Nov. 11, 1930. L. D. SUMMERS 1,781,532

BOILER AND WATER HEATER

Filed Sept. 22, 1927 3 Sheets-Sheet 1

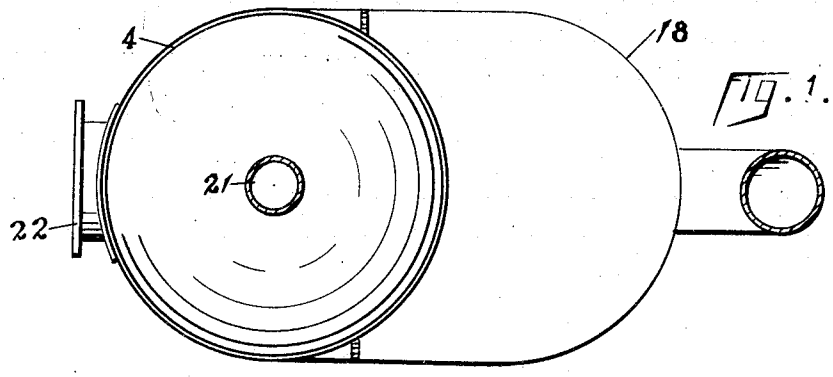


Fig. 1.

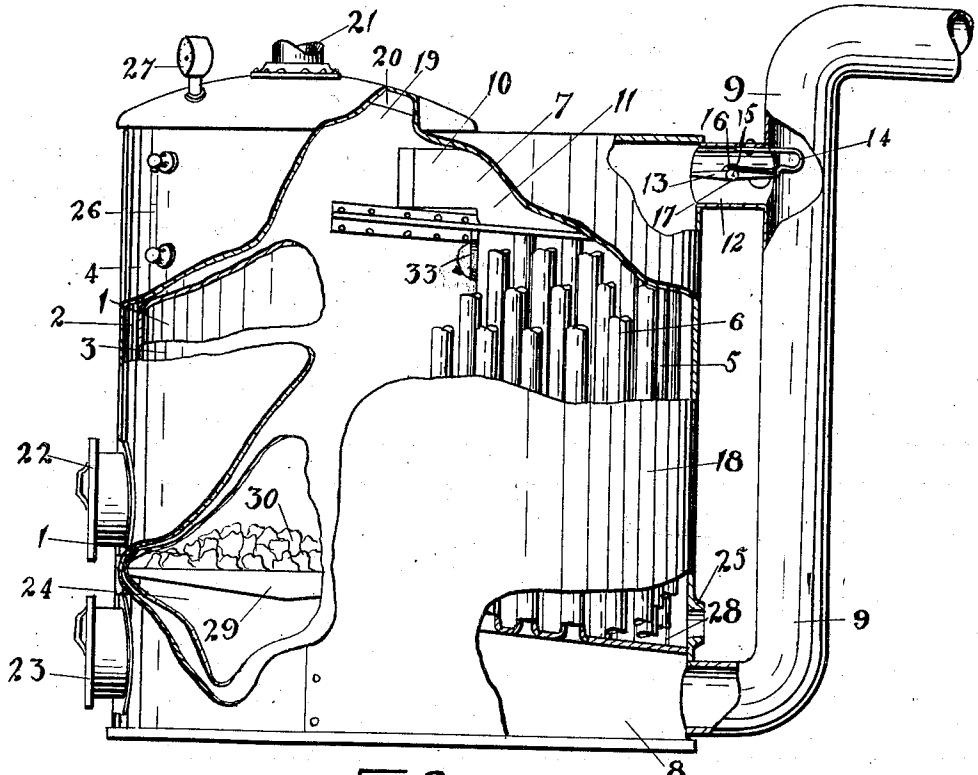


Fig. 2.

