No. 807,097. PATENTED DEC. 12, 1905.

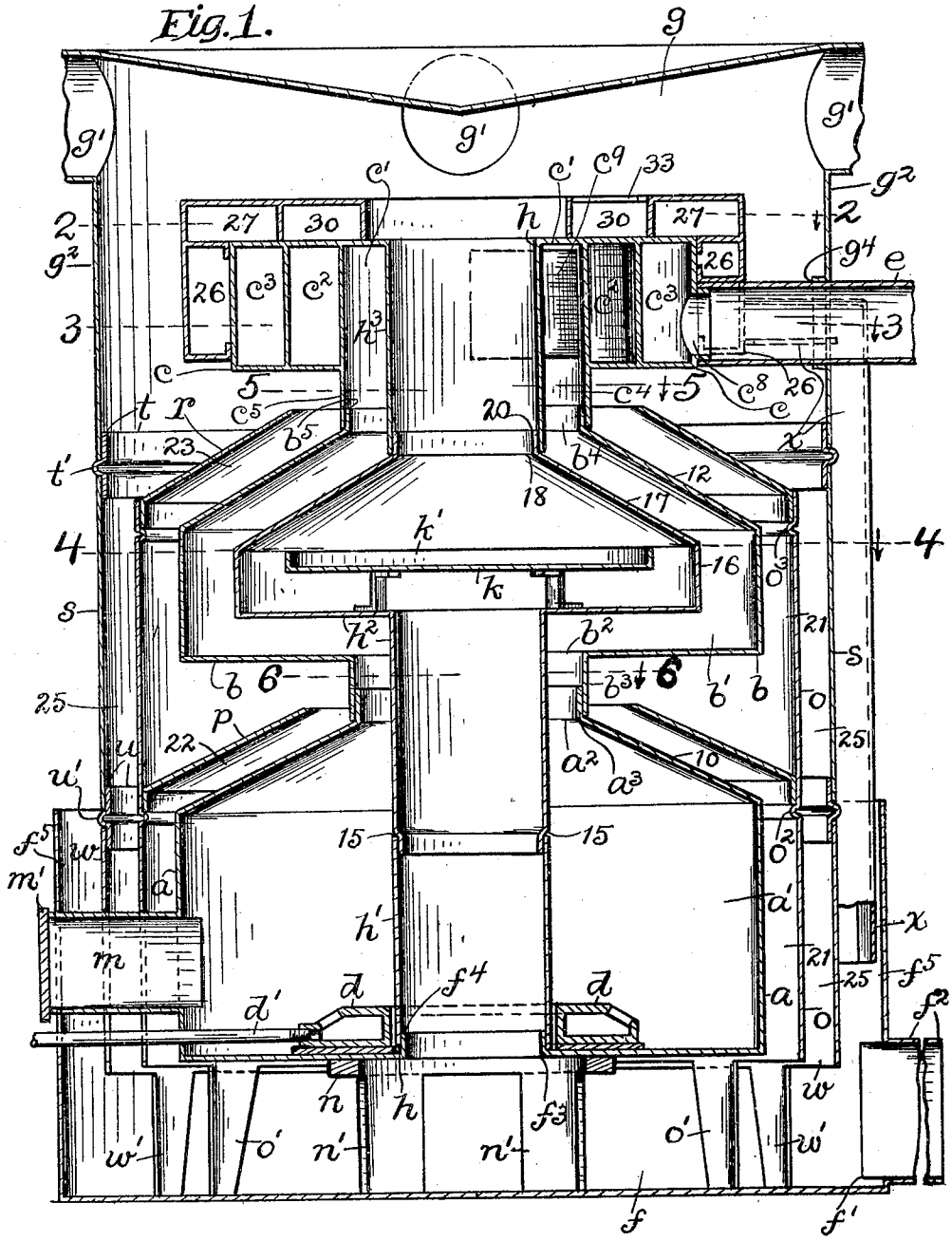
C. W. STRAN.

HOT AIR FURNACE.

APPLICATION FILED FEB. 23, 1904.

5 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Daniel E. Daly.

G. M. Hayes

INVENTOR

Charles W. Stran

BY

Munn & Wooster

his ATTORNEYS.

No. 807,097. PATENTED DEC. 12, 1905.

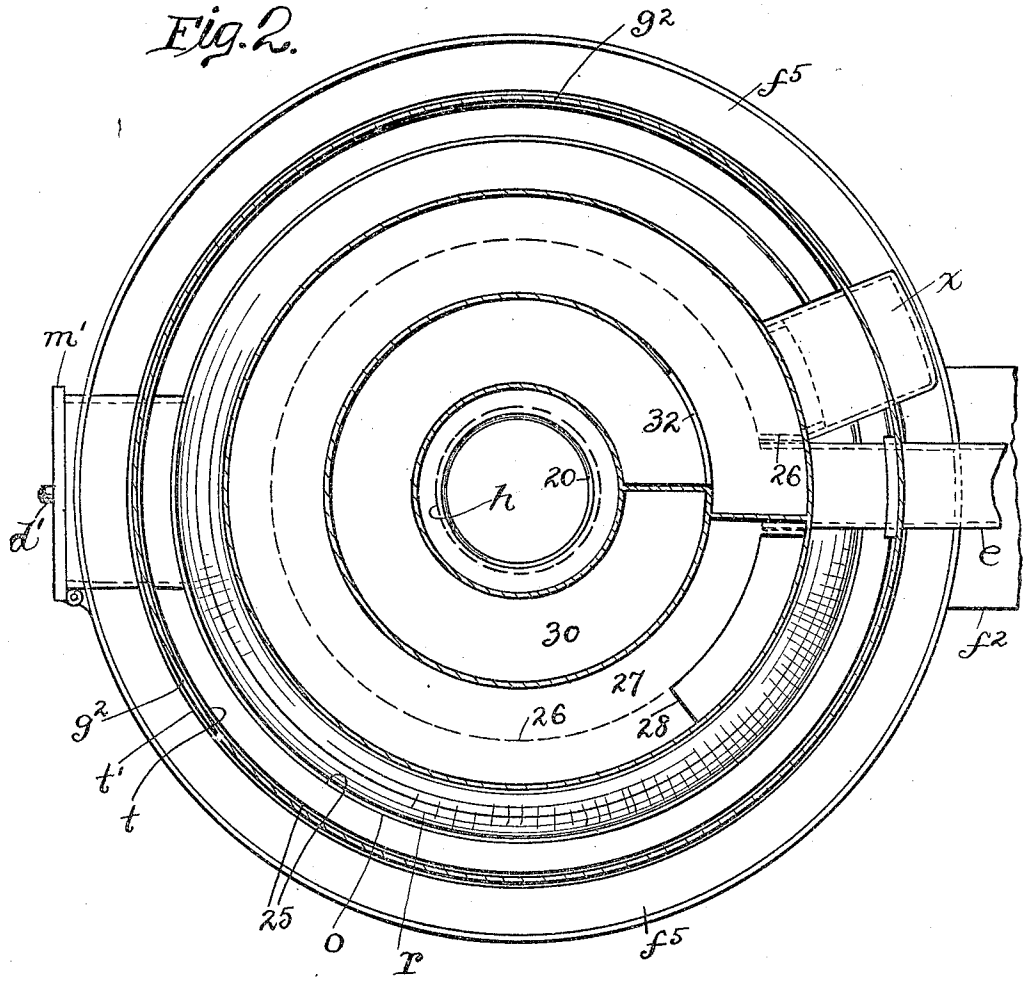
C. W. STRAN.

