

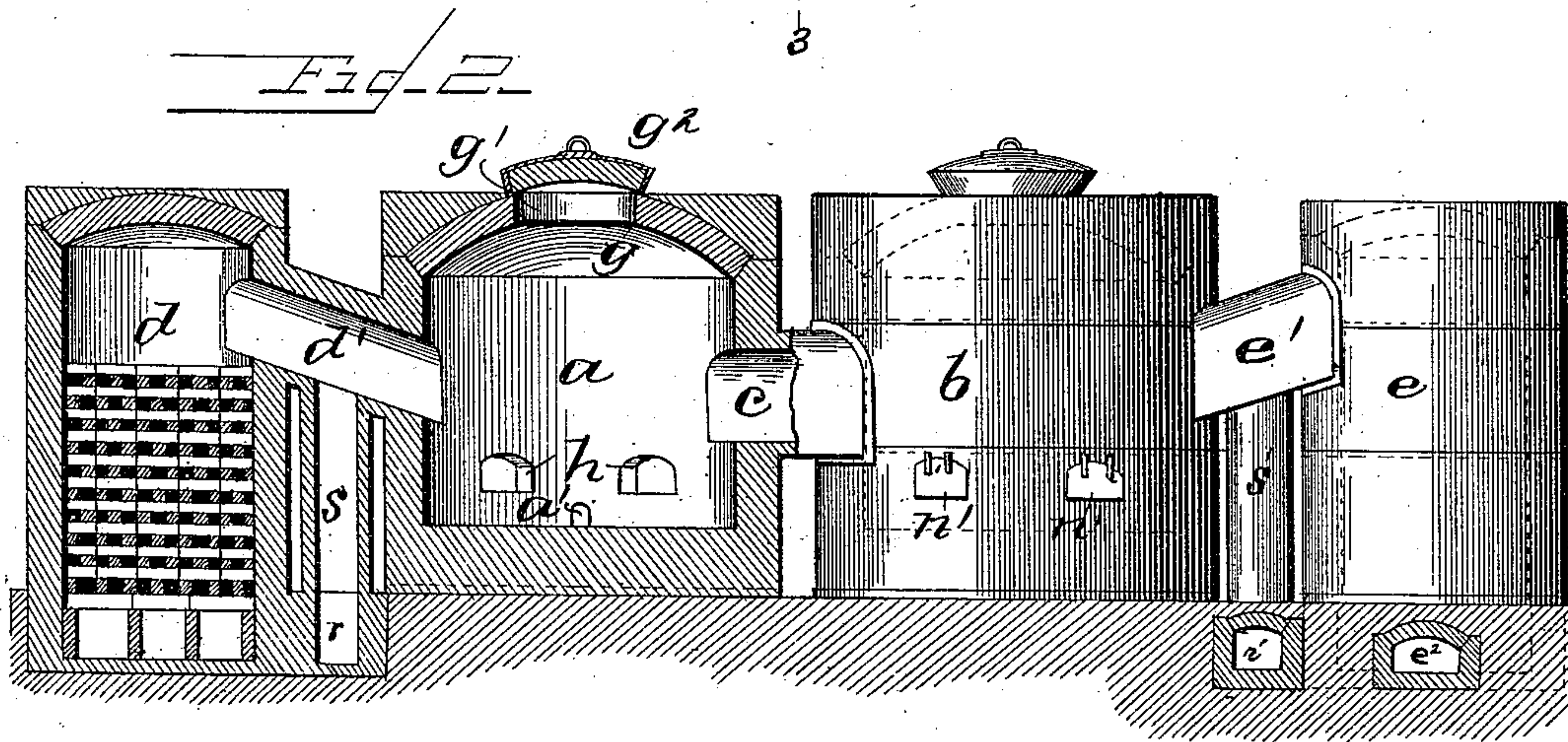
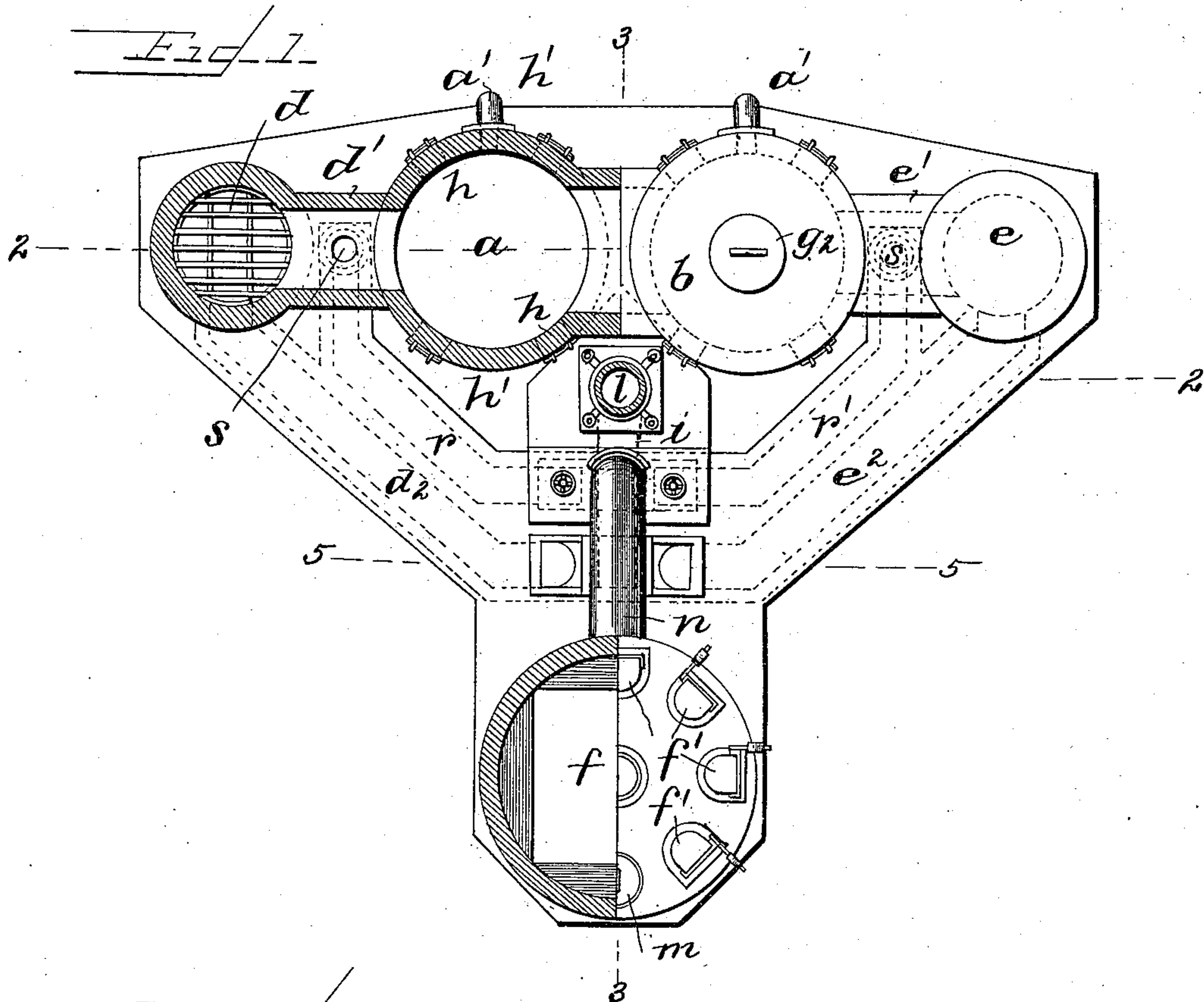
(No Model.)

