March 3, 1970 D. A. CROSS ET AL 3,498,729

AUTOMATICALLY IGNITED OIL BURNING HEATING DEVICES

Filed Jan. 23, 1968 2 Sheets-Sheet 1

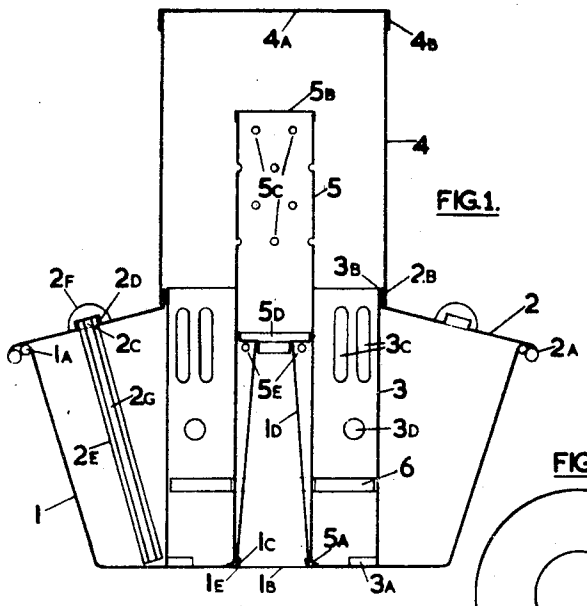


FIG. 1.

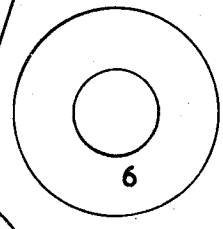


FIG. 3.

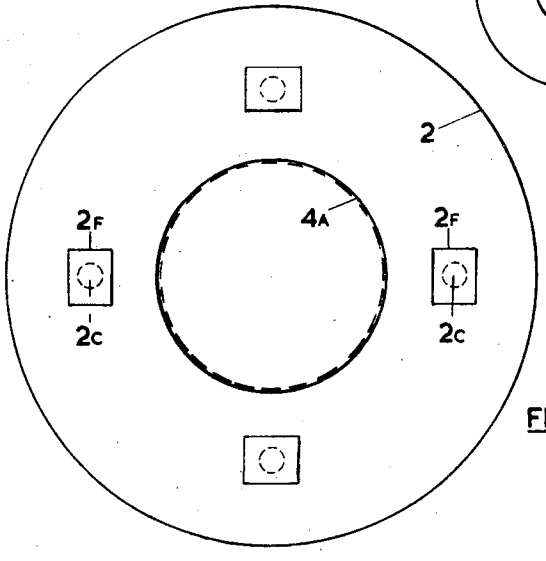


FIG. 2.

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AUTOMATICALLY IGNITED OIL BURNING HEATING DEVICES

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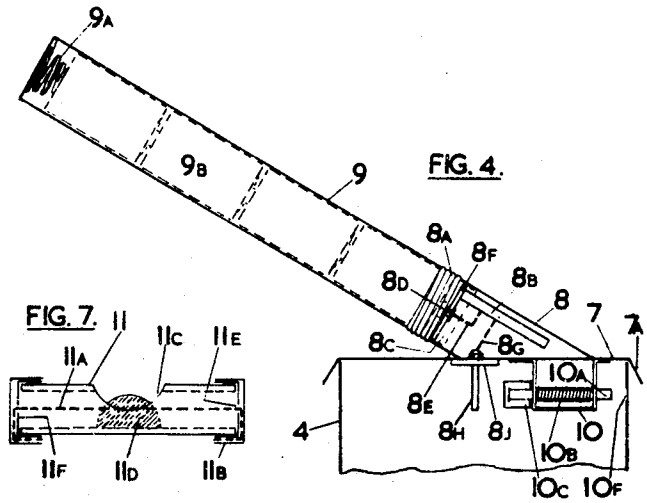


FIG. 4.

FIG. 7.

