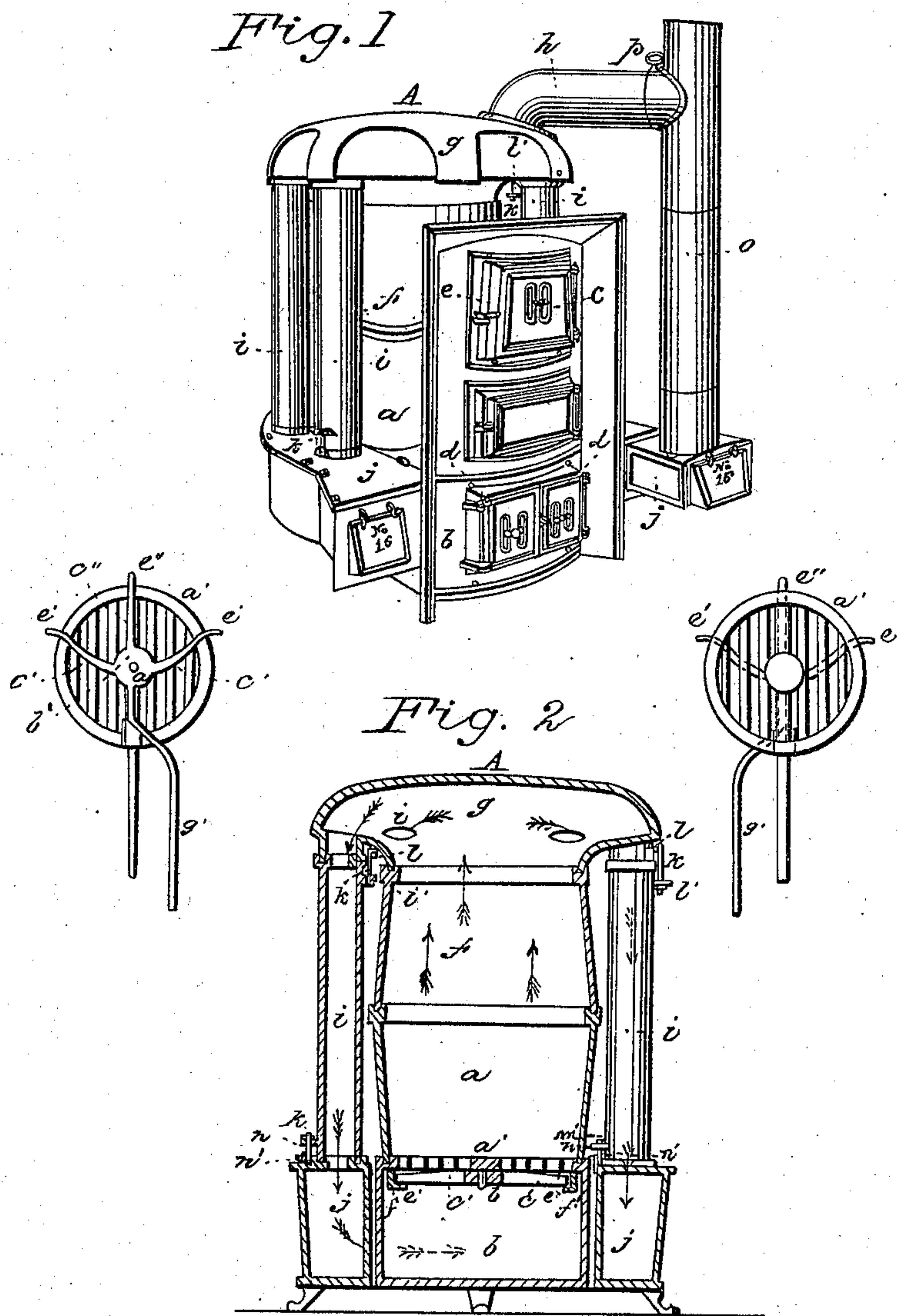


E. D. NORCROSS.

Hot-Air Furnace.

No. 99,585.

Patented Feb. 8, 1870.



Witnesses

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# United States Patent Office.

EDMUND D. NORCROSS, OF AUGUSTA, MAINE.

*Letters Patent No. 99,585, dated February 8, 1870.*

## HOT-AIR FURNACE.

The Schedule referred to in these Letters Patent and making part of the same.

*To all to whom these presents shall come:*

Be it known that I, EDMUND D. NORCROSS, of Augusta, in the county of Kennebec, and State of Maine, have made an invention of certain new and useful Improvements in Air-Heating Furnaces; and do hereby declare the following to be a full, clear, and exact description thereof, due reference being had to the accompanying drawings, making part of this specification, and in which—

Figure 1 is a perspective representation, and

Figure 2, a vertical section of an air-heating apparatus, embodying the features which comprise my invention.

In originating the invention herein described, and which constitutes the subject-matter of this patent, I have consulted economy, both in the original cost of the apparatus, and in the amount of fuel consumed by it, the construction of the furnace being such that I obtain a very large radiating-surface, and distribute this surface at the most available point for reception of heat evolved directly from the incandescent fuel in the fire-pot, as well as from the smoke and gaseous products of combustion escaping from such fire-pot, thus enabling me to thoroughly consume the carbon of the fuel, and secure the greatest amount of heat from a given weight of coal.

