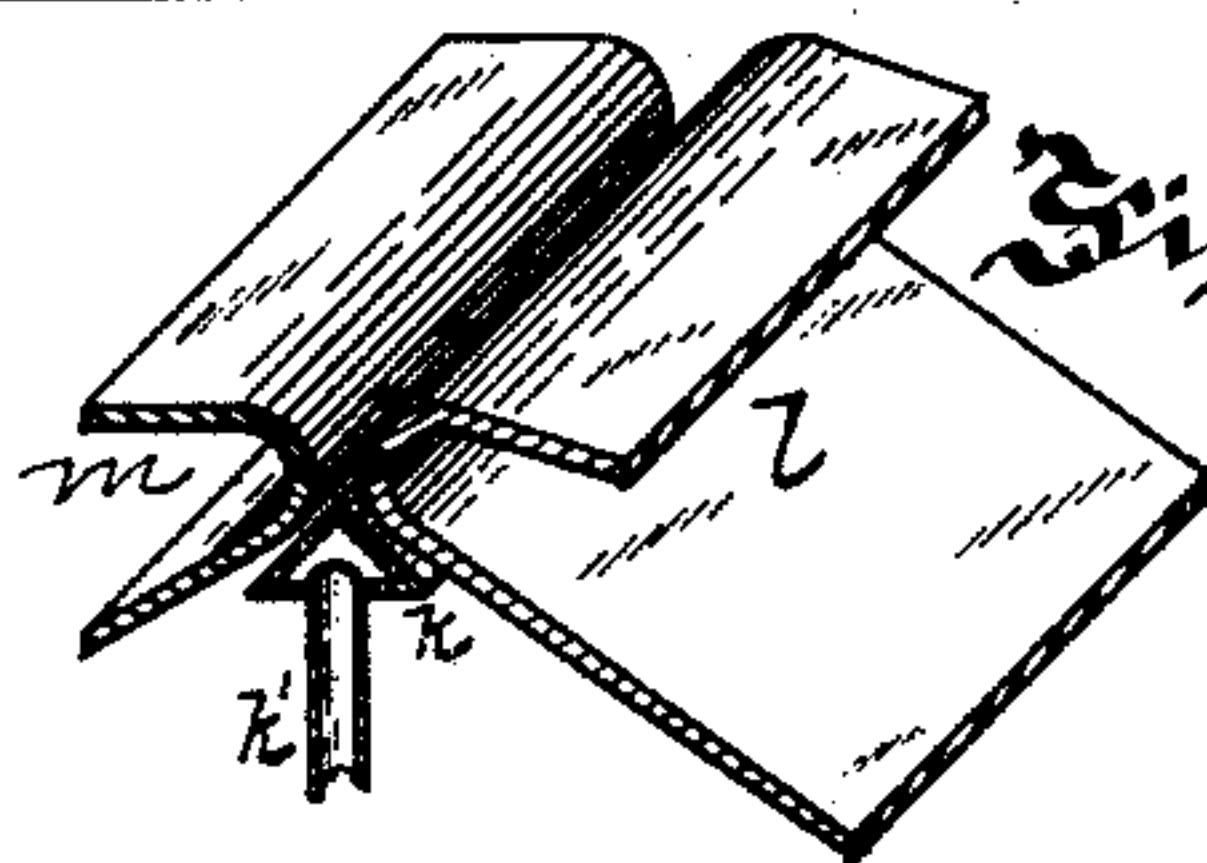
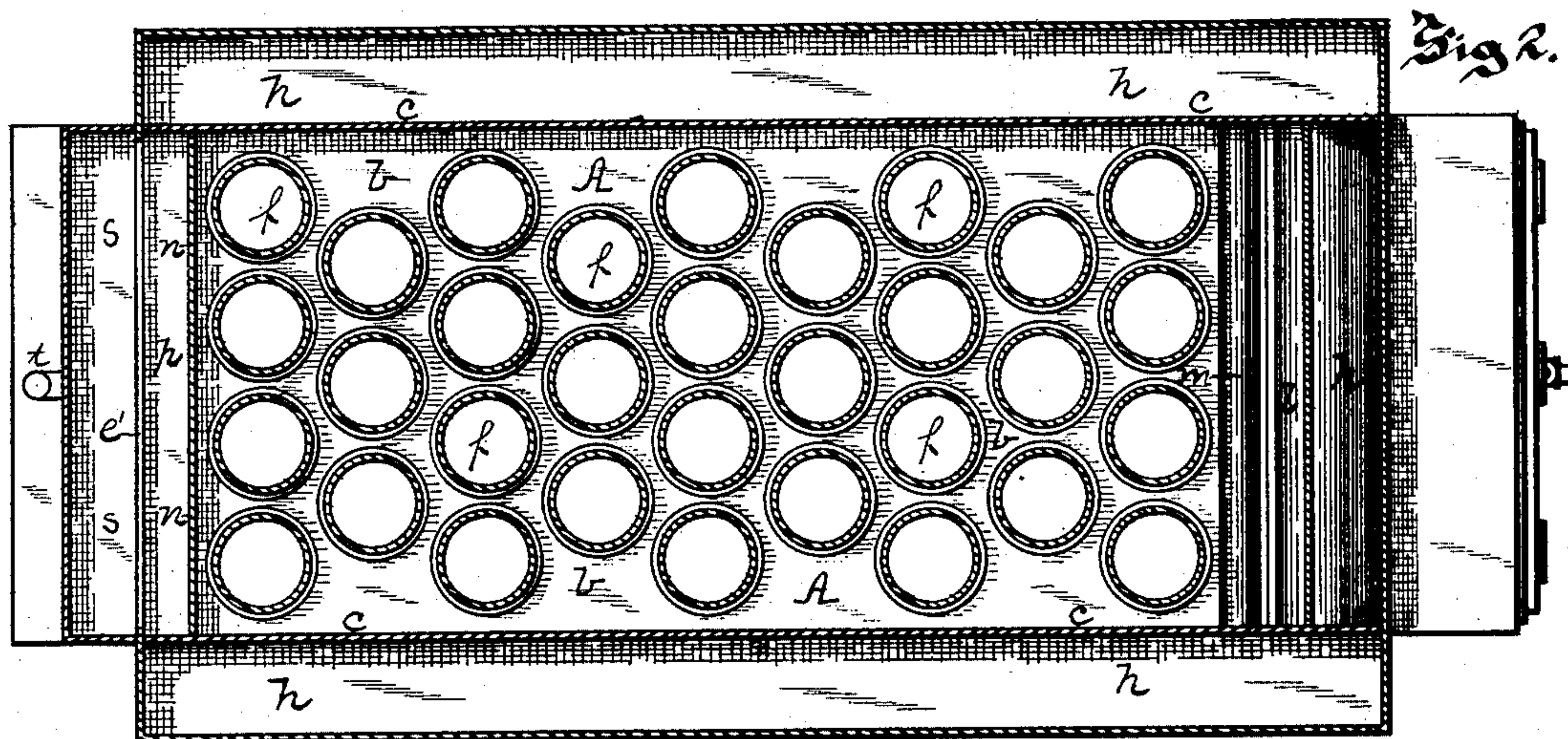
