No. 779,467. PATENTED JAN. 10, 1905.

J. R. CRAVATH.

FURNACE.

APPLICATION FILED NOV. 2, 1903.

2 SHEETS—SHEET 1.

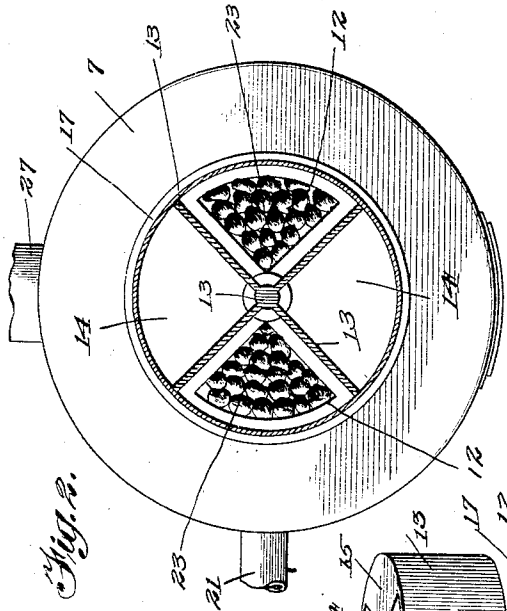


Fig. 2.

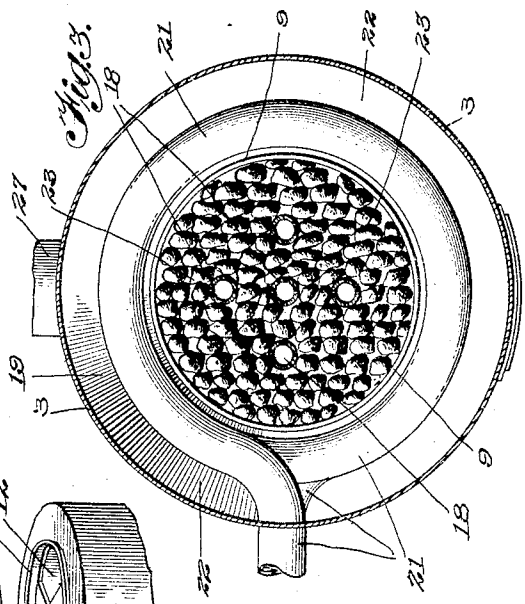


Fig. 3.

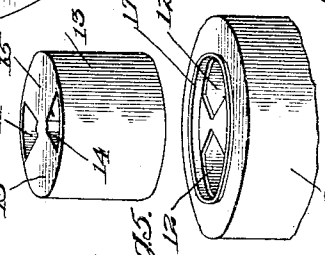


Fig. 5.

Fig. 4.

