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ATMOSPHERIC FUEL GAS BURNER

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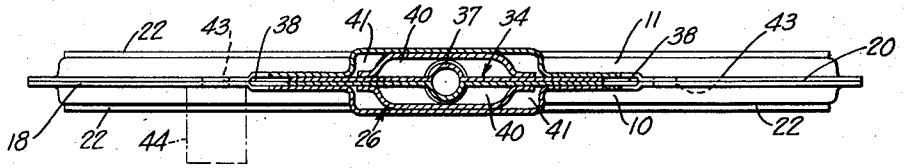

FIG. 4

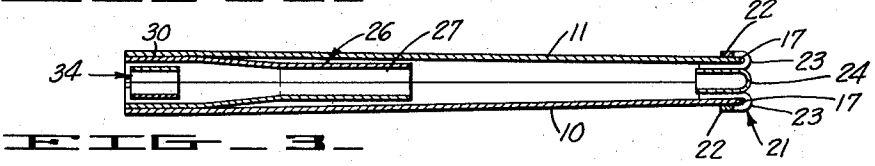

FIG. 3

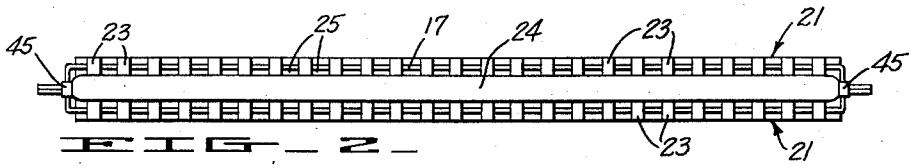

FIG. 2

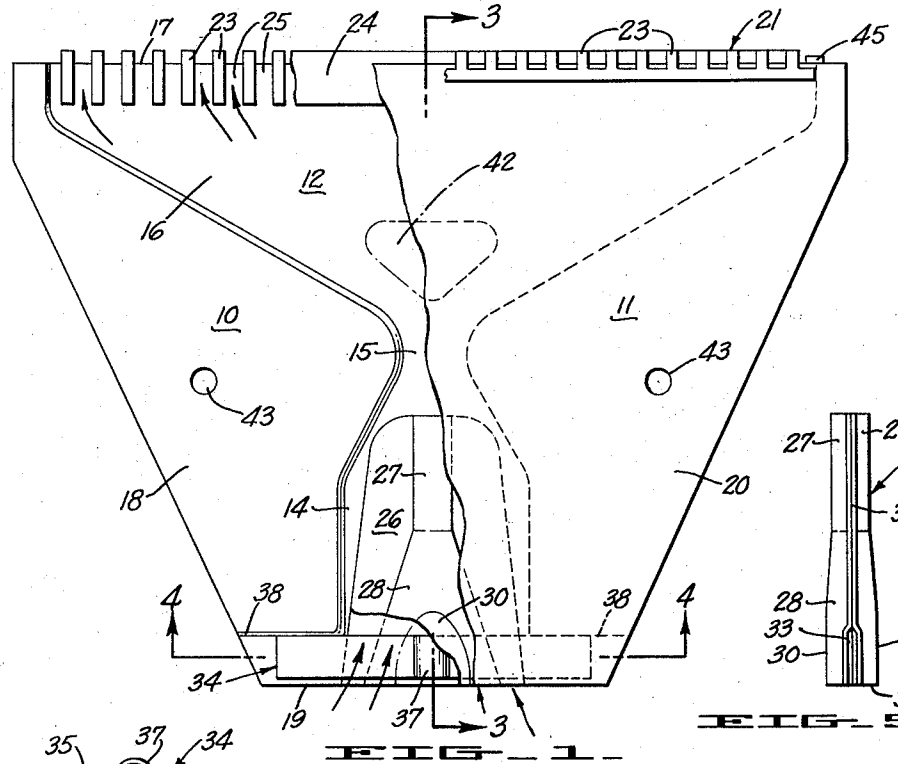

FIG. 1

FIG. 5

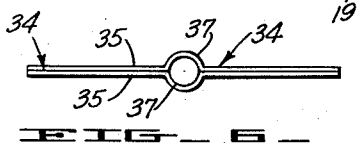

FIG. 6

INVENTOR
Otto W. Hahn

BY Henry Gifford Hardy

ATTORNEY

United States Patent Office

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ATMOSPHERIC FUEL GAS BURNER

Otto W. Hahn, San Francisco, Calif.

