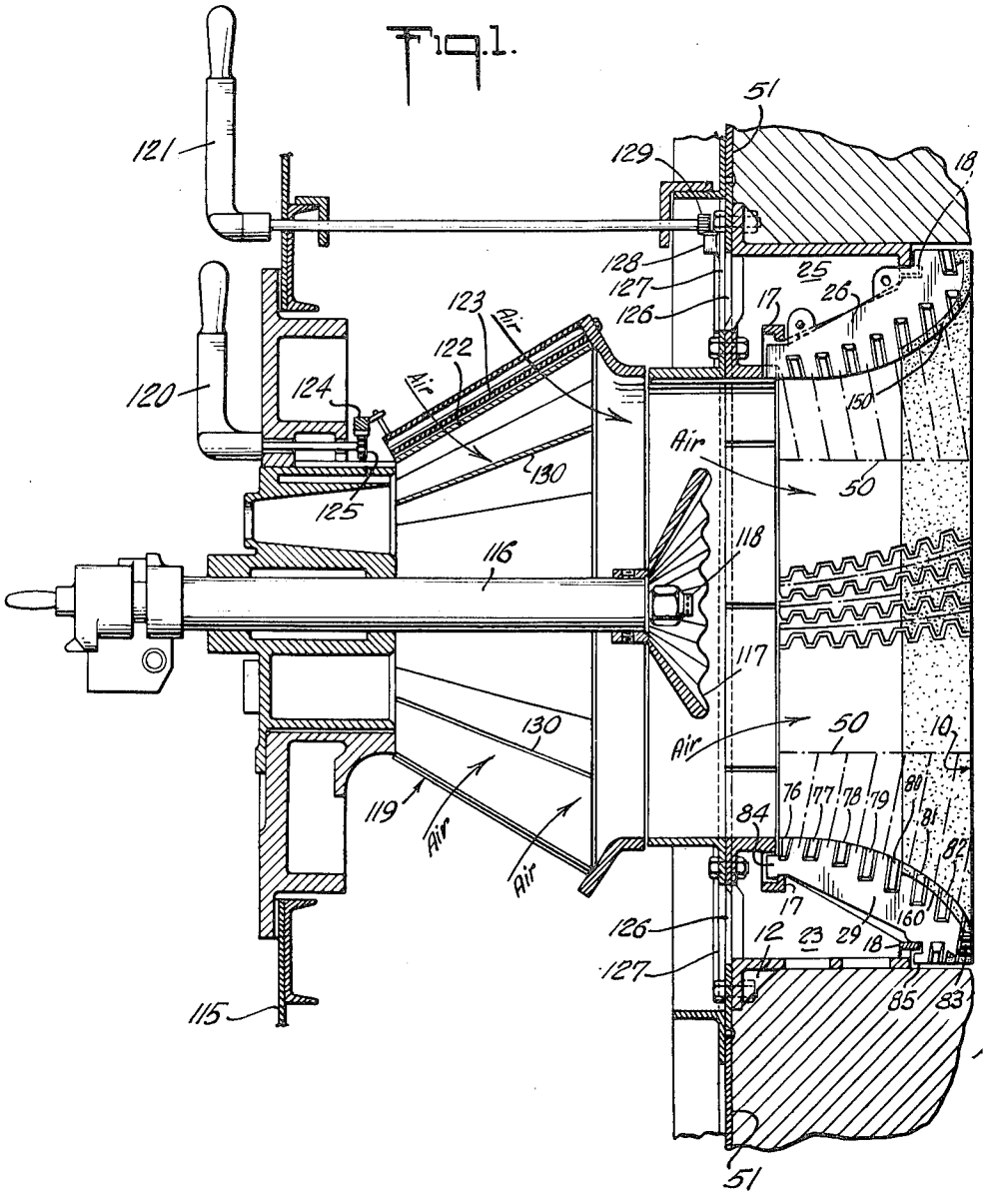
Aug. 31, 1965 E. C. PROWSE 3,203,462

AIR-COOLED BURNER RING

Filed Sept. 18, 1962 5 Sheets-Sheet 1

Fig. 1.



INVENTOR:
Eliot C. Prowse

BY

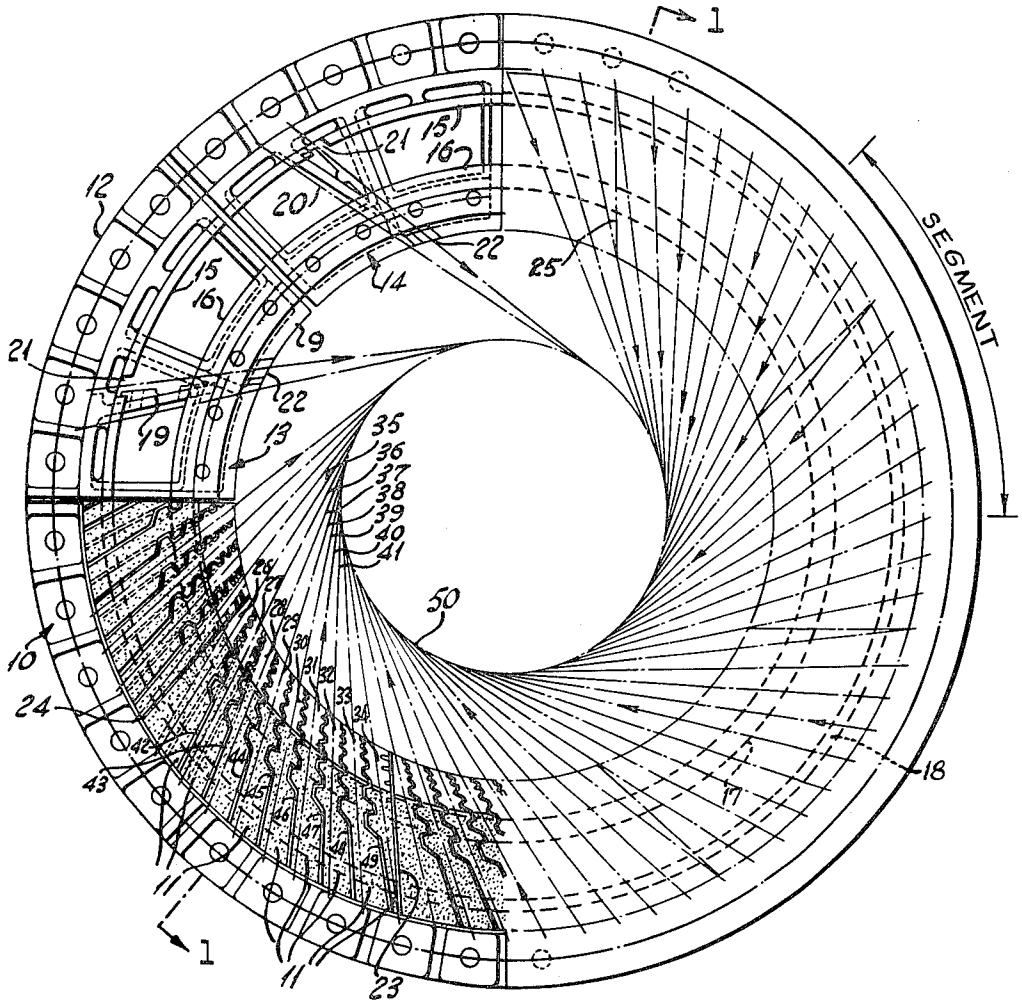
Morrison, Kennedy & Campbell
ATTORNEYS.

