

No. 667,013.

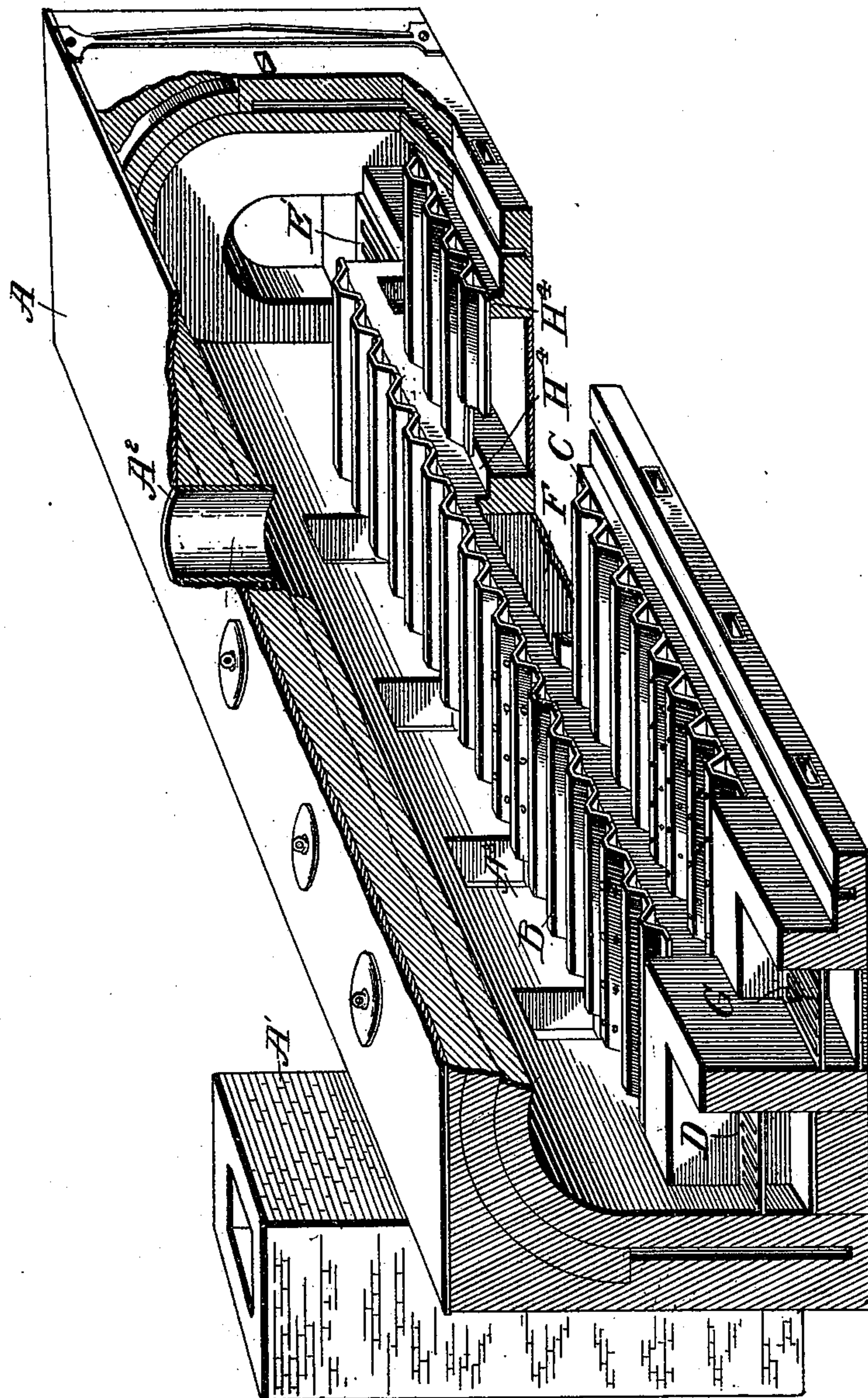
Patented Jan. 29, 1901.

W. S. HULL.  
REFUSE FURNACE.

(Application filed July 10, 1900.)

(No Model.)

