July 4, 1950 J. SCHÄFER 2,513,523

BURNER FOR LIGHTING GAS AND OTHER COMBUSTIBLE GASES

Filed May 9, 1947 2 Sheets-Sheet 1

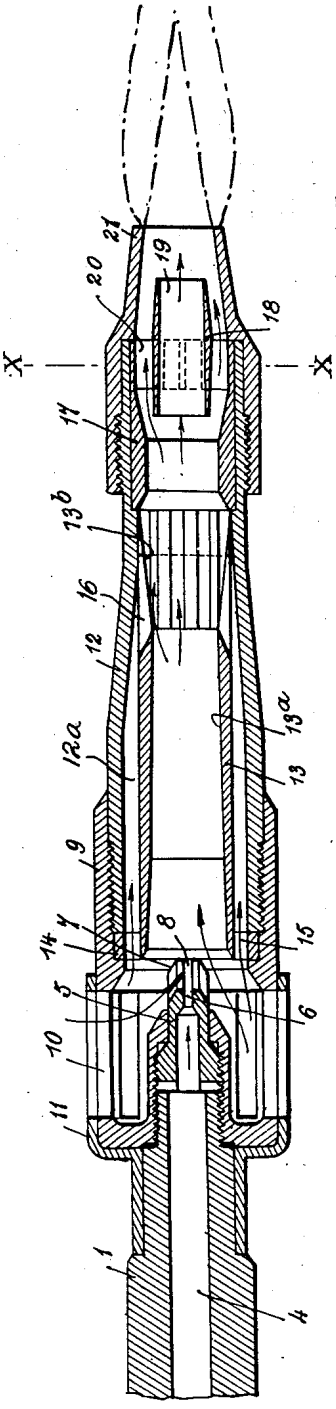

Fig. 1.

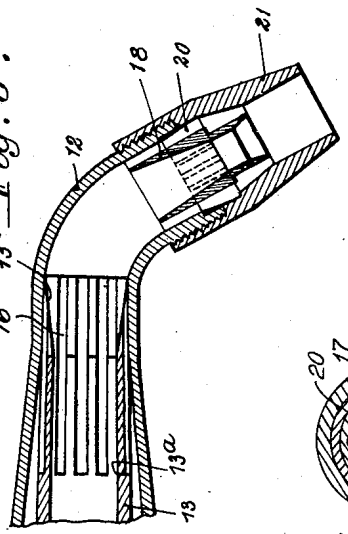

Fig. 5.

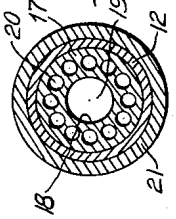

Fig. 1b

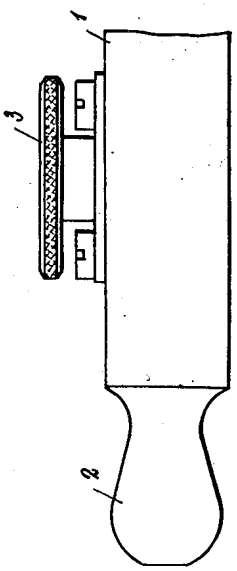

Fig. 1a

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Fig. 2.

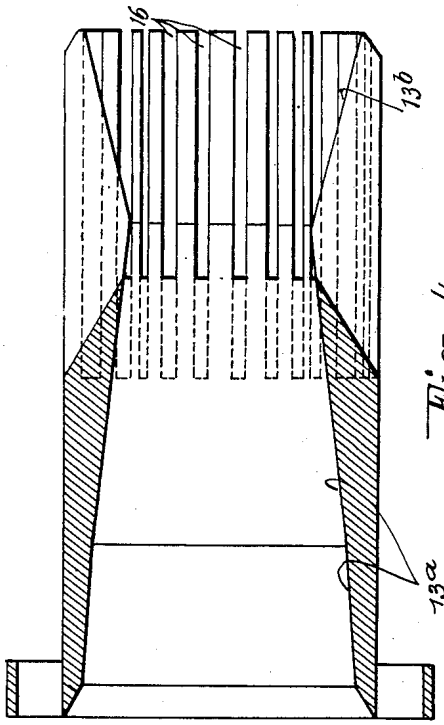


Fig. 4.

