March 28, 1950 A. C. BAUMANN ET AL 2,502,071

BOILER CONSTRUCTION

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FIG. 2

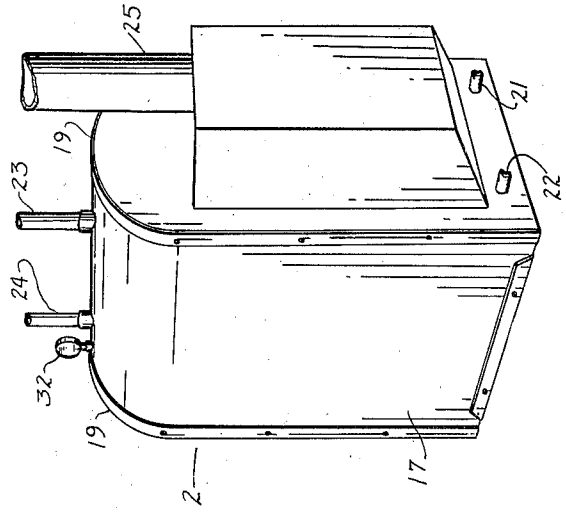
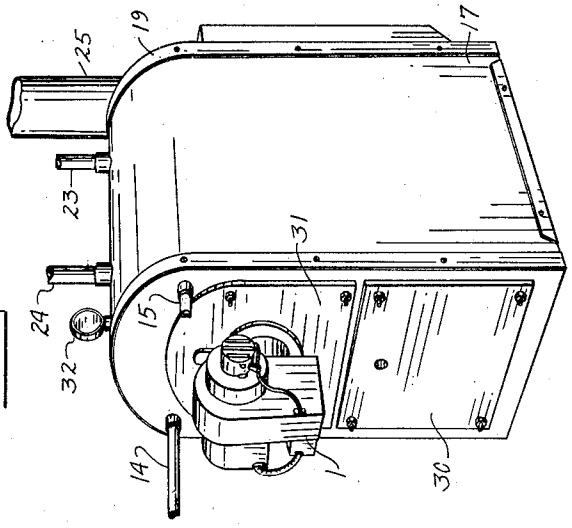


