

(No Model.)

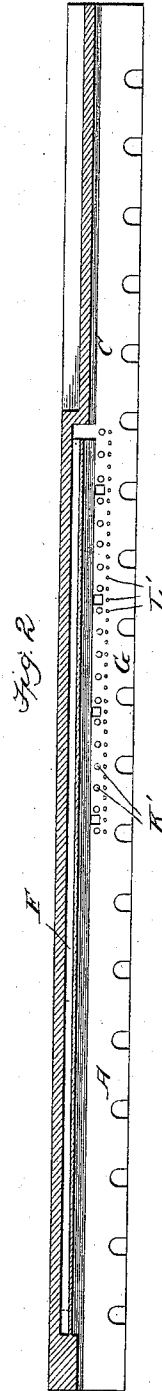
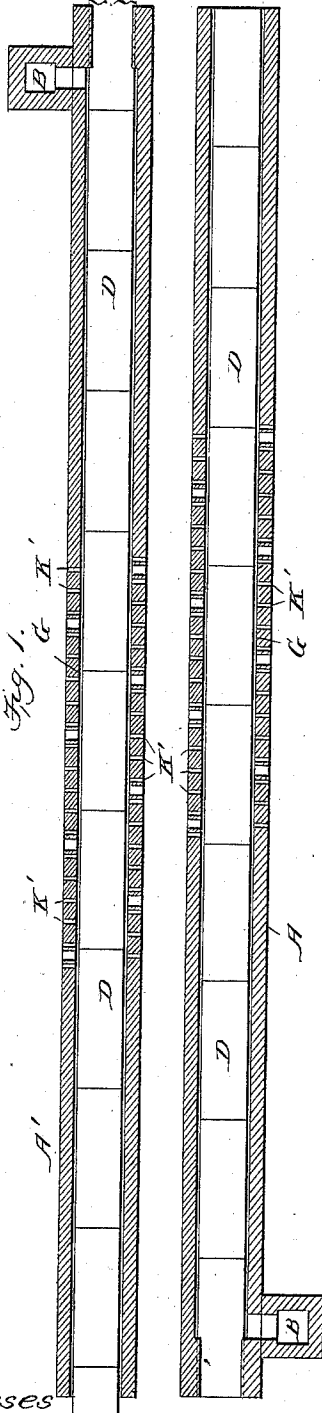
6 Sheets—Sheet 1.

J. C. ANDERSON.

METHOD OF AND APPARATUS FOR BURNING GARBAGE OR OTHER
REFUSE MATERIAL.

No. 526,283.

Patented Sept. 18, 1894.



witnesses

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(No Model.)

6 Sheets—Sheet 3.

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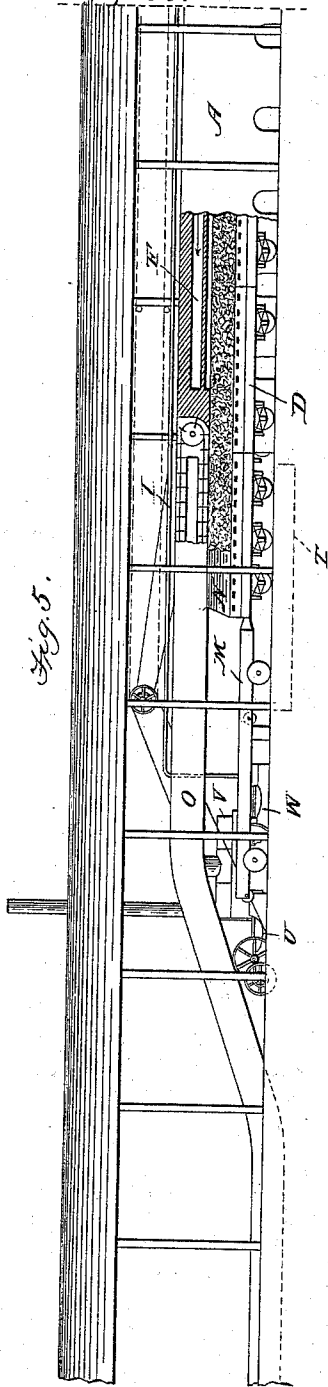


Fig. 5.

