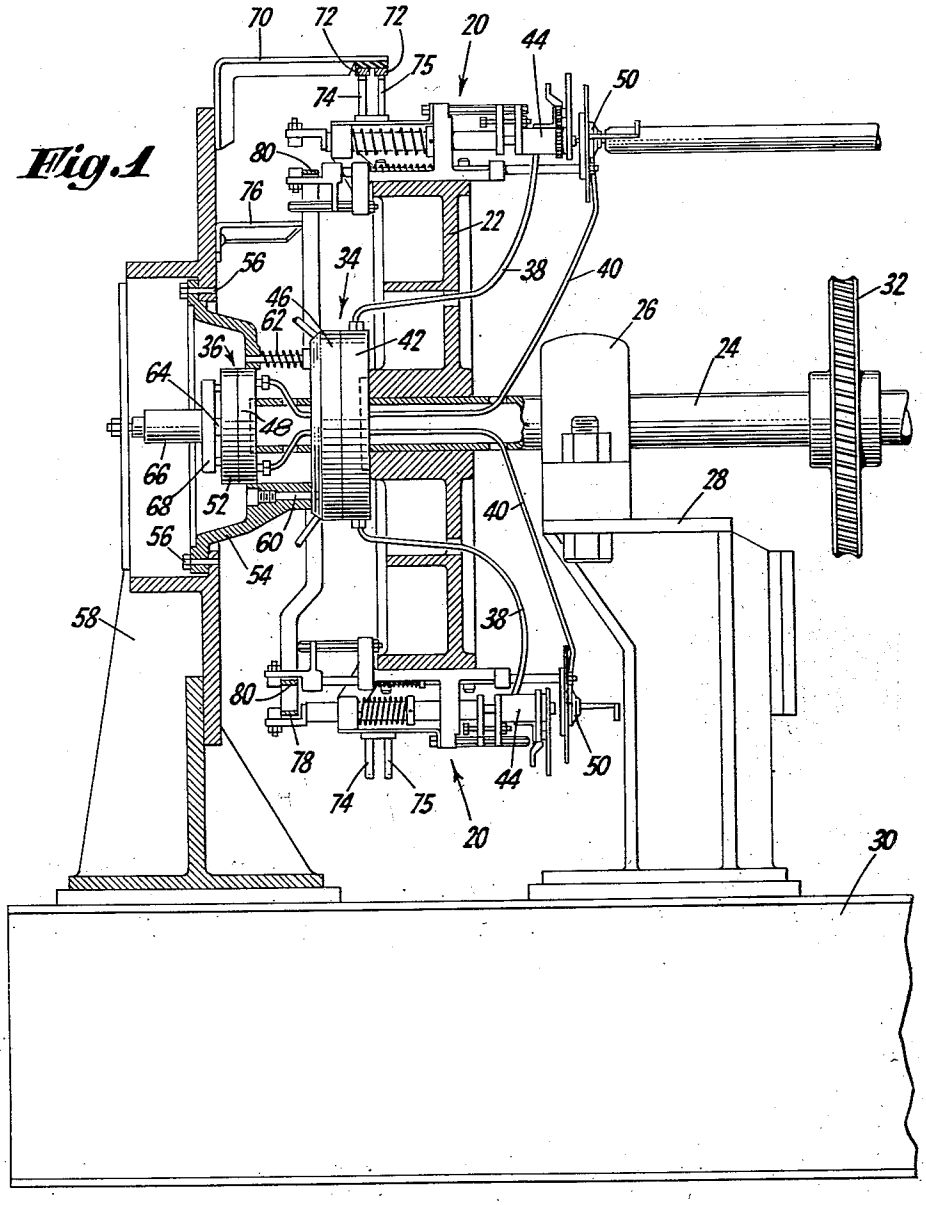
July 23, 1957 E. H. DODGE 2,799,982

EXHAUST MACHINE HEAD ASSEMBLY

Filed Dec. 31, 1953 5 Sheets-Sheet 1

Fig. 1




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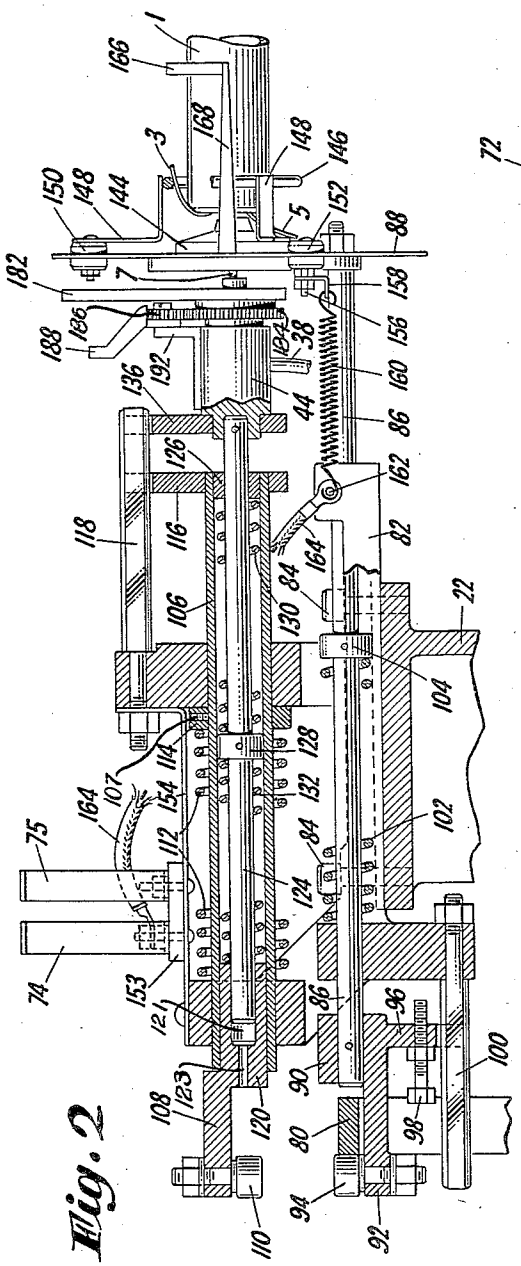


