Aug. 15, 1961 A. J. WAHL ET AL 2,995,796

APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

Filed June 15, 1956 7 Sheets-Sheet 1

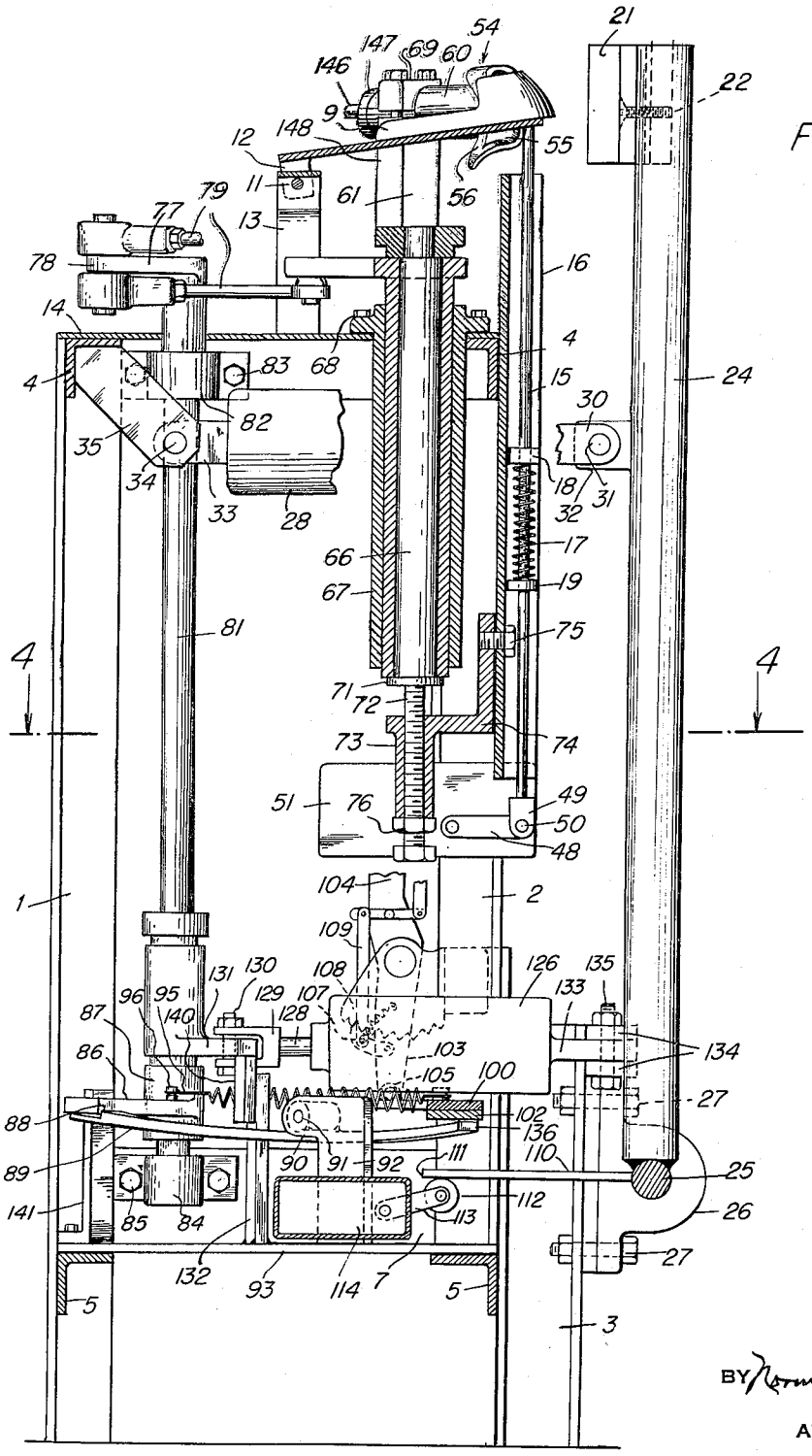


FIG. 1

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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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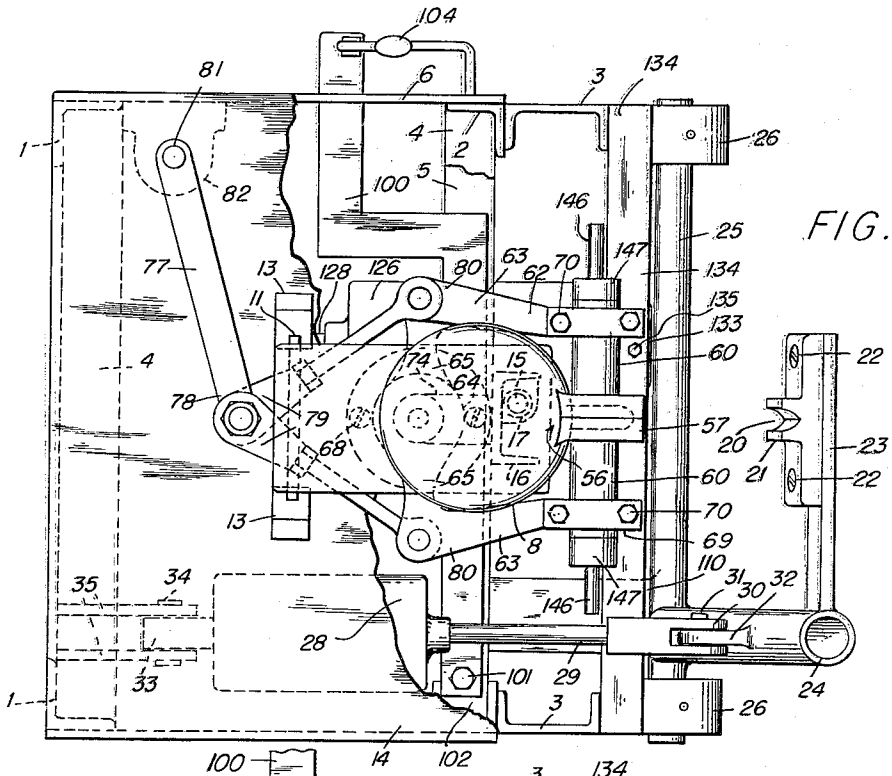


FIG. 2

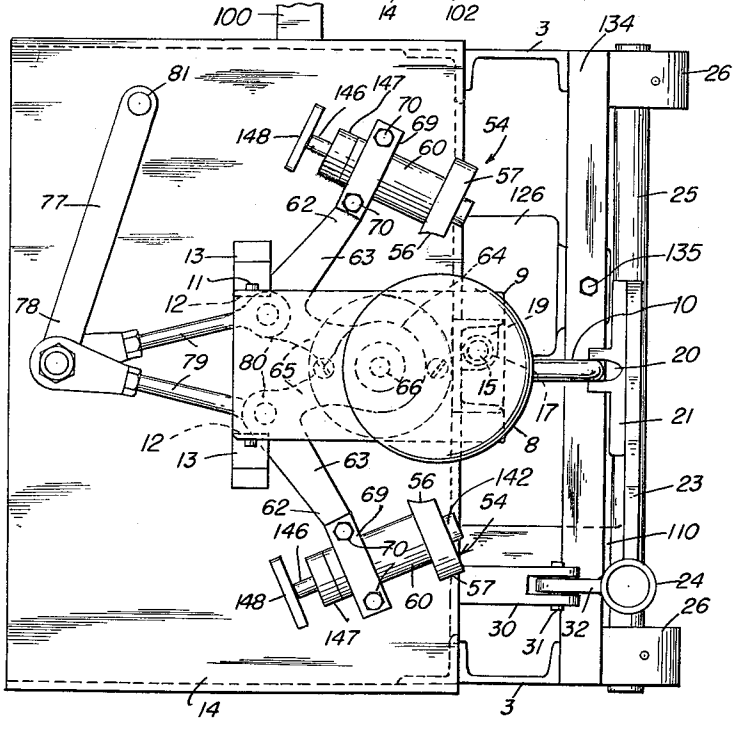


FIG. 3

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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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FIG. 4