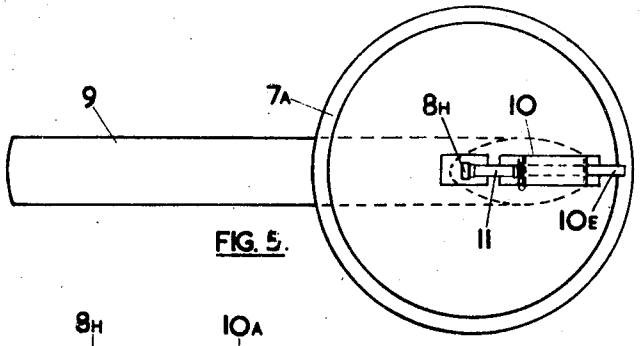


FIG. 5.

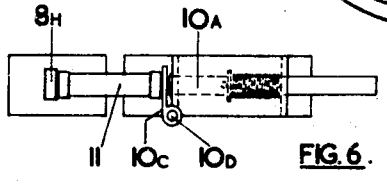


FIG. 6.

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3,498,729

AUTOMATICALLY IGNITED OIL BURNING HEATING DEVICES

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Int. Cl. F23q 7/22
U.S. Cl. 431—18 9 Claims

ABSTRACT OF THE DISCLOSURE

An oil burner which is automatically ignited when the ambient temperature falls to a pre-determined value and which comprises a container for oil and an ignition device carried by a lid which normally closes the top of the container but which is ejected when the ignition device operates. The ignition device includes a thermostat which operates to close an electric circuit through an inflammable cartridge which is itself acting to keep engaged a lock holding the lid on the container, so that when the temperature drops to a certain value the thermostat operates to cause the cartridge to ignite and thus collapse, resulting in the ignited cartridge dropping into the oil container and the lock being released to allow the lid to drop off.

BACKGROUND OF THE INVENTION

This invention relates to an oil burner heating device having particular application to the agricultural and horticultural industries as a heater for providing protection against frost damage. Such a heating device may also be employed for other purposes, such as clearance of frost, snow or ice from sports grounds, building sites, airfields and the like and may further be employed for fog dispersal in like situations.

Previous types of oil burning heating devices which have been used in such situations have been individually and manually ignited by pouring in burning oil or like means which is a hazardous operation and involves the use of a considerable number of operators where a great number of such heating devices is involved as may be the case in the agricultural industry where heating devices of this type are employed as a protection against frost damage.

A previous proposal for an oil burner to be automatically ignited has suggested the use of an ignition device carried by the lid of the oil container and including a bi-metal strip which is adapted to close an electric circuit through an inflammable cartridge to ignite the cartridge; the cartridge also being arranged to hold in place a bolt which locks the lid in position, the arrangement being that when the temperature drops to a certain value the bi-metal strip closes the electric circuit causing igniting of the cartridge which drops into the oil container, thereby releasing the bolt and allowing the lid to be opened by means of a spring which acts upon the lid, tending to urge it into the open position and eject it from the container.

SUMMARY OF THE INVENTION

The object of the invention is to provide an improved oil burning heater having a more robust form of ignition device and simplified operating means to provide a more efficient automatic ignition of the heater when ambient temperature reaches a pre-determined low value.

A further object of the invention is to provide an improved oil burning heater having automatic ignition and improved arrangement of oil container to promote

greater efficiency of combustion and more reliable operation.

According to the invention there is provided an automatically ignited oil burning heater comprising a container for oil and a detachable lid therefor, having mounted thereon an ignition device, said ignition device comprising a thermostat device operable upon the ambient temperature falling to a predetermined value to complete an electric circuit through an inflammable cartridge which normally acts to hold engaged a bolt locking the lid to the container, the electric source being one or more batteries contained in a housing which is attached to the lid and arranged so that the vertical line through the centre of gravity of the combination of lid, ignition device and housing, lies outside the boundary of the lid whereby when the bolt is unlocked the lid is caused to tilt and drop off the container.

Also according to the invention there is provided an automatically ignited oil burning heater comprising an oil container and a detachable lid carrying an ignition device wherein the container has disposed therein a central base flue tube with apertures providing communication between the interior of the base flue tube and the annular space between same and the container wall, there being primary air supply tubes extending downwardly into said annular space, a secondary air supply tube extending centrally upwardly within said base flue tube, having its upper end above the top of the base flue tube and its lower end surrounding an aperture in the base of the container and a flame flue tube extending upwardly from the base flue tube and surrounding the upper end of the secondary air supply tube, which latter has apertures providing inlet for air into the annular space between the secondary air supply tube and the flame flue tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a cross sectional elevation of the heater.

