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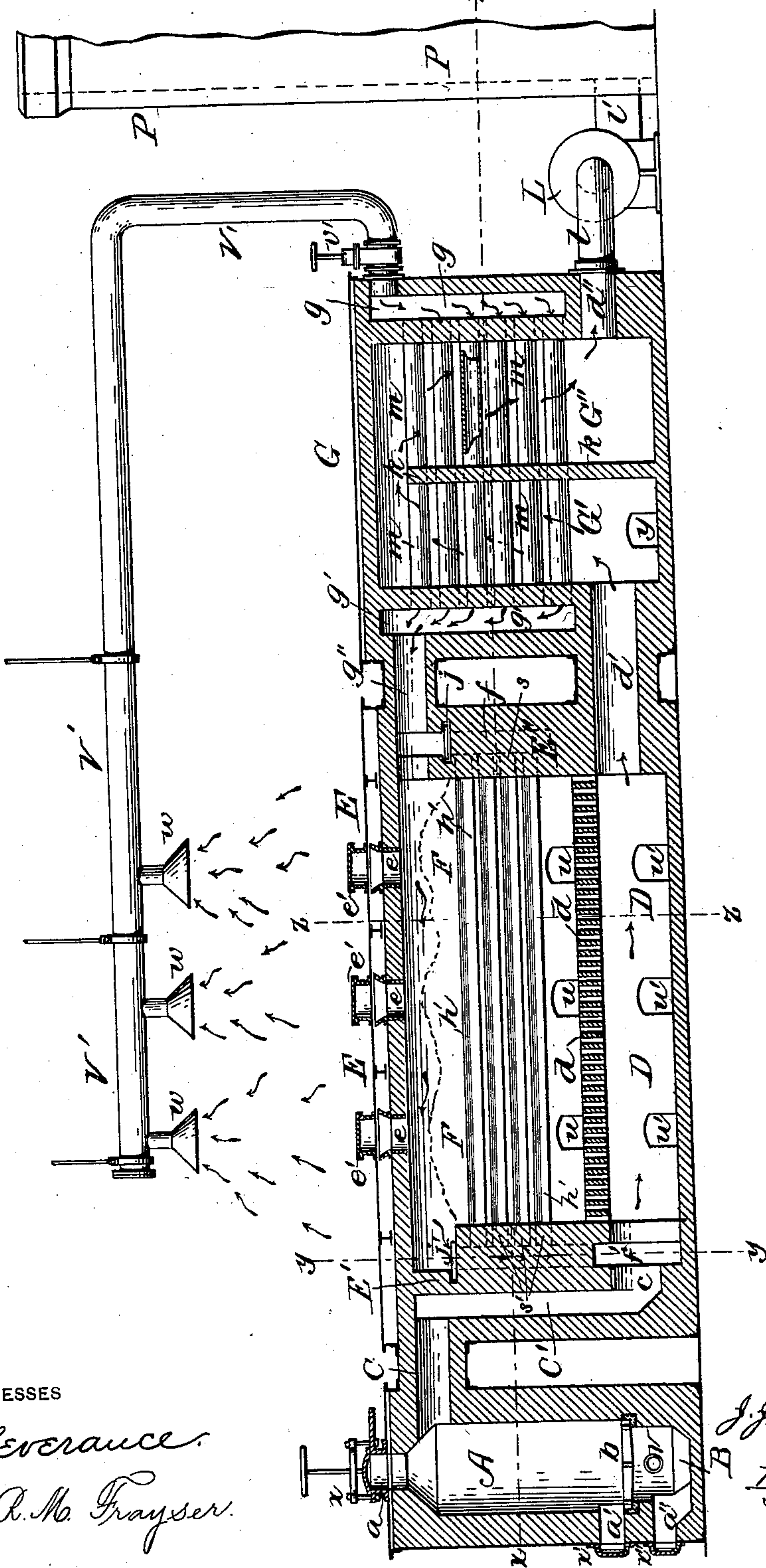
3 Sheets—Sheet 1.

J. J. KENNEDY.  
GARBAGE INCINERATING APPARATUS.

No. 588,998.

Patented Aug. 31, 1897.

Fig. 1.



WITNESSES

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(No Model.)

