

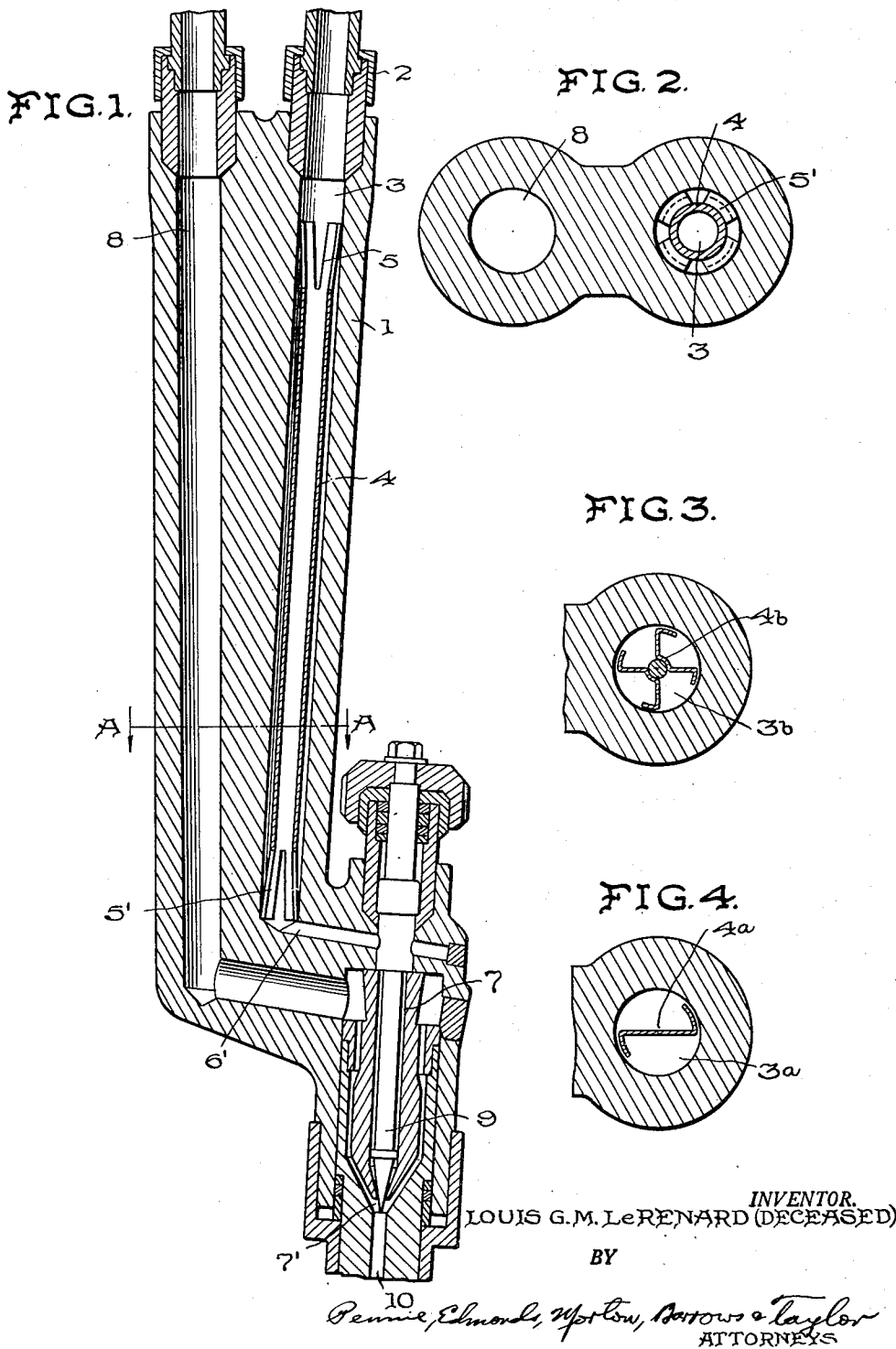
Oct. 20, 1953

L. G. M. LE RENARD

2,655,992

MIXER FOR GAS BURNERS

Filed Nov. 6, 1947



UNITED STATES PATENT OFFICE

2,655,992

MIXER FOR GAS BURNERS

Louis Georges Mathieu Le Renard, deceased, late of Paris, France, by Suzanne Simone Denise Le Renard née Herrenschildt, administratrix, Paris, France, assignor to L'Air Liquide, Société Anonyme pour l'Etude et l'Exploitation des Procédés Georges Claude, Paris, France, a joint-stock company of France

