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GAS MIXING APPARATUS FOR BLOWPIPES

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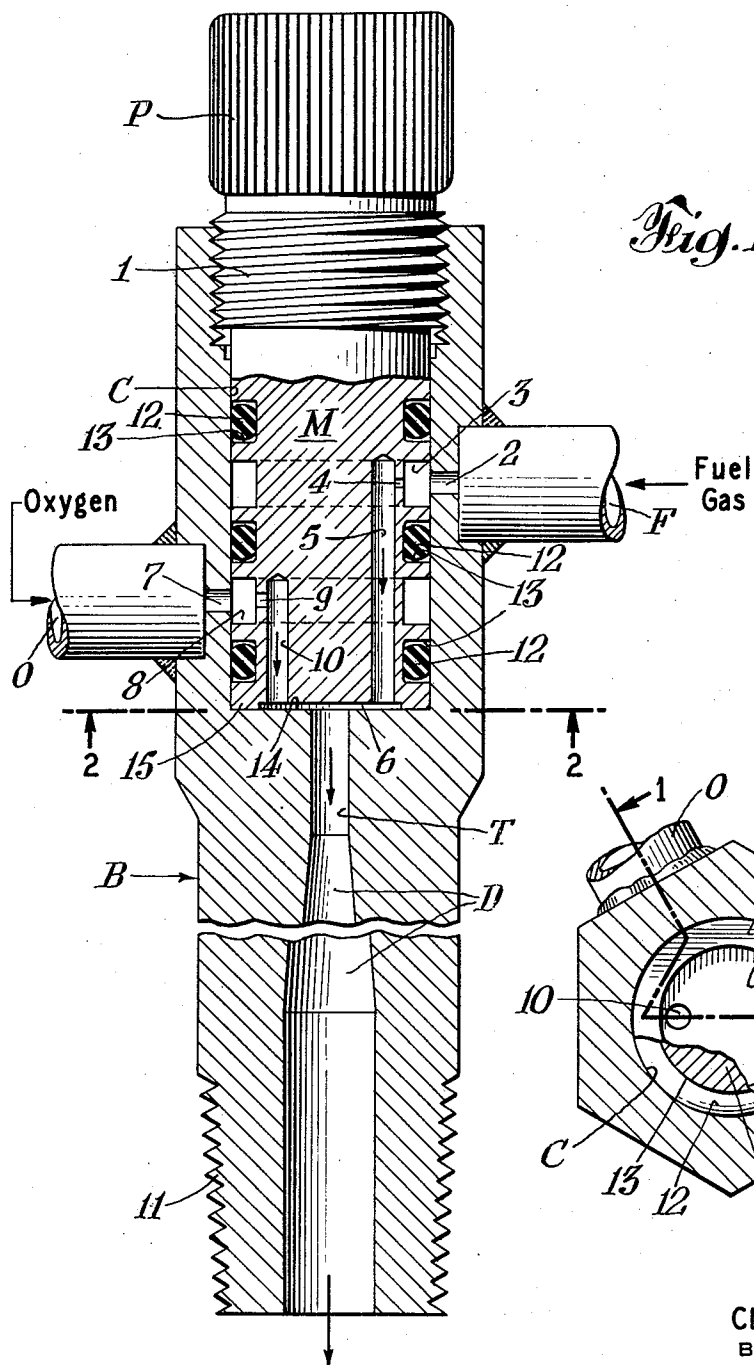


Fig. 1.

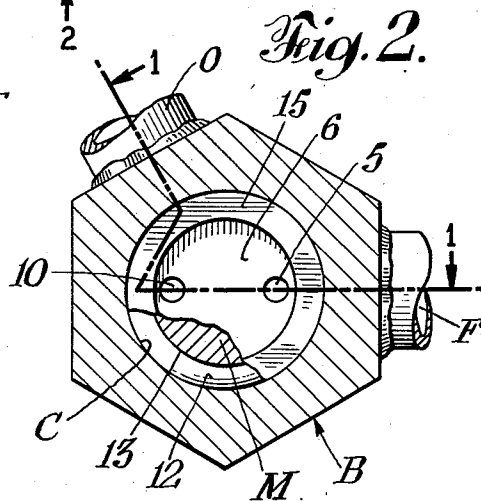


Fig. 2.

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GAS MIXING APPARATUS FOR BLOWPIPES

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9 Claims. (Cl. 158—27.4)

This invention relates to novel blowpipes embodying this mixing principle, including particularly blowpipes made for use with glass working heads.

Heretofore, the mixing of the combustible and combustion-supporting gases in blowpipes has been accomplished either by the well known positive pressure or injector methods. In the case of both of these methods a long mixing chamber is required before intimate mixing is achieved. In addition, these blowpipes employ mixers which are fitted into a removable tip thereby necessitating the removal of the tip for mixer replacement.

It is an object of the present invention to provide a novel and improved apparatus for gas mixing in a blowpipe so that an intimate mixture of gases may be attained without the need for a long mixing chamber required by blowpipes of the prior art.

