(No Model.) 3 Sheets—Sheet 1.

# J. GIBBONS.

## GAS STOVE.

No. 436,656. Patented Sept. 16, 1890.

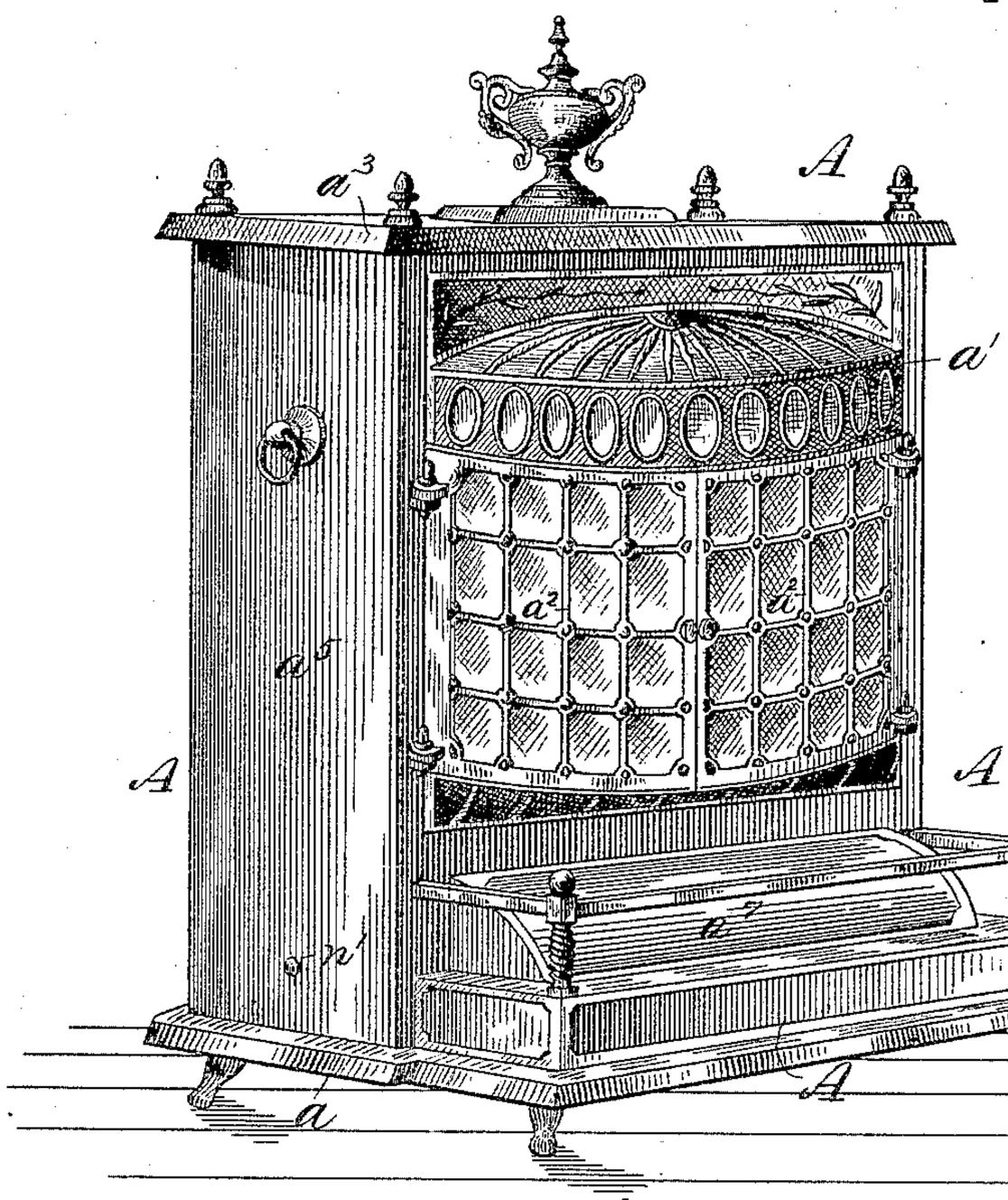


Fig. 1.

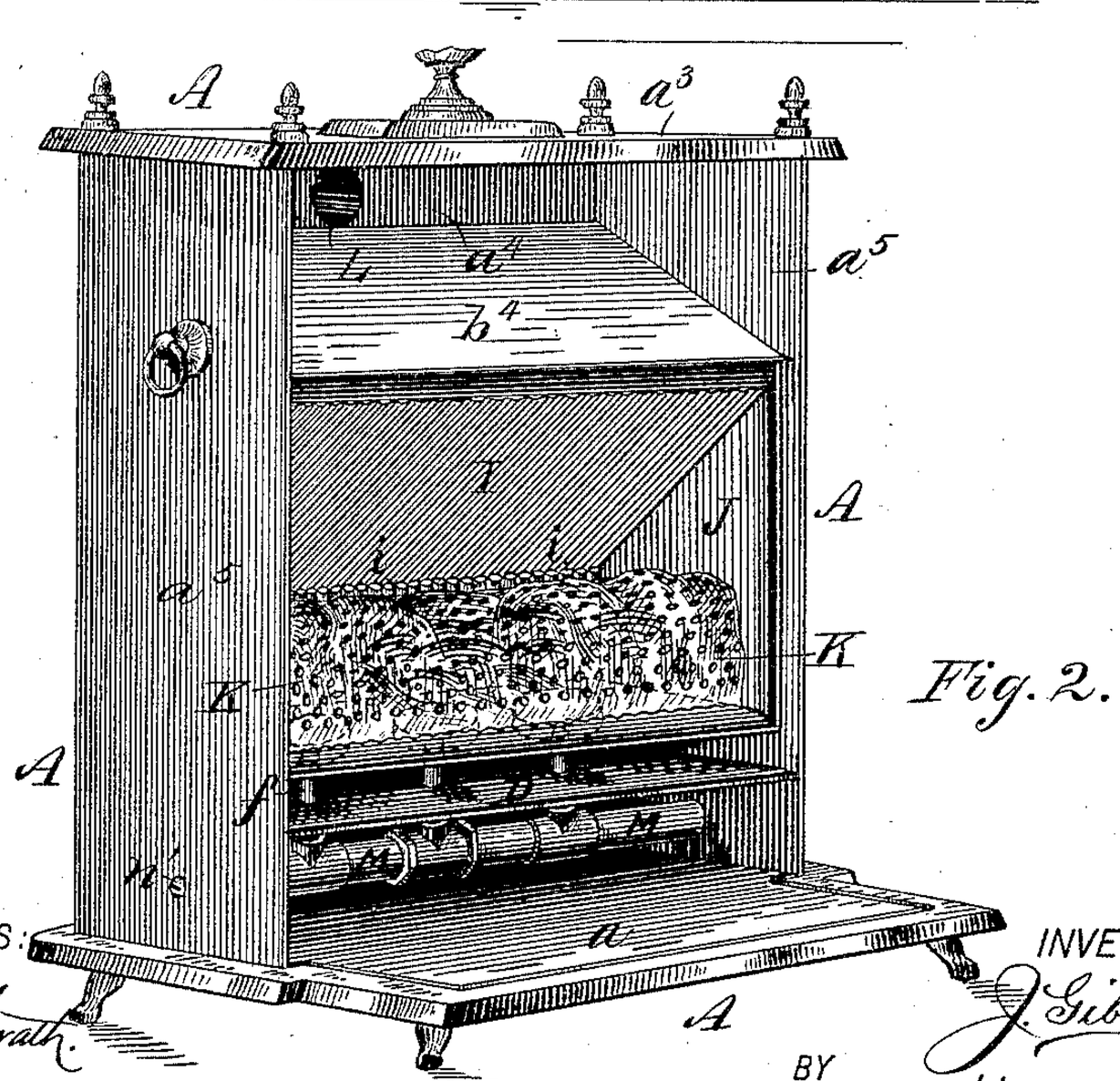


Fig. 2.

