H. K. MOORE.

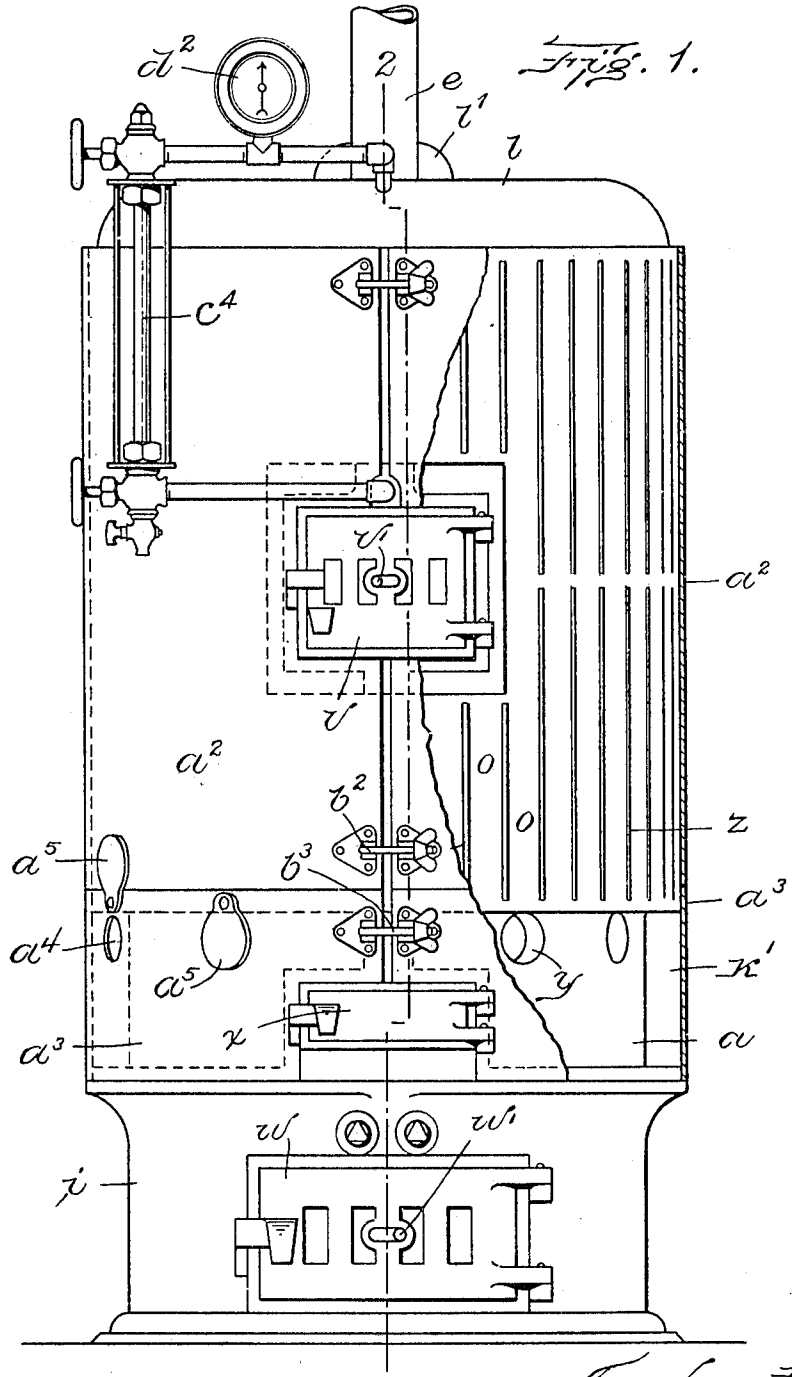
HEATER.

APPLICATION FILED JULY 5, 1906.

