F. D. SCHNEIDER.

HEATER.

APPLICATION FILED APR. 13, 1912.

1,077,761.

Patented Nov. 4, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

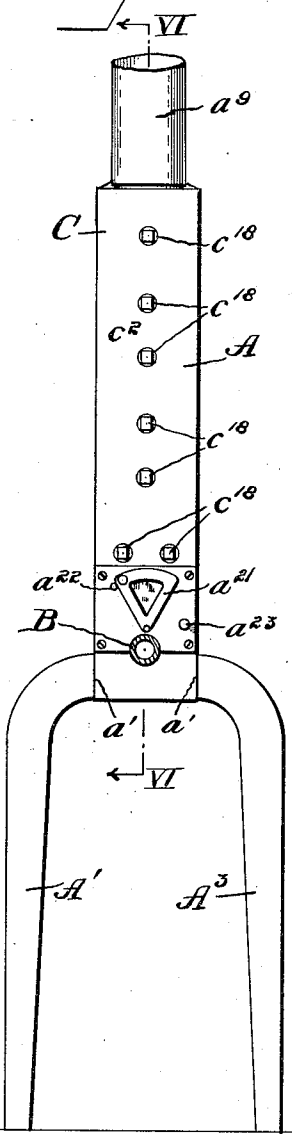
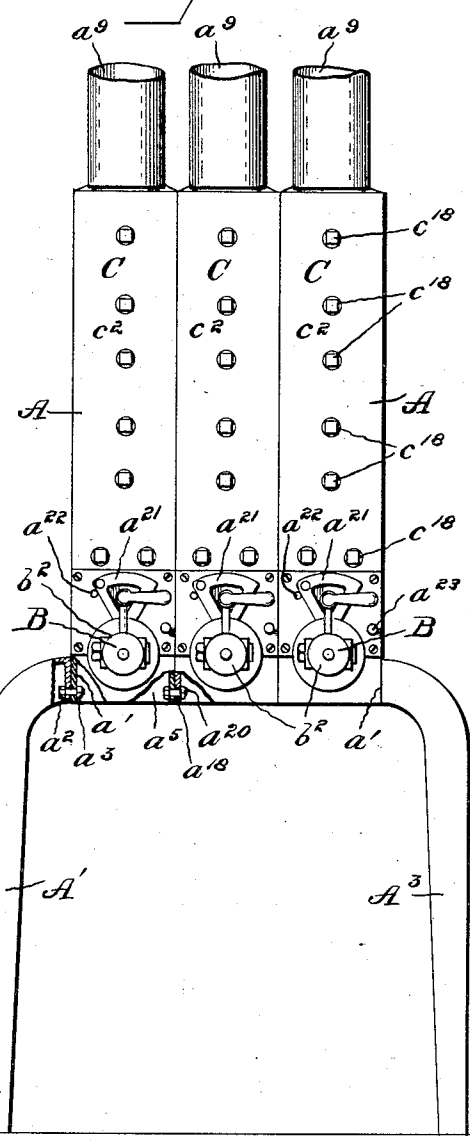


Fig. 2.



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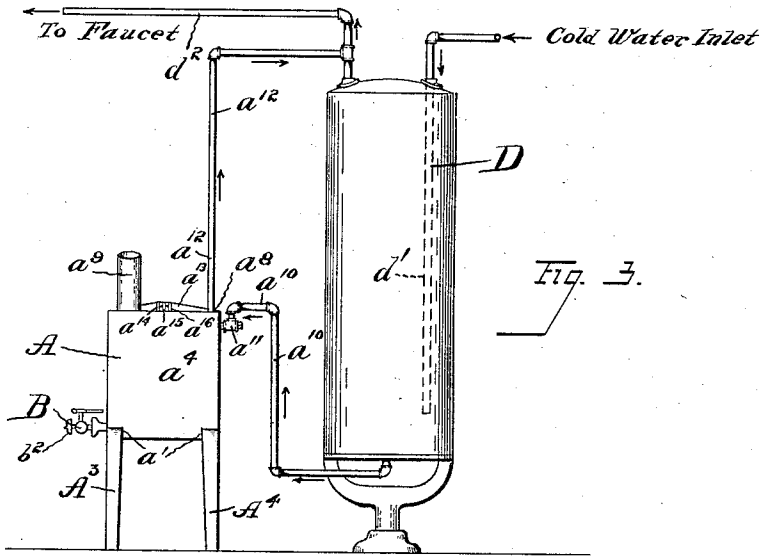


Fig. 3.