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9 Claims. (Cl. 158—99)

The invention relates to improvements in gas burners both for space heaters and other types of gas fired units. More particularly it relates to the production of a simple and remarkably efficient atmospheric fuel gas burner using sheet metal construction throughout.

At the present time there have been numerous burners made from sheet metal, but the commercial burners have in almost every instance, followed the conventional design of horizontal delivery of the fuel gas, with the conventional circular bell-shaped mixing chamber where the fuel gas and combustion air are mixed just before entering the throat of the so-called venturi. Not only are the size and shape of the structures limiting features, but in the construction thereof the requirement for right and left-hand dies doubles the die costs as well as the number of different pieces for use and inventory. In addition, in the operation of such burners, the danger of flashback is ever present.

One of the objects of the present invention is the provision of a vertical atmospheric fuel gas burner in which all of the parts are made from sheet metal stampings and wherein all of the corresponding parts, which are located on either side of the longitudinal vertical plane, are identical and interchangeable with its mate. In this way, a complete identity of parts is established, reducing the number of dies required and eliminating any necessity for right or left-hand dies and parts.

It is a further object of the present invention to produce a vertical atmospheric gas burner where the total weight of metal in the hot zone is very small, and wherein the area of the metal stampings is so arranged as to quickly dissipate heat and produce a cool burning unit. In this manner any coating properly applied to the several parts of the burner is not subject to the extreme action of expansion and contraction and is, therefore, less likely to crack or chip, exposing the metal to rapid disintegration.

It is another object of the present invention to produce an atmospheric gas burner having a removable primary gas-air mixture controller made from a set of stampings which are identical and removable as a unit from the burner entrance.

As a corollary to the above, it is likewise an object of this invention to adapt any burner to different conditions merely by substituting the subassembly comprising a different form of gas-air mixture controller without changing any other part of the burner.

It is another object of the invention to form the burner ports by a comb member with its teeth bent over in a U shape which is secured to the outlet edge of the main body element stamping, giving structural rigidity to the sheet metal.

It is also another object of the present invention to provide a sheet metal atmospheric gas burner which will not flashback, in the mixer or at any other point, even though the gas pressure falls as low as, or is throttled to 1/10 of an inch pressure and which will operate the same for natural gas and bottled gas with the proper normal adaptations.

Still another object of the invention is to supply a burner which has a vertical passage and distribution of gas and air which secures not only a better mixture between the two, but which produces a better and more even distribution of the mixture to all of the outlet orifices.

It is another object of the present invention to provide a sheet metal burner wherein all of the elements which are required to be removed either for cleaning, replacement or repair, are held in position in the assembly with a friction grip only. This means that no screws or other fasteners requiring tools for the assembly and disassembly are required, and the entire examination or replacement can be made simply with the aid of any instrument which will overcome the frictional holding. The reverse is likewise true. Replacement or reassembly of parts is accomplished simply by forcing them into position.

It is another object of the present invention to provide a heating unit comprising a multiple of these burners to produce a high heating capacity in a small space wherein a group of such burners occupies substantially all of the firebox. The assembly of several burners as a single unit concentrates the heat, distributes it more equally and, therefore, uses it to better advantage. For example, six of these burners may be assembled side by side in a firebox having an area no larger than 8½" x 9". Such a six-unit multiple produces a blanket of flame and heat which in place in a firebox handles 120,000 B. t. u. in natural gas at 4" water column pressure. It will be observed that such multiple units in use produce a chimney air flow which actually multiplies the effect of a single unit, which is not possible with any other structure in this art.

Further objects are to provide a construction of maximum simplicity, economy and ease of assembly and disassembly, also such further objects, advantages and capabilities as will fully appear and as are inherently possessed by the device and the invention described herein.

The invention further resides in the combination, construction and arrangement of parts illustrated in the accompanying drawings. And while there is shown therein a preferred embodiment thereof, it is to be understood that the same is merely illustrative of the invention and that the invention is capable of modification and change and comprehends other details of construction without departing from the spirit thereof or the scope of the appended claims.

Referring now to the drawings:

Figure 1 is a side elevational view of a completely assembled atmospheric gas burner of the present invention partially broken away to show the several elements.

Figure 2 is a top plan view.

Figure 3 is a vertical section taken on the line III—III of Figure 1 looking in the direction of the arrows.