949,282. Patented Feb. 15, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

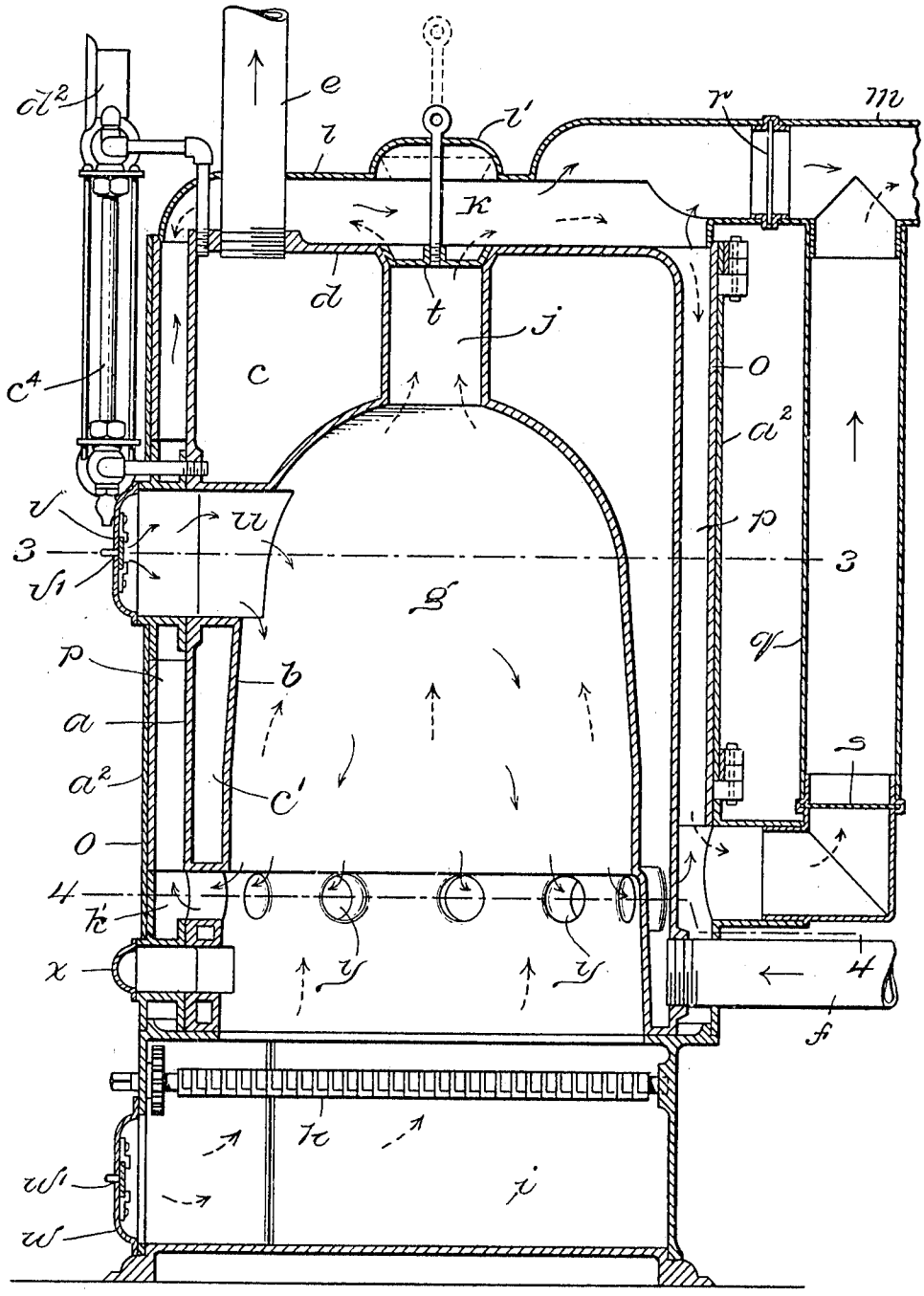

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Fig. 2. Inventor,
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4 SHEETS—SHEET 3.

Fig. 3

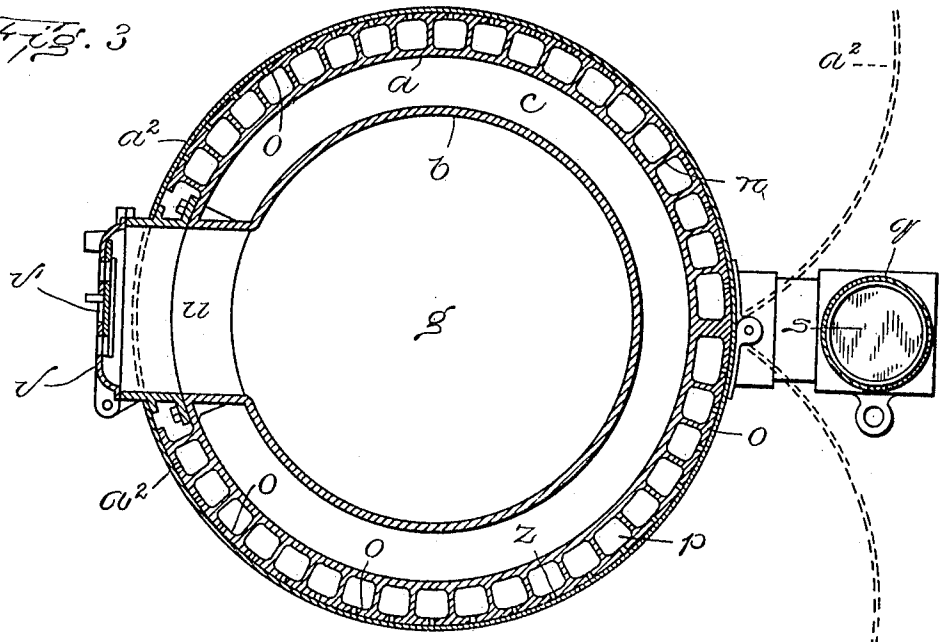

Fig. 4.