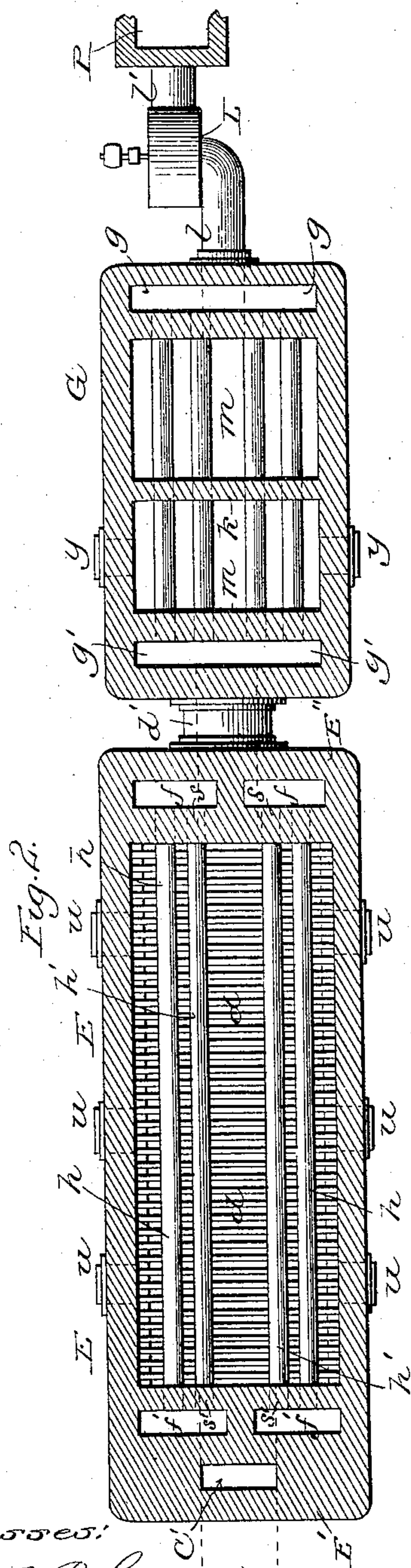
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J. J. KENNEDY.

