2 Sheets—Sheet 1.

J. M. THATCHER.

Hot-Air Furnace.

No. 71,244. Patented Nov. 19, 1867.

FIG. 1

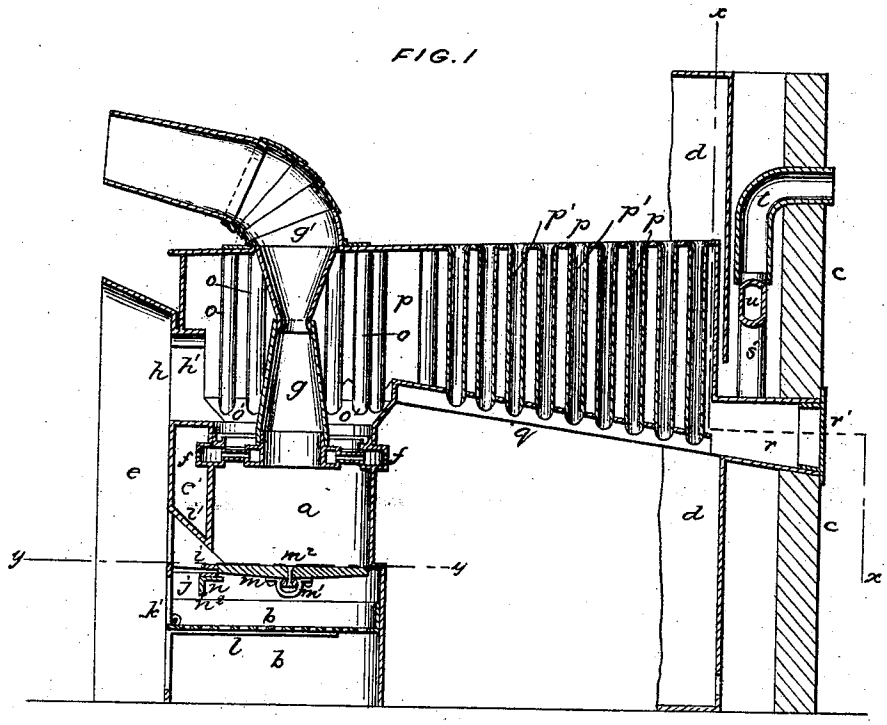


FIG. 2

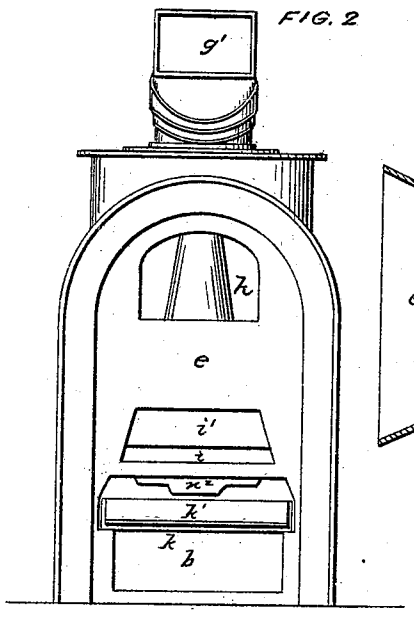


FIG. 3

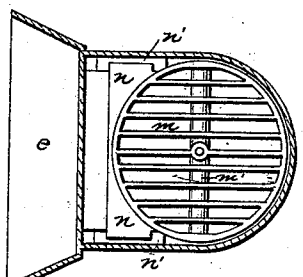
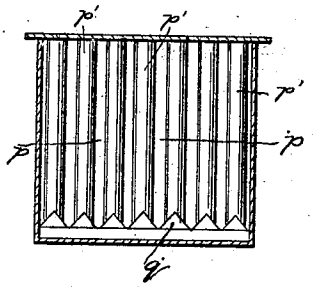


FIG. 4



FIG. 5



WITNESSES:

L. C. Hudwalker

John F. Barnett

INVENTOR:

John M. Thatcher

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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J. M. THATCHER.

