Sept. 24, 1957 O. WILDERMANN 2,807,320

RIBBON TYPE GAS BURNER WITH FLAME CONTROL

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Fig. 1.

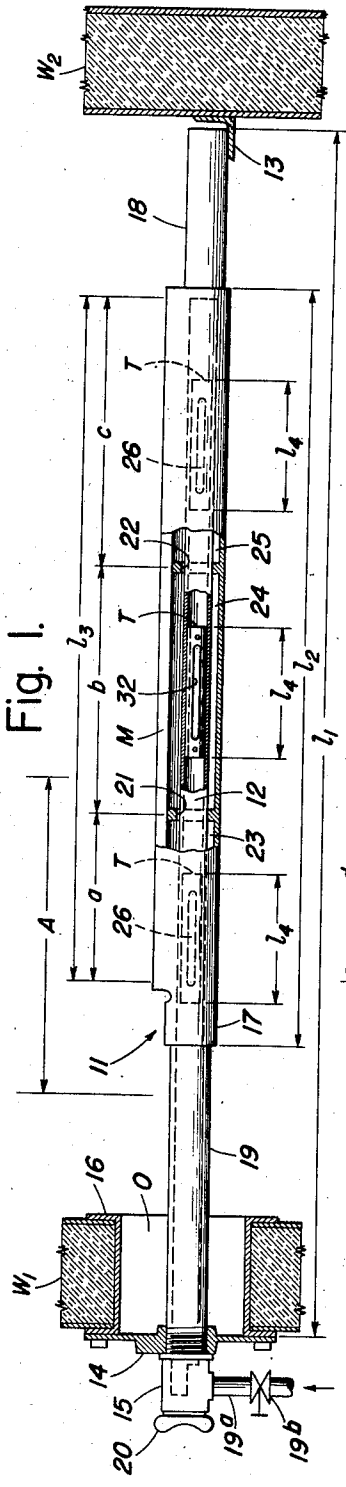


Fig. 2.

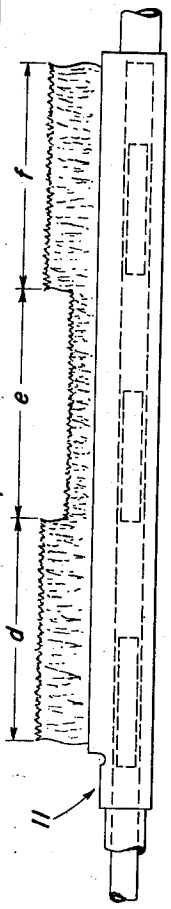


Fig. 3.

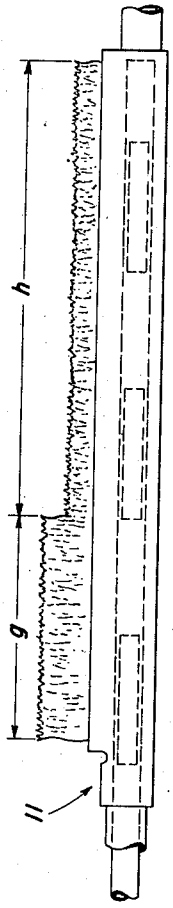
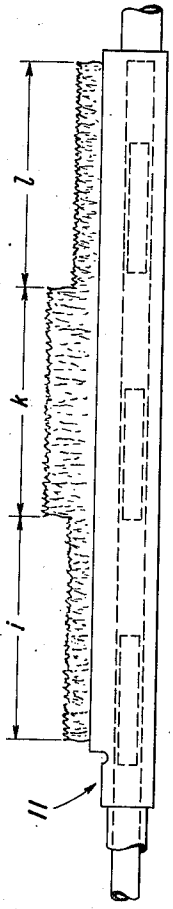


Fig. 4.



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Sept. 24, 1957 O. WILDERMANN 2,807,320

RIBBON TYPE GAS BURNER WITH FLAME CONTROL

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5 Sheets-Sheet 2

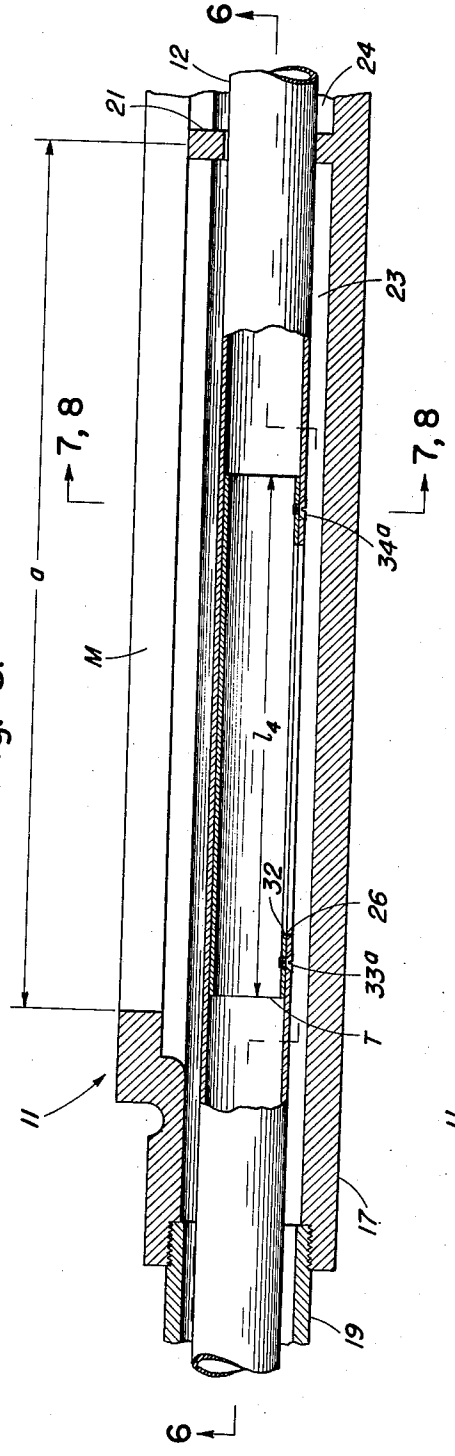


Fig. 5.