HOT AIR FURNACE.

APPLICATION FILED FEB. 23, 1904.

5 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

Daniel E. Daly.

G. M. Hayes.

INVENTOR

Charles W. Stran

BY

Synnestvedt & Wheeler

his ATTORNEYS.

No. 807,097. PATENTED DEC. 12, 1905.

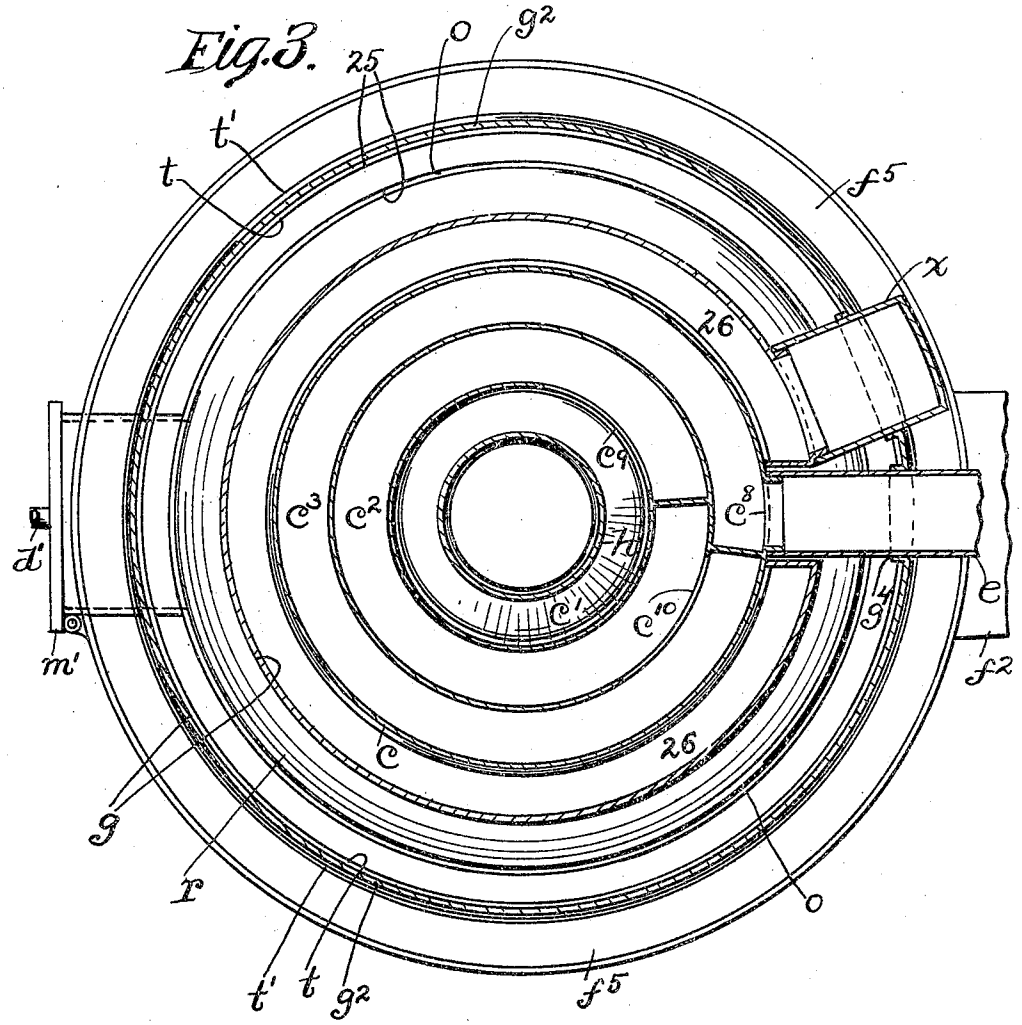
C. W. STRAN.

HOT AIR FURNACE.

APPLICATION FILED FEB. 23, 1904.

5 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

Daniel E. Daly.

G. M. Hayes

INVENTOR

Charles W. Stran

BY

Synnestvedt & Lechner

his ATTORNEYS.

No. 807,097. PATENTED DEC. 12, 1905.