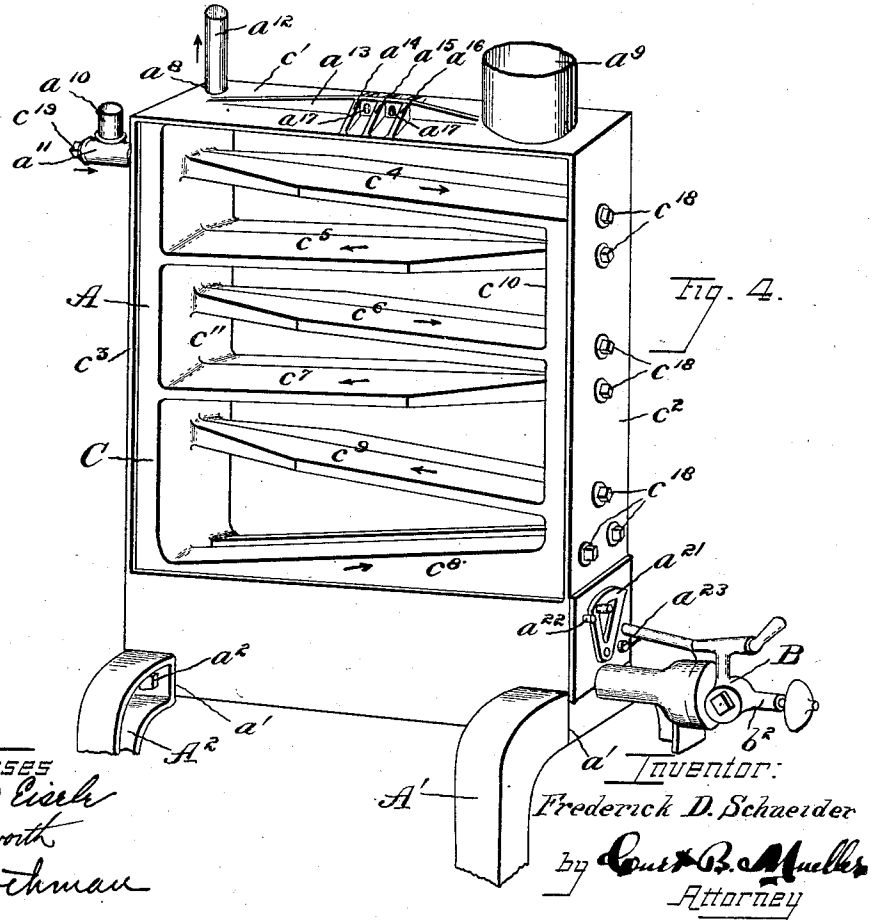


Fig. 4.