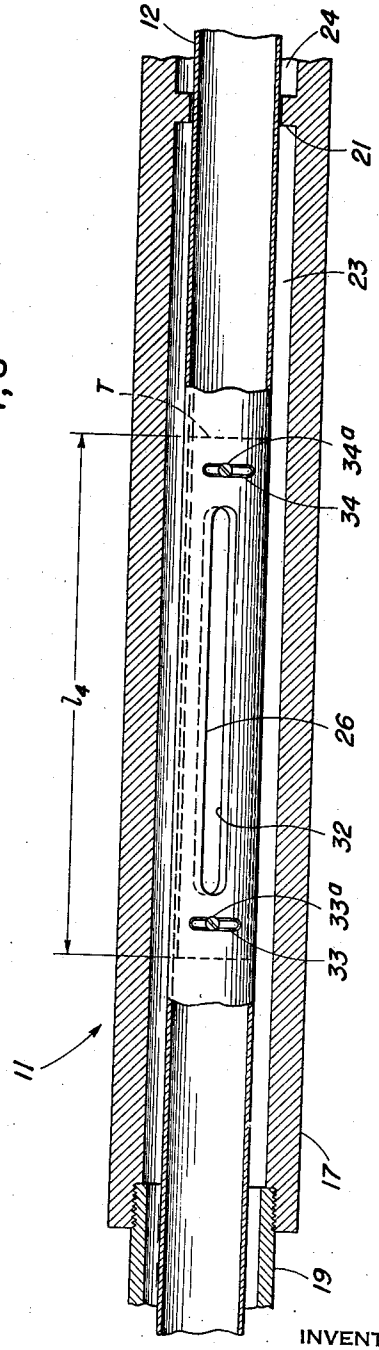


Fig. 6.

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RIBBON TYPE GAS BURNER WITH FLAME CONTROL

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Fig. 7.

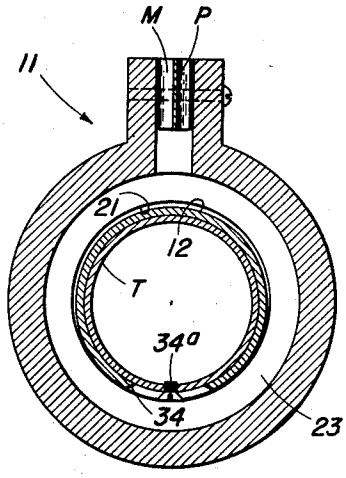
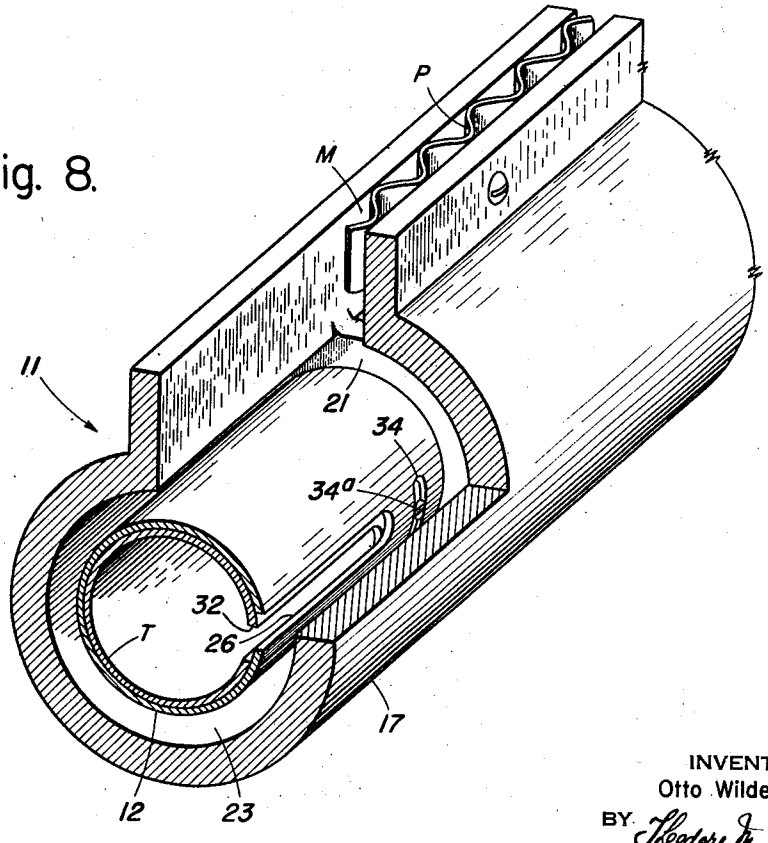


Fig. 8.



