamp means in timed relation to the indexing of the turret to apply a seam clamp upon completion of the shaping of each cup body at the receiving station and for releasing each said clamp means after arrival of the mandrel it opposes at the cup discharging station, and means for discharging cup bodies released by the clamp means at said discharging station, each said mandrel being hollow and having a longitudinal row of orifices opening outwardly from the hollow interior thereof and extending therealong adjacent the area over which the longitudinal center of a blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row at least approximately half-way about the mandrel and each communicating with one said orifice, and said blank shaping means including means for bringing about an evacuation of the mandrel presented at the receiving station.

17. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge side edges which converge to intersect the

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longitudinal center line of the blank, and an adhesive extending along one said edge, said apparatus including a turret having a plurality of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes disposed generally horizontally and parallel each other and the turret axis, means for indexing the turret for serially presenting the mandrels at a plurality of stations including a blank receiving station and a cup body discharging station, means for placing a blank over and in contact with a mandrel at the receiving station with its longitudinal center line overlying and extending along the axis of the mandrel, means operable for shaping the blank about the mandrel at the receiving station with the blank edges overlapping in a side seam over an inwardly directed part of the mandrel, clamp means mounted on the turret opposite the inwardly directed portion of each mandrel over which a side seam is formed, means for actuating the seam clamp means in timed relation to the indexing of the turret to apply a seam clamp upon completion of the shaping of each cup body at the receiving station and for releasing each said clamp means after arrival of the mandrel it opposes at the cup discharging station, and means for discharging cup bodies released by the clamp means at said discharging station, each said mandrel being hollow and having a longitudinal row of orifices opening outwardly from the hollow interior thereof and extending therealong adjacent the area over which the longitudinal center of a blank is placed and a plurality of parallel grooves extending circumferentially in each direction from the orifice row at least approximately half-way about the mandrel and each communicating with one said orifice, and said blank shaping means including means for first partially shaping the sides of the blank about the mandrel at the receiving station with one side leading slightly the partial shaping of the other side, and then bringing about an evacuation of said mandrel to complete the shaping of the blank with the marginal edge of the leading side underlying the marginal edge of the other side to form a side seam.

18. Apparatus as defined in claim 17 wherein the means for placing the blanks includes a clamp bar and means for reciprocating it to alternately press a blank against the mandrel presented at the receiving station and then withdraw out of contact therewith, and wherein the means for bringing about evacuation of mandrels includes an electrically controlled valve and a switch movable with the clamp bar and having an actuator button extending beyond the blank engaging face of the clamp bar to be displaceable by contact with a blank, each said mandrel having a recess therein disposed for being covered by a blank at the receiving station but effective when no blank is present to receive the switch button without effectively displacing the same, thereby to prevent evacuation of any mandrel on which no blank is presented.

19. Apparatus as defined in claim 17 in which the means for partially shaping the blank about the mandrel includes a fork-like member with fork arms of unequal length one disposed at each side of the center of the mandrel, and means for reciprocating the fork-like member toward and from the mandrel to cause the longer arm to first engage and start a shaping of one side of the blank about the mandrel and then the shorter arm to engage and start a shaping of the other side of the blank about the mandrel, thereby to assure a proper overlapping of the blank side edges in side seam formation as the shaping of the blank about the mandrel is completed by vacuum action.

20. Apparatus as defined in claim 17 in which the means for partially shaping the blank about the mandrel includes a fork-like member with fork arms of unequal length one disposed at each side of the center of the mandrel, and means for reciprocating the fork-like member toward and from the mandrel to cause the longer arm to first engage and start a shaping of one side of the blank

about the mandrel and then the shorter arm to engage and start a shaping of the other side of the blank about the mandrel, thereby to assure a proper overlapping of the blank side edges in side seam formation as the shaping of the blank about the mandrel is completed by vacuum action, and wherein the means for placing the blank includes a clamp bar movable with the fork-like member and slidably mounted for movement relative thereto so that the fork-like member can over travel after the clamp bar has engaged a blank on the mandrel and perform its blank shaping function.

21. Apparatus as defined in claim 17 wherein the means for placing the blanks includes a clamp bar and means for reciprocating it to alternately press a blank against the mandrel presented at the receiving station and then withdraw out of contact therewith, and wherein the means for bringing about evacuation of mandrels embodies a mechanically and electrically controlled valve and control devices including a cam operated valve opening control switch, a cam operated valve closing control switch and a switch connected in series with the valve opening control switch and movable with the clamp bar and having an actuator button extending beyond the blank engaging face of the clamp bar to be displaceable by contact with a blank, each said mandrel having a recess therein disposed for being covered by a blank at the receiving station but effective when no blank is present to receive the switch button without effectively displacing the same, thereby to prevent evacuation of any mandrel on which no blank is presented.

