

(No Model.)

2 Sheets—Sheet 1.

J. J. STORER.

FURNACE AND APPARATUS FOR TREATMENT OF REFUSE OF CITIES.

No. 539,096.

Patented May 14, 1895

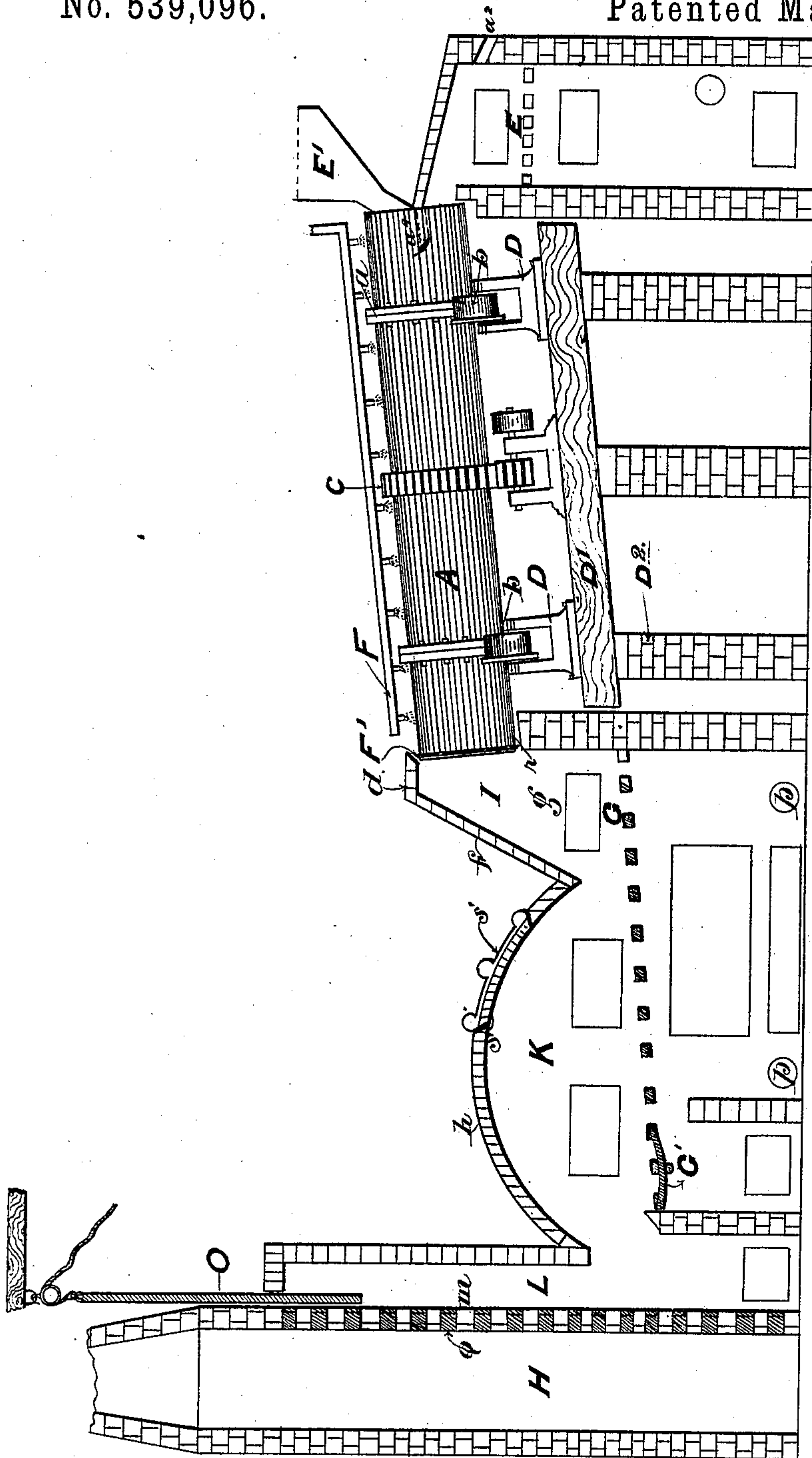


Fig. 1.

