May 5, 1970 J. E. PANCZNER 3,510,287

MOIL SEVERING METHOD AND APPARATUS

Filed Jan. 3, 1967 2 Sheets-Sheet 1

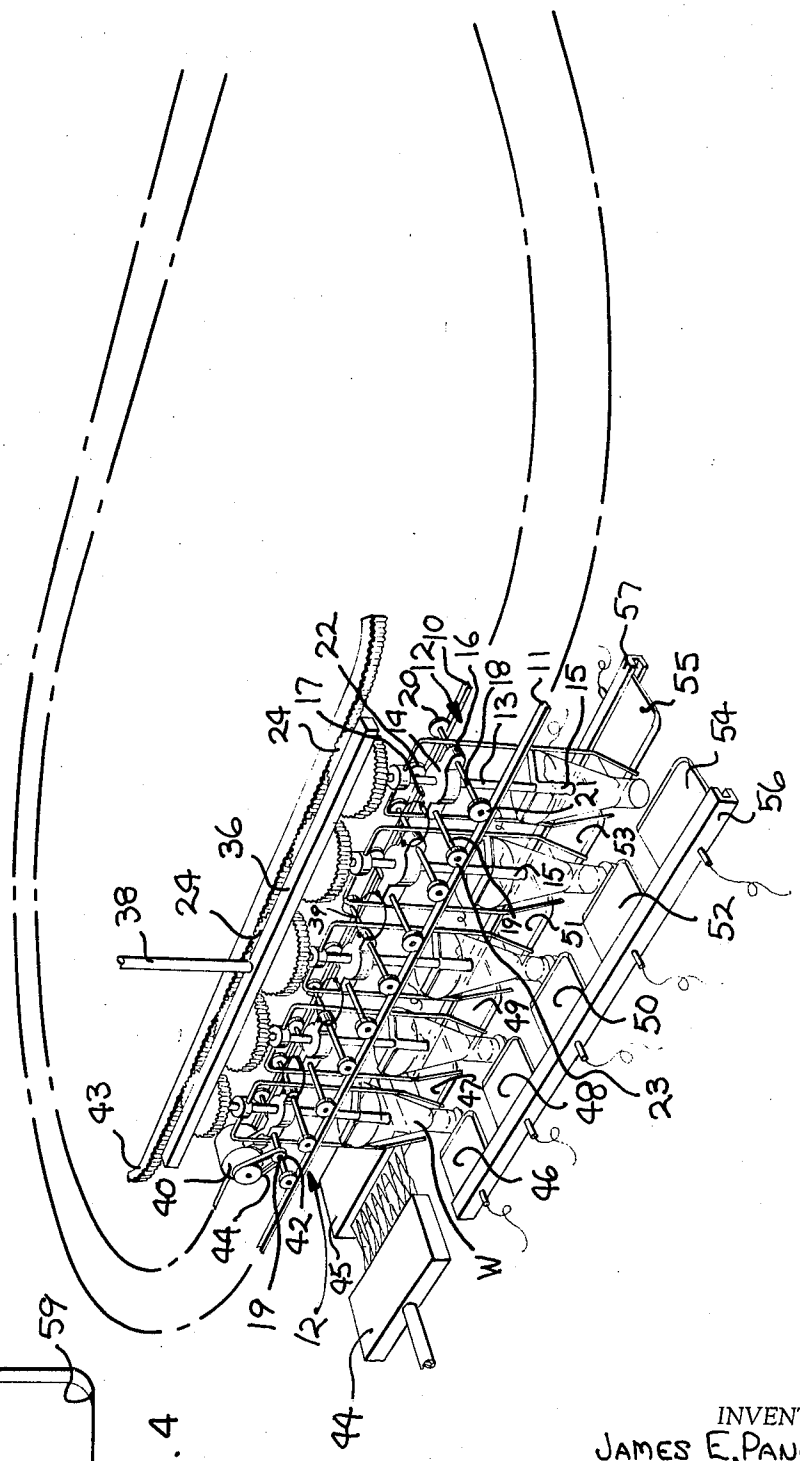