Aug. 31, 1965 E. C. PROWSE 3,203,462

AIR-COOLED BURNER RING

Filed Sept. 18, 1962 5 Sheets-Sheet 2

Fig. 2.



INVENTOR:
Eliot C. Prowse

BY

Morrison, Kennedy & Campbell
ATTORNEYS.

Aug. 31, 1965 E. C. PROWSE 3,203,462

AIR-COOLED BURNER RING

Filed Sept. 18, 1962 5 Sheets-Sheet 3

Fig. 3.

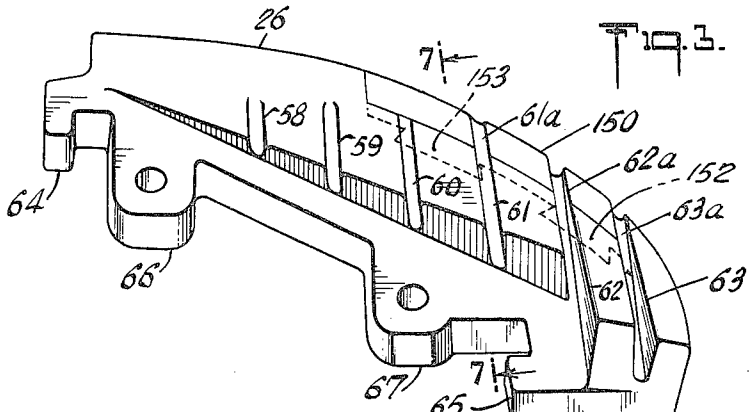


Fig. 4.

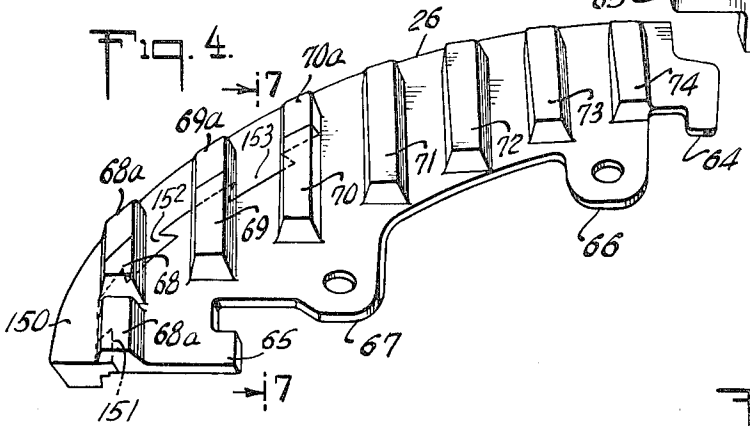


Fig. 7.

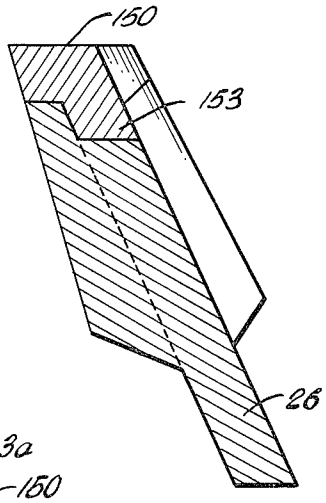


Fig. 6.

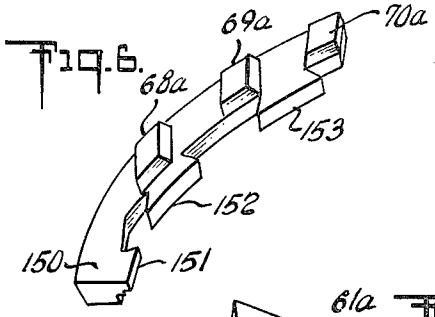
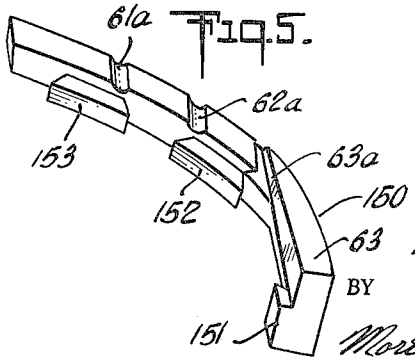


Fig. 5.



INVENTOR:
Eliot C. Prowse

BY

Morrison Kennedy & Campbell
ATTORNEYS.

Aug. 31, 1965 E. C. PROWSE 3,203,462

AIR-COOLED BURNER RING

Filed Sept. 18, 1962 5 Sheets-Sheet 4

Fig. 8.