Fig. 2

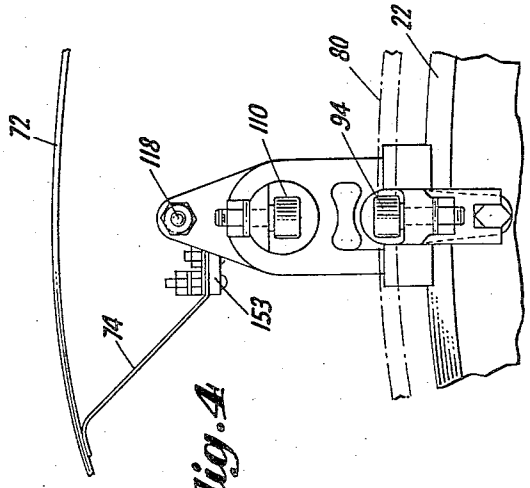


Fig. 4

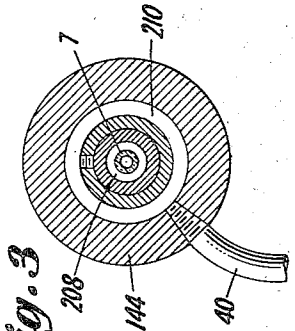


Fig. 3

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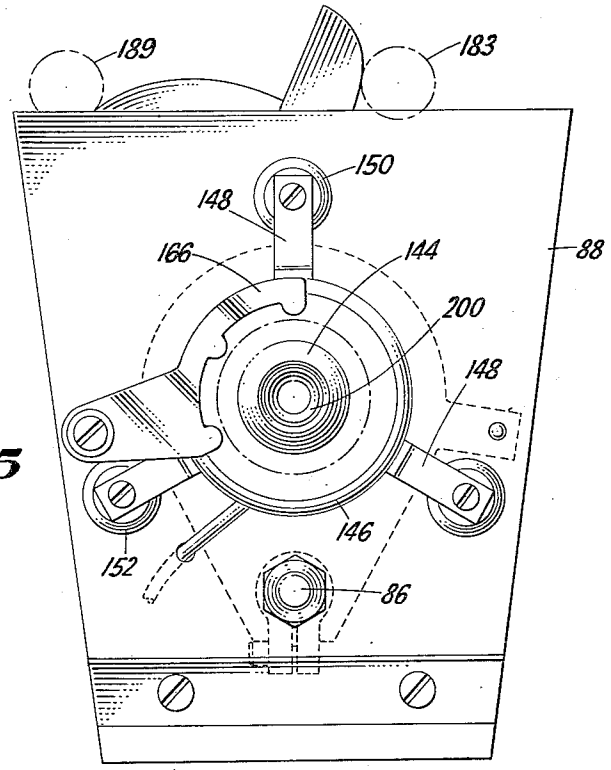



