United States Patent

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[54] **WORKPIECE-POSITIONING APPARATUS AND MACHINE USING SAME**
22 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **72/361,** 72/424, 113/113
[51] **Int. Cl.** **B21d 43/04**
[50] **Field of Search** 72/343, 347-349, 352, 358, 359, 361, 419, 420, 421, 424, 428; 113/113

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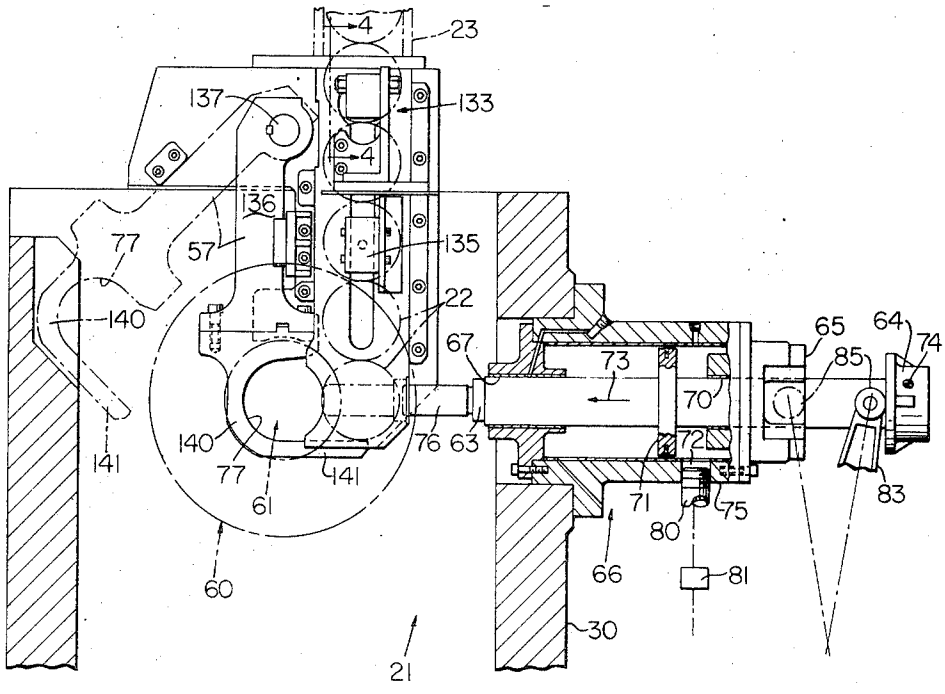
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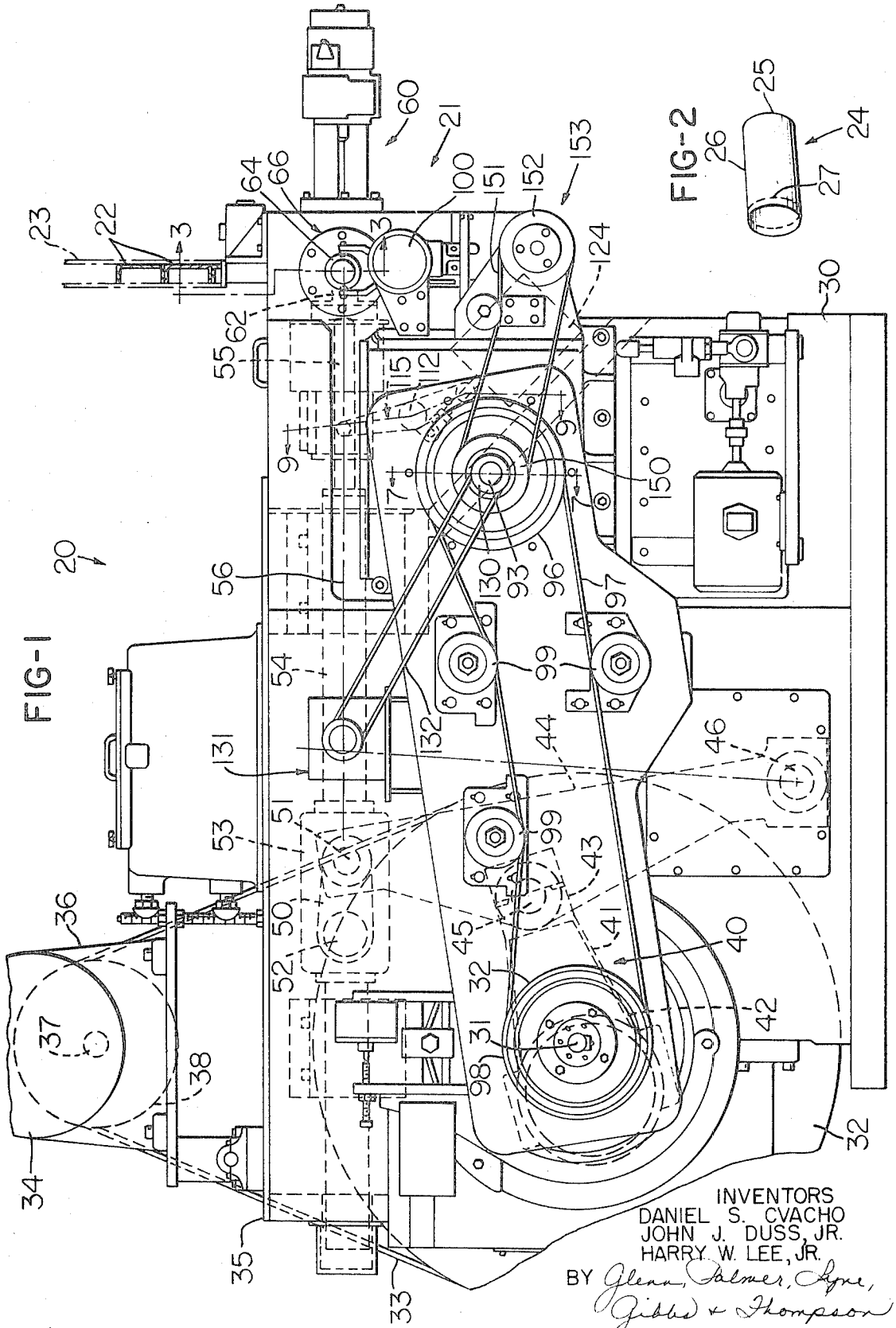
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ABSTRACT: An apparatus for precisely positioning a cup-shaped workpiece or cup into position at a drawing and ironing station of an associated machine. The apparatus utilizes a workpiece-positioning member which is supported for movement toward and away from the station and has a stop provided thereon. A fixed control surface is provided adjacent the positioning member and an actuator is employed to urge the positioning member toward such station causing the positioning member to engage and move the cup into the station to a precise position controlled by a portion of the positioning member engaging the control surface.





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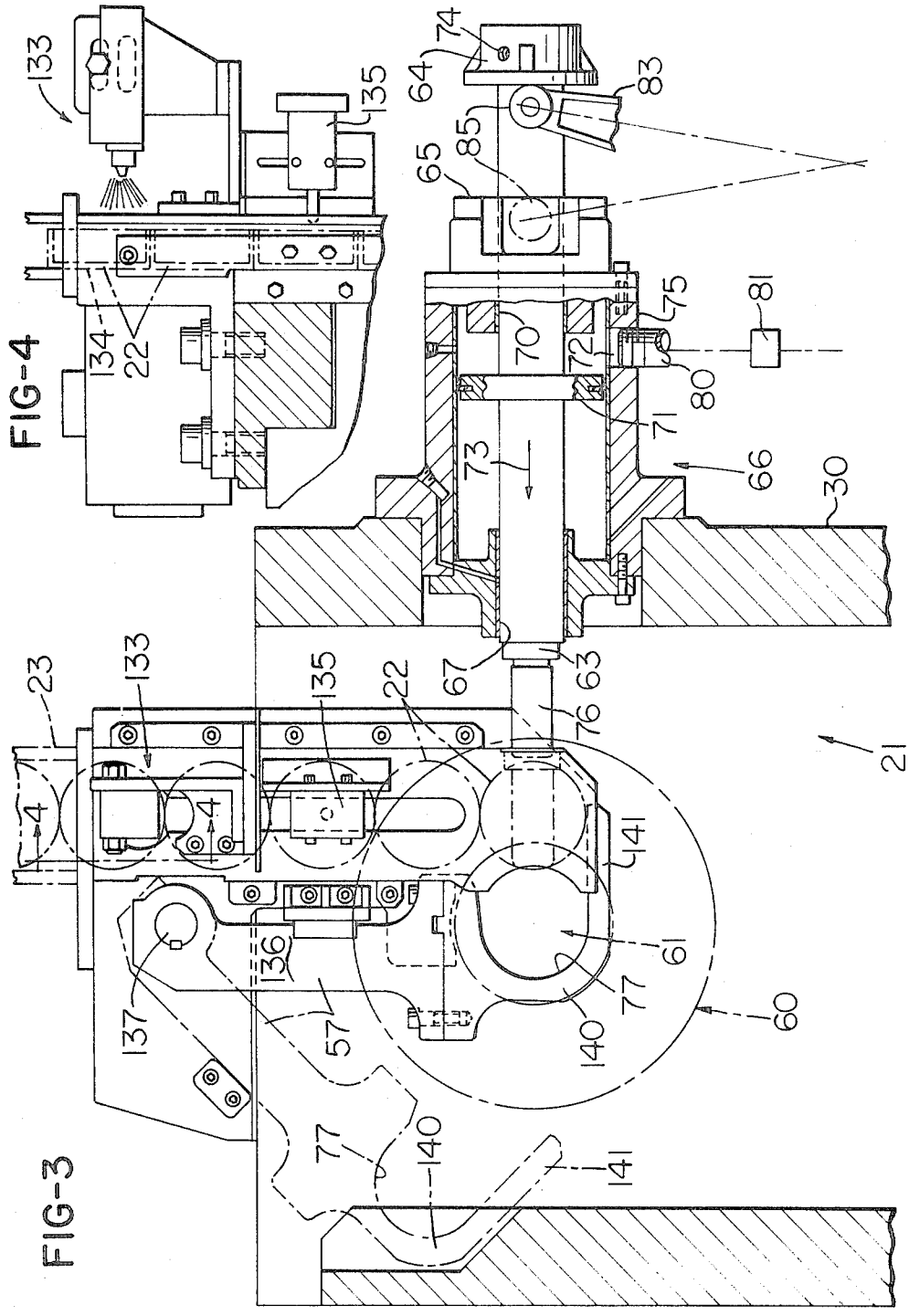