FIG. 1



INVENTORS.
ARTHUR C. BAUMANN
GEORGE K. HURD
BY Joshua R. H. Potts
THEIR ATTORNEY

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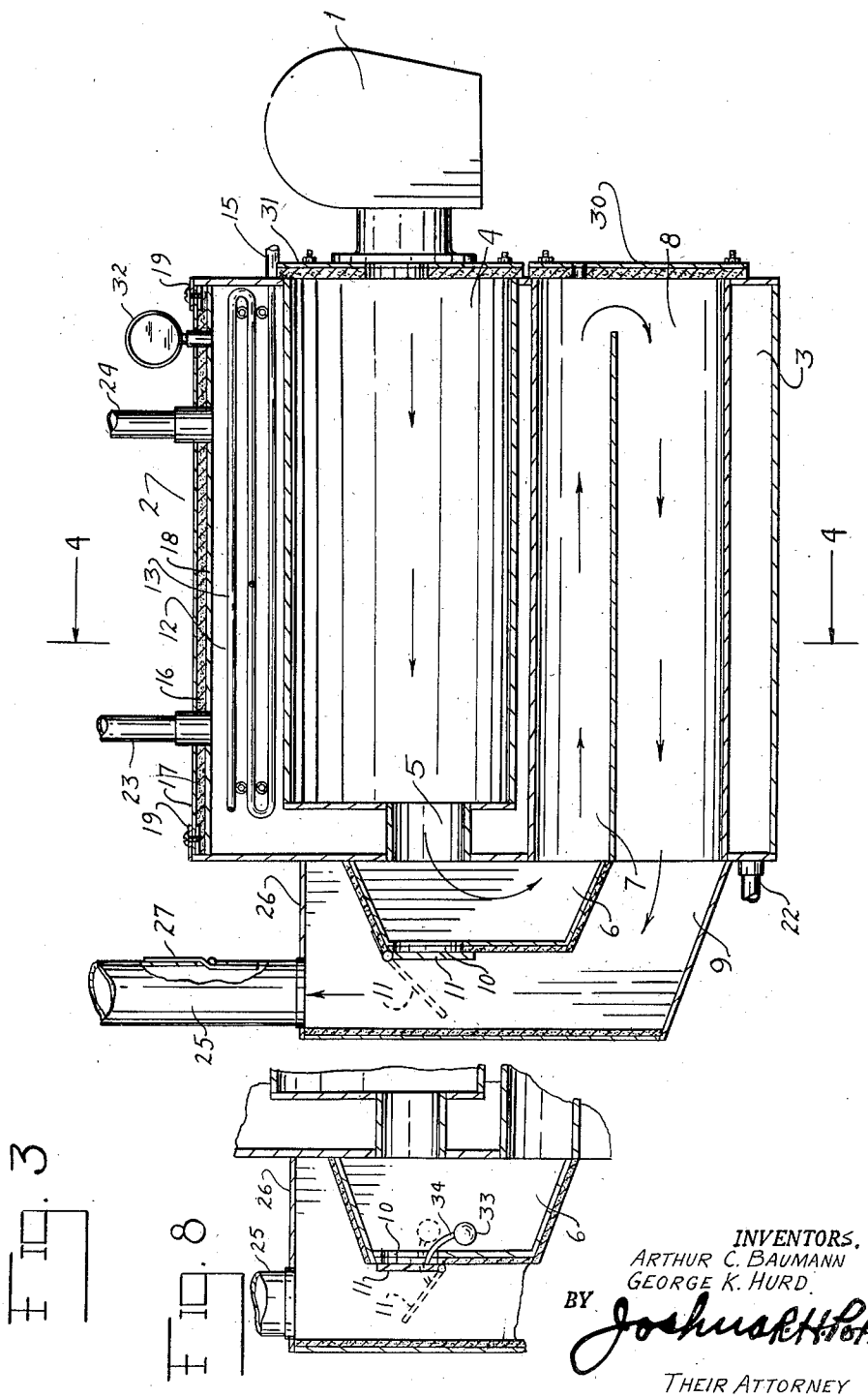


FIG. 3

FIG. 8

INVENTORS.
ARTHUR C. BAUMANN
GEORGE K. HURD.
BY Joshua R. H. Potts
THEIR ATTORNEY

March 28, 1950 A. C. BAUMANN ET AL 2,502,071

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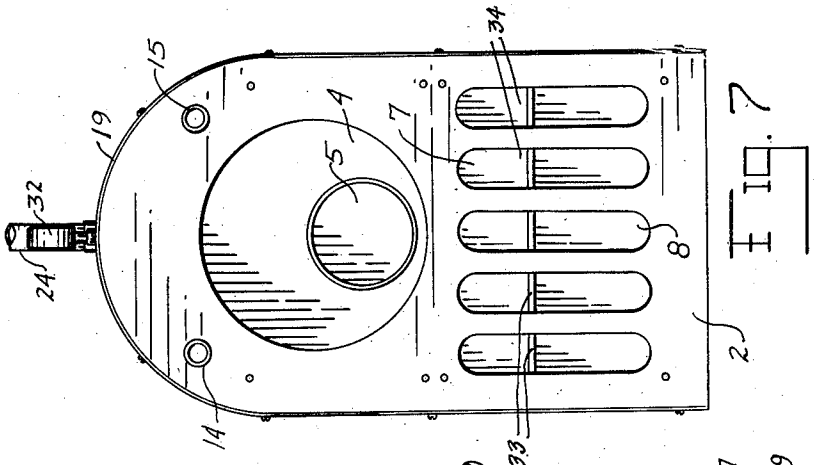