## GARBAGE INCINERATING APPARATUS.

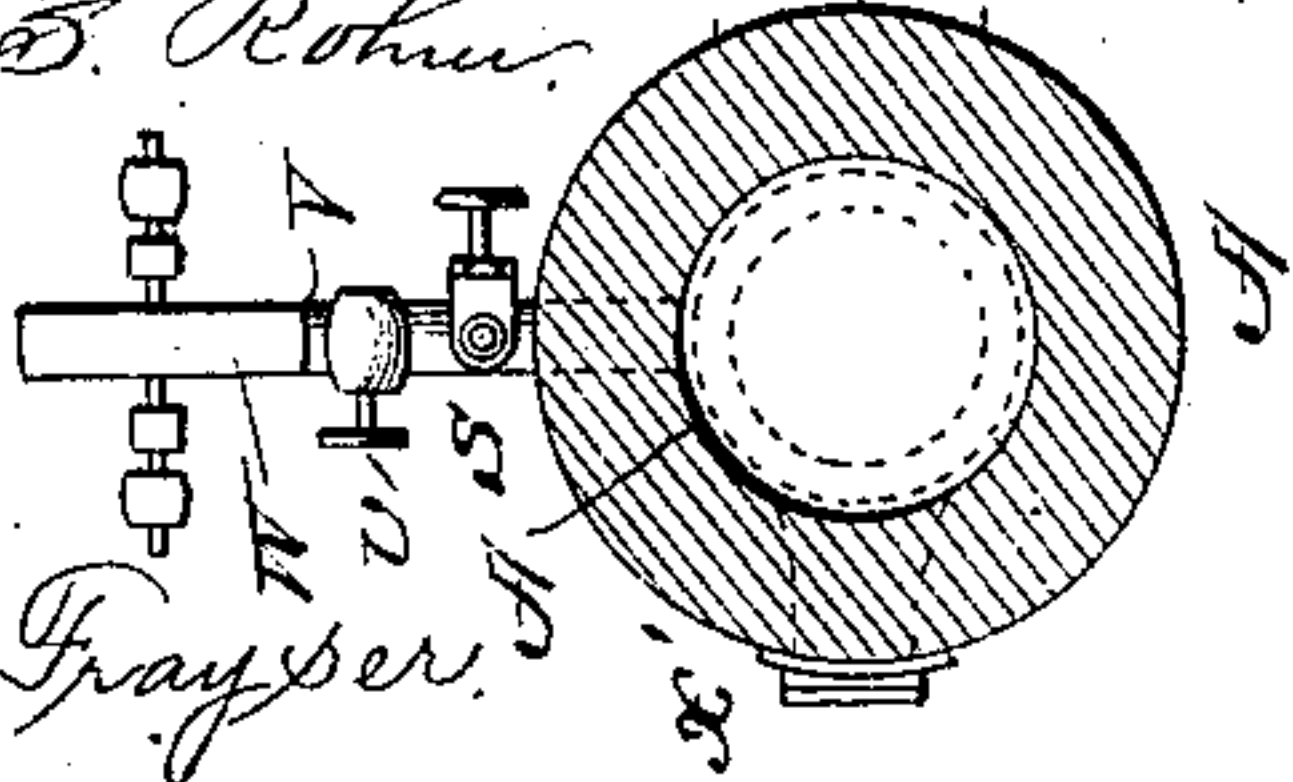
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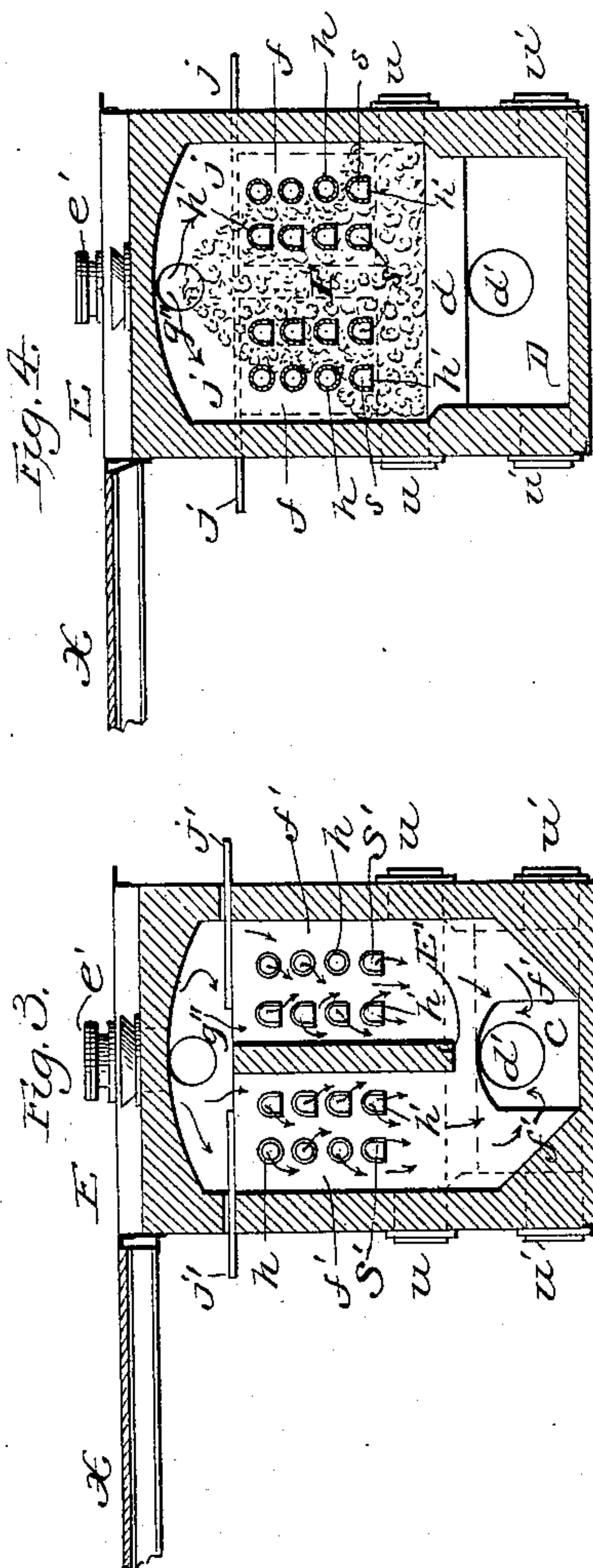


