Oct. 31, 1939. H. M. HILL 2,177,652

MACHINE FOR MAKING CUPS

Original Filed Oct. 6, 1936 7 Sheets-Sheet 1

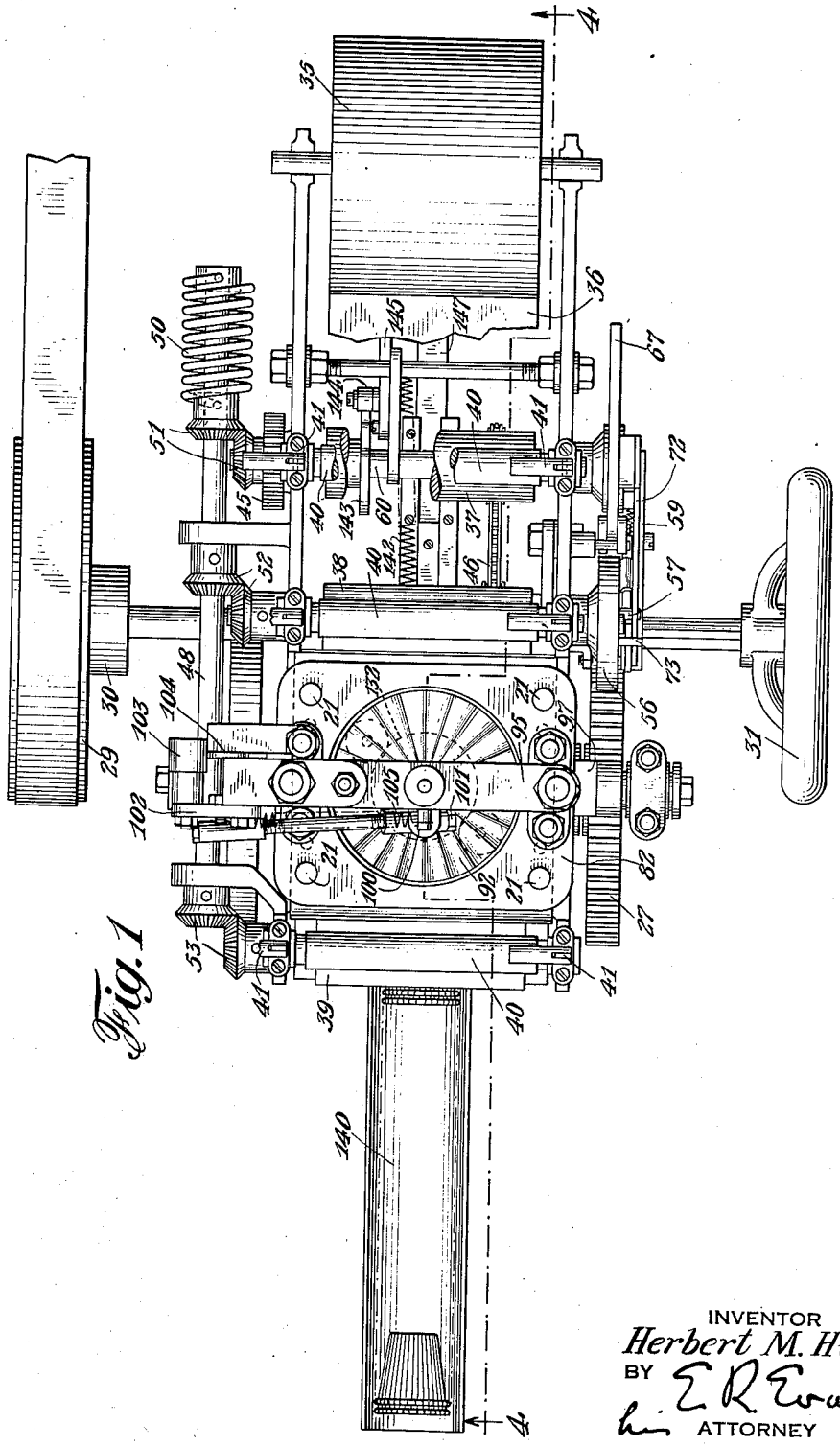


Fig. 1

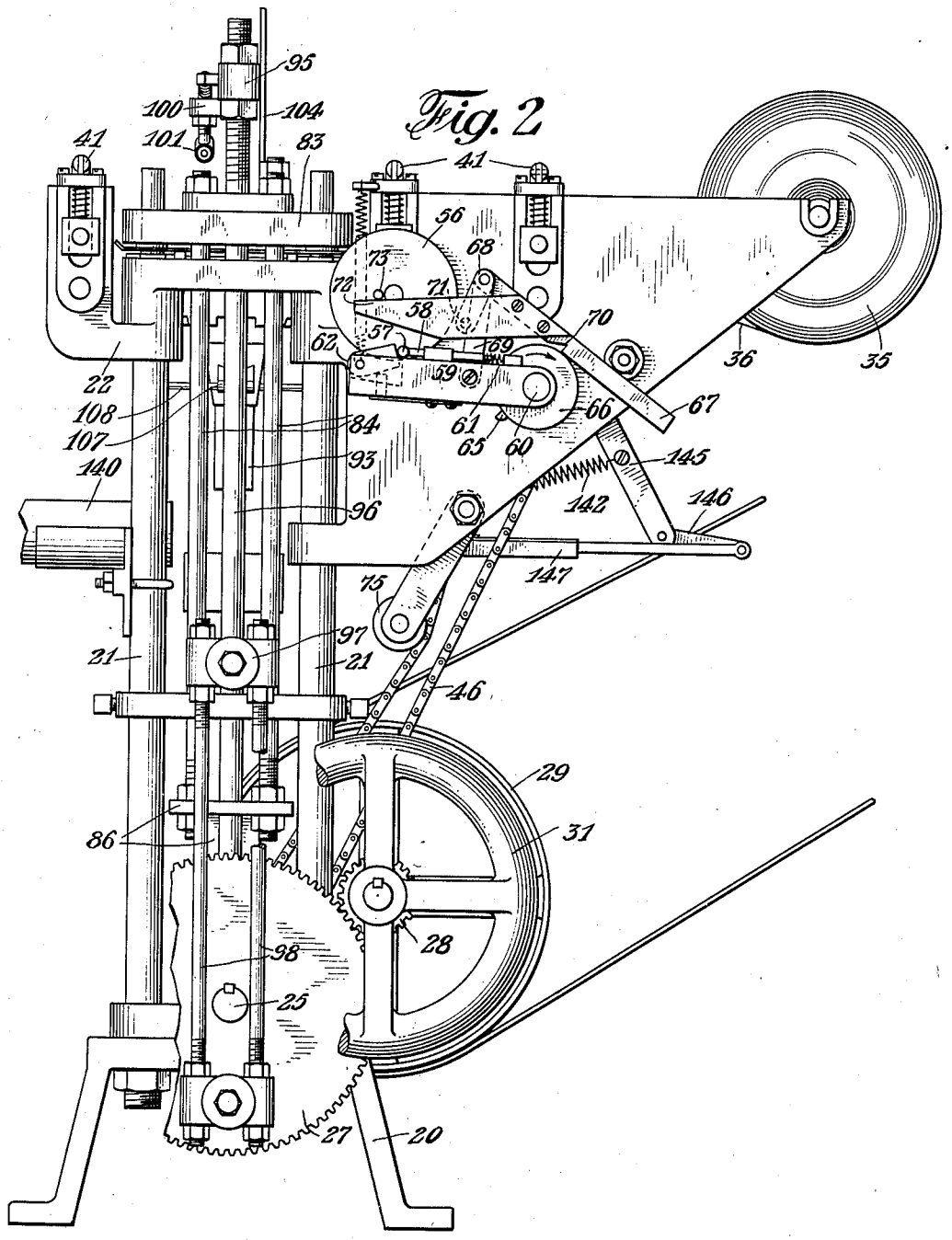
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MACHINE FOR MAKING CUPS