FIG. 7

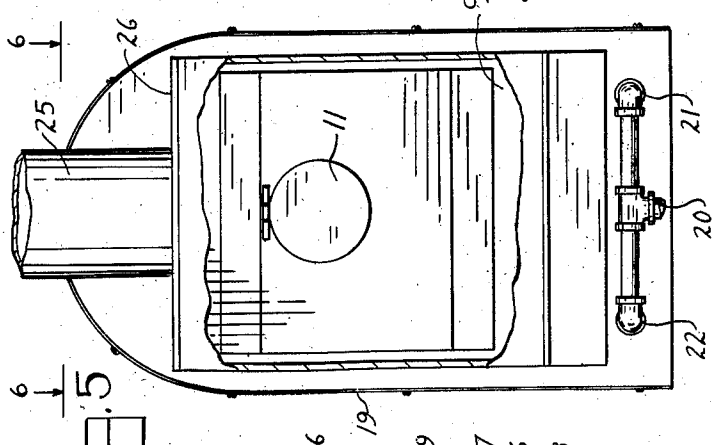


FIG. 5

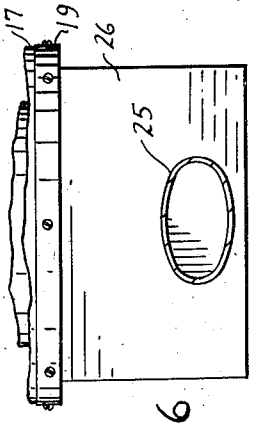


FIG. 6

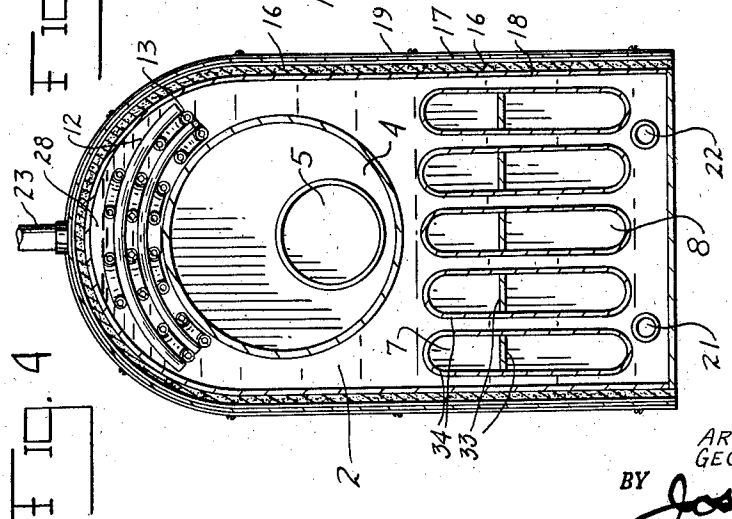


FIG. 4

INVENTORS.
ARTHUR C. BAUMANN
GEORGE K. HURD
BY Joshua R. H. Potts
THEIR ATTORNEY

Patented Mar. 28, 1950 2,502,071

UNITED STATES PATENT OFFICE

2,502,071

BOILER CONSTRUCTION

Arthur C. Baumann, Oaklyn, N. J., and George K. Hurd, Collingdale, Pa.

Application November 23, 1946, Serial No. 711,984

5 Claims. (Cl. 122—149)

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The present construction relates to improvements in boilers, more particularly of the oil fired type.

The principal object of the invention is the provision of a down-draft boiler compact in design, easy to install, efficient in operation, and having special safety features which eliminate certain forms of hazards inherent in oil fired boilers.

Another object of the invention is the provision of a boiler fired by oil with the burner and combustion chamber located at the top of the boiler, and having a greatly improved down-draft flue travel.

Another object is the provision of a multi-flue pass, preferably built into the boiler, which by virtue of its design and arrangement, greatly reduces heat losses in the stack, and also improves the down-draft by permitting the progressive expansion of the gases in their travel from the top to the bottom of the boiler.

