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⑦① Applicant: **UNICAL S.p.A., Via Roma, 123, I-46033 Castel d'Ario (Mantova) (IT)**

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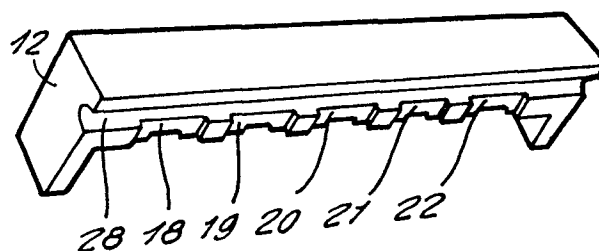
⑦② Inventor: **Jahier, Giovanni, Largo Petrarca, 4, I-46100 Mantova (IT)**

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⑦④ Representative: **Modiano, Guido et al, MODIANO, JOSIF, PISANTY & STAUB Modiano & Associati Via Meravigli, 16, I-20123 Milan (IT)**

⑤④ **Improved burner for a solid fuel-fired steel construction boiler.**

⑤⑦ The involved technical field is that of heating apparatus, and the invention relates to an improved burner for a solid fuel-fired steel construction boiler which develops no dangerous deformations in use and can provide optimum mixing of the products released from the combustion on primary air with secondary air. The solution resides in a burner (1) comprising a refractory stone block (8) having a housing (9) with an apertured (10) bottom adapted to contain at least one refractory material body (11, 12) provided with a means (13-16) of holding the overlying embers, the housing (9) bottom and the surface of said body (11, 12, 30, 31) resting thereon being configured to define a secondary air conveying ducting (28).



"IMPROVED BURNER FOR A SOLID FUEL-FIRED STEEL CONSTRUCTION BOILER"

This invention relates to an improved burner for a solid fuel-fired steel construction boiler.

Known and available on the market are solid fuel-fired steel construction boilers for civil heating applications which comprise a space portion of vertically elongate shape, delimited by longitudinal side walls, a bottom and a cover lined with an interspace containing water to be heated, as well as front and rear faces also provided, at least partially, with a similar interspace.

Said space portion is subdivided into an upper zone and a lower zone, and a burner is provided at the subdivision between the two zones; the upper zone is intended for containing the fuel which is loaded from a door provided in the front face, whilst in the lower zone, there occurs the development of the flame issuing from said burner and conveyance of the flue gases toward a smoke box located at the rear face and provided with a connection to the chimney.

Located on the front face is a combustion air metering unit which comprises an electric fan controlled by an automatic regulating circuit, and a distribution chamber whence primary air flows out toward the top of the upper zone of the boiler, whilst secondary air flows out at the burner to complete the combustion.

The boiler just described has considerable virtues and advantages; however, the burners proposed up to the present time have failed to provide fully satisfactory characteristics, but accumulated work ex-

perience has allowed the development of an improved burner which the present patent is directed to protect.

It is the aim of this invention to provide an improved burner for solid fuel-fired steel
5 construction boilers, wherein no state of dangerous deformations is encountered in operation, and which can provide optimum mixing of the products of combustion promoted by the primary air with the secondary air.

10 Within the above aim, it is an object of the invention to provide a burner whereby the combustion temperature can be pushed to very high values so as to decrease the excess air and further improve the performance level.

15 Another object of the invention is to provide a burner which has those parts which are most liable to wear out of low cost and readily removable, thereby the damage is limited to a minimum with the replacement thereof at the end of a useful life cycle.