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FIG. 6

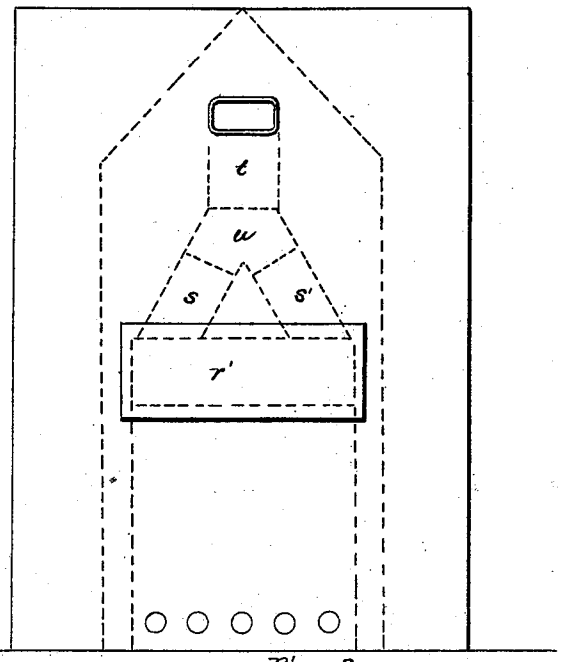


FIG. 7

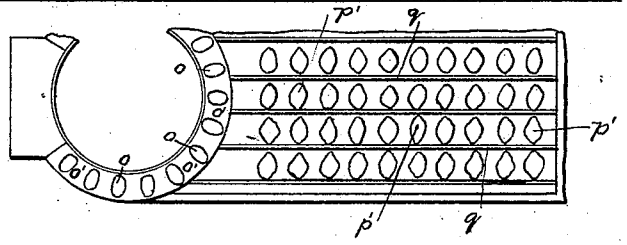
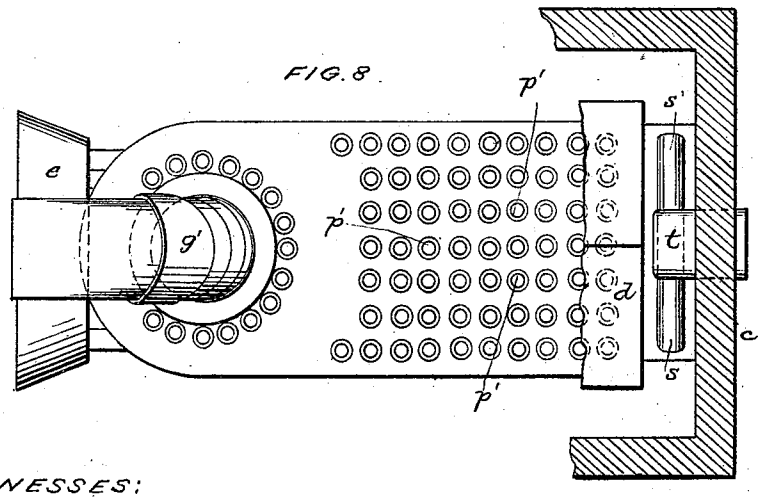


FIG. 8



WITNESSES:

F. C. Sundrick Jr.

John F. Barnett

INVENTOR:

John M. Thatcher

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN M. THATCHER, OF BERGEN, NEW JERSEY.

IMPROVEMENT IN AIR-HEATING FURNACES.

Specification forming part of Letters Patent No. **71,244**, dated November 19, 1867.

To all whom it may concern:

Be it known that I, JOHN M. THATCHER, of Bergen, Hudson county, New Jersey, have invented certain new and useful Improvements in Air-Heating Furnaces; and do hereby declare that the following is a full and correct description thereof, reference being had to the annexed drawings, making a part of this specification, and to the letters of reference thereon.

Figure 1 represents a longitudinal section of a furnace with my improvements; Fig. 2, a front elevation; Fig. 3, a horizontal cross-section through red line *y y*, Fig. 1; Fig. 4, section of sliding plate bearer for grate; Fig. 5, cross-section through red lines *x x*, Fig. 1; Fig. 6, rear elevation of furnace, showing draft-flues and inner wall in dotted lines; Fig. 7, a broken plan view of the corrugated bottom plate of the flue-passage, with air-tubes, looking up from below; Fig. 8, plan view of the furnace with walls and covering broken away.