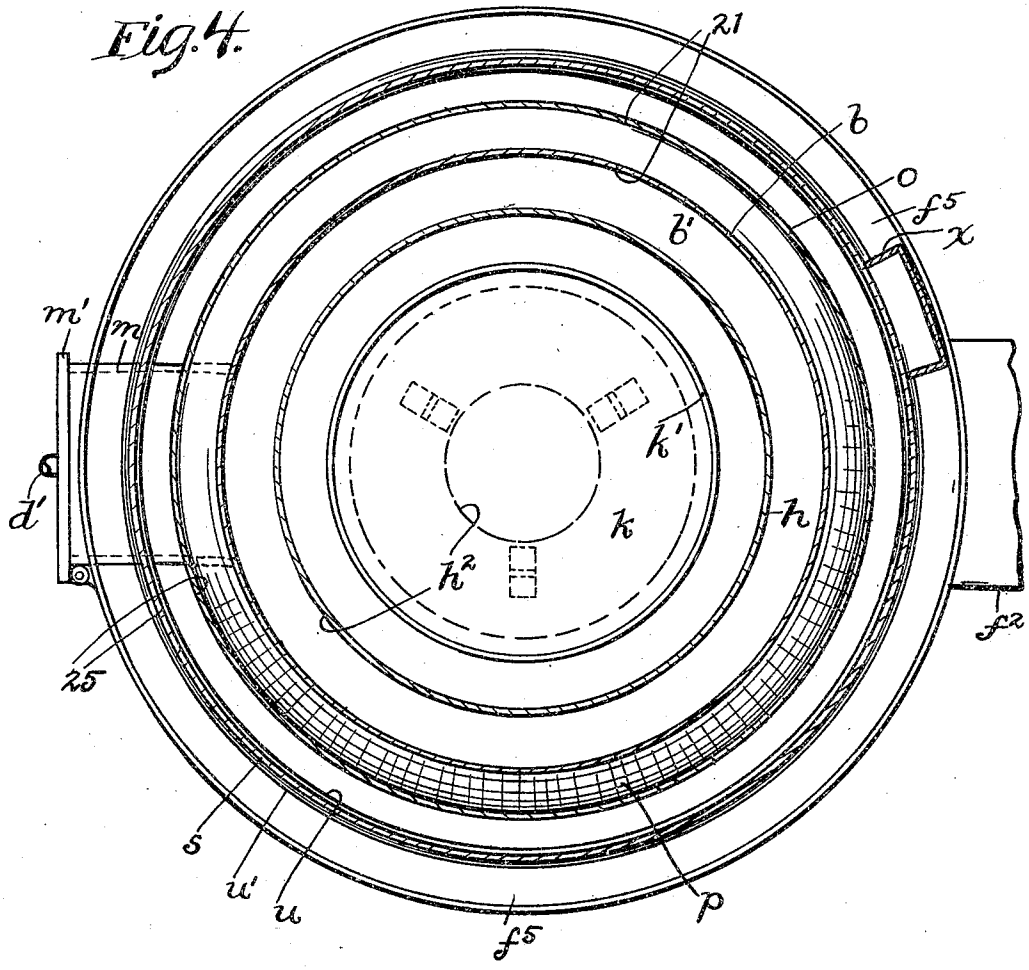
C. W. STRAN.

HOT AIR FURNACE.

APPLICATION FILED FEB. 23, 1904.

6 SHEETS—SHEET 4.

Fig. 4.



WITNESSES:
Daniel E. Daly.
G. M. Hayes

INVENTOR
Charles W. Stran
BY
Spencer Wren
his ATTORNEYS

No. 807,097. PATENTED DEC. 12, 1905.

C. W. STRAN.

HOT AIR FURNACE.

APPLICATION FILED FEB. 23, 1904.

5 SHEETS—SHEET 5.

Fig. 5.

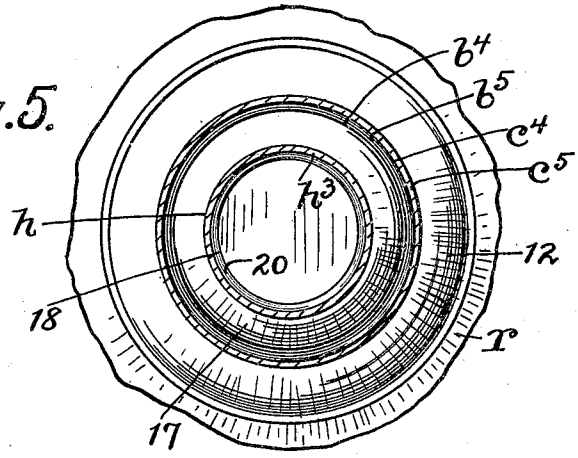
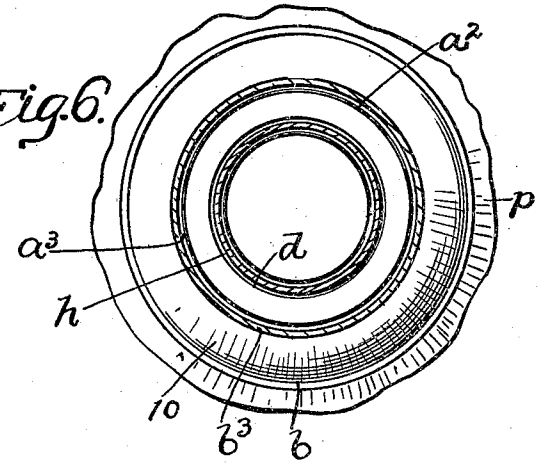


Fig. 6.



WITNESSES:

Daniel E. Daly.

G. M. Hayes

INVENTOR

Charles W. Stran

BY

Spencer & Serrell

his ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES W. STRAN, OF CLEVELAND, OHIO.

HOT-AIR FURNACE.

No. 807,097. Specification of Letters Patent. Patented Dec. 12, 1905.

Application filed February 23, 1904. Serial No. 194,802.

To all whom it may concern:

Be it known that I, CHARLES W. STRAN, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Hot-Air Furnaces; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in hot-air furnaces.