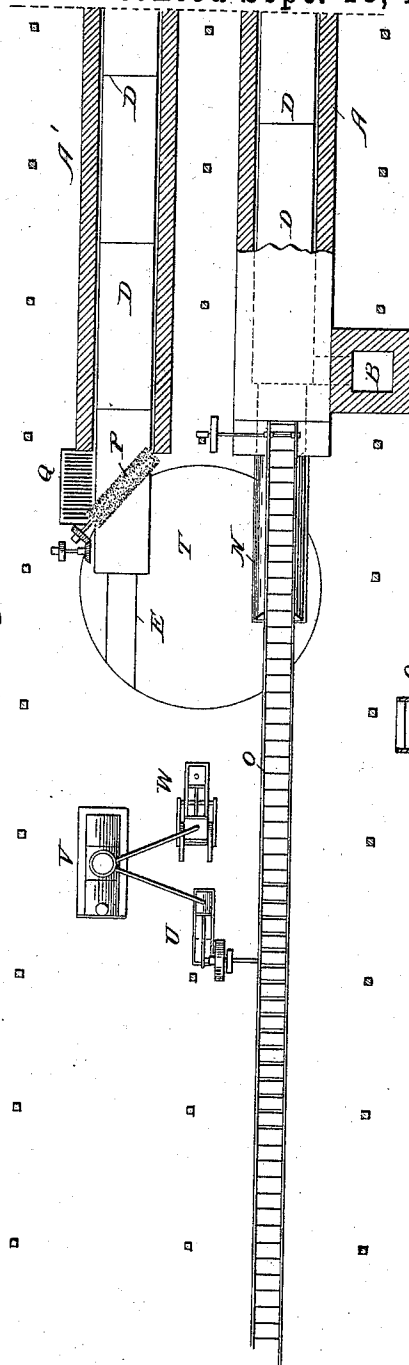


Fig. 6.

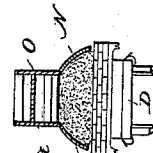


Fig. 6a.