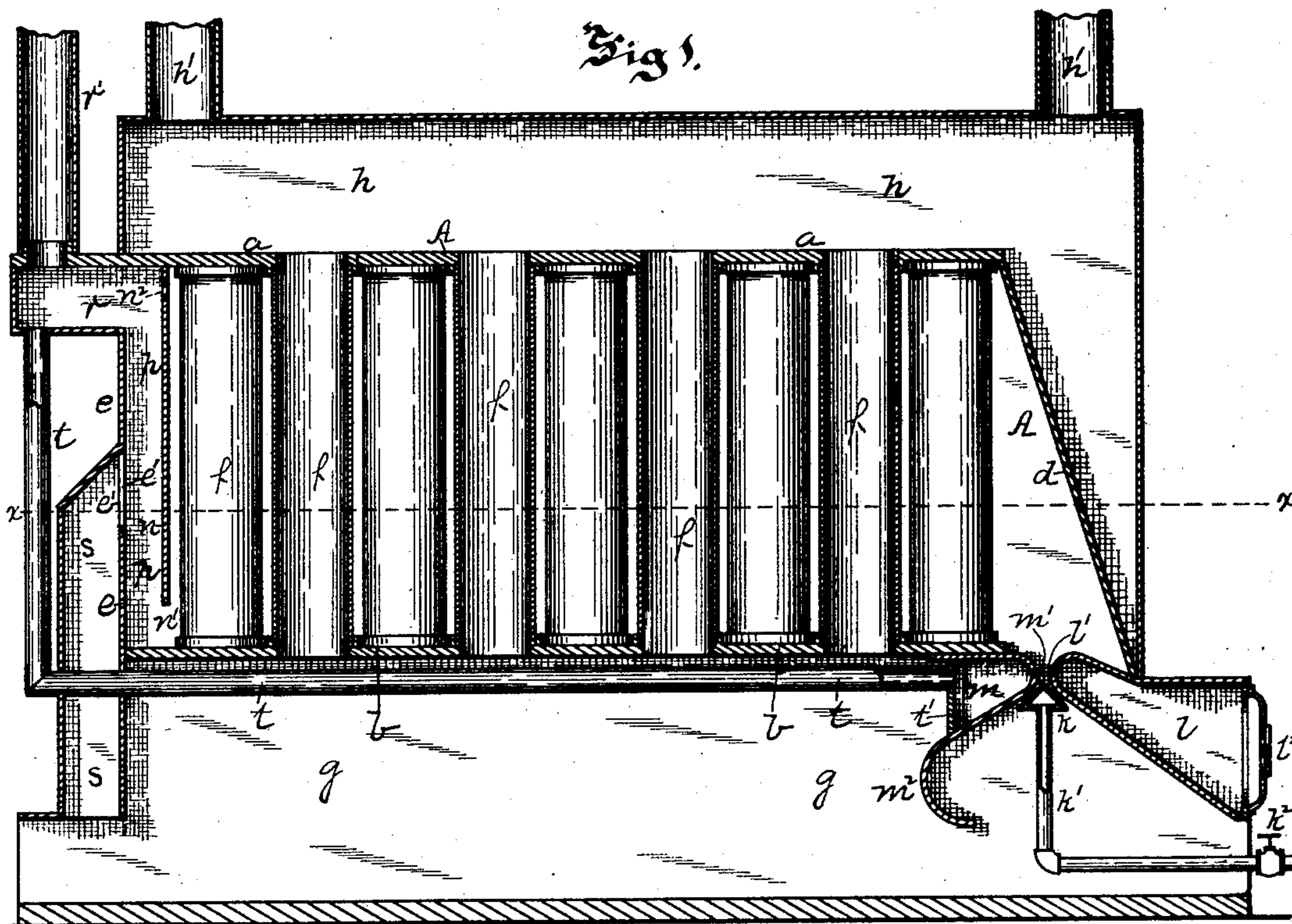


