June 4, 1940. C. BARBIERI 2,203,515

CONTAINER MAKING MACHINE

Filed Oct. 5, 1936 8 Sheets-Sheet 1

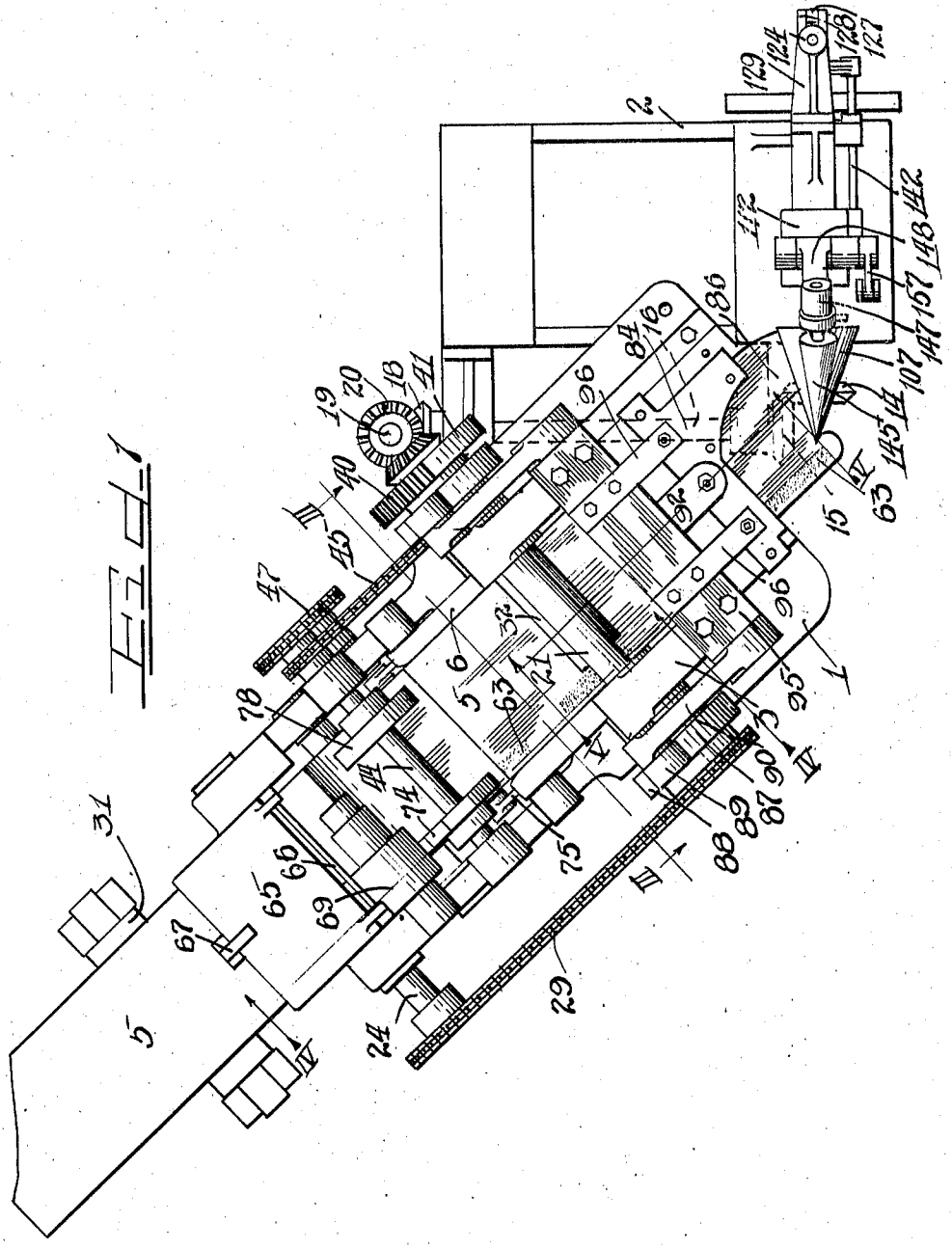


FIG. 1

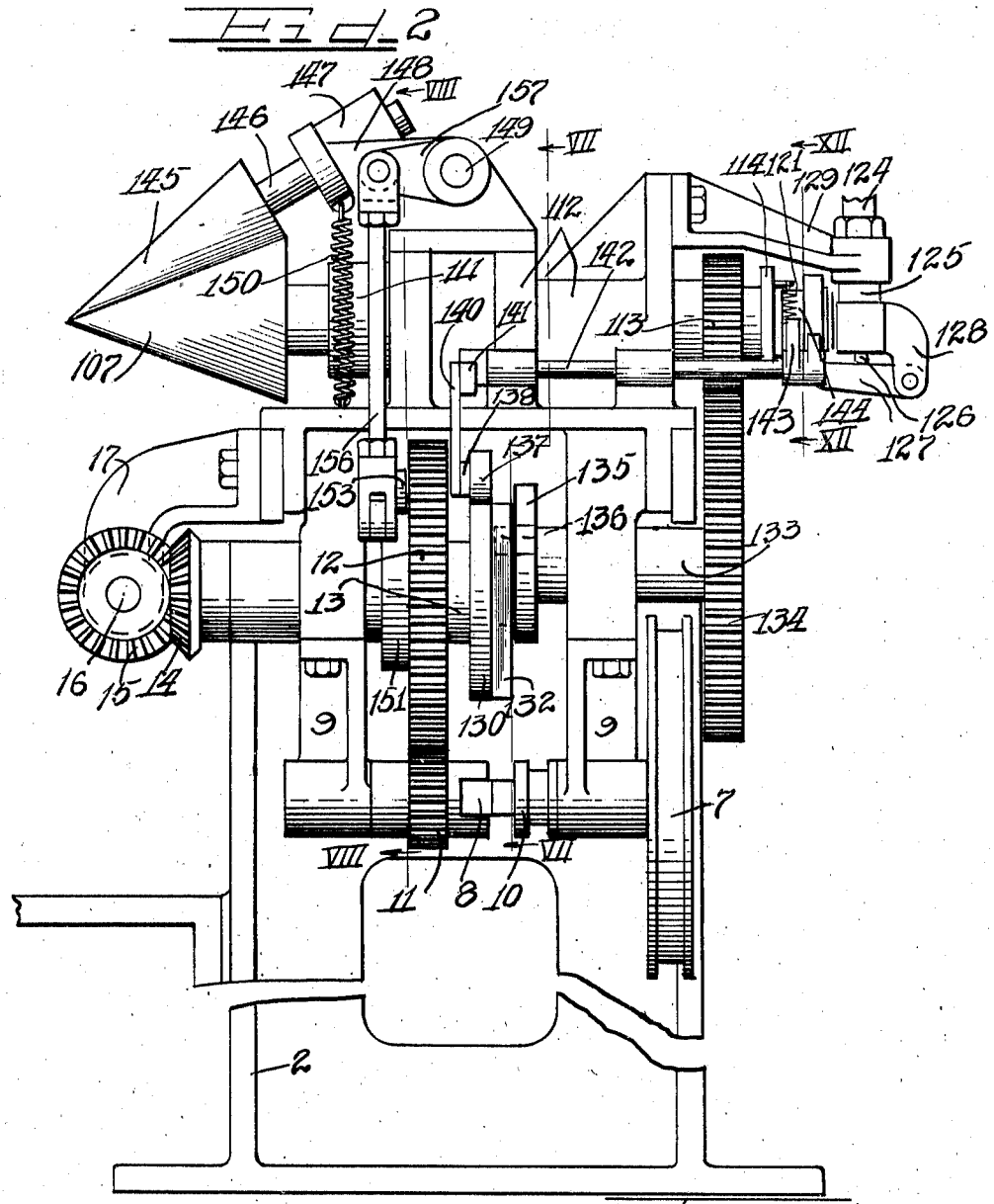
Inventor
Cesare Barbieri.
By Charles O'Neill
Attys.

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CONTAINER MAKING MACHINE

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Fig. 2



Inventor
Cesare Barbieri.