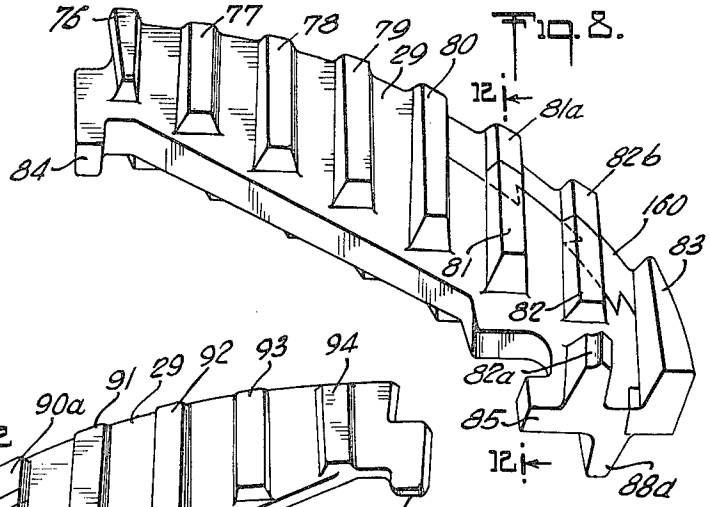


Fig. 9.

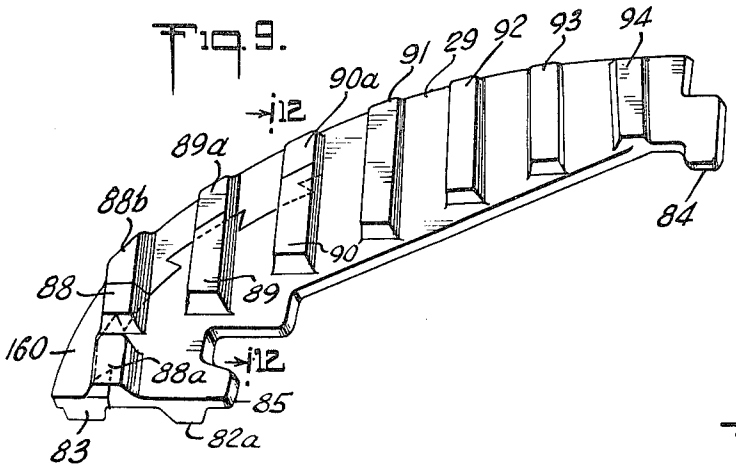


Fig. 11.

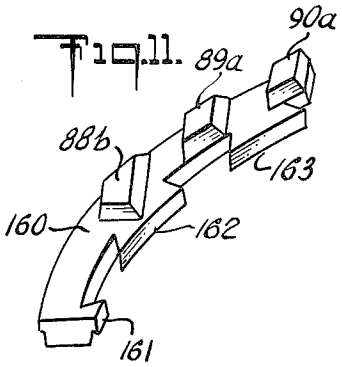


Fig. 10.

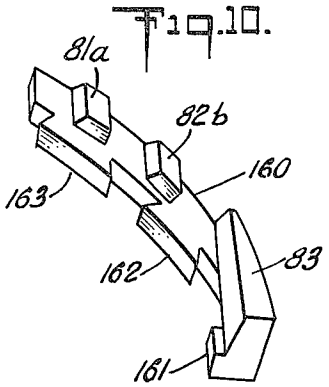
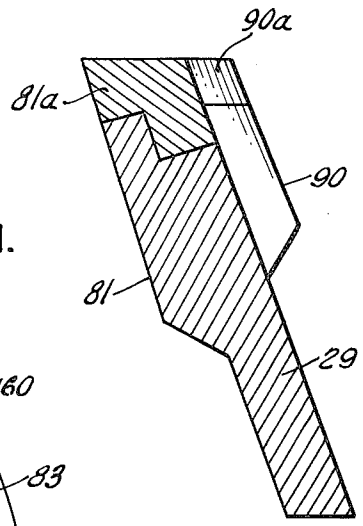


Fig. 12.



INVENTOR
Eliot C. Prowse

BY

Morrison, Kennedy & Campbell
ATTORNEYS.

Aug. 31, 1965 E. C. PROWSE 3,203,462

AIR-COOLED BURNER RING

Filed Sept. 18, 1962 5 Sheets-Sheet 5

Fig. 13.

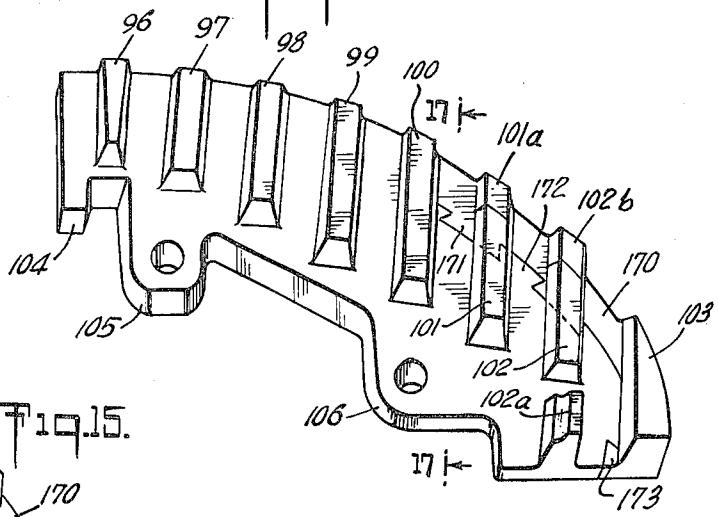


Fig. 15.

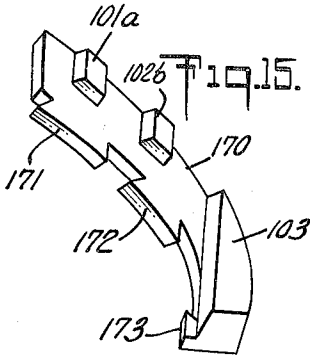


Fig. 14.

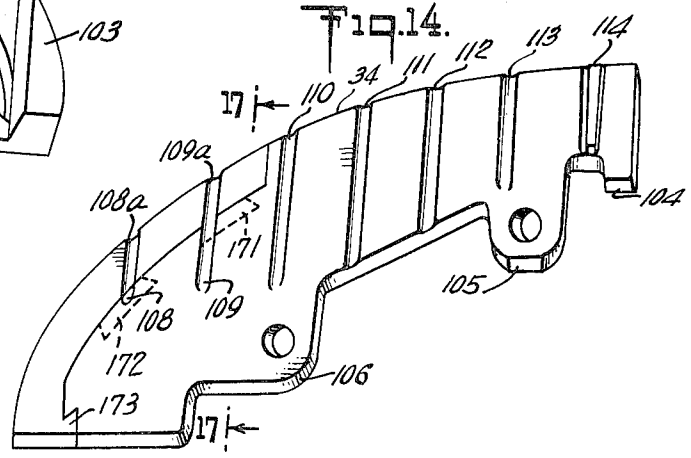


Fig. 16.