Various improvements in the mechanical construction of an air-heating device have made themselves manifest in the course of the experiments which have resulted in my present invention, and these improvements will be herein duly explained.

The invention consists, primarily, in an arrangement of the fire-pot and its surmounting heat-radiating dome, and a plurality of heat-conducting flues, whereby the smoke and hot gases are caused to descend from the dome to the proximity of the lower portion of the exterior of the fire-pot and ash-pit, and to course about them before entering the smoke-escape pipe, thus, in their passage through and exit from the furnace, parting with their latent heat, which is eliminated from them into the hot-air chamber of the device.

Secondarily, my present invention consists in a peculiar construction, as well as application of the grate, whereby not only clinkers which may collect are ground or reduced to such small bulk as to readily escape with the ashes, but the necessity of the use of a poker is avoided, and I am enabled to entirely remove the grate from the furnace, should occasion or necessity dictate, or to tilt it into an inclined position, to remove stones, &c.

Thirdly, and as a matter of mechanical construction, this invention will be found to consist in a mode of suspending the lower encircling chamber or conduit

from the overhanging periphery of the dome, in such manner or by such means that changes in condition of the flues which constitute the suspensories, by reason of variations in temperature, shall not loosen or injure the joints between the parts, as hereinafter explained.

In the drawings which accompany this specification, and which illustrate my invention, I have represented, at A, a furnace, of which *a* is the fire-pot, and *b* the ash-pit, the door of the former being shown at *c*, and that of the latter at *d*, the form and arrangement of the said fire-pot and ash-pit being substantially the same as in many other furnaces in use, and to which no point of novelty attaches itself.

The door *c* of the fuel-supply throat or chute *e* is preferably lined or faced with tin, which is a good non-conductor of heat, the lining or facing being punctured at its lower part with a series of air-inlets, through which, and a register made in the door, oxygen is admitted to the fire-pot, to aid in consuming the gases therein.

The fire-pot *a* is surmounted by or prolonged into an upright cylinder, *f*, this cylinder terminating at top in a semi-flattened spheroidal dome or radiator, *g*, this radiator being provided, at any suitable point in its area, with a horizontal smoke-pipe, *h*, the purpose of this pipe being to afford a direct draught to the apparatus when kindling a new or enlivening a spent fire.

The periphery of the dome *g* is considerably in excess of that of the cylinder *f*, and to the under part of this overhanging periphery, I secure the upper extremities of a series of upright tubes or radiating-flues, *i i i*, &c., of comparatively small diameter, while I attach the lower ends of these tubes to the top of a horizontal yoke-shaped conduit or radiating-chamber, *j*, which nearly encircles the ash-pit, and perhaps the lower part of the fire-pot, and for a considerable part of its extent is concentric or thereabout with the dome *g*, a free communication being afforded throughout the said dome *g*, the pipe *i*, and base-conduit *j*.

I secure the upper extremities of the pipe *i i*, &c., to the dome *g*, in a peculiar and novel manner, that is, by means of short rods or bolts *k*, extending through ears or lugs *l l*, &c., cast upon the dome *h*, and upon each flue, as represented, the base or radiator *j* being secured to the pipes in like manner, by means of bolts *m m'*, &c., and lugs *n n'*, &c., the said lugs being cast, respectively, upon each end of the pipes, and upon a contiguous part of the radiator *j*.

This radiator thus becomes suspended from the dome, and is free to move with the pipes *i i*, &c., under any elongation or contraction of the same, by reason of variations of temperature, thus effectually guarding against loosening of the joints at each end of the pipes or other localities, and maintaining, un-



der all conditions and at all times, a perfectly tight joint, against leakage of gas to the hot-air chamber of the furnace, it being understood that the joints between the various parts are properly packed with a suitable cement.

By suspending the base-radiator *j* from the dome *g*, I obviate a very great, if not insurmountable objection, heretofore found to exist in a rigid union of any kind of such parts, as the expansion and contraction of the pipes, inseparable from their nature and service, soon loosen the joints, and permit of escape of gas to the hot-air chamber of the furnace.

Each extremity, and, it may be, the centre of the base-radiator *j*, are to be provided with doors, to permit of removal of soot or other matter which may collect therein, or to regulate the admission of air to its interior, for the purpose of partially checking the draught upon the fire.

The smoke-flue *h*, leading from the dome *g*, unites with a vertical flue or pipe, *o*, erected upon one extremity of the radiator *j*, and communicating therewith, the said horizontal pipe *h* being provided with a suitable damper, *p*.

The grate which I have adapted in the present instance, possesses several points of novelty in its construction, and in its combination with the fire-pot and ash-pit of the furnace.

Such grate is composed, in general, of two portions *a' b'*, one of which, the upper, *a'*, forms the grate proper, and is in form substantially of an annulus, with an enclosed barred surface, such bars being arranged radially or in parallelism, as may be deemed best.

