United States Patent [19]

Holden

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[54] **BURNER DEVICE**

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[73] Assignee: **Rees-Memphis, Inc.,** Memphis, Tenn.

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[52] **U.S. Cl.**.....**110/7 A,** 431/284, 431/2

[51] **Int. Cl.**.....**F23b 1/28,** F23d 11/02

[58] **Field of Search**....110/18 C, 8 C, 7 A; 263/19 A; 431/4, 278, 284, 2, 269, 349, 263, 283; 239/422, 419.3, 419.5

[56] **References Cited**

UNITED STATES PATENTS

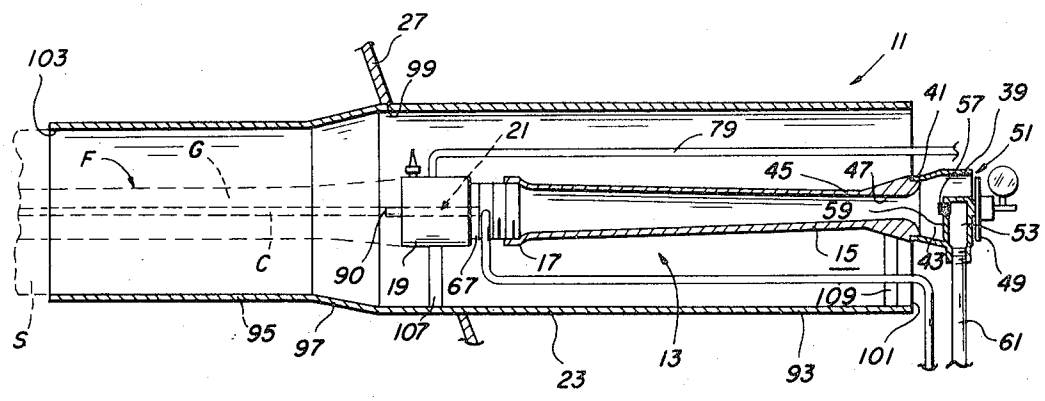
2,360,548	10/1944	Conway	431/8
2,592,491	4/1952	Toeppel	110/8 C
2,988,138	6/1961	Brzozowski	431/263
2,594,094	4/1952	Todo	431/284
3,275,057	9/1966	Ward	431/284
3,302,596	2/1967	Zinn	431/284

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Assistant Examiner—W. C. Anderson
Attorney—John R. Walker, III

[57] **ABSTRACT**

A burner device used in conjunction with an incinerator for igniting the waste material therein, particularly during the start-up period. The burner device includes a venturi injector means for mixing gas and air and projecting the gas-air mixture in a stream through the forward end of the injector means. A flame retention nozzle is provided on the forward end of the venturi injector means for maintaining the gas-air mixture in an ignited condition and directing the flame forwardly. Another injector is provided for injecting a jetlike stream of high pressure raw fuel down the core of the flame to provide an elongated flame. A tubular hood means extends through an aperture in the wall of the incinerator and receives a major portion of the remainder of the burner device with the tubular hood means being in concentric and spaced relationship therewith.

