

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets

(11) Publication number:

0 041 528**B1**

(12)

EUROPEAN PATENT SPECIFICATION(45) Date of publication of patent specification: **25.04.84**(51) Int. Cl.³: **F 22 B 37/06, F 23 M 3/16,
F 24 H 9/18**(21) Application number: **81900007.6**(22) Date of filing: **02.12.80**(86) International application number:
PCT/DK80/00076(87) International publication number:
WO 81/01603 11.06.81 Gazette 81/14(54) **BOILER LINER FOR OIL- OR GAS-FIRED BOILERS.**(30) Priority: **05.12.79 DK 5167/79
12.12.79 DK 5167/79
11.02.80 DK 5167/79
22.01.80 DK 249/80**(43) Date of publication of application:
16.12.81 Bulletin 81/50(45) Publication of the grant of the patent:
25.04.84 Bulletin 84/17(84) Designated Contracting States:
DE GB SE(56) References cited:
**DE - B - 1 949 036
DE - C - 93 180
DE - C - 369 434
DE - C - 830 238
SE - B - 334 207
SE - B - 393 447
US - A - 2 266 551
US - A - 2 540 359
US - A - 2 601 167**(73) Proprietor: **Pedersen, Arne
Enghavevej 10
DK-4180 Sora (DK)**(72) Inventor: **Pedersen, Arne
Enghavevej 10
DK-4180 Sora (DK)**(74) Representative: **Koepsell, Helmut, Dipl.-Ing.
Mittelstrasse 7
D-5000 Köln 1 (DE)**(56) References cited:
**US - A - 2 791 190
US - A - 3 548 764****Billberg, A, Handbok i oljeeldning och
fastighetsuppvärmning. Stockholm 1949, page
163, right, lines 7-9**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

Courier Press, Leamington Spa, England.

EP 0 041 528 B1

Boiler liner for oil- or gas-fired boilers

The invention relates to a boiler liner for oil- or gas-fired central heating boilers in which by means of heat resistant materials together with the heating surfaces of the boiler flow channels for the smoke gas are confined to promote good heat transition conditions.

A boiler liner of this kind is described in US-Patent specification 2,266,551 without, however, realizing that the arrangement of the bricks forming the heat resistant material is decisive for the thermal efficiency of the boiler.

Consequently it is one object of the invention to improve the thermal efficiency of the a.m. boiler, namely by obtaining a more complete combustion and providing a constrained heat flow in the boiler chamber.

For this purpose the invention is characterized in that the material for confining the flame room as well as the material for the flow channels confined by the heating surfaces are highly insulating.

The highly insulating surface opposite the heating surface will closely follow the falling temperature of the gas flow in the flow direction so that in any point along the surface of the material there will be a local balance between convection and radiation which is not affected by the thermal conductivity of the brick material in the flow direction.

Furthermore, the use of highly insulated bricks in the whole liner is important by intermittent operation to obtain a desirable low heating capacity originating in the brick material, partly because the specific gravity is low with a resulting low heating capacity, partly because the high insulation per se results in the fact that at most one third of the brick material will take part in the thermal exchange.

The liner can consist of a horizontal layer of plates, resting against the heating surfaces of the boiler chamber, and of vertical upright plates likewise resting against the heating surfaces. The plates are positioned at an exact distance from the heating surfaces in a manner as to form slot openings the width of which shall be less than half the depth of the slots. Hereby will be achieved a linear smoke gas exhaustion from the slots along the perpendicularly to the slot openings situated heating surfaces and without noticeable turbulence to heat the central section of the boiler chamber for no purpose.

In practice and by laboratory examinations made by Jydsk Teknologisk Institut (Jutland Institute of Technology) at Aarhus it has been established that the boiler liner will ensure temperatures quite close to the heating surfaces after the passage of the smoke gas through the slots being about 300 degrees higher than the temperature in the interior of the remaining boiler chamber. In this manner the boiler liner will allow a complete control of

the smoke loss, and make it possible—proportionally with the quality of the chimney—in each particular case to determine the minimum and/or absolute smoke loss for instance by extending the slot opening along the hind wall of the boiler chamber. By way of a boiler liner of the said description the result will be an extremely low smoke loss.

It is according to the invention practical that the material is designed as a building set, easily adapted to all types of boiler chambers during mounting proceedings, for instance Vermiculite. Vermiculite, produced by the Moler Works of Denmark, is a highly insulating material with low volumetric specific heat and resistant to heat loads of about 1200 degrees C. A material of this character will besides improved combustion conditions and gas flow offer a hitherto unnoticed additional utilization of the supplied energy in thermostat-regulated boilers. Partly because the material is easily cut through, whereby a precise and ideal slot opening is attainable for the individual boiler, and partly because the reflection from the burner chamber narrowed by the material will produce to a higher extent than known by the use of already known fireproof bricks an ideal temperature around the flame of from 950 to 1000 degrees C.

