United States Patent [19]

Bolle

[11] **3,882,801**

[45] **May 13, 1975**

[54] **INCINERATOR FOR DOMESTIC AND INDUSTRIAL SOLID, SEMI-LIQUID OR LIQUID WASTE**

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[22] Filed: **Nov. 16, 1973**

[21] Appl. No.: **416,645**

[52] **U.S. Cl.** **110/14;** 432/119; 110/19

[51] **Int. Cl.** **F23g 5/06**

[58] **Field of Search** 110/14, 15, 19; 432/119

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[57] **ABSTRACT**

The present invention relates to incinerators for domestic and industrial waste of the type comprising, on a frame which may be constructed so as to eventually receive a set of wheels and thus be made movable, a rotary oven in the shape of a truncated cone, fixed precombustion and/or post-combustion chambers being provided at the ends of said oven, the waste being introduced into one of said chambers by means of a loader or feeder, said chambers being connected to a decanting cyclone by means of a gas exhaust pipe, the rotary chamber of the oven being rotatably driven continuously or intermittently through mechanical means.

5 Claims, 10 Drawing Figures

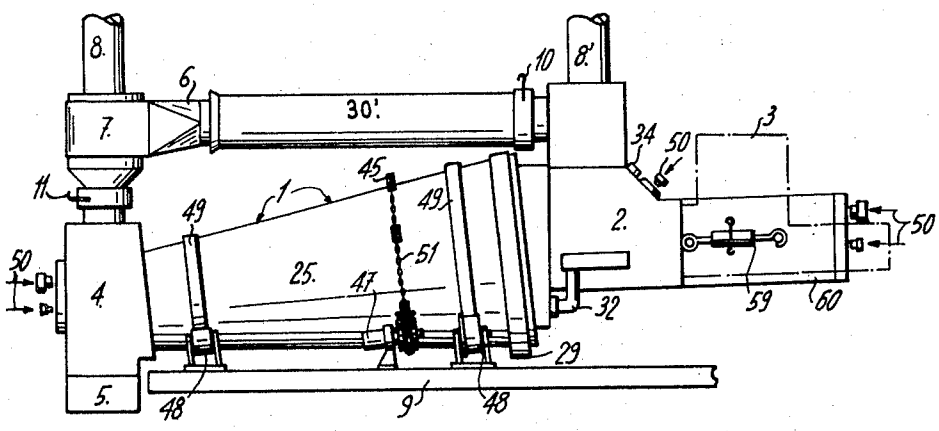


FIG. 1

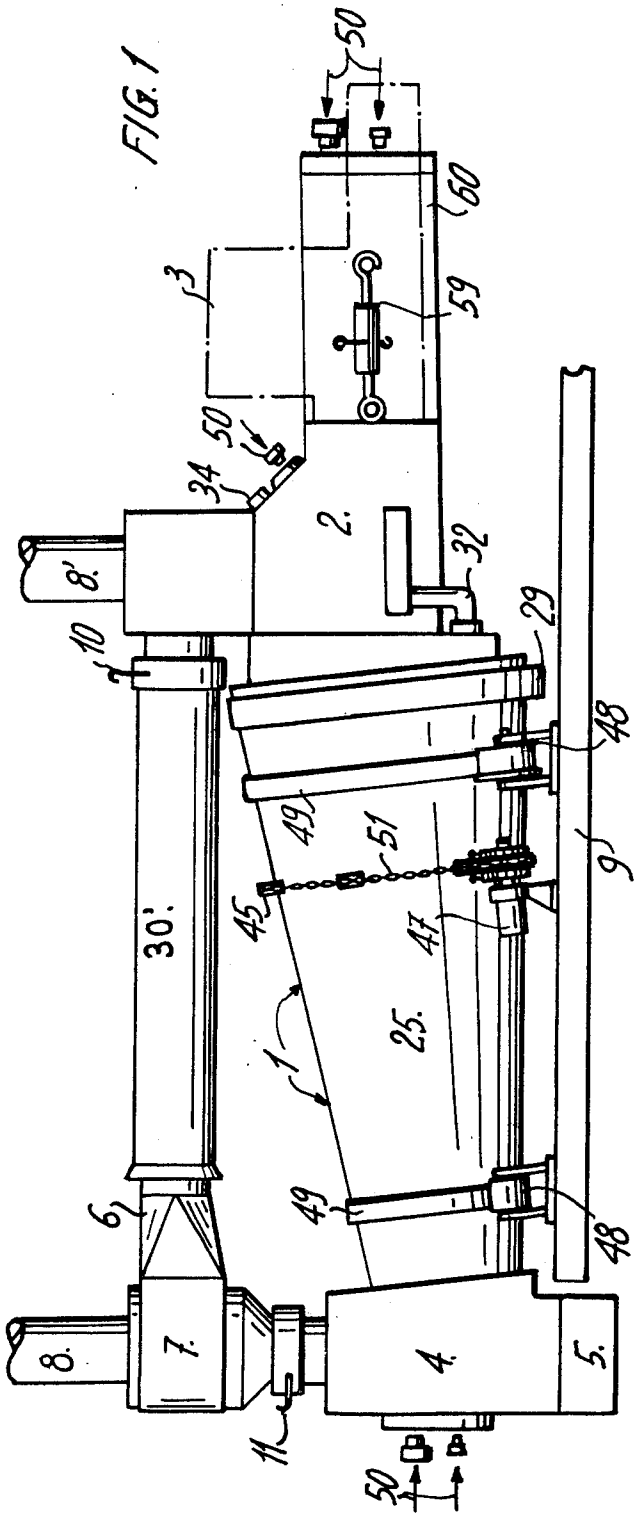
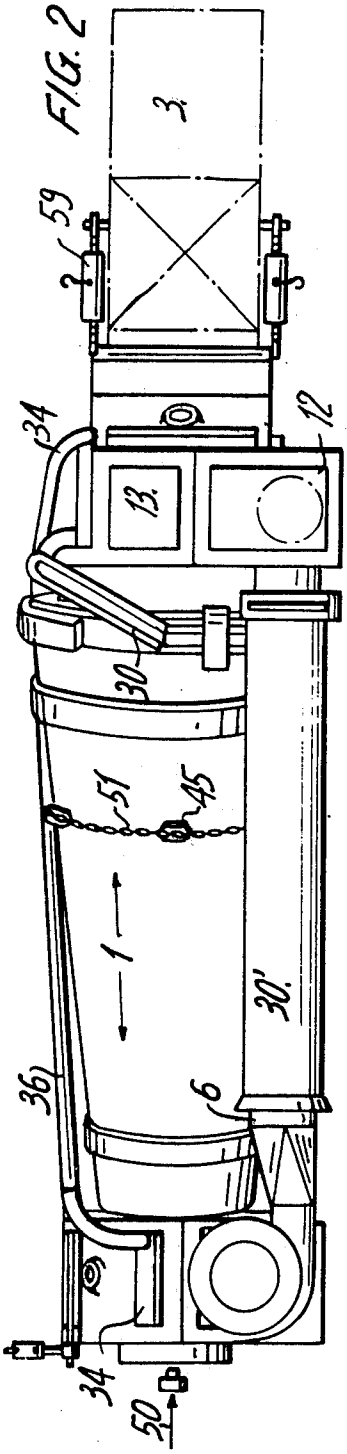