2 Sheets—Sheet 1.



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WITNESSES:

*L. C. Mills*  
*Alfred T. Sage*



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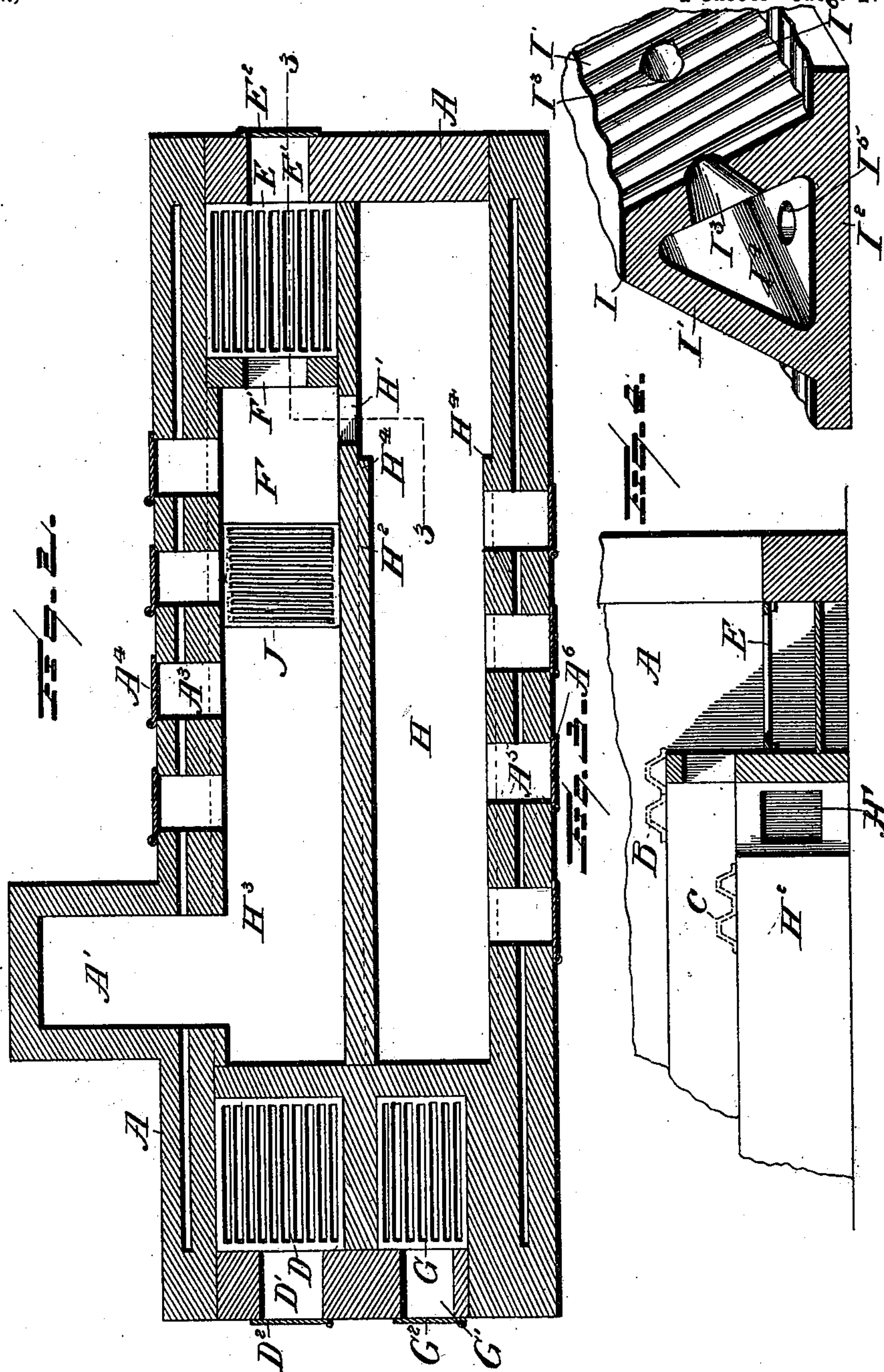
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# UNITED STATES PATENT OFFICE.

WILLIAM S. HULL, OF JACKSON, MISSISSIPPI.