Witnesses
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Francis W. Jones

Inventor
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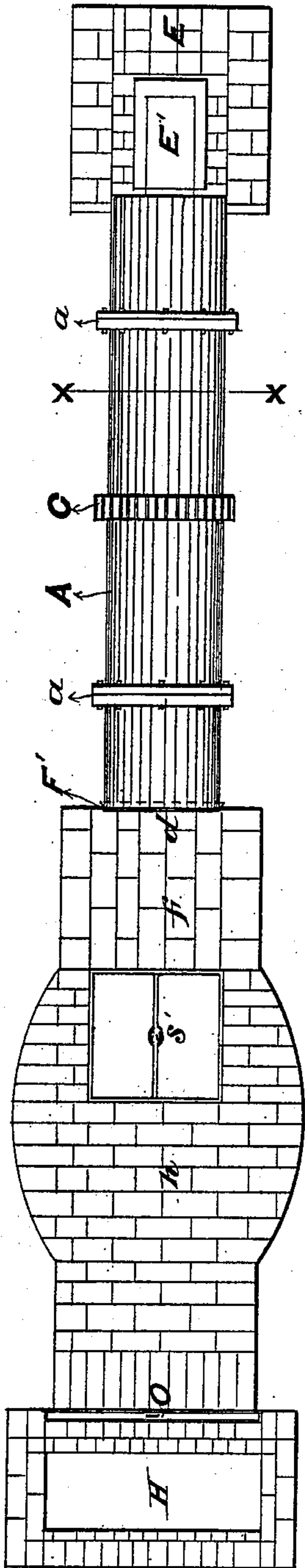


Fig. 2.