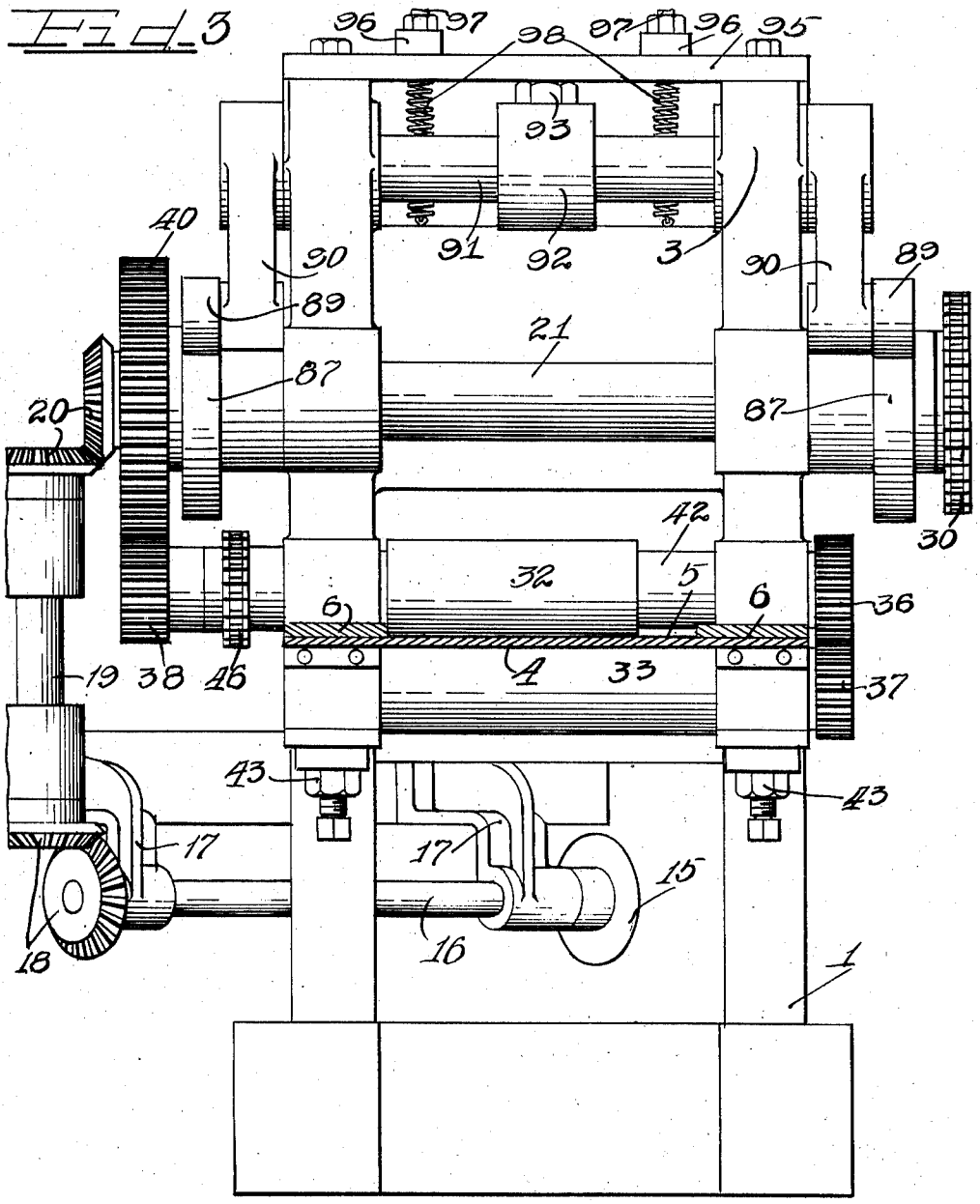
By Charles O. Wilfley Atty.

June 4, 1940. C. BARBIERI 2,203,515

CONTAINER MAKING MACHINE

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Fig. 3



Inventor
Cesare Barbieri
by Charles O'Neill Attys.

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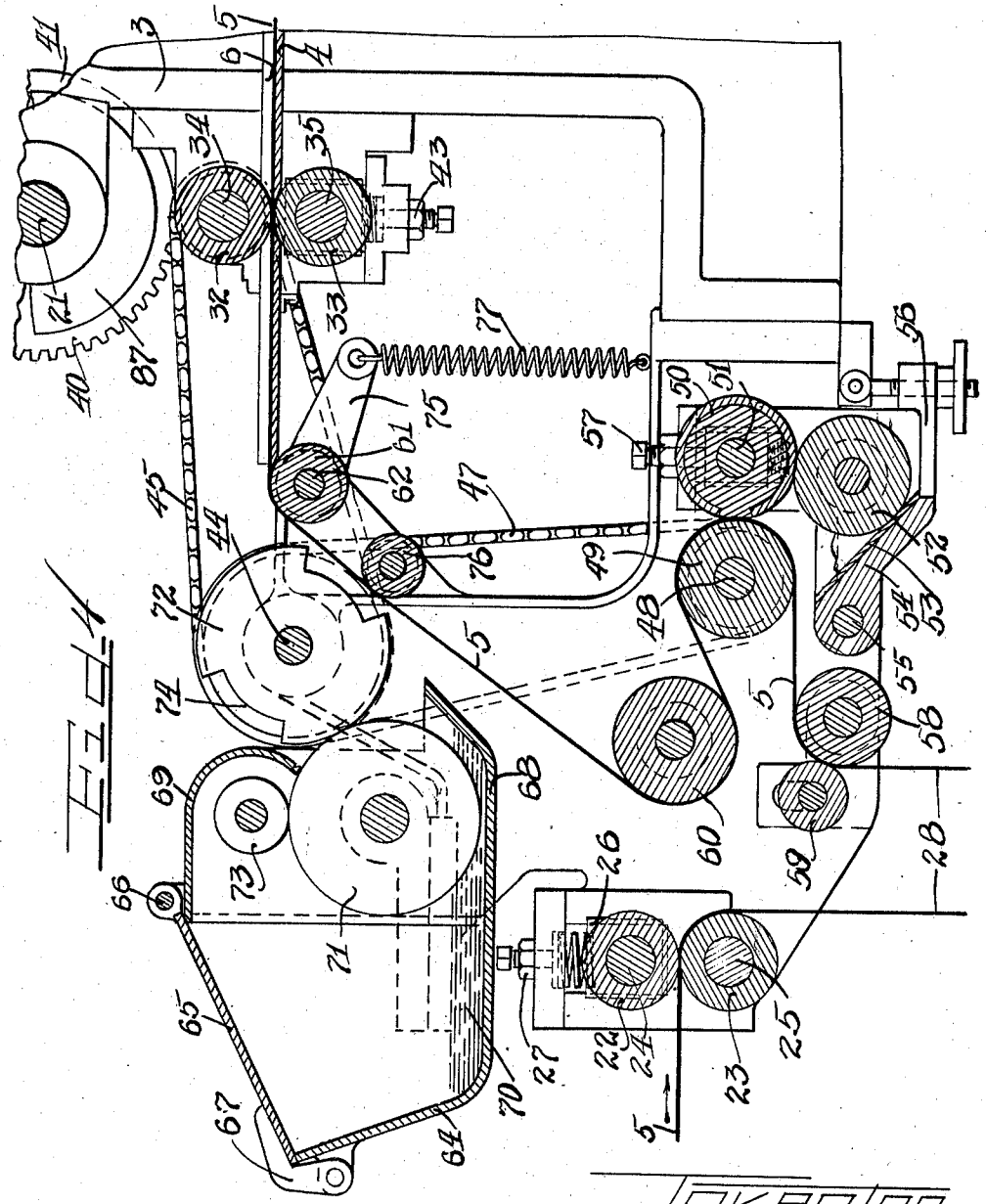


