United States Patent [19]

Henriksen

[11] **3,871,286**

[45] **Mar. 18, 1975**

[54] **INCINERATOR**

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[22] Filed: **Jan. 15, 1973**

[21] Appl. No.: **323,711**

[52] **U.S. Cl.** ..... **110/8 R,** 110/15, 110/40 R

[51] **Int. Cl.** **F23g 5/04**

[58] **Field of Search** ..... 110/8 R, 15, 40 R

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[57] **ABSTRACT**

An incinerator for burning refuse, garbage and the like, wherein a furnace chamber is provided with a horizontally extending movable fire grate. The grate constitutes part of a belt or chain conveyor for conveying material which is to be burned. Above the grate is provided one or more air blower units for blowing combustion air against the material to be burned, and each of the air blower units above the grate is movably mounted in that the blower units are mounted pivotally about a transverse axis above the grate below the furnace chamber ceiling.

3 Claims, 4 Drawing Figures

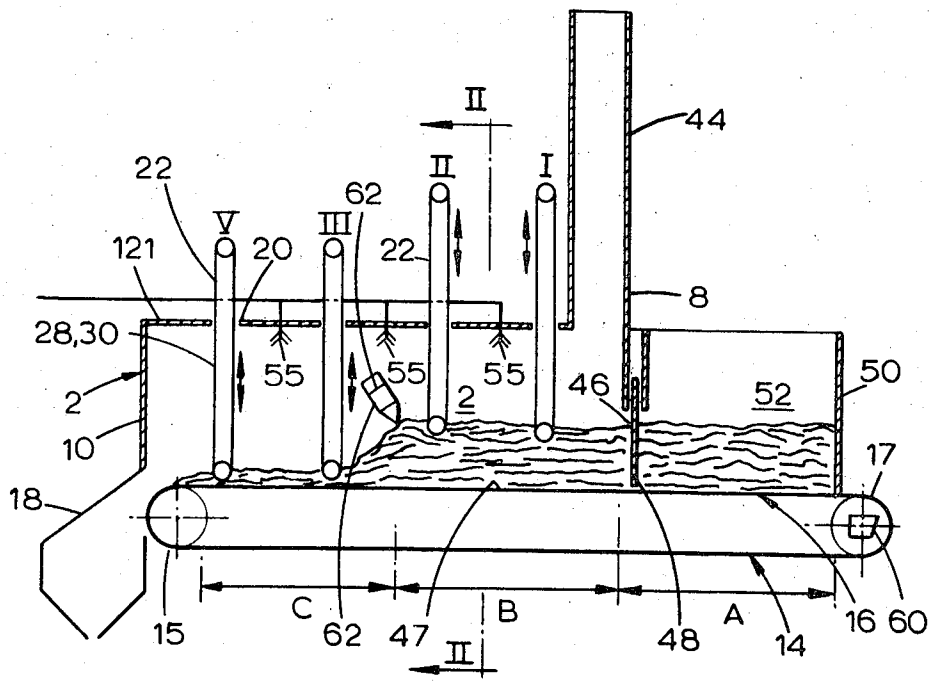


Fig. 1.