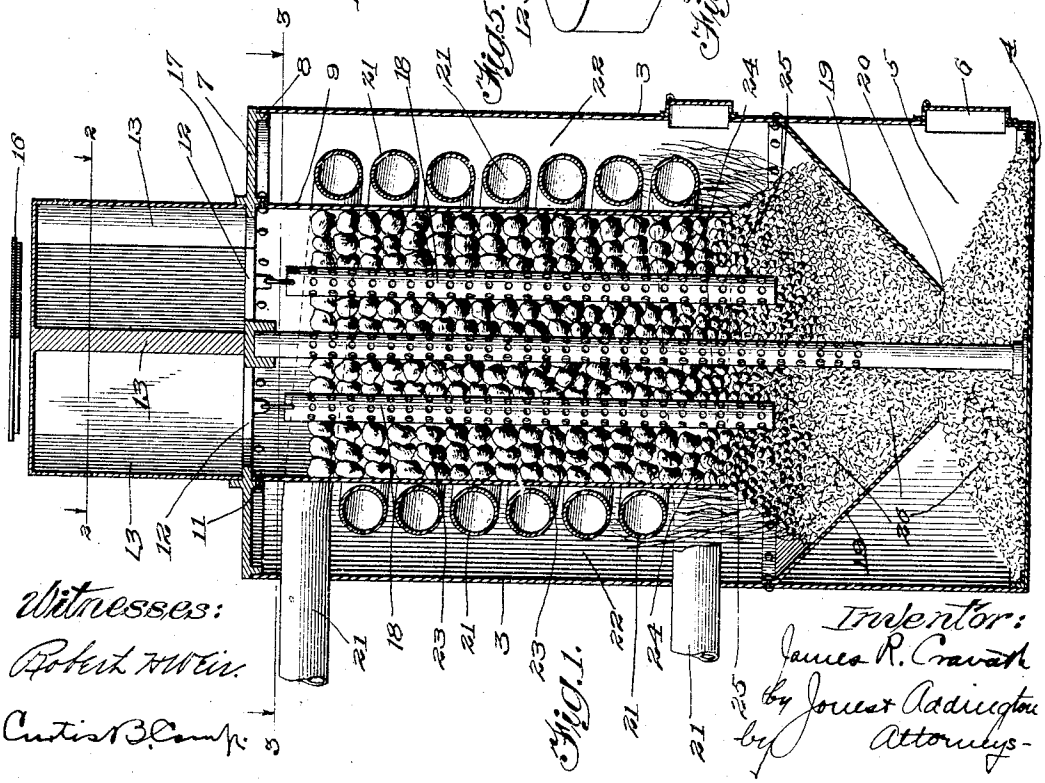


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 6.

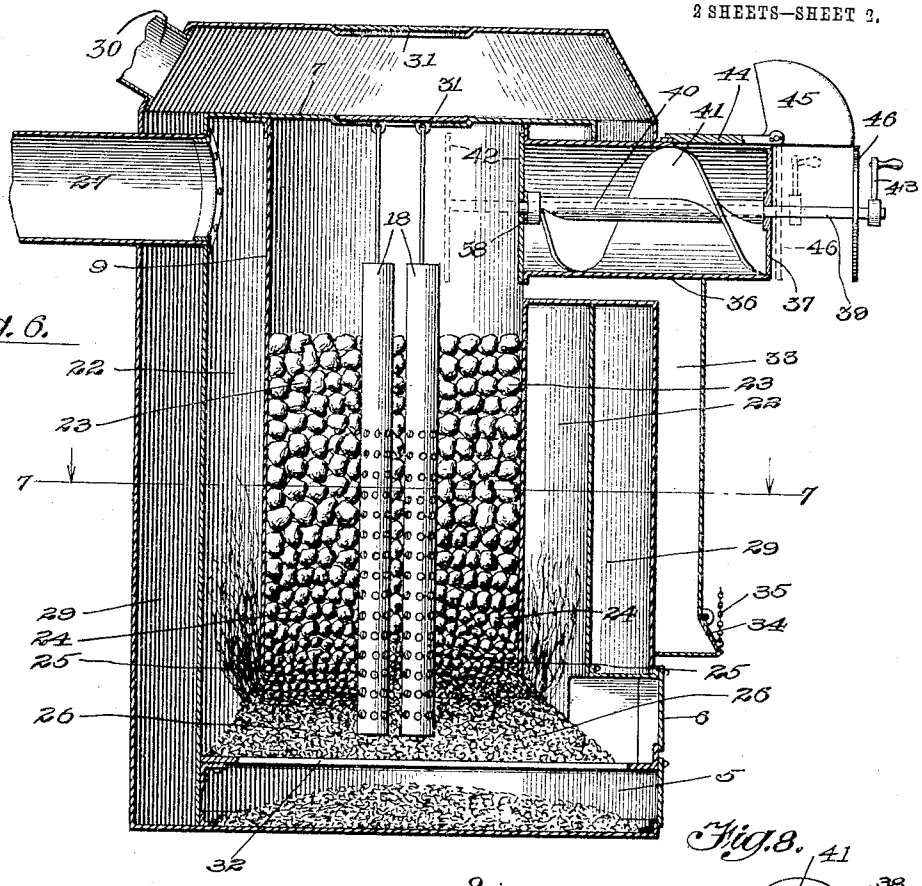


Fig. 8.