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BOILER AND WATER HEATER

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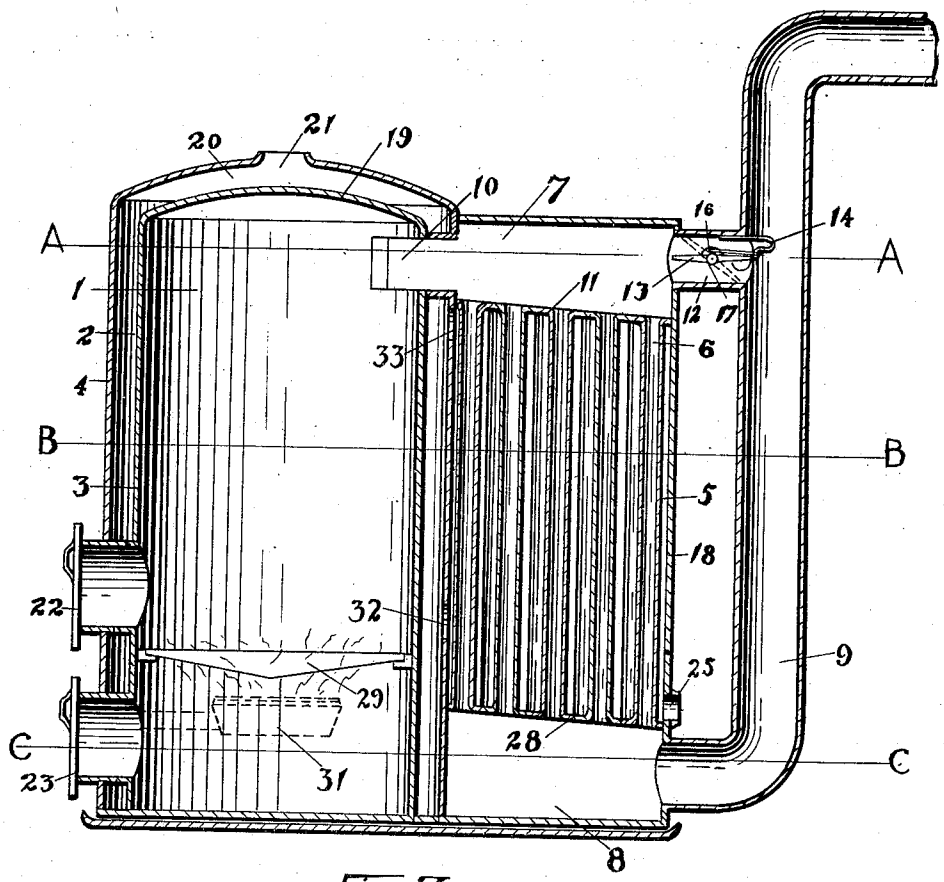


Fig. 3.

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BOILER AND WATER HEATER

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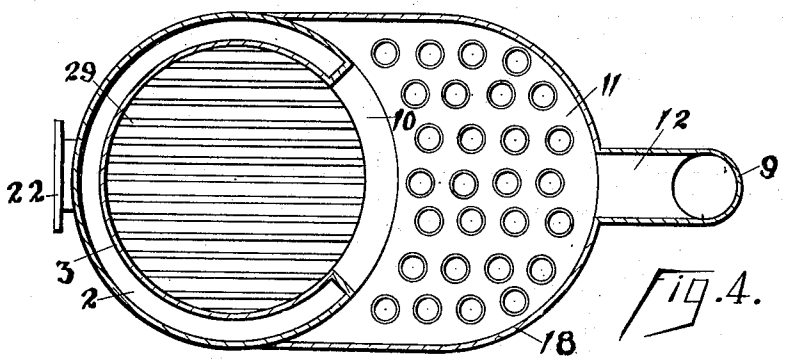


Fig. 4.

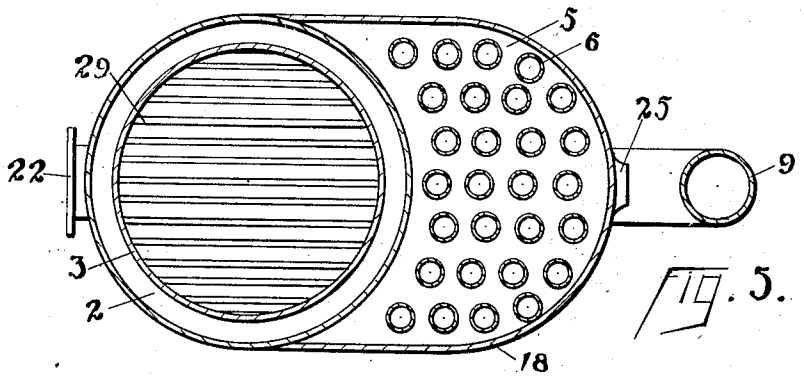


Fig. 5.