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Sept. 24, 1957 O. WILDERMANN 2,807,320

RIBBON TYPE GAS BURNER WITH FLAME CONTROL

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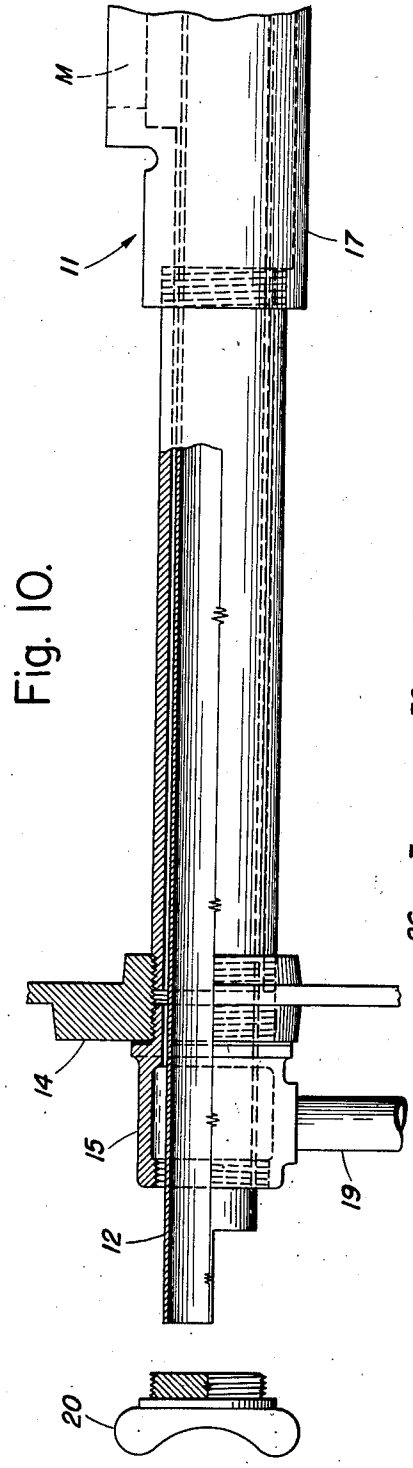


Fig. 10.

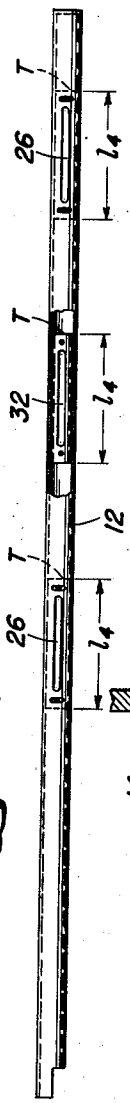


Fig. 10a

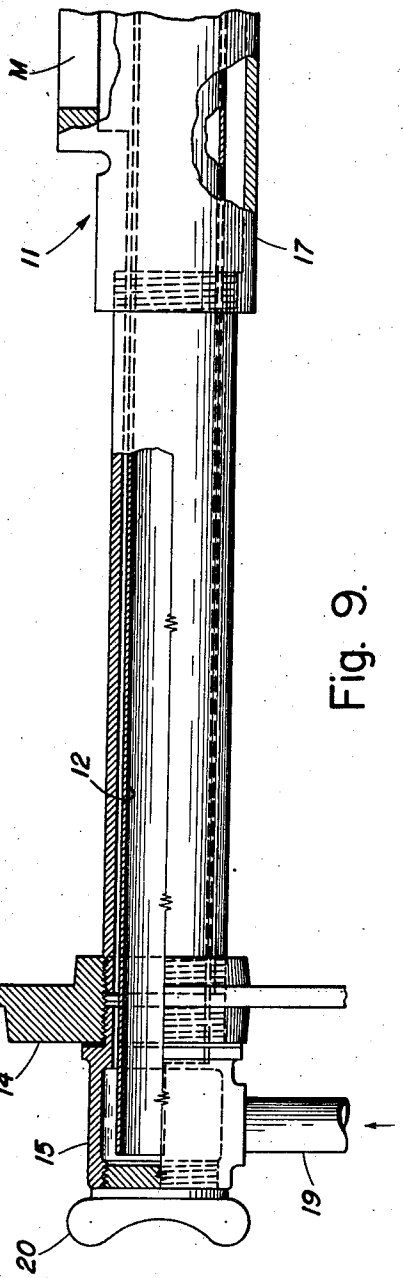


Fig. 9.

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RIBBON TYPE GAS BURNER WITH FLAME CONTROL

