(No Model.) 2 Sheets—Sheet 1.

J. YOUNG.

AIR HEATING FURNACE.

No. 445,130. Patented Jan. 20, 1891.

Fig 1.

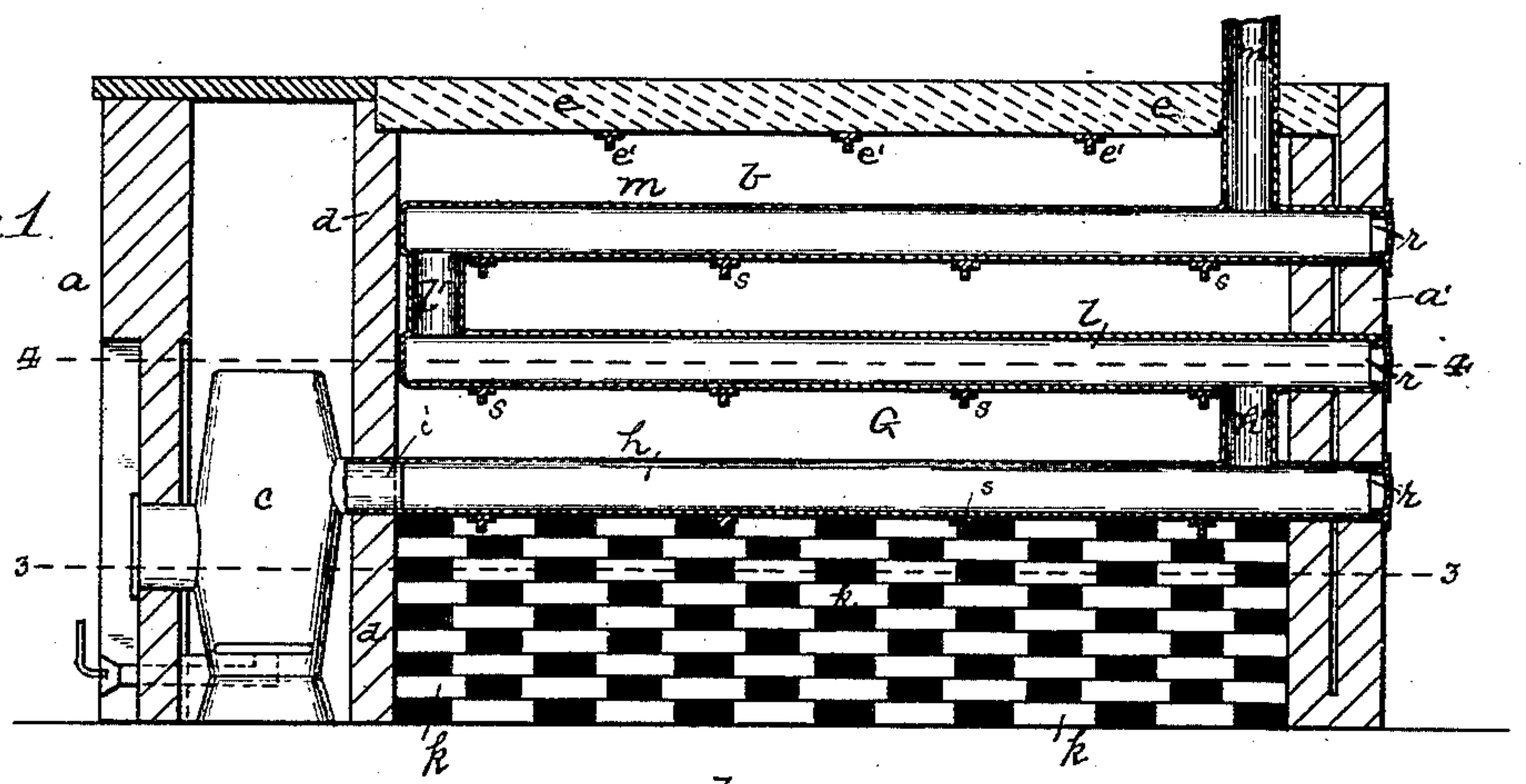


Fig 3.