WITNESSES:

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C. Sedgwick

INVENTOR:

J. Gibbons

BY

Munn & Co

ATTORNEYS

(No Model.)

3 Sheets—Sheet 2.

# J. GIBBONS.

## GAS STOVE.

No. 436,656.

Patented Sept. 16, 1890.

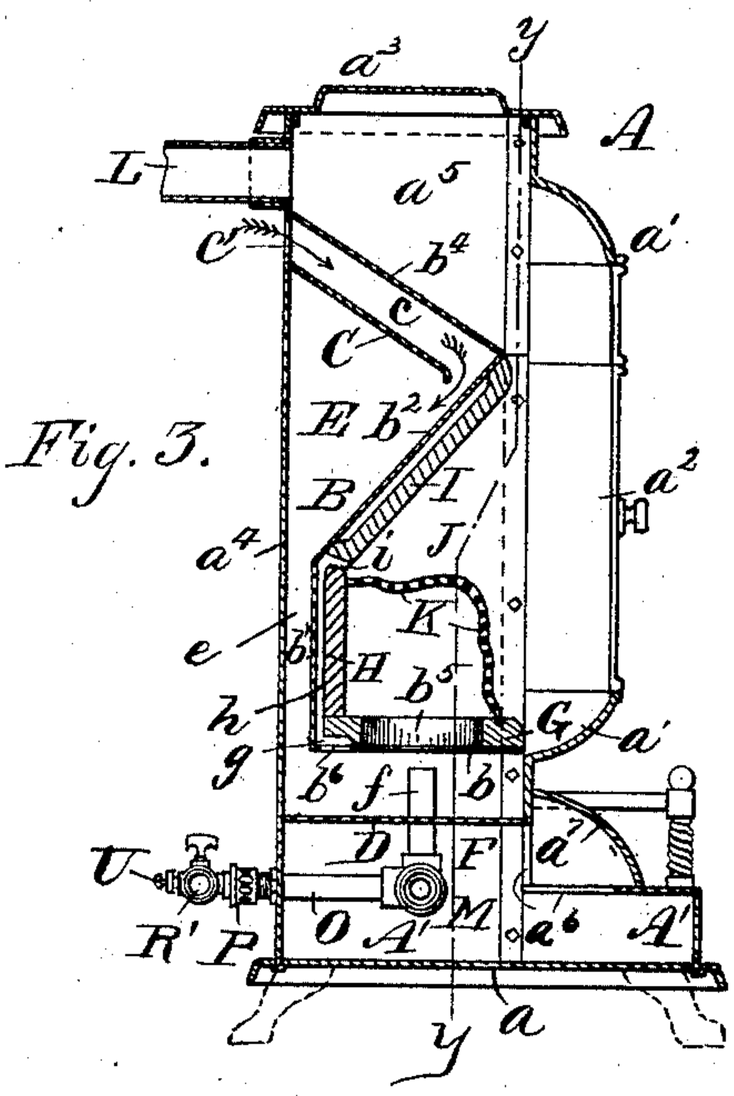

Fig. 3.

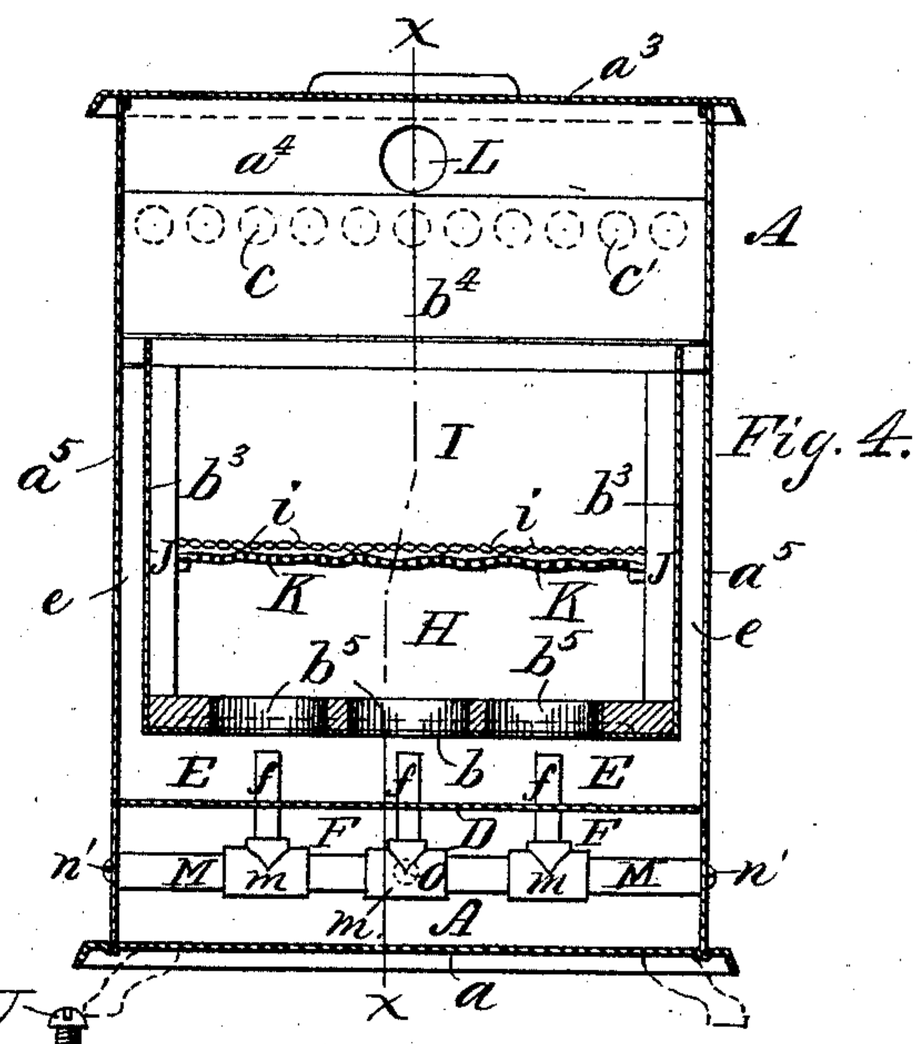

Fig. 4.