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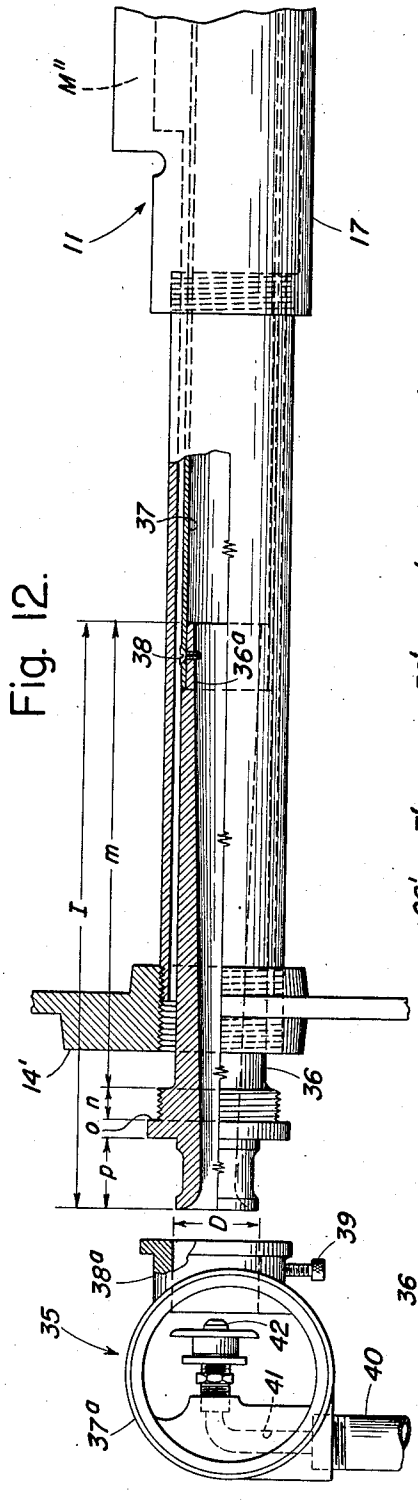


Fig. 12.

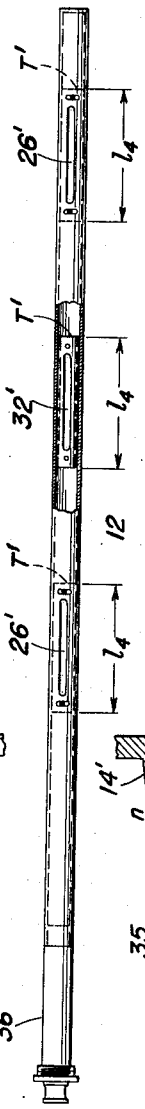


Fig. 12a

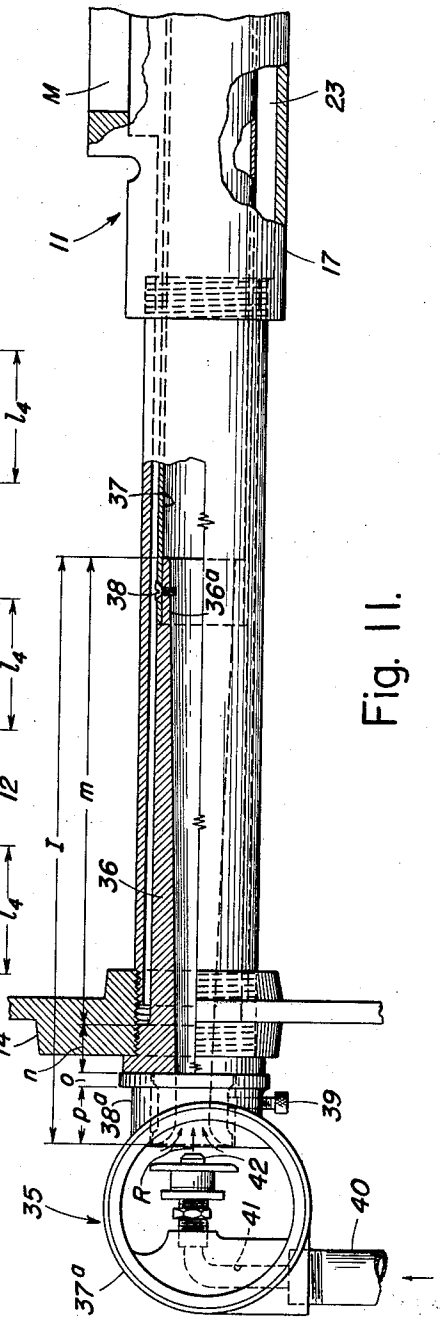


Fig. 11.

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United States Patent Office

2,807,320

Patented Sept. 24, 1957

2,807,320

RIBBON TYPE GAS BURNER WITH FLAME CONTROL

Otto Wildermann, River Edge, N. J., assignor to Ensign Ribbon Burners, Inc., Pelham Manor, N. Y., a corporation of New York

Application June 28, 1954, Serial No. 439,698

11 Claims. (Cl. 158—114)

This invention relates to improvements in ribbon type gas burners so called because they produce a ribbon like flame along the burner mouth extending along the length of the horizontal burner tube that constitutes the burner housing.

More particularly this invention is directed to such ribbon type gas burners in which there are provided means for controlling or adjusting the flame intensity variously along the length of the burner mouth. Indeed burners of such type are known which have a gas distributor tube disposed interiorly of and concentric with the tubular burner housing, so that gas entering the distributor tube will pass through ports or gas passages suitably disposed along the distributor tube, whereby the gas will transfer and spread into and along the surrounding gas chamber space for combustion along the longitudinal burner mouth in a ribbon type flame. In conjunction with such a gas distributor tube there are found means or devices for controlling the height or intensity of the flame along the burner in a complementary fashion, that it is in a manner whereby the flame is rendered greatest at the gas inlet end to drop off toward the dead end of the burner, or conversely the flame is rendered greatest at the dead end to taper off towards the inlet end. Hence, it is a limitation of this manner of control that one end of the flame is increased at the expense of the opposite end of the flange. In other words, the known flame controls of this character are limited because of this interdependence of the heating effects in the sense that an increase of flame intensity at the near end of the burner will produce a decrease at the far end, and vice versa an increase at the far end will interdependently produce a decrease at the near end of the burner tube. Therefore, these known flame controls do not meet a problem that arises where the requirements for heat distribution along the length of the flame are such as to call for a burner that provides greater operational adaptability and versatility as well as more positively controllable flame distribution. The problem which thus presents itself is to provide burner control means whereby the adjustment of one portion or zone of the flame is substantially independent of other zones. A more specific problem is to have an intermediate portion of the flame independently adjustable relative to the end portions thereof.