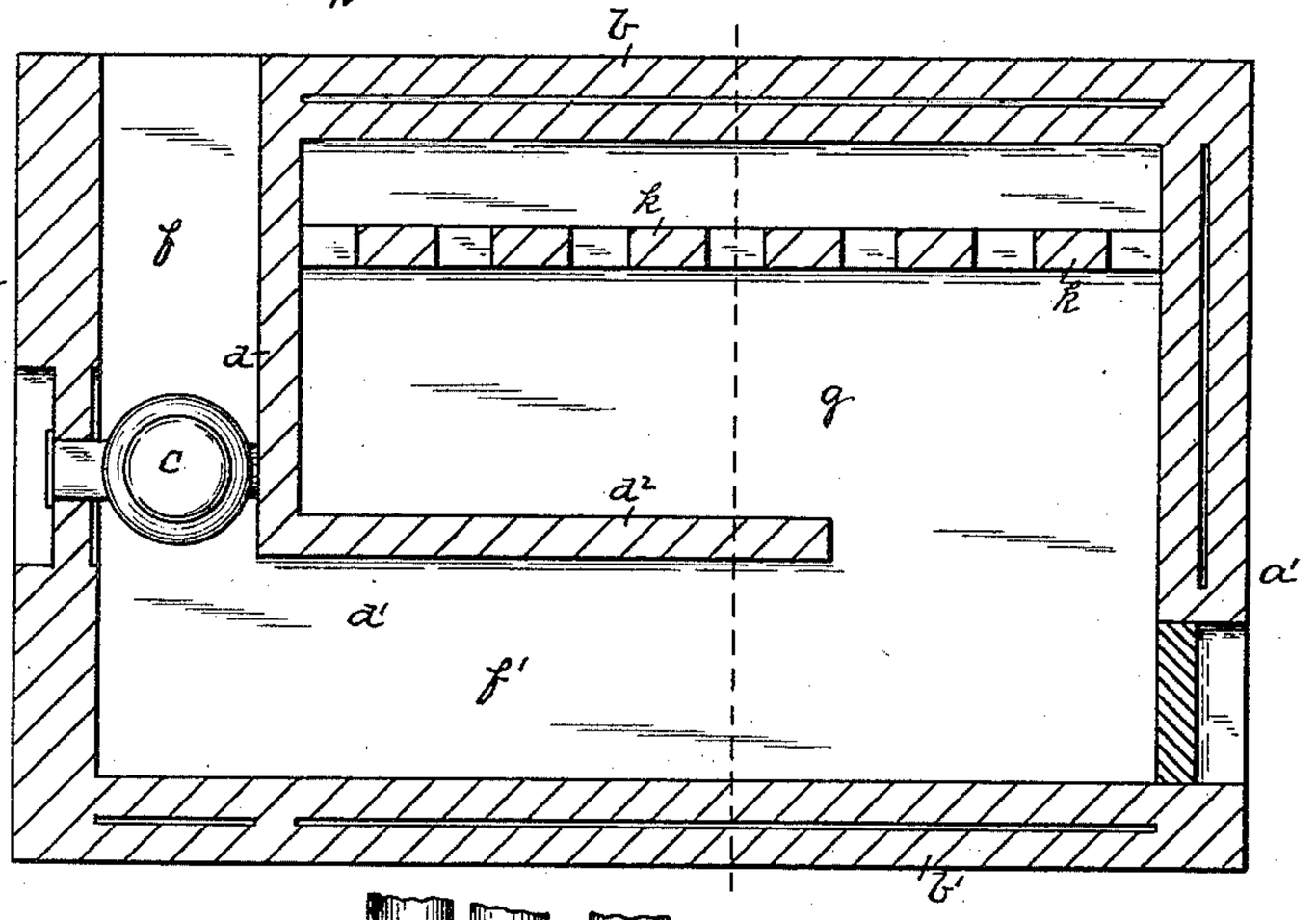