(No Model.)

J. J. H. SCHLAG.
HEAT RADIATING FURNACE.

No. 367,553.

Patented Aug. 2, 1887.



Witnesses:
J. G. May
J. Hooke

Inventor.
J. J. Henry Schlag
By James S. May
Attorney

UNITED STATES PATENT OFFICE.

J. J. HENRY SCHLAG, OF SHALER, ALLEGHENY COUNTY, PENNSYLVANIA.

HEAT-RADIATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 367,553, dated August 2, 1887.

Application filed February 23, 1886. Serial No. 192,866. (No model.)

To all whom it may concern:

Be it known that I, J. J. HENRY SCHLAG, of Shaler township, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Heat-Radiating Furnaces; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to heat-radiating furnaces. These furnaces being of many different forms, and it being found, especially in furnaces heated by natural gas, that so large a portion of heat from the furnace would escape through the smoke-pipe into the chimney that the walls of the chimney are raised to a high heat, and in some cases on account of the overheating in this manner of the chimneys through which the products of combustion were taken from the furnace, conflagrations have occurred, while it often happened that the walls were marred by the overheating thereof. In addition to these objections, it was also found that a great waste of fuel occurred where these highly-heated products of combustion were permitted to escape from the furnace without having the heat therein absorbed by the air of the apartment in which the furnace was located, or of the surrounding chamber within which the heated air was collected and directed by suitable flues to the apartments to be heated. It was also found that in the ordinary furnaces or fire-places where this natural gas was employed there was liability of the products of combustion from the gas consumed intermingling with the air of the apartment, and for this reason rendering it impure, the gaseous odors being found very objectionable, and it also being found that in the ordinary furnace heated by natural gas there was liability of these odors entering into the air heated and passing from the surrounding chamber into the different apartments.