2 Sheets—Sheet 1.

M. V. SMITH.
GARBAGE FURNACE.

No. 546,497.

Patented Sept. 17, 1895.



Inventor

Martin V. Smith
By D. J. Reinohl

Attorney

Witnesses
G. A. Rauberschnitt,
D. J. Reinohl

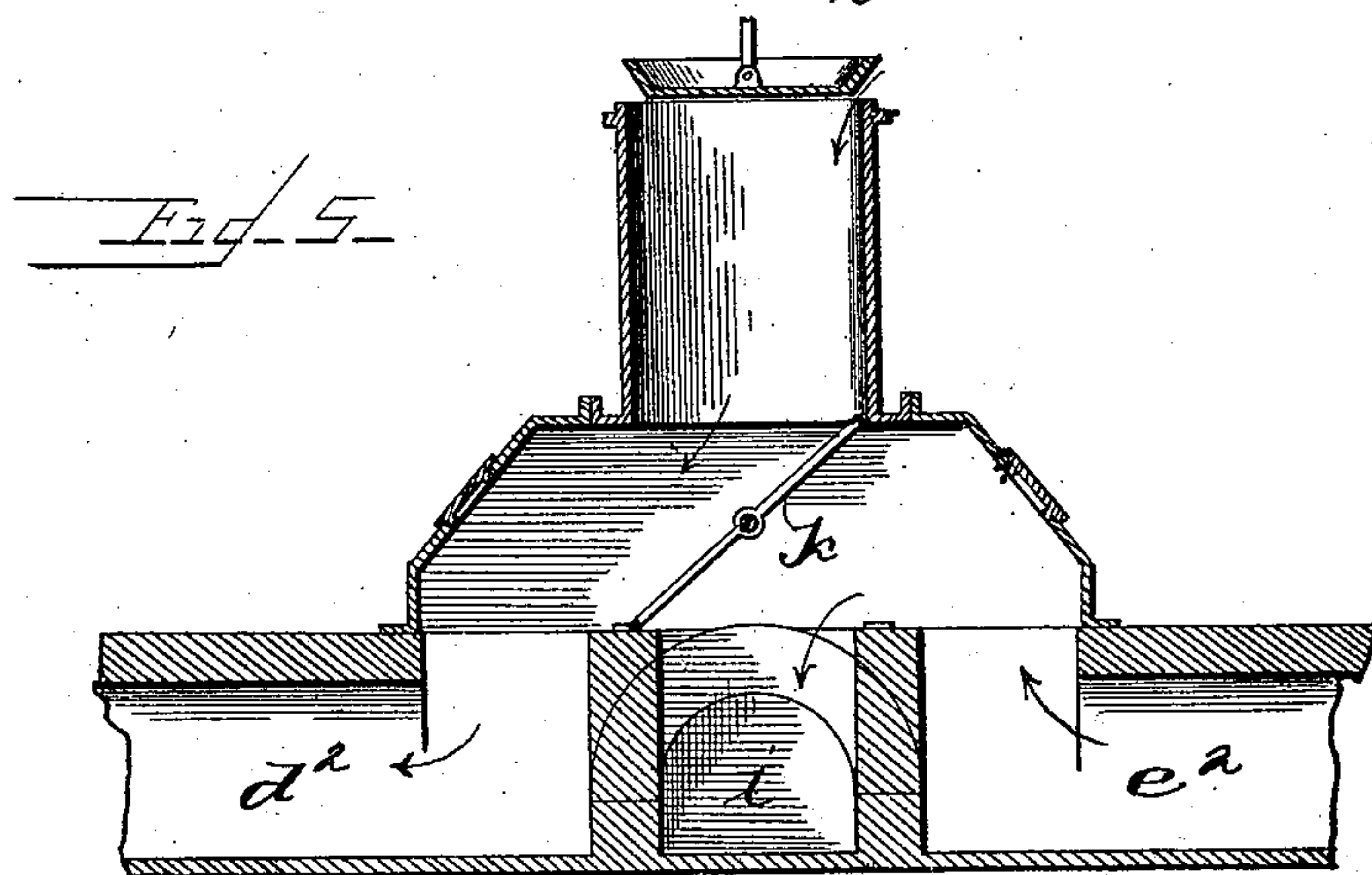
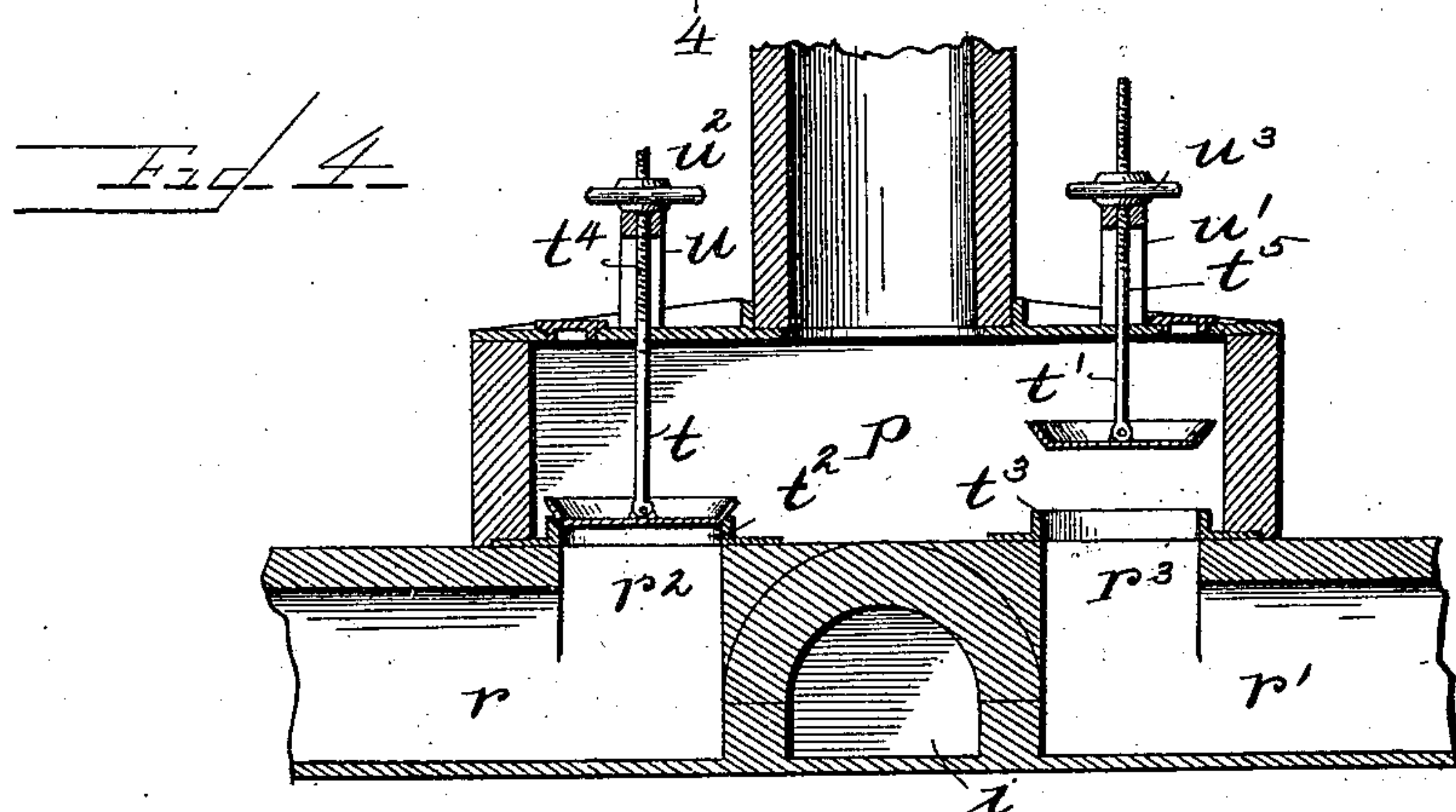
