The present invention relates to the sealing-off of vessels containing gas at a pressure higher than atmospheric and more particularly, to apparatus for sealing off exhaust tubes of incandescent lamps or photoflash lamps containing gas as such pressures.

Hereinafter, the exhaust tubes of such incandescent lamps or photoflash lamps have been sealed off or tipped off at the end of the exhaust operation by a method and apparatus of the type shown in U.S. Patents Nos. 2,273,445, issued February 17, 1942, to M. E. McGowan et al., and assigned to the same assignee as the present application. In such apparatus a chamber is formed about an exhaust tube of a lamp at the tipping-off station by sliding counterpart compartments (which open toward one another) into abutting and hermetic engagement to hermetically enclose a portion of the exhaust tube adjacent the tipping-off point. After compressed air has been introduced into the chamber at a pressure equal to the gas pressure in the incandescent lamp or photoflash lamp, a burner contained in each compartment cooperates with the burner in the other compartment to effect the tipping-off operation on the exhaust tube.

While such method and apparatus are satisfactory for a low production rate in the order of about 600 incandescent or photoflash lamps per hour, an increase of such production rate to the current rate of about 1200 lamps per hour leaves about three seconds for the numerous required operations, such as indexing of a head into the tipping-off station, the formation of the compartment about the exhaust tube, the introduction of the high-pressure air into (and the build-up of) the pressurized ambient atmosphere in the compartment, the tipping-off operation and the retraction of the compartments. Such time is obviously inadequate to perform these many necessary individual operations. In addition, the present utilization by the industry of higher pressures in the neighborhood of 800 to 1500 millimeters of mercury adds to the minimum time required for the tipping-off operation.

To further complicate the problem of minimum required time, the lamp industry is currently using a method of tipping off the exhaust tubes, which method utilizes a pressure within the chamber desirably higher than the fill pressure within the lamp, so that upon softening of the exhaust tube by the tipping-off burners, the greater pressure within the chamber causes an inward collapse of the exhaust tube at the tipping-off point and also prevents blow out of the exhaust tube. A more serious problem involved in the use of this present method and apparatus is the frequent extinction of the flames of the tipping-off burners during each pressurizing of the chamber and the necessity of continually manually adjusting the gas and air mixture being fed to such burners.

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior art practices by the provision of apparatus for tipping off exhaust tubes of vessels, such as photoflash lamps, containing gas at a pressure higher than atmospheric which apparatus is operable efficiently at present high-speed production rates.

A specific object of the present invention is the provision of a pressure chamber disposed about the tipping-off station and several adjacent stations of a conventional exhaust machine, which chamber is cooperated with the turret of the exhaust machine to hermetically seal such photoflash lamps therein during the tipping-off operation of the exhaust tubes of the lamps so that the ambient chamber pressure surrounding the lamps will be higher than the fill pressure within the latter.

Another object of the present invention is the provision of a pressure chamber adapted to permit the discharge of the tipped-off lamps therefrom with a minimized loss of the chamber pressure.

A further object of the present invention is the provision of a pressure chamber adapted to permit the discharge of the tipped-off lamps therefrom with a minimized loss of the chamber pressure.

Another object of the present invention is the provision of means for automatically regulating the flow of gas and air to the tipping-off burners disposed within the pressure chamber, which regulating means is responsive to changes in the pressure within the pressure chamber during the pressurizing and the normal operation of the latter to automatically adjust such flow of gas and air to the tipping-off burners and thereby maintain the tipping-off flames of such burners relatively constant.

The aforesaid objects of the invention, and other objects which will become apparent as the description proceeds, are achieved by providing apparatus for tipping off exhaust tubes of photoflash lamps containing gas at a pressure higher than atmospheric and comprising a pressure chamber about the tipping-off station and adjacent stations of the exhaust machine, which chamber hermetically seals the photoflash lamps from the atmosphere and surrounds the lamp with an ambient pressure greater than the fill pressure of the lamps, and means responsive to changes in the pressure within the pressure chamber for automatically adjusting the flow of gas and air to the tipping-off burners disposed adjacent such tipping-off station.