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Fig. 2



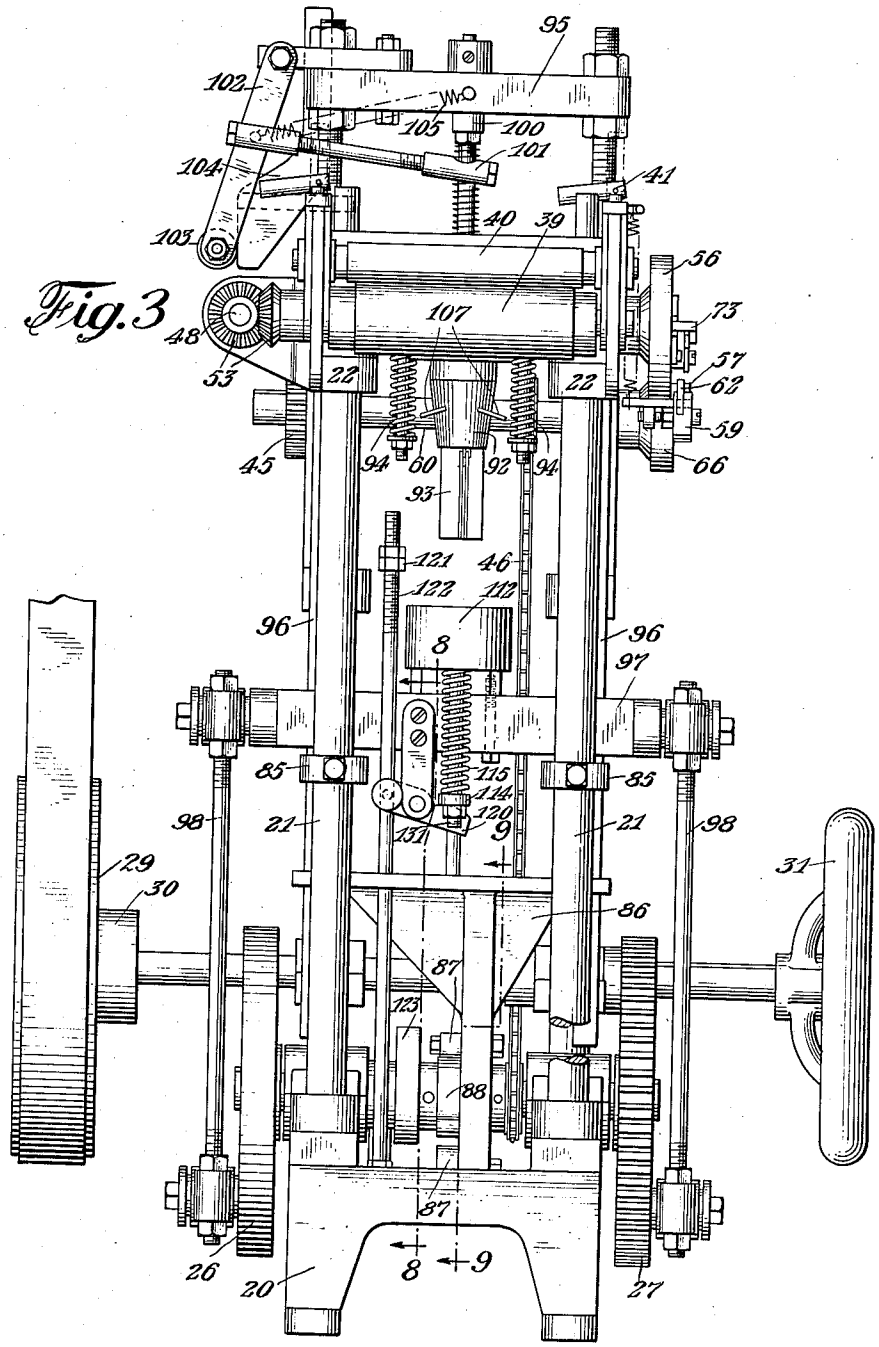
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MACHINE FOR MAKING CUPS