Another object is to provide for a novel blowpipe wherein the mixer is readily accessible for the purposes of cleaning or changing mixer size, and wherein the flashback resistance is improved.

A further object is to provide for a novel blowpipe wherein the mixer can be inserted by hand without the need for wrenches, and wherein metal-to-metal seats are eliminated.

A still further object is to provide for sealing means to prevent leakage either between the gas passages or between either gas passage and the atmosphere.

Other advantages and aims of the invention will be apparent from the following description.

Briefly, the invention comprises introducing a combustible and a combustion-supporting gas into opposite sides of a confined shallow chamber, deflecting said gas streams radially inward within the chamber so that the gases meet head-on within the chamber thereby producing turbulence, impingement and an intimate mixture.

In the drawing:

Fig. 1 is a sectional view of a blowpipe embodying the invention taken along the line 1—1 of Fig. 2, parts being in elevation; and

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1, part being broken away to show sealing ring construction.

One form of apparatus, as shown in the drawing, comprises a blowpipe body B having an inlet O for oxygen and an inlet F for fuel gas. The body B has a cavity of axially aligned stepped borings comprising the cylindrical cavity C of relatively large diameter extending in from the rear end of the body into which the mixer M is inserted, the throat T of relatively small diameter extending forward from the center of cavity C, and a divergent passage D extending forward from throat T.

The mixer M is a cylindrical member with two longitudinally spaced annular gas cavities 3 and 8 separated from each other and each end of the mixer by sealing means 12 fitted in similar annular cavities 13. The mixer has parallel-spaced longitudinal borings 5 and 10 severally communicating between the annular gas cavities 3 and 8

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and opposite sides of a shallow circular counterboring 6 which has a flat surface axially positioned at the base (insert end) of the mixer. The non-insert end of the mixer is provided with a knurled plug P and thread 1 for hand inserting the mixer in the body with a tight fit until the annular lip 15 surrounding counterboring 6 abuts against the base surface 14 of cavity C to form the mixing chamber between the counterboring and the front surface of cavity C.

The diameter of the mixer M is less than that of the cavity into which it is inserted by a very small clearance, thereby allowing easy hand insertion and tightening and use of the sealing rings.

In operation, the fuel gas, for example natural gas or coke-oven gas, from the inlet F passes through the radial boring 2 in the body to the cavity formed between the annulus 3 and the side walls of the body cavity C, enters the radial metering port 4 in the mixer, the longitudinal boring 5, and is discharged into the mixing chamber formed between the shallow counterboring 6 and the base surface 14 of the mixer-holding cavity of the body.

Concurrently, the combustion-supporting gas, for example oxygen, from inlet O passes through radial boring 7 in the body to the cavity formed between annulus 8 and the internal side walls of the body cavity, enters the radial metering port 9 in the mixer, the longitudinal boring 10, and is discharged into the mixing chamber formed between the shallow counterboring 6 and the base surface 14 of the mixer-holding cavity of the body.

The streams of oxygen and fuel gas entering at opposite sides of the mixing chamber are deflected by the base and walls of the chamber so that they are directed radially inward at each other within the confines of the chamber producing turbulence and an intimate mixture of the gases. The mixture so formed passes through the throat T and the divergent passage D to an appropriate heating head or tip, such as a conventional annular glass cut-off head (not shown), which may be connected to the body of the blowpipe by means of threads 11.

The diameter of throat boring T should be sufficiently large that it will allow the mixed gases to freely pass from the mixing chamber as mixing progresses, but not so large that it will not leave a surface 14 at the base of the body cavity sufficient to provide inward deflection of the gases entering from borings 5 and 10.

Prior to mixing, sealing means is provided to prevent leakage between the combustion-supporting and fuel gas passages and between either of these passages and the atmosphere.

In the specific embodiment shown in the drawing sealing is accomplished by the use of resilient O rings 12 (made of rubber or an equivalent material) which are fitted into annuli 13 at the previously disclosed location in the mixer. This arrangement allows for a tight sealing as well as a mixer that is easily removable in a hand operation. However, the sealing between gases may be accomplished under the present invention by use of equivalent sealing means fitted either on the mixer or the internal walls of the body cavity.

In the blowpipe of the present invention the flashback resistance is improved by designing the blowpipe so as to accomplish what is called "wire drawing effect." This is brought about by providing for small diameter mixer metering ports 4 and 9 as well as long, small diameter longitudinal borings 5 and 10 (relative to the dimensions of the mixing chamber).

When using the apparatus described above, a satisfactory flame has been produced by directing oxygen and coke-oven gas at about 5.0 pounds per square inch through longitudinal bores 5 and 10 of 0.052 inch diameter spaced 0.2 inch apart center-to-center into a cylin-

drical mixing chamber having a depth of 0.015 inch and a diameter of 0.325 inch, and then discharging the resultant mixture through an axial throat of 0.07 inch diameter and 0.25 inch length into a divergent nozzle passage having a maximum diameter of 0.172 inch and a length of 1.625 inches, and thence into a heating head (in this example a glass working head). The oxygen metering port diameter was 0.0156 inch and the combustible gas metering port diameter was 0.0135 inch. For this mixer the gas flow would be 15 cubic feet per hour for the coke-oven gas and 17.8 cubic feet per hour for the oxygen. In contrast with this the best blowpipes used heretofore have required a length of about 6 inches between the mixing chamber and the heating head to assure adequate mixing.

