May 29, 1956 O. WILDERMANN 2,747,658

DUAL BAND TYPE GAS BURNER WITH CROSS-OVER FLAME CONNECTION

Filed Sept. 14, 1954 3 Sheets-Sheet 1

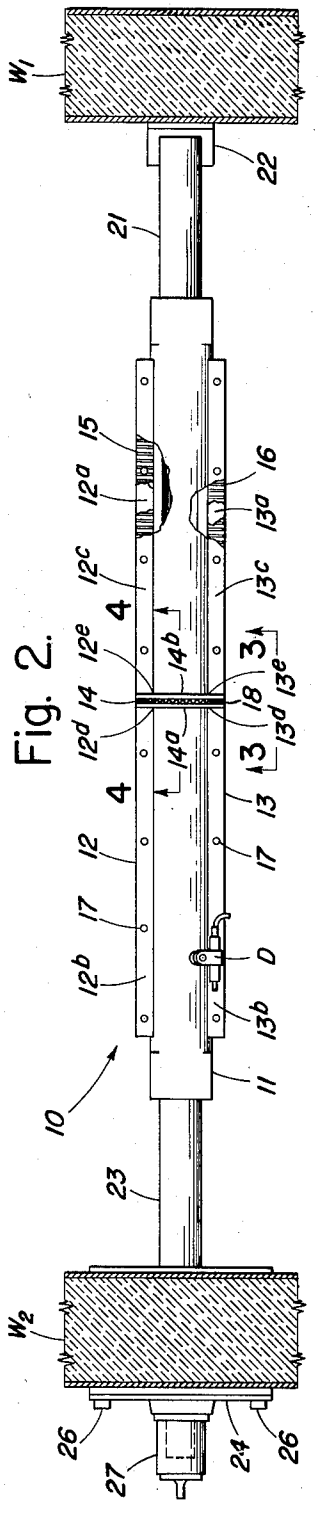


Fig. 2.

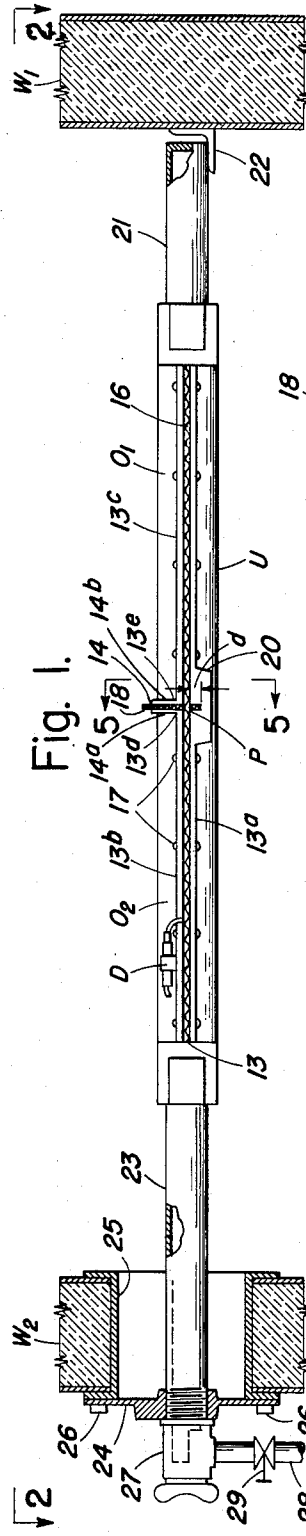


Fig. 1.