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Fig. 3



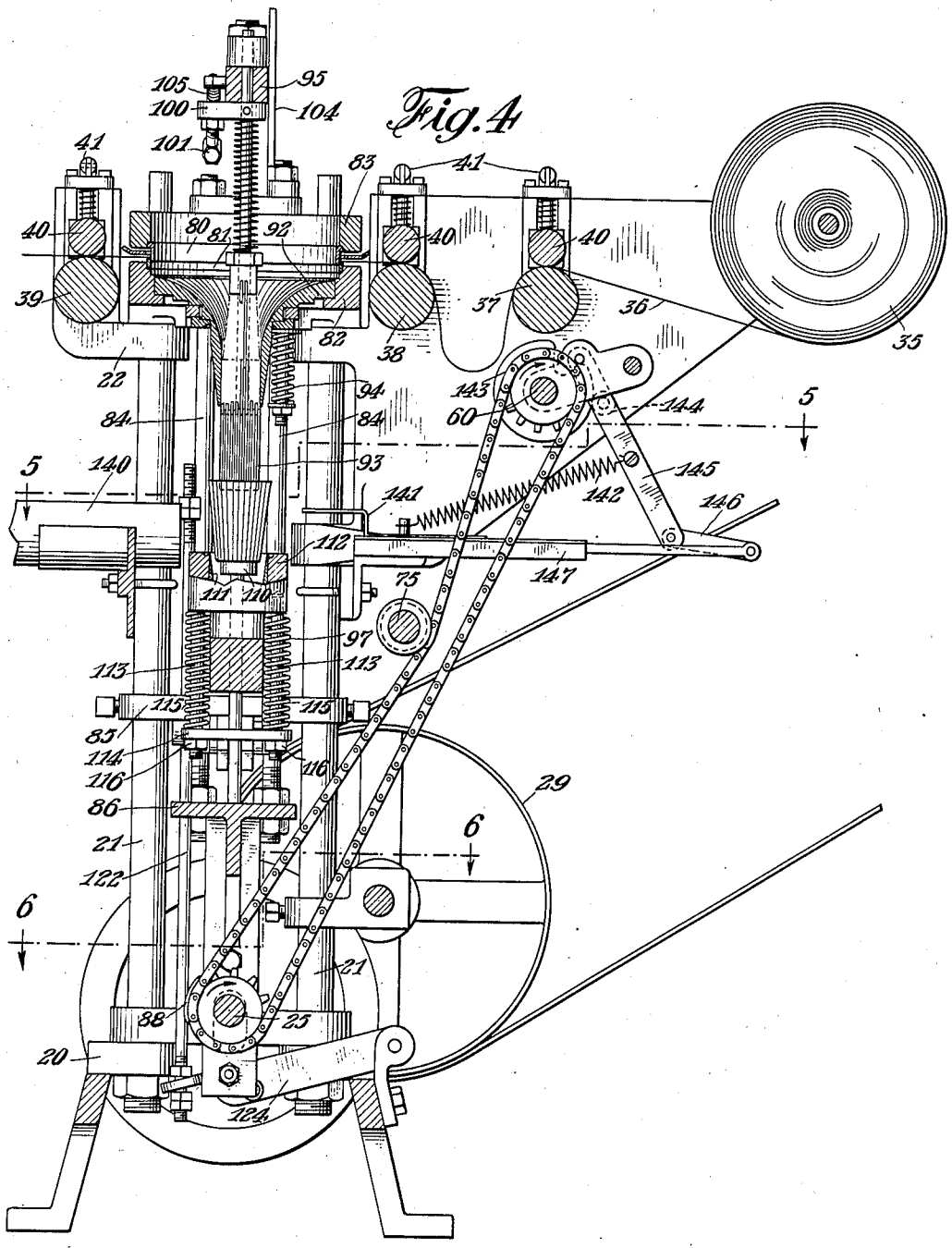
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Fig. 4



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Fig. 5

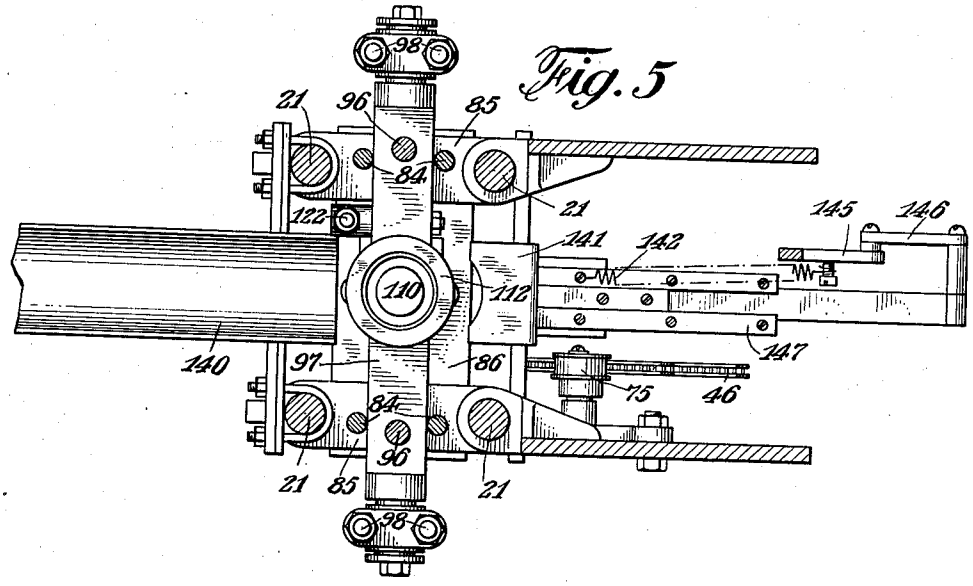
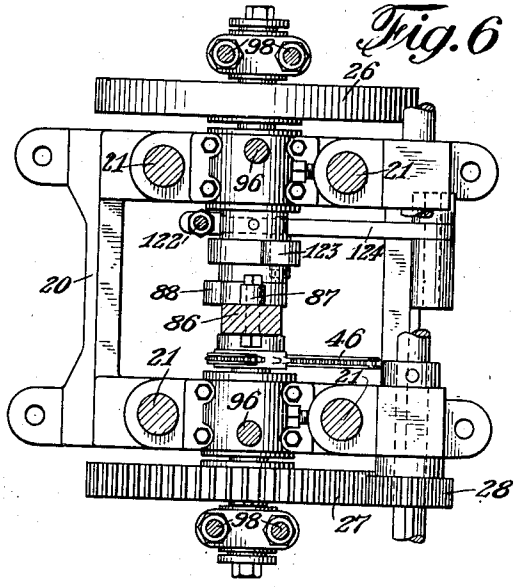