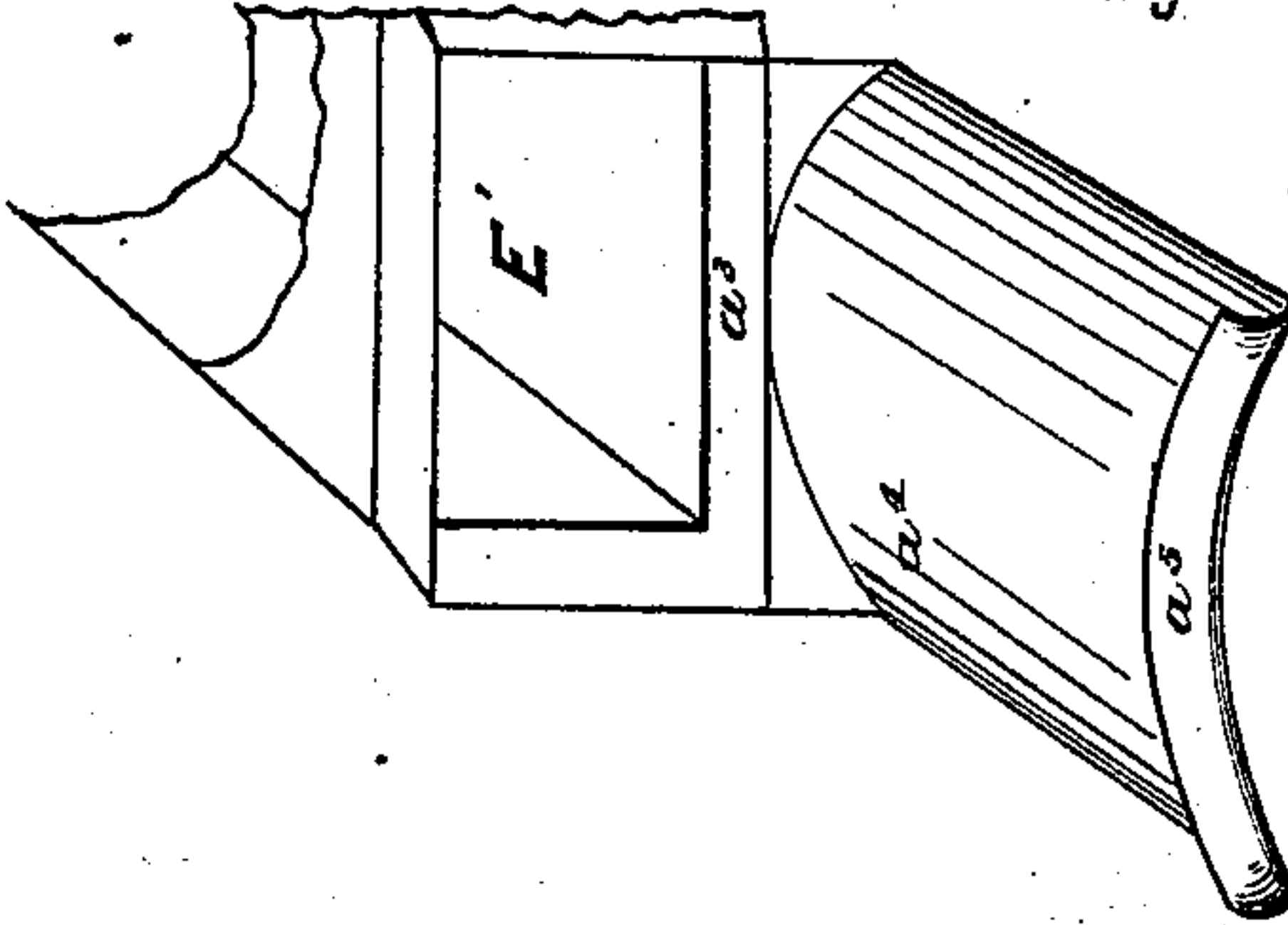


Fig. 5.



Fig. 4.