Figure 4 is a transverse section taken on the line IV—IV of Figure 1 and looking in the direction of the arrows.

Figure 5 is a side elevational view of the air mixture controller assembly.

Figure 6 is a plan view of the gas inlet support which, with the mixture controller, forms a single assembled unit.

Referring more particularly to the drawings in which similar parts bear the same identifying numeral in the several views and with particular reference to Figure 1 showing the completely assembled burner. It will be observed that the burner is polyhedral in form. The main body of the burner is made up of two identical

stampings 10 and 11 which, of course, become interchangeable. Each stamping 10 and 11 is formed with a symmetrical depression 12 which comprises three different zones, zone 14 extends from the lower marginal edge 19 upwardly and is substantially rectangular in shape. It represents the deepest part of the draw and is approximately 5/16" in depth. From zone 14 the draw narrows in plan view to a flat venturi throat 15. From here it passes into the third zone 16 which widens to nearly the entire width of the burner to form the mouth. The depth of the draw in the venturi zone 15 is less than in the zone 14 and the depth of the draw in the zone 16 gradually lessens to a depth of about 3/16".

The form of the upper marginal edge 17 is best shown in Figure 2. The body of the burner is formed by facing the stampings 10 and 11 so that their flat areas 18 and 20 abut. When secured together in any suitable manner, such as spot welding, these flat portions 18 and 20 form vanes of substantial area. It will be observed that when the two identical stampings 10 and 11 are faced as described, each constitutes a side wall of the burner with the zones 14 and 15 and 16 becoming a continuous internal chamber, and forming the volumetric chamber for the mixing and distribution of fuel gas and air.

The burner parts are formed in the following manner: A comb 21 is stamped out of a piece of metal and is provided with a back 22 along one marginal edge having teeth 23 which are bent back in the form of a U as shown in Figure 3, leaving just enough space between the back and the bent over teeth to engage both sides of the edge 17. One comb 21 is provided for each edge 17. By pressing them downwardly so that the inner edge of the bend substantially engages the upper edge 17 and punching them in position before the body members 10 and 11, the comb members 21 will be held firmly in position. The punching or restriking of the comb 21 in position along the edge 17 crimps the inner teeth slightly into the body of the burner stamping, and thereby stiffens the side wall of the burner by a three metal thickness of compressed construction. This greatly increases the durability and integrity of the assembled burner. The back of the comb is on the exterior of the edge 17 while the open ended teeth are on the inner face thereof as clearly shown in Figures 1 and 3. They are readily available for inspection and cleaning without the necessity of removal. It is a matter of preference whether the combs 21 are arranged so that the teeth 23 are opposite those on the other edge or staggered to produce a staggered flame.

The space between the facing inner surfaces of the teeth 23 is filled by a spacer member 24 which forms a solid barrier between the two. This spacer member is pressed into position with a snug fit as shown in Figures 2 and 3 and is held there with frictional engagement only. When in position the side walls of the member 24 are separated from the side walls of the zone 12 along the upper edge thereof by the thickness of the teeth 23 leaving the open ended interstices 25 between the teeth to form the mixed gas fuel and air burner ports. The end of the spacer member 24 may be formed with tabs 45 which abut the upper joined edges of the main body members 10 and 11, and act as stops to effect proper positioning.

The spacer member 24 may be inserted in position with the legs of the U downward, as shown in Figure 3, or with the legs upward. With heavy gases, when the legs are downward, the space between acts as an additional mixing chamber. It is warm in use and materially aids the thorough mixing of fuel gas and air before reaching the ports. With high velocity gases, it causes turbulence and greatly increases combustion efficiency.

The gas-air mixing controller for the burner is likewise composed of two identical stampings 26. The stamping comprises a flat sheet with a substantially semicircular depression 27 for a portion of the distance which widens into a tapering depression 28 which is flattened at 30 so as to decrease its depth. The two halves are joined together, such as by spot welding, to form a unitary assembly having a continuous passage therethrough. The wings 31 are so formed that they permit insertion of the assembly 26 within the chamber formed by the zone 14 so that the cylindrical outlet formed by the mating of the semicircular channels 27 is pointed directly into the throat of the venturi formed by the zone 15. The flattened portion 30 engages the inner faces of the walls of zone 14 so that the assembly retains its precise position upon insertion. The lower edge 32 thereof is stepped back at 33 for the purposes hereinafter described.