In order to attain this object of zonewise independent flame control, this invention provides within the burner housing one or more annular partitions or partitioning ribs which by their spacing from one another along the gas distributor tube define the sequence of the zones or of annular gas supply chambers within the burner housing, which supply chambers communicate with the longitudinal burner mouth. Each annular gas chamber receives gas at an adjusted rate through a corresponding individually adjusted gas passage area, while gas leakage from one chamber to the next may be minimized by the partitions or ribs. The gas distributor tube is axially removable from the burner housing for the purpose of zonewise flame adjustment. That is to say, there is provided for each chamber a blank-off member associated with the distributor tube, which blank-off members have gas ports or gas passage openings registerable with similar ones in the distributor tube. By adjusting these individual blank-off members relative to the distributor tube, the effective gas passage area of each chamber and thus the height and intensity of the flame for any one zone may be varied individually and substantially independently of the other zones.

According to one feature, the blank-off members are disposed internally of the distributor tube and are individually settable through openings in the wall of the distributor tube. Furthermore, the annular partitioning ribs are unitary with the burner housing, so that the gas distributor tube with its internal blank-off members may extend through and be slidably fitted into the openings or bores of these ribs. If the assembly of distributor tube and interior blank-off members be removed from the housing, adjustment of the respective gas passage areas can be made by manipulating the interior blank-off members from without the distributor tube.

According to a more specific feature, the blank-off members are in the form of short lengths of blank-off tubes of a diameter substantially corresponding to the interior contour of the gas distributor tube. Adjusting and position fixing means for the blank-off members comprise locking members extending outwardly from the blank-off means. Each locking member extends into a respective cutout area provided in the distributor tube. Each such locking member is operable to fixingly engage the edge portion defining the cutout area, for securing an adjusted position of the blank-off means. The locking members thus engaged are substantially flush relative to the circumference of the tube to provide for clearing the bores of the partitioning ribs during the longitudinal movement therethrough of the tube when the same is withdrawn or inserted relative to the burner housing. More specifically, the adjusting and position fixing means for the blank-off tubes comprise fixing screws threaded into the blank-off tubes through elongated openings or cutouts provided in the gas distributor tube, whereby the blank-off tubes may be fixed in their adjusted position relative to the distributor tube. More specifically, the position fixing screws have conically countersunk flat heads fixingly engaging the edge portions which define associated openings or cutout areas in the distributor tube, so that the distributor tube itself may present a protrusion-free outer surface to allow for smooth passage of the tube through the bores of the partitioning ribs. That is to say, such a fixing screw has a flat head provided with a conical seating surface, and the edge portion defining the associated opening is bevelled substantially, corresponding to the conicity of the seating surface of the head of the screw. In this way, the conical seating surface of the screw head will fixingly engage upon the bevel face when the screw is tightened.

According to another feature, the partitioning is such that an intermediate zone of the flame may be adjustable relative to adjoining end zones of the flame.

According to one embodiment, the burner construction is equipped for the use of pre-mixed gas, that is a suitable pre-mixture of gas and air. That is, a gas inlet head hollow supply fitting for pre-mixed gas is provided at the inlet end of the burner housing, which fitting is substantially coaxial with the horizontal burner axis and communicates with the inlet end of the gas distributing tube. At its outer end this hollow gas supply fitting has a closure member or plug which is removable without disturbance of a gas supply connection leading to the fitting, so that after removal of the plug the gas distributing tube can be withdrawn from the burner housing when-

ever a zonewise flame adjustment is to be made upon that tube.

According to another embodiment, the burner construction is equipped with a gas inlet head in the form of an inspirator head, that is an injector type gas supply nozzle which mixes gas and air injector-fashion at the burner itself. In this embodiment a venturi-shaped constriction member is coaxially and rigidly connected with the gas distributing tube so as to constitute therewith a subassembly unit removable from the burner housing for the purpose of making zonewise flame adjustment. The outer end or inlet end of the constriction member has associated therewith and surrounding it a removable nozzle housing which comprises a gas supply nozzle or gas jet housing in coaxial relationship injector-fashion with the constriction member or gas distributing tube, the relationship of the parts being such that the nozzle housing is removable with respect to the burner housing as well as relative to the constriction member, while the venturi-shaped member with its gas distributing tube is in turn removable per se from the burner housing.

In a more specific embodiment, there is provided a stationary mounting or shield member which has a threaded opening. The tubular burner housing is screwed into that opening at the inner end thereof, whereas the constriction member with its distributing tube is screwed into the outer end of that opening. The nozzle housing surrounds and fits over the outer end portion of the nozzle member and is removably fastened thereto.

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 part-sectional side view of one embodiment of the burner construction equipped with a gas inlet head for the use of pre-mixed gas, with zonewise flame control indicated along the length of the burner housing.

Figures 2, 3, 4 illustrate various possibilities of zonewise flame control.

Figure 5 is a greatly enlarged detail vertical sectional view of an intermediate portion of the burner structure of Figure 1.

