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HEAT-ABSORBING WATER CONDUITS FOR TANK WATER HEATERS

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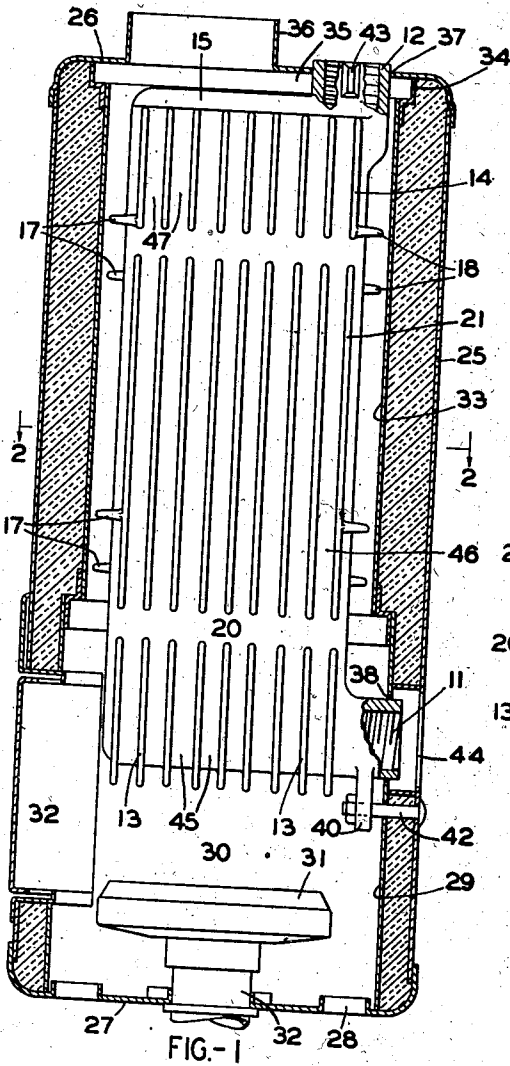