FIGURE 2 is a plan of the heater.

FIGURE 3 is a plan of wick kindler.

FIGURE 4 is a sectional elevation of the ignition device.

FIGURE 5 is a view of the underside of the ignition device.

FIGURE 6 is a larger detail of part of the ignition device.

FIGURE 7 is a larger detail of the igniter.

DESCRIPTION OF PREFERRED EMBODIMENT

For the purpose of illustration the heater shown in FIGURES 1 and 2 is shown constructed generally of circular section; but it is to be understood that construction may be made in any other section as may be expedient to suit manufacturing, storage and transporting requirements and the like.

The base 1 of the heater comprises a metal oil container of downwardly tapered section to provide facilities for nesting when storing and transporting, with economy of storage and transport space. A circular hole 1B is formed through the underside of the base 1, bounded by an inwardly and upward tapering boss 1C to which is affixed over and around, by welding or other suitable means, an upwardly tapered tube 1D of similar metal to base 1, the joint 1E being made in such manner as to provide a permanent oil-tight joint. The height of tube 1D, when so affixed, does not exceed the height of base 1. The upper edge 1A of base 1 is rolled or beaded to obliterate any sharp edge and to provide additional strength. The lid 2 of base 1 is of upwardly tapered section having its lower edge 2A rolled or beaded and so arranged that the inside diameter of edge 2A is slightly less than the corresponding outside diameter of edge 1A, whereby a pressure over-

lapping contact joint is possible between lid 2 and base 1.

Centrally in lid 2 is formed a hole bounded by a cylindrical and upwardly directed flange 2B into which a tube 3, designated base flue, of similar metal to base 1, is inserted by easy-fit to extend downwards into base 1 to rest on the bottom surface thereof, the upper edge 3B of tube 3 remaining level with the upper edge of the flange 2B. Slotted apertures 3A are provided along the bottom edge of tube 3, and further slotted apertures 3C, designated vapour supply slots, are provided in the upper part of tube 3 in such manner that the upper limit of each slot 3C coincides with the underside of the flange 2B of lid 2, the lower limit of each slot denoting the maximum oil level in base 1. The resultant space between the oil level and the underside of lid 2 thus permits combustion and vapourisation of the oil. Below the lower limit of slots 3C are holes 3D which are initially covered by oil. As the oil burns and its level reduces, slots 3C may receive soot deposit. The holes 3D ultimately become uncovered, thereby providing compensation for the possible slight closure of slots 3C, thus maintaining correct supply of oil vapour into tube 3. A further tube 4 devoid of any side apertures, designated flame flue, of similar metal to base 1, is placed by easy fit over the flange 2B on lid 2 in such manner that tube 4 extends vertically upwards, its length being such as to ensure correct combustion conditions. In lid 2, centrally located between the flange 2B and the edge 2A, are formed small apertures 2C bounded by upwardly turned flanges 2D, into which are inserted metallic tubes 2E, designated primary air supply tubes, each having a slotted aperture 2G in its length, tube 2E being so inserted that its upper edge is level with the top edge of the flange 2D and its lower edge resting on base 1. These tubes 2E supply air to the surface of the oil in base 1, and maintain this air supply for complete combustion of the oil. An open-ended half cylindrical cover 2F is fixed above each flange 2D to provide weather protection. An automatically detachable lid 7, more particularly described below, is mounted on the tube 4 for ignition, and a second easy fit lid 4A having a downwardly turned edge 4B is also provided to place on the tube 4 to extinguish the heater.

A cylindrical and removable metal tube 5, designated secondary air supply tube, of similar metal to base 1, is located over the tube 1D. The bottom end of tube 5 is flared outwardly at 5A and rests on the base 1. The tube 5 does not extend beyond the top edge of the tube 4. The upper end of the tube 5 is sealed with a press-on metallic cap 5B. Below the cap 5B apertures 5C are provided extending downwards but not beyond the top edge of the flange 2B on the lid 2. A flat metal ring 5D, designated vapour lock ring, with outside edge turned upwards, and inside edge turned downwards, is fixed to the interior of the tube 5 at a point level with the top of the tube 1D, and the inside downward turned edge of the ring 5D is loosely located inside the top of the tube 1D. At a point just below the top edge of the tube 1D holes 5E are provided in the tube 5 to release vapour formed between the tubes 1D and 5 into the tube 3. Without the ring 5D the vapour would enter the top of the tube 5, thereby preventing combustion of the vapour in the tube 4.