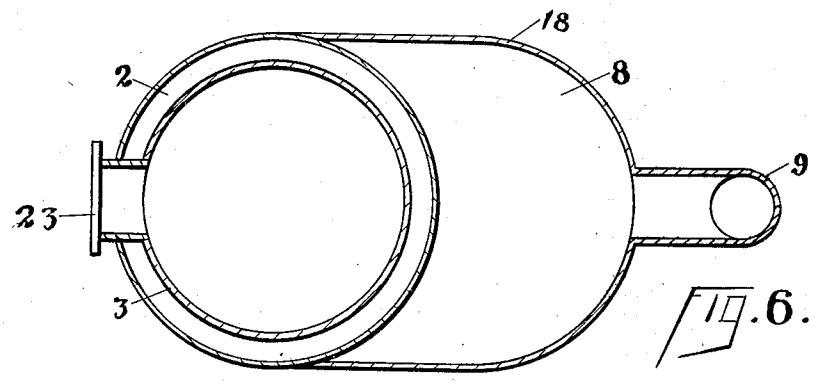


Fig. 6.

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Patented Nov. 11, 1930 1,781,532

UNITED STATES PATENT OFFICE

LOUIS D. SUMMERS, OF DECATUR, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO LEADER IRON WORKS, INC., OF DECATUR, ILLINOIS, A CORPORATION OF DELAWARE

BOILER AND WATER HEATER

Application filed September 22, 1927. Serial No. 221,369.

This invention relates to boilers and water heaters that are adapted to be used for fuels such as coke, hard coal and the like for heating water, or for (building) heating systems.

An object being in this case particularly, to provide a boiler and water heater that will be economical to manufacture, practical and convenient to install and one that will develop a high percentage of efficiency in heat transfer.

A further object of my invention is to provide a boiler and water heater in which hard coal and coke may be used as well as oil or gas and in which I accomplish the maximum of heat transfer from the products of combustion as long as the heated gases are permitted to remain in the tube before they are slowly discharged in their coolest state.

A further object of my invention is to provide a boiler and water heater in which hard coal, coke, gas or oil may be used effectively; and in the details of construction of which boiler and water heater there is an economizer compartment adapted to effectively utilize the principle of counterflow and stratification in permitting the hot gases to pass down through a series of gas tubes adjacent the combustion chamber of the boiler; and while moving slowly down through these tubes, transfer the greater percentage of their heat from the tubes to the water in a central water chamber therein through which the gas tubes extend.

With these and other objects in view, this invention concerns improvements in boiler construction, the details of which will be hereinafter explained in the following paragraphs and illustrated in the drawings forming a part of these specifications; in which drawings like numerals indicate like parts in the several figures.

Figure 1 is a top view of the boiler and water heater of my invention.

Figure 2 is a side elevation thereof disclosing in a cut-a-way interior details of construction of my boiler and water heater.

Figure 3 is a vertical section from front to back of my invention.

Figure 4 is a horizontal cross section taken A—A of Figure 3.

Figure 5 is a horizontal cross section taken B—B of Figure 3.

Figure 6 is a horizontal cross section taken C—C of Fig. 3.

At the present time there is a tendency toward the increased use of boilers and water heaters that may be adapted to use hard coal, coke, gas or oil in order to make such heating equipment adaptable to use in the various local communities where at least one or more of such fuels may be conveniently available.

When burning fuels of the kind above mentioned, it is necessary to have a sufficiently large combustion chamber to provide a complete combustion of the fuels and yet provide a large surface to meet the radiated heat from the burning gases.