50
60
59
3
34
2.
32
8'
10
29
48
49
51
45
47
9
25.
1
30'
6
7.
8.
4.
5.
11

FIG. 2


3
59
34
12
13.
30
51
45
1
30'
36
6
34
50

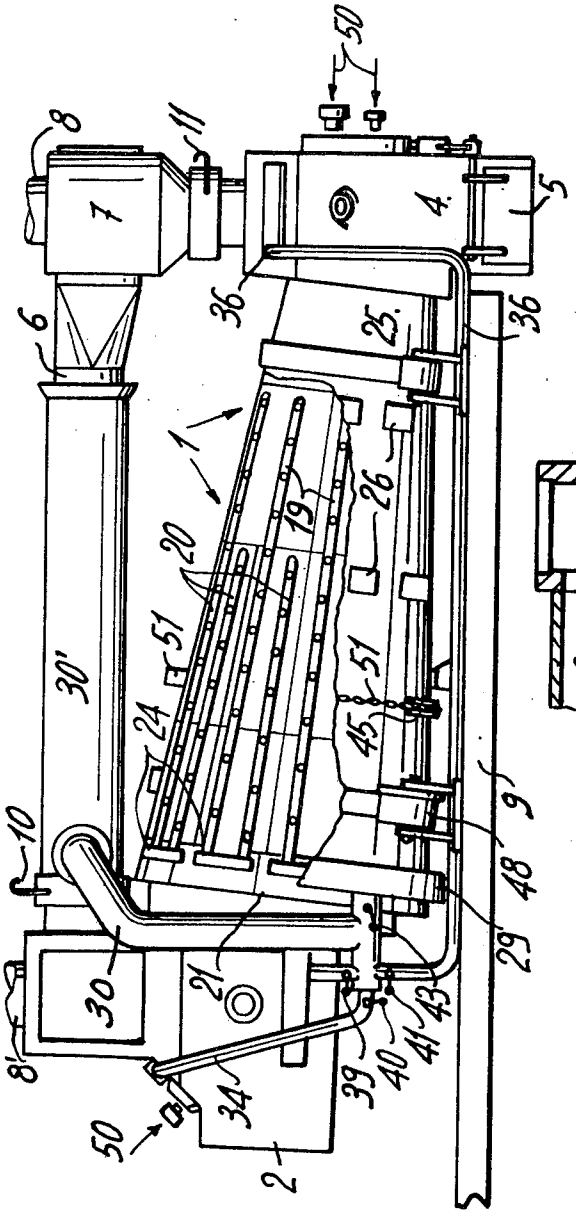


FIG. 3

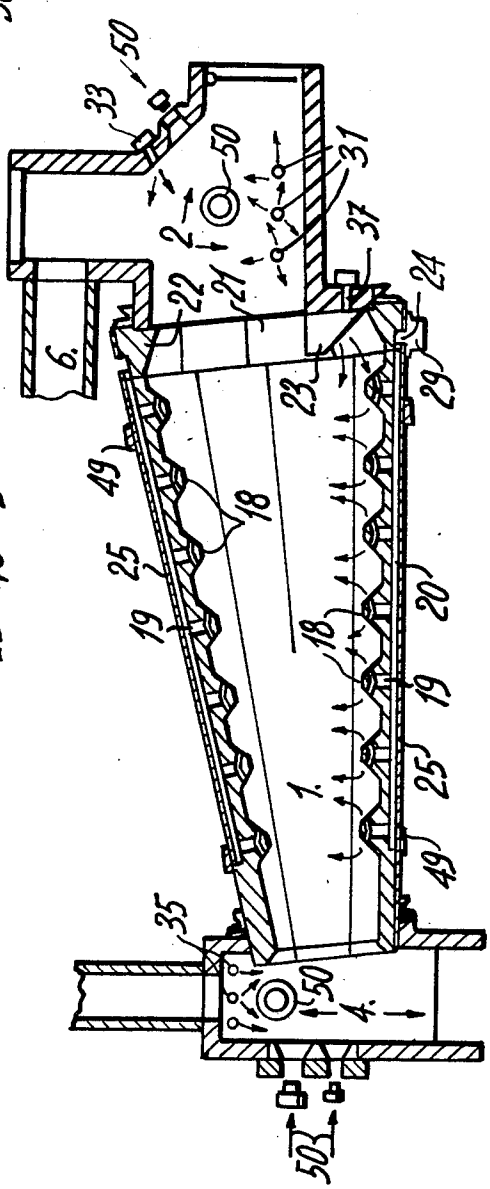