Fig. 5

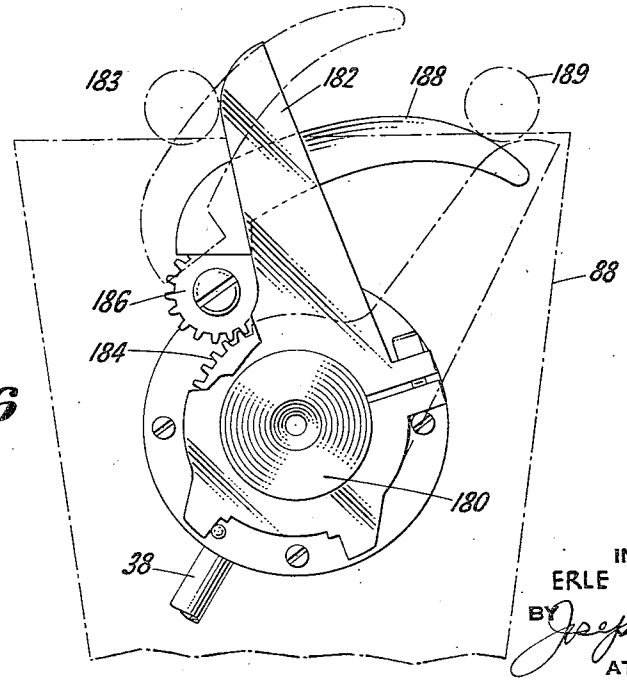



Fig. 6

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Fig. 7

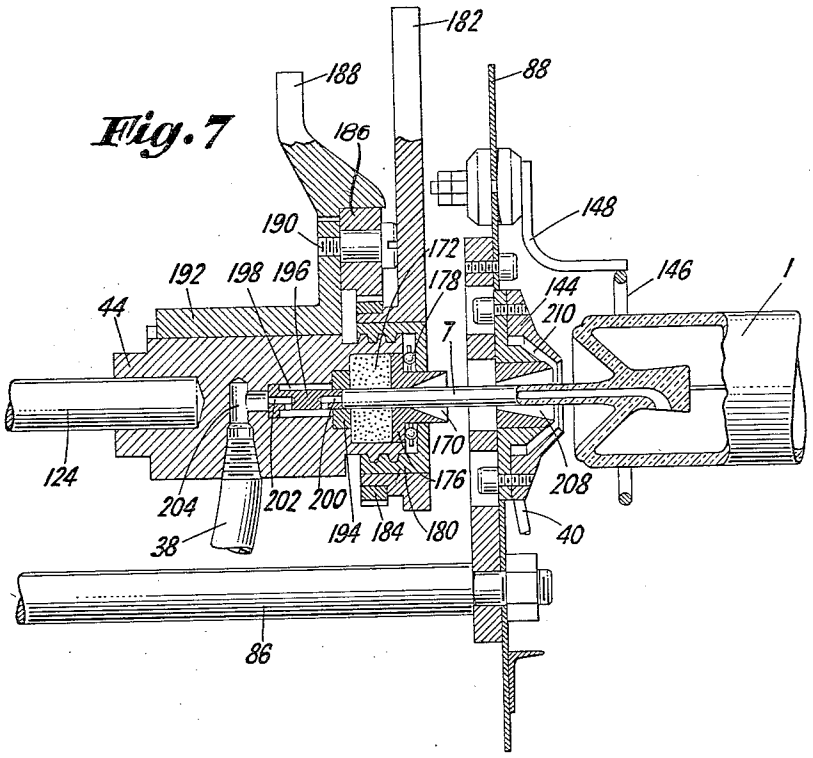



Fig. 8

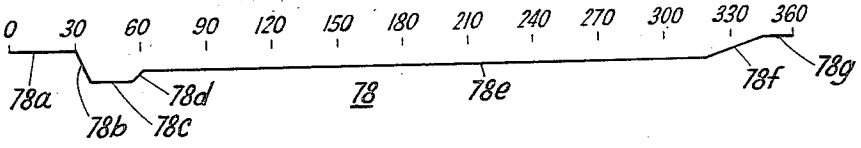
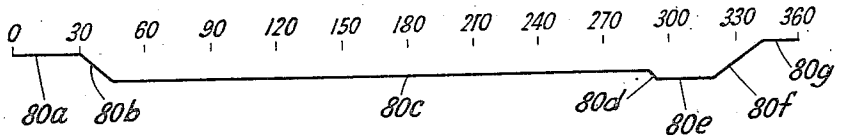