FIG-4

FIG-3

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FIG-5

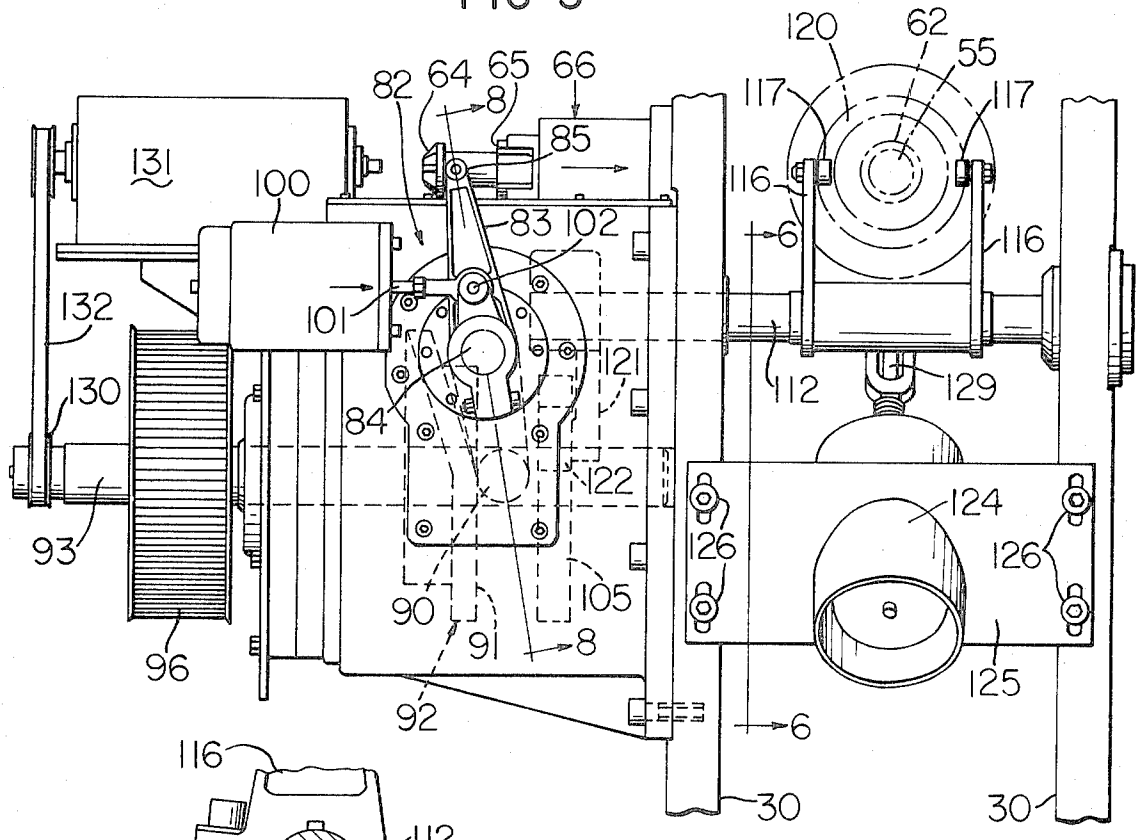
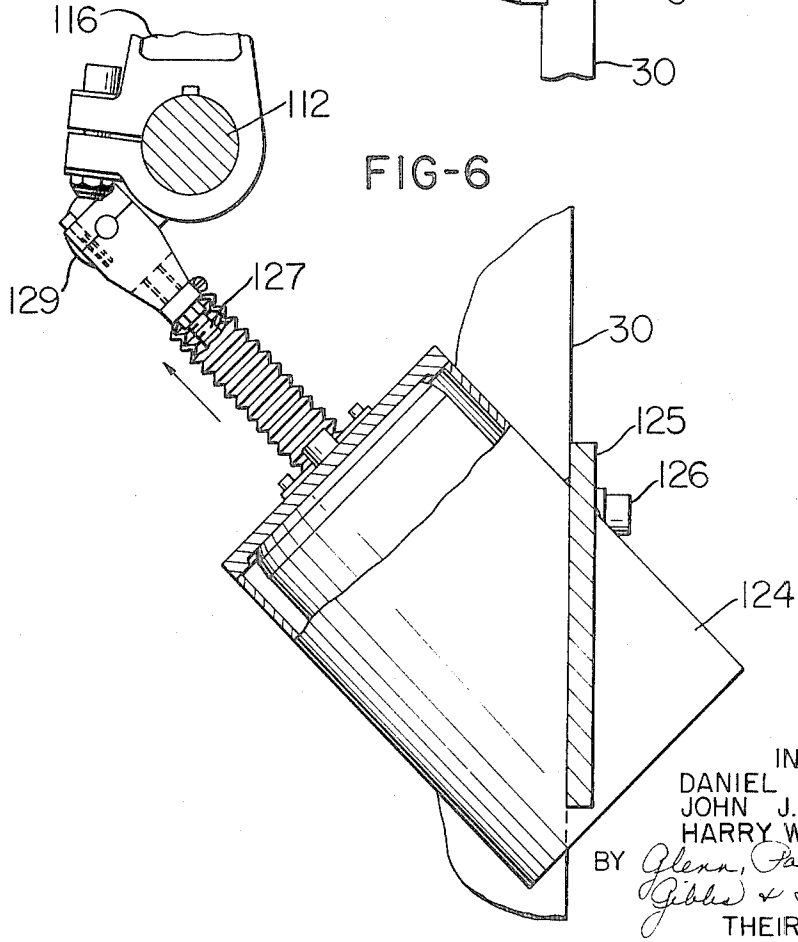
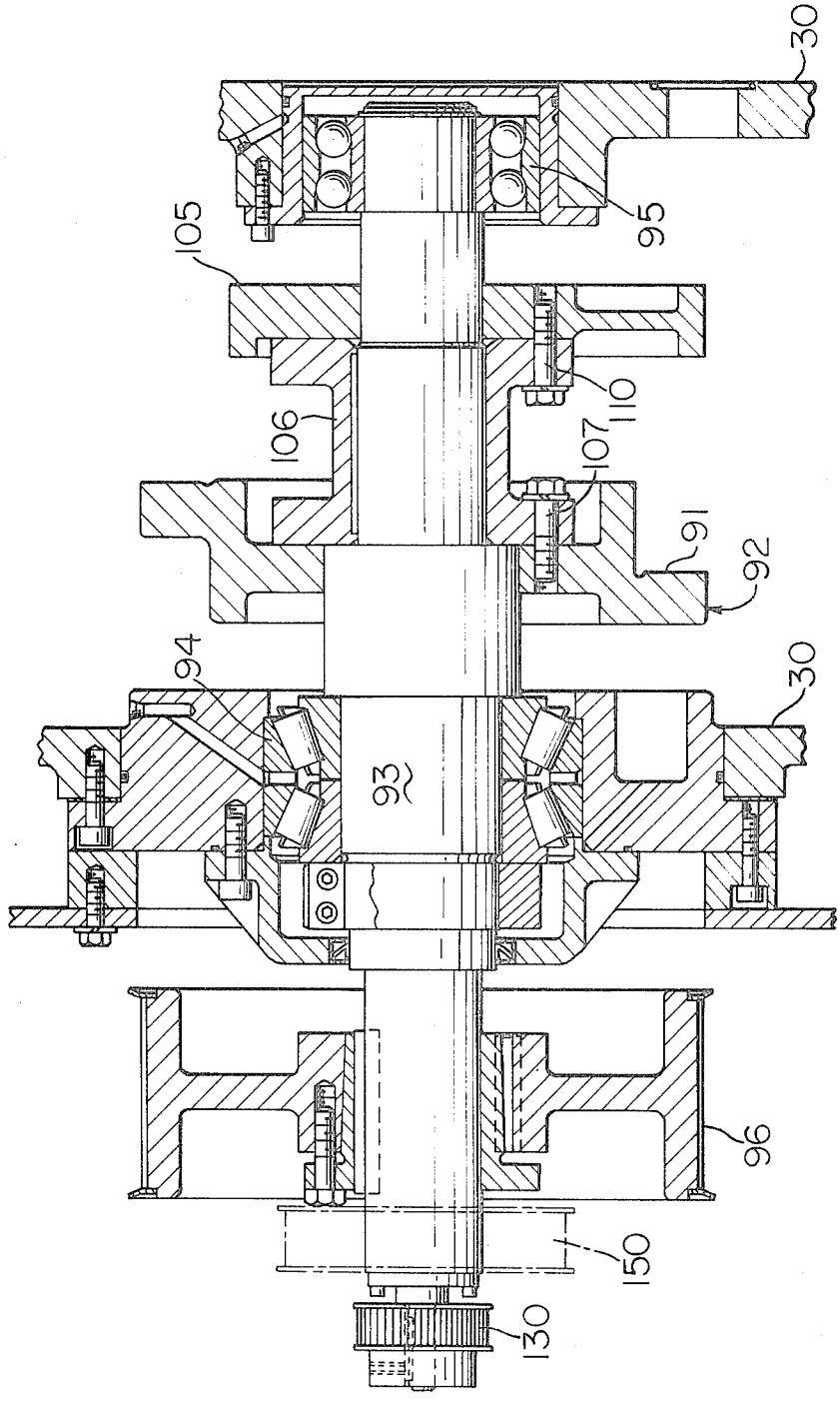