Application November 6, 1947, Serial No. 784,486
In France November 6, 1946

8 Claims. (Cl. 158—27.4)

1

The present invention relates to improvements in gas burners in which the gases are pre-mixed, in particular to welding or cutting blowpipes, with a view to avoiding what are called "flash-backs" or "injector ignition." Devices are known, located either in the induced gas or in the mixture of both gases, for overcoming these drawbacks without causing an excessive loss of pressure head. These devices give good results for blowpipes which operate under a feed pressure for the drawn-in gas coming within the range of pressures for which they have been designed; for example, so called low-pressure oxy-acetylene blowpipes are designed for feed pressures of 8 grams per square centimetre and with the aforementioned devices, they operate without flash backs at all pressures between 0 and 100 grams per square centimetre. However, it has been found that this is no longer true when the upper limit of the normal operating pressure of a blowpipe is substantially exceeded, for example when, in the case of the above blowpipes, use is made as the induced gas, of acetylene reaching the blowpipe under high pressure, for example, 400 grams per square centimetre.

The object of the present invention is to overcome this drawback and, therefore, to increase the scope of use of the burners in question.

For gas burners in which the gases are pre-mixed, and which are already provided with the aforesaid devices with a view to avoiding flash-backs, the invention consists in providing for the gas which acts as an impeller, or inducing gas, inlet ducts having a section, a length and a shape which will ensure laminary flow of said inducing gas through said ducts. These ducts are arranged either in the blowpipe handle or in the inducing gas inlet piping to the blowpipe burner in case it is not provided with a handle, and in all cases, in that portion of the handle or of the piping which immediately precedes the injector.

If, for structural reasons, it is not possible to place the injector and the ducts according to the invention in the immediate vicinity of one another, these ducts are placed at a certain distance, preferably as short as possible, upstream with respect to the injector and it is then necessary that flow shall remain laminary between the downstream end of these ducts and the injector, that is, said flow shall not assume an unstable form which is intermediary between laminary flow and turbulent flow.

In the gas burners of the type referred to

2

above, the ducts have, for manufacturing reasons, diameters which are large relative to their length and, hence, the ducts do not permit laminary flow of gases therethrough. As already stated, when the pressure of the induced gas (acetylene for instance) is high, flashbacks occur. By providing for the inducing gas (oxygen for instance) a laminary flow, said gas passes through the injector with an increased speed and enters the mixer at a great speed so that the speed of the mixture of the induced and inducing gases is always greater than the speed of propagation of the flame through said mixture. Consequently, flashbacks do not occur. According to the invention, one or several members are placed within the duct for the burner inducing gas of present-day blowpipes (which duct, owing to its usual circular shape and diameter, does not per se ensure a laminary flow for the gas), which members form with the said duct a plurality of ducts which enable laminary flow to be obtained; these members may, for example, be located in the duct passing through the blowpipe handle. It has been found that the length of each such duct should be at least equal to ten times its greatest transverse dimension.

With a view to avoiding an excessive loss of pressure head in these ducts, the members in question are of reduced thickness, say one millimetre.

It should be pointed out that, in most oxy-acetylene blowpipes, the flow of acetylene is laminary as a result of its passage through the annular channel between the injector and the mixer, and also due to the section, the shape and the length of said channel; however, it has been found that this arrangement, although necessary, is not sufficient to avoid flash-backs, even when making use of the aforesaid devices; the arrangement according to the invention contributes, in such case, in providing adequate safety when added to these devices.