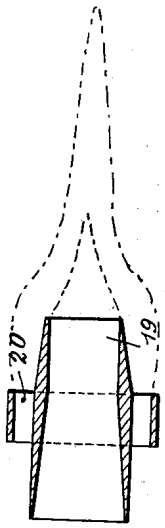


Fig. 3.

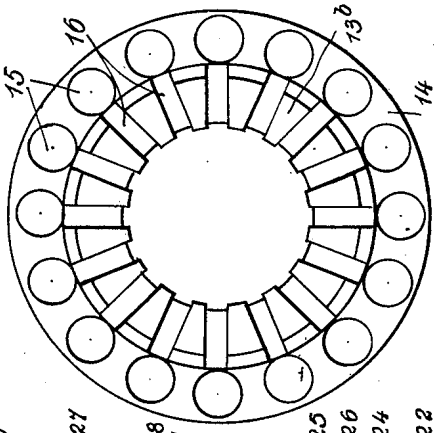
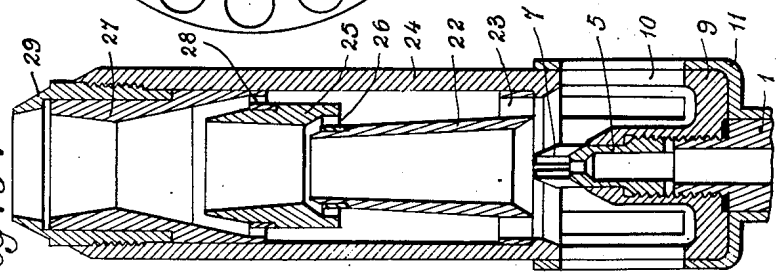


Fig. 6.



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BURNER FOR LIGHTING GAS AND OTHER COMBUSTIBLE GASES

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Application May 9, 1947, Serial No. 746,913
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3 Claims. (Cl. 158—27.4)

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The object of the present invention is an improved burner device for illuminating gas and all other combustible gases giving with air an explosive mixture.

The present burner is made, preferably, to be used in the manner of a blow-pipe, that is to say, in the form of a tubular burner which can be held in the hand, producing at the end a very hot flame, but it can be adapted and used as a fixed burner for stoves, furnaces, crucibles and kilns and heating apparatus of all kinds, its possibilities of use being very vast, because of the high temperatures which it produces, temperatures incomparably higher than those obtained up to now at low pressures with the gases considered. By this invention, one can obtain, with illumination gas, under a low pressure ranging about 40 gr./cm.^{2}, a flame the temperature of which is raised up to 1800° C. and above, permitting the fusion of a large number of metals and their autogenous welding, so that the apparatus replaces advantageonsly, in the case of these metals, the oxyhydrogen blow-pipe, the compressed air blow-pipe and the brazing or welding lamp.

The chief characteristic of the invention is the combination of an injector or gas jet with several diffusing and mixing members placed successively between the injector in question and the lighting end of the burner, in the interior of an envelope or case surrounding them concentrically, provided at the base with an air intake, these members being so established as to produce several successive diffusions or mixings of the combustible gas, by mechanical means and with the intervention of streams of air drawn through each of them by the central gaseous current and striking the gaseous streams and mixing closely with them.

The apparatus may also include to advantage, between the last diffusing and mixing member and the lighting orifice or burner nozzle, a static mixing member operating by contraction of the gaseous current.

Finally, between this mixing member and the above-mentioned lighting orifice there can be arranged a conformator or regulator giving the desired shape to the flame, in combination or not with a cap and the invention has in view, in particular, such a conformator comprising a central pipe, in Venturi form, and a crown of orifice or passages concentric to this central pipe and extending well around the part of the central pipe intermediate its ends and only at a part of its length.

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In order that the invention may be clearly understood and readily carried into effect, reference may be had to the accompanying drawings, on which:

Figure 1 is a longitudinal section of one embodiment, the rear part of the burner being broken away.

Figure 1*a* is a side elevation of the rear part of the burner. Figure 1*b* is a section along the line *x*—*x* of Figure 1.