My said invention consists of several improvements in hot-air furnaces designed to be set in brick-work, or inclosed in any suitable manner; and consists, first, in combining with the fire-pot a central feeding-funnel, contracted at a point a short distance above the place of discharge, and enlarging again above the point of greatest contraction, being in the form of two hollow frustums of cones united together by their smallest ends. The contraction of the upper part prevents the coals from feeding down too fast, and pressing upon the coals in that part of the feeder below, and the enlargement of the lower end permits a free discharge, which is of great advantage in the feeding of soft coals, which are liable to swell and clog the feeder by reason of the heat of the fire.

My invention also consists in the combination and arrangement of a passage-way from and through the furnace front to and into the fire-pot at the bottom thereof, the passage-way being of sufficient width and height to admit of the introduction of a slicer or poker for the purpose of slicing the fire and removing the clinker from the grate-bars forward, the bottom of the passage-way being on a line with the top surface of the grate-bars, and the top and sides of the passage-way being formed by an inclosing-plate extending from the fire-pot to the furnace front, and joining at the sides the ash-pit box, so as to prevent any communication between said passage-way leading from the furnace front into the fire-pot and the hot-air chamber surrounding the fire-pot; and this part of my invention further consists in combining, with said inclosed passage from the furnace front to the fire-pot a downward opening between the furnace front and fire-pot leading from said inclosed passage to the ash-pit, whereby clinkers and other matter removed from the fire-pot may fall into the ash-pit; and this part of my invention also consists in combining, with the ash-pit, a sifting-drawer, having perforations in the bottom when such drawer extends in front of the grate and under the downward passage from the clinker-opening.

My invention also consists in a combination of a sliding dead-plate and grate-bearer with the grate, ash-pit, and the downward passage leading to the ash-pit, said sliding dead-plate extending across the ash-pit, and having its edge next to the grate curved correspondingly to the curve of the grate, so as to support the grate as a bearer, permitting the grate to be oscillated horizontally, for the purpose of shaking out the ashes, and, when moved on its slides away from the grate, permitting the grate to be tipped to discharge its contents into the ash-pit.

My invention also consists in the combination of the corrugated bottom plate of the flue-passage from the fire-pot to the chimney with the air-heating tubes which pass through said passage, which tubes are arranged in rows and joined to the corrugated plate upon the ridges or V-parts of said plate, which project up into the flue-passage, whereby the ashes or other solid matter coming from the fire-pot is prevented from accumulating between the tubes of each row and forced to accumulate in the grooves or depressed portion of the corrugated bottom plate between the several rows of tubes, thus affording facility for cleaning the bottom plate by means of a V-scraper introduced from the rear of the furnace, and at the same time, by keeping a large portion of the corrugated bottom plate free from dust and ashes, largely increasing the air-heating surface of the furnace; and this part of my invention further

consists in combining with the said flue-passage, containing the vertical air-heating tubes, a passage-way of the width of said flue-passage, leading therefrom to and through the rear wall of the furnace, whereby access is obtained from without the walls of the furnace to the flue-passage, for the purpose of cleaning the bottom plate of the same. A door or stopper is provided to close this manhole or cleaning-out passage when the furnace is in operation.

My invention further consists in increasing the depth of the flue-passage containing the vertical air-heating tubes and the length of said tubes relatively to each other in proportion to their distance from the fire-pot, so that a larger air-heating surface is obtained to compensate for the diminished heat acting upon the tubes at a distance from the fire-pot.

My invention also consists in connecting the flue-passage containing the vertical air-heating tube with a main flue or pipe leading to the chimney, by means of two flues or pipes, which form a fork-connection with said main flue, and are connected to the flue-passage containing the vertical air-heating tubes, on opposite sides of said flue, near the bottom thereof, thereby compelling the products of combustion from the furnace to circulate at the sides as well as through the middle of the flue-passage containing the vertical air-heating tubes.