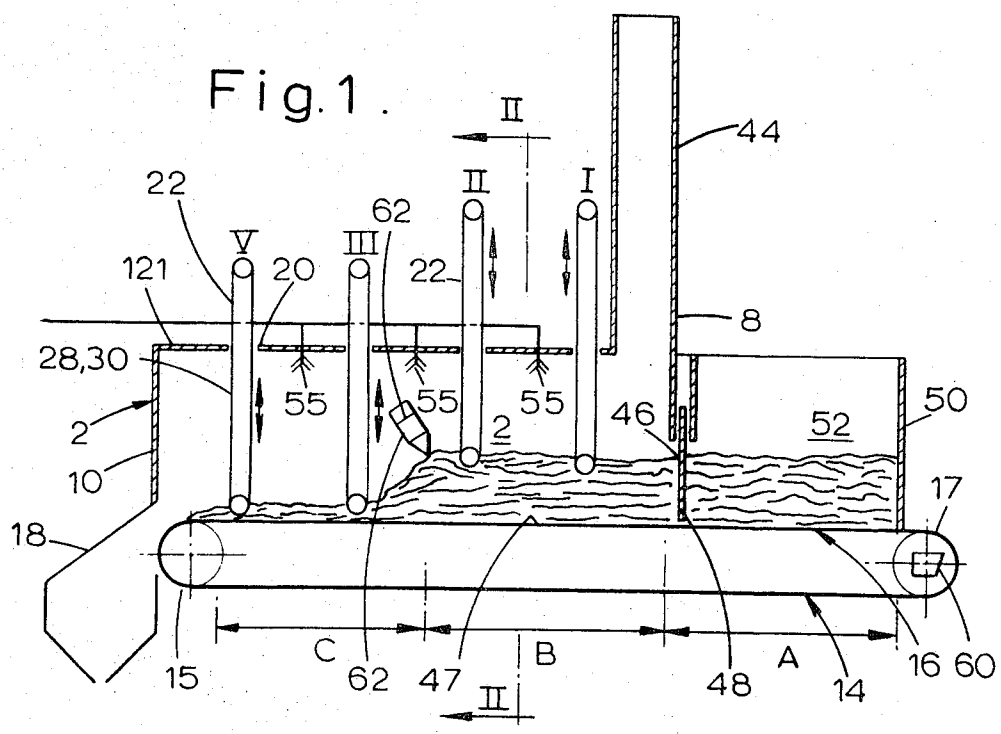

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Fig. 2.

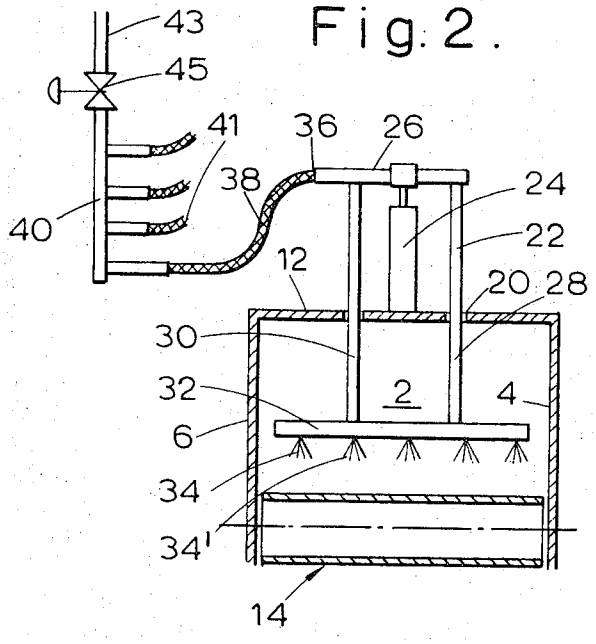

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Fig. 3.

