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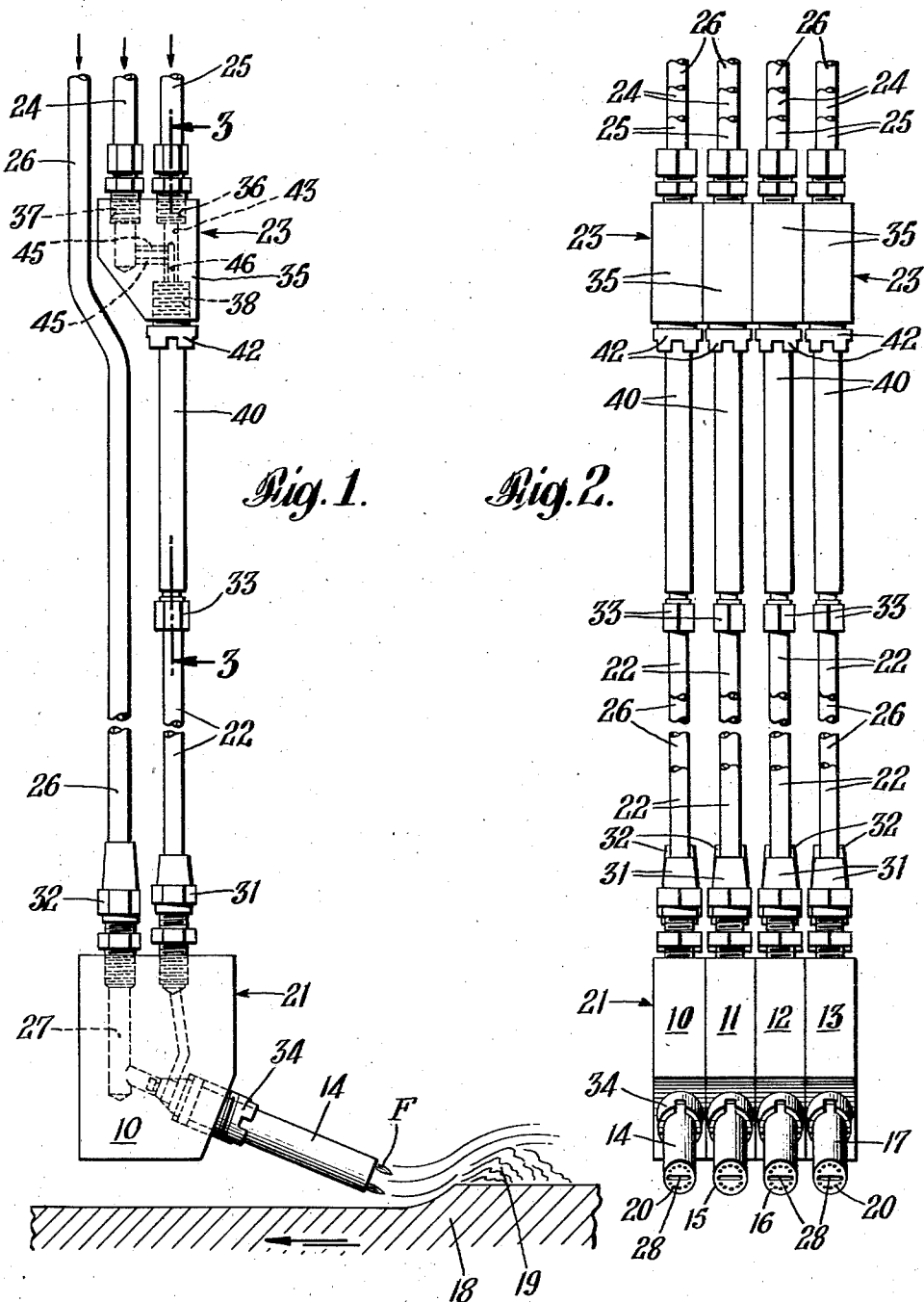
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2,417,670