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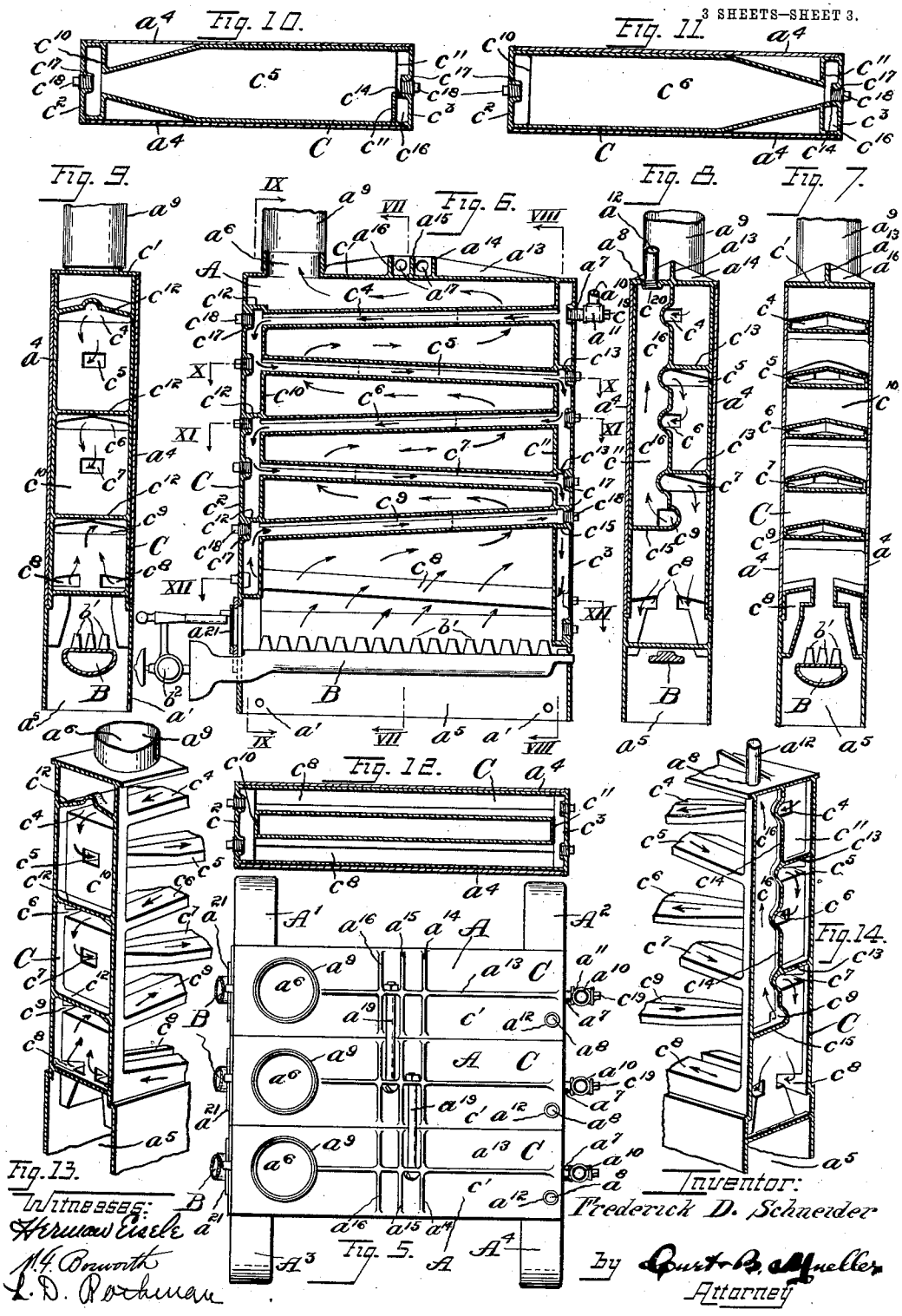
HEATER.

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1,077,761.

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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HEATER.

1,077,761. Specification of Letters Patent. Patented Nov. 4, 1913.

Application filed April 13, 1912. Serial No. 690,489.

To all whom it may concern:

Be it known that I, FREDERICK D. SCHNEIDER, a citizen of the United States, resident of Bedford, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Heaters, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The invention upon which this application is based has reference to heaters, while more particularly to a heater embracing such preferred structural elements as will together originate a single efficient unit purposed to carry out the "method of utilizing heat" set forth in my most recent application, Serial Number 687,649 filed April 1, 1912.

The said invention consists of means which are hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain means embodying my invention, the disclosed means, however, constituting but one of various mechanical forms in which the principle of my invention may be applied.

With reference to the drawings in which like characters of reference designate like parts throughout the several views these are now enumerated in logical sequence as follows:

Figure I is an end view of a heater embodying the invention. Fig. II is a similar view of a plurality of such heaters arranged in series. Fig. III is an elevation showing a heater embodying my invention connected as a closed-circuit-system with a hot water tank, and corresponding with Fig. II of said "method" application. Fig. IV is a perspective of my heater proper with certain parts removed. Fig. V is a partial top plan of Fig. II disclosing a mode of attachment. Fig. VI is a section on line VI—VI of Fig. I looking in a direction nearly opposite to that from which Fig. IV is presented, and corresponds, but for slight modifications, with Fig. V of my method application above referred to. Fig. VII is a full section on line VII—VII of Fig. VI looking in the direction of the indicating arrows. Fig. VIII is a similar section taken on line VIII—VIII of Fig. VI in the same direction of vision. Fig. IX is a like section on line IX—IX looking in the opposite direction. Fig. X is again a full section on line X—X of Fig. VI looking downwardly. Fig. XI is the sectional view on line XI—XI of Fig. VI likewise looking downwardly as suggested by the arrows. Fig. XII is a section similar to those described in the two previous views taken on this line XII—XII of Fig. VI. Fig. XIII is a partial perspective of the end through which the section corresponding to Fig. IX—IX is taken, showing some outermost members removed. Fig. XIV is a view after the manner of the one last described of the opposite end.