4 Claims, 4 Drawing Figures



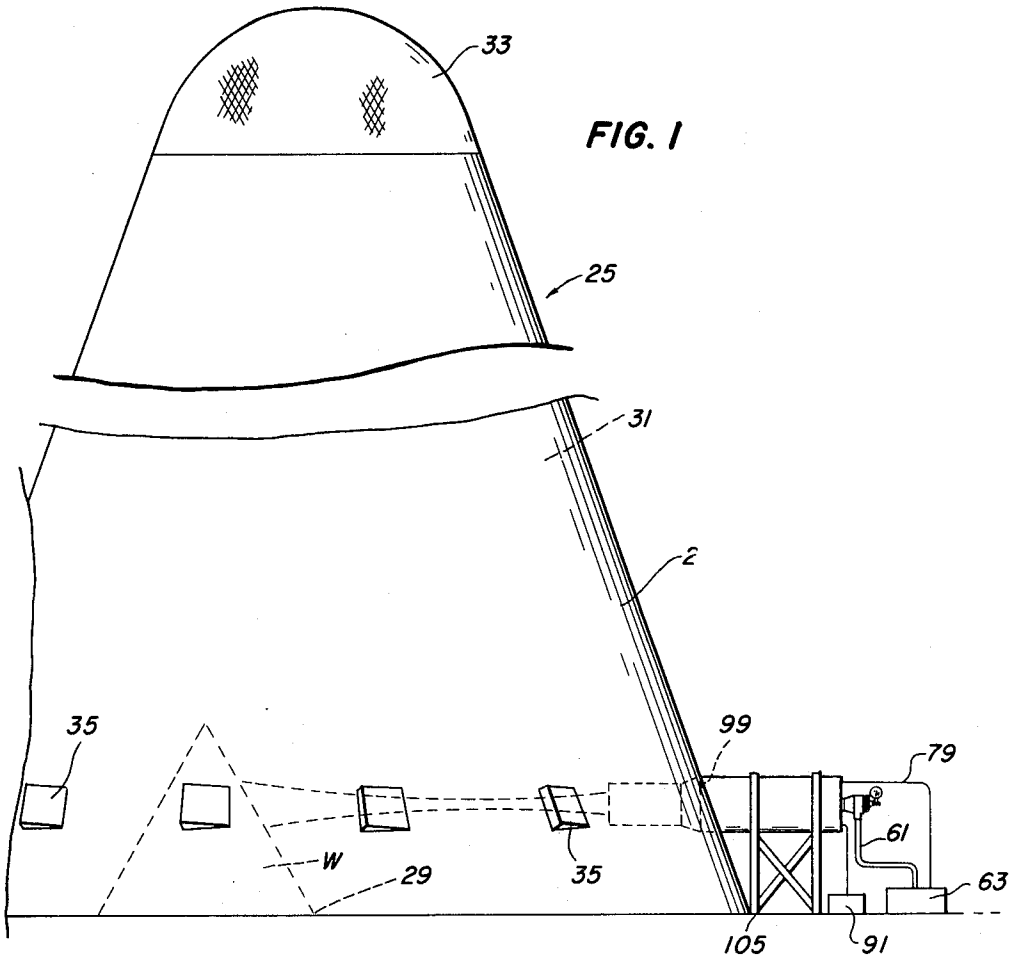


FIG. 1

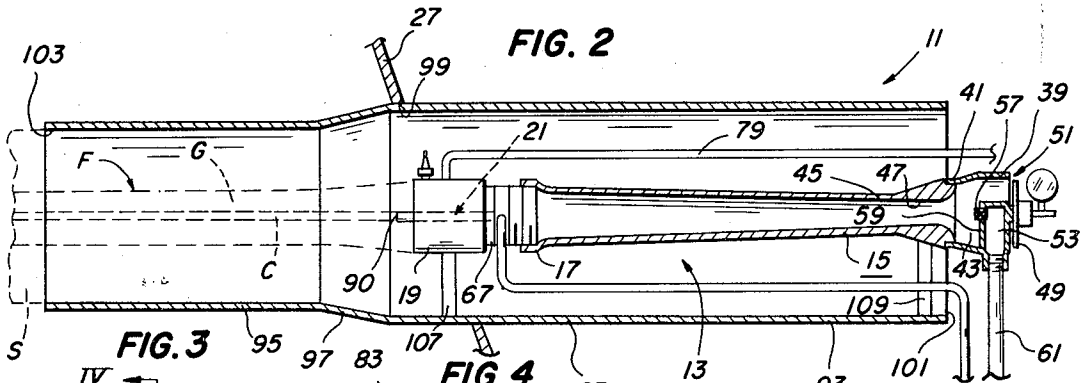


FIG. 2

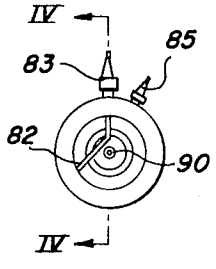


FIG. 3

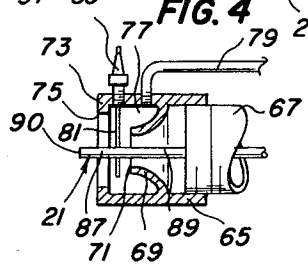


FIG. 4

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BURNER DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a burner device for use with an incinerator.