Figure 6 is a longitudinal horizontal sectional view taken on line **6—6** of Figure 5.

Figure 7 is a cross-sectional view taken on line **7—7** of Figure 5.

Figure 8 is a cross-sectional view in perspective taken on line **8—8** of Figure 5 and with a portion of the burner housing broken away.

Figure 9 is a part-sectional greatly enlarged detail view of the front end portion of the burner structure of Figure 1 equipped with a gas inlet head for pre-mixed gas supply.

Figure 10 is a view of the parts of Figure 9 exploded to illustrate the removal of the internal gas distributing tube.

Figure 10^a is a side view in greatly reduced scale of the gas distributing tube of Figure 10 fully withdrawn.

Figure 11 is an enlarged part-sectional detail view of the front end portion of the burner structure according to another embodiment providing a gas inlet head in the form of an injector type inspirator head, where the venturi-shaped constriction member is unitary with the gas distributing tube.

Figure 12 is a view of the parts of Figure 11 exploded, to illustrate the removal of the internal gas distributing tube.

Figure 12^a is a side view in greatly reduced scale of the gas-distributing tube of Figure 12 fully withdrawn.

According to one embodiment of Figures 1 to 10^a, the burner unit **10** is shown equipped for the use of premixed gas. The burner unit is here shown to be mounted in and supported by an oven front wall W_1 and a rear wall W_2 (see Figure 1). This burner unit comprises a housing structure **11** of length l_1, a gas distributor tube **12** within and coaxial with the housing structure, a bracket **13** for supporting the rear end of the housing structure upon the rear wall W_2, a front shield plate **14** connected with the front end of the housing structure for supporting the same upon the front wall W_1, a hollow gas supply fitting **15** at the front end of the housing structure and connected with the shield plate **14** at the front thereof to have communication with the internal distributor tube **12**. The shield plate **14** in turn is carried by and removably fastened to a flanged liner sleeve **16** mounted in the front wall W_1 and defining an opening O in the wall, through which the burner unit as a whole may be inserted or withdrawn.

The housing structure **11** comprises a cast iron burner housing member **17** proper substantially tubular and of the length l_2 providing a longitudinal burner mouth M of the length l_3; a tubular rearward extension nipple **18** for closing the rear end of the housing **17** and supporting the same through bracket **13** upon the rear wall W_2; and a tubular forward extension nipple **19** supporting the front end of the housing through shield plate **14** upon the front wall W_1. That is to say, the rearward closing nipple **18** is screwed into the rear end of the cast iron housing **17** and thus rigidly and coaxially connected therewith. The forward nipple **19** is screwed into the front end of the cast iron housing **17** and thus rigidly and coaxially connected therewith, the front end of this nipple in turn being screwed into the shield plate **14** and thus rigidly connected therewith. The hollow gas supply fitting **15** is screwed into the shield plate **14** at the outer face thereof, thus connecting with the burner housing to supply gas to and into the distributor tube **12**, the fitting **15** having a lateral gas supply connection **19^a** with control valve **19^b**. At its outer end the fitting **15** has a removable closure member in the form of a screw plug **20**, so that with the plug removed the distributor tube **12** can be withdrawn from the housing without disturbance of the gas supply connection **19^a**.

The cast iron housing **17** is formed interiorly with a pair of annular ribs **21** and **22** which are bored to such a diameter as to allow for sliding passage therethrough of the distributor tube **12**. In this way there are provided within the housing **17** a series of three annular gas supply chambers **23**, **24**, **25** of the lengths *a*, *b*, *c*, respectively, defining the lengths of corresponding zones of the ribbon type flame along the burner mouth M.

For each of the supply chambers **23**, **24**, **25** the distributor tube **12** is provided with a longitudinally elongated gas passage opening **26**, and for each such opening there is provided within the distributor tube a blank-off tube T of the length l_4 having a gas passage opening substantially registerable with the associated opening in the tube. Thus there are three blank-off tubes T having an outside diameter substantially conforming and slidably fitted to the interior contour or diameter of the distributor tube **12**. Each blank-off tube T has a gas passage opening **32** and is rotationally adjustable within the distributor tube **12** to a degree whereby the gas passage openings in the distributor tube **12** can be blanked off to any extent desired. Within and along the burner mouth M (see Figure 8) there extends a corrugated metal strip P to indicate the use here of well known ribbon inserts of this kind.

For the purpose of effecting such blank-off adjustment and for fixing a blank-off tube T in its respective adjusted blank-off position there are provided in the distributor tube **12** a pair of transverse auxiliary elongated openings **33** and **34** for each blank-off tube. That is to say, upon withdrawal of the distributor tube **12** from the housing structure **11** the blank-off tube T within may be adjusted to a desired blank-off position by manipulating the screws **33^a** and **34^a**, and the thus adjusted distributor tube restored to its position within the housing structure.

It will be noted that the position fixing screws **33^a** and

34[a] have a flat head provided with a conical seating surface, and that the auxiliary openings 33 and 34 have their edge portion bevelled substantially in accordance with the conicity of the heads of the screws. In this way, when the screws are tightened, the screw heads will be substantially flush with the outer circumferential face of the distributor tube 12 so that the same may be slid unobstructedly through the bores in the annular partitions or ribs 21 and 22.