For a better understanding of the present invention reference should be had to the accompanying drawings wherein like numerals of reference indicate similar parts throughout the several views and wherein:

Fig. 1 is a fragmentary plan view of a portion of the turret of an exhaust machine for exhausting photoflash lamps and the tipping-off apparatus of the present invention, which apparatus includes a pressure chamber provided with an entrance rotor and exit rotor and having the top portion of the pressure chamber broken away to show the tipping-off mechanism.

Fig. 2 is a longitudinal vertical-sectional view along the line II—II of Fig. 1, taken in the direction of the arrows and showing the turret, the exhaust heads thereon and the pressure chamber in which are disposed preheating means, the tipping-off mechanism and a portion of the discharge mechanism for removing the tipped-off lamps from the pressure chamber.

Fig. 3 is a fragmentary horizontal-sectional view of the entrance rotor to the pressure chamber taken along the line III—III of Fig. 2, in the direction of the arrows.

Fig. 4 is a vertical-sectional view along the line IV—IV of Fig. 1 in the direction of the arrows and showing the turret, an exhaust head which has just indexed into the tipping-off station within the pressure chamber, the pressure chamber, the tipping-off mechanism and the discharge mechanism for removing the tipped-off lamp from the pressure chamber.

Fig. 5 is a fragmentary vertical-sectional view of a
sealing ring carried by the turret and utilized for making a substantially hermetic seal with the pressure chamber, taken along the line \( V-V \) of Fig. 1 in the direction of the arrows.

Fig. 6 is a horizontal-sectional view of a discharge rotor of the discharge mechanism taken along the line \( VI-VI \) of Fig. 4 in the direction of the arrows.

Fig. 7 is an end view along the line \( VII-VII \) of Fig. 4 in the direction of the arrows, of the indexing mechanism for the discharge rotor of the discharge mechanism.

Fig. 8 is an elevational view of the indexing mechanism of Fig. 7 when viewed from the top portion of Fig. 7.

Fig. 9 is a fragmentary view, similar to Fig. 4, and showing first the position of the tipping-off fork and tipping-off burners of the tipping-off mechanism after the tipping-off fork has been moved downwardly to engage the neck portion of the photoflash lamp and, secondly a discharge nest of the discharge mechanism after such nest has been moved upwardly to receive the photoflash lamp, thereby securing such lamp therebetween.

Fig. 10 is a view similar to Fig. 9 and showing the position of the tipping-off fork, tipping-off burners and discharge nest after they have moved downwardly to stretch the plasticized portion of the exhaust tube and affect the tipping-off of the photoflash lamp.

Fig. 11 is a view similar to Figs. 9 and 10 showing an intermediate position of the parts after the tipping-off mechanism has been retracted to the position shown in Fig. 4, and the discharge nest and the photoflash lamp carried thereby have been moved downwardly into engagement with a stop means preparatory for the p_elapsed movement of the discharge nest to cause the discharge of such photoflash lamp.

Fig. 12 is a view similar to Figs. 9 through 11 and showing the position of the discharge nest after it has been pivoted into its lamp-discharge position due to the continued downward movement of the reciprocating means for the discharge nest and action of the stop means, and the discharge of the photoflash lamp from the discharge nest by engagement thereof with a knock-out pin.

Fig. 13 is a schematic view showing the pressure-compensating means for the pressure chamber and the control means for controlling the flow of gas and air to the preheating and tipping-off burners.

Fig. 14 is a side-elevational view of a finished photoflash lamp.

