Feb. 23, 1965 J. FRANZÉN 3,170,419

CONTROL DEVICE FOR FURNACE GASES IN HOT WATER BOILERS

Filed Feb. 13, 1963

FIG. 1

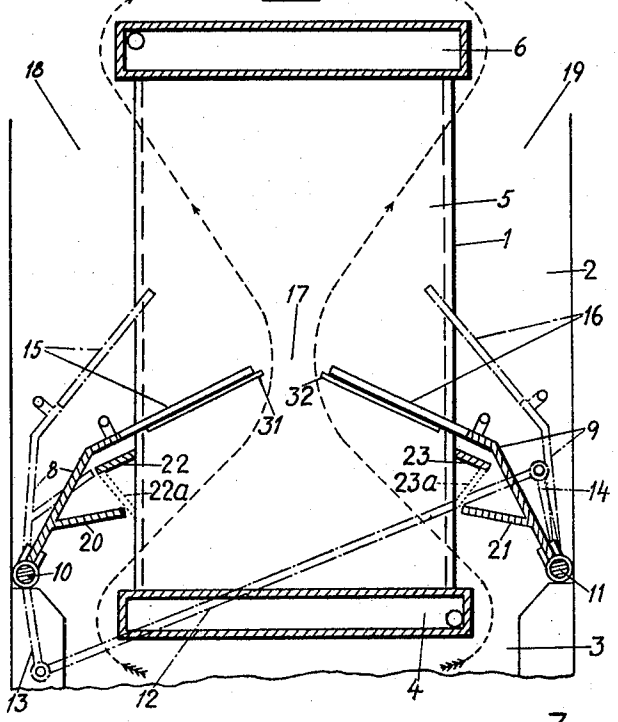


FIG. 2

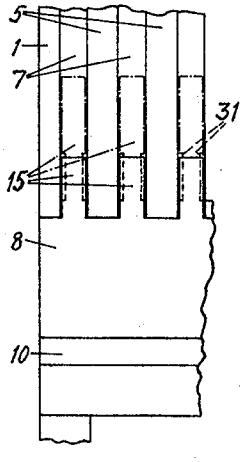
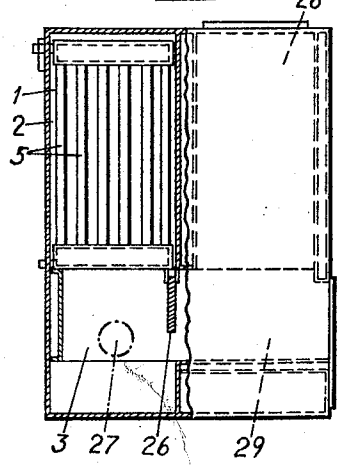


FIG. 3



United States Patent Office 3,170,419 Patented Feb. 23, 1965

3,170,419

CONTROL DEVICE FOR FURNACE GASES IN HOT WATER BOILERS

John Franzén, Askersund, Sweden, assignor to John Axel Franzén, Askersund, Sweden

Filed Feb. 13, 1963, Ser. No. 258,247
Claims priority, application Sweden, Mar. 15, 1962, 2,872/62
6 Claims. (Cl. 110—97)

This invention relates to an improved control device for furnace gases in hot water boilers equipped with sectional heating elements, tubes and the like. The invention refers particularly, without being restricted thereto, to the type of upright central heating boilers in which the sectional heating elements, tubes and the like are in an assembly disposed in parallel space relationship within a heating chamber for the flow of hot furnace gases between the same with the object of heating the circulatory water for room-heating elements and the like in a house.

It is an object of this invention to provide a device in the water heating elemnt assembly per se to direct the stream of hot furnace gases to restricted portions of the assembly especially at low fueling of the boiler.

Another object of the invention is to provide a device in the water heating element assembly per se to concentrate the stream of hot furnace gases to a central narrow stream within the assembly especially at a low fueling of the boiler.