FIG-6



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FIG-7



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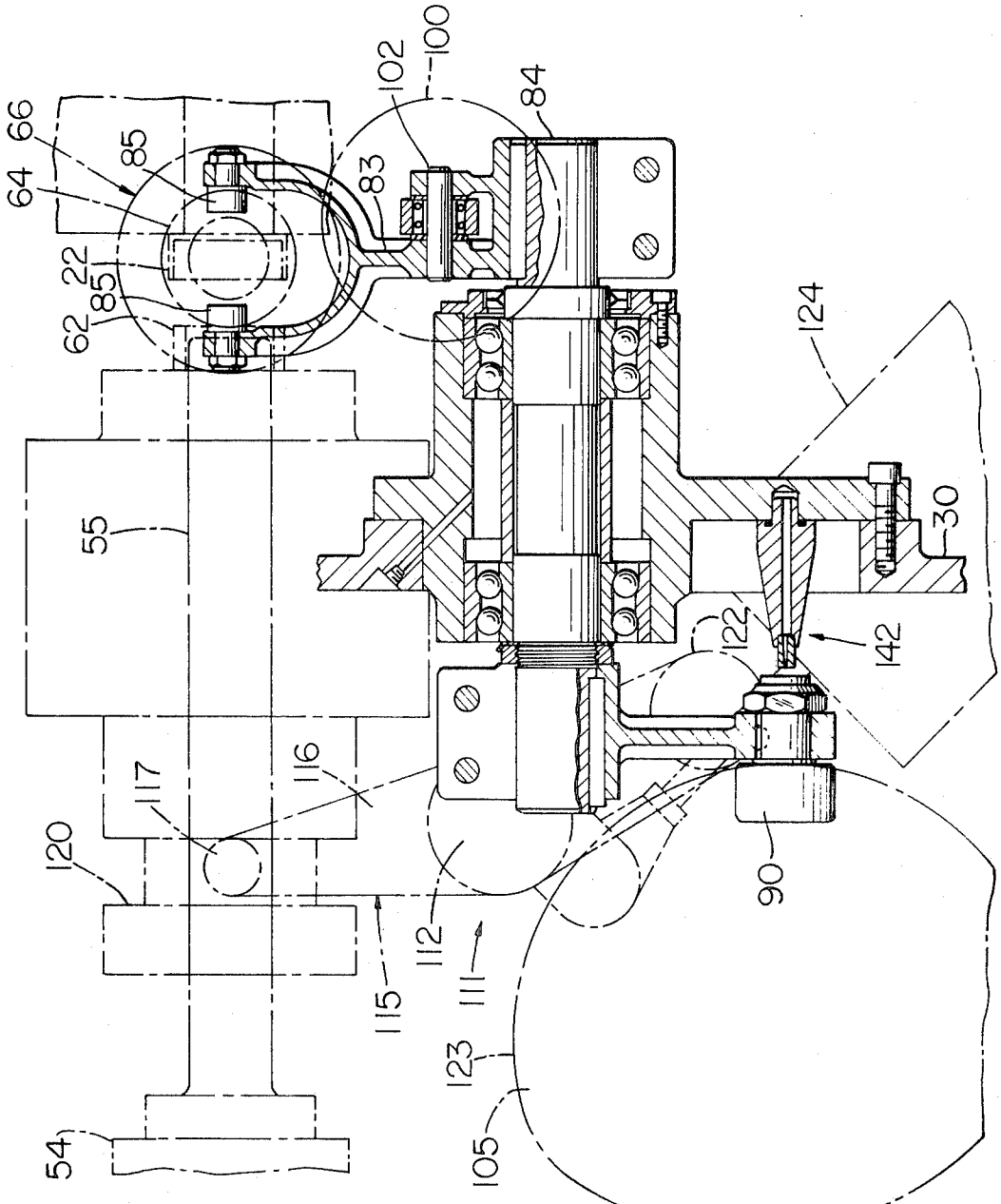


FIG-8

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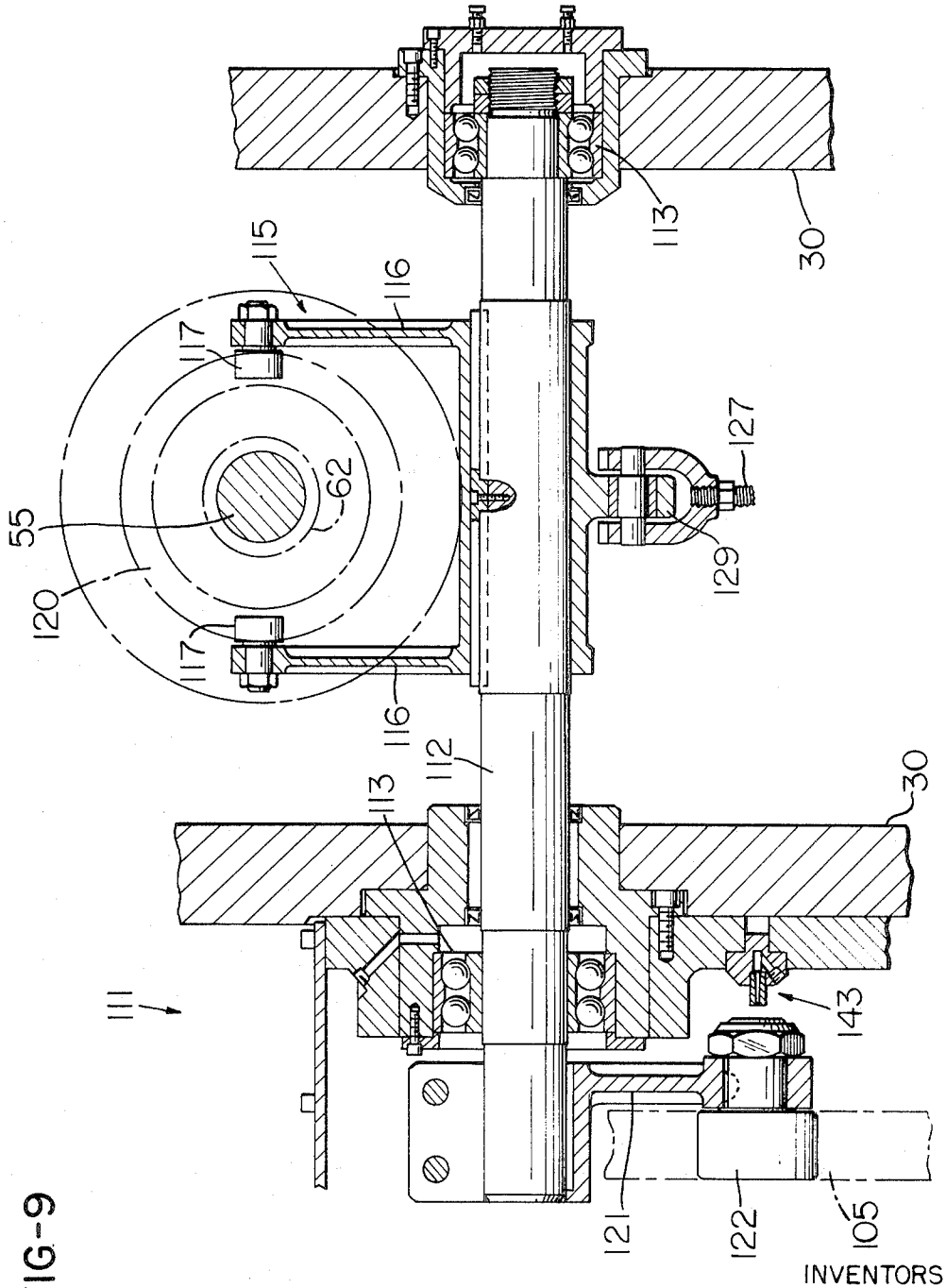