2. Description of the Prior Art

With the emphasis on eliminating air pollution, there is a need in industrial incinerators for auxiliary heat to bring the temperatures up to an optimum point during periods that the incinerator could otherwise make smoke, fumes, etc., and there is a need for auxiliary heat or fuel for the ignition of the waste material to be burned in the incinerator. One attempt at solving the problem of igniting the waste material at start-up has been tests conducted at Oregon State wherein a burner of substantially conventional type having a relatively short flame was attached to a long tube and the burner per se physically brought into the incinerator. The flame from the burner was played against the pile of waste in the center of the incinerator and then after lighting the pile the burner was physically moved out of the incinerator. Most of the prior burners have had short flame lengths, as for example, in the order of 5 – 6 feet, and have been of a flame length acceptable for prior uses such as in boilers, ovens, furnaces, etc. In at least a couple of applications conceived by applicant but not in incinerators, there have been burners which utilized a long flame in which gas was utilized in the core of a flame for causing an elongation of the flame. However, to applicant's knowledge, prior to the present invention there have been no attempts to secure an extremely long flame of 25' and over by natural draft and thermal inspiration. In addition, none of the prior applications known to applicant have utilized an outer sleeve of air surrounding a flame in combination with a jet stream at the core of the flame to provide extremely elongated flames. If the only requirement of a burner was to provide auxiliary heat or fuel to bring the temperatures up during periods that could make smoke, fumes, etc. the prior burners would havd been sufficient, but the requirements of an extremely long flame for igniting the waste material at start up which would have to reach out to the middle or adjacent the middle of the incinerator from the outer wall thereof, as for example, 25 – 30 feet, could not be provided by the previously known short flame burners.

A preliminary patentability search revealed the following U.S. patents, none of which show applicant's concept: U.S. Pat. Nos. 1,817,066; 2,988,138; 3,195,606; and 3,215,187.

SUMMARY OF THE INVENTION

The present invention is directed towards solving the heretofore-mentioned and other problems relative to burner devices to be used in conjunction with industrial incinerators for bringing the temperatures up during periods that otherwise could make smoke, fumes, etc., and for igniting the waste material, causing it to be turbulent, and creating desirable conditions for combustion. It is one of the concepts and objects of the present nvention to provide a burner assembly for projecting an extremely elongated flame from the conical wall of the industrial incinerator to the center thereof, and for providing auxiliary fuel and heat to bring the temperatures up during other desired periods. The means by which applicant accomplishes the above-mentioned concept is by a burner assembly which comprises an inner assembly including a venturi injector means for mixing gas with air and projecting the gas-air mixture in a stream through the forward end thereof, a flame retention nozzle provided on the forward end of the venturi injector means for maintaining the gas-air mixture in an ignited condition and directing the flame forwardly, a second injector means for injecting a jet-like stream of raw high pressure fuel into the middle of the flame from the flame retention nozzle and in the same direction of travel as the stream of gas-air mixture to provide an elongated flame directed from adjacent the conical wall of the incinerator toward the waste material in the incinerator.

A further means for further accomplishing a concept of the present invention is to provide the above described inner assembly in combination with a tubular hood means surrounding a major portion of said inner assembly in spaced concentric relationship thereto with one end of the tubular hood means extending through an aperture in the conical wall of the incinerator and into the combustion chamber of the incinerator and with the other end of the tubular hood means being outside of the conical wall for drawing in outside air in the form of an annular outer sleeve of air surrounding the elongated flame to cause the elongated flame to have a greater length.

An object of the present invention is to provide such an arrangement of parts that the elongated flame is kept properly ignited and extends in a long substantially straight line, with such an arrangement including the positioning of the jetlike core injector means extending forwardly of the flame retention nozzle and with the tubular hood means being tapered forwardly of the flame retention nozzle.

A further object is to provide a burner assembly for an industrial incinerator with at least a major portion of the burner assembly being located outside of the conical wall of the incinerator and projecting a flame long enough to ignite the waste material located in the center of the incinerator.

A further object is to provide such a burner assembly which provides a quick and efficient means for igniting waste material in an incinerator and for furnishing additional fuel and heat during the period in which there is danger of making smoke, fumes, etc.

