

Sept. 9, 1952

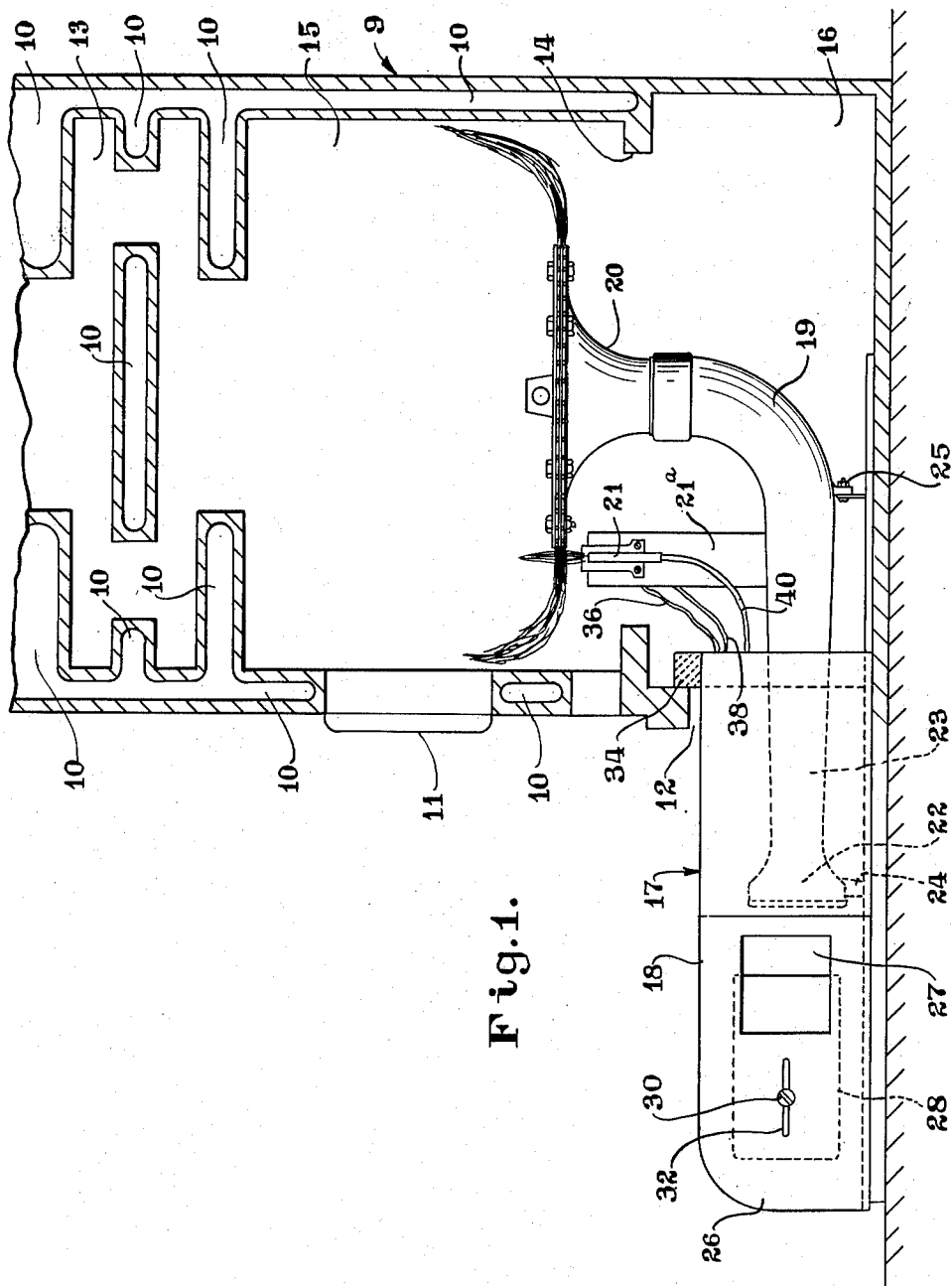
I. V. BRUMBAUGH

2,609,871

GAS BURNER WITH VERTICALLY SPACED PORTS AND INTERIOR BAFFLE

Filed May 1, 1947

3 Sheets-Sheet 1