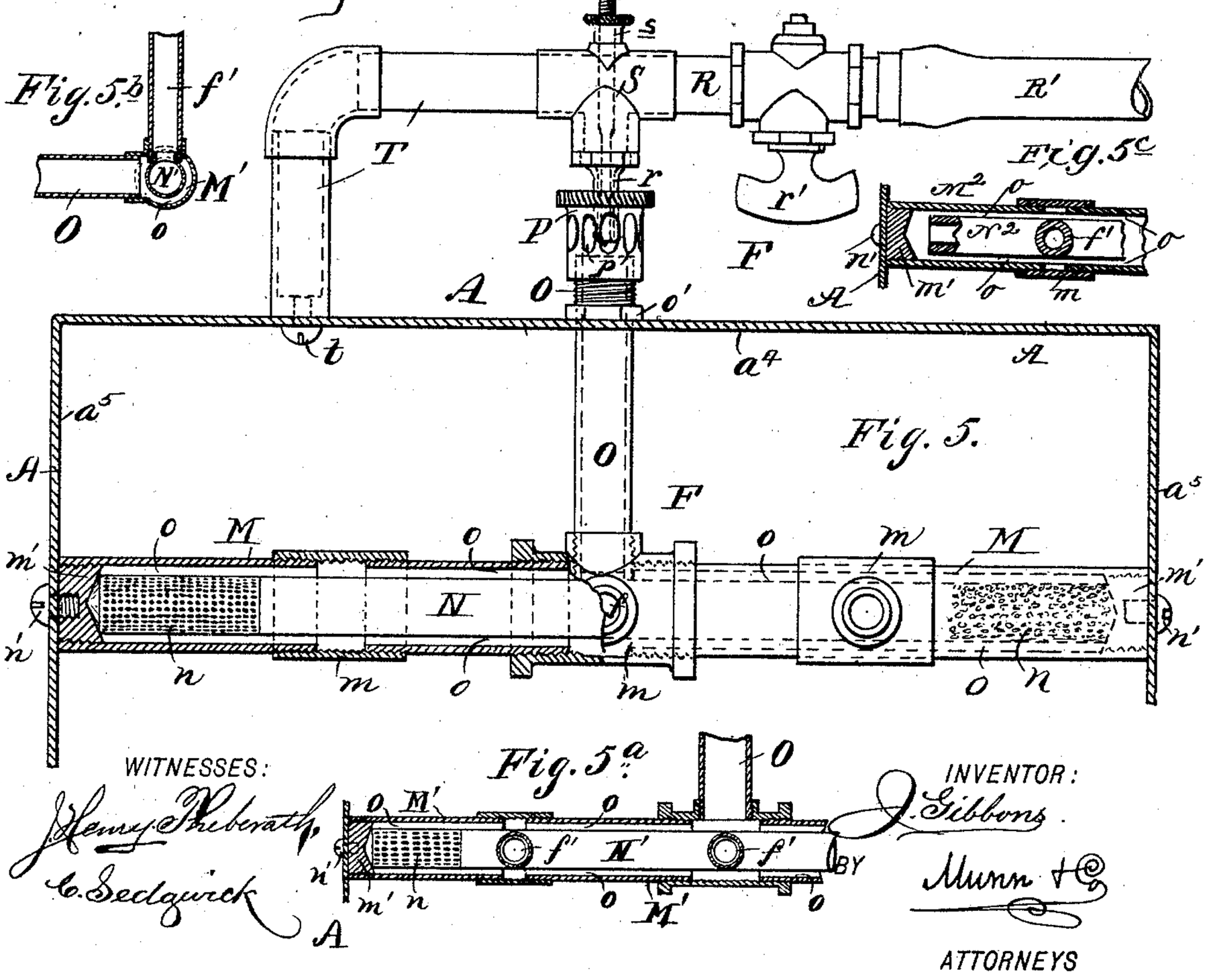

Fig. 5.



Fig. 5a.

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Henry Theberath,

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(No Model.)

3 Sheets—Sheet 3.

# J. GIBBONS.

## GAS STOVE.

No. 436,656. Patented Sept. 16, 1890.

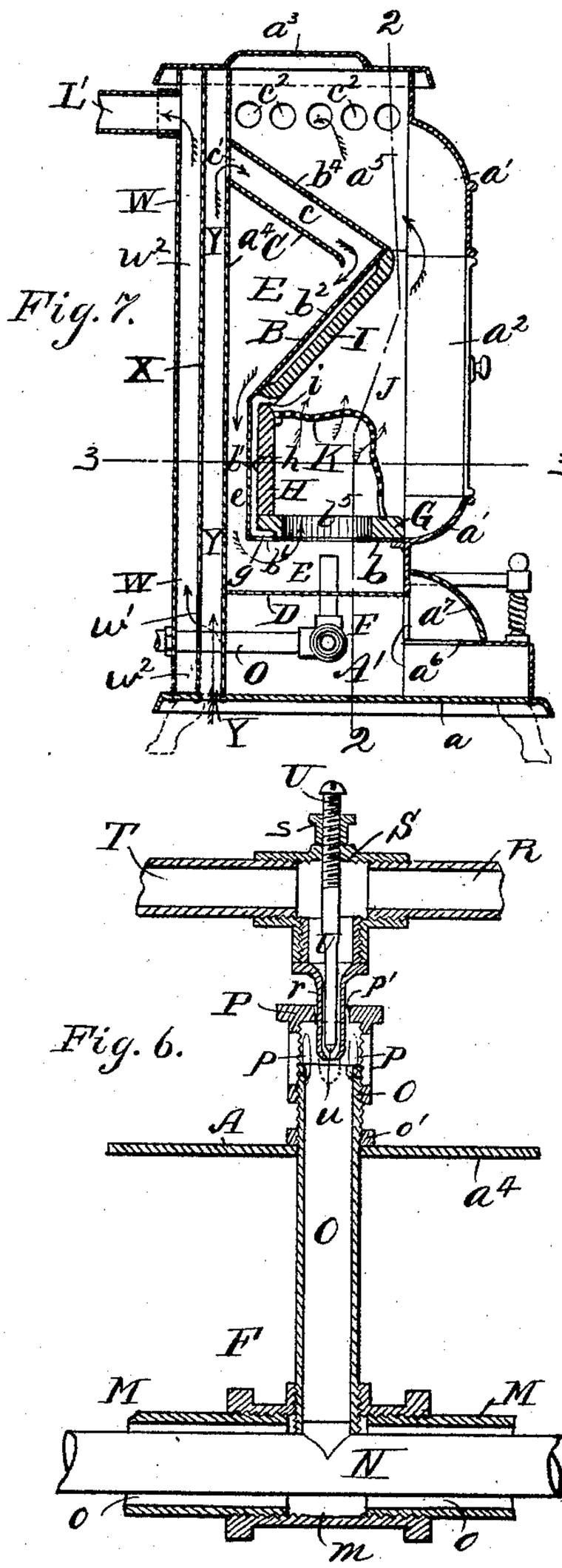


Fig. 7.

Fig. 6.