FIG. 4

FIG. 5

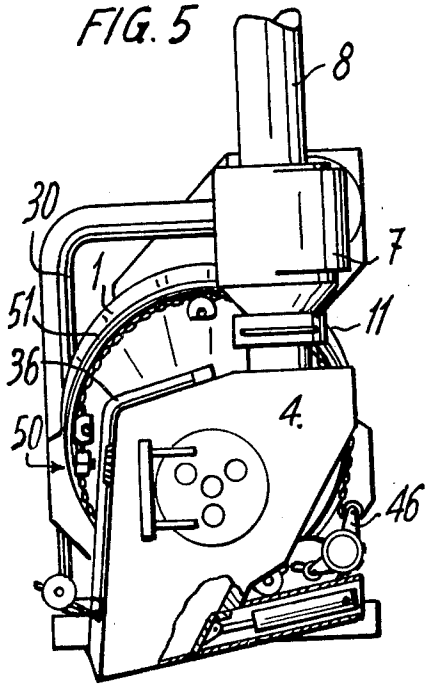


FIG. 6

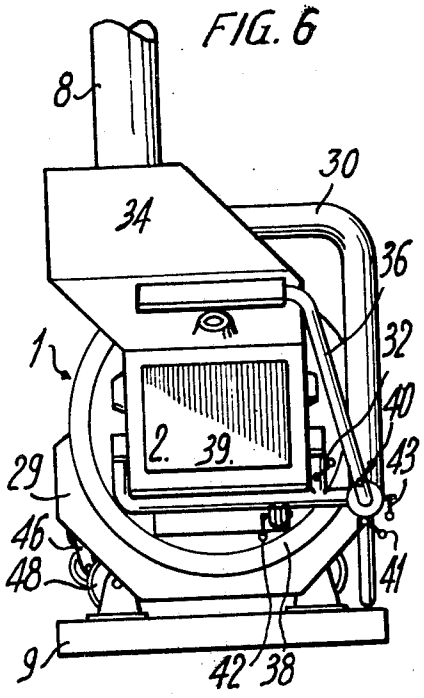


FIG. 7

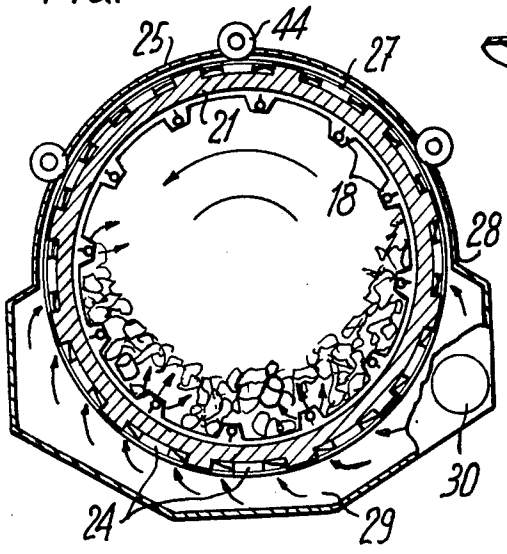
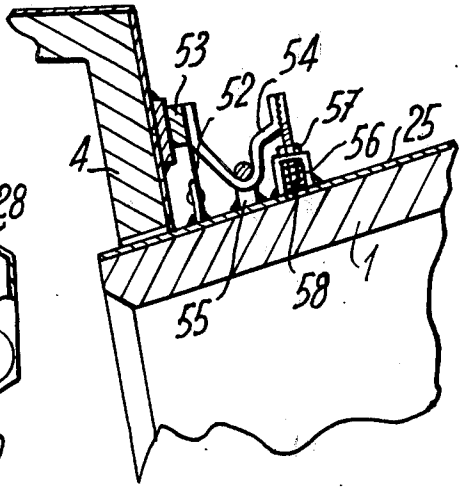