FIG.-1

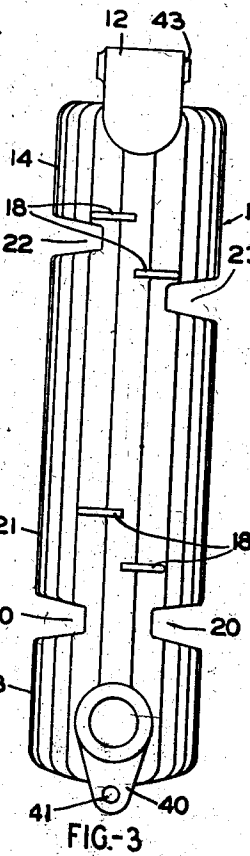


FIG.-3

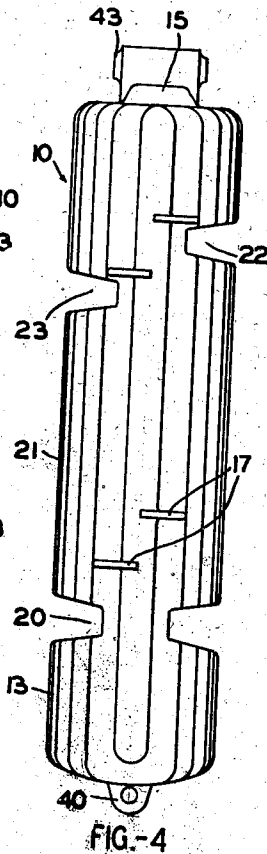


FIG.-4

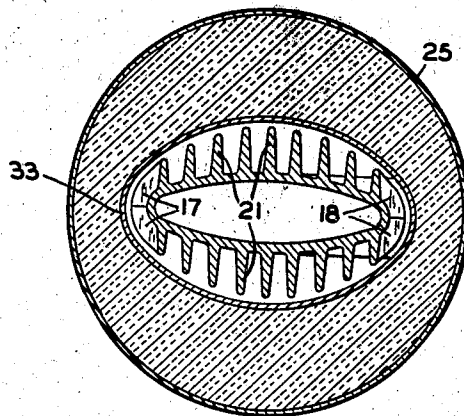


FIG.-2

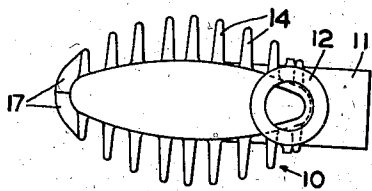


FIG.-5

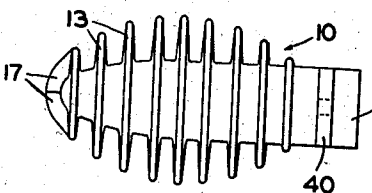


FIG.-6

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HEAT-ABSORBING WATER CONDUIT FOR
TANK WATER HEATERS

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signor to The Hotstream Heater Company,
Cleveland, Ohio, a corporation of Ohio

Application May 11, 1942, Serial No. 442,532

6 Claims. (Cl. 257—248)

This invention relates to improvements in the heat-absorbing water conduits of tank water heaters, such as are used in conjunction with storage tanks or reservoirs for the heating of the water thereof, the conduits of said tank heaters being connected in circulatory communication with said storage tanks or reservoirs and being subjected, for heat-absorbing purposes, to the hot combustion gases produced by the burners of said tank heaters.

The present invention has for its principal object the provision of a novel and improved tank heater water conduit which is in the form of a simple and inexpensive casting of metal now readily available, such as cast iron, and which conduit is particularly well adapted for efficient and rapid heat absorption.

A further object of the present invention is the provision of a novel and improved tank heater water conduit which is provided with heat-absorbing fins so constructed and arranged as to insure such intimate and prolonged contact of the hot combustion gases with the conduit and its fins as to enable a maximum amount of heat to be transferred from such gases to the water in said conduit.

A further object of the present invention is the provision of a novel and improved tank heater water conduit which is of such character that the tank heater casing structure may be readily supported thereon, thus making unnecessary the use of the fastening devices heretofore employed for the mounting of a tank heater water conduit in the enclosing casing therefor, etc.

Further objects of the present invention, and many of its practical advantages, will be referred to in or will be evident from the following description of one embodiment of such invention, reference being had to the accompanying drawing, in which

Fig. 1 is a central vertical sectional view of a tank water heater containing a water conduit embodying the present invention, the conduit appearing in side elevation;

Fig. 2 is a cross-sectional view of said tank heater and its water conduit, the view being on the line 2—2, Fig. 1; and

Figs. 3 to 6 inclusive are respectively a rear elevational view, a front elevational view, a top plan view and a bottom plan view of said water conduit.

Before the tank heater water conduit here illustrated is specifically described, it is to be understood that the invention here involved is not limited to the details of construction or the spe-

cific arrangement of parts herein illustrated or described, as the invention obviously may take other forms. It also is to be understood that the terminology or phraseology herein employed is for the purpose of description and not of limitation, the scope of the present invention being indicated by the appended claims.

As will be evident from the accompanying drawing, the tank heater water conduit 10 here illustrated, for the disclosure of the present invention, consists of a simple and inexpensive one-piece casting, the casting being of metal now readily available, such as cast iron. As best shown in Fig. 1, the conduit 10 is of generally rectangular form in side elevation, and from Fig. 2, it will be evident that said conduit is of generally oval shape in cross-section. At the bottom of said conduit is a rearward extension 11 of tubular form which constitutes the water inlet portion of the conduit, and at the top of said conduit is an upright extension 12 of tubular form which constitutes the water outlet portion thereof, said outlet extension being here shown (see Fig. 1) as offset rearwardly somewhat, for reasons which will hereinafter appear.

For heat-absorbing purposes and for directing and controlling the flow of the hot combustion gases therealong, the conduit 10 is provided on each of its two curved side walls with three longitudinally spaced sets of integral fins, the fins of each such set being laterally spaced, generally parallel and longitudinally disposed, with the fins of the three sets in alignment, as here shown. Although each such set here contains the same number of fins, there being nine fins in each set, it is obvious that the number of fins which each set contains may vary as desired. It is preferable, however, to have the fins of each set in fairly close relationship in order to provide ample heat-absorbing conduit surface and to provide relatively narrow passageways at the sides of the conduit for the combustion gases. The number of fins in each set is preferably, therefore, such as to enable the fins to be spaced fairly close together and to extend from the front of the conduit to the rear thereof.