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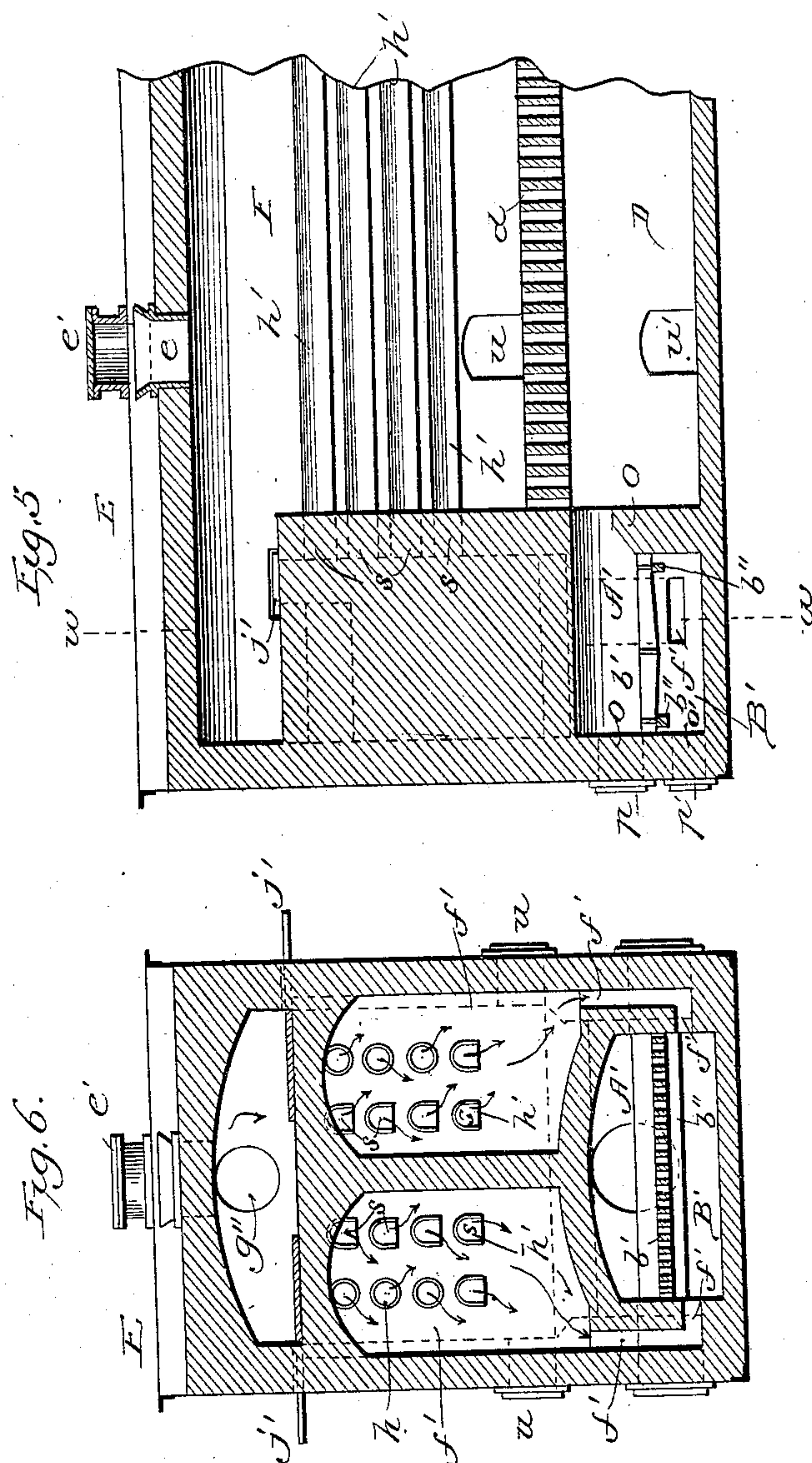
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att'y.



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GARBAGE INCINERATING APPARATUS.

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# UNITED STATES PATENT OFFICE.

JEREMIAH J. KENNEDY, OF PHILADELPHIA, PENNSYLVANIA.

## GARBAGE-INCINERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 588,998, dated August 31, 1897.

Application filed November 15, 1895. Serial No. 569,091. (No model.)

*To all whom it may concern:*

Be it known that I, JEREMIAH J. KENNEDY, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Garbage-Incinerating Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as it appertains to make and use the same.

This invention relates to apparatus for destroying garbage, including all kinds of vegetable and animal refuse, carcasses of animals, &c., and also burning the noxious gases, vapors, and odors given off from garbage in the incinerating operation.

The object of my invention is to provide for economically heating air by the waste heated products from the garbage-furnace and utilizing such heated air for drying garbage and absorbing the vapors and odors arising from the body of garbage being burned and then supporting combustion of gaseous or other fuel by means of such heated air containing the noxious vapors and odors, thereby effecting at the same time the combustion of the fuel and the vapors and odors contained in the air with which the garbage has been treated, and then utilizing the resulting hot products to effect the combustion of the solid portions of the organic substances to be destroyed.

Another object of my invention is to provide an effective and economical construction and arrangement of furnace or furnaces adapted to first consume all the vapors and odors given off by the garbage charged into it and at the same time utilize the calorific value of the garbage burned for heating the air which is used for absorbing and carrying to the fuel-combustion furnace the vapors and odors from the body of the garbage being burned.

The gases, vapors, and odors given off during the operation of incinerating garbage escape from the fresher and cooler portions of the charge and are not destroyed by simply raising them to a high temperature and permitting them to escape into the stack, as is customary.

