A. KOFOD.

BLOWPIPE.

APPLICATION FILED JUNE 22, 1912.

1,125,559.

Patented Jan. 19, 1915.

Fig. 1.

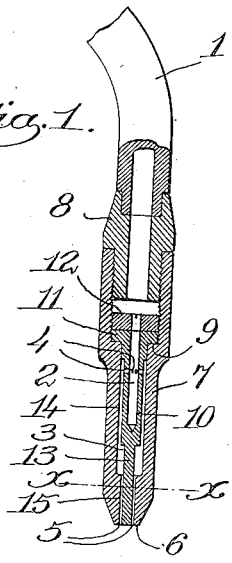



Fig. 3.

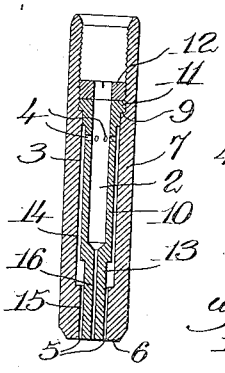



Fig. 5.

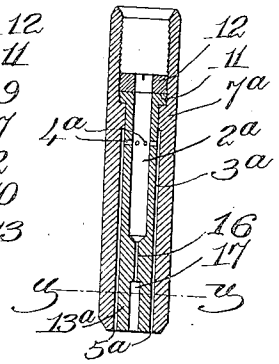



Fig. 2.

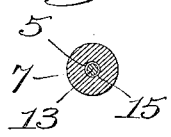



Fig. 4.

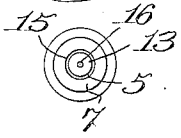



Fig. 6.

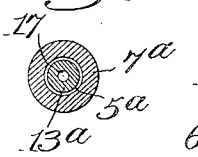



Fig. 13.

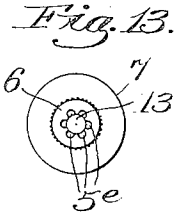



Fig. 7.

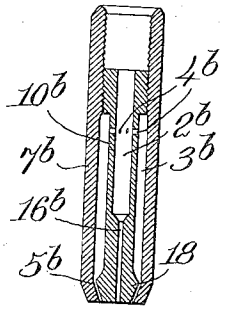



Fig. 9.

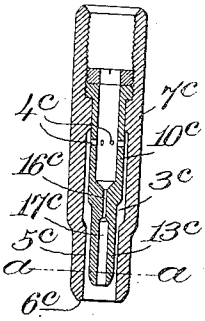



Fig. 11.

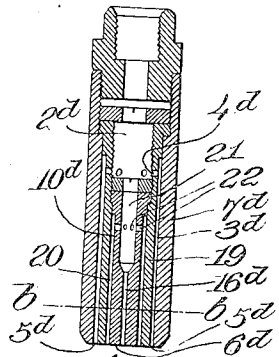



Fig. 8.




Fig. 10.

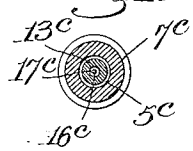
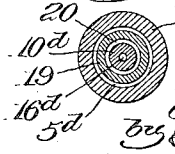



Fig. 12.




Witnesses:
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Thomas J. Drummond.

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by Edmonds Hand & Smith.
Attys.

# UNITED STATES PATENT OFFICE.

AAGE KOFOD, OF ZURICH, SWITZERLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO LIQUID FUEL & GAS COMPANY, OF WHEELING, WEST VIRGINIA, A CORPORATION OF WEST VIRGINIA.

## BLOWPIPE.

1,125,559. Specification of Letters Patent. Patented Jan. 19, 1915.

Application filed June 22, 1912. Serial No. 705,168.

*To all whom it may concern:*

Be it known that I, AAGE KOFOD, a subject of the King of Denmark, residing at Zurich, in Switzerland, have invented an Improvement in Blowpipes, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to blow pipes for heating or welding metal of that type in which the heat is developed by burning a mixture of hydrocarbon gas and oxygen. The temperature of the flame produced by hydrocarbon gas and oxygen when used under ordinary pressures is such that when the metal to be melted is comparatively thick it is necessary to play the flame on the metal for a considerable length of time in order to bring it to the melting point, and unless great care is exercised, the metal is apt to be burned before the welding process is completed, with the result that the weld will be more or less defective. An increased temperature can be produced with these gases by increasing the pressure or the velocity of the gas mixture as it is delivered from the mouth piece of the blow pipe, but when the higher pressure and consequent increased velocity of the gas mixture as it is delivered is used the gases are liable to be imperfectly mixed, thus producing imperfect combustion. Moreover, if the oxygen gas is not completely consumed it has an undesirable oxidizing effect on the hot metal.

