

April 4, 1967

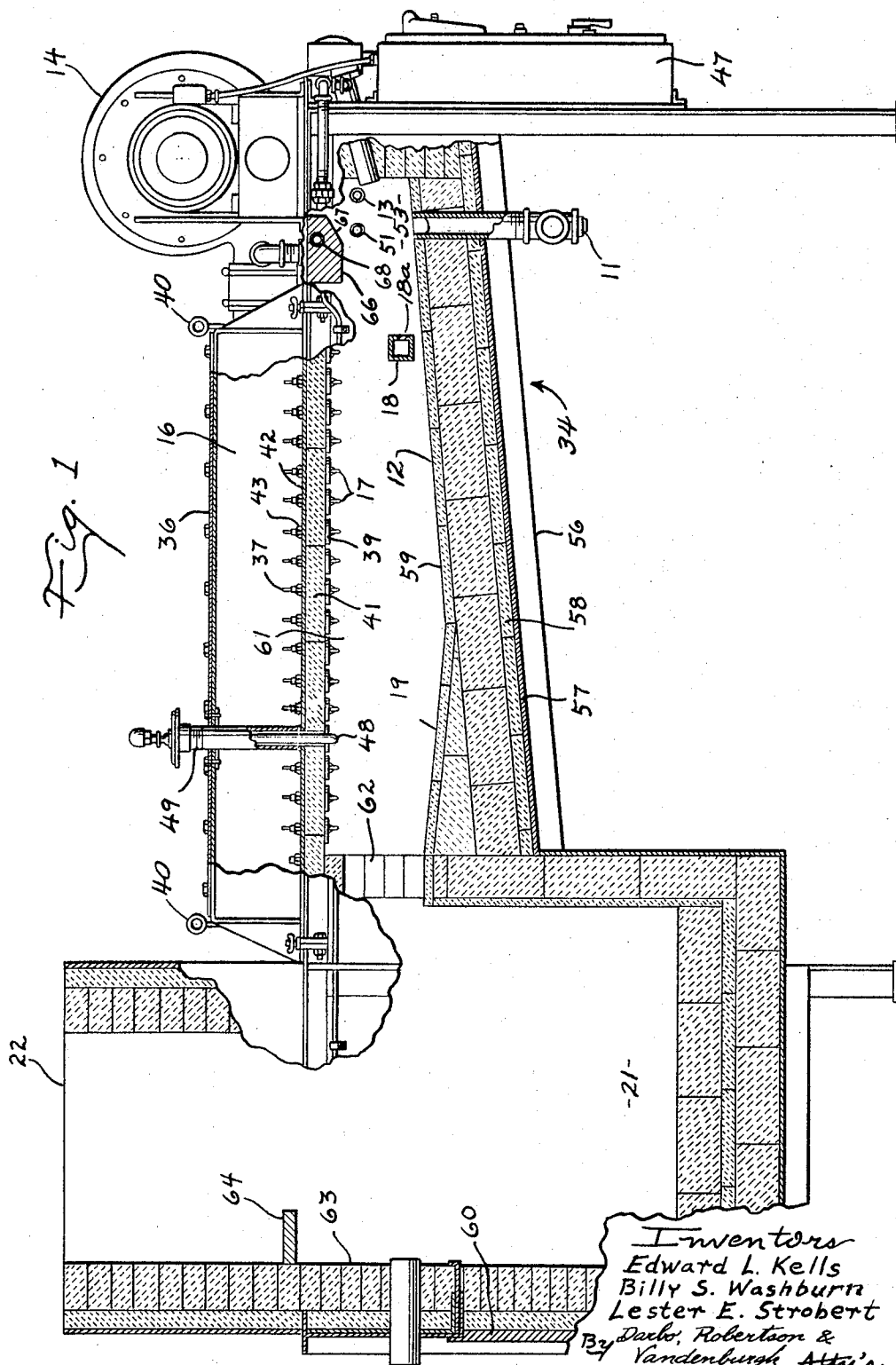
E. L. KELLS ETAL

3,312,183

METHOD AND APPARATUS FOR BURNING SEWAGE PLANT SKIMMINGS

Original Filed Sept. 30, 1963