The figures of the accompanying drawing show various forms of embodiment of the invention in the case of an oxy-acetylene blowpipe in which the oxygen serves as the inducing gas.

Figure 1 is a longitudinal section of the rear section of the blowpipe from the mixer to the inlets for the two gases into the blowpipe.

Figure 2 is a section taken along the plane A—A of Figure 1.

Figures 3 and 4 show, in section, along this same plane A—A, other forms of embodiment of the present invention.

According to Figure 1, the oxygen acting as an

3

inducing gas is introduced under pressure into the blowpipe handle 1, through the connection 2 and enters the rectilinear duct 3 which passes through the handle. This duct does not per se ensure a laminary flow of the oxygen. To accomplish such laminary flow, the duct is provided with an internal tube 4, the wall of which is one millimetre thick and which may be made of metal. The ends 5, 5' of said tube are split in the form of a cross and are bent back so as to bear on the wall of the duct 3 and thus prevent said tube from shifting in position. The length of said tube 4 is ten times its inner diameter or ten times the difference between the inner diameter of the duct 3 and the outer diameter of 4, whichever of these two values is the larger. Moreover, it has been found that the efficiency of this tube is at a maximum when the inner cross-sectional area of the tube and the cross-sectional area of the annular section between the outer wall of the tube and the inner wall of the duct are respectively proportional to the circumference of the inner wall of the tube and the sum of the circumferences of the inner wall of the duct and the outer wall of the tube. Algebraically, this may be expressed:

$$\frac{A_1}{\pi d_1} = \frac{A_2}{\pi(d_3 + d_2)}$$

where A_1 is the inner cross-sectional area of the tube, A_2 is the area of the cross-section between the outer wall of the tube and the inner wall of the duct, d_1 is the inner diameter of the tube, d_2 is the outer diameter of the tube, and d_3 is the inner diameter of the duct, but

$$A_1 = \pi \frac{d_1^2}{4} \text{ and } A_2 = \pi \left(\frac{d_3^2}{4} - \frac{d_2^2}{4} \right)$$

then

$$\frac{\pi d_1^2}{4} = \frac{\pi}{4} (d_3^2 - d_2^2) \\ \frac{\pi d_1^2}{\pi d_1} = \frac{\pi}{\pi} (d_3 + d_2)$$

cancelling, we have

$$d_1 = \frac{d_3^2 - d_2^2}{d_3 + d_2} = d_3 - d_2$$

or the inner diameter of the tube is equal to the difference between the inner diameter of the duct and the outer diameter of the tube. In other words, the hydraulic radii of the tube passage within the tube and the annular passage between the tube and the duct wall are equal.

The oxygen issuing from the conduits 3 and 4 in the form of laminary streams flows into the injector 7 through the conduit 6; this conduit 6, which is of small section, does not transform this laminary flow into an unstable flow preceding turbulent flow, or into a turbulent flow because its length is under ten times its diameter, and it has been found that when a laminary flow from a first duct enters a second duct of a diameter smaller than the diameter of the first duct, said flow remains laminary if the length of the second duct is under ten times its diameter; the same remark is applicable to the flow of the oxygen into the injector as far as the immediate proximity of the orifice 7' thereof.

The acetylene flows through the conduit 8 passing through the blowpipe handle under a pressure of about 400 grams per cm². and it is drawn in by the oxygen flowing out of the injector orifice 7', which is adjustable, for example by means of a needle valve 9, and the oxy-acetylene mixture flows through the mixer 10. During its travel around the annular-shaped injector, the acetylene has a laminary flow.

4

According to Figure 3, the member 4a introduced into the duct 3a is a thin strip having a section in the shape of a Z, the ends of which are more or less held against movement in the duct by friction.

According to Figure 4, this member 4b has a cross-section in the shape of two Z's crossing each other and it is made of two trough parts united by means of a few tack welds.

