

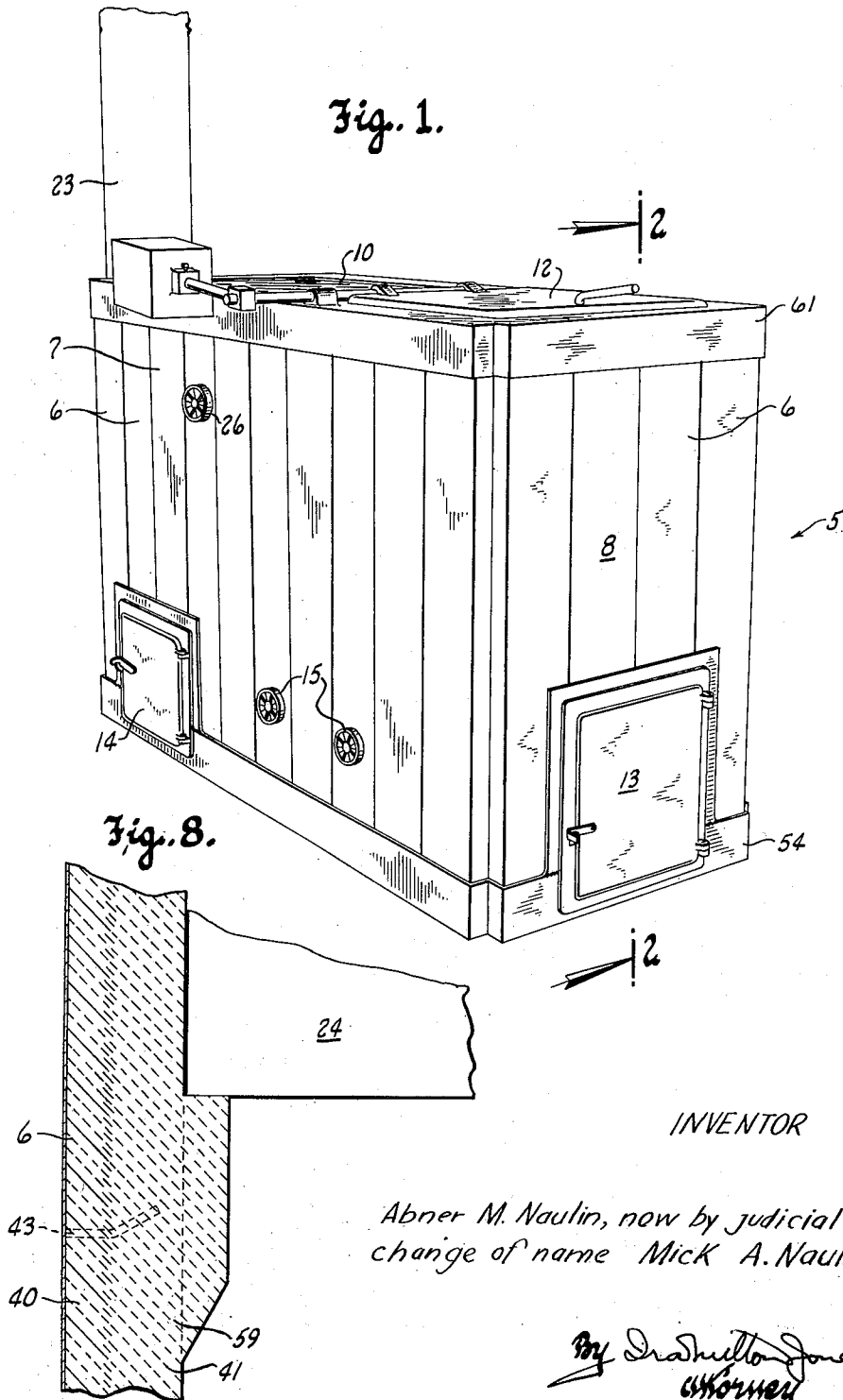
Sept. 10, 1957

A. M. NAULIN, NOW BY JUDICIAL
CHANGE OF NAME MICK A. NAULIN
INCINERATOR WALL CONSTRUCTION

2,805,633

Filed Nov. 27, 1953

6 Sheets-Sheet 1



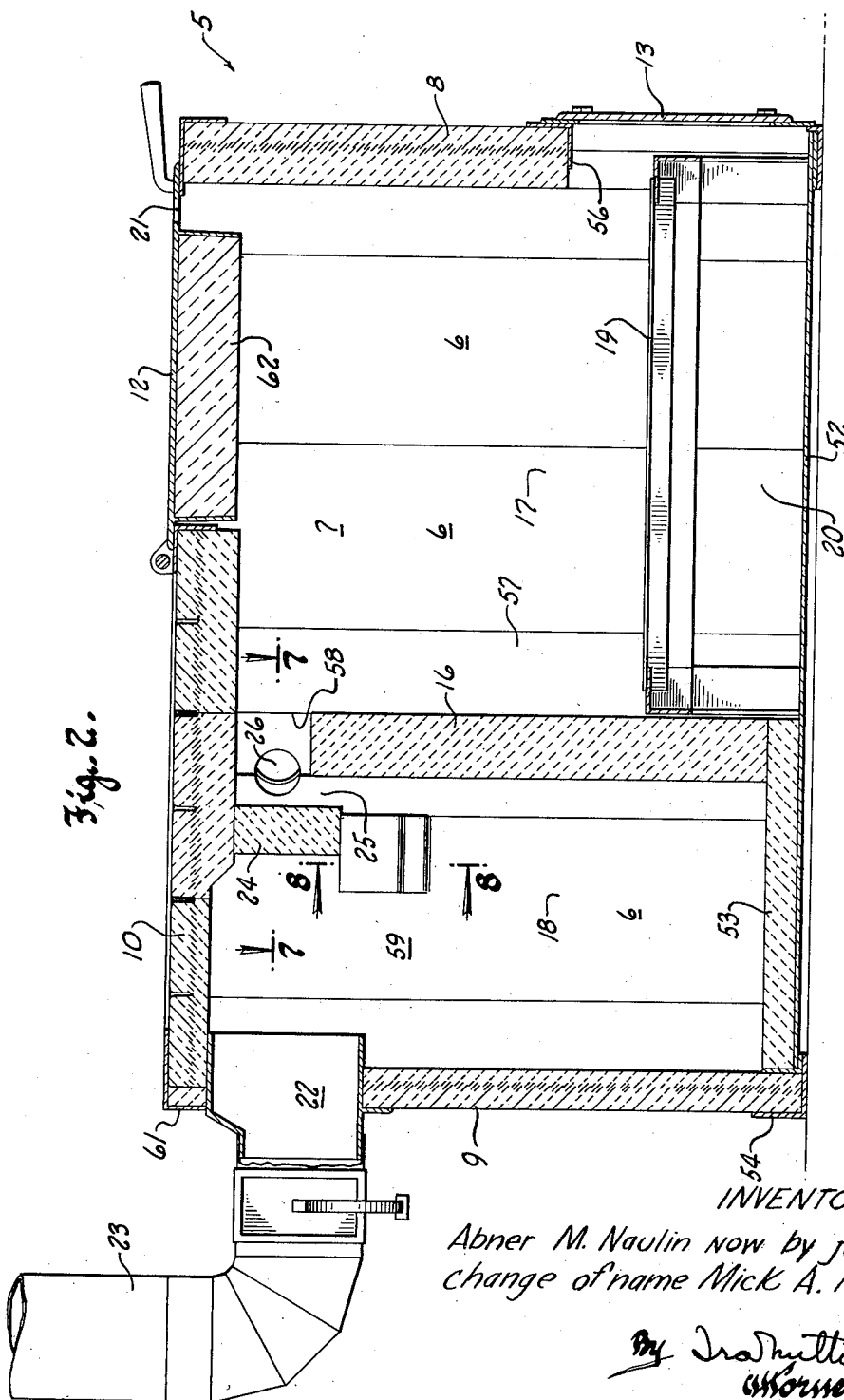