A wick kindler 6, shown in FIGURE 3, is provided to float on the oil in the base 1. The dimensions of the wick kindler 6 are such as to allow its free up and down movement in the space between the tubes 5 and 3. The removal of the wick kindler 6 from the tube 3 can only be effected by lifting out the tube 5, when the flared bottom end 5A engages with the underside of the wick kindler 6. The wick kindler 6 material is such that it will absorb oil yet allowing its upper surface to remain above the oil level; or, alternatively it may be of a higher density absorbent but non-buoyant material supported on a sealed metal float.

The complete heater will be located on a platform of sufficient height from the ground to allow free air ingress to the tube 1D in the base 1 and to prevent damage to the ground by conducted heat.

According to the present invention a device for automatically igniting the oil burning heating device is shown in FIGURES 4, 5, 6 and 7 and is described as follows:

On the open end of the tube 4 of the heater is an automatically detachable metal lid 7 having a downwardly turned edge 7A to provide weather protection. Welded to the top side of the lid 7 is a metal tube 8 fixed at an angle and not protruding beyond the edge of the lid 7. The end opposite the welded end is screw threaded at 8A. Inside the tube 8 is fitted a bi-metal thermostat 8B which completes an electric circuit at a pre-determined ambient temperature and is fixed on a ring type metal platform 8C fixed inside the tube 8. A longer tube 9, blanked off at one end with a metal disc to which is fixed a coiled spring 9A protruding into the tube, the other end being screw threaded at 8A, is screwed onto the short tube 8. Into the tube 9 are placed electric dry batteries 9B in such manner that the voltage is increased in proportion to the number of batteries used. This tube 9 with the batteries, when screwed onto the tube 8, overhangs the edge of the lid 7, and the resultant weight compels the lid 7 to fall away from the tube 4 after a retaining bolt is released automatically in a manner to be described hereunder.

The centre contact of the dry battery nearest the screw thread 8A is in direct contact with a connection 8E to one side of the thermostat 8B, said centre connection being located in an electrically insulated washer 8F fixed to the ring type metal platform 8C. From the other side of the thermostat 8B an electrical connection 8G is made to a metal terminal protruding into the space inside the tube 8. This metal terminal is one end of a metallic pillar 8H, designated igniter pillar, which is fixed to the underside of the lid 7, said pillar being electrically insulated from the lid 7 by its being fixed to electrically insulated material 8J which is fixed in a hole in the lid 7 by means of rivets or screws. On the underside of the lid 7 is fixed a U-shaped metal strip formation 10 extending downwardly from the lid, and in direct line with the igniter pillar 8H. A metal rod or bolt 10A extends through both sides of the formation 10, and is urged to the left by a compression spring 10B. As it is in contact with the lid 7 it is electrically negative, and the igniter pillar 8H, being insulated electrically from the lid 7, is electrically positive. Fixed to the formation 10 on the side nearer to the igniter pillar 8H is a free-moving metal hinged flap 10C. An igniter 11, composed of electrically non-conductive combustible material in tubular form, has located down its centre a metallic wire 11A of predetermined electrical resistance, the ends of which are secured by press-on metal caps 11B. Each end of the igniter 11 has an inner cap 11F with a centre hole 11E through which the wire 11A passes and extends between the inner and outer caps. In the centre of the combustible material is a hole 11C in which is placed pyrotechnic material 11D which contacts wire 11A and combustible material of igniter 11.

The term pyrotechnic material is here employed to describe a fuel/oxidant/cationic and/or anionic additives/inhibitors adhesives/fillers mixture which, when heated to a temperature elevated above ambient temperature, is capable of self-propagative solid state reaction terminating in ignition. It is stable and inert at ambient temperatures in air, water, paraffin, diesel oil, or any other liquid fuel likely to be used in the heater, or in the vapours arising therefrom; is non-corrosive, non-toxic and harmless if brought into contact with parts of the human body or with clothing and is incapable of ignition by friction or buffeting such as would be experienced under the most severe conditions of rough handling, and is also incapable of ignition by heat except at a minimum temperature which is in excess of any ambient temperature likely to be experienced in normal conditions of storage and transport.