Fig. 4

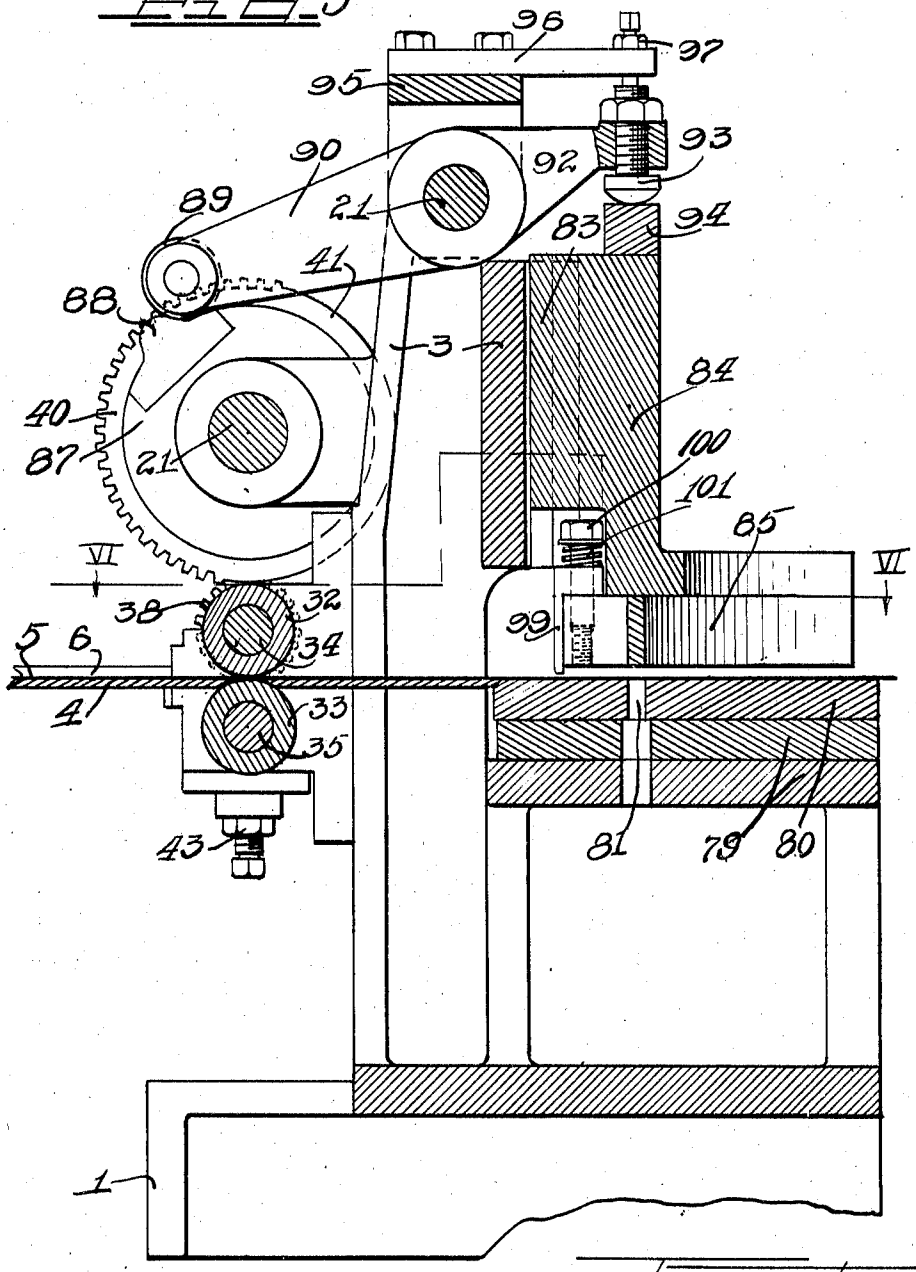
Inventor
Cesare Barbieri
By Charles Orfield Atty.

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Fig. 5

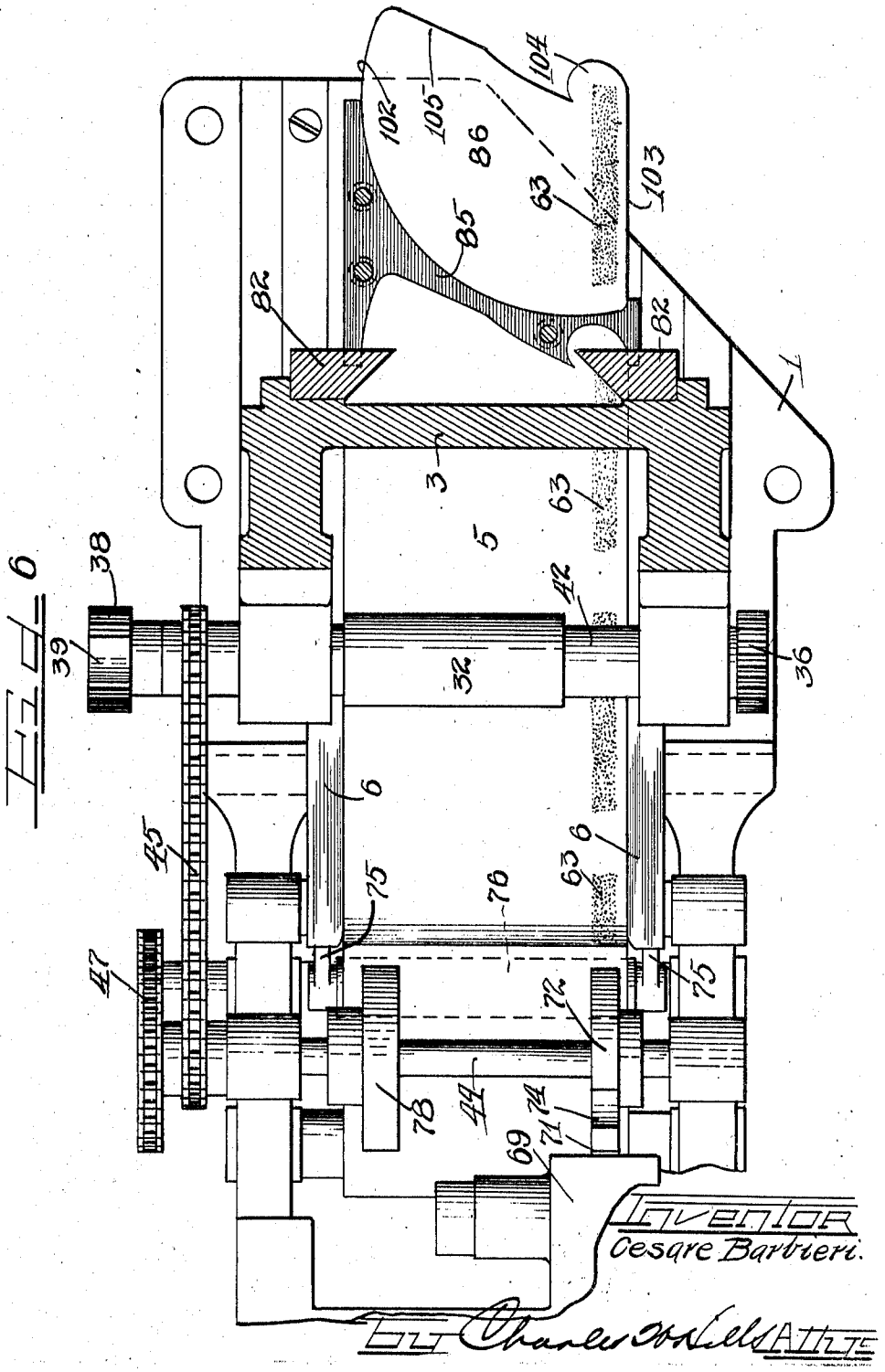


Inventor
Cesare Barbieri
By Charles A. Hill Atty.