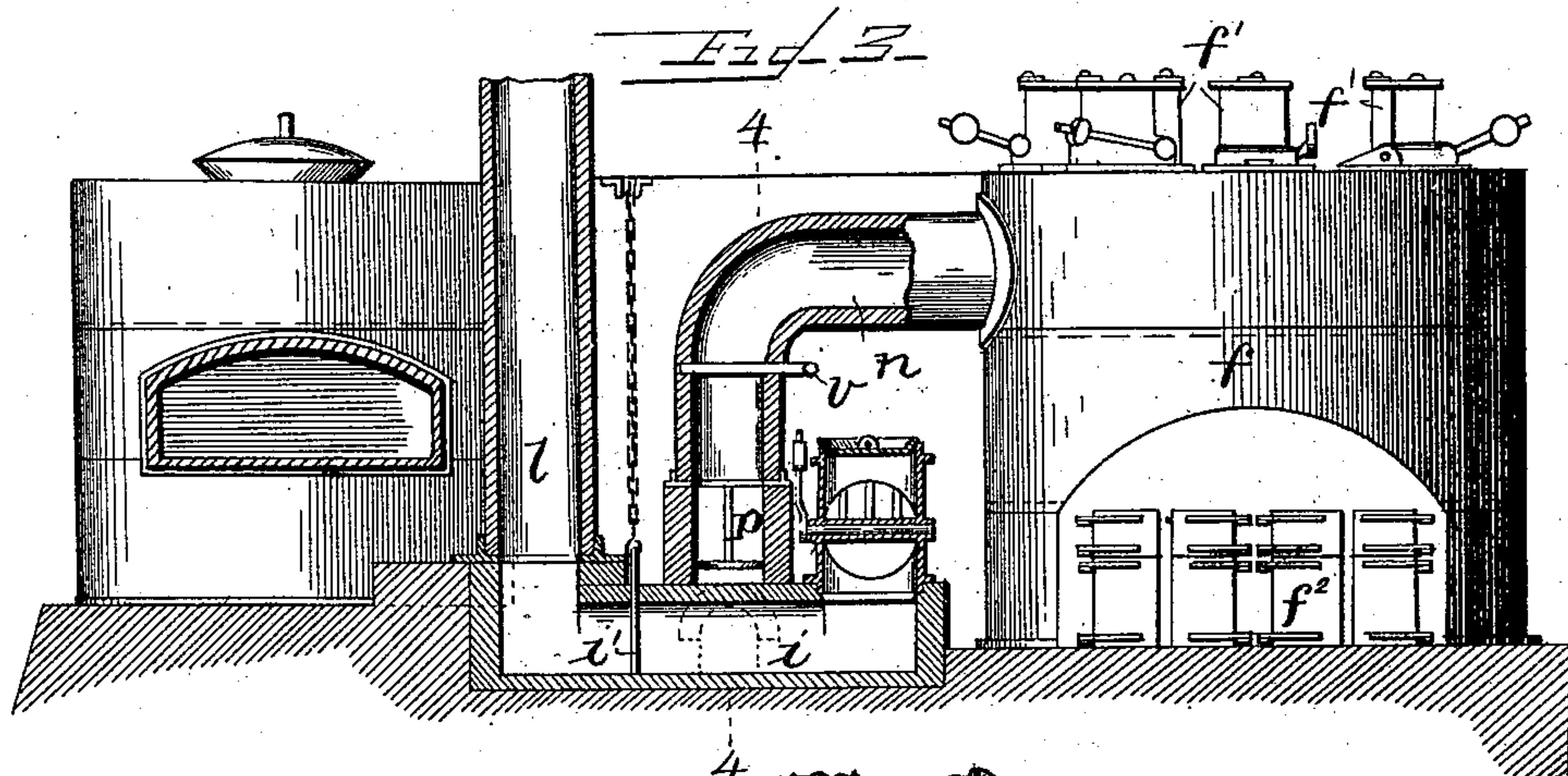
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G.A. Kauberschnitt,
D.W. Reinohl