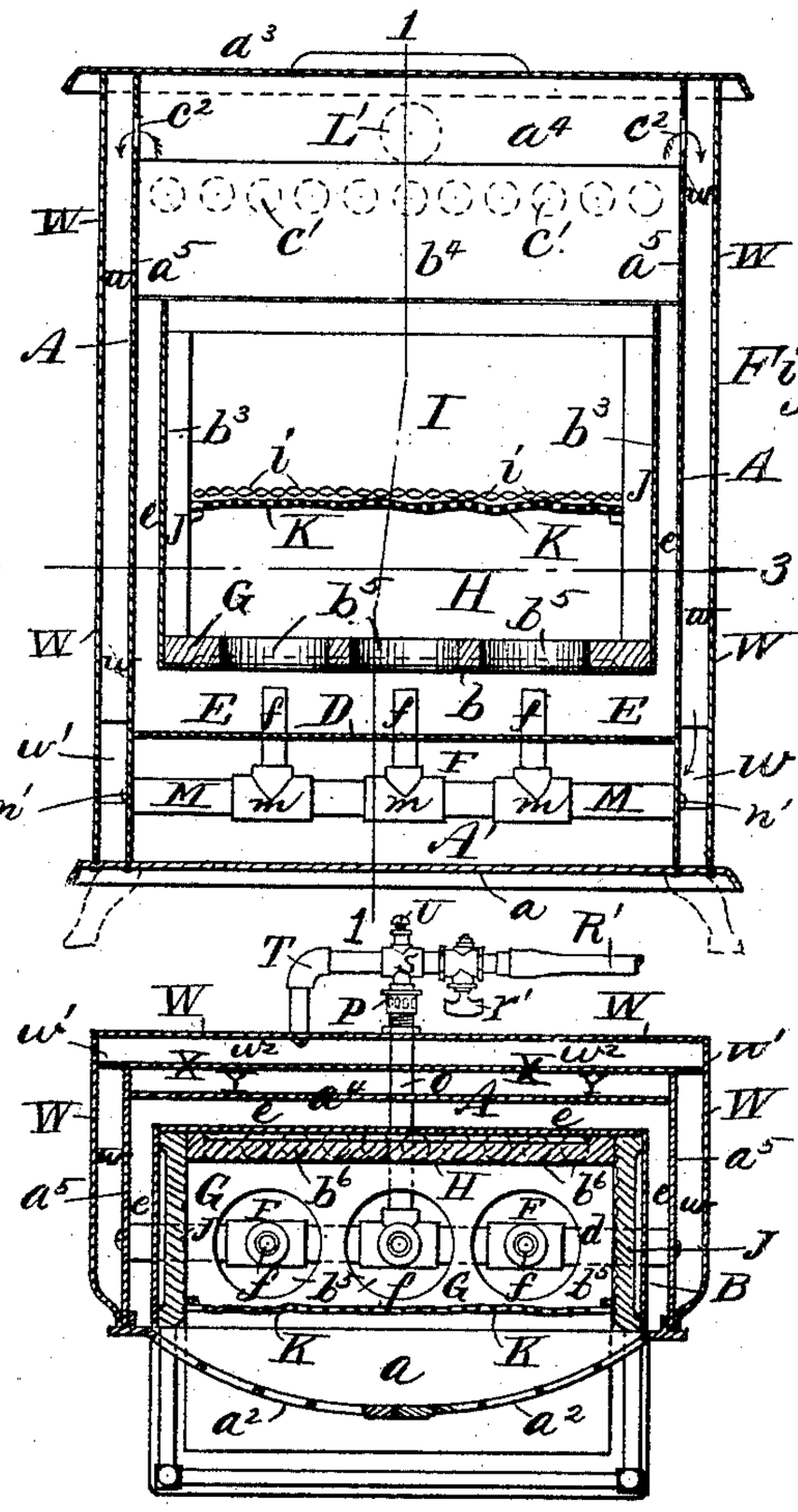


Fig. 8.

Fig. 9.

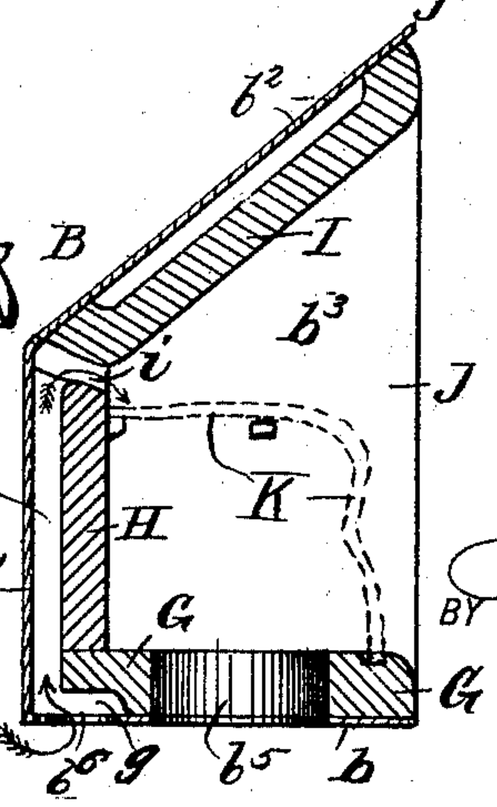


Fig. 10.

WITNESSES:

J. Henry Rheberath.

C. Sedgwick

INVENTOR:

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ATTORNEYS

# UNITED STATES PATENT OFFICE.

JAMES GIBBONS, OF JERSEY CITY, NEW JERSEY.

## GAS-STOVE.

SPECIFICATION forming part of Letters Patent No. 436,656, dated September 16, 1890.

Application filed December 2, 1889. Serial No. 332,255. (No model.)

*To all whom it may concern:*

Be it known I, JAMES GIBBONS, of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Gas-Stove, of which the following is a full, clear, and exact description.

My invention relates to gas or fluid fuel stoves, and has for its object to provide a simple, inexpensive, durable, and efficient stove of this character, preferably having a transparent or partly transparent front to present a cheerful fire somewhat similar to the ordinary open grate and so constructed as to assure a maximum radiation of heat with a minimum supply of fuel.

The invention will first be described, and then will be particularly pointed out in the claims.

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

Figure 1 is a front perspective view of my improved gas-stove. Fig. 2 is a perspective view thereof with the front removed. Fig. 3 is a vertical sectional side elevation of the stove, taken on the line $x\ x$ in Fig. 4. Fig. 4 is a front vertical sectional view taken on the line $y\ y$ in Fig. 3. Fig. 5 is an enlarged sectional plan view of the lower rear portion of the stove, intended more particularly to show the arrangement of the burner and connected gas and air supply pipes. Figs. $5^a$, $5^b$, and $5^c$ are detail views of modifications of the stove-burner. Fig. 6 is a detail sectional plan view of part of the burner and gas and air supply pipes. Fig. 7 is a vertical sectional side elevation, taken on the line 1 1 in Fig. 8, of a modified form of the gas-stove in which a larger heat-radiating surface and air-heating surface are provided. Fig. 8 is a front vertical sectional view taken on the line 2 2 in Fig. 7. Fig. 9 is a plan view, in horizontal section, on line 3 3 3 in Figs. 7 and 8; and Fig. 10 is an enlarged detail vertical sectional view of the fire-pot or mixing-chamber of the stove.

I will first particularly describe the gas-stove with more special reference to Figs. 1, 2, 3, 4, 5, 6, and 10 of the drawings, which show the simplest form of stove-body and the details of the burner and pipe connections used in both forms of stoves.