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Fig. 7

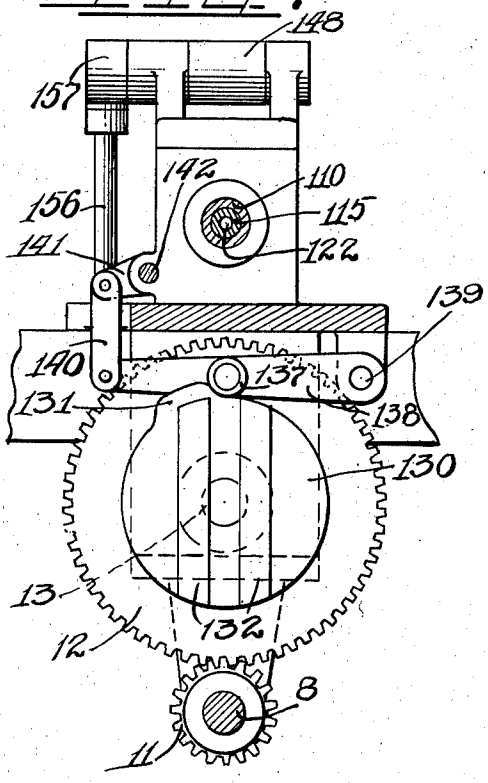


Fig. 8

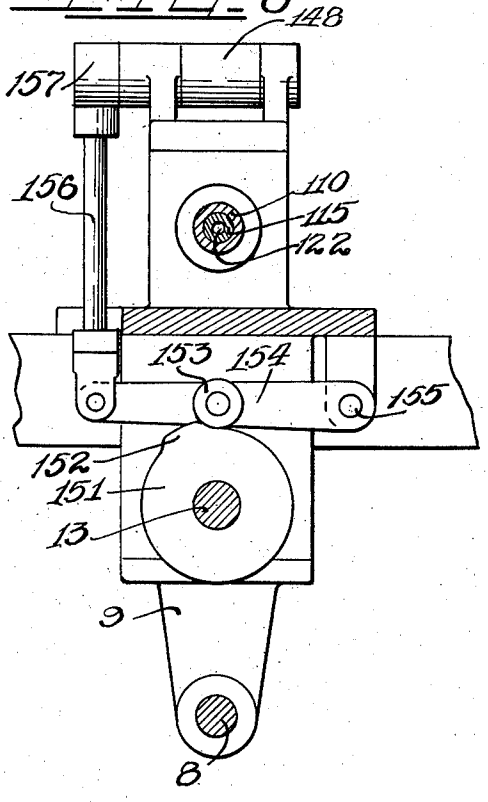
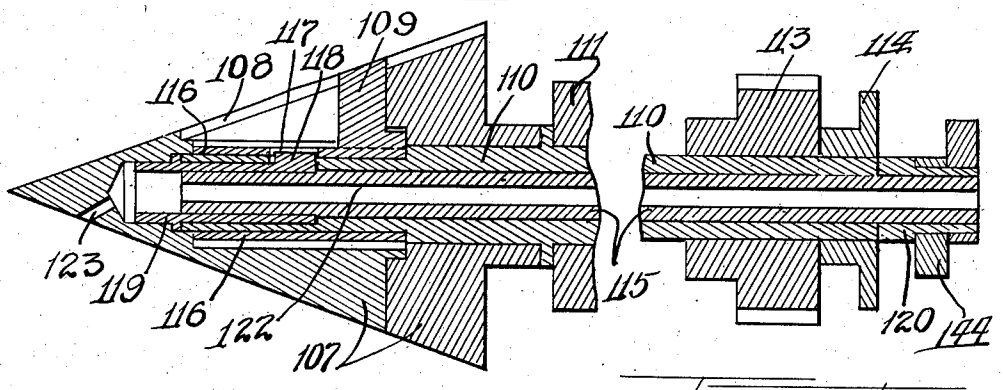


Fig. 9



Inventor
Cesare Barbieri.

by Charles Oblight Atty.

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Fig. 10

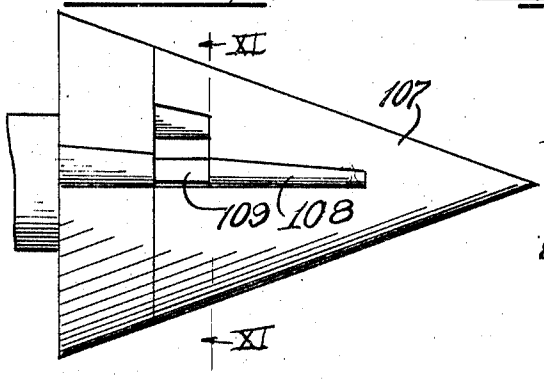


Fig. 11

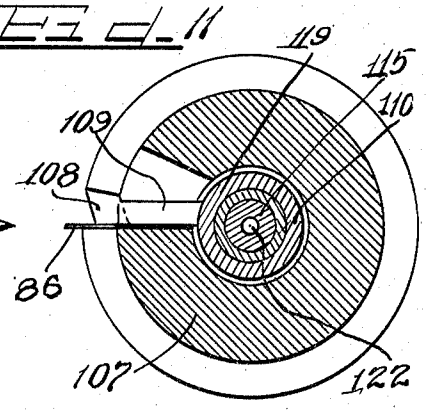


Fig. 12

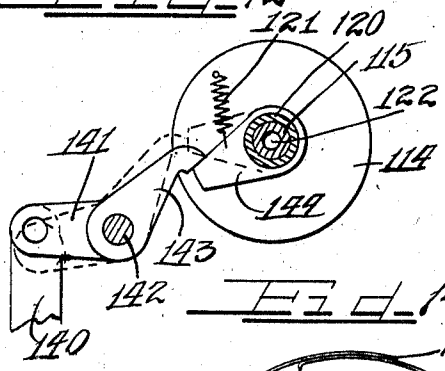


Fig. 13

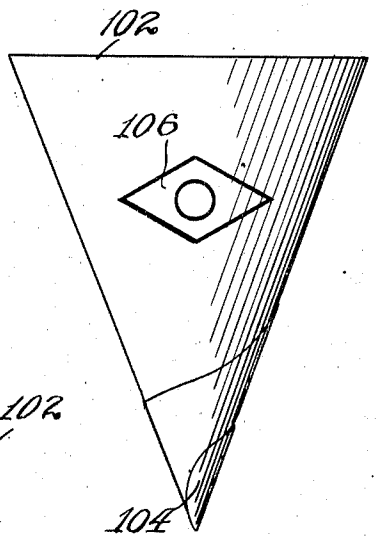
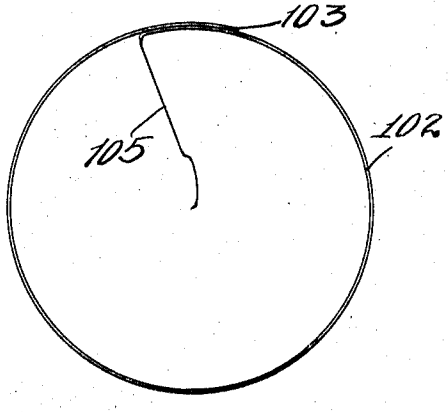


Fig. 14



Inventor

Cesare Barbieri.

By Charles E. Wilkins

Atty

Patented June 4, 1940 2,203,515

UNITED STATES PATENT OFFICE

2,203,515

CONTAINER MAKING MACHINE

Cesare Barbieri, New York, N. Y., assignor to Dixie-Vortex Company, Chicago, Ill., a corporation of Delaware

Application October 5, 1936, Serial No. 104,035

13 Claims. (Cl. 93—36.2)

This invention relates to improvements in container making machines, and also to a new and novel method of making containers, the invention being highly desirable for use in connection with the manufacture of containers from paper or similar sufficiently economical material to warrant disposition of the container after a single usage, and the containers being of the character of paper drinking cups, ice cream cups and holders for similar commodities, although the invention will have other uses and purposes as will be apparent to one skilled in the art.

Economy is one of the essentials in the manufacture of paper containers, such as drinking or ice cream cups and similar economical containers for various commodities. It is therefore desirable to have a machine which will provide a container with a minimum of operations and produce each minute a rather great number of containers which will pass a rigid inspection. The various operating parts of the machine must be relatively accurately timed for proper coordination, and there must be a continuity of run without a jamming of the machine or the formation of defective containers. Difficulty has been experienced at times in the very rapid manufacture of containers of a larger size, since larger blanks, such, for example, as a blank for a twenty-four or twenty-eight ounce container, because such a blank is more difficult to handle than a smaller blank, such, for example, as that for a four or six ounce container. This difficulty is not corrected merely by adjustments of the mechanism and the substitution of larger sized mandrels for smaller mandrels or similar forming parts, because it frequently happens that a machine which will efficiently manufacture smaller sized containers will fail to economically manufacture large sized containers after such adjustments or substitution have been made.

With the foregoing in mind, it is an important object of the present invention to provide a container making machine which operates efficiently and at high speed, and which will manufacture large sized containers with substantially the same efficiency that it will manufacture small sized containers.

Another feature of the invention resides in the provision of a machine wherein a relatively continuous strip of stock is fed directly to the forming mechanism and gripped thereby prior to the severance of a blank from the stock strip.

It is also an object of this invention to provide a machine for making containers of the character of paper drinking or ice cream cups, wherein blanks are successively cut from a relatively continuous strip of stock, and cut in a manner requiring no further cutting or trimming operations upon the blank either during its formation into a container or subsequently thereto.

Also an object of the invention is the provision of a machine which feeds a relatively continuous strip of stock intermittently to forming position, and then severs a blank from this strip.

A further feature of the invention is the provision of a machine capable not only of successively severing blanks from a relatively continuous strip of stock, and forming the severed blanks into containers, but which machine runs continuously while feeding the stock strip intermittently.

Still another feature of the invention is the provision of a container making machine in which a continuous strip of stock is fed to the forming mechanism, the feeding mechanism being driven intermittently and the forming mechanism at variable speed, rapidly during the forming operation and slowly when picking up the next succeeding blank.

It is also an object of the invention to provide a machine of the character mentioned just previously above, wherein a gripper mandrel is used which is operated at its slowest speed when the mandrel grips the approaching end of the continuous stock strip, a blank is severed from the strip and the mandrel operated at a rapid rate of speed during the forming operation.

Another object of the invention is the provision of a machine of the character described herein where the main driving mechanism is at the finish end of the machine.

Still another object of the invention is the provision of a machine arranged to apply successive patches of printing to a relatively continuous strip of stock, apply spaced patches of glue to said strip, feed the strip directly into engagement with forming mechanisms, and then sever a blank from the strip between adjacent patches of gluing, said blanks carrying a predetermined amount of printing thereon.