3 Sheets-Sheet 1



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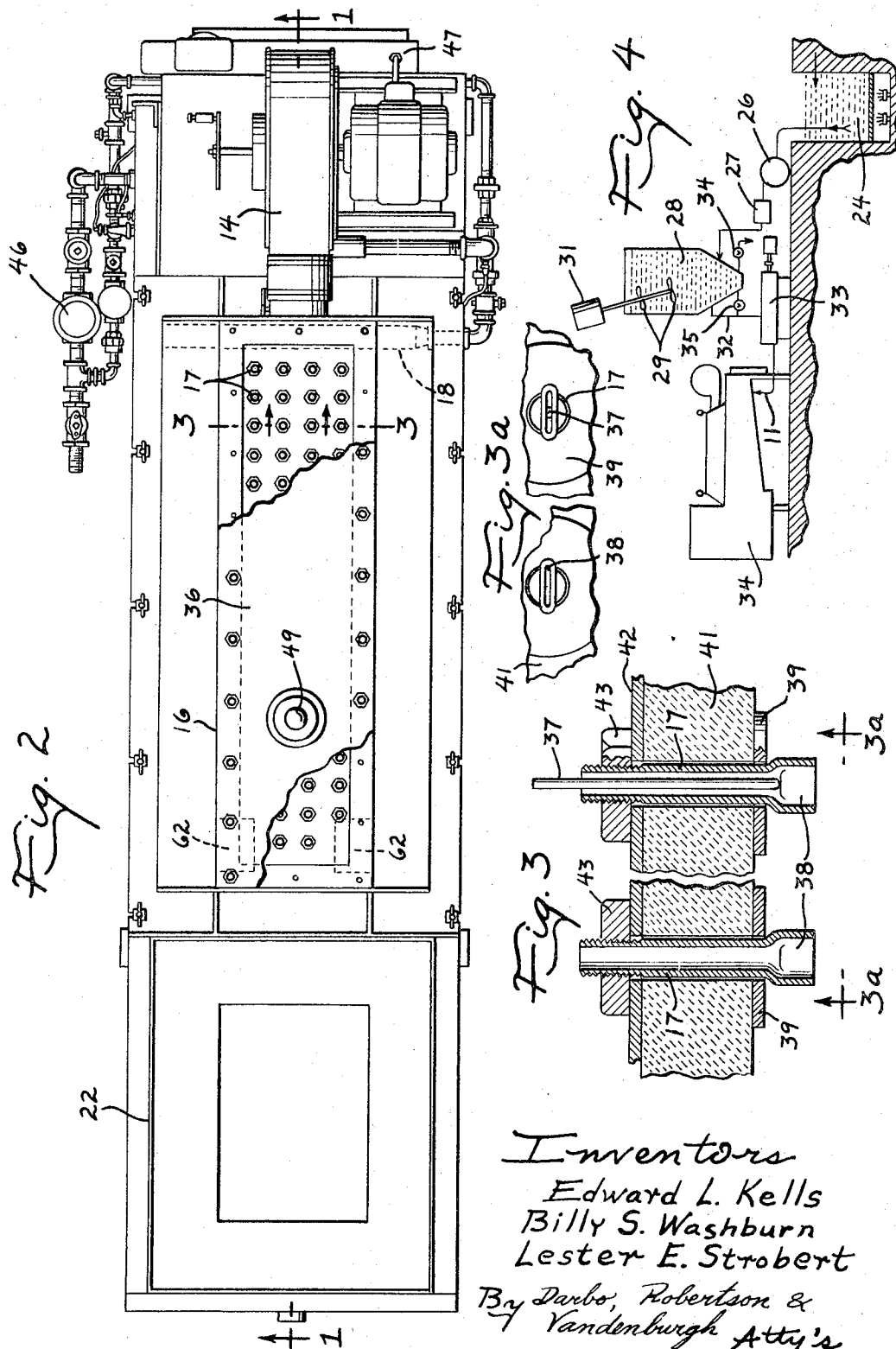
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