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HEATER

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Fig. 1.

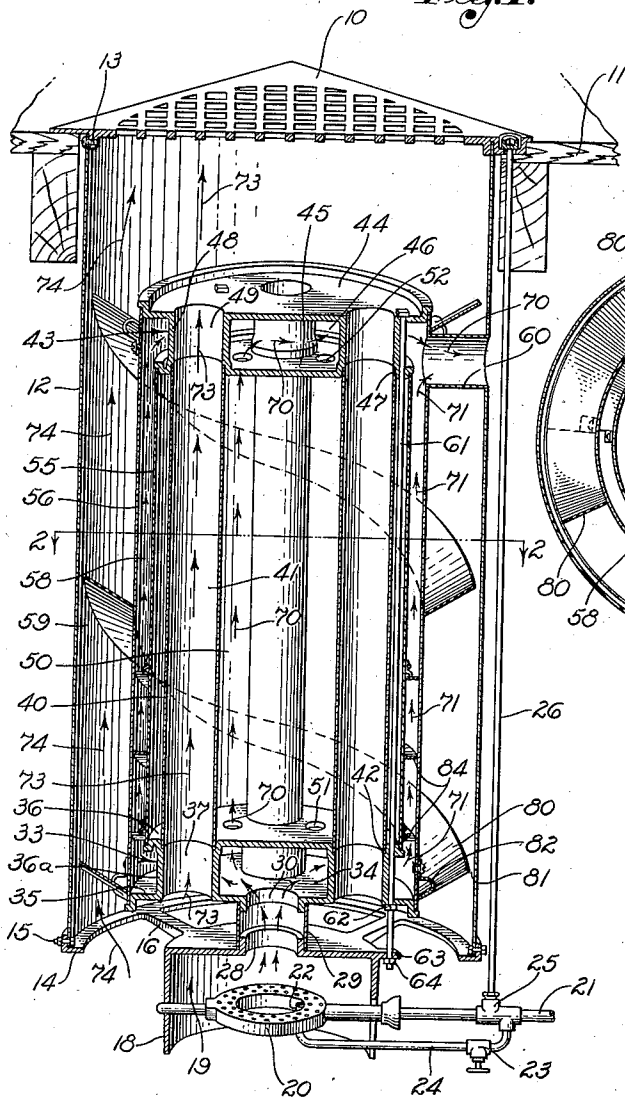
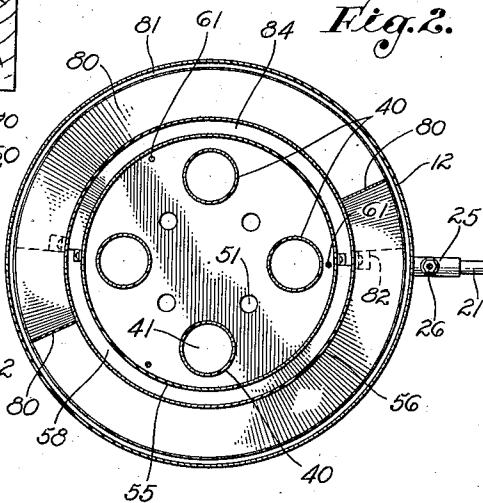


Fig. 2.



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HEATER

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8 Claims. (Cl. 126—116)

My invention relates to a novel heater particularly valuable as an air heater for circulating warm uncontaminated air in a room or other structure.

5 In general, the invention provides a novel heat-transfer system for transferring heat between certain heated products and the medium to be heated. For purpose of illustration I will particularly define the invention in conjunction with
10 a floor furnace structure, though it will be clear that the invention can be utilized in other positions, as for instance by being positioned in the room to be heated, or in other relationships. Thus, with only slight modifications the invention
15 can be utilized as a furnace conducting heated air to various rooms or structures through suitable distribution pipes receiving and transmitting the heated air.

20 It is an object of the present invention to provide a novel heating structure in which both the air and the heated products move constantly upward, and in which no high back-pressures are built up.

25 The invention also includes among its objects the provision of a novel heat-exchange structure providing adjacent primary and secondary passages, the heated products moving through one of these passages and the air moving through the other of these passages so that no contamination of the air by the heated products will
30 result.

35 It is a further object of the invention to provide a structure including one or more novel head structures and to provide a novel relationship between one or more head structures providing chambers therein and one or more tubular structures extending therefrom or therebetween.

40 Another object of the invention is to provide a novel system of venting the heated products from the heater.

45 It is another object of the invention to provide a novel baffle means in the air passage or in the heating passage or in both, and, in one embodiment of the invention, to so position such baffle means as to retard the air or heated products or both in only one end of the passages through which such materials flow.