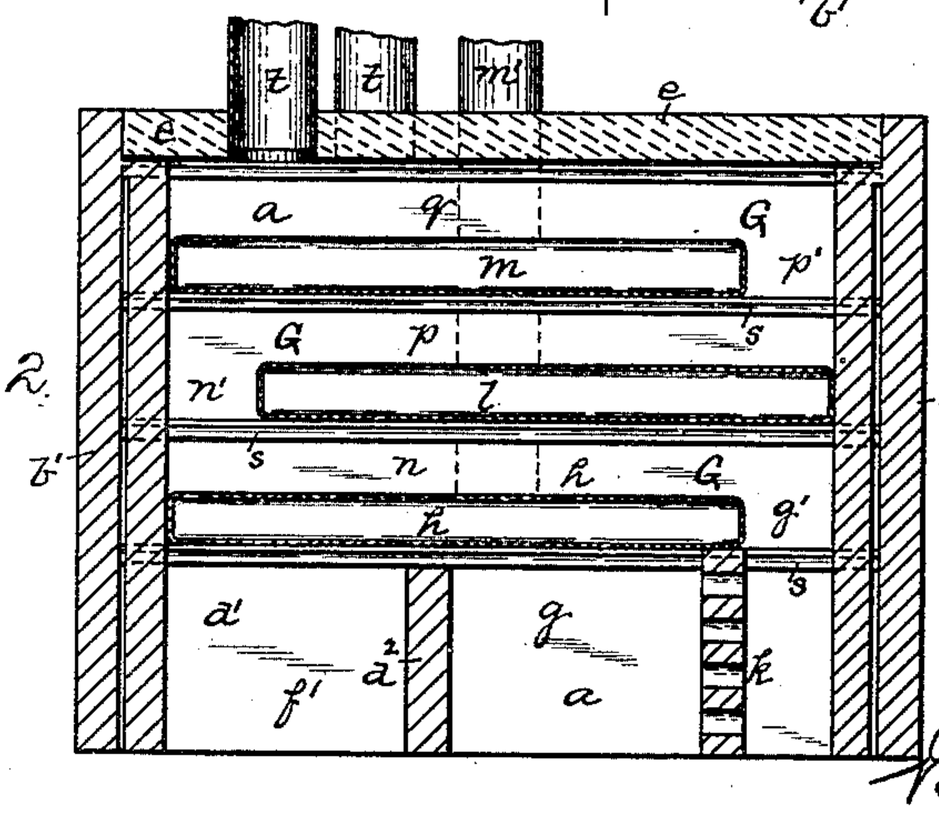