The gas inlet support member 34 is composed of two identical strip stampings with semicircular depressions at the midportion thereof forming a collar 37. The two metal strips 35 so formed are secured together in any suitable manner such as spot welding. The setback 33 of the gas-air mixture controller assembly 26 is just wide enough to receive the double thickness of the two strips 35. The gas inlet support 34 is inserted in the slot 33 of the gas-air mixture controller assembly and secured therein to form a unit subassembly. Since the lower edges 19 of the stampings 10 and 11 are similarly set back at 38 to form a slot accommodating the double thickness of the assembly 34, the complete subassembly can be inserted accurately in proper position and held with frictional engagement, so that it may be inserted, removed, and replaced with ease. The primary air gas mixture controller, as a subassembly, may be substituted in various forms to accommodate individual problems of gas, air supply, and size without changing any of the other portions of the burner.

In assembling the burner of the present invention the stampings 10 and 11 are shaped in the manner described heretofore and secured together after the comb members for each is in place. The comb members 21 are applied with a compressed crimp fit over each of the edges 17 as previously described. The spacer member 24 is then inserted between the teeth 23 which are turned over and lie against the inner face of the chamber formed by the zone 12. Next the primary air-gas controller assembly 26 is prepared with the identical stampings which are faced and secured together, such as by spot welding. Next the gas inlet support member 34, shown in Figure 6, is secured together in any suitable manner, such as by spot welding, and this is inserted in the setback or slot 33 of the gas-air mixture controller and secured in position therein to form a complete subassembly. The subassembly as a unit is placed within the chamber formed by the zone 14, with the extremities of member 34 engaging the slot formed by setbacks at 38, with a suitable friction fit. It is apparent that this subassembly may be so shaped as to locate the center, the height and the vertical position of the burner. It will be observed that the circular collar 37 is axially aligned with the passage through the air mixing chamber 26 and the throat of the venturi of zone 15. The collar 37 is adapted to fit over the standard gas inlet and holds the entire assembly in upright position.

To disassemble in the event of cleaning, repairing or replacement the assembly 34 is easily removed by overcoming the friction fit in slot 38 which then permits the entire subassembly including the gas-air mixture controller to be removed. The spacer member 24 is removed simply by prying it out of position. Everything in the burner which needs to be taken apart or inspected is readily removed and replaced.

In operation the assembled burner, which is shown in Figure 1, is placed on the gas inlet tube by passing the collar 37 around it. Upon opening the valve, fuel gas will then emerge and be released in the vicinity of the top of collar 27 into the gas-air mixture controller and will rise upwardly as shown by the arrows. Primary air

enters the chamber **40** from the bottom as shown by the arrows, and in its movement upward mixes with the gas and this mixture passes up through the cylindrical outlet formed by the juncture of the two semicircular stampings **27**, in the vicinity of the entrance to the venturi of zone **15**. Additional air also comes up from the bottom into the chamber surrounding the gas-air mixture controller assembly **26** and the inner wall of the chamber formed by zone **14**, which chamber is numbered **41**. Additional air from this source is delivered to the air and fuel gas mixture just before the entrance to the venturi of zone **15**. Upon leaving the venturi the mixture expands and spreads laterally and upwardly into the volumetric chamber formed by the zone **12** and, after receiving whatever special effect the spacer **24** may impart, is distributed to and escapes through the interstices **25** left between the teeth **23** which form the ports of the burner. The narrowness of the width of the volumetric chamber formed by the zone **12**, as well as the fact that the combustible mixture is delivered in a substantially vertical passage, gives a remarkably and unexpectedly uniform distribution over the entire length of the mouth of the burner. In the event that a burner might tend to deliver more mixture to the center portion, even distribution may be accomplished by islands or baffles **42** on the interior of the chamber in zone **12**. These islands or baffles **42** may be formed by depressions in the wall stampings of the burner itself, or may be added at the time the walls **10** and **11** are assembled.

It will be observed that a burner has been designed which provides a vertical distribution of mixed air and fuel gas with a preliminary mixing at the venturi of the gas-air mixture controller and then an additional mixing of air at the venturi of zone **15**, prior to the delivery to the orifices. In this manner sufficient and the full amount of oxygen for full combustion is continuously induced, supplied and thoroughly mixed. The superior combustible mixture is supplied evenly to all of the ports for even burning and even heat. It is characteristic of the burner that it cannot be made to flashback at any point even though the gas pressure falls below 1/10" pressure or is throttled back this far.

