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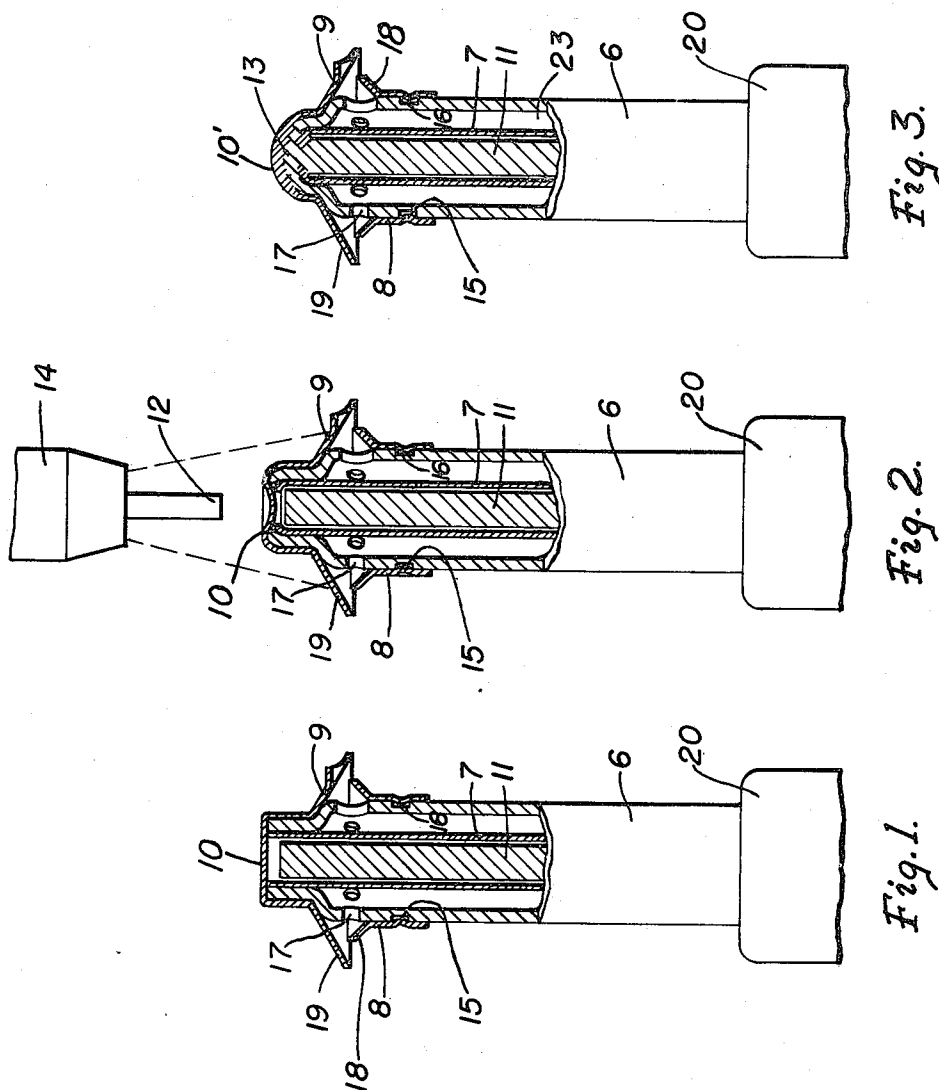
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PILOT BURNER WITH BUILT IN THERMOCOUPLE