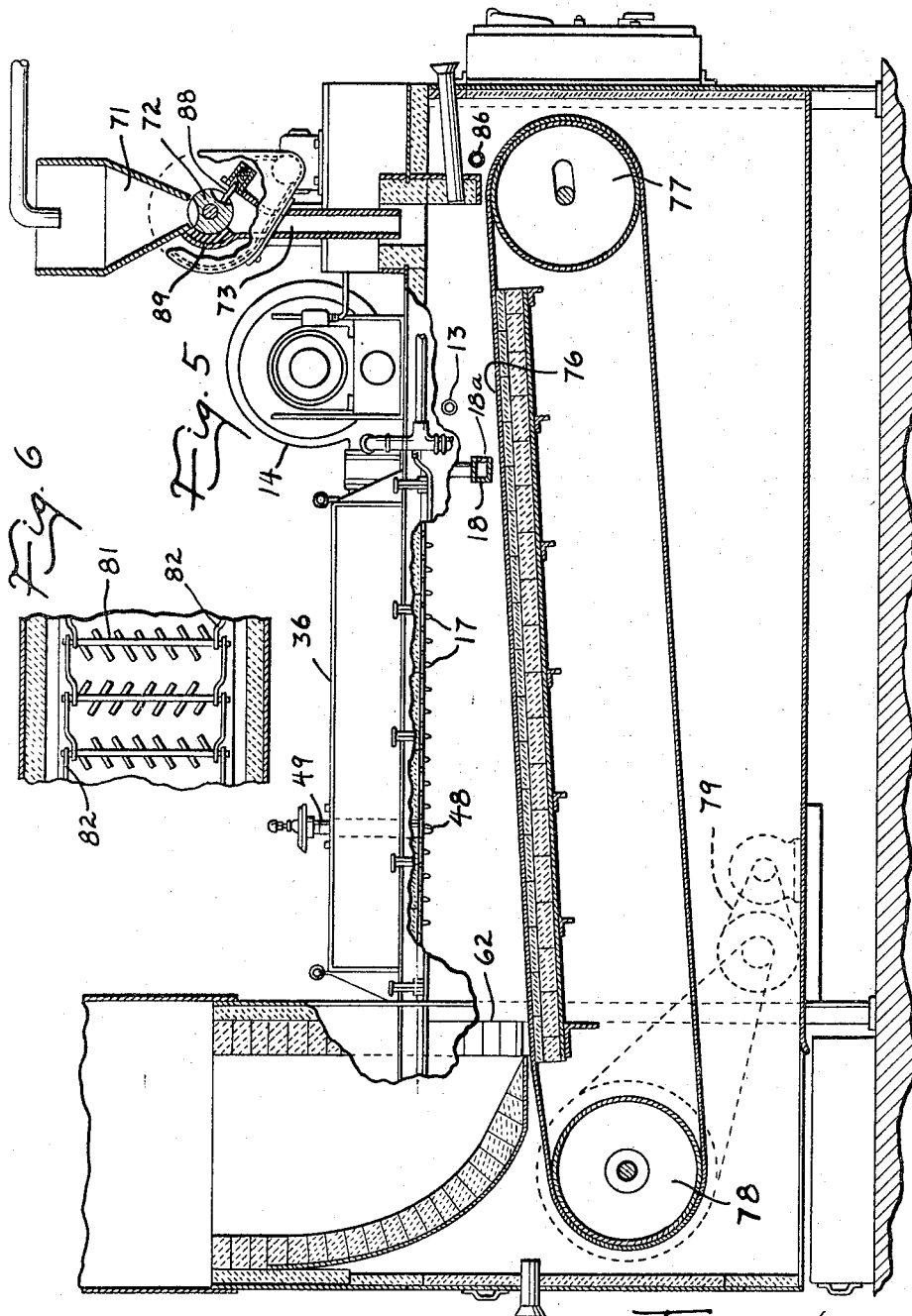
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METHOD AND APPARATUS FOR BURNING SEWAGE PLANT SKIMMINGS