In my apparatus air is first heated to in-

crease its capacity for absorbing the moisture in the garbage and for absorbing and carrying off the vapors and odors. It is then passed in contact with the cooler and fresher portions of the charge of garbage to drive off the moisture and to absorb the watery and combustible vapors and offensive odors, which are then carried to the fuel-furnace or combustion-chamber, where the vapor-charged air supports combustion of gaseous, liquid, or solid fuel, at the same time effecting the combustion of the vapors and odors and the development of great heat. The resulting flame and hot products are passed in contact with the solid portions of the garbage to be destroyed, thereby consuming them with the development of additional heat. The heat developed by the above operation is then utilized to heat the air required to dry the body of garbage and absorb the vapors and gases given off therefrom or given off from succeeding charges of fresh garbage. The operation of the apparatus is thus made continuous and effects a great saving in fuel, since the products of combustion finally pass off at a low temperature.

Garbage containing fat or animal matter when acted upon by the heated air gives off large volumes of rich oily vapors, which are absorbed by the air and carried to the furnace or fuel-combustion chamber, where their combustion takes place, resulting in a saving of fuel required to destroy the solid parts of the garbage.

In conducting the operation the escape of vapors and noxious odors from the apparatus is also prevented and their destruction effected by passing or drawing currents of cold air in contact with the fresher and cooler portions of the charge of garbage and then using such vapor-charged air for causing combustion of the fuel required to destroy the solid portions of the garbage in the manner above described. I prefer, however, to use heated air, for the reason that it will more readily drive off the moisture and absorb the vapors and odors and for the further reason that the capacity of such heated air for absorbing and carrying vapor increases rapidly with its temperature.

My improved apparatus is illustrated in the accompanying drawings, in which—



Figure 1 represents a vertical longitudinal section of one form of my apparatus arranged to burn gas or hydrocarbon vapor for fuel. Fig. 2 represents a horizontal section thereof on the line  $x x$ , Fig. 1. Figs. 3 and 4 represent vertical transverse sections, respectively, on the lines  $y y$  and  $z z$ , Fig. 1. Fig. 5 represents a vertical longitudinal section of a portion of another form of my apparatus arranged to burn solid fuel in the fuel-combustion chamber. Fig. 6 represents a vertical transverse section thereof on line  $w w$ .

In my apparatus I preferably use a gas generator or producer A, in which gas is generated and delivered to the fuel-combustion chamber of the garbage-furnace. The generator A is constructed of brick and inclosed within an iron jacket or shell in the usual manner and is provided at the bottom with the usual ash-pit B, grate  $b$ , and the fuel and ash openings  $a'$  and  $a''$ , closed by lids or doors  $x'$  and  $x''$ . The generator is provided at the top with a fuel-supply opening  $a$  and a closing-lid  $x$  and also with an escape flue or pipe C, connecting with the garbage-furnace. An air-blast pipe V, having a valve  $v$ , leads from a blower W and connects with the ash-pit, and a steam-supply pipe S, having a valve, connects with blast-pipe V for supplying steam, with air, to the generator. By means of the air-blower and the steam-supply pipe connecting as described gas can be generated and delivered under pressure to the fuel-combustion chamber of the garbage-furnace. Though I preferably generate and supply gaseous fuel to the fuel-combustion chamber, I may also obtain good results by constructing a fire-box for solid fuel in the fuel-combustion chamber of the garbage-furnace, as illustrated in Figs. 5 and 6, or by using a separate furnace connecting with the combustion-chamber.

The garbage-furnace E is constructed with thick walls  $E'$  and  $E''$  for containing the necessary gas and air flues and is provided with the usual grate  $d$ , dividing it into the combustion-chamber D below and the garbage-chamber F above. A downtake-flue C' in the end wall  $E'$  connects the gas-outlet pipe C of the generator with the fuel-combustion chamber D through the port  $c$ , adjacent to the air-inlet ports  $f'$ , as shown in Figs. 1 and 3.

The end wall  $E''$  is constructed with the vertical air-inlet flues  $f$  and the end wall  $E'$  is constructed with the vertical air-flues  $f'$ , as shown in Figs. 2, 3, and 4. The inlet-flues  $f$  are provided with dampers  $j$ , as shown in Figs. 1 and 4, and the discharge-flues  $f'$  are provided with the dampers  $j'$  for closing their openings when desired. The inlet-flues  $f f$  and discharge-flues  $f' f'$  are connected by the horizontal pipes  $h$ .

The pipes  $h$  are placed near the side walls of the garbage-chamber F, as shown in the drawings, and are for the purpose of conducting hot air through the garbage-chamber to heat the garbage and drive off the watery vapors and volatile parts of the charge. The

pipes  $h$  also support the body of garbage laterally a short distance away from the side walls, so that a larger surface is exposed to the drying and absorbing action of the air which is passed in contact with the surface of the body of garbage.

