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F. S. SIMPSON
REFUSE INCINERATOR

3,200,776

Filed Aug. 12, 1963

2 Sheets-Sheet 1

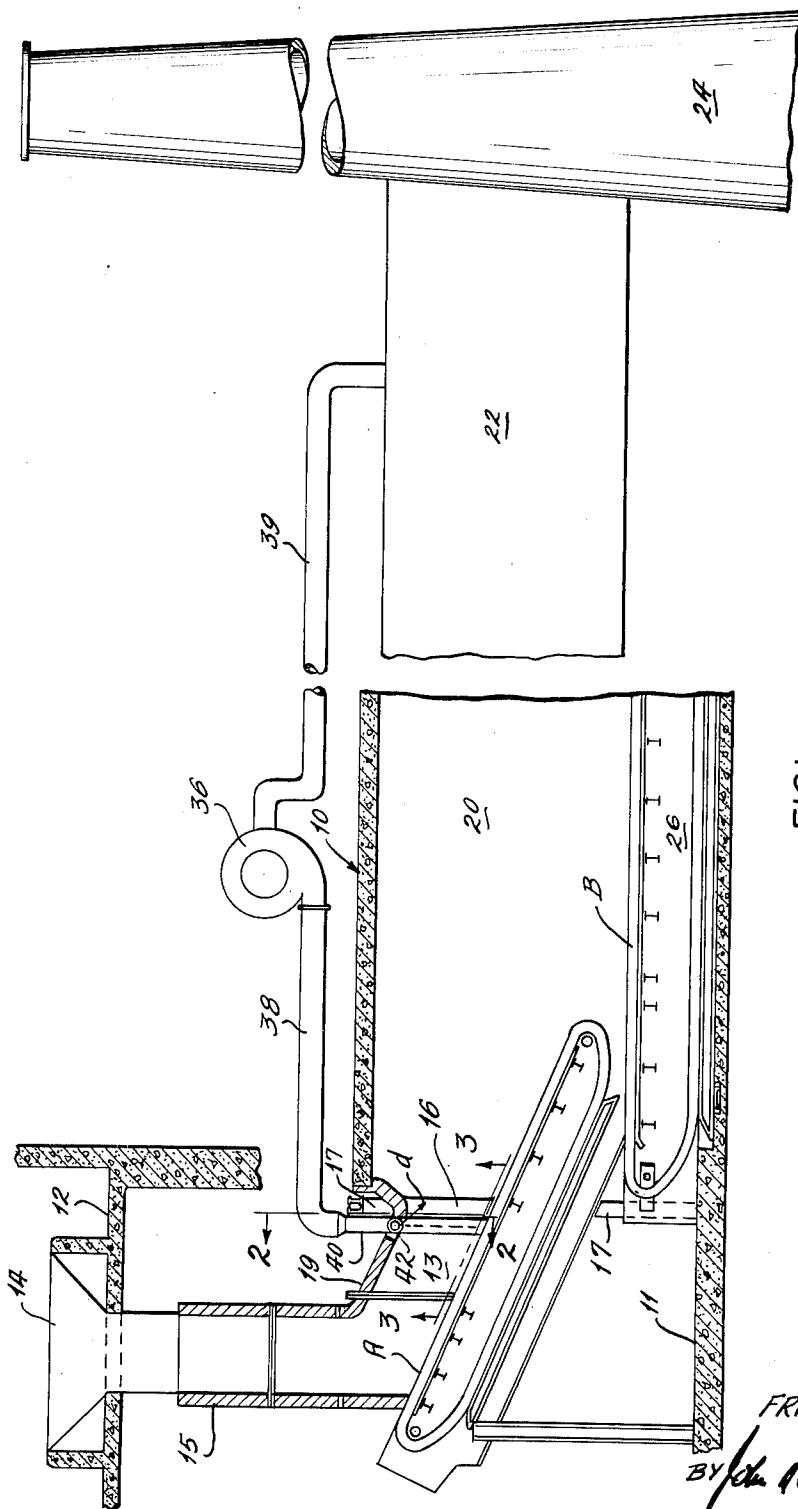


FIG. 1

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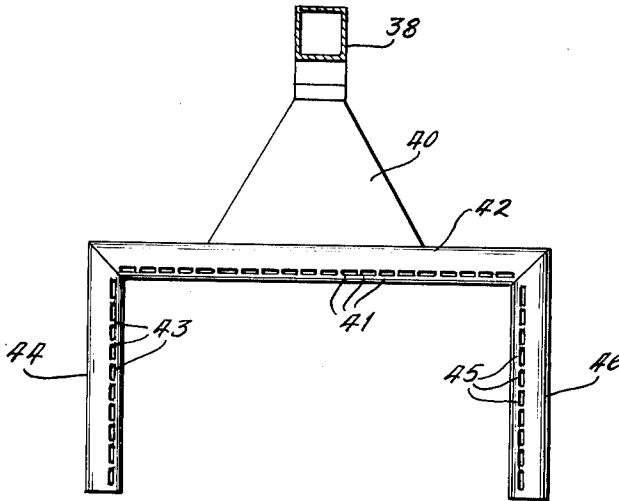