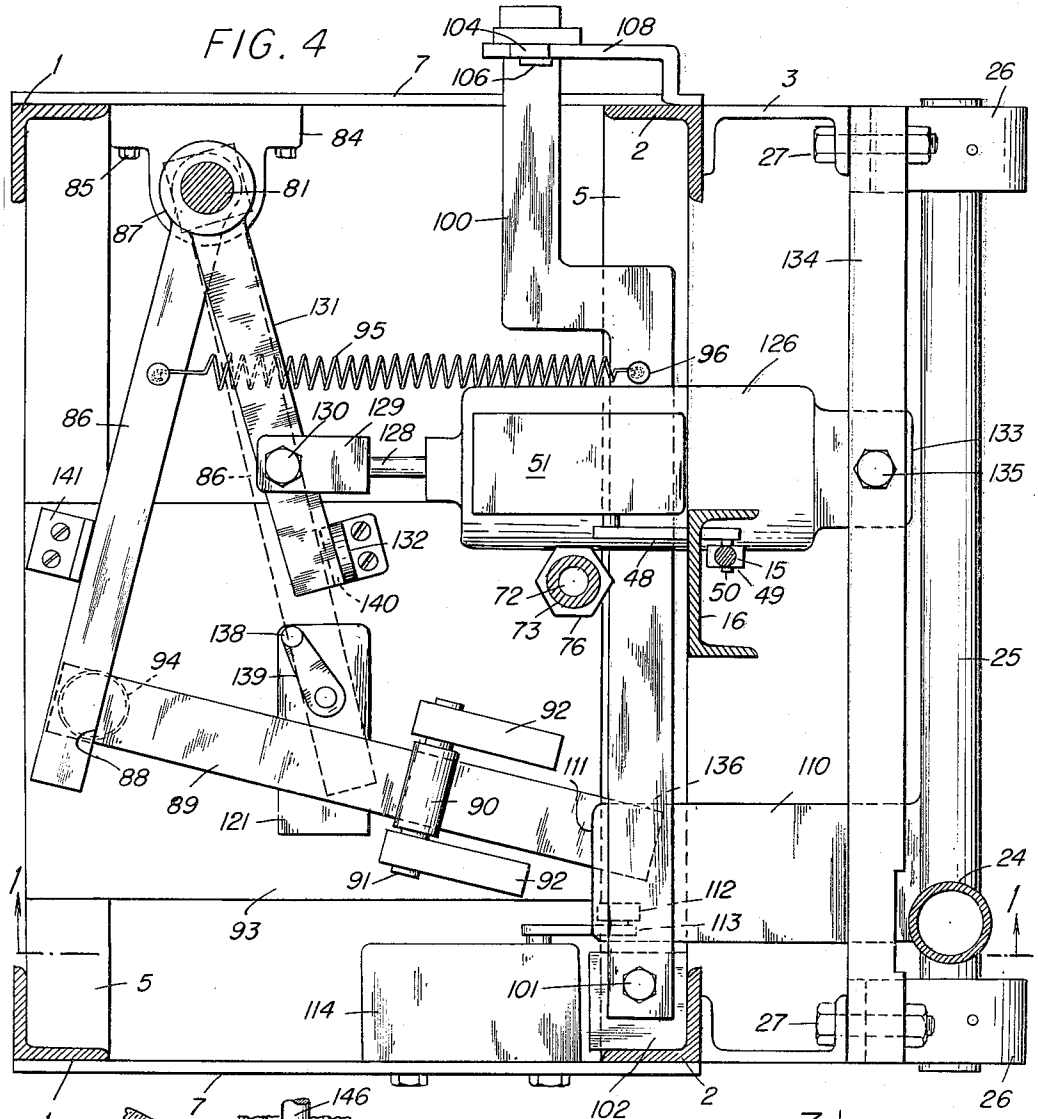


FIG. 5

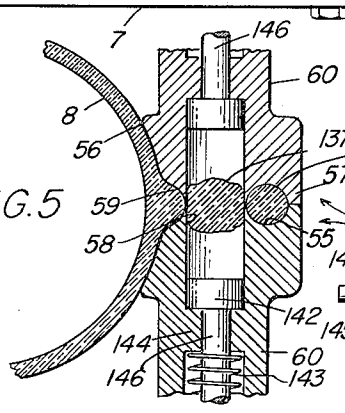


FIG. 7

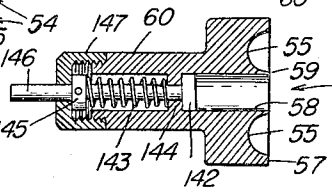
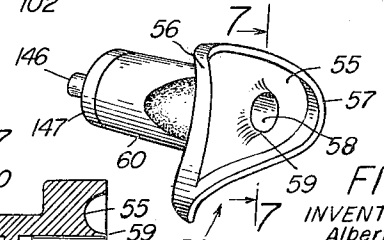


FIG. 6



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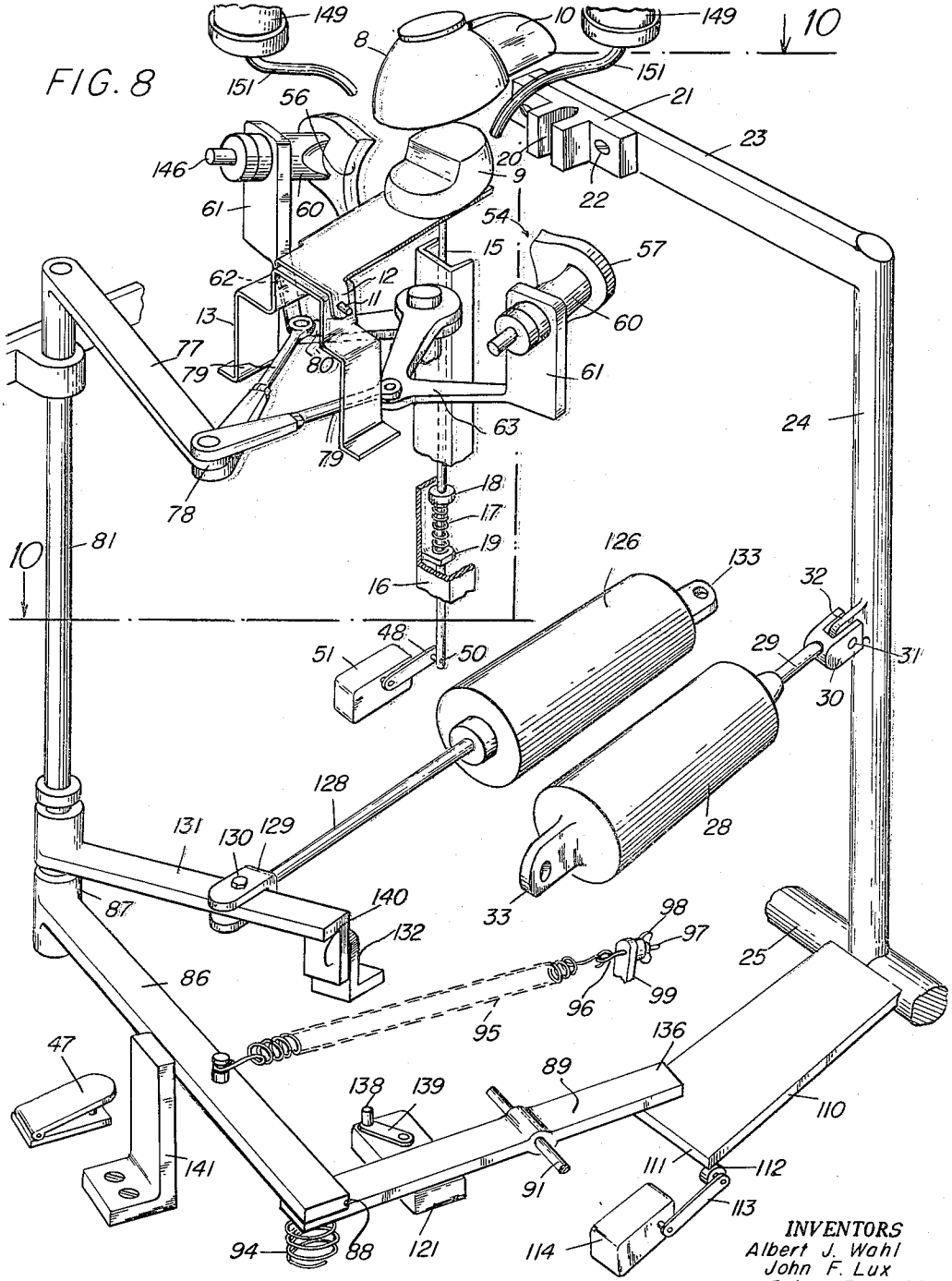
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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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FIG. 8