Fig. 6



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Fig. 7

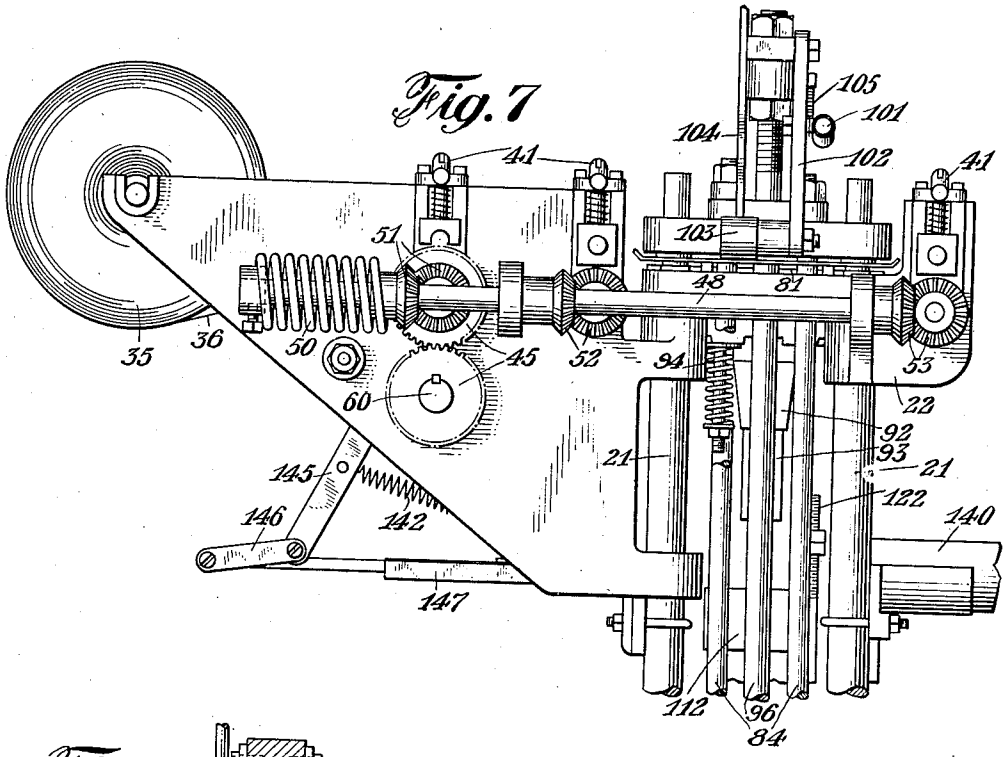


Fig. 8

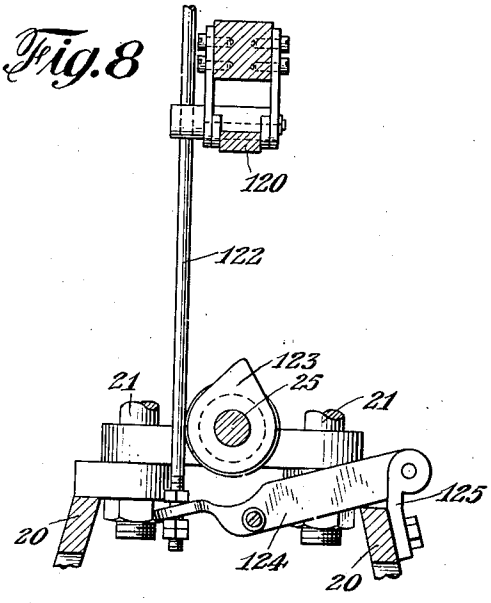
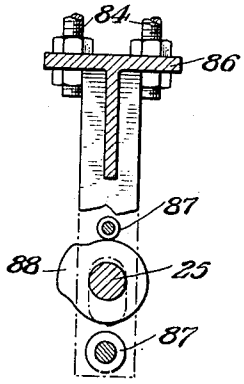


Fig. 9



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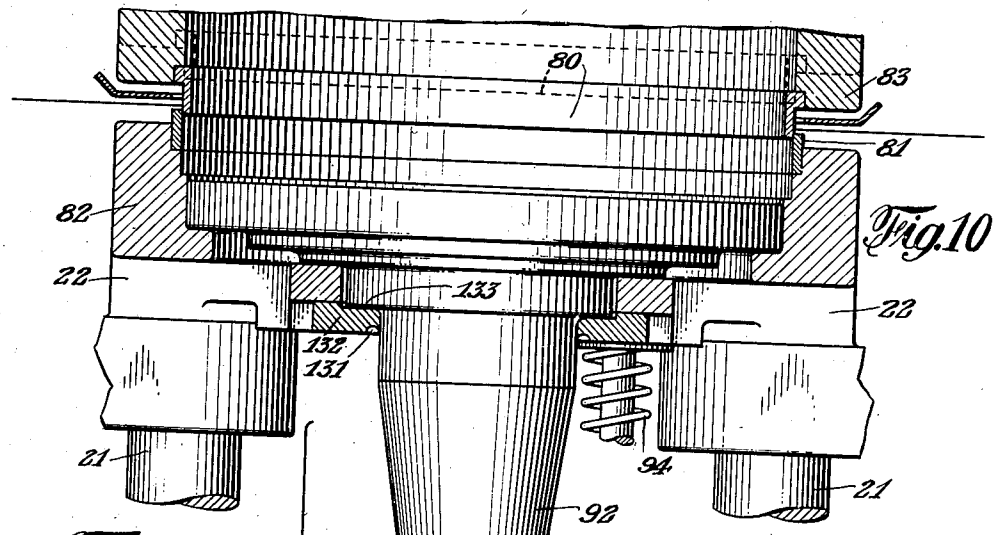