Igniter 11 is of such length that when placed between the igniter pillar 8H and the bolt 10A, the said bolt protrudes further out at 10E through the formation 10. The igniter 11 cannot be placed into position until the bolt

10A is manually moved away from the igniter pillar 8H, and hinged flap 10C is manually moved on its hinged pin 10D across and in front of the bolt 10A. The igniter 11 is then placed between the igniter pillar 8H and the flap 10C. Thus the igniter 11 and the bolt 10A are in compression. The lid 7 is held in position on the top of the tube 4 by means of the other end of the bolt 10A at the position 10E being inserted into a small hole 10F near the top of the tube 4. The bi-metal thermostat 8B, actuated by ambient temperature, causes the electrical energy from the batteries to pass through the igniter 11, whereby the wire 11A becomes heated to a temperature at which the pyrotechnic material 11D ignites, which in turn ignites the combustible material of the igniter 11, and, as the point of ignition is at the hole 11C in the combustible material, the igniter 11, being under spring compression, bends at this point. This allows the spring-loaded bolt 10A to move towards the igniter pillar 8H, and to exert pressure on the flap 10C which is forced to pivot on its hinge pin 10D, thus ejecting the igniter 11 away transversely from the igniter pillar 8H, and the bolt 10A continues moving towards the igniter pillar 8H until the other end of the bolt 10E is free of the hole 10F in the tube 4, thus allowing the weight of the batteries 9B in the tube 9 to pivot the lid 7 away from the top of the tube 4. The igniter 11 falls on to wick kindler 6, thus commencing the sequence of operations described hereunder.

Ignition of the oil absorbed by the wick kindler 6 will first be effected by contacting the upper surface of the wick kindler 6 with an incandescent body, thus commencing the primary vapourisation of the oil in tube 3, supported by means of primary air automatically induced firstly via the apertures 2C in the lid 2, thence via the vapour slots 3C in the tube 3. A sufficient part of the heat generated by this primary combustion and vapourisation is transferred outwardly by conduction through the tube 3 thus raising the temperature of the upper surface of the oil in the base 1 surrounding the tube 3 to ignition point, whereby secondary combustion and vapourisation of the oil is established. As a result, the air induced via the apertures 2C becomes entirely consumed by the secondary combustion and vapourisation, thus depriving the primary combustion and vapourisation of any air supply, with the result that the wick kindler 6 is automatically extinguished. Thereafter, this secondary combustion continuously maintains the vapourisation of the oil surrounding the tube 3, and also maintains the vapourisation of the oil inside the tube 3, but only by means of the heat conducted inwardly through the tube 3 from the heat generated by the secondary combustion, the resultant vapour being induced by natural draught through the vapour slots 3C from the oil surrounding the tube 3, into the interior of the tube 3 where it mixes with the vapour arising from the oil inside the tube 3, thence into the tube 4. At the same time, minor proportions of vapour will arise from the oil in the space between the tubes 1D and 5, thence into the tube 4. Completion of combustion of the vapour in the tube 4 is achieved and supported by means of a secondary air supply which is induced by natural draught via the aperture 1B in the base 1, thence the tube 1D, thence through the aperture in the vapour lock 5D into the tube 5, thence via the apertures 5C in the tube 5 into the tube 4. As steady state combustion proceeds, the oil will be progressively consumed, and the oil level will progressively fall. The continuance of the primary air supply is maintained by means of the slotted tube 2E delivering air via the slotted aperture 2G to the surface of the oil surrounding the tube 3, until the oil is exhausted. It is a further feature of the aforesaid heating device that the combination of the tubes 1D and 5 serves as a heat exchange device, whereby the secondary air supply is pre-heated during its passage through the tube 1D, thereby enhancing the efficiency of the heating device.