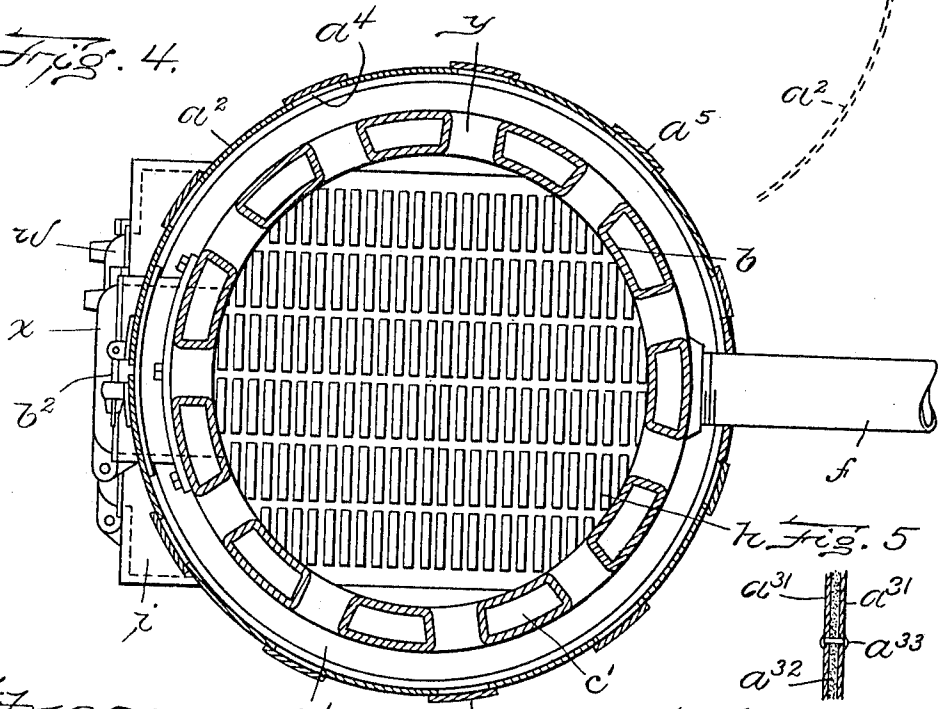

Fig. 5

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4 SHEETS—SHEET 4.

Fig. 6.

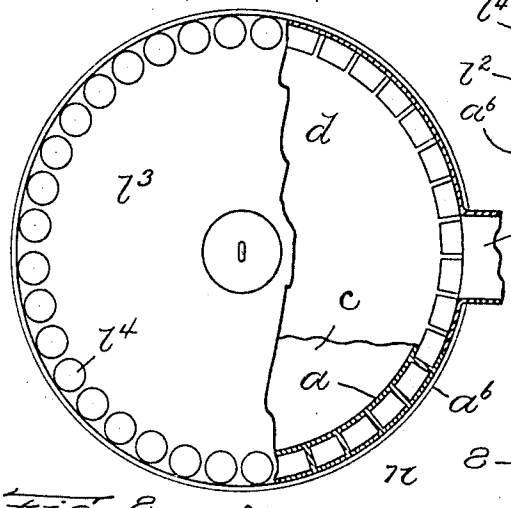


Fig. 7.

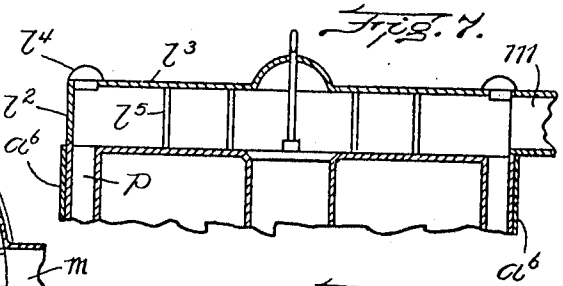


Fig. 8.

