March 8, 1955 E. T. THIEM 2,703,514

CONE CUP MACHINE

Filed Dec. 10, 1949 6 Sheets-Sheet 1

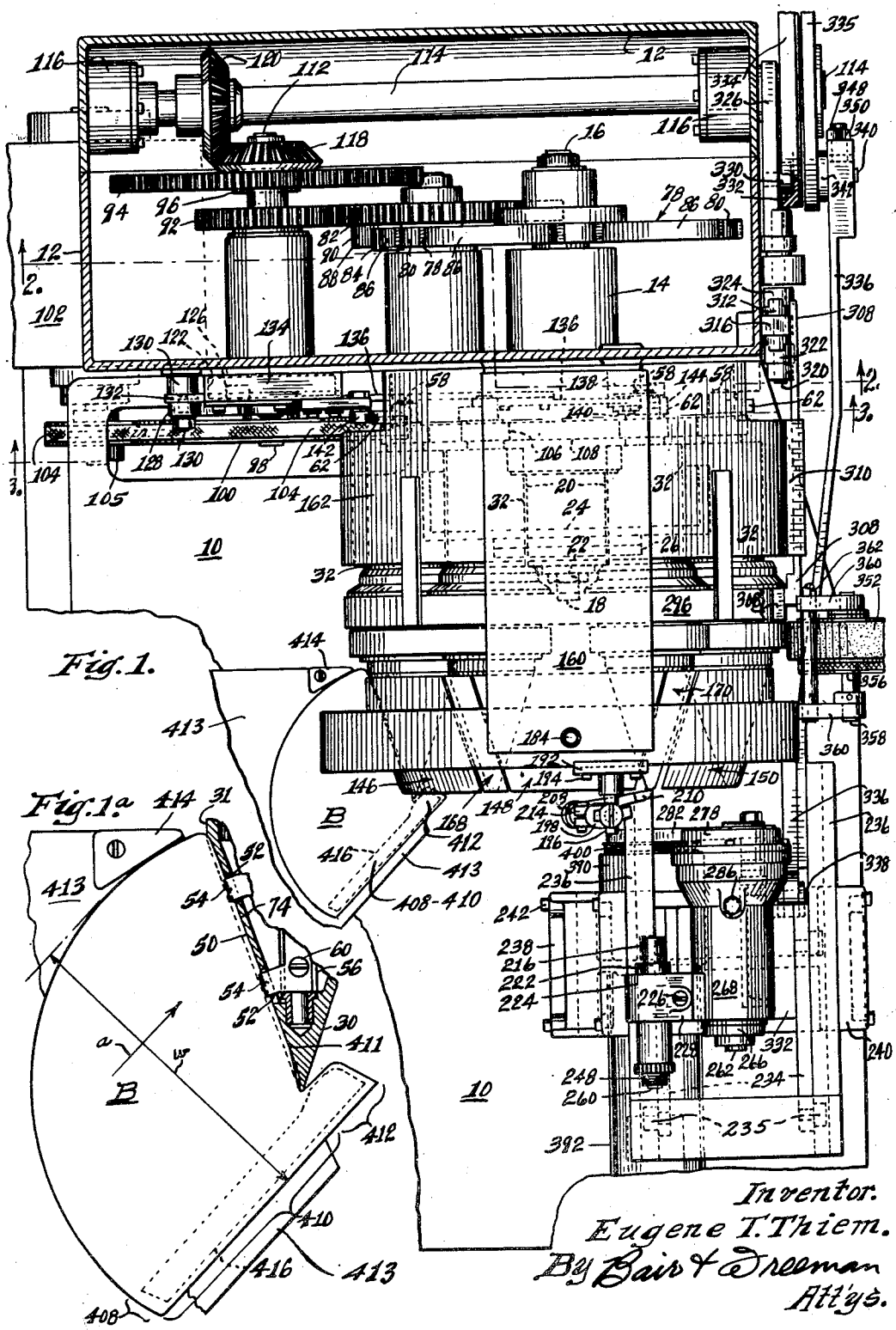


Fig. 1.

Fig. 1a

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Fig. 2.

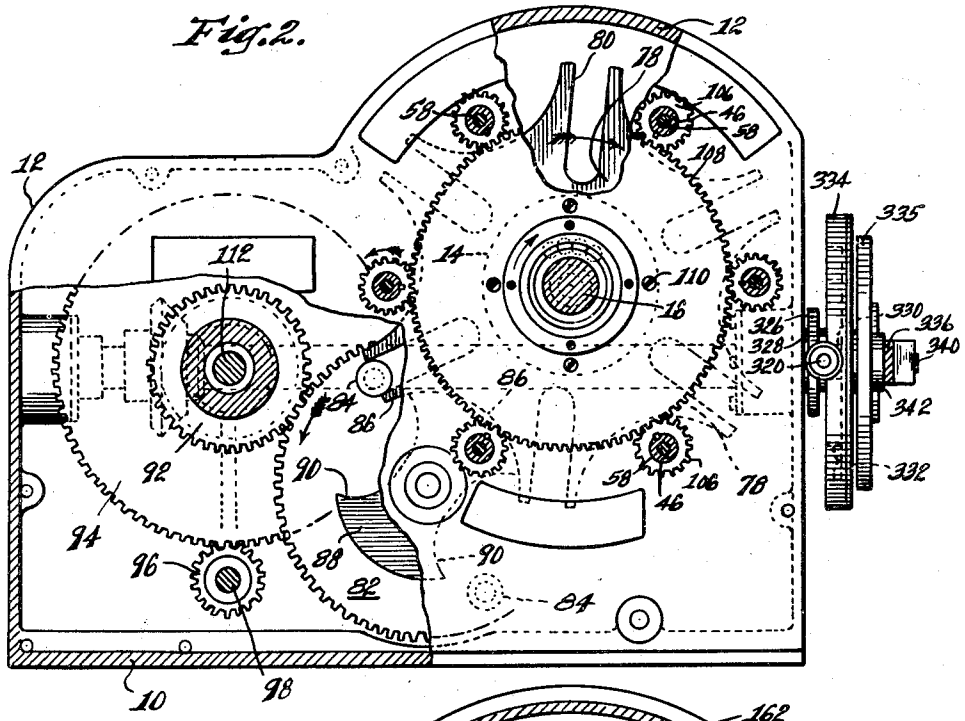
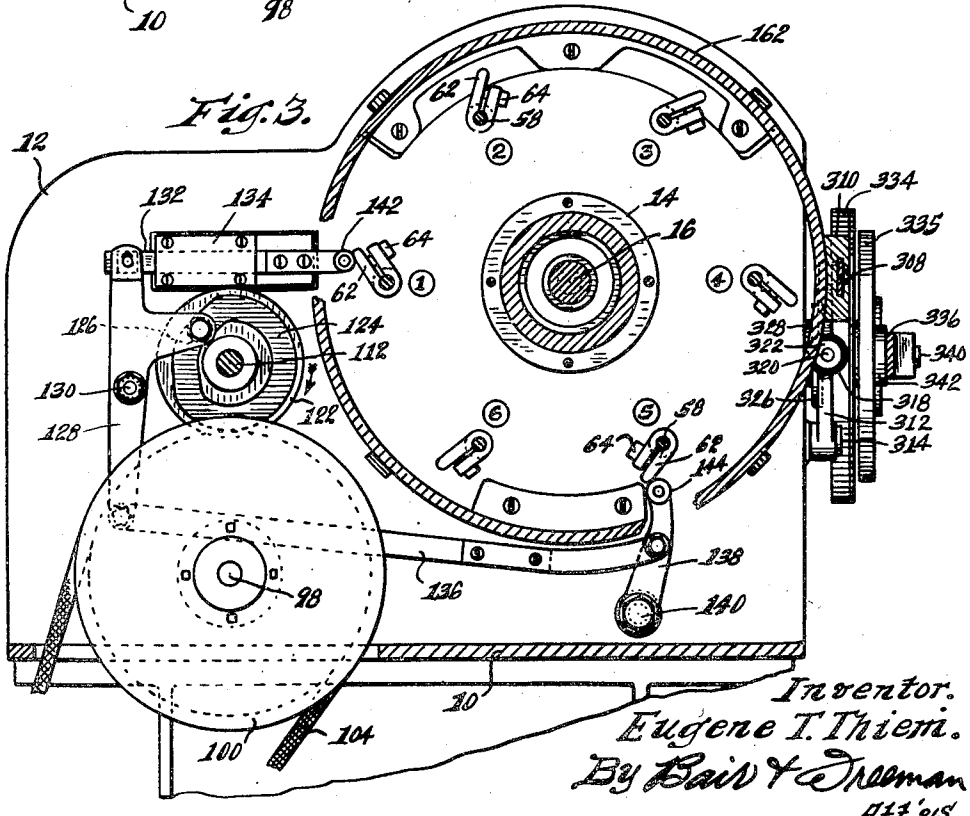


Fig. 3.