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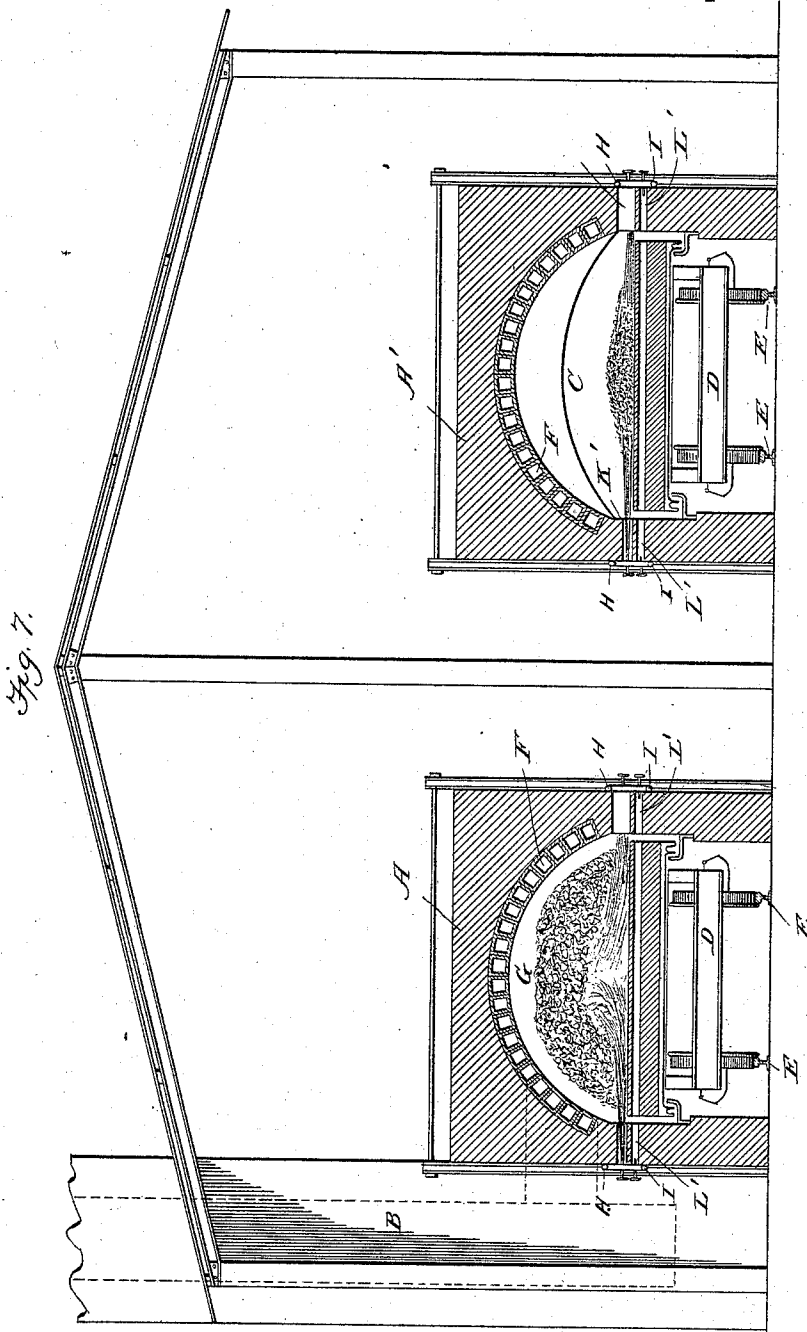
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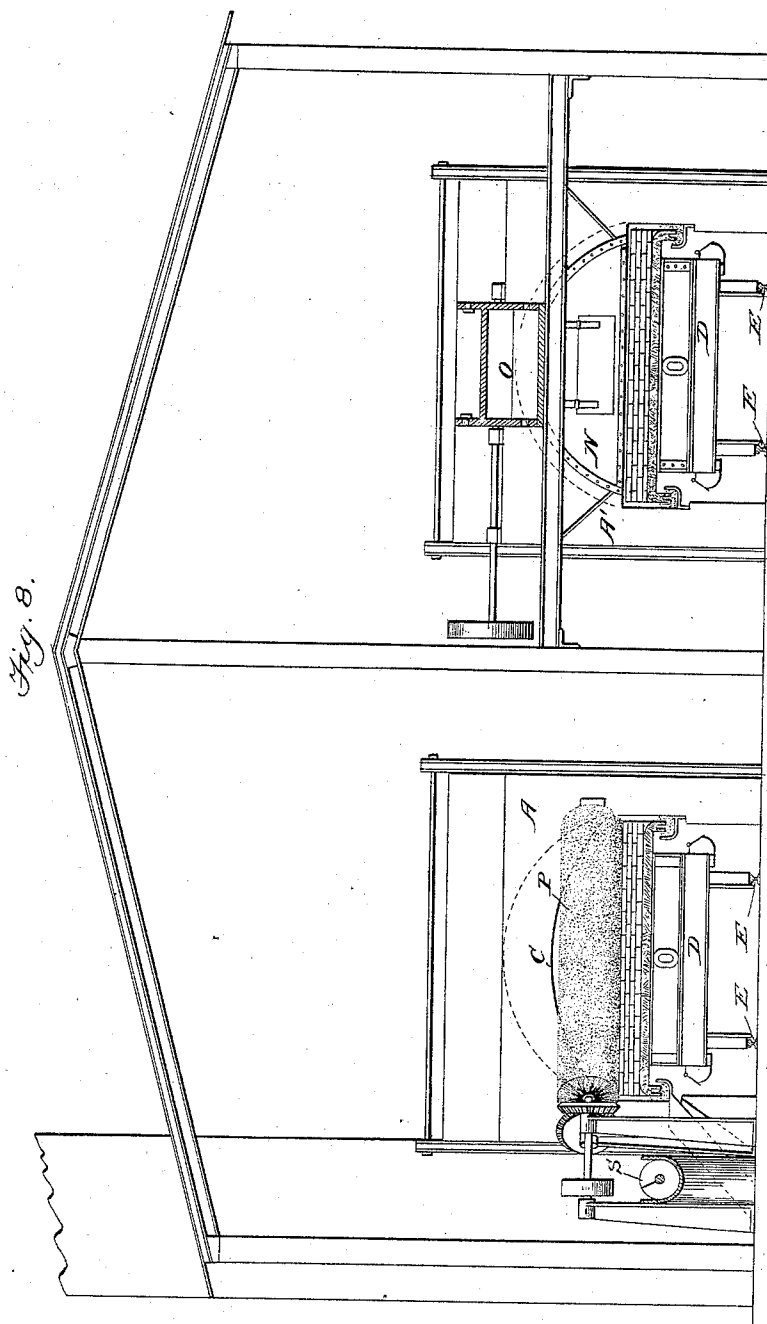