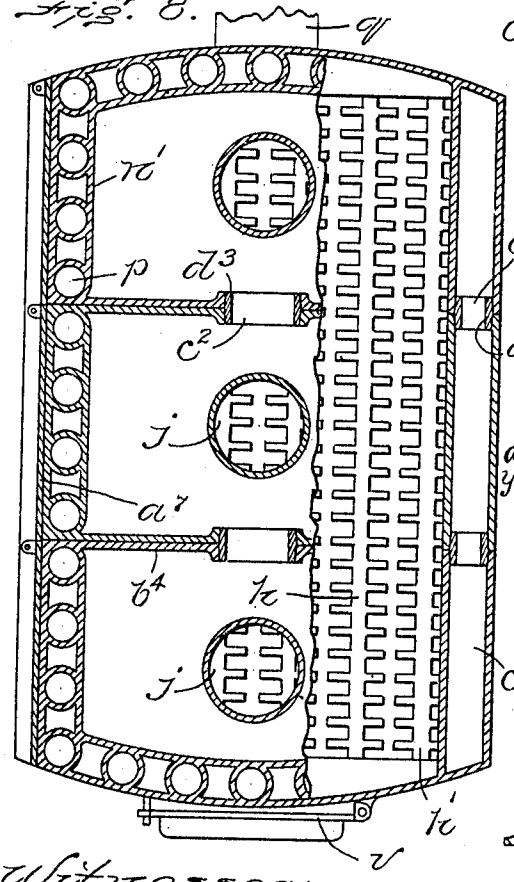
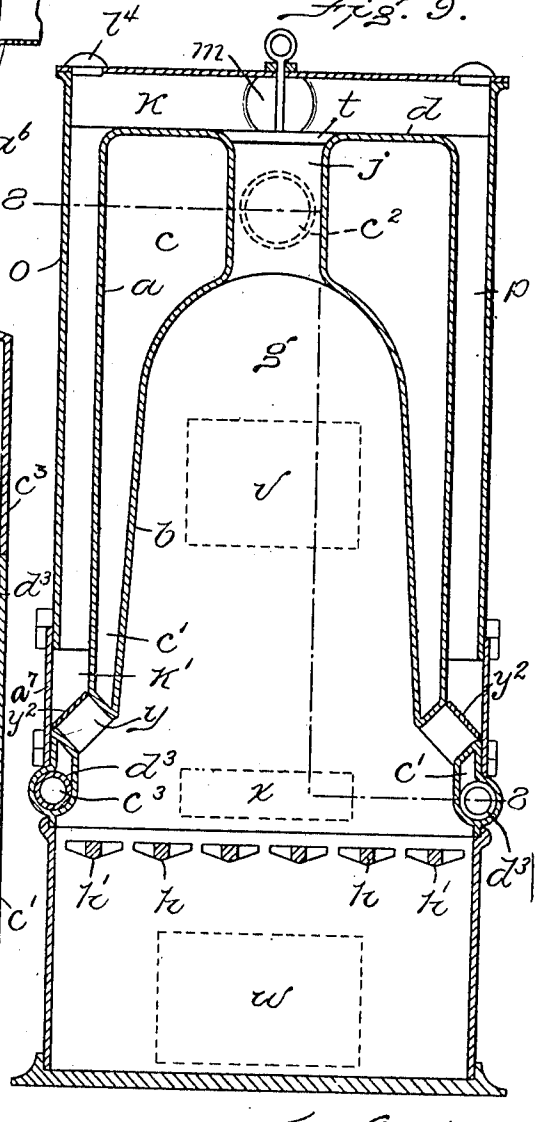


Fig. 9.



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UNITED STATES PATENT OFFICE.

HUGH KELSEA MOORE, OF BERLIN, NEW HAMPSHIRE.

HEATER.

949,282. Specification of Letters Patent. Patented Feb. 15, 1910.

Application filed July 5, 1906. Serial No. 324,711.

To all whom it may concern:

Be it known that I, HUGH KELSEA MOORE, of Berlin, in the county of Coos and State of New Hampshire, have invented certain new and useful Improvements in Heaters, of which the following is a specification.

This invention has for its object to provide a heater for domestic use in which fuel may be burned with the maximum efficiency, and without loss of volatile combustible.

A further object is to construct such a heater so as to be capable of burning different kinds of fuel, such as bituminous or anthracite coal, in the manner best adapted to the particular kind of fuel, without the formation of smoke, soot, creosote or unburned combustible gas.

These objects are attained by providing the heater with a number of air-inlets and outlets for the products of combustion, located at a number of different levels, together with a series of dampers which can be independently adjustable so as to govern and reverse, when needed, the direction of the draft of air through the fire, so as to burn the fuel with either an up or down draft.

Further objects are to construct the heater so that there may be the most rapid and efficient possible conduction of heat from the products of combustion to the heat-carrying medium, by which houses and other buildings are heated, and to enable the heater to be cleaned while it is running.

Of the accompanying drawings,—Figure 1 represents an elevation of a heater containing the principles of which my invention consists. Fig. 2 represents a central vertical section thereof, on line 2—2 of Fig. 1. Figs. 3 and 4 represent horizontal cross-sections on lines 3—3 and 4—4 respectively, of Fig. 2. Fig. 5 represents a sectional view of a fragment of the removable outer sheath. Figs. 6 and 7 represent plan and sectional views of a slighly modified construction. Figs. 8 and 9 represent horizontal and vertical sectional views of another modified construction in which the heater is made of a plurality of sections abutting against one another.

The same reference characters indicate the same parts in all the figures.