The primary object of this invention is to construct a hot-air furnace in which inflammable gas or fluid can be burned with great economy.

With this object in view my invention consists in a hot-air furnace comprising the following: A heater composed of a plurality of interiorly-chambered heating-drums arranged at different elevations, respectively, and in line vertically with the interior chamber of the upper of two adjacent drums in communication at the bottom and centrally with the interior chamber of the lower of the said drums; a hot-air chamber extending over the heater at the top of the furnace and provided with air-outlets; a cold-air chamber extending in under the heater at the bottom of the furnace and provided with an air inlet or inlets; means whereby the passage of air from the cold-air chamber below upwardly along and next exteriorly of the heater to the hot-air chamber above is effected, and means for effecting the passage of air from the cold-air chamber below to the hot-air chamber above, centrally of, and through the heater.

My invention comprises also and more especially meritorious features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation, in central vertical section, of a hot-air furnace embodying my invention. Portions are broken away in this figure to reduce the size of the drawings and to more clearly show the construction. Fig. 2 is a top plan in section on line 2 2, Fig. 1. Fig. 3 is a top plan in section on line 3 3, Fig. 1. Fig. 4 is a top plan in section on line 4 4, Fig. 1. Fig. 5 is a top plan in section on line 5 5, Fig. 1. Fig. 6 is a top plan in section on line 6 6, Fig. 1.

My improved furnace comprises a heater consisting of a plurality of heating-drums arranged at different elevations, respectively. The heater of the furnace illustrated comprises three hollow or interiorly-chambered metal heating-drums a, b, and c, which are circular in plan and arranged a suitable distance apart and in line vertically. The interior chamber of the upper of adjacent heating-drums is in communication at the bottom and centrally with the interior chamber of the lower of the said drums. The lowermost drum a has a conical upper portion 10, which is provided at its upper end and centrally, as shown in Figs. 1 and 6, with an upwardly and annularly flanged circular opening a^2, which forms the outlet from the interior chamber a' of the said drum for the products of combustion arising from a heating-burner d arranged within and resting upon the bottom of the said chamber. The interior chamber b' of the intermediate drum b is provided at the bottom and centrally with an inlet b^2 for receiving the products of combustion escaping upwardly from the outlet a^2 of the drum a, which inlet is formed by an opening formed in and centrally of the bottom of the said chamber and flanged downwardly and annularly, as at b^3, with the flange b^3 snugly embracing the upwardly-projecting flange a^3 extending around the outlet a^2 of and formed upon the drum a. The drums a and b correspond or approximately correspond in dimensions transversely and in general configuration. The drum b has therefore an upper conical portion 12, and the interior chamber b' of the said drum is provided at its upper end and centrally, as shown in Figs. 1 and 5, with an upwardly and angularly flanged circular opening b^4, which forms the outlet from the said chamber for the products of combustion passing into the said chamber from the drum a. The uppermost drum c is provided at the bottom and centrally with an inlet c^4, arranged to receive the products of combustion escaping upwardly from the outlet b^4 of the drum and forms the lower and open end of a chamber c', formed in and centrally of the drum c, which inlet is flanged downwardly and annularly, as at c^5, with the flange c^5 snugly embracing the upwardly-projecting flange b^5, formed and extending around the outlet b^4 of the drum b.

The drum c is provided at one side, as shown in Figs. 1 and 3, with an outlet c^8 for the products of combustion received within the said drum, which outlet is in communication with a flue e, extending from the said drum and adapted to communicate with a chimney. (Not

shown.) A passage-way c^2 is formed interiorly of the drum c and extends almost completely around the chamber c'. The passage-way c^2 communicates at one end with the chamber c' through an opening c^9, formed in the wall between the said chamber and the said passage-way, as shown very clearly in Figs. 1 and 3. The passage-way c^2 communicates at its other end with a passage-way c^3 at one end of the latter through an opening c^{10}, formed in the wall between the passage-ways c^2 and c^3, as shown in Fig. 3. The passage-way c^3 extends almost completely around the passage-way c^2 and communicates at its other end with the outlet c^8 of the drum c, and consequently with the flue e. It will be observed, therefore, that any products of combustion entering the uppermost heating-drum c at its inlet c^4 must pass through the inner chamber c' of the said drum and successively through the passage-ways c^2 and c^3 to the flue e.

A cold-air chamber f is arranged next below the lowermost heating-drum a and is provided at one side with an air-inlet f', formed by a flue f^2, communicating with the said chamber and in open relation with the external atmosphere.

Means for conducting air to be heated from the chamber f upwardly to a hot-air chamber g, formed externally of and surrounding and extending over the uppermost heating-drum c, is provided, and comprises, preferably, a vertically-arranged metal flue h, which is arranged centrally of the series of heating-drums and extends centrally through the outlet a^2 of the interior chamber of the lowermost heating-drum a, centrally through the inlet b^2 of the interior chamber of the central heating-drum b, centrally through the outlet b^4 of the last-mentioned chamber, and centrally through the central chamber c' of the uppermost heating-drum c, and communicates at its upper end with the chamber g, from which hot air is conducted to the place or places desired through air-outlets g', with which the said chamber is provided, as shown in Fig. 1. The air-flue h communicates at its lower end with the cold-air chamber f at the top of and centrally of the said chamber and is composed, preferably, of three circular sections h', h^2, and h^3, arranged at different elevations, respectively, and in line vertically. The lowermost flue-section h' snugly embraces at its lower end an upwardly-projecting flange f^4, formed upon the top wall of the air-chamber f around the air-outlet f^3, with which the said chamber is provided centrally of the said wall, as shown in Fig. 1. The flue-section h' at its upper end snugly embraces the diametrically reduced lower end of the central flue-section h^2, which at the downwardly-facing shoulder 15, formed upon and externally of the said central flue-section by the diametrical reduction of the lower end of the said central flue-section, rests upon the upper end of the lowermost flue-section h'. The central flue-section h^2 within and centrally of the interior chamber b' of the intermediate heating-drum b is enlarged diametrically, as at 16, so as to overhang the bottom of the said chamber a suitable distance above the said bottom and around the inlet b^2 of the said chamber. The said diametrically enlarged portion 16 of the central flue-section h^2 conforms in configuration but is smaller in dimensions than the drum-section b. The upper portion of the central flue-section h^2 is conical, therefore, as at 17, and provided at its upper end with an upwardly-flanged air-outlet 18 with the flange 20, which extends around the said air-outlet, snugly embraced by the lower end of the upper flue-section h^3, which at its upper end adjoins the top of the uppermost heating-drum c, as shown in Fig. 1. The diametrically enlarged portion 16 of the flue-section h^2 is provided interiorly with an air-distributer adapted to distribute or spread the air received within the said portion of the said flue-section over the bottom of and laterally within the said portion of the said flue-section, so as to prevent the said air from passing upwardly through the air-flue h in a straight path and too rapidly, and the said distributer is formed, preferably, by a circular plate k, arranged horizontally within the aforesaid diametrically larger portion 16 of the flue-section h^2 below the upper conical portion 17 of the said flue-section, which plate is supported in any approved manner and provided at its edge with an upwardly-projecting annular flange k', instrumental in causing the air passing upwardly at the said edge from in under the said plate to impinge against the inner surface of the aforesaid conical portion of the said flue-section.