I choose to removably mount my heater through the medium of the end faces of its rectangular casing A between four similar standards A', A^2, A^3, A^4. For this purpose the lower corners a' of the casing A are complementarily fitted with the upper extremities of the standards as suggested in Figs. II and IV. The removable connection may be readily effected by means of bolts a^2 and nuts a^3. The casing A except for two lateral plates a^4 is formed of a single integral casting. It is closed save for a lower draft opening a^5, an upper flue opening a^6, the cold water inlet a^7 and the hot water outlet a^8 and such other openings as it may occasionally become desirable to expose, but of which mention will later be made, their differing purposes being likely to be then better understood. A suitable stack a^9 is mounted over the flue opening a^6 while a cold water inlet pipe a^{10} communicates with the inlet a^7 through a T a^{11}, and a pipe a^{12} communicates directly with the hot water outlet a^8 and all of which are well shown in Fig. VI. The top of the casing is as shown provided with a central longitudinal rib a^{13} and three centrally disposed transverse ribs a^{14} a^{15} a^{16} each of which intersect the former as clearly seen in Figs. III and IV. Each of the two portions of the rib a^{13} that lie between the central rib a^{15} and the outer ribs a^{14} and a^{15} are provided with an opening, both designated as a^{17}. Furthermore the lower lateral sides are provided with a plurality of suitably though correspondingly disposed openings all referred to as a^{18}.

As should now be apparent the possibility is afforded of assembling any number of heaters in either a jointly or severally operating series, depending upon whether the

respective inlets and outlets have a common communication or are distinct and separate, and moreover without a requirement of additional standards. Specifically the end heaters are mounted each upon a pair of standards, whereas the intermediary supporting is effected above, through the openings a^{17} by means of staggeringly disposed nuts and short-length bolts together styled a^{19} and purposely disclosed in Fig. V; and below in turn, through the openings a^{18} by means of other smaller bolts and nuts designated in pairs as (a^{20}). In this manner the series arrangement is facilitated in that a multiple number of heaters may be accommodated without a requirement either for bolts of various lengths or added corner supports.

The casing A supports near its bottom in any approved manner an elongated gas burner B having in this instance a triple row of perforate jets b' outlined very clearly in Figs. VI, VII, and IX. The burner B has attached to it exteriorly of the heater any type of control valve b^2 best adapted to the requirements and this latter in turn connects with the source of fuel. A triangular lighter door a^{21} covered with mica is pivotally mounted over an opening not shown though preferably positioned in that end adjacent the valve b^2 and just above the line of jets b' in order that the flame may be seen. A pair of limiting stops a^{22} and a^{23} are seen to control the range of movement of the door a^{21} in both directions.

The complete interior construction of any heater is formed as an integral casting C and as such constitutes the two end faces of the exterior casing considered as an entirety. This casting C comprises as to that major portion which is confined by its own top c' and end walls c^2 and c^3, those several elements which by reason of their formation and general positioning each with respect to the other, determine the course of the water through the heater, and in so far involve the essence of my inventive conception in its relations to the efficiency claimed.