Fig. 9




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Fig. 10

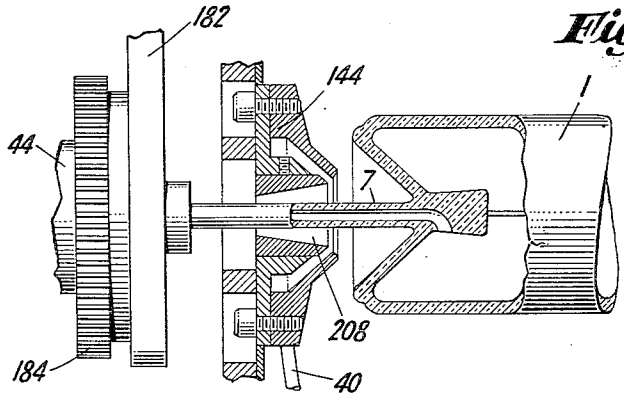



Fig. 11

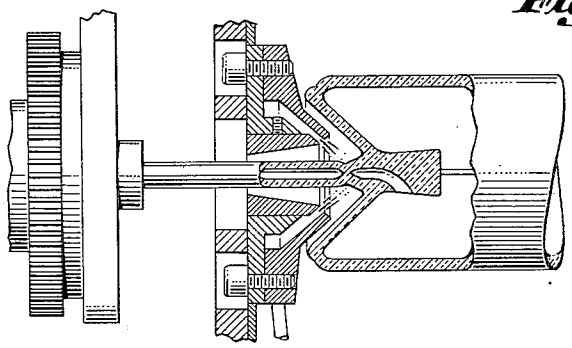
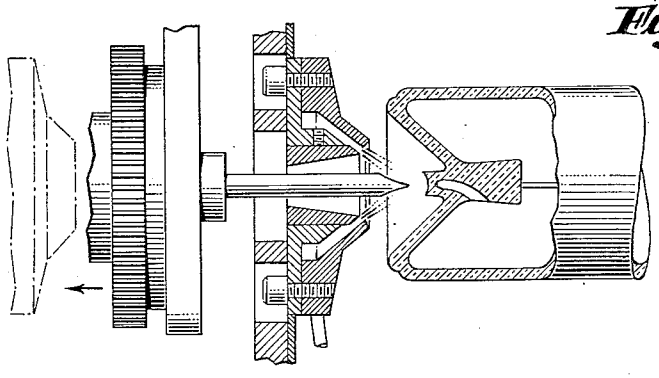


Fig. 12



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2,799,982

Patented July 23, 1957



2,799,982

# EXHAUST MACHINE HEAD ASSEMBLY

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Application December 31, 1953, Serial No. 401,680

3 Claims. (Cl. 53—88)

This invention relates to the manufacture of electric discharge devices and more particularly to the exhausting operation performed on these devices during their manufacture.

An object of this invention is to provide a head assembly for an electric discharge device exhaust machine.

Another object is to provide a head assembly for an electirc discharge device exhaust machine of the continuous motion type, i. e., a head assembly which makes it possible to load, process, and unload the electric discharge devices while the machine is in continuous motion.

A further object is to provide a head assembly for an electric discharge device exhaust machine with its own individual tipping torch for sealing off the tabulation, through which the device is exhausted and filled, after these operations have been performed.

A further object is to provide a head assembly for an electric discharge device exhaust machine with an automatic means for positioning the device with the application of a minimum stress thereto.

A further object is to provide a head assembly for an electric discharge device exhaust machine with automatic means for compensating for variations in the length of the devices and the tabulations projecting therefrom.

A further object is to provide a head assembly for an electric discharge device exhaust machine with automatic means for applying a positive end-on force to the tubulation projecting from the device to effect an accurate positioning thereof and for relieving this force after the tubulation has been gripped by the head.

These and other objects, advantages and features of the invention will be apparent to those skilled in the art from a study of a specific embodiment thereof shown in the accompanying drawings and described below.

In one embodiment of the invention, an electric gaseous discharge device, such as a fluorescent lamp for example, having a tubulation at each end thereof and in communication with the interior thereof, while disposed in a horizontal plane, is carried by a pair of heads through a pre-determined path, along which the exhausting and filling operations are performed. Each head comprises a head block which receives and grips the lamp tubulation and a tipping torch which seals off the tubulation from the lamp after the exhausting and filling operations have been performed thereon. Both the head block and the tipping torch are reciprocably mounted to permit them to move into and out of operative relationship with respect to the lamp tubulation.

In the specific embodiment of the invention illustrated in the accompanying drawings,

Figure 1 is a longitudinal sectional view of a portion of a lamp exhaust machine showing an embodiment of the head assembly of this invention associated therewith.

Figure 2 is a longitudinal sectional view of the head assembly.

Figure 3 is a transverse sectional detail of the tipping torch burner of the head assembly.



Figure 4 is an end view of the head assembly of Figure 2 showing the contact fingers through which a source of electrical energy is connected to the lead wires of the lamp.

Figure 5 is a front elevational view of the head assembly.

Figure 6 is a front elevational view of the head assembly with the burner assembly removed to show the mechanism for opening and closing the head port.