If desired and as here shown, the bottom fins 13 on one side of the conduit may extend down around the bottom of the conduit and merge with the bottom fins 13 on the other side of the conduit (see Figs. 1 and 6). It also is desirable that the top fins 14 on each side of the conduit terminate below the conduit top wall for reasons which will hereinafter appear, the top portion 15 of said conduit—the portion lying above the

fins 14—being of somewhat reduced width, as best shown in Fig. 4.

For heat-absorbing purposes and for directing and controlling the flow of the hot combustion gases therealong, the conduit 10 also is provided at its front and also at its rear with two longitudinally spaced sets of transversely disposed integral fins, the two fins of each of the two front sets being designated by the reference numeral 17 and the two fins of each of the two rear sets being designated by the reference numeral 18. As best shown in Figs. 3 and 4, the two fins of each such front and rear set are longitudinally spaced and extend from opposite sides of the conduit at least to the longitudinal center line thereof. Preferably, the front and rear fins are respectively joined at their outer ends with the adjacent side wall fins, as will be evident from Figs. 1, 5 and 6. Although they need not be, the front and rear fins are in corresponding alignment, the front fins 17 and the rear fins 18 of the two lower sets being located slightly above transverse side wall channels 20, which space or separate the bottom side wall fins 13 from the intermediate side wall fins 21, and the front fins 17 and the rear fins 18 of the two upper sets being located just above transverse side wall channels 22 and 23 which space or separate the intermediate side wall fins 21 from the top side wall fins 14. As best shown in Figs. 3 and 4, the two lower side wall channels 20 are in alignment, and as a result the bottom fins 13 on each side of the conduit are of equal length. The two upper side wall channels 22 and 23, however, are out of alignment, the channel 22 on the right side of the conduit (as viewed from the front thereof) being somewhat higher than the corresponding channel 23. As a result, the top fins 14 on the right side of the conduit have a somewhat shorter length than the corresponding fins 14 on the left side of the conduit, as clearly shown in Figs. 3 and 4.

As best shown in Figs. 2, 5 and 6, the side wall fins 13, 14 and 21 are of varying depth, the fins being of progressively decreasing depth toward the front and rear of the conduit to preserve its generally oval cross-sectional shape. For the same purpose, the transversely disposed front and rear fins 17 and 18 have rounded free edges, as will be evident from Figs. 2, 5 and 6.

As will be readily understood, water conduits embodying the present invention may be used in tank heaters having enclosing casing structures of various forms. Merely for purposes of illustration, therefore, Figs. 1 and 2 show the present water conduit as used in a tank heater having a casing of the form disclosed in my co-pending application for Casings for water heaters, Serial No. 435,757, filed March 23, 1942, to which application reference may be had, if desired. So far as description of such casing is here necessary, it may be stated that said casing comprises an outer cylindrical jacket 25 having circular top and bottom caps 26 and 27, respectively, the bottom cap 27 being provided with suitable air openings 28. Supported on said bottom cap 27, in spaced relation to the cylindrical side wall of the jacket 25, is a generally cylindrical shell 29 which laterally defines a combustion chamber 30, the air inlet openings 28 being in communication with said chamber, as shown in Fig. 1. Located within said combustion chamber is a suitable gas burner 31 mounted on the upper end of a gas and air mixing tube 32, said mixing tube being suitably mounted in a cen-

trally disposed aperture of the jacket bottom cap 27. For affording access to said burner, the jacket 25 and the combustion chamber shell 29 are provided with registering side wall openings which are normally closed by a hinged door 32 with which the jacket is provided.