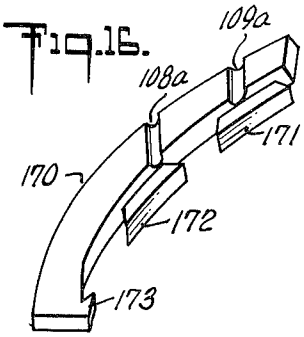
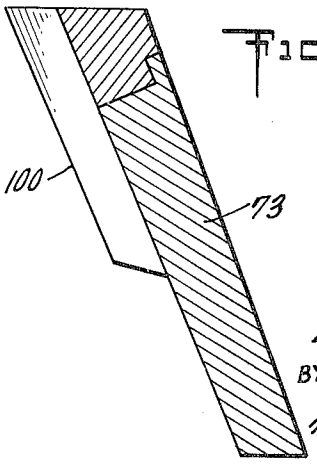


Fig. 17.



INVENTOR:
Eliot C. Prowse.
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

United States Patent Office

3,203,462

Patented Aug. 31, 1965

3,203,462

AIR-COOLED BURNER RING

Eliot C. Prowse, Rutherford, N.J., assignor to Drake Block Co., Inc., a corporation of New York

Filed Sept. 18, 1962, Ser. No. 224,454
9 Claims. (Cl. 158—1.5)

This invention relates to air-cooled burner rings for steam boilers and the like and more particularly to an air-cooled burner ring composed of individual bars which have a portion of their flame exposed faces covered with a suitable material capable of withstanding the high flame temperatures and the action of the products of combustion to result in less bar and air passage cleaning as well as longer life of the bars.

This development is predicated on and is a further development of the invention disclosed in application filed May 4, 1959, Serial No. 810,615, now Patent No. 3,130,773, entitled "Air-Cooled Burner Ring."

The general objects of the invention are to provide an air-cooled burner ring which due to its inherent design and structure will last a long time without the necessity of cleaning or replacing the individual bars making up the ring, and which will be capable of directing and supplying air to the burner in the combustion chamber to result in more complete combustion and higher boiler efficiency.

The prime object of the invention therefore, is to face the flame exposed edges of the individual bars with an insert of a material which possesses a higher melting point than the material of the bar itself and in addition possesses greater resistance to the action of the flame and the products of combustion to which it is subjected.

It is a still further object of the invention to provide bars whose faces contain inserts of a material placed in such a manner as to be compatible with the main portions of the bars and still be able to cool itself and remain in fixed relation to the main portions of the bars

In the specific embodiment illustrated herein, the air-cooled burner ring is made up of a series of individual bars having suitable air passages therebetween for cooling the ring and is so arranged as to direct the heated air into the flame area of the burner throat. The air used for cooling the ring maybe used for primary, secondary or tertiary air, according to the boiler design. As shown herein, the cooling air emanating from the burner ring air passages is used for supplying heated secondary air to the burner from the same windbox which is ordinarily employed for the supplying of primary air to the burner. The burner ring bars are preferably, but not necessarily, made of cast iron and are formed on their opposite faces with grooves and ribs which create the desired air passages therebetween. The ribs on the face of an individual bar are staggered with reference to the ribs on the opposing face of the adjoining individual bar, so that all the bars will be supported in nested ring formation but the ribs do not contact with one another and hence leave a series of continuous air passages between each pair of adjoining bars. The actual spacing of the bars is accomplished by spacing lugs located at each end of the bars. The total area of the air passages may be regulated to control the volume of air (primary, secondary or tertiary) required for complete combustion. The burner ring bars instead of being arranged in a purely radial direction (as they could be in the broader aspects of the invention) are inclined from the radial so that the air discharged from them will be given a tangential swirl which assumes the formation of a cylinder of suitable diameter. This air swirl not only acts as an insulation blanket between the burner flame and the burner ring but also improves combustion by effecting a more thorough mixing of the air

and fuel in the operation of the boiler. Preferably, too, the air passages are arranged to incline forwardly from the vertical in the direction of the air flow to direct the air into the flame area of the firebox, there being a plurality of ring-like series of air passages extending across the entire curved or cone-like face of the burner ring. main in fixed relation to the main portions of the bars.

The burner ring bars can readily be removed and replaced where necessary. They are arranged in segmental groups and are mounted in an annular frame which is made up of as many segmental sections as there are segmental groups of bars. One group of the bars may be readily removed without disturbing the other groups. In order to facilitate such replacement, the burner ring bars of each segmental group comprise one starting bar, a suitable plurality of intermediate bars, and one locking bar. In removing a group of bars, the locking bar is withdrawn, as may be readily done, then the remaining bars slid out through the same space. In replacing the bars, they are inserted one by one in reverse fashion and then locked in place by the locking bar.

The instant invention was conceived to prevent the deposition of products of combustion and erosion of the flame exposed edges of the individual bars with the possibility of the partial closing off of the air passages. Thus, the flame exposed edges of the individual bars are formed with inserts of a suitable high temperature resistant material and are so arranged and inserted in the individual bars as to become an integral part of said bars and still have their own cooling ribs and grooves and thus do not have to depend on heat transfer to the main portions of said individual bars. The means used to permanently locate and hold the inserts are such that there can be no shifting or misalignment which would and could change the operation of the burner ring. In addition, the material of which the inserts are made is such as to be compatible with the material of the main portions of the individual bars and avoid any movement in relation thereto.