INVENTOR.
ISAAC VERNON BRUMBAUGH
BY

Jerome R. Cox
HIS ATTORNEY

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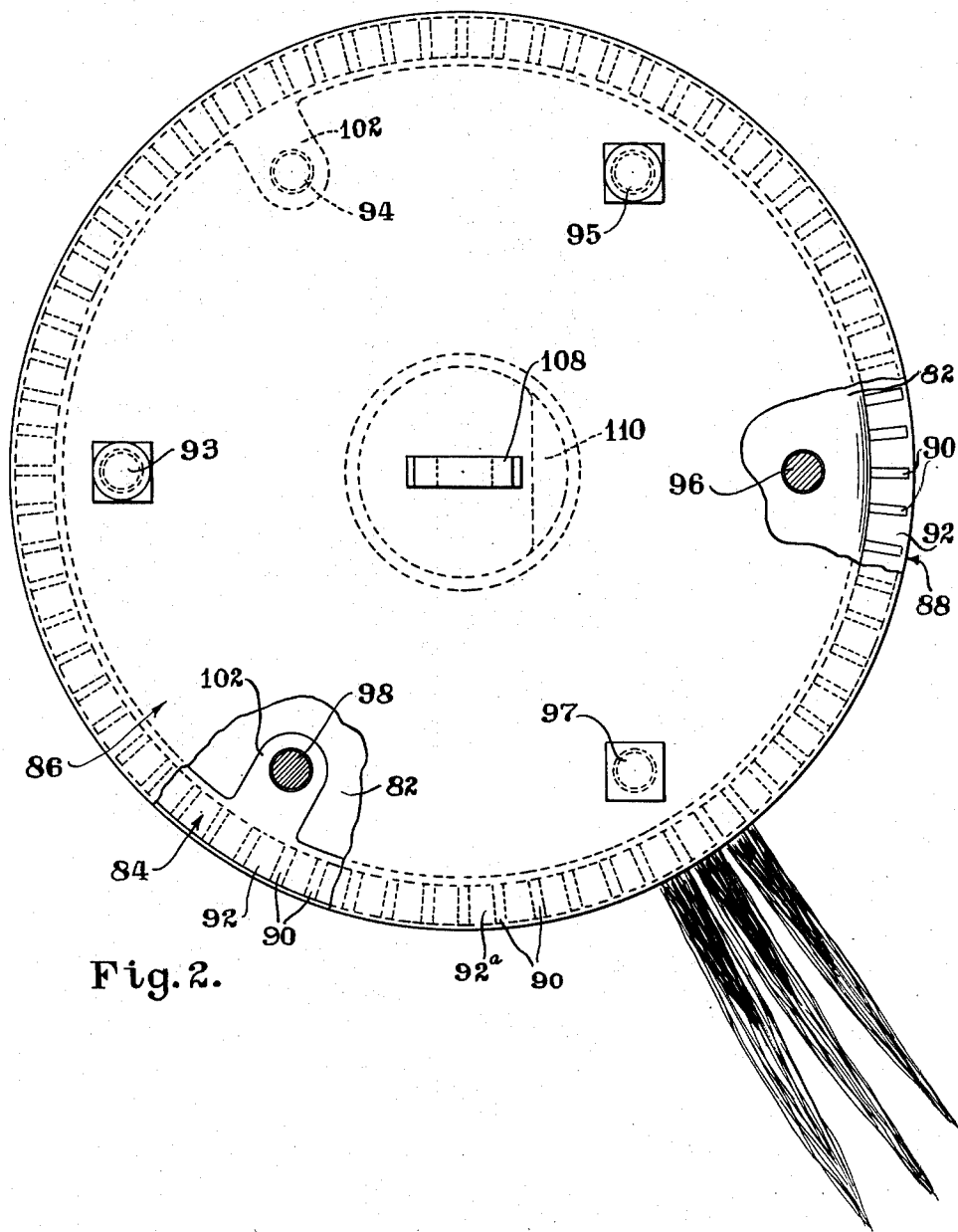


Fig. 2.