20 The proposed aim, and the mentioned objects, are achieved by an improved burner for a solid fuel-fired steel construction boiler, according to the invention, said boiler comprising a space portion lined with an interspace containing water to be heated, subdivided
25 into an upper fuel-containing zone and lower zone wherein the development of the flame and conveyance of the flue gases generated from a burner situated at the subdivision between said upper and lower zones take place, and provided at the front face with a

combustion air metering unit which comprises a distribution chamber supplied from an electric fan whence primary air flows out toward the top of the upper zone whilst secondary air flows out at the burner, characterized in that it comprises a refractory stone block laid in a substantially horizontal plane to delimit the upper and lower zones of the boiler space portion, provided on the top face with a housing which has the bottom formed at a substantially center location with a hole adapted to put into communication said upper and lower zones of the boiler space portion, and adapted to contain, resting on the bottom at the periphery of the hole, at least one body formed from a refractory material having at the space portion directly overlying the hole means of holding the overlying embers, the housing bottom and surface of said body intended to rest on said bottom being configured to define, on coming into contact, a ducting opening in correspondence with the hole and communicating with the air distribution chamber for conveying secondary air.

Further features and advantages will be apparent from the description of two preferred but not exclusive embodiments of the invention, as shown by way of illustration and not of limitation in the accompanying drawings, where:

Figure 1 is a partly exploded view of a first embodiment of the invention;

Figure 2 is a fragmentary sectional view of a

boiler incorporating a burner of the type shown in Figure 1, taken on the plane II-II of Figure 3;

Figure 3 is a section taken on the plane III-III of Figure 2;

5 Figure 4 is a partly exploded view of a first variation of the invention; and

Figure 5 is a detail view of a fire bar provided in the variation of Figure 4.

10 With reference to the cited Figures 1,2,3, generally indicated at 1 is the burner, which is supported on shelves 2 extending from the walls 3 of the boiler space portion lined with the interspace or jacket of water 4 to be heated so as to delimit the upper zone 5a of said space portion containing the
15 fuel, which in the figure is represented by firewood pieces but could indifferently be coal or any other solid fuel, separating it from the lower portion 5b wherein the flame development and conveyance of the flue gases toward a smoke box , not shown in the
20 figure and located at the rear face, take place; provided in a known manner at the front face is a combustion air metering unit which comprises the distribution chamber 6 supplied from the electric fan 7, whence primary air flows out toward the top
25 of the upper zone 5a whilst secondary air is delivered to the burner 1 as explained hereinafter.

The burner 1 comprises the refractory stone block 8, with a refractory material 8a filling at the edges
30 thereof and which has at the top face the housing 9, at

the bottom whereof there is provided the elongate hole 10 which communicates the upper zone 5a with the lower zone 5b of the boiler space portion.

Resting on the bottom of the housing 9, at the edges
5 of the hole 10, are the fire bars formed from a refractory material 11 and 12 which have on the face confronting said hole a plurality of facing serrations: clearly visible in Figure 1 are those of the fire bar 11, respectively indicated at 13, 14, 15, 16, and owing to
10 the particular choice of the sectional view taken on the plane III-III, also in Fig. 3, a serration indicated at 15 is visible in elevation; identical and, as mentioned, confronting them, are the serrations of the fire bar 12, one of which, shown in side elevation, is visible in Figure 3
15 and is indicated at 17.

As is apparent from the drawing figures, the serrations of the fire bars protrude, without coming into mutual contact, into the space portion overlying the hole 10 with surfaces which, extending substantially
20 from the edges of said hole, have an inclined lower portion as at 13a and a substantially vertical upper portion as at 13b, thereby a means of holding the overlying embers is provided.

At the face resting on the bottom of the housing
25 the fire bars 11 and 12 have a series of throughgoing transverse slots: clearly visible in Figures 1 and 2 are those of the fire bar 12, respectively indicated at 18, 19, 20, 21, 22, and the slot 20 is also visible in the sectional view of Figure 3; as regards the fire
30 bar 11, visible in Figure 1 are the outlets of the

slots 23,24,25,26,27, and the slot 25 is fully visible in the sectional view of Figure 3.

The aforesaid slots in the fire bar 12 are in communication with the longitudinal recess 28, and those in the fire bar 11 with the like recess 29, said recesses 28 and 29 are located to correspond with the holes 28a,29a, respectively, formed in the block 8 facing holes such as 6a in communication with the distribution chamber for the combustion air 6.

In this way, the resting of the fire bars 11 and 12 on the bottom of the housing 9 results in the formation of a ducting at the longitudinal recesses and cross slots wherethrough secondary air, entering the holes 28a,29a, reaches from the distribution chamber 6 the space portion directly overlying the hole 10.