FIG. 1

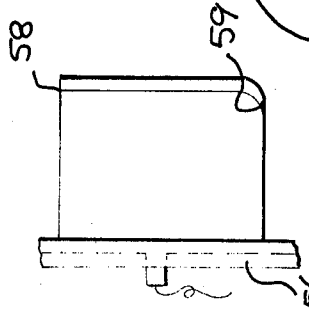

FIG. 4

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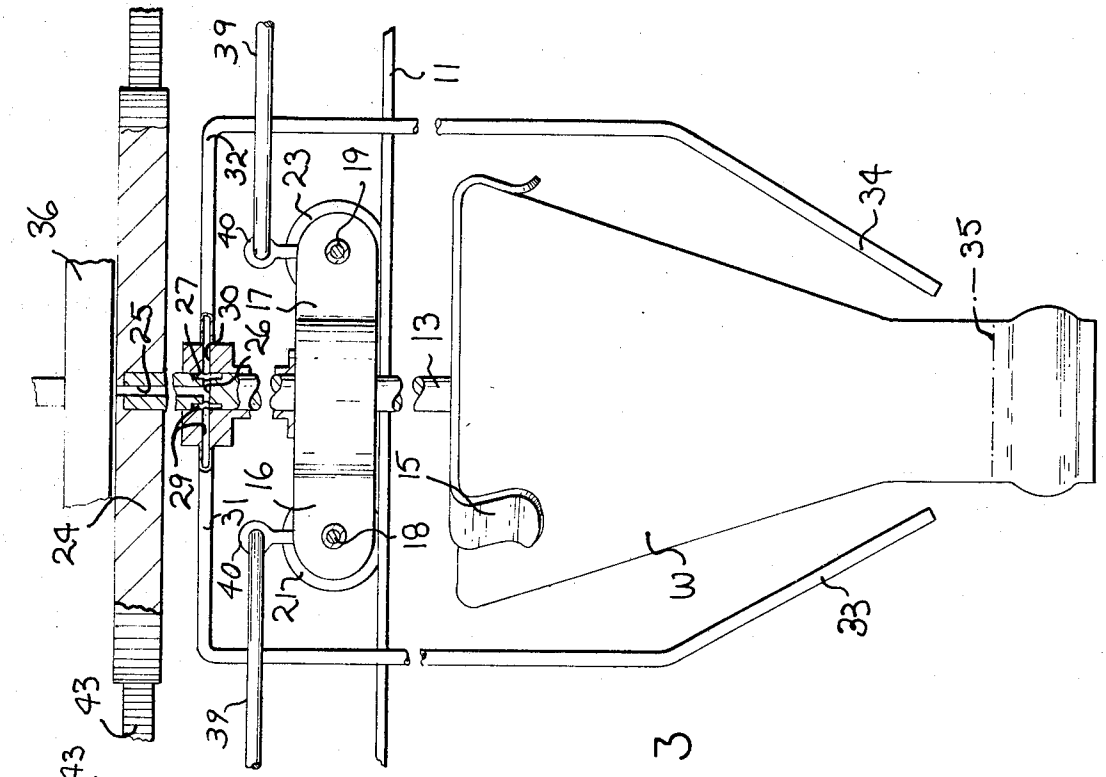