Another object of the invention is to provide a device in the water heating element assembly per se to regulate the breadth of the hot stream within the assembly in accordance with the fueling conditions of the boiler.

A further object of the invention is to provide a device in the water heating element assembly per se to prevent the hot stream of the gases from by-passing the assembly at the entrance of the same.

Still a further object of the invention is to provide a device to raise the temperature of the furnace gases at a low fueling of the boiler and prior to their entry into the water heating element assembly.

With these and other objects in view, the invention essentially is characterized by the provision of a device in the water heating element assembly per se, said device consisting of a number of deflectors for changing the direction of the hot furnace gases within the assembly and capable of being adjusted in such a manner that the cross area of the stream path within the assembly per se through which the hot furnace gases normally have to pass can be reduced as required in the actual spaces between the assembled hot water pipes.

An embodiment of the invention is illustrated in the accompanying drawing, in which:

FIGURE 1 is a view partly in side elevation and partly in cross section of the heating element assembly,

FIGURE 2 is a fragmentary front view of same, and

FIGURE 3 is a side view partially in elevation and partly in cross section of a hot water boiler equipped with a heating element assembly.

The heating element asssembly 1 for the hot water supply is disposed in a chamber 2 within the boiler alongside fuel storage chamber 28 and above a further chamber 3 at the side of furnace 29 from which the combustion fumes and smoke gases enter the chamber 3, herein referred to as the flame chamber. The upward flowing fumes from the flame chamber first pass a lower junction box 4 for upright hot water pipes 5, thence upwardly along these pipes, finally reaching and passing an upper junction box 6 from which they rise to the chimney. It is also possible to guide the same to pass a separate heating arrangement for the supply of separate dish or bath-

water. The hot water pipes 5 are of a broadly flattened shape as shown in FIGS. 1 and 2, and are arranged in parallelism providing a space 7 therebetween as shown in FIG. 2. Normally all of the hot water pipes are of the same gauge, and for practical purposes, the width of the spaces 7 is also the same.

When mass-producing boilers of various sizes, the hot water pipe assembly is formed in its entirely by joining together a number of single sections, in which case, each section consists of a portion of the lower and upper junction boxes 4 and 6 including the pipe between the two boxes.

The flow control device according to the invention is disposed within the heating element assembly and its chamber 2, and in the embodiment shown two guide plates or deflectors 8 and 9 set with synchronized movements of adjustment opposite each other and extending on each side of the pipe assembly for the entire longitudinal direction of the same. The deflectors face the openings of the spaces 7 between the various sections or pipe rows if such are used and are preferably of the somewhat bent form as shown in FIG. 1. The deflectors 8 and 9 are journalled on shafts 10 and 11 respectively, and each deflector can be turned towards or away from the heating elements by means of a control handle located exteriorly of the boiler. The control movement is achieved by a link 12 provided between link rods 13 and 14, which rods extend radially from the shafts 10 and 11 in opposite directions, and by means of which the deflectors can be simultaneously adjusted in a direction towards or away from the heating element assembly.

In FIGS. 1 and 2, the deflectors 8 and 9 are in the form of a comb, with teeth 15 and 16 respectively, which teeth are of substantially the same width as the spaces 7 and are capable of being positioned into the spaces 7 when adjusted towards the heating element assembly. In the transverse direction of the deflectors, the length of the teeth is such that when the deflectors are set in their closed position, there remains only a slight opening 17 of predtermined size, or no opening, between any two teeth set in position from either side, and thus in the first case forms a narrow passage for the flow of the fumes. A wide or narrow centrally disposed opening for the flow of the fumes inside the heating element assembly can thus be established simply by varying the amount of movement of the teeth.