The casting C is best seen as an entirety in the perspective view represented by Fig. IV. It comprises interiorly of the top c' and end walls c^2 c^3, a series of six longitudinally inclined water passages forming alternate portions of the entire length of conduit disposed within the heater. The number is wholly arbitrary. These passages are designated as c^4, c^5, c^6, c^7, c^8 and c^9 not in the order of proximity to either the top or bottom, but in the order respectively in which a given incoming molecule of water is compelled as will later appear, to serially traverse them. Of these passages c^4 c^6 and c^9 are identical as appears in the three sectional views marked as Figs. VII, IX, and XII. An inspection of these views together with Fig. IV discloses them to be of full width, shallow and with those ends adjacent the wall c^3 converging laterally toward the center. The smallest area of opening of these converging portions is partially seen in Figs. VIII and XIV. Two of the remaining alternate passages namely c^5 and c^7 are in turn identical and as appears in the two sectional views indicated as Figs. VII and X. Directing notice to these views and also Fig. IV it will be seen that they correspond precisely in dimension but are reversed so as to have opposite ends converging laterally, adjacent the wall c^2. Such opposite ends are most apparent in respect to area of opening in Figs. IX and XIII. The last of the passages to be considered namely c^8 is of decidedly different configuration by reason in part of being disposed nearest the source of heat. The shape of this passage is best revealed in Fig. VII though Figs. IX, XIII, and XIV also nicely show its relation to the burner B. Strictly it is a bifurcated channel of considerably deeper volume. The bottom is low enough to partially inclose the flames of the burner and hence fulfil the benefits to be expected of a water jacket construction. The middle bifurcation is both to permit a lessening of the distance required between it and the burner and to insure a better draft and hence incipient upward travel of the gaseous elements. Proceeding further with the consideration of the casting C it will be seen formed interiorly with intermediary and decidedly different upright end partitions c^{10} and c^{11} preferably each integral with the several passages and each spaced a like distance from the end walls c^2 and c^3 respectively. The partition c^{10} is provided with alternately different openings corresponding and registering respectively, by reason of the integral structural relationship, with the similarly different end openings of the six passages extending across from it to the other. This communication is manifested clearly in Figs. IX and XIII. The explicit description of the partition c^{11} will be deferred because the object in having it differ from the partition a^{10} will hereafter be more precisely comprehended. The casting C is furthermore provided between the wall c^2 and partition c^{10} with a plurality of substantially horizontal full width partitions each designated as c^{12} and located just above the near end openings of the passages c^4, c^6 and c^9. These partitions c^{12} form conjunctively with the wall c^2 and the partition c^{10} two end water jackets as is most readily apparent in Fig. VI. The other end of the casting is provided with but two half width partitions each c^{13} likewise substantially horizontal and forming in conjunction with the wall c^3 the half width partition c^{11} and a further pair

of differing partition members to be forthwith described, two water jacket chambers of about half the capacity of those at alternate heights at the opposite end. As the further differentiation intimated this end of the casting C is formed with a transverse upright partition c^{14}, positioned midway laterally and extending from the top c' downwardly as far as the bottom of the upper end of the passage c^9. As separately considered the partition c^{14} makes an integral angular corner with the half width partition c^{11}. As is clearly depicted in both Fig. VIII and Fig. XIV the partition c^{14} is bent aside at each end of the upper four passage openings between its extremities in order not to constrict their discharge areas. Finally however opposite the fifth passage opening namely that one which communicates with the passage c^9 it is bent aside in an opposite direction as also seen in Figs. VIII and XIV. Here it joins with still another horizontal partition member c^{15} which later completes with it and the lower of the two other horizontal partitions a zig-zag formation when viewed in cross section. The member c^{15} also forms in conjunction jointly with the member c^{14} and partition c^{11} an elongated half width water-jacket chamber c^{16} seen equally well in Figs. VIII, X, XI, and XIV. It is with this otherwise closed water-jacket chamber c^{16} that the outlet opening of the passage c^9 communicates. The constricted cross sectional area of the discharge opening of the passage c^9 is best disclosed in the two last mentioned figures. By reason moreover of this specific relative formation of the partition members adjacent the end wall c^8 a free fall down to the lower end opening of the passage c^8 is assured.

A concluding cognizance of the detailed parts of the casting C discloses the end walls c^2 and c^3 provided with a plurality of, and in the case of the exemplification arbitrarily adopted respectively six and seven screw threaded openings each designated as c^{17}. Closing these openings at all times when the heater is in operation are a corresponding number of complementarily threaded plugs c^{18} having exteriorly projecting portions squared. The openings c^{17} are located each opposite an end inlet or discharge opening of one of the passages. As will now have been readily anticipated these openings and plugs are in fact a means for permitting direct access to the passage whenever it may prove desirable to cleanse them. That plug which is to be seated in the upper of the openings in the end wall c^3 is preferably the pipe T a^{11} earlier mentioned with a horizontal extremity closed by a nut c^{19} and an upper extremity connected with the cold water supply pipe c^{10}. This common device is best seen in Fig. VI. The top c' of the casting is provided above the water-jacket chamber c^{16} with an opening c^{20} in direct communication with such chamber and it is through this opening that the hottest water issues on its final upward flow through the chamber c^{16} preparatory to entrance into the outlet pipe a^{12}. This specific outlet is the only outlet from the heater proper. It is most clearly seen in Fig. VIII.