With specific reference to the form of the invention illustrated in the drawings, and referring particularly to Figs. 1 and 2, the reference numeral 10 designates a turret of a conventional exhaust machine (of the type shown in U.S. Patent No. 2,113,798, issued April 12, 1938, to D. Mullan) which machine is utilized for the exhausting, chamber 18. To prevent the pressure within the pressure chamber 18 from breaking the hermetic seal between the sealing plates 26 and the sealing ring 30, a thrust roller 33 (Figs. 1 and 4) is mounted on the top of the casting 19 at stations "23" through "28". These thrust rollers 33 engage the top surface, as viewed in Fig. 4, of the right-hand portion of sealing ring 30.

Secured to opposite end portions of the casting 19 (Fig. 1) are an entrance-rotor housing 34 and an exit-rotor housing 34' which form a part of entrance means and exit means, respectively, and which permit the exhaust heads 12 and the sealed-in lamps 11 to move into and out of the pressure chamber 18 with minimum loss of pressure therefrom. The entrance housing 34 surrounds stations "23" and "24" at the left-hand end of the casting 19, as viewed in Fig. 1, and the rotor housing 34' is associated with stations "29" and "30" at the right-hand end of such casting 19. To provide means for permitting the indexing of the exhaust heads 12 and the oxygen-filled lamps 11 carried thereby into the pressure chamber 18 with a minimum loss of pressure within such pressure chamber 18, an entrance rotor 36 is mounted on a freely rotatable shaft 38 (Figs. 2 and 3) journaled in the entrance-rotor housing 34. For the purpose of permitting the egress of such exhaust heads 12 from the pressure chamber 18 (after the tipping-off operation), an exit rotor 40 is similarly mounted on another shaft 38 journalled in the exit-rotor housing 34'.

As an exhaust head 12 and the oxygen-filled lamp 11 carried thereby are indexed from station "23" to station "24" by the motor 39, a/an hub portion 42 on the bottom of such exhaust head 12, as viewed in Fig. 4, passes through an entrance slot 44 (Fig. 3) in the entrance-rotor housing 34 and moves therethrough into one of four hub-receiving slots 46, quadrantly and radially disposed in the entrance housing 34. It will be appreciated from a consideration of Figs. 1 and 3, that by the time the exhaust head 12 and the oxygen-filled lamp 11 have arrived at station "23" the hub portion 42 has entered the hub-receiving slot 46 in the entrance rotor 36. During the next index of the exhaust machine the above-mentioned hub portion 42 moves from station 23 into an exhaust head 12, and the oxygen-filled lamp 11 carried thereby are indexed from station "23" to station "24" by the motor 39, a/an hub portion 42 on the bottom of such exhaust head 12, as viewed in Fig. 4, passes through an entrance slot 44 (Fig. 3) in the entrance-rotor housing 34 and moves therethrough into one of four hub-receiving slots 46, quadrantly and radially disposed in the entrance housing 34. It will be appreciated from a consideration of Figs. 1 and 3, that by the time the exhaust head 12 and the oxygen-filled lamp 11 have arrived at station "23" the hub portion 42 has entered the hub-receiving slot 46 in the entrance rotor 36. During the next index of the exhaust machine the above-mentioned hub portion 42 moves from station...
“23” to station “24” and the hub-receiving slot 46 engaged by such hub portion 42 moves therewith, thereby causing the entrance rotor 39 to rotate 90° in clockwise direction, as viewed in Fig. 3, and causing the hub-receiving slot 46 and hub portion 42 to rotate into registry with an entrance slot 48 leading to the interior of the pressure chamber 18. During such indexing movement the next exhaust head 12 (previously at station “22”) positions itself in another hub-receiving slot 46 in the entrance rotor 36 which has been moved into registry with the entrance slot 44 in the entrance-rotor housing 34, as viewed in Fig. 3. When the turret of the exhaust machine is indexed again, the exhaust head 12 and oxygen-filled lamp 11 at station “24” pass through the entrance slot 48 into the pressure chamber 18 and move from station “24” (Fig. 1) to station “25”, an idle station within the pressure chamber 18.