Fig. 10

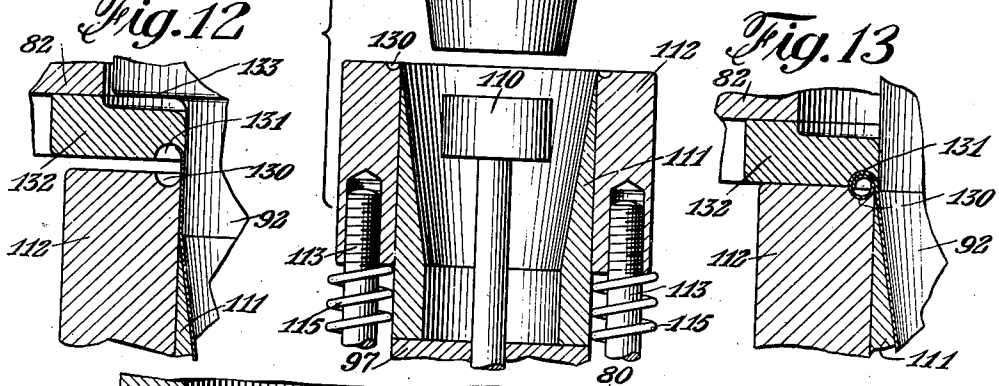


Fig. 12

Fig. 13

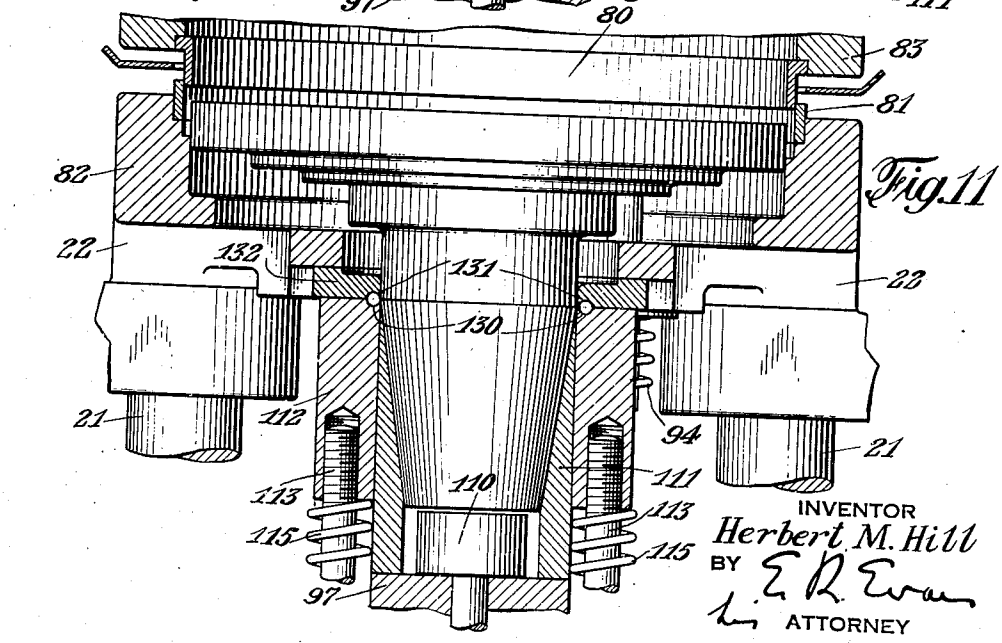


Fig. 11

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2,177,652

UNITED STATES PATENT OFFICE

2,177,652

MACHINE FOR MAKING CUPS

Herbert M. Hill, Leonia, N. J.

Application October 6, 1936, Serial No. 104,324
Renewed February 2, 1939

27 Claims. (Cl. 93—60)

This invention relates to the manufacture of cups or similar receptacles from a blank or a continuous strip of sheet material, such as paper.

The principal object of the invention is to provide an improved machine for automatically and rapidly making one-piece paper cups from wax-impregnated paper or other suitable material without subsequent treatment, as by heating or impregnating after the cups are formed. However, certain features of the invention are not limited to machines of this particular character but may be embodied in machines for forming articles of a different character and for handling other material.

Another object of the invention is to provide a compact, balanced machine of the stated character having the cooperating folding, pressing and beading elements thereof arranged so that the machine may be operated at a high speed, thus increasing the output of the cups.

Another object of the invention is to provide an improved machine for folding cups from flat blanks and then beading the rim or mouth portion of the cups without transferring the cups from a folding or forming station to a beading or crimping station as in the machines generally employed heretofore.

A further object of the invention is to provide a combined folding and beading die assembly having obvious advantages, including simplicity, compactness and increased output.

A further object of the invention is to provide a machine of the character described in which the lateral dimensions of the folding and beading devices are less than the diameter of the blank from which the cups or containers are formed.

A still further object of the invention is to provide improved paper feeding and cup discharge mechanisms operable at a high rate of speed in order to utilize fully the enlarged capacity of the cup-forming devices.

For a better understanding of the invention, reference should be had to the accompanying drawings illustrating a preferred embodiment thereof, wherein

Fig. 1 is a plan view of a machine for making paper cups having a beaded or crimped mouth portion;

Figs. 2 and 3 are side and front elevations of the machine shown in Fig. 1;

Fig. 4 is a vertical section of the machine taken on the line 4—4 of Fig. 1;

Figs. 5 and 6 are horizontal sections taken on the lines 5—5 and 6—6 of Fig. 4;

Fig. 7 is a detail view of one side of the upper part of the machine, showing the drive mechanism for the paper feed rolls;

Figs. 8 and 9 are detail sectional views taken on the lines 8—8 and 9—9 of Fig. 3, respectively, showing the bead cam and cutter cam, and associated parts; and

Figs. 10–13 are detail views of the cutting, folding, pressing and beading elements of the machine in various operative positions.

In accordance with the illustrated embodiment of the invention the machine is supplied with paper stock, circular blanks are cut therefrom, folded and formed into cups or containers in a number of successive, relatively complex operations with a minimum movement or displacement of the paper article as it assumes its final form, whereby a compact organization is provided capable of operating through successive cycles more rapidly than the machines in use hitherto. The cups formed are of a character which has been found most suitable for their intended use as drinking cups and do not represent a compromise for the purpose of obtaining higher output from the machine. Other detailed features and advantages of the machine will appear from the following detailed description thereof.

Referring to the drawings, the machine comprises a main frame consisting of a base 20 and four upright rods or posts 21 extending from the base 20 to an upper frame member 22. This main frame supports the driving elements and reciprocating dies of the machine, as well as the paper-feeding, cutting and cup delivery mechanism. A single drive shaft 25 journaled in said frame is provided with actuating cams and the like for driving the respective parts of the machine in properly timed relation to form and and deliver a cup during each revolution thereof. In the embodiment shown, circular plate members or fly wheels 26 and 27 are keyed to opposite ends of the drive shaft 25, the member 27 being provided with peripheral teeth meshing with a pinion 28 connected to drive pulley 29 representing any suitable source of power for operating the machine. A clutch 30 may be interposed between the pulley 29 and the pinion 28, as shown, and a handwheel 31 may be provided if desired for turning the drive shaft when the latter is disconnected from the source of power. The drive shaft may also be counterbalanced by weighting the fly wheels 26 and 27 to minimize vibration as well understood by those skilled in the art.

While the principal features of the invention relate to the construction and arrangement of the folding, pressing and beading elements of the machine, it is thought that the explanation of the detailed construction and operation of the machine as a whole will be simplified by describing the various steps involved in making a cup, commencing with the paper blank.

A roll of paper stock **35** is supported near the top of the machine frame in such a manner that the web of paper **36** may be continuously drawn therefrom during the operation of the machine by the continuously driven feed roll **37** and presented to the blank-cutting and cup-forming devices. Two intermittently operated feed rolls **38** and **39** are arranged on opposite sides of the upper frame member **22**, said last mentioned feed rolls being rotated at a high speed until a desired length of paper web is fed and then latched until the next cycle of operation, permitting a momentary accumulation of a loop of paper between the feed rolls **37** and **38** as shown in Fig. 4. An idle roll **40** cooperating with each of the driven feed rolls **37**, **38** and **39** maintains the paper web in frictional contact with said rolls. The feed rolls **40** may be spring-pressed against the opposing feed rolls and held by latch members **41** which are releasable to facilitate threading the paper web between the feed rolls.