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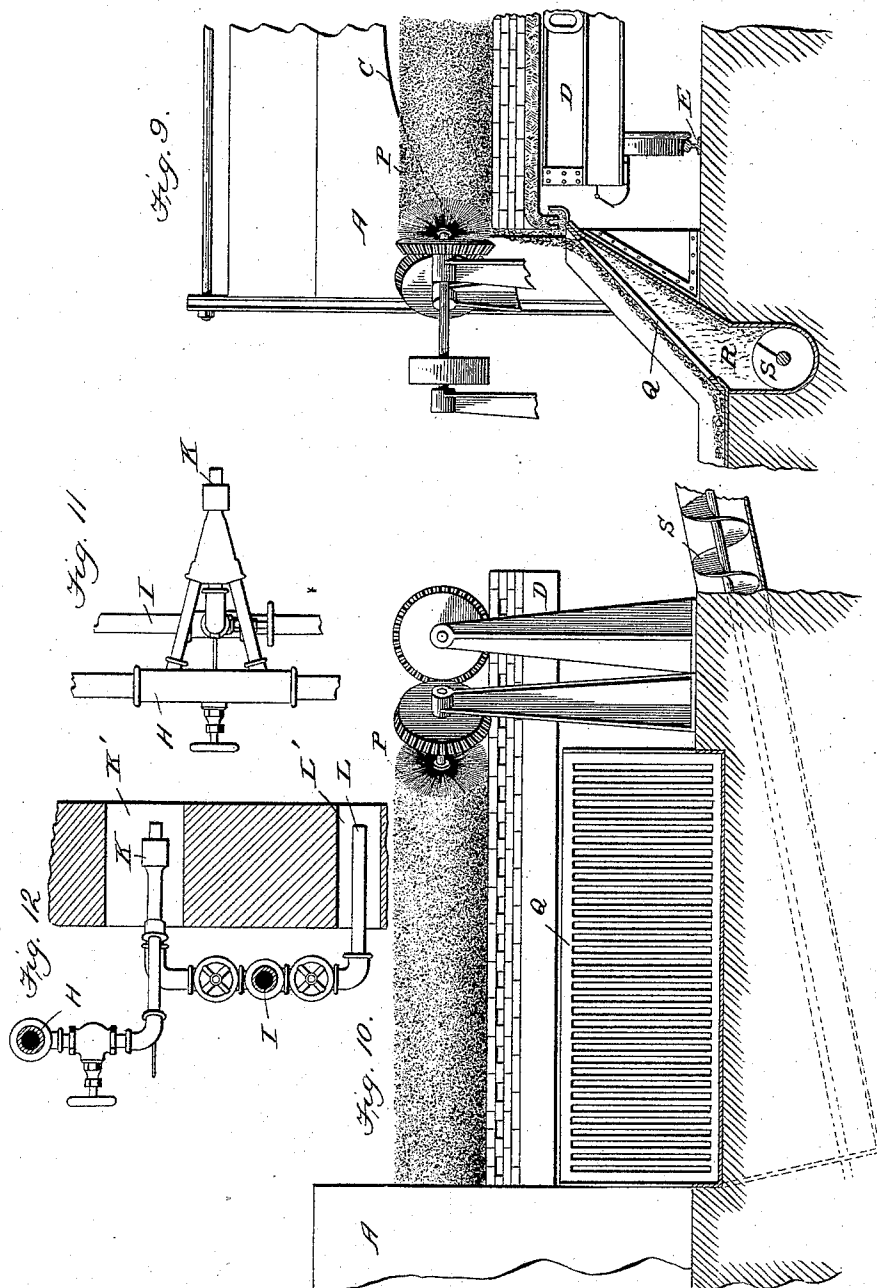
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UNITED STATES PATENT OFFICE.