50 Still another object of the invention lies in providing heating passages and air passages interspaced in a novel manner.

55 Further objects of the invention lie in the constructional details of the heater including the structure utilized for holding the elements in fixed relationship.

Still further objects and advantages of the invention will be made evident to those skilled in the art from the following description.

Referring to the drawing:

Fig. 1 is a mid-sectional view of one embodiment of the invention in perspective.

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1.

If the invention is incorporated in a floor furnace as shown, a top member 10 in the form of 10 a suitable grid or register may rest on the floor 11. An outer shell 12 is secured to a depending flange of the top member 10 by any suitable means such as bolts 13.

This shell 12 may be of sheet metal construction and carries at its lower end a perforate member 14 secured thereto as by bolts 15 and forming a part of a base member, this perforate member including one or more openings 16 separated by outward-extending arms as shown and 20 communicating with the zone beneath the heater to receive the air to be heated, and to deliver this air to suitable passages to be hereinafter described.

Depending from this perforate member 14 and 25 forming a part of the control structure of the base member is a hood 18 open at its lower end and providing a heating or burner chamber 19 in which is positioned a heating means 20 shown as comprising a gas burner supplied with gas 30 through a pipe 21 and providing a suitable pilot 22, gas being delivered to this pilot in amount determined by the setting of a valve 23 in a pipe 24. A suitable valve structure 25 controls the flow to the burner and may be controlled 35 either directly or indirectly in any well known manner. In the embodiment shown, this valve is controlled by a rod 26 which extends upward through the floor 11 so that the valve structure 25 can be controlled from the room to be heated. 40 While I have shown the heating means 20 as comprising a gas burner, it will be clear that the invention is not limited to this feature. Any other type of burner or fire-box might be substituted or the heating means may comprise an 45 electric resistance unit or other heating unit.

Extending upward from the perforate member 14 is a collar 28 around which is positioned a sleeve 29 which receives a corresponding collar 30 of a lower head structure 33. This lower head 50 structure is of novel construction and provides a lower chamber 34 in direct communication with the burner chamber 19 through the collars 28 and 30 and the sleeve 29. Preferably this lower head structure is cast as a single unit 55

though it is possible to build up this head structure of separate units. This lower head structure provides a lower plate 35 and an upper plate 36 of somewhat smaller diameter, the chamber 34 being between these plates. A plurality of tubular members 36a extend between the upper and lower plates and thus through the chamber 34, defining auxiliary passages 37 which thus extend completely through the upper and lower plates and through the chamber therebetween.

A plurality of pipes 40 extend upward from the lower head structure 33 and provide main passages 41 which open on the auxiliary passages 37, cooperating therewith in defining a primary passage means. In the preferred embodiment of the invention the upper ends of the tubular members 36a provide sockets 42 which snugly receive the lower ends of the pipes 40.

Resting on the upper ends of the pipes 40 in the preferred embodiment of the invention is an upper head structure 43 which may be constructed identically with the lower head structure 33 except that no collar 30 or corresponding opening is provided. Thus, the upper head structure may include an upper plate 44 of somewhat larger diameter than a lower plate 45 thereof, an upper chamber 46 being formed between these plates. Sockets 47 corresponding to the sockets 42 receive the upper ends of the pipes 41, and tubular members 48 extend between the upper and lower plates across the upper chamber 46, providing auxiliary passages 49 which cooperate with the main passages 41 and with the lower auxiliary passages 37 in defining the primary passage means.

A suitable shell means extends between the upper and lower head structures and bounds an inner space 50 around the pipes 40. This inner space communicates with the lower chamber 34 through one or more openings 51 formed in the upper plate 36 and communicates with the upper chamber 46 through one or more openings 52 formed through the lower plate 45. A secondary passage means is thus provided by the chamber 34, the openings 51, the inner space 50, the openings 52, and the upper chamber 46.

In the preferred embodiment of the invention this shell means comprises a pair of concentric shells including a smaller or inner shell 55 extending downward from the periphery of the lower plate 45 of the upper head structure 43 to the periphery of the upper plate 36 of the lower head structure 33, these plates providing corresponding recesses receiving the ends of this inner shell. The other of these concentric shells is indicated by the numeral 56 and comprises a large or intermediate shell, extending downward from the periphery of the upper plate 44 of the upper head structure 43 to the periphery of the lower plate 35 of the lower head structure 33, suitable recesses being provided in these plates to receive the ends of this shell 56. The concentric shells 55 and 56 are spaced from each other to define an annular space 58 which communicates at its lower end with the lower chamber 34 and at its upper end with the upper chamber 46. In addition, the intermediate shell 56 cooperates with the outer shell 12 in defining an annular space 59 which, in the embodiment shown, receives a portion of the air moving upward through the opening 16 of the perforate member 14.