The drawings illustrate a furnace for brick-work in which my inventions are embodied. The fire-pot *a* is a cylindrical casting such as commonly used for that purpose, and sits upon a box, also of cast-iron, which incloses the ash-pit *b*. The surrounding outer wall *c* and inner wall *d* are shown (broken off) in the drawings. The fire-pot is placed at sufficient distance from the furnace front *e* to allow the hot-air chamber inclosed in the inner surrounding walls to extend around the fire-pot, between it and the furnace front. An annular box, *f*, is placed upon the upper part of the fire-pot, extending around the same, and is provided with perforations to admit air from the hot-air chamber into it, and is also connected by hollow arms to an interior smaller annular box, which is suspended by said arms in the upper part of the fire-pot, in the middle of the same, said interior annular box being also perforated with holes to permit air supplied to it from the outer annular box to pass into the fire-pot and mingle with the products of combustion. The center feeding-funnel *g* rests upon this interior annular box, and is contracted a short distance above the place of discharge, enlarging above the point of greatest contraction, being of the form of two hollow frustums of cones joined together at their smallest ends, the lower flaring part being just over the fire, and the upper part flaring upward until it joins a conduit, *g'*, which may be bent so as to open through the front wall of the furnace, and which supplies the fuel to the feeding-funnel *g'*, directly over the fire.

It is not essential to this part of my invention that the feeding-funnel shall be supported by the hollow annular air-heating boxes which supply air to the products of combustion in the fire-pot, although I consider it a form of construction which is most desirable. If, however, the air-heating annular boxes are dispensed with, the feeding-funnel may be supported from the top of the furnace by its connection with the conduit *g'*, or by radial arms from the sides of the fire-pot, or in any other suitable manner.

A feeding-door, *h*, connected by jams *h'* to the furnace front and furnace, opens into the upper part of the furnace above the fire-pot, as usual in furnaces. At the bottom of the fire-pot, in the front part thereof, is a clinker-cleaning aperture, *i*, which extends forward to and through the furnace front, the passage-way being inclosed by the plate *i'*, so that it shall not have any communication with the surrounding hot-air chamber *e'*. A stopper may be used to close this clinker-cleaning passage, or that part of it which leads into the fire-pot, if desired, or it may be left open to supply air to the fuel in the fire-pot. The aperture should be of sufficient width and height to permit the introduction and use of a slicer, or a poker, or other suitable instrument for the purpose of slicing the fire, cleaning the grate-bars from clinker, and removing the clinker which may be drawn out through this passage into the room in front of the furnace front, if desired, when the downward passage *j* is not used, in which case there should be a plate across the space between the fire-pot and furnace front, on a level with the top surface of the grate-bar. The downward passage *j* between the furnace front and grate is an opening leading from the clinker-cleaning passage down to the ash-pit, for the purpose of allowing the clinker and ashes to fall from the clinker-cleaner opening into the ash-pit. Below the grate-bars, and extending across the ash-pit forward of them under the clinker-cleaner opening, is an ash-sifting drawer, *k*, provided with a hinged front, *k'*, and having a perforated bottom. This drawer slides in and out of the ash-pit, through the furnace front, on suitable slides *l* at the sides of the ash-pit. The grate *m*, which is of circular form, is supported upon a rocking bearer, m^1, and connected therewith by a center pivot, m^2, so as to have an oscillating motion in two directions—one horizontal, for shaking out the ashes, and the other vertical, to discharge the contents of the fire-pot by tipping the front part of the grate downward, the grate being prevented from tipping upward by reason of the rim extending beyond the line of the front part of the fire-pot. The grate is supported in front by the sliding bearer *n*, which extends across the ash-pit and slides in suitable slides n^1 n^1 on each side thereof. The sliding bearer

n is curved at that part on which the grate rests, to conform to the curve of the rim of the grate, as clearly shown in the drawings. On the under side of the sliding plate, in front thereof, is a lip, n^2, for convenience in taking hold of the plate to draw it forward when it is desired to remove it in order to tip the grate. Above the fire-pot is a series of air-heating tubes, o, disposed in a circular form, which pass through and are supported by an inclined circular plate, o', which joins the top of the fire-pot. The products of combustion pass from the fire-pot into the upper part of the furnace, and from thence into a horizontal flue-passage, p, which contains a series of rows of vertical air-heating tubes, p' p', which, passing through said flue-passage and the upper and lower plates thereof, are secured at their ends in said upper and lower plates. The lower plate q of said horizontal flue-passage is corrugated, the corrugations q being of a V form, and there being a corrugation for every row of air-heating tubes, the air-heating tubes being placed upon the ridges, or that part of the corrugation which projects upward into the flue-passage, so that the ashes or the solid matter coming from the fire-pot cannot remain upon the corrugated part between the tubes constituting a row, but is compelled, by the inclined sides of the corrugations, to fall into the depressed portion of the corrugated surface of the bottom plate, which comes between the rows of tubes, whence it can readily be removed through the rear man-hole by means of a V-scraper. At the rear of the horizontal flue-passage p is a cleaning-out passage-way or man-hole, r, which passes through the two surrounding rear walls and connects with the flue-passage at the bottom thereof. This passage-way is of the width of the flue-passage p, and of sufficient height to introduce a V-scraper or other proper instrument for the purpose of scraping out the ashes from the depressed portions of the corrugated bottom plate.