The channel-bars  $h'$  pass through the garbage-chamber and have under their ends, at one end of the garbage-chamber, air-inlet ports  $s$ , connecting the garbage-chamber with the air-flues  $f f$  and have under their ends, at the other end of the garbage-chamber, outlet-ports  $s'$ , connecting the garbage-chamber with the flues  $f' f'$ . These channel-bars are for the purpose of maintaining channels or passages through the body of garbage under the entire length of each bar for the passage of the hot air through and in contact with the body of garbage to dry it and to absorb its moisture and volatile constituents.

As the hot air passes through the ports  $s$  connecting the garbage-chamber with the air-flues  $f f$  and through the body of garbage along the under sides of the channel-bars  $h'$  to the outlet-ports  $s'$ , connecting the garbage-chamber with the flues  $f' f'$ , it also heats the channel-bars and dries the garbage in contact with their upper surfaces.

The form of the channel-bars may be varied to obtain the best results with the kind of garbage being destroyed, but for kitchen garbage I prefer to use the form shown.

Any number of vertical courses of channel-bars may be used, provided they are spaced horizontally a sufficient distance from the air-pipes and from each other to prevent them from acting as a grate and to insure a column of garbage between adjacent bars.

The continuous downward movement of the body of garbage, due to the combustion of its lower surfaces, causes every part of the charge to be acted upon by the currents of air passing in contact with the outer surfaces or through the channels in direct contact with the garbage.

Feed-openings  $e$ , having tight-closing lids  $e'$ , are provided at the top of garbage-incinerating chamber F.

Lateral openings  $u$  and  $u'$  are constructed in the side walls of furnace E for giving access to the grate and to the fuel-combustion chamber D for removing ashes, &c.

The combustion-chamber D and the garbage-chamber F are connected, respectively, with the air-heating stove G by means of the lower flue  $d'$  and the upper flue  $g''$ .

The air-heating stove G is constructed with double end walls, forming air-inlet flue  $g$  and outlet-flue  $g'$ . The stove G is also divided by a transverse partition-wall  $k$ , extending from the bottom thereof to near the top and forming the connecting-compartments  $G'$  and  $G''$  for causing the hot gaseous products to travel up and down through the chamber in contact with the air-heating pipes  $m$ . These pipes  $m$  are placed horizontally and connect the air-inlet flue  $g$  with the air-outlet flue  $g'$ , as shown



in Figs. 1 and 2. An escape flue or opening  $d''$  for products of combustion in the outer end wall of air-heater G connects by the pipe  $l$  with the exhauster L, which in turn connects by an outlet-pipe  $l'$  with the stack P. An air-inlet pipe  $V'$ , extending horizontally above the garbage-furnace E and having inlet funnels or hoods  $w w$ , connects with the air-inlet flue  $g$  in the heater G. Pipe  $V'$  is also provided with a controlling-valve  $v'$ . The funnels or hoods  $w$  are preferably placed just above the feed-openings of the garbage-furnace, so that offensive vapors and odors which might arise from piles of garbage adjacent to the said openings will be drawn into air-pipe  $V'$  and conducted through the air-heating stove to the garbage-incinerating chamber F.

Platforms X are constructed on a level with the top of the garbage-furnace for permitting carts or wagons to be hauled alongside of the charging-openings  $e$ , so that garbage may be dumped directly into the chamber F.

The apparatus having been constructed and connected as above described and substantially as illustrated in the drawings may be operated as follows: A fire is kindled upon the grate of the generator and is supplied with fuel until a deep body of ignited fuel is formed. Combustion of the fuel is preferably urged by an air-blast from blower W, and after a sufficient body has been heated to incandescence steam is supplied through pipe S and a good fuel-gas generated and delivered under pressure to the combustion-chamber D. The escaping hot products pass through the air-heater G and are drawn off by the exhauster L. As soon as the exhauster is set in motion air will be drawn through pipe  $V'$ , and thence through the air-heating stove G into the garbage-chamber F, and thence through the flues  $f'$  to the gas-inlet port  $c$ , where combustion of the gas is effected. At any suitable time, either before heating up the apparatus or afterward, a body of garbage is charged into the chamber F and subjected to the drying and absorbing action of the currents of hot air from the heating-chamber, by which the vapors and offensive odors will be absorbed and carried into the fuel-combustion chamber, where they will be completely consumed by combustion of the fuel-gas with the vapor-charged air. The resulting flame and hot products will burn and destroy the garbage lying upon grate  $d$ , resulting in the development of additional heat, which will pass off with the products of combustion and highly heat the air, which is drawn through the heating-pipes  $m$  in the air-heating stove G.

In the above operation part of the air may be passed through the pipes  $h$  and the channels  $h'$  by partly or wholly opening the dampers  $j$  and partly closing the dampers  $j'$ , and all the air may be passed through the pipes  $h$  and channels  $h'$  by entirely closing the dampers  $j'$  and opening the dampers  $j$ .