Inventor

Martin V. Smith
By D. C. Reinohl.
Attorney

Attorney

UNITED STATES PATENT OFFICE.

MARTIN V. SMITH, OF PITTSBURG, ASSIGNOR OF ONE-HALF TO CYRUS BORGNER, OF PHILADELPHIA, PENNSYLVANIA.

GARBAGE-FURNACE.

SPECIFICATION forming part of Letters Patent No. 546,497, dated September 17, 1895.

Application filed June 13, 1894. Serial No. 514,391. (No model.)

To all whom it may concern:

Be it known that I, MARTIN V. SMITH, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Garbage-Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My present invention relates to garbage-furnaces—that is, to furnaces by which garbage and like refuse matter is consumed and thus disposed of, its especial object being to provide a process for burning garbage by which not only the solid but the liquid contents of the garbage, such as slop and other foul liquid can be driven off and rendered innocuous and the germs or microbes contained therein be destroyed, and in addition thereto the gases generated from such garbage can be utilized in generating the heat necessary to consume the garbage.

To these ends my invention consists, generally stated, in certain processes and improvements in construction which will be fully disclosed in the following specification and claims.

To enable others skilled in the art to practice my invention, I will describe the same more fully, referring to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a plan view partly in section; Fig. 2, a vertical section on line 2 2, Fig. 1, and showing one of the garbage-furnaces and regenerators in side elevation; Fig. 3, a vertical section on line 3 3, Fig. 1, also showing one of the garbage-furnaces and regenerators in side elevation; Fig. 4, a vertical section on an enlarged scale on line 4 4, Fig. 3; and Fig. 5 a like view on line 5 5, Fig. 1.