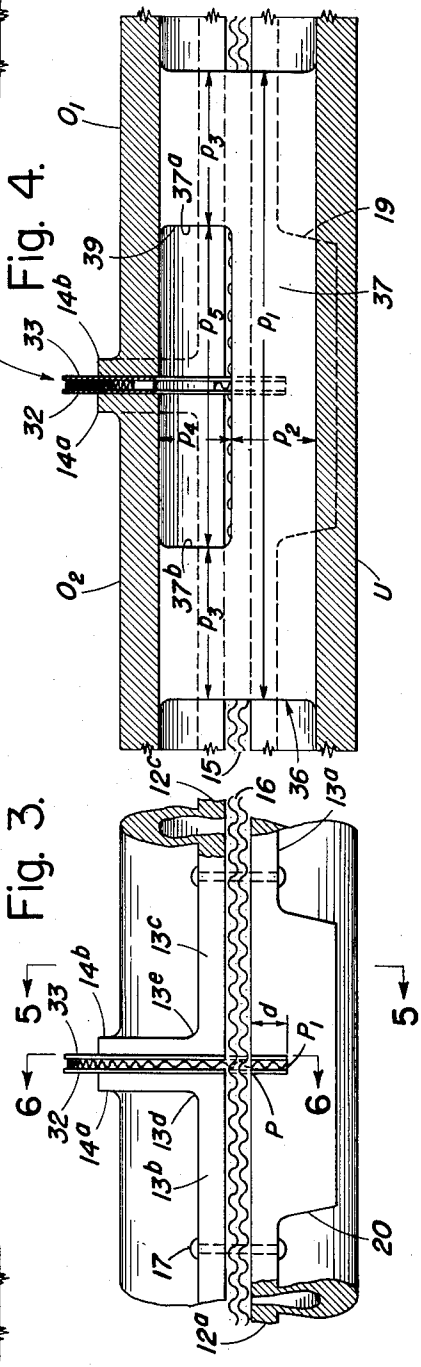


Fig. 4.

Fig. 3.

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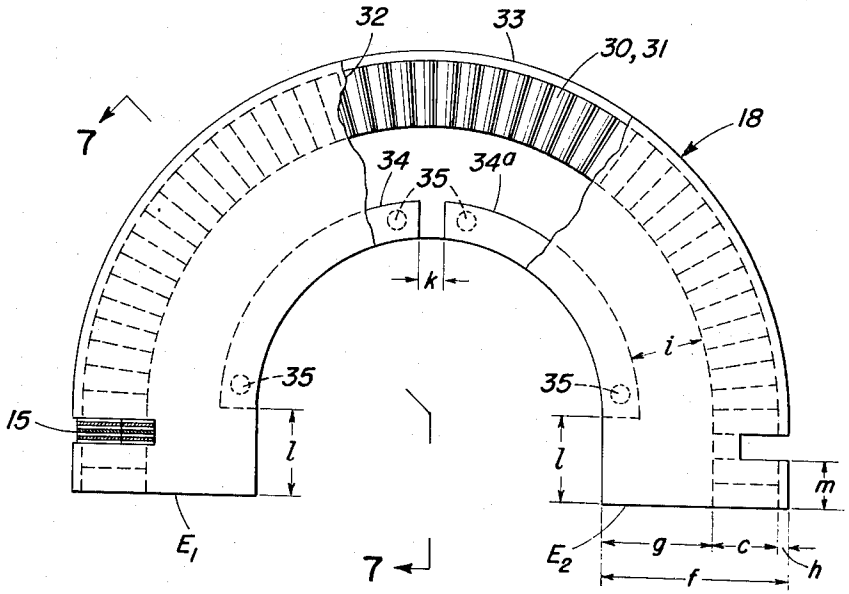
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Fig. 6.



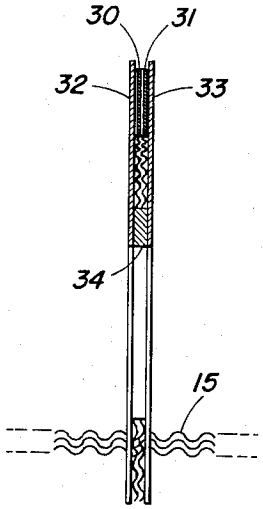


Fig. 7.

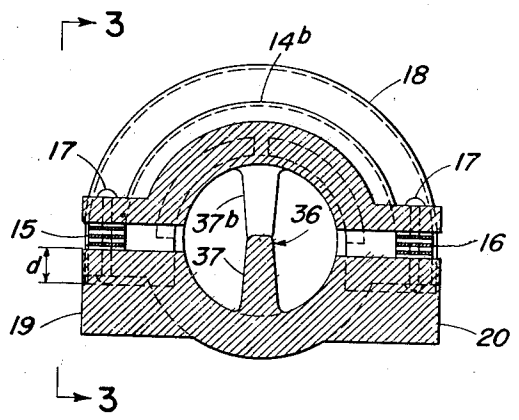


Fig. 5.

