

Oct. 27, 1959

T. B. SHIU

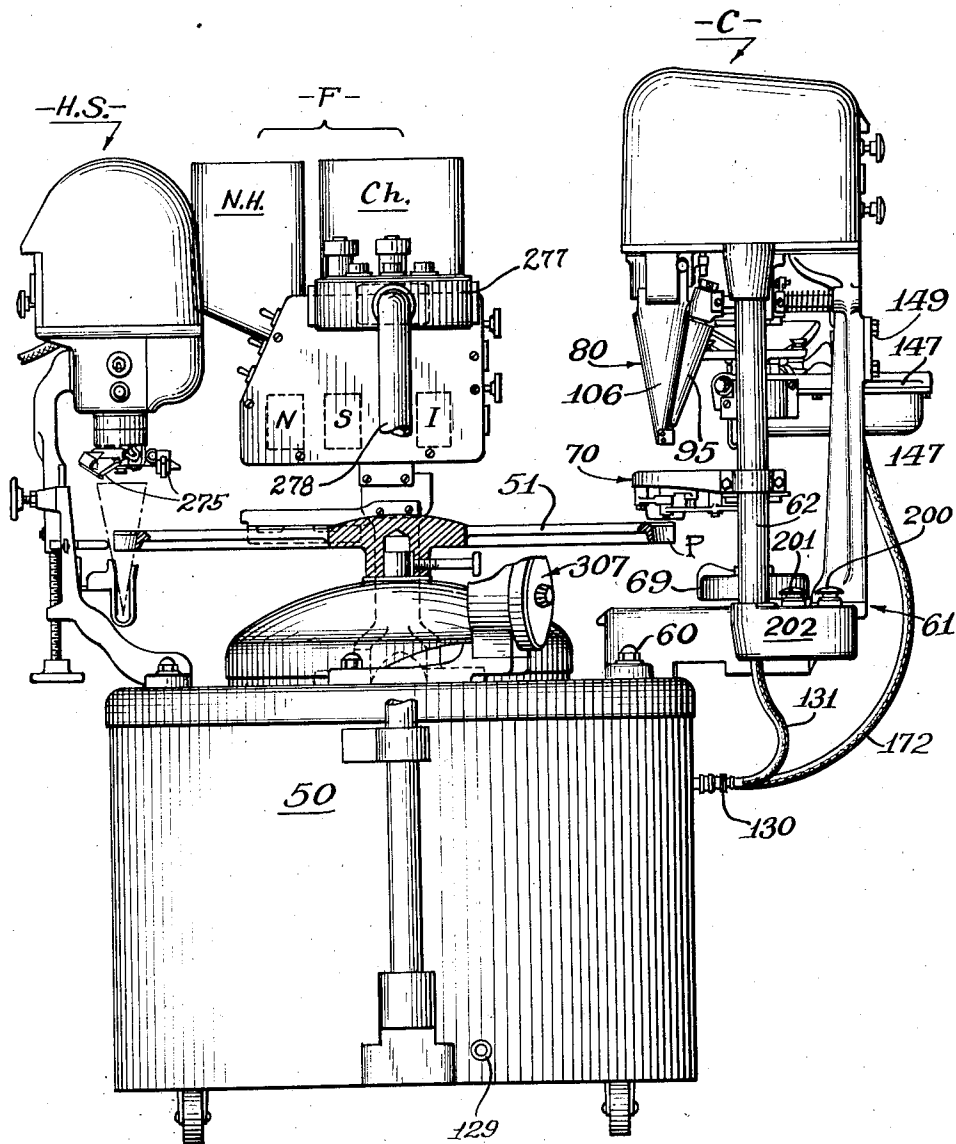
2,909,878

CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

Filed Dec. 13, 1957

21 Sheets-Sheet 1

FIG. 1.



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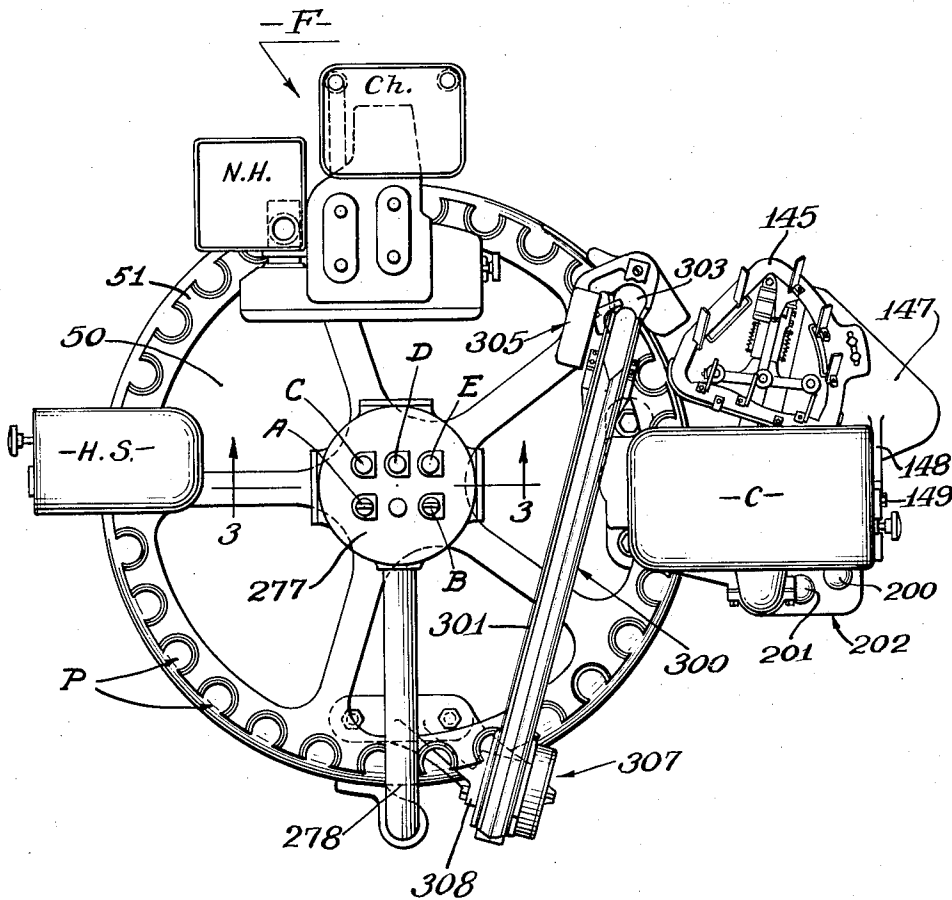
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CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

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FIG. 2.



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FIG. 4.

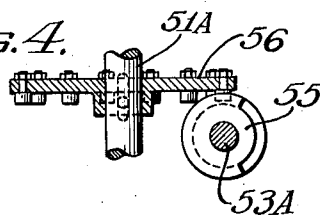
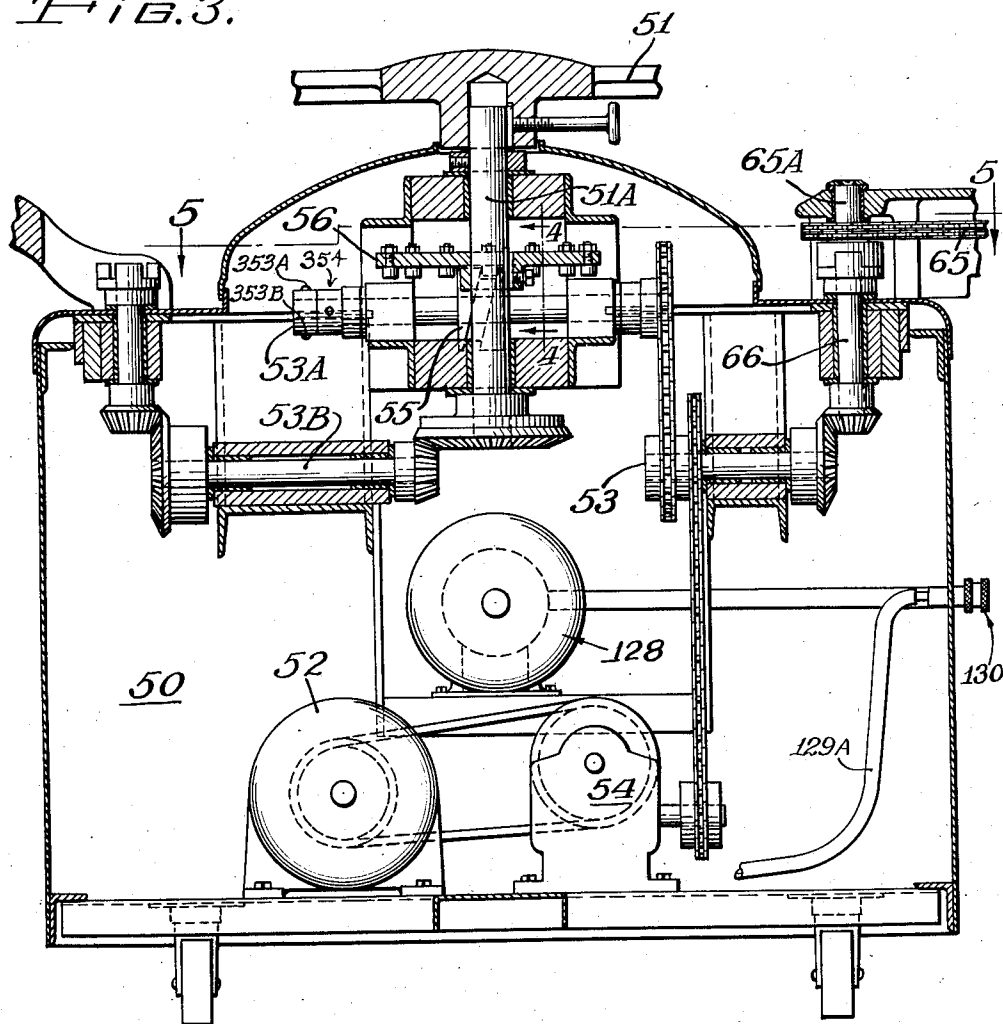


FIG. 3.



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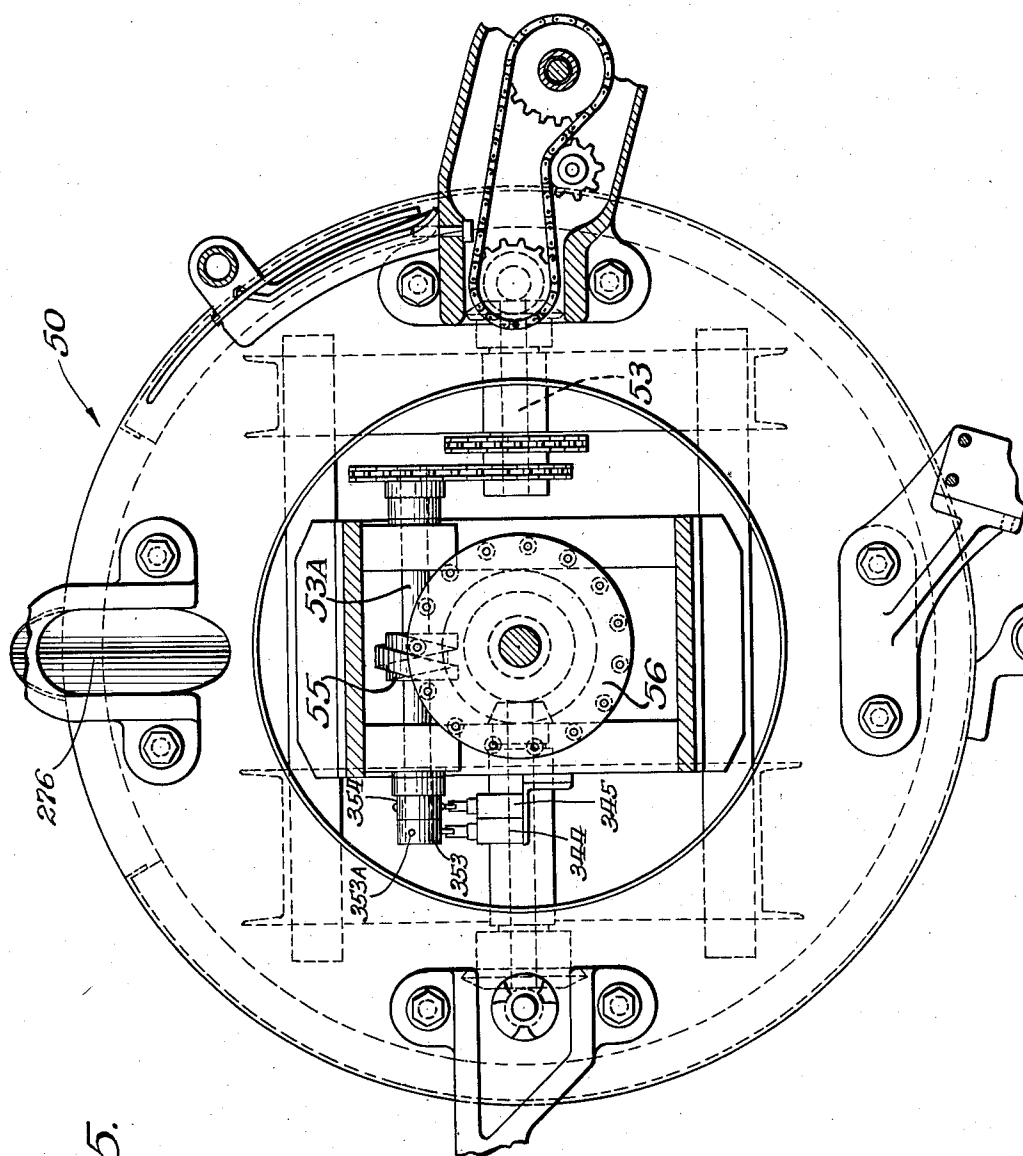


FIG. 5.

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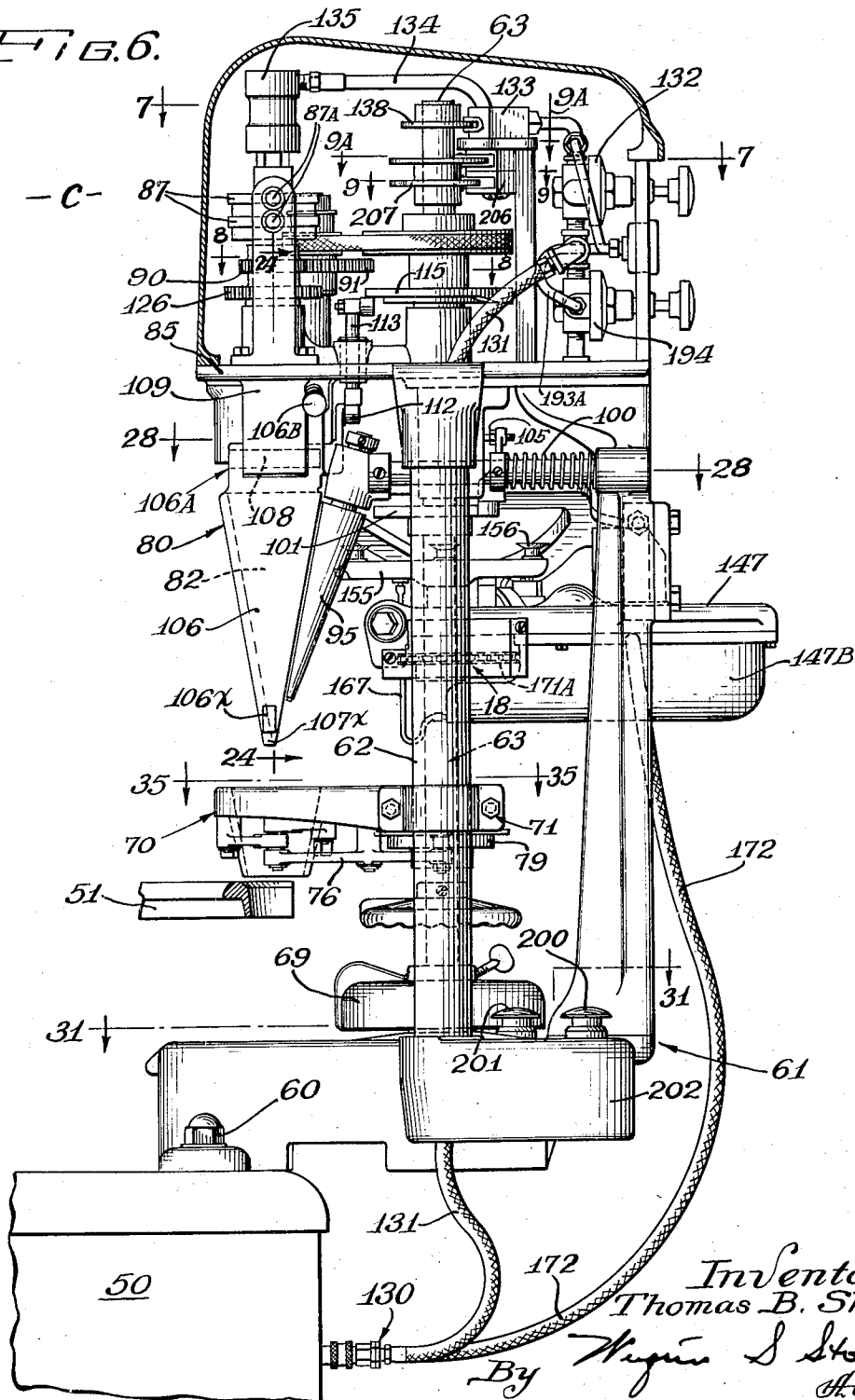
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FIG. 6.