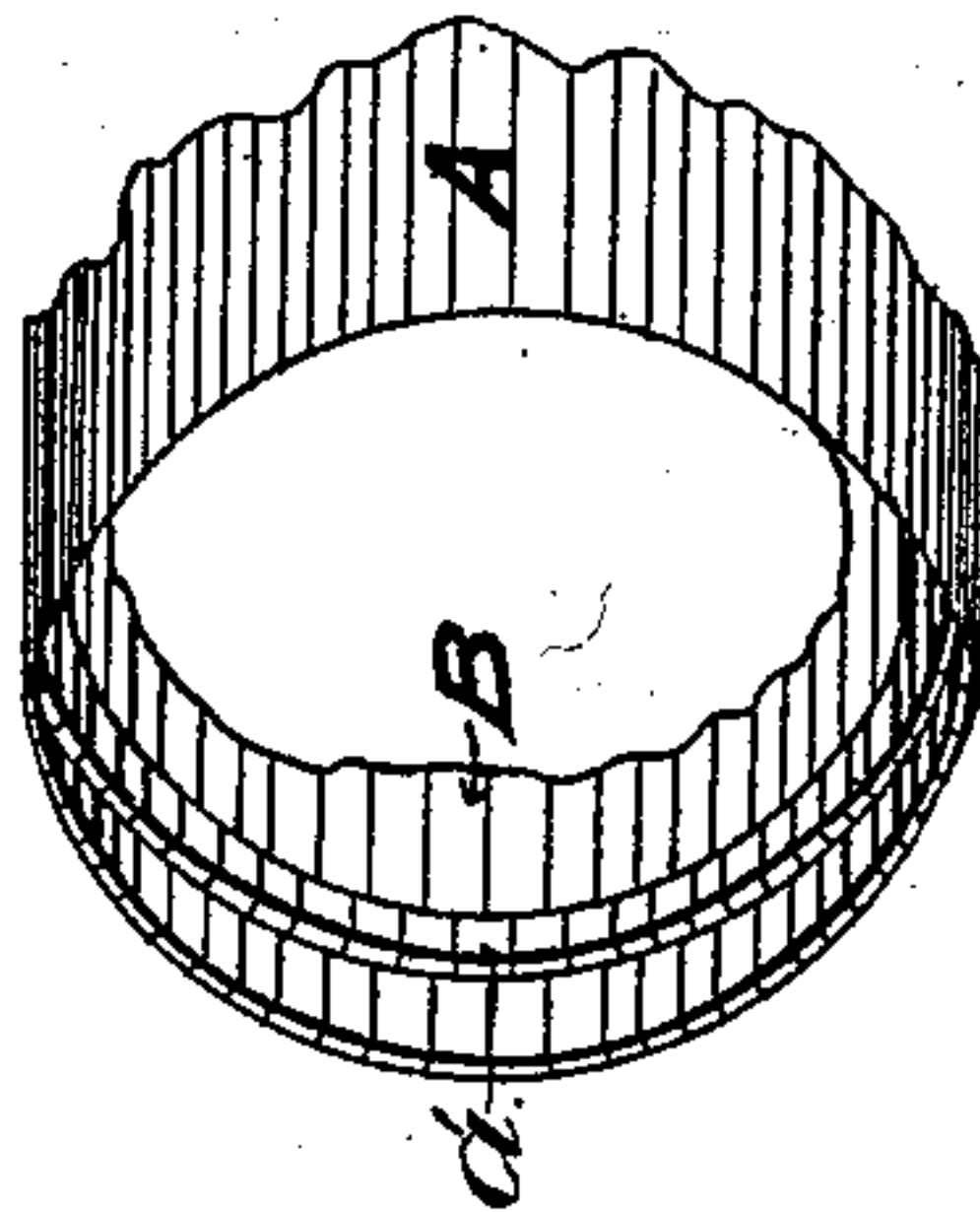


Fig. 3.

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UNITED STATES PATENT OFFICE.

JACOB J. STORER, OF HELENA, MONTANA, ASSIGNOR TO THE ECONOMIC-SANITARY COMPANY, OF MONTANA.

FURNACE AND APPARATUS FOR TREATMENT OF REFUSE OF CITIES.

SPECIFICATION forming part of Letters Patent No. 539,096, dated May 14, 1895.

Application filed March 8, 1893. Serial No. 465,218. (No model.)

To all whom it may concern:

Be it known that I, JACOB J. STORER, of Helena, county of Lewis and Clarke, and State of Montana, have invented certain new and useful Improvements in Furnaces and Apparatus for the Treatment of Refuse of Cities, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings and to the letters of reference marked thereon.

This invention is especially designed for the reduction to ashes of garbage, night-soil, condemned meats, fish and vegetables, and all city refuse of a combustible character, and for the combustion or decomposition of the compound gases emanating therefrom, so that no offensive odors shall escape from the furnace.

Certain previous inventions of mine in apparatus and processes were designed more especially for the drying of packing-house offal and city refuse, so that they might be made commercially valuable as fertilizers, and some of the features of those inventions are retained in this.

The improvements embrace the combination with the well known revolving cylinder furnace of a stationary furnace or fire surface located to receive the continuously discharged contents of said cylinder; of an arched roof over a portion of said grate or fire surface, whereby a reverberatory furnace is formed in which the compound gases are decomposed by the supplied heat and air, and in which horses, cattle and other dead animals may be cremated, and of a perforated wall, common both to smoke stack and furnace flue, for the passage of the decomposed gases into the stack; and of certain other novel devices in combination, all of which will be hereinafter fully set forth.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts.

Figure 1 is a partly-sectional side elevation of my improved apparatus. Fig. 2 is a plan of the same. Fig. 3 is an enlarged perspective view of a portion of the cylinder on line X X, Fig. 2, showing an internal ring or

rifle. Fig. 4 is an enlarged side elevation of the flanged ring or collar on lower end of cylinder. Fig. 5 is an enlarged perspective view of a portion of an improved feed-hopper.