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6 Sheets-Sheet 2



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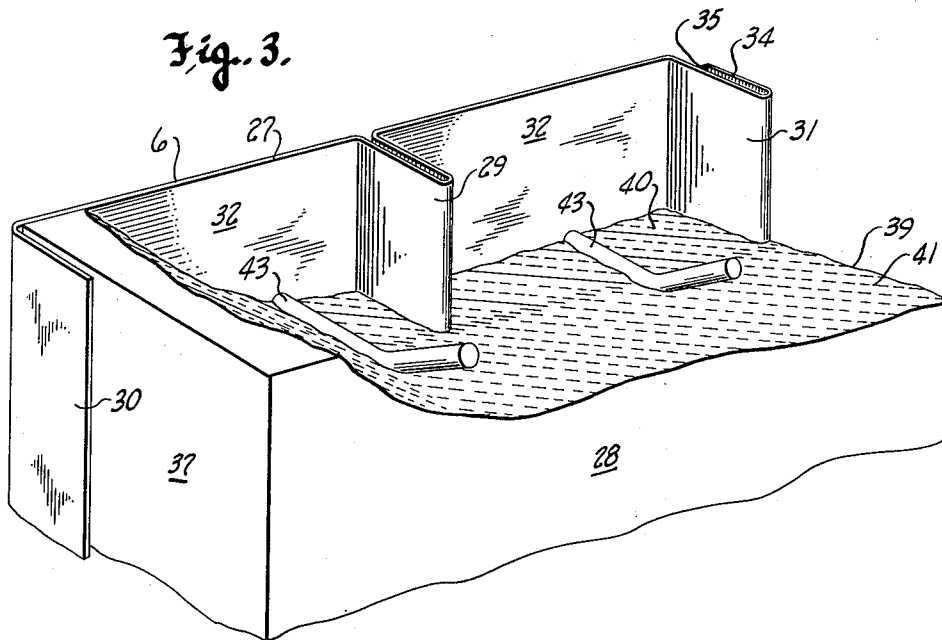
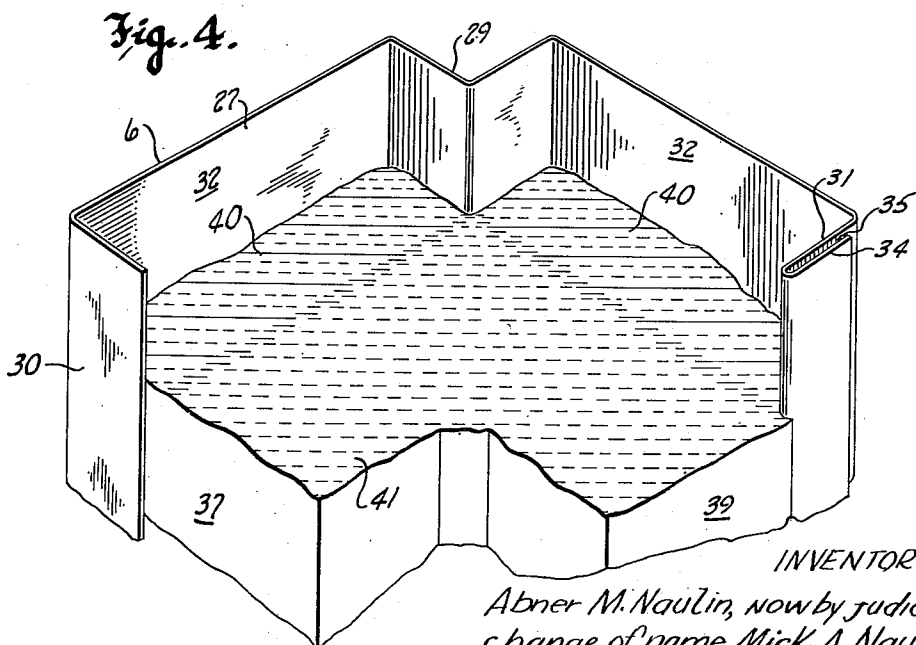
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6 Sheets-Sheet 3