What is claimed is:

1. A blowpipe comprising a body having at one end an externally-communicating cavity of relatively large diameter terminating in a flat base surface, and a discharge passage of relatively small diameter at the other end for a combustible gas mixture leading from said cavity in axial alignment therewith; a mixer secured in said externally-communicating cavity having a flat end face spaced a short distance from and parallel to said bottom surface to provide a shallow mixing chamber, said mixer also having two longitudinal passages for fuel and combustion-supporting gases greater in diameter than the depth of said shallow mixing chamber and less than the diameter of said discharge passage and having orifices spaced from one another in said flat end face on opposite sides of said discharge passage in position to discharge streams of fuel gas and combustion-supporting gas against said flat bottom surface to be deflected radially inward toward and into one another to form a combustible gas mixture; and means for supplying fuel gas to one and combustion-supporting gas to the other of said longitudinal passages through small diameter metering ports of cross-sectional area substantially less than that of said longitudinal passages.

2. A blowpipe comprising an outer body having a cavity of relatively large diameter extending in from one end thereof and terminating in a flat base surface, and a discharge passage of relatively small diameter for a combustible gas mixture leading from said cavity in axial alignment therewith; a mixer body threaded into said cavity and removable therefrom and replaceable therein at will through said end, said mixer body having a flat end face spaced a short distance from and parallel to said bottom surface to provide a shallow mixing chamber, and two longitudinal passages for fuel and combustion-supporting gases greater in diameter than the depth of said shallow mixing chamber and less than the diameter of said discharge passage and having orifices spaced from one another in said flat end face on opposite sides of said discharge passage in position to discharge streams of fuel gas and combustion-supporting gas against said flat base surface to be deflected radially inward toward and into one another to form a combustible gas mixture; said mixer body also having two longitudinally spaced annuli in the external surface thereof severally connected to said longitudinal passages; and said outer body having two radial ducts severally connected to said annuli for supplying fuel gas and combustion-supporting gas, respectively, thereto through small diameter metering ports of cross-sectional area substantially less than that of said longitudinal passages.

3. A blowpipe as claimed in claim 2 having sealing means associated with the outer surface of said mixer body whereby leakage between said gases or either of said gases and the atmosphere is prevented before said gases reach said mixing chamber.

4. A blowpipe as claimed in claim 3 wherein said sealing means is fitted to the mixer body.

5. A blowpipe as claimed in claim 3 wherein sealing means is fitted into the surface of said body cavity.

6. A blowpipe comprising a body having an externally-communicating large axially positioned cylindrical cavity at one end terminating in a flat base, a diverging passage at the other end, and an axial throat boring connecting said cavity and diverging passage, said large cavity having inlets for combustion-supporting and fuel gases connected thereto; a hand-removable mixer inserted in said cavity having a shallow cylindrical mixing chamber between said counterboring and the base surface of said body cavity, longitudinal borings extending perpendicularly to said shallow chamber and severally communicating with said inlets through small diameter metering port means of cross-sectional area substantially less than that of said longitudinal borings and terminating in orifices located near opposite ends of a diameter of the upper face of said cylindrical counterboring, said longitudinal borings having diameters greater than the depth of said shallow mixing chamber and less than the diameter of said axial throat boring; and sealing means whereby leakage between said gases or either of said gases and the atmosphere is prevented before said gases reach said mixing chamber.

7. A blowpipe as claimed in claim 6 wherein said sealing means is fitted to the mixer.

8. A blowpipe as claimed in claim 6 wherein said sealing means is fitted into the surface of said body cavity.

9. A blowpipe comprising a body having a large axially positioned cylindrical externally-communicating cavity at one end, a diverging passage at the other end, and an axial throat boring connecting said cavity and passage, said large cavity having inlets for combustion-supporting and fuel gases connected thereto; a hand-removable mixer inserted in said cavity having a shallow cylindrical counterboring in its base forming a shallow cylindrical chamber between said counterboring and the internal base surfaces of said body cavity, a pair of longitudinally spaced annuli adjacent to and severally communicating with said gas inlets, longitudinal borings extending perpendicularly to said shallow chamber terminating in orifices located near opposite ends of a diameter of the upper face of said cylindrical counterboring, radial boring means including small diameter metering ports severally communicating between said annuli and said longitudinal borings, said smaller diameter metering ports having cross-sectional areas substantially less than that of said longitudinal passages, said longitudinal borings having diameters greater than the depth of said shallow mixing chamber and less than the diameter of said axial throat boring, and a longitudinally spaced sealing ring annulus between said gas annuli and each of gas annuli and an end of said mixer; and a resilient sealing ring in each of said sealing ring annuli.

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