22. Apparatus as defined in claim 2 in which the means for placing the blank includes a clamp bar and means for reciprocating it to alternately press a blank against the mandrel and then withdraw out of contact therewith, and wherein the means for bringing about evacuation of the mandrel embodies a mechanically and electrically controlled valve and control devices including a cam operated valve opening control switch, a cam operated valve closing control switch and a switch connected in series with the valve opening control switch and movable with the clamp bar and having an actuator button extending beyond the blank engaging face of the clamp bar to be displaceable by contact with a blank, said mandrel having a recess therein disposed for being covered by a blank on the mandrel but effective when no blank is present to receive the switch button without effectively displacing the same, thereby to prevent evacuation of the mandrel when no blank is present thereon.

23. In apparatus of the character described, a turret rotatable about a horizontal axis and having a plurality of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes paralleling the axis of rotation of the turret, a body blank receiving station, a shaped body discharging station, means for indexing the turret to serially present the mandrels at the receiving station and later at the discharging station, clamp means at the receiving station and radially reciprocable with relation to a mandrel presented at said station for clamping a blank against each mandrel presented thereat with a portion of the blank extending beyond each side of the mandrel, means also at said receiving station and movable with and also relative to said clamp means for engaging said extended portions of the blank and shaping them partially about the mandrel, means for completing the shaping of each blank about the mandrel at the receiving station solely by vacuum action through the mandrel to provide a shaped body having a lapped side seam, means for clamping the side seams immediately after the shaping of each body and holding the same until each body is presented at the discharging station so as to assure the provision of securely bonded side seams, and means at the discharging station for discharging the cup bodies.

24. In apparatus of the character described, a turret rotatable about a horizontal axis and having a plurality

of frusto-coniform mandrels thereon in equidistantly spaced relation and with their axes paralleling the axis of rotation of the turret, a body blank receiving station, a shaped body discharging station, means for indexing the turret to serially present the mandrels at the receiving station and later at the discharging station, means at the receiving station for clamping a blank against each mandrel presented thereat with a portion of the blank extending beyond each side of the mandrel, means also at said receiving station for engaging said extended portions of the blank and shaping them partially about the mandrel, means for completing the shaping of each blank about the mandrel at the receiving station solely by vacuum action through the mandrel to provide a shaped body having a lapped side seam, means for clamping the side seams immediately after the shaping of each body and holding the same until each body is presented at the discharging station so as to assure the provision of securely bonded side seams, and means at the discharging station for discharging the cup bodies, said means for partially shaping the blanks including a carrier reciprocable radially with relation to the turret axis and having a fork-like member with arms of uneven length engageable with blank portions extending to either side of a mandrel, the longer arm serving to advance the partial shaping of one extended side of the blank about the mandrel ahead of the partial shaping of the other side so that when the shaping of the blank is completed by vacuum action the first mentioned partially shaped side portion will underlie the other side portion in the lapped side seam.

25. Apparatus as defined in claim 24 in which the initially effective blank clamping means and the fork-like member with the arms of uneven length are mounted on a common carrier on which said clamping means is supported for independent yielding movement so that it can come against and clamp a blank while the fork-like member partakes of an over travel to contact and partially shape the clamped blank.

26. Apparatus as defined in claim 24 in which the initially effective blank clamping means and the fork-like member with the arms of uneven length are mounted on a common carrier on which said clamping means is supported for independent yielding movement so that it can come against and clamp a blank while the fork-like member partakes of an over travel to contact and partially shape the clamped blank, said carrier having spaced upper and lower slide bearings in which the clamping means is slidable, an abutment being provided on the clamping means and engageable with the upper bearing to limit movement of the clamping means toward a mandrel relative to the carrier, and spring means constantly tending to hold the abutment against said upper bearing.

27. Apparatus for forming frusto-conical cup bodies from blanks each having a convex top edge, a concave bottom edge, side edges which converge to intersect the longitudinal center line of the blank and an adhesive extending along one said edge, said apparatus including a hollow frusto-coniform mandrel, means for placing a blank over and in contact with the mandrel with its longitudinal center line overlying and extending the axis of the mandrel, and means for bringing about an evacuation of the mandrel and a wrapping of the blank thereabout, said means for placing the blank including a clamp bar and means for reciprocating it to alternately press a blank against the mandrel and then withdraw out of contact therewith, and said means for bringing about an evacuation of the mandrel and a wrapping of the blank thereabout being at least in part electrically controlled and including a switch mounted on and movable with the clamp bar and having an actuating button extending beyond the blank engaging face of the clamp bar to be displaceable upon each contact with a blank on the mandrel for actuating the switch, said mandrel having a recess therein disposed for being covered by a blank on the mandrel and in line with the path of movement of the switch button toward the mandrel so as to be effective

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when no blank is present to receive the switch button without engaging and effectively displacing the switch button and actuating the switch, thereby to prevent evacuation of the mandrel when no blank is present on the mandrel.

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