The feed roll **37** is driven through spur gears **45** (see Fig. 7) connected by a chain **46** or other suitable drive to the drive shaft **25**. A lateral shaft **48** journaled on the upper end of the main frame and extending parallel to the ends of the feed rolls **37**, **38** and **39** is rotated through a helical spring **50**, bevel gears **51**, spur gears **45** and chain **46** from the drive shaft **25**. The feed roll **38** is driven from the shaft **48** through bevel gears **52**, and feed roll **39** through bevel gears **53**.

The feed rolls **38** and **39** are held against rotation during the blank-cutting and initial folding operations. To this end, a disc **56** (see Fig. 2) is mounted on or secured to the feed roll **38**, said disc carrying a projecting lug or latch pin **57** adapted to engage a stop member **58** normally positioned in the path of the latch pin **57**. The stop member **58** is preferably movably mounted on a latch arm **59**, pivoted at **60**, and bears against a spring **61** provided to absorb the shock resulting from arresting the movement of the feed rolls **38** and **39**, the shaft **48** and the disc **56**. A pivoted, spring-pressed stop member **62** is also provided to prevent rebound of the disc **56** as the pin **57** strikes the stop member **58**. While the disc **56** is latched in the position shown in Fig. 2, the continued rotation of the gears **45** and **51** (see Fig. 7) winds up the spring **50** which when the disc **56** is unlatched to release the feed rolls **38** and **39** rotates the latter to feed a predetermined length of the paper web **36** quickly underneath the blank-cutting knife to be described hereinafter.

The latch arm **59** is depressed to release the latch pin **57** from the stop member **58** by a projecting lug **65** on a rotating disc **66** driven by or in accordance with the feed roll drive. As shown, the disc **66** is mounted on the shaft carrying the lower gear **45** and the upper sprocket for the chain **46**. The lug **65** is arranged to depress the latch arm **59** through the pivoted links **67**, **68** and **69**. At a predetermined point in the cycle of operation of the machine, the lug **65** moves the link **67** lengthwise, as by engagement with a notch **70** formed therein, thereby rocking the link **68** about its pivot **71** and depressing the latch arm **59** through the intermediate link **69**. The link **67** carries a horizontal plate member **72** overlying a portion of the disc **56** and engaged by a pin **73** on said disc after the same has been unlatched. The engagement of pin **73** with the plate member **72** lifts the link **67** out of engagement with the actuating lug **65** as soon as the disc **56** and attached feed rolls **38** and **39** have been unlatched and prevents the lug **65** from again actuating the link **67** until the disc **66** has completed another revolution. In order to prevent backlash due to slack in the chain **46**, an adjustable takeup roller **75** may be provided as shown in Fig. 2.

It will be apparent that the rapid intermittent feeding of the web **36** by the spring **50** operating on the feed rolls **38** and **39** merely takes up the slack in the web between the rolls **37** and **38** formed by the continuously driven feed roll **37**. Thus the paper is drawn at a uniform rate from the roll **35** although a predetermined length of paper is fed intermittently and almost instantaneously underneath the cutting knife. After each rotation of the feed rolls **38** and **39**, the rolls are latched by the above-described latch mechanism, shown in the "stop" position in Fig. 2, until the cup blank is cut, the folding die depressed and raised and the cutting knife lifted to permit another length of paper web to be fed.

In the embodiment of the invention shown, the cups are formed from a circular blank which is cut from the paper web **36** by a circular cutter or shearing knife **80** and the cooperating shearing ring **81** (see Figs. 4, 10 and 11). The ring or cutter **81** is mounted in a block **82** secured to the upper frame member **22** or mounted in any suitable manner upon a stationary part of the machine frame. The movable cutter or knife **80** is carried by a reciprocable yoke member **83** secured to the upper ends of four upright posts or rods **84**, symmetrically arranged two on each side of the frame (see Figs. 4, 5 and 7). The posts or rods **84** pass through stationary guide or bearing members **85** and are secured at the lower ends thereof to an actuating member or yoke **86**. The yoke **86**, as shown in Figs. 3 and 9, has a depending portion carrying two rollers **87** engaging a cam **88** mounted on the drive shaft **25**. It will be apparent during the rotation of the shaft **25**, the yoke **86** and the knife or cutter **80** secured thereto are reciprocated in relation to the lower or stationary cutter **81** in properly timed relation to the web-feeding and folding devices, and a circular blank is cut from the web of paper during each rotation of the drive shaft.

The circular blank is cut from the paper stock above the fluted or grooved female die member **92** disposed within the block **82**. The blank is formed with longitudinal plaits and pressed into concave shape, or more specifically into the shape of a cup by a reciprocating male die member **93** in cooperation with the female die member **92**. The die members **92** and **93** are shown in Figs. 1 and 4, and except as noted hereinafter are of a conventional construction. The general form and arrangement of the folding dies may obviously be varied in accordance with the nature of the sheet material being handled and the shape of article desired. The die member **92** is held in the block **82** by springs **94** permitting a limited upward displacement of the die member for a purpose to be described.

As shown, the die member **93** comprises a series of radial blades, telescoping within the shank of

the die as the latter descends through the constricted portion of the die member 92, and forming longitudinal plaits in the paper blank. The die member 93 is carried by a reciprocating crossbar 95 secured to the upper ends of two upright posts or rods 96 mounted on the crosshead or yoke 97 (see Figs. 2, 3, 4 and 5). The crosshead or yoke 97 is reciprocated by rods 98 pivotally secured thereto and to the fly wheels 26 and 27, as shown most clearly in Figs. 2 and 3, whereby the movable die member 93 is moved downwardly and then retracted above the shearing knife 80 during each revolution of the main drive shaft 25. The yoke 97 and die member 93 secured thereto are shown in their extreme lower positions in Figs. 2 and 3.