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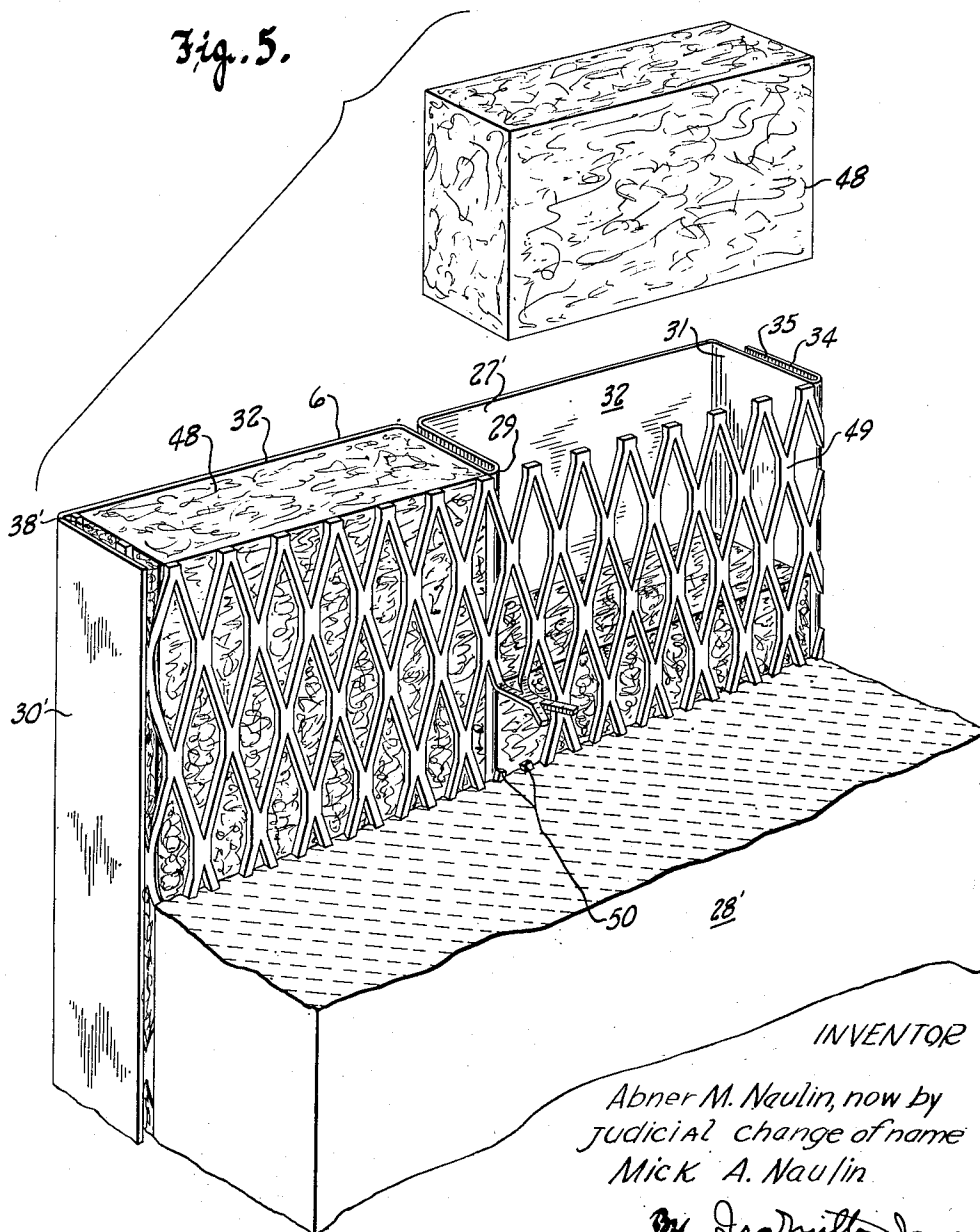
A. M. NAULIN, NOW BY JUDICIAL
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6 Sheets-Sheet 4

Fig. 5.