Thus, in the space portion defined by the serrations of the fire bars 11 and 12 and the hole 10 there is defined a form of pre-chamber where the gas produced by the combustion of primary air with the fuel overlying the burner, still loaded with combustible substances, enter from above and combine with the secondary air which is advantageously pre-heated, to provide a complete combustion which, together with the possibility of pushing much higher the flame temperature thanks to the contribution afforded by the very refractory material which has been adopted for the burner construction, ensures optimum performance.

In addition to this feature, it should be noted that the burner is configured so as not to develop

dangerous deformations, and that those parts of it which are more liable to wear out, i.e. those in direct contact with the embers, have been formed of fire bars which are replaceable, with a very simple
5 operation that any user can carry out, and at very low cost.

With reference to Figures 4 and 5 a variation of the burner will now be described; this variation again includes the refractory stone block 8 with
10 housing 9 provided at the bottom with the hole 10 adapted to put in communication the upper and lower zones of the boiler space portion, and at the edges of the hole 10 there are laid onto the flat bottom of the housing the two fire bars 30 and 31 of
15 refractory material which have, similarly to what has been described for the fire bars 11 and 12, the surface intended to rest onto the bottom formed with throughgoing cross slots 32, 33, 34, 35, 36 for the fire bar 30, in communication with longitudinal recesses
20 such as 37 intended for arranging themselves at the holes 28a, 29a formed in the block 8 for admitting secondary air at the burner.

The embers holding means overlying the hole 10 with which the fire bars 30 and 31 are equipped in
25 this variation comprises a metal grid which is constructed in several parts to avoid dangerous deformations, and is accordingly formed by the round cross-section rods 38 and 39, intended to arrange themselves in corresponding alignment at the axis of the hole 10 follow-
30 ing resting of the cross-pieces 38a, 38b and 39a, 39b

with which they are provided in the cutouts 40,41, 42,43 of the fire bar 30 and confronting cutouts 44, 45,46,47 of the fire bar 31.

5 The invention described herein is susceptible to many other modifications and variations, all of which fall within the purview of the inventive concept: thus, as an example, the fire bars inserted into the housing provided in the refractory stone block may be replaced with a monolithic body, or a series of
10 modular elements, and the secondary air conveying ducting may be formed, at least in part, on the bottom of said housing.

In practicing the invention, all of the details may be replaced with other, technically equivalent
15 elements; further, the materials used, as well as the shapes and dimensions, may be any ones.

CLAIMS

1 1. An improved burner for a solid fuel-fired
2 steel construction boiler, said boiler comprising
3 a space portion lined with an interspace or jacket
4 containing water (4) to be heated, subdivided into an
5 upper fuel-containing zone (5a) and a lower zone (5b)
6 where the flame development and conveyance of the flue
7 gases which are generated in a burner (1) located at the
8 separation between said upper and lower zones (5a, 5b)
9 take place, and provided at the front face with a com-
10 bustion air metering unit which comprises a distribution
11 chamber (6) supplied from an electric fan (7) whence
12 primary air flows out toward the top of the upper zone
13 (5a) whilst secondary air flows out at the burner (1),
14 characterized in that it comprises a refractory
15 stone block (8) laid in a substantially horizontal plane
16 so as to delimit the upper zone (5a) and lower zone (5b)
17 of the boiler space portion, provided on the top face
18 with a housing (9) which has the bottom formed at a
19 substantially center location with a hole (10) adapted
20 to put into communication said upper and lower zones
21 (5a, 5b) of the boiler space portion, and is adapted
22 to contain, resting on the bottom at the periphery of
23 the hole (10), at least one body (11,12,30,31) formed
24 from a refractory material provided at the space portion
25 directly overlying the hole with a means of holding the
26 overlying embers (13-16,38-39b), the housing (9) bottom
27 and surface of said body (11,12,30,31) intended to
28 rest on said bottom being configured to define, when
29 brought into contact, a ducting (28,29) opening at the
30 hole (28a,29a) and communicating with the air distribution

31 chamber (6) for conveying secondary air.