The heater illustrated in this application is designed to heat water or generate steam for a hot-water or steam-heating system for buildings. To that end it consists of an outer shell *a* and an inner shell *b* between which is formed a space *c* containing the heat-carrying medium. When the apparatus is to be used as a hot-water heater, the space *c* is filled entirely full of water up to the top *d* of the shell, and the entire heating system is also filled with water. The heated water flows upwardly from the space *c* through the outlet pipe *e*, while the cool return water flows into the lower part of the space *c* through the return pipe *f*. When on the other hand, the apparatus is used as a steam-heater, the fluid space is filled with water about up to the top of the inner shell *b*, leaving the upper part of the heater as a steam space. Then steam instead of water is caused to flow through the outlet pipe *e* in the ordinary manner to the radiator system, while the water of condensation returns through the pipe *f*. In the preferred embodiment of the invention, the heater shell is cylindrical, and the outer shell entirely surrounds the inner shell, so that the space between the two shells forms water-legs *c'*, and the space *g* in the interior of the inner shell forms the fire-space. Below the water-leg is a grate *h* and beneath the latter an ash-pit *i*. An outlet passage *j* opens from the top of the fire-space *g* and extends through the steam-space of the heater into a smoke-box *k* which is inclosed by a cover *l*. The usual smoke-flue *m* is connected with the smoke-box *k* and leads to a chimney.

Upon the outside of the outer shell *a* are formed gill flanges *n* extending radially outward and having lateral lips *o* forming separated parts of a cylinder outside of the shell *a*. The flanges *n* and lips *o* inclose vertical passages *p* which lie on the outside of the heater and open at their upper ends into the smoke-box *k*, and at their lower ends into another smoke-box *k'*, from which leads a flue *q* connecting with the smoke-flue *m* at a point somewhat removed from the body of the heater. A damper *r* is provided for the smoke-flue *m* between the heater and the point at which the flue *q* joins it, while additional dampers *s* and *t* are provided in the flues *q* and *j*, respectively. Each of these dampers can be operated independently so as to open or shut off any or all of the flues, as desired. When the damper *t* is opened, it is raised into a pocket *l'* formed in the top of the cover *l* to receive it.

A passage *u* opens from outside the heater into the upper part of the fire-space *g* and

is closed by a door v in which is a damper v'. Fuel for feeding the fire is thrown in through the door v and air may also be admitted by opening the damper v' or by opening the door. In the ash-pit wall is a second door w having a damper w', the door being provided for removing ashes and the damper for admitting air to the lower part of the fire beneath the grate when desired. A third door x opens into the fire-space a short distance above the grate, through which clinkers may be removed. Holes y are cast in the shell of the heater passing through the water-leg and forming a communication between the fire-space and the lower smoke-box k'.

From the foregoing it will be seen that by a suitable manipulation and adjustment of the dampers, a draft may be caused in either direction or both directions at once, through the fire-box, and also in either direction through the external passageways p. For instance, if the damper r is closed dampers t and s opened and holes y plugged or covered by sliding dampers as hereinafter described, the draft will flow from the smoke-box k downwardly through the outer passages p and upward through the flue q. On the other hand, if dampers s and t are closed and damper r is opened, the draft will be through the hole y upward, through passages p into and away through the flue m. Furthermore, by closing damper t and opening the damper v' in door v, the inflow of air for the combustion will be through the fuel-door, downwardly through the fire, and out through the holes y into smoke-box k', from which the products of combustion may flow either upward through the passages p, or through the flue q, according to the position of dampers s and r. By opening both the dampers v' and w', air may be admitted into the top and bottom of the fire-space at once, the products of combustion being exhausted through the holes y. When, however, an upward draft through the fire is required, the damper t is opened, door v and damper v' are closed, and either the door w or damper w' opened, whereupon air is admitted to the bottom of the fire-space and the products of combustion exhausted from the top thereof in the ordinary manner.

The particular value of the heater constructed as above described consists in its capability of burning either soft or hard coal, and of burning the former with almost complete combustion, and without the formation of smoke, soot, etc., and without the loss of any of the combustible products of combustion. When soft coal is burned, the grate is covered with ashes to a level nearly up to that of the holes y and the fuel is placed on top. The dampers w', s and t are closed while dampers v' and r are opened. This causes the fresh air to be admitted into the upper part of the fire-space, and the products of combustion to be withdrawn through the holes y and carried through the passages p into the outlet. By this means all of the volatile products of combustion are carried through the zone of incandescent fuel and are entirely converted into incombustible gas, whereby all the potential heat energy of the fuel is utilized.