What we then claim is:

1. An automatically ignited oil burning heater comprising an oil container and a detachable lid having an ignition device thereon, said ignition device comprising an electrical circuit including an electrical source of at least one electric battery, a thermostat device to close the circuit upon the ambient temperature reaching a pre-determined minimum value, and an inflammable cartridge, said ignition device further including a bolt normally locking the lid in position on the container and held in engaged position by said cartridge, and a housing for said electrical source attached to the lid, the vertical line through the centre of gravity of the combination of lid, ignition device and housing lying outside the boundary of the lid, whereby when the bolt is unlocked the lid is caused to tilt and drop off the container.

2. An oil burning heater according to claim 1 wherein the housing comprises a tube, one end of which is fixed to the lid, the tube being arranged so that its axis extends transversely to the vertical axis of the container and the other end of the tube overhanging the lid by a substantial distance.

3. An oil burning heater according to claim 2 wherein the thermostat comprises a bi-metal strip electrically connected to a battery within the housing and having a further electrical connection to a metal stud fixed in and insulated from the lid of the container, the inflammable cartridge being held in compression between said stud and a pivoted flap, which flap in said engaged position is pressed against the end of the locking bolt against the pressure of a spring tending to urge said bolt into the unlocked position.

4. An automatically ignited oil burning heater comprising an oil container and a detachable lid carrying an ignition device, wherein the container has disposed therein a central base flue tube with apertures providing communication between the interior of the base flue tube and the annular space between same and the container wall, there being primary air supply tubes extending downwardly into said annular space, a secondary air supply tube extending centrally upwardly within said base flue tube, having its upper end above the top of the base flue tube and its lower end surrounding an aperture in the base of the container and a flame flue tube extending upwardly from the base flue tube and surrounding the upper end of the secondary air supply tube, which latter has apertures providing inlet for air into the annular space between the secondary air supply tube and the flame flue tube and a wick carrier in the form of an annular ring mounted so as to float upon the oil between the secondary air supply tube and the base flue tube.

5. An oil burning heater according to claim 4 wherein each primary air supply tube comprises a tube having a longitudinally extending slot therein and being disposed so as to extend downwardly towards the base of the container, the upper end of each tube passing through an opening in the upper end of the container and there being disposed about said upper end an open ended cylindrical cover.

6. An oil burning heater according to claim 4 wherein the container is of inverted frusto-conical form and has its upper end formed as a detachable cover provided with a central opening having an upwardly extending flange and wherein the flame flue tube is removably disposed upon said cover with its lower end surrounding said upwardly extending flange, and wherein further the base flue tube and secondary air supply tube are both removably disposed within the container.

7. An automatically ignited oil burning heater comprising an oil container and a detachable lid carrying an ignition device, wherein the container has disposed therein a central base flue tube with apertures providing communication between the interior of the base flue tube and the annular space between same and the container wall, there being primary air supply tubes extending downwardly into said annular space, a secondary air supply tube extending centrally upwardly within said base flue tube, having its upper end above the top of the base flue tube and

its lower end surrounding an aperture in the base of the container and a flame flue tube extending upwardly from the base flue tube and surrounding the upper end of the secondary air supply tube, which latter has apertures providing inlet for air into the annular space between the secondary air supply tube and the flame flue tube and there being a tapered tube extending upwardly within the secondary air supply tube and being sealingly connected at its lower end to the aperture in the base of the container, the upper end of said tapered tube being of smaller diameter than its lower end and located below the lever of the upper end of the base flue tube, there being disposed in said upper end a vapour lock ring which allows passage of secondary air upwardly through said tapered tube into the secondary air supply tube but prevents passage of vapour from the annular space between said tapered tube and the secondary air supply tube upwardly into the secondary air supply tube, there being apertures provided in the wall of the secondary air supply tube below said vapour lock ring communicating with the space between the secondary air supply tube and the base flue tube.

8. An oil burning heater according to claim 7 wherein each primary air supply tube comprises a tube having a longitudinally extending slot therein and being disposed

so as to extend downwardly towards the base of the container, the upper end of each tube passing through an opening in the upper end of the container and there being disposed about said upper end an open ended cylindrical cover.

9. An oil burning heater according to claim 7 wherein the container is of inverted frusto-conical form and has its upper end formed as a detachable cover provided with a central opening having an upwardly extending flange and wherein the flame flue tube is removably disposed upon said cover with its lower end surrounding said upwardly extending flange, and wherein further the base flue tube and secondary air supply tube are both removably disposed within the container.

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126—59.5; 431—342