1 2. A burner according to Claim 1, characterized in
2 the fact that the refractory stone block (8) has a sub-
3 stantially parallelepipedal shape and is supported on
4 shelves (2) extending from walls (3) and faces of the
5 boiler space portion.

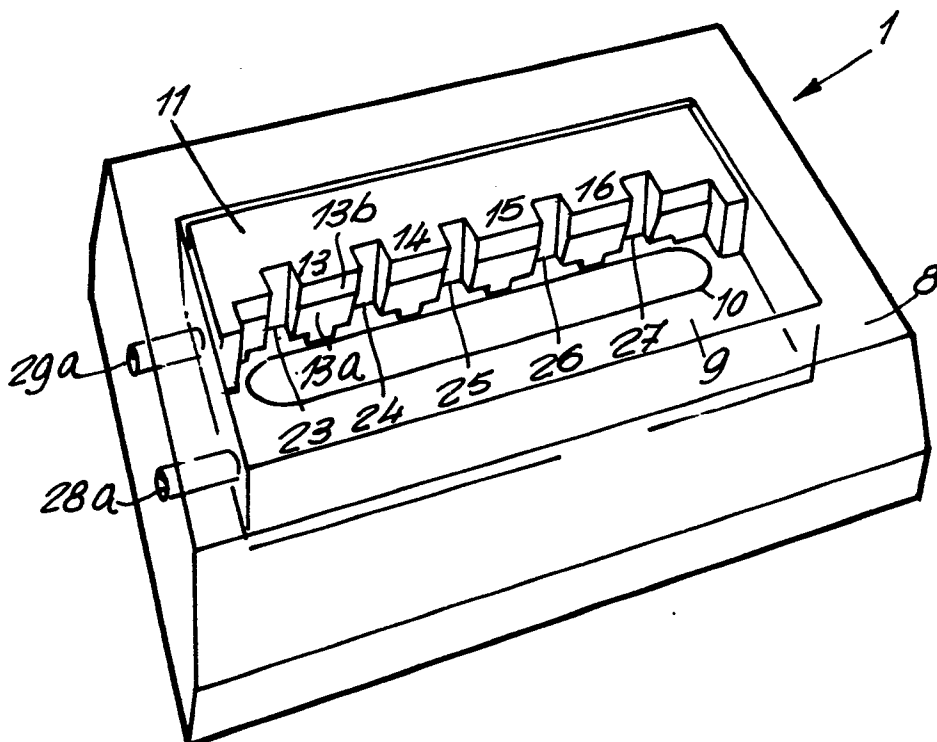
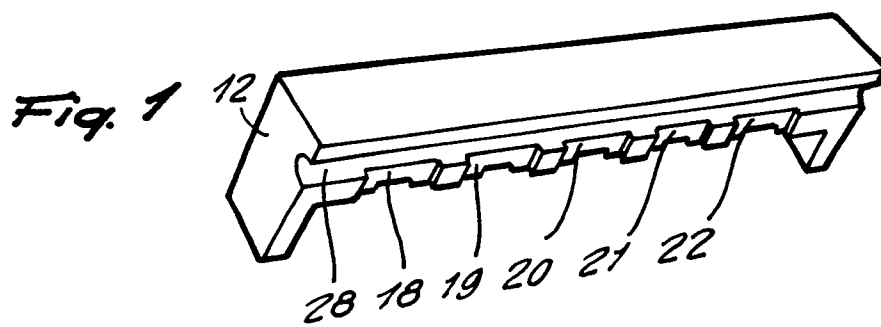
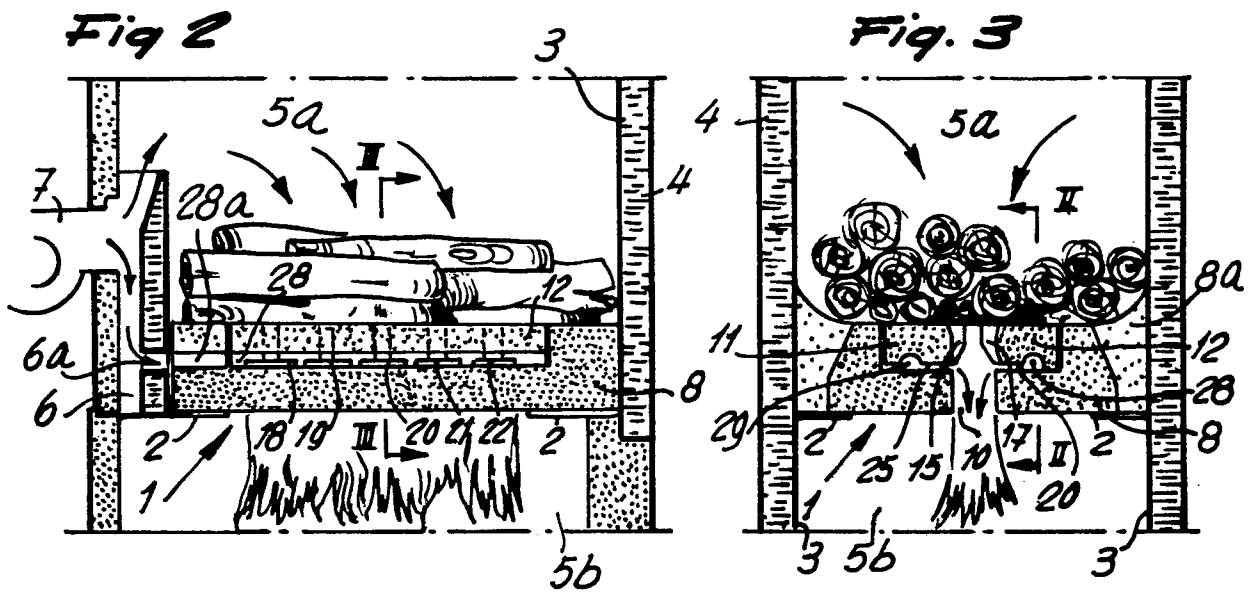
1 3. A burner according to one or more of the preceding
2 claims, characterized by the presence of a filling of
3 a refractory material (8a) between the refractory stone
4 block (8) and at least the walls (3) of the boiler space
5 portion.