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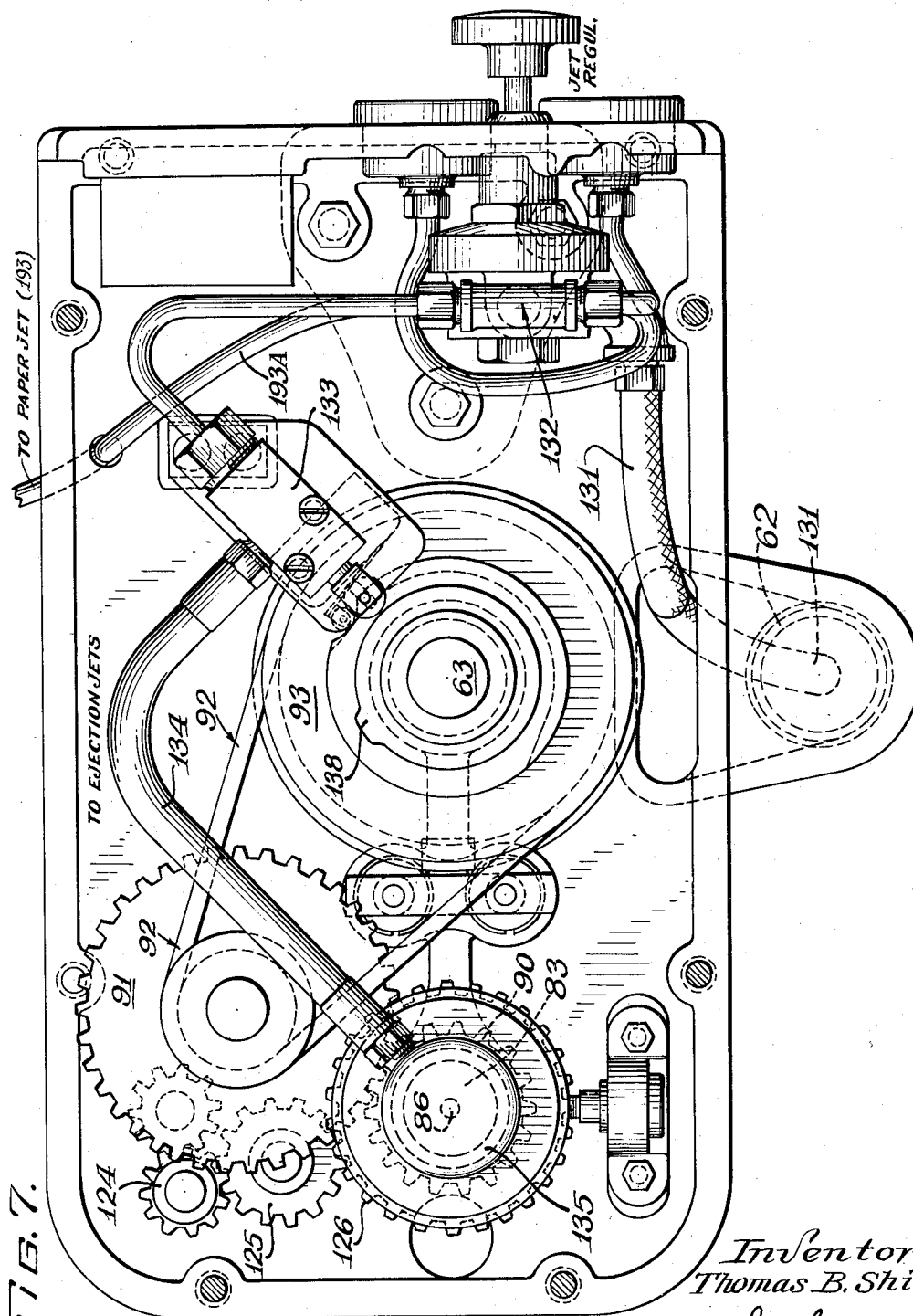
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FIG. 8.

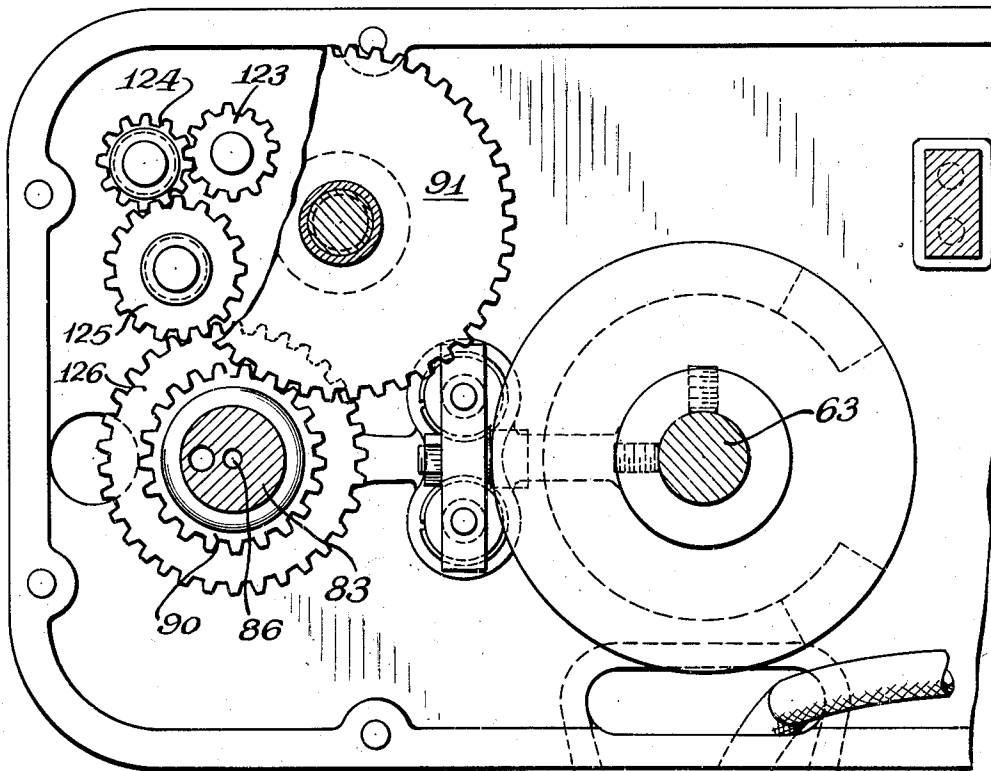


FIG. 9.

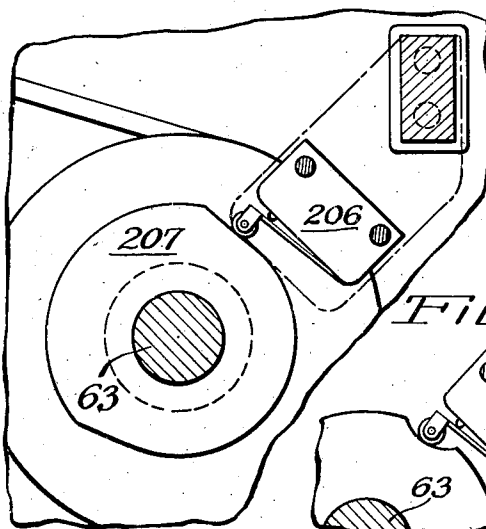


FIG. 10.

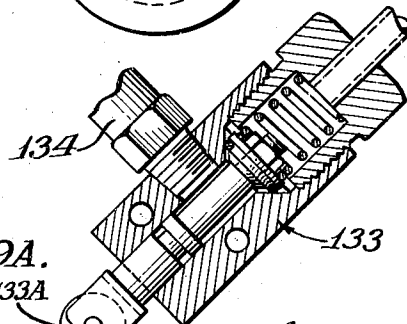
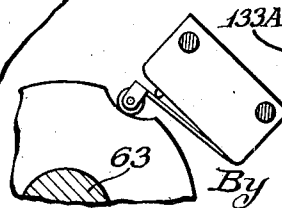


FIG. 9A.



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FIG. 11.

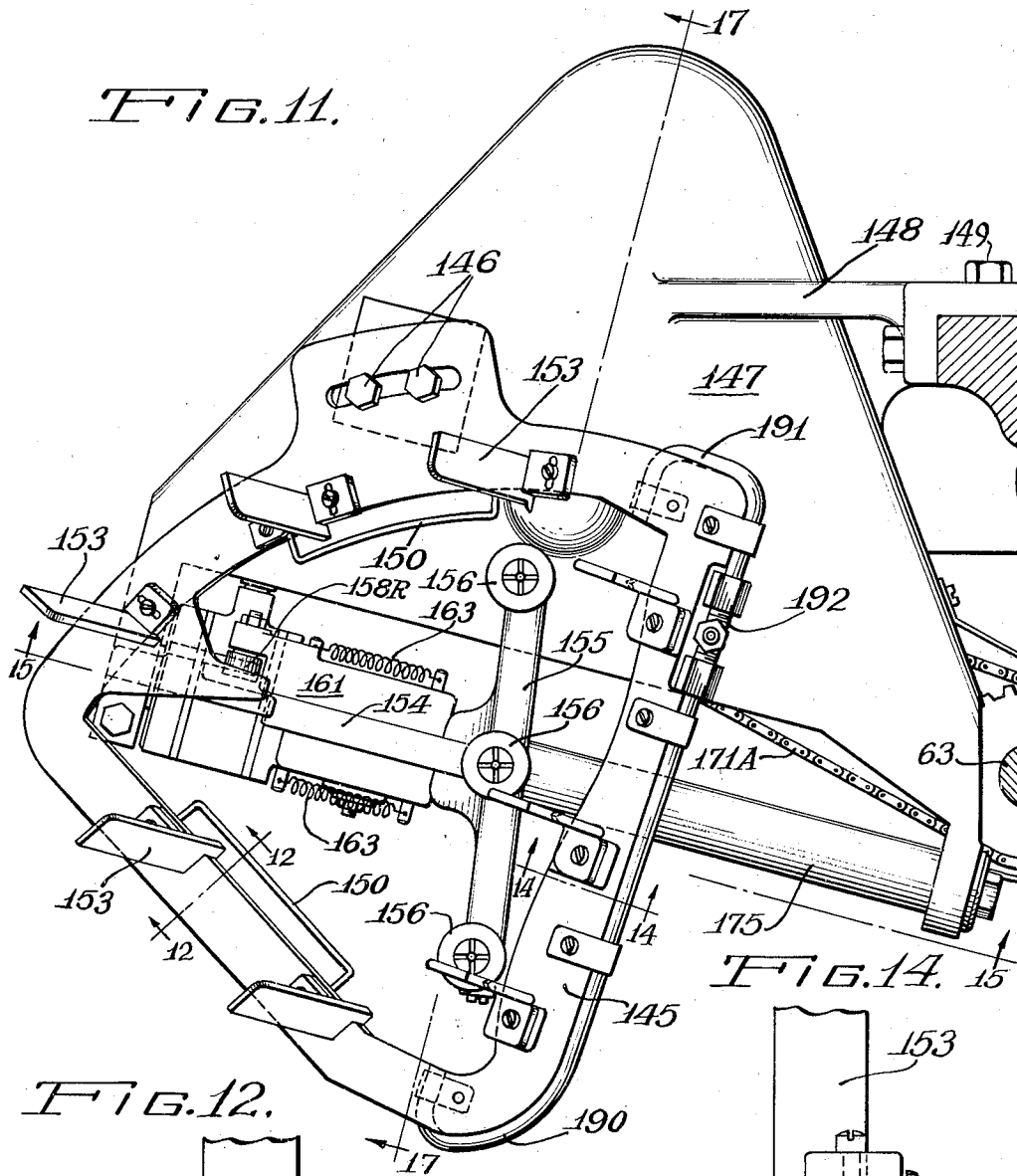


FIG. 12.

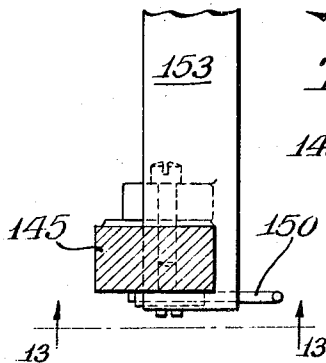


FIG. 13.

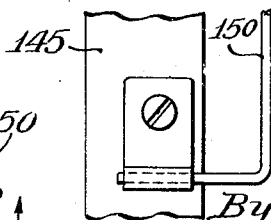
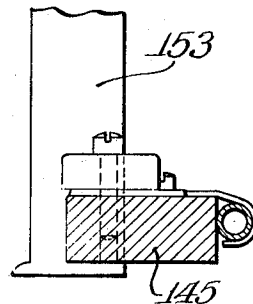


FIG. 14.



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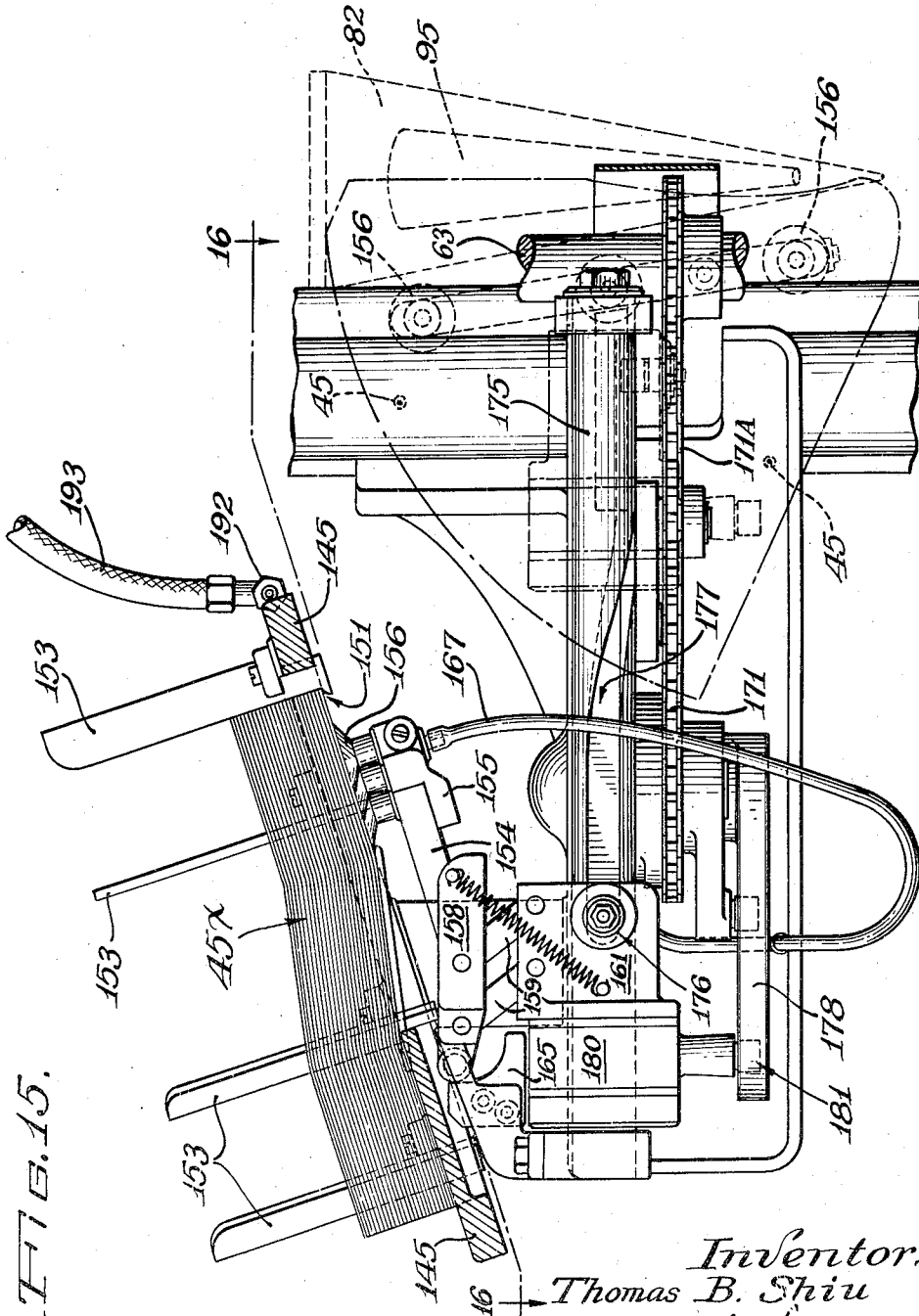


FIG. 15.

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FIG. 16.