Figure 7 is a longitudinal sectional view of the head block and burner assemblies.

Figure 8 is a developed schematic diagram of the cam which effects reciprocation of the head block assembly.

Figure 9 is a developed schematic diagram of the cam which effects reciprocation of the burner assembly.

Figures 10, 11 and 12 are enlarged fragmentary sectional views sequentially illustrating the operation of the tipping torch on a lamp tubulation.

Referring now to the drawings, particularly Figure 1 thereof, the specific embodiment of the head assembly of this invention is illustratively associated with the "Apparatus for Exhausting Electric Discharge Devices" shown and described in the application of Dodge et al., Serial No. 343,842 filed March 23, 1953, now U. S. Patent No. 2,726,799. The head assemblies **20** are mounted on a spider **22** keyed to a shaft **24** supported in bearing bracket **26** mounted on a table **28** on a base **30**. Shaft **24** is driven by gear **32** mounted thereon, the gear being connected to a suitable drive mechanism not shown. Valves **34** and **36** disposed on the shaft **24** are connected to the head assemblies **20** by flexible tubing **38** and **40** respectively. Tubing **38** connects movable plate **42** of valve **34** to head block **44**, the stationary plate **46** being connected to one or more vacum pumps and if desired to a source of flushing and/or filling gas (not shown). Tubing **40** connects the movable plate **48** of valve **36** to head burner **50**, the stationary plate **52** being connected to suitable gas sources (not shown) for feeding the head burner.

A stationary valve plate support **54** is attached by bolts **56** to frame **58** mounted on base **30**. The plate **46** of valve **34** is held stationary and prevented from rotating by means of pin **60** which extends through support **54** and into plate **46**. A gas-tight seal is effected and maintained between stationary plate **46** and movable plate **42**, which is fixedly mounted on the hub of spider **22**, by means of a pair of spring-loaded pads **62** (one of which is shown) mounted in the support **54**. The plate **52** of valve **36** is prevented from rotating, held in frictional engagement, and maintained concentric with movable plate **48**, which is fixedly mounted on shaft **24**, by means of a pair of spring-loaded shoulder pins **64** (one of which is shown) disposed within bosses **66** on support **68** which is attached to support **54**. The tips of the pins **64** extend into apertures therefor in the plate **52** to prevent rotation and to maintain concentricity; and the shoulders of the pins **64** abut the outside face of the valve plate to effect and maintain frictional engagement of the plate **52** with the plate **48**.

The frame **58** has a plurality of inwardly extending arms **70** (one of which is shown) attached thereto which support a pair of commutator tracks **72**. The tracks **72** are engaged during a portion of the operating cycle of the machine by flexible metal fingers **74** and **75** which are a part of the head assembly **20**. The frame **58** also has a plurality of inwardly extending arms **76** (one of which is shown) on which cam tracks **78** and **80**, for actuating certain mechanisms of the head assembly **20**, are mounted and which are concentric with shaft **24**.

A developed schematic diagram of cams **78** and **80** is shown in Figures 8 and 9. In these diagrams, 0°, which

is taken as a reference point, is located directly beneath the shaft **24** (Fig. 1) and an imaginary circle is described about the shaft **24** as a center. Referring first to Figure 9, cam **80** is characterized by a dwell **80***a*, a fall **80***b*, a dwell **80***c*, a fall **80***d*, a dwell **80***e*, a rise **80***f* and a dwell **80***g*. Referring now to Figure 8, cam **78** is characterized by a dwell **78***a*, a fall **78***b*, a dwell **78***c*, a rise **78***d*, a dwell **78***e*, a rise **78***f* and a dwell **78***g*.

Referring now to Figure 2, the head assembly **20** comprises a base **82** which is attached to the spider **22** by bolts **84** and which serves as a support for the several components of the head assembly. A rod **86**, supported in bearings in the base **82**, has a burner plate **88** mounted on one end thereof and a block **90** mounted on the other end thereof. The block **90** has a laterally extending arm **92** in which cam follower **94** is supported and a bifurcated arm **96** depending therefrom. The arm **96** has a screw stop **98** extending therethrough and engagement with the base **82**. The bifurcated portion of the arm **96** rides on a rod **100** mounted on the base **82**. The rod **86** is loaded by spring **102** disposed thereon between a face of the base **82** and collar **104** mounted on the rod.