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Continuation of abandoned application Ser. No. 312,658, Sept. 30, 1963. This application June 10, 1965, Ser. No. 475,302

17 Claims. (Cl. 110—8)

This application is a continuation of Ser. No. 312,658 filed Sept. 30, 1963, now abandoned.

This invention relates to a burner and a method of burning, both suitable for burning the watery and trash-bearing greasy skimmings of a sewage treatment plant largely without the use of separate fuel, except in starting. This disclosure of the invention is offered for public dissemination in the event adequate patent protection is available.

In the operation of sewage treatment plants grease and some other materials which float are skimmed off of the surface of treatment tanks. Although the skimmings are mainly grease, which alone would burn fairly easily, they include a high percentage of water, as well as some varying amounts of trash of various kinds, including rubber. It has long been recognized that this material could be burned, and some incinerators have been used for it. However, a common characteristic of these incinerators is that they have entailed the continuous use of other fuel, such as a fuel-gas supply, either for heating the grease to aid its burning, or in the after-burning or clean-up section of the burner. According to the present invention, outside fuel is usually used only for heating the burner initially to get the burning process started. After that, when the skimmings supply is uniform, the heat developed by the burning grease is so conserved and used that no other fuel is required even when the skimmings are 40 percent water or more, with a sufficiently high temperature being achieved by the burning to destroy the mercaptans in the grease. At least three features cooperate toward achieving this amazing result. In the main burning section, multitudinous air jets are directed toward a slab or hearth on which the molten grease stands or flows, the air jets being sufficiently spaced from the hearth so that on the way to the grease the jets mix with vapor and burn it. The grease is thus struck mainly by spent hot gases or flame, vaporizing more grease. The vapor thus produced replenishes the supply of grease-vapor in the contained atmosphere surrounding the jets. The second feature is the bringing of the heated gases into contact with the grease immediately upon its being introduced into the burner. In the described embodiments one sheetlike air jet is positioned to aspirate some of the hot gases into the vicinity in which the grease is introduced to thus preheat the grease. The preheating starts to drive off the water, melts the grease and increases its flow. As the grease is heated, vapors commence evolving which burn and add further heat to the area of introduction.

A third main feature is the reduction in size of the entire burner or combustion chamber as compared with prior art incinerators. By reduction in size, it is meant that the B.t.u.'s liberated by the combustion in the combustion chamber is increased per cubic foot of volume. In the present invention, the heat generated by combustion should not be less than about 100,000 B.t.u.'s per cubic foot per hour. There is no upper limit except that practical limit, which will vary from embodiment to embodiment, of introducing and mixing sufficient air with

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the grease vapors to burn the grease at a rate equal to that at which it is introduced into the combustion chamber. In the embodiments disclosed, the grease is introduced at a rate at which the burning rate is about 280,000 B.t.u.'s per cubic foot per hour. While it will vary with the character of the grease, this would, for example, be approximately equivalent to 18.7 pounds of grease per cubic foot per hour or 31.2 pounds of grease with 40 percent water per cubic foot per hour. Air is introduced at a rate sufficient to form a combustible mixture with the grease vapors.

This reduction in size has a number of important advantages. It conserves heat by having less wall area for the dissipation of heat. It speeds the reaction which in turn creates a higher temperature within the combustion zone. The higher temperature within the combustion zone speeds the vaporization of the grease and the driving off of the water present. The entire burner or combustion chamber is reduced to such a compact size there is substantially no space within the combustion chamber not used either for the burning of grease vapors, the active production of grease vapors, or the pressure of the air jets or grease.

This comparative compactness enables the maintenance of a temperature of at least about 1850 degrees Fahrenheit in a zone large enough, and occupying a large enough proportion of the burner cross section, so that all grease vapor must reach the critical clean-burning temperature in contact with oxygen. Below the critical clean-burning temperature not far below 1850 degrees Fahrenheit, grease tends to burn incompletely, apparently breaking down initially to constituents which then may not be burned unless this temperature is reached. With burning by the present invention, the exhaust includes no smoke, no unburned carbon, and no mercaptan. Although there is a small amount of fly ash, and some ash retained on the hearth, such ash is deemed substantially harmless, and the proportion is so small that the exhaust appears clean.

There are various other contributing features. For example, in the preferred forms of the invention, the stack is located at the downstream end of the flow, beyond the hottest area from the feed, so that only well-burned material goes up the stack. This is made possible by the aspiration feature previously mentioned which adequately heats the entering skimmings and the surrounding walls without carrying the spent gases back to that vicinity where they would pick up incompletely burned vapors.

While skimmings can be burned without any preliminary processing, the objects of the invention can be more readily achieved if they are homogenized before introduction into the combustion chamber. This ensures that the water is thoroughly dispersed throughout the grease. As a result, the water is more readily vaporized. Furthermore, the elimination of large water pockets prevents localized cooling that otherwise might result therefrom. The possibility of a flame-out is prevented.

Additional features and advantages of the invention will be apparent from the following description and from the drawings.

Designation of figures

FIGURE 1 is a view which is partially a side-elevation view but is mainly broken away to show a longitudinal section of the preferred form of the invention;

FIGURE 2 is a plan view of the form of the invention shown in FIG. 1, the cover being largely broken away;

FIGURE 3 is a view on a larger scale showing two of the air jet tubes, with a regulating rod within one;

FIGURE 3A is an end view of the orifice tubes shown in FIG. 3;

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FIGURE 4 is a flow diagram including the preparation of skimmings for burning according to the present invention;

FIGURE 5 is a longitudinal vertical section through a modified form of the invention;

FIGURE 6 is a fragmentary showing of a further modification.