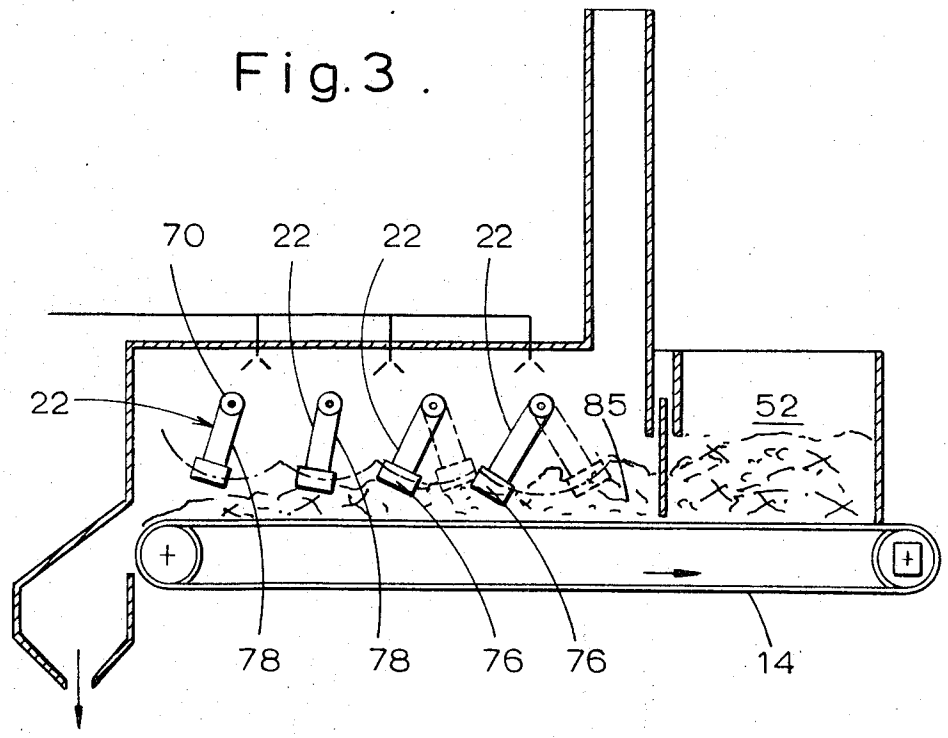
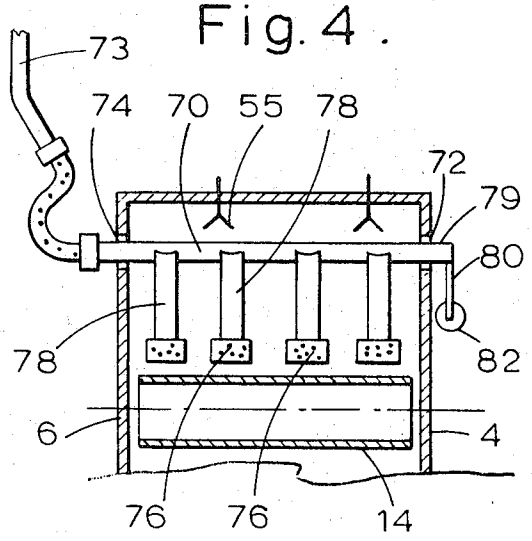

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Fig. 4.


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INCINERATOR

BACKGROUND OF THE INVENTION

The present invention relates to an incinerator for the burning of solid materials, particularly for burning refuse, garbage and the like, and the invention relates more particularly to an incinerator of the type wherein the materials to be burned are conveyed through a furnace chamber on a horizontally extending travelling grate, preferably on a grate means constituting part of a belt conveyor.

There are known several incinerators of this type. In most of these incinerators the grate means is arranged to slope and the feeding of the materials to be burned takes place, for instance, by means of hoppers or screw conveyors. Known incinerators of this type are hampered by several draw-backs, of which the most important are that the incinerators are expensive, have large dimensions and are cumbersome and not dependable and/or effective in use. Many contributing factors make it difficult to obtain uniform and complete burning, primarily caused by the constantly varying composition of the material such as garbage or refuse to be burned. Thus the ability to burn, the calorific value and the proportion of combustible constituents will all inevitably vary with the time. Further, unless separate dryers are provided, the moisture content will also vary substantially. These varying conditions result in complete burning taking a considerable time. In order to increase the burning rate and secure sufficient complete burning it is imperative to supply sufficient quantities of combustion air in an effective way. It is preferable to be able to subject the material to agitation during the burning.

In previous incinerators provided with horizontal or sloping grates it has been proposed to provide tubular means above the grate for blowing jets of combustion air directly onto or down into the materials placed on the grate to be burned. Such blowing means have been found to make possible an improved combustion under some circumstances but not when the composition of the materials to be burned varies even more than usual. Also there still remains the problem of how to agitate the material on the grate.

SUMMARY OF THE INVENTION

The main object of the invention is therefore to provide a new improved incinerator of the aforementioned type, particularly an incinerator with an improved system for the supply of combustion air, an improved means for agitating materials situated on the grate, and an improved method for feeding the materials into the incinerator.

