

J. F. KRAUTER.  
HOT AIR FURNACE.

(Application filed Feb. 14, 1901.)

(No Model.)

2 Sheets—Sheet 1.

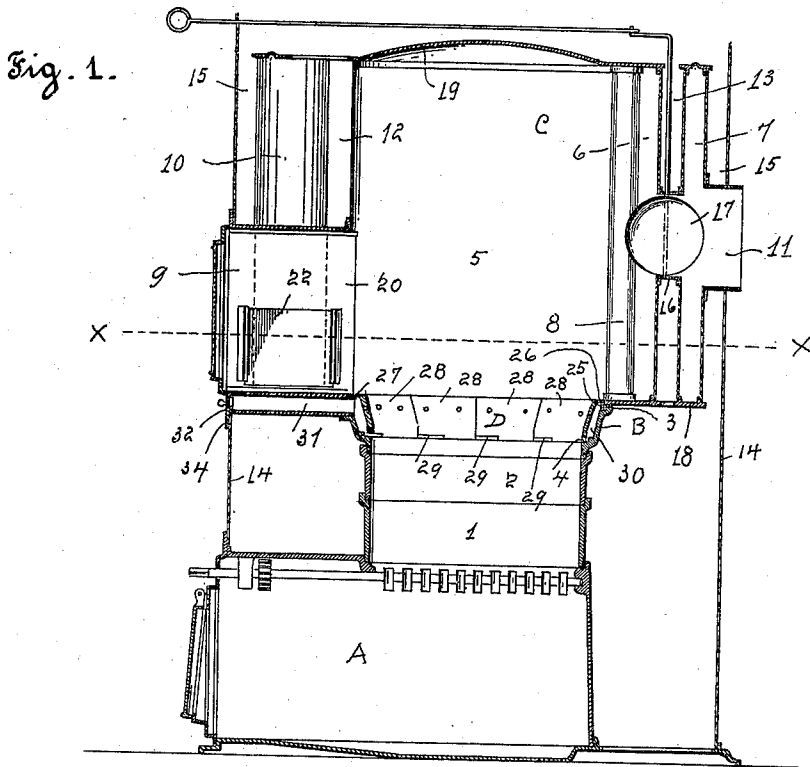


Fig. 2-

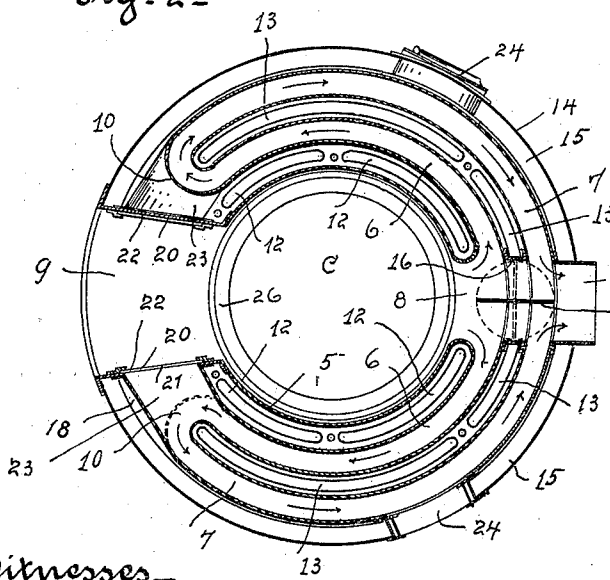
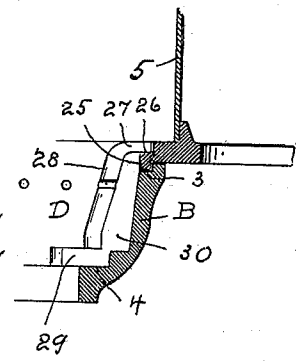