A further object is to provide such a burner assembly in an incinerator which is accessible outside the incinerator for control, adjustment or repair and which is located remote from the primary heat of the incinerator whereby the parts of the burner assembly will last longer than they would if subjected to the intense heat in the inside of the incinerator.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view showing the burner of the present invention in combination with an industrial conical type incinerator, with a portion of the incinerator being broken away.

FIG. 2 is a longitudinal sectional view taken as on the vertical plane through the centerline of the burner assembly of the present invention, and with a portion of the wall of the incinerator being shown.

FIG. 3 is an end view of the inner assembly of the burner.

FIG. 4 is a sectional view taken as on the line IV—IV of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The burner assembly **11** of the present invention comprises in general an inner assembly **13** including first injector **15** for mixing gas with air and projecting the gas-air mixture in a relatively large stream towards the forward end **17** thereof, a flame retention nozzle **19** mounted on the forward end **17** of first injector **15** for igniting and maintaining the gas-air mixture in an ignited condition and directing the flame forwardly, and a second injector **21** for injecting a jetlike stream of high pressure fuel into the middle of the flame and in the same direction of travel thereof to provide an elongated flame. A substantially tubular hood **23** surrounds a major portion of inner assembly **13** in spaced concentric relationship thereto.

Burner assembly **11** is shown in FIG. **1** in combination with a typical conical type industrial waste incinerator **25** which includes a conical wall **27** enclosing a combustion area **29** for waste material such as waste material W. The combustion area **29** is located adjacent the middle of the incinerator **25**, and the conical wall **27** also defines a combustion chamber **31**. The usual screen-covered outlet **33** is provided in the upper end of incinerator **25** to permit the smoke, fumes, etc., from the burning waste to exit therefrom. Incinerator **25** includes a plurality of air inlet doors **35** spaced around the conical wall **27**, and includes other suitable structure well known to those skilled in the art.

Referring now in more detail to burner assembly **11**, first injector **15** and flame retention nozzle **19** are of any suitable construction such as single stage injector Catalog No. H-24 marketed by Combustion Division, Eclipse Fuel Engineering Co., Rockford, Ill., and shown in bulletin L-200. Injector **15** includes a hollow housing **39** at the rearward end **41** of the first injector, which housing **39** defines a mixing chamber **43**. Also, first injector **15** includes an elongated venturi **45** attached to housing **39** and extending forwardly therefrom towards forward end **17**. Venturi **45** has a venturi chamber **47** communicated with mixing chamber **43**. The usual variable air inlet means is provided for housing **39** and includes a disk **49** selectively movable forwardly and rearwardly by suitable means to selectively decrease or increase the opening **51** into mixing chamber **43**. An enclosed gas compartment **53** is provided in housing **39** and an orifice **57** is provided centrally of mixing chamber **43** in the wall **59** of gas compartment **53**. Orifice **57** is directed forwardly and axially of venturi chamber **47**. A pipe **61** leads from a suitable source **63** of gas, such as butane, propane, natural gas or the like, to gas compartment **53**.

Flame intention nozzle **19** is of any suitable flame retention type, such as the type shown and marketed by Combustion Division, Eclipse Fuel Engineering Co., Rockford, Ill., known as the "Unitite" nozzle shown in their bulletin H-22 (new 3/70). Flame retention nozzle **19** includes a cylindrical housing **65** which is axially aligned with venturi **45** and connected to the forward end **17** thereof by an externally threaded nipple **67** which is threaded into the end of venturi **45** and into the end of cylindrical housing **65**. Nozzle **19** includes an inner nozzle portion **69** having an inner nozzle opening **71** communicating with venturi chamber **45** and an outer nozzle portion **73** having an outlet nozzle opening **75** larger in diameter than inner nozzle opening **71** and disposed forwardly thereof. In addition, in the interior of cylindrical housing **65** is a flame retention chamber **77** generally surrounding inner nozzle portion **69**. The type of flame retention nozzle shown in the drawing includes a pilot gas line **79** leading from a suitable gas source, as gas source **63**, to flame retention chamber **77**. If desired, however, this pilot gas line **79** may be omitted and holes, not shown, may be provided in inner nozzle portion **69** leading to flame retention chamber **77** so that a small amount of pilot gas is provided in the flame retention chamber. A suitable nozzle illustrating this latter-mentioned type is also shown in said bulletin H-22 of Combustion Division, Eclipse Fuel Engineering Co., and known as the "Sticktite" nozzle. The "Unitite" nozzle shown in the drawing includes in addition a flame rod **81**, which is coupled with a flame rod plug **83** and other suitable connections and controls well known to those skilled in the art. In addition, the flame retention nozzle **19** shown is provided with an ignition plug **85** extending into flame retention chamber **77** and connected to a suitable source of electricity, not shown, for the purpose of initially igniting the pilot.