INVENTOR.
ISAAC VERNON BRUMBAUGH
BY

Jerome R. Cox
HIS ATTORNEY

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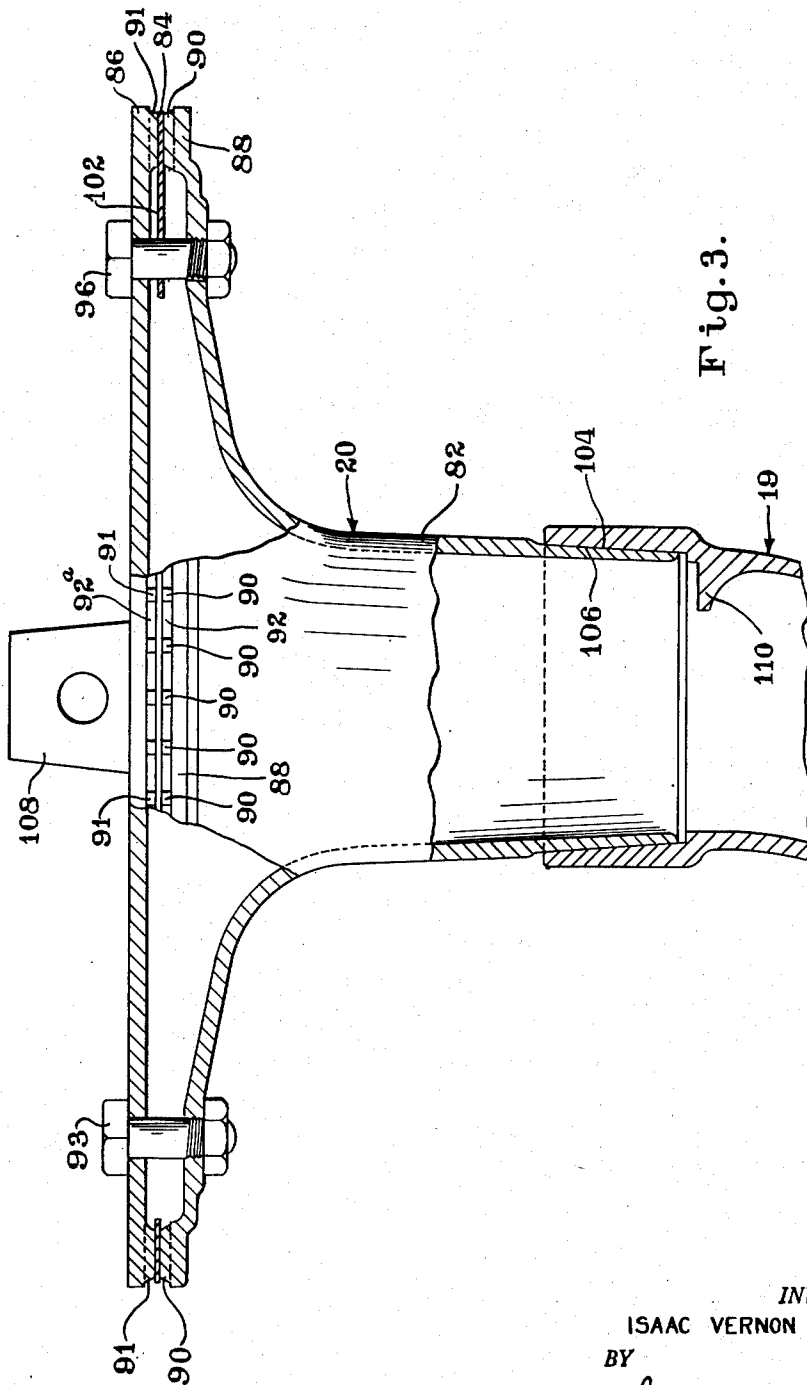


Fig. 3.

INVENTOR.
ISAAC VERNON BRUMBAUGH
BY
Jerome R. Cox
HIS ATTORNEY

UNITED STATES PATENT OFFICE

2,609,871

GAS BURNER WITH VERTICALLY SPACED
PORTS AND INTERIOR BAFFLE

Isaac Vernon Brumbaugh, Clayton, Mo.

Application May 1, 1947, Serial No. 745,138

11 Claims. (Cl. 158—114)

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My invention pertains to gas burners and more particularly to conversion burners suitable for installation in coal burning furnaces and boilers.

Many designs are already available for conversion of coal furnaces to gas burning units. Many of these designs are complicated. Many of these designs are such that the gas flame or flames are directed substantially upward so that the heat is directed to a portion of the furnace above that at which the heat produced by the burning of coal would act. Some of these designs are such that the flames are not uniformly directed around the furnace. Some are such that there is not an adequate area for flame burning to produce the required amount of heat. Other such designs are difficult of installation.