Fig. 3-



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Fig. 4-

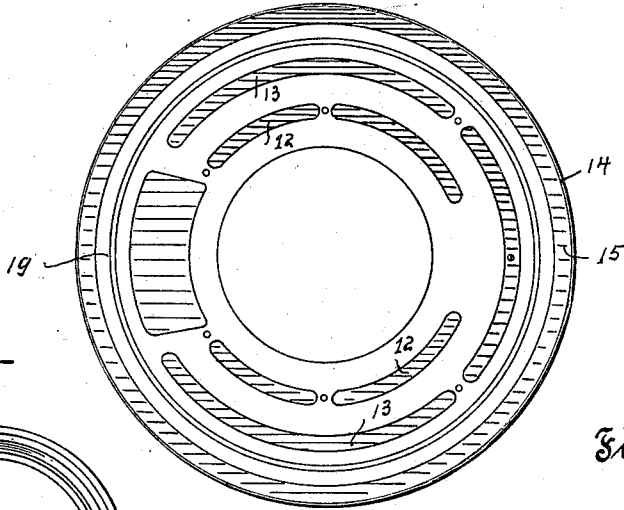


Fig. 6-

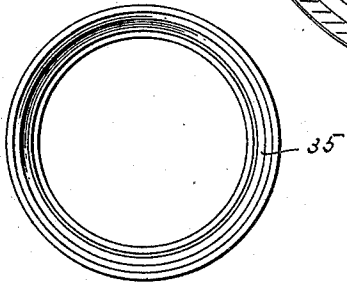


Fig. 5-

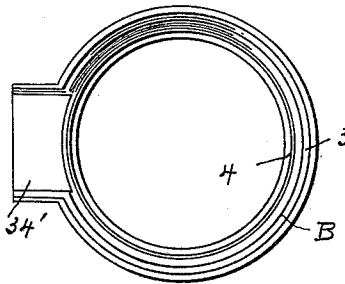


Fig. 8-

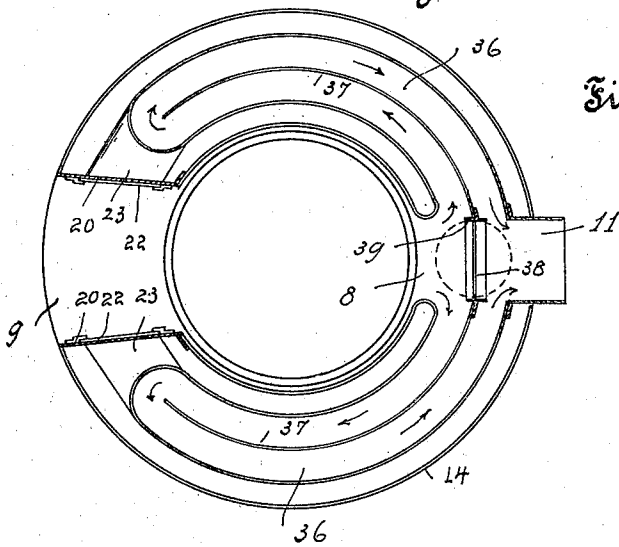
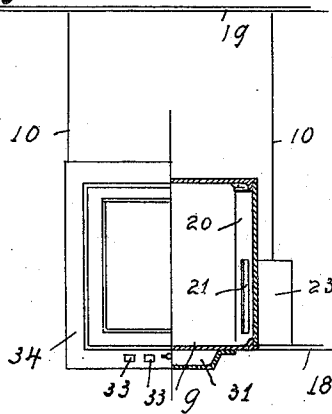


Fig. 7-



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# UNITED STATES PATENT OFFICE.

JOHN FREDERICK KRAUTER, OF TOLEDO, OHIO.

## HOT-AIR FURNACE.

SPECIFICATION forming part of Letters Patent No. 708,563, dated September 9, 1902.

Application filed February 14, 1901. Serial No. 47,205. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN FREDERICK KRAUTER, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Improvement in Hot-Air Furnaces, of which the following is a specification.

My invention relates to improvements in hot-air furnaces, and has for its object to provide a furnace of the kind that is efficient and economical; furthermore, that may be adapted to burn either hard or soft coal with a minimum loss of fuel and heat from imperfect combustion and radiation. I attain these objects by providing a furnace having a high degree of efficiency as to combustion, with a radiator adapted to transmit an increased percentage of the heat produced in the furnace to a passing volume of air. The construction by which these results are attained is hereinafter described, and illustrated in the drawings.