The incinerator in accordance with the invention is of the type comprising a furnace chamber provided with a horizontally extending movable fire grate for conveying material to be burned through the furnace chamber and wherein above the grate are provided air blowers for blowing jets of combustion air against the material. The incinerator in accordance with the invention is characterized in that the air blowers above the grate are mounted to be vertically movable during the combustion process and in that the grate extends at least to the furnace wall at the feeding end of the furnace chamber, which wall is provided with a charging opening on the outside of which extends a charging

zone for reception of material which is to be fed into the furnace chamber through the charging opening.

In a further developed, preferred embodiment of an incinerator in accordance with the invention, the air blowers are in the form of pipes suspended from a transversely extending, pivotally supported hollow beam structure such that the air blowers can undergo pivotal movements above the grate longitudinally thereof. The blowers with the beam can be freely supported but they are preferably connected to an external power means such that the blowers can be subjected to enforced pivotal movements.

An incinerator in accordance with the invention includes a fire grate forming part of a belt or chain conveyor which extends out through the charging opening the part or run of the conveyor positioned outside of the furnace wall constituting in part the charging zone of the incinerator. A closure means for the charging opening consists preferably of a raisable and lowerable or laterally movable door.

There are preferably several longitudinally spaced air blowers above the grate each of which extends laterally across the grate whereby the air blowers can be used not only to blow air onto and down into all of the material on the grate, but may also be utilized to agitate the material.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of incinerators in accordance with the invention will now be described with reference to the accompanying drawings wherein:

FIG. **1** shows a schematic longitudinal section of the incinerator in accordance with the invention,

FIG. **2** shows a schematic cross-sectional view along the line II—II in FIG. **1** and

FIGS. **3** and **4** show a longitudinal sectional view and a cross-sectional view, respectively, similar to the views shown in FIGS. **1** and **2**, of a further developed, preferred embodiment of the invention.

DETAILED DESCRIPTION OF INVENTION

In FIGS. **1** and **2** the reference number **2** designates the furnace chamber of the incinerator comprising side walls **4** and **6**, end walls **8** and **10**, and a horizontally extending ceiling **12**. The floor of the furnace chamber **2** comprises a grate belt conveyor **14** carried by two rollers **15** and **17**, which, as shown, at the material feed end extends outside the wall **8** by way of a run **16** because of which one roller **17** must be positioned outside the incinerator proper. At the discharge end of the conveyor **14** is provided a discharge opening chute **18** at the end wall **10**.

Through openings **20** in the ceiling **12** extend vertically reciprocable air blowers **22**, the purpose of which is partly to supply primary combustion air and partly to subject the materials on the grate to a mechanical treatment.

The blowers **22** are as best appears from FIG. **2**, suspended from a lowerable and raisable suspension means **24**, preferably a hydraulically operated means, and each comprises a hollow frame having an upper tube **26**, two vertically downwardly extending tubes **28**, 30, and a lower horizontally extending tube **32**, provided with downwardly directed blowing jets for supplying combustion air. The frame **26, 28, 30, 32** is preferably made of welded steel piping. The combustion air is introduced into the upper tube **26** by compressed air

being introduced at its end **36** from a flexible pressure hose **38** leading from a header or manifold pipe **40,** which, as is shown, is also provided with further air hose fittings **41** extending to the other blowers shown in FIG. **1.** The combustion air (and possible combustible gas) is supplied from a fan (not shown) via the main air line **43** and the air flow is controlled by means of a main valve **45,** if desired in dependence on an automatic control mechanism which is actuated by a temperature gauge positioned in the chimney **44.**

The chimney **44** of the incinerator is positioned adjacent the wall **8** at the feeding end of the furnace chamber. The wall **8** is provided with a feeding opening or doop aperture **46** itself provided with a raisable and lowerable door **48** which in the lowermost position is flush with the grate surface **47** of the conveyor **14.** The grate surface **47** extends outside the incinerator and is adapted to serve as a feeding or charging zone means in a feeding or charging zone for materials to be burned and this zone is as shown preferably provided with walls **50** whereby is provided a bin-like space **52** for reception of material which is to be fed into the incinerator.