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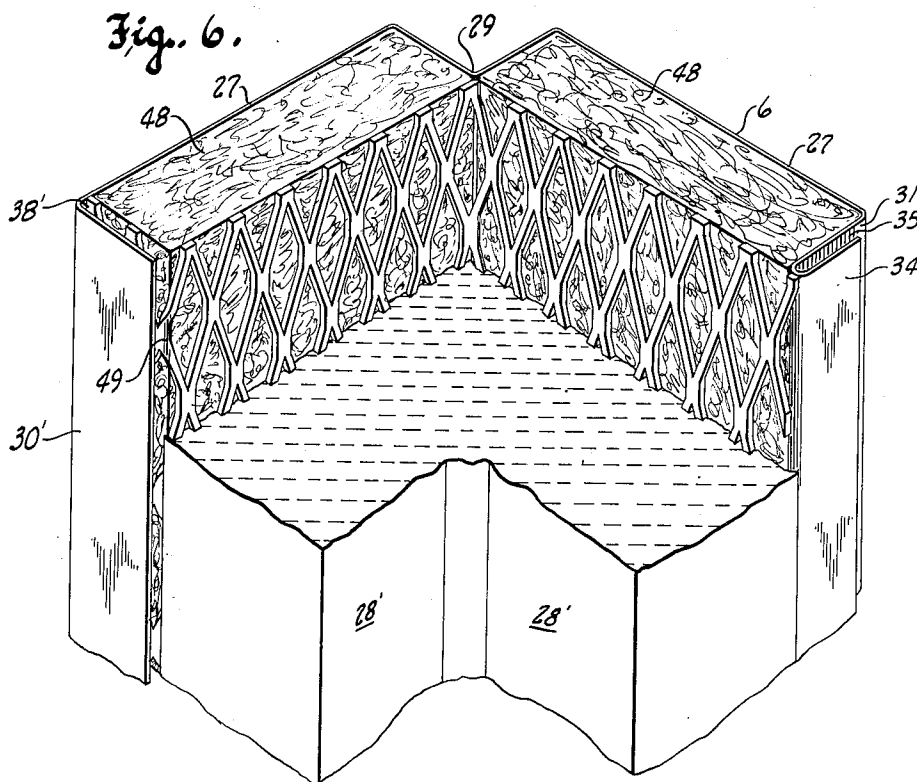
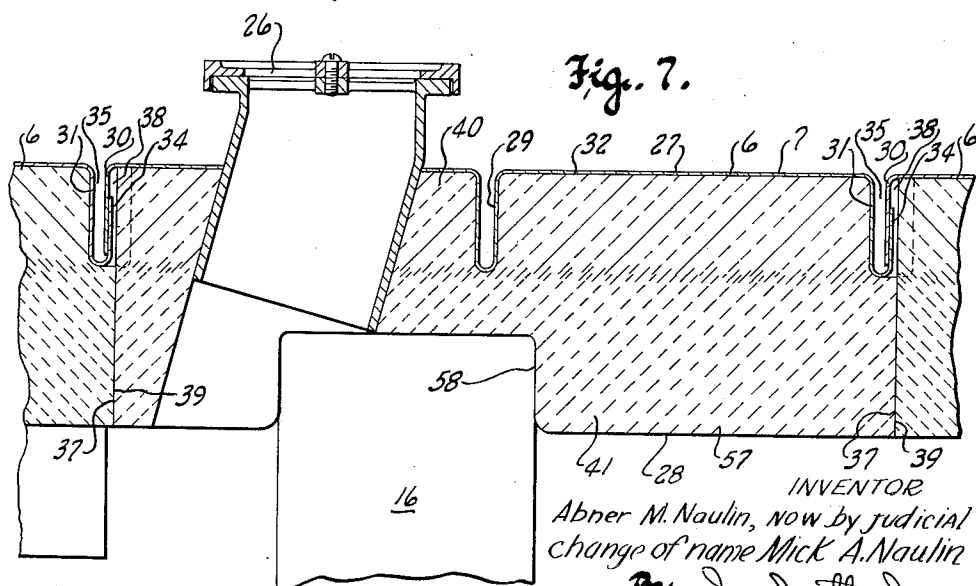
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6 Sheets-Sheet 5



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Fig. 9.

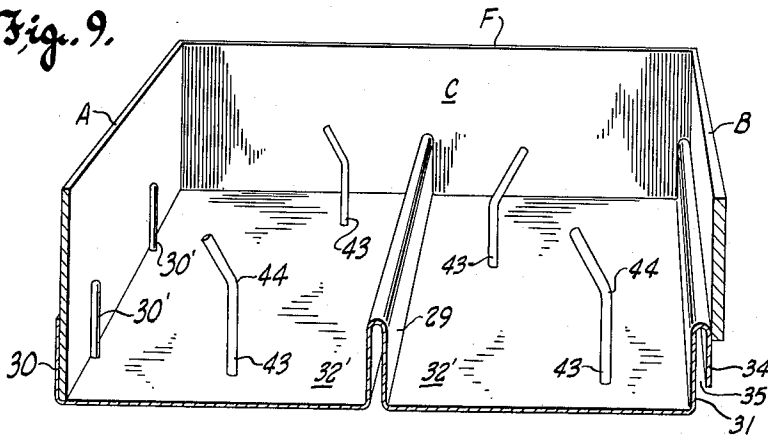


Fig. 10.