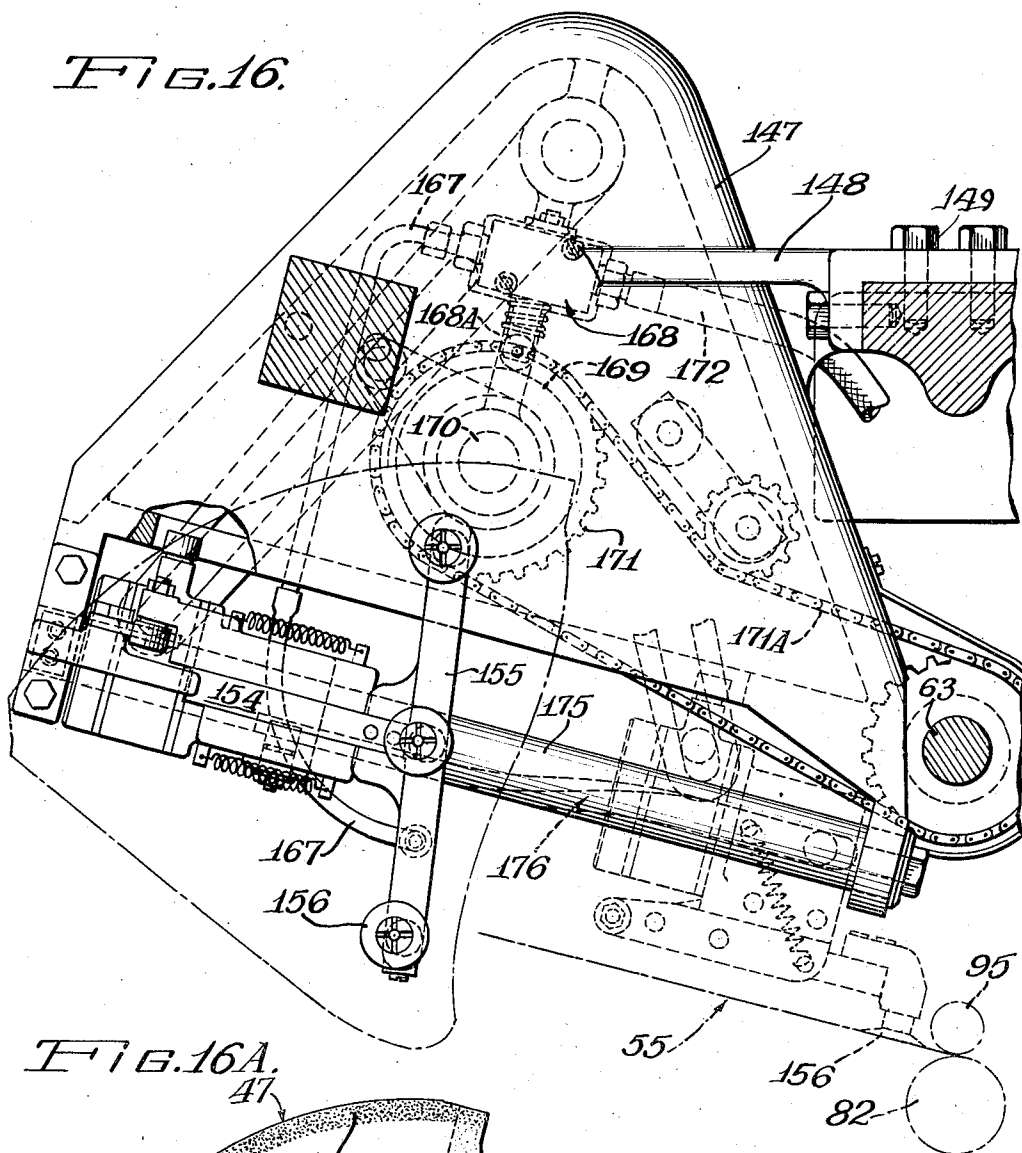
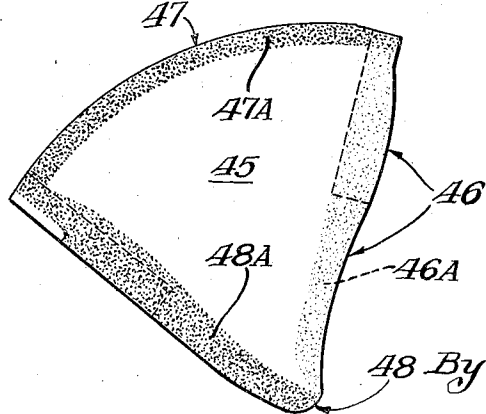


FIG. 16A.



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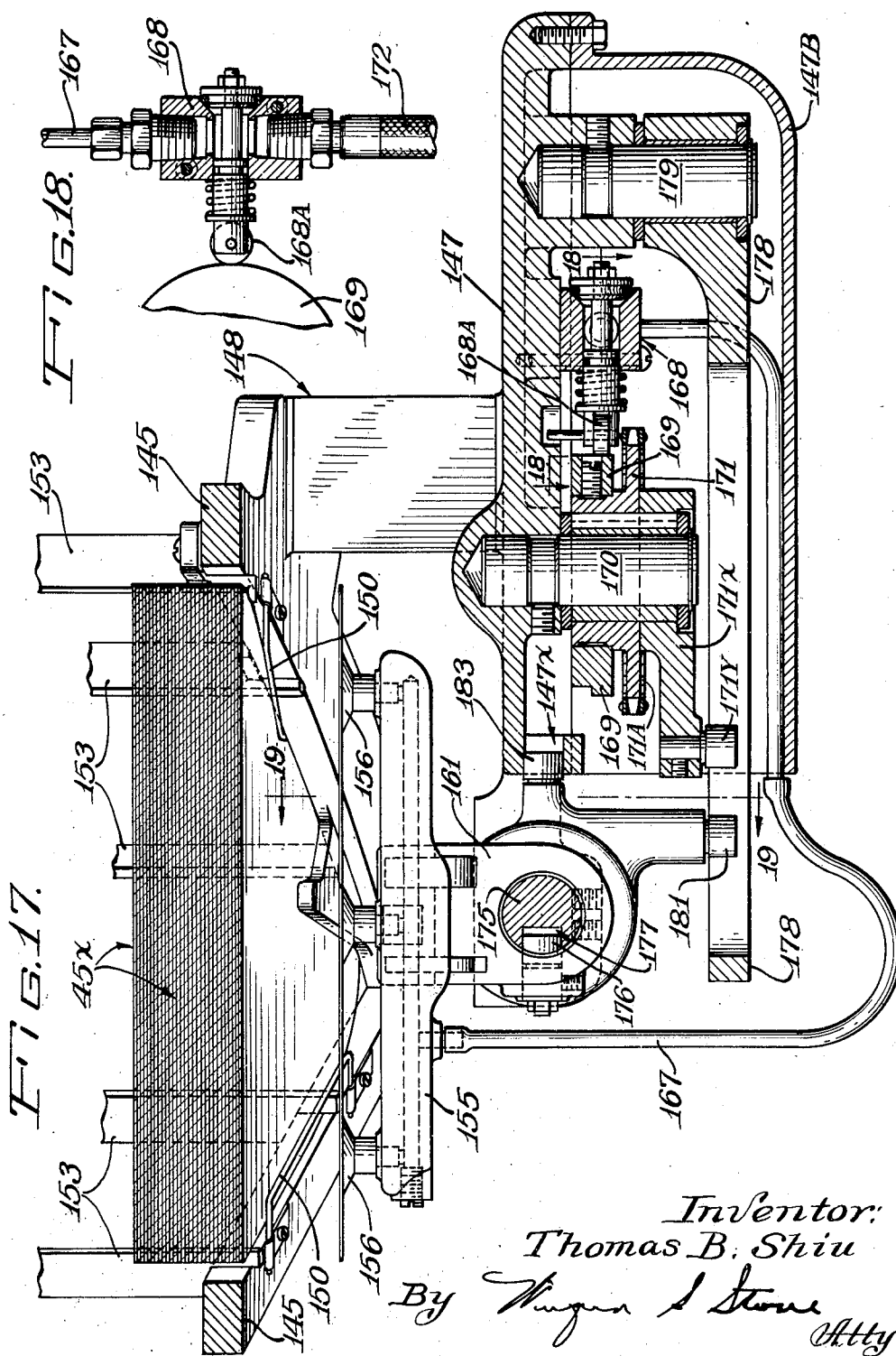
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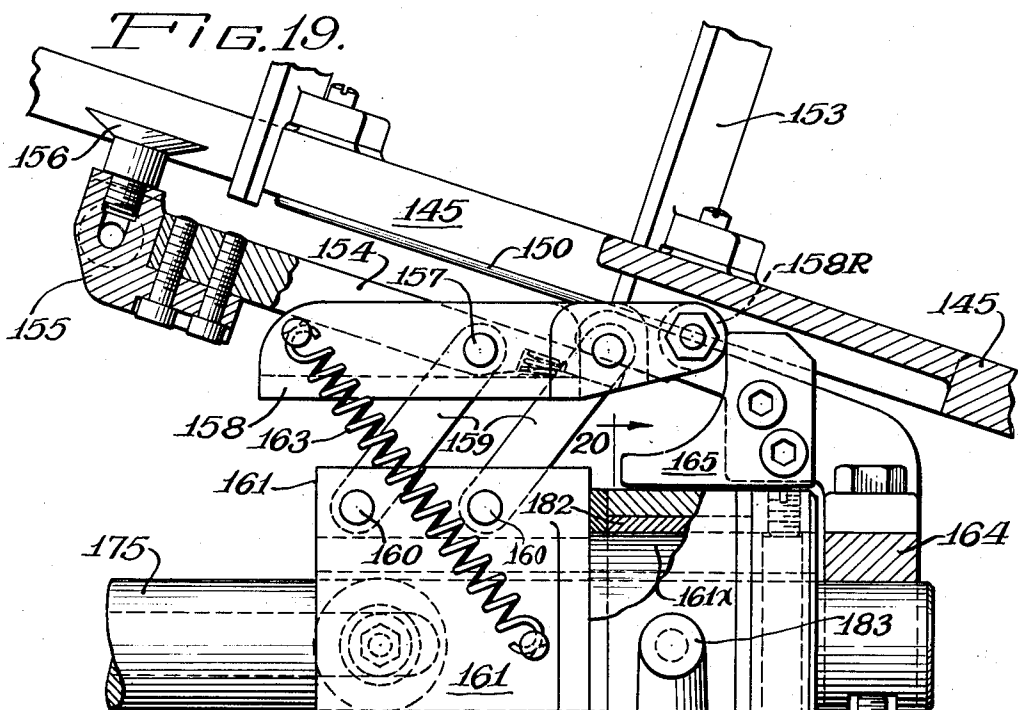
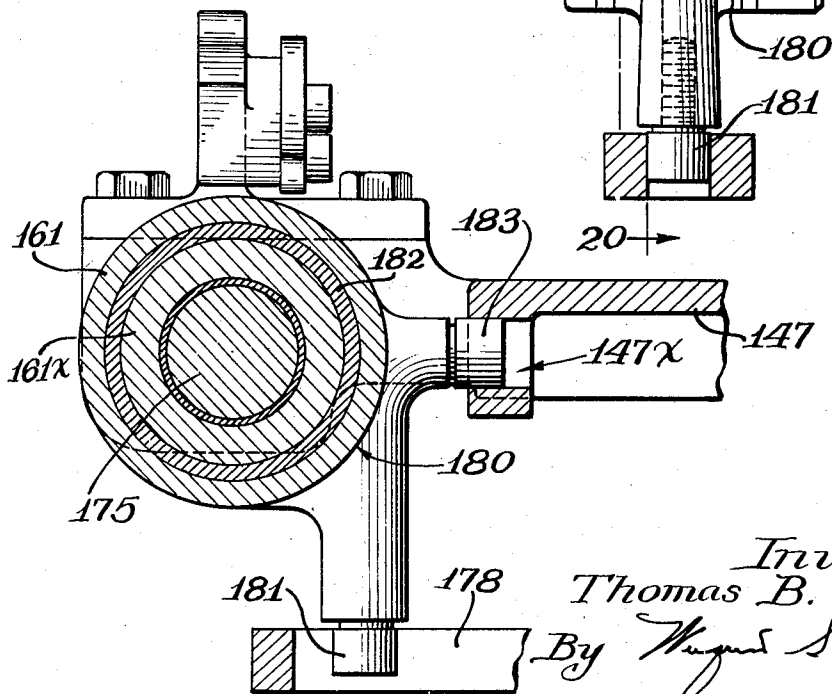


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CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

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21 Sheets-Sheet 12

*Fi* G. 20.

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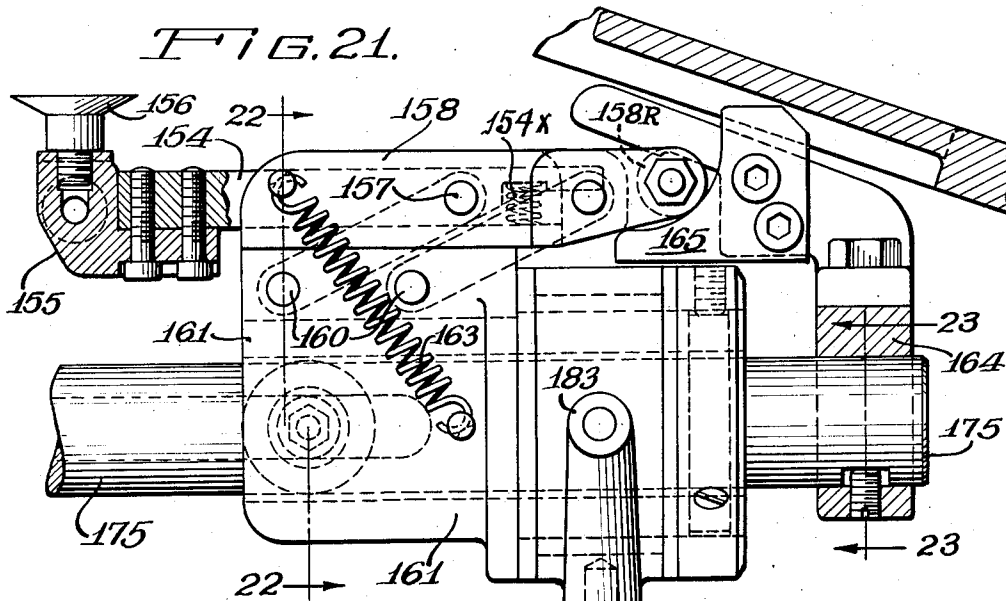
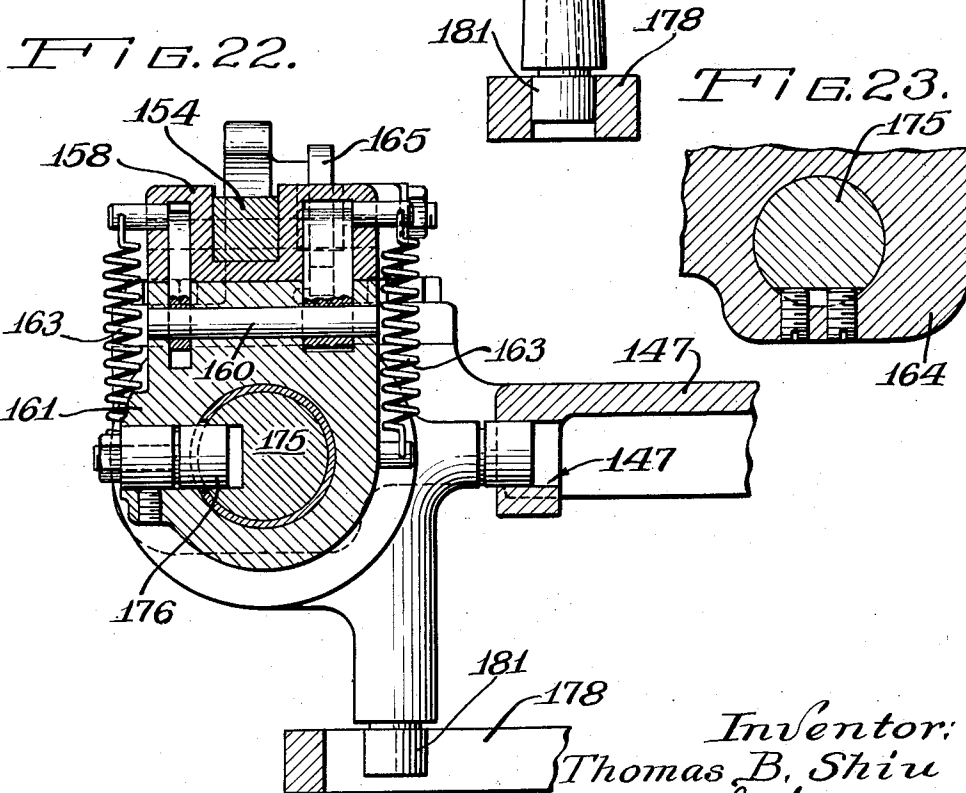
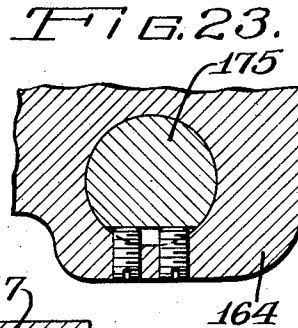
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Filed Dec. 13, 1957

