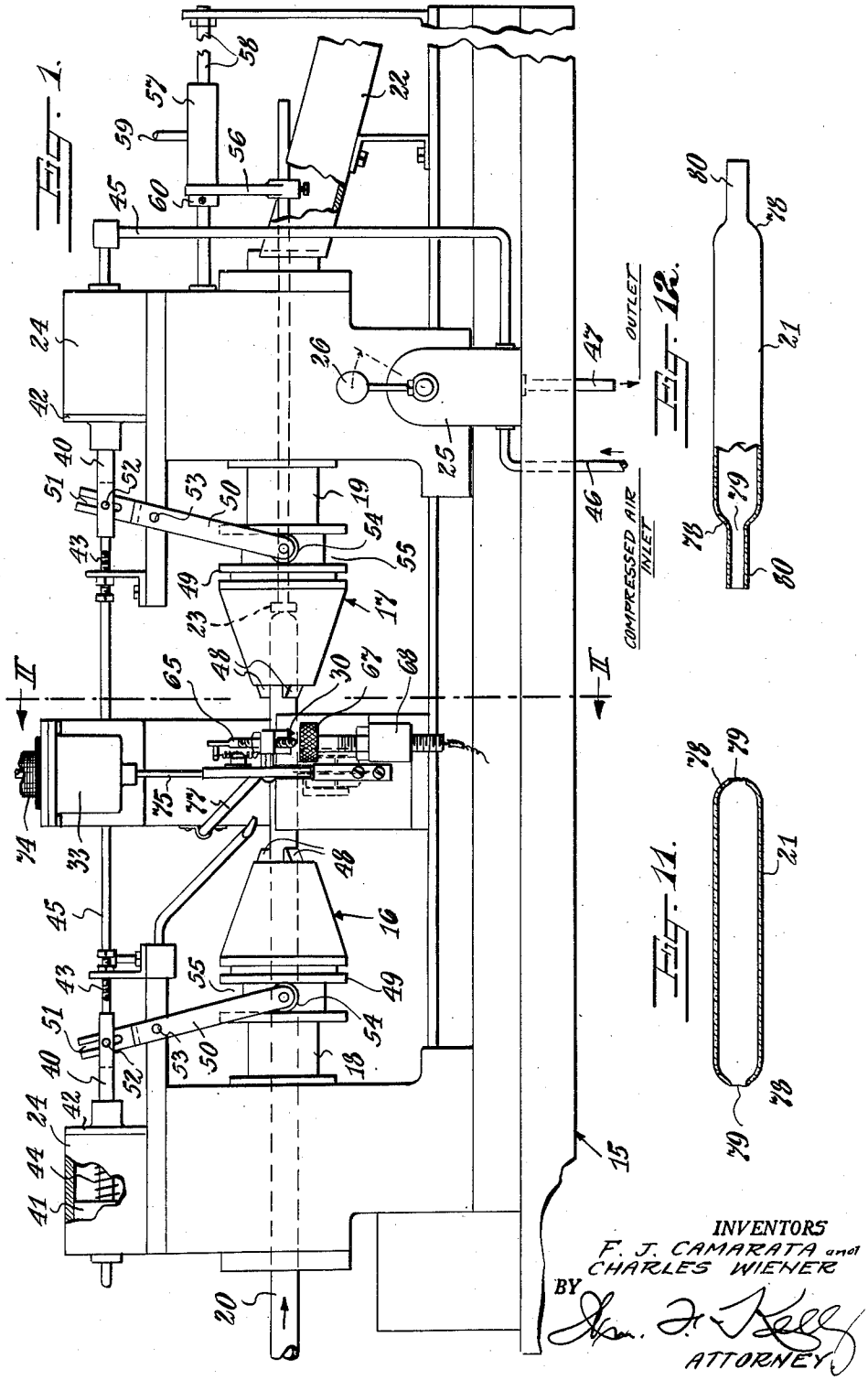
May 20, 1958 F. J. CAMARATA ET AL 2,835,079