The general appearance of one design of gas-stove made in accordance with my invention and illustrated in Figs. 1 and 2 of the drawings shows that it may be preferable to make the stove-body A with a cast-iron base $a$, a cast-iron front $a'$, provided with doors $a^2$, a cast-iron top $a^3$, which may have one or more removable lids or covers, and a back $a^4$, and opposite sides or ends $a^5$ $a^5$, made of sheet metal; but I am not limited as to materials or design. It is preferable to provide the stove front and base with a lower opening $a^6$ to be closed by a removable door-plate $a^7$, which thus gives easy access to the burners and their pipe-connections in the base of the stove-body, as hereinafter described. The stove front and doors $a\ a^2$ will preferably have as large a mica or transparent surface as possible to afford a cheerful fire, quite similar to that of the ordinary coal-burning grate. The stove will have supporting-legs of any approved design.

Within the body of the stove is placed a casing B, which is preferably made of sheet metal, and forms the fire-chamber of the stove, and is preferably lined with fire-brick, as presently explained. I make this fire-chamber with a bottom plate $b$ and a rear wall consisting of a lower vertical portion $b'$ and an upper forwardly leaning or projecting part $b^2$ and with two end walls $b^3$ $b^3$. A continuation $b^4$ of the casing B extends from the top of the rear wall portion $b^2$ rearward and preferably upward to the rear wall $a^4$ of the stove-body. A plate C, which is preferably employed, is fixed at its rear edge and ends to the stove-body a little below the partition-plate $b^4$, but falls short of the plate $b^2$ of the fire-box, and provides between said partition-plates $b^4$ C a space or passage $c$, to which air to support combustion at the stove-burner is admitted through a series of holes $c'$ in the back wall $a^4$ of the stove-body. The plate C is not essential; but its use is preferable, as it leads the air entering at the openings $c'$ directly against the very hot rear portion or plate $b^2$ of the fire-chamber, and thereby facilitates the superheating of the air on its way to the interior of the fire-chamber. A lower plate D, fitted between the four walls of the stove-body a little distance below the fire-chamber B, together with said chamber and

the top extension-plate $b^4$, form an air-chamber E, which has communication with the outside air through the holes $c'$ and passage $c$ when the latter is provided, and has communication with the fire-chamber and front and top portions of the stove-body mainly through openings $b^5$, made through the fire-chamber bottom $b$, and a fire-brick lining, which may be used thereon. Figs. 3 and 4 of the drawings show that the rear and end walls $b'$ $b^3$ $b^3$ of the fire-chamber are preferably removed but a short distance from the adjacent stove-body walls $a^4$ $a^5$ $a^5$, thereby forming comparatively-narrow portions $e$ $e$ $e$ of the chamber E for most effectively heating the air admitted at the passages $c'$ on its way to the point of ignition of the burner F, the nozzles of which pass upward tightly through the bottom plate D of the air-chamber and emit their hot flames directly through the openings $b^5$ into the fire-chamber, with the hot air entering the openings $b^5$ from the chamber E. The lower chamber A', at the base of the stove body A, is a fuel-heating and heat-radiating compartment receiving the burner of the stove, and may be extended more or less beyond the main front of the stove-body to produce a stove of any required design.

The fire-brick or refractory lining of the fire-chamber B consists, preferably, of a bottom or floor brick G, which covers the base-plate $b$ of the chamber, a rear brick H, laid on the brick G next the wall-plate $b'$, an upper brick I, laid on the one H next the wall-plate $b^2$, and two end bricks J J, laid on the bottom brick and in front of the rear bricks H I to hold them in place. At its rear lower part the bottom brick or lining G is cut away or recessed to form a passage $g$, which communicates with a passage $h$, formed behind the rear lower brick H, and it may be by recessing it or by setting it a little forward from the back plate $b'$ of the fire-chamber. The upper rear brick I is preferably recessed at the back to protect the fire-chamber plate $b^2$ behind it; but at the lower edge or part said brick I is fitted closely to the plate $b^2$, and is also corrugated all along the lower edge, or is provided with holes or suitable openings, which may, however, be formed partly or wholly in the upper edge of the lower brick H, thereby producing passages $i$, through which a portion of the superheated air descending through the chamber E may escape forward into the fire-chamber at a point sufficiently above the nozzles or flaming points of the burner F to meet and freely oxygenate any unconsumed gases which may pass upward in the fire-chamber to the level of these passages, and thereby assure a practically perfect gas combustion in the fire-chamber B of the stove. Fig. 10 of the drawings most clearly shows that a row of holes $b^6$, or it may be any equivalent openings, are made in the bottom plate $b$ of the fire-chamber behind the larger openings $b^5$, so that while the main body or volume of superheated air from the chamber E passes directly upward through the openings $b^5$ with the hot products from the burner a portion of this air will pass upward through the passages $b^6$, $g$, $h$, and $i$ behind and through the refractory lining into the fire-chamber, which may also be termed the "mixing-chamber," as therein are intimately mingled the hot gaseous products from the burner, and the superheated air by which combustion is maintained.

Within the fire-chamber B of the stove, I prefer to place a fire-brick or other suitable refractory shell or body K, which preferably has a general angular form transversely and rests upon the bottom of the fire-chamber or its lower fire-brick G, and is also preferably fitted to the end walls or bricks of the fire-chamber, and also preferably fits its rear wall or the lower rear fire-brick H, against which it bears almost immediately below the auxiliary hot-air inlets $i$ above mentioned. This refractory shell or body K forms a combustion-chamber within the fire-chamber, and is preferably perforated throughout, so that it shall retard escape of hot products sufficiently to insure good combustion while allowing necessary free passage of hot gaseous products upward and forward from within it into the fire-chamber and thence upward and rearward over the plate $b^4$ and out through a pipe L, fitted into the rear stove-body wall $a^4$ above said plate $b^4$, and leading to any ordinary chimney-flue or to the open air. The perforated shell or combustion-chamber K is preferably made with an irregular surface, giving it the appearance when incandescent of a red-hot coal or wood fire.

From the aforesaid description it is manifest that when the burner F or source of heat at the bottom of the stove is in operation it will quickly heat the fire-chamber and a draft of air will be induced through the openings $c'$, the passage $c$, and down through the chamber E, over the walls of the fire-chamber B, and thence upward into said chamber, which it reaches in a highly-superheated condition, and wherein the air intimately mixes with the hot products from the burner to maintain combustion at a very high temperature. When the refractory shell or chamber K is used, the combustion therein of the fluid fuel most effectively assures the superheating of the fire-chamber to continue the superheating of air entering it from the chamber or passage E, and the hot products from the combustion-chamber K will rise or escape through its perforations and around its margin into the front and upper parts of the stove-body to highly heat them and give off or radiate heat therefrom to warm the room, the hot products finally escaping through the pipe L to the chimney. That portion of the superheated air passing upward through the passages $g$ $h$ and forward into the fire-chamber through the passages $i$ gives an auxiliary or supplemental supply of hot air to the hot un-

consumed gases which may perchance escape from the shell or chamber K into the fire-chamber, and thereby assures a practically perfect combustion in the stove, so nearly perfect as to allow the connection L to a chimney-flue to be dispensed with without vitiating the air of the room to a dangerous degree.

I consider it advantageous to employ the perforated fire-clay or refractory shell or body K, because it not only forms an efficient combustion-chamber and retards to some extent the too free escape of hot products, and thereby facilitates complete combustion, but it also becomes incandescent and increases the heat-radiating function of the stove, and also presents a very pleasing appearance through the mica or transparent front of the stove-body.