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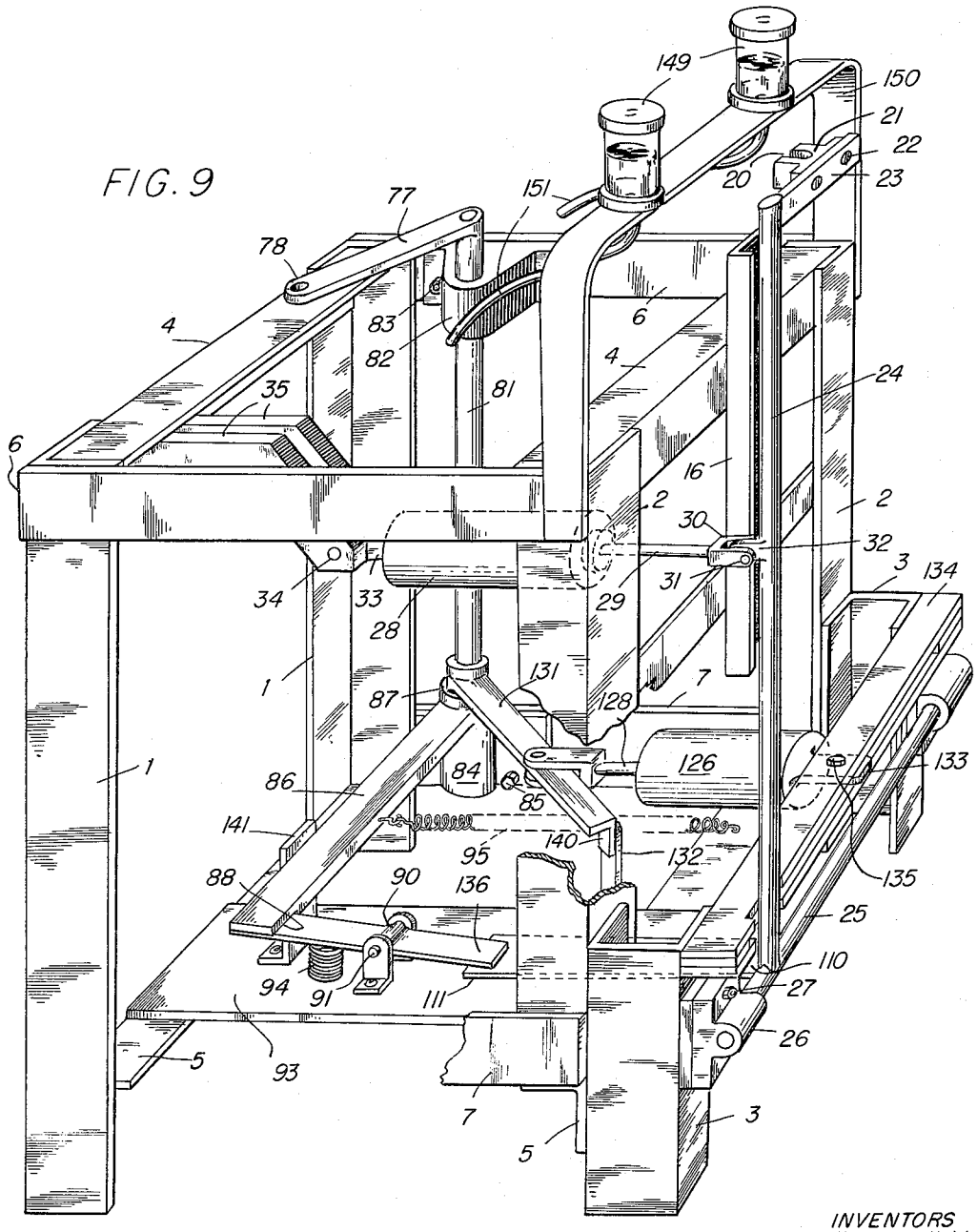
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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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FIG. 9



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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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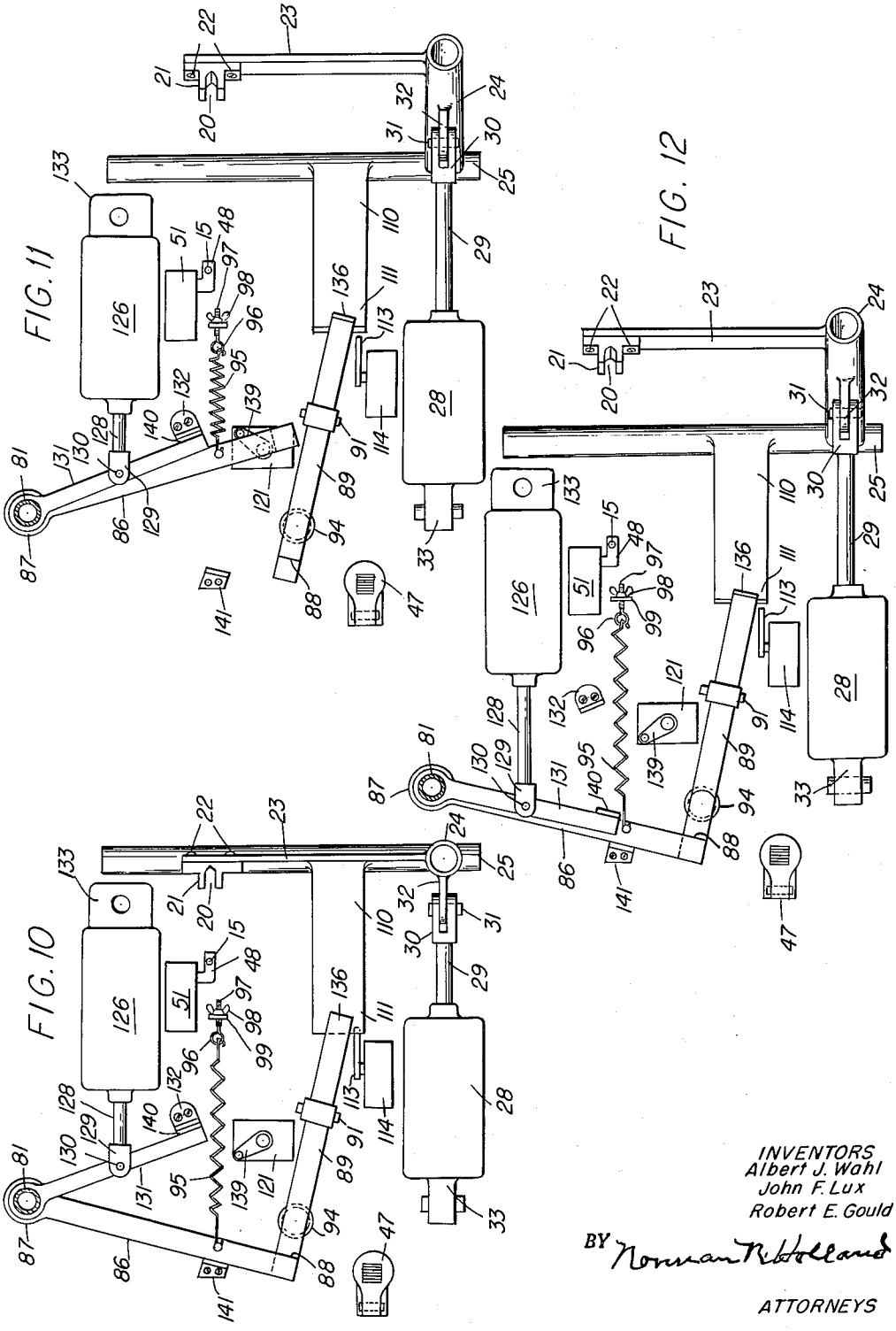


FIG. 11

FIG. 12

FIG. 10

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APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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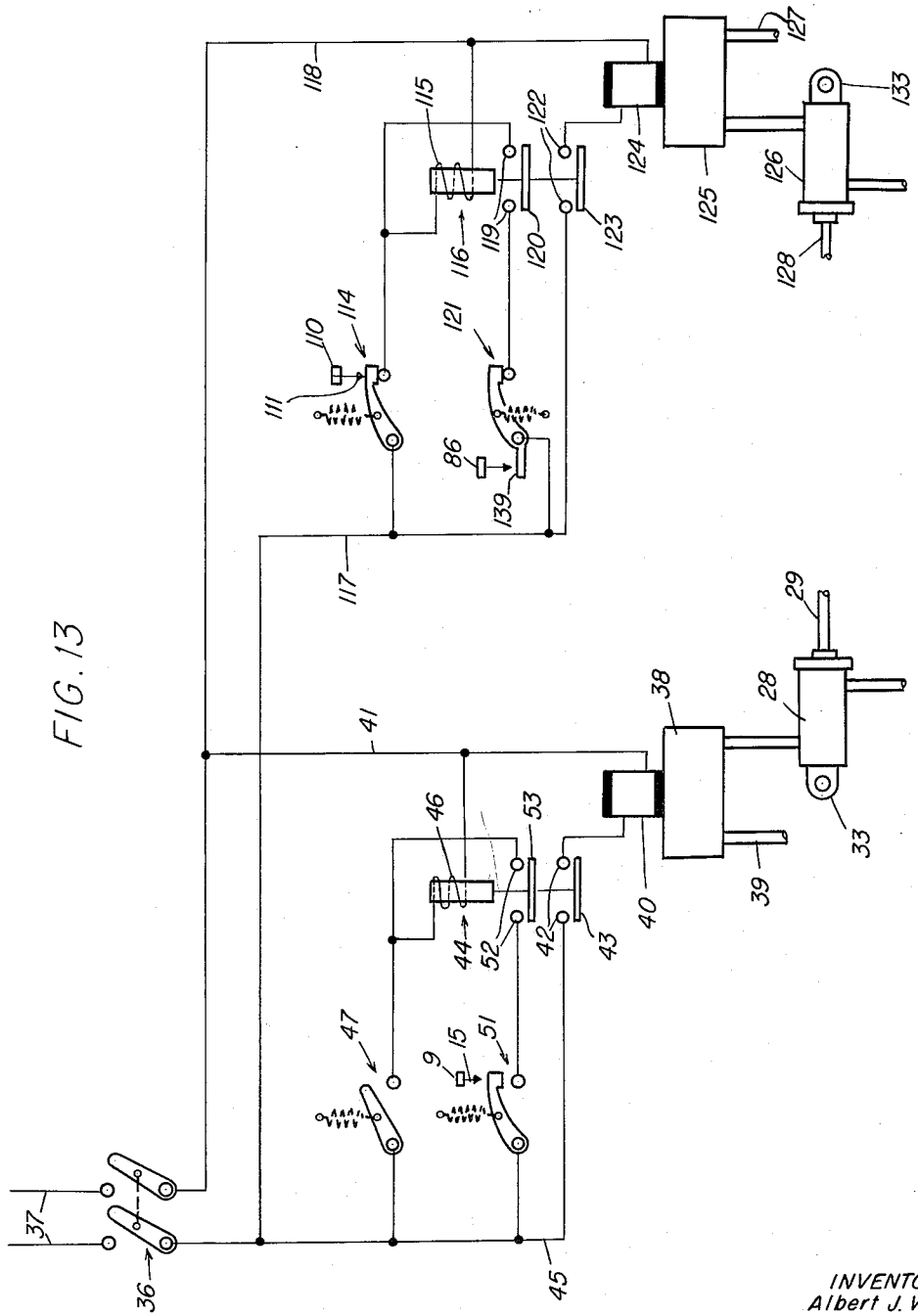