The man-hole is closed, when not used for cleaning out the flue-passage, by a door or stopper, r', from the outside of the rear wall. The use of this man-hole obviates the necessity of taking down portions of the surrounding walls, and taking apart the plates which form the flue-passage p, to clean out the same. The flue-passage increases in depth as it recedes from the fire-pot, and the air-heating tubes correspondingly increase in length, for the purpose of giving a greater air-heating surface to the tubes farthest from the fire than those tubes nearer to the fire. The flue-passage p being of considerable width, the products of combustion would tend to pass through the middle thereof, rather than to be distributed equally throughout the interior, so as to act upon the air-heating tubes at or near the sides of the flue-passage, the same as upon those in the middle. Therefore, I have connected said flue-passage with the pipe leading to the chimney by means of two flue-passages, s s', which connect with the flue-passage p by means of the man-hole passage r near the sides of the said passage, and, rising in an inclined direction, unite to the pipe t, leading to the chimney, by a forked connection, u, or in any suitable manner. The two flues s s' should each be of half the capacity of the required flue-passage from the flue-passage p to the chimney, so that the products of combustion coming from the fire-pot shall be drawn toward the sides of the flue-passage p as they pass through the same, in order to distribute the heat equably upon the vertical air-heating tubes.

What I claim as my invention and improvement in hot-air furnaces is as follows:

1. In combination with the fire-pot a central feeding-funnel, in the form of two hollow frustums of cones, united together at their smallest ends, substantially as described.

2. The clinker-cleaning passage from and through the furnace-front to and into the fire-pot, inclosed by the plate connected with the fire-pot, furnace-front, and ash-pit, so as to prevent communication with the hot-air chamber surrounding the fire-pot, substantially as described.

3. In combination with the clinker-cleaning passage, the downward passage leading therefrom to the ash-pit, substantially as described.

4. In combination with the ash-pit, grate, and downward passage leading from the clinker-cleaning passage-way, the sifting-drawer, having a perforated bottom extending forward of the grate-bars and across underneath said downward passage, substantially as described.

5. The sliding dead plate or front bearer to the grate, in combination with the grate and downward passage, substantially as described.

6. The combination of the corrugated bottom plate of the flue-passage from the fire-pot to the chimney with the air-heating tubes, which pass through said passage, which tubes are arranged in rows and joined to the corrugated plate upon the ridges or V parts of said plate, which project up into the flue-passage, whereby the ashes or other solid matter coming from the fire-pot is prevented from accumulating between the tubes of each row, and forced to accumulate in the grooves or depressed portion of the corrugated bottom plate between the several rows of tubes, thus affording facility for cleaning the bottom plate and increasing the heating-surface, substantially as described.

7. In combination with the flue-passage p and vertical air-heating tubes, the cleaning-passage leading from the rear of said flue-passage, of the full width thereof, to and through the rear wall surrounding the furnace, substantially as and for the purposes described.

8. The combination of the flue-passage in-

creasing in depth with air-heating tubes increasing in length in proportion to their distance from the fire-pot, whereby greater tubular air-heating surface is obtained to compensate for diminished heat, substantially as described.

9. In combination with the flue-passage and vertical air-heating tubes the two connecting-flues, which connect said flue-passage with the main flue leading from the chimney, said two flues connecting with the flue-passage on opposite sides and near the bottom thereof, substantially as described.

JOHN M. THATCHER.

Witnesses:
F. C. TREADWELL, Jr.,
JOHN J. BARNETT.

2