The revolving cylinder A., is preferably constructed of cast iron, in cylindrical sections flanged on their ends, and bolted together as shown at *a*, and the fire brick lining B., is preferably made as shown in Fig. 3, with some rings of bricks projecting inwardly, beyond the others, as shown at *a'*, for the purpose of causing a better agitation and distribution of the garbage, &c., within the cylinder when the latter is revolving, and to serve as riffles for retarding the flow of the introduced liquid or semi-liquid refuse, in order to give it before its discharge, a more prolonged exposure to the hot air and flame passing through the cylinder.

The cylinder is set at a slight downward inclination from the upper to the lower end, and is revolved preferably by spur gear as indicated at C., and is supported in position, so as to revolve with but little friction, by flanged friction wheels *b*, fixed in suitable standards D., and bearing against the peripheries of the cylinder flanges *a*, said standards being supported on timbers D', beneath which are supporting piers D².

At the feed end of the cylinder is a fire-place E., from which the products of fuel combustion are delivered into the cylinder, and at *a*² is an opening in the rear wall of the fire-place, through which pulverized fuel may be injected for heating the cylinder and cremating its contents. The construction and arrangement of the parts above described are, with the exception of the internal brick rings, not new, having been previously invented and described by me in United States Patent No. 481,680, dated August 30, 1892.

Above the fire-place E., is fixed a hopper E' through which the garbage and other refuse matter is fed into the cylinder as the latter revolves. The bottom *a*³ of this hopper is prolonged and extended into the cylinder as indicated in dotted lines Fig. 1; the hopper with its prolongation being shown in perspective in Fig. 5.

It is obvious that were the garbage and

other refuse to continuously fall from a hopper directly into the axis of the cylinder, in the path of the entering pulverized fuel or flame from the fire-place, it would seriously interfere with, and in great measure prevent, by its absorption of heat, the complete combustion of the fuel or gases. Thus, in order to prevent this, the bottom of the hopper is prolonged into a deflecting plate a^4 preferably of triangular or curved cross section, (curved as herein shown) with apex uppermost, and flanks or sides sloping downward and spread out, so that the material fed into the hopper shall, instead of falling directly into the axis of the cylinder, be deflected to the sides thereof. A vertical flange a^5 on the extreme lower end of this deflecting plate, also serves to prevent the garbage, &c., from falling in the path of the products of combustion entering the cylinder from the fire place.

At F., is shown an old device of a pipe for supplying water to keep the cylinder shell cool during the operation of the process, and at F' is shown an improved ring or collar, preferably flanged, as best seen in Fig. 4, fixed about the lower end of the cylinder A., to deflect or guide into a suitable receptacle (not shown) any excess of water that may be discharged from the pipe F, upon the lower section of the cylinder, and to prevent its discharge into the lower fire or grate surface G. On this grate surface G., which is in effect an auxiliary stationary furnace, a constant fire is designed to be kept by the combustion of the garbage falling on it during the operation of the process, and it is located immediately beneath the discharging or lower end of the cylinder A., so as to receive the dried, heated and burning solid substances continuously discharged from said cylinder, when the latter is in operation, and beneath said auxiliary, stationary furnace is a blast pipe for furnishing air for the combustion of the material therein contained. This fire or grate surface G. is preferably made sloping, as shown in Fig. 1, to facilitate the distribution over it of the material, discharged from the cylinder; and at its extreme end, nearest the smoke stack H., is preferably, a dumping section G', the advantages of which will be hereinafter set forth.

The space or chamber I., into which the lower end of the cylinder A., extends and which is above the auxiliary furnace or upper section of the grate surface G., and is inclosed within the walls $d. f. g.$, is called the gas-mixing chamber, while the space or chamber K., between the grate surface and the arched roof h , is called the reverberatory gas-combustion chamber or furnace, and also the furnace for the cremation of dead animals, and the flue L. of this furnace K., has, in common with the stack H., a perforated wall m , through which the gases generated in the operation of the apparatus and process finally pass deodorized into said stack.