Fig 2.



Witnesses:
J. R. Bowley.
Robt. D. Totten

Inventor:
John Young
By James D. Kay
Attorney

(No Model.) 2 Sheets—Sheet 2.

J. YOUNG.

AIR HEATING FURNACE.

No. 445,130. Patented Jan. 20, 1891.

Fig. 4.

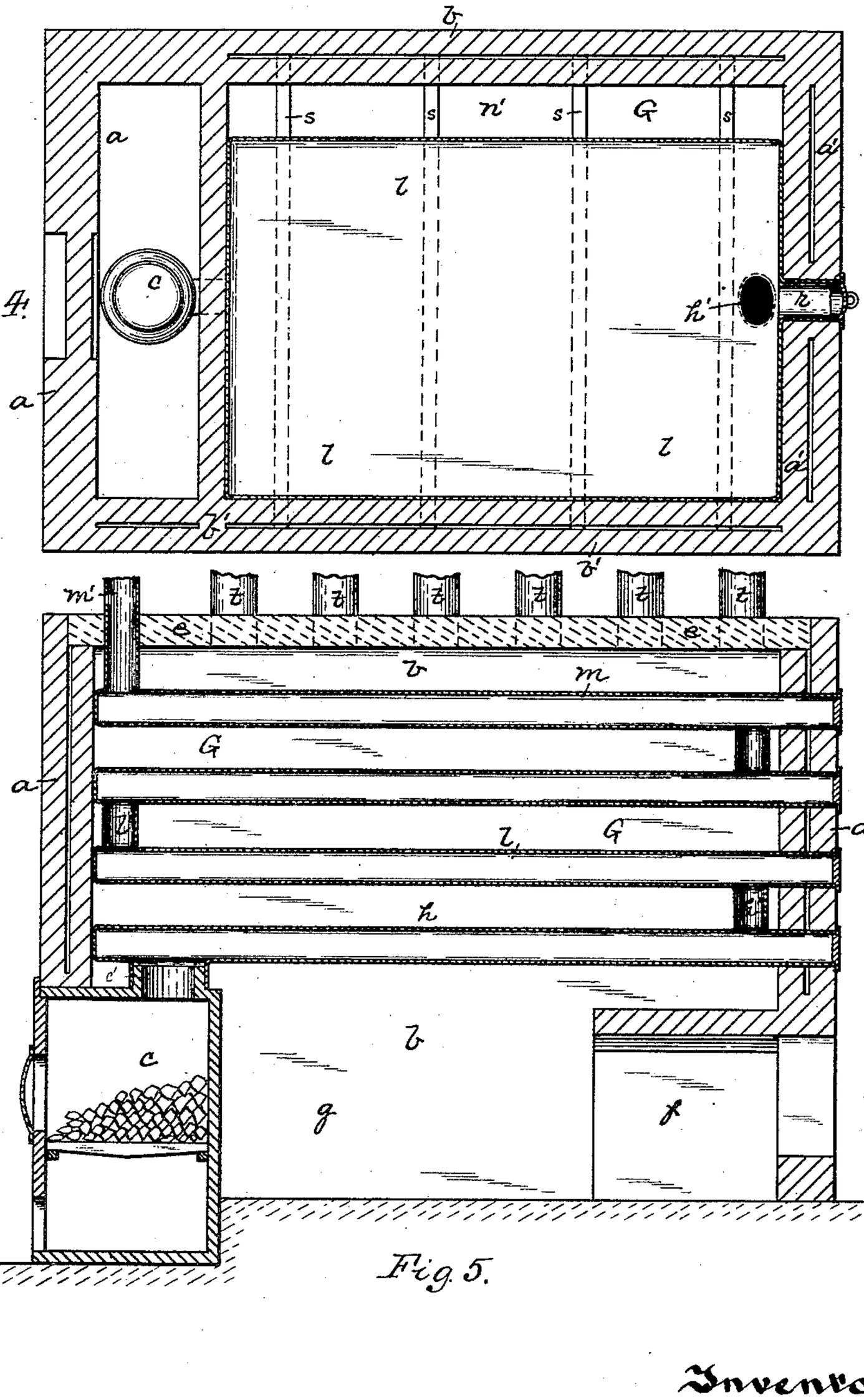


Fig. 5.

Witnesses:
J. A. Coorey.
Robt. D. Totten

Inventor:
John Young
By James D. Kay
Attorney

UNITED STATES PATENT OFFICE.

JOHN YOUNG, OF PITTSBURG, PENNSYLVANIA.

AIR-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 445,130, dated January 20, 1891.

Application filed March 12, 1890. Serial No. 343,626. (No model.)

To all whom it may concern:

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

My invention relates to air-heating furnaces to be employed in heating stores, dwellings, churches, &c., its object being to provide a form of heat-radiating apparatus in which the heat generated can be practically all utilized in the heating of the air, and at the same time to provide a furnace simple and comparatively cheap in construction. The ordinary air-heating furnaces in general use are arranged with one or more drums through which the heated products pass, there being tubes or passages within the drums, and the heated products and air to be heated generally travel in the same direction or in opposite direction the one to the other, while in the ordinary construction of furnace, though part of the heated products pass close to the sheet or plate separating them from the air and will lose their heat quickly, there is generally a large proportion of the heated products which does not come in contact with the plate or plates of the drum and from which the heat is not absorbed by the air, and as a matter of fact a large portion of the heat escapes through the smoke-flue to the chimney.

The object of my invention is to provide a furnace in which these objections are practically overcome and in which practically all the heating products from the stove or other generator are brought into contact with the plates of the drum or radiator, while the heated products and the air are each caused to flow in a slow course and in a thin stratum, which permits the air to absorb practically all the heat from the products of combustion.

The particular improvements included within my invention will be hereinafter more particularly set forth and claimed.