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

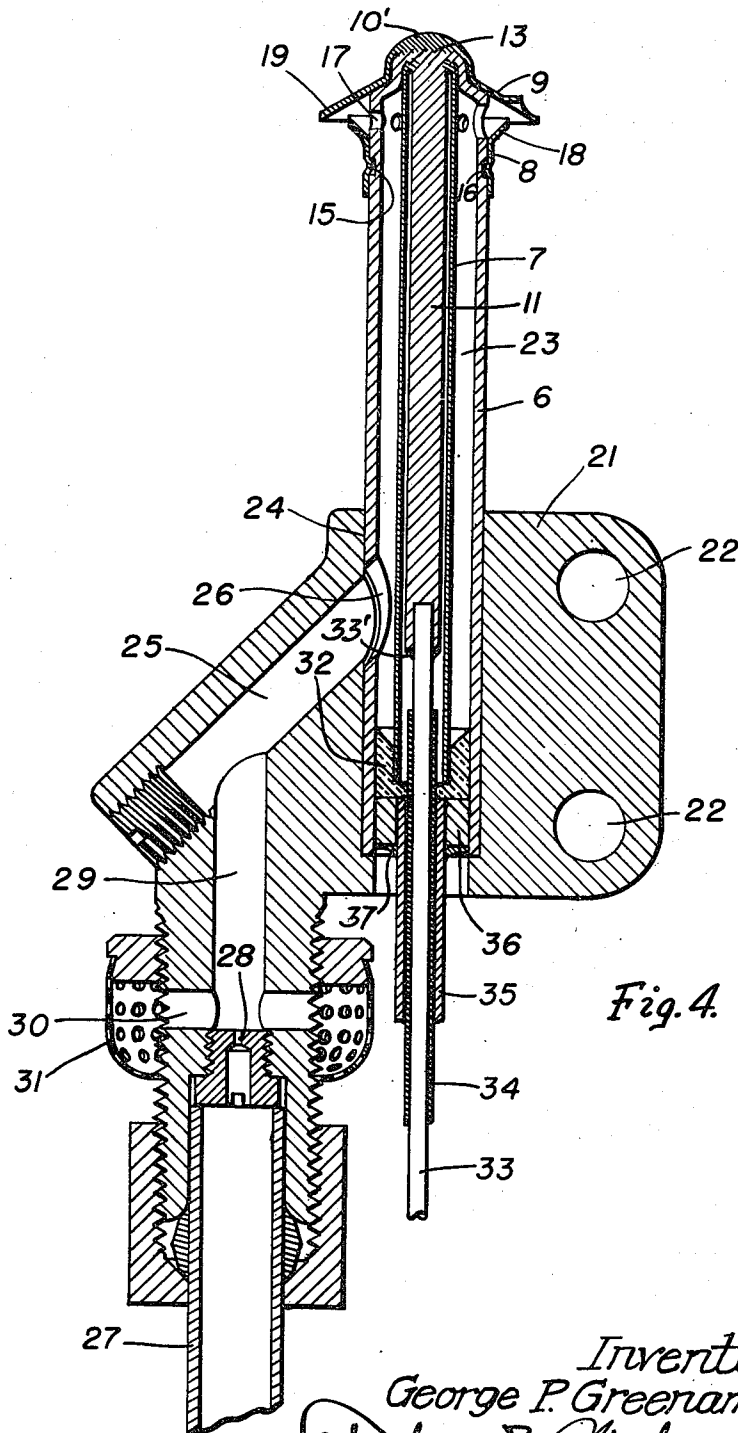


Fig. 4.

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UNITED STATES PATENT OFFICE

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PILOT BURNER WITH BUILT-IN
THERMOCOUPLE

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17 Claims. (Cl. 136—4)

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This invention relates to an improved thermoelectric generator and is more particularly concerned with one designed and adapted to be operated by the heat of combustion of a small gas flame, as on a gas pilot burner.

The principal object of my invention is to provide a pilot light burner with a built-in thermocouple, whereby to simplify the construction, reduce cost, and provide more satisfactory operation, by insuring better play of the flame upon the parts requiring heating, and accordingly easily meet A. G. A. requirements. The present generator functions to generate sufficient millivolts on very low gas pressure to obtain satisfactory operation of a safety valve under conditions where a thermocouple clamped to a pilot burner would be almost certain to fail because of insufficient heat being applied to the thermocouple, although the generator is so designed that there is no danger of excessive heating of the thermocouple in the event of high pressure gas delivery.

A salient feature of the present generator-burner structure is the fact that a small pilot flame, under low pressure conditions, closely surrounds the thermocouple, thereby utilizing all available heat, whereas, in the event of high pressure, the pilot flame is not played full blast upon the thermocouple, only the cooler base portion of the flame being effective for thermoelectric generation.