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DUAL BAND TYPE GAS BURNER WITH CROSS-OVER FLAME CONNECTION

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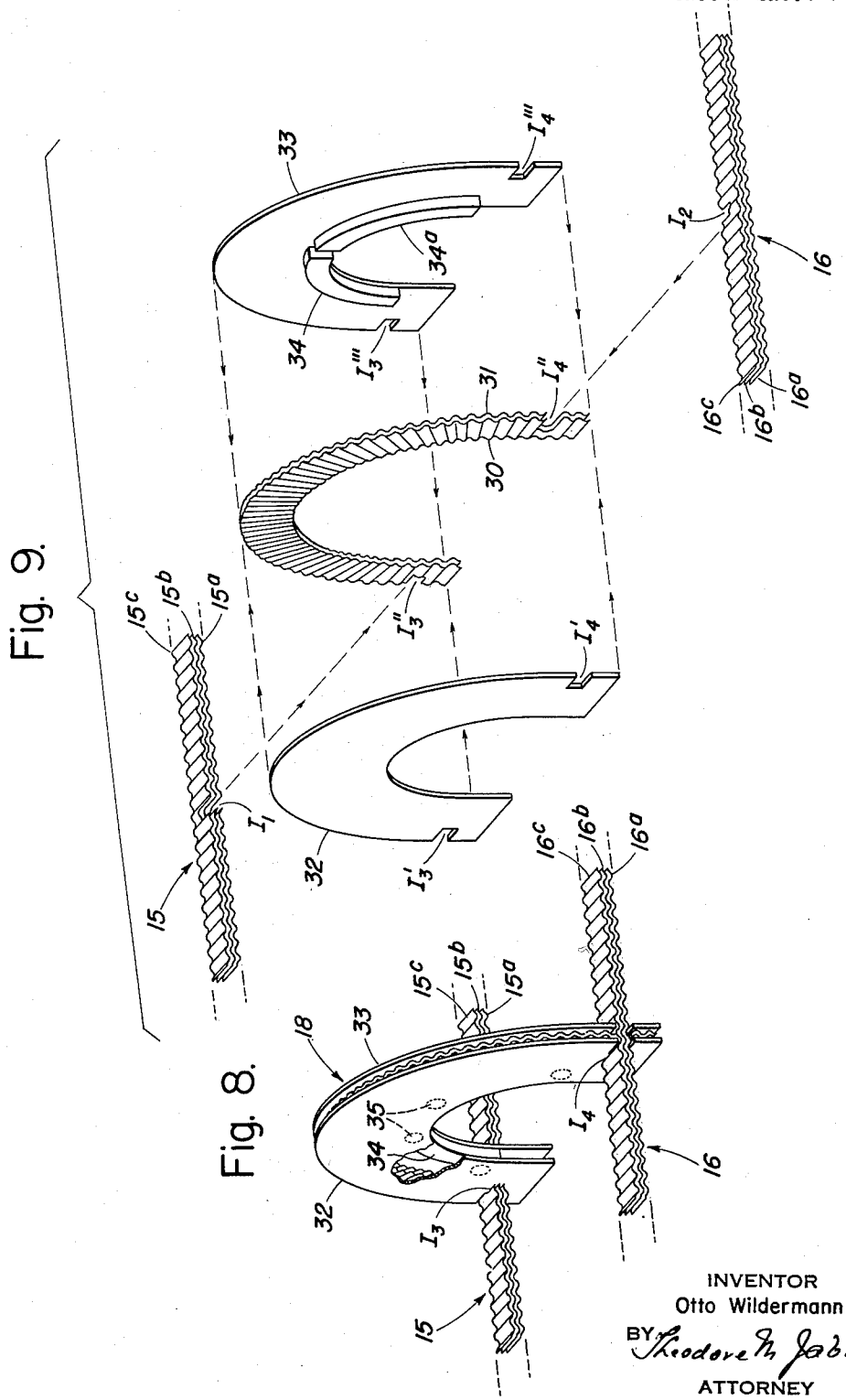


Fig. 9.

Fig. 8.