The die member 93 is swivelled in the crossbar 95 in order that said member may be turned with respect to the female die member 92 as the former descends, thereby ensuring an even, uniform folding of the plaits in the cup blank. To this end, a lateral bar 100 pinned to the shaft of die 93 is pivotally connected to an actuating rod 101 (see Figs. 2, 3 and 4). The outer end of the rod 101 is pivoted to a link 102 having the upper end thereof pivoted to the crossbar 95 and carrying a roller 103 at the lower end. The roller 103 is held in engagement with a cam plate 104, secured to the frame of the machine, by a spring 105. As the crossbar 95 carrying the die member 93 is raised and lowered, the pivoted link 102 moves back and forth, thereby reciprocating the rod 101 and turning the die member 93 through the connecting bar 100. The twisting movement of the die member 93 as the flat blank is folded facilitates the formation of uniform plaits in the folded cup.

The descending movement of the die member 93 ejects the partly completed cup through the bottom of the hollow die member 92 and the cup drops upon a supporting member 110, the stem of which rests upon the yoke 86. As shown in Figs. 4, 10 and 11, the member 110 is located within a conical or tapered pressing die 111 and, when the cup drops beneath the end of the die member 92, the upper end of the cup expands radially because of the resiliency of the paper so that when the pressing die 111 is raised as described hereinafter, the folds or plaits in the cup will be pressed between the die 111 and the complementary tapered outer surface of the die member 92. In order to insure that the cup will be properly seated in the die 111 even when the extruded cup spreads or opens out excessively, pivoted fingers 107 adapted to engage the lip of the cup as the die 111 is raised may be provided, as shown in Figs. 2 and 3. The fingers 107 are pivoted on supporting rods 108 and spring-pressed against the tapered extension of the die member 92.

The pressing die 111 is carried by the yoke 97 within a ring member 112 threaded to receive bolts or rods 113 (see Fig. 4) carrying a crossbar 114 which is loose on said bolts or rods and is urged away from the ring member 112 by springs 115 encircling the rods 113. The normal position of the crossbar 114 is fixed by the nuts 116 on the ends of said rods. The die 111 and ring member 112 are raised by the yoke 97 from the position relative to the die member 92 shown in Fig. 10 until the plaits in the cup are pressed between the pressing die 111 and the outer surface of the die member 92.

At this time, the upward movement of the ring 112 is accelerated and the ring is projected above the upper end of the die member 111, as shown in Fig. 12. This momentary overtravel of the ring 112 is effected by a rocker arm 120 (see Fig. 3), said arm being pivoted to the yoke 97 and arranged to lift the ring 112 with respect to the yoke 97 through the crossbar 114 and the springs 115 when the outer end of said rocker arm is engaged by an adjustable shoulder or member 121 on a vertical pull rod 122. The pull rod 122 is periodically depressed by a cam 123 through the instrumentality of a pivoted intermediate link 124 supported by a bracket 125 on the base of the machine frame, as shown in Fig. 8. In this manner a sudden impulse is imparted to the ring 112 while the die member 92 is being raised against the tension of the springs 94 by the contact of the pressing die 111 with said die member 92.

The ring 112 is provided with a peripheral groove 130 mating with a groove 131 in a crimping die 132 surrounding the die member 92 and abutting against a shoulder 133 on the latter until the pressing die 111 raises the die member 92. As clearly shown in Figs. 12 and 13, the upper lip or mouth portion of the cup is turned over by the crimping die 132 to form a tight bead while the body portion of the cup is pressed between the dies 92 and 111. The upward movement of the pressing die 111 lags behind that of the ring 112 so that the members 112 and 132 engage to provide a beading recess of spiral cross-section before a substantial length of the cup wall is projected into said recess. Fig. 13 illustrates the uppermost positions of the dies 92 and 111 wherein the beaded or crimped mouth portion of the cup is completely formed.

It will be noted that the lateral dimensions of the cup-forming mechanism, excluding the supporting yokes, are less than the diameter of the paper blank cut from the web 36. Therefore, it is apparent that if desired two or more units may be mounted side by side to provide gang operation in which a plurality of cups is formed simultaneously from a single web of paper.

Upon the descent of the yoke 97, the completed cup drops upon the supporting member 110 and is ejected into the delivery trough 140 by the reciprocating ejector bar 141. As shown, the ejector bar 141 may be actuated by a spring 142, being normally held in retracted position by a cam 143 engaging a roller 144 on a link 145 connected through a link 146 to the ejector bar. The ejector bar is supported in a suitable guide member 147 on the opposite side of the frame from the delivery trough 140, and the portion of the ejector bar which engages the cup supported by the member 110 is arranged to tip the cups as they are ejected from the machine so that they will lie in nested relation in the trough 140, as clearly shown in Fig. 1.

It will be apparent from the foregoing that the machine disclosed for the purpose of explaining the invention is adapted to form paper cups or the like rapidly and automatically from paper stock. Obviously certain features of construction described in connection with the cup-making machine are not limited to machines of this character. Furthermore many changes in the construction and arrangement of the component parts will occur to those skilled in the art and may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A machine for folding a sheet comprising two relatively movable forming die members, means for moving one of said die members relative to the other to fold a flat sheet into concave

shape and means for crimping the edge of the folded article while in engagement with one of said forming die members.

2. A machine of the character described comprising means for folding a flat sheet into cup shape, said means including a fluted female die member and a cooperating male die member, and means for crimping or beading the rim of the cup while in engagement with said female die member.

3. A machine for folding a sheet into a cup comprising two relatively movable forming die members, means for actuating said die members to fold a sheet into cup shape with plaited side walls and means cooperating with one of said die members for forming a bead on the rim of said folded cup.

4. A machine for forming cups from flat sheets comprising forming and crimping die members for folding the sheets into cup shape and forming a bead at the mouth portion thereof, all of said forming and crimping die members being relatively movable along a common axis, and means for reciprocating said die members axially to form a cup with a beaded mouth portion.

5. A machine for making paper cups comprising two relatively movable male and female die members adapted to fold a flat blank into a cup having longitudinal plaits, means for holding the cup in juxtaposition to one of said die members and crimping means for beading the rim of the cup while so held.

6. A machine for making paper cups comprising two relatively movable male and female die members adapted to fold a flat blank into a cup having longitudinal plaits, said female die member having a central aperture, means for forcing the cup through said aperture, a pressing die in axial alinement with said first-mentioned die members to receive the extruded cup for pressing the plaits or folds in the wall of the cup and means for beading the rim of the cup while the body portion thereof is held by said pressing die.

7. A machine for making paper cups comprising relatively movable male and female die members adapted to fold a flat blank into a cup having longitudinal plaits, said female die member having a central aperture, means for moving one of said die members with respect to the other to fold the blank into cup shape and force the cup through the aperture in the female die member and means cooperating with the female die member for shaping the extruded cup.