It is, of course, understood that a thermoelectric generator requires two dissimilar metals welded or otherwise joined in a "hot junction" where heat is applied for thermoelectric generation. I have found that the best metals for this purpose are, first, 27% chromium stainless steel; second, an alloy of 42% nickel and 57% copper, known as "Constantan," which alloy is, however, highly subject to corrosion from heat, oxygen and sulphur and must, therefore, be thoroughly protected from these corrosive agents. On the other hand, the 27% chromium stainless steel is highly resistant to heat, oxygen and sulphur. In my improved generator-burner I have accordingly made the inner thermocouple member of Constantan sheathed by a tube of chromium stainless steel, the upper ends of these two members being welded together with the reduced upper end of an outer thermocouple member forming the body of the pilot burner, which is made of chromium stainless steel, the same as the protective sheathing, the outer member having flame apertures provided in the upper end portion, where a hood, that is also of chromium stainless steel, and welded in place in the same junction with the other member, serves as a flame sta-

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bilizer to reduce likelihood of accidental extinguishment of the flame, a further stabilizer ring being suitably secured to the burner below the flame apertures and terminating in axially spaced relation to the hood, to further reduce likelihood of accidental extinguishment of the flame.

The invention is illustrated in the accompanying drawings, in which—

Figs. 1, 2 and 3 are sections illustrating the preliminary assembly for the generator-burner of my invention, the method of welding the hot junction, and the unified construction resulting therefrom, and

Fig. 4 is a section through a combination generator-burner made in accordance with the invention.

The same reference numerals are applied to corresponding parts throughout the views.

Referring to Figs. 1 to 3, the parts numbered 6 to 9 in Figs. 1 and 2 are all made from 27% chromium stainless steel, the part 11 being made from an alloy known as Constantan, consisting of 42% nickel-57% copper. The upper end of this inner thermocouple member 11 is fully protected against corrosion by the top wall 10 of the stainless steel cuplike part 9. The parts 6, 7, 9 and 11 are welded together, as in Fig. 2, by what is known as Heliarc welding, in which an arc is passed between the electrode 12 and the assembly to fuse the parts 6, 7, 9 and 11 together to form a solid junction, as indicated at 13 in Fig. 3, the arc welding being done in the presence of argon gas discharged under pressure from a nozzle 14, as indicated in dotted lines in Fig. 2, to thoroughly envelop the molten metal and prevent oxidation. The wall 10 forms an outer layer of protective stainless steel on the finished junction 13, as indicated at 10' in Figs. 3 and 4. Preliminary to the welding operation, the ring 8 is assembled on the upper end portion of tube 6 by crimping a portion 15 annularly into an annular groove 16 provided in the tube at a predetermined elevation below the series of flame apertures 17, so as to locate the outwardly projecting flange 18 provided on ring 8 just below the level of these apertures and in the proper downwardly spaced relationship to the skirt portion 19 of part 9, which, like the part 8, functions as a pilot flame stabilizer to reduce likelihood of accidental extinguishment of the pilot flame. The parts, preliminary to the welding operation, are placed in a suitable fixture, indicated at 20. The finished burner-generator unit shown in Fig. 3 is ready for use in a water heater in a support like that shown at 21 in Fig. 4, in which the holes 22 are adapted to receive

screws for fastening the pilot burner in the proper lighting relationship to a main burner to which gas will be supplied under control of a thermostatic valve so as to maintain the water in the heater at a preselected temperature determined by the setting of the associated thermostat. In passing, it is important to note that with the present construction, although the outer and inner thermocouple members 6 and 11 respectively, are welded together at 13, this is accomplished without permitting any of the nickel or copper of the inner member 11 to become alloyed with the stainless steel in the outer member 6, and, since the stainless steel is highly recommended for its resistance to heat, oxygen and sulphur, and the inner member 11 is completely sheathed by the surrounding stainless steel tube 7, it is clear that gas conducted through the annular passage 23 cannot come into contact with and cause corrosion of any portion of the inner thermocouple member 11, the alloy of which is highly subject to corrosion from heat, oxygen and sulphur.