The heating-burner d surrounds the lower end of the air-flue h, and a pipe d' for supplying inflammable gas or fluid to the said burner communicates with the burner. A lateral doorway m, which communicates with the interior chamber a' of the drum a, affords access to the burner d, which doorway is closed at its outer end by a suitably-applied door m'.

By the construction hereinbefore described it will be observed that the products of combustion arising from the burner d during the operation of the burner pass from within the drum a into the drum b and against the external surface of the bottom of the upper diametrically enlarged portion 16 of the flue-section h^3 and are spread or distributed by the said portion of the said flue-section over the bottom of the interior chamber b' of the said drum b. The conical portion 12 of the drum b causes the rising products of combustion to pass up over the conical portion 17 of the flue-section h^2, and thence the said products of combustion pass into and through the drum c. It will be observed also that during the upward passage of the products of combustion from the interior chamber a of the

lower heating-drum *a* the air within the central air-flue *h* becomes heated and rises and an upward current of air through the said flue between the cold-air chamber *f* below and the hot-air chamber *g* above is established. The upper diametrically enlarged portion 16 of the central section h^2 of the flue *h* materially enlarges the exposed surface area of the said flue and in conjunction with the air-spreading or air-distributing plate *k* within the said flue-section retards the upward passage of air through the said flue. It will be observed, therefore, that heat radiating inwardly into the flue *h* from the heating-drums *a* and *b* is economically utilized in heating the air passing upwardly through the said flue.

The drum *a* rests upon an annular table *n*, which, as shown in Fig. 1, is arranged centrally of and next below the said drum and has legs *n'* standing upon the bottom of the cold-air chamber *f*.

A vertically-arranged cylindrical open-ended metal shell *o* surrounds the lower heating-drum *a* and the lower portion of the intermediate drum *b* and is enough larger diametrically than the said drums to form an annular air-chamber 21 around the said drums, which chamber is in communication at its lower end with the cold-air chamber *f*. The open-ended cylinder *o* is provided at its lower end with legs *o'*, which stand upon the bottom of the cold-air chamber *f*. The cylinder *o* is provided adjacent the lower end of the upper conical portion 10 of the drum *a* with an annular rib or shoulder o^2, formed interiorly of and upon the said cylinder, as shown in Fig. 1. An annular conical deflector *p* rests upon the shoulder o^2 and surrounds the upper conical portion 10 of the drum *a* and is enough larger diametrically than the said conical portion of the said drum to form an annular air-space 22 between the said drum and the said deflector. The cylinder *o* is provided also and adjacent the lower end of the conical portion of the intermediate drum *b* with an annular rib or shoulder o^3, formed interiorly of and upon the said cylinder. An annular conical deflector *r* rests upon the shoulder o^3 and overhangs the conical portion 12 of the drum *b* and is enough larger diametrically than the said portion of the said drum to form an annular air-space 23 between the said drum and the said deflector, which space is in communication at the upper end of the said deflector with the hot-air chamber *g*. It will be observed, therefore, that during the operation of the furnace currents of air upwardly through the annular chamber 21 from the cold-air chamber *f* below to the hot-air chamber *g* above are established, that the lower deflector *p* deflects the air passing upwardly into the said chamber over the conical portion 10 of the lowermost heating-drum *a* and causes the said air to pass upwardly against the bottom of the intermediate heating-drum *b*, that the said air is spread or distributed laterally by and below the last-mentioned drum, whence the said air passes upwardly around the drum *b* and is deflected by the upper deflector *r* over the conical portion of the said drum *b* and guided by the said deflector *v*, to and in under the uppermost heating-drum *c*, by which the said air is spread or distributed laterally in under the said drum on its way through the hot-air chamber *g*. The ascent of the air heated within and passing upwardly through the chamber 21 is therefore materially retarded, as desired.

The hot-air chamber *g* is formed by a cylindrical shell g^2, which has a top, as shown, and forms the upper portion of the external casing of the furnace. The shell g^2 is provided above the uppermost heating-drum *c* with lateral apertures to form the air-outlets *g'* of the said chamber. The shell g^2 is also apertured laterally, as at g^4, to accommodate the location of the flue *e*. The shell g^2 rests upon a rib *t'*, formed externally of and upon a ring *t*, which at the said rib rests upon an annular casing-section *s*, which surrounds the upper portion of the cylinder *o*. The annular section *s* rests at its lower end upon a rib *u'*, formed externally of and upon a ring *u*, which in turn rests at its said rib upon an annular casing-section *w*, which surrounds the lower portion of the cylinder *o*, and has legs *w'* standing upon the bottom of the cold-air chamber *f*. The annular sections *s* and *w* and the rings *t* and *u* are enough larger diametrically than the cylinder *o* to form an annular air-chamber 25 next externally of the said cylinder, which chamber communicates at its lower end with the cold-air chamber *f* below and is in open relation at the top with the hot-air chamber *g* above. Obviously during the operation of the furnace currents of air upwardly through the air-chamber 25 are established, and the air becomes heated as it ascends through the said chamber. It will be observed that the shell g^2 and the annular sections *s* and *w* and rings *t* and *u* form the external casing of my improved furnace.