Like letters of reference indicate like parts in each of the figures.

The furnace has the garbage chambers or retorts *a b* connected by a passage *c*, and beyond the same are the regenerators *d e*, connected by the flues or passages *d' e'*, and back of the said parts, preferably located centrally in connection with the same, is a gas-producer *f*, which communicates with the furnace, as hereinafter described. These main parts are preferably built of fire-brick within any suit-

able metal casings, as illustrated in the drawings, as are also the flues, chimneys, and other parts above ground. In constructing the several parts the sheet-metal casing of the producer, the furnaces, and the regenerators are placed in proper relative position when the masonry work is constructed or erected within the casing, thus forming their own bond without the use of any braces, tie-bars, or rods, and the casing sustains the masonry as it expands under the high degree of heat of the producer, the garbage-furnace, and the regenerators. The casing also surrounds the flues between the furnaces and the regenerators.

Each garbage chamber or retort is preferably cylindrical in shape and of suitable height, is provided with a solid bottom of masonry on which the garbage rests, and is shown closed at the top by an arch or roof *g*, forming a reverberatory-chamber and having the feeding-port *g'* closed by a cover *g²*, this feeding-port being preferably located centrally of the arch, though it may be located on the upper part of the body portion. Each garbage-chamber has also in the walls thereof the port *h*, closed and controlled by suitable doors or covers *h'*, which afford opportunity for stirring, manipulating, or removal of the contents of the garbage chamber when desired, the doors or covers *h* being so arranged as to be sealed to prevent the escape of any of the liquid contents of the garbage, and, as far as practical, the gaseous-contents thereof in the ordinary manipulation of the furnaces, though they may be open at times for the cooling of the chamber. At the base of each chamber is the discharge-spout *a'*, which is also sealed or closed in such way as to prevent escape of the liquid contents of the garbage, but which may be opened for tapping or drawing off the slag or other residual products from the chamber. These garbage-chambers are in this way made practically sealed or water-tight, and in so doing all the garbage or other refuse matter, whether in solid or liquid condition, is held within the furnace and vaporized and driven off or burned, none of it being permitted to escape from the furnace in a liquid condition.

The regenerator-chambers *d e* are filled with checkerwork composed of refractory ma-

terial, preferably fire-brick, to any desired height, and the flues $d' e'$ preferably lead in a downward inclination into the garbage-chambers so as to throw the flame, hot-air, or heated products directly upon the mass of garbage in the chamber leading to the more rapid drying, heating, and consumption thereof. Leading from the bases of these regenerators are the air-flues $d^2 e^2$, which communicate with a reversing-valve k , which may be of any desired construction, through which the air is fed to the regenerators, said two flues communicating with the escape-flue i , which leads to the stack l for carrying off the waste products, this escape-flue i being controlled by the damper i' .

The producer f may be of any desired construction and has the feeding-hoppers f' communicating therewith, and is also provided with the garbage-feeding port m , having the cover m' by means of which garbage may be introduced into the producer when desired. Leading from the producer is the main gas-flue n , which communicates with the gas-valve chamber p , which in turn communicates with the gas-flues $r r'$ leading to the furnace, the gas-flues connecting by the rising-flues $s s'$ with the flues or combustion-chambers $d' e'$ connecting the regenerators with the garbage-chambers and opening through the bases of said flues $d' e'$, and in which flues $d' e'$ the gas from the producer and the hot air from the regenerator commingle and ignite and pass in such burning condition into the garbage-chamber.

The ports $r^2 r^3$ between the main gas-chamber p and the gas-flues $r r'$ are controlled by the valves $t t'$, which are seated in the valve-seats $t^2 t^3$. The valve-stems $t^4 t^5$ extend up through the cover of the gas-chamber and through the brackets $u u'$, and are threaded at the upper ends and engage with the hand-wheels $u^2 u^3$, resting in said brackets, the valve in this way being under the control of the operator for the reversal of the direction of the current of gas and for the control of the amount of gas flowing from the producer to the furnace. Located in the main gas-flue n is the valve v , which extends across the said flue and is arranged to cut off all communication between the producer and the furnace—such, for example, where the garbage itself is utilized to produce the gas for consumption in the furnace, or where it is desired to clean the producer, which can be done by closing such valve, the furnace being in the meantime operated by the gas produced from the garbage. The producer f has at the base thereof the ash-pit doors f^2 , which are made large to give free access for the cleaning of the producer, this being specially necessary where the producer is also utilized for consuming garbage, as above stated.