FIG-9

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FIG-10

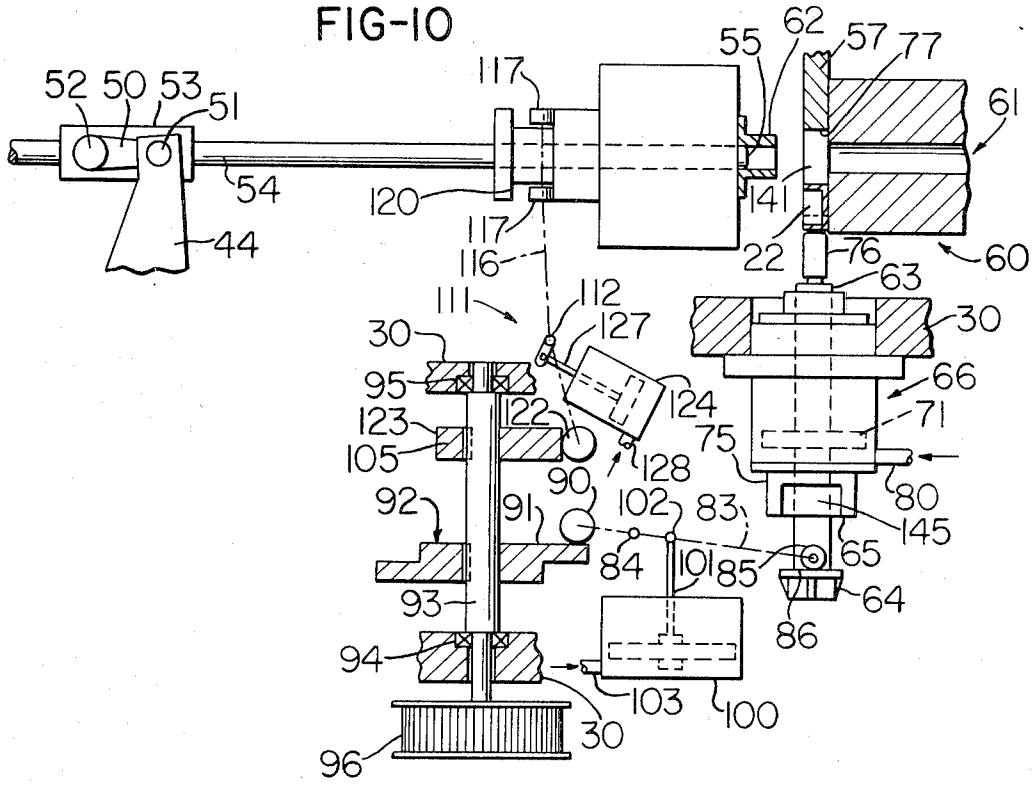


FIG-11

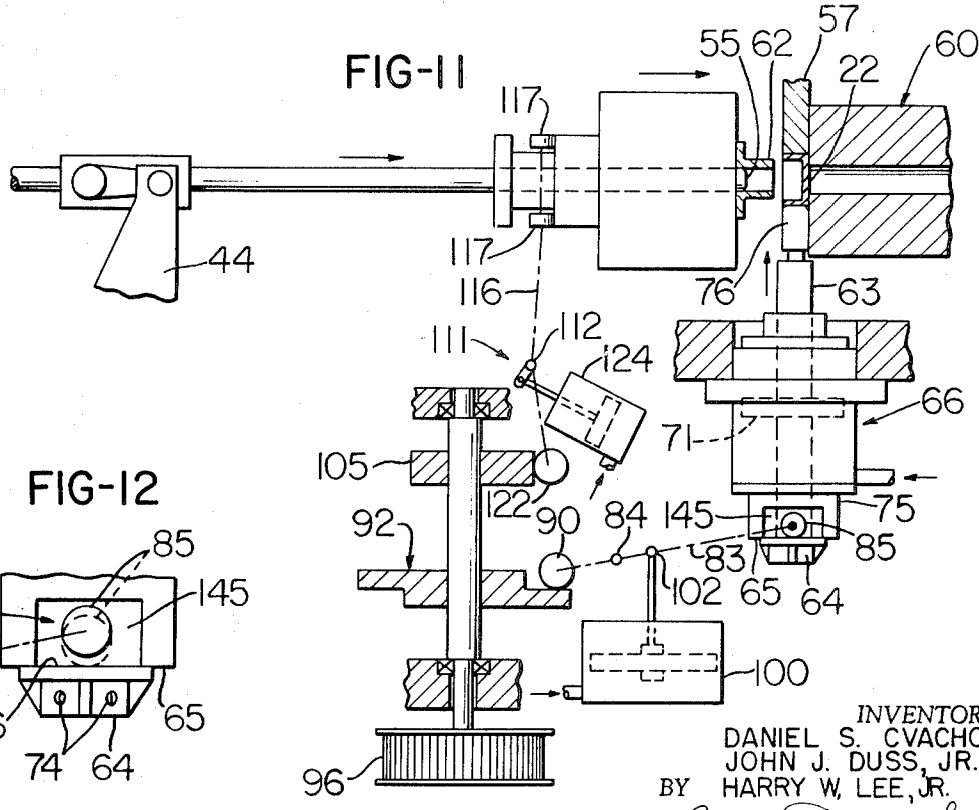


FIG-12

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FIG-13

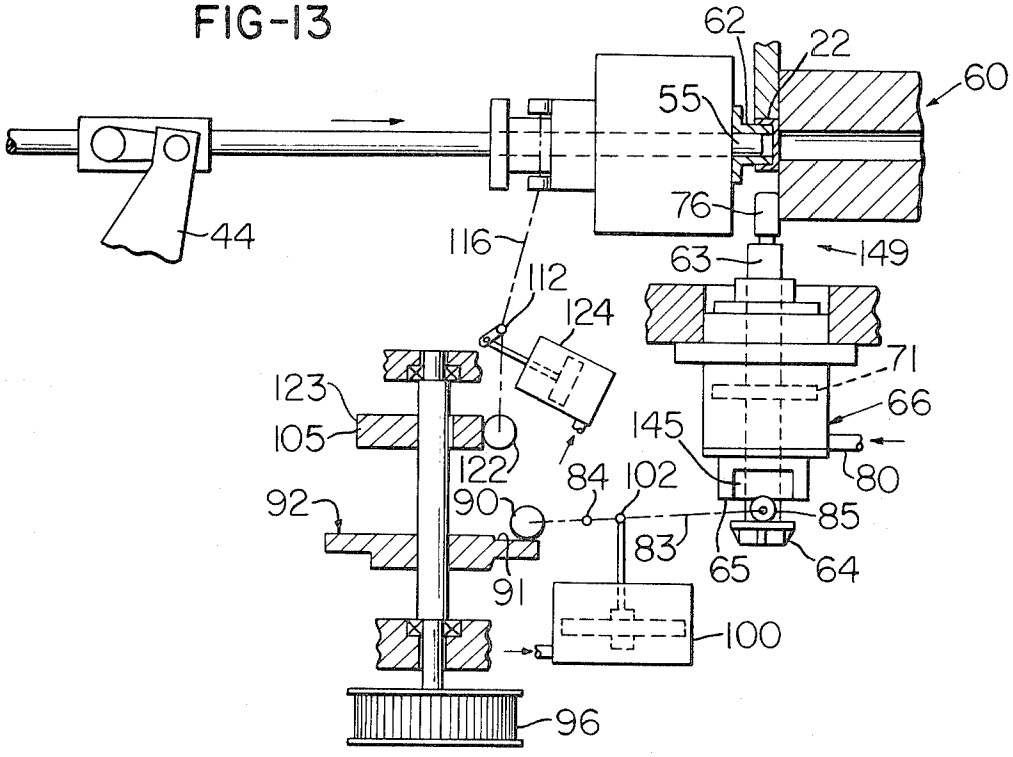
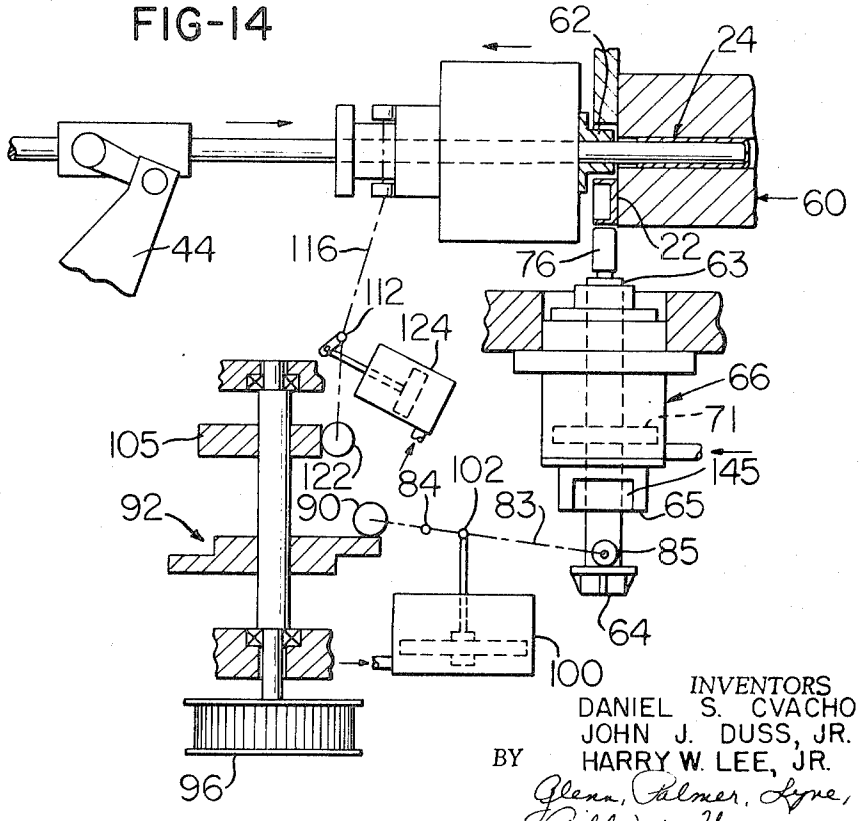


FIG-14



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WORKPIECE-POSITIONING APPARATUS AND MACHINE USING SAME

BACKGROUND OF THE INVENTION

There are numerous machines in current use which receive a cup-shaped workpiece or cup and draw and iron such cup to define an associated container. To assure that each cup is drawn and ironed efficiently and with minimum likelihood of jamming it is necessary that it be precisely positioned ahead of an associated punch and in a synchronized manner with a cup holder usually employed to hold the cup in position within an associated female die and ahead of a cooperating punch. The devices proposed heretofore do not provide the desired accurate positioning of each cup and tend to become less accurate during normal operation thereby drastically reducing the operating efficiency of the associated machines and requiring frequent adjustment to enable the machines to be operated in a continuous manner.

SUMMARY

This invention provides a simple and economical apparatus for precisely positioning a workpiece into a drawing and ironing station of an associated machine wherein a workpiece-positioning member is provided and supported for movement toward and away from the station and such member has a stop provided thereon. A fixed control surface is provided adjacent the positioning member and means is provided for urging the positioning member causing it to engage and move an associated workpiece into the station to a precise position controlled by a portion of the positioning member engaging the control surface. Further, the apparatus of this invention provides precision positioning even after extended use thereof and without requiring frequent adjustment of component parts.

Other details, uses, and advantages of this invention will become apparent as the following description of the exemplary embodiment thereof presented in the accompanying drawings proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings show a present exemplary embodiment of this invention, in which

FIG. 1 is a side elevation with parts broken away of a machine used to draw and iron metal cup-shaped members or cups to form cylindrical containers or cans and which has the positioning apparatus of this invention provided as an integral part thereof;

FIG. 2 is a perspective view of a typical metal can made by the machine of FIG. 1;

FIG. 3 is a view with parts in cross section and parts broken away taken essentially on the line 3—3 of FIG. 1;

FIG. 4 is a view with parts in cross section and parts broken away taken essentially on the line 4—4 of FIG. 3;

FIG. 5 is a view in elevation of a fragmentary portion of the machine of FIG. 1 particularly illustrating the mechanism which limits the rate of movement of a cup-positioning rod toward a drawing and ironing station of the machine;

FIG. 6 is a fragmentary view with parts in cross section and parts in elevation taken essentially on the line 6—6 of FIG. 5;

FIG. 7 is a cross-sectional view taken essentially on the line 7—7 of FIG. 1 with the shaft shown in elevation;