As shown in FIG. 1, there are open space 18 and 19 along the boiler wall on either side of the heating element assembly, in which spaces the deflectors 8 and 9 are pivotally arranged and through which the fumes can pass by the heating element assembly when the deflectors are set in the open position. Since there are spaces between the teeth of the deflectors, it is evident that ineffective fumes can also pass freely through these spaces when the deflectors are partially opened and this results in the loss of heat. For the purpose of preventing such fume escape, the deflectors 8 and 9 are provided with additional deflecting plates or screens 20 and 21 respectively, located at a position close to the shafts 10 and 11, and directed towards and approximately reaching the heating element assembly when the deflectors are in the fully closed position. Somewhat higher, each sectional heating element assembly has been provided with a fixed outwardly extending deflecting plate or screen 22 and 23 respectively, the length of which is such that on setting the deflectors in such a position that the plates 20 and 21 coincide with the fixed plates 22 and 23, the ends of the deflector plates will be set so closely in line that the open flue is blocked, and the hot fumes are forced in between the sections of the heat-

ing element assembly. The screens have the same length as the deflectors in the length direction of the assembly.

Alternatively, the fixed plates **22** and **23** may be bent, or assume an angular shape forming a bracket with side pieces **22***a* and **23***a* being so positioned that the free ends of the movable plates **20** and **21** will pass along the side pieces when the deflector position is being changed for the purpose of forcing the fumes to pass through the space between the sections of the heating element assembly thereby preventing heat loses irrespective of the particular position of the deflectors. The arrows in FIG. 1 indicate the direction of flow of the fumes when the deflectors **8** and **9** are turned fully inward.

Since, according to the extent of actuation, the deflectors thus greatly assist in preventing the fumes from by-passing the heating elements at the opening edges between the same and the wall, the fumes will be more and more concentrated toward the central position of the heating element assembly. Irrespective of the fueling of the boiler and the corresponding throttling of the fumes, this results in the passing fumes giving off their heat content to the elements to an increasing extent while at the same time achieving a suitable exhaust temperature, a more efficient heat exchange rate, and a more favorable fuel economy. This also implies that the exhaust temperature of the fumes on low fuel consumption of the boiler can be raised by opening the deflectors so that sweating and erosive action on the walls of the boiler and chimney flue can be avoided. The duplex type of deflector arrangement will also establish a more symmetrically improved distribution of the thermal strains and stresses.

It is obviously of great importance that the fumes have the highest attainable temperature when striking the heating element, and particularly so on low fuel consumption when the deflectors cause the fumes to be compressed into a central column at the heating element. High initial temperature will in every case produce a high heat exchange co-efficient as well as favorable heating economy. In this particular case, the best result can be obtained by combining with the deflector arrangement a set of heat retaining red hot glow bodies **26** of cast iron or other suitable material which is disposed in the passage between the furnace and the flame chamber **3**. Such glowing bodies are capable of storing heat even under low fueling conditions and contribute greatly to increasing the temperature of the fumes.

In the case of upright boilers of considerable height, a plurality of deflector sets may be arranged one above the other and adapted for manual control as in the embodiment described above, or automatically controlled by a thermostat. The boiler may be equipped with an oil burner as indicated at **27** in FIG. 3, or with the necessary fittings for the installation of such a burner, thus offering alternative methods of firing.

Due to the collection of soot in the heating element, the teeth of the deflectors are dimensioned with a certain amount of play in the spaces between the sections. Since the passing of fumes at these points is considered inappropriate on extremely low fueling conditions, stop ledges or abutments **31** and **32** have been fixedly attached to the sections for the teeth **15** and **16** in their innermost closing position. Apart from restricting the movement of the teeth, the ledges close the gaps which may provide for play, and thus prevent the passing of fumes at the most limited area of flow between the deflector teeth.

The deflector control arrangements have been so designed that they are capable of adjustment when the boiler is in operation. The same can, by means of their foot holders, be locked in position and thus prevented from being inadvertently moved from a position previously found to be favorable from a heat economical point of view even if the deflector plates must be removed for cleaning or the like.