FIG. 3

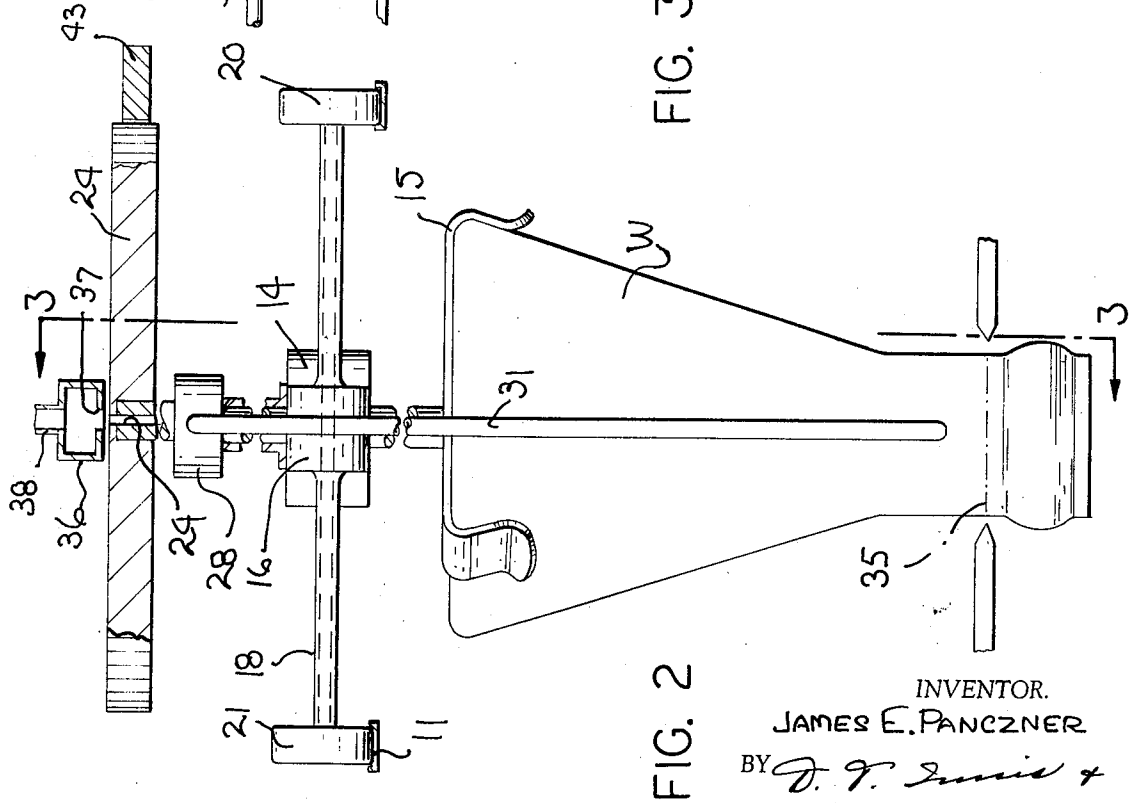

FIG. 2

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MOIL SEVERING METHOD AND APPARATUS

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U.S. Cl. 65—113 14 Claims

ABSTRACT OF THE DISCLOSURE

The invention disclosed provides a method and apparatus for handling hollow glassware through a thermal severing device. The glassware is brought to and through the severing device in a horizontal, linear path. The thermal unit for severing an end moil or trim portion of the glassware from the article is arranged in an elongated or linear array parallel with the linear path for the glassware. The glassware is supported by a chuck at its base or end opposite the moil portion, gripped and carried inverted through the linear thermal unit at the desired elevation to define the moil cut-off line annularly of the glassware. The article is rotated axially while it is simultaneously advanced through the thermal unit. A severed moil section of the ware results upon sufficient narrow-band heating of the rotated ware and the severed glass falls vertically and below the thermal unit. The thermal unit embodiment is a pair of parallel, opposed, sharp edge blade electrodes energized by high voltage, high frequency electrical source means. Air directed to the moil cut-off line prevents an ionized air layer from forming due to air breakdown in the electrical arc.

This invention relates to a method and apparatus for severing the moil from glass articles, such as beakers, tumblers, etc., which articles are formed in the well-known paste mold process of glass forming. More particularly, this invention relates to a method and apparatus for handling a plurality of glass articles through a moil severing process involving the use of high frequency, high voltage current as the severing means.

The present invention provides an arrangement for handling glassware with the moil portion down, wherein the glassware is rotated about its vertical axis while simultaneously therewith it is moved laterally through the moil severing operation. The moil severing operation involves applying to the line of severance a flame or other means for producing a heated band extending circumferentially about the glassware. Glassware with the heated band is then moved into a zone between at least a pair of opposed, blade electrodes energized by a spark gap generator to apply a high (radio) frequency current at a voltage between 10,000 and 15,000 volts whereby current will pass through the heated band resulting in the separation of the moil from the rest of the article. To avoid the commonly produced layer of ionized gas surrounding the article at the line of severance, which layer might carry the majority of the current flow between the electrodes and prevent the current from effectively heating the glass, applicant provides an air jet arrangement for interrupting the ionized gas layer. In order to sever the moil from a plurality of glass articles, a plurality of blade electrodes serially arranged are provided with each pair of electrodes being connected to its own individual spark gap generator.

It has been the practice in the past to sever the moil from the article by the use of gas fired burners, with the glassware rotated within the influence of the burners until the glass is softened sufficiently to permit separation of the moil from the glass article. This method of severing the moil is slow from the standpoint that it is necessary for the glass to absorb the radiant, impinging heat and to conduct the heat within the body of the glass at the severing line until such time as the glass becomes soft and melted to the extent that separation occurs.