The operation is as follows: Fires are made

in the fire-places E. and G., and urged until the interiors of the revolving cylinder—which meanwhile is made to revolve—and of the chambers I and K. are heated to a bright red or white heat. Then the garbage or other material to be cremated is introduced, preferably continuously, into the hopper E', whence it falls into the revolving cylinder A., where it is tumbled about and agitated, and its masses broken up because of the revolutions of the cylinder, and all its parts or particles repeatedly exposed to the action of the hot air and products of combustion which are continuously passing through the cylinder from the fire-place E. The time occupied in the passage of this material from the feed to the discharge end of the cylinder may be regulated by the inclination of the cylinder, the pitch of its interior spirals, if there be any, or by the speed of its revolutions, or by all or any of these causes combined; and they are easily controlled so that the material shall be sufficiently dried before it is discharged upon the fire surface at G. In a cylinder, say sixty feet long, and five feet in internal diameter, set at an inclination of an inch to the foot, and made to revolve two or three times a minute, from ten to fifteen tons of ordinarily moist, house garbage can in an hour be sufficiently dried for instant ignition from the fire surface at G., on which it is discharged. For operating this apparatus to the best advantage the revolving cylinder must be kept filled, or nearly so, with hot air and products of combustion from the fire-place E., in which pulverized coal, petroleum, or other fuel capable of yielding a large volume of flame, may be used. In the passage of the garbage through the revolving cylinder most or all of its moisture will be evaporated, and a portion of it will be ignited, and, hot and blazing, it will continuously fall upon that portion of the fire surface G., immediately beneath the cylinder end where the combustible portions will be consumed by aid of air introduced through the first blast pipe p , while the incombustible portions—the tin cans, scraps of metal, glass, &c.—will by the operator be raked along to the dumping-grate section G', and dumped into the bit beneath.

In other garbage-cremating furnaces the wet garbage, &c., is piled upon a hearth, upon grate bars, or upon the fire itself, and the furnace is then closed and heat and flame are applied to the surface of the mass. The cremation in such furnaces is somewhat hastened by occasional and difficult hand stirring of the mass to expose fresh surfaces to the action of the fire, but the operation is necessarily slow and intermittent, because one charge must be disposed of before the furnace can be re-charged. Hence at these garbage crematories (so-called) there is necessarily an accumulation of city refuse awaiting introduction into the furnace. In disposing of city refuse, proper sanitation requires that there be no accumulation, or continued exposure of

the material at the dumping places, but that it be cremated as fast as collected and delivered. Otherwise the crematories would become breeding places of disease and pestilence. In this cremation process, however, the city refuse may be dumped continuously by the cart-load—as fast as one cart can be emptied and gotten out of the way to make room for another—directly into the cylinder hopper E', whence it falls into the heated revolving cylinder, and there, by the revolutions of the cylinder, is repeatedly tumbled and tossed about and exposed on all sides to the action of the hot products of combustion from the fire-place E., until it is automatically discharged, hot and blazing, as above set forth, from the lower end of the cylinder into the stationary furnace at G., where with the aid of air introduced through the first blast pipe p the cremation to ashes is completed.

The incandescent gaseous products of combustion from the fire-place E., and the hot vapors and gases from the drying garbage together pass from the cylinder into the gas-mixing chamber I., where sufficient air for their complete combustion may be supplied through the annular opening r., about the cylinder end. Then this gaseous volume which has issued from the cylinder passes from the gas mixing chamber I., over the burning garbage on the upper portion of the grate G., into the reverberatory furnace K. and there mixes with the gaseous products of combustion from the said burning garbage and, the requisite additional amount of air being supplied to them from the second blast pipe p., they become thereby, beneath the reverberatory roof, thoroughly mingled and brought to a very high, decomposing temperature, and thence they pass together, deodorized, into the smoke-stack H., through the apertures q., of the wall m., which wall is common both to the stack and to the flue of the gas-combustion furnace. This perforated wall m., which during the operation of the cremation, is kept at a very high temperature by the escaping gases, serves to retard in some degree their outflow, and to that extent, to retain them longer in the gas-combustion furnace under the influence of the applied heat and air which resolve them into their simple, inodorous elements.