Still a further object of the invention is the provision of a container making machine which is highly efficient and economical in operation, and which necessitates a minimum wastage of stock during the manufacture of containers.

It is a further feature of the invention to provide a new and novel method of making containers.

While some of the more salient features, characteristics and advantages of the present invention have been above pointed out, others will be-

come apparent from the following disclosures taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary top plan view of the machine as a whole;

Figure 2 is an enlarged fragmentary end elevational view, illustrating the main drive means at the finish end of the machine;

Figure 3 is an enlarged fragmentary vertical sectional view, with parts omitted, taken substantially as indicated by the line III—III of Figure 1, looking in the direction of the arrows;

Figure 4 is an enlarged fragmentary vertical sectional view, with parts omitted, of the starting end of the machine, taken substantially as indicated by the line IV—IV of Figure 1, looking in the direction of the arrows;

Figure 5 is a fragmentary vertical sectional view through the cutting mechanism, taken substantially as indicated by the line V—V of Figure 1, looking in the direction of the arrows;

Figure 6 is an enlarged fragmentary plan sectional view, taken substantially as indicated by the staggered section line VI—VI of Figure 5, with parts omitted;

Figure 7 is an enlarged fragmentary sectional view, illustrating a portion of the main drive mechanism and the actuation of a part of the forming means, taken substantially as indicated by the staggered section line VII—VII of Figure 2;

Figure 8 is an enlarged fragmentary vertical sectional view, illustrating the actuation of another part of the forming means, taken substantially as indicated by the line VIII—VIII of Figure 2;

Figure 9 is an enlarged fragmentary sectional view through the forming mandrel and its shank structure;

Figure 10 is a fragmentary elevational view of the forming mandrel;

Figure 11 is a vertical sectional view through the forming mandrel taken substantially as indicated by the line XI—XI of Figure 10, looking in the direction of the arrows;

Figure 12 is a fragmentary vertical sectional view of actuating mechanism controlling a part of the forming mandrel, with parts omitted, taken substantially as indicated by the line XII—XII of Figure 2;

Figure 13 is a side elevational view of a finished container; and

Figure 14 is a top plan view of the container of Figure 13.

As shown on the drawings:

For the purpose of clarity, the illustrated embodiment of the present invention has been selected as a machine capable of making a container in the form of a paper drinking cup of substantially true conical shape, with no special formations. It will be understood that by equipping the machine with suitable forming dies or similar mechanisms to add other operations to the making of the container, the apex of the container may be blunted or otherwise shaped, a turned drinking rim or margin may be provided around the mouth of the container, or other similar known shaping operations may be provided. It will also be understood that the invention is not strictly limited to the making of a paper container of conical form, nor of any particular size, although the invention as illustrated and described herein will perform with great efficiency not only as to small sized containers but also as to relatively large sized containers, but different shapes, styles and sizes of containers may be provided with the use of differently shaped forming mandrels, cutting dies, and the making of obvious adjustments to accommodate such.

The Method in General

In general, the method of making a container as embodied in the present invention includes the feeding of a substantially continuous sheet of stock from a source, such, for example, as a roll of stock, which may be paper of the character utilized in the making of paper drinking cups and the like, either of the dry wax or wet wax variety.

From the source, the stock sheet is fed by suitable mechanism to a printing unit which, in this instance, places spaced dabs of printing upon the sheet. Between the source and the printing unit, the sheet is permitted to loop in the form of a U-shaped slack loop, and the sheet is fed continuously to the loop but intermittently away from the loop. After leaving the printing unit, the stock strip is next provided with a series of spaced patches of glue by a gluing unit, and then is fed directly to the forming mechanism.

The forming mechanism is driven at variable speeds, but continuously, so that during the actual forming operations, the mechanism moves at a faster speed, and when it receives the forward edge of the stock strip it moves at minimum speed. The forming mechanism actually grips the leading end of the stock strip and then, by a suitable cutting mechanism, a blank is severed from the strip which is immediately formed into a container by the forming mechanism. As stated, the cutting operation preferably occurs after the forming mechanism has positively engaged the end of the stock strip.

The blanks are successively severed from the intermittently advanced stock strip in a manner to provide a finished blank for the forming mechanism. In other words, this blank does not need any further cutting or trimming operations, but is complete in and of itself for the forming of a container, provided, of course, that the particular container being formed is such as can be formed from a single blank of material. The cutting of the blank is between the spaced patches of adhesive and so as to provide a predetermined amount of printed matter on each blank.

After the container is formed by the forming mechanism, it is automatically ejected therefrom into a suitable container, the finished containers being preferably stacked in nested relationship.

The Machine in General

The machine in general comprises a pair of adjacent frame structures 1 and 2, respectively. The frame 1 carries the main part of the machine, including the initial feeding rolls, the printing mechanism, the gluing mechanism, the main feeding rolls, and the cutting mechanism. The frame structure 2 which is disposed at an angle to the frame 1, as seen best in Figure 1, carries the main drive mechanism and the forming and ejecting mechanisms. It is obvious that the frames 1 and 2 may be made integral with each other, if so desired.

It will be appreciated that both frame structures 1 and 2 will be fabricated and shaped to adequately support the various parts of the machine and journal the respective shafts, all in a manner to meet the exigencies of the particu-

lar construction. Consequently, it is not necessary herein to specifically describe every angle, side plate, etc., of the various frame structures, it being necessary herein to merely indicate the frames generally by numerals 1 and 2, and to mention that the cutting mechanism is mainly carried by a yoke 3 in the form of a superstructure on the frame 1.

The frame 1 includes a bed plate 4, seen best in Figures 3, 4 and 5, suitably supported in position. The stock sheet 5 travels along on this bed plate between a pair of guide members 6—6, seen best in Figures 3 and 6. These guide members extend a sufficient distance to keep the stock sheet in its proper path through the machine. The stock sheet reaches the bed plate 4 just after the application of adhesive thereto, and this bed plate is continuous, save for a suitable opening to accommodate the main feeding rolls, up to the cutting mechanism, and the bed plate merges with a portion of the cutting mechanism so as not to interrupt the continuity of the path of travel for the stock sheet.

The main drive

Certain parts of the machine are driven continuously at constant speed, certain parts are driven intermittently, and certain other parts are driven continuously but at variable speeds through a predetermined speed cycle. However, all parts of the machine are driven from the same general source and the entire machine can be operated by a suitable electric motor or some other source of power. The main driving mechanism for the machine is centered at the finish end of the machine, or that end where completed containers are ejected, and from the finish end of the machine only a single driving connection need be made with the source of power.

The drive mechanism includes a driving wheel 7, which may be in the form of a pulley as shown, a gear, or any other suitable wheel for connection to the particular drive source, not shown. This drive wheel 7 is mounted on a shaft 8 journaled in brackets 9—9 carried by the frame 2. A suitable clutch arrangement 10 is provided for starting and stopping the machine in the event it is desired to stop the machine while the power source is still in operation (Figure 2).

Also carried by the shaft 8 is a pinion 11 meshing with a gear 12 of larger size so as to reduce speed, which gear is carried on a shaft 13 also suitably journaled in the frame 2. The outer end of the shaft 13 carries a bevel gear 14 in mesh with a similar bevel gear 15 disposed at right angles to the first gear and carried by an obliquely disposed shaft 16 journaled in angles 17—17 extending from the frame 2, as seen in Figure 3. A similar bevel gear connection generally indicated at 18 at the other end of the oblique shaft 16 affords a driving connection for the operation of a vertical shaft 19 which, in turn, through a like bevel gear connection 20, drives a horizontally disposed shaft 21 journaled in the superstructure 3 on the frame 1, as best seen in Figure 5.

It is preferable to have the various bevel gears of the same size, and from the construction just above described, it will be seen that the shaft 21 will rotate once for each revolution of the shaft 13. As will be more apparent later herein, a single container will be formed for each revolution of the shaft 13, and having like revolutions between the shafts 13 and 21 enables the various mechanisms to be relatively timed in an easier manner. All of the other operating parts of the machine are connected directly or indirectly with either of the shafts 13 or 21 by connections to be later described.

The initial feeding mechanism

The initial feed mechanism is best seen in Figure 4, with reference to Figure 1 for the drive connection. This mechanism includes a pair of superposed rolls 22 and 23 mounted on shafts 24 and 25, respectively, and journaled in the frame 1. The upper shaft 24 is provided with a floating bearing 26 and a suitable spring and bolt adjustment generally indicated by numeral 27, whereby the pressure between the rolls 22 and 23 may be varied as deemed meet.