It will be appreciated from a consideration of Fig. 3, that the peripheral spacing between adjacent hub-receiving slots 46 is such that at no time during the rotation of the entrance rotor 36 is there a path of communication between the pressurized interior of the pressure chamber 18 and the entrance slot 44 in the entrance-rotor housing 34, thereby minimizing pressure losses within such pressure chamber 18 during the introduction of an exhaust head 12 and the oxygen-filled lamp 11 into the pressure chamber 18. Further, since two hub portions 42 are always in engagement with two of the hub-receiving slots 46, the entrance rotor 36 is locked in position between indexes of the exhaust machine.

Pressure-compensating means

To provide pressure-compensating means for maintaining the pressure within the pressure chamber 18 in the range of about 1050–1150 mm. of mercury, such pressure chamber 18 is connected by air lines 50 and 52 (Figs. 1, 2, 4 and 13) to a pressure-compensating tank 56 (Fig. 13), suitably having about four or five times the volume of the pressure chamber 18. Due to the large volume of the pressure-compensating tank 56 any decrease in the pressure within the pressure chamber 19 is readily compensated for by admission of compressed air through the lines 50 and 52 into such pressure chamber 18. Compressed air is fed from a compressed air supply (not shown) into the pressure-compensating tank 56 through an inlet port 54 and admission of compressed air into the pressure-compensating tank 56 is automatically controlled by a pressure-responsive valve 60, and is thereby responsive to any change in the pressure within the tank 56.

During the next index of the turret 10, the above-mentioned exhaust head 12 at station “25”, the idle station, is indexed with the oxygen-filled lamp 11 carried thereby to station “26”, the preheating station, where a section of the exhaust tube of the oxygen-filled lamp 11, which is to be tipped off, is heated by a preheating means to a temperature of about 650° C, to render such section red hot. This preheating of the exhaust tube conditions the tube for tipping off at the succeeding tipping-off station “27” and reduces the time required for such tipping-off operation. It has been found that heating of such section to the above-mentioned temperature range softens the latter sufficiently so that the exhaust head 12 is indexed to station “27” such tube waivers slightly.

Preheating means

To provide preheating means for heating the above-mentioned section of the exhaust tube at station “26”, preheating burners 64 (Figs. 2 and 13) are mounted on a rigid gas-air line 66 adjacent the normal axial position of the exhaust tube when an oxygen-filled lamp 11 is at station “26” and such preheating burners 64 are directed at the section of such tube which is to be preheated. These preheating burners 64 are connected by the gas-air line 66 to a gas-air mixture 68 (Fig. 13). To provide gas to this gas-air mixer 68, a gas line 70 extends from a gas supply (not shown) through a pressure-responsive valve 72 and a manually preset valve 74 to the gas-air mixer 68. In like manner, an air line 76 connects an air supply (not shown) through another pressure-responsive valve 78 and another manually preset valve 80 to the gas-air mixer 68.

To provide control means associated with the above-mentioned gas and air supply systems, which control means is operable in response to changes of pressure within pressure chamber 19 to regulate the flow of gas and air to the gas-air mixer 68 and hence to the burners 64 (thereby maintaining the thermal output of said burners constant and preventing extinction of the flames of said preheating burners 64), the pressure-responsive valves 72 and 78 are connected by bleeder lines 82 and 84 respectively to the pressure chamber 18. Thus, any change in the pressure within the pressure chamber 18 causes the pressure-responsive valves 72 and 78 to automatically adjust the flow of gas and air to the gas-air mixer 68 to achieve the desired above-mentioned result.

During the next index of the turret 10, the exhaust head 12 and the oxygen-filled lamp 11 carried thereby are moved from station “26”, the preheating station, to station “27”, the tipping-off stage where the lamp 11 is tipped-off and discharged from the pressure chamber 18, as now related.