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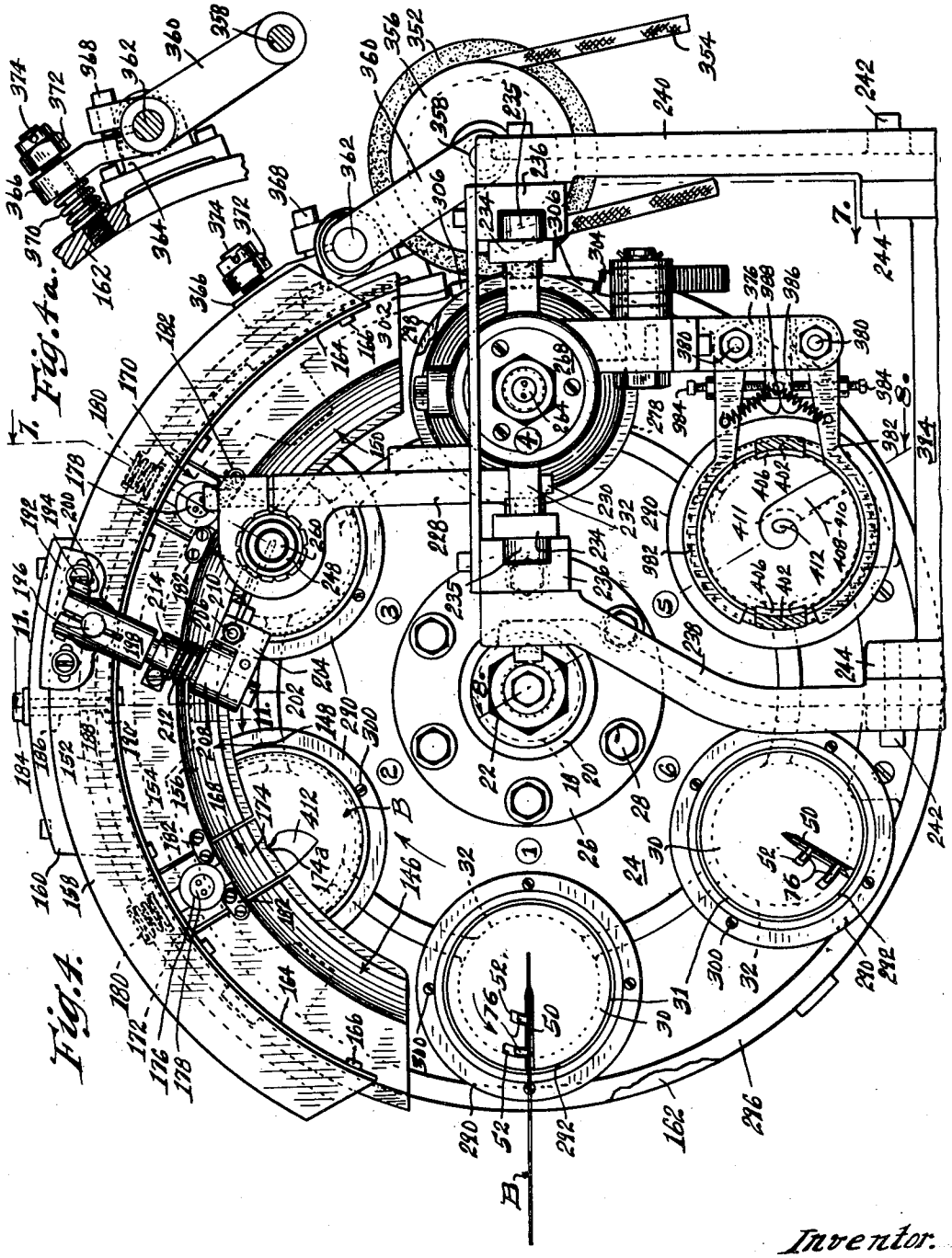


Fig. 4.

Fig. 4a.

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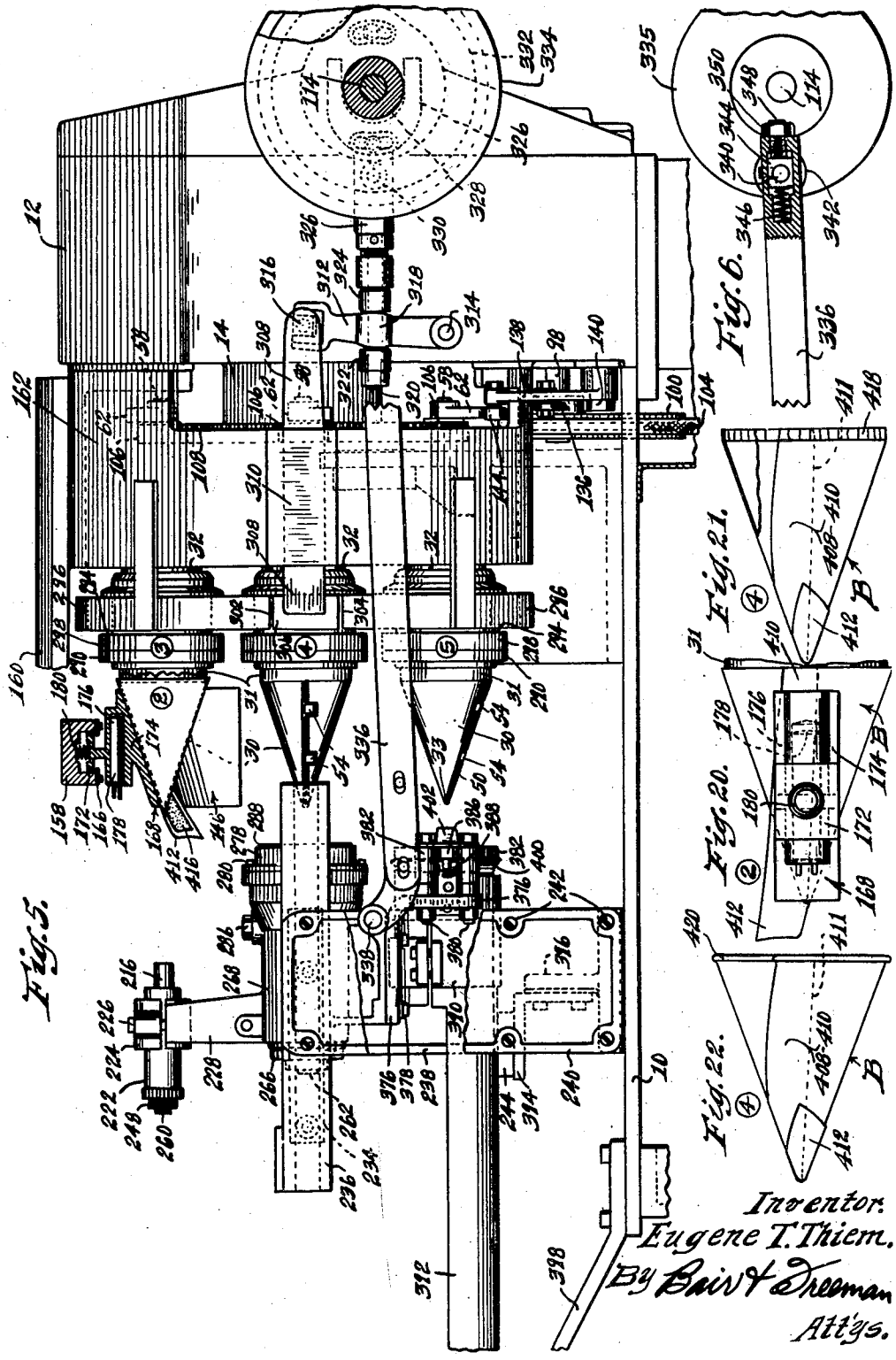


Fig. 5.