## REFUSE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 667,013, dated January 29, 1901.

Application filed July 10, 1900. Serial No. 23,114. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM S. HULL, a citizen of the United States, residing at Jackson, in the county of Hinds, State of Mississippi, have invented certain new and useful Improvements in Refuse-Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to a refuse-furnace, and particularly to an incinerating-furnace adapted for the consumption of garbage, night-soil, dead animals, or any other refuse.

15 The invention has for one object to provide an apparatus embodying a series of parallel grate-bars disposed upon different planes in connection with a flue and means by which the odors and gases passing from the material consumed upon the bars will be properly ignited and consumed before their passage to the outlet of the furnace.

25 A further object of the invention is to provide an improved form of bar by means of which the most advantageous consumption of the refuse may be effected.

30 A further object of the invention is to provide means by which the products of combustion from each of the grate-bars will be passed or carried adjacent to a source of heat, by which the gases therein may be ignited and the odors thus effectually destroyed.

35 In the drawings, Figure 1 represents a perspective of the furnace with portions broken away and in section. Fig. 2 is a horizontal cross-section of the furnace beneath the grate-bars. Fig. 3 is a vertical section thereof on the line 3-3 of Fig. 2, and Fig. 4 is a detail perspective of the preferred form of grate-bar.

40 Like letters of reference indicate like parts throughout the several figures of the drawings.

45 In the drawings the letter A designates the walls or proper masonry composing the furnace, which may be of any desired length and general construction customary in this character of devices. It is provided at one end with a stack A', from which the remaining products of combustion, after treatment in the apparatus, and the heat emitted therefrom are discharged. The upper portion of the incinerator or furnace is provided with a

series of openings A<sup>2</sup>, adapted to be suitably closed, through which the refuse to be consumed may be introduced. Within this furnace-casing there is disposed a series of grate-bars B, with which communication may be had by means of openings A<sup>3</sup> in the wall of the furnace, suitably closed by doors A<sup>4</sup>, and upon a lower plane or level a secondary set of grate-bars C is disposed, so that when the material resting upon the bars B is moved thereon or pushed forward thereon it will fall upon the lower set of bars C, from which the ashes may be removed by means of a series of openings A<sup>5</sup> through the walls of the furnace, which are normally closed by means of suitable doors A<sup>6</sup>. At one end of the grate-bars B a fire-box D is provided, preferably at the end where the stack is located and which will be hereinafter termed the "front" of the furnace, while at the opposite end of the grate-bars B a similar grate E is provided. Communication may be had with the grate D through the opening D' and door D<sup>2</sup>, while similar communication may be had with the grate E by means of the opening E' and the door E<sup>2</sup>. Beneath the series of grate-bars B a return flue or tunnel F extends, which communicates at one end, by means of a throat F', with the grate E and at the opposite end with a smoke-stack A'. At the front end of the lower grate-bars C a grate G is provided, which lies parallel with the grate D and upon a lower plane, while communication may be had with this grate by means of the passage G' and door G<sup>2</sup>. Beneath the grate-bars C a tunnel or flue H is provided, which communicates at the rear end adjacent to the grate E with the flue F by means of an opening H' in the partition-wall H<sup>2</sup>, which separates the flues F and H from each other.

It will be understood that the several grates hereinbefore referred to are provided with the usual ash-boxes and draft devices customary in this art.

While this furnace or incinerator may be operated in connection with any suitable form of grate-bar, still I have provided in the present invention a desirable form for accomplishing the objects of complete combustion and effecting an oxidation of the refuse. The form of bar shown in Fig. 1 is



provided with inclined walls and is substantially V-shaped in form. This bar is perforated at suitable points to permit the passage of air therethrough; but I have illustrated in Fig. 4 a very desirable form of such a bar which may be formed of a suitable refractory material, such as fire-clay or metal, in which the bar I is provided with inclined side walls I<sup>1</sup> and a base I<sup>2</sup>, extending at opposite sides beyond said walls. Each of the side walls is perforated, as at I<sup>3</sup>, and the openings therein bevel inwardly, while the channel I<sup>4</sup> within the center of the bar communicates with the air-space beneath the bar by means of a series of openings I<sup>5</sup>. The sides and base of the bar are also provided with a series of channels or corrugations I<sup>6</sup>, which permit the passage of air upward between the separate bars of the series and along the corrugations, so as to supply the necessary oxygen to the upper portion of the mass of refuse which may rest upon the sides of the bars.

