May 20, 1941. F. R. MAXWELL 2,242,653

INCINERATOR

Filed Aug. 5, 1938 2 Sheets-Sheet 1

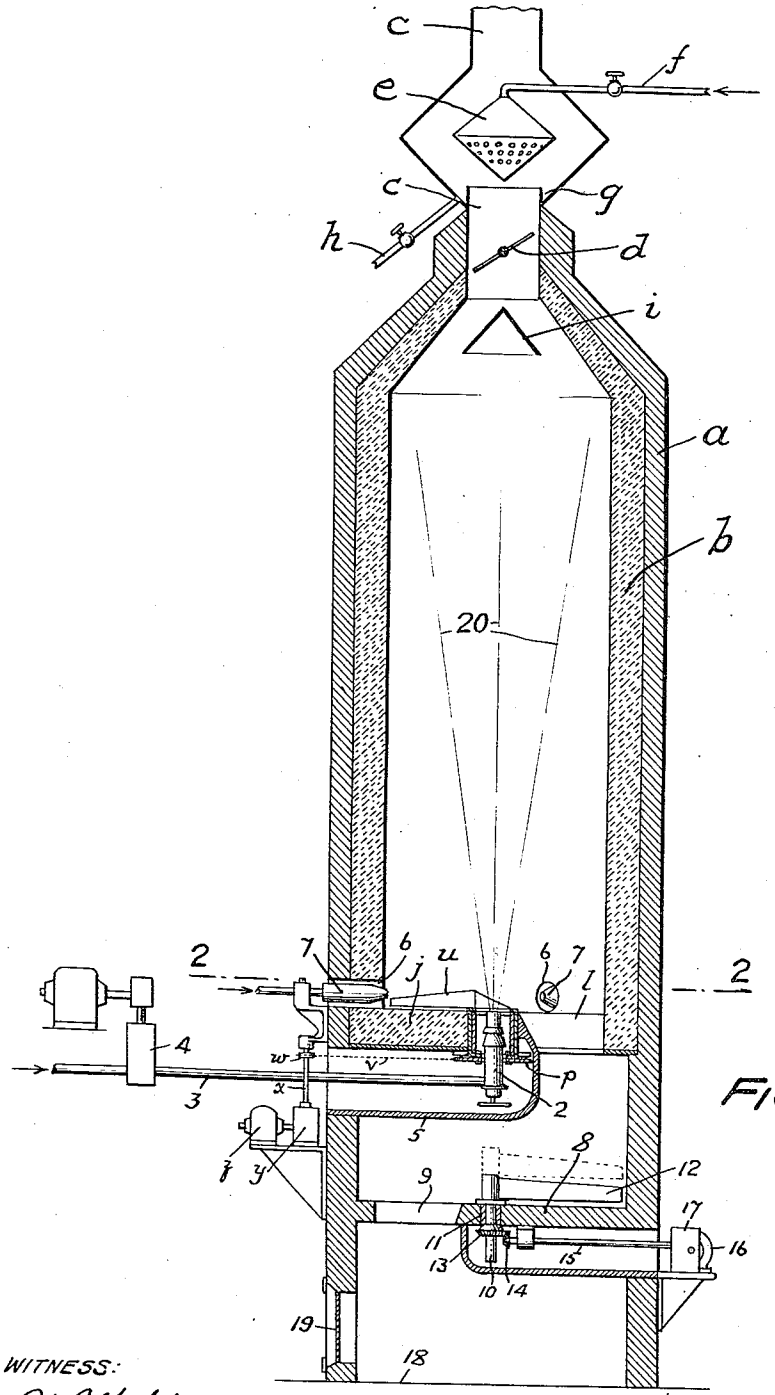


FIG. 1.