A damper O., that may be raised or lowered over the face of the wall m., may be used for still further retarding the final escape of the gases.

A further improvement consists in adapting this reverberatory, gas-combustion furnace K., for the cremation of horses, cattle, mattresses, and other bulky objects, that could not be conveniently introduced into the cylinder furnace. For this purpose the side walls of said furnace K., are curved outwardly, as shown in Fig. 2, to sufficiently enlarge its area, and one or more large openings s., (one herein shown) that may be closed by covers

s', are made in the furnace roof, for the introduction of horses, cattle, &c. Several horses or cattle can, at one time, be placed herein without seriously obstructing the furnace draft, and such objects will be rapidly reduced to ashes by the contact of the intensely hot and burning gases flowing from the gas-mixing chamber, supplemented by the heat radiation from the curved roof and sides of the furnace.

It will be seen that this process does not contemplate the complete cremation—the reduction to ashes—of city refuse in the revolving cylinder furnace, as I have heretofore designed, nor does it contemplate the introduction of wet refuse upon the fire or hearth of a stationary furnace for the purpose of cremation.

The process consists chiefly in automatically tossing and tumbling about and drying city refuse, &c., in a heated, revolving, cylinder furnace, and in then introducing this dried, hot and blazing material directly upon the fire of a stationary furnace, and there cremating it by the aid of air introduced from below.

It is estimated that nearly four-fold more garbage can be dried to the condition of fuel in the revolving cylinder furnace than can be completely cremated therein in the same time, and that in a stationary furnace about fourfold more of dried than of ordinarily wet and green house garbage can be reduced to ashes in a given time, and about tenfold more of dried than of semi-liquid garbage. Hence it is evident that this combination of the two improved types of garbage-cremating furnaces and processes with their auxiliaries possesses great sanitary, commercial and economic advantages over all others.

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

1. In a system designed for the disposal of city refuse, the combination with a revolving, automatically discharging cylinder furnace designed for heating and igniting the refuse, and provided about its receiving end with a fire place by means of which heat is introduced into the said cylinder, of an auxiliary, stationary, combustion furnace fixed at the discharge end of the cylinder to receive the continuously discharged contents thereof, and of a blast pipe for furnishing air for the combustion of the material in said stationary furnace, substantially as herein shown and described.

2. In a system designed for the disposal of city refuse, the combination of a revolving cylinder furnace, provided with a fire place about its receiving end, for heating and igniting the refuse; an auxiliary combustion furnace for cremating the refuse as it continuously falls from the cylinder; a blast pipe for furnishing air to the said combustion furnace; and a furnace adapted for the combus-

tion of gases and the cremation of dead animals; all arranged and operated substantially as herein shown and described.

3. In a system designed for the disposal of
5 city refuse, the combination with a revolving cylinder furnace of a fire place at the receiving end thereof; a gas mixing chamber at and about the delivering end of the cylinder; a
10 garbage-cremating grate surface at the discharging end of the cylinder, forming the bottom of a gas mixing chamber located at and about said cylinder end; a reverberatory gas-combustion and animal-cremating furnace between the gas mixing chamber and
15 smoke stack; means for furnishing a supply of air to the chamber and furnace; and a perforated wall common to the flue of the reverberatory furnace and the smoke stack, for the passage of the gases into the latter; all con-

structed and arranged substantially as herein shown and for the purposes described. 20

4. The combination with a furnace adapted for the cremation or drying of city refuse of a feed hopper provided with a bottom prolonged into a deflecting plate of triangular or curved 25 cross section, said plate being extended into the axis of the furnace with apex uppermost and flanks or sides sloping downward, all constructed and arranged substantially as and for the purposes specified.

In testimony that I claim the foregoing I have hereunto set my hand, in the presence of two witnesses, this 24th day of September, 1892. 30

JACOB J. STORER.

Witnesses:

JAMES F. CLUSTER,
ALEX. R. MACKENZIE.