While the gases or products of combustion from garbage consumed upon the grate-bars B and C would ordinarily be thoroughly consumed by the heat from the fire upon the grate E, still if the character of material to be burned be such that there is an unusual amount of obnoxious gas an additional grate J, as shown in Fig. 2, is provided in the flue F and a suitable flame maintained thereon which will unite and consume any gases which may have passed through the other fires without being properly ignited and consumed. This additional grate is not essential, however, and may be omitted if desired.

While I have described the several grates as adapted to contain the usual form of fires, still it will be obvious that any suitable burners or heating devices—such, for instance, as gas or oil—may be provided and substituted therefor, as they would accomplish a similar result.

In the operation of this furnace a fire is first built upon the grate E, which causes a draft through the flue F toward the stack A'. A fire is next started upon the front grates D and G, from which the products of combustion are carried longitudinally of the series of grate-bars and those from the grate D in connection with the gases evolved in the consumption of the refuse carried over the grate E, so as to be ignited and consumed by the heat therefrom, and through the flue F to the stack, where the remaining products are discharged. The products from the grate G pass longitudinally of the grate-bars C and are then introduced into the flue F, where they will be ignited by the flame from the grate E. This combustion-flue therefore receives the gases from each of the upper grates and provides means by which they may be thoroughly consumed. A proper admission of air to this flue may be effected by any suitable doors—for instance, the fire-door to the grate E—to supply the necessary oxygen for

combustion, so that by the time the gases reach the stack all obnoxious odors have been destroyed. It will also be obvious that the structure of grate herein described permits the passage of heated air from the flues beneath the grates upward through the apertures and into the refuse, thus causing a thorough oxidation of the material to be consumed. It will also be observed that in the present construction the grates are supported upon suitable walls extending upward from the base of the furnace, and the lateral thrust from an arched brick grate is thereby prevented, as is also the internal strain upon the outside walls, caused by the sagging of metal bars from the heat and load thereon. It will be seen that the bars B rest at one end upon a suitable flange H<sup>3</sup>, extending from the wall of the furnace, and that their opposite ends rest upon the upper portion of the partition H<sup>2</sup>, while the grate-bars C are supported upon rests H<sup>4</sup> at the opposite ends of the bars, thus relieving the wall of the furnace from all strain incident to the support of the bars, which are entirely independent of the outside walls. This produces an extended life to the furnace and prevents any injury to the main portion thereof by the shrinkage or bending of the bars, while it also permits the replacement or ready removal of the bars, as may be found necessary. It is also found desirable to pass the main products of combustion over the refuse which rests upon the bars and to obviate the fires which have been heretofore built beneath the bars and which are more destructive to the bars than to the refuse. The present invention contemplates a passage of the products of combustion from the grates over the surface of the material to be consumed, which may be agitated as desired, and after remaining upon the upper set of bars for the desired time will be passed onward to the lower bars, where a final consumption of the refuse may be effected. This operation, in connection with the combustion-flue for the consumption of the gases and the structure of grate-bar, by means of which the material is thoroughly aerated and the necessary oxygen supplied to permit combustion, produces a furnace in which refuse may be incinerated at the minimum expenditure of fuel and within the shortest time possible consistent with an economical and efficient operation, which is necessary in this art. It will be obvious that the heat within the combustion-flue will pass upward through the perforations in the bars and along the corrugations thereof to the mass of refuse above, thus quickly drying the lower portion and presenting the same in a condition by which combustion is more quickly effected when the same comes in contact with a flame. It may be stated that the openings A<sup>2</sup> are directly above the upper set of bars, and as the surface of the refuse thereon is dried or burned the same will be removed or raked



onto the lower bars and there completely consumed, while a new surface is presented for combustion and drying upon the upper bars.

It will be obvious that changes may be made in the details of construction and configuration of the several parts without departing from the spirit of this invention as defined by the appended claims.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a refuse-burning furnace, the combination of two parallel grates one situated above the other, the upper grate arranged to receive the green refuse and the lower grate arranged to receive the dry refuse from the upper grate, a fire-box adjacent to one end of each grate, and a return-flue leading from the opposite end of the grates beneath one of the same to the exit of the furnace; substantially as specified.