Figures 2 and 3 show, on a large scale, in longitudinal section and end view, the detail of a diffusing and mixing member.

Figure 4 shows separately a conformator for regulating or shaping the flame.

Figure 5 illustrates a modification of Figure 1, and

Figure 6 is a longitudinal section of another modification.

Referring to the drawing shown by Figure 1, the apparatus comprises a handle 1, provided with a neck portion 2 for connection with the source of combustible gas, and comprises conveniently, a tap 3, controlling the passage of the gas through the central tube 4 of the said handle 1. At the inner end of this tube 4 is fitted an injector or gas nozzle 5 having a calibrated orifice 6, prolonged by a tubing 7, provided with numerous radial slits 8; this constitutes a first diffusing or mixing member.

The nozzle 5—7 is in the centre of a tubular body 9, of larger diameter provided with lateral apertures 10 for the admission of air controlled by a rotatably mounted casing 11, also provided with slots, forming a valve for regulating the air necessary for diffusing or mixing with the gas and the cooling of the apparatus. The handle 1 carries the air-mixing casing 11 which surrounds the nozzle 5 and which fits onto the body 9. The body 9 which has an air and gas-tight fit on to handle 1, can be formed, as shown on the drawing, so as to serve as a support of the nozzle 5, which is mounted therein with a tight fit. The body 9 receives, by screwing or otherwise, a tubular part 12 forming the envelope of the diffusers.

In the interior of the tubular part 12 there is arranged concentrically the tubular body of a second diffuser 13 coaxially with which is arranged the nozzle 5—7 already described. The inner end of the tube 13 communicates freely, around the nozzle 7, with the interior of the air admission chamber formed within the body 9, and with an annular passage 12*a* located between the members 12 and 13.

The tube 13 is mounted, for example, by means

of a ring 14 which is provided with holes 15 and which is secured between a shoulder of the body 9 and the end of the tubular part 12.

The tubular diffuser 13 comprises, as one can see on Figure 2, a convergent cone 13*a*, then a divergent cone 13*b*, which is tangent or extends to the interior wall of the envelope 12, the wall of this cone 13*b* being provided with a large number of radial slits 16, parallel to the axis whereby the air, drawn in from the apertures 10 and through the holes 15 and the annular space between the envelope 12 and the tube 13, will penetrate into the diffuser cone 13*b* and there penetrate into the gaseous current, intimately mixing with it.

It will be advantageous, as shown, to commence the slots 16 at the smallest diameter of the tube 13, namely, at the intersection of the cones 13*a* and 13*b*.

Beyond the diffuser 13—13*b*, in the interior of the envelope 12, there can be arranged a static mixer 17, operating by contraction of the gaseous stream. Following on this there is arranged a conformator or flame regulator 18, comprising a central pipe 19 and a crown of small circumferentially spaced channels 20 which, in combination with a cap 21, will give the elongated flame shown by Figure 1, or, used alone, will give the more tapered flame shown on Figure 4.

Instead of using the mixer 17, one can bend the envelope 12, between the cone 13*b* and the regulator 18, as shown in Figure 5.

One understands that the first diffusion which is effected in the member 7, transforms the gas into an explosive combustible mixture.

The speed of flow of this explosive combustible mixture into the pipe 13 is determined by:

a. The section of the opening 6 of the nozzle;

b. The number and the section of the slits 8 of penetration of the air into the chamber in front of this opening;

c. The pressure of the gas.

The explosive combustible mixture, made by this first diffusion, thrown with violence or turbulence into the cone 13*a* of the second diffuser, takes with it a second quantity of air coming form the admission chamber of the body 9.

A second diffusion is effected in the convergent cone 13*a* and a third in the cone 13*b* into which penetrate, as previously, multiple streams of air drawn in through the grooves or slits 16, the shape and gauging of which are determined according to the density of the combustible mixture to be diffused.

All these diffusions increase the frequency of the explosions of the combustible mixture and, because of this, finally, the speed of flow and the explosive power are considerably increased so that in increasing the number of diffusions one increases the reach of the final flame and its temperature.

One will notice that in the diffuser 13*b*, the solid blades, separating the slots, guide the combustible mixture and prevent vibrations which would be produced in a smooth tubing.