It is an object of this invention to provide a method and apparatus for severing the moil from a glass article by the use of a high frequency, high voltage current source.

It is an additional object of this invention to provide a method and apparatus for severing the moil from a glass article which is rapid and capable of high speed operation without distortion of the glass article.

It is a further object of this invention to provide a method and apparatus for severing the moil from glass articles in which a plurality of articles are individually conveyed through a severing zone in series utilizing a plurality of serially arranged, blade-type, pairs of electrodes.

Other and further objects will be apparent from the following description taken in conjunction with the annexed sheets of drawings, wherein:

FIG. 1 is a schematic, perspective view of the apparatus of the invention particularly illustrating the severing zone;

FIG. 2 is an elevational view of one of the ware handling members or dollies of FIG. 1 on an enlarged scale;

FIG. 3 is a cross-sectional view taken generally at line 3—3 of FIG. 2; and

FIG. 4 is a top plan view of one of the blade electrodes of FIG. 1, on an enlarged scale.

With particular reference to FIG. 1, the apparatus of the invention is schematically shown and comprises a pair of tracks **10** and **11** which are continuous and describe a pair of horizontally disposed, spaced-apart, oval paths illustrated by the dot-dash line.

These tracks, as shown in section in FIG. 2, are channel-shaped with the channel opening upward to provide guiding surfaces for ware handling members, generally designated **12**. Each of the handling members or dollies **12** is comprised of a central, vertical shaft **13**, which shaft **13** is rotatably supported within a cast bushing **14**. The lower end of the shaft **13** is provided with a three-fingered spring clip **15**, with the fingers thereof extending radially at generally 120° spacing and adapted to frictionally retain the ware or article W to be carried through the moil severing operation.

As is clearly shown in FIGS. 2 and 3, the ware is held by the spring clip **15** at its bottom, with the axis of the ware being vertical. With this arrangement, the moil portion of the ware will be positioned downward so that upon completion of the severing of the moil from the ware, the moil may drop vertically by gravity and be discarded.

Each of the castings **14** is provided with a pair of radially extending bosses **16** and **17**. Each of the bosses **16** and **17** is provided with a horizontal opening through which extend a pair of horizontal shafts **18** and **19**. Each of the shafts **18** and **19** is provided with a pair of wheels, with the wheels **20** and **21** carried by the shaft **18** and wheels **22** and **23** carried by the shaft **19**. The wheels **20, 21, 22** and **23** are adapted to ride within the channel formed in the tracks **10** and **11** and effectively guide the movement of the ware handling mechanism in a path defined by the tracks **10** and **11**.

At the upper end of the shaft **13**, there is provided a pinion **24** fixed to the upper end of the shaft for the purpose of providing a drive connection between the pinion and shaft. As can be seen when viewing FIGS. 2 and 3, the upper end of the shaft **13** is provided with a vertical passage **25** extending downward from the upper end thereof to a cross passage **26**. The cross passage **26** opens into an annular, relieved area **27** in the side of the shaft and a sleeve **28** surounds the shaft and effectively covers the relieved area **27**. The sleeve **28** is provided with a pair of passages **29** and **30** extending radially therefrom

to which are joined a pair of pipes **31** and **32** respectively. Both of the pipes **31** and **32** extend outwardly beyond the diameter of the ware and are then turned downwardly with their lower ends **33** and **34** bent inwardly so as to be directed toward diametrically opposed points on the side of the ware slightly above the line of severance **35**.

As illustrated in FIG. 2, the shafts **18** and **19** may actually be fixed to the bosses **16** and **17** with each of the wheels **20, 21, 22** and **23** being provided with bearings so as to be freely rotatable with respect to the shafts.

The pipes **31** and **32**, with their bent ends **33** and **34**, are adapted to convey air under pressure and to direct the air to impinge on the sides of the ware W at points slightly above the line of severance **35**. This impingement of air is provided so as to physically interrupt any layer of ionized gas which may be formed about the circumference of the ware in the area of the line of severance. It should be understood that when a high frequency, high voltage discharge takes place, ionization of the air frequently occurs, with the highly ionized air forming the conductive path for the electric current offering less resistance to flow of current than the hot glass. Because of this, the current may be prevented from entering the glass and heating it by resistance to current flow. In order to avoid this, the air pipes are provided so as to interrupt this ionized gas layer circumferentially surrounding the article at the line of severance **35**.