The object of my invention is to provide a heat-radiating furnace to be employed with natural or other gaseous fuel in which all, or substantially all, the heat generated from the combustion of the gaseous fuel is absorbed from the heated products of combustion before they enter the pipe leading to the chimney, and all liability of the highly-heated products of combustion passing into the chimney and

raising it to a dangerous heat is overcome, in which there is no opportunity of the heated products becoming intermingled with the air heated thereby and rendering the same impure, in which the radiating-furnace regulates itself according to the amount of gas employed therewith, and in which, in case the gaseous fuel becomes extinguished, as where the supply ceases and again commences to flow, there is no opportunity of gas escaping into the apartment, but it is directed to the pipe leading to the chimney, and has a ready escape from the radiating-furnace.

To these ends my invention consists, generally, in a heat-radiating furnace constructed of a series of vertical tubes of sheet metal or other suitable material extending through the body of the furnace-chamber, so as to form upward passages for the air to be heated from below said chamber through the same, and a gas-burner located at the forward end of said furnace-chamber, so that the flame and heated products of combustion passing from the point of combustion at the forward end of the furnace will be caused to pass around these vertical air-heating tubes, and the air rising through the tubes will be heated thereby, the course of the flame and heated products of combustion being so circuitous in passing around the tubes that all, or practically all, the heat therein is absorbed by the air passing upwardly through the tubes before the products of combustion pass to the stack and are permitted to escape.

It also consists in providing the furnace at the rear end, thereof with an air-entrance, by means of which cold air is introduced into the flue or passage, through which the products of combustion pass to the stack in such manner that this air first acts to prevent a strong draft through the furnace-chamber, and so to prevent the drawing of the heated products of combustion rapidly through the same before all the heat thereof is absorbed, and at the same time to mix with the products of combustion, and in case they are heated so cool them that they will pass to the stack or chimney at such a low temperature that there is no liability of overheating thereof thereby.

It also consists in certain improvements in the construction of the gas-burner employed

with my improved furnace and in the manner of heating the air fed thereto, as well as in other details of construction, hereinafter set forth.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a longitudinal central section of my improved furnace. Fig. 2 is a cross-section of the same on the line *xx*, Fig. 1; and Fig. 3 is a detail perspective view of my improved burner.

Like letters of reference indicate like parts in each.

The furnace-chamber A is formed of the top plate, *a*, bottom plate, *b*, side walls, *c*, front wall, *d*, and rear wall, *e*, the furnace-chamber being of any desired size or shape according as it is found the best results are obtained. I find an oblong furnace-chamber, such as shown, is best suited for the purpose, and that the top plate, *a*, and bottom plate, *b*, are preferably cast to shape, though the side and end walls of the furnace may be wrought metal, if desired.

Extending through the furnace-chamber A are a series of air-heating tubes *f*, these tubes being round, square, or of other suitable shape, and being formed of wrought or cast metal or fire-clay, as desired, the tubes being held in place by suitable collars on the top and bottom plates and tight joints between the tubes, and these joints being formed by any suitable cement. The tubes *f* communicate with the air space or chamber *g* below the furnace-chamber A, and with the apartment above the furnace-chamber, where my improved radiating-furnace is employed within the apartment to be heated, or with the heated air-chamber *h*, which extends above and on the sides of the furnace-chamber A, and has suitable pipes, *h'*, leading off to the different apartments to be heated, the said air-heating chamber also extending in front of the furnace-chamber A, so that the air within the same may absorb the heat through the front wall, *d*, thereof.