The embodiment of the burner structure shown in Figures 11, 12, 12[a] is equipped with a gas inlet head in the form of a removable inspirator head 35 associated with a venturi-shaped injector member 36 which in turn is unitary with an internal gas distributor tube 37 (which tube otherwise corresponds to the distributor tube 12 in the Figures 1 to 10[a] embodiment). In other words, this embodiment provides the removable gas inspirator head 35 along with a removable sub-assembly unit which comprises the air injector member 36. The injector member 36 is shown to have a reduced inner end portion 36[a] fitted into the associated end of the distributor tube 37 and fixed thereto as by a countersunk screw 38.

All component parts of the housing structure 11, namely a cast iron housing member 17' with burner mouth M', a rearward tubular closing nipple (corresponding to nipple 18 of Figure 1 but here not shown), a forward extension nipple (corresponding to nipple 19 of Figure 1 but here not shown), and a shield plate 14', all are substantially the same as the corresponding parts of the embodiment of Figures 1 to 10[a] described above. Equally the same are the compartmentations of the interior of the housing member 17' by means of annular partitioning ribs (corresponding to ribs 21 and 22 of Figure 1 but here not shown), and the provision of the gas distributor tube 37 with gas passage openings 26' and associated interior adjustable blank-off tubes T' having gas passage openings 32', all as described above with respect to the gas distributor tube 12 in the embodiment of Figures 1 to 10[a]. Within and along the burner mouth M (see Figure 8) there extends a corrugated metal strip P to indicate the use here of well known ribbon inserts of this kind.

The venturi-shaped injector member of the total length I is in the form of a generally tubular member having a slender portion *m* extending into the housing structure of the burner, a threaded portion *n* whereby this member is screwed into the shield plate 14', a shoulder portion *o* to set against the front face of the shield plate, and a relatively reduced mouth portion *p*. The inspirator head 35 has a gas nozzle housing comprising a cylindrical portion 37[a] in the form of a casting the open ends of which are pointing sideways. From the wall of the cylindrical portion 37[a] and at right angles to the horizontal axis thereof extends horizontally a hollow neck portion 38[a] having an inner diameter D dimensioned to fit over the mouth portion *p* of the injector member 36. A set screw 39 provided in the neck portion 38[a] holds the inspirator head removably in place upon and operatively connected with the injector member 36. A gas supply connection 40 leads into the inspirator head 35 which is formed with a gas supply passage 41. A gas nozzle or jet 42 is provided within and rigidly connected with the cylindrical portion 37[a] of the gas nozzle housing to connect with the gas supply passage 41. This gas nozzle is horizontally coaxial with the injector member 36 and adjustably spaced from the mouth *p* thereof in a manner to inject into the distributor tube a mixture of gas and air of desired proportions, as is indicated by arrows R.

In the operation of the burner, the position of the gas distributor tube is suitably such that the gas passages face substantially downwardly so as to facilitate or encourage even gas distribution throughout and along the respective burner chambers.

With respect to zonewise adjustment of the flame intensity along the burner mouth, reference is made to Figures 2, 3, 4 showing examples of blank-off adjustments of

the blank-off tubes T. Figure 2 illustrates an adjustment of flame distribution along the burner mouth, whereby outer end zones *d* and *f* become zones of relatively greater flame intensity, whereas an intermediate zone *e* is of diminished flame intensity. Figure 3 illustrates an adjustment where one end zone *g* is of higher flame intensity, whereas the balance of the length of the flame as represented by a longer zone *h* is of relatively diminished flame intensity. According to the Figure 4 adjustment there is an intermediate zone *k* of higher flame intensity, whereas the end zones *i* and *l* are of relatively diminished flame intensity.

The position fixing means for the blank-off members need not be limited to the specific embodiment here shown, although suitable cutout area is to be provided in the wall of the distributor tube, through which the blank-off members can be reached for adjustment, together with means for maintaining them in adjusted position.

What is claimed is:

1. A gas burner of an elongate ribbon-flame type comprising an elongate burner housing having an elongate burner mouth extending substantially along the effective length thereof, a longitudinal gas distributing tube within said housing, a gas inlet head connected with the burner housing to operatively communicate with said distributing tube for supplying gas thereto, and transverse partitioning means provided between said tube and said housing to establish thereby within the housing a longitudinal sequence of gas supply chambers communicating with said burner mouth and defining corresponding zones of flame control, said gas distributing tube having gas passage area for each of said chambers as well as blank-off means adjustable for varying the gas passage area individually for each chamber and thus varying the rate of gas supply thereto from said tube for effecting zonewise flame control; characterized thereby that mounting means are provided for fixedly supporting the inlet end of the burner housing as well as the gas inlet head thereof, that the partitions means are in the form of at least one internal annular rib unitary with said housing and presenting a bore to have said gas distributing tube removably extend therethrough in substantially gas sealing relationship therewith, said gas inlet head comprising a member normally rigidly and operatively connected with respect to said burner housing as well as with respect to said mounting means and disconnectable with respect to said housing and to said mounting means to allow for longitudinal withdrawal from the housing of the gas distributing tube, that the adjustable blank-off means are disposed within said tube, and that cutout area is provided in the tube wall, with the addition of position-fixing means operable for securing the adjusted position of respective blank-off means when the tube has been withdrawn from the housing, said position-fixing means comprising a locking member extending outwardly from said blank-off means into said cutout area and operable to engage the edge portion defining the cutout area, for securing an adjusted position of said blank-off means, said locking member thus engaged being substantially flush relative to the circumference of the tube to provide for clearing the bores of the partitioning ribs during the longitudinal movement therethrough of the tube when the same is withdrawn or inserted relative to the burner housing.

