United States Patent [19]

Schrader

[11] **3,804,079**

[45] **Apr. 16, 1974**

[54] **MELTING KETTLE AND APPARATUS AND METHOD FOR ELIMINATING OBJECTIONABLE EMISSIONS THEREFROM**

[75] Inventor: **William P. Schrader,** Mill Valley, Calif.

[73] Assignee: **Cleasby Mfg. Co., Inc.,** San Francisco, Calif.

[22] Filed: **June 1, 1971**

[21] Appl. No.: **148,726**

[52] **U.S. Cl.** ..... **126/343.5 A,** 23/277 C, 423/210, 404/79

[51] **Int. Cl.** **E01c 19/45**

[58] **Field of Search** ..... 23/277 C; 423/210, 224, 423/245, 246; 126/343.5 A; 94/42; 404/79, 80

[56] **References Cited**

UNITED STATES PATENTS

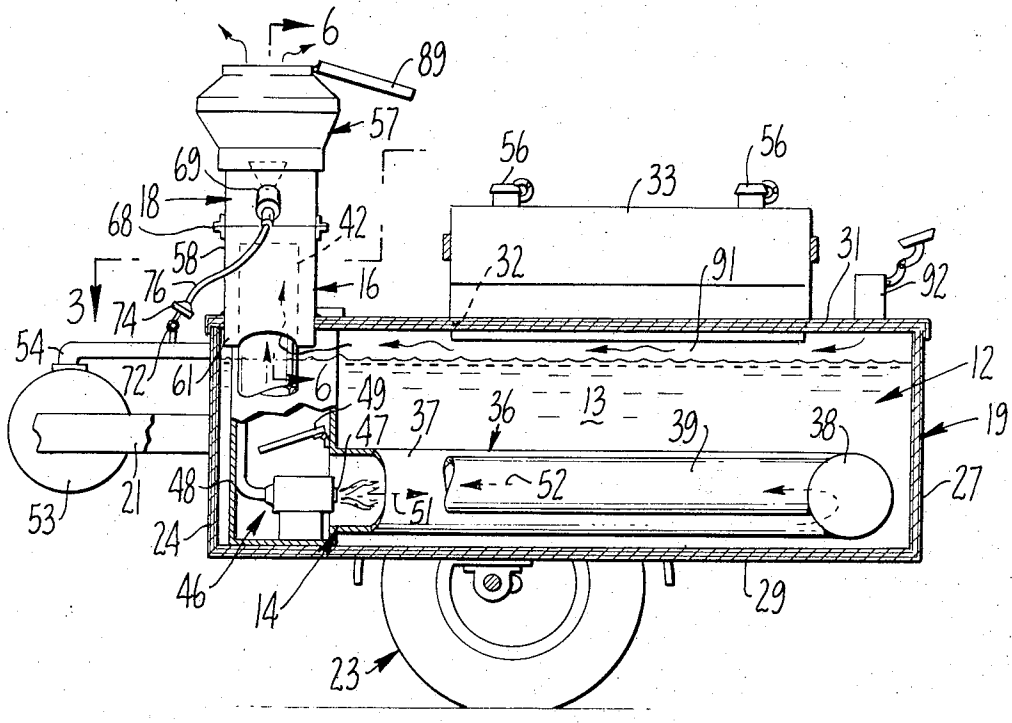
227,945	5/1880	Bailey	126/343.5 A
2,656,008	10/1953	Engel	23/277 C
3,220,403	11/1965	Figge	126/343.5 A
2,833,187	5/1958	Wells et al.	94/42

Primary Examiner—Earl C. Thomas
Attorney, Agent, or Firm—Naylor, Neal & Uilkema

[57] **ABSTRACT**

A melting kettle having provision for drawing off the noxious fumes from the melt and burning them with a flame in a combustion chamber. The kettle comprises an enclosed kettle chamber for holding bituminous material to be heated and melted, a vent stack extending from the chamber, a heat conduit communicating with the kettle chamber and terminating in the vent stack, heat generating means to supply heated air to the conduit for heating the melt, burners disposed in the stack for supplying a flame in the path of the vented fumes, a combustion chamber adjacent the flame jet for supplying fresh air to the heated fumes and an inverted conical flame deflector and mixing baffle at the intersection of the paths of the vented fumes, heated air and flame jet to thoughly mix the various gases and facilitate complete combustion of the fumes.