Located at the forward end of the furnace-chamber is the gas-burner *k*. This can be of any suitable construction, and the air for supporting combustion can be conducted thereto in any desired manner. The construction of the burner preferred by me is a hollow-bar burner, triangular in cross-section, having perforations on the two upper surfaces thereof, to which gas is supplied through the pipe *k'*, which enters the furnace in any suitable manner and is controlled by a suitable valve, *k''*. The supply of air to this burner enters at the front of the furnace through opening *l'*, preferably controlled by a regulator, and thence passes into the air-heating chamber *l*, which extends partly over the burner, the upper portion of said chamber extending above the point of combustion of the gas and air, and there being formed in the inner wall of said chamber perforations *l'*, through which the air entering through the opening *l'* can pass across

the course of the gas entering through the burner *k*. On the opposite side of the burner *k* is the rear air-heating chamber, *m*, which also extends above the point of combustion of the gas and air, and is provided with perforations *m'*, through which the air heated within said chamber can pass across the course of the gas entering through the burner. The lower walls of these air-heating chambers *l m* extend diagonally downward away from the burner, and the lower portion, *m''*, of the lower wall of the chamber *m* is curved forward, as shown, so impeding the current of air from the air-chamber *g* and directing it upwardly to the air-heating chamber *m*, though the incoming air can pass below the said apron *m''* and pass upwardly around the burner *k*, the air-supply to this chamber thus entering first through the air-heating chamber *l*, next through the air-heating chamber *m*, and, finally, upwardly around the burner *k* to the point of combustion. These air-heating chambers *l m* extend, as shown, above the triangular burner *k*, and combustion is formed between the said chambers, so that the walls thereof are highly heated, and the incoming air, striking against said walls, become highly heated, especially those portions of the air which come in contact with the top walls of the chambers, and the air in passing through the perforations passes across the course of the gas entering through the burner *k*, and it, as well as that passing up on each side of the burner, is thoroughly intermingled with the gas and a perfect combustion is formed at the forward end of the chamber A, the flame and heated products of combustion passing upwardly around a series of air-heating tubes, *f*, and so heating the same. At the rear of the furnace-chamber is the deflecting-wall *n*, which extends from the top plate, *a*, down close to the bottom plate, *b*, so that the products of combustion in passing through the furnace will necessarily pass downwardly through the opening or port *n'* at the base of said wall *n*, and then rise upwardly through the flue *p*, formed between the rear plate, *e*, and the deflecting-plate *n*, the products of combustion rising thence through the exhaust-products or mixing-chamber *r*, and part or all of said products of combustion passing thence into the stack *r'*, as hereinafter described.

Communicating with the flue *p* by means of the port *e'* in the end plate, *e*, is the cold-air flue *s*, through which the cold air passes upwardly into the flue *p*, and thence with the products of combustion into the mixing-chamber *r*, the air entering through this flue *s* acting upon the products of combustion with a back-pressure in such manner as to prevent the natural draft of the chimney from drawing the products of combustion through the furnace-chamber before all the heat thereof is absorbed, the air entering through this flue *s* furnishing a more direct supply of air to the chimney in such a manner as to overcome the strong draft. At the same time this cold air mixing

with the products of combustion will, if said products are heated to a high degree, cool the same as they pass together upwardly through the flue *p* and into the mixing-chamber *r*, it being found that though a high heat is generated at the forward end of my improved heat-radiating furnace, the top of the mixing-chamber *r* at the rear thereof is always cold enough to permit the hand to rest thereon.

10 In order to utilize the mixed air and gas from the mixing-chamber *r* and to secure a substantially perfect combustion of all the gas in the furnace, I generally connect the mixing-chamber *r* with the air-heating chamber *m* by a suitable pipe, *t*, the said mixing-chamber *m* being in this case closed by the wall or plate *t'* to prevent the entrance of air thereto. In this case, as the gas escaping at the burner *k* is under more or less pressure, it will act as an injector upon the openings *m'* of the chamber *m* and induce a current of the mixed gases from the mixing-chamber *r* through the flue *t* into the chamber *m*, and thence out through the openings *m'*, to assist in the combustion of gas from the burner *k*. As the area of the pipe or flue *t* may be much smaller than that of the outlet-flue *r'*, no difficulty is experienced in obtaining the downward current of gas through the flue *t*.