It is here evidenced that when heaters embodying my invention are employed in series as previously explained, each of their flue openings may be feasibly connected with tributaries of a common stack and rather similarly their burners may not necessarily be themselves arranged in series, rather burners of various lengths provided, which shall have intermittent jet sections spaced so as to be accommodated within respective lengths of the combined heaters required.

The operation of a heater embodying my invention is then as follows: Considering first the course prescribed by the gases of combustion, a closer inspection of Figs. IV, XII, XI, and X in the order here given and a noting of the course in part prescribed by the close fitting lateral plates a^4 indicated by the arrows in Fig. VI reveals a sinuous or more exactly a zig-zag course which is not in and of itself uncommon to the art, except in so far as its direction of travel is at certain points opposite to that followed by the water. Upon rising from the burner the gases pass up through a rectangular opening occasioned by the longitudinal bifurcation of the passage c^8 and best seen in Fig. XII. Meanwhile the lowermost section of the partition c^{10} and the under face of the passage c^9 serve as baffle plates being inclosed as already made clear by the lateral plates a^4. The rising column of gases so baffled finds its only exit up through the two triangular openings at the upper end of the passage c^9 and which are perfectly illustrated in Fig. XI. Continuing their upward procession the gases are successively baffled by a section of the partition c^{11} jointly with the passage c^7, by a section of the partition c^{10} jointly with the same under surface of the same passage namely c^7, then emerge up through the pair of triangular openings adjacent each side of the upper end of the same passage c^7 as depicted by Fig. X, are next similarly baffled by the joint closure effected by the partition c^{10} and the under side of the passage c^6 and so successively pass in similar wise though in alternately different directions longitudinally along the under sides of the passages c^6, c^5, and c^4 and lastly along the inner surface of the top c' through the flue a^6 on into the stack a^9. This prescribed travel of the gases of combustion is intended to guarantee not only a maximum time of

travel through the heater and distance of travel as well, but also a sacrifice of heat units along a maximum area of water conduit contact, and including the ends always and the sides as well when set up in a laterally contiguous series.

Recalling that it is the determination of the relative direction of flow, that the water shall follow through various portions of the water conduit contrived within the heated zone, which embraces the theoretical as contradistinguished from the structural novelty of this invention, attention is particularly directed to Figs. VI to XIV. The cold water inlet a^7 indicated above communicates first with the upper of the two superposed half width water-jacket chambers seen nicely in Figs. VI, VIII, and XIV. Assuming this upper water-jacket chamber or pocket to have already become filled and to have already absorbed heat units of a residual character, one notices its only available outlet to be through the uppermost passage c^4. Its comparatively shallow diffusion is obviously progressively downward to maintain the upper of the full width water-jacket chambers in the opposite end, full; to overflow and continue progressively downward through the passage c^5; to fill next, the lower of the two half width water-jacket chambers formed in part by the wall c^3; and thereafter to successively move through the passage c^6; to fill the middle of the full width water-jacket chambers adjacent the wall c^2; to traverse the passage c^7; to suddenly drop from the latter's less constricted opening seen in Figs. VIII and XIV; to enter the bifurcated passage c^8 at the very bottom, that is immediately over the burner; and to then have imparted to it its forceful upward propulsion due to the inordinate expansion; to rise up through the lowest water-jacket chamber adjacent the wall c^2 as indicated by the arrows in Fig. XIII; and finally to be impelled along the last traversed passage c^9, across the irregular and lowermost of the water-jacket chambers adjacent the wall c^3 and through the constricted opening seen in Figs. VIII and XIV to be ejected up through the chamber c^{10} as earlier stated.