1 4. A burner according to one or more of the preceding
2 claims, characterized in that the housing (9)
3 provided in the refractory stone block (8) is adapted to
4 contain two fire bars (11,12,30,31) formed from a refrac-
5 tory material and resting on the flat bottom at the edges
6 of an elongate hole (10), provided with a means (13-16)
7 of holding the overlying embers consisting of confronting
8 serrations (13-16) which protrude monolithically there-
9 from, without coming into contact, in the space portion
10 directly overlying said hole (10), extending substantially
11 from the edges of the hole (10) with a surface which
12 has an inclined lower portion (13a) and a substantially
13 vertical upper portion (13b), each of said fire bars
14 (11,12,30,31) being further provided, at the face resting
15 on the housing bottom, with throughgoing cross slots
16 (18-27), communicating with a longitudinal recess (28,29)
17 located at a hole (28a,29a) formed in the refractory stone
18 block (8) communicating with the combustion air distribu-
19 tion chamber (6) for admission of secondary air.

1 5.A burner according to one or more of the
2 preceding claims, characterized in that the
3 housing (9) provided in the refractory stone block (8)
4 is adapted to contain two fire bars (11,12,30,31) formed
5 from a refractory material resting on the flat bottom
6 at the edges of an elongate hole (10), provided with a
7 means of holding the overlying embers consisting of a
8 metal grid (38-39b) adapted to rest in special cutouts
9 (40-47) formed at the edge adjacent to the hole of the
10 top surface thereof, each of said fire bars (30,31)
11 being also provided, at the face resting on the bottom
12 of the housing (9), with throughgoing cross slots (32-36)
13 communicating with a longitudinal recess (37) located
14 at a hole (28a,29a) formed in the refractory stone block
15 (8) communicating with the combustion air distribution
16 chamber (6) for admission of secondary air.