8. A machine for making paper cups comprising two relatively movable male and female die members adapted to fold a flat blank into a cup having longitudinal plaits, said female die member having a central aperture, means for moving one of said die members with respect to the other to fold the blank into cup shape and force the cup through the aperture in the female die member, another die member adjacent the aperture in the female die member and means including said other die member for crimping the mouth portion of the extruded cup.

9. A machine for making paper cups comprising relatively movable male and female die members adapted to fold a flat blank into a cup having longitudinal plaits, said female die member having a central aperture, means for moving one of said die members with respect to the other to fold the blank into cup shape and force the cup through the aperture in the female die member, means including said female die member for gripping the extruded cup and means for crimping or beading the mouth portion of the cup while so held.

10. A machine for making paper cups comprising a hollow shaping die provided with a projecting end portion having a central aperture, means for forcing a folded cup through said aperture and means including the end portion of said die for thereupon gripping said cup.

11. A machine for making paper cups comprising a hollow shaping die provided with a projecting end portion having a central aperture, means for forcing a folded cup through said aperture, means for returning the cup into contact with the projecting end portion of said die and means for crimping or beading the mouth portion of the cup while in contact with said die.

12. A machine for making paper cups comprising a frame, folding dies supported thereon, means for reciprocating one of said dies with respect to the other die, a reciprocable yoke carried by said frame in alinement with the reciprocable die, a crimping die carried by said yoke and means on said yoke for effecting relative movement between said crimping die and the yoke at a predetermined point in the travel of the yoke.

13. A machine for making paper cups comprising a frame, folding dies supported thereon, means for reciprocating one of said dies with respect to the other die, a reciprocable yoke carried by said frame in alinement with the reciprocable die, pressing and crimping dies carried by said yoke, means including said crimping die for beading the mouth portion of the cup and means on said yoke for effecting relative movement between said pressing and crimping dies at a predetermined point in the travel of the yoke.

14. A machine for making paper cups comprising means including a hollow female die for folding a flat blank into cup shape, a movable similar pressing die adapted to receive the folded cup, means for transferring said cup from said folding means to said pressing die, a movable crimping die surrounding said pressing die and means for concurrently advancing said pressing and crimping dies together and then projecting the crimping die ahead of said pressing die to roll a bead at the mouth portion of the cup.

15. A machine for making paper cups comprising means for folding a flat blank into cup shape, a movable pressing die adapted to receive the folded cup, a movable crimping die surrounding said pressing die, a reciprocable yoke carrying both of said dies and means including a member pivoted on said yoke for effecting relative movement between said dies.

16. A machine for making paper cups comprising means for folding a flat blank into cup shape, a movable pressing die adapted to receive the folded cup, a movable crimping die surrounding said pressing die, both of said dies being in axial alinement with said folding means, a reciprocable yoke carrying both of said dies and means for actuating one of said dies with respect to said yoke, said last-mentioned means including a rocker arm pivoted to said yoke and an abutment engaged by said arm as the latter is reciprocated by said yoke.

17. A machine for making paper cups comprising relatively movable shaping dies and means for actuating one of said dies, said means including a reciprocating member carrying said one of said dies, a pivoted rocker arm supported on said member and an abutment engaged by one end of said arm, the opposite end of the rocker arm being connected to said one of said dies.

18. A machine for making paper cups comprising movable shaping dies and means for actuating said dies, said means including a reciprocating member carrying one of said dies, a pivoted rocker arm supported on said member and secured to said one of said dies, an abutment engaged by one end of said rocker arm and means for oscillating said abutment.

19. A machine for making cups from a blank of sheet material comprising folding dies arranged to fold the blank into cup shape, crimping dies for forming a bead at the mouth portion of the cup, means for positioning a blank in operative relation to said folding dies, the lateral dimensions of the cross section of the machine parallel to the blank as it is fed into the machine occupied by the folding and crimping dies being not greater than those of said blank, and means for actuating said dies.

20. A machine for making cups comprising means for supporting a web of sheet material, folding means, means for cyclically operating said folding means and means for intermittently advancing said web in timed relation to the cyclic operation of the folding means, said last-mentioned means including a latch mechanism and releasing means therefor operatively connected to the means for cyclically operating the folding means.

21. A machine for making cups comprising means for supporting a web of sheet material, blank-cutting and folding means cooperating therewith, means for feeding a portion of said web at a substantially steady rate and means for feeding predetermined lengths of the web intermittently to the blank-cutting and folding means at a rate higher than said steady rate, said last mentioned means comprising a latched feed roll, a yielding drive connection to said feed roll and means for intermittently releasing said feed roll.

22. A machine for making cups comprising a cup-holding member conforming to the shape of the body portion of the cup, means engaging the lip of the cup to urge the same into said holding member and separate means for crimping the lip of the cup while the same is held in said holding member.

23. A machine for folding a sheet into a plaited cup comprising relatively movable forming die members, means including said die members for folding a sheet into cup-shape at one station and means at the same station cooperating with said first mentioned die members for forming a bead on the rim of the folded cup whereby beading of the cup is effected without transfer.

24. A machine for folding a sheet into a plaited cup comprising aligned relatively reciprocable forming die members adapted to fold a sheet into cup-shape, means including a reciprocable forming member for forming a bead on the rim of a folded cup and coaxial reciprocable cross-heads supporting one of said forming die members and said last mentioned forming member.

25. A machine for folding a sheet into a plaited cup comprising relatively movable forming die members, means including said die members for folding a sheet into cup-shape, bead forming means arranged to receive a cup-shaped blank as it leaves said forming die members and means for supporting and actuating said die members and bead forming means whereby the bead is formed on the rim of the folded cup without transfer from the station where the initial folding operation is performed.

26. A machine for making paper cups comprising a hollow shaping die provided with a projecting end portion having a central aperture, means for forcing a folded cup through said aperture, a grooved crimping die surrounding said end portion of the first mentioned die and means including said crimping die for shaping the mouth portion of the cup extruded through said hollow shaping die.

27. A machine for making paper cups comprising a hollow shaping die provided with a projecting end portion having a central aperture, means for forcing a folded cup through said aperture, a grooved crimping die surrounding the projecting end portion of said shaping die, a cooperating grooved crimping die adapted to be moved into engagement with the first mentioned crimping die and means including said crimping dies for retaining an extruded cup against said end portion of the shaping die and beading the mouth portion of a cup while held against said last mentioned die.

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