The feed rolls 22 and 23 pull the stock strip 5 from the stock source (not shown) and feed it into a loop 28 of substantially a U-shape, this being merely a slack loop. With reference to Figure 1, it will be seen that the upper shaft 24 carries on its outer end a suitable sprocket wheel engaged by a suitable driving chain 29 also engaged with a sprocket wheel 30 carried by the aforesaid shaft 21, the sprocket wheel 30 being visible in Figure 3. The shaft 25 is preferably driven from the shaft 24 by suitable gears, not shown in the drawings, but which may be of the same character later described herein in connection with the main feeding rolls.

It will thus be seen that the initial feeding mechanism is preferably driven continuously and at substantially constant speed directly from the shaft 21.

Again, with reference to Figure 1, it will be seen that the stock strip 5 may travel over a freely mounted guide roller 31, if such is deemed desirable, before it reaches the initial feeding rolls.

The main feeding mechanism

The main feeding mechanism is located substantially in the center of the machine as a whole, including both frames 1 and 2. In addition to the initial feeding mechanism which merely places a stock strip in condition to be accepted by the main working parts of the machine, only one other pair of feeding rolls is necessary. These are the main feeding rolls 32 and 33 mounted upon shafts 34 and 35, respectively, visible in Figures 1, 3, 4, 5 and 6. With reference to Figure 4, it will be seen that the feeding rolls 32 and 33 act upon the stock strip through a suitable opening in the stock bed plate or table 4. With reference to Figure 3, it will be seen that the shafts 34 and 35 are provided with like gears or pinions 36 and 37, respectively, on one side of the machine, so that the lower shaft 35 is driven by the upper shaft 34.

With reference to Figures 3 and 6, it will be seen that the upper shaft 34 carries on the opposite end a mutilated gear 38 having an arcuate toothless portion 39 (Figure 6), the remainder of the gear being normal. This mutilated gear is in position to be engaged by a large mutilated gear 40 carried on one end of the shaft 21. As seen best in Figure 5, the large mutilated gear 40 has teeth substantially half way around, and the other half of the gear is plain, as indicated at 41. As stated above, this shaft 21 is driven continuously at substantially constant speed, but it is apparent that the feeding rolls 32 and 33 will be driven intermittently, since these feeding rolls will be turned only during a half revolution of the gear 40, while during the other half revolution, the smooth part 41 of this gear will ride in the part 39 of the gear 38 without causing any motion

of the latter gear. Of course, these gears **38** and **40** are so sized that the toothed portion of the gear **40** is sufficient to cause an advance of the stock strip **5** the proper distance for the severing of a container blank.

As seen best in Figures 3 and 6, the upper feeding roll **32** is notched or reduced in diameter adjacent one end, as indicated at **42**, so that this feed roll will not contact with the adhesive carried by the stock strip during its movement.

With reference to Figures 3 and 4, it will be seen that the lower shaft **35** is mounted in a pair of floating bearings, adjacent each of which is a suitable bolt and spring adjustment **43** for varying the pressure between the feed rolls, as may be deemed meet.

The printing mechanism

This mechanism is best seen in Figure 4, with a slight reference to Figures 1, 3 and 6 for the drive connection.

In the upper central part of Figure 4, there is a shaft **44** which carries a suitable sprocket wheel for engagement by a chain **45** which is driven from another sprocket wheel **46** carried by the shaft **34** (Figure 3). Another suitable sprocket wheel and chain connection **47** (Figures 1, 4 and 6) effects a drive from the shaft **44** to a shaft **48**, seen in the lower portion of Figure 4. It will thus be seen that the shaft **48**, as well as the shaft **44**, is driven intermittently, since the drive connection is taken from the aforesaid shaft **34**.

With reference to Figure 4, it will be seen that the shaft **48** carries a suitable roll **49** which not only functions as a feed roll in conjunction with a printing roll **50** carried by a shaft **51**, but also furnishes a backing for the printing roll. Beneath the printing roll is an inking roll **52** which abuts against an inking pad **53** carried upon a base **54** pivoted as at **55**. A suitable latch mechanism **56** holds the base and inking pad in position and permits access thereto for replenishing the ink supply. Both the printing roll and the inking roll are frictionally driven from contact with each other and from the pressure between the printing roll and the roll **49**. It will be seen that the printing roll is mounted in a pair of floating bearings, by which the pressure of the printing roll may be adjusted through a suitable bolt and spring adjustment **57**.

The stock strip **5** passes between the roll **49** and the printing roll **50** and is fed thereby from the aforesaid slack loop **28**, the stock passing over a free roller **58** upon leaving the loop, and the stock strip being held in straight position by a rider roll **59**.

The stock strip **5** next passes around the underside of a freely mounted guiding roll **60** which heads the stock in an upward oblique direction towards another guiding roll **61** immediately adjacent the stock bed plate **4** and mounted upon a shaft **62**. After passing over the free roll **61** and reaching the bed plate **4**, the stock is urged along the bed plate between the aforesaid guide members **6** by the above described main feeding mechanism including the rolls **32** and **33**.

The gluing mechanism

As the stock strip **5** travels between the free rolls **60** and **61**, spaced patches of adhesive **63** (Figure 6) are applied to the strip by mechanism now about to be described.

With reference to Figures 1, 4 and 6, especially Figure 4, it will be seen that the gluing mechanism includes a glue pot **64** having a cover **65** pivoted as at **66** and held in closed position by a suitable latch **67**. This glue pot is provided with a forwardly extending narrower portion **68** covered by a fixed cover **69**.

A suitable adhesive **70**, kept liquid in any suitable manner, may be contained in the glue pot, and in the extended portion of the glue pot a gluing roller **71** is positioned to dip into the liquid. This gluing roller is rotated by frictional contact with the glue applying roller **72** fixed to the aforesaid shaft **44**. A smaller roller **73** contacts the gluing roller **71** to remove excess adhesive before the rollers **71** and **72** contact.

It will be noted that the applying roller **72** is notched as at **74** in diametrical portions, so that this roll will apply the spaced dabs **63** of adhesive directly to the traveling stock sheets **5**. To afford a suitable backing for the stock sheet during the application of the glue, a bell crank lever **75** is freely pivotal on the shaft **62**. At one end thereof, this lever carries a freely mounted backing roll **76**, while the other end of the lever is engaged by the end of a coil spring **77** which is also attached to the frame. The coil spring tends to contract and urge the back roll **76** against the underside of the stock strip to provide a resilient backing for the application of the glue and prevent tearing of the stock strip. As best seen in Figure 6, one of the spring controlled bell crank levers **75** is preferably disposed at each end of the backing roll **76**.

With reference to Figure 6, it will be seen that the spaced dabs **63** of adhesive are preferably applied to the stock strip adjacent a side margin thereof, and these dabs of adhesive will pass beneath the reduced portion **42** of the upper feed roll **32** so that this feed roll will not disrupt the adhesive. Adjacent the opposite side of the stock strip, the shaft **44** is provided with a wheel **78** of substantially the same diameter as the glue-applying wheel **72**, this wheel **78** merely keeping the stock strip in proper alignment with the aid of the pressure from the backing roll **76**.

It will be apparent that the gluing mechanism is operated intermittently with the main feeding rolls **32** and **33**, since, as before explained, the shaft **44** is driven from the shaft **34**.

The blank cutting mechanism

This mechanism is in the main mounted in the superstructure **3** on the frame **1** and is best seen in Figures 3, 5 and 6. With reference to Figure 5, it will be seen that the frame **1** is provided with a laminated bed plate **79** topped by a die block **80** which is flush with the stock bed plate **4**. The die block **80** is apertured as indicated at **81**, and this aperture is of the same contour as the punch die to be later described.

With reference to Figure 6, it will be seen that a pair of vertical beveled rails **82**—**82** are mounted on the cross portion of the superstructure **3**. These rails form a dovetailed track in which the rear portion **83** of a vertically reciprocable die holder **84** rides. The lower portion of the die holder is shaped in conformity with a punch die **85** carried by the holder. As stated before, the aperture **81** in the die block **80** is of the same configuration as the punch die, so that when the punch die descends, it severs the stock strip and removes therefrom a portion of waste material of the same pattern as the shaded top of the punch die, as seen in Figure 6. This punching operation provides a complete container blank **86** which is ready for formation into a container

and requires no further cutting or trimming operations.