One of the objects of my invention is the provision of a gas burner conversion unit of simple and rugged design which may be conveniently manufactured, assembled and installed;

A further object is the provision of such a gas burning conversion unit which will operate efficiently in all types of furnaces even though such furnaces may be designed especially for coal burning and may have inefficient heat exchange units.

A further object is the provision of such a unit which may be conveniently installed and assembled by insertion through the furnace fuel and ash pit doors and still may secure efficient and uniform distribution of the gaseous fuel and heating flames.

A further object is the provision of such a unit having adequate flame area while maintaining the burner ports of sufficiently small size and so spaced that adequate properly placed air supply is provided and efficient burning is secured and while maintaining the flames directed substantially horizontally towards the sides of the furnace so that the hot gases will scrub the surface of the sides.

Further objects, features and advantages of my invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combination of parts and to numerous other features will be apparent from a consideration of the following specification which in conjunction with the drawings discloses a specific embodiment of the invention.

In the drawings:

Figure 1 is a fragmentary view partly in side elevation and partly in vertical section showing a furnace or boiler having installed therein a conversion burner constructed and installed according to my invention;

Figure 2 is an enlarged top plan view of the burner of Figure 1 having portions broken away and portions shown in section and having indicated the paths of several of the gas flames, it

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being understood that in operation similar flames would issue from all of the burner ports; and

Figure 3 is a fragmentary view, partly in elevation, and partly in vertical section showing on an enlarged scale, the burner head and the upper end of the mixing tube of the burner.

Referring now specifically to Figure 1 for a detailed description it may be seen that I have shown a conventional furnace or boiler 9 having water passages 10, a fuel door 11 and an ash pit opening 12. The furnace has flue openings 13 and has a grate opening 14 from which the grate has been removed, the grate opening connecting the fire box 15 to the ash pit 16. Water circulating through the passages 10 is heated by the fire in the furnace 9 and is circulated from the passages to the locations where heat is desired.

Installed in the furnace 9 is a gas conversion unit 17 having an inlet casing 18, a mixing tube 19, a burner head 20, and a pilot burner 21. The inlet casing 18 surrounds the "mixerbell" portion 22 and the adjacent Venturi shaped portion 23 of the mixing tube 19, the portions 22 and 23 being positioned substantially symmetrically in the casing 18 and the forward portions of the tube 19 extending through the inner open end of the casing into the ash pit 16. Supports 24 and 25 resting on the floor of the casing 18 and on the bottom of the furnace 9 support the mixing tube 19 in this position and through the mixing tube 19 thus support the burner head 20. These supports may be formed on the tube but are preferably bolted to lugs which are themselves formed on the tube. A removable cover 26 is provided for casing 18. Thus the casing 18 is sealed except for the open inner end above referred to and for an air inlet opening 27 formed in the cover 26. Normally the opening 27 is partially closed by a slidable plate or shutter 28 adjustably held in any desired position by a lock screw 30 extending through a longitudinally extending slot 32. The ash door opening 12 is entirely closed by the casing 18 and by an air seal 34 formed of fire brick, asbestos or some similar sealing material. The fuel door 11 is maintained closed during operation of the conversion burner. Thus the only air (primary and secondary) which can enter the furnace for mixing with the fuel enters through the opening 27. As will be later described the primary air enters the mixing tube 19 through the inlet end thereof. The secondary air flows into the ash pit 16 around the mixing tube 19 on all sides thereof. Thence it flows up from the ash pit 16 through the grate opening 14, flows around the burner head 20, and mixes with the fuel mixture flowing therefrom. To adjust the total amount of air entering the furnace the screw 30 may be loosened and the plate 28 moved to any desired adjusted position thus changing,

as may be desired, the effective size of the opening 27.

The pilot burner 21 is held in the proper position just below one side of the burner head by a pilot burner support 21^a which at its lower end is bolted to lugs (not shown) formed on the hidden side (Fig. 1) of the mixing tube 19, and has electric leads 36 and 38 and a gas conduit 40 connected thereto.