As shown in Fig. 4, the tubular body 6 of the burner is received in a bore 24 in the burner support 21 and a mixture of gas and air is conducted through a passage 25 in the support through a port 26 in the body 6 for passage upwardly in the burner through the annular passage 23. Any suitable or preferred gas and air mixer may be employed for this purpose, that shown in Fig. 4 being preferred. In that structure, the gas is delivered through a tube 27 and discharged through a small orifice 28 into a passage 29, the upper end of which leads into passage 25. Laterally extending passages 30 communicate with the lower end of passage 29 and primary air is admitted through these passages to be entrained with the gas, a lint screen 31 being provided to exclude dirt and dust particles from being entrained with the air. The lower end of the tubular sheathing 7 is received in a ceramic insulation bushing 32 fitting closely inside the lower end of the tubular body 6 of the burner to seal it. The lead wire 33 which serves as the conductor and is, therefore, sheathed in insulation, as indicated at 34, is connected with the lower end of the inner thermocouple member 11 and suitably soldered thereto with silver solder, as indicated at 33'. A lead tube encases the sheathed lead wire, as shown at 35, and extends up into the brass bushing 36 and is soldered thereto with silver solder, the bushing 36 in turn being similarly soldered to the tubular body 6, all as indicated at 37. Brass bushing 36 abuts ceramic bushing 32, as shown.

In operation, the tubular sheathing 7 completely protects the inner thermocouple member 11 from contact with the gas so that no corrosion can occur, the sheathing 7 and tubular body 6 being of stainless steel, as are also the pilot flame stabilizers 8 and 9. At the same time, advantage is taken of the difference in metals so as to obtain the generation of an electric current from the heat of the pilot flame at the junction 13, where the heat of the pilot flame is concentrated, the junction 13 being at the center of the pilot flame, the base of which starts at the rim of the lower flange or stabilizer 18. The generation occurs even on extremely low gas pressure, under conditions which could easily cause failure with other constructions, where the thermocouple is a separate unit and is merely secured in a fixed relationship to the pilot burner, instead of being built into it, as here. On the other hand, high pressure will not result in the burning out of the thermocouple, because, whereas a small flame

closely surrounds the hot junction 13, thus utilizing all available heat for thermoelectric generation, a high pressure condition does not result in the impingement of the flame full blast on the thermocouple, because under those conditions the junction 13 is at the center of the cooler base portion of the flame, the excess heat of the rest of the flame being dissipated harmlessly to the bottom of the tank to be heated. The unified construction avoids all difficulties incident to misalignment which could hardly be avoided with the old designs where the thermocouple was clamped to the pilot burner. The present construction positively assures accurate coaxial relationship of the thermocouple relative to the burner. I am aware that others have devised pilot burners with built-in thermocouples, but they did not have the parts of the thermocouple arranged in the practical manner herein disclosed to form integral parts of the pilot burner, and they had certain inherent objections which prevented them from being successful commercially. The present design, on the other hand, has been commercially acceptable, and that, it is believed, is largely due to the following advantages, in addition to those already enumerated:

(1) The stabilizing flanges 18 and 19 maintain a nice steady even flame which generates properly, regardless of the mounting position of the pilot. The two stabilizers cooperate to define a single continuous slotted port, which is recognized by the gas industry as the ultimate goal for a stable pilot light.

(2) The upper (and larger) stabilizer 19 provides an ideal conductor to carry the heat of the pilot flame to the hot junction 13. The lower stabilizer, being smaller, draws the base of the flame in underneath the rim of the upper stabilizer. This constant conductive relationship between the upper stabilizer and the base of the flame results in good and uniform electrical generation over the widest range of working pressures.

(3) The novel relationship and combination of inner drilled ports and outer annular port is important. Flame stability is obtained and a tendency for the flame to "blow off" at high pressure is avoided or to "flash back" and burn at the orifices by mounting the two flanges 18 and 19 in close proximity to one another, so as partially to restrict the passage of the air-gas mixture.

It is believed that the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

I claim:

1. In a combination pilot burner and thermocouple, an inner vertical metallic solid rod thermocouple member, and an outer vertical metallic tubular thermocouple member in radially spaced coaxial relation to and surrounding said inner member and having a ported upper end portion on which a radially inwardly projecting portion is provided which is joined to the adjacent end of said inner member to close the upper end of the burner closely above the ported portion and form a hot thermojunction arranged to be heated by the flame from said ports, said outer member having an inlet on its lower end portion for delivery to said ports of a gas and air mixture.