Fig. 6.

Fig. 21.

Fig. 20.

Fig. 22.

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CONE CUP MACHINE

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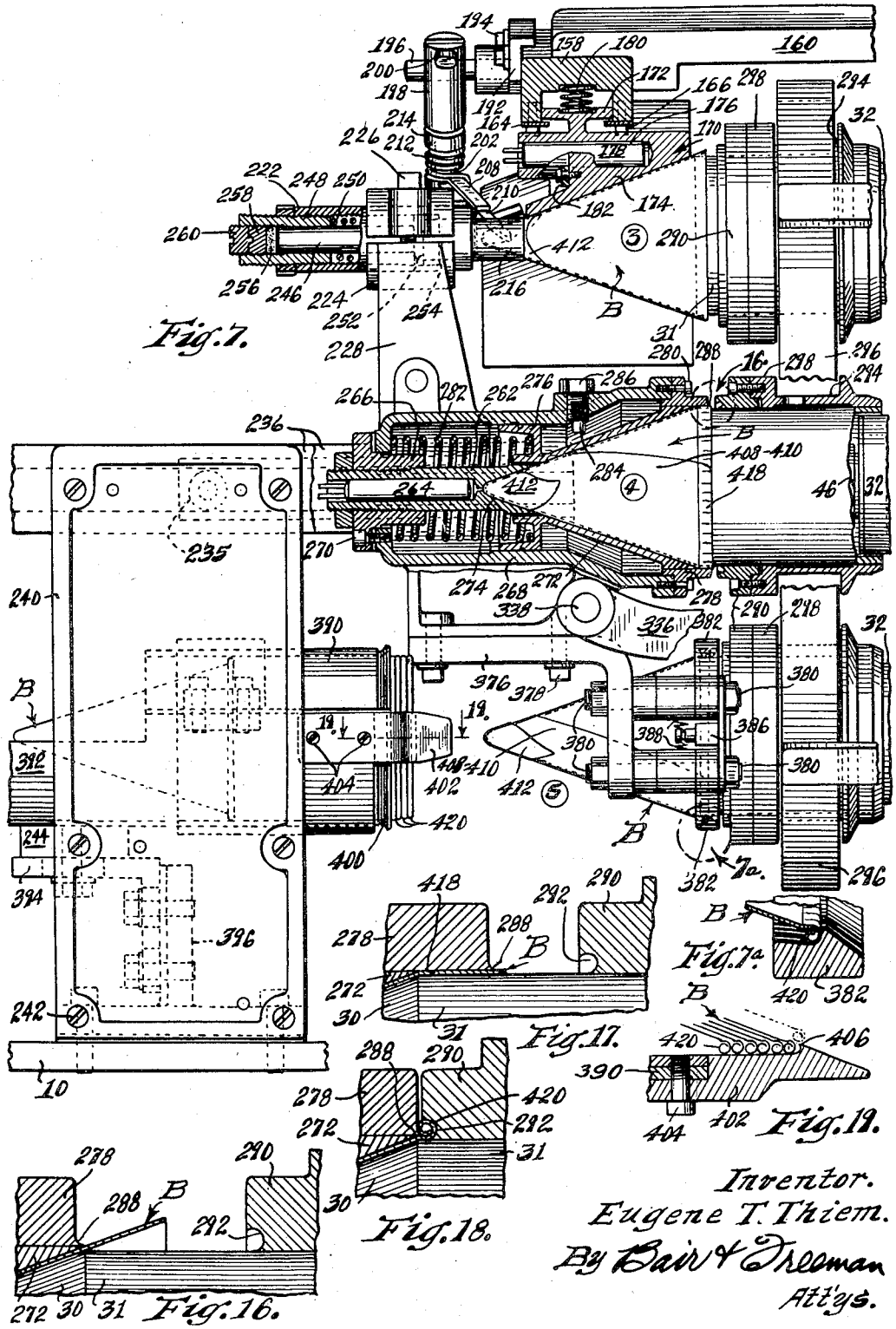


Fig. 7.

Fig. 7a.

Fig. 11.

Fig. 18.

Fig. 16.

Fig. 19.

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CONE CUP MACHINE

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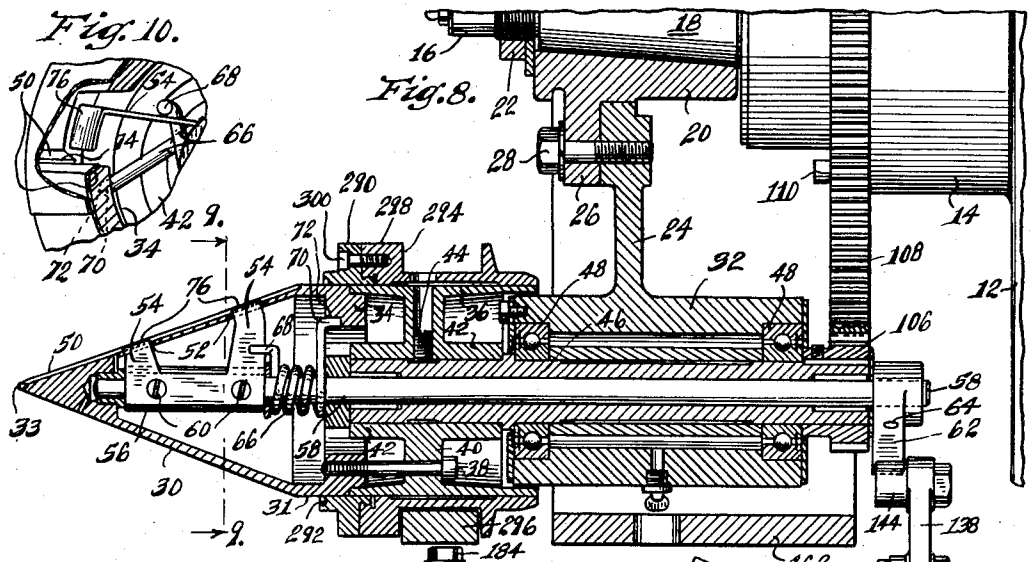


Fig. 10.

Fig. 8.

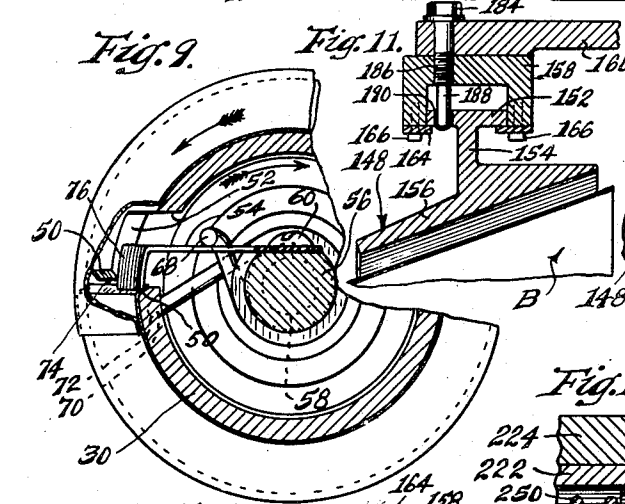


Fig. 9.