Before explaining the modified form of stove-body shown in Figs. 7, 8, and 9 of the drawings I will particularly describe the burner, which is adapted to either stove, as follows: The burner is shown in preferred form more in detail in Figs. 5 and 6 of the drawings, and is made with a main outer pipe M, which may be in one piece; but for convenience of connecting the burner tubes or tips *f* and fitting an interior pipe, hereinafter mentioned, it is made in pieces with suitable fittings *m* interposed in its length, which allows the tips or tubes *f* to be screwed into the fittings. The burner may have one, two, three, or more tubes *f*, as the size of the stove may require, the stove shown having three burner-tubes. (See Figs. 4, 8, and 9 of the drawings.) Within the burner-pipe M is placed another smaller pipe N, which preferably extends quite the whole length of the pipe M, and at its outer portions or ends is perforated or is fitted with short lengths of perforated pipe *n n*. The inner pipe N is preferably held concentrically in the pipe M by means of countersunk heads or plugs *m' m'*, which are screwed or fitted into the ends of said pipe and against conical or otherwise suitably-shaped ends of the perforated pipes *n n* or plugs fitted therein. (See Fig. 5.) Screws *n'*, passed through the body A and preferably its end or side walls $a^5$ $a^5$ into the pipe-plugs *m'*, hold the burner-pipes M N in the stove-body, it being preferable to extend these pipes between the opposite ends of the stove or about parallel with its front. The pipes may, however, be extended between the front and rear plates of the stove-body, or may be otherwise arranged to allow the burner-tubes *f* to flame into the fire-chamber of the stove. Between the two pipes M N there is provided a gas and air passage *o*, with which all the burner-tubes *f* communicate. In the stove shown the gas is fed from a supply-pipe O directly into the inner pipe N at a point as remote as may be from the perforated parts *n n* of the pipe, which in this case is directly at the center of it. This supply-pipe O is preferably screwed through one side of the middle four-way fitting *m* of the pipe M and into the inner pipe N, and is also fitted tightly to the wall of the stove-body, and thereby effectively supports and steadies the center of the main burner-pipe M, and with it strongly braces the sheet-iron walls of the stove-body. A jam-nut *o'* is preferably used on the pipe O outside the stove-body.

With this construction it is obvious that a mixture of air and gas admitted through the supply-pipe O will first enter the inner burner-pipe N and will pass along within it to its perforated end parts *n n*, and through these into the passage *o* between the two pipes N N, and thence to the burner-tubes *f*, which open to the pipe M, and at the tops of which the burner flames into or toward the fire-chamber B of the stove. The two objects sought in this construction are, first, to cause the mixed air and gases supplied to the point or points of ignition of the burner to take as tortuous or sinuous a course as possible, in order to more thoroughly intermix the air and gases, and, second, to break up or subdivide the volume of intermingled gas and air entering the two pipes M N from the feed-pipe O that none of it may pass to the point or points of ignition of the burner without being thoroughly heated or superheated by the burner-pipes, which become very hot while the burner is in operation. It is well known that when a body of gaseous or fluid fuel is passed through a hot pipe that the fluid fuel next the walls of the pipe absorbs most of the heat and makes a shield for the gas at the center of the pipe and allows it to pass quickly through at a much lower temperature than the gas next the pipe-walls. By subdividing the volume of intermingled gas and air in the two pipes M N and causing it to press through the passage *o* in a comparatively thin stratum, the entire body of intermingled gas and air will be highly superheated and will be in the best possible condition for most effective very hot flaming at the burner tubes or tips, where it meets the superheated air from the chamber E of the stove. The lower compartment or chamber A' of the stove-body confines the heat about the burner-pipes to assure thorough superheating therein of the intermingled gas and air, and the compartment also radiates heat to the room or apartment, and also protects the floor or walls from overheating by the hot burner-pipes. The desired objects may be attained by using the pipes M N and having the pipe N fall short of the end plugs *m'* of the pipe M and dispensing with the perforated parts *n n* of the inner pipe, as shown in Fig. $5^c$ of the drawings; but the construction hereinbefore described is preferred, because it enables me to hold the pipe N concentrically in the pipe M by the end plugs of the latter, and the perforated end parts of the inner pipe all the more thoroughly break up and intermix the gas and air as they enter the passage *o* between the pipes M and N.

In accordance with this part of my invention the modified construction of the stove-burner illustrated in Figs. 5ª and 5ᵇ of the drawings may be employed, wherein it will be seen that the gas may be admitted from the feed-pipe O directly to the space *o* between the two pipes M′ and N′, the burner-tubes *f′* being fitted tightly through the outer pipe M′ and into the inner pipe N′ to communicate with the latter. In this form of the burner the tortuous passage between the two pipes M′ N′ and within the pipe N′ provides quite as irregular or circuitous a mixing and heating chamber for the intermingled gas and air on its way from the pipe O to the burner tubes or tips as with the first-described burner; but the former construction is less expensive and more practical, and is therefore preferred over the latter.

Atmospheric air and gas are admitted to the burner-supply pipe O in regulated quantities preferably in the following manner: The outer end of the pipe, which extends beyond the stove-body, is screw-threaded, preferably externally, and to the threads is fitted a ring-valve P, which has an end hole *p′*, receiving the nipple *r* of the gas-supply pipe R, and also has a series of elongated side slots or openings *p*, which admit air to the interior of the pipe O directly at or past the end of the nipple *r*, from which the gas issues into said pipe. (See Fig. 6 of the drawings.) By simply turning the ring-valve on the pipe O to enlarge or contract the area of the air-valve slots *p* beyond the end of the pipe the supply of air to the pipe may be increased or diminished or entirely cut off at pleasure.

The gas inlet or nipple *r* is preferably screwed into a pipe-fitting S, which is supported by an elbow-pipe T, held by a screw *t* or otherwise to the stove-body, and the gas-supply pipe R, which has an ordinary gas-cock *r′*, may be connected by a flexible tube R′ or otherwise with any convenient pipe taking gas from a service-main.

The supply of gas to the pipe O may be accurately regulated by a needle-valve U, which is preferably fitted by a screw-joint into the pipe-fitting S and presents its conical inner end *u* to the discharge-orifice of the gas-nipple *r*, to which it may be adjusted more or less closely for regulating the supply-gas, or to which it may be closed for cutting off the supply at will.

The outer screw-threaded end of the needle-valve is preferably provided with a jam-nut *s* to lock it at any desired adjustment.

It is obvious that by adjusting the needle-valve U and the ring-valve P, the relative quantities of gas and air fed into the pipe O, and thence through the pipes N M to the point of ignition of the burner, may be varied as the nature or quality or pressure of the gas may require to assure a proper working of the burner, or, in other words, to secure complete or practically perfect combustion of the gas.