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 section of a furnace embodying my invention. Fig. 2 is a cross-section of the same. Fig. 3 is a horizontal section on the line 3 3, Fig. 1. Fig. 4 is a horizontal section on the line 4 4, Fig. 1; and Fig. 5 is a longitudinal section of another form of furnace embodying my invention.

Like letters of reference indicate like parts in each.

The brick-work of the furnace is generally composed of two end walls *a a'*, two side walls *b b'*, together with suitable deflecting-walls for directing the flow of the air, as hereinafter described. The roof *e* of the furnace is formed of mineral wool, asbestus, or like non-conducting fire-proof material, so forming a roof which is not liable to permit such radiation of heat as might cause the ignition of the rafters of the building. In Fig. 5 practically the same furnace is shown, except that an ordinary square box fire-place, such as can be constructed of plate metal or built of brick-work, is shown, and that radiators extend from end to end of the furnace, while the air enters at the rear of the furnace, the air passing in practically the same course as that above described.

The furnace is simple in construction and can be built at comparatively low cost, and the practical use of the same has proven that it possesses great air-heating properties, all of the heat being absorbed from the heated products by the air, and the products of combustion and heated air passing from the same being of practically the same temperature, so that there is no loss of heat, and the furnace can be operated at a very small expenditure of fuel.

The heater *c* may be either an ordinary "egg-stove," as it is termed, or any other form of heater, the egg-stove being shown in the main figures of the drawings, while a square box heater—such as can well be formed of wrought metal or cast-iron—is shown in Fig. 5. This heater is either provided with the ordinary feed and ash doors and grate or with a gas-burner, where gaseous fuel is employed for heating the furnace, the former being shown in Fig. 5 and the latter in the other figures. The heater *c* is placed near to the end wall *a* and between it and the partition-wall *d*, extending in from the side wall *b* of the furnace, said wall *d* extending en-

tirely across the furnace, except in the lower part thereof, where an opening d' is formed, through which the air can pass into the lower part g of the air-heating chamber G, and a deflecting-wall d^2 extending out from the lower part of this partition-wall d, so as to force the air toward the opposite end of the air-heating chamber, so forming the air-entrance f between the walls a and d, in which the heater c is placed, and the air-flue f' extending from the opening d' into the base g of the air-heating chamber.

Extending from the side wall b' over the deflecting-wall d^2 and reaching from the partition-wall d to the opposite end wall a' is the horizontal radiator h, this radiator being the full length of the air-heating chamber G and almost the full width thereof, leaving only at one side a passage for the air, as at g', and the radiator being of but little thickness or depth, so forming what might be called a "flat-pan radiator," in which the heated products are held between two horizontal sheets or plates brought comparatively close to each other.

The several radiators h l m, which are all of practically the same construction, are supported on T-bars s, extending across the furnace-chamber and into the side walls thereof. Below the radiator h and dividing the air-flue g' from the lower part g of the air-heating chamber is the checker-work wall k, the openings in which are preferably formed so that they give practically the same area of opening as the main entrance f. Said checker-work wall k serves to retard the flow of the air, so heating it gradually before it ascends to the upper air-compartments of the furnace. Its most important function is, however, to cause the proper feeding of the air to the zigzag air-passage, as the area of all of the openings in the checker-work is made about equal to that of the entrance-flue f, and the air is therefore caused to spread out for the entire length of the checker-work wall in feeding to the air-passage. Within the heating-chamber G and above the radiator h are the other radiators l m, the radiator h extending out from the side wall b' toward but not reaching the side wall b and leaving the air-flue g', above referred to, while the radiator l extends out from the side wall b toward but not reaching the side wall b', leaving the vertical air space or flue n', and the radiator m, above the radiator l, extending out from the wall b' toward but not reaching the wall b, leaving the vertical air space or flue p'. Space is left between these radiators to form the horizontal air-spaces n p q, the upper space being formed between the top of the radiator m and the roof e of the furnace-chamber, and these horizontal air-spaces communicate at the sides of the furnace by the vertical passages n' and p', above referred to, so forming what might be termed a "horizontal zigzag air-course" sidewise through the furnace-chamber. The several radiators h l m communicate alternately at opposite ends by pipes or passages—such as the pipe h'—at one end, leading from the radiator h into the radiator l, while the pipe or pipes l' lead from the opposite end of the radiator l to the radiator m, these pipes being placed, if desired, near the side walls of the radiators, as shown in dotted lines, Fig. 4. The radiator m leads by the smoke-pipe m', at the end opposite to the pipe l', to the chimney.