Fig. 11.

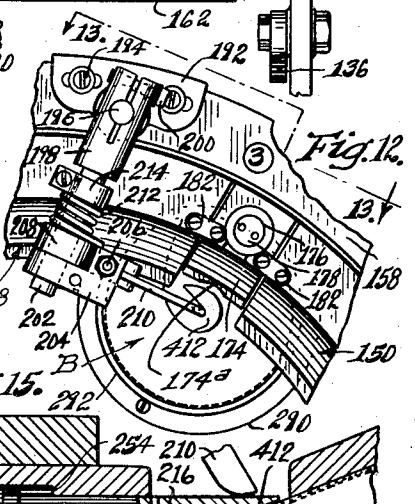


Fig. 12.

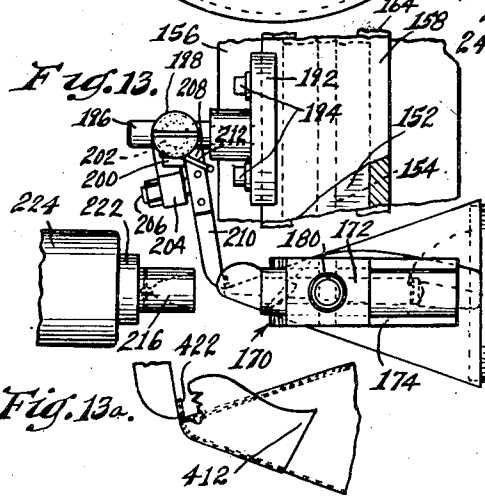


Fig. 13.



Fig. 13a.

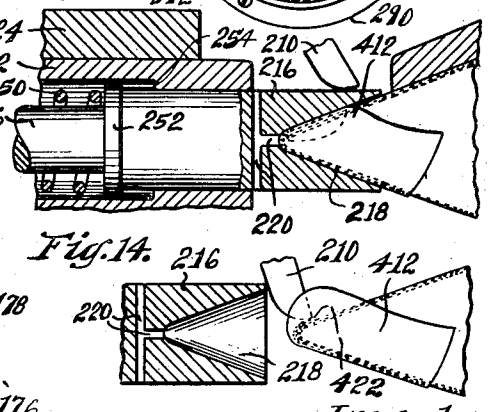


Fig. 15.

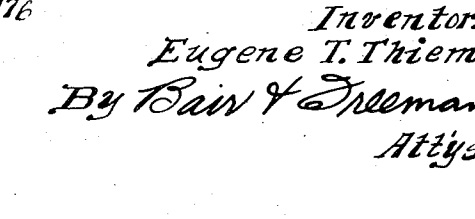


Fig. 14.

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2,703,514

CONE CUP MACHINE

Eugene T. Thiem, Chicago, Ill., assignor, by mesne assignments, to Continental Can Company, Inc., New York, N. Y., a corporation of New York

Application December 10, 1949, Serial No. 132,257

13 Claims. (Cl. 93—36.2)

This invention relates to a machine for automatically forming cups of paper, sheet plastic or the like, the cups being cone-shaped, and provided with a safety fold at the apex and a rim at the upper edge of the cup.

One objection of the invention is to provide a machine of the general character just referred to which is comparatively simple and which automatically performs the functions of wrapping a cone blank on a mandrel for forming a cone-shaped cup, reinforcing the apex of the cone, rimming the upper edge of the cup and finally discharging the finished cup.

Another object is to provide a cup forming machine wherein cone mandrels are provided with gripping fingers to grip the advance edges of cup forming blanks, the mandrels having grooves to receive such advance edges and thereby position the blanks with respect to the mandrels, the gripping fingers holding the blanks so that they may be wound on the mandrels while the mandrels advance around a circle from a blank receiving station of the machine to a cup removing station thereof.

Still another object is to provide a rotary head for supporting a plurality of cone mandrels and a means for intermittently driving the head so that it rotates part of a revolution and then remains stationary for part of the time so that the cup blanks may be received and the cup forming and removing operations may be performed at various stations in a continuous manner, thereby providing a machine which has comparatively great production capacity.

A further object is to provide means to rotate the cone mandrels only while they are moving from station to station and to provide pressure shoes beween the stations for winding the blanks on the mandrels as they are rotated between stations, at least two stations being provided with heating shoes that apply heat and also additional pressure to the seams of the cups to insure that the seams are properly sealed.

Still a further object is to provide one station of the machine with an element that provides a reinforcing safety fold at the apex of the cup where leakage is most likely to occur, thus making for additional thicknesses at the apex, a cone-shaped socket element being provided at this station for rounding the apex and folding down the portion thereof adjacent the safety fold in addition to pressing down a tab over the safety fold if desired.

An additional object is to provide means at a further station for applying heat to the apex of the cup for finishing the apex which of necessity must be the strongest portion of the cup and for spin-rolling a rim on the cup by means of a rotating rimming die and a cooperating tucking die, the rim being formed after the tucking die deforms the upper marginal edge of the cup into cylindrical shape.

A further additional object is to provide a stacker mechanism at a further station of the machine at which station stripping fingers cooperate with the finished cup on the mandrel, remove it therefrom, and transfer it into the stacker mechanism, which mechanism includes holding means to prevent return of the stripped cup with the stripper fingers.

A further additional object is to provide a cone cup forming machine which is adaptable for forming paper cups provided with either gummed or thermoplastic adhesive patterns, or for forming cups made of thermoplastic sheet material blanks which would seal together

under heat applied at the seam without the necessity of an added adhesive pattern.

Figure 1 is a plan view of a machine embodying my present invention for making rolled rim cone cups of the type herein disclosed.

Figure 1*a* is an enlarged view of a portion of Figure 1 to illustrate a portion of a mandrel, shown in section to receive a cup blank.

Figure 2 is a front elevation of the gear box of the machine with one portion broken away and another portion shown in section on the line 2—2 of Figure 1, the turret being removed therefrom, and various operation performing elements likewise removed, with certain linkage thereto and the shaft for the turret shown in section.

Figure 3 is a sectional view on the line 3—3 of Figure 1 showing particularly the drive for the gear box and blank gripper opening mechanisms.

Figure 4 is an enlarged front elevation of the turret portion of the machine and the operating mechanisms omitted from Figure 2.

Figure 4*a* is a sectional view of a portion of Figure 4 to show details of construction to better advantage.

Figure 5 is a side elevation, partly in section adjacent the top of the machine, and is taken from the right side of Figure 1, a cone cup being shown on the upper mandrel but omitted from the lower two.

Figure 6 is a fragmentary detail partly in section, showing certain operating elements omitted from Figure 5.

Figure 7 is an enlarged sectional view on the line 7—7 of Figure 4 showing the mechanism for performing certain operations on the cone cup and its rolled rim, and the mechanism for removing finished cups from the turret.

Figure 7*a* is an enlarged sectional view of the portion of Figure 7 within the dotted circle 7*a*.

Figure 8 is an enlarged sectional view through one of the mandrels and the turret as taken on the line 8—8 of Figure 4 (but showing the mandrel turned 180° to better illustrate the blank gripper mechanism thereof) together with elements for operating the same.

Figure 9 is an enlarged sectional view on the line 9—9 of Figure 8 showing a blank gripper in closed position.

Figure 10 is a fragmentary view similar to Figure 9 showing the blank gripper open.

Figure 11 is a sectional view on the line 11—11 of Figure 4 showing a floating pressure shoe at station (2) of the machine.

Figure 12 is a front elevation of part of the mechanism at station (3) of the machine with a portion thereof as shown in Figure 4 omitted from this figure.

Figure 13 is a view looking in the direction of the arrows 13 adjacent Figure 12 and showing an apex folder blade coacting with the apex of a cup for forming a safety fold.