The object of the present invention is to provide a blow pipe which can be successfully used with the hydrocarbon-oxygen flame without the disadvantages above enumerated, and I accomplish this result by providing a tip or mouth piece for the blow pipe which is formed with a central inlet passage into which the mixed gases are delivered and with an annular expansion chamber that surrounds said inlet passage and communicates therewith through throttling ports so that the mixed gas is throttled or the pressure thereof is reduced as it flows into the expansion chamber, and which is also formed with a circular discharge opening communicating with the expansion chamber and through which the throttled gases pass, said gases being burned as they are delivered from said circular opening.

My invention may be embodied in a variety of constructions, some of which I have illustrated in the accompanying drawings.

Figure 1 is a vertical cross sectional view of a blow pipe tip or mouth piece embodying my invention. Fig. 2 is a section on the line *x*—*x*, Fig. 1; Fig 3 is a view similar to Fig. 1 showing another embodiment of the invention. Fig. 4 is an end view of Fig. 3; Fig. 5 is a view similar to Fig. 1 showing another embodiment of the invention. Fig. 6 is a section on the line *y*—*y*, Fig. 5; Fig. 7 is a view similar to Fig. 1 showing another embodiment of the invention. Fig. 8 is an end view of Fig. 7. Fig. 9 is a view similar to Fig. 1 showing another embodiment of the invention. Fig. 10 is a section on the line *a*—*a*, Fig. 9; Fig. 11 is a view similar to Fig. 1 showing another embodiment of the invention. Fig. 12 is a section on the line *b*—*b*, Fig. 11; Fig. 13 is an end view of the tip showing a slightly different construction from that shown in the other figures.

1 designates a delivery pipe of the blow pipe apparatus to which my improved burner or tip is attached, said pipe leading from a suitable gas-mixing apparatus, not shown, which may be formed in or carried by a suitable handle. My improved tip or mouth piece is formed with the central inlet passage into which the mixed gases are delivered from the pipe 1 and an annular expansion chamber which surrounds the inlet passage and communicates therewith through throttling ports so that the pressure of the gas is reduced as it passes into the expansion chamber. My improved tip is also made with an annular discharge opening which communicates with the expansion chamber and terminates at the end of the tip in an annular burner opening with the result that the mixed gases are delivered from the expansion chamber in a ring which produces a circular flame.

In the embodiment shown in Fig. 1 the inlet passage is shown at 2, the expansion chamber is shown at 3, the throttling ports through which the gas is delivered to the expansion chamber are shown at 4, and the annular discharge opening is shown at 5. A tip or burner having these features may be made in various ways. In the construction shown in Fig. 1 the tip or mouth piece comprises a tubular member 7 which is adapted to screw onto the screw-threaded end 8 of the pipe 1 and is provided with a

central bore having portions 14 and 15 of different diameters, and a seat or shoulder 9, and it also comprises an interior member 10 which is situated within the exterior member 7 and forms therewith both the expansion chamber 3 and annular discharge opening 5. This interior member 10 is shown as provided with a head 11 which seats against the shoulder 9 and is held in position by the lock nut 12 that is screwed into the member 7 and is also provided with a central bore which forms the inlet passage 2. The interior member 10 is formed with the extension 13 which enters the portion 15 of the bore in the exterior member 7, said extension having such a diameter relative to the portion 15 of the bore as to leave the annular discharge opening 5. The throttling ports 4 are formed in the interior member and are preferably situated so as to enter the expansion chamber near the upper end thereof. With this construction the mixed gases under pressure enter the inlet passage 2 and thence pass through the throttling ports 4 into the expansion chamber 3. The relation between the ports 4 and the expansion chamber 3 is such that the gases are delivered to the chamber at a reduced pressure and expand in said chamber, and these expanded gases pass out through the annular discharge port 5 which terminates at the end 6 of the tip in an annular burner opening. The result of this construction is that a circular flame is produced which I have found will generate a sufficient temperature to melt metal without danger of burning it or otherwise injuring it.

In Figs. 3 and 4 I have shown an embodiment of my invention wherein means are provided for delivering a single jet of mixed gas under high pressure through the end of the tip centrally of the circular flame. I accomplish this result by providing the interior member 10 with a central port 16 which communicates with the inlet passage 2 and terminates at the end 6 of the tip. When a tip of this sort is used a jet of gas mixture under high pressure will be delivered from the central bore 16 at a much higher velocity than the annular stream of gas which is delivered through the discharge opening 5. For some purposes this form of tip is preferable to that shown in Figs. 1 and 2.