Another object of the invention is the prevention of accumulated gases in case of ignition failure, and also the provision of an emergency or safety smoke breach, normally closed but automatically operable instantaneously, in the event of an explosion or like mishap.

A further object is the provision of a flue travel entirely surrounded by water including a wet base.

A special object of the invention is the provision of a built-in, tankless hot water heater which may take the form of a coil or pipe, and is adapted for year around service.

Other objects relating to features of construction, combination of elements and arrangement of parts are either obvious or will manifest themselves as the description proceeds.

For a full and more complete understanding of the invention, reference may be had to the following description and accompanying drawings, wherein:

Figure 1 is a perspective view of the front of a boiler embodying our invention;

Figure 2 is a perspective view of the rear of the boiler;

Figure 3 is a longitudinal sectional side elevation;

Figure 4 is a cross-section, approximately on lines 4—4 of Figure 3;

Figure 5 is a fragmentary elevational rear end view;

Figure 6 is a partial section through lines 6—6 of Figure 5;

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Figure 7 is an elevational front end view with the front plates removed; and

Figure 8 is a partial sectional elevation of a modification of the safety damper installed in the smoke breach of the flue pass.

Referring particularly to Figures 1 and 2, it will be seen that the invention is illustrated in connection with an oil fired type boiler comprising an oil burner or unit 1 mounted on the front of the boiler. The burner 1 may be of any conventional type, and forms no part of the present invention. The boiler per se, designated generally by the reference character 2, may comprise a hollow casing fabricated from steel plates for containing the medium circulated through the heating system, which in the present illustration is a hot water system. The boiler construction generally includes a "wet base" 3, a combustion chamber 4 which also constitutes a flue pass, a smoke or flue breach 5, a down-draft flue travel consisting of flue chamber 6, flue passes 7 and 8, and a flue breach 9. As will be seen in Figures 3, 4 and 7, the flue passes 7 and 8, in tier formation, are formed by partitions 33, positioned in and extending short of one end of spaced parallel flue members 34. The water in the boiler circulates around these flue members and gains heat therefrom while reducing the temperature of gases passing downwardly therethrough to the flue inlet. This arrangement provides a flue travel entirely surrounded by water, consisting primarily of a combustion chamber and a built-in economizer.

By providing a flue economizer comprising three separate passes which run substantially the full length of the boiler, a large surface or area is available for the transfer of heat from the hot gases as they travel the several passes on their passage through the boiler, which greatly lowers the stack or chimney temperature, thus effecting a very substantial economy in heat losses which would otherwise be sustained. This transfer of heat from the hot gases is further augmented by providing the wet base 3, which permits utilization of fast heat principles characteristic of large marine boilers. Incidentally, it may be noted that by mounting the burner at the top of the boiler, besides securing improved firing methods, the hazards resulting from a flooded cellar or basement are practically overcome.

The dual flue or smoke breaches 5 and 9 prevent the accumulation of gases in case of ignition failure, but if for any reason an explosion

occurs, we provide an emergency vent, located in a breach 10 of the flue chamber 6. The vent 11 may be pivotally mounted and arranged to be gravity operated, so that it normally closes the breach 10, but is forced open, as indicated in dotted lines in Figure 3, whenever any undue pressure is exerted upon the vent, as in the case of an explosion which may be caused from ignition failure of the fuel. To make the closure of the vent 11 more positive, any expedient, such as a coil spring or the like (not shown) may be used.

A modification of the vent 11 inserted in the safety smoke breach 10 is illustrated in Figure 8. In this modified form, the vent is hinged at the bottom of the safety smoke breach 10, and is adapted to swing outwardly and downwardly in the event of an explosion. The vent 11, in this instance, is normally maintained closed by a weight 33 having an arm 34 secured to the vent. The weight 33 acts as a counterbalance for the vent, and as shown, is located on the inside of the flue breach 10. As a safety precaution against the weight 33 deteriorating through scaling produced by prolonged heat from the flue gases, etc., the weight may be made sufficiently heavy so as to anticipate any such losses.