In the part 17, a mixing is effected whereby the calorific power of the combustible mixture is increased further.

The orifices and conduits of the conformator-regulator 18—19—20 are designed according to the shape and the length of flame desired.

When this conformator is used without a cap (Figure 4), the flame is very long, fixed and set and its temperature constant along its whole length. The explosive mixture passing through

the central pipe 19 of this conformator is projected very far beyond the exit opening and explosions of great frequency are made at a distance ranging about 8 to 10 mm. from this opening, whilst the explosive mixture which passes with retardment through the crown of openings 20 explodes at some millimetres from the exit which shapes the flame as represented in Figure 4.

It has been noticed that in spite of the explosions which are produced around the pipe 19, the temperature of the conformator 18—19—20 does not exceed 80° C. even after several hours working, when the flame attains a temperature exceeding 1800° C., so that one can make this organ of ordinary metals such as brass.

When (Figures 1 and 5) one makes use of a cap 21, the diameter of the exit opening, conical or straight, is determined by the power, the shape and the length of the flame to be produced.

In the modification shown by Figure 6, certain parts of the apparatus of Figure 1 are incorporated and are designated by the same references.

The nozzle 5—7 discharges into the centre of a convergent cone 22, provided with a crown or concentric ring with openings 23, traversed by the peripheral air which passes between the tube 22 and the envelope 24.

The cone 22 is followed by a divergent diffuser 25, a crown of openings 26 for the admission of peripheric air being arranged between these two parts. The diffuser 25 is followed in its turn by a convergent-divergent cone 27, another crown of openings 28 being arranged between the parts 27 and 25 for another admission of peripheral air for diffusion.

The apparatus is finished by a cap 29. In this apparatus there are thus four successive diffusions.

The number of diffusers is moreover variable according to the temperature desired and the diameters of the openings and the conicities of the conduits are determined according to the density of the gases to be diffused.

In use, as in the preceding apparatus, the parts of the burner are cooled by the currents of air passing between the envelope and the various diffusers.

In every case, with the apparatus of Figure 1, as with that of Figure 6, striking back of the flame is impossible and the gas burns more perfectly and without any bad smell, this effect being all the more accentuated as the openings dividing the peripheral currents of air are more numerous.

I claim:

1. In a burner for lighting gas and other combustible gases forming with air an explosive mixture, a tubular envelope, a gas nozzle protruding axially into the rear end of said envelope which is formed with peripheral air admission apertures surrounding said gas nozzle, and a tubular diffuser mounted coaxially in said envelope with its open rear end facing said gas nozzle, said diffuser being spaced from said envelope so as to define therewith an annular chamber which is open at its rear end, and the front end of said diffuser being in contact with said envelope and formed with longitudinal slits connecting said annular chamber to the interior of said front end of the diffuser.

2. In a burner for lighting gas and other combustible gases forming with air an explosive mixture, a tubular envelope formed at its rear end with air admission apertures, a gas nozzle mounted in the rear end of said envelope co-

axially therewith, and a tubular diffuser mounted coaxially in said envelope in spaced relation thereto and with its open rear end facing said gas nozzle, the front end of said diffuser being in contact with said envelope, and said diffuser having a rear portion in the shape of an elongated converging cone, and a front portion in the shape of a diverging cone merging into the inner wall of said envelope and formed with radial longitudinal slits connecting the annular space between said diffuser and said envelope to the interior of said front portion of the diffuser.

3. In a burner for lighting gas and other combustible gases forming with air an explosive mixture, a tubular envelope formed at its rear end with air admission apertures, a gas nozzle mounted in the rear end of said envelope coaxially therewith, a tubular diffuser mounted coaxially in said envelope in spaced relation thereto and with its open rear end facing said gas nozzle, the front end of said diffuser being in contact with said envelope, and said diffuser having a rear portion in the shape of an elongated converging cone, and a front portion in the shape of a diverging cone merging into the inner wall of said envelope and formed with longitudinal slits connecting the annular space between said diffuser

and said envelope to the interior of said front portion of the diffuser, and a static mixing member having a passage which is progressively restricted at its entrance and progressively enlarged at its outlet mounted in said envelope immediately behind said diffuser.

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