When coal is burned with an up-draft, the radiant heat from the incandescent fuel distils the green fuel above it, sending off the volatile products in the form of gases which are too cool to ignite. Thus their heating value is entirely lost. Upon the green coal becoming somewhat more heated, the volatile products are partially burned, but the air after passing through the hot fuel is too much depleted of its oxygen to produce complete combustion. There is only enough oxygen remaining to combine with the hydrogen of the volatile products and set free the carbon contained therein as a black soot. Upon a higher temperature being reached, and the air still having an insufficient amount of oxygen, the hydrogen reduces some of the carbon-dioxid gas already formed, with the formation of carbon-monoxid, and there being also insufficient oxygen, most of the fuel which is combined is converted simply into a monoxid instead of into the dioxid. It is not until the whole mass of fuel approaches incandescence that all of the combustible is combined with oxygen and caused to give up its entire available heat, and every time fresh fuel is thrown on, the same process of distillation and loss of volatile combustible is repeated. By the method of combustion possible with my down-draft arrangement, the same process of distillation takes place in the green fuel, but the volatile products instead of passing away from the source of heat, are carried with the inflowing air through the hottest part of the fire, and there being sufficient oxygen mixed with them they are totally burned, and the reducing action of the liberated hydrogen upon the already-formed carbon-dioxid referred to above is prevented by reason of the fact that sufficient air can be supplied. In case it is desired to force the heater to burn the coal as rapidly as possible and obtain a rapid generation of heat, then the draft in the lower door will also be opened and air admitted both from above and below the fuel. In this case there will be a smaller quantity of ashes on the grate than when the simple down-draft is employed, so that the greater part of the fire-space will be filled with fuel and a large quantity of the latter exposed to the air.

It will be noted that the outlet j passes directly upward from the top of the fire-space, and so is contained within the steam-

space of the heater when the latter is used for generating steam. By this arrangement it is possible to discharge the products of combustion through the steam-space, whereby the steam may be superheated.

It will be noted in Figs. 1 and 3, that between the lips o of the gill flanges n are left small channels z, which, as will be seen from Fig. 1, extend through the greater part of the height of the flanges and almost entirely separate them from each other. They are provided so that the passages p may be cleaned by inserting a paddle through the slots, and moving it up and down. These slots are interrupted and the flanges made continuous at their upper ends and their middle portions in order to give greater strength. Escape of products of combustion through the slots z is prevented by an outer shell consisting of two sheet-iron bands or plates a^2 which are hinged to the back of the heater, and are detachably secured together in front by fastenings b^2. They fit closely around the gill flanges and may be opened when the passages between the latter are to be cleaned. When the cleaning is being done, the damper s is closed and dampers t and r opened. The holes y may also be plugged up if necessary, or closed by sliding dampers y^3 (shown in Fig. 9) and thereby the products of combustion are caused to pass away without going through the passages. It is not essential, however, that the channel z should be left between the lips of the gill flanges, since such lips may be joined together, and thus there will be formed by the connected flanges, closed tubes on the outside of the heater shell. In order to provide for cleaning these tubes, I may make the modified construction shown in Figs. 6 and 7, wherein the smoke box is formed by setting a cylindrical rim l^3 on top of the boiler shell, and providing the same with a circular cover plate l^3 having openings in line with each of the tubes or passages p, which are ordinarily closed by small stoppers or covers l^4. These small covers may be removed and a brush inserted through the holes through the passages. A number of separated rods l^5 resting on the top of the heater shell support the smoke box cover. In all other respects, with a single exception hereinafter noted, the heater shown in Figs. 6 and 7 is identical with the form previously described.

The bands or plates a^2 hereinbefore described may or may not extend through the entire length of the outer shell a, but preferably they extend only as far as the lower ends of the gill flanges, the lower part of the heater being inclosed by the separate plates or bands a^3 mounted similarly to the bands a^2, which are secured by similar fastenings b^3. These bands form between themselves and the outer shell of the heater, the annular smoke chamber k', and may be opened to clean the latter of ash, cinders, etc. In the plates a^3 are formed holes a^4 of which each is in line with one of the passages y opening from the fire-space into the chamber k', to permit insertion of plugs to stop up the passages, and of a cleaning brush to clear these passages of accumulations of ash and coal. Cover plates a^5 are pivoted to plates a^3, and may be swung over the holes a^4 to cover them, and away to open the holes. By having the outer sheath divided in this manner, intermediate its height, it is possible to allow the upper part to remain closed nearly all of the time, and to permit the lower part to be cleaned frequently without entirely uncovering the heater. It is also not necessary to have the outer sheath removable, and this is particularly the case where the tubes p can be cleaned from above, as in the construction of Figs. 6 and 7. In this case, the whole of the heater except the lower casing plates may be covered with a layer a^6 of asbestos or other non-conducting material, while the lower separable casing plates a^3 may be made as shown in Fig. 5, of two outer plates a^{31} of iron, and an interposed layer a^{32} of asbestos, the whole being connected together by widely separated rivets a^{33}. This heat resisting construction is necessary in most cases, because, when the heater is run with the down draft the flames and hot gases coming through the holes y impinge directly upon the plates a^3. If these plates were simply of sheet iron without an intermediate layer of insulating material, the plates would quickly become red hot.