TUBULAR LAMP BULB MACHINE

Filed June 30, 1953 3 Sheets-Sheet 1



INVENTORS
F. J. CAMARATA and
CHARLES WIEHER
BY
ATTORNEY

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Filed June 30, 1953 3 Sheets-Sheet 2

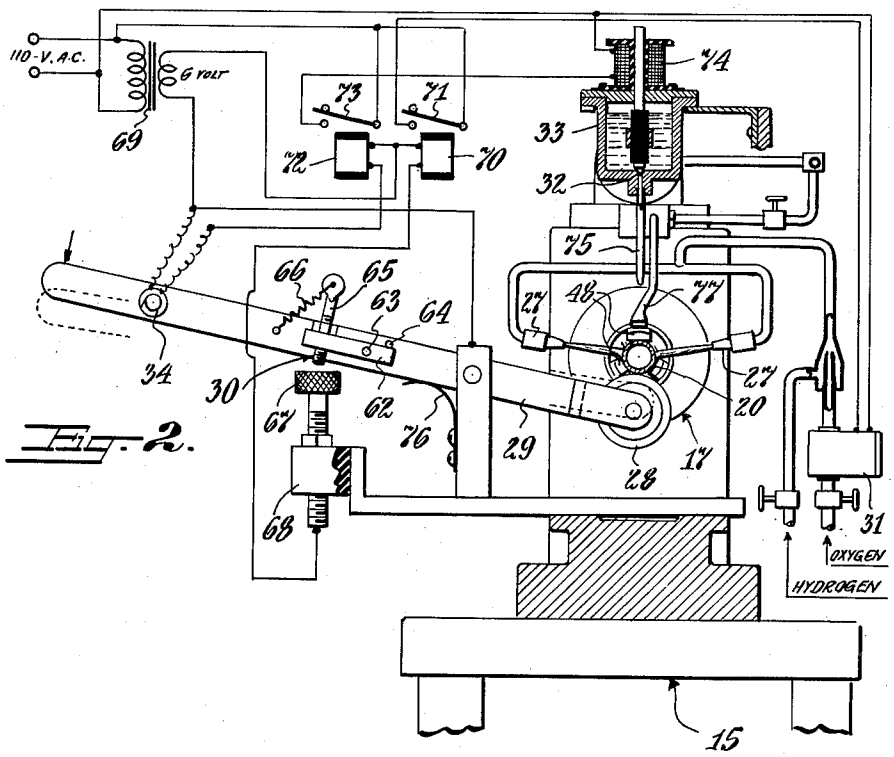

Fig. 2.

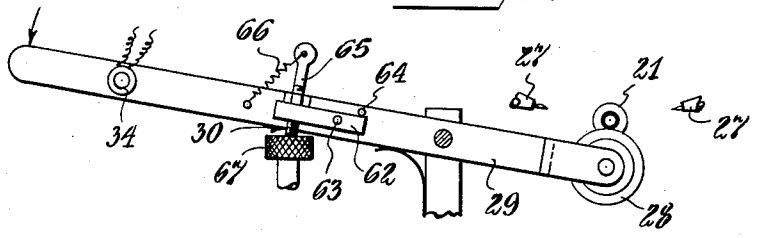

Fig. 3

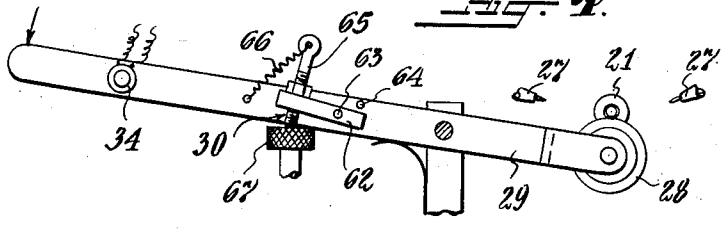

Fig. 4.

INVENTORS
F. J. CAMARATA and
CHARLES WIENER
BY
ATTORNEY

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Filed June 30, 1953 3 Sheets-Sheet 3

Fig. 5.