POROUS DISC TYPE GAS MIXER

Filed Jan. 7, 1944

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

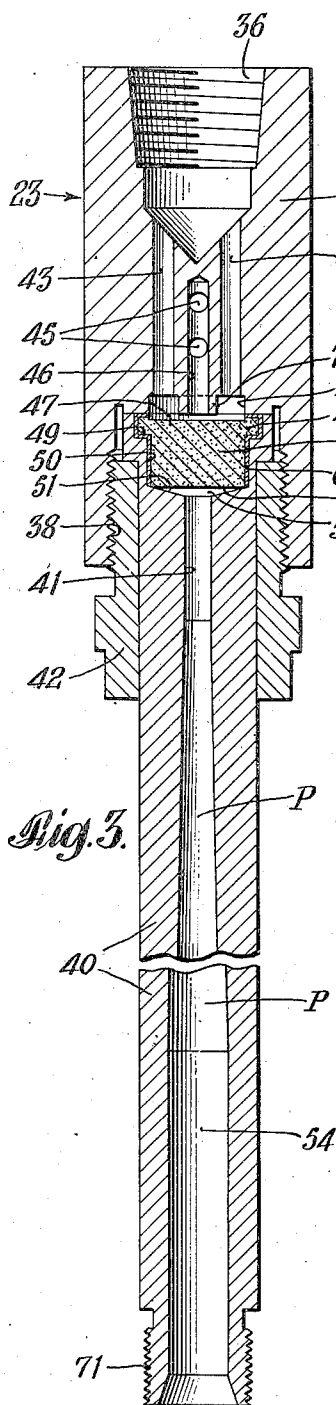


Fig. 3.

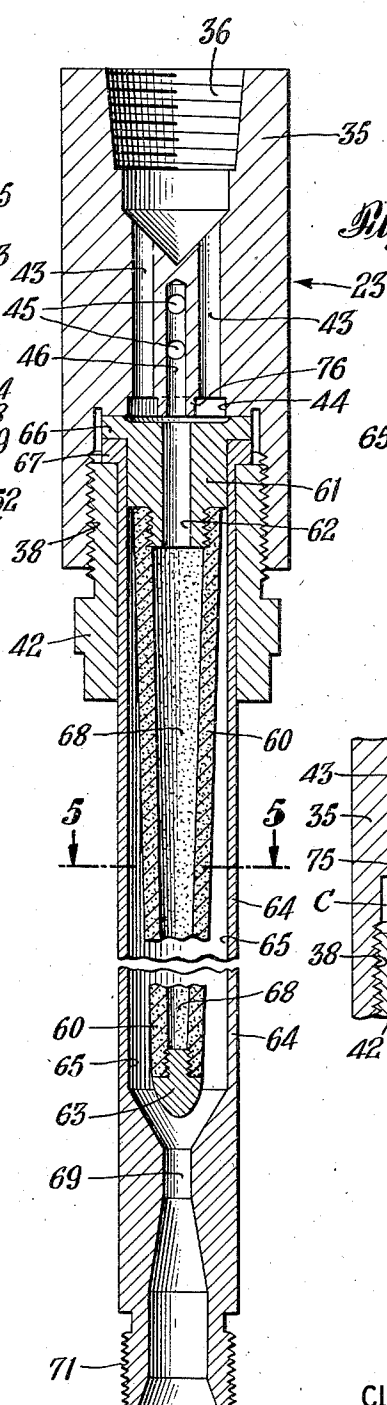


Fig. 4.

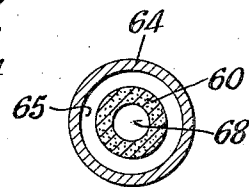


Fig. 5.