It is necessary to maintain a temperature of from 900 to 1600 degrees Fahrenheit in order to produce combustion; and when the flame, while in the process of combustion, touches any surface with a temperature less than approximately 900 degrees, it will break down the carbon forming what is commonly known as soot, which covers the surface with which it comes in contact; thus having a tendency to form a coating over the surface that would somewhat insulate the surface from heat of the products of combustion thus making it harder to heat the surface and thus accomplish a heat transfer to and through the surfaces with which the products of combustion are adapted to come into contact.

In order therefore to provide a boiler and water heater of high efficiency, I provide in my invention an arrangement of structural details in which the combustion chamber is surrounded on all sides and above by a water leg and especially on one side by a water chamber communicatively connecting with the water leg; and this water chamber has a group of upright gas tubes communicatively connecting with the combustion chamber so as to permit the hot gases to move downward through the tubes as they pass to the flue which receives them at their lowest temperature.

It will be seen therefore that to design and construct a practical boiler, it will be necessary to recognize the physical laws in-

volved in its successful operation and also recognize the fact that its design must be such that it will be practical to build and easy to maintain.

A further purpose of my invention is to provide in connection with a boiler and water heater that takes advantage of the principle of counterflow in heat transfer, an automatic damper and heat by-pass control whereby the products of combustion may be permitted to pass directly from the combustion chamber to the flue without having to be directed downward through the fire tubes until the fire gets a good start up to a predetermined temperature level in the flue; after which the damper may automatically and thermostatically close the direct passage and pass the gases in their normal course down through the tubes that extend through the water compartment.

Referring now in detail to the structure of my boiler, and the preferred method of operating the same, I provide a central combustion chamber —1— surrounded by a water leg —2— which fills the space between wall —3— forming the combustion chamber and casing —4— encompassing the water leg.

Communicating with water leg —2— is a water chamber —5— through which a plurality of pipes —6— uprightly extend. Pipes or tubes —6— are provided to normally carry the hot products of combustion from combustion chamber —1— down from upper gas chamber —7— to lower gas chamber —8— before they pass out ultimately through house flue —9— after giving up the greater percentage of their heat within the tubes and the combustion chamber.

It will be evident to those acquainted with the heating art that when the hot products of combustion pass up from the combustion chamber —1— through opening —10— down through pipes —6— that they will move downward through the pipes relatively slow where they settle by heat stratification; and it will be further evident that where the hot gases strike the sloping top plate —11— and the upper ends of pipes —6— that they will make the water in the upper area of water chamber —5— hotter and thus leave the water in the lower part of the water chamber —5— with a lower temperature where the gases are also of lower temperature as they pass out of the lower end of tubes —6—.

If the products of combustion were permitted to pass always out through pipe —12— into upright flue —9— a strong draught would be the result at all times when a heavy fire is going; but by the construction of my invention I utilize the greater percentage of heat units and get the benefits of heat transfer therefrom to the water in water chamber —5— by sending the gases down through tubes —6— and out through lower gas chamber —8— through flue —9— thus getting a slower movement of the gases and holding them within the upright tubes —6— longer so they will give up more of their heat while moving.

However, I provide pipe —12— as a sort of fire booster for creating a strong draught when starting a fire and maintaining that draught until the temperature reaches a certain suitable level to indicate that the fire has a good start; at which level, automatic damper —13— operates to shut off the movement of the gases through pipe —12— and to pass these gases down through tubes —6—.

Automatic by-pass damper —13— is the subject for a distinct and separate application for patent and will not be claimed in this case. This damper is actuated through the expansion and contraction of spring element —14— which is secured to damper —13— at a pivot —15— and to pipe —12— at pivot —16—; and by this action of high temperatures in pipe —9— spring element —14— is caused to expand resulting in the release and pivotal movement of damper —13— on its pivot —17— causing the same by gravity to close the passage through pipe —12—; but as the heat temperature gets lower, element —14— contracts causing the damper to open and start the draught in the fire again.

It will be noted that casing —18— encompasses the water chamber —5— as well as upper gas chamber —7— and lower gas chamber —8—.