FIG. 13

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United States Patent Office 2,995,796 Patented Aug. 15, 1961

2,995,796

APPARATUS FOR SHAPING APPENDAGES ON CERAMIC ARTICLES

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Filed June 15, 1956, Ser. No. 591,706
14 Claims. (Cl. 25—22)

This invention relates to improvements in apparatus for making ceramic articles with appendages, and more particularly to improvements in the apparatus for the final shaping of a handle blank or other appendage, molded integrally with the ceramic article.

Ceramic containers, such as cups and bowls, have been made in the past with integral appendages, such as handles, in order to avoid the formation of slight cracks or checks where the handle is attached to the container, as such defects may become the unhealthful breeding place of bacteria. In the ceramic art, such integral appendaged handles on containers are known as "Sanitas" handles and are either molded integrally with the container of the same material and subsequently finished by hand or are preformed and arranged in a mold so that the body of the cup, or other container, is molded around the ends of the handle. Both of these methods are expensive and relatively slow as compared to the manufacture of containers with handles which are stuck to the outside of the containers.

A third method has recently been practiced in which a handle blank is premolded integrally with the container, which is then partially dried so that the ceramic is in a plastic, yet form-retaining, state, and the handle is then trimmed and shaped to its finished contours by a set of dies which are pressed together. Difficulty has been experienced in the practice of this method due to rupturing, fracturing, and the setting up of strains in the handle and in the cup body adjacent to the handle during the reshaping of the handle blank.

The original molding of one-piece china or pottery containers and handles generally is done with a water content of 19% to 22% in the ceramic material, with the preferred practical range somewhat narrower than this. Ceramic materials with this water content are too plastic to retain their shape and must be partially dried in order to permit handling of the molded article without distortion. Such partially dried ceramic material has been found not to be readily workable without the development of defects, even when considerable care is exercised in cutting away excess material and in pressing or reshaping the contours of a handle.

In the preparation of china or other types of white tableware bodies which are to be shaped into useful articles by a plastic molding process, it is customary to form the desired mixtures of various clays and other materials, such as ground quartz, felspar, and the like, in the proper proportion in water. The resultant material is then passed through a screen to remove foreign substances and the screened, or filtered material, known in the trade as "slip," is then dewatered. This dewatering process usually involves forcing the slip into chambers under pressure. The pressure thus applied to the slip tends to squeeze or crowd together the grains of solid material into what may be considered as a close rearrangement or touching together of the solid grains, with the remaining water distributed in the interstices or cavities between the grains of solid material. This forms a filter press cake which is in a relatively non-plastic condition so that it cannot be distorted to any practical degree without fracture.

It has been found that if a filter press cake is put through a pug mill in which the cakes are sliced by rotating knives, kneaded, and forced together under pressure, the resultant material becomes plastic and moldable. The plasticity and moldable condition of the ceramic material varies with different types of clays and with the amount of water which remains in the filter press cake. This treatment of the partially dried ceramic indicates that the pulp mill treatment restores plasticity to the material by the redistribution of the water around the solid grains and out of the interstices, which permits the solid grains to slip more readily one over the other so as to induce a plastic moldable property in the semi-dry ceramic. According to the present invention, this thixotropic property of various ceramic materials, in which the chief ingredient is clay, is utilized in forming or reshaping a premolded integral handle blank and container into a contained with a handle having the desired contours.

In preforming an integral ceramic container and handle for use in practicing this invention, it is desirable that the ceramic material be forced under pressure into a one-piece plaster-of-Paris or metal mold, so as to eliminate fins and minimize manual finishing of the article. The material used in thus forming the molded container and handle blank is generally found to be in its most workable condition with a water content of 21% or 22%, although, as previously noted, the range may vary somewhat for different materials. In order to make it possible to remove the molded article from the mold without distorting it, the water content must be reduced or the material dried until it contains about 16% or 18% water. This water content is about the maximum moisture which a ceramic article can contain and be removed from a mold in a safe and practical manner. It is a condition of the ceramic which may be said to be a plastic form-retaining state of the material.

In the improved reshaping of an integral ceramic container and handle according to this invention, it has been found that the thixotropic property of the material is most advantageously utilized by the sudden application of the cutting or punching and reshaping force to the semi-dried or plastic form-retaining ceramic material, within a confined space, that is, while supporting the handle blank material, to a certain degree, in all directions by a die or similar shaping tool. This permits the material of the handle to become moldably plastic, without fracturing or deforming the handle or the body of the container. It also has been found that the size or thickness of the handle which is to be reshaped affects the restoration of plasticity to the ceramic material by the thixotropic molding method practiced according to this invention, such that a larger section of material requires a relatively higher water content than does a smaller or thinner section handle. The reduction of the water content below 16% has been found generally not to allow for practical working of the ceramic without undesirable ruptures. An average of about 17% water content has been found to be the most generally practical for the practice of this invention.

An apparatus has been constructed for carrying out the method of making a ceramic container with an integral handle and for shaping the handle from a handle blank premolded integrally with the container, which sequentially and automatically reshapes the handle blank by suddenly applying a reshaping force thereto, and then restores the apparatus to its starting position on removal of the finished article therefrom. This apparatus comprises a set of dies which close with a snap action and provide a certain amount of support to the handle blank in all directions, while closing and punching off excess material from the handle blank and reshaping the contours of the material within the dies. The dies are then opened, punched or cut-off material is ejected from the dies, and the faces of the dies are reoiled to prevent stick-

ing of ceramic material thereto during the next cycle of operation. A machine for carrying out these functions has been built in which the snap action of the dies is obtained by tripping a spring-actuated mechanism, and pneumatic actuators provide the operating power for the other operations. An electrical system provides the desired sequential operating control and certain safety holding circuits to assure against accidental non-sequential operation which might damage an article undergoing reshaping by the machine.

An object of this invention is to provide an improved apparatus for shaping a handle from a ceramic handle blank molded integrally with a container.

A further object of this invention is to provide an improved machine and machine parts for finishing the contours of a ceramic handle integrally premolded with a ceramic container.

Further objects and advantages of this invention will become apparent upon an understanding of the illustrative embodiment of this invention hereinafter described or as indicated in the appended claims, and various additional advantages will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of this specification, wherein:

FIG. 1 is a side elevational view, partly broken away and partly in section, taken along line 1—1 of FIG. 4, of a machine embodying this invention, in which the electrical circuits, pneumatic or fluid connections, and die lubricators are omitted for purposes of more clearly illustrating the mechanical relationship and arrangement of certain mechanical operating parts of the machine, shown in initial starting positions of an operating cycle;

FIG. 2 is a plan view of the machine shown in FIG. 1, with part of the cover plate broken away and with the handle forming dies in closed position and parts of the die operating links under the cup supporting chum shown in dotted lines in order better to illustrate these operating linkages;

FIG. 3 is a plan view illustrating the dies and their operating linkages in open die positions, and the handle aligning guide in its aligning position corresponding to the initial or starting position of these parts of the machine at the beginning of an operating cycle;

FIG. 4 is a sectional view, taken along line 4—4 of FIG. 1, illustrating details of the crank mechanism and related operating parts for providing snap action closing of the handle-forming dies;

FIG. 5 is a sectional view through a portion of a cup and handle with the dies in closed die positions, illustrating the final handle shaping positions of the dies;

FIG. 6 is a perspective view of one of the handle-forming dies, illustrating details of a die face;

FIG. 7 is a longitudinal sectional view, along line 7—7 of FIG. 6, illustrating the ejector mechanism in a die;

FIG. 8 is a schematic representation of the principal operating parts of the apparatus, showing their relationship at the beginning of an operating cycle;

FIG. 9 is a perspective view of the main supporting framework of the apparatus and the mountings of certain of the principal operating parts, other than the dies and their mountings;

FIG. 10 is a schematic plan view, taken along line 10—10 of FIG. 8, with the chum, dies, and the upper die linkages removed, to illustrate more clearly the relative positions of the actuating mechanism and the control switches in their positions at the start of an operating cycle;

FIG. 11 is a schematic diagram of the mechanism shown in FIG. 10 illustrating the relative positions of the operating elements in the closed die positions;

FIG. 12 is a schematic diagram illustrating the operating mechanism shown in FIGS. 10 and 11, illustrating the mechanism in the position in which the die operating spring actuated crank is returned to its open-die position; and

FIG. 13 is a schematic circuit diagram of the electrical control system for the apparatus illustrated in the remaining figures of the drawings.