2. In a refuse-burning furnace, the combination of two parallel grates one situated above the other, the upper grate arranged to receive the green refuse and the lower grate arranged to receive the dry refuse from the upper grate, a fire-box adjacent to one end of each grate, a return-flue leading from the opposite end of the grates beneath one of the same to the exit of the furnace, and a fire-box interposed in the return-flue between the grates and furnace-exit; substantially as specified.

3. In a refuse-burner, the combination of two parallel grates one situated above the other, the upper grate to receive the green refuse and the lower grate arranged to receive the dried refuse from the upper grate, two fire-boxes at one end of the furnace, one adjacent to each grate, and a return-flue leading from the other end of the grates beneath the upper grate to the exit of the furnace; substantially as specified.

4. In a refuse-furnace, the combination of two parallel grates in different vertical planes one situated above the other, the upper grate arranged to receive the green refuse and the lower grate to receive the dried refuse from the upper grate, a fire-box at each end of the upper grate, a return-flue leading beneath said upper grate, a fire-box at one end of the lower grate, and a stack communicating with said return-flue; substantially as specified.

5. In a refuse-furnace, the combination of two parallel grates in different vertical planes one situated above the other, the upper grate arranged to receive the green refuse and the lower grate to receive the dried refuse from the upper grate, a fire-box at each end of the upper grate, a return-flue leading beneath said upper grate, a fire-box at one end of the lower grate, a stack communicating with said return-flue, and means permitting communication between the return-flue and the space above said lower grate; substantially as specified.

6. In a refuse-burning furnace, the combi-

nation of two parallel grates perforated in different vertical planes one situated above the other, the upper grate arranged to receive the green refuse and the lower grate to receive the dried refuse from the upper grate, fire-boxes at the front end of each grate, a return-flue beneath said upper grate, a fire-box at the rear end of said upper grate, at the entrance to said flue, and a stack communicating with said flue at the opposite end from the fire-box at its entrance; substantially as specified.

7. In a refuse-burning furnace, the combination of two parallel perforated grates in different vertical planes one situated above the other, the upper grate arranged to receive the green refuse and the lower grate to receive the dried refuse from the upper grate, fire-boxes at the front end of each grate, a return-flue beneath said upper grate, a fire-box at the rear end of said upper grate, a stack at the front end of said upper grate communicating with said return-flue; and a flue beneath said lower grate communicating with said return-flue at the rear thereof; substantially as specified.

8. In a refuse-burning furnace, the combination with a casing, of two parallel perforated grates one situated above the other, the upper grate arranged to receive green refuse and the lower grate to receive the dried refuse from the upper grate, a return-flue beneath the upper grate, two fire-boxes at one end of the furnace one adjacent to each grate, a fire-box interposed in the return-flue between the grates and the furnace-exit, apertures in the top of said casing above said upper grate, and openings in the side walls of said casing adapted to permit access to the surface of each series of bars; substantially as specified.

9. In a refuse-burning furnace, the combination with a casing, of two parallel perforated grates one situated above the other, the upper grate arranged to receive green refuse and the lower grate to receive the dried refuse from the upper grate, a return-flue beneath the upper grate, two fire-boxes at one end of the furnace one adjacent to each grate, a fire-box interposed in the return-flue between the grates and the furnace-exit, apertures in the top of said casing above said upper grate, openings in the side walls of said casing adapted to permit access to the surface of each series of bars, and a central bridge-wall or partition extending longitudinally of said grates and provided with an aperture to permit communication with said return-flue; substantially as specified.

10. In a refuse-burning furnace, the combination with a casing, of two parallel grates situated one above the other, the upper grate arranged to receive green refuse and the lower grate to receive the dried refuse from the upper grate, a central bridge-wall or partition for supporting at different elevations the adjacent ends of said grates, two fire-boxes at one end of the furnace one above the other

and each communicating with one grate, a re-  
turn-flue beneath said upper grate, a fire-box  
located below said upper grate at one end  
thereof and directly at the entrance to said  
5 return-flue, and means for introducing green  
refuse upon the surface of said upper grate,  
substantially as specified.

In testimony whereof I affix my signature  
in presence of two witnesses.

WILLIAM S. HULL.

Witnesses:

W. M. ANDERSON,  
AMOS R. JOHNSTON.