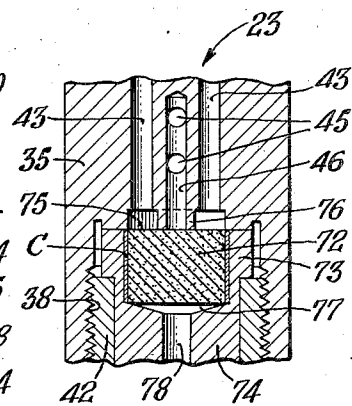


Fig. 6.

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POROUS DISC TYPE GAS MIXER

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3 Claims. (Cl. 158—27.4)

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This invention relates to blowpipes and more particularly to a combined gas mixer and backfire arrester and flashback preventer assembly.

In premixed preheating gas blowpipe arrangements used in machines for thermochemically removing surface defects from ferrous metal bodies such as slabs and billets, the premixed preheating gas outlet passages frequently become clogged or closed by slag formed during the desurfacing operation, causing flash back or backfire which extends to the conventional mixer and the individual gas supply pipes, filling them with carbon and in many instances even melting or distorting them. Consequently, the machine has to be shut down, repaired, and cleaned. Because of flash back and backfire extending far back into the system, many individual parts have to be cleaned, and maintenance costs are high.

The principal objects of the present invention are to provide a combined gas mixer and backfire arrester assembly adapted to prevent flashbacks, the "downtime" for cleaning and repair being greatly reduced.

According to the present invention a combined gas mixer and backfire arrester assembly is provided comprising a self-supporting porous flash arresting element located in a blowpipe close to the nozzle, this same element being adapted to effect mixing of a combustible gas and a combustion-supporting gas. Such gases are separately delivered directly to one face of the element. Such element has many pores which are not straight through but cross and interconnect with one another, so that one gas entering one pore on the upstream face mixes with the other gas entering another pore, before such gases leave the downstream face. Burning of the combustible mixture within a blowpipe may be of two kinds: (1) the rapid popping back known as backfire or (2) the sustained burning known as flashback and following backfire. The mixed gas is caused to flow through a passage having a throat or restricted portion to establish a gas velocity sufficiently high to prevent any flashback flame continuing after backfire reaches the porous element. Any backfire flame reaching the downstream face is blown out almost instantaneously by the pores dividing the flame and each divided flame portion impinges the pore walls and is quenched in being bent through the tortuous pore passages. A sustained flashback flame is prevented to avoid unnecessary heating or carbonizing the porous element. From the throat the mixed gas is expanded and delivered directly to the nozzle. The size of the porous element is such that the pressure drop of the gases is not serious. The invention is especially suitable in large capacity blowpipes and may be used to supply mixed gas to a plurality of nozzles. Any backfire flame is

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spread over the entire downstream face of the porous material.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawings, in which

Fig. 1 is a side elevational view of a desurfacing machine embodying the present invention.

Fig. 2 is a front view of the machine shown in Fig. 1.

Fig. 3 is an enlarged cross sectional view of a combined mixer and arrester assembly, taken on line 3—3 of Fig. 1.

Fig. 4 is a cross sectional view of a modified form of assembly wherein the porous element is a hollow cone closed at the downstream end.

Fig. 5 is a transverse cross sectional view taken on line 5—5 of Fig. 4, and

Fig. 6 is a fragmentary view in cross section of another modification of the invention.

Referring to Figs. 1, 2 and 3, there is shown a plurality of blowpipe units 10, 11, 12, and 13 located side-by-side and having respective nozzles 14, 15, 16 and 17. Such units, so arranged, direct preheating flames F toward a ferrous metal body 18, and, upon the body being moved along underneath the nozzle tips, streams of cutting oxygen, remove thermochemically a layer of surface metal of predetermined thickness from the body 18. A wave 19 of slag containing molten metal is thrown up ahead of the nozzle tips. When preheat holes 20 in the nozzle tips become clogged, a backfire or flash back occurs. The resulting flame may momentarily extend rearwardly through the nozzle, nozzle block 21, and through a mixed gas supply pipe 22 until extinguished by a combined mixer and backfire arrester assembly 23.