General structure

This apparatus comprises a machine adapted to utilize the thixotropic property of semi-dry ceramic material of becoming workably plastic by the sudden application of a reshaping force to the material within a confined space. Such treatment can best be provided by a snap action closure of the shaping tool and requires equipment capable of absorbing a sudden jar for each cycle of operation.

In order to assure a long useful life to the apparatus, the operating mechanism is mounted upon a sturdy main supporting frame, having a generally rectangular form and preferably being constructed of simple structural steel sections rigidly welded together. As is more clearly shown in FIG. 9, a good example of such a frame comprises an angle section post 1 extending upwardly at each front corner, and shorter angle section posts 2, secured, as by welding, to channel section feet 3, forming the rear corner posts of the frame. A rigid structure is provided by securing together the upper ends and lower ends, respectively, of the front posts 1 and the rear posts 2 by transversely extending channel section cross-bars 4 and 5, and rigidly connecting the front posts 1 to the rear posts 2 adjacent the upper ends and lower ends, respectively, by side bars 6 and 7.

According to the present invention, the cup, or other container, is integrally premolded with a blank handle appendage extending laterally therefrom, and the moisture content of the ceramic material then is reduced to between 16% and 18%, so that the article can be handled without damage to its molded form. It is then removed from the mold and is in condition for final shaping of the handle. This is done by the improved apparatus of the present invention, and a cup 8 is adapted to have its handle reshaped by placing it upon a suitable chum 9 in inverted position, with its handle blank 10 extending to the rear thereof, as shown in FIG. 8. The chum supports the cup 8 in approximately centered position on the handle shaping machine for the reshaping operation. This supporting chum 9 is made somewhat smaller than the inside of the cup, or other container, which is to be mounted thereon, so as to provide for loosely supporting the container to permit a slight shifting thereof during the reshaping of the handle. This allows excess material which is punched or pressed from the outer contours of the handle blank adjacent the cup body to pass from the dies without damaging the cup or the handle. It has been found that this loose fit of a cup on its supporting chum is very important in order to avoid a high percentage of fractures.

In order to accommodate different sizes and shapes of containers, a variety of sizes and shapes of chums may be provided. These chums are readily interchanged by simply unbolting and withdrawing a through bolt 11, which pivotally supports the front end of the chum. This bolt 11 extends through a pair of downwardly extending ears 12 on opposite sides of the front edge of the chum and a pair of upwardly extending mounting brackets 13, rigidly secured, as by welding, to the upper side of a cover plate 14. The cover plate 14 preferably is a thin metal plate permanently secured over the main frame, as by welding to the upper cross bars 4 and the side bars 6. This further assures the rigidity and sturdiness of the machine.

The rear end of the chum 9 loosely rests upon the upper end of a push rod 15, slidably mounted within a channel 16 and resiliently biased upwardly by a suitable compression spring 17 which thus provides a resilient

support for the chum. The spring 17 is arranged around the push rod between a collar 18 fixedly secured to the rod and a supporting guide bracket 19 fixedly secured in the channel 16. This provides a resilient biased depressable chum support which is utilized to control a safety holding circuit in the electrical control system for the apparatus, so that the presence of a cup on the chum assures against accidental non-sequential operation which might damage a cup. The operation of the safety circuit is controlled through the push rod 15 which is slidably fitted in an opening in the bracket 19, which thereby serves as a guide bearing for the rod 15 and provides a simple push rod switch control.

Article aligning

The proper alignment of the cup and handle blank on the apparatus is highly important in order to obtain the requisite simultaneous pressure on opposite sides of the handle blank during its reshaping. In placing a cup 8 on the chum, the handle blank 10 is placed to the rear and into an aligning groove 20 in a guide block 21, suitably mounted, as by screws 22, on a cross arm 23 secured to the upper end of an upwardly extending operating column 24. This handle aligning guide operating column 24 is controllably rockably mounted for movement of the guide block 21 from and to handle aligning position, when the electrical control circuit is energized, depending upon the presence or absence, respectively, of a cup on the chum 9. The lower end of the column 24 is suitably secured, as by welding, to a transversely extending shaft 25, which is rotatably supported by journal bearings 26 secured by bolts 27 to the channel section feet 3 to provide for the to and fro movement of the upper end of the column 24 and of the guide block 21.

Actuation of the aligning guide column 24 may be provided by any suitable source of power, as by a fluid or pneumatic power cylinder 28, provided with a piston (not shown) connected to a piston rod 29, pivotally connected through a clevis 30 and a pivot pin 31 to a tongue 32 fixedly secured, as by welding, to the operating column 24. The end of the power cylinder 28 opposite the piston rod end is pivotally supported by a mounting flange 33 rigidly secured to the end of the cylinder and pivotally supported by a pivot pin 34 on a pair of stationary bracket arms 35 fixedly secured, as by welding, to the upper front cross bar 4 of the main supporting frame. This provides for free pivotal adjustment of the actuating power cylinder 28 and its alignment with the guide operating column 24, as it moves to and from handle aligning position.

Control of the operation of the power cylinder 28 is provided by an electrical circuit, schematically illustrated in FIG. 13. This circuit includes a main power system circuit breaker or switch 36, of any suitable type, for connecting and disconnecting the control circuit to a source of electric power supply 37. A suitable valve, such as a solenoid valve 38, controls the supply of fluid or air from a source of fluid pressure 39 to the power cylinder 28 and is operable by a suitable solenoid 40. Energization of the solenoid 40 is obtained by connecting one side to the source of electrical power supply through a suitable conductor 41 and the other side through contacts 42 and contactor 43 of a relay 44 and a conductor 45. The relay 44 is operable by an exciting winding 46 connected to the source of electrical power supply through the conductor 41 and through a manually operable, normally open, circuit breaker 47, such as a treadle switch, connected to the conductor 45.

Under starting conditions, the main switch 36 is closed and the treadle switch 47 is open, so that the relay coil 46 is deenergized and the relay contacts are open. In this condition the fluid valve solenoid 40 is deenergized, as its energizing circuit is open through the open contacts 42 and contactor 43 of the relay 44. This fluid valve is suitably connected to the fluid pressure source 39 and the power cylinder so constructed that, when the solenoid 40 is deenergized, the power cylinder piston retracts the piston rod 29 and rocks the guide operating column 24 to handle aligning guide position, as shown in FIGS. 1, 3, 8, 9 and 10, and places the guide block 21 in position for reception and alignment of a handle blank.

When a cup 8 is placed upon the chum 9, with its blank handle appendage 10 aligned in the aligning groove 20 of the guide block 21, the chum 9 is depressed under the pressure of the weight of the cup thereon, and the push rod 15 is resiliently pushed downwardly against the pressure of the spring 17. The lower end of the push rod 15 operably engages an electric switch operating handle 48 through a suitable connection, such as a clevis 49 connected to the handle 48 through a pivot pin 50. Depression of the push rod 15 is adapted to operate the switch handle 48 so as to close a normally open circuit breaker 51, such as a micro-switch, and thereby establish a holding circuit for maintaining the relay coil 46 energized through the micro-switch 51, and contacts 52 and contactor 53 of the relay 44. Thus, even if pressure on the treadle switch 47 were to be released and this circuit opened, the presence of a cup, or other container, on the chum 9 would keep the micro-switch 51 closed and the relay coil 46 energized through the safety holding circuit including the micro-switch 51 and the relay contacts 52 and contactor 53. This safety holding circuit assures energization of the valve solenoid 40 through the relay 44 as long as a cup rests on the chum 9, and thus assures that the guide 21 will remain out of its handle aligning position after it has been moved initially away from a cup on the chum and until the cup is removed and pressure released from the handle 48 of the micro-switch 51.