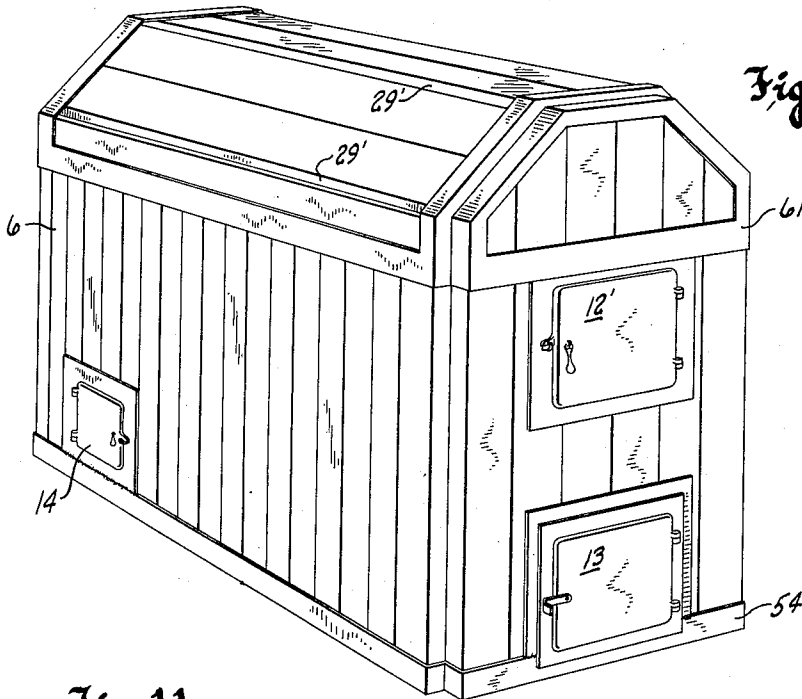
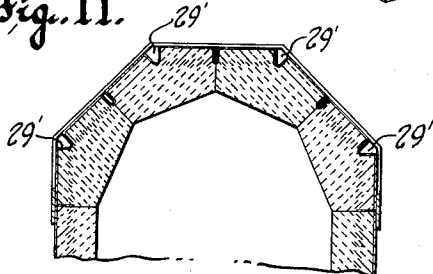


Fig. 11.



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INCINERATOR WALL CONSTRUCTION

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Application November 27, 1953, Serial No. 394,608

6 Claims. (Cl. 110—1)

This invention relates to incinerators and similar combustion equipment, and has as its general purpose to provide an incinerator or the like which may be assembled from prefabricated parts.

Heretofore incinerators have been of two general types. One type was manufactured as a unit and had to be moved to its location bodily. Since an incinerator is naturally a heavy and bulky object, moving a combustion device of this kind from the factory to the installation site was a difficult and expensive job. Not only was it expensive to ship and handle such an incinerator, but the large size of the device often made it necessary to enlarge a doorway or otherwise demolish a part of a building wall in order to install the unit, and this operation was not only very costly but extremely time consuming and inconvenient.

The other type of incinerator was essentially of masonry construction and was built up of brick and mortar at the installation site, in much the same way that a brick house would be built. Its construction was of course slow and cumbersome and consequently it, too, was expensive, but it was sometimes preferred to the type which was built as a unit because its installation did not entail transportation and handling of a bulky, ponderous object and, more important in many cases, it was not necessary to demolish any standing walls in order to move the bricks and mortar into the installation site.

With a view toward eliminating the high labor, transportation and handling costs which characterized previous types of incinerators, the present invention has as its main purpose and object to provide a lightweight but sturdy wall element or section for an incinerator or the like which may be manufactured at very low cost and which may be very readily assembled with other similar wall sections into a complete and very efficient incinerator.

A further object of this invention is to provide a wall section for an incinerator or the like which is sufficiently light in weight to be conveniently handled by one man and which, moreover, may be inexpensively prefabricated from readily available standard materials.

An additional object of this invention resides in the provision of a wall element or section for an incinerator or similar combustion device comprising an outer wall of sheet metal fabricated from a standard form of sheet metal stock and a refractory lining anchored thereto.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate two complete examples of the physical embodiments of the invention constructed according to the best modes so far devised

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for the practical application of the principles thereof, and in which:

Figure 1 is a perspective view of an incinerator constructed in accordance with this invention;

Figure 2 is a vertical sectional view through the incinerator taken on the plane of the line 2—2 in Figure 1;

Figure 3 is a fragmentary perspective view of one of the wall sections of the incinerator of this invention, portions being shown broken away;

Figure 4 is a view similar to Figure 3, but showing a corner wall section;

Figure 5 is a view similar to Figure 3, but showing a modified embodiment of the wall section of this invention;

Figure 6 is a view similar to Figure 4 showing a modified embodiment of the corner section corresponding to the Figure 5 wall section;

Figure 7 is a fragmentary sectional view taken on the plane of the line 7—7 in Figure 2;

Figure 8 is a fragmentary sectional view taken on the plane of the line 8—8 in Figure 2;

Figure 9 is a perspective cross sectional view through the metal outer shell or casing of a wall section of the preferred type shown in Figure 3 with a form in place thereon preparatory to having the refractory material placed therein;

Figure 10 is a perspective view of a modified embodiment of an incinerator of this invention; and

Figure 11 is a fragmentary cross-sectional view of the sections forming the top of the Figure 10 incinerator.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts throughout the several views, the numeral 5 designates generally an incinerator embodying the principles of this invention and comprising a plurality of individual wall sections or elements 6 which cooperate to form a pair of side walls 7, a front wall 8, a back wall 9 and a partial top wall 10. A charging door 12 cooperates with the partial top wall to close the top of the incinerator, and clean-out doors 13 and 14 are provided in the front wall and one side wall, respectively. There are also adjustable air inlets 15 at suitable locations in the side walls.

A refractory baffle 16, which extends across the interior of the incinerator from one side wall to the other, divides the incinerator into a combustion chamber 17 and an expansion chamber 18. A horizontal grate 19 extends across the lower portion of the combustion chamber to support the refuse to be combusted, and which of course is deposited in the combustion chamber through the charging door 12. The combustion residue drops through the grate into an ash pit 20 below the grate, whence it may be removed through the front clean-out door 13. Preferably this clean-out door is high enough to extend above the grate, to permit access to the portion of the combustion chamber just above the grate and thus enable removal of incombustible residue too large to drop through the grate.