The same principles of construction and operation by which draft in either or both directions at once may be obtained through the fire, are shown in Figs. 8 and 9, as applied to a sectional heater. As here shown, each section is composed of an outer shell a, inner shell b, forming between them a steam or water space c, and water legs c', and inclosing the fire space q, while the outer shell has flanges n' forming passages p which lead from the upper smoke box k to the lower smoke chamber k'. The shells are cast with passages y leading through them and opening into the lower smoke chamber and the fire space. Flat plates a^7 are hinged to the sides of the sections at their lower parts, and inclose the chambers k'. These plates may, if desired, be integral or fixedly secured to the shell. The forward section has a wall extending across its front end in which is a fuel door v, an ash door w, and a clinker door x, while the rear section has the outlet flues m and q, the same as previously described. Each section has a passage j leading through the water space and opening from the fire space into the smoke box k, which passage is adapted to be closed by a damper t. The grate h extends

the length of the heater. The sections where they come together have vertical plane end walls b^4 inclosing the water chambers which lie in contact, as shown in Fig. 8, and have registering openings c^2 and c^3, the former being in the space occupied by the steam when the heater is used as a steam generator, and the latter being at the bottom of the water legs. Push nipples d^3 are forced into the holes of the adjacent sections. When the front and rear sections are placed together, the heater has its smallest dimensions, but the same can be easily enlarged by separating these sections and inserting as many intermediate sections, which are flat both in front and in rear, as may be required to suit the purpose for which the heater is intended. The draft holes y are approximately vertical and may be cleaned by shaking the outside grate bars h' which come directly under them.

A water-glass is represented in Figs. 1 and 2 by c^2, and a pressure gage by d^2. When the apparatus is used for a hot-water system, the water-glass c^4 is omitted and the gage applied directly to the outlet-pipe e.

Under the ordinary conditions of running the heater, the products of combustion are caused to flow through the passages p in contact with the gill flanges n, and the lips o of the latter. Thereby the hot gases are brought into contact with a large area of iron, and their heat is rapidly absorbed by the latter, and conducted to the water in the heater. In order to absorb the greatest possible proportion of the heat from the gases, the area of iron with which they come in contact should be made as great as possible, and the flanges should be integral with the shell, and this is done by the arrangement of flanges shown and described above.

I claim:—

1. A heater having a fire space, a fuel support, draft outlets through the sides of the fire-space above said support, draft inlets respectively above such passages and below the fuel support, a draft outlet from the top of the fire-space, and means for independently opening and closing said draft inlets and outlets, whereby a draft may be created through the fuel in either direction exclusively, or both directions at once.

2. A heater comprising a water-space, a fire-space, a discharge flue, passages within and without the water-space communicating with the fire-space and the discharge flue, and dampers for said passages for governing and reversing the direction of the draft through said passages.

3. A heater comprising a water-space, a fire-space, a discharge flue, passages within and without the water-space communicating with the fire-space and the discharge flue, a fuel-support within the fire space, admission openings above and below the fuel-support, and dampers for causing air to flow through the fire-space and external passages in either direction.

4. A heater comprising a water-space, a fire-space, a discharge flue, passages within and without the water-space communicating with the fire-space and the discharge flue, a fuel-support within the fire space, admission openings above and below the fuel support, and dampers independently operable to produce a flow of air downwardly or upwardly downwardly through the external passages.

5. A heater comprising a fluid-space, a fire-space, a direct outlet from the fire-space through the fluid-space, provisions for admitting air to the upper and lower portions of the fire-space, a draft outlet below the upper air-inlet, passages external to the fluid space communicating with the last-named draft outlet, and independent dampers for opening or closing the inlets and outlet and either end of the external passages.

6. A heater comprising a fluid-space, a fire-space, a direct outlet from the fire-space through the fluid-space, an exhaust flue into which said outlet opens, provisions for admitting air to the upper and lower portions of the fire-space, a draft-outlet below the upper air-inlet, passages external to the fluid-space communicating with the last-named draft-outlet, and opening at their opposite ends into the exhaust flue, and independent dampers for opening or closing the inlets and outlet and either end of the external passages.

7. A heater comprising a water and steam receptacle, a fire-space within the said receptacle, an outlet for the products of combustion leading through the steam-space of the receptacle, and external conduits for leading the products of combustion in contact with the shell of the heater beside the steam space, whereby the steam in the latter may be superheated.

8. A heater comprising a water and steam receptacle, a fire-space within the receptacle, an internal outlet conduit for the products of combustion leading from the upper part of the fire-space through the steam space of the receptacle, conduits leading from the lower part of the fire-space upward externally beside the steam space, and provisions for controlling the flow of the products of combustion so that they may pass through either.