A suitable vent means is provided adjacent the upper head structure 43 and includes a vent

pipe 60 extending across the annular space 59 and communicating both with the upper chamber 46 and with the upper end of the annular space 58, conducting the products to the exterior of the outer shell 12. These products may be either discharged directly exterior of this outer shell or may be conducted from the vicinity of the heater by an additional vent communicating with the pipe 60.

My heater thus includes an inner structure comprising the upper and lower head members between which extend suitable tubular means such as the pipes 40 and the concentric shells 55 and 56. These elements are held together by any suitable means. In the embodiment shown a plurality of relatively long bolts 61 extend downward through the upper head structure 43 through the innerspace 50 and through the lower head structure 33, a nut 62 being threaded on this bolt to engage the lower plate 35, thus clamping the tubular means between the upper and lower head structures. This bolt may also extend downward through a lug 63 of the perforate member 14, receiving a nut 64 which clamps the sleeve 29 between the lower head structure 33 and the perforate member 14. This clamping means has been found to be very desirable in holding the elements of the inner structure together and also holding the inner structure relative to the perforate member 14.

In the structure shown the primary passage means conducts the air to be heated, while the secondary passage means conducts the heated products. It will be clear, however, that the opposite arrangement could be utilized without departing from the spirit of the invention. With the construction shown the heated products moving upward through the sleeve 29 can reach the vent 60 by two paths. The first of these paths includes the secondary passage means, the heated products moving upward from the lower chamber 34 through the openings 51 into the inner space 50 which thus comprises an inner heating space, these products then moving through the openings 52 and into the chamber 46 and being discharged through the vent pipe 60, this flow being indicated by the short arrows 70. The other path includes the annular space 58 which thus comprises an annular heating space, the products moving upward from the lower chamber 34 through this space to the upper chamber 46, or directly to the vent pipe 60, as indicated by the short arrows 71.

On the other hand, the air to be heated moves through two paths. The first of these paths includes the primary passage means, the air moving upward through the openings 16 of the perforate member 14 through the auxiliary passages 37, through the pipes 40 and through the auxiliary passages 49, the air continuing its upward movement by passing through the top member 10 and into the room. This path is indicated by the relatively long arrows 73. The second path for the air includes the outer annular space 59, the air rising through the openings 16 of the perforate member 14 and moving through the outer annular space 59 and thence through the top member 10 into the room, this path being indicated by the relatively long arrows 74.

It will be noted that as the air and the heated products move upward through their corresponding passages they are in heat-transferring relationship, it being necessary for the heat to pass through relatively thin walls usually of sheet metal construction. To further increase this

heat transfer, it is possible to dispose a suitable baffle means in such position as to retard the upward movement of the air or the heated products or both. In the form of the invention illustrated, this baffle means is of novel construction. I have found that a helically disposed baffle means is very effective in this regard. As illustrated, a helical vane 80 is positioned in the outer annular space 59, engaging the intermediate shell 56 but extending only partially across the outer annular space 59, the outer portion of this vane terminating short thereof to define a clearance space 81. Further, I have found it advantageous to incline this vane rather than permitting it to extend horizontally from the intermediate shell 56. By thus inclining the helical vane means from the horizontal, an imaginary radially extending vertical plane traversing the outer annular space 59 will intersect the helical vane 80 in a line inclined from the horizontal rather than in a line extending horizontally. Such a helical vane 80 causes a major portion of the air to spiral around the outer annular space 59, a smaller portion of this air being guided upward by the inclined surface of the vane so as to move through the clearance spaces 81. Such a construction maintains the outer shell 12 cooler than would otherwise be the case, thus reducing heat losses to the surrounding atmosphere.

While any suitable means may be utilized for securing the helical vane 80 in place, I prefer to cut the lower and upper portions of this vane inward from the periphery thereof, leaving a tongue 82 which can be bent inward and secured to the intermediate shell 56 as shown. In the preferred embodiment I prefer to utilize two of the vanes 80, each vane making one complete turn between the lower and upper ends of the outer annular space 59. With this construction one vane 80 will start and terminate on one side of the intermediate shell 56, while the other vane will start and terminate on the other side of this intermediate shell 56.