30 When my improved heat-radiating furnace is in use, the flame and heated products of combustion formed at the forward end of the furnace from the heated air and gas, as above described, pass backwardly through the furnace-chamber *A* and around the air-heating tubes *f*, the said air-heating tubes breaking joints with each other, so that the flame and heated products must pass in a circuitous course from one end of the furnace to the other, and while so passing the air entering said tubes from the cold-air chamber *g* will be raised to a high heat by the flame and heated products passing around said tubes, the highest heat being of course generated at the forward end of the furnace, where the tubes are raised to the highest heat, it being found that even with a small consumption of gas the first three or four rows of tubes are kept at a low-red heat. As the products of combustion have their caloric withdrawn therefrom by the air rising through the tubes, they become gradually colder and colder, until, on account of the circuitous course through which they pass when they strike against the deflecting-plate *n* at the rear of the furnace-chamber, substantially all the heat or caloric is absorbed therefrom, the air passing upwardly through the forward series of tubes being of course much more rapidly heated and passing through the same much more quickly than through the series of tubes at the rear of the furnace, but the air rising more slowly through the rear tubes and absorbing much heat through the walls thereof, a gradual heating of the air being thus obtained without permitting the escape of any of the heated products of combustion with the same and the rendering of the same impure.

When the heated products strike against the deflector-plate *n*, they necessarily pass downwardly along the same to the port *n'* at the base thereof, and thence upwardly through the flue *p*, and when they come in contact with the air entering said flue from the cold-air flue *s*, they are cooled thereby, and the passage of any highly-heated products of combustion from the furnace into the chimney is prevented. At the same time the air entering through the flue *s*, which in absorbing the heat from the products of combustion has itself become partially heated and part of the products of combustion, will pass through the pipe *t* into the air-heating chamber *m*, and be supplied to the burner, as above described. It is found that by regulating the amount of gas fed to the furnace the operation of the furnace can be accurately regulated, as the gas will draw in the required amount of air for causing combustion with the same through the several openings or passages, and the amount of air fed to the rear of the furnace in order to cool the products of combustion will be regulated by the draft through the furnace, it being found that where the amount of gas consumed is small the draft through the flue *s* is but light, but that it increases as the amount of fuel employed increases, and that even though a very high heat is generated within the furnace-chamber, the amount of air supplied through the flue *s* is sufficient to keep the rear of the furnace cool, and to act as a back-pressure on the heated products of combustion passing through the furnace-chamber, so causing all or substantially all the caloric to be absorbed therefrom by the air passing through the flues or tubes *f*. All the heat radiated through the walls of the furnace also passes into the apartment where the furnace is located or into the surrounding chamber.

At the upper end of the deflector-plate *n* are formed one or more small openings, *n''*, forming a direct communication from the upper part of the furnace-chamber *A* with the exhaust-port *p* and mixing-chamber *r*, these openings being employed for the purpose of permitting the escape of any unconsumed gas from the furnace-chamber directly to the stack, so that in case the supply of gas should be cut off, so extinguishing the flame, and should it again commence to flow, any gas from the burner will pass to the upper part of the furnace-chamber, and thence to the rear thereof and through the openings *n''* to the chimney, so preventing the gathering of any large portion of gas within the furnace or the formation of any explosive mixture therein. It is also found that no time is required to heat up the furnace-chamber, as the full heat of the furnace-chamber is obtained as soon as the gas at the burner is lighted, and for the reasons above given there is practically no waste of fuel, the air heated is pure and free from all sulphurous or gaseous odors, and the furnace regulates itself according to the amount of gaseous fuel fed thereto.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In heat-radiating furnaces, the furnace-chamber having the deflector-plate *n*, provided
5 at the base with the port *n'* and forming the exhaust-flue *p*, and the cold-air flue *s*, communicating with the flue *p* above said port *n'*, substantially as and for the purpose set forth.

2. In a heat-radiating furnace, the combination of the hollow-bar gas-burner with the air-heating chambers *l m*, extending on each side
10 of and above the same, and having perforations passing through the inner walls thereof, said inner walls forming an air-chamber between
15 them, substantially as and for the purpose set forth.

3. The combination, with the furnace-cham-

ber having the mixing-chamber *r* and the burner located at the forward end thereof, of the air-heating chamber *m* at the side of the
20 burner, and the flue *t*, communicating with the chambers *r* and *m*, substantially as and for the purpose set forth.

4. The furnace-chamber having the deflector-plate *n*, port *n'*, and exhaust-flue *p*, and
25 provided with one or more gas-escape openings, *n''*, at the upper end of the deflector-plate, substantially as and for the purpose set forth.

In testimony whereof I, the said J. J. HENRY SCHLAG, have hereunto set my hand.

J. J. HENRY SCHLAG. 30

Witnesses:

I. E. BARNES,
JAMES I. KAY.