Appendage reshaping

After the container 8 and its handle blank 10 have been properly aligned in their position on the supporting chum 9 and the aligning guide 21 has been moved out of handle aligning position, the apparatus is adapted automatically to reshape the handle blank by the sudden closing of a pair of dies 54 simultaneously on opposite sides of the handle blank. Each handle forming die preferably is made with a similar complementary face 55, FIGS. 5, 6 and 7, with an inner wall 56 corresponding to the complement of the shape of the handle adjacent to the cup and an outer wall 57 corresponding to the complement of half the outer contours of the finished handle. In the center of each face 55 is a central opening 58 surrounded by a central wall 59, corresponding to the complement of half the contours of the finger hole through a finished handle. Each die 54 is formed with a cylindrical supporting housing 60 mounted on a bracket 61, fixedly secured to the free end 62 of an arm 63 of a bell crank. The free end 64 of the other arm 65 of each bell crank is coaxially pivotally supported eccentrically relative to the cup supporting chum 9 on a stub shaft 66, journalled in a long sleeve bearing 67 which extends downwardly through an opening in the cover plate 14 and is detachably secured thereto by bolts 68. This mounting of the dies 54 provides for simultaneously swinging them in opposite directions along arcuate paths of larger radius than the radius of the cup 8 and for closing them with the inner sides of the inner walls 56 thereof substantially tangent to the outer surface of a cup on the chum 9, as shown in FIGS. 2 and 5. This provides for a minimum of excess ceramic material being scraped or punched off or pressed out from the dies along the sides of the cup, and thus minimizes the tendency of such material to press the cup body away from its handle and cause fractures or strains in the cup or its handle. The combination of this method of closing the dies with the use of a chum slightly smaller than the inside of the container provides for greatly improved results in reshaping of the handles with negligible damage to the cups and handles from fractures or strains due to the reshaping operation.

In order to provide for reshaping different styles of handles by correspondingly different dies, the die supporting housings **60** are secured to the brackets **61** by detachable straps **69** extending over the housings and suitably fastened by bolts **70** to the brackets **61**. Also, the vertical position of the pivotal mounting of the bell cranks can be adjusted, to a degree, by a vertically adjustable support for the stub shaft **66**. This support comprises a thrust plate **71**, mounted on the end of an adjusting screw **72**, threadedly engaging a mounting sleeve **73** depending from a supporting bracket **74**. This supporting bracket is rigidly secured, as by a screw **75**, to the guide channel **16**, which is suitably secured, as by welding, to the rear top cross bar **4** of the main frame. Vertical adjustment of the screw **72** provides a corresponding adjustment in the vertical position of the stub shaft **66** and of the die mounting brackets **61**. Final adjustment is set by tightening of a lock nut **76** on the screw **72**. Such adjustment is limited, however, due to the related operating connections of the bell cranks to the dies.

The desired snap action closing of the dies **54** for sudden or "shock" working of the ceramic is provided by actuating these dies to closed die positions by a trigger release, spring actuated mechanism. This mechanism includes an arrangement for simultaneously actuating the two dies and comprises a crank **77** pivotally secured, at one end **78** thereof, to a pair of links **79**, each pivotally connected to the elbow **80** of one of the die supporting bell cranks. The crank **77** is fixedly mounted on an upwardly extending drive shaft **81** and forms a driving connection with the upper end thereof, for transmitting power from the shaft **81** to the dies **54**. The shaft **81** is rotatably supported adjacent its upper end by a sleeve bearing clamp **82**, suitably fastened, as by screws **83**, to one of the upper side bars **8** of the main frame of the machine. The lower end of the drive shaft **81** is supported by a thrust end bearing mounted in a bracket **84** suitably secured, as by screws **85**, to one of the lower side bars **7** of the main frame of the machine. Actuation of the drive shaft **81** is provided through a spring actuated crank **86** rigidly secured to a collar **87** having a fixed driving connection with the lower end of the drive shaft **81**. Thus, a turning of the crank **86** produces a corresponding turning of the drive shaft **81** and of the upper crank **77**, which transmits this motion through the links **79** to the bell crank elbows **80**, the crank arms **63**, the brackets **61**, and the housings **60**, to the dies **54**.

At the beginning of an operating cycle, the actuating crank **86** is latched in extended open-die position as shown in FIGS. 1, 4, 8, 9 and 10, by a step **88** on a latching bar **89**. This latching bar is pivotally mounted, as by welding, to the underside of a sleeve **90** supported by a pivot pin **91**, on a pair of bracket arms **92**. These arms **92** are mounted on a base plate **93**, which extends between and is fixedly secured, as by welding, to the lower cross arms **5** of the main frame of the machine. The latching bar **89** is resiliently biased into latching engagement with the end of the actuating crank **86** by a compression spring **94**, seated on the base plate **93**, and a main actuating tension spring **95** is secured to the crank **86** and biases it into firm latching engagement with the step **88** on the latching bar. The other end of the main tension spring **95** is secured to a suitable anchoring eyelet **96**, preferably adjustable to provide for adjustment of the operating tension of the main spring **95** for varying the tension of this spring as required for proper reshaping of handle blanks of various sizes and materials.

This adjustment of the main actuating spring **95** may be provided in any suitable manner, as schematically illustrated in FIGS. 10, 11 and 12, by a simple conventional threaded eyelet shank **97** and wing nut **98**, which cooperate with a suitable stationary bracket **99**, or may comprise a linkage for providing a wider range of adjustment, as shown in FIGS. 1, 2 and 4. The latter linkage includes a crank **100** to which the main spring **95** is connected by an eyelet or pin **96**. The spring tension is adapted to be varied by shifting the position of the spring crank **100** around its pivotal mounting to one of the rear corner posts **2** of the main frame. This pivotal mounting is conveniently provided by a pivot pin in the form of a bolt **101**, extending through the crank **100** and a mounting plate **102** secured to a rear corner post **2**. In order to provide for adjustment of the spring tension, the other end of the spring crank **100** is secured to the lower end **103** of an operating handle **104** by a suitable pivot pin **105** extending through a boss **106** on the crank **100**. The handle **104** is provided with a conventional pawl **107** and ratchet **108** mounted on one of the rear frame posts **2** and a conventional pawl release rod and linkage **109** on the handle for releasing the spring biased pawl when it is desired to shift the handle **104** to release the tension on the main spring **95**. To increase the spring tension the handle is pulled forward, that is to the left, in FIGS. 1, 2 and 4. This turns the lower end **103** of the handle to the right in these figures, and the pawl **107** rides over the ratchet teeth to hold the handle **104** and, therefore the crank **100** is in any desired position of spring tension.

Sequential reshaping operation

In the initial operating position of the apparatus, when the main line circuit breaker **36** is closed, connecting electric power to the control circuit, and the handle aligning guide **21** and its operating column **24** are in handle aligning position, as shown in FIGS. 1, 8, 10 and 13, an operating arm **110** fixedly secured to the shaft **25**, to which the column **24** is secured, is in its lower position with the free end **111** thereof in engagement with a roller **112** on an operating handle **113** of a normally open circuit breaker **114**, such as a micro-switch. In this position, the arm **110** depresses the switch handle **113** and biases the switch **114** to closed circuit position. This energizes an exciting winding **115** of a relay **116** by connecting it to the source of electric power supply **37** through conductors **117** and **118**. This closes relay **116** and completes a holding circuit for the relay coil **115** through relay contacts **119** and contactor **120** and a normally closed circuit breaker **121**, such as a micro-switch.

Closing of the relay **116** also closes a circuit through relays contacts **122** and contactor **123** and a solenoid **124** of a fluid or pneumatic solenoid valve **125**, which controls the flow of pressure to a power cylinder **126** from a source of fluid pressure **127**. This power cylinder **126** is provided with a piston (not shown) connected to a piston rod **128** pivotally connected at its outer end through a clevis **129** and a pivot pin **130** to a resetting arm **131** adapted to reset the spring biased actuating crank **86** in its spring tensioned open die position. In this position of the solenoid valve **125**, the piston of the power cylinder **126** is retracted so as to draw the resetting arm **131** away from the actuating crank **86** and against a suitable stop **132**. The end of the power cylinder **126** away from the piston rod **128** is suitably pivotally mounted by a flange **133** secured to the cylinder to allow slight pivotal adjustment of the cylinder as it operates the arm **131**. This flange **133** extends between a pair of cross bars **134** secured to the rear posts **2** of the main frame of the machine, and a pivot pin, such as a bolt **135** secures the flange **133** to the cross bars **134**.

When a cup **8** is placed on the chum **9** and the treadle switch **47** is depressed, so as to energize relay **44** and, therefore solenoid **40**, the valve **38** supplies fluid pressure to the power cylinder **28**, so as to rock the guide column **24** and guide **21** out of handle aligning position. This rocking of the guide column **24** turns the shaft **25** to which it is secured and raises the operating arm **110**, and thus releases pressure on the switch handle **113** and allows the switch **114** to assume its normally open position. The opening of switch **114** under these conditions does not affect any of the controls, as the relay coil **115**

remains energized through its holding circuit established through the normally closed switch **121** and the relay contacts **119** and contactor **120**.

Rocking of the guide column **24** to its fully open position away from its handle aligning position, raises the free end **111** of the operating arm **110** into engagement with the adjacent end **136** of the latching bar **89** and rocks it around its pivotal mounting **91**, so as to raise the end **136** and lower the opposite stepped end **88**. This has the effect of triggering or releasing the spring actuated crank **86** from its latched position against the step **88** and, under the tension of the main spring **95**, the crank **86** swings around toward the resetting arm **131**.

