April 15, 1941. P. M. FORSTER 2,238,360

NOZZLE

Filed April 10, 1939

Fig. 1.

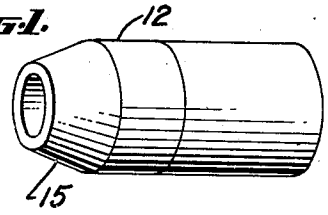
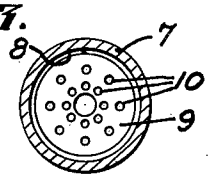


Fig. 3.



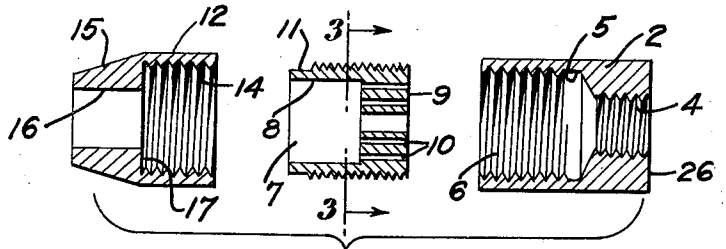


Fig. 2.

Fig. 4.

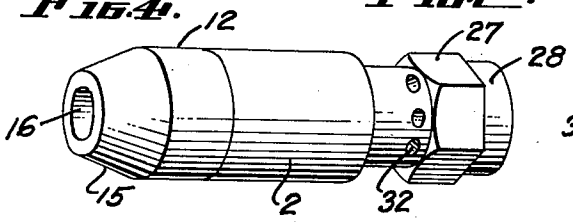


Fig. 5.

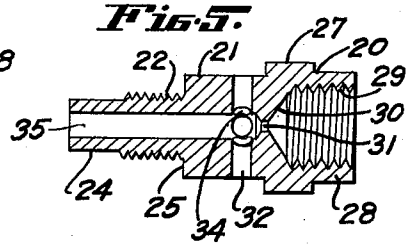


Fig. 7.

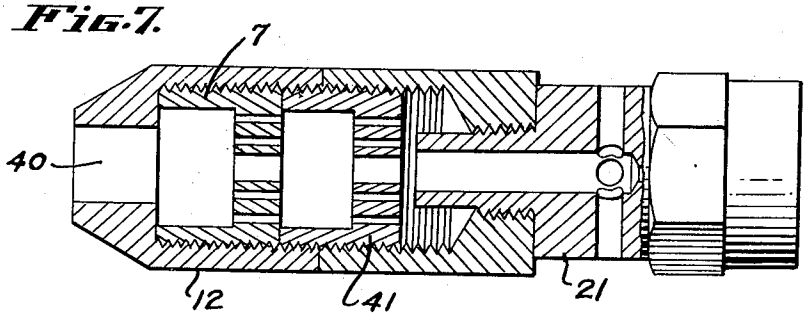
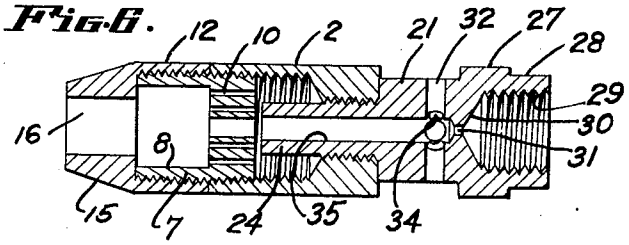


Fig. 6.



INVENTOR.
PERCY M. FORSTER
BY
A. Denham Owen
ATTORNEY

Patented Apr. 15, 1941

2,238,360

UNITED STATES PATENT OFFICE

2,238,360

NOZZLE

Percy M. Forster, Berkeley, Calif.

Application April 10, 1939, Serial No. 267,037

3 Claims. (Cl. 158—116)

My invention relates to nozzles, and particularly to a form of nozzle producing a long, fine-pointed flame.

The interior construction of a torch tip is of vital importance in the outline of the flame cone. The form of tip which I have developed is adapted to give a long needle-like flame which is so concentrated in its heating action that a piece of paper may be held immediately adjacent the flame cone near the nozzle without burning or charring, and will maintain this pointed shape at pressures ranging from 1 to 50 pounds per square inch on the gas supply. There is a noticeable absence of side flame.

The effect is produced, so near as I am now able to determine, by properly proportioning the length and diameter of the nozzle opening, and by providing a sharply defined shoulder immediately preceding the entry to that opening. The basic nozzle may be modified by adding an air intake portion when pure gas is used, or used without such intake when the gas is pre-mixed with compressed air.