The air is supplied to the pipes **31** and **32** through the passage **25** in the shaft **13** from an air manifold **36**. As indicated in FIG. 1, the air manifold **36** extends horizontally in line with the plurality of the dollies positioned in the severing portion of the apparatus. The air manifold, as best shown in FIG. 2, has a longitudinal slot **37** opening downward and provides the means of communicating the air supplied to the manifold by a pipe **38** with the passage **25** in the shaft **13**.

As can readily be seen when viewing FIG. 1, there are a plurality of dollies **12** linked together by rings **39** which pass through small bosses **40** provided on each of the radial bosses **16** and **17**. These rings **39** accurately space the dollies with respect to each other and provide the required relative motion between the dollies so that they may circumnavigate the tracks **10** and **11**.

The dollies are moved at a constant speed through the mechanism illustrated in FIG. 1 by a motor **40** carried by one of the dollies and having the output of the motor drive a belt **41** which in turn drives a pulley **42** connected to the shaft **19** of the one dolly to rotate the shaft and drive the wheels fixed thereto. In this manner the entire train of dollies may be driven at a preselected constant speed around the tracks **10** and **11**.

As previously indicated, it is necessary that the ware be rotated about its vertical axis during the flame heating of the ware to form the conductive band at the line of severance, and it is also necessary that the ware be rotated during its movement between the electrodes. This rotary movement is imparted to the ware supporting shaft **13** by engagement of the pinion **24** with a stationary rack **43** mounted above and extending parallel to the line of movement of the dollies **12**. As the dollies are moved from left to right, as viewed in FIG. 1, the pinion **24** engages the rack **43** resulting in rotation of the ware, it being understood that only the shaft **13** turns, with the sleeve **28** and the cast bushing **14** remaining stationary with respect to this rotation.

The severing zone illustrated in FIG. 1, consists first of a pair of gas fired burners **44** and **45** which produce a pair of opposed narrow sheets of flame extending throughout the length of the burners. The flames will impinge on the ware at the preselected line of severance to effectively produce a band of heated glass at the line of severance. It is necessary that the glass be heated so that an electrically conducting path will be formed in the glass at the preselected line of severance.

As previously indicated, the ware is rotated so that the heat is uniformly applied to the ware as it passes between the burners **44** and **45**. After passing between the burners, and while the ware is still rotated, the dollies will carry the ware between a first pair of opposed blade-type electrodes **46** and **47**. These blades are connected to a conventional arc-type high frequency voltage generator (not shown).

As the ware enters the space between the electrodes **46** and **47**, the heated band thereon provides a conductive path for the current to flow from one blade to the other, with the current flowing through the glass itself with the hottest portion of the glass serving as the path of least resistance. If the ware were held in the zone or area between the blades **46** and **47** for a sufficient time, complete severance of the moil from the ware would be accomplished. However, in order to provide an arrangement for severing a plurality of pieces of ware successively at relatively high speeds, it has been found necessary to divide the blade electrodes, which would be much longer in length, into a plurality of segments or individual pairs of electrodes **48, 49, 50, 51, 52, 53, 54** and **55**.

In actual practice and for high speed operation, the blades are each approximately five inches in length and separated by a three quarters of an inch gap. The blades are set so that they present a gap of one-fourth to three-sixteenth of an inch between their edges and the ware to be severed. For convenience of mounting the blades on one side of a path of travel of the ware, are mounted in an insulating channel member **56** and the complementary blades which are positioned at the opposite side of the ware are mounted in a similar channel member **57** of insulating material.

As specifically shown in FIG. 4, the configuration of the blade electrode is such that one edge **58** is relatively square, while the opposite trailing edge **59** is rounded off. It should be pointed out that each of the pairs of blades which constitute an arc-producing arrangement, is supplied by its individual and separate high frequency, high voltage arc generator (not shown). The forward edges of the blades are sharpened to a relatively thin knife-edge being formed of a conductive metal oppositely bevelled to provide an included angle of approximately 30°.