Referring to the drawings:

FIG. 1 is a sectional view through a boiler wall showing the windbox, burner assembly and individual bars of the air-cooled burner ring with their flame exposed edges formed with the high temperature resisting inserts and showing the air inlet dampers for the primary and secondary air;

Fig. 2 is a front view of the eight segments making up the complete burner ring from the fire face side and shows the segmental grouping of the bars and also the mounting ring therefor. The view is sectioned to first show 90° of the annular mounting ring with two segments thereof, then 90° of the burner ring bars with the inserts on their faces, while the remaining 180° depicts the direction of flow of air emitted from the air passages between the inclined bars to result in a tangential swirl;

FIG. 3 is a perspective view of the inclined starting bar looking at the front or starting side and shows the air passages and mounting means together with the high temperature resisting insert on the flame exposed edge of the bar;

FIG. 4 is a perspective view of the back side of the inclined starting bar and shows the face ribs and mounting means together with the insert;

FIG. 5 is a perspective view of the front side of the insert shown in place in the inclined starting bar of FIG. 4;

FIG. 6 is a perspective view of the back side of the insert shown in place in the inclined starting bar of FIG. 5;

FIG. 7 is a sectional view through the inclined starting bar shown in FIG. 4 and FIG. 5 taken along the line 7—7;

FIG. 8 is a perspective view of the front side of an inclined intermediate bar and shows the face ribs used to form the air passages and the mounting means together with the high temperature resisting insert on the flame exposed edge of the bar;

FIG. 9 is a perspective view of the back side of the inclined intermediate bar and shows the face ribs and mounting means together with the insert;

FIG. 10 is a perspective view of the front side of the insert shown in place in the inclined intermediate bar shown in FIG. 8;

FIG. 11 is a perspective view of the back side of the insert shown in place in the inclined intermediate bar shown in FIG. 9;

FIG. 12 is a sectional view through the inclined intermediate bar shown in FIG. 8 and FIG. 9 taken along the line **12—12**;

FIG. 13 is a perspective view of the front side of an inclined locking bar and shows the face ribs used to form the air passages and the mounting means together with the high temperature resisting insert on the flame exposed edge of the bar;

FIG. 14 is a perspective view of the back side of the inclined locking bar and shows the air passages and mounting means together with the insert;

FIG. 15 is a perspective view of the front side of the insert shown in place in FIG. 13;

FIG. 16 is a perspective view of the back side of the insert shown in place in FIG. 14; and

FIG. 17 is a sectional view through the inclined locking bar shown in FIG. 13 and FIG. 14 taken along the line **17—17**.

FIG. 1 is a sectional view through a boiler wall showing the windbox, burner assembly and individual bars, while FIG. 2 is a front view of the eight segments making up the complete burner ring **10** from the fire face side, with the inclined individual bars **11** mounted on the annular supporting frame **12**. The annular frame **12** is made up of eight segments, all alike, and of which **13** and **14** are typical examples, and contain the segment **15** of an outer circular bar mounting ring **18** (larger diameter) as well as the segment **16** of an inner circular bar mounting ring **17** (smaller diameter). When the frame segments are bolted in place, they form a complete outer cylindrical shell with two complete circular bar mounting rings upon which the inclined bars **11** are mounted. It will be noted that the segments **13** and **14** of the annular mounting frame are formed with guide vanes **19** and **20** which not only tend to direct the air into the passages between the inclined bars **11** but in addition form the means for starting and locking each segmental group of inclined bars in place. It will also be noted that the segments of the outer and inner circular bar mounting rings **18** and **17** on each of the segments **13** and **14** of the annular mounting frame **12** are milled at points **21** on the outer circular mounting ring **18** and at points **22** on the inner face **9** of the segments **13** and **14**. The bars **11** are arranged in eight segmental groups and are of three different types, as will subsequently appear. It will further be noted that each segmental group of bars starts and ends at the guide vanes **23**, **24** and **25** located beneath the bars and directed in the same plane as the bars in order that they may be bolted thereto.

The mounting of a segmental group of bars **11** (each group consisting of nine bars) is started by taking a starting bar **26** and inserting it into the slot **21** milled in the outer circular bar mounting ring segment **15** and at the same time mount its other end over the inner circular bar mounting ring segment **16** and then slide it on said mounting ring up to the guide vane **24**, to which it is bolted. The same operation must again be gone through to insert and mount the seven intermediate bars **27** to **33** which are held entirely in place by the outer circular bar mounting ring **18** and the inner circular bar mounting ring **17**. The inclined locking bar **34** is now placed in position in the

milled slots **21** and **22** and bolted in place to the guide vane **23** and thereby complete the mounting of a complete segment of burner ring bars. The spacing of the bars is accomplished by small lugs on the sides which accurately space each bar from the succeeding one to give an accurate air emission area between the bars. Thus each starting bar **26** is formed at one end and at one side with a spacing lug **68***a* (FIG. 4); each intermediate bar **29** is formed at opposite ends and on opposite sides with spacing lugs **82***a* and **88***a* respectively (FIGS. 8 and 9); and each locking bar **34** is formed at one end and at one side with a spacing lug **102***a* (FIG. 13). The same procedure is carried out for all eight segments which go to make up the complete burner ring **10** and it is evident that any one of the eight segments may be readily removed for repair and inspection (or if necessary replacement) without disturbing any of the other segments. The lines **35**, **36**, **37**, **38**, **39**, **40** and **41** indicate the tangential paths of the air which is emitted by the air passages **42**, **43**, **44**, **45**, **46**, **47**, **48** and **49** between the bars and directly indicates how a portion of the cylinder of tangential swirling air **50** is formed where the air converges. The air inlet into the air-cooled burner ring is shown by the arrows marked "Air" and it can be seen how the air could be used for either primary, secondary or tertiary air for normal burner use.

It is not deemed necessary to repeat the foregoing description for each of the eight segments contained in the air-cooled burner ring, as they are all alike and the elements that go to make them up are all interchangeable.

It may also be noted that the diameter of the cylinder **50** can readily be varied simply by changing the angle of inclination of the inclined bars **11** by removing each series of bars and substituting another series with a suitable angle of inclination. In addition, the bars may also be changed to thus vary the volume of air therethrough if necessary by varying the air space contained therebetween.