In both the latter examples, the length of these members is equal to ten times the largest transverse dimension of each duct thus obtained, that is, ten times the diameter of the duct 3a in respect of Fig. 3, and ten times the radius of the duct 3b in respect of Fig. 4.

I claim:

1. A gas burner having an injector, a mixer, means including a first duct for carrying a combustible gas to the injector, means including a second duct for carrying a combustion-supporting gas to the injector, said means including said first duct, said means including said second duct, and said injector being so constructed and arranged that the combustion-supporting gas acts as the inducing gas and the combustible gas acts as the induced gas in the injector, and a laminary flow-producing structure in said second duct comprising at least one elongated member extending rectilinearly longitudinally thereof and substantially coextensive therewith, said elongated member being of such configuration that said second duct is divided into a plurality of parallel passages, the lengths of said passages being at least ten times as great as their largest transverse dimensions, whereby the combustion-supporting gas passing therethrough to the injector is maintained in a laminary state.

2. The apparatus defined in claim 1 in which said elongated member is a cylindrical tube spaced from the duct wall to provide a central passage within the tube and an annular passage between the tube and the duct wall.

3. The apparatus of claim 2 in which each end of said tube has longitudinally-separated sections splayed outwardly to bear against the inner wall of said second duct.

4. The apparatus of claim 1 in which said elongated member is a cylindrical tube spaced from the wall of said second duct to provide a central passage within the tube and an annular passage between the tube and the duct wall, said second duct and said tube being of such dimensions that the hydraulic radii of said central passage and said annular passage are equal.

5. The apparatus of claim 1 in which said elongated member has a substantially Z-shaped cross-section.

6. The apparatus of claim 1 in which said elongated member has a cross-section substantially in the form of two inter-connected Z's.

7. A gas burner having an injector, a mixer, a first duct extending substantially parallel to the injector for supplying a combustible gas thereto, a second duct extending substantially parallel to the injector and said first duct for supplying a combustion-supporting gas to the injector, and a pair of spaced transversely-extending conduits connecting said first and second ducts, respectively, to said injector, the transversely extending conduit connecting the second duct to the injector having a length less than ten times its transverse dimension, and a laminary flow-producing structure in said second gas duct comprising at least one elongated member extending rectilinearly longitudinally thereof and substantially coex-

5

tensive therewith, said elongated member being of such configuration that said second duct is divided into a plurality of parallel passages, the length of each of said passages being at least ten times as great as the largest transverse dimension of the passage, so that the combustion-supporting gas passing through said passage is maintained in a laminar state.

8. A gas burner including an injector having a central passage and an annular passage surrounding the central passage, a mixer to which said central passage and said annular passage lead, a first duct connected at one end to the annular passage in the injector for supplying a combustible gas to the mixer, a second duct connected at one end to the central passage in the injector for supplying a combustion-supporting gas to the mixer, and a laminar flow-producing structure in said second gas duct comprising at least one elongated member within said second duct extending rectilinearly longitudinally thereof and substantially coextensive therewith, said elongated member being of such configuration that said second duct is divided into a plurality of parallel passages, the length of each of said passages being at least ten times as great as the

6

largest transverse dimension of the passage, so that the combustion-supporting gas passing through said passages is maintained in a laminar state.

SUZANNE SIMONE DENISE LE RENARD
NÉE HERRENSCHMIDT.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
804,002	Fouche	Nov. 7, 1905
887,467	Delcampe	May 12, 1908
931,623	Kimball	Aug. 17, 1909
1,029,691	Kirkwood	June 18, 1912
1,194,740	Hunter	Aug. 15, 1916
1,361,804	Adams	Dec. 14, 1920
1,400,024	Caracristi	Dec. 13, 1921
1,645,337	Messer	Oct. 11, 1927
1,994,841	Thomas	Mar. 19, 1935
2,389,166	Seaver	Nov. 20, 1945

FOREIGN PATENTS

Number	Country	Date
8,320	Great Britain	of 1894