JAMES C. ANDERSON, OF HIGHLAND PARK, ILLINOIS.

METHOD OF AND APPARATUS FOR BURNING GARBAGE OR OTHER REFUSE MATERIAL.

SPECIFICATION forming part of Letters Patent No. 526,283, dated September 18, 1894.

Application filed January 30, 1894. Serial No. 498,526. (No model.)

To all whom it may concern:

Be it known that I, JAMES C. ANDERSON, a citizen of the United States, residing at Highland Park, in the county of Lake and State of Illinois, have invented certain new and useful Improvements in Methods of and Apparatus for Burning Garbage or other Refuse Material; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain new and useful improvements in the method of and apparatus for burning garbage and other refuse material.

It has for its object to overcome all the difficulties at present experienced, and especially that which is found as the result of the admixture of wet garbage and coal ashes, as will be best understood as I proceed hereinafter to describe the principles of my invention.

In large cities the daily accumulation of garbage, ashes and street sweepings in some cases amount to thousands of tons, and this refuse matter contains all the germs of infectious diseases, so that the problem of successfully disposing of this refuse material in such manner as to effectually destroy all disease germs, and at the same time to utilize the residuum, has been the subject of deep study by hygienic officers and engineers. Where large quantities of refuse material is accumulated, it generally consists of garbage (commonly called slops), coal ashes (in which there is a large percentage of unconsumed coal), rags, paper, metal cans, &c., and in addition to this class of refuse there is also accumulated large bodies of street sweepings. It has long been recognized that the most effectual and scientific method of getting rid of this refuse is to burn the same, but it has been found difficult to do so where there is any very considerable amount to be treated, because it becomes a slow and expensive process, owing to the presence of a large amount of fluid and moisture contained in the material. The fire employed is deadened, and the heat reduced by each successive charge, thus

retarding the process and requiring an undue and expensive use of fuel, and the action of the heat as at present employed, tends to produce a crust or envelope surrounding the body treated and to protect the interior or core against the incinerating action of the fire. This result is due to the fact that carbonaceous gases are produced, and in the absence of the necessary amount of oxygen, the carbonaceous gases huddle and form the envelope or crust referred to, and this action is intensified where there is a presence of coal ashes and cinder, because the gases penetrate and fill the interstices and thus avoid the attack of oxygen.

As before stated my invention has for its objects to overcome all these difficulties and to successfully burn or incinerate the refuse material in such manner as to effectually prevent the escape of any and all poisonous gases, absolutely destroy disease germs, avoid all objectionable smoke, completely and thoroughly attack and reduce to ashes all combustible material, and to recover and utilize all metal which may be admixed with the refuse; and with these ends in view my invention consists of the method and apparatus hereinafter and in detail described.

In order that those skilled in the art may fully understand my invention I will now proceed to describe the apparatus which I have devised, referring to the accompanying drawings, in which—

Figure 1 is a horizontal section of the burning tunnels. Fig. 2 is a longitudinal vertical section of one of the said tunnels. Figs. 3 and 5 are side elevations of my improved incinerator with parts broken away. Figs. 4 and 6 are horizontal sections of the same. Fig. 6^a is a cross section showing the relation of the convex hopper and a car to illustrate the manner of piling the load upon the car. Fig. 7 is a cross section on the line 4—4 of Fig. 4. Fig. 8 is an end view, the right hand side showing the ingress and the other side the egress. Fig. 9 is a detail end view on enlarged scale, showing the separating screens and conveyer in section. Fig. 10 is a side elevation of the construction shown in Fig. 9. Fig. 11 is a plan view partly in section showing the arrange-

ment of oil and air pipes by which the fuel is supplied; and Fig. 12 is a side elevation of the same.