A similar helical baffle means may be disposed in the inner annular space 58 through which the heated products rise. Such a baffle means may be constructed as previously described, being composed of two helically disposed vanes 84 each making one complete revolution in the inner annular space 58 between the lower and upper ends of this vane. While the vanes 84 can terminate short of the intermediate shell 56, and while these vanes may be inclined upwardly as indicated with respect to the vanes 80, this is not necessarily the case. In the embodiment shown the vanes 84 extend horizontally across the inner annular space 58, extending completely across this space so as not to provide the clearance spaces 81 previously described.

In many instances I have found it advisable to utilize helical vanes in only the lower portion of the annular space. Thus, in Fig. 1 the helical vanes 84 terminate at their upper ends near the mid-portion of the annular space 58 and do not extend completely therethrough. The result is that the heated products are moved spirally and are confined in only the lower portion of the annular space 58. By thus confining the heated products, the walls bounding this annular space 58 will be much warmer toward the lower ends thereof than toward the upper ends thereof. Correspondingly, the vanes 80 may extend only in the lower portion of the outer annular space 59, correspondingly retarding the air in the lower portion of this annular space. However, this fea-

ture is not essential in this outer annular space 59, and the helical vanes 80 may extend completely therethrough, especially if clearance spaces 81 are provided.

The advantages of my invention are manifold. My tests adequately indicate that its heat-transfer efficiency is extremely high. This is due to the fact that substantially all of the heat units are conducted from the heated products before they are discharged through the vent pipe 60, my tests indicating that the temperature of the vented products is only very slightly higher than the temperature of the air expelled into the room. This increased thermal efficiency is also accounted for in the preferred embodiment of the invention by the provision of an air passage which completely surrounds the hot inner structure of the heater. By this construction the outer shell 12 is maintained relatively cool so that radiation or conduction losses to the surrounding atmosphere are minimized. It will be quite apparent that if the heated products were moved upward through the outer annular space 59, this outer shell 12 would be excessively warm, resulting in a large wastage of heat to the surrounding atmosphere.

Another feature of my invention is that the heated products and the air to be heated move constantly upward in the heater, the direction of movement thereof being never reversed as in certain existing heaters. A very satisfactory circulation of air is thus provided, and there is no zone in the path of travel of the heated products in which unburned-gas may accumulate with a consequent explosion hazard. Furthermore, the upward flow of the air and the heated products is maintained without building up of excessive back-pressure, yet the air and the heated products are moved by the baffle means so as to "scour" the walls of the corresponding passages, setting up sufficient turbulence so that all portions of the air or heated products come into pressure-transferring relationship with the walls of these passages. In addition, the heated products are always maintained separate from the air to be heated. Thus, in heating with natural or artificial gas no carbon monoxide can enter the room to be heated.

The upper and lower head structures are also important features of the invention, the chambers therein being of especial advantage in receiving and distributing the heated products and in venting the products from the upper end of the inner structure.

Finally, the invention does not recirculate the contaminated air already in the room to be heated. Instead, a continuous flow of fresh air reaches the lower end of the heater and moves upward into the room after being heated.

While I have described in detail one embodiment of the invention it will be clear to those skilled in the art that other embodiments can be utilized, and that the features herein set forth could be utilized in various other types of heater. Various changes may thus be made in the construction of my heater without departing from the spirit of the present invention.

I claim as my invention:

1. In combination in a heater: a head structure providing a small plate and a larger plate spaced from each other to define a chamber and providing a plurality of tubular members which extend through said chamber and providing auxiliary passages extending completely through said plates and said chamber therebetween said

auxiliary passages receiving the air to be heated; a small shell extending away from said head structure and contacting said small plate near the periphery thereof; a larger shell concentric with said small shell and contacting said larger plate, said shells being spaced from each other to define an annular space communicating with said chamber; and heating means communicating with said chamber and with said annular space for delivering heated products thereto.

2. In combination in a heater: a pair of vertically extending concentric shells spaced from each other to define an annular heating space, the inner of said concentric shells providing an inner heating space; a heating means below said shells and delivering heated products to said annular heating space and said inner heating space; pipe means traversing said inner heating space and providing passage means for conducting the air to be heated upward therethrough; a perforated base member providing one or more passages conducting air to the lower ends of said pipe means; and vent means communicating with the upper ends of said annular heating space and said inner heating space for conducting said products therefrom.

3. A combination as defined in claim 2 including baffle means in said annular heating space for retarding the upward movement of said products therein, said baffle means extending through only a part of the vertical dimension of said annular heating space to retard the upward movement of said products in only said portion.