This spring actuation of the crank **86** rotates the drive shaft **81**, which correspondingly swings the crank **77**, the links **79**, and the bell cranks, from the positions shown in FIGS. 3, 4 and 10, so as to snap closed the dies **54** to the positions shown in FIGS. 2 and 11. As these dies close on a handle blank **10**, excess ceramic material is punched off the outer contours of the handle, and the inner contours of the finger hole are formed by a combined punching and compressing or pressure molding, with excess material **137** being forced into the central openings **58** of the dies, as shown in FIG. 5.

Swinging of the spring actuated crank **86** to closed die position, as shown in dotted lines in FIG. 4, and more clearly in FIG. 11, causes the side of the crank **86** to engage an upwardly extending roller **138** on an operating handle **139** of the normally closed circuit breaker **121** and to bias it to open circuit position. This opens the holding circuit of the relay **116** and deenergizes the relay coil **115**, which opens the relay and deenergizes the solenoid **124** through the relay contacts **122**. In deenergized solenoid position, the solenoid valve **125** admits fluid pressure to the power cylinder **126** from the source **127**. This extends the piston rod **128**, which extends the resetting arm **131** towards the actuating crank **86**, so that a finger **140**, secured to the end of the arm **131**, engages the crank **86** and swings it back until it engages a stop **141** secured to the base plate **93**, as shown in FIG. 12. This return swing of the crank **86** turns the drive shaft **81** through a corresponding angle and likewise swings the crank **77**. This draws the links **79** and the bell cranks back to their starting positions and swings the dies **54** back to the open die positions, as shown in FIGS. 1 and 3.

As shown in FIG. 5, the material punched from the finger hole, in forming the handle, passes into the central openings of the dies **54**. It is essential that this material be cleaned from the dies after each cycle of operation to prevent clogging of the dies and thereby rendering impossible further shaping of the finger holes in the handles. As is more clearly shown in the sectional view, in FIG. 7, an ejector plunger **142** is arranged in the central opening **58** in the die and is resiliently biased to the rear of the opening by a compression spring **143** seated between a shoulder **144** in the die housing **60** and collar **145** secured to an ejector stem **146**, which extends away from the face of the die. A suitable screw cap **147** threadedly engages the end of the die housing **60** and holds the collar **145** in place and provides a guide for the end of the ejector stem **146** which extends through a central opening in the cap **147**.

Swinging of the dies **54** to open die positions, as shown in FIG. 3, brings the outer ends of the ejector stems **146** into engagement with stops **148** before the dies **54** are fully open. The further movement of the dies to full open positions cause the die housings **60** to slide along the ejector stems **146**, moving the housing shoulders **144** toward the stem collars **145**, and forcibly moving the ejector plungers **140** forwardly through the central openings **58** of the dies and effectively ejecting the ceramic material therefrom. This thoroughly cleans the inside of the dies for the next cycle of operation.

Provision also is made to prevent sticking of ceramic material to the faces of the dies by supplying a thin film of oil over the faces after each operation. An oiling mixture of about 90% kerosene and 10% lard oil is conveniently stored in a pair of oilers **149** mounted on a bracket **150**, secured to the rear end posts **2** of the main frame of the machine. Suitable drip tubes **151** extend from the oilers to positions directly over the faces of the dies in open die positions, and the oily mixture is slowly dripped from the oiler tubes **151** over the faces of the dies. This material spreads very easily and forms a thin film which prevents sticking of the ceramic to the dies, without any injurious effects to the ceramic comprising the handles.

Return of the actuating crank **86** to its open die position, as shown in FIG. 12, releases pressure on switch handle **139** of the normally closed switch **121** and closes this switch. This resets the switch for the initial operating position of the apparatus, but does not, however, establish any closed electric circuit, as the relay **116** is deenergized and its contacts **119**, in series with the switch **121**, are open under this condition.

Return to starting position

At this point, the shaping of the cup handle has been completed, and the cup may be removed from the chum **9** and pressure on the treadle switch **47** released. This opens both switches **51** and **47**, which deenergizes relay **44** and opens the circuit of the solenoid **40**, thus actuating the valve **38** to remove fluid pressure from the power cylinder **28**, so as to cause retraction of the piston rod **29**. This rocks the guide column **24** back to handle aligning position of the guide **21** and lowers the free end **111** of arm **110**. Lowering of this arm releases pressure on the end of the latching bar **89**, and compression spring **94** biases the step **88** of the latching bar **89** upwardly and back into latching engagement with the end of the spring actuated crank **86**.

Lowering of arm **110** also causes its free end **111** to reengage and depress handle **113** of normally open switch **114**, thus closing the energizing circuit of relay coil **115** and closing this relay. Closure of this relay reenergizes solenoid **124** through relay contacts **122** and contactor **123**, which causes the solenoid valve **125** to cut off pressure from power cylinder **126**. This retracts piston rod **128**, thus retracting the resetting arm **131** to its initial position against the stop **132**, out of the path of travel of the spring actuated crank **86**, and completely restores the apparatus to its initial starting condition.

It is thus seen that the present invention provides a new and improved apparatus for forming ceramic containers with integral handles by taking advantage of the thixotropic property of ceramics under certain moisture content conditions. The apparatus provides for automatically carrying out the desired sequence of operations and incorporates novel and improved features for eliminating manufacturing defects and strains in the ceramic containers and the handles. It also incorporates various novel arrangements and electric circuits for assuring against accidental non-sequential operations which might damage an article being shaped on the machine.

Obviously, various changes may be made in the form, construction, and arrangement of the parts of the apparatus without departing from the spirit and scope of this invention and without sacrificing any of its advantages. It is to be understood, therefore, that the matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, we claim:

1. A machine for shaping an appendage blank molded integrally with a ceramic container comprising a base, support means for loosely supporting the container on said base in an inverted position, guide means positioned adjacent to said support means for aligning the appendage blank in a desired position; a pair of complementary appendage-forming dies, mounting means on said base for movably mounting said dies and for providing simultaneous movement in opposite directions and for closure

of said dies into registry with a snap action with the inner sides thereof substantially tangent to the outer surface of a container on said supporting means for molding and punching the appendage blank to finished appendage contours while supporting it in substantially all directions, spring drive means operatively coupled to said die mounting means for closing said dies with the snap action, means for actuating said appendage blank aligning means from and to appendage aligning position, means for controlling the actuating means for movement of said appendage aligning means away from aligning position prior to closure of said dies and for return thereof to aligning position on opening of said dies, and second drive means for actuating said dies to open-die positions.

2. A machine for forming an integral ceramic container and handle comprising a base, support means for loosely supporting a preformed integral container and blank handle appendage of plastic ceramic in form-retaining state, guide means for aligning the blank handle appendage on the container in a desired position on said base, first drive means for actuating said guide means from and to handle aligning positions, means for controlling said handle guide actuating drive means, means responsive to pressure on said supporting means for controlling an electrical holding circuit for said means controlling said handle guide actuating means, a pair of complementary handle-forming dies, means movably mounting said dies on said base adjacent said support means for movement in opposite directions and for closure with the inner sides thereof substantially tangent to the outer surface of a container on said supporting means, second drive means for closing said dies with a snap action, third drive means for extending said dies to open-die positions, control means responsive to closure of said dies by said second drive means for controlling actuation of said third drive means for extending said dies to open-die positions, and means responsive to the positions of said handle guide in and out of handle aligning position for respectively latching said die closing means in open-die position and releasing said die closing means therefrom.

3. A machine for forming an integral ceramic container and a handle comprising a base, support means for loosely supporting a preformed integral container and blank handle appendage of plastic ceramic in form-retaining state, a pair of complementary handle-forming dies each having an inner and an outer wall and a central wall and passage, means including a pair of bell cranks each having two arms connected by an elbow and supporting one of said dies on an end of one arm and having the ends of the other arms thereof coaxially pivotally mounted on said base and eccentric to said container supporting means for swinging movement of said dies in opposite directions along arcuate paths and for closure of said dies with said inner walls thereof substantially tangent to the outer surface of a container on said supporting means, first drive means including a spring actuated crank with links pivotally secured to the elbows of said bell cranks and pivotally secured to said spring actuated crank at a point thereon in line with said bell crank coaxial pivotal mounting and with the center of said container support for swinging said dies into closed positions with a snap action, second drive means for extending said spring actuated crank and dies to open-die positions, electrical control means responsive to closure of said dies for controlling actuation of said second drive means for extending said crank and dies to open-die positions, means for latching said spring actuated crank in open-die position and for releasing said spring actuated crank therefrom, and control means for retracting said second drive means from extended position after the release of said spring actuated cranks.