FIG. 8 is a view with parts in cross section and parts broken away taken essentially on the line 8—8 of FIG. 5;

FIG. 9 is a view taken essentially on the line 9—9 of FIG. 1;

FIG. 10 is a schematic illustration of the punch, die, cup-positioning apparatus, and cup-holder positioning device comprising the machine of FIG. 1 with certain components rotated 90° and with the machine shown essentially at the beginning of an operating cycle wherein a cup is dropped by gravity from an associated chute into position so that it may be precisely moved to the drawing and ironing station;

FIG. 11 is a schematic illustration similar to FIG. 10 and shows the cup precisely positioned in the drawing and ironing station and the cup holder and punch moving theretoward;

FIG. 12 is a fragmentary view particularly illustrating the cup-positioning member in its precisely controlled forward position and the manner in which a linkage associated with such positioning member may be provided at comparatively loose tolerances;

FIG. 13 is a schematic illustration similar to FIG. 10 and shows the cup holder holding the associated cup in position with the punch moving toward the cup and its associated die and with the positioning member being retracted; and

FIG. 14 is a schematic illustration similar to FIG. 10 and shows the punch in its full forward position with the cup extruded through the associated die and with the cup holder starting its return stroke.

DESCRIPTION OF ILLUSTRATED EMBODIMENT

Reference is now made to FIG. 1 of the drawings which illustrates an exemplary drawing and ironing machine 20 which utilizes one exemplary embodiment of the positioning apparatus of this invention which is designated generally by the reference numeral 21. The machine 20 is particularly adapted to draw and iron metal cup-shaped workpieces or cups 22 which are supplied by gravity through a supply chute 23 to the forward end of the machine 20 to form single-piece can bodies or containers 24, see FIG. 2, each having a bottom wall 25 and an integral sidewall 26 of substantially right circular cylindrical configuration. An annular outer portion is subsequently trimmed from the sidewall 26 along a line 27 and the terminal edge of the trimmed can suitably flanged and an end closure fixed thereagainst to define a completed container.

The machine 20 has a supporting frame 30 which supports a rotatable shaft 31 which has a wheel 32 keyed thereto. The wheel 32 and shaft 31 are driven by a drive 33 which may be in the form of a chain drive, a drive belt, or the like. The machine 20 has a drive motor 34 which is supported on an upper portion 35 of the supporting frame 30 and the motor 34 is operatively connected to a gear box assembly 36 which has a driving shaft 37 extending outwardly therefrom and a drive wheel 38 is keyed to the shaft 37. The wheel 38 has the drive 33 operatively connected therearound so that upon starting motor 34 to rotate the drive wheel 38 the wheel 32 and shaft 31 are rotated in a simultaneous manner.

The machine 20 has an eccentric crank assembly 40 which is provided with a crank arm or crank 41 which has its inner end 42 operatively connected to the shaft 31 and its outer end 43 pivotally connected to a lever 44 by a pivot pin 45. The lever 44 has its lower end portion supported for pivoting movement by a pivot pin 46 which is carried by a lower portion of the supporting frame 30.