According to the present invention, the combined mixer and arrester assembly 23 includes a self-supporting porous element 39, which not only serves finally and thoroughly to mix the gases but also serves to arrest and extinguish a backfire. Equal volumes of fuel gas and oxidizing gas such as acetylene and oxygen under equal pressure, respectively, enter the assembly 23 through separate pipe lines 24 and 25 and leave well mixed through the mixed gas supply pipe 22.

Cutting gas such as oxygen is supplied by a pipe line 26 to a passage 27 in the block 21 and leaves the nozzle tip through a flat discharge orifice 28. Screw couplings 31 and 32 are respectively used on the mixed gas supply pipe 22 and the cutting gas supply pipe 26 so that they may be readily detached from the nozzle block 21. Pipe 22 is detachably connected to the assembly 23 at its other end by a screw coupling 33. Nozzle 14 is detachably retained in the nozzle block 21 by a threaded sleeve 34. By having these parts

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detachable, they may be quickly and easily disassembled, cleaned and reassembled.

As shown in Fig. 3, the combined mixer and backfire arrester assembly 23 includes a casing 35 having two inlet sockets 36 and 37 (Fig. 1) and a single outlet socket 38. Each of such sockets is internally threaded to receive an externally threaded hollow coupling sleeve to connect a pipe to the casing. The socket 38 extends axially for a considerable distance into the body 35 and is of sufficient diameter to receive a porous element 39, the upper end portion of an elongated metal pipe 40 having a mixed gas delivery passage P provided with a throat or restricted portion 41, and a threaded coupling sleeve 42 designed to retain the porous element 39 and the pipe 40 within the body 35 upon being screwed into the threaded outlet socket 38.

Spaced vertical passages 43 lead from the threaded inlet socket 36 to an annular gas distributing chamber 44 in the bottom of the socket 38. Horizontally extending passages 45 lead from the inlet socket 37 (Fig. 1) to a central vertical passage 46 formed between the spaced passages 43 and discharging downwardly into the bottom of socket 38. The porous element 39 has an upstream face 47 facing the bottom of both the annular chamber 44 and the central passage 46; the face 47 being recessed to provide space so that gases are mixed and distributed well over the face before entering the porous element 39. Acetylene and oxygen are delivered respectively to inlet sockets 37 and 36 and mix together at the bottom of the outlet socket 38. Since the pressures of the gases are equal, any flow from one inlet opening to the other inlet opening is prevented.

The porous element 39 has a radially extending flange 48 which fits on a shoulder 49 of an annular recess 50 in the upper end of the elongated pipe 40. Recess 50 is adapted to contain the porous element 39. As the coupling sleeve 42 is tightened within the socket 38 the flange 48 of the porous element is brought tightly against the bottom of the socket 38. The outer annular surface of the porous element 39 is provided with a coating C of gas sealing material or paint so that the pores of the element are completely sealed to prevent any leakage of gas in a lateral direction. Such coating C extends also over the top of flange 48 so that when the porous element is tight against the bottom of the socket 38 a gas-tight or hermetic seal is present.

The recess 50 in the elongated piece 40 has a frusto-conical bottom providing a shallow axial convergence 51 receding from the flat downstream face 52 of the porous element, forming a mouth 53 in which the gas leaving the element is collected and directed into the throat or restricted portion 41 of the mixed gas passage P. It will be noted that the throat 41 is of considerably less diameter than the outlet portion 54 of the passage P. The effect of the mouth 53 and throat 41 is to increase the collective velocity of the gas such that the gas itself will either blow out or greatly impede a flash back continuing after a backfire. On reaching the porous element, a backfire is readily and finally extinguished by the cooling effect of porous material and by the tortuous shaped pores which cause the flame to come against many heat conductive walls (bronze containing a large amount of copper) and bend and quench it in many small parts through the numerous pores. The restricted portion 41 thus

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prevents premature breakdown of the porous element material by heat.