Although the following disclosure offered for public dissemination is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose, as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

General description

The grease skimmings to be burned should be prepared by removing any large separate batches of water and homogenizing the remainder. In the preferred form of the invention, these prepared skimmings are then pumped at a metered rate (i.e. uniformly except perhaps for pulse-like regular variations) through a pipe 11 extending upwardly through the hearth 12. As the skimmings thus enters the burner, any grease not already melted is melted and eventually all of it is melted and runs slowly down the hearth 12. Intense heat within the burner causes vaporizing of the grease as it flows down the hearth. This intense heat is normally produced by the burning of the grease itself, but in the start-up period is produced by preheating the combustion chamber with a grease burner 13. A blower 14 discharges air into a manifold 16 from which a multitude of orifice tubes 17, seen best in FIG. 3, extends downwardly. These orifice tubes are flattened at their ends as seen in FIG. 3A to provide thin streams moving toward the hearth. However, the spacing of the orifice is well above the hearth, with the result that the thin streams mix with the surrounding gases containing unburned grease vapors, and due to the high temperature, burn them. The largely burned gases at high temperature, thus produced, impinge upon the molten grease on the hearth, vaporizing it and carrying the vapors back around throughout the combustion area.

Air is also pumped into a transversely extending tube 18 which has slotlike orifices adjacent its bottom and facing in the upstream direction, to provide a sheetlike stream or jet generally parallel to the hearth and short distance above it extending the width of the hearth. The purpose of this stream is to aspirate some of the flame or vapors from the main burning section toward the entrance area 53. The grease is melted both by the heat thus drawn from the main burning area, and also the heat from flame in entrance area or foresection 53 produced by the mixing of this air with the grease vapor. These flames probably do not heat the skimmings so much directly as indirectly, i.e., by heating the walls, so that the skimmings are heated by intense radiated heat. This heat not only melts the grease to allow it to run over the hearth and to vaporize it, but also converts all of the water in it to steam. The final portion 19 of the hearth preferably slopes upwardly in the downstream direction, so that if there is any grease unvaporized at this point it will be collected and burned. With preferred maximum rate of feed, a pool of hot oil forms here, the surface of which is impinged by the jets from orifice tubes 17. The air jets above the end portion of reverse slope 19, being beyond the pool of oil supply an excess of air to burn the last residues of vapor and produce a clean well-burned discharge.

All of the walls are lined with firebrick or other refractory. Hence, the walls radiate heat intensely and continue to do so for a substantial period in case there may be momentary lulls in the burning of the grease.

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If there should be a severe interruption, the preheat burner 13 would be automatically restarted. All metal parts exposed within the burner are of high temperature resistant stainless steel.

More detailed description

The skimmings from the plant are discharged into a storage tank 24. Sewage treatment plants now usually have such a tank. It need not be heated, except that in extremely cold weather it should be heated mildly, if necessary, to keep the grease in a soft condition. From this tank the skimmings may be drawn by a non-clogging centrifugal pump 26 which pumps the grease through a trash grinder 27 unless that is found not to be needed in a particular instance. From the grinder 27, the skimmings flow into the bottom of a homogenizing tank 28. Homogenizing impellers 29 in this tank are driven by a motor 31. The homogenized skimmings normally flow from a point above the bottom of tank 28 through a conduit 32 to a feed pump 33. Water which gathers at the bottom of tank 28 is drawn off by opening a valve 34. The operator observes the outflow and shuts the valve 34 when grease begins to appear. Valve 35 is normally closed, but can be open to draw the last of the skimmings to feed pump 33 if desired.

The feed pump 33 preferably feeds the grease into the burner 34 at a uniform rate (adjustable by a variable speed drive) through the feed pipe 11. To this end, the feed pump 33 is preferably a positive displacement type of pump, the encased floating-helix pump, known commercially as the Moyno pump being preferred. The feed opening preferably flares laterally below the surface of the hearth to overflow along a wide area. A nine inch overflow for a 22" hearth has been found adequate. For a hearth much wider, two or more of such flared feed overflows are contemplated.