As is shown in Figure 1, the mixing tube 19 curves upward towards its outlet end until at its connection with the burner head 20 it extends substantially vertically upward. As is shown most clearly in Figure 6, I provide means whereby the burner head 20 may be assembled quickly, tightly, and simply with the vertical outlet end of the mixer tube 19. Because the head is symmetrical it does not matter in what rotatable position the head is assembled on the mixer tube 19. The inner socket of the upper end of the mixing tube 19 is tapered and the outer surface of the lower end of the burner head 20 is tapered. Thus as will be more fully explained the lower end of the burner head may be inserted in the upper end of the mixing tube and rotated to secure a tight airtight joint therein. I also provide means, later to be described, to equalize the distribution of the air-gas mixture in the burner head and whereby the pressure of the air-gas mixture as it enters the burner ports is equalized. I also provide special means to insure sufficient port area while keeping the ports sufficiently small to prevent the flame from flashing back through the ports, burning at the gas orifice 89, and noisy operation.

Referring especially to Figure 3, it may be seen that the lower end of the burner head 20 is telescoped into the upper end of the mixing tube 19 and is thus supported by the tube 19. The head 20 comprises a lower funnel shaped member 82, an annular spaced member or separator ring 84 and an upper closure member 86.

As suggested above one important portion of my invention is the special design by which I provide a relatively large port area consisting of a relatively large number of relatively small and restricted ports extending horizontally so as to direct the flames of burning gas substantially horizontally towards the side walls of the furnace at substantially the same level as that at which the greatest heat of a coal burning fire is directed. The extreme upper part of the flaring funnel shaped member 82 of the burner head 20 extends substantially horizontally as at 88. Adjacent the periphery, this horizontal portion 88 is formed with a plurality of upwardly extending radial ribs 90 equally spaced from each other around the periphery of the portion 88. Equally spaced ribs produce flames of uniform length. As shown in Fig. 2 there are 72 ribs, but it must be understood that there may be more or less than 72 ribs. I prefer to vary the number of the ribs depending on the size of the burner head. The ribs however must not be too wide as it is important for the flame to travel quickly around the burner in both directions from the pilot burner flame. I prefer also that ribs be fairly close together so that the burner ports are restricted sufficiently to prevent flashing back and noise in lighting, in operation and in turning the burner off. The spacer member 84 is substantially annular and fits tightly onto the top of the ribs 90 when the parts of the burner head are rigidly bolted together, and thus form a row of ports such as are shown at 92 (Fig. 2). Similarly the upper

closure member 86 is formed adjacent its periphery with an equal number of downwardly extending radial ribs 91 equally spaced from each other around the periphery of the member 86, the ribs 91 being arranged to be positioned directly above the ribs 90. Thus when the parts of the burner head are secured together, there is also formed an upper row of ports such as are shown at 92^a positioned between the closure member 86 and the separator ring 84. Each of the ports 92^a are positioned above one of the ports 92 so that there are provided a plurality of pairs of superimposed ports arranged in superimposed rows so as to produce a plurality of pairs (72 as shown) of substantially horizontally projected flames. These flames are separated from each other horizontally as shown in Fig. 2. They are also separated vertically. Thus secondary air flows around and is intimately intermixed with the burning gases and insures complete combustion.

I prefer to provide a relatively large number of ribs and thus secure a relatively large number of burner ports. Thus I insure a large number of flames that are literally separate as is indicated in Figure 2. This allows the flow of secondary air in between the flames assuring faster and more complete combustion of the gas. Complete combustion is not possible in designs where the flames are not properly aerated. The multiplicity of closely spaced ribs also insures a rugged sturdy structure which will not be warped and destroyed by the alternate heating and cooling of the burner head. If fewer wider ports were used there would be a tendency for the upper and lower members and the separator 84 to warp and cause a changing of the size of the ports resulting in a lack of uniformity in heating and the possibility of "flash back." With the large number of closely spaced, relatively narrow ribs, I have designed a burner which is not only very simple to construct and assemble and very efficient to operate, as has been previously pointed out, but is also sturdy and durable.

The funnel shaped portion 82, the separator 84, and the closure member 86 are secured to each other by a plurality of strong (large) bolts such as are shown at 93, 94, 95, 96, 97 and 98 (Fig. 2), it being noted that while all of these bolts extend through and secure the lower member 82 and the upper member 86 to each other, alternate bolts 94, 96 and 98 also extend through lugs 102 formed on the separator ring 84 and thus secure the ring 84 in position between the members 82 and 86. These large bolts also securely hold the top plate 86 in its proper position. The burner head becomes quite hot and the parts must be rigidly bolted together.