I will now particularly describe the modified form of stove shown in Figs. 7, 8, and 9 of the drawings, as follows: In this construction there is an auxiliary outer casing W, fitted to and around the back and both ends of the stove-body A, and about midway between the body-back $a^4$ and the back wall of the casing W there is fitted another plate or partition X, which extends clear across to the two ends of said casing. This provides two chambers or spaces *w w*, one between each end plate $a^5$ of the stove-body A and the adjacent end wall of the casing W, and each of these chambers *w* communicates by an opening or passage *w′* made through the lower end portion of the partition X with a common chamber $w^2$, formed between said partition and the back wall of the casing W, said chamber $w^2$ having communication by a pipe L′ fitted to the upper part of the back wall of the casing with any suitable chimney-flue or outlet. Between the partition X and the stove-body, wall $a^4$ and the rearwardly-extending parts of the end walls $a^5$ $a^5$ of the body which meet the plate X, there is formed a chamber or flue Y, which opens at its lower end to the atmosphere and at its upper part has communication, through the series of holes *c′* in the stove-body, with the air-heating chamber E, which surrounds the fire and mixing chamber B of the stove. A series of holes or suitable openings $c^2$ made in the upper part of each end wall $a^5$ establish communication between the interior of the stove-body above the fire-chamber with the adjacent end chambers *w* of the auxiliary casting W of the stove.

With this construction it is manifest that the supply of air to maintain combustion at the burner, instead of being taken in directly through the holes *c′*, as in the single-casing stove, will be first received into and through the passage or chamber Y and will pass upward therethrough to and through the holes *c′* and thence into the air-chamber E, around the fire-chamber B, and into and through it with the hot products from the burner, and thence to the front of the stove-body and above the fire-chamber; but instead of passing off directly through a pipe L, as in the single-casing stove, the hot waste products will pass through the openings $c^2$ in the end plates $a^5$ $a^5$ into the end chambers *w w* of the casing W and down them to and through the passages *w′ w′* into the bottom of the common chamber $w^2$ and upward through it to the pipe L′ and thence to the flue. By thus causing the hot products to traverse down the ends of the stove and then upward at the back of the stove they more effectively radiate heat from the stove to assure its maximum heating effect, and the air admitted at the openings *c′* to the superheating-chamber E is heated in the passage or chamber Y before it enters said openings, which increases the efficiency of the

stove by utilizing the waste hot products in the outer casing W, or its chamber $w^2$, to first heat the air-supply before it enters the body proper and superheating-chamber of the stove.

I am not limited to the use of ordinary illuminating or heating gases in my stove, as hydrocarbons or light oils may be supplied to the burner with good results, as will readily be understood.

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

1. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front by a transparent or partly transparent outer wall, of partitions located above and below said chamber, which has back and end walls set away from the stove-body, and a burner flaming into or toward the fire-chamber, substantially as described, whereby a superheating-chamber for air maintaining combustion at the burner is formed all around the fire and mixing chamber except at its front, through which the fire or incandescent interior of the stove is visible, as herein set forth.

2. In a gas-stove, the combination, with the stove-body closed at the front and provided with an interior fire and mixing chamber having a rear wall $b'$ $b^2$ set away from the adjacent wall of the stove-body, of partitions $b^4$ D above and below the fire-chamber and forming an air-superheating chamber next the fire-chamber, said stove-body having an opening for air below the partition $b^4$, and a burner flaming into or toward the fire-chamber, substantially as herein set forth.

3. In a gas-stove, the combination, with the stove-body closed at the front and provided with an interior fire and mixing chamber having a rear wall $b'$ $b^2$ and end walls $b^3$ $b^3$ set away from adjacent walls of the stove-body, of partitions $b^4$ D above and below the fire-chamber and forming an air-superheating chamber all around the fire-chamber except at its front, said stove-body having an opening for air below the partition $b^4$, and a burner flaming into or toward the fire-chamber, substantially as herein set forth.

4. In a gas-stove, the combination, with the stove-body closed at the front by a transparent or partly transparent outer wall and provided with an interior fire and mixing chamber having a rear wall $b'$ $b^2$ set away from the adjacent wall of the stove-body, of partitions $b^4$ D above and below the fire-chamber and forming an air-superheating chamber next the fire-chamber, said stove-body having an opening for air below the partition $b^4$, and a burner flaming into or toward the fire-chamber, substantially as herein set forth.

5. In a gas-stove, the combination, with the stove-body closed at the front and provided with an interior fire and mixing chamber having a rear wall $b'$ $b^2$ set away from the adjacent wall of the stove-body, of partitions $b^4$ D above and below the fire-chamber and forming an air-superheating chamber next the fire-chamber, said stove-body having an opening for air below the partition $b^4$, and a plate C below the partition $b^4$ and forming a passage $c$, conducting air directly to the rear wall of the fire-chamber, and a burner flaming into or toward the fire-chamber, substantially as herein set forth.

6. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber, of interior partitions forming an air-superheating chamber within the stove-body next the fire-chamber, said fire-chamber formed or provided with two distinct passages or series of passages for the superheated air, one passage or series of passages receiving superheated air to maintain combustion at a burner and the other passage or series of passages receiving a portion of the superheated air and conducting it to the fire-chamber at a point or points beyond the flame of the burner to assure more complete combustion, substantially as herein set forth.

7. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front by a transparent or partly transparent outer wall, of interior partitions forming an air-superheating chamber within the stove-body next the fire-chamber, said fire-chamber formed or provided with two distinct passages or series of passages for the superheated air, one passage or series of passages receiving superheated air to maintain combustion at a burner and the other passage or series of passages receiving a portion of the superheated air and conducting it to the fire-chamber at a point or points beyond the flame of the burner to assure more complete combustion, substantially as herein set forth.

8. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front and provided with bottom openings and having refractory linings at its inner or rear wall, of interior partitions forming an air-superheating chamber within the body next the fire-chamber, said fire-chamber linings provided with or set so as to form passages $h$ $i$, discharging superheated air from the lower openings into the fire-chamber at a point beyond the flame of the stove-burner, substantially as herein set forth.

9. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber provided with a fire-brick or refractory lining G H I, of partitions $b^4$ D in the stove-body, forming next the fire-chamber a chamber E for superheating air, said fire-chamber provided with one or more passages $b^5$, receiving hot products of a burner and the main body of superheated air from the chamber E, and also provided with passages $b^6$ $g$ $h$ $i$ at the linings G H I, which receive part of the superheated air and discharge it into the fire-

chamber at a point removed from the hot-product inlets $b^5$, substantially as herein set forth.

10. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front by a transparent or partly transparent outer wall and provided with inlets for superheated air and hot products from a burner, and partitions forming with the stove-body and fire-chamber an air-superheating chamber next the fire-chamber, of a perforated refractory shell or body placed in the fire-chamber and visible through its front and forming a combustion-chamber receiving hot products from the burner and air from the superheating-chamber, substantially as herein set forth.

11. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front and provided with inlets for superheated air and hot products from a burner, and partitions forming with the stove-body and fire-chamber an air-superheating chamber next the fire-chamber, of a perforated refractory hollow shell or body placed in the fire-chamber and ranging along its bottom, rear, and end walls and forming a combustion-chamber receiving hot products from the burner and air from the superheating-chamber, substantially as herein set forth.