Tipping-off mechanism

At station “27”, tipping-off burners 86 (Figs. 1, 2, 4 and 13) and mounted on a reciprocable tipping-off fork 87, are directed at the preheated section of the exhaust tube 14 (as viewed in Fig. 4), a gas-air line 88 to another gas-air mixer 90 (Fig. 13). As shown in Fig. 5, a portion of the gas-air line 88 within the pressure chamber 18 is desirably flexible to permit the joint reciprocation of the tipping-off burners 86 and tipping-off fork 87. This gas-air mixer 90 in turn is connected by an air line 92 through a manually preset valve 94 to a branch connection of the air line 76 and by a gas line 96 through another manually preset valve 98 to a branch connection with the gas line 70. It will be appreciated from a consideration of Fig. 13 that the flow of gas and air to the mixer 90 is automatically controlled by the pressure-responsive valves 72 and 78 (when changes in pressure within the pressure chamber 18 are transmitted by the bleeder lines 82 and 84 respectively to such valves 72 and 78) thereby maintaining the thermal output of the tipping-off burners 86 constant to heat the tubing to about 1000° C. and preventing extinction of the flames of said tipping-off burners 86.

In order to provideventing means for the removal of the combustion gases produced by the preheating burners 64 and the tipping-off burners 86 from the pressure chamber 18 (which gases naturally rise to the top of such pressure chamber, as viewed in Fig. 4), vent lines 100 are mounted in the top of the casting 19 (Figs. 4 and 13) and connect vent openings 101 in such casting 19 through the bleeder valves 102 to the atmosphere. It will be appreciated that the above-atmospheric pressure within the pressure chamber 18 will cause the expulsion of the combustion gases, which collect near the top of such pressure chamber 18, through the vent holes 101 (which are aligned with the burners 64 and 86), the lines 100 and the bleeder valve 102, which are only slightly opened. The relatively small loss of compressed air through the venting means from the pressure chamber 18 will of course be compensated for by the operation of the above-described compensating means.

As shown in Figs. 2 and 4, a discharge nest 104 is pivotally mounted at 106 (below and in axial alignment with the oxygen-filled lamp 11 and the tipping-off fork 87) on a yoke 108 affixed to a plunger 110 which is reciprocable in suitable bearings 112 provided in the casing 19. The
Discharge mechanism

This discharge mechanism (Figs. 2, 4, 7 and 8) is similar in construction to the entrance and exit means affixed to the casting 19 and has a discharge rotor 134 affixed to a shaft 135 extending through and journaled in the bottom portion of the discharge-rotor housing 136. To permit entrance of the tipped-off lamp 11 from the guide chute 130 into one of four quadrantly-disposed lamp-receiving apertures 132 in the discharge rotor 134 (Fig. 6) the casting 19 is provided with discharge apertures 140 (Fig. 4).

In order to cause indexing of the lamp receiving aperture 132 from (for example) position "A", its lamp receiving position in alignment with the bottom of the guide chute 130, as viewed in Fig. 4, into position "C", its lamp discharging position (two indexes away) in alignment with a discharge chute 142 mounted on a bracket 144 upstanding from the bed-plate 22, the drive shaft 139 which carries the discharge rotor 134 is connected to a drive disc 146 (Figs. 4, 7 and 8). This drive disc 146 has quadrantly disposed bush-feeding apertures 132a which align themselves at position "C" with the lamp-receiving apertures 132 and is driven by an indexing mechanism.

This indexing mechanism (Figs. 4, 7 and 8) has an air cylinder 145 pivotedly mounted at 150 on the bracket 144, the spring-biased piston rod 152 of which air cylinder 148 carries an operating rod 154 which engages movement of the tipping-off fork 87, the discharge nest 104 is moved upwardly a distance D₂ (from the solid-line position to the plasticized condition. The tipping-off fork 87, the discharge nest 104 is moved upwardly a distance D₂ (from the dotted-line position to the solid-line position, shown in Fig. 9) to receive the oxygen-filled lamp 11.