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DUAL BAND TYPE GAS BURNER WITH CROSS-OVER FLAME CONNECTION

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Application September 14, 1954, Serial No. 455,989

4 Claims. (Cl. 158—99)

This invention relates to improvements in ribbon type gas burners so-called because they burn with a ribbon type flame due to certain ribbon type inserts or strips provided in and along the burner mouth or gas passage opening that extends along the burner tube which constitutes the burner housing.

Usually, the burner housing is produced with solid walls as of cast iron in which the required gas passage openings are provided by cutting or milling. The longitudinal gas passage opening or burner mouth has an insert consisting of one or a plurality of transversely corrugated metal strips assembled with the corrugations interengaging in contacting relationship whereby the gas passage area of the burner mouth is in effect subdivided due to the corrugations into a multitude of closely spaced minute orifices or gas passages producing effective combustion in a ribbon type flame with attendant advantages, such as set forth in patent to William B. Ensign No. 2,210,069.

More particularly, this invention relates to improvements in ribbon type gas burners of what is herein termed the dual band type, as exemplified in patent to William B. Ensign No. 2,575,101, where a pair of lateral flames arranged in opposition to one another are interconnected by a cross-over flame, requiring but a single ignition device at one side of the burner to ignite one of the lateral flame bands, since the ignition propagates itself by way of the cross-over to the lateral band or flame on the opposite side. That is to say, such a dual band burner has a pair of laterally extending longitudinal gas passage areas or burner mouths facing substantially horizontally in opposite directions, which lateral passages together with the cross-over flame connection in plan view present an H-shaped flame pattern upon the burner housing. Each burner mouth is provided with such flame subdividing ribbon inserts as have been referred to and outlined above, and a suitable insert or insert assembly is also provided in the cross-over gas passage area, as exemplified in the Patent No. 2,575,101. Such a dual band type of burner in effect represents the equivalent of a pair of single flame ribbon type burner installations, having the advantage that the number of wall openings and oven wall sleeves as well as the number of burner mountings is halved, with all-around simplification and savings in construction cost and maintenance, as well as reduction of heat losses through the oven walls.

This invention is particularly concerned with improvements in the manner of mounting the cross-over insert relative to the burner housing as well as relative to the associated longitudinal ribbon inserts, the object being to provide a simple, secure, and inexpensive assembly of all the ribbon inserts in the burner housing along with an optimum of flame continuity throughout the flame pattern especially at the junctions or joinders between the longitudinal inserts and the cross-over insert. That is to say, an important aspect or problem to be met lies in the fact that the burner is to be safeguarded as far as possible against flame interruption at any point of the flame pattern as well as against back flashing of the flame into the interior of the burner housing. Hence, this invention is concerned with improving the junction or functional continuity between the longitudinal inserts and the cross-over inserts even while attaining the aforementioned objects of providing simple, secure, effective, and inexpensive mounting of all the inserts relative to one another as well as relative to the burner housing. In this connection the invention is also concerned with improving the cross-over insert structurally as well as improving the associated portions of the burner housing.

As a matter of comparison and in view of the improvements contemplated by this invention, the prior structure in the Patent No. 2,575,101 shows a cross-over insert construction which in conformity with the cross-sectional shape of the upper half of the burner housing is in the form of an arcuately shaped assembly unit to be seated as such and secured in the cross-over flame opening, which is cut transversely into the burner housing to have communication with the longitudinal flame openings of the two lateral burner mouths. The cross-over insert extends in a vertical plane at right angles to the horizontal plane in which the longitudinal inserts are disposed, the lower ends of the arcuate cross-over insert thus having what substantially amounts to an abutting relationship between it and the longitudinal inserts in the burner mouths.

The cross-over insert assembly unit of this prior construction comprises one or a plurality of arcuately shaped elements of corrugated strip material such assembly of corrugated elements in turn being confined and sandwiched between a pair of correspondingly arcuately shaped end or cover plates. The end plates and the intermediate strip elements all arcuately conforming to one another are fastened together into an assembly unit as by countersunk rivets or other suitable means.

Hence, in the prior construction, after the lateral or main ribbon inserts were in place and secured, the cross-over insert assembly unit could be put in place and seated atop and transversely of the two main longitudinal inserts and in substantially abutting relationship at right angles therewith. In the prior construction this cross-over insert unit is secured in place and to the upper portion or half of burner housing by special fastening means as in the form of tab portions extending from and bent at right angles from the periphery of the arcuate end plate members of the cross-over insert unit. That is to say, such tab portions or ears are contiguous to corresponding portions of the burner housing and fastened thereto as by soldering, brazing, or welding, or otherwise.