Similar letters of reference denote like parts in the several figures of the drawings.

A, A' represent two tunnels arranged side by side and with a suitable space between them. Each tunnel is provided with a draft stack B, said stacks being arranged at opposite ends respectively, as shown. The tunnels are formed with arch roofs as shown at Fig. 7, which arches lower toward the exit ends, as shown at C, Fig. 7, in the same ratio as the load on the cars is reduced by incineration.

D is a series of cars which travel upon tracks E arranged within the tunnels. The platforms of the cars are fireproofed and sealed at the sides in any suitable manner, such for instance as shown and described in Letters Patent granted to me March 6, 1888, No. 379,041, for improvement in the method of burning brick.

The arched roof of each tunnel is provided with flues F which convey the heat and products of combustion in the direction indicated by arrows at Fig. 3.

What I denominate the fire zone in each tunnel, is indicated at G, and it is at these localities that the vapor fuel is injected under pressure into the tunnels. The fuel proper consists of oil and air. The oil is conveyed from any suitable tank or stand pipe, by gravity, through a pipe H, and the air under high pressure through a pipe I. (See Figs. 3, 11 and 12.) The oil pipe is provided with a series of injecting nozzles K, and the air pipe with a series of nozzles L. The former enter openings K' and the latter enter openings L' through the walls of the tunnels.

The air and oil conduit pipes are provided with a series of cocks or valves, as indicated in Figs. 11 and 12, by means of which the air and oil may be mixed and forced into the fire zone through the nozzles K'; and an auxiliary supply of air through the nozzles L' as may be desired. The purpose of this construction and arrangement is such that the burning vapor or fuel may be projected with great velocity against and into the load upon the car, in order that it may bore into and practically stir up such load, as clearly shown at the left hand side of Fig. 7, to prevent the formation of the carbon crust or envelope hereinbefore referred to, and furnish oxygen to the carbon secreted within the interstices of said load. In order that this action may take place it is desirable that the oil and air should be injected from both sides of each tunnel, and hence the importance of arranging such tunnels with a space between them as hereinbefore stated.

The flues F are so arranged, as shown at Fig. 3, that the gases and products of combustion are conveyed from the fire zone back and over the arch, and over the loaded cars, so that as the cars for instance in tunnel A' enter, the heat generated in the fire zone of said tun-

nel is brought into contact by radiation, with the wet load upon the cars, and operates to drive out the moisture and gases of the same, and dry the load. The moisture and gases driven out of the load are drawn along in the direction of the movement of the cars under the arch or roof of the tunnel, and into the fire zone where, under their heated condition and with the admixture of the oxygen injected into the fire zone, they become highly inflammable, and igniting aid in the incineration of the dried load upon the cars, and from this point the draft is to the stack B. This action not only avoids the dampening of the fires, which takes place in the present system of burning garbage, but on the contrary furnishes a highly desirable and auxiliary agent to assist in consuming the load upon the cars.

In the tunnel A, which is arranged alongside and parallel with tunnel A', the arrangement of flues and draft is exactly reversed, because the reloaded cars move in the opposite direction, and this arrangement is necessary because great expedition is desirable, as I have found from experience that a car should be unloaded, reloaded and started into the second tunnel about every five minutes.