The upper end of the lever 44 has a link 50 which has one end pivotally connected thereto by a pin 51 and the opposite end of link 50 is pivotally connected by a pin 52 to a housing assembly 53 which is suitably fixed to an axially reciprocating structure in the form of a shaft 54 of extended length which may be supported for reciprocating movement in any known manner and has a punch or ram 55 provided at the forward end thereof. The motor 34 and housing assembly 53 together with the intermediate wheels, linkages, and drive connections comprise what may be considered the moving means for the shaft 54 and hence punch 55.

The shaft 54 is supported horizontally for reciprocating rectilinear movement along a longitudinal axis 56 and as blanks or cups 22 are serially fed by gravity from the supply chute 23 into the forward end of the machine 20 the cup-positioning apparatus 21 of this invention positions each cup 22 within a workpiece or cup receiver 57 arranged adjacent an extrusion die 60, see FIG. 3, so that each cup 22 is precisely aligned ahead of the punch 55 at what will be referred to as a drawing and ironing station 61 for the machine 20. With each cup 22 thus aligned at station 61 a workpiece or cup holder 62 is moved into position, see FIGS. 1 and 13, to hold the cup 22 so that with forward movement of the punch 55 the cup is extruded to define the single-piece container 24.

The positioning apparatus 21 is of simple and economical construction and provides precise positioning of the cup within the cup receiver 57 to assure operation of the drawing and ironing machine 20 in an efficient manner and with minimum likelihood of jamming of cups 22 during the extrusion process. As seen particularly in FIG. 3 of the drawings, the positioning apparatus 21 comprises a work-piece-positioning member or rod 63 which is supported for substantially horizontal movement toward and away from station 61 and the rod 63 has a stop 64 provided thereon. A fixed control surface 65 is provided adjacent the rod 63 and urging means in the form of a fluid cylinder 66 is utilized to urge the rod 63 toward the drawing and ironing station with a substantially constant force which is easily controlled and the rod 63 in this example comprises the telescoping rod portion of the fluid cylinder 66. The cylinder 66 causes its rod 63 to engage and move each associated cup 22 into the station 61 to a precise position controlled by stop 64 engaging the control surface 65.

The rod 63 is suitably slidably supported by sleeve bearings 67 and 70 arranged at opposite ends of the air cylinder 66 and a piston 71 is fixed to the central portion of the rod 63 and supplied with air on one side thereof through an inlet 72 so as to continuously urge the rod 63 toward station 61 as indicated by the arrow at 73. The rod 63 has the stop 64 in the form of a collar suitably fixed thereon by a plurality of setscrews 74 so that the stop 64 may be adjustably positioned to an infinite number of axial positions along the rod 63.

The control surface 65 in this example of the invention is provided on a housing portion 65 of air cylinder 66 and the housing 75 is fixed to the machine frame 30. The rod 63 is in the form of a telescoping rod which has portions extending from opposite ends of housing 75; however, it will be appreciated that the rod 63 may be independently supported, if desired, and a suitable urging means operatively connected thereto in a known manner.

The rod 63 has a reduced diameter outer end portion 76 which is particularly adapted to engage an associated cup 22 adjacent the drawing and ironing station 61 and move such cup into an arcuate recess 77 provided in the cup receiver 57. The surface defining recess 77 is held to a closely controlled tolerance to assure that each cup 22 is precisely positioned ahead of the cup holder 62 to enable such cup holder to engage and suitably hold the cup against the die 60 and enable efficient extrusion thereof once the punch 55 is urged forcibly thereagainst. The air cylinder 66 is provided with air under regulated pressure from any suitable source through a line 80 which is operatively connected to an adjustable air pressure regulator 81 whereby the rod 63 is continuously urged toward the drawing and ironing station 61 by the air cylinder 66 and the entire force required to move rod 63 and each cup 22 into position is supplied by such air cylinder.

The supply chute 23 of machine 20 serially feeds cups 22 toward the station 61 and it is only necessary for rod 63 to precisely position and hold each cup in position until the cup holder 62 engages and holds the cup against the die 60 whereupon the rod 63 may be retracted in preparation for subsequent forward movement and positioning of the next cup to be extruded. In view of the continuous urging of rod 63 provided by the air cylinder 66, the positioning apparatus 21 is provided with a mechanism indicated generally at 82 in FIG. 5 which limits or restrains the rate of movement of rod 63 toward station 61 and until the stop 64 engages control surface 65.

In drawing and ironing machines proposed heretofore, the positioning of a workpiece such as a cup 22 is controlled by attempting to control the forward movement of a cup-positioning rod with a linkage mechanism which is operatively connected to the punch and cup holder and is driven by the machine. However, it has been found that in these types of presently used machines it is very difficult to control the movement of the cup-positioning rod even by using components manufactured to precision tolerances. In addition, in those machines where movement is controlled by mechanical linkages to precise tolerances it has been found that wear in such linkages due to normal use results in improper positioning of cups to be drawn and ironed, which results in misalignment, jamming, and improper extrusion.

As previously mentioned, the mechanism 82 limits and in essence controls the rate of movement of rod 63 toward station 61. Further, because the extent of forward movement of rod 63 is precisely controlled by the fixed control surface 65, the positioning apparatus 21 is virtually unaffected by wear and extended operating usage whereby the mechanism 82 may be inexpensively made using comparatively loose tolerances.

The mechanism 82 comprises a pivoted lever 83, see FIGS. 5 and 10, which is pivoted about a fixed pivot shaft 84 and has one end portion which has a roller 85 provided thereon which is adapted to be engaged by an inner portion 86 of the stop 64. A cam roller 90 is suitably rotatably supported on the opposite end portion of the lever 83 and the cam roller 90 engages a cam surface 91 of an associated cam 92 which is driven by the machine 20 whereby the cam 92 controls the position of the outer end of the lever 83 and its roller 85 which engages the stop collar 64 and serves to control the rate of movement of the rod 63 toward the drawing and ironing station 61.

The cam 92 is suitably fixed to and rotates with a horizontal shaft 93 which is rotatably supported by antifriction bearings 94 and 95 at opposite ends thereof and each bearing is supported on an associated portion of the machine frame 30. Each of the bearing assemblies 94 and 95 is suitably lubricated in a known manner and the bearing assembly 94 is in the form of an axial and radial thrust bearing.

As seen particularly in FIGS. 1 and 7 of the drawings, the shaft 93 has a drive wheel 96 suitably keyed thereto and the wheel 96 is driven by a nonslip belt 97 which is in turn driven by a driving wheel 98 which is keyed to the shaft 31 of the machine 20. The belt 97 is provided with a plurality of tensioning devices 99 which control the tension thereof to assure that the belt 97 operates in a nonslipping manner. Thus, it is seen that the shaft 93 is driven by the shaft 31 which drives the crank assembly 40.

The positioning apparatus 21 has another actuator in the form of a second fluid cylinder 100, see FIGS. 1 and 10, which has a piston rod 101 extending outwardly therefrom which is operatively connected to the pivoted lever 83 at 102. The air cylinder 100 is supplied with air under regulated pressure from a suitable pressure source through a line 103 and the cylinder 100 operates to constantly urge its rod 101 outwardly and thereby pivot the lever 83 about its pivot 84 to hold the cam roller 90 urged against the cam surface 91. With this arrangement it will be seen that the rate of movement of the roller 85 toward station 61 is directly controlled by the cam 92 which is synchronized with the reciprocating movement of the punch 55.

As previously mentioned, the machine 20 has a cup holder 62 which holds each cup 22 in position at the drawing and ironing station 61 once the positioning rod 63 aligns the cup within the cup receiver 57. Means is provided for synchronizing the movement of the positioning member 63 with the movement of the holder 62 and in this example of the invention such means is provided by shaft 93 as will now be described.

The shaft 93 has a cup holder actuating cam 105 suitably fixed thereto by fixing such cam to a flange 106, see FIG. 7, which is keyed to the shaft 93 and has the cup feeder cam 92 fixed to one end thereof by bolts 107 and the cup holder cam 105 fixed to its opposite end by bolts 110.

As seen particularly in FIGS. 5, 8, and 9 the machine 20 also has an actuating assembly 111 for moving the cup holder 62 toward and away from the drawing and ironing station. The assembly 111 comprises a shaft 112 which is rotatably supported in antifriction bearing assemblies 113 at opposite ends thereof and each of the bearing assemblies 113 is carried by a portion of the machine frame 30. The actuating assembly 111 also has a yoke 115 fixed to shaft 112 and comprised of a pair of upstanding arms 116 each having a roller 117 rotatably sup-

ported thereon adjacent its outer end. The rollers 117 are received within an annular groove 120 in the cup holder 62 and with pivoting movement of the shaft 112 in its bearing assemblies 113 the yoke 115 and hence the cup holder 62 is moved in a controlled manner toward and away from the drawing and ironing station 61.