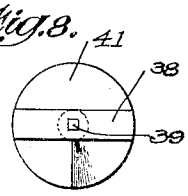
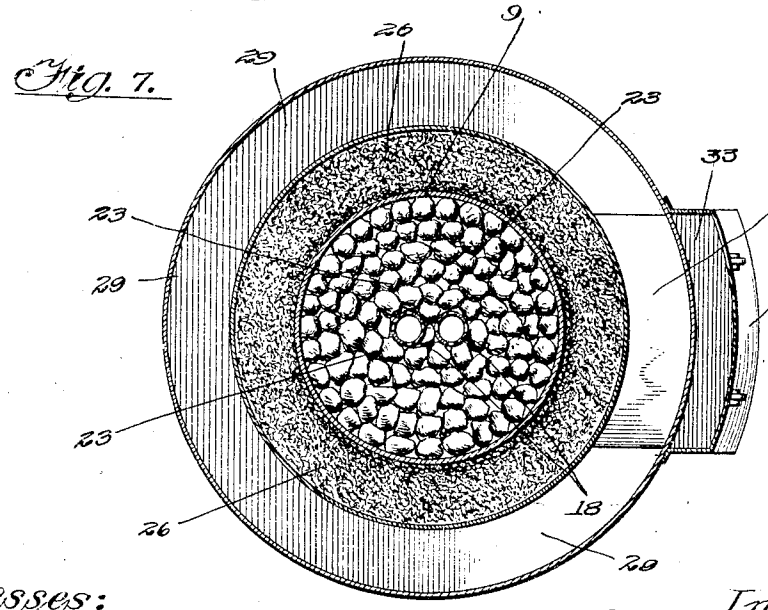


Fig. 7.



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No. 779,467. Patented January 10, 1905.

UNITED STATES PATENT OFFICE.

JAMES R. CRAVATH, OF CHICAGO, ILLINOIS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 779,467, dated January 10, 1905.

Application filed November 2, 1903. Serial No. 179,535.

To all whom it may concern:

Be it known that I, JAMES R. CRAVATH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Furnaces, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved heating apparatus which may be adapted for use as a stove, furnace, heater, or the like.

One object of my invention is to enable bituminous coal to be burned without requiring constant attention and without offensive black smoke and soot and without obnoxious gases escaping from the stove or furnace into the room.

My invention is particularly designed for burning bituminous coals containing a large amount of volatile matter and which do not tend to form cakes when burned in finely-powdered form. Such coal is found in large quantities throughout the United States, most generally west of the Allegheny mountains.

By the use of my invention bituminous coal may in many cases be substituted for anthracite, resulting in a very great saving in cost to the consumer. Where bituminous coal is now used, my invention makes it possible to secure as cleanly combustion and as steady fires as are obtained with anthracite coal, with no additional attention over that at present required in the burning of anthracite coal.

To accomplish the above and other beneficial results, I provide in the preferred embodiment of my invention an inverted fire-pot. The draft is admitted at the top of my inverted fire-pot and passes down through the burning coal and coke (the coke being the bed of incandescent coal from which the volatile gases have been burned) and out into a combustion-chamber or space communicating with said fire-pot at the bottom thereof and preferably located between the fire-pot and the outer wall of the stove or between the fire-pot and the hot-air chamber of a furnace. I provide also an air-sealed stoke-hole or opening near the top of said fire-pot, through which coal may be admitted without allowing any smoke or disagreeable fumes which may have collected in the top of the fire-pot to escape into the room. The air of combustion may also be admitted through said opening. By admitting the air of combustion near the top of the fire-pot the volatile gases coming from the coal and the draft of air are raised to a high temperature and are thoroughly mixed as the draft of air admitted at the top of the fire-pot carries them down through the hot bed of burning coke at the bottom thereof. The volatile gases imperfectly burned make the black smoke and soot which are the objectionable features of bituminous coal when used in an ordinary stove or furnace. By this invention they are kept at a high temperature and mixed as they pass through the fire and into the combustion-chamber. They are consequently consumed, thus doing away with soot and smoke and at the same time securing greater economy.