FIG. 10



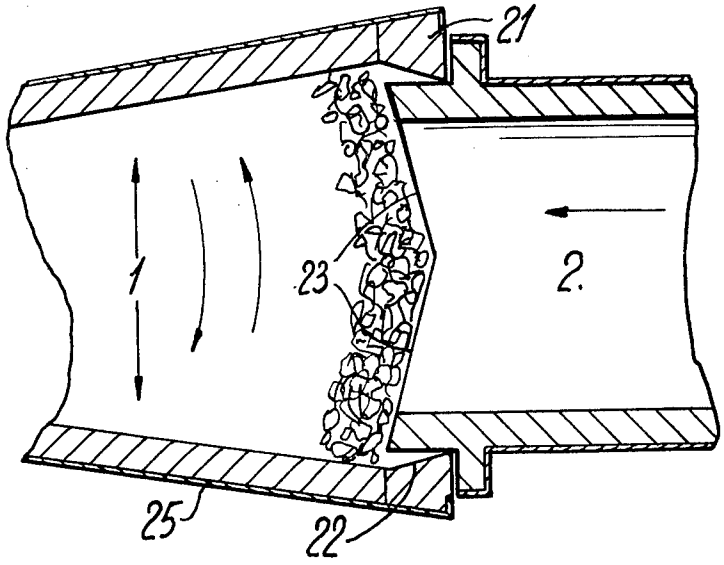
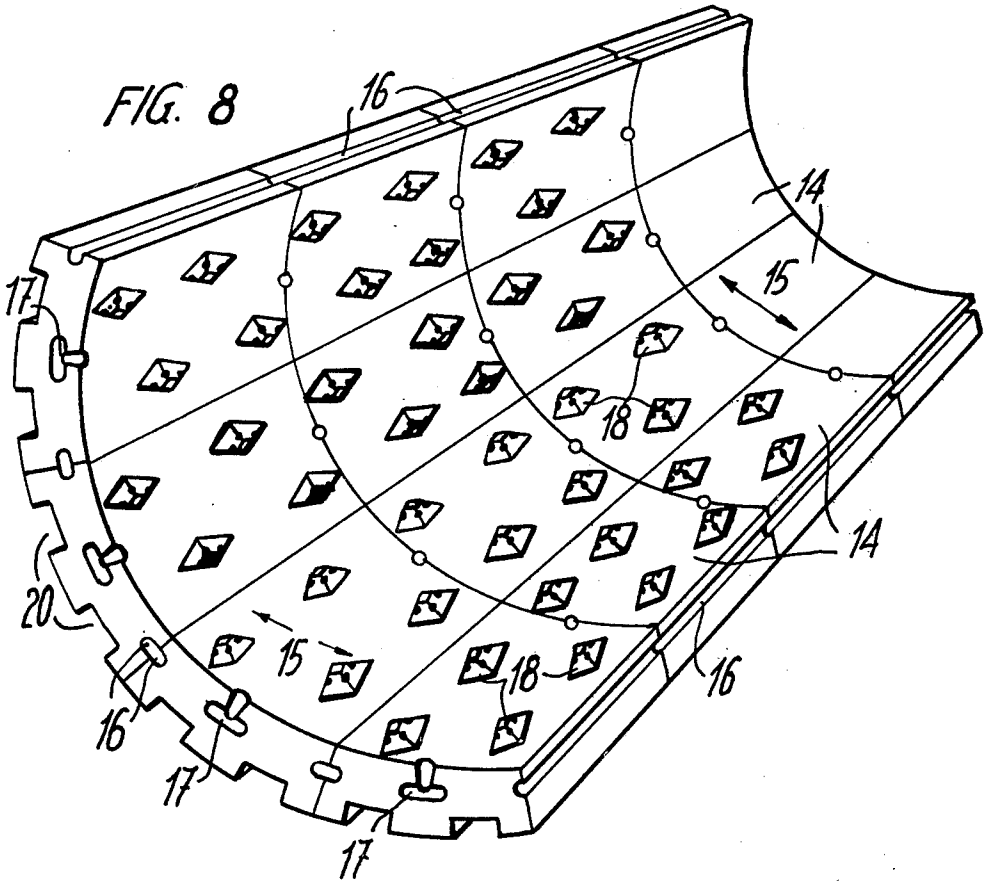


FIG. 9

FIG. 8



INCINERATOR FOR DOMESTIC AND INDUSTRIAL SOLID, SEMI-LIQUID OR LIQUID WASTE

The incinerator according to the invention is characterized by the fact that each fixed chamber provided at each end of the rotary chamber of the oven may be cut off from the gas exhaust pipe by means of a register or gate so as to direct the burnt gases against the flow of waste into the front stationary chamber in which waste is inserted for pre-combustion of readily inflammable waste and post-combustion of gases, or else so as to direct the gases in the direction of the flow of the waste in the oven, to the rear stationary chamber for post-combustion of the less inflammable waste and gases.

The incinerator in question is also characterized by the fact that apertures opening in each chamber of the oven are susceptible of being totally or partially closed to assure the controlled introduction of the combustion air, and in that the two stationary chambers on each side of the rotary chamber of the oven are equipped with burners and/or injectors to permit the incineration of all waste, readily or not readily inflammable solid, semi-liquid or liquid, or of neutralizing solutions. The apertures are made in such a manner that the combustion air, penetrating in the middle of the waste, is either forced in to accelerate the combustion of the waste and gases emanating therefrom, or else it is completely or partially stopped to slow down the combustion.