Combustion of refuse in the combustion chamber may be started in any conventional manner, as for example by means of a gas or oil burner (not shown) which raises the refuse to be burned to its kindling temperature, and combustion air is supplied to the combustion chamber through ports 21 in the charging door, at the front thereof. Combustion gases move from the combustion chamber across the baffle toward an outlet 22 in the rear wall of the incinerator, whence they pass into a flue 23.

Spaced a short distance behind the baffle is a drop wall 24 (sometimes referred to in the art as a drop arch) which extends across the incinerator, parallel to the baffle, and cooperates with the baffle to define a restricted throat 25 through which the combustion gases must pass on their

way from the combustion chamber to the expansion chamber, and wherein their velocity is greatly accelerated. An air inlet 26 in each side wall, at the throat permits secondary combustion air to be drawn into the gases passing through the throat to assure combustion of all gaseous substances leaving the combustion chamber.

The drop arch extends downwardly from the top wall, and its lower edge is spaced slightly below the top of the baffle, so that it cooperates with the baffle to deflect downwardly the combustion gases passing through the throat. As such gases enter the expansion chamber they are of course rapidly decelerated, and this deceleration, together with the downward impetus given to the gases by the drop wall as they move through the throat, causes the gases to drop any fly-ash which they may be carrying, so that substantially smoke-free combustion gases pass into the flue outlet, which is situated at the top of the expansion chamber above the zone therein in which fly-ash may be carried, into the expansion chamber by the stream of gas issuing from the throat. The clean-out door 14 in the side wall gives access to the bottom of the expansion chamber to facilitate the removal of accumulated fly-ash therefrom.

Where the nature of the refuse to be burned in the incinerator is such as to create an unusual amount of smoke and fly-ash, a second igniter in the form of a gas or oil burner may be installed in the expansion chamber, as will be obvious to those skilled in the art.

The wall sections from which the shell or housing of the incinerator of this invention is built up may be prefabricated from readily available materials, and at the installation site may be quickly and easily assembled with one another and with the other parts to form the complete incinerator. As best seen in Figure 3, the basic wall section comprises a rectangular sheet metal outer wall member 27 and an inner refractory liner 28 of cementitious material anchored to the outer wall member. The outer wall member comprises two adjacent sheet metal channels joined by a central rib 29 and having flanges 30 and 31 extending along its opposite longitudinal edges, perpendicular to its substantially flat web portions 32.

One of the flanges, here designated 31, has an integral outwardly projecting tongue 34, comprising an extension of the flange bent laterally outwardly and back upon itself and cooperating with the body of the flange 31 to define an outwardly opening groove or slot 35 in which the flange 30 on an adjacent wall section is adapted to be received, thus enabling adjacent wall sections to be interconnected with one another, as best seen in Figure 7.

As may also be seen from Figure 7, the edge 37 of the cementitious refractory lining which is adjacent the flange 30 is spaced from the inner surface of said flange a distance to permit insertion of a tongue 34 on an adjacent section into the inwardly opening slot 38 defined by such spacing.

The opposite marginal edge portion 39 of the refractory liner extends laterally outwardly beyond the tongue so as to have a snug abutment with the inwardly spaced edge 37 on the refractory liner of the adjacent section.

In fabricating the wall section, the sheet metal outer wall member is laid flat with its open side up and a form F is mounted thereon as shown in Figure 9. This form has one wide side wall A, a narrow side wall B, and end walls C notched to accommodate the rib 29. All walls of the form are rigidly connected with one edge of all of them lying in a common plane. The form is of such size that when placed in position on the wall member as shown in Figure 9 with its wide side wall A contiguous to the inner face of the flange 30 where it is held by pins 30' welded to and rising from the web 32', its opposite narrow side wall B is seated on and slightly overhangs the fold joining the flange 31 and its tongue 34. This relationship results in the previously described disposition and shape of the side edges 37 and 39 of the refractory lining.

Any of a variety of cementitious aggregates may be

used in casting the refractory liner, but preferably vermiculite or the like is included in the mixture in order to keep the weight of the finished casting as low as possible. Preferably, too, the refractory liner is formed from two different aggregates, poured into the mold or form F in layers, the layer 40 adjacent the outer wall member comprising an aggregate selected primarily for light weight and relatively high heat insulation qualities, while the layer 41 which forms the inner face of the module and which is given its desired flat face by simply striking off the excess material with a striker board moved across the top edges of the form, is cast from an aggregate which is selected primarily for its ability to resist intense heat and abrasion. The second layer is poured while the first is still wet so that the two layers will fuse and bond themselves to one another.

To anchor the refractory liner to the sheet metal outer wall member, a number of anchor studs 43 are spot welded or otherwise secured at spaced apart points to the inner face of the sheet metal wall member, projecting inwardly therefrom, substantially perpendicularly to the web surface of the outer wall member. The anchor studs thus extend into the refractory material to lock the same to the outer wall member, it being understood that the anchor studs are secured to the outer wall member before the refractory liner is cast thereon. Preferably the free inner end portion of each anchor stud is bent at an angle of about 30° to the remainder thereof, as at 44, to provide a head which will prevent the refractory liner from slipping off of the stud but which will nevertheless not hold the liner so tightly as to interfere with its normal expansion and contraction due to heating and cooling. After the refractory material has hardened and the form is removed the withdrawal of its side wall A provides the slot 38.