The lower portion *b'* of the grate is composed of several radial or peripheral arms or bars *c' c' c'*, emanating from a central head or block, *d'*, the two portions *a' b'* being pivoted together in such manner that the former may be partially rotated upon or with respect to the latter, by which means both an abrading and a crushing action is exerted upon the clinkers which may form, and which otherwise collect and remain upon the grate.

The lower portion or half *b'* of the grate is provided with several integral outstanding or lateral prongs or arms *e' e' e'*, the purpose of these prongs being to rest upon ribs or ledges *f' f' f'*, formed upon or applied to the inner walls of the ash-pit of the furnace, and immediately below the fire-pot.

Furthermore, and in completion of the grate, its lower portion *b'* is constructed with a long handle or lever, *g'*, extending out from its front part, and somewhat to one side of its centre, the purpose of this handle being not only to impart semi-rotary reciprocation or shakes to the lower part of the grate, but to tilt such grate into a sloping position, for the purpose of removing stones or other injurious or non-combustible substances which may collect in or below the fuel in the fire-pot, the side-prongs or trunions *e' e'*, before mentioned, serving as a turning-point, to facilitate this movement of the grate.

When the grate are in a normal or horizontal position, the free end of the handle *g'* should be lodged upon a hook or stud affixed to the wall of the ash-pit.

The employment of a grate, made as above described, dispenses with the necessity of employing a poker to clear the fire, and permits of this clearing without escape of dust from the furnace.

Its construction and operation are such that it may be removed instantly and at any time from the ash-pit, should necessity or desire suggest it, thus enabling a new grate to be introduced, without disturbance to the furnace in general.

The operation of an air-heating apparatus, organized as before explained, is as follows:

Upon first igniting fuel within the fire-pot, the damper *p* is to be adjusted in such manner as to open free communication between the fire-pot and dome, and the smoke-discharge flue, in order to produce great draught.

The fuel being sufficiently ignited, this damper is to be partially or wholly closed, when the smoke and hot gases from the incandescent fuel are deflected downward through the pipes or flues *i i*, &c., thence into the base-radiator or conduit *j*, and from thence into the upright smoke-escape flue *o*, having, in their transit, parted with their latent heat, which is diffused by radiation from the dome *g*, pipes *i i*, and base *j*, into the hot-air chamber of the furnace.

An equable draught and temperature are maintained throughout the series of pipes *i i*, although, at first sight, it might appear that those nearest the smoke-discharge flue would attain the greater temperature.

The portion of the base-radiator *j*, at or near the fire-pot and ash-pit, as well as its large heat-radiating area, in combination with the pipes *i i*, enables me to convey the smoke and gases at once away from the smoke-discharge flue, and by conducting them through a tortuous or indirect passage, entirely extract from them their latent heat, thus economizing greatly the consumption of coal, and securing the best possible results.

I am thus enabled, not only to secure a very large amount of radiating surface in very small comparative compass, but to locate this surface where it shall come in direct contact with the atmospheric air at the bottom of the air-chamber of the apparatus, and where it shall receive the greatest amount of heat from the fuel.

The construction of this furnace is very simple, which fact adds to its other virtues that of very low cost.

As it contains no complexity of parts, it is very readily cleaned, thus doing away with the necessity of dismembering it annually.

A sliding or adjustable collar should be applied to the direct smoke-flue, in order to compensate for expansion and contraction of parts, but for which provision, much injury would ensue to the brick-work in which the apparatus is enclosed.

#### Claims.

1. The arrangement, about the ash-pit and lower part of the hot-air chamber of an air-heating furnace, of a jacket or equivalent device, constituting a heat-radiating surface, communicating with the fire-box, so as to receive the heat and other products of combustion evolved from the fuel, substantially as and for the purposes set forth.

2. In an air-heating furnace having a considerable portion of its heat-radiating surface in the form of a box or conduit disposed at or near the bottom of its hot-air chamber, and about or near its ash-pit, suspending this radiator from the dome by upright flues, in such manner that variations in length of these flues shall not result in loosening of or injury to the joints between such flues and dome and radiator or other part, for the purpose explained.

3. The mode herein described of uniting the dome *g*, pipes *i*, and base-radiator or box *j*, that is, by means of the short rods or bolts *k* and *m*, and the ears *l l* *n n*, or their equivalents, for the purpose explained.

4. The combination and arrangement of the upright flues *i i*, dome *g*, yoke or conduit *j*, and smoke-flue *o*, in manner and for the purpose as hereinbefore explained.

5. In combination with the fire-pot and dome of an air-heating furnace, a range of upright flues, when one end-pipe of such range is in communication with



the interior of the dome, and with a closed flue or conduit extending about the lower part of the fire-box or ash-pit, and the opposite end-pipe in communication with a smoke-discharge flue and the said conduit, essentially as explained.

6. In an air-heating or other apparatus, applying the grate to the furnace thereof, in such manner as to lower its front edge, for convenience in removing clink-

ers, non-combustible matters, &c., when such grate is capable of being entirely removed from such furnace.

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Witnesses:

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