WITNESS:

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INCINERATOR

Filed Aug. 5, 1938 2 Sheets-Sheet 2

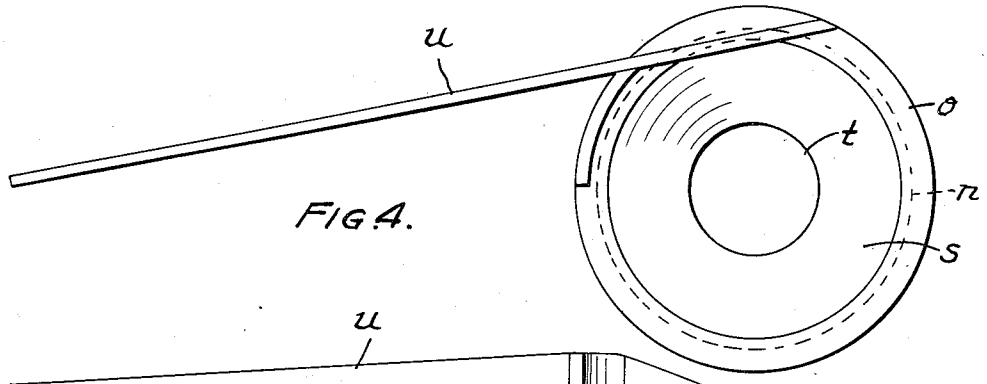


FIG. 4.

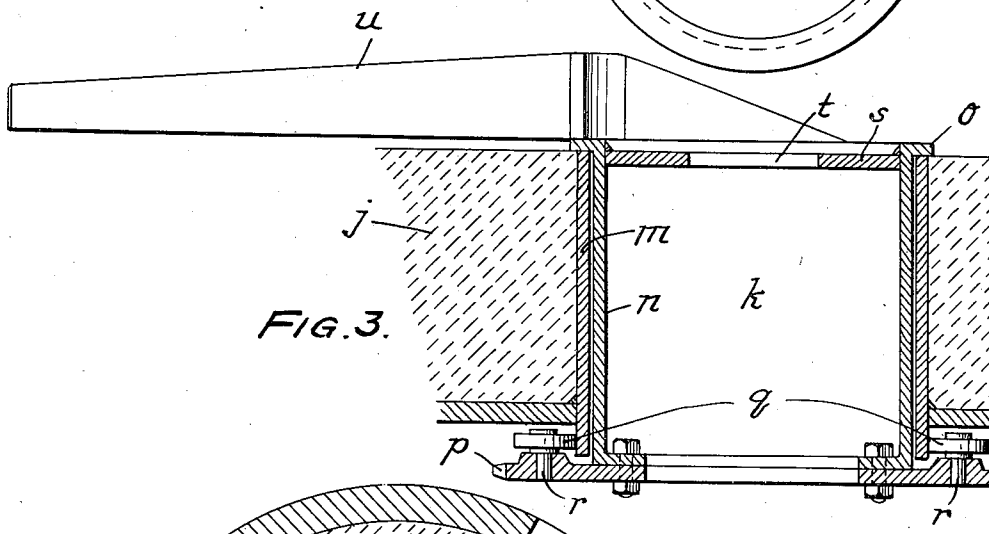


FIG. 3.

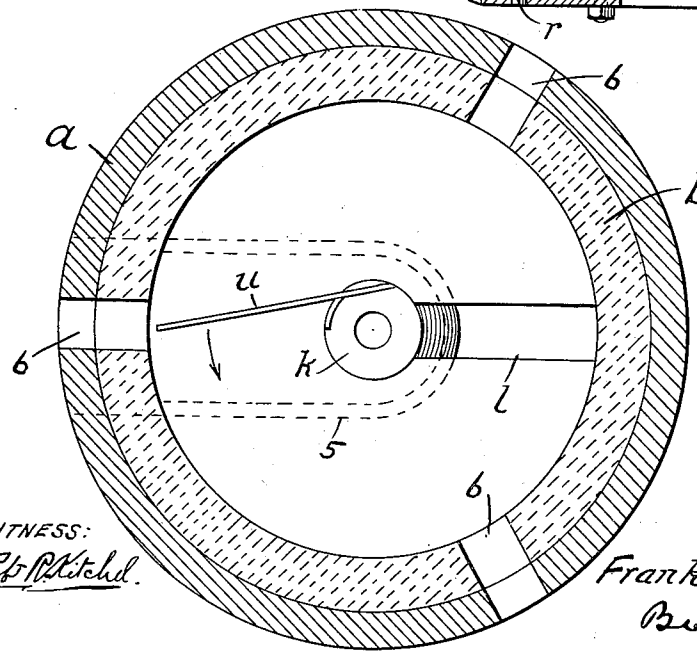


FIG. 2.