FIG. 2

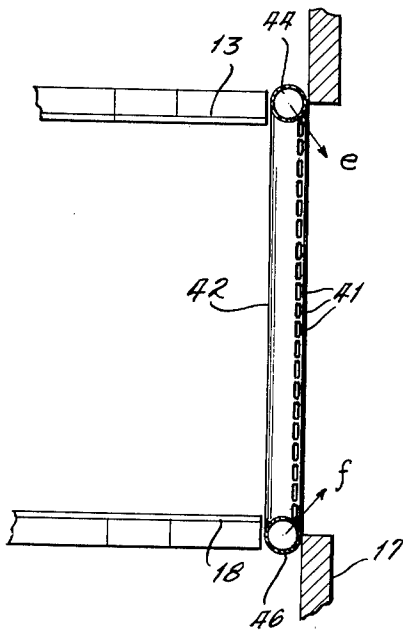


FIG. 3

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REFUSE INCINERATOR

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6 Claims. (Cl. 110—15)

This invention relates to incinerators of the type employed in municipal refuse disposal, and more particularly to a method and apparatus for suppressing fire travel from the combustion zone into an adjacent charging zone of such an incinerator.

An incinerator of the character referred to is illustrated by the patent to W. M. Duncan, No. 2,862,463. Such incinerators usually have a combustion chamber fifty or a hundred feet long, the floor of which is provided by the upper reach of an endless traveling grate. Between the upper and lower reaches of the traveling grate, provision is made for forcing air (to support combustion) upwardly through the grate and into the bed of burning refuse on it. Under modern operating conditions, the bed of refuse on the traveling grate (at the charging end) may have a depth on the order of four or five feet.

The refuse to be incinerated is a mixture of rubbish with or without garbage—some wet and difficultly combustible, other very dry and highly inflammable. While optimum operating conditions are achieved when the refuse is supplied to the incinerator at a rate such as to maintain the maximum depth of bed, this is seldom achieved. The refuse is usually brought in by trucks operating on no fixed schedule, and discharged into a deep hopper from the bottom of which it is progressively fed through an opening into the combustion zone of the incinerator. The opening has to be sufficiently large to accommodate passage at a rate such as to maintain the optimum depth of bed, and (except to the extent that it is filled with refuse) the opening is permanently open. When there is a delay in the arrival of refuse, the supply in the hopper may become depleted. When the hopper is sufficiently empty that the supply of refuse incompletely fills the opening into the combustion zone, or the refuse is loosely packed, dry, and air laden, a condition exists which invites combustion to proceed countercurrent to the feed of refuse, back through the opening, and into the hopper. Such can do considerable damage.

It is an object of this invention to provide a method of preventing the likelihood of back-travel of fire from the combustion zone of an incinerator through the permanently open charging opening.

According to this invention, the permanently open opening (through which the refuse is moved from the hopper into the combustion zone of the incinerator) is located above the bed of refuse on the traveling grate; and a current of inert gas is maintained across the opening. "Inert gas," as here used, means gas which is substantially devoid of oxygen in a form which will support combustion. These inert gases may be, and preferably are, hot flue gases drawn directly from the stack or breeching of the incinerator and projected athwart the opening so as to smother any fire that approaches the opening. On the other hand, since the inert gases are already hot, they tend to rise toward the top of

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the combustion chamber rather than to blanket the bed of refuse to an extent such as to inhibit its combustion. While such incinerators are usually operated under forced draft through a traveling grate, the locus of ignition is at the top (which is several feet distant from the grate) of the moving bed of refuse, so that, during operation, the pressure in the combustion zone (above the bed) is always somewhat less than atmospheric. Consequently, the pressure differential on opposite sides of the opening is such as to draw the injected inert gas toward the stack. The curtain formed by the continual projection of inert gas, athwart the opening, also reduces the tendency of air (from the hopper) to flow through any portion of the opening which is unoccupied by refuse, and hence minimize the supply of oxygen to sustain back-traveling flame.