Preferably the entire manifold 16 and roof below it can be raised by securing chains to lifting rings 40 for servicing the inside of the burner. Also the top plate 36 of the air manifold 16 is preferably removable (as by removing the ring of screws around its periphery). Its removal gives access to the upper ends of the orifice tubes 17 so that they may be inspected, cleaned if necessary, and regulated. As shown in FIG. 3, the preferred manner of regulation requires only the insertion of rods 37 in enough of the orifice tubes 17 in a given area to reduce the total flow in that area to the desired value. The flattened end portion 38 of each tube supports the rod 37 therein. The flattened portion 38 also supports, externally, washers 39 which support the insulating firebrick material 41 along the roof of the combustion chamber. The orifice tubes 17 are held in position clamping the insulating firebrick 41 against support plate 42 by nuts 43 threaded to the upper ends of the orifice tubes 17.

The orifice tubes 17 are spaced as shown (centered 3" apart in both directions) along the entire roof over the hearth to the rear of the transverse tube 18. On the size referred to herein, there are about 150 orifice tubes.

It is contemplated that the control or volume reducing rods 37 will be needed in most of the orifice tubes 17 over the upstream half of the hearth. More air in each area than is beneficial is undesirable because it has a cooling effect.

Usually, the skimmings have a high percentage of water. The water content is quite likely to be in the neighborhood of 35-45 percent occasionally, and according to the present invention these can be satisfactorily self-burned (i.e., burned without separate fuel). Even skimmings comprising fifty percent can be burned without using separate fuel, if the remaining content of the homogenized skimmings constitutes good fuel such as grease and this high percentage of water is not maintained too long.

In the event that an excessive water content interferes with the burning of the skimmings, or if the skimmings

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supply should be interrupted, and either condition lasts a sufficient time to permit the burner to cool off, it is desirable to start the main gas burner 13. This is controlled by an electrically operated valve 46 which in turn is controlled by devices within control box 47, all in response to a thermo-couple 48 extending into the burner through a tube 49 in the cover. When the temperature, sensed by thermo-couple 48, falls below a given value, valve 46 supplies gas to main burner 13. Pilot burner 51 burns continuously, and is provided with automatic electric ignition. Air is continuously supplied through main burner 13, since it is in a quantity useful for combustion of the grease vapors in the foresection 53 of the grease burner when fuel gas is not being supplied.

The hearth 12 may be supported by framework such as channel beams 56. They may support a steel plate 57, above which are successive layers of refractory insulation. The first layer 58 may be chosen for relatively high insulating value, perhaps being largely formed of glass fibers. For the top layer 59, or inner face, silicon carbide is chosen for high ability to withstand thermal shocks and strains due to the flame and intense heat, and at the same time much cooler oil or even water. All seams, especially those exposed to liquid, are cemented with conventional refractory cement.

Preferably, the hearth surface, even the part sloping downstream, is of a retentive nature. By "retentive," it is meant that the surface is either roughened, ribbed, or undulated so as to retain small minute pools of molten grease. An undulated surface is preferred to abrupt shoulders so that if an excess quantity of ash accumulates, the rear door 60 (carrying its lining) can be opened and the excess ash easily scraped down into the ash pit 21. Occasionally an accumulation of ash in ash pit 21 can be cleaned out. Small amounts of ash on the surface of the hearth are not objectionable and indeed seem to be beneficial.

Present experience indicates that the burner works more satisfactorily if the exit from the main combustion chamber 61 is partially choked as by choke walls 62. The combined effect of these choke walls and the choking effect of the rearwardly rising hearth portion 19, is to produce a high-speed jet of apparently flaming gases moving rearwardly from the exit they form, this jet impinging against the opposite wall portion 63. The wall portion becomes incandescent and has high catalytic action. This effect, together with the turbulence produced by the jet, seems to ensure the completion of all possible combustion. This effect is aided by providing a baffle 64.

In the foresection 53 of the combustion chamber, the roof is provided, extending across its width, with a downward projection 66 which has a sloping face 67 facing generally toward the area of skimming feed. The circulating gases strike this face and heat it, and because it is facing directly toward the entering skimmings, it is believed to have maximum radiating value for heating the incoming skimmings. This protuberance 66 also gives protection to a support member 68, which may be further protected by circulating air through it.

Preferably small air-cooled sight glasses are provided at opposite ends of the structure for observing conditions within the combustion chamber.