FIGURE 1 is a sectional view of FIG. 2 taken along the line **1—1** and shows the air-cooled burner ring **10** mounted on the furnace wall **51** by means of bolts. The inclined intermediate bar **29** is mounted on the inner circular bar mounting ring **17** and outer circular bar mounting ring **18** by means of retaining lugs **84** and **85** located on the underside of said bar. The ribs **76**, **77**, **78**, **79**, **80**, **81**, **82** and **83** formed on the front side of the bar **29** indicate the means employed in directing the air slightly forward into the firebox area, while still maintaining the tangentially swirling air cylinder **50**. It must be noted that the net result of the large volume of air which is being emitted through the plurality of passages between the burner ring bars will in reality form a cylindrical swirling blanket of tangentially flowing air between the face of the burner ring and the cylinder **50**, which blanket will not only insulate the bars making up the burner ring from the direct heat of the burning fuel but will in addition supply heated air to induce more complete combustion. The secondary air cylindrical blanket directly causes the burning gases to swirl and mix with the secondary air and moreover imparts additional swirl to the primary air to give complete combustion control. In addition, the air blanket prevents the flame from impinging on the back wall of the boiler by causing the flame to ball out in response to the ever increasing tangential swirling motion and thereby fill the firebox to more evenly distribute the heat and thus prevent damage to the brick work on the back wall of the boiler.

The inclined starting bar **26** is shown mounted on the inner and outer circular bar mounting rings **17** and **18** by means of retaining sections **64** and **65** bolted to the guide vanes. In connection with this mounting and retaining means, it might be simply stated that the means is so designed as to anchor the burner ring bars on the inner circular bar mounting ring **17** and permit the bars to expand and contract on the outer circular bar mounting ring **18**. It will be noted that the flame exposed faces

of the bars 26 and 29 are provided on their flame exposed edges with high temperature resisting material inserts 150 and 160 to prevent the deterioration of these surfaces under oxidation and flame action and thus prevent the build up on these surfaces of products of combustion which would tend to change the air emission and thus necessitate cleaning and eventual replacement.

In FIG. 3 is shown a perspective view of the front side of an individual starting bar 26 which is the same as bar 26 shown in FIG. 1. This bar is mounted on and bolted to the guide vane 25 and serves as the starting bar for every segmental group of burner ring bars. The main portion of the bar 26 is formed on its front or starting side with a plurality of air-passage grooves 58, 59, 60, 61, 62 and 63 which serve to cool the bars and deliver the heated cooling air to form the cylindrical blanket when the adjoining locking bar is in place. The retaining lugs 64 and 65 serve as the mounting and guide means and the perforated ears 66 and 67 serve as the anchoring means whereby the bar is bolted to the guide vane. The bar 26 is formed with the high temperature resisting material insert 150 on its flame exposed edge, which insert contains on its front side air-passage grooves 61*a*, 62*a* and 63*a* forming continuations of the grooves 61, 62 and 63 respectively and thus forming a cooling means for this insert.

In FIG. 4 is shown the back side of the starting bar 26 of FIG. 3. The bar is formed on said back side with a plurality of cooling ribs 68, 69, 70, 71, 72, 73 and 74 which when placed in conjunction with an intermediate bar 29 forms a tortuous air passage of given cross sectional area to permit the passage therethrough of a given volume of air for cooling said bars and for combustion control. The mounting means 64, 65, 66 and 67 remain the same and are shown reversed. The high temperature resisting material insert 150 is formed on its back side with cooling ribs 68*a*, 69*a* and 70*a* forming continuations of the ribs 68, 69 and 70 respectively on the main portion of the bar and thus form an additional cooling means for this insert.

In FIG. 5 is shown a perspective view of the front side of the high temperature resisting material insert 150 with its cooling passages 61*a*, 62*a* and 63*a* as well as mounting and retaining lugs 151, 152 and 153 formed on the inside edge of the insert, which lugs thus anchor said insert to the main portion of the bar. It will be noted that the lugs 152 and 153 are of a lesser thickness than the main body of the bar to thereby allow the metal of the main body of the bar, during casting thereof, to extend upward over these lugs and provide sidewise anchorage while the ends of the lugs 151, 152 and 153 are outwardly extended to provide radial anchorage. This will become more apparent in the explanation of FIG. 7.

In FIG. 6 is shown a perspective view of the back side of the high temperature resisting insert 150 with its cooling ribs 68*a*, 69*a* and 70*a* and the mounting and retaining lugs 151, 152 and 153. Here again it will be noted that the metal of the ribs 68, 69 and 70 on the main portion of the bar extend upwardly over the lugs 152 and 153 to thus aid in providing sidewise anchorage. Therefore, the combination of the upwardly extending sections of the main portion of the bar serve to anchor the insert in a sidewise direction while the extended ends of the lugs serve to anchor the insert in a radial direction, the air-passage grooves and ribs formed on the insert furnishing the necessary cooling means to control the temperature of the insert.

FIG. 7 is a section through the starting bar of FIGS. 3 and 4 taken on the line 7—7 and clearly shows the vertical extensions of the metal of the main portion of the bar used to lock the insert against sidewise displacement and still provide the cooling air passages between the bars.

In FIG. 8 is shown a perspective view of the front side of an individual intermediate bar 29 with a plurality of cooling ribs 76, 77, 78, 79, 80, 81, 82 and 83 formed on said front side and so arranged as to nest into and form air passages between it and the adjoining starting bar 26 disclosed in FIGS. 3 and 4, and in addition fit into the ribs of the locking bar 34 disclosed in FIG. 13. Retaining lugs 84 and 85 are utilized as hereinbefore described. There are seven of these intermediate bars in each segmental group, as before stated. The bar 29 is formed on its flame exposed edge with the high temperature resisting material insert 160 having on its front side cooling ribs 81*a*, 82*a* and 83 forming extensions of the ribs 81, 82 and 83, respectively, formed on the main portion of the bar and thus forming a cooling means for the insert. This front side face of the bar is also formed with the spacing lug 82*a* at its right end as stated before.

FIG. 9 is a perspective view of the back side of the individual intermediate bar 29 shown in FIG. 8. The bar 29 is formed on said back side with a plurality of cooling ribs 88, 89, 90, 91, 92, 93 and 94 which are arranged to nest into the cooling ribs (as stated under FIG. 8) 76, 77, 78, 79, 80, 81, 82 and 83 formed on the front side of a like adjoining intermediate bar or on an adjoining locking bar as shown in FIGS. 13 and 14 in order to provide the tortuous air passages before referred to. Retaining lugs 84 and 85 are formed on opposite ends of the bar as well as a spacing lug 88*a* at its left hand end. The high temperature resisting material insert 160 on its back side is formed with cooling ribs 88*b*, 89*a* and 90*a* forming continuations of the ribs 88, 89 and 90 on the main portion of the bar and thus form an additional cooling means for the insert.