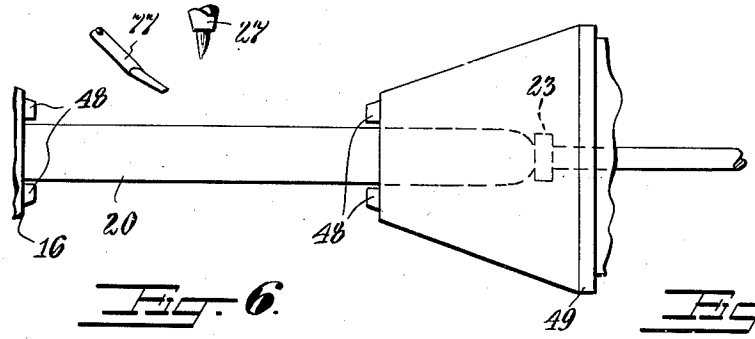


Fig. 6.

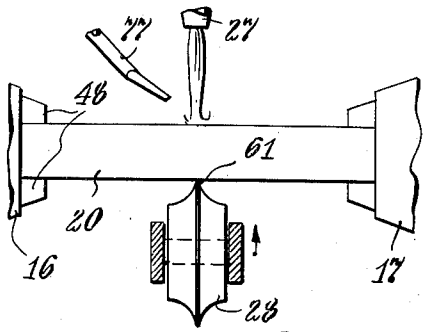


Fig. 7.

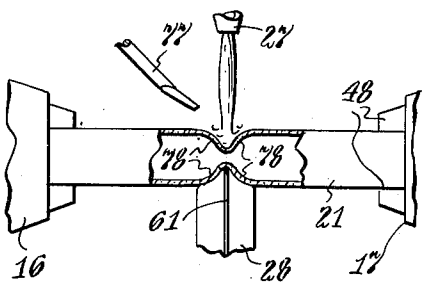


Fig. 8.

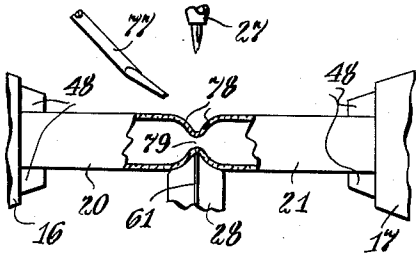


Fig. 9.

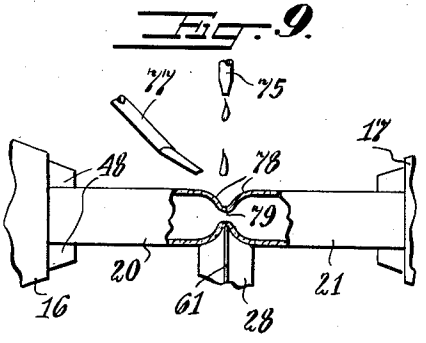
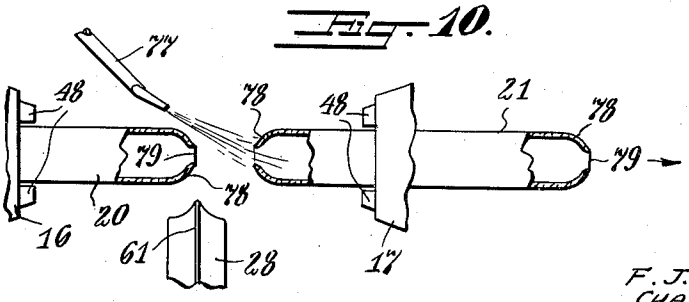


Fig. 10.



INVENTORS
F. J. CAMARATA and
CHARLES WIENER
BY
John J. Kelly
ATTORNEY

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TUBULAR LAMP BULB MACHINE

Frank J. Camarata and Charles Wiener, Bloomfield, N. J., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application June 30, 1953, Serial No. 365,002

4 Claims. (Cl. 49—7)

This invention relates to tubular lamp bulb manufacture and, more particularly, to an improved means for successively forming ends on bulbs from tubular glass stock and severing the glass between contiguous ends of the successively formed bulbs.