I have found in practice that air by reason of its non-conducting properties is slow to receive heat and when heated is equally slow to give it off, that in order to radiate the greatest amount of heat from a volume of heated air or gases it is necessary to pass it thinly over or between good conducting-plates, and that to heat a volume of air it is best accomplished by passing it thinly over or between heated conducting-plates. I have also found that when the same volume of heated air is passed through cylindrical or cubical shaped flues or passages a large proportion of the heat is lost. In the construction of my improved furnace I have therefore provided circuitous narrow passages for the heated air and gases from the furnace to the flue between broad plates, which also form the sides of narrow intervening air-flues connecting the air-chamber in the bottom with the air-chamber in the top of the outer casing of the furnace.

In the drawings, Figure 1 is a transverse vertical section through a furnace constructed according to my invention. Fig. 2 is a horizontal section on the line *xx* of Fig. 1. Fig. 3 is an enlarged detail view of the annular air-chamber formed by the perforated sectional lining and the top section of the fire-pot. Fig. 4 is a top plan view of the top

plate of the heating-drum, showing the air-passages. Fig. 5 is a top plan view of the top section of the fire-pot. Fig. 6 is a modification of same as adapted for a hard-coal furnace. Fig. 7 is a part elevation and part section of the fuel-door and fuel-door opening, and Fig. 8 is a horizontal section showing a modified form of a heating-drum.

In the drawings, A designates the ash-pan, which is of the usual form of construction and is provided with the necessary fittings, such as grates and doors. Upon this ash-pan is mounted the sectional fire-pot, composed of bottom section 1, intermediate section 2, and top section B, which latter is flared outward toward the top and has formed upon its rim a rabbet 3, and near the base of the section there is formed an inner shoulder 4.

C designates the heating-drum, superimposed and supported by the fire-pot. The drum comprises a fire-pot dome 5 and intermediate semicircular heating-drum 6 and an outer heating-drum 7. The intermediate heating-drum communicates with the dome over the fire-pot at the rear of the furnace through the flue 8, which extends from the bottom to the top. From this flue-opening the drum curves concentrically upon both sides of the dome toward the fuel-opening 9 of the furnace. Opposite the fuel-duct the ends of the inner heating-drum are reversely curved outward to form return-elbows 10, which communicate with the outer heating-drum 7, which in a like manner concentrically encircles the inner heating-drum. The course of the gases during the operation of the furnace is indicated in Fig. 2, and, as will be seen by the direction of arrows, the gases will pass from the dome through the flue 8 into the intermediate heating-drum and circle toward the front upon both sides of the dome and return through the outer drum 7, from which the gases find exit through the smoke-pipe collar 11. By thus providing an inner and an outer heating-drum arranged concentrically around the dome over the fire-pot I have greatly increased the heating-surface of a furnace by forming the annular air-ducts 12 between the dome and the intermediate heating-drum and the annular air-ducts 13 between the drums 6 and 7, and upon inclosing the heater in the furnace-casing 14

the usual air-duct 15 is formed. For starting a fire in the furnace a direct draft is desired, which is provided for by a flue-collar 16 between the inner and outer heating-drums 5 in a line with the flue 8 and the smoke-pipe collar 11. In the collar 16 there is mounted a damper 17, by means of which the gases of combustion may be allowed to escape directly into the smoke-pipe or by closing of the damper 10 the gases are obliged to travel through the inner drum toward the front of the furnace and then through the outer drum to the smoke-pipe. The drums and dome are constructed of sheet metal and are clamped between and closed by the bottom plate 18 and 15 the top plate 19 in the usual manner. Both of the plates 18 and 19 are provided with openings for the passage of air between the dome and the drums and between the drums, 20 and to the bottom plate and the dome there is suitably bolted the fuel-supply duct 9, communicating with the interior of the dome. In the side walls 20 of the duct 9 there are formed openings 21, normally covered by removable sliding plates 22. By removing the 25 plates access may be had through these openings to both drums for the purpose of cleaning through the connecting-throats 23.

24 designates clean-out doors, through 30 which the rear portion of the outer drum may be reached for cleaning.