In that example of the invention shown in Figs. 4 and 5, it will be noted that the casing 35 of the assembly is of substantially the same shape as the casing of the previously described assembly, and that the only differences reside in the shape and construction of the mixed gas supply pipe and the porous element. A long hollow frusto-conical self-supporting porous element 60 is threaded at its large end upon a base 61 having a central mixed gas passage 62 for the delivery of the gases to the interior of the porous element. Threaded in the outer end of the porous element 61, is a deflector or closure element 63 of solid or nonporous metal. An elongated pipe 64, generally more hollow than the pipe 40, has an enlarged chamber 65 adapted to receive the porous element 60 and the base 61. Base 61 has a radial flange 66 against which is abutted a flange 67 of the elongated pipe 64. Upon the coupling sleeve 42 being tightened in the threaded socket 38, base 61 and elongated pipe 64 are rigidly secured to the casing 35.

The gases upon coming together at the bottom of the outlet socket 38, pass down through the central passage 62 of the base 61, fill up a chamber 68 in the porous element 60, and then pass outwardly through the pores of the porous element to the chamber 65 of the pipe 64. By the time the gases reach the chamber 65, they are thoroughly and finally mixed. A restricted throat 69 in the pipe 64 increases the velocity of the gas the same as did the throat 41 in that form of the invention shown in Fig. 3. Any flames resulting from a backfire are diverted by deflector 63 upon entering the chamber 65. Each of elongated pipes 40 and 64 has a threaded outlet end portion 71 adapted to receive the coupling 33 of the pipe connection 22 to connect the assembly 23 to the nozzle block 21. Any sustained burning flashback flame is prevented by the high gas velocity in the throat 69 after backfire. The comparatively shallow chamber formed between the outer or downstream face of the porous element 60 and a wall 64 of the pipe or casing functions similarly to the chamber 53 in Fig. 3 in being of small enough volume to cause the outflowing gas to have a high enough velocity for the same purpose, i. e., preclude a continued burning.

In that form of the invention shown in Fig. 6 the gases entering the casing 35 are not permitted to be previously mixed prior to entry into a porous element 72. The porous element 72 lies within a flanged inner end 73 of a mixed gas delivery pipe 74, similar in configuration to pipe 40 of Fig. 3, and has a flat upstream face 75 which is brought up flush against a skirt portion 76 surrounding the central gas inlet passage 46. By this construction, the gases from the passages 43 and 46 directly enter the porous element 72 without being previously mixed and mixing takes place wholly within the porous element 72. Thoroughly mixed gases leave downstream face 77 of the porous element 72, and pass on downwardly through a restricted throat 78 of the pipe 74.

A self-supporting porous element suitable for the purposes of this invention may be formed of carbon particles compacted with a carbonaceous binder, such as pitch, baking the compacted mass slowly to drive off volatile matter, and then slowly cooling the element.

Another form of porous element which has been found to be satisfactory is that known to the trade

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as Porex, which is formed by sintering together a collection of bronze particles into a single self-supporting mass forming circuitous pores through it. The sintering operation leaves the mass with certain of the pores interconnected with one another. The mass may be finally compressed, if found necessary, to reduce the pores to smaller size. As is well known, bronze being largely of copper is a good heat conductor to distribute the heat energy of backfire throughout the porous mass.

The pores of the porous element are in the form of circuitous passages, any one of which interconnects with or crosses several other passages and delivers portions of its gas to or receives portions of the gas of these other passages. The gases of one pore are thus forced to mix and be mixed with gases of the other pores, with the result that by the time the gases have traversed the full thickness of the element, they are thoroughly mixed.

In many instances a hanging flame is precluded from continuing in the restricted portion of the elongated mixed gas passage. The porosity of the element is such that both effective mixing results and maximum flash back resistance is obtained. The overall size of the element will depend upon the gas flow requirement. One porous element may be designed and arranged to serve several nozzles.