Thereafter, as shown in Fig. 9-11, the tipping-off burners 86 continue to heat the heated portion of the exhaust tube which has now been heated to a temperature of about 1000° C. and is in a plasticized condition. The tipping-off fork 87 and the discharge nest 104 with the lamp 11 held therebetween are lowered a distance D₂ (from the solid-line position shown in Fig. 10 to the solid-line position shown therein) to stretch the plasticized portion of the exhaust tube and permit the tipping-off burners 86 to sever such stretched portion from the remaining portion held in the exhaust head 12 and to form a rounded tip on the tipped-off portion of the exhaust tube remaining with the tipped-off lamp 11.

Either simultaneously or separately, as desired, the tipping-off fork 87 is moved upwardly a distance D₃ and the tipped-off lamp 11 held in the discharge nest 104 is moved downwardly a distance D₃ (from the dotted-line positions, shown in Fig. 11, to the solid-line position, shown therein) at which solid-line position the right-hand portion of the pivoted spring-biased discharge nest 104 comes into engagement with a stationary stop 126, mounted in and projecting from a suitable opening in the casting 19. Thereafter, the further continuous downward movement of the yoke 108 and the plunger 110 a distance D₃ (from the dotted-line position shown in Fig. 12 to the solid-line position shown therein) causes the discharge nest 104 with the tipped-off lamp 11 to pivot 90° in counterclockwise direction about its pivot 106, as viewed in Fig. 12, against the restraining action of the spring 114 (Fig. 2) from the dotted-line position to the solid-line position, shown in Fig. 12. Near the end of such pivoting movement the seat of the tipped-off lamp 11 engages a knock-out pin 128 affixed to and projecting from the yoke 108, thereby unseating such lamp 11 from the discharge nest 104 and causing it to fall downwardly into an adjacent guide chute 130 mounted in a hermetically sealed bore provided in the bottom portion of the casting 19 (Fig. 4). The tipped-off lamp 11 drops downwardly under the force of gravity through the guide chute 130 into a discharge mechanism secured by means of its discharge-rotor housing 136 to the bottom portions of the casting 19, as viewed in Fig. 4, and below the bottom of the guide chute 130.
Thereafter, the indexing mechanism (not shown) for the exhaust machine successively indexes the exhaust head 12 (still carrying a portion of the exhaust tubulation of the tipped-off lamp 11) from the station "27" through station "28" (Fig. 1), and idle station, and into station "29" where the hub portion 42 of such exhaust head 12 passes through an entrance slot 46 in the exit-rotor housing 40 and into a hub-receiving slot 46 in the exit-rotor 40 at station "29." The exhaust head 12 is then indexed to station "30" causing 90° clockwise rotation of the exit rotor 40, as viewed in Fig. 1, and thence to station "31." During the latter index, such exhaust head 12 leaves the exit means to the pressure chamber 18 through an exit slot 176 (Fig. 1) provided in the exit housing 34, with a minimum loss of pressure from the pressure chamber 18.

Thereafter, the discharge tipped-off photoflash lamp 11 is provided in the usual manner with a base 178 to become a finished photoflash lamp, as shown in Fig. 14. It will be recognized by those skilled in the art that the objects of the present invention have been achieved by the provision of apparatus for tipping-off the exhaust tubes of vessels, such as photoflash lamps, containing gas at a pressure higher than atmospheric. Such apparatus is operable at high-speed production rates and cooperates with the turret of the exhaust machine to hermetically seal such photoflash lamps within a pressure chamber of the apparatus during the tipping-off operation of the exhaust tubes of such lamps, so that the ambient pressure surrounding the lamps will be higher than the fill pressure of the latter. In addition, the apparatus is operable to cooperate with the exhaust heads of the exhaust machine to permit the ingress and egress of such exhaust heads into the pressure chamber with a minimum loss of pressure within the latter. The apparatus is further operable to permit the discharge of the tipped-off photoflash lamps from the pressure chamber with a further minimum loss of pressure therefrom. Further, the apparatus is equipped with means for automatically regulating the flow of gas and air to the tipping-off burners disposed within the pressure chamber and such means is responsive to changes in the pressure within the chamber to automatically adjust such flow of gas and air to the tipping-off burners, thereby maintaining the tipping-off flames of such burners relatively constant.