With the voltage applied to the pair of electrodes, for example **46** and **47**, entrance of a glass article, with the heated band thereon, into the gap will result in an arc breakdown or discharge with current flowing through the glass. The time that the article is between the electrodes **46** and **47** is insufficient to accomplish complete severance of the moil. The article will progress from between the electrodes **46** and **47** to a position between the electrodes **48** and **49**, then to the position between electrodes **50** and **51** and ultimately to the position between the electrodes **54** and **55**, at which time there has been a sufficient current flow through the glass to cause complete separation of the moil from the article. Obviously, if the article is moved through the severing zone at slower rates, the severing may occur at a position prior to the position of the electrodes **54** and **55**.

It has been found that if the blades of the electrodes do not have the rounded trailing edge **59**, arcing may occur between adjacent electrodes on the same side, such as electrodes **46** and **48**, with the glass serving as the conductive bridge between the electrodes. Applicant has found that by providing the rounded trailing edge, displacement of the arc out of the path normal to the path of the movement of the ware is prevented.

The voltage generators which are connected to each pair of electrodes are rated to produce a voltage of 10,000 to 15,000 volts at a frequency in the range of 300 cycles per second to one megacycle with a current output of between 4 and 5 amps. RMS.

With the foregoing in view, it can be seen that applicant has provided a method and apparatus for severing

the moil from glass articles which is effective to accomplish the severing of a large number of articles per unit of time. With the present apparatus and with the dimensions mentioned, it is possible to sever articles at a rate in excess of 200 pieces per minute.

It will be readily appreciated that after the severance of the moil from the ware, the ware may be easily removed from the apparatus, and articles having the moil thereon may be loaded into the holders preparatory to their movement through the severing operation.

While the above detailed description has been limited to the specific apparatus shown, it should be obvious that other apparatus for holding and rotating the ware through the heat zone and high frequency field could be used. For example, individual motors could be mounted on each of the dollies, with the motors individually driving each spindle. Furthermore, the dollies themselves, instead of being conveyed and guided on a pair of tracks, could be moved by a rotating turret where the spindles or shafts **13** would be mounted at spaced, radial points about the circumference of the turret.

I claim:

1. The method of severing a moil portion at the one end of a glass article comprising the steps of inverting the article with its central axis vertical, moving the inverted article with the moil lowermost in a horizontal path, supporting the article from the top portion thereof at a distance sufficient to permit unobstructive dropping of the moil by gravity when severed, directing heat toward the article by an elongated heat energy source disposed parallel to said path at an elevation corresponding to a moil cut-off line on the article whereat the moil and article are to be severed, said elongated source being in closely spaced proximity to the surface of the article as it moves in said path, rotating the inverted article about its central axis while moving the latter in said path, thereby heating the glass circumferentially at the moil cut-off elevation, maintaining the heating of the glass sufficiently to effect thermal severing at the moil cut-off line, thereby allowing the cut-off moil portion to separate from the article while in said path and fall below said heat energy source.

2. The method of claim **1**, wherein the horizontal path is a linear path extending through the elongated heat energy source, the latter being linear and substantially parallel with said path.

3. The method of claim **1**, wherein the step of directing heat toward the article by an elongated heat energy source is carried out by a high voltage, high frequency electric arc source.

4. The method of claim **3**, further including the step of impinging a stream of air onto the article outer surface substantially at the moil cut-off line and at right angles to said electric arc heat source, said stream of air interrupting any ionized gas layer around the moil cut-off line of the article resulting from breakdown of air during electric arc discharges.

5. The method of claim **3**, wherein the step of high voltage, high frequency electric arc heating is carried out by simultaneously axially rotating and horizontally moving the inverted article between a pair of linear, opposed, sharp edge blade electrodes.

6. The method of claim **5**, wherein the step of electric arc heating is carried out by providing a plurality of blades in end-to-end relation on opposite sides of the article and individually energizing said blades by a high voltage, high frequency electrical source.