Figure 13*a* is an enlarged view of a portion of Figure 13 to more clearly show the safety fold being formed at the apex of the cup.

Figure 14 is a view somewhat similar to Figure 13*a* showing a further step in the apex-folding operation.

Figure 15 is somewhat similar sectional view showing the final step in the apex-folding operation and showing a folder plunger engaging the apex folder blade and completing the folding of a tab over the safety fold.

Figure 16 is an enlarged sectional view of that portion of Figure 7 shown within the dotted circle indicated at 16 and illustrating the parts in Figure 7 before the rim of the cup is bent down to a cylindrical shape.

Figure 17 is a similar view showing the parts in the position of Figure 7, the rim of the cup being bent to cylindrical shape.

Figure 18 is a similar view showing another position of the parts in which the rim is rolled around the top of the cup.

Figure 19 is an enlarged sectional view on the line 19—19 of Figure 7 showing a cup holding element of the cup delivery tube.

Figure 20 is a plan view of a mandrel with a cup thereon and of a pressure and heating shoe at station (2) of the machine.

Figure 21 is an elevation, partly in section, showing the cup finished except for rolling the rim; and

Figure 22 is a similar elevation showing the completed cup with its rolled rim.

On the accompanying drawings, I have used the reference numeral 10 to indicate a base and 12 to indicate a gear housing thereon. The gear housing is provided with a bearing 14 in which a spindle 16 is rotatably mounted. The spindle 16, as illustrated in Figure 8, has a tapered portion 18 on which the hub 20 of a turret is secured as by a nut 22. The turret consists of a disc 24 secured to an annular flange 26 of the hub 20 as by cap screws 28, the disc supporting six cone-shaped cup-forming mandrels 30 and each mandrel being journaled in a hub 32 of the disc.

Describing one of the mandrel supporting means in detail, the mandrel has a cylindrical base 31 terminating in a base plate 34 secured to a sleeve 36 by screws 38 as shown in Figure 8. The screws extend through a web 40 which web extends inwardly from the sleeve 36 and terminates in a hub 42 mounted as by a set screw 44 on a sleeve 46. The sleeve 46 in turn is journalled in ball bearings 48 mounted in the hub 32. The mandrel 30 also has its apex rounded as indicated at 33.

Referring to Figure 9 wherein a lateral cross section of the mandrel 30 is shown, a V-groove 50 extends along the surface of the mandrel (left side of the mandrel in Figure 1*a*). It is cut out as indicated at 52 to accommodate blank grippers 54. These are in the form of sheet metal fingers secured to an enlarged head 56 on a rod 58. The rod is oscillatable in a bore of the sleeve 46, the fingers being secured to the head 56 by screws 60 and short arms 62 being clamped to the other ends of the rods as shown in Figures 3 and 9. Figure 3 shows clamp screw 64 for clamping the arms 62 of the six rods 58 in the desired position on the rods 58.

Wrapped around each rod 58 is a spring 66 having one end 68 engaging one of the fingers 54 and its other end 70 engaging in an opening 72 of the base 34 as shown in Figure 8. Referring to Figure 9, the bottom of the V-notch 50 is indicated at 74. This serves as a stop means for the cone cup blank as will hereinafter be described. The fingers 54 terminate in down-turned flanges 76 to engage the marginal edge of the blank as will also be described.

For rotating the turret disc 24 one-sixth of a revolution at a time, and for causing it to remain stationary between the periods of rotation, I provide suitable mechanism such as a Geneva movement which will now be described. A disc 78 (Figure 2) is secured to the shaft 16 and is provided with radial grooves 80. The disc 78 is driven intermittently by a gear 82 having a pair of indexing rollers 84 to cooperate with the radial slots 80 of the Geneva disc 78. The disc 78 also has semi-circular depressions 86 in which the edge of a second disc 88 on the gear 82 is adapted to travel. The disc 88 has a pair of semi-circular depressions 90 to receive the extremities of the Geneva disc 78 during a portion of the rotation of the gear 82.

The gear 82 and the disc 88 rotate counter-clockwise for rotating the turret clockwise one-sixth of a revolution each half-revolution of the gear. For driving the gear 82 I provide a pinion 92 operatively secured to a gear 94 which in turn meshes with a pinion 96. The pinion 96 is secured to a drive shaft 98 having thereon a pulley 100 as shown in Figure 3 which may be belted to a suitable motor 102 as shown in Figure 1 by a belt 104. The motor pulley is illustrated in 105.

The Geneva movement described will rotate the turret disc 24 one-sixth revolution, then permit it to remain stationary for a period of time, then rotate it another one-sixth revolution and so on. During the time the turret is rotating, it is desirable to rotate the cone mandrels 30 but permit them to remain stationary during the time the turret is stationary. This is accomplished by providing on each sleeve 46 a pinion 106 as shown in Figure 8 which pinion is in mesh with a stationary gear 108. The gear 108 is secured to the bearing 14 of the gear housing 12 by cap screws 110.

In addition to driving the turret through the Geneva movement, the shaft 112 on which the gear 92 is mounted drives a cross-shaft 114 journalled in bearings 116 of the gear housing 12 as shown in Figure 1. The mechanism for driving the shaft 114 from the shaft 112 consists of bevel gears 118 and 120. The shaft 114 is for driving various mechanisms of the machine as will hereinafter appear.

Referring to Figure 3, the shaft 112 also drives a disc 122 having therein a cam groove 124. A roller 126 is adapted to travel in the groove 124 and is carried by a lever 128 pivotally mounted at 130 on the gear housing 12. The upper end of this lever drives a slide 132 in a guide 134 and the lower end is connected by a link 136 to a lever 138 pivoted at 140 in the gear housing. The slide 132 and the lever 138 carry rollers 142 and 144 respectively which are adapted to engage the arms 62 on the gripper operating rods 58 at stations (5) and (1) respectively of the turret. These stations are indicated throughout the various drawings by numerals in circles to distinguish from reference numbers.

Floating pressure shoes are provided for engaging the cup blanks on the mandrels as the mandrels carry the blanks to stations (2), (3), and (4) successively. These shoes are designated as 146, 148 and 150 in Figure 4. They are similar in cross-section, the shoe 148 being shown in Figure 11, but they vary slightly in the way they are cut off at the left and right hand ends as illustrated in Figure 4.

Each shoe comprises an arcuate base 152, a radial web 154 and a flange 156 (see Figure 11) which is a segment of an internal cone surface. The bases 152 are received in an arcuate supporting channel 158 supported by a bracket 160 which in turn is supported on a shroud 162 surrounding the hubs 32 of the turret disc 24 and the pinions 106 together with the gear 108 that meshes with them. The shroud 162 in turn is secured to the gear housing 12. The bases 152 of the floating shoes 146, 148 and 150 are held from dropping out of the channel 158 by arcuate cover straps 164 held in position by cap screws 166.

Intermediate the shoes 146 and 148 is a heated pressure shoe 168, and intermediate the shoe 148 and the shoe 150 is a second heated pressure shoe 170. These shoes are similar, the shoe 170 being shown in Figure 7. It is somewhat similar in cross-section to the shoes 146, 148, and 150, having a base 172 in the channel 158 and a cone-shaped presser flange 174. The central portion of this flange may be dished slightly as indicated at 174*a* at station (2) in Figure 4 and at station (3) in Figure 12 to conform somewhat to the contour of the mandrel 30 so as to provide a wider pressure and heating area than possible with tangential engagement as will hereinafter be described more fully.

Each of the shoes 168 and 170 is of the construction shown in Figure 7, having a socket 176 to receive a heating element 178, preferably of the electric type. Each heated pressure shoe is backed by a spring 180 so as to give pressure in addition to the weight of the shoe as distinguished from the floating shoes 146, 148, and 150 held against the mandrels merely by their own weight.