This will ensure a clean combustion which again will reduce the pollution from the chimney smoke substantially, and produce a desirable temperature of about 400 to 500 degrees C in the slot opening between heating surfaces and the plates, which in case of slightly sulphur containing oils will ensure improved conditions of formation of SO_2 , sulphurous acid, in the contact with the heating surfaces of the boiler. The heating surfaces will thus be kept mainly free of soot deposits.

The temperature attained in the slots between the plates and the heating surfaces of the boiler is conditioned by the inlet temperature of the gases through the slots, as well as by the fall of temperature appearing during the passage of the gases through the slots. A relative wide slot will thus procure excessive temperatures, whereas a relative narrow slot will result in temperatures unnecessarily far below the conversion temperature for SO_2 to SO_3 , and accordingly too slow rate of formation of sulphuric acid.

It has been proved in practice that the boiler liner during 8 to 14 days after the installation will disintegrate old firm deposits and clean the heating surfaces completely.

The highly insulating effect of the materials will bring about that the assimilated heat is stored at temperatures near to the flame temperature, and cause that the stored volume of heat will be quickly given off by radiation, as the surface of the Vermiculite plates will be

cindered, and it will appear that the temperature will rise comparatively more due to the said radiation when the flame is extinguished. At the same time an undesirable heat convection will fail to manifest in the boiler chamber, which by known flame limitations is strengthened by the presence of good heat conductors and/or heat absorbing bricks. The returned radiation from the highly insulating material will provide that the interval between the sparks will be prolonged, which has been documented by laboratory research. The aggregate effect of the boiler liner will result in efficiency effect of the supplied energy of up to 96 per cent. In this respect the boiler liner according to the invention differs completely from known flame temperature regulation methods and so-called "smoke turning plates", in which materials are applied that produce the said heat convection in the boiler chamber after the extinguishing of the fire.

The invention relates furthermore to a procedure of mounting the boiler liner according to the invention in all types and sizes of boilers.

There are mainly two existing categories of boilers viz. cast iron boilers with heating surfaces in corrugated profile, and plate iron boilers with smooth surfaces. The boiler liner can be built up from the bottom of the boiler as a building set, as the longitudinal plates are adjusted to the depth of the boiler chamber, and the crosswise plates keep the longitudinal plates interlocked with the already mentioned pre-calculated precise slot opening at the heating surfaces. It is according to the invention advantageous that the material is suspended on metal angles, fastened to the rigging screws distended in the upper section of the boiler.

In boilers having heating surfaces with corrugated profile, the bottoms of the profile will form natural openings for the desired slot openings, when the plates are resting against the profile.

In boilers with smooth heating surfaces those plates resting against the heating surfaces are provided with 2 cm deep grooves, by which the ideal slot opening has been obtained.

The invention will in the following be described in detail with reference to the drawing in which

Figure 1 shows an oil-fired cast iron boiler with corrugated profiles and a boiler liner according to the invention seen in perspective from the front and in partwise section,

Figure 2 shows an oil-fired plate iron boiler with smooth heating surfaces and a boiler liner according to the invention seen aslant from the front in perspective and in partwise section, and

Figure 3 a boiler liner seen from the front with separate individual parts.

Figures 1 and 2 show sections of oil-fired boilers, in the foremost wall of which the burner tube of the oil burner is situated. Above the burner tube and resting on a foundation of highly

insulated plates 2 shaped according to the form of the boiler is placed a layer of plates 3, resting in boilers with corrugated profile against the heating surfaces 5 of the boiler, by which are produced slot openings 4 between the plate material and the indentations of the heating surfaces. Upright on this layer of plates 3 can be placed two plates 6 in boilers with corrugated profile, whereby linear hot air flow along the heating surfaces is provided. The said plates 6 and loosely placed plates 7, covering the intervals between the plates, are kept in due position by the crosswise passing adaption plates 8.

In boilers with smooth heating surfaces 5, cf. Figure 2, the plates 3 of the layer to form slot opening to the heating surface 5 are provided with 2 cm deep grooves. These grooves will provide the desired slot opening 4, when the plates 3 are squeezed against the heating surfaces. The plates 3 are kept in due position by the crosswise passing adaption plate 8.

In boilers with heating surfaces with corrugated profile the liner can, as shown in Figure 3, be suspended by means of rigging screws 10, distended horizontally from side wall to side wall in the upper section of the boiler chamber. The rigging screws 10 are provided with open bends 11 of a special alloy of spring steel, and in the openings of which the angle bars 13 are suspended. The four angle irons 13 form the basis of the mounting of the boiler liner according to same principles as specified with reference to Figure 1. The horizontal bars of the angle irons 14 are coated with the same highly insulating material as that of which all the plates are made.

In the shown embodiment the combustion gases from the flame will attain an extremely high temperature in the circumference of the flame due to the counterradiation of the plates. Hereby is secured a high quality of combustion.