The rotary oven/chamber in the shape of a truncated cone, which is composed of a wall of concrete or any other refractory material encircled by a sheet metal ferrule or sleeve, is characterized in that the refractory truncated-cone wall is composed of prefabricated sector-shaped elements assembled side by side to provide truncate-conical rings which are joined end to end. The component elements of the rings and the rings themselves are interlocked by means of joints which are cast, after the assembling, into grooves cut in the edges of the sector-shaped parts and of the rings, the rectilinear joints connecting the sectors being continuous over the whole length of the rotary chamber, while the circular joints assembling the rings are interrupted at regular intervals.

Another characteristic of the rotary oven chamber resides in the fact that the insertion of the combustion air is effected through apertures cut in multiple projecting nozzles which are pyramid-shaped and molded integral with the prefabricated elements composing the rotary chamber, said nozzles being distributed on the inside wall to stir up the waste during its progression in the course of the incineration, said apertures originating from a central hole crossing the refractory wall at right angles with each nozzle and opening into transverse grooves cut around a ring coupled to the rotary chamber on the side of its large base, said grooves each connecting two longitudinal channels.

The distribution of the combustion air into the rotary chamber is effected through windows provided in the ferrule or sleeve encircling said rotary chamber and capable of being partially obturated during the rotation of the chamber by a fixed sheet-metal belt including an extension in the form of a hood into which a blower discharges air, in such a manner that the combustion air is distributed only by the nozzles located at the level of the waste during the rotation of the oven.

Other details shall be brought out during the following description, with reference to the attached drawings, in which:

FIG. 1 is an elevational view of the incinerator according to the invention.

FIG. 2 is a top plan view of the incinerator shown in FIG. 1.

FIG. 3 is an elevational view of the incinerator in which the sleeve of the rotary chamber has been partially broken away.

FIG. 4 is a longitudinal sectional view of the incinerator.

FIG. 5 is an end view, from the front of the incinerator.

FIG. 6 is an end view, from the rear of the incinerator.

FIG. 7 is a transverse sectional view of the rotary chamber of the incinerator at right angles with its larger end.

FIG. 8 is a perspective detail view showing the construction of the rotary chamber of the oven.

FIG. 9 is a sectional view showing a detail of the coupling of the rotary chamber and of the front stationary chamber of the oven.

FIG. 10 shows a detail view of the joint which assures the tightness between the stationary chambers and the rotary oven chamber.

In the drawings, particularly in FIGS. 1 to 4, the incinerator in question comprises a rotary chamber 1 in the shape of a truncated cone, communicating with a stationary precombustion and/or postcombustion chamber 2 in which the waste is inserted by means of a loader 3. At the other end, rotary chamber 1 communicates with a second stationary post-combustion chamber 4, equipped with an ash-pan 5.

The two stationary chambers 2 and 4 which surround the rotary combustion and reaction chamber 1 are connected by a duct 6 for exhaust of the burned gases, provided at the upper portion and opening into an exhaust cyclone 7 connected with a chimney 8.

This oven unit is supported by a frame 9 which may be consturcted so as to receive a set of wheels, if need be, thus making the incinerator movable.

Duct 6 connecting oven chambers 2 and 4 includes dampers 10 and 11, located respectively at the outlet of pre-combustion and/or postcombustion chamber 2, and at the outlet of post-combustion chamber 4 respectively. Thus, it is easy to understand that by closing damper 10 and opening damper 11, the burned gases are directed with the flow in the direction of movement of the waste traveling through rotary chamber 1 from chamber 2 to chamber 4. On the contrary, by opening damper 10 and closing damper 11, the gases are directed against the flow of movement of the waste. This double operation with and against the flow of the waste permits the incineration of all waste, solid, semi-liquid or liquid, readily or not readily inflammable and neutralizing solutions. If necessary, a second chimney 8' may be adapted on stationary pre-combustion and/or post-combustion chamber 2, which is provided with an opening normally closed by a removable cover 12, while another opening also closed by a removable cover 13 may permit, if need be, loading of waste by gravity directly into said chamber 2.