In view of such prior construction and mounting of the cross-over insert, it is another object to provide for a manner of mounting the cross-over insert relative to the longitudinal main ribbon inserts, whereby the use of special fastening means directly between the cross-over insert and the burner housing as well as soldering or welding or brazing or other accessories as a means of securing the insert relative to its environment are avoided, yet whereby there are attainable all the aforementioned safeguards of flame continuity and back flash prevention throughout the H-shaped flame pattern, as well as structural simplicity combined with ease of assembly and low production cost.

To attain any of these objects, this invention proposes to establish the longitudinal main ribbon inserts and the cross-over insert in interlocking as well as intersecting relationship with respect to one another. To that end, the cross-over insert unit is first fitted and seated into the burner housing, and only thereafter are the longitudinal ribbon inserts put in place in the burner housing so as to interengage and interlock with the respective bottom end portions of the arcuate cross-over insert unit, instead of assuming the mere abutting relationship of the aforementioned prior construction. That is to say, each end

portion of the cross-over insert unit has a recess or cutout into which enters and interlockingly fits the respective longitudinal ribbon insert when applied subsequent to the proper seating of the cross-over insert assembly.

According to one feature a compact and secure interlocking relationship is established between the respective inserts by providing recesses or cutouts in both the cross-over insert and in the longitudinal ribbon inserts, so that they will compactly interengage and interlock by way of their respective recesses secure against displacement in any direction.

In conjunction with this novel interlocking relationship between the longitudinal and the cross-over ribbon inserts, other features lie in structural improvements in the cross-over assembly unit, as well as in improvements pertaining to the structure of the burner housing environmental to the cross-over insert assembly.

According to one feature the arcuate cover plates of the cross-over insert assembly are fixedly spaced in parallel planes with respect to one another by means of spacer strips or members disposed at or along the inner periphery of the cover plates, which spacer members in turn are spaced from one another to provide gas passages between them. The spacing of the cover plates from one another is such as to closely confine between them an assembly of the aforementioned arcuate elements of corrugated strip material, the cross-over assembly as a whole in turn being fitted closely into the cross-over passage area or cross-cut of the burner housing and to a depth reaching beyond, that is a distance below the horizontal plane of the longitudinal main ribbon inserts by way of intersection therewith.

Another feature provides improved construction of the cast iron burner housing around and in the vicinity of the cross-over, so that the improved cross-over mounting of this invention may thereby be inserted and employed conveniently, fitted closely and reliably and be operated effectively. That feature provides for a rib construction or rib extending in a vertical plane internally longitudinally and medially of the cast iron tubular burner housing, this rib extending like an inverted bridge from one side to the other side of the cross-over, thus providing not only a free space or transverse gas passage or communication at the cross-over proper, but also a rigid interconnection between the two top portions of the burner housing where they are separated by the cross-cut of the transverse flame connection.

More specifically, this inverted bridge or rib interconnects and is also integral with the corresponding bottom and top portions of the cast iron burner housing, thus imparting great rigidity to the burner housing, thus counteracting deformation relative to one another of those upper portions of the housing which constitute large longitudinal overhangs extending towards each other, and defined by the combination of longitudinal and transverse flame passage areas of the H-shaped flame pattern upon the burner housing.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

In the drawings:

Figure 1 is a semi-diagrammatic side view of the dual band gas burner installed.

Figure 2 is a top view of the burner taken on line 2—2 of Figure 1, with parts of the burner housing broken away to expose the longitudinal ribbon inserts.

Figure 3 is an enlarged partial view of the middle portion of the burner housing taken on line 3—3 of Figure 1, showing more clearly the novel intersection of the respective inserts.

Figure 4 is an enlarged sectional view of the middle portion of the burner housing, taken on line 4—4 of Figure 2.

Figure 5 is an enlarged cross-sectional view of the burner housing taken on line 5—5 of Figures 1 and 3.

Figure 6 is an enlarged view of the cross-over insert assembly detached from the burner housing and viewed upon its flat side, with a portion of the cover plate broken away, and interlocked with one of the longitudinal ribbon inserts.