21 Sheets-Sheet 13



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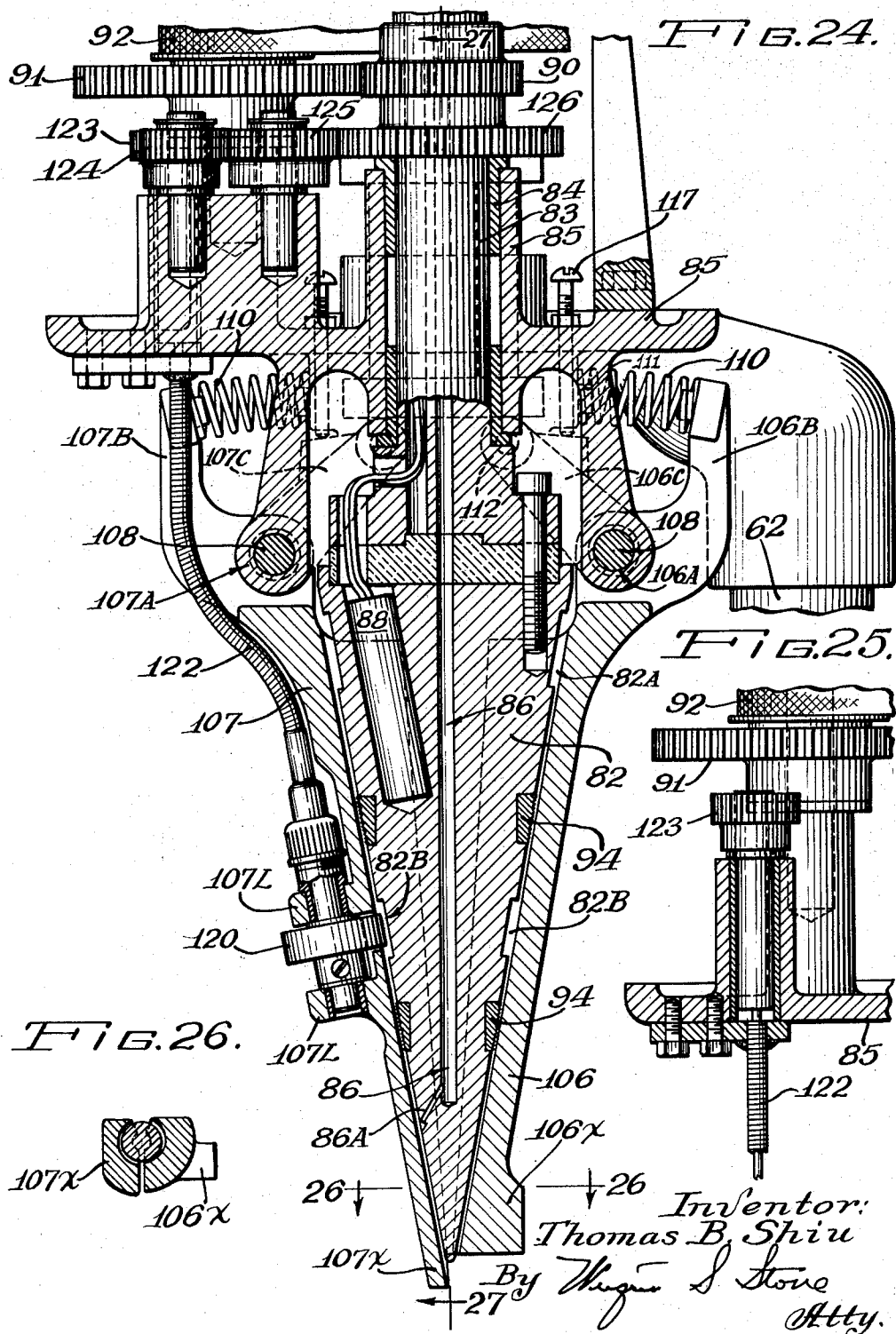
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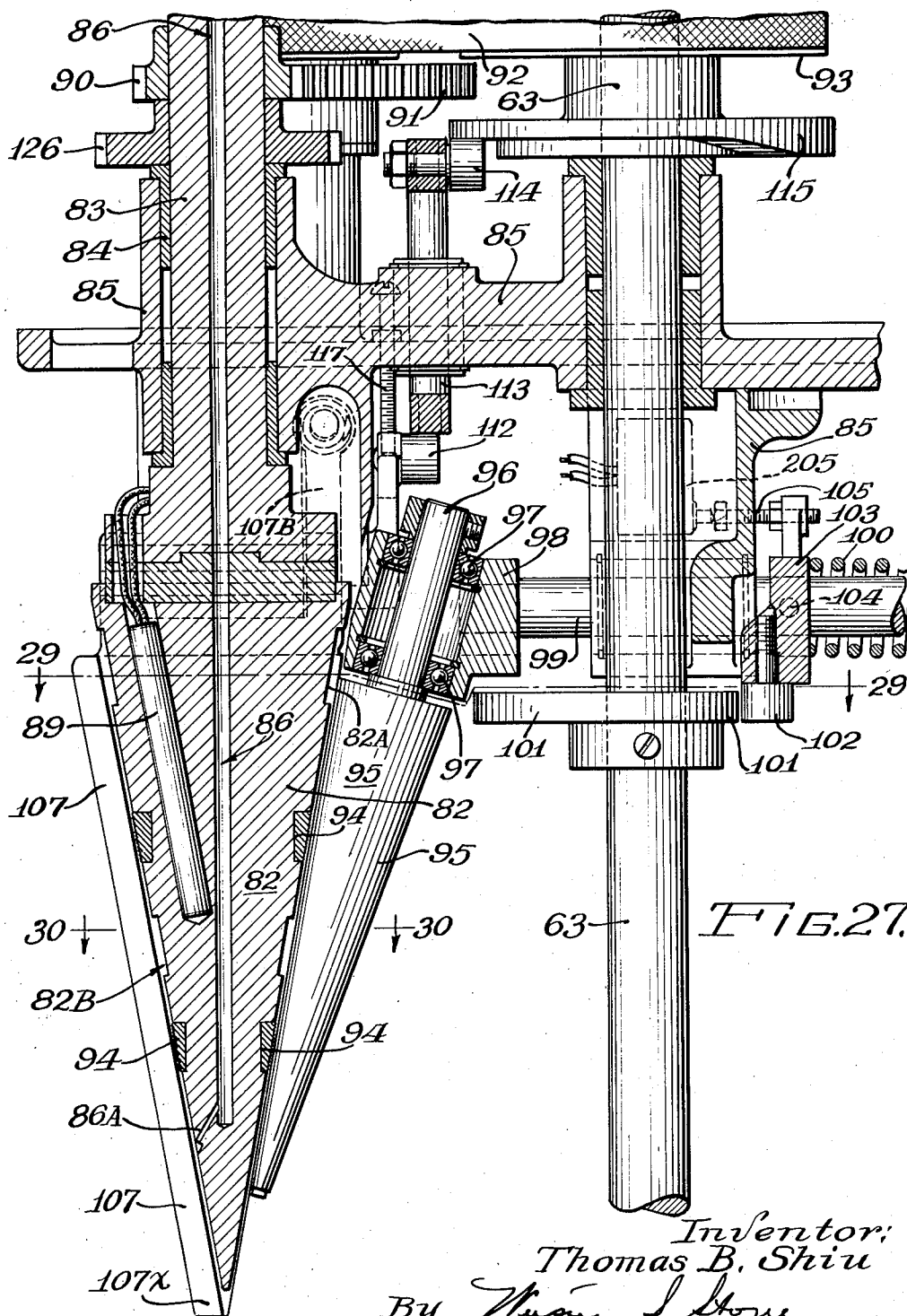
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CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

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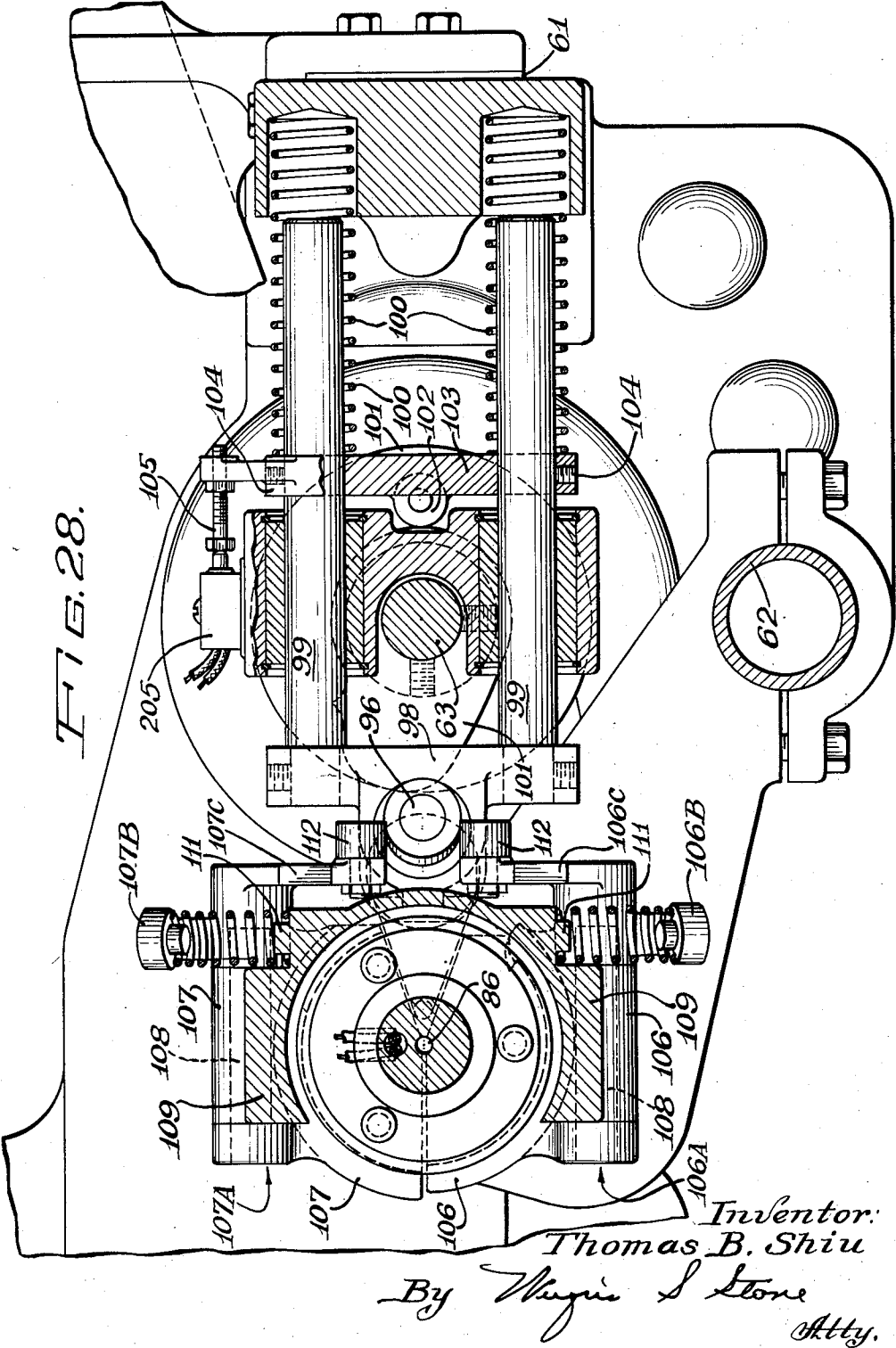
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FIG. 29.

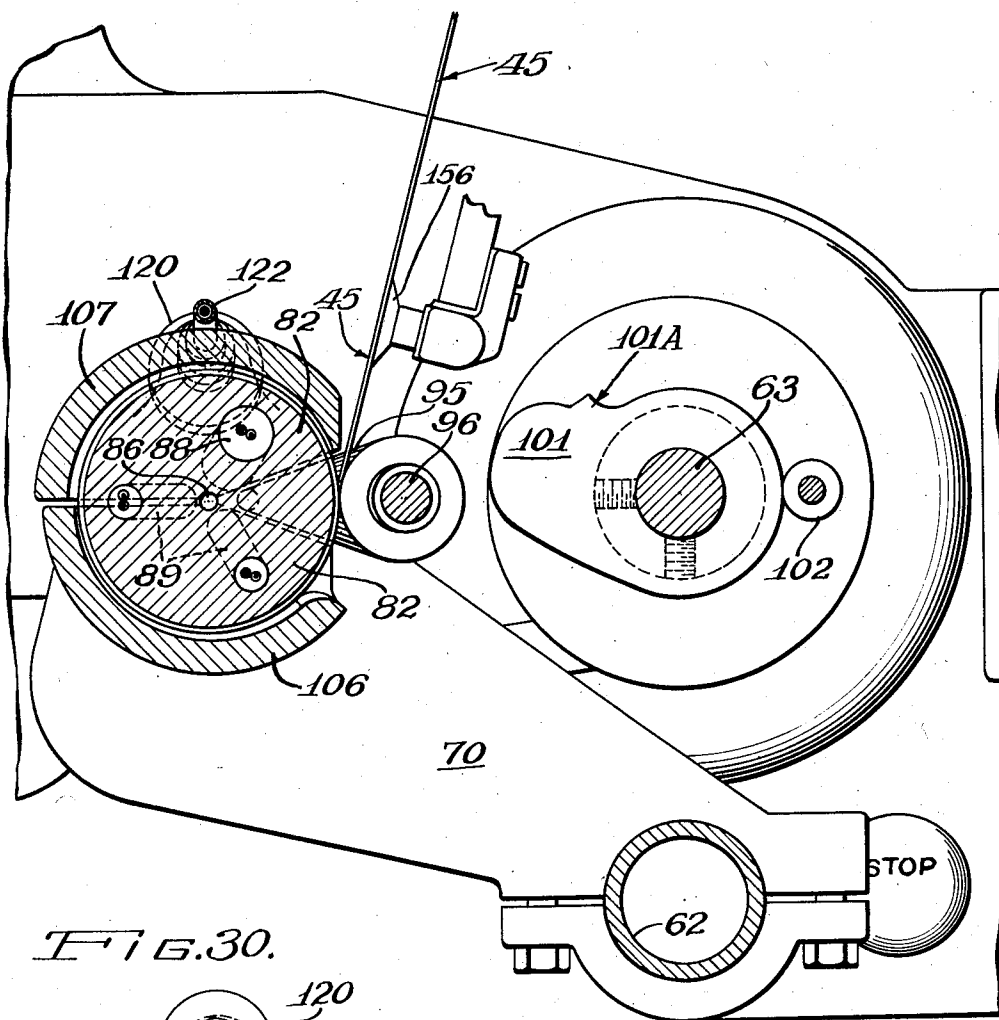
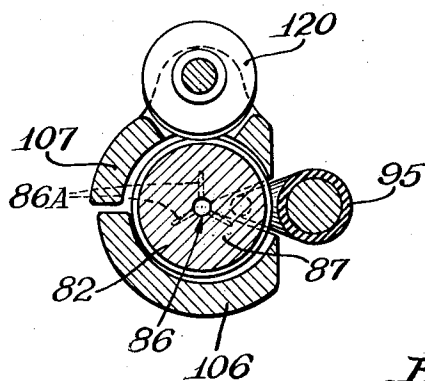


FIG. 30.



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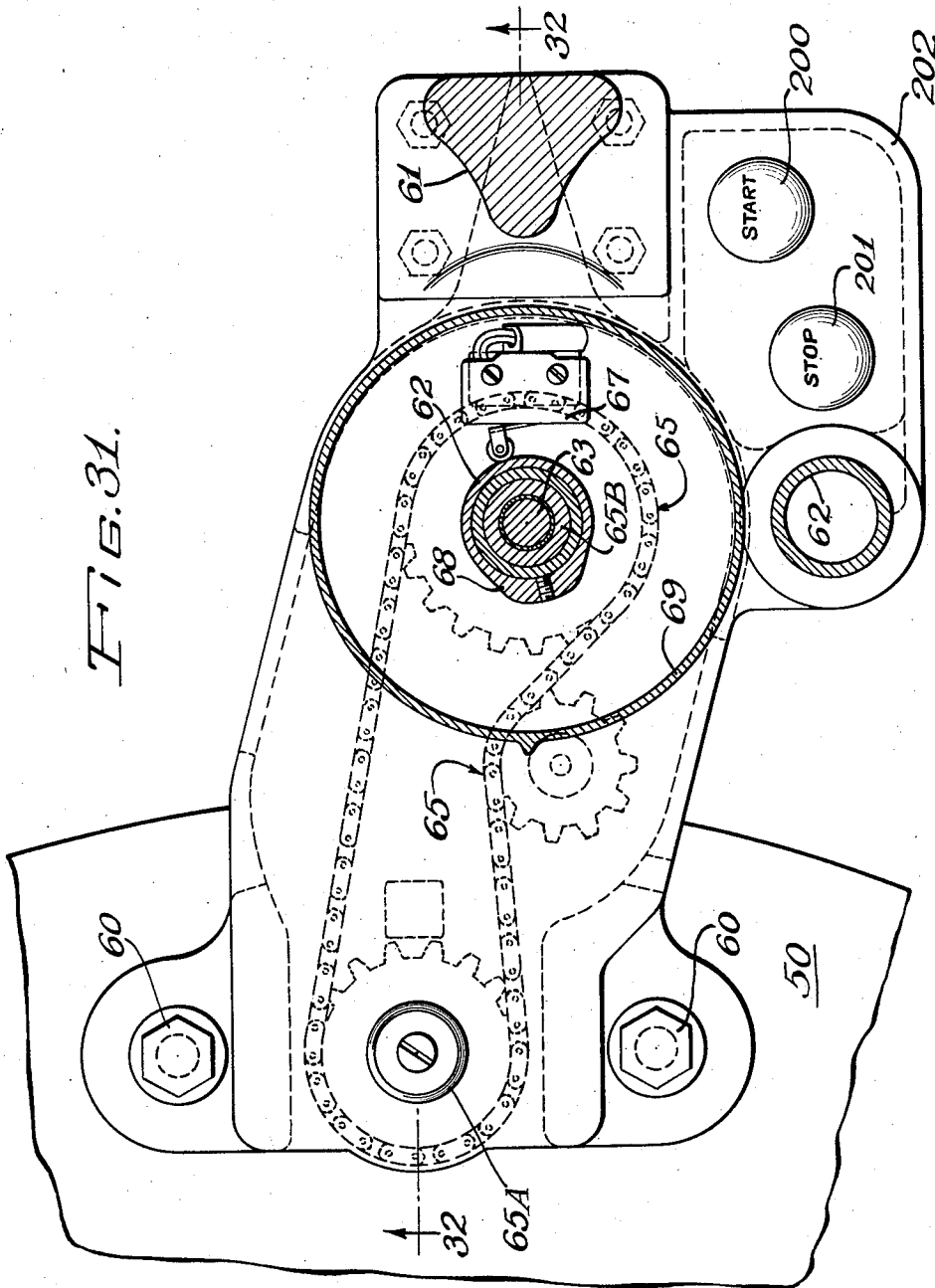
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CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

Filed Dec. 13, 1957

21 Sheets-Sheet 18



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2,909,878

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FIG. 35.