9. A heater comprising a water and steam receptacle, a fire-space within the receptacle, an internal outlet conduit for the products of combustion leading from the upper part of the fire-space through the steam space of the receptacle, conduits leading from the lower part of the fire-space upward externally beside the steam space, and provisions for controlling the flow of the products of combustion so that they may pass through

either the internal or external conduits exclusively, or through all, and in either direction through the external conduits.

10. A heater comprising a shell adapted to contain a heat-carrying medium and inclosing a fire-space, an outlet conduit leading from the upper part of said fire-space through said shell, flanges projecting outward from the exterior of the shell and having lateral lips, approaching each other, forming passages which communicate with the lower part of the fire-space, and means for causing the products of combustion to pass through either the internal conduit or the external passages at will.

11. A heater comprising a shell adapted to contain a heat-carrying medium, flanges projecting outward from the shell and having lateral lips approaching each other, forming passages, and a fire-chamber within the heater having an outlet for the products of combustion connecting with the above-named passages.

12. A heater comprising a shell adapted to contain a heat-carrying medium, flanges projecting outward from the shell and having lateral lips approaching each other, forming passages partly open on the outer sides, an outer sheath fitting about the flanges to close the spaces between them and removable to permit cleaning the passages, and a fire-chamber within the heater having an outlet for the products of combustion connecting with the above-named passages.

13. A heater comprising outer and inner shells including between them a water-chamber, and within the inner shell a fire-space, flanges projecting from the outer shell, a sheath or casing surrounding the flanges and inclosing longitudinal passages, a fuel-support below the fire-space, provisions for admitting air to the fire-space above and below the fuel-support, and passages through the heater shells at a level between the air inlets opening internally into the fire-space and externally below the passages between the external flanges.

14. A heater comprising a shell adapted to contain a heat-carrying medium and having integral outwardly projecting flanges on the exterior of the shell spaced apart from each other to provide conducting passages, and a combustion chamber within the heater having outlets for the products of combustion opening into said passages.

15. A heater comprising a shell having a fluid chamber, and within the same a combustion space, separated flanges inclosing passages on the exterior of the heater shell, which passages open into an annular chamber surrounding the shell, passages extending from the combustion space to said chamber to permit escape therethrough of the products of combustion, and a separately removable sheath closely surrounding said flanges and forming the outer wall of said passages and annular chamber.

16. A heater comprising a shell having a fluid chamber, and within the same a combustion space, separated flanges inclosing passages on the exterior of the heater shell, which passages open into an annular chamber surrounding the shell, passages extending from the combustion space to said chamber to permit escape therethrough of the products of combustion, and an outer sheath or casing surrounding and forming the outer wall of said annular chamber, consisting of plates pivoted to the heater each inclosing a part thereof and adapted to be independently swung open to expose the passages.

17. A heater comprising a shell having a fluid chamber, and within the same a combustion space, separated flanges inclosing passages on the exterior of the heater shell, which passages open into an annular chamber surrounding the shell, passages extending from the combustion space to said chamber to permit escape therethrough of the products of combustion, and an outer sheath or casing surrounding and forming the outer wall of said annular chamber, having openings in line with the several last-named passages to permit admission of a cleaning instrument, and removable closures for such openings.

18. In a heater having inner and outer shells containing a fluid space and a combustion chamber, integral flanges formed on the outer shell inclosing passages extending up and down, and connecting at their lower ends with the combustion chamber, and opening at their upper ends into a smoke box, a cover for the smoke box having openings in line with said passages permitting insertion of a cleaning instrument, and displaceable closures for such openings.

19. In a heater having outer and inner shells inclosing a liquid chamber and a fire space, flanges on the upper part of the outer shell spaced apart to form flues or passages, and removable plates outside of the lower portion of the shell, forming a chamber beneath said flanges, and passages opening from the fire space into said chamber, each plate consisting of a plurality of metal layers with an interposed asbestos sheet, secured together.

20. A sectional heater, each section of which has inner and outer shells containing between them a fluid chamber, and within the inner shell a fire space, the outer shell having exterior flanges on its upper part forming separated passages, outlets from the fire space through both shells and the water space, and movable plates outside the outer shell forming chambers into which the fire-space outlets open.

21. A sectional heater, each section of which has a fire space, shells outside of such

space inclosing between them a fluid space, outlets from the upper and lower parts of the fire space for escape of the products of combustion, and openings to the fluid space for connection with the adjacent sections to permit flow of fluid from one to another, and an end section having provisions for admitting air above and below the fuel in the fire space.

22. A heater having a fire space, a fluid space, provisions for supplying fuel into the upper part of the fire space, and an arrangement of draft passages adapted to permit a draft downwardly through the fresh fuel and upwardly through the burning fuel, the heater being composed of sections placed side by side and the fluid spaces of adjacent sections connected together.

In testimony whereof I have affixed my signature, in presence of two witnesses.

HUGH KELSEA MOORE.

Witnesses:
GEO. F. RICH,
MABEL E. DOOLEY.