Although vertical tubes are preferred, horizontal tubes may be used with the same being disposed in superposed relationship. Instead of the fixed screening plates **22** and **23**, the deflector plates **20** and **21** may be curved or angular. The deflectors may be adapted for sliding movement instead of pivotal movement. The invention is not limited solely to hot water boilers, and the control device according to the invention may also be utilized in heating element assemblies of such type as, for example, economizers.

I claim:

1. In a heat exchange assembly, wall means defining a chamber, a furnace, means for passing hot furnace gases through the chamber, a water heating element located within the chamber for supplying hot circulatory water for heating rooms and like purposes, and control means within the chamber for the hot furnace gases, said water heating element including a plurality of broadly flattened tubes having opposite ends, said tubes being arranged in spaced apart parallel relationship and being of a width less than the distance between opposite wall means of the chamber for providing spaces within the chamber at each end of the heating element, water dividing and water collecting boxes connected to the opposite ends of the tubes, said control means including a deflector plate mounted in the space in the chamber at each end of the heating element intermediate said boxes and essentially disposed in the spaces between the tubes so that gases passing through the chamber are caused to move inwardly of the tubes adjacent one of the boxes, then axially of the heating element sweeping the surfaces of the tubes in the spaces between the tubes and thence outwardly of the tubes adjacent the other box, and means movably mounting said plates in said spaces in the chamber for adjusting the cross-sectional area of the axial path of the gases in the heating element.

2. The heat exchange assembly as claimed in claim 1, in which said deflector plate is provided with spaced teeth substantially corresponding in width to the width of the spaces between said tubes adapted to enter the spaces between said tubes.

3. In a heat exchange assembly, wall means defining a chamber, a furnace, means for passing hot furnace gases through the chamber, a water heating element located within the chamber for supplying hot circulatory water for heating rooms and like purposes, and control means within the chamber for the hot furnace gases, said water heating element including a plurality of broadly flattened tubes having opposite ends, said tubes being arranged in spaced apart parallel relationship and being of a width less than the distance between opposite wall means of the chamber for providing spaces within the chamber at each end of the heating element, water dividing and water collecting boxes connected to the opposite ends of the tubes, said control means including a deflector plate positioned in the space in the chamber at each end of the heating element intermediate said boxes, each of said plates being provided with teeth corresponding in width to the spaces between said tubes and adapted to be disposed in such spaces so that gases passing through the chamber are caused to move inwardly of the tubes adjacent one of the boxes, then axially of the heating element sweeping the surfaces of the tubes in such spaces and thence outwardly of the tubes adjacent the other box, a shaft in the space at each end of the heating element on which the deflector plate is pivoted, means for simultaneously adjusting said plates, such means including a link, further link means connected to each shaft and extending radially therefrom in opposite directions, and means coupling said link to said further link means whereby actuation of the link simultaneously moves said plates toward or away from each other.

4. The heat exchange assembly as claimed in claim 3, further including screen means provided for each deflector plate in proximity to said shaft with such screen means being directed towards said heating element with the free end thereof closely adjacent the ends of said tubes

when the deflector plates are moved to their extreme position towards said heating element for preventing bypassing of the furnace gases at such ends of the tubes.

5. The heat exchanging assembly as claimed in claim 4, including a stationary screen attached to each end of said heating element and directed towards the deflector plate so that when the deflector plates are in their positions adjacent the heating element the free end thereof coacts with the free end of the movable screens.

6. The heat exchange assembly as claimed in claim 1, further including a plurality of heat retaining glow bodies located between the furance and said chamber for elevating initial temperature of the furnace gases prior to the entrance thereof into said chamber.

References Cited by the Examiner

UNITED STATES PATENTS

2,070,223	2/37	Butler	165—96
2,083,745	6/37	Risdon	126—101
2,540,359	2/51	Torpy et al.	110—97

JAMES W. WESTHAVER, *Primary Examiner.*

FREDERICK KETTERER, *Examiner.*