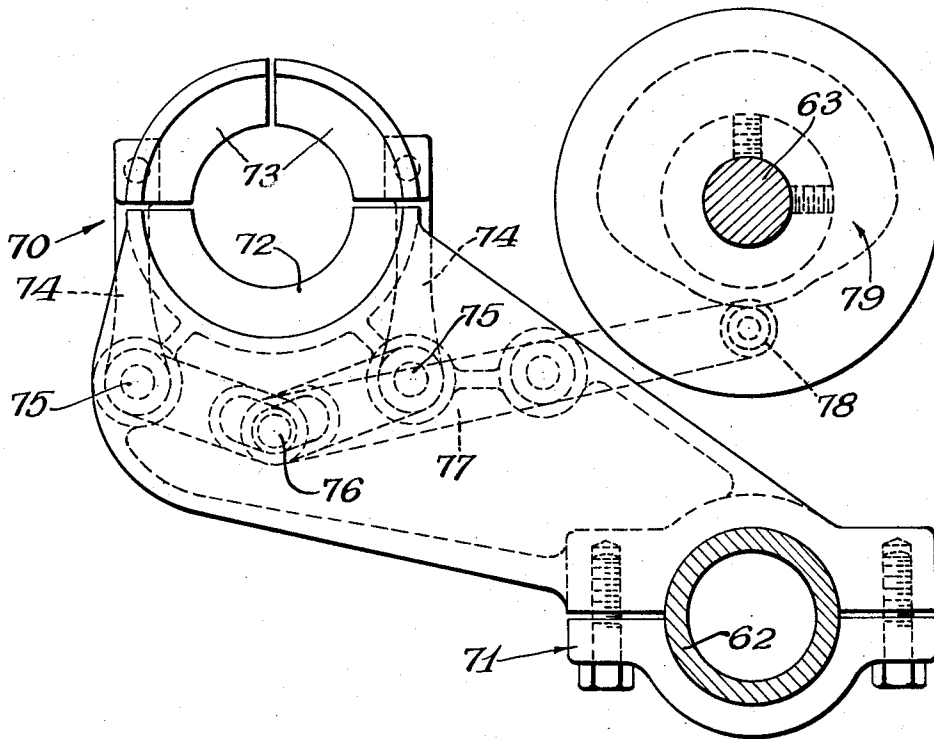
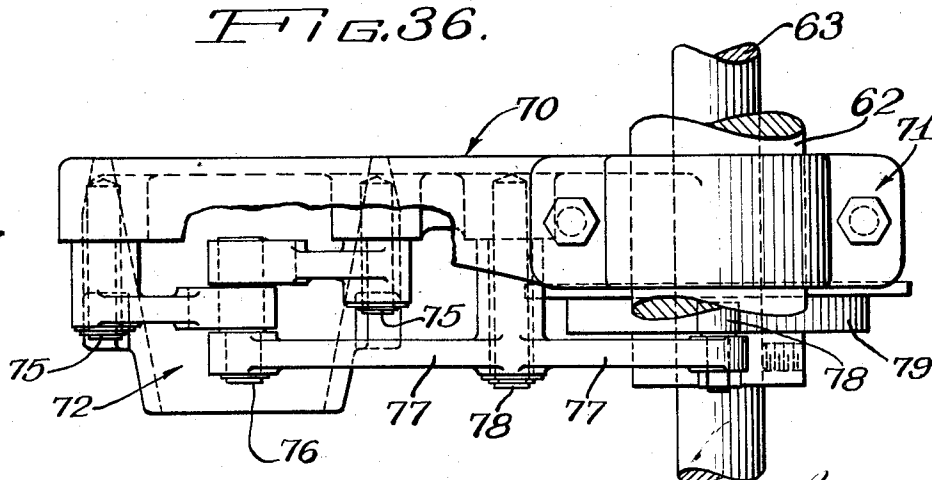


FIG. 36.



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2,909,878

CONTINUOUS-FLOW CONFECTIONARY PACKAGING MACHINE

Thomas B. Shiu, Chicago, Ill., assignor of one-fourth each to Nicholas A. Cummings and Thomas N. Cummings, Chicago, and one-fourth to Benjamin R. Peterson, Jr., Wheaton, Ill.

Application December 13, 1957, Serial No. 702,690

25 Claims. (Cl. 53—183)

This invention pertains to container-fabricating and packaging machinery and has as its broad objective the provision of a highly compact apparatus for manufacturing a packaged ice cream confection, or the like, such apparatus including, among its other important features, a highly efficient and simplified mechanism for high-speed formation, concurrently with other processing operations, of the containers in which the ice cream product is packaged and sealed.

In practice, the packaging container is a conical paper cup, the rapid formation of which constitutes a first step in a continuous-flow process in which each container is launched, as soon as formed, upon a step-by-step travel relative to certain rapidly-acting loading and filling devices which deposit therein the constituent ingredients of the confection, following which top portions of the cup are automatically folded-in and heat-sealed as the final step in the process.

As a means for progressively transporting the conical paper cups through several processing positions, the apparatus provides a master power and coordinating unit comprising a cylindrical housing and chassis surmounted by a concentrically-circular carrier rotatively advanced step-by-step about its hub and having circumferentially-spaced peripherally-located cup-seating pockets, which are disposed to travel beneath a plurality of processing instrumentalities mounted on the housing at radial locations about the turning axis of the carrier.

One of the important features of the new processing apparatus is the elimination of ready-made cups and problems incident to the utilization of such cups in a rapidly-flowing multi-step process of the class described.

To this end the invention provides means for concurrently fabricating ready-to-use cups of such strength that they may be loaded at once with a substantial content of ingredients such as ice cream and syrup.

The invention further provides a novel means for synchronizing the cup-forming operations with an intercepted feeding of finished cups into carrier pockets in timed relation to the step-by-step advances of the rotary carrier by utilizing interdependent driving means for the carrier mechanism and the cup-forming mechanisms, and gating the passage of the newly-formed cups into the carrier in synchrony with the operations of both mechanisms to assure a constant flow of perfectly-shaped cups.

Additional features of novelty and utility pertain to the provision of: a simplified mandrel system which shapes and ejects immediately usable cups at high speed, and means coacting therewith to orient and feed paper blanks thereto; a novel mechanism for maintaining consistent registry of blanks on a rapidly-moving forming mandrel; a gating means for intercepting the rapidly ejected cups at an intermediate station from which they are released safely into open-sided pockets in the carrier; a master assembly and power unit concentrically mounting the processing mechanisms about the carrier and including a master drive mechanism which steps the carrier and

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drives all of the foregoing instrumentalities in timed coordination.

Still further objects relate to structural and functional details of the preferred embodiment of the mechanisms described hereinafter in view of the annexed drawings, in which:

Fig. 1 is an elevation of the processing machine with portions broken away in the foreground;

Fig. 2 is a top plan view of the complete machine;

Fig. 3 is a vertical section through the master drive unit to enlarged scale with parts broken away;

Fig. 4 is a sectional fragment of the stepping carrier as seen along lines 4—4 of Fig. 2;

Fig. 5 is a top plan view of the master drive unit with parts broken away and the dome cover removed, looking along lines 5—5 of Fig. 2;

Fig. 6 is a vertical section of the forming mechanism with parts of the power unit shown in elevation;

Fig. 7 is a plan view taken along lines 7—7 of Fig. 6;

Fig. 8 is a sectional view taken along lines 8—8 of Fig. 6;

Fig. 9 is an enlarged plan detail of the overlap cam switch, with parts in section, as seen along lines 9—9 in Fig. 6;

Fig. 9-A is a fragmentary plan detail of the stop cam switch, taken above the view of Fig. 9 along lines 9A—9A in Fig. 6;

Fig. 10 is an enlarged sectional detail of the cup-ejection air valve;

Fig. 11 is a top plan detail of the feeding mechanism for the paper cup blanks;

Figs. 12 and 13 are enlarged sectional details of the supporting wires for the paper blanks, taken respectively at lines 12—12 in Fig. 11, and 13—13 in Fig. 12;

Fig. 14 is an enlarged sectional detail of the anti-static blower tube supporting means taken along lines 14—14 in Fig. 11;

Fig. 15 is an elevational view of the paper blank feed, with parts shown in section, as viewed in the direction of lines 15—15 of Fig. 11;

Fig. 16 is a view of the lower parts of the blank feeding mechanism, partly in plan and partly in section, looking down along lines 16—16 in Fig. 15;

Fig. 16-A is an inside plan view of one of the paper cup blanks;

Fig. 17 is a vertical section through the blank feeding mechanism as taken along lines 17—17 of Fig. 11;

Fig. 18 is an enlarged sectional detail through the blank-releasing air valve looking along lines 18—18 of Fig. 17;

Fig. 19 is a partial sectional detail through the rocker means in the blank-feeding mechanism as viewed in the direction of lines 19—19 of Fig. 17;

Fig. 20 is a sectional detail looking along lines 20—20 of Fig. 19;

Fig. 21 is an operational detail showing parts of Fig. 19 in a different operating position;

Fig. 22 is a sectional detail similar to Fig. 20 but taken along lines 22—22 of Fig. 21;

Fig. 23 is a sectional detail taken along lines 23—23 of Fig. 21;

Fig. 24 is an enlarged vertical section through the forming mandrel, as seen on lines 24—24 of Fig. 6;

Fig. 25 is a sectional detail of the spinner drive partly seen in elevation in Fig. 24;

Fig. 26 is a sectional detail of the mandrel tip at lines 26—26 of Fig. 24;

Fig. 27 is a vertical sectional detail through the forming mandrel mechanism viewed on lines 27—27 of Fig. 24;

Fig. 28 is a horizontal section through parts of the mandrel mechanism looking down on lines 28—28 in Fig. 6;

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Fig. 29 is a horizontal section looking down on lines 29—29 in Fig. 27;

Fig. 30 is a horizontal sectional detail at lines 30—30 through the lower portions of the mandrel means in Fig. 27;

Fig. 31 is a horizontal section on lines 31—31 at the base of the cup-forming unit, as seen in Fig. 6;

Fig. 32 is a vertical section in the region depicted in Fig. 31, and is taken along lines 32—32 of the latter;

Fig. 33 is a horizontal sectional detail of the power unit drive coupling seen on lines 33—33 of Fig. 32;

Fig. 34 is a complementary sectional detail of the power take-off coupling cooperable with the means of Fig. 33 and as seen along lines 34—34 in Fig. 32;

Fig. 35 is a top plan view of the cup seat and gate with parts shown in section, as seen in the direction of lines 35—35 of Fig. 6;

Fig. 36 is an elevational view of the parts shown in Fig. 35;

Fig. 37 is an operating schematic and partial circuit diagram.

A commercial embodiment of the machine is depicted in Fig. 1, and includes a cup-forming unit designated generally at C, and located at what may be considered as the first processing station, following which, in counterclockwise direction in this view, is a filling or loading unit F consisting of an upstanding housing enclosing three independently operating filling devices indicated in dotted lines, namely, an ice cream injection valve I, a syrup or chocolate valve S, and a nut valve N, these three devices being mainly concealed from view by the housing. This unit F is located at the third station, the second station being occupied by the cake-cone feed (300) referred to hereinafter in view of Figs. 2 and 37, but which has been omitted from Fig. 1 to clarify this view.

The ice cream valve is adapted to be connected to a source (such as the ram in Fig. 37) of flowable ice cream under a constant head of pressure, and requiring that the valve operate intermittently, whether or not there is any cup present in the carrier, in order that back pressure does not build up in the ram and cause the ice cream valve to discharge an oversize portion. The chocolate or other flavoring syrup is contained in a reservoir Ch; and a supply of chopped nuts or the like is contained in a nut hopper NH, but the release of both of these latter ingredients is positively controlled by electromagnetic valves actuated by switches (not seen) operated by cups in the carrier.

At a position regarded as the last processing station, there is situated a novel heat-sealing mechanism HS, which constitutes the subject matter of a copending application, Serial No. 677,862, filed August 13, 1957, it being understood that another copending application, Serial No. 379,332, filed September 10, 1953, discloses related subject matter particularly as to the drum console power head and carrier, and that other components of the machine, such as the ice cream valve and cake-cone loading means, are likewise the subject matter of still other applications which may be referred to from time to time hereinafter.

The cooperative combination of the aforesaid processing components is centered about a mobile drum-shaped master power and coordinating head 50, such as shown in Figs. 1 and 2, it being observed that the view of Fig. 2 includes the cake-cone feed or loading means 300, which is omitted for convenience from the showing of Fig. 1.

As depicted in Fig. 3, the master power head 50 includes a motor 52 driving a plurality of countershafts 53, 53A, 53B through sprocket drives from reduction gearing 54.

The rotary carrier 51 (Figs. 3, 4, and 5) is advanced step-by-step through the agency of a barrel cam 55 on one of the countershafts 53A driving a pinion wheel 56 on the carrier spindle 51A.

The countershaft 53 (Fig. 3) drives a synchronizing power take-off spindle 66 which in turn drives the cup-

forming mechanism C in timed relation to the step-by-step movements of the rotary cup carrier, the latter constituting a special cup outfeeding means which is synchronized with the formation and discharge of cups by unit C to provide a continuous formation, loading, and outfeeding conveyance of cups in coordination with the other processing instrumentalities, as will appear.

It is emphasized that precise and reliable operation of the cup-forming means, as the basis for the initial processing step in the system, is of great importance; and this initial operation, in turn, depends partly for its success upon the provision of a special paper cup blank particularly shaped and treated for use in the novel cup-forming apparatus, such a blank being the subject matter of a copending application, Serial No. 648,350, filed March 25, 1957.

One of the blanks 45 is depicted in Fig. 16-A, the shape thereof being roughly triangular with certain curves formed along the leading edge at 46, the closing margin at 47, and the apex seal at 48. Lanes of heat-sealable adhesive border the margins of the blank and are correspondingly identified at 46A, 47A, 48A, it being observed that the latter two lanes are indicated by the heavier mottling area on the inside face of the blank, while the lane 46A is on the outside face thereof, so that when the blank is turned into a cone the lane 48A will be lapped over the lane 46A. It is in this sense that the edge 46 is the leading edge since it is first to enter the cup-forming mandrel system when the blanks are fed thereto.

The cup-forming mechanism, generally indicated at C in Figs. 1 and 2, is mounted eccentrically of the carrier spindle on the power drum 50 by means of bolts 60 engaging the foot of a composite bracket casting 61 serving as one of the principal supports for this mechanism.

Located behind a tubular post 62, which is another part of the bracket means (Fig. 6) is an upright power shaft 63 driven (Figs. 31 and 32) through a known type of electromagnetic clutch means 64—64A from a sprocket and chain drive means 65 concealed in a hollow foot portion of the bracket; the sprocket means at spindle 65A in turn being driven through a flexible coupling means 59 (Figs. 33, 34) from the synchronized power take-off spindle 66 situated radially of the carrier axis on the top of the power drum 50.

It may be noted here that one of a number of control switches 67 is situated at the foot of the bracket and housed beneath a bell knob 69 and keyed for rotative adjustment with bushing 65B which travels with the apertaining sprocket drive wheel floating with its clutch member at the foot of the power shaft 63, there being a cam 68 fast on this bushing to actuate switch 67 once per revolution of shaft 66 for control purposes to be described, in connection with the auto-synchronous feature.

Clamped on post 62 (Fig. 6) is a cup-receiver and gating bracket 70 positioned to overlie the rotary carrier 51 and receive temporarily the newly-formed cups as they are discharged from the conical mandrel means thereabove and to direct and regulate the transfer of such cups subsequently into pockets in the carrier, as will more fully appear hereinafter.

In the assembly views of Figs. 1 and 6 the mandrel means is indicated generally at 80, the structural details thereof being described with reference to Fig. 24, wherein it will be seen that a principal conical mandrel 82 has a spindle 83 journaled in a bushed bearing 84 seated in a bore in a floor of supporting casting 85 carried at the top of the post 62. Traversing this spindle and the mandrel to a point close to the lower apex portion thereof is a small air passage 86 having three (Fig. 30 also) discharge orifices 86A leading out through the sidewall of the mandrel for the purpose of ejecting finished cups, as will appear. The mandrel also has an internal bore adapted to house a small thermostatic sensing unit or cartridge 88, the lead wires from which pass upwardly through a bore in the spindle 83 running alongside the

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air passage (Fig. 28) to connect with brush contact rings 87 (Fig. 6).