The cup holder actuating assembly 111 also has an arm 121 fixed to the shaft 112 and extending downwardly therefrom and the arm 121 has a cup feeder cam roller 122 suitably rotatably supported thereon. The roller 122 is adapted to engage a cam surface 123 provided on the cup holder feed cam 105. The cam 105 is an eccentric cam and of a roughly oval-shaped outline and as the cam roller 122 is held urged thereagainst it pivots the shaft 112 in its bearings 113 and precisely positions the cup holder toward and away from the drawing and ironing station 61 as determined by the contour of the cam surface 123 and inasmuch as the cam 105 is fixed to the shaft 93 the movement of the cup holder 62 is synchronized with extruding movements of the punch 55 and with movements of the rod 63.

As seen particularly in FIGS. 5 and 6 and schematically in FIG. 10, the machine 20 has another actuator in the form of another fluid or air cylinder 124 which is fixed to a plate 125 which is adjustably attached to a portion of the machine frame 30 by a plurality of bolts 126. The air cylinder 124 has a telescoping rod 127 extending outwardly therefrom which is urged outwardly by air under regulated pressure provided to such cylinder through a conduit 128. The rod 127 has its terminal outer end portion fixed to a lug 129 which comprises a part of the yoke 115, see FIG. 9. As the rod 127 is moved by its cylinder 124 it pivots the yoke 115 and shaft 112 to thereby hold the cam roller 122 urged against the cam surface 123 provided on the cam 105 which controls the movement of the cup holder 62 whereby with rotation of shaft 93 the cam 105 cooperates with the cup holder actuating assembly 111 to move the cup holder 62 toward and away from the drawing and ironing station 61.

The machine 20 has a wheel 130 suitably fixed to the shaft 93, see FIGS. 1 and 7, and the wheel 130 is operatively connected to a signal generator 131 by a drive belt 132. The signal generator 131 is operatively connected to the main control system, not shown, of the machine 20 in a manner well known in the art and may be utilized to synchronize the movement of the punch 55 with the rotation of shaft 93 and hence with the movement of the cup holder 62 and the cup-positioning rod 63.

As previously mentioned, each cup 22 is serially fed into the machine 20 through the gravity chute 23 which is provided with suitable guides so as to feed cups 22 toward the drawing and ironing station 61. To assure that each cup is initially positioned closely adjacent the front face of the female die 60 an air nozzle assembly 133 is provided and directs a jet of air toward the open end of each cup 22 urging it against a back guide 134 comprising the chute 23, see FIG. 4. The air nozzle assembly 133 is horizontally adjustable toward and away from chute 23 to assure efficient positioning of the cups 22. If desired, another air nozzle assembly 135 may be provided and arranged adjacent the drawing and ironing station 61.

The cup receiver 57 is in the form of an arm having an elongated portion 136 which has its upper end supported on a pivotable shaft 137 and the lower end of the arm 136 terminates in a C-shaped portion 140 which has the precisely controlled arcuate surface 77 defined therein. The C-shaped portion has an extension 141 extending outwardly therefrom and with the receiver 57 in its normal operating position the extension 141 is arranged substantially horizontally and is adapted to receive the lowermost cup 22 thereon as it drops from the gravity chute 23.

As the lowermost cup 22 drops onto extension 141 the outer portion 76 of the rod 63 is moved outwardly thereagainst in a precisely controlled manner sliding the cup 22 along the extension 141 and nesting it within the controlled arcuate surface 77. The positioning movement, i.e., extent of movement, of the rod 63 toward the extruding station 61 is precisely controlled by the control surface 65. It will also be appreciated that the stop 64 may be axially adjusted on the rod 63 so that it engages the control surface 65 in such a position as to take into account cups 22 having outside diameters which may vary within known tolerance limits and thereby assure that once the cup holder 62 is moved into position it will be received within the cup 22 with minimum likelihood of jamming, or the like.

However, should a cup 22 jam within the female die 60, for example, the receiver 57 may be pivoted outwardly by rotating its supporting shaft 137 so that the receiver 57 is moved to the dotted line position as illustrated in FIG. 3 of the drawings to provide easy access to the jammed cup 22 or partially extruded container 24.

To assure that he point of contact between cam roller 90 and cam surface 91 is free of dirt, foreign particles, and the like, a jet of high-velocity air is directed theretoward from an associated air nozzle assembly 142, see FIG. 8. Another air nozzle assembly 143 is provided as shown in FIG. 9 and arranged so that it directs a jet of high-velocity air toward the point at which the cam roller 122 engages the cam surface 123 of cam 105. Each assembly 142 and 143 may be supplied with air under pressure from any suitable source and in a known manner.

Having presented a detailed description of certain components of the machine 20, a brief presentation will now be made of the general operation of the punch, positioning apparatus, cup holder, and related components of machine 20 and these components are shown schematically in FIG. 10 at the beginning of a cup-extrusion cycle with the machine in the position shown in FIG. 1 of the drawings. It will also be noted that in the schematic showings of FIGS. 10, 11, 13, and 14 a number of the components are not shown in their true positions and this has been done for clarity and ease of presentation.

In the position of FIG. 10 a cup 22 has been fed through the gravity chute 23 and is at rest on extension 141 of the C-shaped portion 140 of the cup receiver 57. Continued operation of the machine results in rotation of shaft 93 and the cams 92 and 105 carried thereon and with the air cylinders 100 and 124 urging their respective rods 101 and 127 outwardly, their associated cam rollers 90 and 122 are held tightly against cams 92 and 105. During this time the air cylinder 66 continues to urge rod 63 against the cam roller 85 so that the end portion 76 of such rod is urged toward the drawing and ironing station 61.

As the machine 20 continues through its cycle the cam 92 is rotated to such a position that the pivoted end of lever 83 and roller 85 move within recess 145 provided in the outer housing portion 75 of the air cylinder 66 and such portion has the control surface 65 provided thereon. As the roller 85 moves within recess 145 the stop 64 is urged by air cylinder 66 against control surface 65 whereby the inner end 76 of rod 63 engages and precisely positions the cup 22 supported on extension 141 within arcuate recess 77 and essentially as illustrated in FIG. 11. The cup 22 is precisely positioned due to the precise location of the fixed control surface 65 and the location of the stop 64 along the rod 63.

With continued operation of the machine 20 and surface 86 of stop 64 against control surface 65 the roller 85 lifts away from the inside surface 86 of the stop and moves within recess 145 from the dotted line position to the solid-line position illustrated at 147 in FIG. 11. The configuration of the cam surface 91 is such that the cam 92 rotates with the shaft 93 through an arc of approximately 25° to define a dwell period during which the rod 63 is at its controlled innermost position and holds the cup 22 in position waiting for the cup holder 62 to be urged thereagainst.

The cup holder 62 is moved into position by its cup holder actuator assembly 111 and in a controlled manner as determined by the configuration of the cam surface 123 of cam 105, see FIG. 13, whereupon the configuration of the cam sur-

face 123 is such that once the cup holder 62 is in position it remains in position for a dwell period determined by the configuration of the cam surface 123 and for a sufficient time period to allow the punch 55 to move forward and extrude the cup 22 to define the completed container 24. During this dwell period the configuration of the cam surface 91 of cam 92 is such that the air cylinder is overridden and the rod 63 retracted outwardly as illustrated at 149 toward its initial position.

The punch 55 is then moved to its full forward position, shown in FIG. 14, and the cup holder 62 is moved to its fully retracted position by its cam 105 followed by retraction of the punch 55 so that the various cooperating components of machine 20 again assume the positions illustrated in FIG. 10 in preparation for the positioning of another cup, movement of a cup holder into position, and extrusion thereof.

In this presentation of the invention the description of the operation of components parts of the machine 20 has been made without reference to the actual times involved. However, it will be appreciated that the various components cooperate to assure smooth and continuous operation of the machine 20 so as to enable extrusion of several hundred cups 22 per minute to define containers 24.

The recess 77 provided in the receiver 57 is shown as an arcuate recess defined by a substantially smooth continuous surface; however, if desired, such recess may be comprised of a plurality of cooperating planar surfaces which may be arranged in any suitable manner.

The detailed description presented above has been primarily concerned with the movement of cups 22 to the extruding station and the precision extrusion thereof; however, it will be appreciated that the extruded containers or cans 24 are also moved away from the machine in a synchronized manner and for this purpose a wheel 150 may be suitably fixed to the shaft 93, see FIGS. 1 and 7, and operatively connected by a belt 151 to a wheel 152 of a can discharge assembly 153.

The air cylinders 66, 100, and 124 are of the type which may have their telescoping rods overridden and pushed inwardly within their respective cylinders whereby in the event of jamming of any kind there is less tendency for their associated linkages to be damaged. In addition, the use of a common shaft to synchronize the movements of the cup holder and cup-positioning rod with the extruding movements of the punch, assures efficient operation over extended operating periods once the machine has been set up without requiring frequent stops for adjustment of cooperating linkages even after normal wear of parts due to extended operation.