2. In a combination pilot burner and thermocouple, an inner vertical metallic solid rod thermocouple member, an outer vertical metallic tubular thermocouple member in radially spaced coaxial relation to and surrounding said inner

member and having a ported upper end portion on which a radially inwardly projecting portion is provided which is joined to the adjacent end of said inner member to close the upper end of the burner closely above the ported portion and form a hot thermojunction arranged to be heated by the flame from said ports, said outer member having an inlet on its lower end portion for delivery to said ports of a gas and air mixture, and a tubular corrosion resisting sheath closely surrounding the inner rod member within the outer tubular member and spaced radially with respect thereto sufficiently for unrestricted flow of gas and air mixture therebetween.

3. In a combination pilot burner and thermocouple, an inner vertical metallic solid rod thermocouple member, an outer vertical metallic tubular thermocouple member in radially spaced coaxial relation to and surrounding said inner member and having a ported upper end portion on which a radially inwardly projecting portion is provided which is joined to the adjacent end of said inner member to close the upper end of the burner closely above the ported portion and form a hot thermojunction arranged to be heated by the flame from said ports, said outer member having an inlet on its lower end portion for delivery to said ports of a gas and air mixture, and a tubular corrosion resisting sheath closely surrounding the inner rod member within the outer tubular member and spaced radially with respect thereto sufficiently for unrestricted flow of gas and air mixture therebetween, said sheath being metallic and having its upper end joined to the inner and outer members at the thermojunction.

4. In a combination pilot burner and thermocouple, an elongated vertical tubular burner body of one metal adapted to serve as one of two thermocouple members and having radial flame ports provided in circumferentially spaced relation in the upper end portion and means for supplying a combustible mixture of gas and air to the lower end portion, and an elongated solid rod of another metal adapted to serve as the other of the two thermocouple members extending vertically lengthwise of said burner body in coaxial radially spaced relation thereto but joined therewith at its upper end adjacent the flame ports to close the upper end of the burner closely above the radial flame ports and form a hot thermojunction adapted to be heated by the flame from said ports.

5. In a combination pilot burner and thermocouple, an elongated vertical tubular burner body of one metal adapted to serve as one of two thermocouple members and having radial flame ports provided in circumferentially spaced relation in the upper end portion and means for supplying a combustible mixture of gas and air to the lower end portion, an elongated solid rod of another metal adapted to serve as the other of the two thermocouple members extending vertically lengthwise of said burner body in coaxial radially spaced relation thereto but joined therewith at its upper end adjacent the flame ports to close the upper end of the burner closely above the radial flame ports and form a hot thermojunction adapted to be heated by the flame from said ports, and a tubular corrosion resisting metal sheath closely surrounding said rod in annularly spaced relation to the inside of said burner body allowing unrestricted flow of gas and air mixture therebetween.

6. In a combination pilot burner and thermo-

couple, an elongated vertical tubular burner body of one metal adapted to serve as one of two thermocouple members and having radial flame ports provided in circumferentially spaced relation in the upper end portion and means for supplying a combustible mixture of gas and air to the lower end portion, and an elongated solid rod of another metal adapted to serve as the other of the two thermocouple members extending vertically lengthwise of said burner body in coaxial radially spaced relation thereto but welded thereto at its upper end adjacent the flame ports into a solid hot thermojunction closing the upper end of the burner closely above the radial flame ports and adapted to be heated by the flame from said ports.

7. In a combination pilot burner and thermocouple, an elongated vertical tubular burner body of one metal adapted to serve as one of two thermocouple members and having radial flame ports provided in circumferentially spaced relation in the upper end portion and means for supplying a combustible mixture of gas and air to the lower end portion, an elongated solid rod of another metal adapted to serve as the other of the two thermocouple members extending vertically lengthwise of said burner body in coaxial radially spaced relation thereto but welded thereto at its upper end adjacent the flame ports into a solid hot thermojunction closing the upper end of the burner closely above the radial flame ports and adapted to be heated by the flame from said ports, the metal of said burner body being corrosion resistant, and a tubular corrosion resisting metal sheath closely surrounding said rod in annularly spaced relation to the inside of said burner body allowing unrestricted flow of gas and air mixture therebetween and welded at its outer end with the burner body to said rod.