In FIG. 10 is shown a perspective view of the front side of the high temperature resisting material insert 160 with its cooling ribs 81*a*, 82*b* and 83 and mounting and retaining lugs 161, 162 and 163 formed on its inside edge to anchor said insert to the main portion of the bar. It will be noted that the ribs 81*a* and 82*b* are narrower than the insert to thus allow the metal of the bar 29 at the rib portions 81 and 82 to extend upwardly to the ribs 81*a* and 82*b* and thus act as a sidewise anchoring means. The lugs 161, 162 and 163 act, in the same way as the lugs 151, 152 and 153 on the starting bar 26, in anchoring the insert 160 against radial displacement.

In FIG. 11 is shown a perspective view of the back side of the high temperature resisting material insert 160 with its cooling ribs 88*b*, 89*a* and 90*a* and the mounting and retaining lugs 161, 162 and 163. Here again the ribs 88*b*, 89*a* and 90*a* are narrower than the insert to allow the metal of the main portion of the bar at the rib portions 88, 89 and 90 to extend upwardly to the ribs 88*b*, 89*a* and 90*a* and thus anchor the insert against sidewise displacement.

FIG. 12 is a section through the intermediate bar of FIGS. 8 and 9 taken along the line 12—12 and clearly shows the vertical extensions of the ribs on the main portion of the bar at both sides to form sidewise anchorage while the mounting and retaining lugs form the radial anchorage.

FIG. 13 is a perspective view of the front side of an individual locking bar 34 with a plurality of cooling ribs 96, 97, 98, 99, 100, 101, 102 and 103 which are so arranged as to nest into the cooling ribs 88, 89, 90, 91, 92, 93 and 94 of an adjoining intermediate bar 29 as shown in FIGS. 8 and 9. One retaining lug 104 is used here and is moved into place as the bar 34 is slid into position radially, then the retaining lug 104 is moved circumferentially to hook over the outer circular bar mounting ring 18 and then bolted in place by means of the perforated ears 105 and 106 onto the guide vanes. This bar 34 is placed into the milled slot 22 contained in the face of the frame segment 9 and in the slot 21 in the outer circular bar mounting ring 18. The bar 34 contains a spacing lug 102*a* at its right hand end. The bar 34 is formed on its flame exposed edge with a high temperature resisting material insert 170 which is formed on its front side with cooling ribs 101*a*, 102*b* and 103 forming continuations of the

ribs **101** and **102** on the main portion of the bar and which form a cooling means for the insert.

FIG. 14 is a perspective view of the back or closing side of the locking bar **34** shown in FIG. 13. The bar **34** is formed on said back side with a number of air-passage grooves **108**, **109**, **110**, **111**, **112**, **113** and **114** which allow the passage of air between it and the adjoining starting bar **26**. The mounting means **104**, **105** and **106** remain as above described. The high temperature resisting material insert **170** is formed on its back side with air-passage grooves **108***a* and **109***a* forming continuations of the grooves **108** and **109** in the main portion of the bar and which thus form another cooling means for the insert.

FIG. 15 is a perspective view of the front side of the high temperature resisting material insert **170** with its cooling ribs **101***a*, **102***b* and **103** and the retaining lugs **171**, **172** and **173** formed on the inside edge of the insert, which lugs anchor said insert to the main portion of the bar. It will be noted that the ribs **101***a* and **102***b* are narrower than the insert to thus allow the metal of the main portion of the bar at the rib portions **101** and **102** to extend upwardly to the ribs **101***a* and **102***b* and thus provide sidewise anchoring means. The lugs **171**, **172** and **173** act, in the same way, as the lugs **151**, **152** and **153** on the starting bar **26**, in anchoring the insert **170** against radial displacement.

FIG. 16 is a perspective view of the back side of the high temperature resisting material insert **170** with its air-passage grooves **108***a* and **109***a* and the retaining lugs **171**, **172** and **173** formed on its inside edge to provide radial anchoring means for said insert. It will be noted that the lugs **172** and **173** are slightly narrower in width than the insert so as again to allow the metal of the main portion of the bar to extend upwardly over said lugs and thus provide sidewise anchorage.

FIG. 17 is a section through the locking bar **34** taken along the line **17—17** of FIGS. 13 and 14 and again clearly shows the vertical extensions of the metal of the main portion of the bar on both sides to thus anchor the insert against sidewise displacement while the lugs anchor it against radial displacement.

From the foregoing description it will be understood that the high temperature resisting material inserts and the individual bars to which they are anchored constitute a composite integral structure even though the components are of different materials. In making the composite bars, the inserts are precast in molds of their own pattern and then sand molds are prepared from patterns conforming to the composite bars as if they had no inserts. Then the precast inserts are inserted in the mold cavities of the sand mold in the places which they occupy in the finished casting. Hence, when the molten metal (for example iron) is poured into the sand molds the metal will fill up the mold cavities unoccupied by the precast inserts and flow into the recesses presented by the inside edges of the inserts, thereby providing the anchorage means described above. After casting, of course, the finished castings will be dressed and cleaned in the usual way.

Preferably the main portions of the bars (those portions cast in the sand molds) will be made of a good grade of gray iron, while the precast inserts will be made of chrome nickel steel containing from 25% to 30% of chrome and from 12% to 17% nickel. The coefficient of expansion of the iron is about .00059", while the coefficient of expansion of the chrome nickel steel is about .00061". Accordingly, no problem will arise from the slightly different rates of expansion of the two materials even though the inserts are subjected to a higher temperature than the main portions of the bars. This is especially true in view of the fact that the cooling ribs and air-passage grooves maintain the temperature of the inserts pretty close to the temperature of the main portions of the bars.

While chrome nickel steel is preferred, the inserts may be made of some other material so long as it is compatible with the material of the main portions of the bars, which in the present instance is gray iron. In any case, the material of the inserts should be capable of resisting a higher temperature than the material which is used for the main portions of the bars.