While present exemplary embodiments of this invention, and methods of practicing the same, have been illustrated and described, it will be recognized that this invention may be otherwise variously embodied and practiced by those skilled in the art.

What is claimed is:

1. An apparatus for precisely positioning a workpiece into a drawing and ironing station of an associated machine comprising, a workpiece receiver supported at a fixed position adjacent said station, a workpiece-positioning member supported for movement toward and away from said station said positioning member having an inner end and having a stop provided thereon, a fixed control surface provided at a fixed position adjacent said positioning member, and means urging said positioning member toward said station until said stop engages said control surface causing said positioning member to engage and move an associated workpiece toward said workpiece receiver to a precise position controlled by said stop engaging said control surface so that said inner end of said positioning member and said workpiece receiver confine the associated workpiece therebetween at said precise position.

2. An apparatus as set forth in claim 1 and further comprising a holder for holding said workpiece in said precise position at said station and means synchronizing the movements of said positioning member and said holder to assure said workpiece is in position prior to engagement and holding thereof by said holder.

3. An apparatus for precisely positioning a workpiece into a drawing and ironing station of an associated machine comprising; a workpiece-positioning member supported for movement toward and away from said station and having a stop provided thereon; a fixed control surface provided adjacent said positioning member; means urging said positioning member toward said station until said stop engages said control surface causing said positioning member to engage and move an associated workpiece to a precise position controlled by said stop engaging said control surface; a holder for holding said workpiece in position at said station; and means synchronizing the movements of said positioning member and said holder to assure said workpiece is in position prior to engagement and holding thereof by said holder; said synchronizing means comprising, a rotatable shaft driven by said machine, a first cam fixed on said shaft for rotation therewith, an actuating assembly operatively associating between said first cam and said holder to control the movement thereof, and a second cam fixed on said shaft for rotation therewith and operatively associating with said positioning member, said cams being rotated simultaneously by said shaft and cooperating to assure said synchronized movements.

4. An apparatus as set forth in claim 1 in which said positioning member comprises an elongated member supported for axial movement in a direction substantially perpendicular to the longitudinal axis of a punch comprising said machine, said member having said stop fixed at a predetermined position along the length thereof.

5. An apparatus for precisely positioning a workpiece into a drawing and ironing station of an associated machine comprising, a workpiece-positioning member supported for movement toward and away from said station and having a stop provided thereon, a fixed control surface provided adjacent said positioning member, means urging said positioning member toward said station until said stop engages said control surface causing said positioning member to engage and move an associate workpiece to a precise position controlled by said stop engaging said control surface, said positioning member comprising an elongated member supported for axial movement and having said stop adjacent one end thereof, and a mechanism which limits the rate of movement of said member toward said station, said urging means continuously urging said member against said mechanism and toward said station until said stop engages said control surface, said mechanism being controlled for movement to comparatively loose tolerances due to the precise positioning provided by said stop engaging said control surface.

6. An apparatus as set forth in claim 5 in which said urging means comprises an air-operated cylinder having said member provided as its telescoping rod.

7. An apparatus as set forth in claim 5 in which said mechanism comprises a pivoted lever having one end portion which is adapted to be engaged by an inner portion of said stop, a cam roller provided on an opposite end portion of said lever, a cam operatively connected to and driven by said machine, and an actuator operatively connected to said lever and holding said cam roller against said cam to control the position of said one end portion, said urging means holding said stop against said one end portion to thereby control said rate of movement of said member toward said station.

8. An apparatus as set forth in claim 7 in which said urging means comprises an air-operated cylinder having, an outer housing fixed to said machine, said control surface provided on a portion of said housing, and said member provided as its telescoping rod.

9. An apparatus as set forth in claim 7 in which said actuator is in the form of an air cylinder.

10. A machine comprising a die, a reciprocating punch cooperating with said die for drawing and ironing an associated workpiece at a drawing and ironing station of said machine to define a container, a workpiece receiver at said station for confining a side portion of said workpiece, a workpiece-positioning member supported for movement toward and away from said station and having a stop provided

thereon, a fixed control surface provided adjacent said positioning member, and means urging said positioning member toward said station causing said positioning member to engage and move an associated workpiece to a precise position controlled by said stop engaging said control surface, and a mechanism which limits the rate of movement of said member toward said station, said urging means continuously urging said member against said mechanism and toward said station until said stop engages said control surface, said mechanism being controlled for movement to comparatively loose tolerances due to the precise positioning provided by said stop engaging said control surface, said receiver and positioning member cooperating to hold said workpiece in precise alignment ahead of said die to enable efficient drawing and ironing by said punch.

11. A machine as set forth in claim 10 and further comprising a holder for engaging the precisely aligned workpiece and holding it in position against said die.

12. A machine as set forth in claim 10 in which said workpiece comprises a cup-shaped article and further comprising a holder for engaging the precisely aligned cup-shaped article and holding it in position against said die to enable said efficient drawing and ironing thereof.

13. A machine as set forth in claim 10 in which said receiver comprises a pivotal arm having a C-shaped portion defining the terminal outer end thereof, said arm being held in a fixed position during normal operation and being easily pivoted away from said station to enable easy access to a workpiece which may be jammed at said station.

14. A machine as set forth in claim 10 in which said workpiece comprises a cup-shaped article, said receiver comprises a pivotal arm having a substantially C-shaped outer end portion provided with an extension portion which extends toward said positioning member and away from the bight of such C-shaped portion, and further comprising means conveying each cup-shaped article generally toward said station, said extension provided on said C-shaped portion of said arm being adapted to support the lowermost cup-shaped article adjacent said station and guide each lowermost cup-shaped article toward the bight of the C-shaped portion during movement of said cup-shaped article by said positioning member.

15. A machine as set forth in claim 14 in which said conveying means comprises a gravity chute.

16. A machine as set forth in claim 12 and further comprising means synchronizing the movements of said positioning member and said holder to assure said cup-shaped article is in position prior to engagement and holding thereof by said holder.

17. A machine comprising a die; a reciprocating punch cooperating with said die for drawing and ironing an associated workpiece at a drawing and ironing station of said machine to define a container; a workpiece receiver at said station for confining a side portion of said workpiece; a workpiece-positioning member supported for movement toward and away from said station and having a stop provided thereon; a fixed control surface provided adjacent said positioning member; means urging said positioning member toward said station causing said positioning member to engage and move an associated workpiece to a precise position controlled by said stop engaging said control surface; said receiver and positioning member cooperating to hold said workpiece in precise alignment ahead of said die to enable efficient drawing and ironing by said punch; a holder for engaging the precisely aligned workpiece and holding it in position against said die to enable said efficient drawing an ironing thereof; and means synchronizing the movements of said positioning member and said holder to assure said workpiece is in position prior to engagement and holding thereof by said holder; said synchronizing means comprising, a rotatable shaft driven by said machine, a first cam fixed on said shaft for rotation therewith, an actuating assembly operatively associating between said first cam and said holder to control the movement thereof, and a second cam fixed on said shaft for rotation therewith and operatively associating with said positioning member, said cams being rotated simultaneously by said shaft and cooperate to assure said synchronized movements.

18. A machine as set forth in claim 17 in which said positioning member comprises an elongated member and said stop comprises a stop collar which is substantially infinitely adjustable along the length of said elongated member and further comprising means for fixing said collar at any desired position along said elongated member.

19. A machine as set forth in claim 17 in which said positioning member comprises an elongated member supported for axial movement and having said stop in the form of an infinitely axially adjustable stop attached adjacent one end of said elongated member, and further comprising a mechanism which limits the rate of movement of said elongated member toward said station, said urging means continuously urging said member against said mechanism and toward said station until said stop engages said control surface, said mechanism being controlled for movement to comparatively loose tolerances due to the precise positioning provided by said stop engaging said control surface.

20. A machine as set forth in claim 19 in which said urging means comprises an air-operated cylinder having said member provided as its telescoping rod.

21. A machine as set forth in claim 19 in which said mechanism comprises a pivoted lever having one end portion which is adapted to be engaged by an inner portion of said stop, a cam roller provided on an opposite end portion of said lever, a cam operatively connected to and driven by said machine, and an actuator operatively connected to said lever and holding said cam roller against said cam to control the position of said one end portion, said urging means holding said stop against said one end portion to thereby control said rate of movement of said member toward said station.

22. A machine as set forth in claim 21 in which said urging means comprises an air-operated cylinder having, an outer housing fixed to said machine, said control surface provided on a portion of said housing, and said elongated member provided as its telescoping rod.

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