As will be understood an incinerator of this type can be provided with a number of other conventional implements but as these are not necessary for the full understanding of the present invention they are not described or shown. It should, however, be mentioned that the incinerator is preferably provided with secondary air blowing means **55** positioned along the ceiling.

An incinerator in accordance with the invention operates in the following manner:

It is assumed that the incinerator is empty and is to be started up for burning garbage. The air blowing means **22** are raised to an upper position. The bin **52** is filled up to a suitable height as shown, the door **48** across the feeding opening **46** is raised up and then the grate conveyor **14** is started, for instance by means of an electrical motor **60** positioned in the roller **17,** whereby the charge in the bin **52** is moved into the zone of the incinerator designated by letter B. The burning can now be initiated with the conveyor **14** stopped. The air blowers designated I and II are lowered down onto the garbage and the air blowing fan is actuated. The garbage is ignited at the inlet end, preferably at the top, by means of an oil burner or the like **62,** or alternatively by a gas or oil burner associated with the air blowing jets **34.** The garbage now progressively burns and collapses and the blowers are correspondingly lowered either due to their own weight or by means of hydraulic cylinders **24.** During this stage or phase of the operation the space **52** is filled anew with a fresh charge of garbage. When the burning of the charge in the zone B is for instance 70% completed, the air blowing means I and II, and the door **48** are raised, the grate conveyor **14** is started anew resulting in a new charge of garbage being brought into the incinerator. The grate conveyor **14** is stopped when the new charge has reached zone B, the preceding charge then being positioned downstream of the same in the zne designated C. All of the air blowers are now lowered into position on top of the respective garbage volumes in the zones B and C and the door **48** is lowered down onto the grate whereafter a new charge of garbage can be fed into the space **52** simultaneously with the continuance of the burning in the incinerator zones B and C. The burning garbage positioned in the zone C ignites the new charge positioned in zone B. It is this phase of the operation which is illustrated in FIG. **1.** When the charge of garbage in zone C is almost completely burned out the charge in zone B is about 50–70% burned. The door **48** is raised anew and the grate conveyor **14** is actuated again after raising of the blowers **22** whereby a third charge is brought into zone B simultaneously with the burned garbage from zone C falling down from the grate conveyor via the chute **18,** into an ash collector which preferably constitutes part of a conveyor or truck, in order to be removed.

It will be understood that the stepwise change of position of the charges etc. and thus the speed or rate of the burning can be adjusted in accordance with the characteristics of the material to be burned.

As will be understood the burning in the incinerator shown in the drawing takes place in two steps or phases while the incinerator comprises three zones having equal or substantially equal lengths and being designated A, B and C. Thus the incinerator operates continuously but in three distinct phases. Due to the constantly varying composition of the material to be burned the burning is inherently likely to take place in an uneven manner, but in an incinerator in accordance with the invention, due to the effective air supply and the other described features, the burning is sufficiently completed and as mentioned to ensure this the air blowers can be moved down into the layer of garbage positioned on the grate such that the burning is effected throughout the whole material. Furthermore, the air blowers can if necessary be utilized to agitate the garbage on the grate by movement of the grate forwardly whilst the blowers remained lowered resulting in the garbage being agitated. The charging zone or bin **52** is charged from a superimposed hopper or it can be charged directly from a truck (not shown).

FIGS. **3** and **4** illustrate a further developed, preferred embodiment of an incinerator in accordance with the invention. The blowers **22** for primary air are in this embodiment, instead of being hoistable and lowerable through openings in the furnace ceiling, supported in suspended position from all together four transverse, hollow beams **70,70,** etc. arranged below the furnace ceiling and which are pivotally supported in bearings **72** arranged in the opposed furnace walls **4,6.** At least on one side these beams extend out through the furnace wall and are on the outside at the ends **74** connected to a source **73** for primary combustion air, such that the beams serve as air ducts for supply of air to the respective blower heads **76, 76,** etc. which are mounted at the lower ends of the suspended pipes **78, 78,** etc. In contrary to the embodiment shown in FIGS. **1** and **2,** the blowers in this embodiment constitute as shown separate pipe means.