4. In combination in a heater: a head structure providing lower and upper plates spaced from each other to define a chamber and providing a plurality of tubular members which extend through said chamber and define auxiliary passages which extend completely through said upper and lower plates and said chamber therebetween; a plurality of vertically-disposed pipes extending from said head structure and providing main passages forming continuations of said auxiliary passages, said main and auxiliary passages thus forming a primary passage means; shell means around said pipes and extending from said head structure and providing an inner space around said pipes, the one of said plates adjacent said pipes providing one or more openings communicating between said chamber and said inner space whereby said chamber and said inner space form a vertically-extending secondary passage means, one of said passage means communicating with the air to be heated, said shell means including two concentric shells extending from said head structure and spaced from each other to define an annular space communicating with said chamber, the inner of said concentric shells bounding said inner space; and a heating means communicating with the other of said passage means for delivering heated products thereto.

5. In combination in a heater: a lower head structure providing upper and lower plates spaced from each other to define a lower chamber and providing one or more tubular members which extend through said lower chamber to define lower auxiliary passages which traverse said plates and said chamber therebetween; an upper head structure providing upper and lower plates spaced from each other to define an upper chamber and providing one or more tubular members which extend through said upper chamber to define upper auxiliary passages which traverse the upper and lower plates and said upper chamber defined therebetween; one or more

pipes extending between said upper and lower head structures and providing main passages connecting said upper and lower auxiliary passages to define a primary passage means; shell means extending between said upper and lower head structures around said pipes and including two concentric shells extending between said head structures and spaced from each other to define an annular space communicating between both of said chambers, the inner of said concentric shells bounding an inner space around said pipes, said lower plate of said upper head structure and said upper plate of said lower head structure providing one or more openings communicating between said inner space and said upper and lower chambers whereby said chambers and said inner space form a vertically-extending secondary passage means, one of said passage means communicating with the air to be heated; and a heating means communicating with the other of said passage means for delivering heated products to one end thereof.

6. In combination in a heater: an upper head structure providing upper and lower plates spaced from each other to define an upper chamber and providing one or more tubular members which extend between said upper and lower plates through said upper chamber to define upper auxiliary passages which traverse said plates and said upper chamber therebetween, the lower plate of said upper head structure being smaller than said upper plate thereof; a lower head structure providing upper and lower plates spaced from each other to define a lower chamber and providing one or more tubular members which extend through said lower chamber to define lower auxiliary passages which traverse the upper and lower plates and said lower chamber defined therebetween, said upper plate of said lower head structure being smaller than said lower plate of said lower head structure; shell means including a long large shell extending between the upper plate of said upper head structure and the lower plate of said lower head structure and including a shorter smaller shell extending between said lower plate of said upper head structure and said upper plate of said lower head structure, said shells being spaced from each other to define an annular heating space communicating with said upper and lower chambers, said smaller shell bounding an inner space around said pipes, said lower plate of said upper head structure and said upper plate of said lower head structure providing one or more openings communicating between said inner space and said upper and lower chambers whereby said chambers and said inner space form a vertically-extending secondary passage means, one of said passage means communicating with the air to be heated; and a heating means communicating with the other of said passage means for delivering heated products to one end thereof.

7. A combination as defined in claim 4 in which said one of said plates providing said openings is of smaller diameter than the other of said plates, and in which the smaller of said concentric shells extends away from and contacts said smaller plate near the periphery thereof, and in which the larger of said concentric shells extends away from and contacts the larger of said plates to permit direct communication between said annular space and said chamber.

8. In combination in a heater: an upper head structure providing a large upper plate and a small lower plate spaced from each other to de-

fine an upper chamber and providing one or more tubular members extending through said upper chamber to define one or more auxiliary passages which extend completely through said upper
5 chamber; a lower head structure providing a small upper plate and a large lower plate spaced from each other to define a lower chamber and providing one or more tubular members extending through said lower chamber to define one or
10 more auxiliary passages which extend completely through said lower chamber; means extending between said upper and lower head structures to define heat-transferring passage means one of which includes said auxiliary passages, said
15 means including a long large shell extending be-

tween the large upper plate of said upper head structure and the large lower plate of said lower head structure and including a shorter smaller shell extending between the small lower plate of said upper head structure and the small upper
5 plate of said lower head structure, said shells being spaced from each other to define an annular space communicating between said upper and lower chambers and forming another of said pas-
10 sage means; and heating means communicating with one of said passage means, the other of said passage means communicating with the air to be heated.

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