2 Claims, 10 Drawing Figures



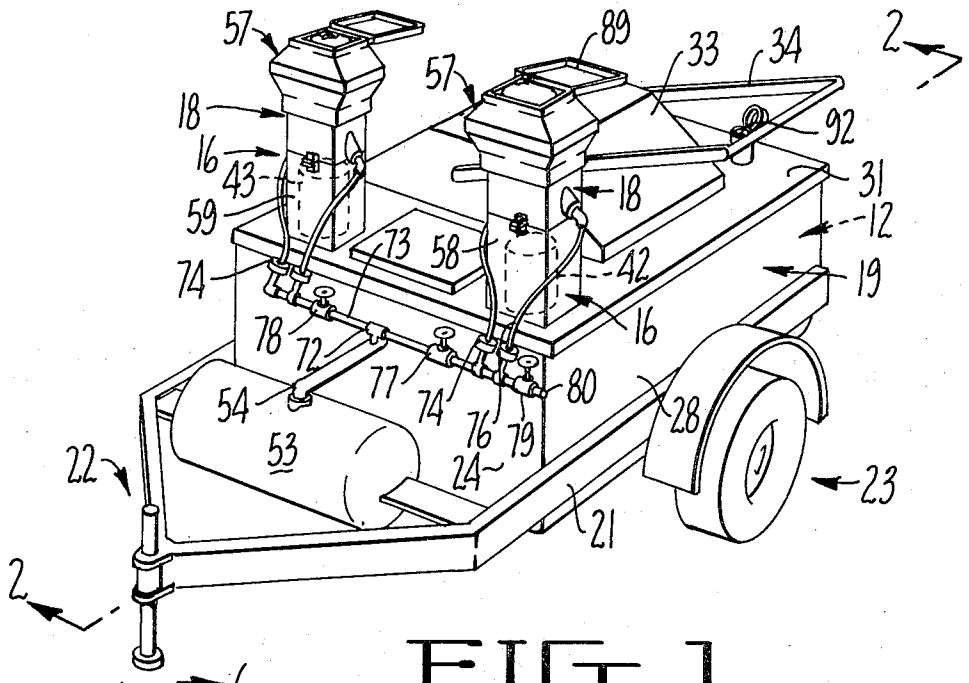


FIG. 1.

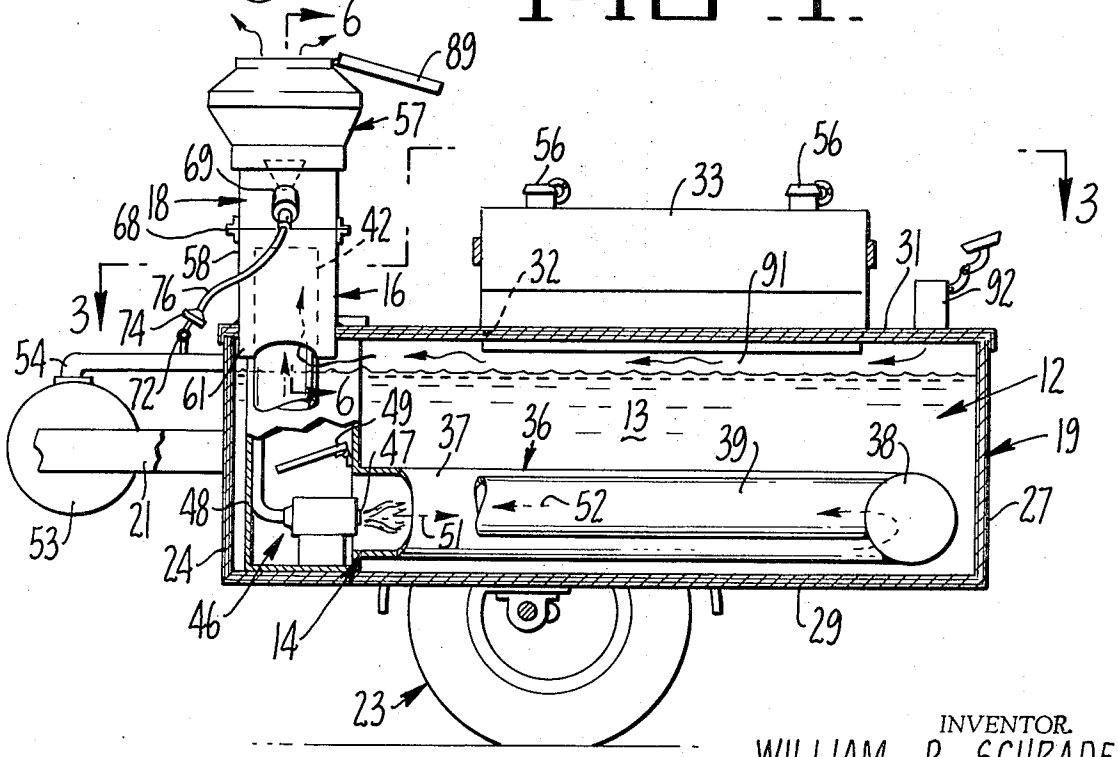


FIG. 2.

INVENTOR.
WILLIAM P. SCHRADER
BY
Naylor & Neal
ATTORNEYS

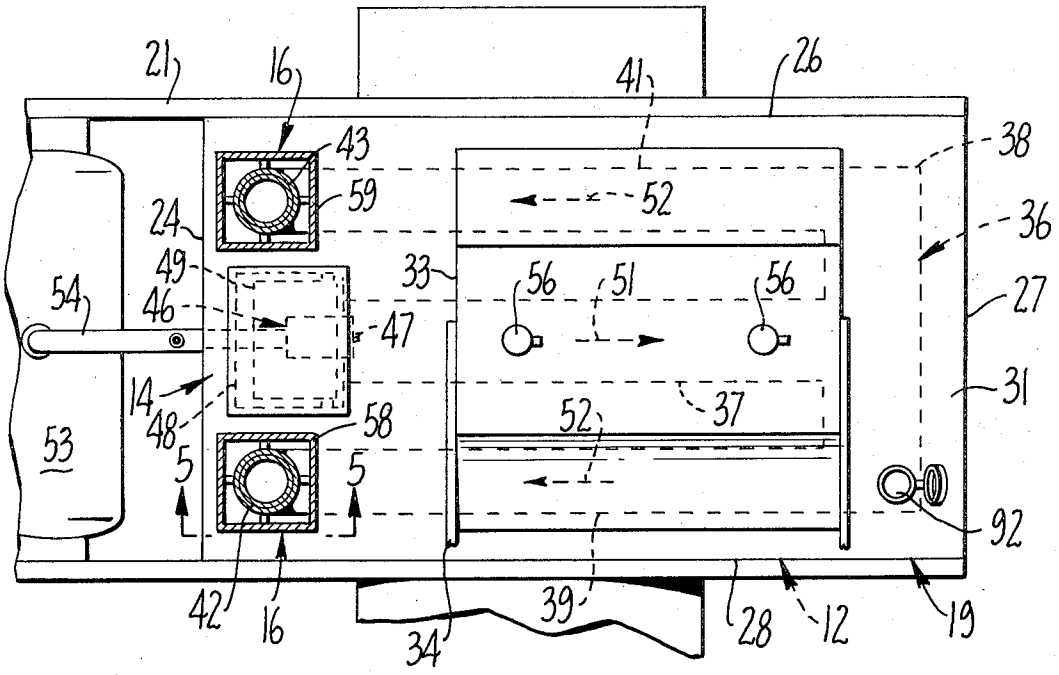


FIG. 3.

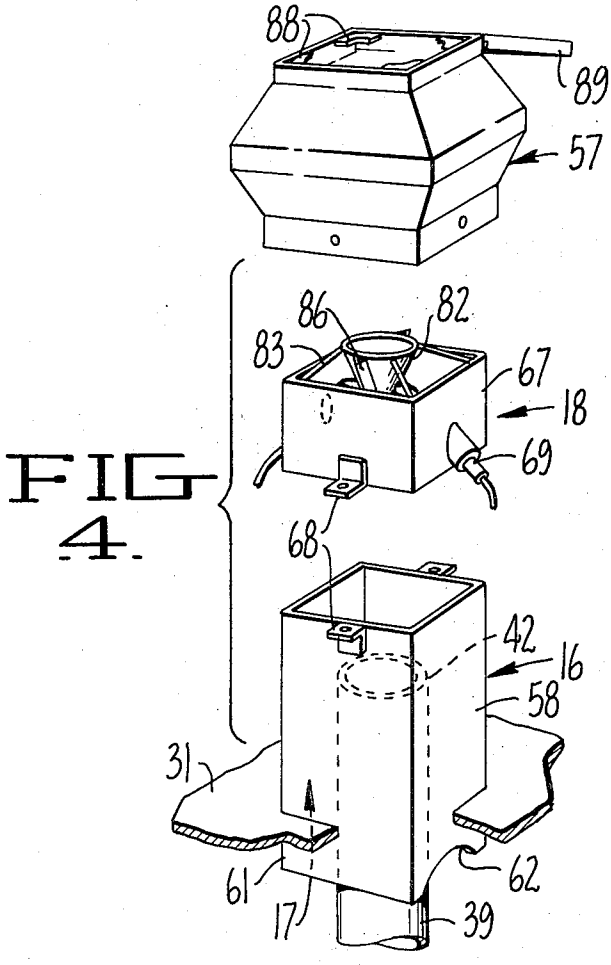


FIG. 4.

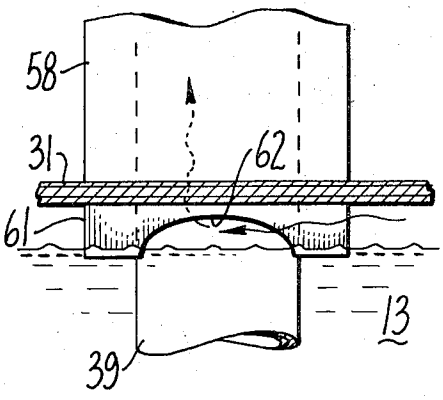


FIG. 5.

INVENTOR.
WILLIAM P. SCHRADER
BY
Naylor & Neal
ATTORNEYS

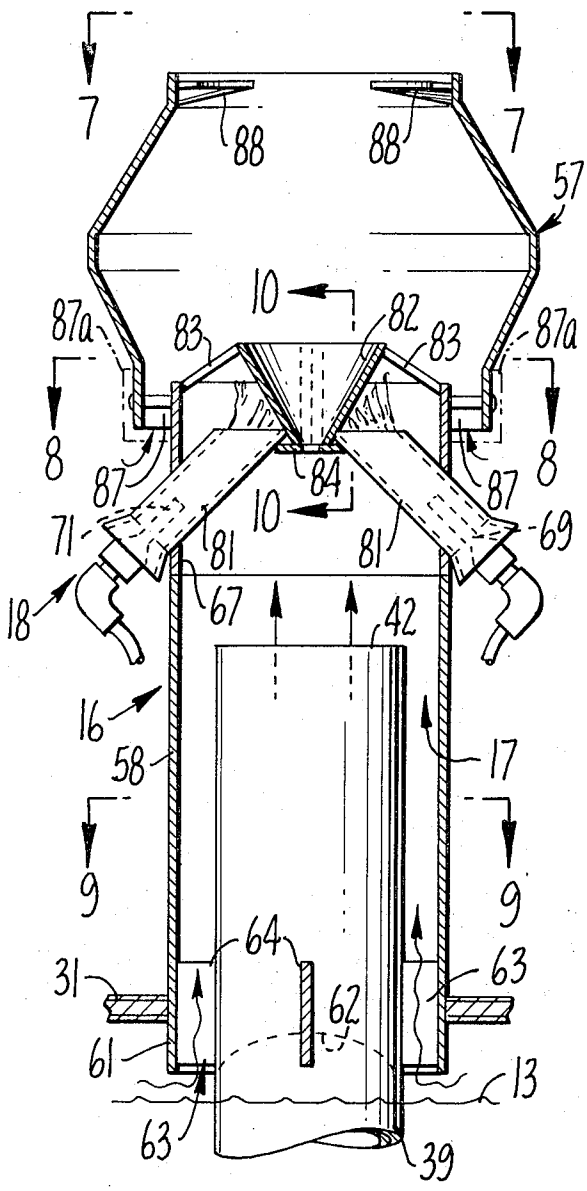


FIG. 6.

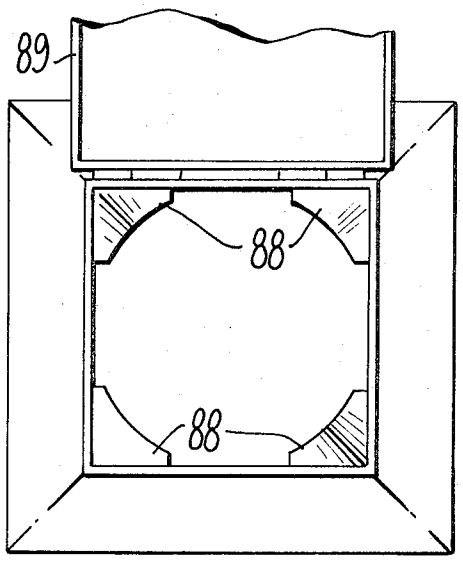


FIG. 7.

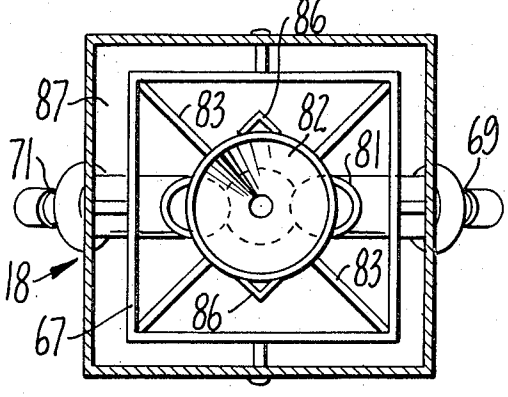


FIG. 8.

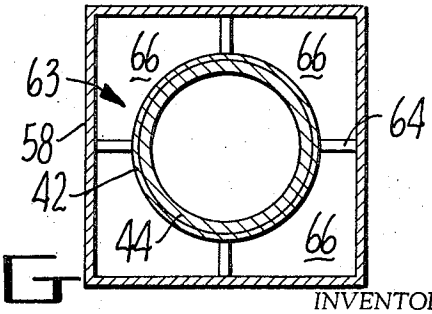


FIG. 9.

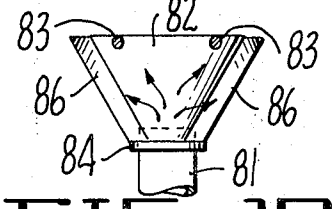


FIG. 10.

INVENTOR.
WILLIAM P. SCHRADER
BY
Naylor & Neal
ATTORNEYS

MELTING KETTLE AND APPARATUS AND METHOD FOR ELIMINATING OBJECTIONABLE EMISSIONS THEREFROM

BACKGROUND OF THE INVENTION

This invention relates to a melting kettle for heating bituminous materials of the type used in roofing and roadbuilding and more particularly to such a kettle having provision for drawing off the noxious fumes vaporized from such materials when they are heated and to render the fumes inoffensive.

Melting kettles for heating and melting bituminous materials of the asphaltic tar type are well known and have been used for many years in the roofing and roadway surfacing industries. Generally, these kettles are self-contained and transportable to the job site. As such, it is necessary that they do not require any undue servicing and that they be uncomplicated and reliable in operation.

The bituminous materials heated in these kettles inherently include compounds that vaporize and form objectionable fumes, smoke and odors which have become an increasing nuisance and problem in recent times. This problem is aggravated when the melt is heated to the higher temperatures used today wherein hydrocarbons of the higher order or length are vaporized.

Conventionally these fumes have been vented directly into the atmosphere without any smog or smoke control. This venting of the melting chamber posses several problems. Since these fumes are sometimes near their flash point it is imperative that no blocking of this venting take place because of the danger of confinement of explosive fumes.

Forced venting, for efficient removal of these fumes is desirable, and is illustrated in U.S. Pat. No. 2,833,187 to Wells, et al and U.S. Pat. No. 3,220,403 to FIGGE. As shown in these patents, a vent stack is provided in communication with the top of the kettle chamber and the hot air from the heating tubes is exhausted into this vent stack to create a draft therein. This draft functions as an ejector for the fumes but, as such, only acts to direct these fumes to a particular area of the atmosphere and does nothing to degrade these fumes.

SUMMARY

It is therefore a principal object of the present invention to provide a device for consuming noxious fumes generated in a melting kettle and to degrade them by oxidation before venting them to the atmosphere.

It is another object to draw the fumes through a stack, exterior of the melting chamber, and to direct a flame into the path of the fumes to heat them and then eject the heated fumes into a combustion chamber where the fumes are completely burned.

It is still another object to exhaust the heated air from the heating tubes of the melting kettle into the vent stack to provide a forced draft for the fumes and to increase the temperature of the fumes. Subsequently, the temperature of the fumes is further increased by a flame jet and the high temperature fumes burned in a combustion chamber with fresh air.

Yet another object is to direct the vented fumes, the heated air from the heat tubes and the jet flame over a deflecting and mixing surface where the different gases are thoroughly mixed to increase the heat factor of the fumes.

Still another object of the present invention is to provide a forced draft system for an enclosed melting kettle wherein scavenging air is drawn in at one end of the kettle and across the surface of the melt and ejected through a vent stack at the other end of the kettle. Heat is supplied to the stack to form a draft therefore, This heat is supplied by either or both of the heated air from the main burners and by a flame jet in the stack such that the draft will be in operation even when the main burner is shut down. It has been found that this venting system also facilitates extinguishing a fire in the main kettle chamber by closing the scavenging air inlet and increasing the draft in the vent stack.

A further object of the present invention is to provide a smog control apparatus and method for melting kettles of the aforementioned type which may be easily incorporated on existing kettles and provides control in a simple and efficient manner without needing servicing or supervision and also provides for easy cleaning of the components thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred form of the invention is illustrated in the accompanying drawings forming part of this specification, in which:

FIG. 1 is a perspective view of a melting kettle incorporating the preferred embodiment of the present invention;

FIG. 2 is an elevational sectional view, with parts broken away, of the device in FIG. 1 and taken substantially along the plane of line 2—2 thereof;

FIG. 3 is a plan sectional view of the device in FIG. 2 and taken substantially along the plane of line 3—3 thereof;

FIG. 4 is a partial perspective view of the present invention illustrating the vent stack, afterburner stage and combustion chamber stage in exploded relationship;

FIG. 5 is an elevational section of the lower end of the vent stack taken along the plane of line 5—5 of FIG. 3;

FIG. 6 is a partial elevational section of the present invention as illustrated in FIG. 2 taken substantially along the plane of line 6—6 thereof;

FIG. 7 is a partial plan view of the combustion chamber of the device in FIG. 6 taken along the plane of line 7—7 thereof;

FIG. 8 is a plan sectional view of the afterburner stage of the device in FIG. 6 taken substantially along the plane of line 8—8 thereof;

FIG. 9 is a plan sectional view of the vent stack and terminal end of the heat conduit tube of the device in FIG. 6 taken substantially along the plane of line 9—9 thereof; and

FIG. 10 is a partial elevational view of the deflector in the afterburner stage of the device in FIG. 6 taken substantially in the plane of line 10—10 thereof.

While only the preferred embodiment of the present invention is illustrated it should be appreciated that various modifications may be made within the scope of the claims attached hereto.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings it will be seen that the melting kettle

of the present invention includes; an enclosed kettle chamber **12** for holding the melt **13** during heating, heating means **14** for supplying heat to the chamber, vent means **16** communicating with the chamber and extending exterior thereof and providing an enclosed path **17** for the fumes and vapors driven off of the melt during heating, and after burner means **18** positioned in the vent means **16** and adapted to heat the vented fumes and burn them.

Looking to FIGS. **1, 2** and **3** there is shown a conventional type melting kettle **19** for heating bituminous materials, such as asphaltic tar, which are used for roofing or roadway surfacing. The kettle includes a kettle chamber **12** carried on a chassis frame **21** and made transportable by providing drawbar and hitch **22** and running gear and wheels **23.**

The kettle chamber is of a rectangular box shape and is defined by side walls **24, 26, 27** and **28** and a bottom wall **29.** The walls preferably are made of metallic inner and outer sheels with an insulative material, such as asbestos, therebetween. A top wall or platform **31** overhangs the sides and has a loading opening **32** therein. Opening **32** is closed by hinged cover **33** which is raised and lowered by handle **34.**

A heat conduit **36** extends through the lower portion of the kettle chamber and conventionally includes a cylindrical main heat tube **37,** manifold **38** and a pair of return heat tubes **39** and **41.** The return tubes turn upward through the surface of the melt and exit the chamber through the top wall **31** such that the terminal ends **42** and **43** of the return tubes are exterior of the kettle chamber. These terminal ends extend somewhat above the top wall and may have insulative sleeves or lining **44** to prevent the hot air from contacting the terminal end of the tube, especially in the area of the kettle chamber.

Heat generating means **46** supplies heated air through the heat conduit **36** to raise the temperature of the bituminous material in the kettle above its melting point. The heat means takes the form of a main burner **47** in fire box **48** directing a flame longitudinally into the heat tube **37.** A damper **49** regulates the entering air to the main burner **47** and heat conduit **36.** The damper is desirable with the present invention because the down draft through the fire box **48** may be so great as to blow out the main burners in the absence of damping. As shown, the damper is hinged for adjustment. The heated air passes along the heat tube **37** in the direction of arrow **51,** through the manifold **38** and branches into the return heat tubes **39** and **41.** The heated air continues back along the return tubes in the direction of arrow **52** and as such exchanges heat through the tube with the melt. Finally the heated air is exhausted through the material ends **42** and **43** of the heat conduit and into the vent stack.

Fuel, such as LP gas, is supplied to the main burner **47** from tank **53** through line **54.**

As mentioned, when bituminous materials are thus heated fumes and vapors are given off from the melt. Heretofore, these fumes were allowed to enter the surrounding atmosphere through vents **56** and contaminate the environment. Vents **56,** while conventional, are provided with the present invention, as required by law in some locals, but they are closed when the fumes are vented through the vent stack.

To degrade or consume these noxious fumes they are directed through the vent means **16** to the afterburner **18** and combustion chamber **57** where they are futher heated and mixed with fresh air to burn them up. In the instant embodiment two stacks **58** and **59,** are provided, one for each heat return tube **39** and **41.** Since each stack is identical, only one will be described, but it should be appreciated that any number of stacks may be supplied, as long as they collectively have the capacity to handle all of the expected fumes from the melt.

Each stack takes the form of a square in cross section and is welded at its lower end to the top wall **31** of the kettle. The stack extends into kettle a short ways to form a skirt **61** having cutouts **62** at either side thereof. Skirt **61** prevents any splashing melt from entering the stack, while cutouts **62** provides a path for the fumes even from an over filled kettle (see FIG. **5**). Since, during transport, the wave action is in a to-and-fro direction the solid walls of the skirt will knock down this wave action and the fumes may still vent through cutouts **62.**

The square stack **58** forms an opening **63** with the heat tube **39,** through which the fumes and vapors exit the kettle chamber. Proper spacing and support between the vent stack **58** and heat tube **39** is provided by brackets **64.**

It should be noted, that even with the lower skirt **61** some clogging of the stack will occur especially at the lower end. By making the stack and heat tube of dissimilar cross sections, enlarged vent areas **66** are produced through which any condensed coke may be easily scraped to facilitate cleaning. Other dissimilar geometric cross sections of the stack and tube may be chosen which provide easily cleaned passageways and still provide the proper venting area.

Immediately above the stack **58** and contiguous therewith is the afterburner means **18.** Square tube **67,** forming an extension of vent means **16,** forms the throat of the afterburner and is coupled to the stack **58** with brackets **68.**

In the preferred embodiment, the upper end of the heat return tube **39,** the stack **58,** and square tube **67** of the afterburner are concentric such that the vented fumes and exhausted heated air commingle along a coextensive path.

Burners **69** and **71** are supported in confronting relation by opposite walls of square tube **67.** Further the burners are inclined 45° to the vertical and are directed to provide a jet flame into the path of the fumes.

Burners **69** and **71** are of a type similar to main burner **47** and may be supplied fuel from the same source. As shown in FIG. **1** a tee connection **72** is made in main supply line **54** and supplies fuel into transverse manifold line **73.** Fuel-air mixing venturis **74** combine the proper ratio for the burners and are situated adjacent manifold **73** away from the heat of the stack. Flexible lines **76** carry the fuel mixture to each burner. Valves **77** and **78** control the fuel to each of the stacks **58** and **59** so that only one venting stack may be used if desired. Valve **79** is supplied between manifold line **73** and connection **80** so that an external fuel supply may be utilized if desired.

The burners are carried in tubes **81** and direct their flames toward the outer surface of an inverted thuncated cone **82.** The cone is supported at the upper end of the afterburner stage centrally of the stack. Rods **83** support the upper end of the cone and the tubes **81** support the lower end of the cone through washer **84.**

The vented fumes and heated air and the jet flames from burners **69** and **71** converge around the outer surface of the cone and a high heat load is exchanged thereat. Baffles **86** formed from angle pieces are attached along the elements of the cone surface to help spread out the flame. The cone **82**, rods **83**, washer **84** and tubes **81** are preferably made of stainless steel to withstand the high temperatures. Similarly the rods **83** support the cone in such a way to keep it from collapsing.

The cone **82** is supported with its top slightly above the upper surface of square tube **67** and acts to divert the high temperature fumes into combustion chamber **57.** Combustion chamber **57** is of a similar but slightly larger cross sectional area than stack **67** and encircles the top thereof. Fresh air enters along the margins of the combustion chamber and stack as at **87.** Alternatively, the open area at **87** may be eliminated or closed (for example, by the closures **87***a* as shown in phantom in FIG. **6**), and fresh air may be provided through enlarged tubes **81.** The latter arrangement minimizes the possibility that down drafts may blow unburned emissions from the bottom of the combustion chamber.

The high temperature fumes ignite either in the flames of the burner or in the combustion chamber and are degraded or consumed to an oxidized state, rendering the fumes inoffensive. The combustion chamber is of a bulbous shape to provide sufficient area for complete combustion to take place. Baffles **88** in the corners at the top of the combustion chamber divert any vapor toward the center and prevent them from channeling up the corners unburned.

Hinged cover **89** may close off the combustion chamber and vent stack from the elements when not in use.

In operation, the kettle chamber is filled with blocks of asphalt material through opening **32** and cover **33** is closed. Heat is generated by main burner **47** and travels along heat conduit **36** through heat tubes **37, 39** and **41** and out the terminal ends **42** and **43** thereof. Burners **69** and **71** are also ignited.

As the temperature of the asphalt increases the more volitile compounds therein will evaporate and be drawn up the vent stack **16** as at **91.** Fresh air may be allowed to enter the top of the kettle chamber through inlet **92.** As previously mentioned, if at any time a fire starts in the kettle it is only necessary to close the fresh air inlet. It has been found that such a fire may be extinguished in 30 seconds with such a method.

As the fumes enter the stack they contact heated air exhausting from the heat conduit and their temperature is increased somewhat. Further up the stack the fumes and commingled heated air pass adjacent inverted cone **82** and are subjected to the flame from jet burners **68** and **69.** The high temperature fumes next enter conbustion chamber **57** where they are completely consumed. The fumes thus undergoes degradation by oxidation and may suitably be vented into the atmosphere.

If at any time it is desirable to shut down the main burners **47** the jet burners **69** and **71** may still be kept going to provide proper venting of the kettle and consume any residual fumes. Similarly, one of the vent stacks may be closed off with cover **89** and its burners shut off while a single vent stack and jet burner is kept in operation.

From the foregoing it will be seen that a novel melting kettle having provision for consuming the noxious fumes from the melt is provided:

I claim:

1. In a self-contained portable melting kettle for bituminous material of the type comprising:

a. a wheel supported chassis;

b. a kettle carried by the chassis, said kettle having a closed top with an opening therein through which bituminous material may be introduced into the kettle and a cover associated with the top to selectively close the opening to confine vapors within the kettle;

c. a longitudinally extending combustion pipe carried by said chassis and extending within the interior of the kettle to effect the heating of bituminous material contained within the kettle, said pipe having an inlet end and an outlet end;

d. a burner carried by said chassis and disposed at the inlet end of said combustion pipe to direct flame longitudinally into the pipe; and,

e. at least one flue pipe carried by said chassis and communicating with the outlet end of the combustion pipe, said pipe extending directly from the interior of the kettle through an opening therefor in the closed top of the kettle to an open exhaust end disposed above the kettle;

the improvement comprising an apparatus carried by the chassis to remove fumes from the interior of the kettle and effect combustion thereof, said apparatus comprising:

1. a stack disposed at the open exhaust end of the flue pipe in generally concentric spaced apart relationship thereto whereby the exhaust of flue gas from the flue pipe creates a low pressure area within the stack;

2. a duct communicating the gas space of the interior of the kettle with the low pressure area within the stack whereby the low pressure within said area functions to induct vapors from the kettle into the stack; and,

3. an afterburner disposed within the stack to ignite bituminous vapor inducted into the stack from the kettle, said afterburner including a pair of confronting jet burners and further comprising an inverted conical flame deflector and mixing baffle carried within the stack at the intersection of the fumes inducted into the stack and the gas exhausted from the flue pipe and wherein the afterburner directs flames against the deflector to thoroughly mix the gas exhausted from the flue pipe and vapors drawn into the stack from the kettle.

2. In a self-contained portable melting kettle for bituminous material of the type comprising:

a. a wheel supported chassis;

b. a kettle carried by the chassis, said kettle having a closed top with an opening therein through which bituminous material may be introduced into the kettle and a cover associated with the top to selectively close the opening to confine vapors within the kettle;

c. a longitudinally extending combustion pipe carried by said chassis and extending within the interior of the kettle to effect the heating of bituminous material contained within the kettle, said pipe having an inlet end and an outlet end;

d. a burner carried by said chassis and disposed at the inlet end of said combustion pipe to direct flame longitudinally into the pipe; and,

e. at least one flue pipe carried by said chassis and communicating with the outlet end of the combustion pipe, said pipe extending directly from the interior of the kettle through an opening therefor in the closed top of the kettle to an open exhaust end disposed above the kettle;

the improvement comprising an apparatus carried by the chassis to remove fumes from the interior of the kettle and effect combustion thereof, said apparatus comprising:

1. a stack disposed at the open exhaust end of the flue pipe in generally concentric spaced apart relationship thereto whereby the exhaust of flue gas from the flue pipe creates a low pressure area within the stack;

2. a duct communicating the gas space of the interior of the kettle at one end of the kettle with the low pressure area within the stack whereby the low pressure within said area functions to induct vapors from the kettle into the stack;

3. a fresh air inlet communicating with the gas space of the interior of the kettle at the end of the kettle opposite the end communicating with the duct whereby scavenging fresh air may enter the interior of the kettle and be drawn across the upper surface of a melt within the kettle and into the vent stack; and,

4. an afterburner disposed within the stack to ignite bituminous vapor inducted into the stack from the kettle.

* * * * *