The series of shoes 146, 168, 148, 170, and 150 are linked together in the order just listed as illustrated in Figure 4 by links 182. With such an arrangement all of the shoes may be threaded into the supporting channel 158 from either end and after they are installed a screw 184 (see Figure 11) is passed through the bracket 16 and threaded at 186 into the supporting channel 158. The lower end of the screw is turned down as at 188 to enter an opening 190 in the base 152 of the shoe 148, the opening being slightly larger than the element 188 to avoid restricting the movement of the shoe. The projection 188 thereby holds the entire assembly of five shoes in position against dislodgement from their supporting channel 158 but permits them to float freely as dictated by gravity and the springs 180 opposed by the mandrels as they pass beneath the shoes.

At station (3) of the machine means are provided for forming a leak-proof safety fold at the apex of the cup and for reinforcing the apex by means of a tab to overlie the safety fold. This is perhaps best shown in Figures 4 and 12 to 14. It consists of a bracket 192 secured to the supporting channel 158 by screws 194. A rod 196 extends from the bracket 192 and has clamped thereto a bracket 198. The clamp screw is shown at 200.

A rod 202 extends from the bracket 198 and has rigidly mounted thereon a bracket 204 carrying a stop screw 206. An arm 208 is pivoted on the rod 202 and carries an apex folder blade 210. The arm 208 is biased to normally engage the stop screw 206 by means of a spring 212, one end of which engages the bracket and the other

end of which engages a clamp collar 214. The outer end of the blade 210 is approximately tangent to the circular path followed by the apices of the cones 30 as the turret rotates.

Also at station (3) a tab folder plunger 216 is provided (see particularly Figures 7 and 13 to 15). The plunger 216 has a conical socket 218 with which passageways 220 communicate for permitting escape of air. The plunger 216 is slidably carried in a sleeve 222, the sleeve being clamped in a boss 224 by a clamp screw 226 (see Figures 4 and 5). The boss 224 is carried by an apex folder bracket 228 which, as shown in Figure 4, is secured by screws 230 to a cross head 232. The sides of the cross head are secured to bars 234 having rollers 235 which travel in guideways 236. The left hand guideway is supported by a bracket 238 and the right hand one is supported by a bracket 240. These brackets are secured by screws 242 to flanges 244 extending upwardly from a bracket 394 on the base 10.

Returning to Figures 7 and 15, the plunger 216 has a rod-like stem 246 extending on through the sleeve 222 and slidable in an adjustable sleeve 248 threaded into the sleeve 222 for backing up a spring 250 at its left hand end, the right hand end of the spring being engaged with the plunger 216 for tending to extend it toward the right in relation to the sleeve 222 so that in its normal position a flange 252 on the plunger 216 engages a stop shoulder 254 in the sleeve 222. At times the rod 246 is pushed toward the left to compress the spring 250 as shown in Figures 7 and 15 and at its limit of movement in this direction compresses a rubber disc 256 in the adjusting sleeve 248 which is backed up by a set screw 258 and a locking set screw 260.

At station (4) the cross head or reciprocating carriage 232 carries a heated apex pressure plunger 262 for sealing and setting the apex of the cone cup, and mechanism is operated at this station for spin-rolling a rim on the cup which will now be described. The pressure plunger 262 shown in Figure 7 has a socket receiving an electric heating element 264. The plunger is threaded in a bushing 266 which in turn is secured to a carriage housing 268 by screws 270. The housing 268 is formed as part of the cross head or reciprocating carriage 232.

A cone 272 forms an extension of a cone-shaped socket 274 in the plunger 262 and this cone carries at its small end a cylindrical flange 276. The flange 276 is slidable in the housing 268 and the large end of the cone is slidable in a bead tucking die 278 of the housing 268 secured thereto by screws 280. The cone 272 is normally biased toward the right in Figure 7 by a spring 282 with its flange 276 against a stop lug 284 of a screw 286.

The extension 278 forms a rim tucking die having a tucking lip 288. Slidable and rotatable on the sleeve 36 and the cylindrical base 31 of each cone 30 is a rimming die 290 having an annular rimming groove 292. The die 290, as shown in Figure 8, is secured by screws 300 to a pulley member 298 having an outwardly opening groove 294 around it. This groove normally travels along a C-shaped track arranged in a plane normal to the axis of the turret, which track keeps the rimming dies 290 at the axial position illustrated in this figure. The C-track 296 has extremities indicated at 302 and 304 in Figures 4 and 5. The gap between these extremities is bridged by a shoe 306 which is somewhat thinner than the C-track 296 to prevent its contact with a friction wheel 352 to be later described. The shoe 306 is carried by a slide 308 which is guided in a slideway 310 on the shroud 162 and is actuated by a forked lever 312 pivoted at 314 to the gear housing 12. The forked end has a block 316 slidable therein which block is pivoted to the slide 308.

Intermediate the ends of the lever 312 an enlargement 318 is provided. This enlargement is perforated so that a rod 320 extends loosely therethrough and the rod carries collars 322 and 324 for engaging opposite sides of the enlargement 318. The rod 320 terminates in a fork 326 which straddles a hub 328 on the cross shaft 114. The fork 326 carries a roller 330 received in a cam groove 332 of a cam disc 334.

The cross head or carriage 232 is reciprocated by means of a link 336 pivoted thereto at 338. This link extends toward the right from the pivot as shown in Figure 5 and the link is completed in Figure 6 wherein I illustrate a crank pin 340 on the disc 334 extending from a boss 342 on the face of the disc. A bearing block 344 is rotatable on the pin 340 and is slidable in relation to the link 336 for adjustment purposes. A spring 346 tends to keep the bearing against an adjusting screw 348 threaded in the link 336. The screw 348 is provided with a lock nut 350 to retain the adjustment. This arrangement permits the inward limit of movement of the carriage 232 and all the mechanism carried thereby to be finely adjusted.

At station (4), means is provided for rotating the rimming dies 290 and the pulleys 298. This means consists of the friction wheel 352 shown in Figures 1 and 4. This wheel may be faced with leather or the like to provide the necessary friction against the periphery of the pulley 298 at station (4) and is constantly rotated by an electric motor or the like (not shown) which may be relatively small. The drive from this motor to the wheel 352 consists of a V-belt 354 and a V-pulley 356. The wheel 352 and the pulley 356 are mounted on a shaft 358 rotatable in arms 360 carried by a shaft 362. The shaft 362 is supported in a bracket 364 for rocking movement and has clamped thereto an arm 366 by means of a clamp screw 368.

The arm 366 is biased clockwise as shown in Figure 4*a* by a spring 370 against a stop nut 372 on a stud 374 extending from the shroud 162 on which the bracket 364 is also mounted. This arrangement permits the nut 372 to be adjusted so that when a pulley 298 is at station (4) the arm 366 is slightly away from the stop nut 372 and so that the spring 370 can thus provide the necessary pressure engagement between the friction wheel 352 and the pulley for driving the pulley from the wheel. The pulley will also be started in its rotation just before reaching station (4) and will disengage from the wheel just after leaving this station.

At station (5) means is provided for stripping the finished cup from the mandrel and inserting it in nested relationship to the previously finished cup in a delivery tube. This mechanism consists of a bracket 376 secured to the carriage 232 by screws 378. The bracket is angle-shaped as shown in Figure 7 and carries a pair of studs 380 on which cup stripper fingers 382 are pivoted. These fingers carry stop screws 384 (see Figure 4) which are biased to engage a stop bar 386 extending from the bracket 376 by means of springs 388.

Mounted at station (5) is a delivery tube 390 having a half-cylinder extension 392. The delivery tube and its extension are supported by angle bracket 394 which is secured to an upstanding lug 396 from the base 10. The outer end of the tube extension 392 may be suitably supported by an angle brace 398 shown in Figure 5.