The operation may be made continuous by

keeping the exhauster L and the air-blower W in operation.

Since a separate blower is used for supplying air under pressure to the gas-generator, the operation of generating gas and supplying it to the combustion-chamber will not be interrupted when the lids  $e'$  at the top of the garbage-chamber are opened, as would be the case if I depended upon the exhauster alone for drawing air into the gas-generator as well as drawing air through the heater and in contact with the body of garbage. If I exhausted air through the gas-generator as well as through the air-heating apparatus and garbage-furnace, the generation of gas and combustion thereof would cease whenever the covers of the charging-openings of the garbage-chamber were removed to introduce an additional charge, since then the whole volume of air would be drawn by the exhauster directly through the charging-opening into the garbage-chamber and no air would be drawn through the gas-generator. No gas would then be made and air only would be drawn through the garbage-chamber, causing a rapid lowering of temperature of the fuel-combustion chamber, and the air with its charge of vapors and odors would be passed through the stack into the outer air.

By using a blower to operate the generator fuel-gas will always be delivered at a high temperature into the combustion-chamber of the garbage-furnace and combustion of the fuel, vapors, and odors will be continuous, notwithstanding the fact that one or more lids of the charging-openings are removed.

Fig. 5 represents a vertical longitudinal section of a good form of my apparatus arranged to burn solid fuel.

Fig. 6 represents a vertical transverse section on the line  $w w$ , Fig. 5.

Similar letters of reference in Figs. 5 and 6 represent similar parts in Figs. 1, 2, 3, and 4.

The furnace  $A'$  is constructed in the usual manner with a bridge-wall O, grate  $b'$ , resting on bars  $b''$ , ash-pit  $B'$ , and fuel and ash openings  $o$  and  $o'$ , closed by doors  $p$  and  $p'$ .

This apparatus may be operated as follows: Solid fuel is delivered upon the grate  $b'$  and ignited, and combustion maintained by air drawn through the apparatus by the exhauster L. At any suitable time, either before or after heating up the apparatus, garbage is charged into the chamber F and exposed to the action of the currents of air. After acting on the body of garbage the air with its charge of vapor and odor is drawn through the flues  $f' f'$  into ash-pit  $B'$ , then up through the furnace  $A'$  to support combustion of the fuel on the grate  $b'$ , and at the same time consuming all vapors and odors. The hot products of combustion are then drawn through the combustion-chamber D to effect the combustion of the solid portions of the garbage and develop additional heat for heating the air passing through the air-heater G.

It will be observed that in my apparatus it



is impossible for vapor, odor, or product of combustion to pass from the apparatus except through the fuel-furnace and thence through the exhauster, and since all vapors and odors are burned in the combustion of the fuel, with the air carrying them, it is impossible for vapors and odors to escape unconsumed from the apparatus.

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

1. In a garbage-incinerator the combination of an air-heating chamber having an air-inlet and an air-outlet; a garbage-chamber having an air-inlet, outlets for air and vapors from the charge of garbage, inlet and outlet ports in opposite walls, means for maintaining draft-channels connecting said inlet and outlet ports through the charge of garbage, flues connecting the inlet-ports with the air-inlet, flues connecting the outlet-ports with the outlet for air and vapors and a flue connecting the air-inlet of the garbage-chamber with the air-outlet of the air-heating chamber, substantially as described.

2. A garbage-incinerator divided by a grate into a garbage-chamber having an air-inlet, and a fuel-furnace having a fuel-supply, inlets for air and vapors from the charge of garbage, and an outlet for the products of combustion; and having an air-heating chamber, a flue connecting the air-outlet of the air-heating chamber with the air-inlet of the garbage-chamber and flues connecting the garbage-chamber with the inlets of the fuel-furnace, substantially as described.

3. A garbage-incinerator divided by a grate into a garbage-chamber having an air-inlet and a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion and an outlet for the products of combustion, and having air-flues connecting the garbage-chamber with the air-inlet ports of the fuel-furnace, and also having a series of air-pipes passing through the garbage-chamber and connecting at one end with said air-flues, and connecting at the other end with air-flues connecting said air-pipes with the upper part of the garbage-chamber, and also having dampers for regulating the amount of air passing through said air flues and pipes, substantially as described.

4. A garbage-incinerator having a fuel-furnace, a garbage-chamber, a series of channel-bars passing through the garbage-chamber, inlet and outlet ports in opposite walls of the garbage-chamber, said ports being directly under said channel-bars and connecting at one end with flues connecting with the fuel-furnace and at the other end with flues connecting with the outer air, substantially as described.