Rotary oven chamber 1 is composed of a truncated-conical wall made of concrete or any other refractory material, formed of a plurality of rings 14 providing

sectors **15** which are coupled to one another along their sides and ends, as shown in FIG. **8**, by means of joints cast, after assembly, into grooves **16** cut in rectilinear lines in the edges of the sectors. Rings **14** are then interlocked by means of split joints cast into grooves **17** cut in circular lines in the edges of sectors **15**. All of the above mentioned component elements are prefabricated, and they are easily interchangeable in case of damaged oven elements.

For injection of the combustion air into rotary chamber **1**, the inside wall in equipped with numerous nozzles **18**, pyramidal in shape, which are molded integral with sectors **15**, their number decreasing substantially toward the small end Of the rotary chamber. These nozzles which project into the oven contribute to the stirring up of the waste during its progression through the chamber. They are provided with an air inlet channel **19** which is divided into several holes opening around the top of each nozzle, to assure an efficient diffusion of the combustion air in the middle of the waste. These air inlet holes which pass through the refractory wall of rotary chamber **1** come out on the outside wall, opposite nozzles **18**, into longitudinal channels **20** formed in the rotary chamber along its outer surface (FIGS. **3** and **8**) and extending alternately over all or a portion of its length.

On the side of its larger end as shown in FIG. **9**, rotary chamber **1** comprises a narrow ring **21** interlocked by means of cast joints and forming a rim **22** sloped toward the inside which restricts the opening of the rotary chamber and is intended to retain mud and liquid waste so that they do not penetrate between the joined sides of rotary chamber **1** and of stationary chamber **2**. Said chamber also comprises projecting V-shaped ramps which extend partially into rotary chamber **1** at right angles relative to the horizontal portion in which the waste is located to assure its discharge and protect the joint.

As shown in FIG. **3** the periphery of the narrower end of ring **21** includes interrupted grooves **24** cut perpendicularly to the longitudinal channels **20** of rotary chamber **1**, with which they communicate and couple in pairs.

Rotary chamber **1** thus constructed is encircled by a sheet-metal ferrule or sleeve **25** which is integral therewith and which comprises on its periphery several windows, **1** not shown, which are closed by sliding shutters **26** for the inspection and ash-removal of air channels **20**. At right angles to the end ring **21**, sleeve **25** is cut out, at regular intervals corresponding to grooves **24** provided in said ring, with apertures **27** at right angles to which the sleeve or ferrule is encircled by a fixed belt **28** made of sheet-metal and forming, only on one portion of its periphery, an air inlet hood **29** in such a manner that only nozzles **18** in contact with the waste are fed with combustion air through channels **20** (FIG. **7**). Rollers **44** are mounted on eccentric shafts between fixed belt **28** and rotary sleeve **25** to maintain the necessary and adjustable distance between them so as to alleviate the entrance of additional air and prevent any friction. Hood **29** is fed with combustion air by means of a duct **30** originating from a pipe **30'** arranged coaxially to burned gas exhaust duct **6** so as to warm up the combustion air sent to the various chambers of the oven (FIGS. **3** and **6**).

Apertures **31** connected to air intake duct **30** by a tube **32** open into the stationary pre-combustion and/or post-combustion chamber **2** at its base. Apertures **33** connected to air intake **30** by another tube **34** (FIGS. **3** and **4**) also open into the upper part of chamber **2**.

Apertures **35** connected to combustion air intake **30** by a tube **36** (FIGS. **3** and **4**) also open into stationary chamber **4**.

Finally, apertures **37** connected to air intake **30** by a tube **38** (FIGS. **4** and **6**) open into rotary chamber **1**, particularly at its entrance.

The introduction of combustion air into the various chambers of the oven is controlled by valves which cut off the tubes from the air intake **30**. Thus a valve **39**, on tube **32**, controls the entrance of the air, through apertures **31**, into stationary chamber **2**. A valve **40**, on tube **34**, controls the entrance of air through apertures **33** into chamber **2**. A valve **41**, on tube **36**, controls the entrance of air through apertures **35** into stationary chamber **4**. A valve **42** (FIG. **6**) on tube **38**, controls the entrance of air through apertures **37** into rotary chamber **1**. Finally, a valve **43**, on air intake **30**, controls the entrance of air into hood **29** which feeds channels **20** and consequently nozzles **18** of rotary chamber **1**.

Stationary pre-combustion and/or post-combustion chambers **2** and **4** are each equipped with burners and/or injectors to turn on the oven and to incinerate readily inflammable waste.