8. A structure as set forth in claim 7 including a sheath of corrosion resistant metal welded to the upper end of the rod with the upper ends of the burner body and tubular sheath covering the upper end of the rod and forming a portion of the solid hot thermojunction.

9. In combination, a combined tubular metallic burner body and thermocouple member having a tapered outer end portion and having a plurality of flame ports provided therein adjacent said taper, a conically formed cover piece secured on the tapered end portion and overhanging the ported end portion to stabilize and protect from extinguishment the flames projecting from the ports, and a rod of another metal adapted to serve as a companion thermocouple member extending lengthwise of said burner body in coaxially spaced relation thereto but joined therewith at its tapered outer end to form a hot thermojunction adapted to be heated sufficiently for thermoelectric current generation by the heat of the aforesaid flames.

10. A structure as set forth in claim 9 wherein the central portion of said cover piece and the tapered outer end portion are welded together with the outer end of the rod in a single solid weld forming the thermojunction.

11. A structure as set forth in claim 9 including a ring secured to and surrounding the outer end portion of said burner body adjacent the flame ports on the opposite side from and disposed in a predetermined spaced relationship to the inner side of the cover piece to further stabilize and protect from extinguishment the flames projecting from the ports.

12. A structure as set forth in claim 9 includ-

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ing a tubular sheath of corrosion resisting metal closely surrounding the rod and spaced annularly relative to the inside of the burner body and joined at its outer end to the tapered outer end of the burner body.

13. A structure as set forth in claim 9 including a tubular sheath of corrosion resisting metal closely surrounding the rod and spaced annularly relative to the inside of the burner body and joined at its outer end to the tapered outer end of the burner body in a single solid weld joining the outer ends of the rod and burner body.

14. A structure as set forth in claim 9 including a tubular sheath of corrosion resisting metal closely surrounding the rod and spaced annularly relative to the inside of the burner body and joined at its outer end to the tapered outer end of the burner body in a single solid weld joining the outer ends of the rod and burner body, the structure further including a thickness of corrosion resisting metal covering and sheathing the outer end of the rod and melted with the rest of the metal in the single solid weld.

15. A structure as set forth in claim 9 including a tubular sheath of corrosion resisting metal closely surrounding the rod and spaced annularly relative to the inside of the burner body and joined at its outer end to the tapered outer end of the burner body in a single solid weld joining the outer ends of the rod and burner body, an elongated element of another metal adapted to serve as the other of the two thermocouple members extending lengthwise in said burner body in radially spaced relation thereto but joined therewith at its outer end adjacent the flame ports to form a hot thermojunction, a conically formed flange element secured on the outer end of said tubular burner body and projecting radially outwardly and downwardly from above said flame ports, a second conically formed flange element of smaller diameter than the first mentioned flange element and secured to the tu-

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bular burner body in coaxially spaced relation to said first mentioned flange element so as to define between the rims of the flanges thereof a somewhat restricted, continuous, slotted, flame port, said first mentioned flange element being adapted to conduct heat from the pilot flame to the hot junction.

16. A thermoelectrically generating pilot burner comprising an inner thermocouple element inside an outer tubular burner body which constitutes the other thermocouple element, the inner and outer elements being joined to form a hot junction, said body having circumferentially spaced inner ports provided therein, an upper upwardly tapered conical flange secured to the burner body above said inner ports, a lower downwardly tapered conical flange of smaller diameter than the upper flange and secured to the burner body below said inner ports, the flanges being disposed with their outer rim portions in close proximity providing therebetween a single outer annular slot-like port that is narrow in relation to the width of the inner ports, the first named upper flange serving to conduct heat from the pilot flame to the hot junction.

17. A burner as set forth in claim 16 wherein the tubular burner body has an upwardly and inwardly tapered upper end portion closely above the inner ports terminating in the hot junction, this tapered upper end portion cooperating with the upper flange in conducting heat from the pilot flame to the hot junction.

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