A sleeve **106**, supported in bearings in the base **82**, has an arm **108** mounted on one end thereof, and a cam follower **110** depending from and supported by the arm. The sleeve **106** is loaded by spring **112** disposed thereon between a face of the base **82** and collar **114** which is mounted and held rigidly on the sleeve **106** by set screw **107** (Fig. 2). The other end of sleeve **106** has a bifurcated arm **116** mounted thereon, the bifurcated portion thereof riding on a guide rod **118** mounted on the base **82**. The arm **108**, which is mounted on one end of the sleeve **106**, has a sleeve portion **120** disposed within the sleeve **106** and rigidly fixed thereto. The sleeve portion **120** of arm **108** serves as a bearing for one end of rod **124**. The sleeve portion **120** of arm **108** is provided with a bore **121** within which an end of rod **124** is slidably movable, and an orifice **123** to prevent air from being trapped in the bore **121**. The rod **124** is supported near the other end thereof by bearing **126** in sleeve **106**. A collar **128** is mounted on rod **124** substantially midway between the ends thereof. Springs **130** and **132** are disposed on rod **124** on opposite sides of collar **128**. The head block **44**, which is mounted on the right end of rod **124**, as seen in Fig. 2, has a bifurcated arm **136** mounted thereon, the bifurcated portion thereof riding on rod **118**.

The burner plate **88**, which is mounted on rod **86**, has a burner **144** mounted thereon. An electrical contact ring **146**, concentric with burner **144**, is supported on metal legs **148** mounted on insulating buttons **150** and **152** on plate **88**. Lead-wire **3** of lamp **1** is electrically connected to the flexible metal finger **74**, mounted on insulator **153** of bracket **154** on the base **82**, through ring **146**, one of the legs **148**, screw **156** which extends through insulating button **152**, bracket **158** which is mounted on the screw **156**, spring **160** which connects the bracket **158** to terminal post **162** mounted on base **82**, and wire **164** which connects the insulated terminal post **162** to the finger **74**. Lead-wire **5** of lamp **1** extends across the face of burner **144** and is grounded, through the several components of head assembly **20** to finger **75**. A cradle **166**, for receiving lamps at the loading end of the machine, and for momentarily supporting the lamps after tipping of the tubulations thereof, is attached to an arm **168** mounted on burner plate **88**.

Referring now to Figure 7, the tubulation **7** which projects from lamp **1** supports the lamp during the cycle of the machine. The tubulation **7** extends through burner **144** on the burner plate **88**, and a funnel guide **170** and resilient collar **172** seated in head block **44** mounted on rod **124**. The funnel guide **170** has a flange **176** which abuts a face of resilient collar **172**. A ball-bearing race **178**, concentric with the funnel guide **170**, is disposed between the flange **176** of the funnel guide and a cap **180** which is threaded on the block **44**. A lever **182** clamped



to the cap **180** has a gear **184** mounted thereon. The gear **184** meshes with gear **186** (Fig. 6) of lever **188** which is pivotally mounted at **190** in bracket **192** on block **44**.

As was mentioned above, the tubulation **7** projects through resilient collar **172** in block **44**. The free end of the tubulation **7** lies within a collar **194** seated in block **44** and abuts the shank end of ejector pin **196** which is slidably disposed in chamber **198** in block **44**. The ejector pin **196** is provided with a port **200** at one end thereof and a port **202** at the other end thereof, each port being defined by a pair of connecting holes drilled in the pin at right angles to one another. Port **200** establishes communication between the lamp tubulation **7** and the chamber **198** in the block. Port **200** establishes communication between chamber **198** and bore **204**, the bore **204** being in communication with tubing **38**.

Referring now to Figures 4 and 7, the burner **144**, which is mounted on burner plate **88**, is provided with a centrally located aperture **208** through which tubulation **7** extends and a gas chamber **210** to which gas is supplied through tubing **40**.

The operation of the head assembly of this invention will now be described. Since the head block **44** and the burner **144** are moved into and out of encompassing relationship with respect to tubulation **7** of lamp **1** by the travel of cam followers **110** and **94** over cam tracks **78** and **80** respectively, the operation will be described in terms of the rises, dwells and falls of the cam tracks. As was pointed out above the description of the developed schematic diagram of cams **78** and **80** (Figs. 8 and 9), 0°, which is taken as a reference point, is located directly beneath the shaft **24** (Fig. 1) and an imaginary circle is described about the shaft **24**.