25 designates a flange integral with the bottom plate 18 and encircling the dome-opening of the plate, and in diameter is adapted 35 to enter the rabbet 3 of section B of the fire-pot. Upon the top of the plate around the same opening there is also formed a rabbet 26 of a depth to receive the flange 27 of the lining D. The lining D is made of sections 40 28, which are suitably perforated and provided with incuts 29 upon their bottom edges, which are supported upon the shoulder 4. When the sections of the lining are assembled in position within the fire-pot, an annular 45 air-space 30 is formed to supply air to the fire above the fuel through the incuts and perforations in the lining. The air in the chamber is replenished through a duct 31, which is secured to the under side of the fuel- 50 duct, and the draft of air is controlled by means of a sliding valve 32, by means of which the openings 33 in the fuel-door frame 34 may be closed. The fire-pot section B is dished and provided with a projecting lip 34' of depth 55 and width to receive the air-duct 31. For a hard-coal furnace the duct 31 is omitted and a fire-pot section 35 substituted without the sectional lining to form an air-chamber. Otherwise no alterations are made in construction of the furnace to use hard coal. 60

In the modification shown in Fig. 8 I have provided a single heating-drum 36, provided with an internal diaphragm 37, to cause a like flow of the gases as in the furnace arranged with a double drum. A direct-draft damper 38 is mounted on the collar 39, which 65 is secured to the diaphragm in a line with

the flue-opening 8 and the smoke-pipe collar 11. This form of radiator, while it embodies the principle of construction of my invention, is not as desirable as that shown in the other figures, because of the reduced radiating-surface. 70

As appears in the drawings, the heating-drums are upon the same level as the dome 75 over the fire-pot, and with it constitute a compact radiator provided with largely-increased heating-surface surrounding contracted air-passages, formed to draw air in thin volumes between the highly-heated 80 plates of the dome and drums from the air-supply in the base to the distributing-chamber in the top of the casing. By this construction a largely-increased percentage of the heat generated in the furnace is utilized, 85 thereby lessening the quantity of fuel required. In furnaces heretofore constructed little air can come in contact with the dome of the fire-pot over the fuel-supply duct, thereby reducing their efficiency, which defect 90 is also remedied by my construction.

What I claim to be new, and desire to secure by Letters Patent, is—

1. In a hot-air furnace, the combination with a fire-pot, of a radiator comprising a 95 central cylindrical dome mounted on the fire-pot and having a fuel-duct for the fire-pot extending from one side and a flue opening opposite therefrom into an inner drum extending concentrically around the dome to 100 opposite sides of the fuel-duct; an outer drum concentrically disposed around the inner drum and connected at opposite sides of the fuel-duct by elbows with the inner drum; narrow vertical air-passages between the 105 outer and inner drums and between the inner drum and the dome; an exit-flue for the outer drum set horizontally opposite the flue of the dome, and an intermediate flue connecting the outer and inner drums in alignment with the exit-flue and having a damper adapted, when open, to admit direct draft from the flue of the dome through the intermediate flue to the exit-flue, and, when 110 closed, to force the draft circuitously through the drums. 115

2. In a hot-air furnace, the combination with a fire-pot having an outwardly-flared detachable top section provided with an inner shoulder around the base of the section, 120 and with an incut at one side in its rim, of an annular base-plate for the dome mounted horizontally on the fire-pot, with its inner rim on the rim of the top section, a dome for the fire-pot, provided with a side opening 125 and mounted on the base-plate concentric with its inner rim, a perforated lining for the top section of the fire-pot, formed of detachable sections, having the lower ends of the sections supported on the inner shoulder of 130 the top section, and the upper ends curved outward and supported by the inner rim of the horizontal plate, forming, with the top section of the fire-pot and the rim of the

plate, an annular air-space around and with-  
in the top of the fire-pot, plates secured to  
the annular horizontal plate, and to the dome  
around its side opening, forming a fuel-duct  
5 for the fire-pot, a plate angled at the sides  
and secured to the base-plate beneath the  
fuel-duct, and to the top section of the fire-  
pot around the opening formed by the side  
inlet in its rim, forming an air-duct for the  
annular air-space and a frame including the 10  
outer ends of both ducts, provided with in-  
dependent closures for the ducts.

In witness whereof I have hereunto set my  
hand this 9th day of February, A. D. 1901.

JOHN FREDERICK KRAUTER.

Witnesses:

IRVING E. MACOMBER,  
HERMAN H. MARTIN.