FIG. 5 shows another form of the invention which differs in two major respects. One is feed from above. The skimmings (preferably prepared as in FIG. 4) are fed to a hopper 71. Unless metered by the feed pump, they are metered by a metering rotor 72. Either way, they drop down a chute 73 into the burner, at a uniform (if pulsating) rate. The burner could be identical in other respects to that of FIGS. 1 and 2. However, the second major difference shown is the inclusion of an endless conveyor 76 of stainless steel running around an idler roller 77 and a drive roller 78, which may be driven by a variable speed drive represented by the belt 79. The

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conveyor 76 may be in the form of a plain band as illustrated in FIG. 5, or it may be in the form of a chain of scrappers or rabblers 81 connected by endless side chains 82. Whether rabblers or band, the endless conveyor moves quite slowly. The direction of movement, as presently preferred, is from the feed end toward the stack end. Less slope in that direction than illustrated might be desirable.

To prevent grease from flowing or spattering through the opening in which the endless conveyor enters the burner, an air supply tube 86 is provided with orifices facing to blow air inwardly through that opening along the endless element, the orifices extending all across the width of the endless element.

burner, an air supply tube 86 is provided with orifices shown, and with an automatic scraper 88. When a pocket is in the position where it might otherwise form an opening for flow from the hopper 71, such flow is prevented by a pad 89 of rubber or neoprene or other grease resistant rubber-like material.

Blower 14 has been shown in the same position in FIG. 5 as in FIG. 1. However, the amount of separation this causes between the bank of orifice tubes 17 and the feed area may be excessive. If so, the proved spacing of FIG. 1 should be used, and the blower placed elsewhere. Incidentally, although the bank of orifice tubes is important to one aspect of the invention, and has been shown in both forms because proved successful, other aspects of the invention would be satisfied by any other successful use of air to help vaporize and burn the grease. This might be, for example, blasts through the hearth or the like spraying the molten grease in an area where it is already hot and easily vaporized.

Speed of burning

It is best to accumulate skimmings until they can be burned at a speed of feed near the capacity of the burner. The burner of FIGS. 1 to 3 with a hearth 22 inches by 6½ feet takes skimmings at the rate of 350 pounds per hour, with water mostly under 40 percent of the total, 30 percent being common. The skimmings can be accumulated in the homogenizing tank 28 with the impellers idle, and when it is about full the bottom water may be drained off, the remainder quickly homogenized and the burning begun. Two such tanks used alternatively may be found to give better results than continuous transfer to and drawing from one homogenizing tank.

What is here claimed is:

1. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of draining free water from the skimmings, homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to at least about 1500 degrees Fahrenheit, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

2. The method of self-burning greasy skimmings from

a sewage treatment plant, even when including large percentages of water, comprising the steps of homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to at least about 1500 degrees Fahrenheit, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

3. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to at least about 1500 degrees Fahrenheit, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

4. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to a temperature at which the skimmings will self-burn, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

5. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large per-

centages of water, comprising the steps of feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to a temperature at which the skimmings will self-burn, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

6. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of draining free water from the skimmings, homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to at least about 1500 degrees Fahrenheit, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, and conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass.

7. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of draining free water from the skimmings, homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to at least about 1500 degrees Fahrenheit, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

8. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to a temperature at which the skimmings will self-burn, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor,

directing a stream of air upstream of the hearth to the entry end thereof to aspirate in that direction some of the grease vapor thus produced and burning it to heat the entry end of the combustion chamber and the incoming skimmings, substantially discontinuing the supply of heat other than by burning the skimmings, and conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass.

9. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis to the upper part of a sloping hearth in a furnace preheated to a temperature at which the skimmings will self-burn, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

10. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of homogenizing the drained skimmings, feeding the skimmings on a constantly metered basis by overflow onto the upper part of a sloping hearth in a furnace preheated to a temperature at which the skimmings will self-burn, blowing air steeply toward the hearth from slim air orifices directly above the hearth and spaced therefrom approximately the distance required for substantial burning-use of the air as it approaches the hearth in a confined atmosphere laden with grease vapor, substantially discontinuing the supply of heat other than by burning the skimmings, conserving the heat in a compact combustion chamber to maintain a temperature of at least about 1850 degrees Fahrenheit in a zone through which all grease vapors pass, and discharging the confined atmosphere from the combustion chamber in a jet stream, providing an excess of oxygen in the jet stream and impinging the jet stream against a glowing refractory catalytic surface to complete the combustion of any combustibles therein.