While in accordance with the patent statutes one best known embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

I claim:

1. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having a predetermined pressure therewithin, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said chamber and to deliver a vessel to the tipping-off position within said chamber, said chamber being operable by movement of said head to permit ingress of such vessel thereinto with a minimum loss of pressure within said chamber, tipping-off means disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping-off of the exhaust tube of such vessel while in said chamber, and control means connected to said tipping-off means and said chamber and operable in response to changes in pressure within said chamber to maintain the thermal output of said tipping-off means constant.

2. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto, means connected to said chamber for introducing a compressed fluid to said chamber, an exhaust a predetermined pressure within said chamber, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said chamber and to deliver a vessel to the tipping-off position within said chamber, means disposed at the entrance to said chamber and operable by movement of said head to permit ingress of such vessel thereinto with minimum loss of pressure within said chamber, tipping-off means disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping-off of the exhaust tube of such vessel, and control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to maintain the thermal output of said tipping-off means constant.

3. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto, supply means connected to said chamber for introducing compressed air to said chamber to provide a predetermined pressure within said chamber, compensating means connected to the supply means and said chamber to rapidly adjust the pressure within said chamber to the predetermined pressure when such chamber pressure falls below such predetermined pressure, control means connected to said compensating means and operable in response to changes in pressure within said compensating means to maintain such pressure relatively constant, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said chamber and to deliver a vessel to the tipping-off position within said chamber, means disposed at the entrance to said chamber and operable by movement of said head to permit ingress of such vessel thereinto with minimum loss of pressure within said chamber, tipping-off means disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping-off of the exhaust tube of such vessel, and control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to maintain the thermal output of said tipping-off means constant.

4. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto, means connected to said chamber for introducing compressed air to said chamber to provide a predetermined pressure within said chamber, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said chamber and to deliver a vessel to the tipping-off position within said chamber, means disposed at the entrance to said chamber and operable by movement of said head to permit ingress of such vessel thereinto with minimum loss of pressure within said chamber, tipping-off means disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping-off of the exhaust tube of such vessel, and control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners.

5. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto, means connected to said chamber for introducing compressed air to said chamber to provide a predetermined pressure within said chamber, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said chamber and to de-
Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto and an exit therefrom, means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners, and discharge means disposed at the exit to said chamber and operable by movement of said head to permit egress of such vessel thereinto with minimum loss of pressure within said chamber.

7. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto and an exit therefrom, means connected to said supply means and said chamber and operable by movement of said head to permit ingress of such vessel thereinto with minimum loss of pressure within said chamber, a plurality of burners disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping-off of the exhaust tube of such vessel, supply means connected to said burners for supplying gas and air to the burners, control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners, and discharge means disposed adjacent the tipping-off position of said apparatus and operable to receive the tipped-off vessels and discharge the latter from said chamber with minimum loss of pressure within said chamber, and means disposed at the exit to said chamber and operable by movement of said head to permit egress of said head from said chamber with minimum loss of pressure within the chamber.
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13 hermetic engagement with said exit and operable by movement of said head to permit egress of said head out of said chamber with minimum loss of pressure within the chamber.

10. Apparatus for tipping off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of said apparatus having an entrance thereto and an exit therefrom, means connected to said chamber for introducing compressed air to said tipping-off position within said chamber, means disposed at the entrance to said chamber and operable by movement of said head to permit ingress of such vessel thereinto with minimum loss of pressure within said chamber, a plurality of burners disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping off of the exhaust tube of such vessel, supply means connected to said burners for supplying gas and air to the burners, control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners, guide means disposed within said chamber adjacent the tipping-off position of said apparatus and operable to receive the tipped-off vessel to a discharge position to permit discharge of said tipped-off vessel from said aperture with a minimum loss of pressure within said chamber, and means disposed at the exit to said chamber and operable by movement of said head to permit egress of said head out of said chamber with minimum loss of pressure within the chamber.