The invention further contemplates obtaining accurate duplication of successively fabricated bulbs, together with rapidity of formation, minimizing of hand operations and bulb spoilage and inclusion of automatic controls and simplification of duties of the operator in the cycle of required operations, and provision of machinery conducive to accomplishment of these several objectives as well as other objects, advantages and results which will become apparent to persons skilled in the art to which the invention appertains as the descripton proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawings in which like numerals of reference indicate similar parts throughout the several views:

Figure 1 is a front elevation of an arbitrarily selected embodiment of machine illustrative of our invention;

Figure 2 is a vertical cross-section thereof on line II—II of Fig. 1 in the direction of the arrows;

Figures 3 and 4 are views of the operating lever and associated parts showing successive positions;

Figures 5 to 10 are views showing successive steps of forming, cutting and discharging the bulbs;

Figure 11 is a longitudinal sectional view of the formed bulb; and

Figure 12 is a side elevational view partially in section showing the addition of extension tubes on said bulb.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral **15** (Figs. 1 and 2) designates a glass-working lathe in general, wherein are provided axially aligned synchronously driven head chuck **16** and tail chuck **17**. Each chuck is mounted on a spindle **18**, **19** respectively by which the chuck is rotated, said spindles and chucks being hollow so that the head chuck **16** and spindle **18** may receive the stock material in the form of a quartz glass tube **20** therethrough and the tail chuck **17** and its spindle **19** may receive the work, which, when completed as a bulb **21** (Figs. 3–4, 7–12), may be discharged rearwardly of the chuck **17** through said tail spindle **19**. A chute **22** is provided at the far end of the tail spindle **19** to receive and carry off the work or bulb **21**.

In conjunction with the tail spindle **19** and chuck **17**, we provide a gauge **23** (Figs. 1 and 5) that can be introduced, like a ram rod, into the far end of the spindle **19** and to an appropriate position to limit introduction, from the other direction, of the work piece **20** into the tail chuck **17**. After the work piece **20** is located and the chuck **17** closed, the gauge **23** is removed thereby clearing the passage through the spindle **17** for subsequent discharge of the work.

Individual air cylinders **24** (Fig. 1) for each chuck **16**, **17** are provided to simultaneously operate the chucks. The inlet and exhaust for both air cylinders **24** are under control of a valve **25** the swingable handle **26** of which is at the front of the lathe **15** convenient to the operator.

Located to function on the work **20** between the two chucks **16**, **17**, is a battery of flame nozzles **27** (Figs. 2–8), and according to the present showing, two nozzles **27** are shown, one at the front and one at the rear of the work **20**. The flames are adjusted to bring the glass **20** to high enough a temperature to soften the glass to plastic or workable condition. When the operator observes the glass **20**, to have attained proper temperature, a tool **28** (Figs. 2–4, 6–10) mounted on an operative lever **29**, and having a two-stage advancement characteristic is swung into contact with the work **20** at the heated area. The tool **28** is formed to press the glass **20** inward to make a rounded shoulder or end formation during the first stage of advancement of the tool, and very conveniently the tool functions to thus round the end of that part of the tube **20** which is about to become severed as the bulb **21**, as well as at the part of the tube **20** which is about to become the end of the work **20** as an end of the bulb **21** to be next formed and severed. When the tool **28** has been pressed toward the tube axis, an appropriate distance to give the predetermined shouldered formation (Fig. 7) to the glass, an electric switch **30** (Figs. 1–4) is automatically closed. Said switch **30** completes an electric circuit to an electrically operated valve **31** (Fig. 2) in the oxygen line to the flame nozzles **27** such that the oxygen supply will be stopped and the flame from the nozzle **27** reduced to the status of a pilot light of the flow of hydrogen merely burning in air. The glass **20** therefore cools (Fig. 8) below its plastic state whereupon the tool **28** is operated toward the tube on the second stage of advancement of the tool, which then scores or cuts the glass tube **20** (Fig. 9), severing the bulb **21** from the tube thereat. A blast of air from a pipe **77** (Figs. 1–2, 5–10) opening toward the severed end of the bulb **21** (Fig. 10) will blow the bulb through the spindle **19** (Fig. 1) to aforesaid chute **22** as soon as the grip of the chuck is released. While it is feasible to have this air blast controlled by aforesaid hand operated valve **25** to supply the air blast whenever handle **26** is swung to cause the chucks **16**, **17** to open, separate control, as by a foot valve (not shown) may be provided for the air blast and thus both conserve the air supply and give the operator greater latitude in the timing and force utilized in ejecting the bulb **21**. Furthermore, to promote cooling and severing between the proximate shoulders of the glass tubing **20**, water (Fig. 9) may be dripped at the impressed area of the tubing, if desired, and an electrical control for the purpose is shown effective upon a needle valve **32** (Figs. 1–2) of a drip cup **33**. A push button **34** (Figs. 2–4) on the hand operated tool carrying lever **29** is provided for the operator to open the drip valve **32** when desired.