The continuous passage of air both through and around the gas-air mixture controller assembly **26**, keeps this member surprisingly cool during continued operation and the heat generated by the burner during operation is carried to the very substantial area of the fins **18** and **20** and thus dissipated, causing the operation of the burner itself, to be cool at all times even under severe continuous operation. Likewise, it will be observed that the total weight of metal in the hot zone at the burner ports is very small compared with most burners where the ports are drilled or cast which require a heavy volume of metal. This further provides a cooler and safe operation. Because of the cool operation there is no deterioration of the metal or the coating material.

Burners of the present invention find particular usefulness in multiple units so as to provide a maximum output of B. t. u.'s for a minimum of space. To this end perforations **43** are made in the fins **18** and **20** for the passage of a bolt or draw screw. Spacer ferrules **44**, which are preferably cylindrical with an axial bore for the passage of the bolt or draw screw, are provided to space the burners apart leaving only a small amount or scant clearance between the burner assemblies. When two or more of these burner assemblies are made into a unit it is apparent that the entire surface, when ignited in operation, becomes a blanket of flame and heat which permits a concentration of heat, using it to better advantage than has heretofore been possible.

When a group of burners are joined into a unit to occupy the entire firebox, for example a multiple of six units assembled for use in a firebox having an area no larger than 8½" x 9", the air intake at the bottom thereof produces a chimney effect for the entire area. Air is induced both through and around the burners, providing an overabundance of air. This inducement of air greatly aids the combustion of the fuel gas by supplying the required amount of oxygen for full combustion and insuring equal and homogeneous mixtures for each burner. The chimney effect produced by such multiple units actually, by test, increases and exceeds the total performance for a like number of individual burners.

The chimney advantage cannot be gained by multiple units of the conventional burners where the primary air is supplied to the globular or bell-shaped intake which is at right angles to the chimney flow. Accordingly, increasing the chimney air would not and could not increase combustion or multiply and increase the combined effect of the single burners.

The double mixing of air through the two venturis provides a complete and thorough mixture of air and gas within an extremely short distance, which may be enhanced if desired by the turbulence of the spacer adjacent the burner ports. This results in better operation of the device and a remarkagle increase in the efficiency of its operation.

I claim:

1. A gas burner comprising two identical fan-shaped metal stampings, each having a symmetrical open Y-shaped depression with the narrowest depression width at the waist thereof, faced and secured together with the depressions outward to form a central vertical passage terminating at the top in a wide mouth of narrow transverse width and flanked by integral substantial cooling fins, a comb member having laterally bent over teeth and engaging both sides of the longitudinal edge of said mouth with the back of the comb member on the outside, one comb member for each stamping, a spacer member plugging the mouth opening between the teeth sets of said comb members and cooperating therewith to form burner ports between the individual teeth of each set, a gas-air mixture controller comprising two identical stampings, each having a symmetrical depression narrowing in width from inlet to outlet, faced with the depressions outward to form a central vertical opening with lateral abutting faces and fitted as a unit coaxially within the lower leg portion of said burner vertical passage and spaced laterally from the internal margins thereof permitting intake air to pass through and around said mixture controller, and a pair of strip stampings having median semicircular depressions faced and joined to provide a circular collar for coupling to a gas supply line and having lateral wings fitted within and held by the lower marginal edges of the burner with said collar located coaxially within said mixture controller.

2. A gas burner comprising two identical fan-shaped metal stampings, each having a symmetrical open Y-shaped depression with the narrowest depression width at the waist thereof, faced and secured together with the depressions outward to form a central flattened and elongated vertical passage with a narrow throat substantially midway thereof terminating at the top in a wide mouth of narrow transverse width and flanked by integral substantial cooling fins, a comb member having laterally bent over teeth and engaging both sides of the longitudinal edge of said mouth with the back of the comb member on the outside, one comb member for each stamping, a spacer member plugging the mouth opening between the teeth sets of said comb members and cooperating with them to form burner ports between the individual teeth of each set, a gas-air mixture controller comprising two identical stampings, each having a symmetrical depression narrowing in width from inlet to outlet, faced with the depressions outward to form a central flattened and elongated opening tapering to a cylindrical opening having lateral abutting faces and fitted as a unit coaxially within the lower leg portion of said vertical passage and spaced laterally from the internal margins.

thereof permitting intake air to pass through and around said mixture controller, and a pair of strip stampings having median semicircular depressions faced and joined to provide at the midportion thereof a circular collar for coupling to a gas supply line and having lateral wings fitted within and held by the lower marginal edges of the burner with said collar located coaxially within said mixture controller.