It will also be noted that water leg —2— surrounding combustion chamber —1— is relatively thin above dome —19— of drum —3— at position —20— for instance; thus providing only a thin body of water above dome —19— just at a point over the area of the dome where the hottest gases strike the dome within the combustion chamber and result in an intense application of heat to the water above the dome from which the water leaves the dome through pipe —21— to be carried over the water heating system.

Door —22— is used for admitting hard coal or coke and the like when such fuel is used in my boiler while door —23— is used, in connection with such fuels, as a clean-out door; but when gas or oil are used, such fuel would be admitted to lower chamber —24— through an opening in casing —4— preferably in the relative position of door —23—.

A cold water return pipe —25— is provided for admitting the supply of water to the lower area of water chamber 5.

A water gauge —26— is provided to indicate the water level while a steam gauge —27— is used for safety.

Sloping plate —11— and sloping plate —28— are provided for the enclosure of water chamber —5— and are used also for the

support of tubes —6— extending through water chamber —5—.

Grate —29— is used for supporting a fire where coke or hard coal —30— is being burned.

Figure 3 discloses a gas or oil combustion unit —31— in dotted lines showing how the same would be used if grate —29— were removed and only oil or gas used.

This boiler is so designed as to recognize the principle of counterflow and stratification in transferring heat from the products of combustion to water in the effort to secure the highest possible efficiency in a heating plant.

In this connection I bring all cold water returns to the lowest part of the economizer section through spud —25— thereby bringing the coldest water in contact with the coldest gases before they leave the lower gas chamber as they enter the house flue; thus securing the highest over-all efficiency. The water chamber of the economizer section and the water leg about the combustion chamber are cross connected below and above through the water ways —32— and —33— respectively so as to establish a ready circulation and carry the water to the point that is absorbing the most heat from the products of combustion due to the physical laws governing the heating of water where hot water moves up above the level of the cold water. Thus in this situation the water being heated would maintain in the boiler what may be termed a thermostatic balance. That is the tendency of the coldest water to remain on the bottom and the hottest water to be delivered to the top.

The cross connections —32— and —33— respectively therefore accommodate a free passage to both the water units in proportion to their respective ability to heat the water.

Hence to explain in detail: the water circulation in the water compartment: cold water enters the water compartment through cold water return —25— where as it enters the water chamber —5—, it receives an application of comparatively low temperature heat conducted from the hot products of combustion at their lowest temperature level before leaving the heating plant through pipe —9—. At this level, the water rises as it becomes heated and by displacement in the circulation thereof, it passes over into water leg —2— through opening —32— and as it is gradually heated rises to the top level of the hottest water where through a communicating aperture —33— the hot water may pass freely from chamber —5— to water leg —2—.

It will also be noted that by providing sloping heads —11— and —28— for chamber —5— enabling the hot water to freely circulate between chamber —5— and water leg —2—, I make it unnecessary to have connected with the top of the boiler any more than the one hot water outlet.

To those skilled in the heating art, it will be evident that certain minor details of construction may be varied and would be permissible within the spirit and scope of my invention, but the preferred design and method of operation has been illustrated in the drawings and described in the above paragraphs.

Having thus described the merits and character of my invention and the preferred details of construction thereof, I claim:

A boiler and water heater comprising in cooperative combination an upright drum forming a combustion chamber, a second upright drum encompassing the first and spaced therefrom forming a relatively thin water leg about the combustion chamber drum and a relatively thin water space above the combustion chamber drum; an outer wall connected with and partially encompassing said second drum; said outer wall provided with an upper and a lower outlet on the side thereof for the hot products of combustion and a house flue connected with said outlets; spaced header plates secured to said second drum and encompassed by said outer wall so as to form an upper gas chamber above the upper plate and a lower gas chamber below the lower plate, said upper gas chamber being in communication with said combustion chamber and a water chamber between the two plates; a plurality of fire tubes connecting said plates establishing communication between said upper and said lower gas chambers; said second drum provided with an upper and a lower opening establishing water communication between said water leg and said water chamber; means for admitting cold water into said water chamber and means for releasing water from the top of said second drum over said first drum.

In witness whereof, I hereunto set my hand, this 23d day of Aug., A. D. 1927.

LOUIS D. SUMMERS.