As each head assembly of a pair of head assemblies **20** located in axial alignment with one another on opposite ends of the machine moves from 0° to 30°, the cradle **166** mounted on burner plate **88** receives a lamp **1** which is fed thereto either manually or mechanically. After the head assembly has rotated 30° the burner **144** and the head block **44** then move inwardly toward the end of the lamp to encompass the tubulation **7**. The burner plate **88** is moved inwardly by the fall **80***b* of cam **80** (Fig. 9). As the cam follower **94** (Fig. 2) rides along the fall **80***b* of cam 80, the spring 102, which loads rod **86** on which burner plate **88** is mounted, drives the burner plate inwardly. Head block **44** is moved inwardly to encompass tubulation **7** by the fall **78***b* (Fig. 8) of cam **78**. As the cam follower **110** rides along the fall **78***b* of cam **78**, the spring **112** which loads sleeve **106** through collar **114** fixed to sleeve **106** drives sleeve **106** inwardly until collar **114** strikes base **82**. As the sleeve **106** moves inwardly, the rod **124** which is disposed therein is carried inwardly by it. The inward movement of rod **124** on which the head block **44** is mounted moves the head block into encompassing relationship with respect to tubulation **7**. The tubulation **7** of the lamp is now disposed as in Fig. 7, i. e., it extends through aperture **208** in burner **144**, funnel guide **170** and resilient collar **172** in block **44**, with the free end thereof lying within collar **194** and abutting the shank end of pin **196** which is in chamber **198**. Since this condition occurs prior to the time that sleeve **106** has completed its inward travel, the remainder of the inward travel of sleeve **106** effects a rearward displacement of the rod **124** within bore **121**, places a load on spring **132** and thus prevents excessive end pressure through the head block **44** on tubulation **7**.

With each end of the lamp **1** now supported by its tubulation **7** within the resilient collar **172** of the head block **44**, the lamp having been lifted from the cradle **166** by the inward movement of the head block **44** into encompassing relationship with respect to the tubulation **7**, collar **172** is now clamped tightly to tubulation **7** by actuation of lever **188**. This action occurs during dwell **78***c* of cam **78**. Lever **188** is actuated by a spring-loaded

cam follower 189 (Fig. 6) supported on a suitable fixed member (not shown) of the machine and lying in the path traversed by the lever 188. As the lever 188 moves into engagement with and rides past the spring loaded cam follower 189, it is displaced thereby. The rotational movement of lever 188 is translated through gear 186 of lever 188, gear 184 of lever 182, and lever 182 which is clamped to cap 180, into a tightening of cap 180 on block 44. Tightening of the cap 180 effects a clamping of the resilient collar 172 tightly about the tubulation 7 through ball-bearing race 178 and flange 176 of funnel guide 170. The lamp 1 is now supported by the resilient collar 172 and an airtight seal about the tubulation 7 has been effected. The cam follower 110 then traverses rise 78*d* of cam 78 (Fig. 8) thereby retracting sleeve 106 and relieving the load which has been placed on rod 124 by spring 132 during the latter portion of the inward travel of sleeve 106. When this occurs there is no end pressure through the head block 44 on the tubulation.

Processing of the lamp on the exhausting and filling machine as it moves through its operating cycle is now effected. Evacuating, and/or flushing, and/or filling of the lamp may be accomplished through valve 34 (Fig. 1) which is connected to the lamp through tubing 38, bore 204 (Fig. 7), port 202, chamber 198, port 200, and tubulation 7. Conditioning of the electrodes of the lamp by the passage of current therethrough is accomplished by connecting the commutator tracks 72 (Figs. 1 and 3) to a source of electrical energy (not shown). The tracks 72 are engaged by flexible metal fingers 74 and 75 mounted on the insulator 153 of bracket 154 on head base 82. The finger 74 is electrically connected to lead-wire 3 of lamp 1 (Fig. 2) through wire 164, insulated terminal post 162, spring 160, bracket 158, screw 156, leg 148 of ring 146 and ring 146. As was mentioned above, lead-wire 5 of lamp 1 extends across the face of burner 144 and is grounded to finger 75 through the several head components.

When these processing operations have been completed, the tubulation 7 is tipped from the lamp 1. Tipping of the tubulation 7 is effected by burner 144, hereinafter referred to as the tipping torch. The tipping torch is lit by a pilot (not shown) suitably mounted on a fixed support such as a stationary member of the machine adjacent to the path traversed by the tipping torch and disposed at a point in the operating cycle where it is desired that tipping be performed. When the cam follower 94 (Fig. 2) traverses fall 80*d* (Fig. 9) of cam 80, the tipping torch 144 mounted on burner plate 88 is advanced toward the lamp 1 from the position shown in Figure 10 to the position shown in Figure 11, since the burner plate 88 is mounted on one end of rod 86 and cam follower 94 is mounted on arm 92 of block 90 which is mounted on the other end of rod 86. During the dwell 80*e* of cam 80, the tipping torch 144 heats the tubulation 7 to a molten state (Fig. 11).