Figure 7 is cross-sectional view of the cross-over insert, as taken on line 7—7 of Figure 6.

Figure 8 is a perspective view of the cross-over insert assembly removed from the burner housing, and interlocked with the longitudinal ribbon inserts.

Figure 9 is an exploded perspective view of assembly shown in Figure 8.

The dual band gas burner unit is diagrammatically shown in Figures 1 and 2 installed and supported at the rear end and at the front end upon oven walls W_1 and W_2, respectively. The burner unit **10** here comprises a substantially tubular cast iron housing **11** proper having longitudinal lateral burner mouths or gas passage openings **12** and **13**, and a cross-over flame connection or transverse gas passage opening **14** extending across the top portion of the housing, thus interconnecting the lateral horizontal flame openings **12** and **13** of the housing.

Due to these longitudinal and cross-over flame openings the burner housing may be said to comprise a lower or bottom portion U and a pair of upper or top portions O_1 and O_2.

Each of the lateral longitudinal burner openings is defined by a horizontal lower flange or lip and a pair of horizontal upper flanges or lips, all these flanges extending along and laterally from the burner housing to constitute the longitudinal burner mouth along the respective sides of the housing. That is to say, the longitudinal opening **12** constitutes a longitudinal burner mouth by reason of a lower flange or lip 12^a and a pair of upper flanges or lips 12^b and 12^c, the opposite longitudinal opening **13** constituting a longitudinal burner mouth by reason of a lower flange or lip 13^a and a pair of upper flanges or lips 13^b and 13^c.

The transverse opening **14** is of arcuate shape conforming to the shape of the upper half of the burner housing, and has a pair of correspondingly shaped arcuate flanges 14^a and 14^b. Hence, these arcuate flanges extend in parallel vertical planes at right angles to the planes of the horizontal flanges, so that at their one end the vertical arcuate flanges join and merge with respective inner ends of the horizontal flanges 12^b and 12^c thus constituting flange corner junctions 12^d and 12^e respectively, while at their other ends the vertical arcuate flanges join and merge with respective inner ends of the horizontal flanges 13^b and 13^c respectively, thus constituting flange corner junctions 13^d and 13^e respectively.

Longitudinal ribbon inserts **15** and **16** which extend in a horizontal plane are provided in the longitudinal lateral burner mouths **12** and **13** for subdividing the gas passage areas thereof into a multitude of minute gas passage openings or orifices, which longitudinal inserts are here shown as being secured in place as by means of rivets **17**. A transverse ribbon insert **18** is provided in the cross-over flame connection or transverse gas passage area **14**, structurally associated with the longitudinal inserts in such a manner as to intersect and interlock at right angles therewith as indicated by the intersection point P.

The cross-over insert assembly **18** being of arcuate or arched shape in conformity with the shape of the burner housing has intersecting as well as interlocking relationship with the longitudinal ribbon inserts **15** and **16**, and is therefore shown to have its ends extend a distance "*d*" downwardly beyond the longitudinal inserts **15** and **16**, which downward ends thus extend or cut partly into the lower half of the cast iron burner housing and there-

by into lug portions 19 and 20 provided as reinforcements of that portion of the housing at each respective side thereof.

The burner housing 10 is provided at its rear end with a tubular extension nipple 21 which is longitudinally substantially coaxial with the burner housing, and is closed at its outer end, whereby the rear end of the housing is supported upon the rear oven wall W_1 as by means of a supporting bracket 22. The front end of the burner housing is provided with a tubular extension nipple 23 substantially coaxial with the burner housing, the outer or front end of which nipple is fixedly held in and by a front closure plate or shield plate 24 whereby the front end of the burner unit is supported upon a customary so-called oven sleeve or cylindrical frame 25 mounted in the front oven wall W_2 the oven sleeve representing the wall opening through which the burner unit is inserted or removed. That is to say, the shield plate 24 having suitable adjustable admission openings (not shown) for combustion air is removably held upon the oven sleeve 25 as by means of fastening bolts indicated at 26. A gas supply connection for the burner is indicated by a fitting 27 and a gas supply pipe 28 leading thereto at right angles to the longitudinal burner axis and provided with a control valve 29. An ignition spark device D is provided at one side of the burner housing, to insure ignition of the flame along burner mouth 13, to propagate itself by way of the cross-over flame connection to the opposite burner mouth 12.