The delivery tube 390 has a flanged entrance as shown in Figure 7, the flange being cut away at each side to accommodate a pair of receiving fingers 402 which are secured to the sides of the delivery tube by screws 404. As shown in Figure 20, each finger is rigidly mounted and includes a ratchet-like projection 406 to engage the rim of a cup as will be described later on.

In Figures 1 and 1*a*, I show the flat shape of a cup blank B. In general it is a segment of a disc having a circular outline and provided with a substantially rectangular tab, the width of which is indicated at 408 in Figure 1*a*, the length of which is indicated at 410. This tab is extended at 412 to provide additional thickness at the apex of the cone and to cover a safety fold at the apex.

The blank B may be fed as a continuous strip of paper in the direction of the arrow *a* the width of the strip being somewhat wider than the width of the blank itself indicated by the dimension line *w* and the blank being cut out of this web without severing the web itself. This strip comes from a continuously fed roll of paper and the blank is completely severed therefrom and fed to the mandrel at station (1) where it is grasped by the gripper fingers 54. The feeding of the paper and the severing of the blank therefrom form no part of my present invention so have not been illustrated nor described in detail. It is sufficient to indicate that the blanks are fed by suitable means on to a plate 413 against a blank guide 414 and with the advance edge 411 of the blank received in the V-groove 50 against the bottom 74 thereof, this position being illustrated particularly in Figures 1*a* and 9.

Instead of severing the blanks from a strip, they may be pre-cut, stacked in a magazine, and removed one at a time from the magazine.

On the underside of the tab **408–10** in Figure 1*a*, a gum pattern is indicated by the dotted outline **416**. The gum appears also in Figure 5 at station (2) and may be of the heat-seal type. Briefly, the cone cup is designed to be formed into a cone from the flat shape shown in Figure 1*a* after leaving station (1) and while passing stations (2) and (3) and arriving at station (4), the cone cup forming operation being completed at station (4). At station (3) a safety tab **422** is formed as will hereinafter be more fully described and it is optionally covered by the tab **412**. At station (4), the rim of the cup is formed cylindrically as indicated at **418** in Figure 21 and is thereafter formed into a roll as indicated at **420** in Figure 22.

Practical operation

In the operation of my cone cup-forming machine, a mandrel **30** arrives at station (1) with its blank gripper fingers **76** open (roller **142** engaging arm **62** at station (1) in Figure 3). After the blank B is fed to the cone with its advance edge **411** in the groove **50**, the fingers close as shown at the left side of Figure 4, this action being accomplished by the cam **122** of Figure 3 and the roller **142** of the slide **132**. The bottom **74** of the groove **50** is the limiting means for the blank at station (1). The mandrel is now ready to be advanced to station (2).

While the mandrel is in transit from station (1) to station (2), it revolves under the action of its pinion **106** rolling around the periphery of the gear **108**, the movement of course being accomplished by one of the rollers **84** of the gear **82** coacting with one of the slots **80** of the Geneva disc **78**. The coaction of the pinion **106** with the gear **108** accomplishes a complete revolution of the mandrel clockwise in relation to the turret as it is in transit from station (1) to station (2) so that at station (2) the blank gripper fingers **76** are again radially outward from the center of rotation of the turret. The blank B is wiped around the mandrel by the floating shoe **146**, the pressure of which, due to gravity, is sufficient for accomplishing a satisfactory wiping operation.

This completes the first blank wiping revolution and the mandrel stops and remains stationary with the adhesive lap **408–410** tangent to the outer circular travel line of the mandrel. At this position the mandrel is under the heating pressure shoe **168** as shown adjacent the top of Figure 7 with the spring **180** slightly compressed. The slight concavity **174a** in the shoe **168**, if provided as hereinbefore mentioned, serves to cover more area of the adhesive and thus improves the setting thereof. The heat applied at this point aids the adhesive in penetrating the paper and at station (2) the first stage of sealing the side seam or lap of the cup is thus accomplished. The mandrel is then ready for transit to station (3).

As to the reason for the heat and the pressure on the gummed lap seam, in the past it has been difficult to make a cone cup with the side seam securely snug and tight. To overcome this, I stop the seam on the outer circle of travel at stations (2) and (3) and apply heat and pressure for setting the adhesive as well as causing penetration of the adhesive into the fibres of the paper for producing a seam that holds better.

As the mandrel revolves between stations (2) and (3), a second wiping revolution is accomplished by the floating pressure shoe **148**. Slightly before the mandrel reaches station (3), the sharp apex of the cup engages or impacts the blade **210** to form the safety fold **422**, as shown in Figure 13. The fold is bent over as shown more particularly in Figure 13*a* wherein a portion of the tab **412** has been broken away to show the safety fold more clearly.

The next step at station (3) is for the tab folder plunger **216** to advance (toward the right in Figure 14) which finishes folding the safety fold **422** around the rounded apex **33** of the mandrel **30** as illustrated due to the plunger engaging the blade **210** and swinging it in a direction along the inclined surface of the cone cup arriving at station (3). The tab **412** is open as illustrated at station (2) in Figure 5 (the mandrel of station (3) being broken away to show station (2)) and this tab is still loose in Figures 13, 13*a*, and 14 as the plunger **216** advances. However, its cone socket **218** engages the tab and folds it over the safety fold **422**, the final position being shown in Figure 15.

The tab **412** may be omitted in which case the cone socket **218** would press the safety fold **422** down securely but the tab does reinforce the apex of the cone cup by being folded over the safety fold, thus providing several thicknesses of material at the weakest point of the cup which is the apex. As the plunger **216** advances, it pushes the blade **210** out of the way as illustrated in Figure 15 and when the plunger recedes, the spring **212** returns the blade to a position against the stop screw **206** which position is shown in Figure 13. In Figure 12, the parts are in the same position as in Figure 13—that is, before the plunger **216** advances. The mandrel is now ready to advance to station (4).

As the mandrel is in transit from the station (3) to station (4), a third wiping operation is performed to more securely iron down the side seam as well as the safety fold **422** and the tab **412** that covers it. The cup is then ready for spin-rolling its rim.

Just before the mandrel reaches the station (4) position the friction pulley **352** engages the rimming die **290** and the adjacent periphery of the pulley **298** for rapidly rotating the die. As the tucking die **278** advances from the position of Figure 16 to the position of Figure 17, it bends down a cylindrical flange **418** on the mouth of the cup as shown in Figure 21 and this flange is then ready for forming into a cup rim. The rim is formed by advancing the rimming die **290** toward the left from the position of Figure 17 to the position of Figure 18 while the same is being rotated thereby causing the annular groove **292** to engage the cylindrical flange **418** of Figure 17 and turn it into the rolled rim **292** of Figures 18 and 22. As the rimming die advances, the tucking die **278** which formed the cylindrical flange **418** recedes to permit the rimming die to spin-roll the rim **420**.

The tucking die **278** is propelled in both directions by movement of the carriage **232** and the rimming die **290** is advanced by the shoe **306** engaging in the groove **294** of the pulley **298** and moving the pulley out of alignment with the C-track **296**. The rimming die is then retracted and the groove of the pulley again aligned with the C-track for advance of the mandrel to the next station.

In addition to the forming of the cylindrical flange **418** and the rolled rim **420** on the cup at station (4), the cup is pressed against the mandrel by the cone **272** under the action of the spring **282** as the cone and its rear guide portion **276** slide in the members **278** and **268**. At the same time, the heating plunger **262** applies additional heat and pressure to the safety fold **422** and its covering tab **412** to more thoroughly set the parts that form the apex and adjacent portions of the cup. As the annular groove **292** spins the rim **420** on the cup, the rim is turned about three-fourths of a circle and the upper end of the flange **418** finally engages the tucking lip **288** so as to tuck the leading edge of the flange under the roll being formed and its final shape is slightly more than a complete circle as shown in Figure 18.

After the carriage **232** has been retracted, the turret is again advanced for moving the completed cup from station (4) to station (5).