Chuck operating mechanism

Attempt has been made in the foregoing description to set forth the general organization of instrumentalities used in the furtherance of our invention. However, a more detailed description may be indulged in for assistance in better duplication of the invention by posterity. Thus it may be said that the chuck-operating cylinders **24** (Fig. 1) have piston rods **40**, one in each cylinder extending axially thereof from an internal piston **41** forwardly out of one end of the cylinder through a cylinder head **42**. Opposite to the projecting forward end of said piston rod is an adjustable stop **43** limiting amplitude of forward movement of the piston **40**. Within the cylinder **24** is a spring **44** which is under compression between

the cylinder head 42 and piston 41 thereby tending to retract the piston 41 and piston rod 40. An air control pipe 45 (Fig. 1) leads from the rear end of each cylinder 24 to afore-mentioned hand operated valve 25. Said valve is conveniently any well-known three-way valve by which air pressure may be admitted from an inlet source 46 through the valve to the air control pipes 45 or may shut off that pressure supply and open the control pipes 45 to an outlet 47.

The piston rods 40 are arranged to operate collet jaws 48 (Figs. 1–10) of the chucks 16, 17 by a longitudinal sliding of a collar 49 by which said jaws 48 may be contracted against or released from the tube 20. The operative connection from the piston rod 40 to the collet collar 49 is by a lever 50 (Fig. 1) having an end slot 51 adjacent to the piston rod 40 which has a transverse pin 52 riding in said slot, obtaining a swing of the lever 50 by reciprocation of the piston rod 40. Said lever is of the first class type so is provided with an intermediate pivot fulcrum 53. The lower end of the lever 50 is forked to depend at opposite sides of the collar 49 and is provided with antifriction means, such as rollers 54 riding in a groove 55 of said collar 49. The arrangement is such that the air pressure in the cylinders 24 applies the gripping engagement of said jaws 48 with the tube 20, and the spring 44 applies the releasing movement to the collar 49 and jaws 48.

Gauge operating mechanism

After the bulb 21 (Fig. 10) has been shaped and cut-off of the work piece or tube 20, said tube is slid forward by hand an appropriate distance for forming a successive bulb therefrom. (See Figs. 1 and 5.) The distance of such forward movement is determined by placing gauge 23 (Fig. 5) in position to limit sliding of the tube 20 forwardly. Said gauge 23 provides a headed rod insertable as far as needed into the tail spindle 19. An end of said rod protrudes from the tail spindle 19 and is carried by a lateral arm 56 (Fig. 1) through which it is adjustably mounted. Said arm extends to said rod from a carriage or sleeve 57 mounted upon a rail or track 58 off-set from and parallel to said rod. Said track has ample length to enable the rod to be completely withdrawn from the spindle 19. A handle 59 is shown as part of said carriage or sleeve 57 to enable the operator to conveniently slide the carriage. An adjustable stop 60 is located on the rail to limit sliding of the carriage 57 and to thereby locate the inner headed end of the rod at the predetermined position required for establishing proper length of the bulb 21 to be formed. All bulbs will therefore have precisely the same length.