Referring to the accompanying drawings, in which the same reference characters indicate similar parts throughout the several figures, Figure 1 is a sectional elevation of a hot-water heater embodying my invention. Fig. 2 is a sectional view taken on the line 2 2, Fig. 1. Fig. 3 is a sectional view on the line 3 3, Fig. 1. Fig. 4 is a perspective view of the top of the fire-pot made on a diminished scale. Fig. 5 is a perspective view of the fuel-receptacle. Fig. 6 is a sectional elevation of a hot-air furnace equipped in accordance with my invention. Fig. 7 is a sectional view taken on the line 7 7, Fig. 6; and Fig. 8 is an end view of the stoking-chamber.

Referring now to the drawings by reference characters, I provide the usual outer casing 3, which may be made of any suitable material or design. Any suitable piece 4 may be provided at the bottom of the casing 3 to inclose the ash-pot 5, which has a door 6 formed in the casing 3, through which the ashes may be removed. A plate 7 is fitted upon the top of the casing 3 in any suitable manner, preferably by the annular shoulder or rim 8.

The cylindrical casing or jacket 9 constitutes an inverted fire-pot, which may be suspended from the plate 7 by means of bolts passing through a downwardly-extending

flange 11 formed upon the inner face of said plate. The form of my inverted fire-pot is not essential, and any suitable means of supporting the same within the casing 3 may be adopted in lieu of that above described. The plate 7 has openings 12 12 formed therein and carries a drum or stoking device 13, as seen in Figs. 4 and 5. The drum or stoking device 13 has longitudinal openings 14 14 formed therein and is provided with sealed portions 15 15. The openings 14 14 in the drum are provided with suitable covers 16. The drum 13 is loosely held in position on the plate 7 in any suitable manner, as by the flange 17. The operation of the drum 13 in stoking the fire is as follows: The drum is revolved upon the plate 7 until the longitudinal openings 14 14 therein are out of alinement with the openings 12 12 in the plate 7. The cover 16 is then removed from the drum and the longitudinal openings therein filled with coal. The cover 16 is then replaced in position on the drum and the drum rotated until the openings 12 12 and 14 14 are again in alinement, when the coal drops from the drum into the fire-pot 9. It will be readily seen that when the cover 16 is removed the openings 12 12 in the plate 7 are sealed by the sealed ends 15 15 of the drum, and when the drum is rotated to drop the coal in the fire-pot the openings 14 14 are sealed at their upper ends by the covers 16. The form of the drum 13 and the particular disposition of the openings therein are not essential—as, for instance, the drum may be made with a different cross-section and have a different movement to the axis of the fire-pot—and many other changes in the details of construction of the plate 7 and the drum 13 might be made without departing from the spirit of my invention.

The draft-opening for admitting air to the upper end of the fire-pot may be provided in any suitable manner, as by the removal of one or both of the lids or covers 16 or by the partial lifting thereof.

To facilitate the passage of the draft from the top of the fire-pot 9 down through the coal and the burning coke in the bottom thereof, I provide perforated draft-tubes 18, made of any suitable material, preferably fire-clay. The draft-tubes may be attached in any suitable manner to the interior of the fire-pot; but I prefer to suspend them from the plate 7, as shown in Fig. 1. If desired, one or more of the draft-tubes 18 may be made to extend to the bottom of the ash-pot 5; but this is not essential.

Attached in any suitable manner to the walls of the casing 3 I provide a conical-shaped ash-hopper 19, having an opening 20 formed in the bottom thereof, through which the ashes sift into the ash-pot 5. Any suitable form of ash-supporting arrangement may be adopted in lieu of that described, and bars may be used in the opening 20, if desired.

A coil 21 for heating hot water may be used in connection with my improved stove, said coil being located in the combustion-chamber 22 and preferably coiled about the fire-pot, as shown in Figs. 1 and 2. The ashes 26 extend down through the ash-hopper 19 into the ash-pot 5. The hot bed of coke 25 rests upon the ashes 26, and just above the coke 25 and extending for a short distance into the fire-pot 9 is the partially-burned coal 24, the unburned coal 23 filling the remainder of the fire-pot 9. It will be noted, however, that as the fire increases it burns upwardly in the fire-pot 9, and under normal conditions when the fire is well under way the bed of live coals extends half-way up the fire-pot 9. By the omission of the coils 21 the device becomes a heating-stove.