Preferably the outer wall member of a section of this invention is cut from standard metal roof decking, which is usually about 12 inches wide. Such roof decking has the rib 29 and the interlocking flanges 30 and 31 and tongue 34 performed thereon. In the basic wall section the rib 29 projects into the refractory liner and tends to stabilize the same against shifting laterally with respect to the outer wall member. However, in the case of the corner section illustrated in Figure 4, this medial rib 29 facilitates production of a unit which is cooperable with the straight wall modules. Thus in the corner section the rib 29, which is in the nature of a deep crease, is opened up from a 180° angle to a 90° angle to dispose the two outer wall panels at right angles to one another and likewise to dispose the two legs of the rib perpendicular to one another. The cementitious refractory liner of the corner section is formed in substantially the same manner as that in the basic wall section, due provision being made in the mold for forming the necessary inside corner.

A basic wall section for an incinerator having a capacity of from 75 to 100 pounds per hour measures about 12 by 41½ inches and, with its refractory liner, weighs in the neighborhood of 60 pounds, so that it can be handled by one man without serious inconvenience.

The incinerator shown in Figure 10 is an industrial type, about nine feet long, six feet high and three to four feet wide. The basic wall sections are the same as those just described but of course substantially longer to provide for the greater height of this incinerator. The sections which comprise the top wall of the incinerator of this embodiment have the creases 29' of their metal outer wall members opened up to an acute angle so that the two longitudinal segments of the outer wall member are disposed at an obtuse angle to one another, and as shown in Figure 11, the sections are therefore substantially keystone shaped in cross section, with no inside corner in the cementitious liner. By virtue of this arrangement the interconnected sections of the top wall

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form an arch resting on the side walls and there is no danger of the refractory liner of the top wall dropping from its own weight.

In the incinerator of the Figure 10 embodiment the charging door 12' is located in the front wall, directly above the clean-out door 13.

In the modified embodiment of the wall section of this invention illustrated in Figure 5 the sheet metal outer wall member 27' comprises a length of standard roof decking, as in the version previously described, but instead of having a refractory liner made up entirely of cementitious material, the refractory liner of this section comprises an inner refractory wall member 28' and an intermediate layer 48 of fibrous insulation between the outer wall member and the refractory wall member. An expanded metal supporting member 49 secured to the sheet metal outer wall member, as by tack welding, facilitates manufacture of the section of this embodiment since it retains the batts of fibrous insulative material in position during the pouring of the cementitious refractory inner wall member and also locks the refractory liner firmly to the outer wall member. When the cementitious inner wall member is cast, in fabricating the section of this embodiment, the cementitious material will penetrate the foramina of the expanded metal and embrace and interlock with the reticulations thereof. In addition, the expanded metal reticulations may be cut through at certain points, as at 50, to enable the cut reticulations to be bent outwardly to provide tang-like anchor lugs which further secure the inner refractory wall member.

The marginal edge portion of the expanded metal adjacent to the flange 30' on the outer wall member is bent inwardly, parallel to and spaced from said flange to cooperate therewith in defining an inwardly facing slot or groove 38' in which the tongue 34' on an adjacent section is receivable. Said edge of the expanded metal thus adjoins the inner surface of the sheet metal member and may be spot welded or otherwise bonded thereto.

As may be seen from Figure 6, the principles of the modified structure of the invention shown in Figure 5 may also be employed in corner sections. Wall and corner sections embodying the modification just described may be advantageous in certain installations where a better heat insulation of the outer wall member is desired than might be possible where the cementitious refractory liner is cast directly against the outer wall member. It will be recognized, of course, that the modified embodiment of the invention will be somewhat more difficult and expensive to fabricate than that first described.

In assembling an incinerator embodying the principles of this invention, a frame 54 is first laid down. Preferably the frame is channel shaped in cross section around most of its perimeter, with the flanges of the channels extending upwardly to have the lower portions of the wall sections snugly received therebetween. A rectangular metal plate 52 forms the bottom of the incinerator, and in the expansion chamber is protected by a refractory lining 53. The frames of the clean-out doors are secured to the frame and extend upwardly therefrom. Next the grate is set in place, and then the individual wall sections are placed upright in the frame, being interlocked with one another as described earlier. Shorter wall sections are used at the cut-outs for the clean-out doors and at the flue outlet, the frames of the clean-out doors having inwardly extending flanges 56 at their tops upon which the bottoms of the sections above them may rest. Inward displacement of these sections at their bottoms is prevented by reason of their interlocking engagement with adjacent corner sections.

In two of the side wall sections 57 the refractory liner is provided with a medial groove 58 which extends along

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the entire length thereof and in which the end portions of the baffle 16 are received so that the baffle is supported in an upright position by its engagement in these grooves. These sections 57 also have the necessary apertures for the air inlets 26. The baffle may, of course, comprise a pre-cast monolithic block of cementitious refractory material, as may the drop wall 24.

Another pair of wall sections 59 may be provided with inwardly extending ledges 60, cast integrally with the refractory liner and upon which the drop wall is adapted to rest, and the drop wall may thus be adjusted forward and backward during assembly of the incinerator to establish the width of the throat 25 in accordance with the combustion conditions which are expected to prevail in the incinerator when it is in service. If desired, the baffle and drop wall may be cemented in place with a small amount of mortar or the like, although it is not necessary that this be done.

When the walls are erected and the baffle, drop wall, and flue outlet are in place, a top frame 61, similar to the bottom frame, is laid on top of the walls, and sections are then laid in place in this frame to form the top wall of the incinerator. Hingedly connected to the front one of these top wall sections is the charging door 12, which is preferably made of cast iron with a cementitious refractory lining 62.

Because of the sectional construction of the incinerator of this invention, and because the individual units from which it is assembled are not too numerous, but are nevertheless of fairly small and convenient sizes, assembly of the incinerator of this invention may be readily accomplished in a very short time by one or two relatively unskilled workmen.