As suggested above I provide special means for quickly assembling the burner head 20 with the mixer tube 19. The lower end of the funnel shaped member 82 is formed as at 104 with an exterior taper while the upper end of the mixing tube is formed with an interior taper or socket as at 105. The lower end of the member 82 may thus be inserted in the socket at 105 to form a gastight tapered joint. A lug 108 formed on the closure member 86 and provided with a hole, makes it possible to twist and lift the head 20 in disassembling and also aids in the assembly operation. Thus it is possible to insert the mixing tube through the ash pit door and the burner head through the fuel door and assemble the two units in position even though

it might be impossible in many furnaces to insert the whole mixing and burner assembly through either door because of the relative sizes of the doors and the mixing and burner assembly.

Finally, as stated above, I provide special means to equalize the distribution of the air-gas mixture in the burner head and where-by pressure of the air-gas mixture as it enters the ports 92 and 92^a is equalized. Formed within the mixer tube 19 adjacent its upper end thereof and on the opposite side of the tube from the direction of the inlet end of the tube is a baffle or ledge 110 faired on its under side and so shaped as to equalize the pressure of the air-gas mixture in the burner head regardless of the fact that the mixing tube is itself curved. This baffle is integrally formed with the curved mixing tube and scientifically compensates for the curve. The burner head is symmetrical and will not interfere with the equalization of pressure regardless of how it is rotated in the socket 106. Thus in assembling the parts it is unnecessary to rotatably position the head 20.

In view of the full description above, the operation will, it is believed, be clear. In assembling the burner, the mixing tube 19 and casing 17 are inserted in the ash pit door 12 and sealed therein by the sealing means 34. The pilot burner assembly 21—21^a may be inserted through the fuel door, bolted in place and connected to gas line 40 and electrical leads 36 and 38. Or the pilot burner assembly may be assembled with the casing 17 and inserted with it through the ash pit door. The burner head 20 is then easily and simply inserted through the fuel door 11 and the lower tapered end thereof at 104 is inserted in the tapered socket at 106 to form a gastight joint. The door 11 is then closed and thereafter maintained closed. The primary air is adjusted or regulated by positioning the shutter 66 and securing it in position by the bolt 68. The cover 26 is placed in position. The total primary and secondary air is adjusted or regulated by positioning the shutter 28 and securing it in position by the lock screw 30. The pilot burner is lighted. Thereafter when gas is turned on in the tube 76, it flows through the orifice 80, the mixing tube 19, the burner head 20, out all of the many pairs of small ports and is ignited by the pilot burner 21, the flame travelling from port to port around the burner head instantly. This creates a draft which draws air in through the opening 27. The primary air is entrained into the burner by the energy of the gas and travels with the gas through the mixing tube and out of the burner ports. The secondary air passes around the mixing tube and up the sides of the burner head to meet the flaming air-gas mixture at the ports. The many small flames extend out in substantially horizontal directions from the ports and begin the heating of the furnace at the portion thereof where the furnace is designed to receive the heat when burning coal. I thus utilize most efficiently the heat of the gas combustion. The baffle 110 insures equalization of pressure in the burner head and insures flames of equal size all around the burner head.

My conversion burner is thus sturdy in construction, simple for installation and most efficient in operation.

It is to be understood that the above described embodiment of my invention is for illustration only and various changes may be made in details all coming within the scope of my invention.

I claim:

1. A burner comprising a burner head having a lower member formed with a plurality of upwardly extending radial ribs spaced around the circumference of the member and extending inward from the periphery, a spacer ring superimposed upon said ribs, and a closure member positioned above and spaced from the lower member so as to form a chamber between said lower member and said closure member; and having an annular ribbed portion adjacent to its periphery resting on the spacer ring and formed with a plurality of downwardly extending radial ribs equal in number to the number of upwardly extending radial ribs on the lower member and spaced around the circumference of the closure member so that each rib is vertically above one of the ribs on the lower member and extending inward from the periphery of the closure member so that there are formed a plurality of relatively small burner port openings.