Tool operating mechanism

The forming and cutting tool 28 (Figs. 2–10, particularly Fig. 6) is a metallic wheel adapted to be rotated by contact with the rotating glass tube 20 and capable of withstanding the high temperature attained by the glass in the area where contact of the tool 28 is effected. Said wheel is formed with a medial ridge or cutting edge 61 (Figs. 6–10) and has its periphery concave at both sides of the ridge on a curvature appropriate to form the glass 20 with the desired rounding to produce the proximate shoulders in the glass of the tube. The operator refrains from applying the tool 28 until the glass 20 is in a satisfactory plastic condition from the applied heat, and then, even though the ridge 61 is quite sharp, it functions more especially at this stage to press the glass inward (Fig. 7) since the glass has a natural tendency to contract when rendered plastic, due to surface tension. Thus, as the operator depresses lever 29 (Figs. 2–4) for initial amplitude of swing, the shoulders are formed (Fig. 7) with a depression of glass therebetween.

Said lever 29 as shown in Figs. 2, 3 and 4, has an electric switch 30 mounted thereon comprising a teeter element 62 pivoted at 63 intermediate of its ends. A pin 64 fixed in the lever 29 above the forward end of said teeter element 62 constitutes a limiting stop to teeter in one direction and the teeter element is spring-loaded to normally keep it against said stop 64. The other end of said teeter element 62 has a screw 65 extending downwardly therethrough, the upper end of said screw being shown in the form of an eye to which a spring 66 is attached for applying the above-mentioned spring loading to the teeter element 62. The lower end of the screw 65 constitutes an electrical contact point for engagement with a suitably mounted cooperating contact member 67 which is insulated from grounding to the machine 15 or lever 29. As shown, this cooperating contact member 67 is in the form of a bolt threaded in an insulative block 68 (Fig. 2). The contacts 65, 67 are adjusted so as to close when the tool 28 has substantially completed its forming operation (Fig. 7). However, by virtue of the teeter element 62, the lever 29 may still be depressed a short distance further (Fig. 9), and it is during this final interval of depression of the lever 29 that the tool 28 is caused to cut and sever the bulb 21 from the work piece or tube 20 (Fig. 10).

During said final interval of depression of the tool-carrying lever 29 (Fig. 9) the switch 30 is continuously closed, and the circuit therethrough, receiving current from a transformer 69 (Fig. 2), energizes a relay magnet 70 and thereby closes a main-line relay switch 71 which thereupon passes current to an electrically controlled shut-off valve 31 for the oxygen. Heat on the glass 20 is therefore reduced (Fig. 8) and continued engagement and pressure of the tool 28 with the glass of the tube 20 (Fig. 9) scores and severs the glass thereat.

If so desired, especially to increase the rapidity of operation, cooling of the glass where severance is intended, may be promoted by drops of water (Fig. 9) being applied thereat. This has been shown herein as optional to the operator and rendered effective by closing another circuit from transformer 69 (Fig. 2) to a second relay magnet 72 which closes another main-line relay switch 73 that connects with a solenoid 74 (Figs. 1 and 2) on top of drip cup 33. The solenoid 74, when energized, lifts the needle 32 and permits water to drop from a directing pipe 75 above the glass tube 20, as in Fig. 9. The operator then releases lever 29 which swings upward under the influence of a spring 76 (Fig. 2) and lowers the tool 28 (Figs. 1 and 10) and admits air to a pipe 77 directed toward the severed end for blowing the bulb 21 through the spindle 19 to discharge said bulb from said tubular spindle 19 into chute 22.

The discharged tube 21, as shown in Fig. 11 is hollow glass with rounded end shoulders 78 and holes 79 centrally of said shoulders. In subsequent steps of fabrication, the bulb has extension end tubes 80 sealed thereto at said holes 79 and as shown in Fig. 12.