Referring more particularly to detail Figures 3 to 9, each of the longitudinal inserts 15 and 16 is here shown to comprise an assembly of ribbon elements of corrugated strip material known of itself, the insert 15 thus comprising ribbon elements 15^a, 15^b, 15^c, the insert 13 comprising ribbon elements 16^a, 16^b, 16^c. The longitudinal inserts 15 and 16 fit closely or tightly into their respective burner mouths or openings, and they are secured in place by aforementioned rivets 17 extending through the flanges of the burner mouths as well as through the ribbon inserts themselves. Each of these longitudinal ribbon inserts 15 and 16 has cut into its inner edge portion an indentation I_1 and I_2 respectively (see Figure 9) to interengage corresponding indentations provided in the respective downward end portions of the cross-over insert assembly 18.

The cross-over insert 18 is in the form of an arcuate or arched or semi-circular assembly unit the arched shape of which conforms to the cross-sectional shape of the upper portion of the burner housing. The cross-over insert 18 here comprises a pair of arcuate ribbon elements 30 and 31 of corrugated strip material confined between a pair of cover plates 32 and 33 which are of similar arcuate shape although flatwise of substantially greater width than that of the ribbon elements between them. Hence (see Figure 6) the width of the ribbon elements designated as "*c*" is smaller as compared with the width "*f*" of the cover plates. The relative dimensioning of the ribbon elements 30, 31 and of the cover plates is such that a margin "*g*" of substantial extra width of cover plate extends inwardly from the inner edge of the ribbon elements, while only a very small margin "*h*" of extra width of cover plate extends outwardly from the outer edge or periphery of the ribbon elements.

The two cover plates 32 and 33 are spaced from each other as well as connected to each other by means of a pair of spacer elements or spacer strips 34 and 34^a shaped to conform to the arcuate contour of the inner edge of the cover plates. The spacers 34 and 34^a have between their inner or upper ends a distance "*k*" while the outer or bottom ends are spaced a distance "*l*" from respective bottom edges E_1 and E_2 of the cover plates. A space or lane "*i*" appears along the spacers 34 and 34^a, that is a lane between these spacers and the arcuate ribbon elements 30, 31.

With the cover plates and the interposed spacer elements fixed together as by means of spot welding indicated at 35, the spacing of the plates from one another is accurate so that the ribbon elements are closely and durably confined between them, such mounting to insure the desired quality and continuity of the flame along the cross-over path thereof. Passages are provided for the gas to reach the cross-over insert, by reason of the spaces "*k*" and "*l*" and the arcuate lane "*i*." Each of the two lower end portions of the arched cross-over insert assembly is provided with an indentation I_3 and I_4 respectively spaced a distance "*m*" from the respective bottom edges E_1 and E_2 of the cover plates.

Important characteristics of this invention lie in the relationship of parts, that is in the manner in which the longitudinal inserts 15 and 16 are assembled and interlocked with the cross-over insert 18 upon the burner housing, to meet the problems initially set forth. This characteristic relationship is established by first placing or seating the cross-over insert 18 in the cross-over opening of the burner housing so that the indentations I_3 and I_4 will match or be lined up with the horizontal longitudinal gas passage openings of the burner housing, and thereupon placing the longitudinal inserts 15 and 16 into their openings so that their indentations I_1 and I_2 in turn will engage over and upon the associated indented portions of the cross-over insert in interlocking relationship therewith. In this way, the longitudinal inserts 15 and 16 fit closely into the respective indentations I_3 and I_4 of the cross-over insert 18 while the end portions of the cross-over 18 in turn fit closely into respective indentations I_3 and I_4 of the longitudinal inserts 15 and 16. By providing this interlocking relationship there is established a continuation of minute subdivisional gas passage openings or minute orifices transitional from the longitudinal inserts to the cross-over insert, providing the desired and safe flame continuity and flame propagation between the two lateral ribbons or flame bands of the burner. But importantly this manner of mounting provides at once also a simple and safe manner of anchoring and securing the cross-over insert assembly 18 relative to the longitudinal inserts 15 and 16 as well as relative to the burner housing without the need of other fastening and securing means.