2. A burner for installation in a coal burning furnace for conversion thereof to a gas burning device comprising a burner head having an upwardly flaring, substantially funnel shaped lower member having an exteriorly tapered lower portion, a substantially cylindrical intermediate portion flaring outwardly to merge with a substantially horizontal annular ring at the upper portion, the annular ring being formed with a relatively large number of upwardly extending radial ribs substantially equally spaced around the circumference of the member and extending inward from the periphery only a relatively short distance; a substantially annular spacer ring superimposed upon said ribs and formed with a plurality of inwardly extending ears; a substantially circular flat closure member positioned above and resting on the spacer ring and formed with a plurality of downwardly extending radial ribs equal in number to the number of ribs on the annular ring and substantially equally spaced around the circumference of the closure member and extending inward from the periphery of the plate member only a short distance so that each downwardly extending rib of the closure member corresponds to and is positioned above an upwardly extending rib of the annular ring and so that there are formed a plurality of pairs of relatively small openings for burner flames, one opening of each pair being above the spacer ring and the other opening being directly below the first opening and below the spacer ring; and a plurality of relatively heavy bolts extending through said closure member, the ears of said spacer member, and the horizontal annular ring of the lower member to secure said parts in fixed position relative to each other.

3. A burner for installation in a coal burning furnace for conversion thereof to a gas burning device comprising a burner head having an upwardly flaring, substantially funnel shaped lower member having a relatively small lower portion and a substantially cylindrical intermediate portion flaring outwardly to merge with a substantially horizontal annular ring shaped upper portion, the annular ring shaped portion being formed with a relatively large number of upwardly extending radial ribs substantially equally spaced around the circumference of the member and extending inward from the periphery only a relatively short distance; a substantially annular spacer ring superimposed upon said ribs and formed with a plurality of inwardly extending ears; a substantially circular flat closure member positioned above and resting on the spacer.

ring and formed with a plurality of downwardly extending radial ribs equal in number to the number of ribs on the annular ring shaped portion and substantially equally spaced around the circumference of the closure member and extending inward from the periphery of the closure member only a short distance so that each downwardly extending rib of the closure member corresponds to and is positioned above an upwardly extending rib of the ring shaped portion and so that there are formed a plurality of pairs of relatively small openings for burner flames, one opening of each pair being above the spacer ring and the other opening being directly below the first opening and below the spacer ring; a plurality of bolts extending through said closure member, the ears of said spacer member, and the horizontal annular ring shaped portion of the lower member to secure said parts in fixed position relative to each other; and a curved mixing tube member having a socket into which the lower portion of the lower member of the burner head fits and also having an interior baffle for equalizing the distribution of fuel gas within the burner head.

4. A burner comprising a burner head having a lower member formed with a plurality of upwardly extending integral radial ribs spaced around the circumference of the member and extending inward from the periphery; a spacer member superimposed upon and contacting with said ribs; and a closure member positioned above and spaced from the lower member so as to form a chamber between said lower member and said closure member and formed adjacent to its periphery with a plurality of downwardly extending integral radial ribs spaced around the circumference of the closure member and forming an annulus which rests on and contacts with the spacer ring; a plurality of said ribs being aligned with ribs of the lower member to form pairs of vertically aligned ribs.

5. A burner comprising a burner head having a lower member formed with a plurality of upwardly extending integral radial ribs; a spacer ring superimposed upon and contacting with the ribs of said lower member; and a closure member positioned above, and spaced from the lower member so as to form a chamber between said lower member and said closure member and formed adjacent to its periphery with a plurality of downwardly extending integral radial ribs spaced around the circumference of the closure member and forming an annulus which rests on and contacts with said spacer ring; a plurality of said ribs being aligned with ribs of the lower member to form pairs of vertically aligned ribs.

6. A burner comprising a burner head having a lower member; a spacer member formed with a plurality of upwardly extending radial ribs superimposed on and contacting with the ribs of said lower member; and a closure member spaced from the lower member so as to form a chamber between said lower member and said closure member and formed adjacent to its periphery with a plurality of downwardly extending integral radial ribs spaced around the circumference of the closure member and forming an annulus which is superimposed on and contacting with said spacer ring; a row of substantially rectangular shaped holes being formed between the ribs of said lower member and said spacer ring and a row of substantially rectangular shaped holes being formed between said spacer ring and the ribs of said closure member and positioned so that each of the substantially rec-

tangular holes in the upper row is positioned directly above one of the holes in the lower row.

7. A gas burner for installation in a coal burning furnace for the conversion thereof to a gas burning device comprising a burner head having an upwardly flaring substantially symmetrical and funnel shaped portion through which the fuel gas flows and formed with a lower end portion; and a longitudinally curved mixing tube separate from the burner head but assembled thereto and having an interior socket into which the lower end portion of the funnel shaped member fits, said mixing tube having means comprising a baffle formed inside of the curved tube adjacent to its upper end and on the side opposite to the center of curvature of the tube and on the side opposite to the direction to which the lower end of the mixing tube extends, for equalizing the distribution of fuel gas mixture within the burner head, said burner head being rotatable relative to said mixing tube member and the equalization of distribution of fuel gas being regardless of the rotative position of the head relative to the mixing tube member.