The objects of my invention are:

To provide a nozzle in which the flame, regardless of pressure, does not leave the tip;

To provide a flame of defined form which is unchanged by pressure variations on the gas supply;

To provide a form of nozzle which produces a sharply pointed flame cone;

To project a pointed flame which concentrates its heat in the flame cone;

To provide a nozzle which limits the flame heat to the cone only;

To provide a concentrating nozzle requiring no adjustments;

To eliminate the effect of variations in pressure of the gas source on the shape of a flame; and

To produce a nozzle of preferred characteristics in a simple manner from easily procurable materials.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of a preferred form of my invention which is illustrated in the drawing accompanying and forming a part of the specification. It is to be understood that I do not limit myself to the showing made by the drawing and description as I may adapt a variation of the preferred form within the scope of my invention as set forth in the claims.

My invention may be better understood by reference to the drawing, in which

Fig. 1 is a perspective view of a preferred form of my nozzle, arranged to burn a mixture of gas and air;

Fig. 2 is a separated, in-line, view of the elements of the nozzle of Fig. 1, shown partially in section;

Fig. 3 is a sectional view of an element of my nozzle, taken in the direction indicated by arrows 3—3 in Fig. 2;

Fig. 4 is a perspective view of a modification of my nozzle arranged to burn gas and air;

Fig. 5 is a sectional view of an element of the nozzle shown in Fig. 4;

Fig. 6 is a sectional view of the nozzle assembly of Fig. 4; and

Fig. 7 is a sectional view of a modification for use with larger nozzle bore diameters.

Referring now to Figs. 1 and 2, an inlet housing comprises a cylindrical shell 2 internally threaded to form an inlet port 4 which is surrounded by an end face 26 and may be screwed onto a supply line connected to a source of gas and air, not shown. Forwardly from port 4, the diameter of the bore is increased, and a short smooth-bored section 5 carried into a threaded portion 6 arranged to receive grid housing 7.

Externally threaded grid housing 7 is screwed into the threaded portion 6 of housing 1. Grid housing 7 has a cylindrical bore 8 closed at the end nearest body 1 by a thick wall 9. Wall 9 is perforated by a plurality of apertures 10 parallel to the axis of the bore 8, and constitutes a grid to break up and spread the gas stream coming through inlet aperture 4. The threaded housing 7 is of sufficient length to screw tightly into the housing 1 and still leave threads exposed onto which may be screwed a nozzle tip 12, over an unthreaded terminal portion 11 of grid housing 7.

The nozzle tip 12 comprises the internally threaded cylindrical portion 14 which fits over the grid housing 7, and a tapered nose 15. Within the nose 15 is a bore 16, which is reduced abruptly in diameter from that of threaded portion 14 by a sharp shoulder 17. The presence of this shoulder seems to be essential to the proper functioning of my device.

The bore 16 should preferably be $\frac{5}{32}$'' in diameter, and I have found this dimension to be somewhat critical in producing the desired result. The corresponding dimension for the length of the bore 16 is approximately from $\frac{1}{8}$'' to $\frac{5}{16}$''. If the length is less than this figure, the flame spreads out beyond the nozzle tip and the heat is not concentrated, but can be felt on all sides. If the length is greater than these limits, the flame tends to leave the tip and may go out entirely.

In Figs. 4, 5, and 6, the device is shown modified to permit its use with a straight gas connection, drawing the oxygen for combustion from the air.

The form shown in Fig. 4 is secured by adding the element of Fig. 5 to the basic form of Fig. 1. The adapter 20 shown in Fig. 5 consists of a body 21 which has projecting forwardly there-

from a cylindrical section 22 threaded to fit within the port 4 of the inlet housing 1 and having an unthreaded portion 24 extending therebeyond of sufficient length to almost engage the grid 9 when the threaded portion 22 has been screwed into the threaded inlet aperture 4 as far as possible, this distance being determined by the engagement of a shoulder 25 with the end face 26 of housing 1. Rearwardly from the shoulder 25, a nut portion 27, which may be of hexagonal or other shape, is formed about the cylindrical portion for engagement with a wrench or other tool to secure a tight fit, and the adapter is continued cylindrically beyond the nut portion 27, terminating in a cylindrical portion 28. Cylindrical portion 28 is internally threaded to engage with a gas fitting not shown in the figure, and the chamber portion 29 surrounded by the threaded end is forwardly terminated by a conical surface 30 at the apex of which an orifice 31 is drilled. The diameter of orifice 31 may be from .004 to .006 inch. A smaller diameter may admit insufficient gas to permit lighting the flame, and a larger diameter will admit so much gas that the mixture is excessively rich. These values are applicable particularly when the range of pressures on the gas supply varies between one and fifty pounds per square inch.