2. The gas burner according to claim 1, in which said position fixing means comprise a screw having flat head provided with a conical seating surface and threaded into said blank-off means and adapted when tightened to have conically countersunk and position-fixing engagement with the edge portion defining the associated cutout area of the tube wall, said edge portion being bevelled substantially corresponding to the conicity of said head of the screw.

3. The gas burner according to claim 1, in which said cutout area comprises an elongated auxiliary opening and the position fixing means comprise a screw having a flat

head provided with a conical seating surface and threaded into said blank-off means and adapted when tightened to have countersunk and position-fixing engagement with the edge portion defining said auxiliary opening, said edge portion being bevelled substantially corresponding to the conicity of said head of the screw.

4. The gas burner according to claim 1, in which the gas passage area comprises elongated openings extending longitudinally of the tube, in which said cutout area comprises an elongated auxiliary opening extending transversely of the tube, and the position fixing means comprise a screw having a flat head provided with a conical seating surface and threaded into said blank-off means and adapted when tightened to have countersunk and position-fixing engagement with the edge portion defining the respective transverse auxiliary opening, said edge portion being bevelled substantially corresponding to the conicity of said head of the screw.

5. The gas burner according to claim 1, in which said blank-off means comprise a length of blank-off tubing substantially conforming to the inner curvature of the distributor tube and slidably movable therein and provided with gas passage area substantially corresponding to the associated gas passage area of the distributing tube, and in which the position fixing means comprise a screw having a flat head provided with a conical seating surface and threaded into said blank-off tubing and adapted when tightened to have countersunk and position fixing engagement with the edge portion defining the associated cutout area, said edge portion being bevelled substantially corresponding to the conicity of said head of the screw.

6. The gas burner according to claim 1, in which said housing is compartmented by a pair of said annular partitioning ribs to provide for an intermediate chamber with the gas passage area adjustable relative to that of the adjoining end chambers of the flame.

7. The gas burner according to claim 1, in which said gas inlet head comprises a hollow gas inlet fitting disposed substantially coaxially with the burner axis and having communication with said gas distributing tube, in which said fitting has a lateral gas supply connection extending substantially transversely of the said axis, said fitting having at the outer end thereof a removable closure member allowing for the withdrawal through said fitting of said gas distributing tube when said closure member is removed.

8. The gas burner according to claim 1, in which said gas inlet head comprises a gas inspirator head having a gas nozzle housing, and means are provided for disconnectibly connecting the nozzle housing relative to said mounting means, relative to said housing and also relative to the venturi-shaped constriction member mentioned below, with the addition of a venturi-shaped constriction member surrounded injector-fashion by said gas nozzle housing and connected in coaxial relationship with the inlet end of said distributing tube, and means for disconnectibly connecting said constriction member relative to said mounting means and relative to said burner housing, said venturi-shaped member thus being removable from the burner housing and from said mounting means as a unit together with said tube.

9. A gas burner according to claim 1, in which said gas inlet head comprises a gas inspirator head having a gas nozzle housing, and means are provided for disconnectibly connecting the nozzle housing relative to said mounting means, relative to said housing, and also relative to the venturi-shaped constriction member mentioned below, with the addition of a venturi-shaped constriction member surrounded injector-fashion by said gas nozzle housing and connected in coaxial relationship with the inlet end of said distributing tube, and means for disconnectibly connecting said constriction member relative to said mounting means, and relative to said burner housing, said venturi-shaped member thus being removable from the burner housing and from said mounting means as a unit together with said tube, with the further addition that the firstmentioned connecting means comprise a connection directly between said venturi-shaped member and the gas nozzle housing surrounding it.

10. The gas burner according to claim 1, in which said gas inlet head comprises a gas inspirator head having a gas nozzle housing, and means are provided for disconnectibly connecting the nozzle housing relative to said mounting means, relative to said housing, and also relative to the venturi-shaped constriction member mentioned below, with the addition for a venturi-shaped constriction member surrounded injector-fashion by said gas nozzle housing and connected in coaxial relationship with the inlet end of said distributing tube, and means for disconnectibly connecting said constriction member relative to said mounting means, and relative to said burner housing, said venturi-shaped member thus being removable from the burner housing and from said mounting means as a unit together with said tube, with the further addition that the firstmentioned connecting means comprise a connection directly between the inlet end of the burner housing and the inner side of said mounting means, and that the lastmentioned connecting means comprise a connection directly between said constriction member and the outer side of said mounting means, as well as a connection directly between said constriction member and the nozzle housing surrounding it.

11. A gas burner of the longitudinal ribbon flame type in which a longitudinal burner housing has a longitudinal burner mouth, a longitudinal gas distributing tube within said housing, and a gas inspirator head connected with the burner housing to operatively communicate with said distributing tube for supplying gas thereto; characterized thereby that mounting means are provided in the form of a shield plate having a threaded opening for fixedly supporting therein the inlet end of the burner housing, with the addition of a venturi-shaped constriction member surrounded injector-fashion by said gas inspirator head seated upon and disconnectibly connected in coaxial relationship with the outer free end of said constriction member, said constriction member having a threaded intermediate portion screwed into the outer end of said threaded opening and thus outwardly removable therefrom together with said distributing tube, the adjacent end of said burner housing having a threaded end portion screwed into the inner end if said threaded opening.

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