The punch die is actuated by a pair of cams 87 fixed to the continuously rotatable shaft 21 adjacent opposite ends thereof. Each of these cams is provided with a relatively small cam hump 88 (Figure 4) which acts against a roller 89 carried by a crank arm 90. With reference to Figure 3, it will be seen that these crank arms 90 are fixed to opposite ends of a shaft 91 freely journaled in the side uprights of the structure 3. Substantially in the center thereof, the shaft 91 has another crank arm 92 fixed thereto and extending in the opposite direction from the crank arm 90. The end of the crank arm 92 carries a round-headed bolt and nut contactor 93 which rests against a pad 94 on the die holder 84. Accordingly, each time the cam hump 88 raises the crank arm 90, the punch die will be caused to descend and sever a blank from the stopped stock strip 5. As seen best in Figure 5, the severance of the blank will occur after the advance of the stock has stopped, or, in other words, after the toothed portion of the mutilated gear 40 has left the other mutilated gear 38.

The upright side portions of the structure 3 are connected by a top cross-beam 95, from which a pair of arms 96 extends. Connected at one end to each of these arms by a suitable adjustable connection 97 is a spring 98, the other end of which is connected to the upper portion of the die holder 84. These springs maintain the die holder in contact with the contact member 93 at all times, and accordingly result in a raising of the die holder after each cutting operation.

To prevent the elevation of the forward end of the stock strip together with the punch die, the rear edge of the punch die is provided with a presser 99 reciprocable on the shank of a bolt 100 and urged downwardly by a spring 101 disposed between the bolt head and the presser member. The presser member is arranged to extend below the punch die, and consequently, due to the action of the spring, will hold down the forward edge of the stock strip until after the punch die has been raised.

The blank and container made therefrom

With reference to Figures 6, 13 and 14, it will be seen that the blank 86 is of the type to form a conical container. The blank has substantially the shape of a sector of a circle, including an arcuate edge 102 forming the mouth of the container, a substantially straight side edge 103 adjacent which is the patch 63 of adhesive, a rounded extension 104 which is wound around the apex of the finished container, and a projection 105 on the other side edge, which projecting portion is gripped by the forming mechanism. When the blank is formed into a cone, the margin adjacent the edge 103 and that adjacent the projection 105 are overlapped, as seen in Figure 14, and held together by the adhesive patch 63 which also aids in holding the rounded projection 104 in position around the apex of the cup, as seen in Figure 13. On the underside of the blank 86, as seen in Figure 6, there will be a patch of printing 106 which, when the cup is properly formed, will appear on the outside of the finished container, as seen in Figure 13.

The forming mechanism and its operation

This mechanism and its operation is illustrated in Figures 2, 7, 8, 9, 10, 11 and 12, and is mounted on the frame structure 2.

The forming mechanism includes a conical mandrel 107 having a slot 108 in the side thereof for the reception of the projection 105 of the blank 86. Inside the mandrel, a gripper 109 firmly holds the blank engaged with the mandrel.

In the manufacture of large sized containers, it is preferable to use a gripper of the character of the gripper 109 rather than hold the blank to the mandrel by suction, since suction does not operate as satisfactorily with large sized blanks as it does with smaller sized blanks, while the gripper will operate satisfactorily with practically any size blank.

The mandrel is disposed at the proper angle to pick up the portion 105 of a blank, as best seen in Figure 1. However, it will be understood that what the mandrel actually picks up and grips first is the forward end of the stock strip 5, the blank 86 not being severed from the strip preferably until after the gripper 109 has actually engaged the part 105 of the stock strip.

With reference to Figure 9, it will be seen that the mandrel is fixedly mounted on a hollow shaft 110 which is journaled in a bearing 111 carried by a suitable bearing housing 112 on the upper portion of the frame 2 (Figure 2). Also fixed to the hollow shaft 110 is a driving gear 113 and a bushing 114, for purposes that will later appear.

Located within the hollow shaft 110 is another hollow shaft 115 which controls the operation of the gripper 109. This gripper is fixed to a floating sleeve 116 disposed around the reduced forward end of the shaft 110. The sleeve is apertured as indicated at 117 to accommodate a key 118 carried by another sleeve 119 fixed to the hollow shaft 115, the key 118 extending through a suitable aperture in the forward portion of the shaft 110. At the rear end thereof, the shaft 115 has a sleeve 120 fixed thereto, which sleeve is connected by a spring 121 to the aforesaid bushing 114. The action of the spring tends to hold the shaft 115, which of course is relatively rotatable in respect to the shaft 110, in such position relatively to the shaft 110 that the gripper 109 is maintained in closed or gripping position. To open the gripper, it is necessary to hold the shaft 115 against rotation with the shaft 110 and against the action of the spring 121.

Of course, the time the gripper is held in open position is relatively short compared with the time it remains in closed position. The gripper must be held in open position to permit the ejection of a finished container from the mandrel and while the mandrel receives the forward edge of the stock strip in the slot 108. The gripper is in closed position immediately after the reception of the forward edge of the stock strip and during the formation of the container.

The hollow shaft 115 provides an interior air passage 122 communicating with an oblique air outlet 123 near the nose of the mandrel to permit a blast of air to be forced through the mandrel to eject a finished container therefrom when the gripper is in open position. The blast of air comes from a suitable source through a conduit 124 (Figure 2) leading into a valve casing 125 holding a suitable air valve controlling communicating with the passage 122. This valve is controlled by a suitable pin 126 actuated periodically and at the proper time by any suitable mechanism through a lever 127 pivoted to a forked lug 128 carried by the valve housing. The valve housing is in turn carried by a bracket 129 secured to the bearing housing 112.

The mandrel is rotated continuously but at a

variable speed. In other words, the mandrel passes through a speed cycle, including a relatively high speed and a relatively very slow speed, but the mandrel preferably never stops. From the showing in Figures 2 and 7, it will be seen that on its inner end the shaft 13 carries a cam member 130 having a cam hump 131 thereon. The member 130 also carries a pair of spaced rails 132 forming a diametral track therebetween. Journaled in the frame 2 is a shaft 133 which is out of alignment with the shaft 13 and which carries on its outer end a relatively large gear 134 in mesh with the gear 113 fixed to the mandrel shaft 110.

On the inner end of the shaft 133 a wheel 135 is fixed which carries an off-center pin 136 engaged in the track between the rails 132. It will thereupon be seen that the shaft 13 drives the shaft 133 at a variable speed through the engagement of the pin 136 in the diametral track. When this pin is farthest from the center of the shaft 13, the shaft 133 will be driven at its fastest speed, and conversely, when the pin is nearest the center of the shaft 13, the shaft 133 will be driven at its slowest speed. By properly positioning the two shafts 13 and 133 relatively to each other, the duration of the slow and fast speed portions of a revolution may be varied to suit, such, for example, as slow speed during a quarter revolution and fast speed during the remaining three-quarters of a revolution. The gear 134 being considerably larger than the gear 113 on the mandrel shaft results in the mandrel shaft making several revolutions to one revolution of the shaft 133, but nevertheless the variable speed will be transmitted to the mandrel shaft by the gear 134.

The mandrel gripper 109 is preferably open during the slower part of the mandrel speed cycle, since at this time an ejection of a finished container occurs and the reception of the forward edge of the stock strip after the ejection also occurs. This opening of the mandrel gripper at the proper time is accomplished by the cam 130 on the shaft 13. The cam hump 131 strikes a roller 137 carried intermediately by a lever 138 pivoted as indicated at 139, thus elevating the lever. The free end of the lever 138 is pivoted to a link 140 which in turn is pivoted to a crank arm 141 fixed to a shaft 142. The consequent rotation of the shaft 142 results in an inward movement of a hook 143 secured to the other end of the shaft. This inward movement causes the hook to engage a crank 144 fixed to the sleeve 120 which in turn is fixed to the gripper shaft 115. The action of the hook is shown clearly in Figure 12.

While the hook is in engaged position, as shown by the full lines in Figure 12, the gripper shaft 115 is held against rotation with the mandrel shaft 110 and against the action of the spring 121. This causes an opening of the gripper which is maintained during the time the cam hump 131 maintains the lever 138 in elevated position. Immediately upon the hump passing beyond the roller 137, the spring 121 causes a rotation of the gripper shaft 115 relatively to the mandrel shaft 110 until the gripper is in closed position, when the gripper shaft continues to rotate along with the mandrel shaft. The operation of the spring 121 will move the hook and crank 144 to the dotted line position seen in Figure 12.

The fact that the mandrel rotates at a relatively high speed during the formation of the blank into a container and slows down only when a container is ejected and a new blank is cut greatly facilitates the rapid manufacture of containers.

During the forming of the blank into a container on the mandrel, a presser cone 145 rests against the blank on the mandrel, to insure adequate adhesion of the overlapping margins of the blank and otherwise maintain the blank in proper position until the container is completely formed ready for ejection. This presser cone is mounted on a rotatable shaft 146 journaled in a bearing 147 carried on the outer end of an arm 148 fixed to a transversely disposed shaft 149. The presser cone 145 is normally held against the blank on the mandrel by a tension spring 150 attached at opposite ends to the bearing 147 and the frame 2.