As a succinct summary it may be stated that the water passes at first progressively downward within a residually heated zone and toward the source of heat, then by preference though not necessarily, suddenly downward into closest proximity with the source of heat, and finally progressively upward away from the source of heat. Mention should here be tersely made of the established fact that the relative distance traveled by the water throughout the three distinctly different directions has apparently no pronounced effect on the operation other than as it alters the degree of efficiency. By having the cold water enter above, the maximum per cent. of heat units are extracted from the heating elements just prior to their entrance into the stack as waste, and this successful reversal of flow from that established in heaters generally known to-day is not accomplished as it has been heretofore with the dominating assistance of extraneous pressure, but wholly by reason of the varying apportionment of the intensity of the heat applied at relatively specific points along the conduit disposed within the heater proper. For the elucidation of this circumstance which makes an apparently inoperable heater, operable as a part of a closed-circuit-system, consideration of Fig. III is advised. As remarked in the first identification of the various figures this view represents my heater proper connected in the well known manner with a hot water tank D, the cold water inlet communicating by means of the pipe a^{10} with the bottom, while the hot water outlet communicates with the top of such tank. The connection with the tank D on the part of the extraneous source of supply or pressure main is effected through the top and by agency of the pipe d' which extends preferably to within a short distance of the bottom, connected preferably through the same T as is the outlet pipe a^{12}, is a pipe d^2 which leads to the faucet. As should be readily understood by those sufficiently skilled in the art, any established pressure actually exerted in the pipe d' is dissipated when exerted upon the contents within the tank D to such an extent that the same measure of flow would not circulate through a heater embodying my invention but follow the more direct route directly up through the tank. Therefore the assistance of pressure heretofore required to cause water to travel downwardly toward the source of heat is not invoked, and it is this avoidance which differentiates my heater from the prior art. It is only when the heat is applied and hence a heated zone established, having the described intensity of contactual relationship with specific sections of the conduit disposed within the heated zone, that the enforced circulation desired, commences. A contiguous relationship, to be exact, with an intervening conductor of heat such that the application of heat may be adjusted to produce an upward flow of sufficient force to draw the water downwardly as sought and as will insure the attainment of the greatest possible efficiency.

Having now fully described my invention, what I claim and desire to secure by Letters Patent is:

1. A heater comprising a member forming downwardly and upwardly inclined zig-zag water passages and a substantially straight interjacent section connecting the lower

openings of said passages, a pair of members forming in conjunction with said first mentioned member a zig-zag flue passage, and heating means communicating below with said flue passage and disposed adjacent the upwardly inclined of said water passages.

2. A water heater comprising a member having a plurality of water passages in series communication with each other, means adjacent said member and forming in conjunction therewith a devious passage for the gases of combustion, said water being caused to travel successively in a direction opposed and corresponding to that traversed by the gases.

3. A water heater comprising an integral casting having a plurality of separate end and intermediately extending water passages in series communication with each other, one of said passages being provided with an inlet opening, another of said passages being provided with an outlet opening, means including plates for forming in conjunction with said casting a zig-zag flue passage between said water passages, and heating means in communication with said flue passage and intersecting the lower of said water passages.

4. A water heater comprising a casing, a plurality of superposed water passages alternately inclined in opposite directions therein, the proximate ends of a plurality of adjacent upper passages having series communication each with another, the lower ends of two alternate lower passages having series communication with each other, said casing and water passages forming together a single zig-zag flue passage, and heating means below and in communication with said flue passage.

5. In an apparatus for heating and causing the circulation of a fluid, a closed endless conduit system which includes a zig-zag passage comprising elongated interjacent portions and having a continuously downward direction from its inlet to its discharge end, a second zig-zag passage comprising elongated interjacent portions located below the first and having a continuously upward direction from its inlet toward its outlet end, and a duct which connects the lower discharge end of the first mentioned passage and the lower intake end of the second mentioned passage, heating means located below said passages, and an elongated inclosing casing which embraces said passages and heating means, and forms in conjunction therewith a single zig-zag flue having elongated interjacent portions through which the generated heat will flow upward in contact with said two passages, such elongated interjacent flue portions being interposed respectively between adjacent pairs of interjacent portions of said fluid conduit whereby a maximum travel of the heat units is assured.

6. A closed-circuit-system water heater comprising a casing, a zig-zag water conduit disposed therein and having adjacent sections inclined in reverse directions, a single zig-zag flue conduit enveloping said first mentioned conduit at alternately opposite ends, heating means disposed below and communicating with said flue conduit, said water conduit having a top inlet and lower outlet.

7. A water heater comprising the combination of a casing an elongated member inclosed by said casing and having separate end chambers, and a plurality of zig-zag conduits having elongated interjacent portions, said conduits communicating with each other through one of said chambers, the upper ends of said portions forming flue openings in conjunction with said casing, and heating means positioned below said conduits.

8. A water heater comprising the combination of heating means, a member forming a plurality of superposed zig-zag water conduits positioned above said heating means, alternate portions of said conduits being upwardly inclined in a given direction and tapered laterally at their upper ends, intermediate portions being upwardly inclined in the reverse direction, and a member associated with said casting and forming in conjunction therewith a zig-zag flue passage.