In practicing my invention in a furnace such as above described, the fire is started in the producer, the coal fed thereto, and as soon as gas is generated from the coal it is fed

through the main gas-flue n into the gas-valve chamber p , and thence into one or the other gas-flue r or r' to furnace, and, in connection with the air passing through the regenerators, combustion is formed within the garbage-chambers $a b$ of the furnace, and the products of combustion pass through such chambers into the regenerator d or e , and thence through the air-flue to the stack, the direction of the flow of gas and air being reversed from time to time until the furnace and its regenerators are raised to a degree of heat sufficient to produce incandescence of the refractory walls of the chamber. When the furnace and regenerators are raised to the proper heat, the garbage is fed into garbage-chambers $a b$ through the feeding-ports g' of each chamber, and in the first or primary operation of the furnace the garbage is fed to both such chambers, the entire liquid, as well as solid contents, passing into the same and resting upon the solid bottom of the chambers, as one of the peculiar features of the furnace is that it consumes all the slop and other foul liquids which have heretofore been drawn from garbage before it was introduced into the furnace-chamber or permitted to drain from the same into the furnace itself. The garbage is charged into the chambers until it reaches well toward the top thereof, standing in a cone-shaped mass, and in the first operation the heat generated from the gas obtained from the producer is utilized to act upon the garbage until it is raised to such heat and sufficient moisture is driven off to permit the actual formation of gas from garbage, which is in the form of steam, hydrogen gas, and carbonic oxide gas, when such gas is burned and so utilized for heating the mass of garbage in the garbage-chamber.

As the garbage-chambers are practically sealed, and all liquids from the garbage, &c., are held therein, the action upon the garbage is practically as follows: The outer surface of the mass is first acted upon, the moisture evaporated or driven off, and the pile of garbage charred on its surface to the depth of several inches, while the moisture in the mass is either converted into gas by the high heat, or it collects on the bottom of the chambers to be subsequently converted into gas. As the heat continues to increase, the generation of gas from the garbage is correspondingly increased and such gas with the vapor from the liquid rises through the outer coating of charred matter and burns around the same, the mass of garbage underneath such surface being converted into gas, which gas when it escapes from the pile is ignited and burned, as above stated, and acts upon and heats the mass of garbage in the adjoining chamber, evaporating or driving off the liquid contents thereof and drying the same. The highly-heated waste products of combustion containing the fumes of burned matter and the undestroyed microbes or disease germs then pass from the second garbage-cham-

ber into the regenerator at that end of the furnace and are caused to impinge against and circulate around the highly-heated checker-work contained in the regenerator, by which the current is retarded and broken and odors and microbes or disease germs contained in the fumes annihilated. As soon as gas is generated from the garbage contained in the one or the other garbage-chamber, the supply of gas from the producer may be partially or entirely shut off and fresh garbage fed to one of the garbage-chambers—such, for example, as the garbage-chamber *a*, and combustion is produced from the gas generated in the other garbage-chamber *b* by the heated air passing into the same from the regenerator *e* and the flame and heated products of combustion pass into such garbage-chambers *a* and serve to evaporate or drive off the moisture from the garbage therein and raise such garbage to the necessary heat for generating gas therefrom. The fumes and heated products then pass through the regenerator *d*, and thence through the flue *d*² to the escape-flue and chimney, and fresh garbage is fed to the chamber *a* from time to time, as desirable, until the garbage in the chamber *b* is practically consumed. The furnace is then reversed and garbage is fed to the garbage-chamber *b*. The air passes through the flue *d*² to the regenerator *d*, and the heated air so obtained supports combustion in the garbage-chamber *a*, the flame and heated products passing thence into the chamber *b* and drying and heating the garbage therein, and the fumes and heated products pass thence into the regenerator *e* and through the flue *e*² to the escape-flue and stack. In this way the garbage itself is utilized in generating gas from the mass of garbage in one chamber for heating and consuming the mass of garbage in the other chamber, and while the garbage in the first chamber is being consumed the heat generated therefrom is drying and consuming the garbage in the other chamber, the cost of burning the garbage being in this way reduced to a minimum. The heat in the regenerators is always sufficiently high to destroy the microbes and disease germs and burn up the organic matter in the fumes and render them inodorous. From time to time the operators may rake off the outer surface of the cone or mass of garbage, so exposing that underneath the same to the direct action of the flames to reduce it to ashes or slag. Garbage may be fed to either chamber, it being desired, however, that the masses of garbage shall extend high up within the chamber in the cone-form above referred to, as it is found that the best results are obtained under such conditions. The flues or combustion-chambers leading from the regenerators to the garbage-chambers direct the flame and heat directly down upon the mass of garbage on account of their inclination, which also aids in the burning of the mass.