7. Apparatus for handling glassware in severing a moil end portion thereof comprising an endless movable carriage, means engaging the carriage defining a closed path of movement for the latter, plural rotary article chucks connected to said carriage for movement therewith, means connected to said carriage for driving the latter in said path, said chucks each including means for releasably engaging a piece of glassware and for holding it by its end portion opposite said moil end with the axis of the glassware depending perpendicularly from the path of said carriage with the moil end portion lowermost, said chucks supporting said glassware at a height sufficient to permit unobstructed dropping of the moil by gravity when severed, the chucks moving in a horizontal span of said closed path thereby holding the glassware in a vertically inverted position, stationary horizontal guide means disposed along said horizontal span, means on said chucks engaging said guide means for moving the glassware forward in a level fashion through said horizontal span, elongated linear glass burn-off means supported along said horizontal segment of the carriage path spaced laterally from the inverted glassware moving horizontally past said burn-off means while held by said chucks and disposed vertically with respect to said glassware at predetermined height to define the moil severing line, and means engaging said chucks during their movement in said horizontal segment of the carriage path for rotating the chucks and glassware, whereby the movement of the glassware along said horizontal segment effects severing the moil portion of the glassware and said severed moil separates from the glassware by gravity.

8. The apparatus defined by claim **7**, wherein the movable carriage comprises a plurality of dollies, means connecting the dollies end-to-end in chain-like fashion, the dollies including a pair of spaced transverse shafts, rollers on opposite ends of the shafts, said stationary horizontal guide means comprising a pair of horizontal, parallel, spaced-apart tracks, said rollers running on said tracks thereby guiding the horizontal span of movement of the chucks.

9. The apparatus defined by claim **7**, wherein the means on said chucks releasably engaging the glassware comprises a spindle rotatably mounted on said carriage, plural spaced-apart fingers connected to said spindle depending axially and engageable with the side of the glassware, the chuck including a base support for the glassware intermediate said fingers, whereby the engagement of the fingers on the glassware seats the bottom of the latter against said support, a pinion connected to said shaft, and the means for rotating the chucks comprising a linear stationary member engaging said pinion of each chuck in movement through said horizontal span rotating the pinion simultaneously with horizontal movement of the chuck in said span.

10. The apparatus defined by claim **7**, wherein said burn-off means comprises a pair of elongated horizontal heaters in facing, spaced-apart relationship, opposed, spaced-apart, horizontal blade electrodes adjacent said heaters and disposed in the same horizontal plane, and a source of high frequency, high voltage current connected to said electrodes.

11. The apparatus defined by claim **10**, including a source of air under pressure, a pair of air conducting pipes having one end in communication with said source of air, the other end of said pipes being directed to impinge air on the ware at the line of severance of the moil from the ware whereby said air pipes deliver streams of air obliquely to the plane of the severance line of the glassware to interrupt any ionized gas layer formed by voltage discharge from the electrodes.

12. The apparatus defined by claim **10**, wherein each blade electrode is comprised of plural, spaced, end-to-end, blades having an inner facing edge bevelled to a sharp edge and the trailing corner thereof rounded to prevent interelectrode discharge during glassware movement from one blade to the next blade.

13. Apparatus for handling glassware articles in severing a moil end portion and thereby form a mouth end thereon comprising an endless chain-like carriage element, means engaging the carriage element guiding it in a closed path, plural article holding chucks rotatably connected on said carriage element for movement therewith, means connected for driving said carriage in said path, said chucks each including plural finger-like members ex-

tending axially of the chuck and reciprocatingly movable toward and away from such axis for releasably engaging a glassware article thereby holding it by its bottom end portion with its central axis perpendicular to the carriage element with the moil end portion lowermost, said chucks supporting said glassware at a height sufficient to permit unobstructed dropping of the moil by gravity when severed, stationary horizontal guide means disposed along said path, means connected to said chucks and engaging said guide means for maintaining the glassware in an inverted vertical position and at a predetermined horizontal elevation, elongated linear glass burn-off means, means for supporting said burn-off means beneath said carriage path along said guide means, the burn-off means being supported thereby in closely spaced lateral position with respect to the moil portion of the inverted glassware article on said chucks, a source of thermal energy connected to said burn-off means, the burn-off means applying thermal energy onto the glassware articles at a moil severing line, and means engaging said chucks during their movement along said guide means for rotating the inverted glassware held thereby, the glassware having the moil portion thereof severed during its horizontal and rotary movements along said burn-off means, the separated moil

portion being discarded by dropping below said burn-off means.

14. The apparatus defined by claim **13**, wherein the burn-off means comprises opposed, linear, horizontal, spaced-apart burn-off members each connected to said source of thermal energy and directing heat onto the moil of the glassware from opposite sides thereof during movement of the inverted glassware between the burn-off members, the separated moil of the glassware dropping by gravity from the space between said burn-off elements.

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U.S. Cl. X.R.

65—70, 272, 274, 284