I would here remark that the sectional construction of the different portions of the furnace as hereinbefore described is important and valuable in the assemblage of the parts and for repairs.

The cold-air chamber *f* extends upwardly around the annular section *w*, as at f^5, and the said upwardly-extending portion of the said chamber communicates at its upper end with the atmosphere externally of the furnace. It will be observed, therefore, that cold air does not only pass into the cold-air chamber *f* at the air-inlet *f'*, but also directly into the upper annular portion f^5 of the said chamber. The direct communication of the upper annular portion f^5 of the chamber *f* with the atmosphere externally of the furnace is more

especially for the purpose of taking cold air directly from the room in which the furnace is located; but obviously the said portion of the said chamber can be covered, if desired.

To more effectually utilize the heat passing into the uppermost heating-drum *c*, an air passage-way 26 is formed next externally of and extends, as shown in Figs. 1 and 3, almost completely around the said drum, which air passage-way communicates at one end, as shown in Fig. 3, with the upper end of an air flue *x*, which extends upwardly from and communicates with the upper annular portion f^5 of the cold-air chamber *f*, as shown in Fig. 1. The air passage-way 26, as shown very clearly in Fig. 2, communicates at its opposite end with one end of an air-conducting passage-way 27 through an aperture or opening 28, formed in the wall between the passage-ways 26 and 27. The passage-way 27 is formed next above the outer portion of the heating-drum *c* and arranged concentrically with the inner air-flue *h* and communicates at its other end with an air-conducting passage-way 30 through an opening 32, formed in the wall between the passage-ways 27 and 30, as shown in Fig. 2. The passage-way 30 is formed next above the inner portion of the drum *c* and arranged concentrically with the central air-flue *h*, and the said inner air-conducting passage-way 30 has an air-outlet 33 formed in the top wall of the said passage-way and communicating with the hot-air chamber, as shown in Fig. 1. It will be observed, therefore, that any excess of heat in the uppermost heating-drum *c* is utilized to advantage in heating air conducted from the flue *x* to and around and over the said drum.

What I claim is—

1. A hot-air furnace comprising a heater consisting of a plurality of heating-drums arranged at different elevations respectively and in line vertically with their interior chambers in communication; a hot-air chamber exteriorly of and adjacent to the upper portion of the heater and having air-outlets; a cold-air chamber exteriorly of and adjacent to the lower portion of the heater and having an air-inlet communicating with the atmosphere externally of the furnace; means for conducting air from the cold-air chamber to the hot-air chamber centrally through the heating-drums, and means for conducting air upwardly along and externally of the drums from the cold-air chamber to the hot-air chamber.

2. A hot-air furnace comprising a heater consisting of a plurality of heating-drums arranged at different elevations respectively and in line vertically with their interior chambers in communication; a hot-air chamber extending over the heater; a cold-air chamber extending below the heater and in communication with the atmosphere externally of the furnace; means for conducting air from the cold-air chamber to the hot-air chamber centrally through the heating-drums, and means for conducting air upwardly along and externally of the drums from the cold-air chamber to the hot-air chamber.

3. A hot-air furnace comprising a heater consisting of a plurality of heating-drums arranged at different elevations respectively and in line vertically, with their interior chambers in communication; a hot-air chamber extending over the heater; a cold-air chamber extending below the heater and in communication with the atmosphere externally of the furnace; a flue arranged to conduct air from the cold-air chamber to the hot-air chamber through the heating-drums, and means for conducting air upwardly along and externally of the drums from the cold-air chamber to the hot-air chamber.

4. A hot-air furnace comprising a heater consisting of a plurality of heating-drums arranged at different elevations respectively, with their interior chambers in communication; a hot-air chamber exteriorly of and adjacent to the upper portion of the heater; a cold-air chamber extending below the heater and in communication with the atmosphere externally of the furnace; an upright air-flue extending through the heating-drums and communicating, at its lower end, with the cold-air chamber, which flue communicates, at its upper end, with the hot-air chamber.

5. A hot-air furnace comprising a heater; a hot-air chamber exteriorly of and adjacent to the upper portion of the heater; a cold-air chamber extending below the heater and communicating with the atmosphere exteriorly of the furnace; an upright flue extending through the heater and communicating, at its lower end, with the cold-air chamber, which flue communicates, at its upper end, with the hot-air chamber, and means for retarding the passage of air upwardly through the said flue.

6. A hot-air furnace comprising a heater; a hot-air chamber extending over the heater; a cold-air chamber extending below the heater and communicating with the atmosphere exteriorly of the furnace; an upright flue extending through the heater and communicating, at its lower end, with the cold-air chamber, which flue communicates, at its upper end, with the hot-air chamber; means for retarding the passage of air upwardly through the said flue; means whereby the passage of air exteriorly of the heater from the cold-air chamber to the hot-air chamber is effected, and means for retarding the last-mentioned passage of air.

7. A hot-air furnace comprising a heater consisting of a plurality of heating-drums arranged at different elevations respectively and in line vertically, with their interior chambers in communication; a hot-air chamber exteriorly of and adjacent to the upper portion of the heater; a cold-air chamber extending below the heater and communicating with the atmosphere exteriorly of the furnace; an up-

right inner flue extending through the heating-drums and communicating, at its lower end, with the cold-air chamber, which flue communicates, at its upper end, with the hot-air chamber; and means for conducting air upwardly along the exterior of the drums from the cold-air chamber and comprising an upright outer flue communicating, at its lower end, with the cold-air chamber; air-conducting passage-ways formed next exteriorly of the upper portion of the heater and establishing communication between the aforesaid outer flue and the hot-air chamber.