Continuous or intermittent rotation of the combustion and reaction chamber **1** is effected by a link chain **51** encircling the oven and supported on sprockets **45**, passing over a rocking stop element **46** surrounding the pinion engaged with the chain and driven by a motor **47** (FIGS. **1** and **5**). This arrangement avoids slippage, as may occur in friction driving devices. It also avoids the mechanical stress of gear driving means. The stability and seating of the rotary chamber **1** during its rotation are assured by rollers **48** affixed to frame **9**, on which rest two roller paths **49** integral with sleeve **25** (FIGS. **1** and **6**).

The joints which assure tightness between rotary chamber **1** and stationary chamber **2** and **4** are each composed of a steel strip **52** affixed around sleeve **25** by means of a crown and rotating with same. The steel strip is maintained under pressure against a circular shoe **53** integral with the stationary chamber, by means of V-shaped levers **54** held by hooks **55** integral with sleeve **25** to which they are hinged. The pressure of each lever **54** against steel strip **52** and against shoe **53** is assured by a spring **56** acting against a nut **57** screwed on a threaded rod **58** integral with the end of lever **54** which is opposite the end pressing against the steel strip **52**. Nut **57** permits regulating the pressure of spring **56** and removal of lever **54** from its hook **55** (FIG. **10**) to disassemble the device.

The waste loading device **3**, whether utilizing screws, plungers or any other system, is affixed by means of screw jacks **59** hinged on both sides of chamber **2** and fastened on each side of the loader, which enables it to be removable and replaced easily, for example, for eventual substitution by an additional chamber **60** equipped with burners and/or injectors **50**.

I claim:

1. An incinerator for domestic and industrial waste comprising, a frame, a rotary oven mounted on said frame, said oven being in the shape of a truncated cone, means for rotating said oven, a stationary pre-combustion chamber connected to one end of said

oven and communicating therewith, a stationary post-combustion chamber connected to the other end of said oven and communicating therewith, burners associated with each of said chambers, said precombustion chamber receiving said waste to be incinerated, an exhaust cyclone, gas exhaust ducts connecting each of said chambers to said cyclone, a damper isolating each of said chambers from the gas exhaust ducts and said cyclone whereby the burned gases may be directed against the direction of flow of waste or with the direction of flow of waste in the oven by the selective closing of one damper and the opening of the other damper or vice versa.

2. An incinerator according to claim **1** including a set of wheels mounted on said frame to provide a mobile incinerator.

3. An incinerator for domestic and industrial waste comprising a rotary oven of generally tubular truncated conical shape and open at both ends, a stationary pre-combustion chamber connected to one end of said oven, a stationary postcombustion chamber connected to the other end of said oven, burners associated with each of said chambers, each of said chambers communicating with said oven and having a plurality of apertures therein, said oven having a plurality of apertures through its sidewall, a sleeve surrounding and spaced from the outer periphery of said oven in the area containing said openings to provide a circumferential chamber with which said openings communicate, ducts connecting the openings in said pre-combustion and post-combustion chambers with said circumferential chamber, valve means connected to said ducts for controling the introduction of combustion gases into said oven through said circumferential chamber in such a manner that the combustion gas penetrating into the waste in the oven is either blown in to accelerate the combustion of the waste and gases emanating therefrom, or it is completely or partially stopped to slow down the combustion of said waste.

4. An incinerator for domestic and industrial waste including a rotary oven of generally tubular truncated conical shape comprising a wall of refractory material, a sheet-metal sleeve surrounding said wall and spaced therefrom, means driving said oven in continuous or alternating rotation, said wall of refractory material including a plurality of sector shaped elements assembled side by side so as to form truncated-conical rings, each of said elements having grooves in the end and side edges thereof which are aligned with related grooves in adjacent elements when said elements are assembled and connecting means cast in said grooves to interlock said elements and rings.

5. An incinerator for domestic and industrial waste comprising a rotary oven between a stationary pre-combustion chamber and a stationary post-combustion chamber and communicating with each of said chambers, the waste being loaded into said pre-combustion chambers, a removable waste loading device, means attaching said loading device to said last mentioned chamber, said means comprising screw jacks hinged on opposite sides of said chamber and connected to related sides of said loading device.

* * * * *