In the shown embodiment, the beams extend out through the furnace wall also on the other side with a closed end part **79** which is connected to a pivot arm **80,** the outer end of which for instance can be coupled to a hydraulic cylinder **82** such that each of the beams can be forcibly pivoted during the operation of the incinerator. Hereby the material to be burned **85** and which is fed along the grate **14** can be subjected to stirring, mixing and distributing movements. The length of the suspended air pipes **78** is suitably adjusted such that the blower heads are positioned at a short distance above the grate in their lowermost position, such that the blowers as illustrated in FIG. **3** normally will be pushed somewhat forwardly by the contact with the

material to be burned when the grate is moving forwardly. During the operation of the incinerator the two foremost blower units may for instance pivot freely such that they normally will rest against the material to be burned by means of their own weight while the two rearmost blowers can be subjected to forced pivotal movements in order to carry out the beforementioned stirring, mixing and if desired, distributing movements. The furnace walls are preferably provided with windows or sight-glasses such that the operator of the incinerator during the operation can control and adjust the blowers in suitable fashion.

Practical trials with this embodiment of the invention have proved that the combustion is so effective that a complete combustion of all combustibles may take place even if the proportion of not combustible is up to 90% of the material to be burned. If the layer on the moving grate is very thin and positioned below the contact range of the blower heads, the blowers should still undergo pivotal movements back and fore above the material layer in order to obtain best possible penetration of the material with combustion air with a corresponding high degree of complete combustion.

It will be understood that other embodiments of the invention can also be realized within the scope of the invention as defined by the appendant claims. Thus the number and shape of the air blowers can be varied and the stepwise burning can be arranged to occur in less or more steps, for instance in only two steps or in four or five steps, in accordance with the size of the incinerator and the characteristics of the material to be burned. It should furthermore be mentioned that the movable grate need not necessarily extend outside the furnace chamber since it could alternatively be discontinued, for instance just inside the wall **8,** since as a continuation of the grate or alternatively at a level somewhat higher, could be arranged a floor outside of the furnace chamber, which floor could serve as part of the charging zone. The charging could in such a case, for instance, be accomplished by means of a truck provided with a bulldozing blade or the like, such that the charge could be moved into place on the grate through the charging opening. Finally it is conceivable to employ a separate belt conveyor for feeding the furnace chamber so that the grate conveyor need not extend past the charging opening.

What is claimed is:

1. An incinerator for burning refuse, garbage and the like material, said incinerator comprising:

a furnace having end walls, side walls and a ceiling;

a fire grate conveyor means extending horizontally within said furnace for moving material to be burned from one end wall of said furnace to the other end wall thereof;

said side walls, end walls, ceiling and fire grate conveyor means defining a furnace chamber;

at least one air blower unit means mounted within said furnace chamber for blowing combustion air against said material to be burned when positioned on said fire grate conveyor means, each of said blower unit means including perforated blower heads and mounting means extending across said furnace chamber in a direction transverse to the direction of movement of said fire grate conveyor means for providing pivotal movement of each of said blower unit means about an axis extending in said transverse direction.

2. An incinerator as claimed in claim **1,** wherein each of said air blower unit means comprises a hollow beam extending across said furnace chamber in said transverse direction and forming said axis, and at least one pipe-shaped blower tube fixedly coupled to and communicating with said hollow beam and extending towardly therefrom, said blower tubes having connected at the bottom thereof one of said perforated blower heads.

3. An incinerator as claimed in claim **2,** wherein each of said hollow beams extend through said side walls of said furnace, and further comprising combustion air supply means connected to one end of each of said hollow beams, and means for pivoting said hollow beams about said axes connected to the opposite ends of each of said hollow beams.

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