9. A water heater comprising the combination of heating means, a member forming a plurality of superposed and upright zig-zag water conduits spaced above said heating means, said upper conduit having elongated interjacent portions tapered at their upper ends, and means forming in conjunction with said member a zig-zag passage.

10. A water heater comprising a casing, a zig-zag water conduit forming in conjunction with said casing alternate end flue-openings, the bottom section of said conduit being provided with a medial slot and heating means below said slot and communicating with said openings.

11. A water heater comprising heating means, an elongated casing above said heating means, a hollow zig-zag casting disposed in said casing and forming in conjunction therewith a correspondingly elongated zig-zag flue passage, the lowermost of said hollow sections being formed with a central longitudinally extending slot and inclosing said heating means.

12. A water heater comprising heating means, a casing above said heating means, said casing being provided interiorly with oppositely disposed water-jacket chambers, an inlet and an outlet communicating with different chambers, and a plurality of inclined water conduits extending between

said chambers, said conduits forming in conjunction with said casing openings adjacent said chambers, said openings communicating with said heating means.

13. A heater comprising a burner, an elongated casing above said burner, said casing being provided at each end with a plurality of water-jacket chambers, an inlet and an outlet communicating with different of said chambers, and a plurality of oppositely inclined water conduits communicating each with different pairs of said chambers, the upper ends of said conduits forming in conjunction with said casing openings adjacent opposite of said chambers, said openings communicating with said heating means.

14. A water heater comprising an elongated casing, heating means below, and a member within said casing forming in conjunction therewith a zig-zag flue passage having elongated interjacent portions in communication with said heating means, said member itself provided with separate end chambers and intermediary passages connecting opposite pairs of said chambers, said member furthermore provided with water inlet and outlet openings communicating with different of said end chambers.

15. A water heater comprising the combination of a casing having an inlet and an outlet, upright partitions adjacent opposite sides of said casing and provided with openings, cross partitions interposed respectively between said casing ends and upright partitions, said cross partitions being located above alternate of said openings, a plurality of ducts extending between said upright partitions and communicating each with a pair of said openings, said ducts forming in conjunction with said casing openings intermediately of said upright partitions, and heating means positioned below and communicating up through said last mentioned openings.

16. A water heater comprising the combination of an elongated casing having an upper inlet and lower outlet, upright partitions adjacent opposite ends of said casing and provided with a plurality of alternately different sized openings, cross partitions interposed respectively between said casing ends and upright partitions and forming chambers, said cross partitions being located above alternate of said openings, a plurality of flat ducts extending at an inclination between said upright partitions and communicating each with a pair of said openings, said ducts being beveled and forming in conjunction with said casing openings intermediately adjacent said upright partitions, and heating means positioned below and communicating up through said last mentioned openings.

17. A water heater comprising the combination of heating means, a member forming a plurality of superposed zig-zag water conduits positioned above said heating means, the bottom section of said lower conduit being intersected by a longitudinally extending opening, each of the remaining sections of said conduits being intersected at their upper ends by an opening, and a pair of plates forming in conjunction with said openings a single flue passage.

18. A heater comprising a member forming downwardly and upwardly extending zig-zag water passages and a duct connecting the lower openings of said passages, an inclosing casing, and laterally projecting means forming in conjunction with said member and casing a zig-zag flue passage, and heating means communicating below with said flue passage and disposed adjacent the upwardly extending of said water passages.

19. A heater comprising a member forming downwardly and upwardly extending zig-zag water passages having elongated interjacent portions, said member also forming a duct connecting the lower openings of said water passages, the downwardly extending of said passages being located above the other, an elongated casing, baffling means associated with said member extending longitudinally of said casing spaced from alternately opposite ends thereof and disposed above said interjacent portions respectively, and heating means below said passages.

20. A water heater comprising an elongated casing, a set of superposed water passages in series communication with each other and inclined alternately in opposite directions longitudinally of said casing, said set having an upper inlet end and a lower discharge end, a second set of water passages similarly arranged below the first, said second set having an inlet below and an upper outlet, a duct connecting the discharge end of the upper set with the inlet end of the lower set, heating means below said sets of passages, and means forming in conjunction with said casing a zig-zag flue passage having longitudinally extending interjacent portions in series communication with said heating means.

Signed by me, this 10th day of April, 1912.

FREDERICK D. SCHNEIDER.

Attested by—

H. F. LEICK,

L. E. MUELLER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."