Suitably mounted on the upper end of the combustion chamber shell 29, and providing an upright flue passageway for the hot combustion gases produced by the burner 31, is a tubular shell 33, said shell being of oval-shaped cross-section, as clearly shown in Fig. 2. Suitably mounted on the upper end of this oval-shaped shell 33 is a ring member having an annular peripheral flange 34 which extends upwardly into engagement with the jacket top cap 26 and which laterally defines a cylindrical header or collecting chamber 35 in communication with the flue passageway of the shell 33, said header or collecting chamber and the combustion chamber 30 being here shown as having the same diameter. In the jacket top cap 26 and laterally offset somewhat with respect to the flue passageway of the oval-shaped shell 33 is a circular outlet for the combustion gases of the header chamber 35, said outlet being surrounded, as is usual, by an upright annular flange 36 for connection to a stack or chimney (not shown).

As best shown in Fig. 1, the conduit 10 is arranged in upright position in the combustion chamber 30 and the oval-shaped flue passageway leading therefrom. In the jacket top cap 26 is a suitable aperture 37 for the reception of the upright outlet extension 12 of the conduit 10, and in the rear portion of the cylindrical combustion chamber shell 29 is a suitable aperture 38 for the reception of the rearwardly projecting inlet extension 11 of said conduit. If desired, said inlet extension may have cast thereon or be otherwise provided with a depending lug 40 (see Figs. 1 and 3) to which the tank heater casing may be bolted or otherwise suitably secured. As here shown, said lug is provided with an aperture 41 for the reception of a bolt 42 extending inwardly through the jacket side wall and the combustion chamber shell 29, and by suitably tightening the nut on the inner end of said bolt, a rigid connection of the tank heater casing to the conduit 10 can be easily and conveniently effected. Although the oval-shaped conduit 10 fits more or less snugly within the correspondingly shaped flue passageway of the upright shell 33, as clearly shown in Fig. 2, and there is thus no necessity for providing at the top of the conduit additional means for preventing said conduit from turning about its longitudinal axis, the upright outlet extension 12 of said conduit may be provided, if desired, with lateral projections 43 and the jacket top cap aperture 37 provided with corresponding extensions to receive said projections, as will be readily understood.

In use of the present tank heater with a water storage tank or reservoir (not shown), for the heating of the water thereof, the conduit 10 of said tank heater is connected in circulatory communication with said storage tank or reservoir. In other words, the conduit inlet extension 11 is connected to a suitable supply pipe (not shown) leading from the storage tank or reservoir, the jacket side wall being provided with a suitable aperture 44 to receive said pipe, and the outlet extension 12 of said conduit is connected to a suitable return pipe (not shown) leading to said storage tank or reservoir. For the connection of

the conduit inlet and outlet extensions to such pipes, any suitable means may be used, the conduit extensions being here internally threaded for simple and convenient connection to externally threaded pipes. Due to the rearwardly offset disposition of the conduit outlet extension 12 and the forwardly offset disposition of the flue gas outlet flange 36, there is ample space therebetween for the convenient connection to said conduit extension of the return pipe leading to the storage tank or reservoir, and ample space therebetween for the mounting of a down draft diverter or the like on the pipe (not shown) which connects the flange 36 to the stack or chimney.

As best shown in Fig. 1, the transverse lower side wall channels 20 of the conduit 10 (formed by interrupting the side wall fins 13 and 21) lie just below the entrance to the oval-shaped flue passageway. When the hot combustion gases produced by the burner 31 first enter the vertically disposed and relatively narrow passages 45 provided by the bottom side wall fins 13, they travel along the bases of said passages and hence are in intimate contact with the side walls or primary heat-absorbing surface of the conduit. The gases have a tendency, however, to move outwardly from the conduit walls, and the function of the lower transverse channels 20, into which the gases flow from the bottom fin passages 45, is to direct the now unobstructed gases into the oval-shaped flue passageway with the desired velocity and with the desired distribution across the conduit side walls. In travelling upwardly through the relatively narrow passages 46 provided by the intermediate side wall fins 21, the gases remain in intimate contact with the conduit side walls and the fins 21 thereof and a substantial amount of heat is absorbed from such gases by the water in the conduit as said gases travel through these intermediate fin passages.