We claim:

1. A machine for forming shoulders in a glass tube and severing the glass between contiguous shoulders, comprising receiving and rotating means for receiving and securing the glass tube and rotating the latter, a battery of burners connected to a source of combustible gases for applying heat to said glass tube sufficient to soften a predetermined portion thereof, a tool engageable with the predetermined heated portion of said glass tube, advancing means for moving said tool toward and away from the axis of the glass tube, said tool being operable during a first advancement toward said predetermined heated portion to form rounded shoulders therein with a depression of glass therebetween, valve means associated with said battery of burners for controlling the flow of combustible gases thereto, electrical circuit means comprising electrical means for operating the valve means and circuit closing means operable by movement of said advancing means toward said axis to cause energization of said electrical means and attendant operation of said valve means to thereby reduce the

amount of heat applied to said predetermined portion and permit the cooling thereof, and said tool being operable during a second and further advancement toward said axis to score the depression in the cooled shouldered portion of said glass tube thereby severing the glass tube.

2. A machine for forming shoulders in a glass tube and severing the glass between contiguous shoulders, comprising receiving and rotating means for receiving and securing the glass tube and rotating the latter, gauging means, means for moving said gauging means into said receiving and rotating means for permitting reception of the glass tube therein in a predetermined position, a battery of burners connected to a source of combustible gases for applying heat to said glass tube sufficient to soften a predetermined portion thereof, a tool engageable with the predetermined heated portion of said glass tube, advancing means for moving said tool toward and away from the axis of the glass tube, said tool being operable during a first advancement toward said predetermined heated portion to form rounded shoulders therein with a depression of glass therebetween, valve means associated with said battery of burners for controlling the flow of combustible gases thereto, electrical circuit means comprising electrical means for operating the valve means and circuit closing means operable by movement of said advancing means toward said axis to cause energization of said electrical means and attendant operation of said valve means to thereby reduce the amount of heat applied to said predetermined portion and permit the cooling thereof, and said tool being operable during a second and further advancement toward said axis to score the depression in the cooled shouldered portion of said glass tube thereby severing the glass tube.

3. A machine for forming shoulders in a glass tube and severing the glass between contiguous shoulders, comprising receiving and rotating means for receiving and securing the glass tube and rotating the latter, a battery of burners connected to a source of combustible gases for applying heat to said glass tube sufficient to soften a predetermined portion thereof, a tool engageable with the predetermined heated portion of said glass tube, advancing means for moving said tool toward and away from the axis of the glass tube, said tool being operable during a first advancement toward said predetermined heated portion to form rounded shoulders therein with a depression of glass therebetween, valve means associated with said battery of burners for controlling the flow of combustible gases thereto, electrical circuit means comprising electrical means for operating the valve means and circuit closing means operable by movement of said advancing means toward said axis to cause energization of said electrical means and attendant operation of said valve means to thereby reduce the amount of heat applied to said predetermined portion and permit the cooling thereof, said tool being operable during a second and further advancement toward said axis to score the depression in the cooled shouldered portion of said glass tube thereby severing the glass tube, and pneumatic means disposed adjacent said tube for removing said severed portion from said receiving and rotating means.

4. A machine for forming shoulders in a glass tube and severing the glass between contiguous shoulders, comprising receiving and rotating means for receiving and securing the glass tube and rotating the latter, gauging means, means for moving said gauging means into said receiving and rotating means for permitting reception of the glass tube therein in a predetermined position, a battery of burners connected to a source of combustible gases for applying heat to said glass tube sufficient to soften a predetermined portion thereof, a tool engageable with the predetermined heated portion of said glass tube, advancing means for moving said tool toward and away from the axis of the glass tube, said tool being operable during a first advancement toward said predetermined heated portion to form rounded shoulders therein with a depression of glass therebetween, valve means associated with said battery of burners for controlling the flow of combustible gases thereto, electrical circuit means comprising electrical means for operating the valve means and circuit closing means operable by movement of said advancing means toward said axis to cause energization of said electrical means and attendant operation of said valve means to thereby reduce the amount of heat applied to said predetermined portion and permit the cooling thereof, said tool being operable during a second and further advancement toward said axis to score the depression in the cooled shouldered portion of said glass tube thereby severing the glass tube, and pneumatic means disposed adjacent said tube for removing said severed portion from said receiving and rotating means.

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