In order to remove any soot or like deposits within the horizontal radiators, I form at the rear ends thereof the hand-holes r, closed by suitable caps, these hand-holes extending through the end wall a'.

The air-pipes for carrying the heated air to the building can be formed through the roof e of the furnace-chamber, as indicated at t. The heated products and smoke from the heater c pass directly into the lower radiator h. The sectional area of this radiator is so much greater, however, than the entrance c' of the heater that the heated products will spread out within the radiator and pass through the same in a slow or sluggish course and in a longitudinal direction through the radiator, and upon reaching the pipe h' will pass rapidly through the same, their motion being accelerated on account of the small sectional area of the pipe or passage in comparison with the radiator, and these products will then strike upon the top wall of the radiator l and spread within the same, flowing in a like sluggish course to the opposite end thereof, and then passing in like manner through the pipe l' into the radiator m and through the same to the smoke-pipe m'. It is thus evident that in these shallow broad pans forming the radiators the greater part of the heated products are practically brought into direct contact with the plates of the radiators, so that the heat contained therein can be radiated through the same to the air, and that on account of the necessarily slow or sluggish course of the heated products and the great radiating-surface of the radiators exposed to the air within the air-heating chamber the furnace affords a large surface for the radiation and absorption of the heat by the air passing through the same. It is also evident that the heated products as they pass rapidly through the connecting-pipes between the radiators, and striking against the roof of the one they enter, are spread out therein, and that any heated products which may not have been brought in contact with the plates of the lower radiator will be brought into contact therewith in one of the other radiators. At the same time the air as it enters the furnace passes first around the heater or stove c and by exposing the stove to the heat of the cool air prevents the too high heating of the same and brings the cold air into direct contact with the most highly-heated portion of the furnace. The air passes in its course through the flue f' into the lower chamber g and into contact with the under face of the radiator h,

and it then passes in a horizontal or zigzag sidewise course between the several radiators, the air passing upwardly through the passage g', thence through the horizontal passage n and vertical passage n' into the horizontal passage p, and thence through the vertical passage p' into the horizontal passage q, from which it passes to the air-pipes t in the roof e. It will be noticed that in this course the air passes at right angles to the course of the heated products through the radiators, and it is found that in such course much greater friction is created between the air and the surfaces of the radiators through which the heat is passing, the heat-waves from the radiators naturally flowing on the outer surfaces of the radiators in the direction of the heated products passing through the same, while the air is passing at right angles to the movement of these heat-waves, and these heat-waves retard the flow of the air, so creating greater friction between the air and the surface of the radiators; but the air is enabled to break up these heat-waves and so absorb the heat more readily. The action is practically the same with the heated products within the radiators, which are in like manner retarded in their flow by the current of air at right angles to the same, and this leads still further to the absorption of heat by the air, so that practically all the heat generated is absorbed through the walls of the shallow horizontal radiators, it being found that the temperature of the products of combustion escaping through the smoke-flues m' is practically the same as that of the air passing through the several air-heating pipes t.

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

1. The air-heating furnace having side and end walls, the partition-wall d, forming an air-entrance flue f between an end wall and said partition-wall, said flue communicating with the lower part of the air-heating chamber, and the heater c, located in said air-entrance flue f, substantially as and for the purposes set forth.

2. The air-heating furnace having side and end walls, the air-entrance flue f, said flue communicating with the lower part of the air-heating chamber g, the heater c, located in said air-entrance flue f, the checker-work wall k, having the area of the openings therein about equal to the area of the entrance-flue, and the horizontal pan or radiator connected to said heater c and extending over said chamber g to said checker-work wall k, substantially as and for the purposes set forth.

In testimony whereof I, the said JOHN YOUNG, have hereunto set my hand.

JOHN YOUNG.

Witnesses:
JAMES I. KAY,
J. N. COOKE.