As viewed in Fig. 27, the main mandrel cone is provided with another internal cavity which seats one of a pair of electric heater cartridges 89, both of which may be seen in Fig. 29, the same being connected, along with control thermostat means, to their energizing circuit through the contact rings and brushes 87, 87A (Fig. 6).

Means for rotating the mandrel at high speed includes (Figs. 7, 8, 24, and 27) a pinion 90 fixed on spindle 83 and driven by a gear 91 carried on a stud shaft journaled in the bracket casting, this gear in turn being driven through a belt drive 92 working on pulley 93 on the vertical clutch-driven power shaft 63 heretofore mentioned.

Referring still to Figs. 24 and 27, it will be noted that the mandrel is provided with a number of peripheral grooves including an open one indicated at 82A near its top, and another at 82B near the middle adapted to accommodate the peripheral parts of a speeder wheel or roller hereinafter described, while knurled stainless steel driving inserts 94 are seated in the remaining grooves to assure good driving traction with the paper blanks.

A small conical presser roller 95 is rotatably mounted alongside the mandrel by means of a spindle 96 working in ball bearings 97, which in turn are seated in a small casting 98 carried on a pair of slide rods 99 adapted to reciprocate in bores in the supporting bracket 85 (Fig. 28 also) the latter view showing to advantage a pair of compression springs 100 employed to urge the presser roller into normal driving engagement with the forming mandrel and a paper cup blank carried thereon.

Means for intermittently withdrawing or relieving the presser roller includes (Figs. 27, 28, and 29) a relief cam 101 fast on drive shaft 63 and working against a cam roller 102 carried beneath an adjustable cross arm 103 fixed at desired positions along the slide rods by means of set screws 104, such that for each revolution of the main drive shaft 63 the presser roller 95 will be urged outwardly away from the mandrel, and returned thereagainst by springs 100 (the mandrel, however, making three revolutions in the interim), it being noted at this juncture that a special supervisory control switch 205 is adjustably positioned alongside the slide rods to be actuated by means of an adjustable screw stud 105 carried by the cross arm. The switch 205 is a jam-sensing switch connected cooperably with a main mandrel control switch (to be described) to stop the mandrel only in an open condition in the event a paper blank bunches or jams between the mandrel and surrounding guide shells.

It should be observed that the relief cam 101 has a fast lobe, by reason of which the withdrawal and release of the presser cone will occur with a snap action to admit the blanks and free the cups quickly in the high-speed forming and discharge operations achieved by this machine; and in order to avoid bouncing of the presser roller in its snap-action return movement, a low relief lobe or step 101A is provided to follow the main lobe on the cam 101 (Fig. 29).

As depicted in Fig. 29, one of the paper blanks 45 is about to enter between the mandrel 82 and presser roller 95, and it will also be noticed in this view that the mandrel is substantially surrounded by a pair of coating guard shells 106, 107, the purposes of which is to guide and closely confine the travel of the blank peripherally with the main cone and to restrain the blank from running askew, cooperably with the like purposes of certain speeder-roller means hereinafter described.

The guide shells 106, 107 are preferably made of aluminum, and are both cast with aligned pivot bores (Figs. 6, 24, and 28) 106A, 107A, respectively, in which are received pivot pins 108 seated in opposite pendant post sections 109 of the bracket floor-plate casting 85. Thus, the two shells 106, 107 are mounted to pivot toward and away from the mandrel.

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Referring to Fig. 24, each shell casting is provided with an upwardly offset spring arm 106B or 107B, respectively, each having at its end a stud to mount a corresponding compression spring 110 seating on a like stud means 111 forming part of the floor casting, whereby the shells are normally urged closely toward the mandrel against adjustable limiting stops 117 (Fig. 27).

Means operable to rock or open the guard shells away from the mandrel includes a lever arm 106C or 107C on each shell (Figs. 24 and 28) the same being cast integrally with the corresponding shell body, and each arm having at its end a roller 112 situated beneath the end of a corresponding actuating plunger or tappet 113 (Figs. 6 and 27) slidable in a bore in casting 85 and having at its upper end a roller 114 disposed to engage a profile cam 115 which serves to depress the plungers, and hence the appertaining shell-rocking levers, once per revolution, thereby momentarily widening the normally narrow clearance between the same and the mandrel so that the finished conical cups, on the one hand, and the entering blanks, on the other, will have a suitable clearance.

Guide shell 106 (Figs. 24 and 26) has an enlarged protuberance 106X at its lower end for the purpose of concentrating heat at the apex region of the cup so that the thermosensitive adhesive at the tip portion 48 (Fig. 16A) of the formed blank will be positively and adequately sealed at this critical region; and it may be noted also that the companion shell 107 has its lower end portion 107X extended past the apex of the mandrel cone for the purpose of spinning-in the tip portions 48 of the blank sealed by the means 106X. Thus, the apex portions of the blank are turned in to a condition of complete closure; and these portions are thoroughly sealed.

The consistently reliable fabrication of instantly loadable conical cups at high speed with forming and heat-sealing of the type achieved by the present apparatus, using the special blanks disclosed in the copending application alluded to, presents a number of very difficult problems, one of which is that of initiating and maintaining proper registry of the blank throughout its fast travel with the mandrel means, so that uniformity of cup shape is maintained and down-time resulting from jamming of blanks is minimized, it being impossible for mass production purposes to assure such uniform thickness and flatness and texture of paper stock, adhesive coatings, etc., as to avoid occasional deviations in registry and bunching of the paper blanks between the mandrel and guide shells with consequent jamming of the forming mechanism; and for these exigencies certain supervisory jam-detecting and guarding switch means is provided, as will more fully appear hereafter.

At high forming speeds (e.g. one cup per second) a good paper blank, despite a proper starting orientation and the outside guide shells, will tend to creep out of registry on the mandrel. This tendency is corrected by provision of a small speeder roller 120 (Fig. 24) journaled in bushed bearings set in lugs 107L forming an integral part of one of the guide shells 107. This roller is preferably made of stainless steel with a bonded rubber periphery exposed through a cut-out in the shell opposite the groove 82B in the mandrel, by reason of which the correspondingly positioned portions of the rotating blank are pressed inwardly, the effect being somewhat that of forming a temporary annular guide rib in the cup, which tends to ride true in said groove.

The speeder roller is driven through a small flexible shaft means 122 terminating at its upper end and in a pinion 123 driven through intermediate pinions 124, 125 from a gear 126 on the mandrel shaft 83, the ratio of this gear system being such as to rotate the speeder roller at a greater peripheral speed than the mandrel 82, with the result that it also overdrives the blank and further corrects the tendency to creep out of registry.

Where a forming speed of 60 cups per minute is sought,

each blank will remain in the mandrel system for about two-thirds of a second and make several revolutions (at least three) during that interval to assure extended heating exposure for consistently thorough sealing, the remaining fraction of each second of transit time per blank being expended in the blank-infeeding and cup-discharging movements.

The finished cups are positively and rapidly ejected by means of a timed air jet issuing from the ejection ports 86A (Fig. 27) at a time when the guide shells are diverged under control of the opening cam 115.

Compressed air is supplied from external sources (not shown) to a coupling nipple 129 on the drum leading internally via connection 129A to the drum outlet nipple 130 (Figs. 1, 3, and 6), to which is coupled the flexible hose 131 leading up through post 62 and into the dome of the forming unit (Fig. 7) and thence through a regulating valve means 132, a cam-operated valve means 133, feed pipe 134, a standard revolving joint 135, and down into the shaft bore 86 for escape from the ejection posts 86A near the apex of the mandrel, whereby the finished paper cup is blown clear of the mandrel down into the cup receiver or trap 70.

The ejection valve 133 (Fig. 7) is actuated at the end of each cup-forming cycle by means of a cam 138 (Figs. 6 and 7), this valve being detailed in Fig. 9-A and having a roller 133A at the end of its valve stem adapted to ride the ejection cam 138.

Upon discharge from the mandrel, the newly-formed cup will be shot directly into the split annular seat of the cup trap or gate 70 (Figs. 1, 6, 35, and 36) which consists of an angular bracket clamped as at 71 on post 62, and having a split cup-seating arc 72 (Fig. 35) at its end, this seat being completed by provision of two movable arcs 73 carried on crank arm 74 respectively pivoted at 75 (Fig. 36) on the bracket and joined by a common pivot 76 connecting them for joint opening and closing motion with a rocker arm 77 having a cam roller 78 riding a cup-release cam 79 rotating with shaft 63. It is a characteristic of this cup trap that it presents a generous contact area for engagement with the fast-moving cup, by reason of which damage and crumpling of the cup is avoided.

Shortly before the completion of each cup-forming cycle, as delimited by one revolution of the drive shaft 63, cam 79 rocks lever 76 to quickly diverge and close the movable trap arcs 73 and release any previously deposited cup for gravitation into a seat in the rotary carrier 51 therebelow, Fig. 1.

Means for feeding paper blanks 45 into the mandrel, in the manner heretofore referred to in view of Fig. 29, comprises a somewhat sextant-shaped hopper casting or stacking bed 145, having a large opening approximately the shape of the blank 45 (Fig. 11) and which is adjustably secured by slot bolts 146 on a triangularly-shaped chassis member 147 having an integral bracket arm 148 bolted as at 149 to the upright post 61, as seen at the upper right of Fig. 1 and also in Fig. 6.

Spaced along two of the three inside margins of the hopper frame or casting are wire blank-supporting ledges 150 (Fig. 11) attached suitably as illustrated in Figs. 12 and 13, there being a narrow drop-off beak 151 (Fig. 15) formed integrally on the third inside margin to complete the normal three-point support for a stack of the paper blanks in the manner indicated generally at 45X in Figs. 15 and 17. Situated at intervals about the hopper frame are upstanding guard fingers 153 for confining the stack of blanks which may attain a height about as shown, the feeding being done from the bottom of this stack by a mechanically oriented and actuated pneumatic pick-up and delivery mechanism now to be described.

Means for seizing and removing the bottommost blank in the stack comprises, referring to Fig. 11, a somewhat

T-shaped lever on the cross arm 155 of which are several suction cups 156. The stem 154 of this lever, as seen best in Figs. 19, 21, and 22, is pivotally mounted on a pin 157 which is seated in a toggle block 158 supported on a pair of toggle links 159 which in turn are carried on pins 160 secured in a special slide casting 161, which is subject to a compound (angular and linear) motion, as will more fully appear hereafter.

The tail of the T-lever stem 154 is normally urged upwardly by a small compression spring 154X seated on the bottom of the block 158 (Fig. 21) and the toggle block itself is normally pulled down flat on the slide casting by a pair of traction springs 163, Figs. 21 and 22, provided the slider 161 is advanced away from its stop bracket 164, Fig. 19, also, to the position shown in Fig. 21. When the slider is moved reversely to abut said stop bracket, a roller 158R on the tail of the toggle block rides up upon a cam block 165 from the advanced position of Fig. 21 to the retracted position of Fig. 19 so as to cam the toggle block into an elevated pick-up position thereby pressing the suction cups 156 up against the bottommost paper blank, as in Fig. 15, in which condition they will seize said blank owing to the suction effect produced from a flexible vacuum line connection 167 leading therefrom (Fig. 17) to a cam-controlled pick-up valve means 168 housed beneath the plate member 147.

A vacuum control cam 169 rotates with a sprocket gear 171 turning about a stud shaft 170 (see Fig. 16 also) fixed in plate 147, and pulses the valve 168 through its cam rider 168A (Fig. 18 also) once per revolution. Valve 168 connects via line 172 (Fig. 6) to a suction terminal (from pump means 128) on the power drum lying alongside the pressure terminal at 130.

As previously mentioned, the blank pick-up and transport head undergoes a compound movement consisting of a linear reciprocation of the slide casting 161 along a slide rod 175 (Figs. 11 and 17) and a rotative or angular motion about this same rod, the latter motion being derived from the linear motion by means of a spiral roller 176 (Figs. 15 and 17) carried on slide casting 161 and working in a helical groove 177 in rod 175, it being noted, however, that the groove 177 is axially straight in the first portion of its extent along the slide rod, and becomes spirally offset toward the end, with the result that the turning of the slide casting 161, and hence of the entire vacuum pick-up means, occurs near the end of the linear advance for the purpose of orienting the seized blank 45 by swinging it into a nearly vertical plane, as in dotted lines in Fig. 15, for entry between the forming cone or mandrel 82 and the presser cone 95.

The linear displacement of the feed assembly or head, particularly the slider 161, is effected, referring now to Figs. 15 and 17, by means of a driving lever 178 pivotally carried on the underside of plate 147 on a stud shaft 179, there being a pendant roller 181 (Figs. 19 and 20, also) on a driving slide 180 which actually carries the compound slider 161 by its sleeve 161X adapted to rotate in a bushed bearing 182 in the driving slide, so that the compound-motion section 161 can turn in the driving slide while being at the same time constrained to move linearly with the latter.

The driving slide 180 is stabilized against any tendency to rock on the slide rod 175 by means of a stabilizing side roller 183 (Figs. 17, 19, and 20) working in a straight groove 147X in a portion of plate 147 paralleling rod 175.

Driving lever 178 (Fig. 17) is oscillated by means of a crank 171X splined to rotate with the sprocket gear 171, the crank having a roller 171Y which rides against the inside margin of the driving lever 178 to reciprocate the driving slider 180 at 181, as described.

Sprocket gear 171 is driven, as in Figs. 15 and 16, through chain 171A trained over a sprocket 185 fast on the vertical drive shaft 63 (see also Fig. 6 middle).

The mechanisms carried on the underside of the plate

147 are preferably shielded by means of a casing 147B (Figs. 6 and 17).

In order to eliminate sticking of the paper blanks, particularly from static electric charges, and assure that only one blank will be picked off at a time by the suction means 156, the sheets in the hopper are briskly ruffled by means of a jet of compressed air directed into their lowermost edges (Fig. 11) through the ends of jet tubes 190, 191 carried on the hopper frame 145 and connecting with a coupling T 192, which is fed with compressed air via a flexible tube 193 (Figs. 15 and 7) leading up into the dome of the cup-forming unit for connection with duct 193A and thence into a second regulating valve 194 (Fig. 6) fed from the previously-mentioned connection 131 supplying both regulating valves 132 and 194.

As previously noted, the cake cone unit has been omitted from Fig. 1 to clarify other parts of the view, but said unit is indicated generally at 300 in Figs. 2 and 37, and comprises an elongated downwardly-inclined chute section 301 mounted by brackets (not seen) footed and bolted onto the top of drum 50 at its opposite ends, so that the chute extends as a chord of the arc of the carrier 51 with its lower terminus situated above the so-called second station, said terminus being provided with an oscillable, spring-closed gate means 303 moved to an open or cone-dropping position by energization of a solenoid 305 under control of the cup-feeler switch 306 (Fig. 37).

Cake cones made of pastry dough are originally packed in protective cartons from which they are manually transferred into the special feed chute 301 in which they lie in serial sequence to move downwardly toward the discharge gate means 303. These cones are somewhat fragile and must be handled with care, and the cake-cone loading or feeding means in general must be reliable in operation not only to assure deposit of a cone in each newly formed cup, but deposit of such cone in undamaged condition, since the processing operations at the subsequent filling and sealing stations are automatic and are controlled (excepting for the ice cream filler) by the paper cups without regard to whether the latter are carrying a cake cone or not.

Such requirements have necessitated the provision of cone-feeding means with special features relating to the construction of the chute section itself, the gating mechanism and a means ancillary to the effect of gravity for positively producing an advance of the cake cones toward the gating means at the lower end of the chute.

In Fig. 37, the aforesaid advancing means is represented schematically by the coil 308 of an electromagnetic vibrating means which is a subassembly located at the head of the chute and is generally indicated at 307 in Fig. 2, and which is partially seen also in Fig. 1. This mechanism, includes a vibrating coil 308 is energized from the standard 60-cycle alternating current mains and sets up an alternating field acting upon an armature means 309 connected to the chute to vibrate the latter and jog the cake cones toward the discharge gate.

The cone-releasing gate is controlled by a feeler switch 306 situated relative to the rotary carrier 51 in a position to be engaged and actuated by the lower portion of a newly-formed paper cup being advanced by the carrier away from the first or forming station, to the second station at which the cake cone is to be dropped.

Summary of operation

Operator's supervisory controls for the cup-forming mechanism include a start button 200 and a stop button 201 (Figs. 6, 31, and 37) for actuating corresponding switch means contained within a housing section 202 of the bracket casting. This switch means energizes relays to set up holding and supervisory circuits for the electromagnetic clutch 64—64A, thus coupling the main drive shaft 63 with the synchronizing drive head 66 on the power drum, button 201 being effective to break

the holding circuits for said clutch, as will be more fully described in view of Fig. 37.

It may be also remarked here with reference to Fig. 2 that a number of additional control buttons and switches A, B, C, D, and E, relating to control circuits to be described hereinafter, for the master power unit and associated instrumentalities, are carried on an overhead circular shell 277 supported concentrically above the carrier hub by a goose-neck structure 278 attached to the side of the drum.

Referring to Fig. 37, the machine is conditioned for operation by closure of master control switches A and B (located in the overhead shell 277, Figs. 2 and 37), which respectively connect the low voltage or "8-volt" supply to the countershaft control circuits for actuating air-valve solenoids of the heat sealer and ice cream valve.