WITNESS:
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Patented May 20, 1941

2,242,653

UNITED STATES PATENT OFFICE

2,242,653

INCINERATOR

Frank R. Maxwell, Rose Valley, Pa., assignor to Sun Shipbuilding & Dry Dock Company, Chester, Pa., a corporation of Pennsylvania

Application August 5, 1938, Serial No. 223,182

10 Claims. (Cl. 110—7)

This invention relates to an incinerator for the burning of waste material. More particularly the incinerator according to this invention is adapted for the burning of waste material carrying substantial and even large amounts of water such, for example, as sewage sludge and the like.

The incinerator according to this invention is simple and economical in construction and, at the same time, has been found to be of high efficiency and economical of fuel.

In general the incinerator according to this invention involves a furnace body provided with a bottom inlet for waste material to be burned, inlets for fuel and means for the discharge of ash. More particularly, means are provided whereby combustion in ash discharged from the furnace body is permitted to become complete and the heat of the ash largely utilized in the furnace body.

Having now indicated, in a general way, the nature and purpose of this invention, I will proceed to a detailed description of a preferred embodiment thereof with reference to the accompanying drawings in which:

Figure 1 is a vertical sectional view of an incinerator embodying this invention.

Figure 2 is a cross-sectional view showing a detail of construction of the incinerator shown in Figure 1.

Figure 3 is a fragmentary sectional view showing a detail of construction of the ash removal means.

Figure 4 is a plan view of the ash removal means.

In the several figures *a* indicates a cylindrical shell, the interior of which is lined with refractory material *b*. The shell *a* forms a furnace and is contracted at its top and connected with a stack *c* provided with a damper *d*. Above the outlet from the shell the stack is enlarged and provided with a spray head *e* to which water is supplied through a valved pipe *f*. The water spray from head *e* serves to wash the smoke passing through the stack and the water is collected in a gutter *g* and carried off through a valved pipe *h*. Centered with the stack *c* and positioned within the contracted upper end of the shell *a* is a conical baffle *i* arranged with its open base downward.

The lower end of the furnace shell *a* is mounted on any suitable foundation and is provided with a hearth *j* having a central aperture *k* and a radial opening *l*. The central opening *k* is lined with a metal sleeve *m*, which extends below the underside of the hearth and within which is mounted a rotatable member *n* provided at its upper end with an annular flange *o*, adapted to rest on the upper end of the sleeve *m* for the support of member *n*. A sprocket p is secured on the lower end of member *n* and guide rollers *q*, mounted on vertical shafts *r* extending from sprocket *p* are arranged to bear on the outer surface of sleeve *m*. The upper end of member *n* is partially closed by a member *s* having a central aperture *t* and welded to the member *n* at its upper end. An arm *u* is secured to the flange *o* on member *n* and extends radially of the hearth *j*. A chain *v* engaged with sprocket *p* engages a sprocket *w* on a vertical shaft *x* mounted outside of the shell *a* and adapted to be driven by a motor *z* through a reduction gearing *y*.

Extending with member *n* is a nozzle **2**, the discharge end of which is about at the level of the surface of the hearth *j* and centered in the aperture. The nozzle **2** is adapted for the discharge into the furnace of waste, as sewage sludge, to be burned and is connected by means of a conduit **3** with the discharge of a pump **4**, the intake of which is connected with a supply of waste material. A shield **5** of metal or other suitable material is arranged with the hearth to enclose the member *n* and nozzle **2**. Equally spaced about the circumference of the shell *a* at about the level of the surface of the hearth *j* are a plurality of radial apertures **6** through which extend burners **7**, which may be oil, gas or other fuel burners.