From the foregoing description taken together with the accompanying drawings it will be readily apparent that this invention provides an incinerator of simplified sectional construction which may be shipped from the factory to the location site in the form of a number of relatively small, easily handled prefabricated units and which may be very readily and expeditiously assembled by one or two men who need not be particularly skilled craftsmen.

What I claim as my invention is:

1. A wall section for an incinerator or the like comprising: a substantially channel shaped metal outer wall member having inwardly projecting flanges; an integral outwardly projecting tongue extending along one of said flanges to cooperate therewith in defining an outwardly opening groove, the other flange having a depth to fit in a corresponding groove in a similarly formed adjacent outer wall member; anchoring means secured to said outer wall member and projecting inwardly from the inner face thereof; and a cementitious refractory liner having said anchoring means embedded therein and thereby secured to said outer wall member overlying the inner face thereof, said liner having its edge adjacent said other flange spaced therefrom a distance to define an inwardly opening groove in which the tongue on an adjacent similar wall section is receivable to thus enable interlocking connection of the sections.

2. A wall section for an incinerator or the like comprising: a substantially flat rectangular sheet metal outer wall member having inturned flanges along its longitudinal sides; a sheet of substantially flat foraminous metal secured to said outer wall member overlying the same and spaced from and parallel thereto; a layer of cementitious refractory material secured to said foraminous metal by having portions thereof embracing the reticulations of the foraminous metal, and having its maximum thickness at the side of said foraminous metal remote from the outer wall member, said layer of cementitious material extending from one of the flanges to within a short distance from the other flange; fibrous insulation in the space between the refractory material and the outer wall member; means on one of said flanges providing a tongue extending along the length of said one

flange; and said foraminous metal forming with said other flange a groove in which a corresponding tongue on an adjacent similar section is receivable to interconnect adjacent sections.

3. A wall section for an incinerator or the like comprising: a unitary sheet metal outer wall member having two adjacent angularly disposed portions, each of which is channel shaped in cross section, the adjacent flanges of said two channel shaped portions being joined together at a bend, the outer flange of one of said two channel shaped portions being folded back upon itself to form a tongue which cooperates with said flange proper to define an outwardly opening groove for the reception of a flange on an adjacent section, the outer flange of the other channel shaped portion being engageable in a similar groove in another section, and refractory material filling the two channel shaped portions of the outer wall member except for a narrow space along said outer flange of said other channel shaped portion, and said refractory material extending inwardly beyond the flanges and across said bend.

4. A wall section for an incinerator or the like adapted for assembly with other similar sections into a wall having a substantially arcuate cross section, said section comprising: a unitary sheet metal outer wall member having two adjacent channel shaped portions with their webs disposed at an obtuse angle to one another and their flanges extending inwardly perpendicularly to their webs, the adjacent flanges of said two channel shaped portions being joined together at an acute-angled bend, the outer flange of one of said two channel shaped portions being folded back upon itself to form a tongue which cooperates with said flange proper to define an outwardly opening groove for the reception of a flange on an adjacent section, the outer flange of the other channel shaped portion being engageable in a similar groove in another section, and refractory material filling the two channel shaped portions of the outer wall member except for a narrow space along said outer flange of said other channel shaped portion, and said refractory material extending inwardly beyond the flanges and across said bend.

5. A corner wall section for an incinerator or the like comprising: a unitary sheet metal outer wall member having a pair of adjacent right angularly disposed wall portions and means connecting said portions together to form a corner, said member also having an inwardly directed flange at the outer edge of each wall portion, one of said two flanges being folded back upon itself to form a tongue which cooperates with the said flange proper to define an outwardly opening groove for the reception of a flange on an adjacent section, the other of said two flanges being of a width to be received in a similar outwardly opening groove of another section, and a liner of refractory material covering the inner faces of said wall portions and filling the corner defined thereby, said liner being contiguous to the flange which is folded back upon itself but being spaced a short distance from the other flange to provide an inwardly opening groove in which the tongue of an adjacent section is receivable.

6. An incinerator comprising an enclosure having top and bottom walls connected by upright side and end walls,

characterized by the fact that said upright side and end walls are formed by interconnected vertically extending identical flat wall sections and identical right angular corner sections; the corner sections each comprising a unitary sheet metal outer wall member having right angularly disposed wall portions and means connecting said portions together to form a corner, said member also having an inwardly directed flange at the outer edge of each wall portion, one of said two flanges being folded back upon itself to form a tongue which cooperates with the said flange proper to define an outwardly opening groove for the reception of a flange on an adjacent flat wall section, the other of said two flanges being of a width to be received in a similar outwardly opening groove of another flat wall section, and a liner of refractory material covering the inner faces of said wall portions and filling the corner defined thereby, said liner being contiguous to the flange which is folded back upon itself but being spaced a short distance from the other flange to provide an inwardly opening groove in which the tongue of an adjacent flat wall section is received; the flat wall sections each comprising a substantially channel shaped metal outer wall member having inwardly directed flanges, one of which is folded back upon itself to form a tongue which cooperates with the said flange proper to define an outwardly opening groove for the reception of a flange on an adjacent section, the other flange having a depth to fit a similar outwardly opening groove of another section, anchoring means secured to said outer wall member and projecting inwardly from the inner face thereof, and a cementitious refractory liner having said anchoring means embedded therein and thereby secured to said outer wall member overlying the inner face thereof, said liner being contiguous to the flange which is folded back upon itself but being spaced a short distance from the other flange to provide an inwardly opening groove in which the tongue of an adjacent section fits.

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