Although the upper conduit channels 22 and 23 (formed by interrupting the side wall fins 21 and 14) aid in effecting the desired travel of the side wall gases through the passages 47 provided by the top side wall fins 14, the primary function of these two upper channels is to direct inwardly into the top fin passages the gases travelling along the front and rear of the conduit. As there is little secondary heat-absorbing surface at the front and at the rear of the conduit, the gases which travel along these "feeder" paths reach the channels 22 and 23 with a fairly high temperature, even through their course of travel has been made somewhat tortuous by the lower sets of front and rear fins 17 and 18. By providing the channel 22 just below the right-hand upper front and rear fins 17 and 18 and the channel 23 just below the left-hand upper front and rear fins 17 and 18, the gases travelling along the front and rear of the conduit are caused to travel inwardly into such channels, from which they flow upwardly through the passages 47 of the top side wall fins 14. The result is the extraction from these diverted hot gases of much of the heat thereof, as will be readily understood.

By having the top side wall fins 14 terminate below the top portion 15 of the conduit, as heretofore mentioned, the gases flow into the header or collecting chamber 35 with uniform velocity or draft, notwithstanding the reduced and offset character of the outlet from such chamber.

From the foregoing description thereof, it will

be evident that the present conduit, in the form of a simple and inexpensive metal casting, is of exceptionally efficient character. Its longitudinal and transverse fins provide the desired amount of secondary heat-absorbing surface and such fins, together with the transverse channels 20, 22 and 23, effectively direct and control the flow of hot combustion gases in a manner to enable a maximum amount of the heat of such gases to be transferred to the water in the conduit. The strength of such conduit is such as to enable the casing of the tank heater to be readily supported thereon, the casing in effect being built around the conduit. As a result, the use of the fastening devices and the like, heretofore used in mounting the usual coiled conduit in an enclosing casing, is wholly unnecessary. Moreover, by merely removing one or both of the jacket end caps, the longitudinal passages provided by the side wall fins may be readily cleaned by a ram-rod type of device, all as will be readily understood.

To those skilled in the art to which the present invention relates, further features and advantages of the invention will be evident from the foregoing description of one embodiment thereof.

What I claim is:

1. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and interrupted to provide on each side of said body a transversely disposed portion free of fins, and a pair of transversely disposed external fins on the front of said body and extending from opposite sides thereof to at least the longitudinal center line of said body, there being one front fin above the front end of each of the aforesaid transversely disposed portions.
2. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and interrupted to provide on each side of said body a transversely disposed portion free of such fins, one of such transversely disposed portions being located at a lower level than the other, and a pair of transversely disposed external fins on the front of said body and extending from opposite sides thereof to at least the longitudinal center line of said body, there being one front fin above the front end of each of the aforesaid transversely disposed portions.
3. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and interrupted to provide on each side of said body a transversely disposed portion free of fins, a pair of transversely disposed external fins on the front of said body, and a pair of transversely disposed external fins on the back of said body, one of said front fins and one of said back fins being located just above the ends of one of the aforesaid transversely disposed portions and the other front fin and the other back fin being located just above the ends of the other aforesaid transversely disposed portion.
4. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and interrupted to provide on each side of said body a transversely disposed portion free of longitudinal

fins, and other external fin means extending transversely of said body at the front thereof and located above at least parts of the aforesaid transversely disposed side portions which are free of longitudinally disposed fins.

5. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and interrupted to provide on each side of said body a transversely disposed portion free of longitudinal fins, and other external fin portions extending transversely of said body at the front thereof, there being one such transversely disposed fin portion located in the region of each of the aforesaid transversely disposed side portions which is free of longitudinally disposed fins.

6. A tank heater water conduit, comprising a hollow body having a water inlet and a water outlet, a plurality of longitudinally disposed external fins on each side of said body and extending from substantially the front of said body to substantially the rear thereof, the longitudinally disposed fins on each side of said body being interrupted to provide thereon a transversely disposed portion free of longitudinally disposed fins, and other external fin means extending transversely of said body at the front and at the back thereof and located above at least parts of the front and rear ends of the aforesaid transversely disposed side portions which are free of longitudinally disposed fins.

CLARENCE H. MORROW.