Just before the mandrel reaches station (5) the gripper fingers **54** are opened to the position of Figure 10 by means of the roller **144** on the arm **138** as illustrated in Figure 3. The edge **411** of the blank B has thus been gripped continuously from the time the blank leaves station (1) till the cup is finished and ready to be discharged at station (5). This prevents the blanks from slipping on the mandrels at any time while the cups are being formed. At station (5), the cup is removed from the mandrel by means of the cup stripping fingers **382** which, as the bracket **376** advances to the position of Figure 7, swing outwardly against the action of the springs **388** and snap over the rim of the cup, this position being shown particularly in Figure 7*a*. Upon the reverse movement of the bracket **376**, the cup is carried by the fingers **382** and stacked in the cups already removed from the mandrels in previous cycles of operation of the machine and which were caused to slide into the delivery tube **390**.

In entering the delivery tube, the rim of the cup passes between a pair of rigid fingers **402** and snap past the ratchet-like projections **406** thereof as shown by dotted lines in Figure 19 whereupon the cup then springs out to its full circular shape behind these projections to prevent it from being withdrawn when the stripper fingers **382** are next moved toward the next cup at station (5) for stripping it from the mandrel. The size of the tube **390** is such as to frictionally engage the cups with

enough tension to cause them to be closely connected and gradually fed through the delivery tube into the half-cylindrical extension 392 thereof from which they may be removed for packing.

Station (6) is an idle station where nothing is performed on the cup and the fingers 54 are opened just prior to reaching station (1).

Some changes may be made in the construction and arrangement of the parts of my cone cup machine without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. In a cup forming machine, a plurality of cup forming mandrels, means for intermittently moving said mandrels in a circular path to predetermined stations and for intermittently stopping the mandrels at the stations, means for rotating the mandrels during their circular path travel, a support, a plurality of gravity operated pressure shoes mounted on said support for movement independent of each other and for successively engaging the cup blanks on said mandrels to closely wind them around the mandrels during their travel and rotation between stations, and spring means at predetermined stations for applying pressure greater than that applied by said gravity operated pressure shoes and heat to the seams of the formed cups while they are not rotating at said stations.

2. In a cup forming machine of the character disclosed, a rotary head, a plurality of cup forming mandrels carried thereby, means for intermittently moving said head so that said mandrels arrive at predetermined stations and remain stationary for a time period at the stations, means for rotating the mandrels during their travel from station to station, a support, a plurality of pressure shoes loosely mounted on and floatingly carried by said support independent of each other but constrained against rotary movement with said head, said shoes successively engaging the cup blanks on said mandrels during the travel and rotation of the mandrel between stations, and means at predetermined stations for applying heat to the seams of the cups while on said mandrels and not rotating at said stations.

3. In a cup forming machine, a rotary head, a plurality of cone mandrels carried by said head, each rotatable relative thereto, means for driving said rotary head and rotating said cone mandrels and thereby winding the blank on the mandrel, and floating segmental pressure shoes mounted against rotation with said head as it rotates to effect winding of the blank on the mandrel as the mandrel and head rotate, said shoes being gravity actuated for contacting the blank tangentially on the mandrel as the mandrel moves relative to the shoes and at the same time rotates.

4. In a cup forming machine, a rotary head, a plurality of cone mandrels carried by said head and each rotatable relative thereto, means for driving said rotary head and rotating said cone mandrels and thereby winding the blank on the mandrel, and gravity actuated segmental pressure shoes to effect winding of the blank on the mandrel as the mandrel and head rotate, said shoes being linked together and held at one point against rotation with said head, said shoes contacting the blank tangentially on the mandrel as the mandrel moves relative to the shoes.

5. In a cup forming machine, a rotary head, a plurality of mandrels rotatably carried by said head, means for driving said head and rotating said mandrels and thereby winding the blank on the mandrel, segmental pressure shoes mounted against rotation as said head rotates to effect winding of the blank on the mandrel as the mandrel and head rotate, said shoes being gravity actuated for contacting the blank on the mandrel as the mandrel moves relative to the shoes, and means for applying pressure greater than that applied by said pressure shoes and for heating and thereby sealing the seams of the cups while on the mandrels when the mandrels are stationary between intermittent movements of said rotary head.

6. A cup forming machine comprising a rotary head, mandrels carried thereby, means cooperating therewith for forming cone cups on the mandrels, means at one station of the machine for engaging and bending over the apex of the cup to provide a safety fold at said apex, and a cone-shaped socket element at said station movable to engage the folded over apex and lay a tab of the cup seam over such apex.

7. In a cup forming machine, a rotary head, mandrels carried thereby for forming cone cups, the cup blanks being wound on the mandrels, means at one station of the machine for engaging and bending over the apex of the cup to provide a safety fold at said apex, a cone-shaped socket element at said station movable to engage the folded over apex and the portion of the cup adjacent said apex, and means at a further station of the machine for applying heat to the apex of the cup and conducting heat to the cup beyond said apex.

8. In a cup forming machine, a rotary head, mandrels carried thereby and rotatable relative thereto for forming cone cups by winding cup blanks on the mandrels, means at one station of the machine for engaging the apex of the cup and folding it over on one side of the cup to reinforce the apex, a cone-shaped socket element at said station movable to engage and round said folded over apex, and means for applying heat to said apex.

9. In a cup forming machine, a rotary head, a plurality of cone mandrels carried thereby and rotatable relative thereto, means for intermittently advancing said head and rotating said cone mandrels while the head is advancing, means for winding a cup blank on each cone mandrel so that a substantially cone-shaped cup is formed, means at one station resiliently engaging the apex of the cup as the mandrel is moved to said station for bending over the tip of the cup after it is substantially formed to make a leak-proof safety fold, a cone-shaped socket element movable at said station into engagement with the apex of the cup and engaging said means for moving it out of the way, said cone shaped socket element crushing and rounding the safety-fold apex of the cup and laying a tab portion of the cup blank over said bent over safety fold apex.

10. In a cup forming machine, a rotary head, a plurality of cone mandrels carried thereby and each rotatable relative thereto, means for intermittently advancing said head and rotating said cone mandrels during each such advance, means for winding a cup blank on each cone mandrel, means at one station resiliently engaging the apex of the cup as the mandrel is moved to said station for bending over the tip of the apex to provide a safety fold, and a socket element movable into engagement with the apex of the cup and engaging said means for moving it out of the way, said socket element crushing and rounding the apex of the cup and said safety fold.

11. A cup forming machine comprising a rotary head, a plurality of cone mandrels carried thereby and rotatable relative thereto, means for intermittently advancing said head and thereby said cone mandrels station to station and for rotating the mandrels while the head is advancing, means between stations for winding the blank on the cone mandrel, means for applying heat and pressure to the seam of the cup when said head is stationary, a pivoted projection at one station biased to move toward the cup and thereby resiilently engage the apex of the cup to bend it over as the head rotates and thereby form a safety fold at said apex, and a pressure cone at said station engageable with the apex of the cup and operable to lay a tab over said safety fold.

12. A cup forming machine comprising a rotary head, a plurality of cone mandrels rotatably carried thereby, means for intermittently advancing said head and for rotating the mandrels while the head is advancing, means between stations for winding the blank on the cone mandrel, means for applying heat and pressure to the seam of the cup when said head is stationary, a projection at a following station for engaging the apex of the cup to bend it over as the head rotates and thereby form a safety fold at said apex, and a pressure cone engageable with the apex of the cup and operable to round the apex and smooth down said safety fold.

13. In a machine for forming cups having a safety fold in the apex thereof and a reinforcing tab overlying the safety fold, a rotary head, mandrels carried thereby and rotatable relative thereto for forming cone cups by winding cup blanks on the mandrels, an instrument in the path of the cups, as the cups are carried by said mandrels, said instrument engaging successive apexes of cups and forming a safety fold therein, and means successively engaging

the tab on each cup and laying it over said safety fold and into surface engagement with the cup body.

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