Of course, the presser cone must be elevated away from the mandrel to permit ejection of a finished container. To this end, a cam 151 is provided on the shaft 13. This cam has a hump 152 positioned for engagement with a roller 153 carried intermediately by a lever 154 pivoted at one end, as at 155, and the free end of the lever being engaged with the forked lower extremity of a rod 156 (Figures 2 and 8). The upper end of this rod 156 is pivotally connected to a crank 157 fixed to the aforesaid shaft 149. Therefore, when the cam 151 raises the lever 154, the crank 157 is rotated so as to raise the presser cone 145 together with its bearing 147 away from the mandrel 107 against the action of the spring 150. Immediately upon the cam hump passing the roller 153, the spring 150 will restore the presser cone to its initial position.

The operation

The operation of the present machine is believed to be sufficiently apparent from the foregoing as to warrant only a brief summary at this point.

The initial feeding rolls 22 and 23 feed the continuous stock strip 5 from the supply source to the slack loop 28. From this slack loop, the stock strip is fed through the machine by the main feeding rolls 32 and 33 aided by the pressure between the backing roll 49 and printing roll 50. As the stock strip passes the printing roll, spaced patches of printing are placed on the underside thereof, and as the stock strip next passes the gluing mechanism, spaced dabs 63 of adhesive are applied to the upper face of the stock strip adjacent a side margin thereof.

As before stated, the shaft 21 is continuously driven from the shaft 13, and the initial feeding rolls are also continuously driven by means of the chain drive 29 from the shaft 21, while the main feeding rolls 32 and 33 are driven intermittently from the shaft 21 through the medium of the mutilated gears 38 and 40. The stock strip is consequently fed intermittently directly into engagement with the mandrel 107. The forward end of the stock strip, upon the actuation of the main feeding rolls, is fed with the part 105 directly into the mandrel groove 108 and gripped by the gripper 109 just prior to the severance of the blank 86 from the stock strip by the cutting mechanism.

At the time of reception of the forward end of the stock strip, the continuously moving mandrel is operating at its slowest speed, with the gripper held in open position. Then the gripper is released to closed position, and the blank is severed from the strip. Immediately upon the severance of the blank, the speed of the mandrel

increases and the blank is wound around the mandrel and formed into a container with the mandrel moving at a relatively high speed. Upon the formation of the container, the speed of the mandrel again slows, the gripper is held in released position, the presser cone 145 is elevated, and the finished container ejected from the mandrel by a blast of air. Immediately following the ejection of the finished container, the mandrel again receives the forward end of the strip in the groove 108 and the process is repeated.

During the cutting of the blank from the stock strip, the main feeding rolls 32 and 33 are idle, because the smooth part 41 of the gear 40 is engaged with the smooth part 39 of the gear 38. During the formation of the container upon the mandrel, the main feeding rolls are again actuated to advance the stock strip, and the feeding rolls again become idle upon the entrance of the part 105 of the stock strip into the mandrel groove.

It will be noted that, due to the fact that the stock strip is fed directly into and is gripped by the mandrel prior to the severance of the blanks, there is no opportunity for the blanks to become out of alignment or out of proper position, and a large blank may be handled just as readily as a small blank. It will further be noted that no further trimming or cutting operations are necessary upon the blank, either during or after the forming operation, the single stroke of the punch die having severed a complete blank in its final form. Such a process results in a minimum amount of waste of stock, this waste being exemplified by the heavy shaded die part 85 seen in the right hand portion of Figure 6.

It will be further noted that the use of the machine as above described, and the practice of the method embodied in this invention, results in a very rapid and economical production of containers, large and small containers being produced with equal facility.

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

I claim as my invention:

1. In a conical cup making machine, cup forming means arranged to grip the forward edge of a stock strip, feeding means arranged to feed a substantially continuous stock strip into said forming means, and cutting mechanism arranged to sever a conical cup blank from said strip after the forward edge of the strip has been gripped by said forming means, said cutting mechanism including a cutting element shaped to sever a complete conical cup blank from said strip.

2. In a conical cup making machine, container forming mechanism containing gripping means, feeding means arranged to advance a substantially continuous stock strip directly into engagement with said gripping means, and cutting mechanism timed to sever a blank for a conical cup from said strip after said gripping means have engaged the forward end of said strip, said cutting mechanism being arranged to sever a finished conical cup blank requiring no further trimming.

3. In a container making machine, container forming mechanism containing gripping means, feeding means arranged to advance a substantially continuous stock strip directly into engagement with said gripping means, and cutting mechanism timed to sever a container blank from said strip after said gripping means have engaged the forward end of said strip, said cutting mechanism including a punch die and an apertured die block arranged to strike out a part of said strip and thus provide a container blank and simultaneously remove waste stock.

4. In a container making machine, container forming mechanism containing gripping means, feeding means arranged to advance a substantially continuous stock strip directly into engagement with said gripping means, and cutting mechanism timed to sever a container blank from said strip after said gripping means have engaged the forward end of said strip, said cutting mechanism being arranged to sever a finished container blank requiring no further trimming and simultaneously remove the waste stock from the path of said strip.

5. In a container making machine, a driving element, forming means arranged to be driven through a variable speed cycle by said driving element, feeding means connected to said driving element to be driven intermittently thereby and timed to advance the forward end of a substantially continuous stock strip periodically to said forming means, the strip end reaching said forming means when the same are moving through the slower part of said speed cycle, and cutting means timed to sever a container blank from said strip after it has reached the forming means and while the feeding means are idle.

6. In a container making machine, a continuously operable driving element, initial feeding means connected to said driving element for continuous operation thereby to deliver a substantially continuous stock strip from a source into position for passage through the machine proper, forming means arranged to be continuously driven by said driving element but at variable speed through a predetermined speed cycle, and main feeding means arranged to be intermittently driven by said driving element for advancing said strip to said forming means at the slow part of said speed cycle.

7. In a container making machine, a continuously operable driving element, initial feeding means connected to said driving element for continuous operation thereby to deliver a substantially continuous stock strip from a source into position for passage through the machine proper, forming means arranged to be continuously driven by said driving element but at variable speed through a predetermined speed cycle, main feeding means arranged to be intermittently driven by said driving element for advancing said strip to said forming means, and cutting means also actuated by said driving element to sever a container blank from said strip after the forward end of the strip has reached the forming means.

8. In a container making machine, a continuously operable driving element, initial feeding means continuously driven by said driving element to advance a substantially continuous stock strip, forming means continuously driven at variable speed by said driving element, other feeding means driven intermittently by said driving element to periodically advance said strip to said forming means, and cutting mechanism also actuated intermittently by said driving element to sever a container blank from said strip after the forward end thereof has been engaged by said forming means.

9. In a container making machine, forming means, feeding means arranged to advance a substantially continuous stock strip towards said forming means, and cutting mechanism including a die shaped to sever a finished container blank from said strip by striking out a section of said strip corresponding to the waste stock occurrant between adjacently severed blanks, said cutting mechanism being timed to operate after the forward end of said strip has been firmly engaged by said forming means.

10. The method of making a conical paper cup, including feeding a substantially continuous stock strip towards forming position, and cutting a finished substantially sector-shaped blank having a projecting tab from the forward part of said strip by removing from said strip a section corresponding in general to waste stock between adjacently severed blanks, forming said blank into conical cup shape and shaping said tab about the apexial region of the cup.

11. In a container making machine, a conical forming mandrel carrying gripping means, driving means arranged to rotate said forming mandrel continuously but at variable speed through a predetermined speed cycle, feeding means arranged to feed the leading end of a stock strip directly into engagement by said gripping means at the slower range of speed of said speed cycle, and cutting means timed to sever a blank from said strip after gripping has occurred but before a faster part of said speed cycle is reached.

12. The method of making a conical paper cup with the aid of a forming mandrel, including the steps of feeding a substantially continuous ribbon of stock towards the mandrel, engaging the forward end of the ribbon with the mandrel, then severing a completed blank from the leading portion of the stock ribbon, and thereafter winding the blank around the mandrel into a conical cup.

13. The method of making a conical paper cup with the aid of a forming mandrel, including the steps of feeding a substantially continuous ribbon of stock towards the mandrel, engaging the forward end of the ribbon with the mandrel, then severing a completed substantially sector-shaped blank from the leading portion of the stock strip by striking out of said ribbon a section corresponding in general to waste stock between successively severed blanks, and thereafter winding the blank around the mandrel into a conical cup.

CESARE BARBIERI.