While the furnace is being operated, where

it is found desirable, the gas from the producer may, of course, be employed to assist the gases generated in the garbage-chambers and the gas flows through the gas-flues *r* or *r'* and enters the flues *d'* or *e'* through the base thereof, rising so as to commingle with the heated air from the regenerator, ignite and so form perfect combustion of such gas within the garbage-chambers. When the fuel therein is found to be in proper condition, the garbage can also be introduced into the producer through the garbage-port *m* and be consumed therein and the gas generated from such garbage utilized in heating the main chambers and consuming the garbage therein.

The ports *h* may be employed as a means for raking or stirring the mass of garbage or for cleaning the furnace, but should always be kept tightly closed when the chambers contain such a mass of liquids as to extend above them to prevent escape of such liquid. From time to time the tapping-hole may be opened and the slag or residual products from the burning of the garbage may be removed from the garbage-chamber, the material running or being scraped out through the same.

It will be noticed in connection with the construction of the furnace that the producer is located close to the furnace-chambers and therefore that the gas is utilized in its heated condition, necessity for regenerating the gas itself being overcome. It will also be noticed that the escape-flue *i* passes directly under the gas-valve chamber, the valve *k* being located on one side of the gas-valve chamber and the stack on the other side thereof. This construction is found very advantageous in the building of the furnace as it is necessary that the air-flues *d*² *e*² be outside of the gas-flues *r* *r'*, and it is very desirable to reduce the length of the flues from the producer to the furnace and to construct the whole furnace as compactly as possible. By carrying the main gas-flue *n* over the valve *k* it connects with the gas-flues within the air-flues, and by carrying the escape-flue *i* under the main gas-flue it connects with the stack *l*, which can be placed centrally of the whole furnace, and occupy space which would otherwise be open, while causing the same draft on all parts. I am thus enabled to provide for the rapid and economical burning of garbage whether it be in liquid or in solid form, the practical working of the invention showing that both liquid and solid garbage can be quickly consumed at an expense which is merely nominal, the heat obtained from the gases generated from the garbage providing practically all the fuel necessary to operate the furnace, it being found that in one furnace fifty or more tons of garbage can be consumed in a day by the employment of not more than two tons of coal.

Having thus fully described my invention, what I claim is—

1. A garbage furnace having a sealed garbage chamber or retort and a feeding port in

the crown thereof, in combination with an air heater adjoining said chamber and connected thereto by a downwardly inclined flue.

2. A garbage furnace having adjoining connected and sealed garbage chambers or retorts, in combination with an air regenerator adjoining each of said chambers and connected thereto by a flue.

3. A garbage furnace having adjoining connected and sealed garbage chambers or retorts, in combination with air regenerators connected to said chambers by flues, and a gas producer provided with flues which connect with the flues between the regenerators and the garbage chambers.

4. In a garbage furnace the combination with a producer having a main gas supply pipe leading to the garbage chambers or retorts, and regenerators at the ends of said garbage chambers provided with air flues leading to the reversing valve located between the

producer and down-take of the main gas flue, and an escape flue leading centrally under the main gas flue to a stack between the same and the furnace.

5. A regenerative furnace in combination with a producer and the main gas flue leading therefrom and downward to the gas valve chamber, from which flues lead to the garbage chambers or retorts, and having the regenerators at the ends of said chambers and the air flues leading therefrom to the reversing valve, and the escape flue leading centrally under the gas valve chamber and communicating with the stack.

In testimony whereof, I, the said MARTIN V. SMITH, have hereunto set my hand.

MARTIN V. SMITH.

Witnesses:

J. E. DAVISON,

ROBERT C. TOTTEN.