In Figs. 5 and 6 I have illustrated another embodiment of my invention in which the expansion chamber $3^a$ is of uniform size throughout its length and is also of the same cross sectional area as the discharge passage $5^a$. There will, therefore, be no throttling effect between the expansion chamber and the discharge passage. In this embodiment also the central bore 16 is enlarged at its end, as shown at 17, so that the gases under high pressure which are delivered from the inlet passage $2^a$ will expand in the enlarged chamber 17 and will be burned under a reduced pressure.

In Figs. 7 and 8 I have shown an embodiment of the invention wherein the discharge opening $5^b$ is frusto-conical in shape, this being secured by making the end of the central member $10^b$ with the conical portion 18 and giving the bore of the exterior member $7^b$ a conical shape at its end. In this embodiment of the invention I have shown the central discharge passage $16^b$ which delivers the gas under high pressure centrally of the annular flame.

In Figs. 9 and 10 I have shown an embodiment of the invention wherein the end of the central member $10^c$ is situated a slight distance back from the end $6^c$ of the tip so that the exterior member projects beyond the end of the annular discharge opening $5^c$. In this embodiment I have shown the central discharge passage $16^c$, the end of which is enlarged at $17^c$. This construction results in a comparatively weak elongated flame.

In Figs. 11 and 12 I have shown a construction which is especially advantageous for welding sheet metal of considerable thickness. In this embodiment I have shown the tip as provided with two concentric annular discharge openings as well as a central discharge opening. Said tip or mouth piece comprises the exterior cylindrical member $7^d$ having a central bore of uniform diameter which receives a cylindrical member 19 which is smaller than said bore thereby to form the annular expansion chamber $3^d$ which leads to and communicates with the annular discharge opening $5^d$. This member 19 has the inlet passage $2^d$ and the throttling ports $4^d$ through which the gas mixture passes to the expansion chamber $3^d$. The member 19 is provided with a central bore in which is received an inner member $10^d$ of such a size that an annular space 20 is formed between said inner member and the member 19. This inner member $10^d$ is provided with a central passage 21 which communicates with the annular space 20 through the throttling ports 22, and said member is preferably also provided with a central discharge port $16^d$ through which gas mixture under higher pressure is delivered through the end $6^d$ of the tip. With this construction the gas is throttled as it passes through the ports $4^d$ and 22 so that two concentric circular flames of gas burning under a lower pressure are produced and centrally of said flames is a third flame of the gas burning under a higher pressure.

In the embodiments of the invention shown in Figs. 3, 4, 7, 8, 11 and 12 the flame issuing from the central passage is some-

what elongated relative to the circular flame, and in all of these constructions the flame produced will be an annular or circular flame having an elongated central portion.

I have found that with a tip embodying my invention as above described it is possible to successfully use a gas mixture formed of hydrocarbon gas and oxygen without danger of burning the metal.

While I have herein shown the discharge opening as a continuous annular opening, yet it will be obvious that the same effect could be secured by making said opening in the form of a circular row of apertures $5^e$, as shown in Fig. 13. These apertures are shown as drilled in the exterior member 6 and are formed to extend from the tip of the member 6 to the expansion chamber.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a mouth piece for a blow pipe, the combination with an exterior member having a central bore extending entirely therethrough, of an inner member situated within said exterior member and having a diameter smaller than that of the bore to provide an annular expansion chamber between said members, the inner end of the inner member being secured to the exterior member, said inner and outer members providing between them a circular discharge opening which communicates with the expansion chamber and through which the gas producing the working flame is delivered, said inner member having a central inlet passage and throttling ports connecting said passage with the expansion chamber.

2. In a mouth piece for a blow pipe, the combination with an exterior member having a central bore extending entirely therethrough, the inner end of said bore being enlarged thereby to provide an interior shoulder, of an inner member situated within said exterior member and having a diameter smaller than that of the bore to provide an annular expansion chamber between said members, and also having a head at its inner end to seat against said shoulder, said inner and outer members providing between them a circular discharge opening which communicates with the expansion chamber and through which the gas producing the working flame is delivered, said inner member having a central inlet passage and throttling ports connecting said passage with the expansion chamber.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

AAGE KOFOD.

Witnesses:
CARL CUBLE,
AUGUST RUEGG.