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GAS BURNERS

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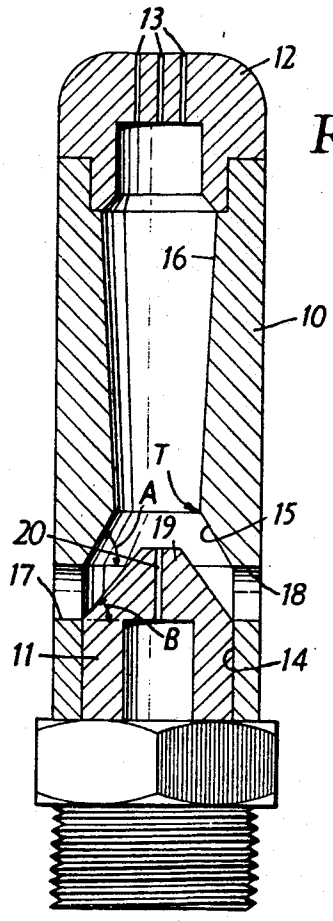
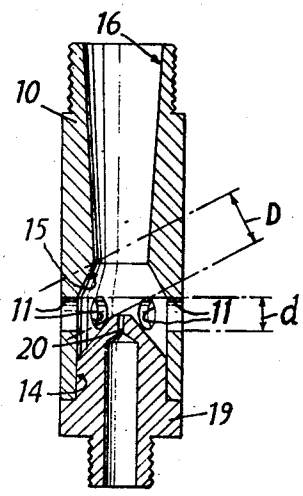


Fig.1.

Fig.2.



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GAS BURNERS

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ABSTRACT OF THE DISCLOSURE

A single-stage gas burner so constructed as to be able to burn "natural gas" which has a calorific value far higher than that of towns' gas or town gas and which is supplied at a far higher mains pressure. The design of the annular space into which air is entrained combined with the number of air ports (or the total area of the air ports) through which the entrained air passes create correct aeration for combustion and velocity such as to prevent "lighting back."

This invention relates to gas burners.

The advent of so-called "natural gas" (which term is intended to include the gas which is being found by the companies or consortia which are operating deep sea drilling rigs in the North Sea off the east coast of England) makes it necessary to redesign existing gas burners or to design new gas burners because of the high mains pressure at which the natural gas will be supplied to the consumer and because the natural gas has a high calorific value.

Towns' gas is, in general, supplied at a mains pressure of five inches water gauge which is stepped down to two and a half inches water gauge for consumers' use. Natural gas, on the other hand, will in all probability be supplied at a mains pressure of the order of twenty inches water gauge which will be stepped down to, say, eight inches water gauge for consumer's use. Further, the calorific value of towns' gas is of the order of 400 to 500 B.t.u. whereas that of natural gas is of the order of 1000 B.t.u. or more.

The principal object of the present invention is, therefore, to provide a gas burner which will give the degree of aeration necessary to produce a mixture of air and natural gas which will burn satisfactorily at the burner head and will not "light back."

It is known that a right circular cone is obtained by rotating a right-angled triangle using one of its legs or sides as the axis of rotation. Any reference herein to an element or part of the gas burner as being frusto-conical refers to the frustum of a right circular cone which is obtained by the base of the triangle forming a right angle with that side of the triangle which is equal to the height of the triangle and which is used as the axis of rotation, the hypotenuse of said triangle being inclined with respect to said base at an angle which will hereinafter be referred to as "the angle of the cone."

According to a first aspect, the present invention consists in a single-stage gas burner which includes a main body defining a passageway, an injector and a burner head having burner ports therein; said passageway having a cylindrical first portion, a second portion which is frusto-conical and which has the end thereof which is of largest diameter connected to said cylindrical first portion, and a third portion which is frusto-conical and which has the end thereof which is of smallest diameter connected to that end of said second portion which is of smallest diameter, said first, second and third portions being axially aligned with one another; said injector including a body

of which at least a part is intended for accommodation in said cylindrical first portion and a nipple which is of frusto-conical section and which is coaxially arranged with respect to said first and second portions and which has at least one axially extending injector orifice therein; the angle of the cone of said frusto-conical second portion falling within the range from 50° to 60° and the angle of the cone of the frusto-conical nipple falling within the range from 40° to 50°; and at least two radial air ports formed in that part of said main body which defines said cylindrical first portion of said passageway.

Preferably, the angle of the cone of said second portion is 60° and the angle of the cone of said nipple is 50°.

In one embodiment according to the invention, the annular passage defined on the one hand by the exterior surface of the frusto-conical nipple and on the other hand by that part of the inner surface of the main body which defines said second portion of said passageway is such that the ratio between the dimension of the radially outer end of said annular passage and the dimension of the radially inner end of said annular passage is of the order of one and one half.

In another embodiment according to the invention, the downstream end of the injector orifice is located axially of the tube, between those ends of said second portion of said passageway which are of largest and smallest diameters.

In another embodiment according to the invention, the diameter d of each air port and the distance D between the throat formed by the junction of those ends of the second and third portions which are of the smallest diameter on the one hand and the centre of the nipple (said centre being substantially coincident with the longitudinal axis of said main body) on the other hand are such that the ratio D/d is equal to or is of the order of 1.5.

In yet another embodiment according to the invention, the area a of the throat formed by the junction of those ends of the second and third portions which are of the smallest diameter on the one hand and the total A of the areas of the individual air ports are such that the ratio A/a ranges from 1¼ to 2.