11. Apparatus for tipping-off an exhaust tube of a vessel containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto and an exit therefrom, means connected to said chamber for introducing compressed air to said chamber to provide a predetermined pressure within said chamber, an exhaust head adapted to receive an exhaust tube and operable to move into hermetic engagement with said exhaust tube and to stretch the exhaust tube at the tip-off point to seal off the latter, said exhaust head being hermetically sealed to the chamber when the head is in engagement with the latter by the pressure within the chamber, a thrust roller disposed on the chamber and engageable with the head while such head is in the tipping-off position to prevent the pressure within the chamber from breaking the hermetic seal between the chamber and the head, an entrance rotor disposed at the entrance of said chamber in hermetic engagement with the entrance, said entrance rotor being provided with slots which are engageable by said head and being operable by movement of said head when said head engages one of said slots to permit ingress of such lamp thereinto with minimum loss of pressure within said chamber, a plurality of burners disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping off of the exhaust tube of such lamp, supply means connected to said burners for supplying gas and air to the burners, control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners, a tip-off fork and a nest disposed within said chamber at the tipping-off position and operable during the tipping-off operation to move into lamp-supporting position and to stretch the exhaust tube at the tip-off point to seal off the latter, said nest being further operable to move the tipped-off vessel to a discharge position, discharge means disposed adjacent the discharge position of said nest and operable to receive the tipped-off vessel from said nest and discharge the latter from said chamber with minimum loss of pressure within said chamber, and means disposed at the exit to said chamber and operable by movement of said head to permit egress of said head out of said chamber with minimum loss of pressure within the chamber.

12. Apparatus for tipping off an exhaust tube of a photoflash lamp containing gas at a pressure higher than atmospheric, comprising a pressure chamber disposed about a tipping-off position of the apparatus and having an entrance thereto and an exit therefrom, means connected to said chamber for introducing compressed air to said chamber to provide a pressure within said chamber higher than the pressure within said lamp, an exhaust head adapted to receive an exhaust tube and operable to move into slidable engagement with said chamber and air deliver a lamp to the tipping-off position within said chamber, said head being hermetically sealed to the chamber when the head is in engagement with the latter by the pressure within the chamber, a thrust roller disposed on the chamber and engageable with the head while such head is in the tipping-off position to prevent the pressure within the chamber from breaking the hermetic seal between the chamber and the head, an entrance rotor disposed at the entrance of said chamber in hermetic engagement with the entrance, said entrance rotor being provided with slots which are engageable by said head and being operable by movement of said head when said head engages one of said slots to permit ingress of such lamp thereinto with minimum loss of pressure within said chamber, a plurality of burners disposed adjacent the tipping-off position of such apparatus and positioned to effect the tipping off of the exhaust tube of such lamp, supply means connected to said burners for supplying gas and air to the burners, control means connected to said supply means and said chamber and operable in response to changes in pressure within said chamber to regulate the supply of gas and air to said burners thereby maintaining the thermal output of said burners constant and preventing extinction of the flames from said burners, a tip-off fork and a nest disposed within said chamber at the tipping-off position and operable during the tipping-off operation to move into lamp-supporting position and to stretch the exhaust tube at the tip-off point to seal off the latter, said nest being further operable to move the tipped-off lamp to an unloading position, guide means disposed within said chamber adjacent the unloading position of said nest and operable to receive the tipped-off lamp from said nest when the latter is in the unloading position, a discharge rotor provided with a plurality of apertures, one of which apertures is always in registry with said guide means to receive a tipped-off vessel from the latter and is hermetically sealed to said chamber, means connected to said discharge rotor for moving said aperture and said tipped-off vessel to a discharge position to permit discharge of said tipped-off vessel from said aperture with a minimum loss of pressure within said chamber, and an exit rotor disposed at the exit to said chamber in hermetic engagement with said exit and operable by movement of said head to permit egress of said head out of said chamber with minimum loss of pressure within the chamber.

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