The built up and narrowed burner chamber will contribute to uphold the greater initial air velocity in the chamber, whereby the convection of the area concerned is improved, after which the heat flow at a temperature of between 400 and 500°C will continue through the slots between the plates 3 and the heating surfaces 5. Due to the so-called Coanda effect along the heating surfaces 5, the heat flow will remain in immediate contact with the heating surfaces up to the ceiling 15 of the boiler, after which the heat flow severely drained of heat energy will escape out through the flues of the boiler into the chimney.

In case the chimney of the central heating plant does not allow for the obtained low temperature of smoke, and provided it being impossible to improve otherwise the chimney conditions, the plates 3 are dismantled and shortened, so as to form a free opening to the hind wall of the boiler 16. The chimney temperature will thus be raised by about 10 degrees C for each $\frac{1}{2}$ cm cut off the plates.

Claim

Boiler liner for oil or gas fired central heating boilers in which by means of heat resistant materials together with the heating surfaces of the boiler flow channels for the smoke gas are confined to promote good heat transition conditions, characterized in that the material for confining the flame room as well as the material for the flow channels confined by the heating surfaces are highly insulating.

Patentanspruch

Kesselauskleidung für öl- oder gasbefeuerte Zentralheizungskessel, in welcher mittels hitzebeständigen Materialien zusammen mit den Heizflächen des Kessels Durchströmkanäle für das Rauchgas begrenzt werden, um gute Bedingungen für den Wärmeübergang zu

begünstigen, dadurch gekennzeichnet, daß sowohl das den Brennraum begrenzende Material als auch das Material für die durch die Heizflächen begrenzten Durchströmkanäle hochisolierend sind.

Revendication

Doublage de chaudière pour chaudières de chauffage central a mazout ou à gaz par lequel, au moyen de matières réfractaires combinées avec des surfaces de chauffe de la chaudière, on limite les passages d'écoulement pour les gaz chauds afin de permettre de bonnes conditions de transfert thermique, caractérisé en ce que la matière pour le confinement de la chambre de combustion de même que la matière pour les passages d'écoulement limités par les surfaces de chauffe, sont hautement isolantes.

5

10

15

20

25

30

35

40

45

50

55

60

65

4

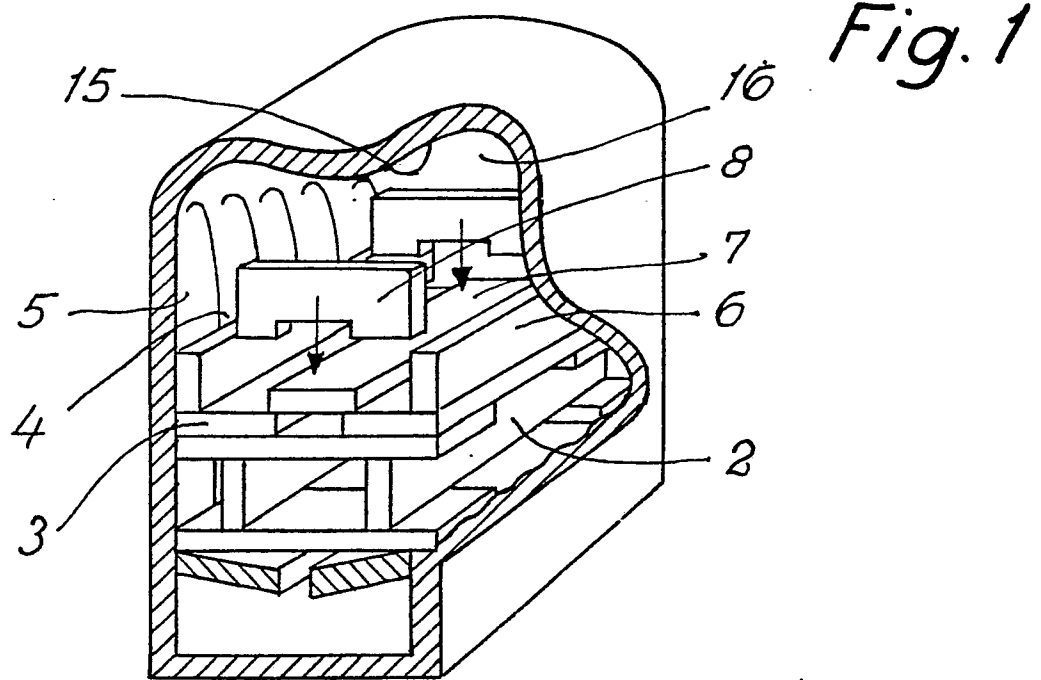


Fig. 2

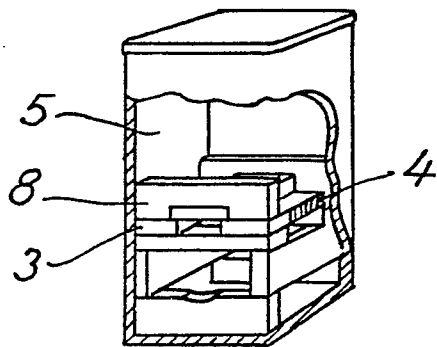


Fig. 3