8. A hot-air furnace comprising a heater; a hot-air chamber exteriorly of and adjacent to the upper portion of the heater; a cold-air chamber extending below the heater and communicating with the atmosphere exteriorly of the furnace; an upright inner flue extending through the heater and communicating, at its lower end, with the cold-air chamber, which flue communicates, at its upper end, with the hot-air chamber; and means for conducting air upwardly along the exterior of the heater from the cold-air chamber to the hot-air chamber and comprising an upright outer flue communicating, at its lower end, with the cold-air chamber; an air-conducting passage-way formed next exteriorly of and extending around the upper portion of the heater and communicating, at one end, with the aforesaid outer flue, and another air-conducting passage-way formed next above the heater and communicating, at one end, with the first-mentioned passage-way and in communication, at its other end, with the hot-air chamber.

9. In a hot-air furnace, an interiorly-chambered heating-drum having a conical upper portion and provided with an outlet; means for conducting products of combustion from the said outlet; a hot-air chamber above; a cold-air chamber below; an upright flue extending through the interior chamber of the drum, which flue communicates, at its lower end, with the cold-air chamber and is in communication, at its upper end, with the hot-air chamber; an open-ended cylinder surrounding the drum and enough larger diametrically than the drum to form an annular chamber interiorly of the cylinder and exteriorly of the drum, and an annular deflector supported from the cylinder and overhanging the conical portion of the drum and enough larger diametrically than the said conical portion to form a space around the said conical portion, which space is in communication below with the cold-air chamber and communicates above with the hot-air chamber.

10. In a hot-air furnace, an interiorly-chambered heating-drum having a conical upper portion and provided with an outlet at the upper end and centrally of the said conical portion; means for conducting products of combustion from the said outlet; a hot-air chamber above; a cold-air chamber below; an upright flue arranged centrally of the drum and extending through the aforesaid outlet, which flue communicates, at its lower end, with the cold-air chamber and is in communication, at its upper end, with the hot-air chamber; an open-ended cylinder surrounding the drum and enough larger diametrically than the drum to form an annular space interiorly of the cylinder and exteriorly of the drum; and a conical deflector supported from the cylinder and overhanging the conical portion of the drum and enough larger diametrically than the said conical portion to form a space around the said conical portion, which space is in communication below with the cold-air chamber and communicates above with the hot-air chamber.

11. In a hot-air furnace, an interiorly-chambered heating-drum having a conical upper portion and provided with an outlet; means for conducting products of combustion from the said outlet; a hot-air chamber above; a cold-air chamber below; an upright flue extending through the interior chamber of the heating-drum, which flue communicates, at its lower end, with the cold-air chamber and is in communication, at its upper end, with the hot-air chamber; an open-ended cylinder surrounding the drum and enough larger diametrically than the drum to form an annular space interiorly of the cylinder and exteriorly of the drum, which cylinder is provided with legs standing upon the bottom of the cold-air chamber, and a conical deflector supported from the cylinder and overhanging the conical portion of the drum and enough larger diametrically than the said conical portion to form a space around the said conical portion, which space is in communication below with the cold-air chamber and communicates above with the hot-air chamber.

12. In a hot-air furnace, an interiorly-chambered heating-drum having a conical upper portion and provided with an outlet; means for conducting products of combustion from the said outlet; a hot-air chamber above; a cold-air chamber below; an upright flue interiorly of the drum, which flue communicates, at its lower end, with the cold-air chamber and is in communication, at its upper end, with the hot-air chamber; an open-ended cylinder surrounding the drum and enough larger diametrically than the drum to form an annular chamber interiorly of the cylinder and exteriorly of the drum; an annular deflector supported from the cylinder and overhanging the conical portion of the drum and enough larger diametrically than the said conical portion to form a space around the said conical portion, which space is in communication below with the cold-air chamber and communicates above with the hot-air chamber, and an annular chamber formed externally of the aforesaid cylinder and communicating, at its lower end,

with the cold-air chamber and, at its upper end, with the hot-air chamber.

13. A hot-air furnace comprising a heater having two interiorly-chambered heating-drums arranged one above the other, with the upper portion of each drum conical, and with the interior chamber of the higher drum communicating, at the bottom, with the interior chamber of the lower drum; means for conducting products of combustion from the interior chamber of the higher drum; a hot-air chamber adjacent the upper portion of the heater and having an outlet; a cold-air chamber at the bottom of the heater and in communication with the atmosphere externally of the furnace; an upright flue extending through the drums, which flue communicates, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber, and means whereby air is conducted from the cold-air chamber upwardly around the drums and over the conical portions of the drums to the hot-air chamber.

14. A hot-air furnace comprising a heater having two interiorly-chambered heating-drums arranged one above the other, with the upper portion of each drum conical, and with the interior chamber of the higher drum communicating, at the bottom, with the interior chamber of the lower drum; means for conducting products of combustion from the interior chamber of the higher drum; a hot-air chamber adjacent the upper portion of the heater and having an outlet; a cold-air chamber at the bottom of the heater and in communication with the atmosphere externally of the furnace; an upright flue extending through the drums and provided, within the interior chamber of the higher drum, with a diametrical enlargement overhanging the bottom of the said chamber, which flue communicates, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber, and means whereby air is conducted from the cold-air chamber upwardly around the drums and over the conical portions of the drums to the hot-air chamber.

15. A hot-air furnace comprising a heater having two interiorly-chambered heating-drums arranged one above the other, with the upper portion of each drum conical, and with the interior chamber of the higher drum communicating, at the bottom, with the interior chamber of the lower drum; means for conducting products of combustion from the interior chamber of the higher drum; a hot-air chamber adjacent the upper portion of the heater and having an outlet; a cold-air chamber at the bottom of the heater and in communication with the atmosphere externally of the furnace; an upright flue extending through the drums and provided, within the interior chamber of the higher drum, with a diametrical enlargement overhanging the bottom of the said chamber, which flue communicates, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber, and means within the aforesaid diametrically-enlarged portion of the flue for spreading and distributing the air received within the said portion over the bottom of the interior space of the said portion.