The cars D are so constructed that when coupled together the ends of the same will be in actual contact, and they are caused to enter and be propelled through the tunnels by suitable rams indicated at M, so that a train of coupled cars may be gradually progressed within and through the tunnels in the manner well known in tunnel kilns for burning brick upon fireproof cars. At the initial point or ingress of each tunnel is arranged a loading hopper N (Figs. 6 and 8) and conveyer O (Fig. 6) the latter being operated by machinery in any suitable manner. The hopper N is of convex form, as shown at Figs. 6, and 6^a. It is arranged at the entry end of each tunnel, and above the path of the traveling cars D, so that when the latter are successively brought to the door of the kiln the conveyer blades will deliver the garbage over the end of the hopper, and in returning will drag the garbage backward, packing it under the convex hopper and upon the floor of the car, all surplus being carried back through the trunk within which the conveyer travels, and back to the dump.

The upper or curved surface of the hopper N has an open slot from end to end which is closed by the conveyer trunk and the horizontal partition therein, over and under which the conveyer blades travel, as clearly indicated in Figs. 5 and 6^a.

At the exit end of each tunnel is arranged an oblique metal brush P mounted in horizontal boxes, and adapted to be rotated in such manner as to sweep or brush the incinerated load from each car as it makes its exit from the tunnel. (See Figs. 3, 4, 6, 8, 9, and 10.)

Below the brush P is arranged a screen Q composed of grate bars or constructed in any

other suitable manner, and below the screen is arranged a receptacle and trough R, into which the incinerated and ash-like material falls. In the bottom of this trough R is arranged a rotary worm conveyer S, which conveys the contents of the trough to any suitable dump, or to a room where it may be mixed with any suitable fertilizer adjunct. (See Figs. 9 and 10.)

The un-incinerated material which may have been commingled with the garbage and ashes, such as metal cans, &c., and which has been melted and reduced by the action of heat in the tunnel, is separated by the screen Q and delivered at one side, as shown in Fig. 9, and may be used in the construction of sash and other weights.

At the left hand side of Fig. 6 the circle T, represents a turn table arranged at each end of the kilns with tracks thereon, and after the loaded car has made its exit for instance from the tunnel A', and has had its incinerated load swept off, it runs upon the turn table T, and the latter is revolved to bring the car into alignment with the tracks E, within the tunnel A, and the cars are then loaded again and forced through said tunnel and out at the exit end, and under the action of the rotary brush P, and there again loaded.

Attention is directed to the location of the fire zones of each tunnel, and to the fact that preferably they are so arranged as to be not opposite to each other, as seen at Fig. 1; and the proportion of the tunnels and cars and fire zones are such that while the capacity of each of the tunnels is ten cars, the fire zones have a capacity for three cars, and the distance between the exit end of the fire zone and the exit of the tunnel is such as to accommodate three cars. This arrangement is preferred in order that there shall be only a comparatively small number of car loads to cool after leaving the fire zone, so that the load may be quickly cooled and removed, before the platform of the car cools too much. For if the load is removed, the car reloaded and, through the medium of the turn table, expeditiously returned to the adjacent tunnel A, the latent heat of the car platform is utilized in evaporating the moisture of the load.

U represents the engine which is employed to provide the necessary power for operating the movable parts of the apparatus.

V is an ordinary boiler, and W is an air compressor used for compressing the air in the air conduit pipe.

The cars are moved along the tracks by a ram M, arranged at the entrance of each tunnel. This ram for convenience is mounted upon trucks in order that it may be adapted to different positions necessary.

As I have already explained, the tunnels are arranged side by side for convenience and expedition in treating the material to be operated upon, but while they may be arranged as described and in contact with each other, I prefer to separate them as shown, in

order that I may inject the oil and air into the fire zones from both sides of the tunnels. This is especially desirable to secure the boring and stirring action accomplished by the column of fire, and avoids the necessity of mechanical devices which would be necessary, and which in view of the presence of such intense heat would be undesirable at least, if not altogether impracticable.