Referring now more particularly to Figs. 6, 7, and 8, Fig. 6 shows another form of my device adapted for use as a furnace. I have illustrated my invention in Figs. 6, 7, and 8 as applied to a hot-air furnace, and it will be understood that it can be applied in an obvious manner to a hot-water or other form of furnace. As shown in the drawings, the usual hot-air shaft or chamber 29 communicates with a distributing-pipe 30. In the top of the hot-air chamber 29 and in the top of the plate 7, that extends across the top of the fire-pot 9, I preferably provide openings 31 31, having suitable lids or covers and adapted to afford access to the interior of the furnace for the purpose of cleaning or repairing the same.

The bars 32, disposed near the bottom of the furnace in any suitable manner, form a support for the ashes and the fuel above the ashes and at the same time permit ashes to be easily poked down from under any portion of the fire. The air of combustion is admitted near the top of the fire-pot 9 through the draft-passage 33. I prefer to construct the draft-passage 33 with a door or shutter 34 attached thereto for controlling the supply of the air admitted to the fire-pot, which door or shutter may be regulated at a distance by the chain 35; but this is not essential. Any form of opening near the top of the inverted fire-pot 9 for admitting the air of combustion thereto may be used in lieu of the draft-passage 33. I have adopted the form of draft-passage shown to prevent the escape into the room of smoke or offensive gas which may collect in the top of the fire-pot. In case there is not strong enough draft at any time to have a current of draft-air entering through the whole area of the draft-opening such smoke might escape at the draft-opening if the intake of draft were not lower than the opening into the top of the fire-pot.

Arranged near the top of the inverted fire-pot 9 is a stoking-chamber, consisting of a

cylinder or barrel 36. One end of the cylinder or barrel 36 opens into the fire-pot 9. The other end thereof is closed by the end piece 37, which is securely attached thereto in any suitable manner. Extending transversely across the open end of the cylinder is a bar or strip 38, (see Fig. 8,) said strip being secured in any suitable manner to the cylinder 36. Through the piece 37 and the strip 38 in a line with the longitudinal axis of the cylinder 36 are provided openings adapted to receive the rod or shaft 39. The shaft 39 is irregular in cross-section, in the present instance being square, and fits within a corresponding shaped bore in the sleeve 40, said sleeve having a screw or worm feeding device 41 formed thereon. The sleeve 40 is thus loosely mounted upon the shaft 39 to permit the shaft 39 to move longitudinally through the sleeve 40, the sleeve 40 being held in position in the cylinder by the strip 38. Permanently mounted upon the end of the shaft 39 is a disk 42, a similar disk 46 being mounted upon the opposite end thereof. A handle 43 is provided upon the end of the shaft for rotating the screw-feeding device 41. A suitable opening is provided in the top of the cylinder 36, through which coal may be placed in the cylinder, said opening being provided with a cover 44. Attached to the cover 44 is a cam 45, said cam being adapted to drop down between the end piece 37 and the disk 46 when the cover 44 is raised.

It will be seen that when the cover 44 is raised the cam 45 will extend down between disk 46 and the end piece 37. With the cam 45 in this position the disk 42 effectually seals the end of the cylinder 36. The cylinder 36 having been filled with coal and the cover 44 swung down to close the opening therein, the shaft 39 is moved transversely through the sleeve 40, the inner disk 42, carried upon the inner end of the shaft, being moved into the fire-pot and unsealing the opening from the cylinder into the fire-pot. The shaft 39 is now rotated by means of the handle 43, and the coal contained in the cylinder is precipitated into the fire-pot 9 by means of the screw feed 41. An interlocking air-sealed stoking device is thus produced, the inner disk 42 sealing the opening into the fire-pot while the coal is being placed in the cylinder and the cover 44 sealing the opening for the admission of coal into the cylinder while the coal contained therein is being fed into the fire-pot.