1 6. A burner according to one or more of the
2 preceding claims, characterized in that the
3 metal grid comprises a plurality of a round cross-section
4 rods (38,39) adapted to arrange themselves aligned at the
5 longitudinal axis of the underlying hole (10), each of
6 which is provided with at least two crosspieces
7 (38a,38b,39a,39b) resting in the fire bar cutouts (40-47).

1 7. An improved burner for a solid fuel-fired
2 steel construction boiler, characterized in
3 that it comprises one or more of the features described
4 and/or illustrated.



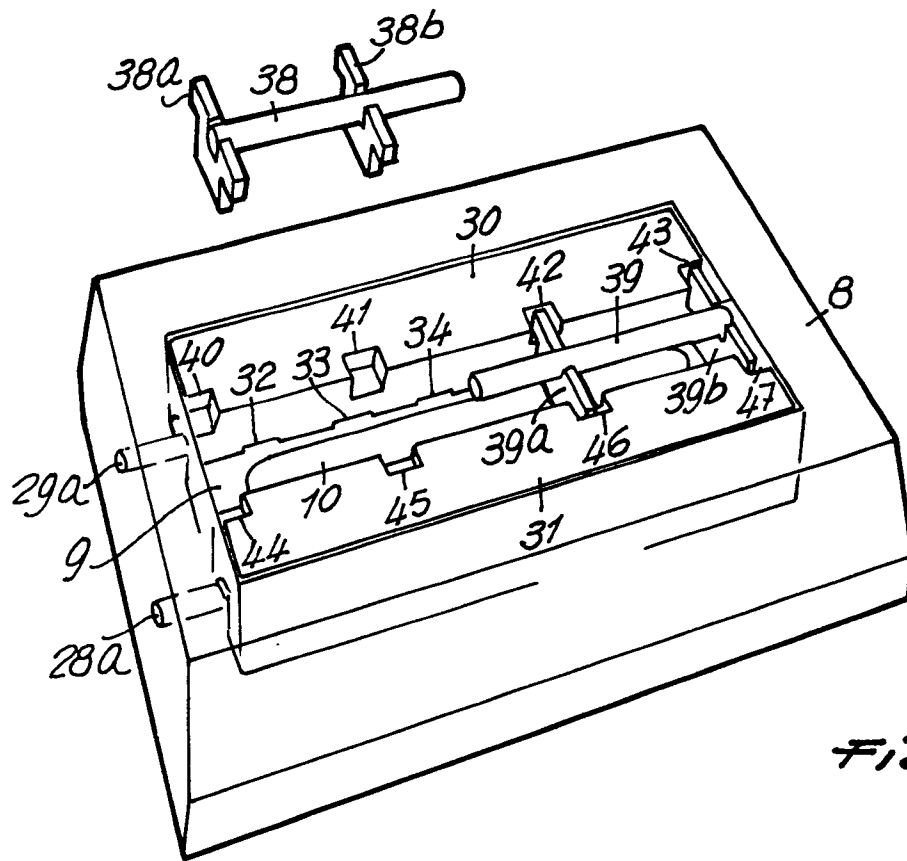


Fig. 4

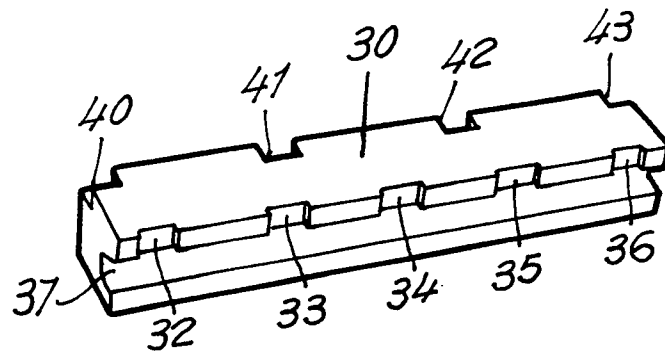


Fig. 5