The present invention will now be more particularly described with reference to the accompanying drawing in which:

FIGURE 1 illustrates an axial section of the preferred embodiment of a single stage gas burner according to the present invention; and

FIGURE 2 illustrates an axial section of an alterative embodiment of such a burner.

Referring to FIGURE 1, there is illustrated diagrammatically therein a gas burner having a main body **10** defining a passageway, an injector **11** and a burner head **12** having burner or flame ports **13** therein. The passageway defined by the main body **10** comprises a cylindrical first portion **14**, a second portion **15** which is frusto-conical and a third portion **16** which is frusto-conical. It will be noted that the three portions **14**, **15** and **16** are axially aligned and are connected to one another so as to form a continuous passageway of which a part is the burner tube. Two radial air ports **17**, **18**, which are diametrically opposed to one another, are provided in the main body **10**, each port being (if circular) of a diameter such that said port extends axially of the body **10** from a point or region of said body **10** which is adjacent that part of the frustoconical portion **15** which is of largest diameter to a point or region of said body **10** which is adjacent that part of a frusto-conical nipple **19** which is of largest diameter. The nipple **19** has an axially directed orifice **20**.

The preferred value of the angle A of the cone of the frusto-conical portion **15** is 60° whereas the preferred value of the angle B of the cone of the frusto-conical

nipple **19** is 50°, and these two angles provide an annular passage which is in communication with the ports **17, 18** and also with the throat T (which is formed at the junction of the two connected parts of the portions **15, 16** which are of smallest diameter) and with the space in the immediate vicinity of the downstream end of the orifice **20**. The ratio between the dimension of the radially outer end of said annular passage (which dimension is equal or substantially equal to the shortest distance between that part of the nipple **19** which is of largest diameter and that part of the second portion **15** which is of largest diameter) and the dimension of the radially inner end of said annular passage (which dimension is equal or substantially equal to the shortest distance between that part of the nipple **19** which is of smallest diameter and the throat T) is of the order of one and one-half (1.5), said dimensions being calculated by reference to one half of any axial section of said annular passage.

Said downtsream end of the orifice **20** is located, axially of the burner tube (or axially of the portion of the gas burner in which air entrained through the ports **17, 18** mixes with the gas stream emerging from the orifice **20**), between the diametral planes containing those parts of the portion **15** which are of largest and smallest diameters.

The angle A of the cone of the frusto-conical portion **15** may be selected from the range from 50° to 60° and, similarly, the angle B of the frusto-conical nipple **19** may be selected from the range from 40° to 50°. It is considered to be essential, however, that the angle A should always be greater than the angle B by an amount which is of the order of 10°.

Referring now to FIGURE 2, there is illustrated therein a single stage gas burner (without the burner head thereof) in which the parts thereof which are the same as those of the burner shown in FIGURE 1 are indicated by the same reference numerals as have been employed in the description of said FIGURE 1. Thus, a main body **10** is provided with radial air ports **11** of which four are visible and of which the remaining two (of the total of six) are provided in the portion of said main body which has been cut away. The main body **10** defines a passageway having intermediate its ends a frusto-conical portion **15** of which the end of smallest diameter forms a throat T, said passageway being completed on the one hand by a cylindrical portion **14** and on the other hand by another frusto-conical portion **16**, said portions **14, 15** and **16** being connected to one another in the manner already explained with reference to FIGURE 1. There is also provided a frusto-conical nipple **19** having, as illustrated, one axially extending injector orifice **20**, said nipple being constructed as already described with reference to FIGURE 1.

If the ratio D/d is increased, (in other words, if D is increased without increase of d), aeration is increased beyond the desirable limit and the flame is inclined to lift from the burner ports, D being the distance between the

throat (formed by the junction of the portions **15, 16**) and the centre of the nipple **19**, and d being the diameter of each air port **11**.

Further, and by way of example, with a 1¼ gas injector in which the diameter of the throat T is ¾ inch and each air port of the six air ports **11** has a diameter of ⅜ inch, the ratio A/a is approximately 1½, A being the sum of the areas of the individual ports **11** and a being the area of the throat T.

By way of a further example, with a ½ gas injector in which the area a of the throat T is 0.11 square inch and the sum A of the areas of the six individual air ports **11** is 0.2256 square inch, the ratio A/a is approximately 2.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. A single-stage gas burner which includes a main body defining a passageway, an injector and a burner head having burner ports therein; asid passageway having a cylindrical first portion, a second portion which is frusto-conical and which has the end thereof which is of largest diameter connected to said cylindrical first portion at one end thereof, and a third portion which is frusto-conical and which has the end thereof which is of smallest diameter connected to that end of said second portion which is of smallest diameter, said connection forming a throat of predetermined diameter, the larger end of said third portion having a restricted portion leading to the burner head, said first, second and third portions being axially ailgned with one another, orifices in said cylindrical portion closely adjacent its connection with said frusto-conical portion, said injector including a nipple having a frusto-conical end portion slidably and sealably received in the other end of said cylindrical portion, said frusto-conical end portion having an orifice coaxially arranged with respect to said throat and adjacent said orifices, said orifices being the sole air inlet openings, and the angle of the cone of said second portion being substantially 60° and the angle of the cone of the nipple being substantially 50° whereby the annular passage formed therebetween flares inwardly.

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