We have discovered that the down-draft may be greatly improved by progressively increasing the cross-section of the flue passes, or the openings thereto, from the top of the boiler downwardly.

It is our theory that such a relation or arrangement permits a progressive expansion of the gases in their passage from the top to the bottom of the boiler, but we do not wish to be confined to this theory. It is a proven fact, however, that when a cross-section of the flue passes is appreciably increased in the direction the flue gases are travelling, namely downwardly, a much better down-draft is obtained. For example, in one household size of boiler having the dimension of 20" wide, 24" long, and 40" high, a greatly improved down-draft is obtained by having the openings to the passes of substantially the following areas: the size of the flue breach 5 is approximately 8" in diameter or the equivalent area of .3491 sq. ft.; the area of the flue pass 7 is substantially that of a circular cross-section of about 9" or the equivalent area of .4418 sq. ft.; and the pass 8 is approximately equal to the area of a 10" circle or .5454 sq. ft. From this data, it will be appreciated that substantial expansion is provided for the gases in their downward flue travel of the boiler, with the result that a considerably stronger draft is created than otherwise present in a boiler construction in which the flue passes are of substantially the same area throughout their continuous lengths.

By virtue of the construction just described, there is the added advantageous feature that by increasing the area of the flue passes, the surface of the water walls of the boiler is correspondingly increased, which in turn provides that amount of increased surface area for the transfer of heat. Consequently, this novel feature of progressively increasing the area of the flue passes downwardly serves the dual function of improving the draft of the stack as well as providing increased surface area for heat transfer purposes.

Referring particularly to Figures 3 and 4 of the drawings, it will be seen that our boiler embodies a built-in tankless water heater 12, the coils 13 of which run substantially the entire length of the boiler, and are arranged in tiers in an arcuate formation, the spacing of the coils as well as the tiers being approximately one diameter of the pipe forming said coils. It will be noted that a steam chest 28 is formed in the top of the boiler, which chest is approximately 4" deep, and the uppermost set of the coils 13 is mounted so as not to be above the water level.

The coils 13 are preferably of copper tubing, and in a boiler having the dimensions given above, the water heater may comprise about 65' in length of ⅝" diameter tubing. Since the heater 12 is entirely immersed in the water circulating through the boiler, it is obvious that the temperature thereof will be substantially that of the water circulating in the heating system. The heater 12 is fed by intake and outlet pipes 14 and 15.

We prefer to construct the combustion chamber 4 of sheet steel that will withstand the highest temperatures developed by any burner without requiring a refractory. This permits faster or more rapid heat recovery and also a saving of time and money in both installation and maintenance of the boiler.

Another improved feature of our construction is applying a coating or lining of insulation material 16 between a crown sheet 18 of the boiler and an exterior ornamental cover 17. The insulation covers the entire exterior side and top walls of the boiler, and the cover sheet 17 may be secured in place by any suitable means, such as a metal band 19 secured to the front and rear edges of the side walls (see particularly Figures 1 and 2). By this construction, heat losses due to radiation are substantially reduced, which in turn contributes to the general operating efficiency of the boiler.

The customary feed line 20 is provided for introducing water at the bottom of the boiler (see Figures 4 and 5), and this may take the form of a center tap having two branches which connect to openings 21 and 22, thus providing a supply of water on each side of the bottom of the boiler. Lines 23 and 24 are provided at the top of the boiler for circulating water through the heating system. A flue pipe 25 is connected at the top of the flue chamber 26, and the flue pipe in turn connects with a chimney or flue stack (not shown) leading to the outside. The construction, design, and/or arrangement of the parts just described may take any conventional form.

For the purpose of draft regulation, a damper 27 is mounted in the flue pipe, and this damper may be automatically controlled thermostatically. Dampers of this type are well-known and are of several conventional forms. A further novelty of our boiler construction resides in the provision of easily removable flue travel plates 30 and 31 (see Figure 1) for inspection and/or cleaning purposes. Suitable openings are tapped into the top of the boiler to accommodate a gauge 32, which in the present illustration is a water gauge.