11. In the method of self-burning greasy skimmings from a sewage treatment plant, which skimmings include grease and a large percentage of water, in a combustion chamber of a given cubic volume and including a hearth, the improvement comprising the steps of: preheating the combustion chamber to a temperature at which said skimmings will self-burn; feeding the skimmings into the combustion chamber on a metered basis at a rate at which the amount of grease introduced per hour for each cubic foot of said volume has a B.t.u. content, when burned, in excess of about 100,000; and introducing combustion air into the chamber at a rate in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below about 1850 degrees Fahrenheit, and directing at least a portion of said air in a jet generally toward the burning grease from a position such that the jet will circulate hot burned gases back over unburned grease on the hearth.

12. Apparatus for self-burning greasy skimmings from a sewage treatment plant, which skimmings include grease and a large percentage of water, said apparatus including: a combustion chamber of a given cubic volume and including a hearth; means to preheat the combustion chamber to a temperature at which the skimmings will

self-burn; means to feed the skimmings into the combustion chamber on a metered basis at a rate at which the amount of grease introduced per hour for each cubic foot of volume of said volume has a B.t.u. content, when burned, in excess of about 100,000; and means to introduce combustion air into the chamber at a rate in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below about 1850 degrees Fahrenheit, said means directly introducing at least a portion of said air in a jet directed generally toward the burning grease and in a direction so as to circulate hot burned gases back over unburned grease on the hearth.

13. The method of self-burning greasy skimmings from a sewage treatment plant, even when including large percentages of water, comprising the steps of grinding said skimmings and draining free water therefrom, concurrently homogenizing the skimmings to thoroughly disperse the remaining water by intermingling it with the grease, feeding the homogenized skimmings on a constantly metered basis to a combustion zone and burning the skimmings in said zone.

14. The method of disposing of the greasy material portion of the waste, which includes water and greasy material, in a sewage treatment plant having a combustion chamber with a hearth, said method including the steps of: separating the surface material of the sewage in the plant from the water on which it is floating; grinding said surface material and blending the grease and any entrained water to thoroughly disperse this water by intermingling it with the grease; depositing said ground and blended material on said hearth at a metered rate to be burned in said chamber; and introducing air into said chamber in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below a temperature at which said material will burn.

15. The method of disposing of the greasy material portion of the waste, which includes water and greasy material, in a sewage treatment plant having a combustion chamber with a hearth, said method including the steps of: separating the surface material of the sewage in the plant from the water on which it is floating; grinding said surface material and blending the grease and any entrained water to thoroughly disperse this water by intermingling it with the grease; depositing said ground and blended material on said hearth at a metered rate to be burned in said chamber; and introducing air into said chamber in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below a temperature at which said material will burn, said air being introduced in a plurality of jets; and directing at least some of said jets so as to circulate the burning gases over the unburned material on the hearth.

16. Apparatus for disposing of the greasy material separated from the surface of the water portion of the waste upon which it is floating in a sewage treatment plant, said apparatus including: a combustion chamber having a hearth; means to grind said surface material and to blend the grease and any entrained water to thoroughly disperse this water by intermingling it with the grease, and to deposit said ground and blended material on said hearth at a metered rate to be self-burned in said chamber; and means to introduce air into said chamber in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below a temperature at which said material will burn.

17. Apparatus for disposing of the greasy material separated from the surface of the water portion of the waste upon which it is floating in a sewage treatment plant, said apparatus including: a combustion chamber of a given cubic volume and including a hearth; means to grind said surface material and to blend the grease

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and any entrained water to thoroughly disperse this water by intermingling it with the grease, and to feed the ground and blended material onto said hearth on a metered basis at a rate at which the amount of grease introduced per hour for each cubic foot of volume of said given volume has a B.t.u. content, when burned, in excess of about 100,000; and means to introduce air into the chamber in a plurality of jets at a rate in excess of the stoichiometric amount in relation to the amount of grease introduced and less than that required to cool the chamber below a temperature at which said material will self-burn, some of said jets being directed so as to circulate hot burned gases over the unburned material on the hearth.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,312,183

April 4, 1967

Edward L. Kells et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 3, for "scrappers" read -- scrapers --;
line 11, for "wtih" read -- with --; line 15, for "burner, an
air supply tube 86 is provided with orifices" read, as the
beginning of a new paragraph, -- The metering rotor 72 may be
provided with pockets as --.

Signed and sealed this 3rd day of December 1968.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents