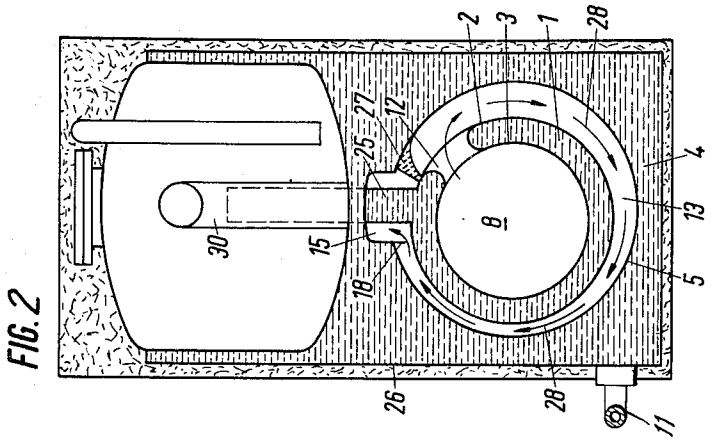
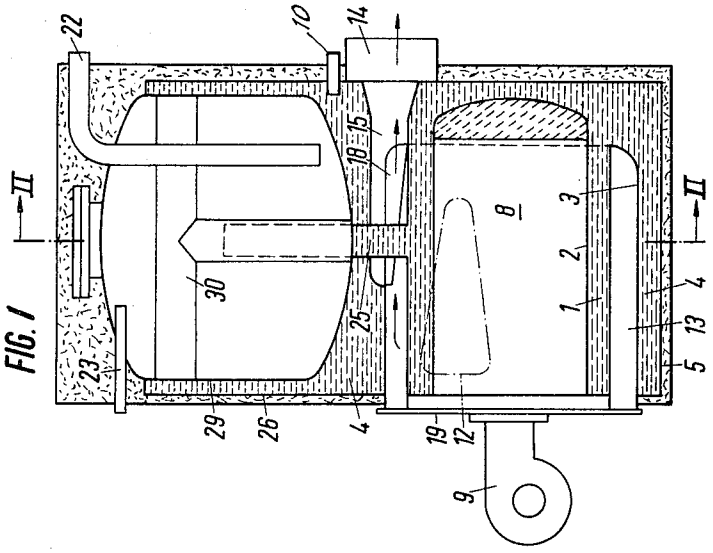
Feb. 22, 1966 G. OSPELT 3,236,212

BOILER

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BOILER

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FIG. 3

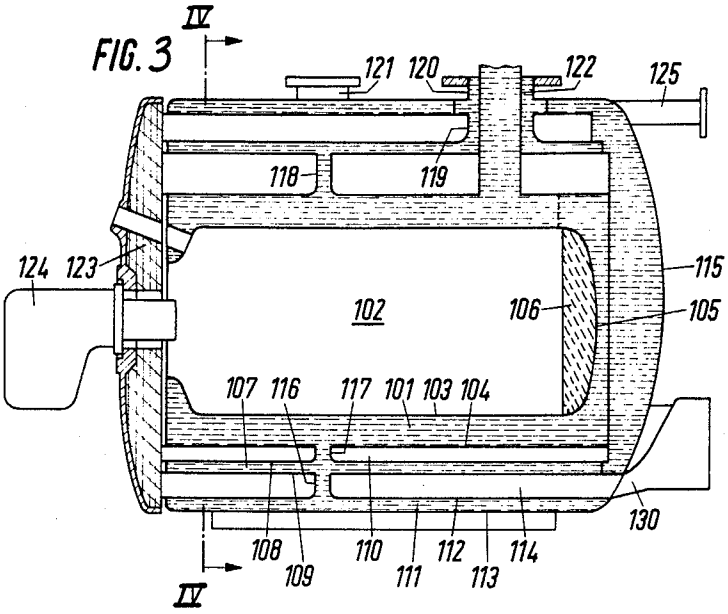
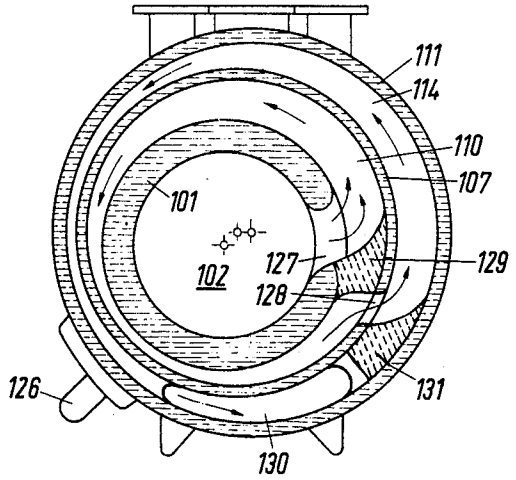


FIG. 4



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FIG. 5

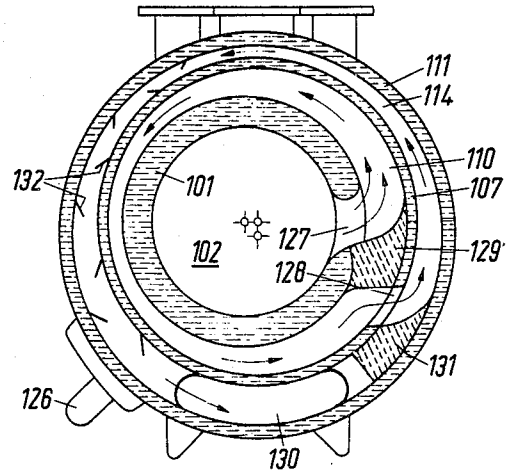
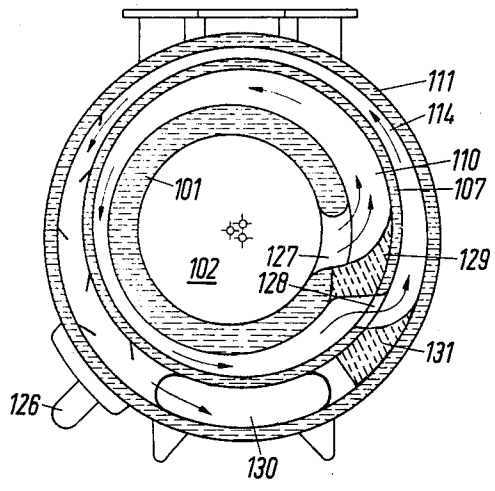


FIG. 6



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3,236,212

BOILER

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3 Claims. (Cl. 122—136)

The present invention relation relates to a boiler which comprises a substantially horizontally arranged first water jacket having a substantially cylindrical outer wall and forming a combustion chamber for a burner for liquid and gaseous fuels, and which also comprises a substantially horizontally arranged second water jacket surrounding said first water jacket in spaced relationship thereto and having a substantially cylindrical inner wall, the interior of said second water jacket communicating with the interior of said first water jacket.

Boilers of the above-mentioned type are known in which the outer wall of the first water jacket is coaxially arranged with regard to the inner wall of the second water jacket. In the annular chamber between the two water jackets there is inserted a helical guiding wall so that the combustion gases passing from the combustion chamber at the front end thereof into the said annular chamber pass through the latter along a helical path in the longitudinal direction of said annular chamber. The speed of the gases cooling off can be held constant by so arranging the pitch of the helical guiding wall windings that it will decrease in the direction of the off-flowing gases.

It is an object of this invention, with a boiler of the above-mentioned type, by simple structural arrangements and means and, above all, without additional inserts, to bring about that the speed of the combustion gases cooling off will remain approximately constant over at least the major portion of their path through the boiler, because otherwise with a decrease in the gas velocity due to the decrease in temperature, also a reduction in the heat transfer occurs.

It is another object of this invention to provide a boiler with two water jackets arranged noncoaxially with and in spaced relationship to each other, in which the gases passing through the annular chamber between said jackets will be subjected to strong turbulence and will intensively sweep the walls of the water jackets.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIGURE 1 is a vertical central section through a boiler;

FIGURE 2 is a vertical section along the line II—II of FIGURE 1;

FIGURE 3 is a vertical central section through a boiler of another modification;

FIGURE 4 is a vertical section taken along the line IV—IV of FIGURE 3;

FIGURE 5 shows a vertical central section through a modified boiler according to the invention;

FIGURE 6 is a section through still another modification of a boiler of the invention.

The present invention is characterized primarily in that the first water jacket is arranged eccentrically with regard to the inner wall of the second water jacket, said first water jacket being provided with a discharge opening extending in the direction of the generatrix of cylinder. This discharge opening establishes communication of the combustion chamber with the annular chamber between the first and second water jackets, at least near that portion of said annular chamber which has the maximum clear width. Furthermore, in conformity with this invention, the flue gas discharge from said annular chamber is spaced from said discharge opening in circumferential direction by a distance greater than that between said discharge opening and that portion of said annular chamber which has the least clear width, the water jackets communicating with each other for conveying water.

This arrangement brings about in a particularly simple manner that the cross-section of the annular chamber which is located between the two water jackets and is passed through by the gases, continuously decreases in flow direction, while the gases pass through said annular chamber in tangential direction, i.e. in circumferential direction. The eccentricity between said two water jackets may be so dimensioned that the reduction in the cross-section is of such magnitude that the gas velocity will at least approximately remain constant. This brings about as uniform as possible a heat transfer over the length of the path of the gas within said annular chamber. Expediently, the discharge opening in the first water jacket extends over about the axial length of this first water jacket so that the annular chamber will, from the very start be well passed through throughout by the gases. The inner wall of the second water jacket may, at the place of the flue gas withdrawal be provided with a channel-like depression in axial direction toward the flue gas discharge.

Referring now to the drawing in detail, the boiler according to FIGS. 1 and 2 comprises a first water jacket **1** with cylindrical horizontally arranged walls **2** and **3**. The second water jacket **4** is formed by a vertically arranged cylindrical outer wall **26** and a horizontally arranged cylindrical inner wall **5**. The two water jackets **1** and **4** are connected at their back sides for conveying water (FIG. 1). The feeding line and the return line of the boiler are designated with the reference numerals **10** and **11**, respectively. The inner chamber **8** of the first water jacket **1** and the annular chamber **13** are at the front side of the boiler closed by a detachable cover **19** carrying the burner **9**. The first water jacket **1** is eccentrically located with regard to the inner wall **5** of the second water jacket, i.e. is somewhat offset toward the left with regard to FIG. 2. The cross-sectionally widest portion of the annular chamber **13** is according to FIG. 2 located on the right-hand side. Near a portion above said widest portion the water jacket **1** is provided with a discharge opening **12**. This discharge opening **12** is offset by approximately 45° with regard to the cross-sectionally widest portion of the annular chamber **13**. The flue gas discharge **14** is located at the highest portion of annular chamber **13** (with regard to the drawing), i.e. is arranged offset by approximately 90° with regard to the cross-sectionally widest or cross-sectionally narrowest portion of the annular chamber **13**. Annular chamber **13** is connected with the flue gas discharge **14** by a trough or passage-like axially extending depression **15** in the inner wall **5** which at one side thereof is provided with a sheet metal member **18**. The lower edge of member **18** is spaced from wall **2** by a forwardly increasing distance (FIG. 2) and brings about that the gases, prior to reaching the trough or passage-like depression **15**, will everywhere uniformly pass through the annular chamber **13**. Between the depression **15** and the discharge opening **12**, the annular chamber is closed by a partition **27** arranged in annular chamber **13** and extending over the axial length thereof. Therefore, the gases can pass only along the path indicated by the arrow **28** in circumferential direction about appreximately the entire circumference of the first water jacket **1**. While doing so they first pass at approximately constant speed through the cross-sectionally narrowing portion of the annular chamber **13** and

then pass through the cross-sectionally broadening portion in which their velocity will be reduced. In view of the decrease in velocity in this shorter portion of the circumference of the annular chamber, the heat transfer will be somewhat decreased. However, due to the reduction in the gas velocity, the deviating resistance during the deviation of the gases from the circumferential direction into the axial direction, will be greatly reduced. In the upper portion of the water chamber surrounded by the wall **26**, there is arranged the heater **29** for the consumer water. This heater has a T-shaped pipe **30** which is passed through by boiler water and serves as heat exchanger and communicates with the second water jacket **4**. Into the vertical portion of the T-shaped pipe **30** extends a conduit **25** which communicates with the first water jacket **1**. The feeding line and the discharge line of the heater for the consumer water are designated with the reference numerals **22** and **23**, respectively.

The boiler according to the invention may, in an advantageous manner be so designed that it is provided with three water jackets arranged eccentrically with regard to each other so that between the first and the second water jacket there will be formed an inner annular chamber, while between the second and third water jacket there will be formed an outer annular chamber. Furthermore, the combustion chamber, the two annular chambers, and the flue gas discharge are so connected to each other that the two annular chambers will be passed through successively by the combustion gases in one and the same circumferential direction. Such a boiler, which yields a particularly high exploitation of the heat of the combustion gases, is illustrated in FIGS. 3 to 6. More specifically, the boiler according to FIGS. 3 and 4 has a first water jacket **101** confining a combustion chamber **102** and formed by two cylindrical horizontally arranged walls **103** and **104**. Wall **103** has its rear end provided with a bottom **105** which closes the combustion chamber **102**. Mounted on said bottom **105** is a fire-resistant lining **106**. First water jacket **101** is surrounded in spaced relationship thereto by a second water jacket **107** which is composed of two cylindrical horizontally arranged walls **108** and **109**. Between the water jackets **101** and **107** there is provided an annular inner chamber **110**. The second water jacket **107** is surrounded in spaced relationship thereto by a third water jacket **111** which is composed of two cylindrical horizontally arranged walls **112** and **113**. Between the water jackets **107** and **111** there is provided an annular outer chamber **114**. The rear end of wall **113** is equipped with a bottom **115**. The water jackets **101**, **107** and **111** are closed at their front end, whereas their rear ends are open and communicate with each other in a water-conducting manner. For purposes of obtaining a good water circulation, the bottom portions of the water jackets are interconnected by connections **116** and **117**. Furthermore, the first water jacket **101** and the second water jacket **107** have their upper portion connected to a connection **118**, while the second water jacket **107** communicates with the third water jacket **111** by a connection **119**.

The highest portion of the third water jacket **111** is by means of a stand-pipe **120** and at a somewhat lower section by means of two return pipes **121** connected with a heater for consumer water (not illustrated) which heater is heated up by boiler water. In view of the thermo-syphon effect, the boiler water circulates through the heater for the consumer water. The connection **119** is below the stand-pipe **120** arranged in such a way that the boiler water heated in the second water jacket **107** can flow directly into the stand-pipe **120**. Mounted on the first water jacket **101** is a stand-pipe **122** which extends in spaced relationship through the connection **119** and also through the stand-pipe **120** and extends into the heater for the consumer water. The hottest boiler water passes through stand-pipe **122** from water jacket **101** upwardly whereby the thermo-syphon circulation through the heater for the consumer water will be greatly accelerated.

The annular chambers **110** and **114** are at the front end closed by a cover **123** which carries a burner **124**. The boiler feeding line is designated with the reference numeral **125** while the boiler return line is designated with the reference numeral **126**.

The first water jacket **101** is arranged eccentrically with regard to the second water jacket **107** and more specifically, according to FIG. 4, is offset toward the left in downward direction. On the right-hand side, the first water jacket **101** has a discharge opening **127** which extends in the direction of a generatrix of cylinder. The gases pass from combustion chamber **102** through opening **127** into the inner annular chamber **110** which is passed through by the gases in circumferential direction. During this course the gases first pass through the long narrowing portion of the annular chamber **110** and then through a short but again broadening portion. The gases then pass into the outer annular chamber **114** through an overflow opening **128** in the second water jacket **107** which overflow opening extends along a generatrix of this water jacket **107** and is offset by approximately 315° with regard to the discharge opening **127**. Between the discharge opening **127** and the overflow opening **128** there is in the annular chamber **110** provided a partition **129**. The again broadening portion of the inner annular chamber **110** brings about that the gas velocity decreases and thus the deviating resistances decrease during the deviation of the gases at the overflow opening **128**. The second water jacket **107** is eccentrically arranged with regard to the third water jacket **111** and in conformity with FIG. 4 is offset toward the left. Also the outer annular chamber **114** is passed through by the gases in circumferential direction over a long cross-sectionally narrowing portion and a short cross-sectionally widening portion. At the end of the widening portion of the outer annular chamber **114**, said chamber **114** is connected to the flue by means of a flue gas discharge **130**. Between the flue gas discharge **130** and the overflow opening **128** there is provided a partition **131** in the outer annular chamber **114**.

FIGURE 5 illustrates an embodiment of the boiler in which with the same location of the discharge opening **127**, and of the overflow opening **128** and of the flue gas discharge **130**, similar to FIG. 4, the eccentricities are so selected that annular chambers **110** and **114** will assume such a shape that at the end of their widening portion, i.e. at the overflow opening **128** and the flue gas discharge **130** they have a greater clear width than in the arrangement of FIG. 4. The first water jacket **101** is with regard to the second water jacket **107** offset toward the left, while the second water jacket **107** is offset with regard to the third water jacket **111** in upward direction. As a result thereof, particularly at the flue gas discharge **130**, a sufficiently large clear cross-section of the outer annular chamber **114** is created the surface of which corresponds substantially to the cross-sectional surface of the flue gas discharge **130**, so that, above all, at this location at which a considerable deviation of the gases is effected, the deviating resistances will be considerably reduced. Inasmuch as the temperature of the combustion gases, which in addition to the gas velocity also influences the heat transfer, has in the last portion of the outer annular chamber **114** dropped already to a rather low value, the increase in the clear cross-section of the last-mentioned portion will not result in any material drawback. The heat transfer in this last-mentioned portion of the outer annular chamber **114** may furthermore be increased by providing guiding panels or deflector plates **132** in the outer annular chamber **114** for guiding the gases back and forth.

FIGURE 6 shows a compromise solution in which the eccentricity of the first and second water jackets with regard to each other is selected in conformity with FIG. 4, whereas the eccentricity between the second and third water jacket is selected in conformity with FIG. 5. With this boiler, the narrowing portion of the inner annular

chamber **110** is made as long as possible. The greatest width of the outer annular chamber **114** is, however, also with this boiler arranged where the strong deviation of the flue gases from the tangential direction of flow into the axial direction of flow occurs so that also at this location of deviation low deviating resistances will be encountered. The widening of the outer annular chamber **114** at the flue gas discharge **130**, which widening is created by the eccentricity of the second and third water jackets in conformity with FIGURES 5 and 6, has in particular with boilers of large axial length and great through-flow quantities, the advantage that the center angle of the flue gas discharge **130** which has the shape of a ring segment and should have a sufficiently large cross-sectional surface, will not have to exceed a desired permissible magnitude.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A boiler which includes: a substantially horizontally disposed first water jacket confining a combustion chamber for cooperation with a burner and having a substantially cylindrical outer wall, at least a second substantially horizontal disposed water jacket surrounding said first water jacket in spaced relationship thereto and communicating with said first water jacket while having a substantially cylindrical inner wall having its longitudinal axis offset with regard to the longitudinal axis of the outer wall of said first water jacket so that the adjacent walls of said two water jackets form with each other an annular chamber of crescent-shaped cross section, said first water jacket having an axially extending discharge opening for the passage of combustion gases from said combustion chamber into said annular chamber, said discharge opening being located at least near that portion of said annular chamber which has the greatest inside width, said annular chamber having outlet means for the combustion gases which is offset circumferentially with regard to said discharge opening by an angle of between 270 and 360°, and partition means provided in said annular chamber and located between said discharge opening and said outlet means.

2. A boiler which includes: a substantially horizontally disposed first water jacket confining a combustion chamber for cooperation with a burner and having a substantially cylindrical outer wall, a second substantially horizontally disposed water jacket surrounding said first water jacket in spaced relationship thereto, said second water jacket communicating with said first water jacket and having a substantially cylindrical inner wall having its longitudinal axis offset with regard to the longitudinal axis of the outer wall of said first water jacket so that the adjacent walls of said two water jackets form with each other a first annular chamber of crescent-shaped cross section, said first water jacket having axially extending first discharge opening means for the passage of combustion gases from said combustion chamber into said first annular chamber, said first discharge opening means being located at least near that portion of said first annular chamber which has the greatest inside width, said first annular chamber having second discharge opening means offset circumferentially with regard to said first discharge opening means by about 315°, partition means in said first annular chamber between said first and second discharge opening means, a substantially horizontally disposed third water jacket surrounding said second water jacket and having a substantially cylindrical inner wall in spaced relationship thereto, said third water jacket communicating with said second water jacket and having a substantially cylindrical inner wall having its longitudinal axis offset with regard to the longitudinal axis of the outer wall of said second water jacket so as to confine therewith a second annular chamber of crescent-shaped cross section, said second discharge opening means forming a passage for the combustion gases from said first annular chamber into said second annular chamber, said second discharge opening means being located at least near that portion of said second annular chamber which has the maximum inside width, said second annular chamber having an outlet for the gases which is offset circumferentially with regard to said second discharge opening means by about 315°, and partition means in said second annular chamber between said second discharge opening means and said outlet.

3. A boiler according to claim **2**, which includes gas deflector plates on the water jacket walls inside said annular chambers.

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