Spaced below the hearth *j* is a second hearth **8**, provided with a radial opening **9** out of line with and preferably opposite to the radial opening *l* in hearth *j*. A shaft **10**, splined in a rotatable sleeve **11**, mounted in a suitable bearing centrally of the hearth **8**, extends above the hearth **8** and carries a radially extending arm **12**. The sleeve **11** carries a gear **13** in mesh with a gear **14** on a shaft **15**, adapted to be driven by a motor **16**, through a reduction gearing **17**. By virtue of the splined connection between shaft **10** and driven sleeve **11**, the shaft **10** may be raised or lowered to adjust the arm **12** with respect to the surface of hearth **8**.

Beneath the hearth **8** is an ash pit **18** provided with an ash removal door **19**.

In the operation of the incinerator, the construction of which is described above, the burners **7** are fired using, for example, oil as a fuel, and the interior of the shell *a* heated up to a relatively high temperature. Then waste matter to be incinerated, as, for example, sewage sludge containing a substantial amount of water, is in-

jected through nozzle 2 by the operation of pump 4 drawing from any suitable source of supply.

The waste material, as sewage sludge, is discharged from the nozzle 2 vertically upward within the shell in the form of a spray indicated by the lines 20, Figure 1. The baffle *i* prevents the passage of the spray into the stack *c*.

As the waste material, as sewage sludge, is sprayed upward in the furnace, it is heated and a substantial amount of the water is vaporized off before the spray reaches the top or contracted portion of the shell. The solid matter drops back downward within the shell toward the hearth *j* and is largely consumed by combustion. The ash largely consumed falls upon the surface of the hearth *j*.

The arm *u* is revolved over the surface of the hearth *j* by operation of the motor *z*, which serves to turn the member *n* to which the arm is secured, through the medium of shaft *x*, sprockets *w* and *p* and chain *v*. The arm *u* pushes the ash on the surface of hearth *j* to the radial opening *l*, through which the ash falls upon the hearth 8.

The arm 12, set at a distance above the surface of the hearth 8, is rotated by operation of the motor 16 and serves to carry the ash to the radial opening 9, through which it falls into the ash pit 18, from which it may readily be removed through the ash door 19.

The nozzle 2 and pipe 3, which serves to supply waste material to the nozzle, and the rotatable member *n* and its driving gear are protected from the heat of the ash passing through radial opening *l* and on hearth 8 by the shield 5.

It has been found that the ash falling upon the hearth *j* includes only partially combusted solid matter of the original waste material and the completion of the combustion of such material can be readily accomplished on the hearth 8 so that the ash passing from the hearth 8 through the radial opening 9 into the ash pit 18 will be, to all intents and purposes, completely burned out. The adjustabilty of the arm 12, operating with respect to the hearth 8, facilitates the complete combustion on the hearth 8 by spreading the ash dropping through the radial opening *l* in a bed of efficient thickness and which may be adjusted by adjustment of the shaft 10 vertically with respect to the driven sleeve 11.

In practice it has been found that the incinerator of this invention is highly efficient and economical in operation inasmuch as after it has been initially heated up and the combustion of waste material has gotten under way, the amount of fuel necessary to be supplied to the burners 7 is at a minimum, the combustion of solid material, in the case of sewage sludge, serving to supplement the fuel so as to maintain sufficient heat in the furnace to evaporate the water component of the waste material, such as sewage sludge.

The smoke passing from the incinerator through the stack *c* will be washed by the spray head *e*.

It is understood that this invention shall not be limited to the particular structure described in detail for illustrative purposes, it being contemplated that various modification may be made in detail without departing from the scope of the invention.

What I claim and desire to protect by Letters Patent is:

1. An incinerator comprising a vertically extending shell, a hearth having an opening therethrough positioned in the lower part of the shell, burners within the shell adjacent to the hearth, means for injecting material to be incinerated into the shell in the form of a spray in a direction vertical to the hearth, and means for discharging ash from the hearth through said opening therethrough.

2. An incinerator comprising a vertically extending cylindrical shell contracted at its top, a hearth having a radial opening therethrough positioned in the lower part of the shell, burners within the shell adjacent to the hearth and means positioned centrally of the hearth for injecting material to be incinerated into the shell in the form of a spray in a direction vertical to the hearth and radially extending rotary means for discharging ash from the hearth through the radial opening therethrough.