Other objects and advantages of this invention will appear from the following detailed description when taken in conjunction with the accompanying drawings, forming a part thereof, and in which:

FIGURE 1 is a side elevational view partly in section schematically illustrating an incinerator equipped with a device to suppress ignition and subsequent flame back-travel into the feeder;

FIGURE 2 is a fragmentary elevational view taken on the line 2—2 of FIGURE 1 looking in the direction of the arrows; and

FIGURE 3 is a fragmentary bottom plan view taken along line 3—3 of FIGURE 1.

FIGURE 1 illustrates the general arrangement of elements in such an incinerator plant. In this particular arrangement, the incinerator, generally indicated as 10, is located at a lower level 11 of the plant. At a substantial elevation thereabove, indicated as 12, is located the hopper charging opening 14. Hopper 15 connects with the opening 14 and extends downwardly toward the lower level 11. A downwardly inclined conveyor, indicated as A, forms the bottom of the hopper 15. The conveyor A extends downwardly and into the incinerator 10 through a large opening 16 in its front wall 17. Within the incinerator 10, and well below opening 16, is a traveling grate B extending from adjacent the front wall 17 to an ash discharge opening at the discharge end of the grate B. Hopper 15 has a top wall 19 inclined downwardly in parallel relation with the upper run of conveyor A and spaced therefrom a distance from four to five feet. The downwardly inclined wall 19 terminates adjacent the front wall 17 at the top of opening 16. Opening 16 extends for the full width of conveyor A, and for a distance above it sufficient to pass refuse at a rate such as to maintain the optimum bed depth on grate B.

The top surface of the upper reach of conveyor A forms the floor of opening 16, and it is preferred that the elevation of such surface (where it traverses opening 16) be above the top of the bed of refuse on grate B—which, as aforesaid, is usually four or five feet deep.

Above the grate B is the combustion chamber 20 of the incinerator, and this in turn is connected directly with the breeching 22 and the stack 24. Gases from the combustion pass through the breeching, or flue, 22 into the stack and create a natural draft which maintains subatmospheric pressure in the combustion chamber.

Below the upper run of the grate B is a chamber 26. Air for combustion is supplied to the chamber 26 in the usual manner, at a pressure equal to, or greater than, atmospheric and flows through openings in the grate B. Air flowing through the openings in the grate B passes through the bed of refuse on the grate B to sustain combustion within the combustion chamber 20, and the gases of combustion then flow to the stack 24 due to the natural draft in the stack 24.

Located adjacent the incinerator is a motor-driven blower 36. A duct 39 extends from the intake of the blower 36 to the breeching 22 so as to feed the inert gas from the flue to the blower 36. The discharge duct 38 from the blower 36 is connected with a tuyere 40, as shown in FIGURE 2. The gases from the tuyere 40 flow into a manifold which frames that part of opening 16 that lies above the upper surface of conveyor A. The manifold consists of a horizontal pipe 42 which in turn is connected at its opposite ends to two vertical pipes 44 and 46. The lower ends of the pipes 44 and 46 are closed. Pipe 42 has a plurality of orifices 41 disposed to direct the jet of inert gas issuing from these orifices in the direction of the arrow *d*, shown in FIGURE 1. The pipes 44 and 46 have a plurality of orifices 43 and 45, respectively, located to direct the jets of gas along the arrows *e* and *f*, respectively, of FIGURE 3. As shown in FIGURE 1, the pipe 42 is located between the front wall 17 and the end of the inclined wall 19. Opposite side walls 13 and 18 connect with the inclined wall 19 and extend downwardly at least as far as the surface of the upper run of conveyor A. Pipes 44 and 46 are disposed between the ends of walls 13 and 18 and the front wall 17, as shown in FIGURE 3.

For example, when the opening 16 is four feet high and eight feet wide; and the orifices 41, 43 and 45 are in the form of slits (0.3" x 3.0") of which there are twenty in pipe 42, and ten each in pipes 44 and 46, the blower may be such as to deliver 2,000 cubic feet per minute (at a hydrostatic pressure of eight to ten inches) through a discharge duct 38 which is eight inches in diameter. This arrangement provides a curtain which is thin yet substantially continuous peripherally, and the individual jets issuing from the several orifices have sufficient velocity to maintain substantial continuity across the opening 16 when completely void of refuse.