Second injector **21** includes an injector pipe **87** having a portion **89** thereof extending axially of nozzle **19** and terminating at a distal end opening **90** directed forwardly and along an extension of the axis of nozzle **19**. Pipe **87** extends through an aperture in the side of nipple **67** and is in communication with a suitable source **91** of high pressure fuel, preferably liquid, such as fuel oil, or, if desired, it may be gas, such as natural or liquified petroleum gas, without departing from the spirit and scope of the present invention. It is apparent that the fuel coming directly from the fuel source **91** through pipe **87** to opening **90** is not mixed with anything such as air, that is, it is non-premixed. The distal end opening **90** is disposed in spaced relationship forwardly of outer nozzle opening **75**, as best seen in FIGS. **2** and **4**. The location of this distal end opening **90** forwardly of outer nozzle portion **73** is important since in this location the ignited flame has stability and will not be blown out by the jet of fuel emanating from distal end opening **90**.

Hood **23** includes a rearward tubular portion **93**, a forward tubular portion **95** smaller in diameter than rearward tubular portion **93**, and a frusto-conical intermediate portion **97** integrally attached at the opposite ends thereof respectively to tubular portions **93**, **95** with the intermediate portion **97** extending between portions **93**, **95**. Forward tubular portion **95** extends through an aperture **99** in conical wall **27** with the tubular hood being directed towards the waste material W at combustion area **29**. The rearward opening **101** in hood **23** opens into the outside atmosphere, and the forward opening **103** in hood **23** opens into combustion chamber **31** so that when the air inside of combustion chamber **21** is heated, the air will rise and outside air will be drawn into the combustion chamber **31** through the interior of hood **23**, which action will be better understood in connection with the remaining portions of burner assembly **11** in the description of the operation to follow hereinafter. Hood **23** is fixedly supported in the above-described position by suitable means such as the supporting framework **105**.

Inner assembly 13 extends forwardly into the interior of hood 23 and is fixedly supported therein as by the struts 107, 109. The position in which inner assembly 13 is supported is preferably such that housing 39 is on the exterior of hood 23 and the inner assembly 13 extends forwardly and axially of hood 23 where it terminates adjacent the forward end of rearward tubular portion 93. In other words, intermediate portion 97 is disposed forwardly of the nozzle 19 and the distal end opening 90 so that the velocity of the ignited flame will be increased when it passes through the intermediate portion 97 and the forward portion 95, as will be better understood in the description of the operation of the device to follow.

To operate the burner assembly 11 of the present invention the gas from gas source 63 is turned on by suitable valves, not shown, so that gas pressure is provided in gas compartment 53 whereupon the gas exits from the orifice 57 in the form of a stream of gas that is projected forwardly through mixing chamber 43 and to be mixed with the gas in the proper proportions whereupon the gas-air mixture, which is in a stream, continues to move forwardly through venturi chamber 45 and into the nozzle 19. The gas-air mixture is ignited by the flame in flame retention nozzle 19 and is maintained in this ignited condition by the flame retention nozzle. It will be understood that initially the gas in the flame retention chamber 77 which is supplied by the pilot gas line 79 is ignited by the spark plug 85 and due to the sheltered area of the flame retention chamber, which somewhat surrounds and is behind the inner nozzle opening 71, will remain ignited and supplied with gas through the pilot gas line 79. The above-mentioned flame emanating from nozzle 19, if it were not for the present invention, would project for only a short distance. However, with the combined effect of the high pressure fuel being projected from the distal end opening 90 down the core or center C of the gas-air mixture portion G of the flame F and the outer annular sleeve S of air being drawn in through hood 23, the flame F will be projected for an extremely long distance to the waste material W at the combustion area 29. Thus, the core C of raw fuel as it moves down the middle of the gas-air portion G is being heated, cracked, etc., where there is very little burning of this core of fuel since there is very little oxygen at the core, but as the core fuel C reaches the tip of the flame, it begins to pick up oxygen and because it is already hot, will then readily burn. Since the core fuel C is not subjected to limitations of energy such as the kinetic energy thereof being used up, the core fuel C gives distance to the flame. In other words, the core fuel C does not inspirate air such as that done by the gas G where kinetic energy is used up, but utilizes its energy to project the flame C. Also, it will be understood that the annular sleeve S of air which is moving through the hood 23 in the same direction and surrounding the gas-air portion G will give velocity and direction to the flame, particularly as the velocity of the sleeve S picks up in going through the reduced frusto-conical portion 97. In addition, it will be understood that as the air in combustion chamber 31 heats up and gives a greater differential in pressure between the inside and outside of incinerator 25, the air velocity of sleeve S will increase and project the flame F farther.