Before the cam follower 94 completes its traversal of dwell 80*e*, cam follower 110 starts to traverse rise 78*f* (Fig. 8) of cam 78. When the cam follower 110 rides along rise 78*f* it retracts sleeve 106 (Fig. 2), to which it is connected by arm 108. Retraction of sleeve 106 loads spring 130 which is disposed therein concentric with rod 124 on which head block 44 is mounted, since bearing 126 is fixedly attached to sleeve 106 and one end of spring 130 is in abutting relationship with respect thereto. Rod 124, loaded by spring 130, retracts the head block 44 and thereby effects a stretching and eventual severing of the molten tubulation 7. After the head block 44 has retracted sufficiently to effect a severing of the tubulation 7, the cam follower 94 then traverses rise 80*f* (Fig. 8) to effect retraction of the tipping torch 144. The cam follower 94 and the cam follower 110 then continue to traverse rises 80*f* and 78*f* until dwells 80*g* and 78*g* respectively are reached. At this time, the tipping torch 144 and the head block 44 have reached their fully retracted positions. Since the tubulations 7 at each end of the lamp supported it during the operating cycle of the machine, tipping of the tubulations 7 therefrom frees the lamp from the head blocks 44 and permits it to rest in the cradles 166 momentarily until it is removed from the machine.

Although the completed lamp has been delivered from the machine, the heads which carried it must be prepared to receive another lamp. More particularly, the tubulations 7 must be removed. Before this can be done, however, the gripping force exerted thereon by the resilient collar 172 in head 44 must be relieved. This occurs when the lever 182 (Fig. 6) moves into engagement with and rides past spring-loaded cam follower 183 which lies in its path, the cam follower 183 being supported on a suitable fixed member (not shown) of the machine. Rotation of the lever 182 effects rotation of threaded cap 180 on which it is mounted. Rotation of cap 180 loosens it and relieves the force which had been previously applied through ball-bearing race 178 and flange 176 of funnel guide 170 to resilient collar 172. Since lever 182 is connected to lever 188 through gears 184 and 186, the lever 188 is also displaced by the rotation of lever 182 (Fig. 6).

The tubulation 7 is now free to be ejected from the head block 44. This is accomplished by connecting the valve 34 (Fig. 1) to a source of compressed air (not shown). This blast of air into the head block 44 through tubing 38 and bore 204 (Fig. 7) drives the ejector pin 196 forward within the chamber 198 until the head thereof hits the collar 194. This stroke of ejector pin 196 pushes the tubulation 7 out of the resilient collar 172 and the funnel guide 170. The return stroke of the ejector pin 196 within its chamber 198 is effected by the tubulation 7 of the next lamp when the head assembly 20 moves into encompassing relationship therewith.

What I claim is:

1. In apparatus for exhausting electric discharge devices and the like having a tubulation projecting therefrom, the combination of a head assembly comprising: a base member; a head block reciprocably mounted on said base member, said head block having an opening therein for receiving the tubulation of the device, means for effecting a hermetic seal about the tubulation, and means through which said head block is connected to exhausting means; means for advancing said head block to move it into encompassing relationship with respect to the tubulation of the device and to apply a force thereto end-on to insure proper positioning of the tubulation in the head block; and means for removing this force after positioning of the tubulation has been effected.

2. In apparatus for exhausting electric discharge devices and the like having a tubulation projecting therefrom, the combination of a head assembly comprising: a base member; a head block reciprocably mounted on said base member, said head block having an opening therein for receiving the tubulation of the device, means for effecting a hermetic seal about the tubulation, and means through which said head block is connected to exhausting means; means for advancing said head block to move it into encompassing relationship with respect to the tubulation of the device and to apply a force thereto end-on to insure proper positioning of the tubulation in the head block; means for removing this force after positioning of the tubulation has been effected; and a tipping torch disposed in operative relationship with respect to the tubulation extending into said head block to effect a sealing thereof after the exhausting operation has been effected.

3. In apparatus for exhausting electric discharge devices and the like having a tubulation projecting therefrom, the combination of a head assembly comprising: a base member; a head block reciprocably mounted on said base member, said head block having an opening therein for receiving the tubulation of the device, means for effecting a hermetic seal about the tubulation, and means through which said head block is connected to exhausting means; means for advancing said head block to move it

into encompassing relationship with respect to the tubulation of the device and to apply a force thereto end-on to insure proper positioning of the tubulation in the head block; means for removing this force after positioning of the tubulation has been effected; a tipping torch reciprocably mounted on said base member, said tipping torch having an aperture therein in axial alignment with the opening in said head block which receives the tubulation of the device and through which the tubulation extends; and means for reciprocating said tipping torch axially



with respect to the tubulation to move said tipping torch into and out of operative relationship with respect thereto to effect a sealing thereof after the exhausting operation has been effected.

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