I wish it to be understood that I do not confine myself to the exact details of construction and arrangement shown and described, so long as the apparatus involves the generic principle of the arrangement of the tunnels, and the application of heat in such manner that the initial load upon the cars is dried and evaporated before incineration, and the vapors eliminated are conveyed to the fire zone and commingled with the necessary amount of oxygen to convert them into inflammable gases and to cause them to ignite and assist in incinerating the dry load upon the cars. I of course prefer the arrangement described, which involves carrying the heat from the fire zone back over the arch so that the radiated heat shall be utilized for evaporating the moisture of the load upon the cars, but it will be understood that radiated heat may be derived from other sources, such as an independent fire, and it will also be understood that the direct heat, of the fire zone may be utilized to evaporate the moisture, but these modifications are only partially successful, and are not as economic as the arrangement shown, and while I have shown an apparatus involving two parallel tunnels with the necessary loading and unloading devices, and with turn tables, &c., all of which I have devised for the purposes of economy and expeditious treatment, it will be understood that a single tunnel with its necessary adjuncts may be used without departing from the spirit of my invention, or that more than two may be used.

Having described the apparatus I will now briefly describe the method involved. The garbage and other material, either alone or mixed, is loaded upon suitable cars, and the cars so loaded are caused to enter a drying and burning kiln in regular succession, so that the heat generated by the applied fuel will in traveling to the draft stack pass over the arch above the cars, and heat the same, causing radiated heat to attack the loaded car underneath the arch, and to extract therefrom all moisture and gases of whatever character, which moisture and gases in the form of vapor are then carried forward and below the arch of the tunnel, to the fire zone, and at that point mingled with a suitable quantity of oxygen to convert the same into inflammable gases, where they are ignited and serve as auxiliary fuel for consuming the dried load upon the car, thus utilizing what has heretofore retarded combustion, to assist and augment the same. At the point where the load upon the car is subjected to the incin-

erating action of the heat or flame supplied with oxygen, a column of flame is forced, under pressure, into the body of the load to attack the carbon concealed within the interstices and to also stir said load.

What I claim is—

1. The method herein described of burning garbage and other refuse material, which consists in loading the same upon movable fire-proofed cars, passing the same through a continuous kiln toward a fire zone located at one point thereof supplied with oil and air under pressure and ignited, subjecting the material in its progress toward the fire zone to the action of radiated heat, and extracting the moisture and gases from the mass, conveying the moisture and gases so extracted, to the fire zone, and at that point supplying them with oxygen and causing them to combine with the injected fuel and to attack and incinerate the advanced load to be operated upon, substantially as set forth and described.

2. The method herein described of burning garbage and other refuse material which consists in loading the same upon movable fire-proofed cars, passing the same through a continuous kiln, toward a fire zone located at one point thereof supplied with air and oil under pressure and ignited, subjecting the material in its passage toward the fire zone to the evaporating and drying action of radiated heat, conveying the moisture and gases extracted from the load to the fire zone, mixing therewith a suitable quantity of oxygen, and forcing the flame produced by the admixture of fuel and gases against and into the load upon the advanced car, substantially as set forth and described.

3. In an apparatus for burning garbage, &c., the parallel tunnel kilns A, A' reversely

constructed as described, with tracks and movable cars, and suitable means for propelling the cars, and a turn table T arranged at the ends of the tunnels, substantially as and for the purpose described.

4. The tunnels A, A' arranged in parallelism to each other and separated, and each tunnel provided on both sides with fuel feeding devices, substantially as and for the purpose set forth.

5. In combination with the tunnels A, A', and the movable cars D, the hopper N and conveyer O, substantially as and for the purposes set forth.

6. In combination with the tunnels, as A, A', the hopper N arranged at the entrance to the tunnel above the path of the cars, and made of convex form to pile the load in arch form, substantially as set forth.

7. In combination with the tunnels A, A', and the movable cars D, the revolving brush P adapted to sweep off the load from the cars, substantially as described.

8. In combination with the tunnels A, A' movable cars D, and revolving brush P, the screen Q, trough R, and conveyer S, substantially as and for the purpose set forth.

9. In combination with the tunnels A, A' having openings G on opposite sides, the oil and air pipes H, I, compressor W, and suitable valves for regulating the pressure and supply of oil and air, substantially as and for the purposes described.

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

JAMES C. ANDERSON.

Witnesses:

WM. C. MCINTIRE,
N. CURTIS LAMMOND.