12. In a gas-stove, the combination, with the stove-body having an interior fire and mixing chamber closed at the front and having inlets for superheated air and hot products from a burner, and partitions forming with the stove-body and fire-chamber an air-superheating chamber next the fire-chamber, said fire-chamber also having auxiliary passages receiving part of the superheated air and discharging it into the fire-chamber at a point removed from the hot-product inlet at the burner, of a perforated refractory hollow shell or body placed in the fire-chamber and directly receiving hot products from the burner with air from the superheating-chamber, the auxiliary superheated-air inlets to the fire-chamber being beyond or outside of the perforated shell or body, substantially as herein set forth.

13. In a gas-stove, the combination, with the stove-body having an air-inlet $c'$, of a fire-chamber having passages $b^5$ $h$ $i$, partitions $b^4$ D in the stove-body and forming therein an air-superheating chamber behind the fire-chamber, and a perforated shell or body K in the fire-chamber below the air-inlet $i$, and receiving hot products of a burner at the fire-chamber passages $b^5$, substantially as herein set forth.

14. In a gas-stove, the combination, with the stove-body having an air-inlet $c'$, of a fire-chamber having passages $b^5$ $h$ $i$, partitions $b^4$ D C in the stove-body, forming therein an air-superheating chamber and air-passage $c$ behind the fire-chamber, and a perforated shell or body K in the fire-chamber below the air-inlet $i$ and receiving hot products of a burner at the fire-chamber passages $b^5$, substantially as herein set forth.

15. In a gas-stove, the combination, with the stove-body having an air-inlet at its upper rear part, of a fire and mixing chamber within the body, partitions forming an air-superheating chamber behind and next the fire-chamber, a jacket and partition forming an atmospheric air-inlet next the back of the stove-body, which communicates with the air-superheating chamber within the body, and forming also a hot-air passage behind said air-inlet, and also forming hot-product passages at both ends of the stove-body, which communicate with the fire-chamber and with the rear hot-air passage, and a hot-product outlet from the passage of the jacket, substantially as herein set forth.

16. In a gas-stove, the combination, with the stove-body having an air-inlet at its rear part, of a fire and mixing chamber within the body, partitions forming an air-superheating chamber behind and next the fire-chamber, a jacket W and partition X, forming passages Y $w$ $w$ $w^2$ at the rear and ends of the stove-body, the lower openings $w'$ being provided between the passages $w$ $w$ $w^2$, and an outlet for hot products from the rear passage $w^2$, said passage Y opening to the air at or near the base of the stove, substantially as herein set forth.

17. In a gas-stove, the combination, with the stove-body provided with a fire-chamber and an adjacent air-superheating chamber, of a burner consisting of two main pipes, one within the other, with a space between them, and a fluid-fuel feed device communicating with one of the main pipes and the other pipe discharging hot products into the fire-chamber, both main pipes communicating with each other at a place or places distant from the feed device, one of the two main pipes and the feed device of the burner being fitted to the walls of the stove-body to form a mutual bracing for the body and burner, substantially as herein set forth.

18. In a gas-stove, the combination, with the stove-body provided with a fire-chamber and an adjacent air-superheating chamber, of a burner consisting of two main pipes M N, the outer pipe M held to opposite walls of the stove-body and having burner tubes or tips flaming into the fire-chamber, and the inner pipe N, communicating at its outer ends with the pipe M′, and a gas and air feed pipe O, communicating with the pipe N at a point distant from its outlets to the pipe M, said pipes M O being fitted to the walls of the stove-body to form a mutual bracing for the body and burner, substantially as herein set forth.

19. In a gas-stove, the combination, with the stove-body provided with a fire-chamber and an adjacent air-superheating chamber, of a burner consisting of two main pipes, one within the other, with a space between them, a feed-pipe communicating with one of the

main pipes, the other pipe discharging hot products into the fire-chamber, both main pipes communicating with each other at a place or places distant from the feed-pipe, one of the main pipes and the feed-pipe being fitted to the walls of the stove-body to form a mutual bracing for the body and burner, independent gas and air inlets to the feed-pipe consisting of a ring-valve fitted adjustably to said pipe and having side openings admitting air, a gas-supply nipple entering the ring-valve, and a needle-valve in the gas-nipple, substantially as herein set forth.

20. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, and a fluid-fuel feed device communicating with one of the pipes, the other pipe having openings at which the burner flames, and both main pipes communicating with each other at a place or places distant from the fuel-feed device, substantially as described, whereby the fluid fuel must traverse a sinuous course through the two main pipes to the point of ignition, as herein set forth.

21. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, and independent gas and air inlets communicating with one of the pipes, the other pipe having openings at which the burner flames, and both main pipes communicating with each other at a place or places distant from the gas and air inlets, substantially as described, whereby the admitted gas and air must traverse a sinuous course through the pipes to the point of ignition, as herein set forth.

22. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, a fluid-fuel feed-pipe forming a mixing-chamber and communicating with one of the main pipes, the other main pipe having openings at which the burner flames, and both main pipes communicating with each other at a place or places distant from the feed-pipe, and independent fluid-fuel and air inlets at the feed-pipe, substantially as described, whereby the air and fluid fuel admitted to and commingled in the feed-pipe must traverse a sinuous course through the main pipes to the point of ignition, as herein set forth.

23. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, a fluid-fuel feed device communicating with the inner pipe, the outer pipe having openings at which the burner flames, and both pipes communicating with each other at a place or places distant from the fuel-feed device, substantially as herein set forth.

24. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, a feed-pipe communicating with the inner pipe and forming a mixing-chamber, the outer pipe having openings at which the burner flames, and independent fluid-fuel and air inlets at the feed-pipe, both main pipes communicating with each other at a place or places distant from the feed-pipe, substantially as herein set forth.

25. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, a fluid-fuel feed device communicating with one of the pipes and the other pipe having openings at which the burner flames, both main pipes communicating with each other at a place or places distant from the feed device by perforations of the inner pipe breaking up the fluid-fuel currents passing from one pipe to the other, substantially as herein set forth.

26. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, a feed-pipe communicating with one of the pipes and forming a mixing-chamber, the other main pipe having openings at which the burner flames, both main pipes communicating with each other at a place or places distant from the feed-pipe by perforations of the inner pipe breaking up the fluid-fuel currents, and independent fluid-fuel and air inlets at the feed-pipe, substantially as herein set forth.

27. In a gas-stove, the burner made with two communicating main pipes, one within the other, one of the pipes having openings at which the burner flames, the outer pipe having plugged or closed ends, and the inner pipe fitted to said ends for centering it within the outer pipe, said inner pipe having perforations breaking up the fluid-fuel currents passing through them from one pipe to the other, substantially as herein set forth.

28. In a gas-stove, the burner made with an outer pipe M and an inner pipe N, perforated at its end parts, plugs or heads $m'$ in the outer pipe to which the ends of the inner pipe are fitted, a feed-pipe O, communicating with the inner pipe, and one or more burner tips or openings at the outer pipe, substantially as herein set forth.

29. In a gas-stove, the burner made with two main pipes, one within the other, with a space between them, one of said pipes having tips or openings at which the burner flames, a feed-pipe communicating with the other pipe and forming a mixing-chamber, both main pipes communicating with each other at a place or places distant from the feed-pipe, a ring-valve fitted adjustably on the feed-pipe and having air-inlet openings, a gas-nipple discharging into the ring-valve, and a needle-valve in said nipple, substantially as herein set forth.

JAMES GIBBONS.

Witnesses:
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