3. A gas burner comprising two identical fan-shaped metal stampings, each having a symmetrical open Y-shaped depression with the narrowest depression width at the waist thereof, faced and secured together with the depressions outward to form a central flattened and elongated vertical passage with a narrow throat about midway thereof terminating at the top in a wide mouth of narrow transverse width and flanked by integral substantial cooling fins, a comb member having laterally bent over teeth and engaging both sides of the longitudinal edge of said mouth with the back of the comb member on the outside and structurally stiffening the same, one comb member for each stamping, a spacer member plugging the mouth opening and frictionally held between the teeth sets of said comb members and cooperating therewith to form burner ports between the individual teeth of each set, and a gas-air mixture controller assembly comprising two identical stampings, each having a symmetrical depression narrowing in width from inlet to outlet, faced with the depressions outward to form a central flattened and elongated opening tapering to a cylindrical opening having lateral abutting faces and fitted as a unit coaxially within the lower leg portion of said burner vertical passage and spaced laterally from the margins thereof permitting air to pass through and around said mixture controller, and a pair of strip stampings having median semicircular depressions faced and joined to provide at the midportion thereof a circular collar for coupling to a gas supply line coaxially therewith, said assembly having lateral wings fitted within and held frictionally by the lower marginal edges of the burner coaxially within said vertical passage.

4. A gas burner assembly comprising a plurality of burners according to claim 3 joined together with a bolt passing transversely through the integral cooling fins at either side and spaced laterally with suitable clearance, by ferrules.

5. A substantially flat vertical sheet metal atmospheric gas burner comprising a body having a vertical relatively flat passage therethrough terminating with an elongated outlet opening with narrowly spaced parallel outlet edges, a gas-air mixture controller located coaxially at the entrance end of said vertical opening, comb members having their teeth bent in lateral U shapes with the legs thereof secured downwardly over the outlet edges of said body with the backs of said combs on the outside thereof, and a spacer member plugging the outlet opening removably retained between the rows of teeth, the interstices between said edges, teeth rows and spacer forming the burner ports.

6. A substantially flat vertical sheet metal gas burner as defined by claim 5 wherein said comb member are restruck in position along the longitudinal outlet edges of said passage during assembly to form a three-metal thick compressed construction along the longitudinal outlet edges of said burner.

7. A substantially flat vertical sheet metal gas burner as defined in claim 5 including a removable and interchangeable gas-air mixture controller for locating the center, height and vertical position of said burner with respect to the gas supply line outlet.

8. A vertical, flat, sheet metal atmospheric gas burner comprising, in combination a body having an open Y-shaped vertical passage therethrough, said passage having a long and short axis in transverse section, terminating in a wide mouth of narrow transverse width and having substantial lateral fins extending outwardly from said passage corresponding with said long axis, a flattened gas-air mixture controller assembly having a long and a short axis in transverse section, spaced coaxially within the leg portion of said vertical passage with the long axes of each in the same vertical plane, and a support member having lateral extensions frictionally engaging both the said mixture controller assembly and the body between the faced stampings of each, for securing said mixture controller assembly to said burner body, and having a centrally disposed collar for securing the burner assembly on a gas line, said body being faced identical stampings secured together and said mixture controller assembly being faced identical stampings secured together.

9. A vertical flat sheet metal gas burner as defined in claim 8 including slot means formed in the lateral fins of said body for frictionally holding the said spacer and mixture controller coaxially within the leg portion of the vertical passage.

References Cited in the file of this patent

UNITED STATES PATENTS

1,115,132	Topp	Oct. 27, 1914
1,878,427	Ronstrom	Sept. 20, 1932
2,348,011	Koppel	May 2, 1944
2,454,229	Sparrow	Nov. 16, 1948
2,470,880	Zimbelman et al.	May 24, 1949
2,541,428	Leo et al.	Feb. 13, 1951
2,615,509	Whittington	Oct. 28, 1952
2,628,675	Palmer	Feb. 17, 1953
2,655,210	Neuls	Oct. 13, 1953