4. A machine for forming an integral ceramic container and handle comprising means for loosely supporting a preformed unfired container with a blank handle appendage in plastic form-retaining state, means including a guide for aligning the blank handle appendage in a desired position, means for actuating said handle guide from and to handle aligning positions, means for controlling said guide actuating means, an electrical holding circuit for said means controlling said guide actuating means, circuit breaker means response to the presence of a container on said supporting means closing said holding circuit therethrough, a pair of complementary handle-forming dies, means mounting said dies eccentrically with reference to said container supporting means for swinging movement in opposite directions along arcuate paths and for closure with the inner sides thereof substantially tangent to the outer surface of a container on said supporting means, means for swinging said dies into closed positions with a snap action, means for extending said dies to open-die positions, means responsive to closure of said dies for controlling actuation of said means for extending said die to open-die positions, means responsive to the positions of said handle guide in and out of handle aligning positions for respectively latching said die closing means in open-die position and releasing said die closing means therefrom, and means operable in response to movement of said guide into handle aligning position for providing for retraction of said die extending means from extended position.

5. A machine for forming an integral ceramic handle and container comprising means for loosely supporting a preformed integral container and blank handle appendage of plastic ceramic in form-retaining state, means including a guide for aligning the blank handle appendage in a desired position, pneumatic means for actuating said handle guide from and to handle aligning positions, manually controllable electrically responsive means for controlling actuation of said pneumatic means, electrical control means responsive to the presence of a container on said supporting means for controlling an electrical holding circuit for said electrically responsive means controlling said pneumatic means, a pair of complementary handle-forming dies each having an inner and an outer wall and a central wall and passage, means mounting said dies eccentrically with reference to said container supporting means for swinging movement in opposite directions along arcuate paths and for closure of said dies with said inner walls thereof substantially tangent to the outer surface of a container on said supporting means, means including a spring actuated crank for swinging said dies into closed positions with a snap action, means for extending said crank and dies to open-die positions, electrical control means responsive to closure of said dies for controlling actuation of said means for extending said crank and dies to open-die positions, means responsive to the positions of said handle guide in and out of handle aligning position for respectively latching said spring actuated crank in open-die position and releasing said spring actuated crank therefrom, and electrical control means operable in response to movement of said guide into handle aligning position for providing for retraction of said crank and die extending means from extended position.

6. A machine for forming an integral ceramic container and handle comprising means for supporting a preformed integral container and blank handle appendage of plastic ceramic in form-retaining state, means including a guide for aligning the blank handle appendage in a desired position, fluid means for actuating said handle guide from and to handle aligning positions, manually controllable electrical means for controlling actuation of said fluid means, electrical control means responsive to pressure on said supporting means for providing an electrical holding circuit for holding said electrical means controlling said fluid means, a pair of complementary handle-forming dies each having a face with an inner and an outer wall therearound and a central wall and passage, means

mounting said dies for operation in opposite directions and for closure with the inner walls thereof substantially tangent to the outer surface of a container on said supporting means, means including a spring actuated crank for swinging said dies into closed positions with a snap action, means for extending said crank and dies to open-die positions, an ejector pin in each of said die central passages, means for resiliently biasing said ejector pins away from the face of the die to allow space in said central passage for ceramic punched from the center of the blank handle appendage, means for extending said ejector pins toward the faces of the dies on movement of said dies to open-die positions for ejecting ceramic material from within said die central passages, electrical control means responsive to closure of said dies for controlling actuation of said means for extending said crank and dies to open-die positions, means responsive to the positions of said handle guide in and out of handle aligning position for respectively latching said spring actuated crank in open-die position and releasing said spring actuated crank therefrom, and electrical control means operable in response to movement of said guide into handle aligning position for providing for retraction of said crank and die extending means from extended position.

7. A machine for shaping a ceramic handle blank molded integral with a ceramic container comprising means for loosely supporting the container and handle while in a plastic and form-retaining state, means including a guide for aligning the handle blank in a desired position, means for actuating said guide from and to handle aligning positions, means for controlling actuation of said guide actuating means, a pair of complementary handle-forming dies each having a face with an inner and an outer wall therearound and a central wall and passage, means supporting said dies for simultaneous movement in opposite directions and for closure with said inner walls thereof substantially tangent to the outer surface of a container on said supporting means, means including a resiliently biased crank for swinging said dies into closed positions with a snap action, means for extending said crank and dies to open-die positions, an ejector pin in each of said die central passages, means for resiliently biasing said ejector pins away from the faces of the dies to allow space in said central passages for ceramic punched from the center of a handle blank, stop means engageable by said ejector pins on movement of said dies to open-die positions for extending the ejector pins toward the faces of the dies for ejecting ceramic material from within said die central passages, means for placing a small amount of kerosene and oil on the faces of said dies when said dies are open, means responsive to closure of said dies for controlling actuation of said means for extending said crank and dies to open-die positions, means responsive to the positions of said guide in and out of handle aligning position for respectively latching said resiliently biased crank in open-die position and releasing said resiliently biased crank therefrom, and means operable in response to movement of said guide into handle aligning position for providing for retraction of said crank and die extending means from extended position.

8. A machine for forming an integral ceramic container and handle comprising means for loosely supporting a preformed integral container and blank handle appendage of plastic ceramic in form-retaining state, means including a guide for aligning the blank handle appendage in a desired position, means for actuating said handle guide means from and to handle aligning positions, manually controllable electrical means for controlling actuation of said guide actuating means, electrical control means responsive to the presence of a container on said supporting means for providing an electrical holding circuit for said electrical means controlling said guide actuating means, a pair of complementary handle-forming dies each having an inner and an outer wall and a central wall and passage, means including a pair of bell cranks each having two arms connected by an elbow and supporting one of said dies on an end of one arm and having the ends of the other arms thereof coaxially pivotally mounted and eccentric to said container supporting means for swinging movement of said dies in opposite directions along arcuate paths and for closure of said dies with said inner walls thereof substantially tangent to the outer surface of a container on said supporting means, a spring actuated crank, means including links pivotally secured to the elbows of said bell cranks and pivotally secured to said spring actuated crank at a point thereon in line with said bell crank coaxial pivotal mounting and with the center of said container support and said handle guide for swinging said dies into closed positions with a snap action, means for extending said spring actuated crank and dies to open-die positions, electrical control means responsive to closure of said dies for controlling actuation of said means for extending said crank and dies to open-die positions, means responsive to the positions of said handle guide means in and out of handle aligning position for respectively latching said spring actuated crank in open-die position and releasing said spring actuated crank therefrom, and electrical control means operable in response to movement of said guide means into handle aligning position for providing for retraction of said crank and die extending means from extended position.

9. In apparatus for making a cup-like article with integral handle, a holder for supporting a cup with integral handle blank, a pair of co-operable hole forming reshaping dies arranged for movement relative to one another toward the handle blank and drive means operatively coupled to said dies for closing the dies with a snap action on the handle blank to cut the handle hole and shape the exterior.

10. In apparatus for making a cup-like article with integral handle, a cup holder, a pair of co-operable hole forming reshaping dies, means for moving one of them relative to the other to move the dies toward closed position, drive mechanism operatively coupled to the dies for closing the dies with a snap action on the handle material supported by the cup to cut the handle hole and shape the exterior of the handle and means for aligning the cup on the support.

11. In apparatus for making a ceramic cup-like article with integral formed handle wherein the cup is made in the clay state with an appendage blank to be reshaped and has been dried to form retaining condition, a cup holder, a cup aligner, a pair of co-operable hole forming reshaping dies each having a material receiving opening arranged for movement relative to one another and to the appendage blank, drive means operatively coupled to said dies for closing the dies with a snap action on the appendage blank, to restore plasticity to the appendage blank and to cut the handle hole and contour the handle, means for removing the cut material from the openings and a lubricator for lubricating the work.

12. In apparatus for making a ceramic cup-like article integral formed handle wherein the cup is made in the clay state with an appendage blank to be reshaped and has been dried to form retaining condition, a cup holder, a pair of co-operable hole forming reshaping dies, a support for moving each die toward closing relation to the appendage blank, drive means operatively coupled to said dies for closing the dies with a snap action to cut the handle hole and restore plasticity to the blank material acted upon for reshaping it and means for varying the vertical position of the dies relative to the cup holder.

13. In apparatus for making a cup-like article with an integral handle, a holder for supporting the cup with an integral handle blank, a pair of cooperable handle-shaping dies, means mounting said dies in coupled relation to each other on opposite sides of the handle blank for

opening movement away from each other and closing movement toward each other, drive means for operating said mounting means to open the dies, a spring device, means connecting the spring device to the mounting means for stressing the spring device responsive to movement of the dies to open position, and means for abruptly releasing the spring device to snap the dies to closed position on the blank, thereby forming the blank into a handle by thixotropic action.

14. In apparatus for making a cup-like article with an integral handle, a holder for supporting the cup with an integral handle blank, means for aligning the cup on said holder, a pair of cooperable handle-shaping dies, means mounting said dies in coupled relation to each other on opposite sides of the handle blank for opening movement away from each other and closing movement toward each other, drive means for operating said mounting means to open the dies, a spring device, means connecting the spring device to the mounting means for stressing the spring device responsive to movement of the dies to open position, and means for abruptly releasing the spring device to snap the dies to closed position on the blank, thereby forming the blank into a handle while restoring the plasticity of the handle blank by thixotropic action.

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