8. A burner for gas comprising a burner head having a plurality of substantially parallel series of ports producing a series of peripheral flames, each of the ports of each series being substantially in vertical alignment with a corresponding port of the other series, each port being separate from and spaced laterally from each other port of the same series and aligned vertically and spaced vertically with the corresponding port of the adjacent series, and each port being spaced laterally from each of the next adjacent ports of the same series a greater distance than the distance that it is spaced vertically from the aligned port of the adjacent series so that the flow of gas to each port is augmented by the flow of gas from the vertically aligned port to produce a single series of spaced peripheral flames.

9. A burner for installation in a coal burning furnace for the conversion thereof to a gas burning device comprising a burner head having an upwardly flaring substantially symmetrical and substantially funnel shaped exteriorly tapered lower portion, a substantially cylindrical intermediate portion flaring upwardly and outwardly to merge into a substantially horizontal annular ring forming the upper portion, the annular ring upper portion being formed with a relatively large number of upwardly extending integral radial ribs substantially equally spaced around the circumference of the member and extending inward from the periphery only a short distance; a substantially annular spacer ring superimposed upon said ribs and formed with a plurality of inwardly extending ears; a substantially circular flat closure member positioned above and resting on the spacer ring and formed with a plurality of integral downwardly extending radial ribs equal in number to the number of ribs on the annular ring, substantially equally spaced around the circumference of the closure member and extending inward from the periphery of the plate member only a short distance so that each downwardly extending rib of the closure member corresponds to and is positioned in alignment above an upwardly extending rib of the annular ring and so that there are formed a plurality of pairs of relatively small openings for burner flames, one opening of each pair being above the spacer ring and the other opening being aligned directly below the first opening and below the spacer ring; and means comprising fastening elements ex-

tending through said ears and secured to the closure member and the burner head for securing the closure member, the spacer member and the horizontal annular ring of the burner head in fixed position relative to each other.

10. Burner apparatus comprising a tube for supplying fuel, a burner head to which said fuel is delivered and which is formed with a plurality of rows of superimposed substantially horizontally extending passages leading to a plurality of rows of superimposed and individual burner port openings so that a plurality of rows of superimposed individual burner flames are directed substantially horizontally outward from said burner; said burner head comprising an upwardly flaring substantially funnel shaped lower member, having a relatively small lower portion, a substantially cylindrical intermediate portion flaring outwardly to merge with a substantially horizontal upper portion formed as an annular ring; a substantially annular spacer superimposed on said annular ring shaped portion and formed with a plurality of inwardly extending ears; a substantially flat and substantially horizontal closure member positioned above, secured to the lower member and spaced from said lower member so as to form a chamber between said lower member and said closure member, said plurality of rows of superimposed substantially horizontally extending passages being formed between the substantially horizontal peripheral edges of said lower member and said closure member; a plurality of bolts extending through said closure member, through said ears of said spacer member and through said substantially horizontal ring portion of the lower member to secure said members together; and a curved mixing tube having a socket into which the lower portion of the lower member of the burner fits and also having means including an interior baffle for equalizing the distribution of fuel gas within the burner head.

11. A burner comprising a burner head having a lower member formed with a plurality of upwardly extending integral radial ribs; a spacer ring superimposed upon and contacting with the

ribs of said lower member; and a closure member positioned above, and spaced from the lower member so as to form a chamber between said lower member and said closure member and formed adjacent to its periphery with a plurality of downwardly extending integral radial ribs spaced around the circumference of the closure member and forming an annulus which rests on and contacts with said spacer ring; a plurality of said ribs being aligned with ribs of the lower member to form pairs of vertically aligned ribs, in which a plurality of pairs of cooperating ports for gas issuing from said burner head are formed between the lower member and the closure member and the vertically aligned ribs, the ports of each pair being separated from but positioned closely adjacent to each other and each pair being separated from each other adjacent pair by a pair of said vertically aligned ribs for a greater distance than the distance between the ports of each pair.

ISAAC VERNON BRUMBAUGH.

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