5. A garbage-incinerator divided by a grate into a garbage-chamber having an air-inlet, and a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion, and an outlet for products of combustion, air-

flues connecting the garbage-chamber with the air-inlet ports of the fuel-furnace, and a gas-supply flue and ports connecting with the fuel-furnace, in combination with a gas-generator connecting with said gas-supply flue in the garbage-incinerator, an air-blower and a pipe connecting it with the gas-generator, and an exhauster connecting with the outlet-flue of the incinerator, whereby a continuous current of gas will be delivered to the incinerator, and a continuous current of air will be drawn through the garbage-chamber in contact with the body of garbage, for absorbing the vapors and odors, and the same burned with said gas, substantially as described.

6. A garbage-incinerator divided by a grate into a garbage-chamber having an air-inlet and a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion and an outlet for the products of combustion, and having air-flues connecting the garbage-chamber with the air-inlet ports of the fuel-furnace, and also having a series of channel-bars passing through the garbage-chamber and connecting through ports at one end with said air-flues and connecting through ports at the other end with air-flues connecting said channel-bars with the air-inlet of the garbage-chamber, and also having dampers for regulating the amount of air passing through said air flues, ports, and channels, substantially as described.

7. A garbage-incinerator divided by a grate into a garbage-chamber having an air-inlet and a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion and an outlet for products of combustion, and having air-flues connecting the garbage-chamber with the air-inlet ports of the fuel-furnace, and also having a series of air pipes and channels passing through the garbage-chamber and connecting at one end with said air-flues, and connecting at the other end with air-flues connecting said air pipes and channels with the air-inlet of the garbage-chamber, and also having dampers for regulating the amount of air passing through said air flues, pipes and channels, substantially as described.

8. A garbage-incinerator having in combination an air-heating chamber, a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion and an outlet-flue for delivering the hot products of combustion to the air-heating chamber; a garbage-chamber having a grated bottom separating it from the fuel-furnace, an air-inlet flue connecting with the air-outlet of the air-heating chamber and a series of channel-bars connecting at one end with flues which connect the garbage-chamber with the air-inlet ports of the fuel-furnace, and at the other end with flues which connect with the air-supply from the air-heating chamber, substantially as described.

9. A garbage-incinerator having in combination, an air-heating chamber; a fuel-fur-



nace having a fuel-supply, air-inlet ports and an outlet-flue for delivering the hot products of combustion to the air-heating chamber; a garbage-chamber having an air-inlet flue connecting with the air-outlet of the air-heating chamber, and a series of pipes connecting at one end with flues connecting with the garbage-chamber, and connecting at the other end with flues connecting with the air-inlet ports of the fuel-furnace, substantially as described.

10. A garbage-incinerator having in combination, an air-heating chamber, a fuel-furnace having a fuel-supply, air-inlet ports for supplying air for combustion and an outlet-flue for delivering the hot products of combustion to the air-heating chamber; a garbage-chamber having a grated bottom separating it from the fuel-furnace, an air-inlet flue connecting with the air-outlet of the air-heating chamber, and a series of channel bars and pipes connecting at one end with flues which connect the garbage-chamber with the air-inlet ports of the fuel-furnace, and at the other end with flues which connect with the air-supply from the air-heating chamber, substantially as described.

11. A garbage-incinerator divided by a grate into a fuel-furnace having a fuel-supply, inlets for air and vapors from the charge of garbage and an outlet for the products of combustion, and a garbage-chamber having an air-inlet, inlet and outlet ports in opposite walls, means for maintaining draft-channels connecting said inlet and outlet ports

through the charge of garbage and having flues connecting the inlet-ports with the garbage-chamber and air-inlet and flues connecting the outlet-ports with the inlets of the fuel-furnace, substantially as described.

12. A garbage-incinerator having an air-heating chamber; a fuel-furnace having a fuel-supply, inlets for air and vapors from the charge of garbage and an outlet for the products of combustion; a garbage-chamber having an air-supply flue connecting with the air-outlet of the air-heating chamber, inlet and outlet ports in opposite walls, means for maintaining draft-channels connecting said inlet and outlet ports, through the charge of garbage, flues connecting the inlet-ports with the garbage-chamber and air-supply from the air-heating chamber, and flues connecting the outlet-ports with the inlet of the fuel-furnace, substantially as described.

13. In a garbage-incinerator, the combination with the chamber F and a combustion-chamber in operative relation thereto, of the flues  $f, f$ , the flues  $f', f'$ , and the channel-bars  $h', h'$ , connecting the flues  $f, f$ , with the flues  $f', f'$ , through the chamber F, said flues  $f'$ , connecting with the combustion-chamber, substantially as shown and described.

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

JEREMIAH J. KENNEDY.

Witnesses:

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SAMUEL S. BOGGS.