Referring more particularly to detail Figures 4 and 5, there is provided internally of the burner housing a rib structure 36 extending in a vertical plane as well as longitudinally of the burner housing. This rib structure integrally connects the bottom portion U with the inner ends of two top portions O_1 and O_2 of the housing. That is to say, this rib structure is in the form of what might be called an inverted bridge structure here shown to comprise a body portion 37 as represented by a rib portion defined by the length p_1 and the height p_2, and a pair of rib portions 37^a and 37^b of the length p_3 and the height p_4 extending upwardly from the ends of the body portion 37. In other words, there is also formed by this rib structure 36 an opening defined by the height p_4 and the length p_5. This rib structure 36 thus integrates the free inner ends of the upper housing portions O_1 and O_2 with the bottom portion U of the housing, at the same time reinforcing the bottom portion U in the vicinity of the intersection points of inserts 15, 16, 18.

Whereas the inserts 15, 16, 18 have been shown to comprise flame-subdividing elements of the type represented by the corrugated strip material, it will be understood that the invention is not limited to the use of that specific kind of material, but that other kinds of flame-subdividing elements may be employed within the scope of this invention.

With respect to the cross-over insert 18 it is to be noted that any clearance that might exist between its lower edges and the bottom of the cross-cut in which it is placed may be readily sealed with a spot of soldering or welding without thereby in any way affecting the continuity of the flame inasmuch as such sealing spots are located at points P_1 below the intersections P of the respective inserts.

What is claimed is:

1. A dual band gas burner having a longitudinal burner housing provided with a pair of opposedly arranged longitudinal burner mouths presenting longitudinal gas passage areas for establishing a lateral flame along each side of the housing, and provided with a cross-over flame connection extending between said lateral burner mouths for establishing a transverse flame across the top of the burner housing, to allow flame ignition to propagate from one longitudinal burner mouth thereof through said cross-over connection to the opposite burner mouth, a longitudinal insert for each burner mouth to subdivide the gas passage area thereof into a multitude of minute gas passages, and an arcuate cross-over insert mounted in said cross-over flame connection to similarly subdivide the gas passage area thereof into a multitude of minute gas passages; characterized by the fact that the transverse gas passage area has at each end a downward extension intersecting with respective longitudinal gas passage areas, and by the provision of retaining means for said cross-over insert to hold the same interconnected with the respective longitudinal inserts, which retaining means comprise recessed end portions provided upon said cross-over insert to extend and fit into said downward extensions of the transverse gas passage area, said recessed end portions having fitted therein the respective longitudinal inserts in locked relationship therewith, whereby there is established a continuity of said minute flame openings together with flame continuity at the transitions between said longitudinal inserts and said cross-over insert.

2. A gas burner according to claim 1, in which each of the longitudinal inserts comprises a recessed portion at the inner edge thereof, having the recesses thereof shaped to engage over a corresponding associated recessed portion of the cross-over insert in a manner to establish double-interlocked relationship of the respective pairs of the associated recesses.

3. A gas burner according to claim 1, in which the cross-over insert comprises as elements of assembly therein a plurality of metal strips formed with transverse corrugations and combined with one another to have contacting and matching relationship with respect to one another to constitute said multitude of gas passages, a pair of cover plates matching the outer edge contour and the ends of said strips and providing extra width plate portions inwardly from the inner edge of said corrugated strips, a plurality of spacer elements interposed between and along said extra width plate portions and spaced from said strips and from one another, and fastening means for securing said plates and said spacer elements to one another, whereby said corrugated strips are confined closely between said cover plates, in which unit the recess in the recessed portions thereof is in the form of an indentation cut into the outer linear contour of the matching elements and shaped to fit corresponding cross-sectional dimensions of the longitudinal inserts associated therewith.

4. A gas burner according to claim 1, with the addition that the burner housing is in the form of a casting having an internal rib structure extending vertically and longitudinally in the form of an inverted bridge structure internally interconnecting the inner ends of the upper housing portions as defined by said longitudinal and said transverse gas passage areas of the housing, said inverted bridge structure also further having integral connection with the corresponding bottom portion of the housing to strengthen said bottom portions in a manner to compensate for the weakening thereof by said downwardly extending portions of said transverse gas passage area.

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