It will therefore be evident that the methods and principles disclosed herein allow of attaining objects and advantages heretofore unobtainable and therefore since many matters of arrangement, combination, design and details may be variously modified without departing from the principles involved, it is not intended to limit the invention to such matters except insofar as specified in the appended claims.

What is claimed is:

1. An air-cooled burner ring adapted to be mounted in a furnace wall and defining a burner throat, said ring comprising a circular series of elongated bars spaced apart to provide between them substantially throughout their length a series of inwardly directed air passages open at the outer edges of the bars for the entrance of cooling air and open at the inner edges of the bars for the discharge of heated cooling air into the flame area of the burner throat, adjacent bars on their opposing side faces having a zig-zag configuration which provides air passages of corresponding tortuous form in the direction of length of the bars, and mounting means for said bars permitting their individual expansion and contraction, said bars being formed of a high temperature resisting material and presenting inner edges with inserts of the same matching configuration and of a still higher temperature resisting material at least in the ring area subjected to the highest flame temperatures.

2. An air-cooled burner ring adapted to be mounted in a furnace wall and defining a burner throat, said ring comprising a circular series of individual elongated bars spaced apart to provide between them substantially throughout their length a series of inwardly directed air passages open at the outer edges of the bars for the entrance of cooling air and open at the inner edges of the bars for the discharge of heated cooling air into the flame area of the burner throat, said bars comprising main portions and small insert portions on the inner edges of the main portions, said insert portions having side faces and inner edge faces flush with the side faces and inner edge faces of the main portions, the air passages between a great majority of individual bars being constituted by a series of ribs and grooves formed on the main portions of said bars and extending transversely of the lengths of the bars, the ribs of one bar projecting into the grooves of adjacent bars, whereby the heated cooling air is discharged into the flame area of the burner throat in the same transverse direction in which the ribs and grooves extend, and mounting means for said bars permitting their individual expansion and contraction, characterized by the fact that the main portions of the aforesaid bars are formed of a high temperature resisting material and the insert portions of the aforesaid bars are formed of a still higher temperature resisting material at least in the ring area subjected to the highest flame temperature, said insert portions being formed with ribs and grooves extending transversely of the length of the bars and forming continuations of the ribs and grooves on the main portions of the bars in the direction of the air discharged into the flame area of the burner throat.

3. An air-cooled burner ring adapted to be mounted in a furnace wall and defining a burner throat, said ring comprising an annular mounting frame having an outer cylindrical shell and two concentric rings of different diameters located inwardly of said shell at the front and back thereof, and a circular series of individual elongated bars spaced apart to provide between them substantially throughout their length a series of inwardly directed air passages open at the outer edges of the bars for the en-

trance of cooling air and open at the inner edges of the bars for the discharge of heated cooling air into the flame area of the burner throoat, said bars being individually supported at their opposite ends upon the two concentric rings of the annular mounting frame for individual expansion and contraction, said outer edges of the bars extending at an inclination from the supporting ring of smaller diameter to the supporting ring of greater diameter and spaced from the outer cylindrical shell to leave an annular air supply chamber open for the entrance of air and communicating with the inlet openings of the air passages between the individual bars, and said inner edges of the bars being of arcuate shape and flared in the direction of the length of the individual bars from the supporting ring of smaller diameter towards the supporting ring of greater diameter, and said arcuate and flared inner edges of the bars being flush with one another in all directions to provide a flame exposed surface which is interrupted only by the air passages formed between the bars and leading into the flame area of the burner throat, characterized by the fact that said bars are formed of a high temperature resisting material and have inserts on their inner edges of a still higher temperature resisting material, said inserts forming the flame exposed surface in the ring area subject to the highest flame temperature.

4. An air-cooled burner ring according to claim 3, wherein the circular series of individual bars are divided into a plurality of segmental groups for independent mounting and dismounting, each said group comprising a starting bar, a plurality of intermediate bars, and a locking bar, and wherein the annular mounting frame is formed with a plurality of anchoring elements, one located between each pair of adjoining segmental groups of bars, both the starting bar and the locking bar of adjoining segmental groups being bolted to the corresponding anchoring element, and the intermediate bars of each group being individually supported by the two concentric rings on the annular mounting frame.

5. An air-cooled burner ring adapted to be mounted in a furnace wall and defining a burner throat, said ring comprising a circular series of elongated bars spaced apart to provide between them substantially throughout their length a series of inwardly directed air passages open at the outer edges of the bars for the entrance of cooling air and open at the inner edges of the bars for the discharge of heated cooling air into the flame area of the burner throat, and mounting means for said bars permitting their individual expansion and contraction, said bars comprising main portions formed of a high temperature resisting material and presenting flame exposed edge faces and side faces and small insert portions formed of a still higher temperature resisting material and likewise presenting flame exposed edge faces and side faces, said main portions providing the major areas of the air pasages both in a lengthwise and transverse direction, and said insert portions providing minor areas of the air passages both in a lengthwise and transverse direction and located in the burner ring area subjected to the highest flame temperature, said flame exposed edge faces and side faces of said insert portions being flush with said flame exposed edge faces and side faces of said main portions.

6. An air-cooled burner ring according to claim 5, wherein the main portions of said bars and the said insert portions include contacting edges which are formed with mutually interlocking elements which anchor the insert portions securely in place.

7. An air-cooled burner ring according to claim 6, wherein said interlocking elements consist of lugs and recesses which prevent radial displacement of the insert portions as well as other lugs and recesses which prevent sidewise displacement of the insert portions.

8. An air-cooled burner ring according to claim 5, wherein the inset portions on the inner edges of said bars are in the form of chrome nickel steel castings.

9. An air-cooled burner ring according to claim 5, wherein the insert portions on the inner edges of said bars have approximately the same coefficient of expansion as the high temperature resisting material of the main portions of the bars.

References Cited by the Examiner

UNITED STATES PATENTS

1,532,041	3/25	Couch	110—28
1,610,707	12/26	Rathgeb	126—163

JAMES W. WESTHAVER, *Primary Examiner.*

FREDERICK L. MATTESON, JR., *Examiner.*