The orifice 31 extends forwardly from the conical surface 30 for only a short distance, roughly $\frac{1}{32}$ of an inch, where it enters the end of center bore 35. A number of symmetrically spaced suction ports 32 are drilled through the element 20. These ports may be slightly larger than $\frac{1}{16}$ of an inch in diameter, and their common intersection results in an expansion chamber 34, which, in accord with the well-known principles of gaseous flow, acts to reduce the pressure immediately beyond the orifice 31 and to cause an inspiration of air from the surrounding atmosphere through ports 32. This air will join the gaseous fuel and mix therewith as the combination passes down a center bore 35 which extends forwardly throughout the remainder of the cylindrical portions 22 and 24 in alinement with the axis thereof.

It will be obvious to those familiar with the art that the construction described produces a simple venturi throat at the orifice 31, the downstream expanded portion 34 being formed by the intersection of bores 32; and in consequence, over a considerable range of gas pressures, sufficient air will be drawn in through the ports 32 to insure proper combustion when the mixture is ignited at the nozzle tip 15.

When it is desired to have a larger flame and still retain the advantages of my invention, a tip of the form shown in Fig. 7 may be used. This form differs from that of Fig. 6 by the greater diameter of the nozzle bore 40, which may be as much as ½ inch or more, and by the presence of a second grid 41. The second grid 41 is desirable to keep the flame from blowing away from the nozzle tip. With this construction, I find it is preferable to use a bore 40 about equal in length to the diameter. However, as the sizes increase I find the general proportions set out for the $\frac{3}{32}$ of an inch size are satisfactory.

The construction described has no moving parts and its effectiveness in operation over the range of pressures between one and fifty pounds per square inch is apparently dependent in large part upon the proper proportioning between the diameters of the nozzle aperture in nose 15 and the length thereof. Another feature which now seems important is the relatively sharp shoulder at the entrance to the bore.

The nozzle so far described is formed of brass, but it will be recognized that any other easily machined metal may be substituted therefor. It will also be obvious that the exact shape and arrangement of the elements is susceptible of variation, and I deem all variations which include an equivalent proportioning of the nozzle aperture to fall within the scope of the appended claims. Further variations in design which are also believed equivalent to the structure here set forth include modifications of the intake aperture designed to secure sufficient air for combustion, and the exact shape and dimensions of the elements shown. It is also to be understood that other variations may be made in my design which are within the scope of a mechanic skilled in the arts to which my design appertains, and I intend that all such variations shall be covered by the claims.

I claim:

1. A burner nozzle adapted to produce a fine pointed flame at widely varying pressures comprising a body member having an orifice tip with a substantially cylindrical inner bore, a cylindrical chamber adjacent said bore, larger than the latter and having a substantially right angular wall adjacent the end of said cylindrical bore, the cylindrical wall of said chamber being imperforate, a grid forming an intermediate wall in said chamber and having a central bore of materially greater diameter than the grid openings which are spaced radially therefrom, and means for conducting a combustible mixture into said chamber in line with said central bore.

2. A burner nozzle adapted to produce a fine pointed flame at widely varying pressures comprising a body member having an orifice tip with a substantially cylindrical inner bore and a tapered outer portion, a cylindrical chamber adjacent said bore, larger than the latter and having a substantially right angular front wall adjacent the end of said cylindrical bore and an apertured rear wall, the cylindrical wall of said chamber being imperforate, a grid extending across said chamber between said front and rear walls and having a central bore, and a plurality of bores of smaller diameter spaced radially therefrom, and means for conducting a combustible mixture into said chamber through said apertured rear wall and in line with said central bore.

3. A burner nozzle adapted to produce a fine pointed flame at widely varying pressures comprising a body member having an orifice tip with a substantially cylindrical inner bore with its axial length not substantially exceeding its diameter nor substantially less than half of said diameter, a cylindrical chamber adjacent said bore, larger than the latter and having a substantially right angular front wall adjacent the end of said cylindrical bore, the cylindrical wall of said chamber being imperforate, a grid extending across said chamber and having a relatively large central bore and a plurality of bores of smaller diameter spaced radially therefrom, and means for conducting a combustible mixture into said chamber in line with said central bore.

PERCY M. FORSTER.