16. A hot-air furnace comprising a heater having two interiorly-chambered heating-drums arranged one above the other, with the upper portion of each drum conical, and with the interior chamber of the higher drum communicating, at the bottom, with the interior chamber of the lower drum; means for conducting products of combustion from the interior chamber of the higher drum; a hot-air chamber adjacent the upper portion of the heater and having an outlet; a cold-air chamber at the bottom of the heater and in communication with the atmosphere externally of the furnace; an upright flue extending through the drums and provided, within the interior chamber of the higher drum, with a diametrical enlargement overhanging the bottom of the said chamber, which flue communicates, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber, and a horizontally-arranged plate within the said diametrically-enlarged portion of the flue, which plate overhangs the bottom of the space within the said enlarged portion of the flue and is provided with an upwardly-projecting flange extending along the edge of the plate.

17. A hot-air furnace comprising a heater having two interiorly-chambered heating-drums arranged one above the other, with the upper portion of each drum conical, and with the interior chamber of the higher drum communicating, at the bottom and centrally, with the interior chamber of the lower drum at the upper end and centrally of the conical portion of the lower drum; a hot-air chamber adjacent the upper portion of the heater and having air-outlets; a cold-air chamber at the bottom of the heater and in communication with the atmosphere externally of the furnace; an upright flue arranged centrally of the drum and provided, within the interior chamber of the higher drum, with a diametrical enlargement having a conical upper portion and overhanging the bottom of the interior chamber of the said drum, which flue communicates, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber, and means within the aforesaid diametrically-enlarged portion of the flue for spreading and distributing the air received within the said portion over the bottom of the interior space of the said portion, and means whereby air is conducted from the cold-air chamber upwardly around the drums and over the conical portions of the drums to the hot-air chamber.

18. A hot-air furnace comprising a heater consisting of three interiorly-chambered drums arranged at different elevations respec-

tively and in line vertically, with the interior chambers of adjacent drums in communication with each other; means for conducting products of combustion from the heater; a hot-air chamber extending around and over the uppermost drum and having air-outlets; a cold-air chamber extending in under the lowermost drum and upwardly around the lower portion of the heater and communicating, at the upper end of its upwardly-extending portion, with the atmosphere externally of the furnace; a flue extending through the drums and communicating, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber; means for retarding the passage of air upwardly through the said flue, and means whereby air is conducted from the cold-air chamber upwardly externally of the heater to the hot-air chamber.

19. A hot-air furnace comprising a heater consisting of three interiorly-chambered drums arranged at different elevations respectively and in line vertically, with the interior chamber of adjacent drums in communication with each other centrally of the respective drums; means for conducting products of combustion from the heater; a hot-air chamber extending around and over the uppermost drum and having air-outlets; a cold-air chamber extending in under the lowermost drum; and having an air-inlet communicating with the atmosphere externally of the furnace; a flue extending through the drums and communicating, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber; means for retarding the passage of air upwardly through the said flue; means whereby air is conducted from the cold-air chamber upwardly externally of the heater to the hot-air chamber, and a deflector for deflecting the last-mentioned air, during its ascent, inwardly against the heater.

20. A hot-air furnace comprising a heater consisting of three interiorly-chambered drums arranged at different elevations respectively and in line vertically, with the upper portions of the intermediate and lowermost drums conical and with the interior chambers of adjacent drums in communication with each other; means for conducting products of combustion from the heaters; a hot-air chamber externally of the upper portion of the heater and having an outlet; a cold-air chamber extending in under the heater and provided with an air-inlet communicating with the atmosphere externally of the furnace; means for conducting air from the cold-air chamber upwardly through the heating-drums to the hot-air chamber; an open-ended cylinder surrounding the intermediate and lowermost drums and enough larger diametrically than the said drums to form an annular chamber interiorly of the cylinder and exteriorly of the said drums, and annular deflectors supported from the said cylinder and overhanging the conical portions of the intermediate and lowermost drums and enough larger diametrically than the said conical portions to form air-spaces around the said conical portions, which air-spaces are in communication with the cold-air chamber below and with the hot-air chamber above.

21. A hot-air furnace comprising a heater consisting of three interiorly-chambered drums arranged at different elevations respectively and in line vertically, with the upper portions of the intermediate and lowermost drums conical and with the interior chambers of adjacent drums in communication with each other; means for conducting products of combustion from the heater; a hot-air chamber externally of the upper portion of the heater and having an outlet; a cold-air chamber extending in under the heater and provided with an air-inlet communicating with the atmosphere externally of the furnace; means for conducting air from the cold-air chamber upwardly through the heating-drums to the hot-air chamber; an open-ended cylinder surrounding the intermediate and lowermost drums and enough larger diametrically than the said drums to form an annular chamber interiorly of the cylinder and exteriorly of the said drums, which cylinder is provided with legs standing upon the bottom of the cold-air chamber; annular deflectors supported from the said cylinder and overhanging the conical portions of the intermediate and lowermost drums and enough larger diametrically than the said conical portions to form air-spaces around the said conical portions, which air-spaces are in communication with the cold-air chamber below and with the hot-air chamber above; an annular chamber formed next exteriorly of the aforesaid cylinder-section by a casing having legs standing on the bottom of the cold-air chamber, and the last-mentioned chamber communicating, at its lower end, with the cold-air chamber and, at its upper end, with the hot-air chamber.

In testimony whereof I sign the foregoing specification, in the presence of two witnesses, this 4th day of February, 1904, at Cleveland, Ohio.

CHARLES W. STRAN.

Witnesses:
C. H. DORER,
G. M. HAYES.