The contacts 340 of switch A connect power from one side of the 8-volt supply via conductor 341 to one common terminal of each of the air-valve solenoids, the remaining supply conductor 342 connecting in common to one contact of each of two countershaft switches 344, 345 in the drum. The remaining contact of switch 344 connects via conductors 347 and 347A to the remaining terminals of the heat sealer "on" valve solenoid 348, and the ice cream valve "on" solenoid 350; while the remaining terminal of the other countershaft switch 345 connects via conductors 346 and 346A to the remaining terminals of the heat sealer and ice cream valve "off" valve solenoids 349 and 351, respectively.

On the end of master countershaft 53A (Figs. 3, 5, and 37) are two button cams 353, 354, each of which is provided with two small buttons such as 353A, 353B (seen in Fig. 3), which are 180 degrees apart so that each of said countershaft switches will be actuated twice per revolution of the master countershaft with a consequent energization of each pair of "on" and "off" solenoids twice per revolution of said countershaft, since the carrier 51 moves the distance of two cup pockets per revolution of countershaft 53A, and said sealer and ice cream valve are therefore actuated through a complete operating cycle (opened and closed) in correspondence with each cup advance.

It may be noted here that, while the nut and syrup valves N and S are structurally a part of the filler unit F, they are operated electromagnetically from the low voltage supply, and are both controlled by corresponding feeler switches (not seen) located beneath the carrier slightly in advance of the said valves to be actuated by engagement of feeler fingers with the lower parts of the paper cups in the carrier, in advancing toward the respective positions thereof. Since the operation of the chocolate and nut valves is not directly and positively controlled by other components of the claimed combination or subcombination, further details of these devices and their control circuits are not set forth herein.

Closure of master switch B (Fig. 37) effects the connection of 117-volt power via contacts 356, conductor 357, to the heater units (not shown) in the heat sealer, and via rotary contacts 87—87A to the heaters in the cone mandrel 82.

Another pair of contacts 360 on master switch B connects 117-volt power via conductor 361 to energize the pump motor 128.

It may be observed here that switches A and B, as depicted in Fig. 37, are lever switches which remain in the operated or non-operated conditions into which they are turned, while the remaining switches C, D, and E are momentary button switches and remain operated only so long as held down.

With the pump motor 128 and necessary low-voltage and heater circuits established by operation of switches A and B, as aforesaid, the operator may start the carrier 51 in step-by-step travel by pushing the button of start switch C (Fig. 37), thereby closing "start" contacts 365 and applying power via conductor 366 to energize the

"start" relay 367, whereby to close relay contacts 368, 369 and energize the main driving motor 52 via conductor 370, so that the master countershaft 53A will be driven through the described sprocket drive from the reduction gear unit G.

The "start" relay sets up its own holding circuit through normally closed "stop" master switch contacts 372 of switch D, conductor 373, closed "start" relay contacts 374, 375, and jumper 376.

In order to stop the carrier, the "stop" switch D is operated, thereby opening contacts 372 and breaking the holding circuit to drop out relay 367.

If the operator wishes to nudge or jog the carrier along, the "jog" switch E is operated to close contacts 380 and energize the "jog" relay 382, via conductor 381, whereby to close relay contacts 383, 384, and apply power via jumper 385 and the normally closed contacts 386, 387, on the "start" relay (which must be in non-actuated condition for the jogging operation) so that the main drive motor 52 is then energized, as before, via conductor 370, which is commoned to the starting contact 369, along with normal contact 387.

When the "start" relay is held in, as aforesaid, responsive to operation of the start switch C, the carrier will continue to step independently of any operation of the cup-forming mechanism, and by reason of the intermittent actuation of the two countershaft switches 353, 354, there will be a concurrent alternate opening and closing of the heat sealer jaws 275, and intermittent operation of the ice cream valve in synchronism with the stopping periods of the carrier; and these operations occur without regard to the presence or absence of cups in the carrier, since the absence of cups has no harmful effect on the sealer jaws, and any ice cream ejected will be collected via a small return chute 276 (Fig. 5), for ultimate manual return to the ram.

Referring to the diagram of Fig. 37, to start the cup-forming apparatus, assuming master motor 52 to be running, as aforesaid, button 200 is pushed, thereby closing start switch 200A which applies power from one line terminal T₁ via conductor 203 to conductor 204 connecting with the parallel supervisory switches 205, 206, one or the other of which will normally be closed, switch 205 being the anti-jam switch heretofore mentioned as actuated by the stud 105 on the presser roller assembly (Fig. 28), while switch 206 is the overlap switch into the dome (Fig. 6) actuated by a cam 207 on cup drive shaft 63.

Since no paper jam normally exists, switch 205 will be closed and power will therefore be connected to the normally closed stop switch 201A, and thence via conductor 212 to the coil of a first relay 213 for which the energizing circuit is completed to the remaining power line terminal T₂, so that relay 213 pulls in, thereby closing its holding contacts 214, which replace or shunt the starting connection to terminal T₁ initially set up by start switch 200A, with the result that the first relay 213 continues in operated condition.

Operation of relay 213 at once causes operation of a second relay 220 as a result of closure of contacts 217 on the first relay, thereby completing a power circuit from power source T₁, contacts 217, conductor 218 to the coil of secondary relay 220, causing the latter relay to pull in and likewise set up its own holding circuit at its now-closed contacts 221, which will be connected to power T₁ via conductor 222 and cam stop switch contacts 223, actuated by cam 224 on drive shaft 63.

Another incident to operation of the secondary relay 220 is closure of clutch-operating contacts 226 to apply direct current from a source 228 via conductor 229 to energize the coil 64B of clutch means 64 to interconnect the synchronizing spindle 65A, 66, and cup drive shaft 63; and as soon as this happens the cycling stop switch 223 will close and complete the aforesaid holding circuit for the secondary relay, so that under usual conditions the cup drive shaft 63 will always complete one revolution

even though the primary relay 213 might be dropped out.

The foregoing starting circuit is under control of an automatic cam "start" switch 67 in series with the operator's starting switch 200A and power terminal T₁. A cam 68 on the drive-sprocket side of the clutch closes this automatic start switch once per revolution, the actuations of this switch action occurring in rapid succession, so that there is no delay appreciable to the operator upon pushing starting button 200 before the mandrel system begins to operate. This feature is part of the supervisory synchronizing means, as will appear more fully hereafter.

When clutch 64—64A is held actuated by the aforesaid operation and locking-in of the primary and secondary relays, cup-drive shaft 63 will be driven without interruption (barring a jam-up) until the operator's stop switch 201—201A is actuated; and concurrently the paper-feeding means is driven through sprocket drive 65 causing the pneumatic pick-up head with suction cups 156 to execute its compound movements repeatedly in seizing the bottommost paper blank from the stack and simultaneously advancing and turning the same for entry in between the heated forming mandrel 82 and the yieldable presser cone 95 (at this time standing away from the mandrel owing to action of the cam 101 in retracting same), the pair of guide shells 106, 107 likewise being rocked away by the cam and tappet means 113—115, said shells being closed, and said presser being snapped back, when the leading edge of the blank is in proper entry, with resultant spinning of the blank into a conical cup and concurrent overdriving and guiding of the latter by the speeder wheel. The sealing of the heat-sensitive adhesive begins with the first overlap of the complementary sealing deposits along margins 46, 46A—48, 48A of the blank, the adhesive along the top lane 47 being unaffected in this phase, and such sealing is fully completed by the time the cup has made three revolutions (owing to step-up drive ratio at the pulley means) at which time the guide shells and presser roller are again opened out to free the cup and admit the next blank.

When the guide shells and presser cone are released or opened, the ejection valve 133 is momentarily opened by cam 138 admitting compressed air from line 134 and pump means 128 in the power head 50 into the mandrel via the rotary joint 135, in consequence of which the finished cup is blown clear of the mandrel by air issuing from ports 86A at the apex of the mandrel.

The newly-formed cup moves with considerable velocity and lodges directly in the cone receiver or gate 70; and meanwhile the next inserted blank stands ready to be drawn onto the mandrel. Before the ensuing cup-spinning phase the previously completed cup will be gated or discharged into one of the open-sided seats or pockets P in the carrier 51, which is at this time stopped, the discharge cam 79 on shaft 63 acting in this interval through link means 77 to open the gate jaws 73 and release the cup.

The rotary carrier 51 steps in exactly-maintained synchronism with the foregoing operation of the various parts of the cup-forming and discharging mechanism by reason of the common interdriving means 53A, 55, 51A, 66, 65A for the carrier, and the main cup drive shaft 63 of the cup-forming and gating means. While the next cup is being formed, the carrier 51 will advance one step and carry the previously gated cup into the second station below the discharge end of the cake-cone feeding unit 300, the apex portion of the cup in this position closing the cup feeler switch 306 to energize the cone gate solenoid 305 and discharge a cake-cone into said cup, which will thereafter be moved by the carrier preferably through several steps before arriving at the third station beneath the ice cream valve I in the filler or loading head generally designated F.

The ice cream valve, as disclosed in the previously-identified application, includes a vertically reciprocable

nozzle portion 352, the movements of which are controlled by two air valve solenoids 350, 351 which in turn are controlled by the countershaft switches 344, 345 in the drum 50, actuated as aforesaid at regular intervals by the button cams on countershaft 53A.

The cup, after being loaded with a cake cone and a portion of ice cream, is moved by the carrier two more steps, stopping first beneath the syrup valve S and next beneath the nut valve N, the respective valve means of which are respectively actuated by solenoids indicated schematically in Fig. 37, the solenoids being controlled by cup feeler switches (not shown) similar to switch 306, whereupon the filling of the cup is completed.

Subsequent plural stepping of the carrier will lodge the filled but still-open cup beneath the closing and sealing unit HS, which has heated, trihedrally-nesting jaws 275 to seize the upper margins of the cup and fold and seal the same in a trifoliate pattern more particularly described in the aforesaid copending application, Serial No. 677,862, filed August 13, 1957, whereupon the processing operation is completed; and still further stepping of the carrier will move the sealed package away from the heat sealing station through such a plurality of steps (before again approaching the first station) as will give ample time to the attendants to remove the cup package for careful packing in boxes to be deposited in low-temperature hardening rooms until ready for shipment.

It is now emphasized that the over-all synchronizing control, subject only to the operator's supervisory control at button switches 200, 201, originates in the power head or drum 50 and the associated cam and pinion instrumentalities 55, 56, actuated from the countershaft means 53A thereof, all of the operations of the cup-forming mechanism including the gating of the finished cups into the rotary carrier, being coordinated with the movements of said carrier through interdrive means 65A, 66, and cup drive shaft 63, the ice cream valve and heat-sealing unit likewise being accurately synchronized with the carrier movements by control means in the power head in the form of the countershaft switches 344, 345, it being emphatically essential that the filled cup shall be accurately spotted beneath the closing and sealing jaws to prevent mutilating or destroying the end product.

The production rate of the disclosed machine is consistently high owing to the concurrent internal fabrication of the paper cup as a step of the process, and to the fact that cups are completed at a high speed of one per second and yet are ready for loading at once upon transfer into the carrier after being intercepted for only a brief interval for safety purposes by the gating means. To achieve such results, the fabrication of the cup not only must be rapid, but the loading of the newly-formed cups undamaged into the carrier pockets must be effected with comparable speed and accuracy.

By reason of the aforesaid operative interdependence of the cup-forming mechanism and the gating means with the stepping mechanism of the carrier, a cup will be formed only during an interval which bears a fixed time relation to the starting and stopping of the carrier, and no cup can be released into the carrier while the latter is in motion; yet, in case of a paper jam in the mandrel system, the carrier can continue its travel so that partially processed units will be completed, all without disturbing the basic synchronism of the system as a whole.

In this connection, it should be recalled that when the starting button 200 is pressed, the cup-forming mechanism always cycles itself into a condition of synchronism with the carrier stepping drive through the "starting switch" means, which is positively driven from the master stepping shaft 53A through the agency of the power head or take-off spindle means 65A, 66, so that while it is possible to start and stop the cup-forming mechanism at will, and to stop the same automatically in case of a jam, this part of the system is auto-synchronous, and the system as a whole is automatic in all respects save for

manual removal of the sealed packages from the carrier, which operation is performed manually because of the fragile character of the finished product and the necessity for care in packing the sealed cups properly in cases for transfer to the hardening rooms, which procedure also affords opportunity for final visual inspection of each package.

The provision of open-sided cup pockets P in the carrier enables the operators to slide the finished cups sidewise out of their seats with only a slight starting lift to unseat them. This feature saves a good deal of time and eliminates damage which otherwise frequently occurs where the finished cup has to be lifted wholly clear of a closed seat in order to remove it.

Initially, the paper cup is very light in weight and requires a certain amount of care to avoid crumpling in such rapid operations as ejecting the cup instantly from the mandrel system and loading the same in the carrier. But as the cup progresses around its loading circuit, it becomes increasingly heavier and tends to settle and wedge itself into the carrier pocket. The open-sided form of carrier pockets P moderates such wedging, yet hold the cups securely during such a vigorous operation as the seizure, folding-in, and sealing of the top wings.

In the previously-mentioned copending application Serial No. 379,332, there is shown a mobile power head or drum having features similar in part to those of the power unit 50 depicted herein in Figs. 1 and 3. However, the device of the copending disclosure operates with ready-made containers which are of a construction wholly different from that in the instant application and which are closed in a manner quite different from that set forth herein, the prior device being distinguished, among other things, by the fact that it is incapable of concurrently processing (i.e. loading with a plurality of ingredients at different stations, and sealing) and concurrently fabricating its own containers for high speed serial infeeding into the processing line.

In the preferred duty cycle, cups will be formed at the rate of 60 per minute or one per second, and as previously elaborated, the blank will remain on the mandrel for only about two-thirds of the cycle, although it will be turned through a plurality of revolutions in that brief interval.

It will be apparent therefore that the carrier can advance once per second to lead-out this rapid supply of cups.

One-third of a second in this duty cycle is allowed for infeeding of the blank and ejection of the finished cup, and these two actions begin at nearly the same instant.

The carrier comes to rest during each such cycle just before the ejection occurs, although the ejected cup will be briefly arrested by the interceptor or gate for about one-quarter of the cycle, beginning with the stoppage of the carrier and commencement of the ejecting operation.

Thus, the carrier is at rest for substantially one-half cycle or 180 degrees, graphically speaking; and the new cup rests in the interceptor for about one-quarter of a cycle or 90 degrees, beginning at the same instant, which leaves 90 degrees of the stopping phase in each second during which the gate can be opened and the new cup caused to gravitate through the short remaining distance into the carrier transport means.

While the master driving means, including the master or carrier countershaft 53A and the associated take-off spindle means 66, etc., are substantially auto-synchronous as regards the master drive unit itself and the associated sealer and filler control or countershaft switches 353A, 353B, the interdriving means including the sprocket drive means 65 and positive electromagnetic clutch means 64 would drive the main cup-driving and timing countershaft 63 in step with the carrier only so long as an initial synchronism might remain undisturbed; and in order to free the machine from such an operating handicap, the

auto-synchronizing feature including the switch means 67—68 and associated supervisory circuits are provided so that no matter what the cause of stoppage may be so far as the cup-forming mechanism is concerned, whether by the operator's act or a jam-up, the synchronism will automatically be restored whenever the operator actuates the starting control, and the interval required to establish such synchronism is so brief as to be insignificant.

I claim:

1. In a continuous-flow processing and packaging machine, improvements comprising: a rotary cup carrier; master drive means for rotating said carrier step-by-step at a predetermined rate; driven cup-forming mechanism operable to form a cup from a paper blank; means operatively associated with said forming mechanism for feeding paper blanks one at a time into said forming mechanism; means operably controlled by the forming mechanism for discharging the formed cups one after another into space toward said carrier; cup-intercepting means positioned between the carrier and forming mechanism and having a cup seat with releasable gate operable to receive, hold, and release discharged cups; together with means driven from said master drive means operatively driving and actuating said forming mechanism, said feeding means, said discharging means, and said gate in timed coordination for operation in duty cycles each completed between successive steps of the carrier, whereby one cup can be completely formed and delivered into said carrier during any said duty cycle.

2. In an ice cream confection machine, in combination, a rotary step-by-step carrier having concentrically located, open sided pockets thereabout; rotary mandrel means mounted radially of the turning axis of the carrier and including coacting blank-infeeding means and pneumatic cup-ejection means for forming a paper blank into a cup and forcibly ejecting the same into space in a direction into the path of said pockets in an interval between synchronized steps of the carrier; coacting driving and interdriving means for stepping said carrier and actuating said mandrel means in synchrony as aforesaid; gating means controlled by the mandrel means and positioned between the latter and the carrier operable to intercept and release ejected cups in sequence into the carrier at times when the latter is at rest between steps; an electrically controlled ice cream valve positioned to inject a charge of ice cream into each cup at a stopping station beyond said gating means in the direction of carrier travel; electrically-controlled cup-closing and sealing means located at a stopping station beyond said ice cream valve in the direction of carrier travel; and switch means actuated cooperatively with the carrier-stepping means at predetermined intervals corresponding to each carrier step and connected in control circuits with said ice cream valve and said closing and sealing means to actuate the same at times when said carrier is at rest.