The length of the passage subject to flash back is materially reduced, and the gases are mixed and the backfire arrested in the same casing.

While various changes may be made in the detailed construction, it shall be understood that the changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A combined porous type gas mixer and backfire arrester assembly for a blowpipe, comprising a casing having two separate gas inlet openings, an enlarged outlet opening, a pipe having an end portion contained in the enlarged outlet opening, said pipe having an enlarged axially extending chamber and restricted gas passage portion in communication with each other, a hollow frusto-conical porous element spaced from the wall of and extending within the enlarged chamber into close proximity with the restricted gas passage portion, a solid metal deflector piece closing the outer end of the porous element to divert a flame resulting from the backfire issuing rearwardly from the restricted gas passage portion, a base connected to the opposite end of the porous element, said base having a mixed-gas passage therethrough to deliver the gases entering the outlet opening to the interior of the porous element, and means securing the base and the pipe within the enlarged outlet opening.

2. A porous type backfire arrester assembly comprising in combination a porous element of heat conductive sintered and compressed metal particles strong enough to resist the impact of a backfire, said element having interconnected pores of tortuous shape small enough in size to preclude the passage of a backfire flame, whereby such a flame is extinguished by the chilling action of its impingement upon numerous heat conductive pore walls and such a flame is divided and frequently bent around numerous such heat conductive walls in the tortuous paths constituted by said pores, a casing enclosing said element, an inlet passage in the casing leading to an upstream face of the porous element and at least a

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major portion of the upstream face of said element being exposed to gas from the inlet passage, an outlet passage in the casing leading from the downstream face of said element and at least a major portion of the downstream face of said element being exposed to said outlet passage for arresting any backfire flame, a shallow chamber in said outlet passage constituted on one side by the downstream face of said element and on an opposite side by a wall of said casing, said element being gas permeable and mounted to require the passage of gas between the inlet and outlet passages to be through the pores of said element, said shallow chamber being of small volume and the outlet passage adjacent thereto being constricted to prevent any continued burning or flashback to exist therein following a backfire.

3. In a blowpipe, in combination, a casing member portion having therein a gas mixing chamber, an oxygen supply passage opening into said chamber, and a fuel gas supply passage opening into said chamber, for preliminarily mixing oxygen and fuel gas within said gas mixing chamber; a combined gas mixer and backfire arrester comprising a self-supporting body of porous material secured within said casing member portion and having the pores exposed on at least a major portion of the upstream surface thereof in communication with said gas mixing chamber, to more thoroughly mix within said body of porous material the gases preliminarily mixed in said mixing chamber; and another casing member portion constituting a gas mixture delivery pipe secured to said first mentioned casing member and having an enlarged passage portion and also having a restricted passage portion communicating with said enlarged passage portion and with the pores exposed on at least a major portion of the downstream surface of said body of porous material to any backfire flame, a shallow chamber constituted on one side by the downstream face of said porous material and on an opposite side by a wall of said second mentioned casing member portion whereby the velocity flow of the gas mixture through said restricted passage portion and shallow chamber inhibits propagation of flashback adjacent the downstream surface of said body of porous material, and said body of porous material arresting propagation of backfire therethrough and into said mixing chamber and into said fuel gas supply passage.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
713,421	Fouche	Nov. 11, 1902
Re. 16,149	Southgate	Aug. 25, 1925
1,223,308	Bone et al.	Apr. 17, 1917
1,097,264	Reich	May 19, 1914
1,290,878	Barrows	Jan. 14, 1919
2,235,433	Kehl	Mar. 18, 1941
2,242,471	Jones et al.	May 20, 1941
2,008,130	Damm	July 16, 1935

FOREIGN PATENTS

Number	Country	Date
477,958	French	Aug. 21, 1915
262,881	German	Apr. 26, 1912