Many changes may be made in the construction of my stoking device without departing from the spirit of my invention, and other interlocking sealing means may be employed.

The coal is introduced into my improved fire-pot through the air-sealed stoking devices, as heretofore described, and feeds down upon the fire by gravity, the ashes passing through the openings below the fire. The principal part of the air of combustion is admitted, as previously stated, at the top of the fire-pot and passes down through the draft-tubes and the burning coke and ashes and out through the combustion-chamber 22 and smoke-flue 27. The volatile gases given off by the coal are thoroughly mixed with the air of combustion by passage through the lumps of coal in the fire and are consumed because of the heat as they are carried through the hot bed of burning coke and coal at the bottom of the fire-pot. It will be seen that the annoying properties of bituminous coal—namely, black smoke and soot—are utilized to advantage in my improved fire-pot. It will be noted that the principal draft is admitted at the upper end of the fire-pot and passes downward therethrough. Special means are provided for excluding air from the bottom of the furnace, as otherwise the downward draft through the fire-pot would be interfered with. Of course a slight amount of air may be admitted below the fire, and this in some cases may be desirable; but air should not be admitted below the fire in sufficient quantity to interfere with the principal draft, which is the downdraft through the fire-pot.

It will be understood that my invention may be adapted to burn other fuels than bituminous coal, as anthracite coal, wood, &c.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein, a combustion-chamber communicating with the lower end of said fire-pot, means for admitting the fuel at the top of said fire-pot, means for admitting the principal draft at the upper end of said fire-pot, a draft tube or tubes adapted to extend into the fuel in said fire-pot and provided with openings to furnish air to the greater part of said fuel and a stoking device arranged at the upper end of said fire-pot and constructed to permit fuel to be inserted in said fire-pot without opening the same to the air.

2. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein having means to permit the removal of ashes, means for admitting the principal draft to the upper end of said fire-pot, a combustion-chamber communicating with the lower end of said fire-pot, and a stoking device arranged at the upper end of said fire-pot and constructed to permit fuel to be inserted in said fire-pot without opening said fire-pot to the air, substantially as described.

3. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein having means to permit the removal of ashes, means for admitting the principal

draft to the upper end of said fire-pot, a combustion-chamber communicating with the lower end of said fire-pot, a stoking-chamber arranged at the upper end of said fire-pot and having two doors one an inlet for fuel and the other communicating with said fire-pot, and interlocking means associated with said doors to insure the closing of one of said doors when the other door is open, substantially as described.

4. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein, means for admitting the principal draft at the upper end of said fire-pot, a combustion-chamber communicating with the lower end of said fire-pot, a stoking-chamber arranged at the upper end of said fire-pot and having two doors one an inlet for the fuel and the other communicating with said fire-pot, a cam attached to one of said doors and a disk attached to another of said doors and coacting with said cam to insure the closing of one of said doors when the other door is open, substantially as described.

5. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein having means to permit the removal of ashes, means for admitting the principal draft to the upper end of said fire-pot, a combustion-chamber communicating with the lower end of said fire-pot, a stoking-chamber arranged at the upper end of said fire-pot, a screw feeding device disposed in said chamber, said chamber having two doors one an inlet for the fuel and the other communicating with said fire-pot, and interlocking means associated with said doors to insure the closing of one of said doors when the other door is open, substantially as described.

6. In a device of the character described, the combination with an inverted fire-pot, of a suitable support for the fuel contained therein having means to permit the removal of ashes, means for admitting the principal draft to the upper end of said fire-pot, a combustion-chamber communicating with the lower end of said fire-pot, a stoking device arranged at the upper end of said fire-pot and constructed to permit fuel to be inserted in said fire-pot without opening the same to the air and a draft-passage having its outlet communicating with said fire-pot at the upper end thereof and having its intake situated lower than its outlet, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

JAMES R. CRAVATH.

Witnesses:
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M. R. ROCHFORD.