3. Concurrently acting apparatus for forming and loading conical cups comprising: a rotary carrier having circumferentially spaced cup seats located at uniform steps thereabout; a power unit mounting said carrier for movement in a horizontal plane; master driving means in said unit, and means providing an intermittent driving connection between said master drive means and said carrier for effecting step-by-step uniform rotary travel of the latter; cup-forming and feeding mechanism including a rotary cone-forming mandrel and means mounting same on said power unit above and at one side of said carrier and including a cup countershaft connected to rotate said mandrel; means providing interruptible driving connection between said cup countershaft and said master drive means of the power unit; a hopper for cup blanks mounted adjacent said mandrel, blank pick-up and transport means having a timed driving connection with said countershaft and mounted relative to said hopper to pick off blanks one at a time therefrom and

deliver the same onto said mandrel to be turned into a cup thereby; cup-feeding means located between the mandrel and carrier and operatively controlled and driven from said cup countershaft for intercepting cups leaving the mandrel and freeing the same serially for gravitation into cup seats in the carrier; together with cup-releasing and ejecting means cooperatively associated with said mandrel and controlled from said cup countershaft for ejecting formed cups from the latter in timed relation to stepping of said carrier and freeing operation of said cup-feeding means while the carrier is stopped.

4. In combination, cup-forming mechanism including driven cup fabricating means operable in cycles to form a blank into a cup in each cycle, and blank-feeding means driven in timed coordination therewith for feeding blanks serially thereto at the beginning of each said cycle; a cup transport having serial cup pockets; intermittent drive means for advancing the transport one pocket at a time along a path in alignment with said fabricating means to receive cups therefrom; and self-cycling means for driving said fabricating means in step with said intermittent drive means in a timed relation in which said transport comes to rest to receive a cup substantially at the end of each said cycle, and starts to advance the distance of one pocket subsequent to the beginning of such cycle; together with means for regulating and guiding the passage of cups from the fabricating means into pockets in said transport.

5. Packaging apparatus for automatically forming and immediately loading conical cups comprising: a rotary cup carrier having circumferentially spaced cup seats located at uniform steps thereabout; a console power head mounting said carrier for movement in a horizontal plane; master drive means in said head; means providing a driving connection between said master drive means and said carrier for effecting timed step-by-step rotary travel of the latter; cup-forming and out-feeding mechanism including rotary cone-forming mandrel means and means mounting same on said power head at one side of said carrier; a cup countershaft carried by said head and connected to rotate said mandrel means; means providing a self-synchronizing, start-stop driving connection between the said countershaft and said master drive means of the power head; supervisory control means for starting and stopping said cup countershaft; a hopper for cup blanks mounted adjacent said mandrel means; travelling blank pick-up and transport means drivingly connected with said cup countershaft and mounted relative to said hopper to pick off blanks one at a time therefrom and deliver the same into operative engagement with said mandrel means for forming by the latter; a cup-intercepting trap having a cup seat positioned relative to said mandrel means to receive a cup therefrom; cup-releasing gate means part of said trap and operatively interconnected with said cup countershaft to release any cup trapped therein at a time when the carrier is stationary; together with pressure-operated cup-discharging means cooperable with said mandrel means for forcibly ejecting formed cups from the same into said trap in timed relation to stepping of said carrier and release-operation of said cup-gate means; and control means actuating said feeding, ejecting and gate means from said countershaft in step with movements of the carrier for operation as aforesaid.

6. Apparatus for packaging an ice cream confection comprising, in combination with a master power console having a driven master countershaft and at least one power take-off spindle driven in synchronism therewith and situated at its top at a position radially of the center thereof, and further including a source of both negative and positive air pressure; rotatable cup-shaping mandrel means mounted on and above said console adjacent said power take-off spindle and having a driving connection therewith; means including a mechanically and suction-actuated paper-blank feeder driven synchronously with

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said mandrel means to feed cup blanks one at a time thereto, said blanks being provided with a heat sealable adhesive; means for heating said mandrel means to seal the shape of cups formed thereby; a circular cup carrier having cup pockets about its rim and mounted to rotate beneath said mandrel means about said center; means driving said carrier start-stop from said master countershaft in intermittent steps; positive air-pressure cup-ejecting means cooperably controlled and associated with said mandrel means for ejecting cups therefrom for movement into said pockets; means for feeding cake cones seriatim into a position above the path of ejected cups in the carrier pockets; means located at a position to be operably controlled by newly-deposited cups to release the leading one of said cones into the controlling cup therebeneath; means at a position farther from said cone feeding means and radial of said center for injecting ice cream confectionery into the cake cone of each cup moved to said position by the carrier; heat-sealing means on the power unit at a still farther radial position beyond said injection means and including heated jaws and means operating the same to seize, seal, and release the top of the loaded paper cups, and means controlling the operation of said injecting and heat-sealing means from said master countershaft to actuate the same respectively at times when the carrier is at rest with one of said carrier pockets in register therewith.

7. Concurrently acting cup-forming and feed-out apparatus comprising a rotary hot-mandrel system for turning heat-sealable blanks into conical cups; means for feeding said cup blanks seriatim into said mandrel system; air-jet ejection means cooperable with the mandrel system and operable approximately simultaneously with said feeding means to expel finished cups therefrom; driven mechanism actuating said feeding means, said ejection means and said mandrel system in timed coordination to repetitiously feed and form blanks one at a time into cups and forcibly eject the finished cups in a certain path from said mandrel means; a rotary cup carrier with cup-seating formations disposed beneath the mandrel system and in said ejection path; cup-gating mechanism operably controlled by means part of said mandrel system and interposed in said path between the carrier and mandrel system to intercept, momentarily hold, and quickly release ejected cups and drop each of the same into one of said carrier seating formations; a stepping mechanism operable to move said carrier one uniform step at a time; and motor-driven means drivingly interconnecting said driven and said stepping mechanisms for concurrent actuation, as a result of which cups are formed one at a time and rapidly transferred by forced ejection, intercepting, and gating into said carrier for step-by-step travelling by the latter over a predetermined circuitous processing path.

8. For use in a machine of the class described, in cooperative combination: a rotary mandrel system including a main mandrel and a presser mandrel movable toward and away therefrom to press upon a paper blank thereon for spinning into a cup on the main mandrel and thereafter to release its pressure upon said cup when the presser roller is opened away therefrom; an open-bottom stacking hopper for paper cup blanks adjacent said mandrel system; feed means including a pneumatic blank pick-up device movable back and forth linearly and angularly between the bottommost blank stacked in said hopper and an oriented infeeding position adjacent said main and presser mandrels to insert a blank between the latter in open relation; a power-driven master countershaft; a main-driving shaft for the mandrel system; clutch means operable to drivingly interconnect and disconnect said master countershaft and said system driving shaft; feed drive means driving said feeding device in synchrony with said mandrel system from said system-driving shaft; and operator's control means for said clutch including a starting control means and a stopping control means

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respectively operable to engage and disengage said clutch means in a predetermined uniform cycle of operation commencing with a closure of the presser mandrel toward the main mandrel and ending with an opening separation of the presser mandrel from the main mandrel; and mechanism including timing means driven from said system driving shaft for moving said presser roller toward said main mandrel at the beginning of said cycle; and away therefrom near the end of said cycle.

9. Claim 8 further characterized in that said main mandrel is provided with an air-ejection jet port and valve means connected and openable to admit compressed air thereto to eject a cup from the main mandrel; and valve control means operating automatically under control means actuated by said system driving shaft for opening said valve means substantially at the termination of the cycle aforesaid to forcibly eject finished cups therefrom at a time when said presser roller is away from the mandrel as aforesaid.

10. In a cup-forming mechanism: a rotary forming mandrel; a rotatable press roller mounted to move toward and away from the mandrel and normally spring-urged to ride against a blank on the mandrel; a cup drive shaft and counterdriving means connecting same to rotate the forming mandrel; means driven by the cup drive shaft for periodically moving the presser roller away from the mandrel to admit a cup blank and thereafter releasing same for spring movement to press and ride upon the blank; a pair of pivoted guide shells movable toward the mandrel to closely confine a blank for rotation therewith, said shells being movable oppositely to open away from the mandrel; means controlled from said cup drive shaft for opening and closing said guide shells relative to the mandrel in synchrony with the opening and closing of said presser roller to permit discharge of a formed cup and to admit a blank as aforesaid.

11. In a cup-forming machine, a conical forming mandrel especially for use with cup blanks having heat-sealable adhesive thereon, electric heater means in said mandrel, driven shaft means for rotating said mandrel, a pair of guide shells of heat-conductive material and pivotally mounted close to said mandrel to converge to a normal, closely spaced relation thereto and confine the travel of a cup blank therewith; and also to diverge therefrom to free the finished cup and admit another blank; presser roller means mounted for movement against a blank on said mandrel and away therefrom to free a cup and admit a blank as aforesaid; and an extension on at least one of said shells providing a heat-conductive protuberance adjacent the apex of the conical mandrel to provide a concentration of heat thereat and to guide the corresponding portion of the formed cup into complete closure at its apex.

12. A construction according to claim 11 further characterized by the provision of a speeder roller mounted on at least one of said shells and having a peripheral portion exposed through said shell to engage the surface of a blank on said mandrel and means cooperably driven with said mandrel for rotating said speeder roller at a speed substantially in excess of that of the mandrel whereby to aid in keeping the blank in predetermined registry on the mandrel.

13. Apparatus according to claim 12 in which said mandrel has a concentric groove opposite said speeder roller of a depth to permit the latter to press said blank at least slightly therein to further assure registry as aforesaid.

14. In a high-speed mechanism for forming conical paper cups from prepared blanks having heat-sensitive seaming adhesive thereon, a conical forming mandrel and means for rapidly rotating the same; a presser roller yieldingly urged against the mandrel to press a blank thereagainst for rotation therewith; a pair of heat-conductive guide shells pivotally mounted to converge and diverge relative to the mandrel into and from a position closely

about the total periphery of the mandrel except in a mutually spaced-apart region flanking said presser roller, whereby to concentrate heat about a blank on the mandrel and confine the blank thereon; electrically energized heating means in the mandrel and means for conducting energizing current thereto; one of said shells having an extension opposite the apex portion of the mandrel to turn the apex portions of the blank thereon to complete the bottom closure for the cup, and the companion shell having an enlarged body mass opposite a substantial apex portion of the mandrel to augment the concentration of heat at said apex portion and ensure complete adhesive sealing of said bottom closure for the cup.

15. In an automatic container-forming apparatus of the class described, a rotatable mandrel mounted with its axis at an angle to the vertical for spinning a paper blank into a container; drive means for rotating said mandrel; a hopper mounted relative to said mandrel to hold flat paper blanks horizontally in a stack; blank-feeding means including a pick-off device and means mounting same for compound linear and angular motion along a path between said hopper and mandrel, said device carrying releasable blank-seizing means adapted to be pressed against the surface of a blank and operable to releasably hold the blank substantially in planar shape; mechanism part of said feeding means for reciprocating the pick-off device linearly a predetermined portion of the distance between one side of said stack and the mandrel to present said seizing means against a surface of an outermost blank in the stack and seize and separate the blank from the stack responsive to linear motion of the pick-off device away from the hopper and toward said mandrel; means part of said feeding means acting automatically as a function of movement of the pick-off device a certain distance away from hopper to turn said device an amount to orient said blank into a plane approximately paralleling the periphery of said mandrel while simultaneously travelling the blank toward and finally onto the mandrel; and means operating in timed relation to the engagement of said blank with the mandrel as aforesaid for disabling said seizing means to free the blank for subsequent travel with the mandrel.

16. In a machine for concurrently forming empty paper packaging units and immediately travelling the same in uniform start-stop motion relative to a succession of loading devices, the combination of: a unit carrier and cyclically-operable start-stop drive means therefor operable in repetitious duty cycles to advance and stop the carrier; package-unit forming mechanism operable in duty cycles from a main driving and timing shaft to form one said unit per cycle and release the same close to the end of such cycle; auto-synchronizing and control means providing a synchronizable interdriving means between said carrier drive means and said main shaft and including an electrically-actuated clutch operable to drivingly interconnect and disconnect said drive means and main shaft; a control circuit including start and stop switching means connected with said clutch to operate, hold, and release the same; and auto-synchronizing switch means operated cyclically by said main shaft and connected in said control circuit to delay operated actuation of said clutch means by said starting switch means until said main shaft is in a predetermined angular timing and phase-relation with respect to the aforesaid duty cycle of said carrier drive means whereby the release of said packaging units by the forming mechanism is made to occur in each cycle thereof only at a time when a duty cycle of the carrier is substantially at an end.

17. In cooperative combination, mechanism for forming and seaming cups from prepared blanks fed thereto; feed means coacting with said forming means for feeding blanks thereto; ejecting means operatively synchronized with said forming means for ejecting formed cups therefrom along a predetermined trajectory; means located on said trajectory and operating in synchrony with said

forming means for intercepting and releasing ejected cups for gravitation therefrom; a processing carrier having cup pockets and moving in a plane below said intercepting means at a level at which the gravitating cups can drop directly into said pockets; and start-stop driving means operatively coupled with said carrier and said forming means to advance and stop the carrier in synchrony with the release of cups by said intercepting means.

18. In cooperative combination: a travelling cup carrier and drive means operable to advance and stop the same at uniform intervals; automatic forming mechanism operable in cycles to make one paper cup per cycle from a prepared blank and including coating means for operatively feeding such blanks thereto, and cooperative means for ejecting finished cups therefrom near the end of such cycle for transfer into said carrier serially at times when the carrier is stopped; together with synchronizing interdrive and autosynchronous control means operatively associated with said drive means and said forming mechanism to stop the carrier substantially at the conclusion of each cup-forming cycle prior to ejection of the correspondingly formed cup, and to advance the carrier thereafter during an interval occurring within the limits of an ensuing cycle and regulate the actuation of the forming mechanism in predetermined phase relationship with cyclic operation of said carrier.

19. In a continuous-flow confection-fabricating and packaging machine, in cooperative combination: self-synchronous cup-making apparatus including paper-blank-feeding, spinning, and cup-ejecting mechanism coordinately operable in cycles to spin a blank into permanent cup form and eject the same; a circuitously-travelling cup carrier mounted to receive cups ejected from said cup-making apparatus and transport the same into and out of alignment with a predetermined number of successive loading devices respectively located and adapted to deposit confection ingredients into each cup in timed coordination with the arrival and stoppage of said cups at the respective station locations thereof along the circuit of said carrier; and cooperative master driving and interdriving and control mechanism for actuating said cup-making apparatus and advancing said carrier in timed relation to the cycles of said cup-making apparatus in such manner that the carrier can advance only in the interval following the commencement of any such cycle, and substantially at or prior to the conclusion of such cycle.

20. Apparatus for forming and loading containers comprising: an intermittently advanced carrier with container seats spaced in sequence; drive mechanism for moving said carrier intermittently in advancing cycles; loading mechanism positioned adjacent the carrier and operable to direct a charge of material into a container in a carrier seat at a certain location along the path of advance thereof; a first control means operatively associated with said drive mechanism for actuating said loading mechanism at a certain time during each said cycle; means having an operating cycle for forming one cup per cycle from a prepared blank; means operating in timed relation with said cup-forming means to feed a proposed blank thereto at the commencement of each forming cycle; means operating in timed relation with said forming means in each forming cycle to transfer finished cups therefrom into one of said carrier seats; a second control means operatively associated with said forming mechanism for actuation to drivingly interconnect and disconnect the same with said drive mechanism for both sustained operation in successive forming cycles, and optionally in single cycles, as aforesaid.

21. Apparatus according to claim 20 further characterized in that said second control means includes automatic stopping means acting to stop operation of the forming mechanism at the end of each forming cycle; and manually-actuated control means operably interrelated with said automatic stopping means to prevent

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stopping operation of the latter and effect repetitious cyclic operation of the forming mechanism.

22. Apparatus according to claim 20 further characterized in that said second control means includes a supervisory control means operatively associated therewith and with cup-shaping mandrel means in said forming mechanism and actuated by a jammed blank thereon to stop the forming operation by automatically effecting a disconnecting operation of the second control means.

23. In a machine for forming tapered frangible paper containers and transporting the same relative to a loading means for deposit of a material charge therein, improvements comprising: a container carrier in the form of a rotatable member having an outer periphery with a series of container-seating openings therethrough and each positioned closely adjacent said periphery with a sidewall portion thereof opening laterally through said periphery, said opening limited in size to prevent a tapered container of predetermined size normally resting down in said seat from escaping sidewise therethrough but large enough to permit passage of the container sidewise out through said lateral opening provided the container is elevated in the seat far enough to align a sufficiently narrower part of the taper thereof with the opening.

24. In a machine for forming conical paper cups from preshaped blanks prepared with heat-sealable adhesive, improvements in forming and sealing means including: a rotatable shaping mandrel of heat-conductive material on which said blanks are received and turned into conical

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cup-shape; means for rotating the mandrel; means situated internally of the mandrel for heating the same; jacket means forming a spaced shell substantially about said mandrel for confining the blank thereon, said shell comprising a plurality of heat-conductive members mounted in juxtaposition to the mandrel for movement into normally closed jacketing relation in close proximity to the mandrel, and into an open relation spaced from the mandrel wholly free from a formed cup thereon; and jacket-actuating mechanism operable to open and close the shell members relative to the mandrel as aforesaid, together with means for pressing a blank against the mandrel during closed condition of the jacket means, and for relieving pressure on the blank during open condition of the jacket means.

25. Apparatus according to claim 24 further characterized in that said pressing means includes spring means normally urging the same toward the mandrel to engage a blank thereon and permitting the pressing means to yield responsive to jam-up of blank paper between the same and the mandrel, there being a supervisory operating control operatively associated with said rotating means and including an actuating member therefor moved responsive to jam-up yielding of the pressing means to disable said operating means.

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