3. An incinerator comprising a vertically extending shell, a hearth having an opening therethrough but otherwise impervious positioned in the lower part of the shell, burners within the shell adjacent to the hearth, means for injecting material to be incinerated into the shell in the form of a spray in a direction vertical to the hearth and means rotatable in a plane parallel to that of the hearth surface and adapted to sweep the hearth and move ash thereon to the opennig therethrough.

4. An incinerator comprising a cylindrical shell contracted in its upper portion, a hearth having an opening therethrough in the lower portion of said shell, burners in said shell adjacent to said hearth, means extending through said hearth centrally and adapted for the discharge upwardly into said shell of material to be incinerated in a direction vertical to said hearth, a baffle positioned in the contracted portion of said shell in line with said means adapted for the discharge upwardly into said shell of material to be incinerated and adapted to divert downwardly material discharged into said shell and means for discharging ash from the hearth through said opening therethrough.

5. An incinerator comprising a cylindrical shell contracted in its upper portion, a hearth having a radial opening in the lower portion of said shell, burners in said shell adjacent to said hearth, means extending through said hearth centrally and adapted for the discharge upwardly into said shell of material to be incinerated in a direction vertical to said hearth and an arm rotatable with respect to the surface of said hearth and adapted to sweep ash on said hearth into said radial opening.

6. An incinerator comprising a cylindrical shell contracted in its upper portion, a hearth having a radial opening in the lower portion of said shell, burners in said shell adjacent to said hearth, means extending through said hearth centrally and adapted for the discharge upwardly into said shell of material to be incinerated in a direction vertical to said hearth, an arm rotatable with respect to the surface of said hearth and adapted to sweep ash on said hearth into said radial opening, a second hearth in said shell below said first mentioned hearth and adapted to receive ash passing through the radial opening in said first mentioned hearth, said second hearth having a radial opening and an arm rotatable with reference to the surface of said second hearth and adapted to sweep ash on said second hearth into the radial opening therein.

7. An incinerator comprising a cylindrical shell contracted in its upper portion, a hearth having a radial opening in the lower portion of said shell, burners in said shell adjacent to said hearth, means extending through said hearth centrally and adapted for the discharge upwardly into said shell of material to be incinerated in a direction vertical to said hearth, an arm rotatable with respect to the surface of said hearth and adapted to sweep ash on said hearth into said radial opening, a second hearth in said shell below said first mentioned hearth and adapted to receive ash passing through the radial opening in said first mentioned hearth, said second hearth having a radial opening and an arm rotatable with reference to the surface of said second hearth and adapted to sweep ash on said second hearth into the radial opening therein and means for adjusting said last mentioned arm vertically with respect to the surface of said second hearth.

8. An incinerator comprising a shell, a hearth having an opening therethrough in the lower portion of the shell, burners in said shell, means extending through the hearth for the discharge upwardly into said shell of material to be incinerated in a direction vertical to said hearth and an arm rotatable in a plane parallel to that of the hearth surface and adapted to sweep ash on said hearth into said opening therethrough.

9. An incinerator comprising a vertically extending shell contracted in its upper portion, a stack leading from the contracted upper portion and having an enlarged portion adjacent to its point of connection with the shell, a hearth having an opening therethrough positioned in the lower part of the shell, burners within the shell adjacent to the hearth, means for injecting material to be incinerated into the shell in a direction vertical to the hearth, means for discharging ash from the hearth through said opening therethrough and a baffle positioned in the contracted upper portion of the shell in line with the path of travel of material to be incinerated injected into the shell.

10. An incinerator comprising a vertically extending shell contracted in its upper portion, a stack leading from the contracted upper portion and having an enlarged portion adjacent to its point of connection with the shell, a hearth having an opening therethrough positioned in the lower part of the shell, burners within the shell adjacent to the hearth, means for injecting material to be incinerated into the shell in a direction vertical to the hearth, means for discharging ash from the hearth through said opening therethrough, a baffle positioned in said contracted upper portion of the shell in line with the path of travel of material to be incinerated injected into the shell and a spray head positioned in the enlarged portion of the stack.

FRANK R. MAXWELL.