When the incinerator is in operation, the refuse is brought in in trucks to the upper level 12 and dumped from the trucks through the hopper charging opening 14 into the hopper 15 so as to fill the hopper with refuse. This refuse, or rubbish, leaves the hopper through the discharge opening 16 at the speed of travel of the conveyor A. As the rubbish emerges from hopper 15, it is surrounded by a curtain of inert gas flowing in the direction of the several arrows *d*, *e* and *f*. This curtain purges air from about the rubbish in the charging zone of the incinerator, and, consequently, any highly inflammable material in the rubbish cannot be ignited so that back-travel of flame between the walls 13, 18 and 19 of the hopper 15 is suppressed and prevented. As long as there is rubbish to be fed from the hopper 15, the surface of the conveyor A is protected from the hot gas issuing from the holes 41, 43 and 45. As shown by the arrows *d*, *e* and *f*, these holes are all located to direct the curtain of inert gas toward the combustion chamber 20 where it will be sucked up the stack 24 by natural draft.

The curtain of inert gas discharged by the jets *d*, *e* and *f*, impinges directly upon the rubbish at opening 16. Because of the high velocity from the orifices 41, 43 and 45, penetration of these inert gases into the refuse may purge it of entrained air.

Changes in and modifications of the construction described may be made without departing from the spirit of my invention or sacrificing its advantages.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In the art of refuse disposal in an enclosed incinera-

tor having a traveling grate through which air is passed upwardly to support combustion on said grate of a deep bed of combustible refuse and said traveling grate having an inlet end at which the refuse is deposited on the traveling grate through a permanently open opening in the incinerator enclosure, the improvement which comprises, locating said permanently open opening at said inlet end of said traveling grate and so that it extends substantially above the top level of the bed of refuse on the traveling grate, subjecting inert gas to a pressure greater than that which exists within said incinerator, and projecting a curtain of said pressurized inert gas athwart said opening.

2. A method for controlling back-travel of fire in an incinerator having a combustion chamber with a charging opening, a grate traveling lengthwise beneath said combustion chamber, a feeder discharging through said charging opening chamber adjacent one end of said grate and through which refuse is fed onto said grate, comprising the steps of:

(a) creating a curtain of inert gas around the stream of refuse as it enters said combustion chamber by discharging a series of jet streams of inert gas in a direction athwart said feeder discharge, and

(b) creating a negative pressure gradient in said furnace in a direction to cause a flow of inert gas away from said discharge into said combustion chamber.

3. A device for confining combustion in an incinerator having an enclosed combustion chamber normally at subatmospheric pressure, a traveling grate in said incinerator provided with apertures supplying air to the fuel on said grate and to said combustion chamber, an opening in the enclosure for said combustion chamber at the infeed end of said traveling grate, and a feeder for feeding a stream of refuse through said opening onto said grate, said device comprising,

(a) means located at said opening provided with a series of orifices adapted to be addressed toward the upper sides of the stream of refuse fed through said opening, and

(b) a source of inert gas under pressure connected with said means to produce a jet flow from said orifices,

said orifices being located on said means adapted to create a curtain of flowing inert gas at said opening and about the stream of refuse as it moves into said combustion chamber to inhibit back-travel of flame through said opening.

4. In an incinerator having in combination walls forming a combustion chamber, an infeed opening in one of said walls, means to maintain said combustion chamber under subatmospheric pressure, a traveling grate for moving burning refuse through said combustion chamber from said infeed opening, apertures in said grate to supply air to said combustion chamber, and a refuse feeder with a discharge end communicating with said opening and including a support for the stream of refuse delivered by said feeder and extending into said combustion chamber above the infeed end of said grate, the improvement comprising,

(a) means located at said opening in said wall and provided with orifices adapted to be opening toward the upper sides of the stream of refuse fed into said furnace through said opening, and

(b) a source of inert gas under pressure connected with said means to produce a flow from said orifices, said orifices being located on said means adapted to create a curtain of flowing inert gas about the stream of refuse in the vicinity of said opening to exclude air fed to said combustion chamber from penetrating the stream of refuse from the combustion chamber to the opposite side of the curtain and back-travel of flame over said support into said feeder.

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5. The combination as defined in claim 4 in which said refuse feeder is a vertical hopper and said support for the stream of refuse is an inclined endless conveyor forming the bottom of said hopper.

6. In an incinerator having an enclosed endless traveling grate having an inlet end for receiving, supporting, and moving a deep bed of refuse from end to end thereof while burning with the support of air impelled upwardly through said grate, the improvement which comprises, an enclosure for said grate having an infeed opening adjacent said inlet end adapted to be located above the top level of the maximum bed of refuse, and means for forcing a curtain of inert gas inwardly at said opening.

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