From the foregoing description, it is apparent that we have provided a very compact boiler construction which has the same effective capacity of much larger boilers heretofore manufactured. This in itself means minimum weight and ease in handling. By being able to reduce materially the size of the boiler, installation thereof is facilitated because it may be taken through small cellar doors or windows. This avoids any disassembly or reassembly operation in order to in-

stall the boiler. It also occupies considerably smaller space, which is an important factor in many installations.

With respect to the efficiency of the boiler, the same is greatly increased by our improvements in such features as a stronger down-draft; having a flue travel completely surrounded by water; locating the fuel burner at the top of the boiler, reduces heat losses sustained in those types of boilers where the burner is located in the bottom, etc. By having the combustion chamber constructed of steel capable of withstanding the highest temperatures developed by any burner, the use of a refractory is avoided, which affords the advantages pointed out above.

It is obvious that certain modifications of our invention, as illustrated, will occur to those skilled in the art, and may even be in accordance with present approved practices; for example, the tankless hot water heater which we have disclosed may be replaced by a built-in tank at the top of the boiler.

It is our desire and intention to include all such modifications as may be provided in putting the invention into practice within the purview of the appended claims.

What is claimed is:

1. A boiler comprising a casing, a combustion chamber in the upper part of the casing, a plurality of flue passes disposed in alignment in the lower part of the casing, an inner flue chamber communicating with and connecting the flue passes and the combustion chamber, a flue, an outer flue chamber surrounding the inner flue chamber and communicating with the outlet ends of said flue passes and with the flue, and emergency vent means on the inner flue chamber and adapted to be opened by an abnormal force of combustion gas for by-passing the latter directly into the outer flue chamber and flue.

2. A boiler comprising a casing, a combustion chamber in the upper part of the casing, a flue pass in the lower part of the casing, an inner flue chamber communicating with and connecting the flue pass and the combustion chamber, a flue, an outer flue chamber surrounding the inner flue chamber and communicating with the outlet end of the flue pass and with the flue, and emergency vent means on the inner flue chamber and adapted to be opened by an abnormal force of combustion gas for by-passing the latter directly into the outer flue chamber and flue.

3. A boiler comprising a casing, a combustion chamber in the upper part of the casing, a flue, flue passes positioned in tier formation in the lower part of the casing, an inner flue chamber communicating with and connecting the upper tier of flue passes and the combustion chamber, an outer flue chamber surrounding the inner flue chamber and connecting the outlet ends of the lower tier of flue passes with the flue, and emergency vent means on the inner flue chamber and adapted to be opened by an abnormal force of combustion gas for by-passing the latter directly into the outer flue chamber and flue.

4. A boiler comprising a casing, a combustion chamber in the upper part of the casing, a flue, flue passes positioned in tier formation in the lower part of the casing, an inner flue chamber communicating with and connecting the upper tier of flue passes and the combustion chamber and an outer flue chamber connecting the outlet ends of the lower tier of flue passes with the flue, a vent on the inner flue chamber, and means normally maintaining the vent closed and yieldable to an abnormal force of combustion gas for opening the vent and by-passing the gas directly into the outer flue chamber and flue.

5. A boiler comprising a casing, a combustion chamber in the upper part of the casing, a flue, an upper tier of flue passes in the lower part of the casing, a lower tier of flue passes associated with and of greater capacity than the upper tier, an inner flue chamber connecting said upper tier with the combustion chamber, an outer flue chamber surrounding the inner flue chamber and connecting said lower tier with the flue, a vent on the inner flue chamber, and means normally maintaining the vent closed and yieldable to an abnormal force of combustion gas for opening the vent and by-passing the gas directly into the outer flue chamber and flue.

ARTHUR C. BAUMANN.
GEORGE K. HURD.

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