The effectiveness of the burner assembly 11 of the present invention can be appreciated when it is considered that an injector such as the Elipse single stage injector previously described without the use of the present invention will provide a flame of approximately 5 – 6 feet long, whereas, such an injector in combination with the present invention can project a flame for 20 or more feet.

Although the invention has been described and illustrated with respect to a preferred embodiment thereof, it is not to be so limited since changes and modifications may be made thereto which are within the full intended scope of this invention.

I claim:

1. In an incinerator having a conical wall enclosing a combustion area for waste material adjacent the middle thereof and a combustion chamber above said combustion area, said wall having an outlet adjacent the upper end thereof for the hot gases to exit and having an aperture in the side thereof, a burner assembly comprising an inner assembly including first injector means having a rearward end and a forward end, said first injector means including a hollow housing at said rearward end defining a mixing chamber, said housing including variable air inlet means for selectively varying the amount of air introduced into said mixing chamber, an elongated venturi extending forwardly from said housing towards said forward end and having a venturi chamber communicated with said mixing chamber and orifice means in said mixing chamber directed towards said venturi chamber, nozzle means disposed on the forward end of said first injector means including an inner nozzle portion having an inner nozzle opening communicating with said venturi chamber, an outer nozzle portion having an outer nozzle opening larger in diameter than said inner nozzle opening and disposed forwardly thereof, and means defining a flame retention chamber generally surrounding said inner nozzle portion, and second injector means including an injector pipe having at least a portion thereof extending axially of said nozzle means and terminating at a distal end opening directed forwardly and along an extension of the axis of said nozzle means; and substantially tubular hood means surrounding a major portion of said inner assembly in spaced concentric relationship thereto with one end of said tubular hood means extending through said aperture into said combustion chamber and with the other end of said tubular hood means being outside of said conical wall whereby when there is less pressure in said combustion chamber than the pressure outside of said conical wall outside air is drawn in around said inner assembly in the form of an annular outer sleeve of air, gas supply means including a gas inlet pipe leading to said orifice means for supplying gas thereto for direction by said orifice means through said mixing chamber where air is mixed therewith and the gas-air mixture is projected through said venturi chamber, through said flame retention chamber where the ignition of said gas-air mixture is maintained, and out said nozzle means in the form of a flame extending forwardly of said nozzle means; fuel supply means including a fuel conduit leading to said injector pipe for supply fuel thereto for direction out said distal end opening of said injector pipe along the axis of the flame emanating for said nozzle means and with the annular

outer sleeve of air causing the flame to be elongated outwardly from said burner assembly; and said burner assembly being directed towards said combustion area for the ignition of the waste material.

2. The apparatus of claim 1 in which said distal end opening is disposed forwardly of said outer nozzle opening.

3. The apparatus of claim 1 in which said hood means includes a rearward tubular portion, a forward tubular portion smaller in diameter than said rearward tubular portion and a frusto-conical intermediate portion between said forward and rearward portions and joined respectively with said forward and rearward portions at the opposite ends of said intermediate portion.

4. The apparatus of claim 1 in which said hood means is disposed with said intermediate portion thereof being forwardly of said nozzle means.

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