Aug. 20, 1935. A. RAVA 2,011,872

HIGH TEMPERATURE TORCH

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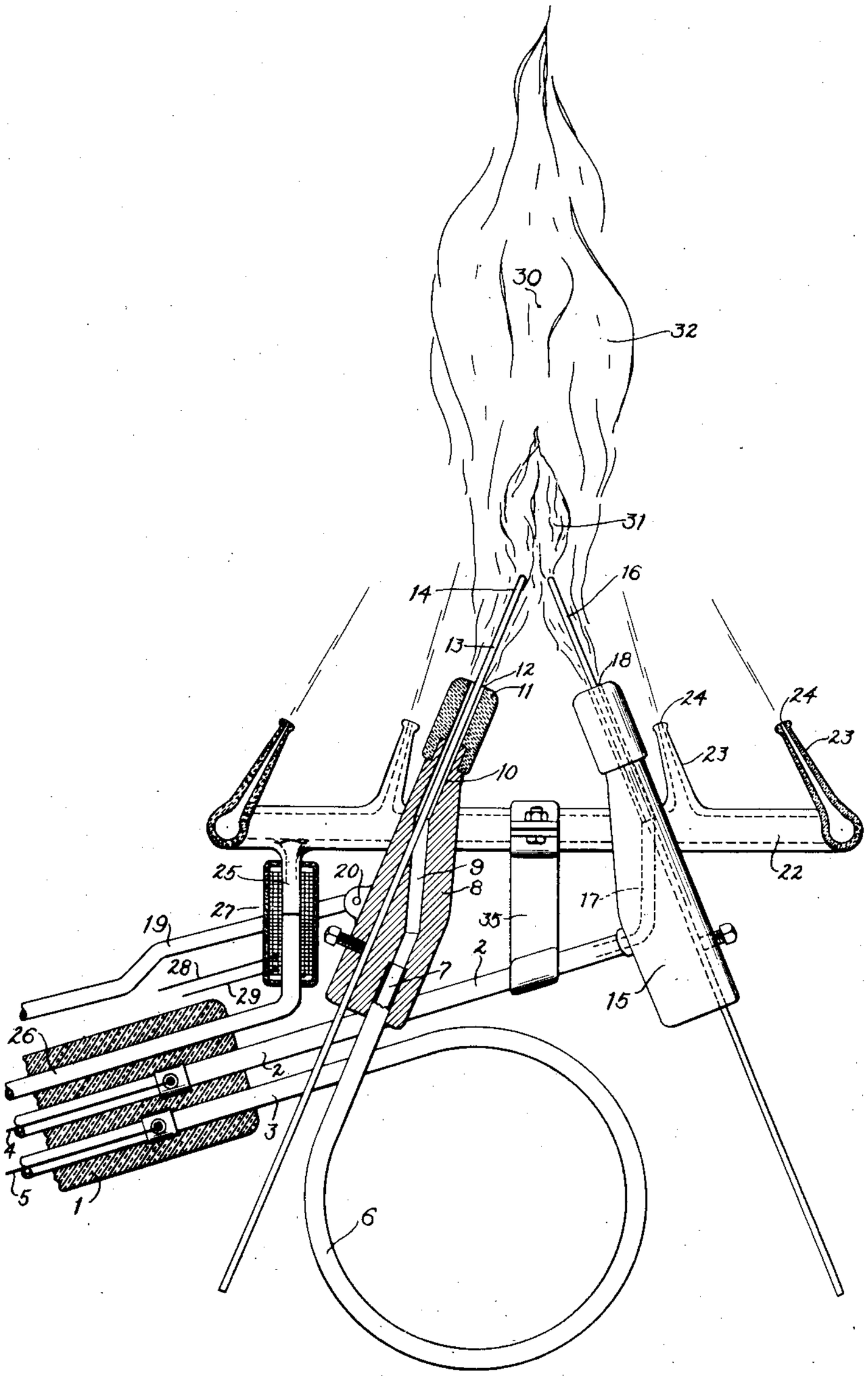

Fig 1

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HIGH TEMPERATURE TORCH

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13 Claims. (Cl. 219—8)

This invention relates to methods and means for producing high temperature flames.

Although my invention has numerous applications, it is particularly applicable to the production of non-reducing flames for use in the various metallurgical, chemical, ceramic and other allied arts. An illustrative use is the fusing and melting of refractory material and/or the glazing of the same.

In some aspects my invention is an improvement on what is called in the art the atomic hydrogen torch and on the method of using the same.

It is an object of my invention to provide an improved method and means for producing a high temperature flame.

Another object is to provide a method and means for producing a high temperature flame in a unitary torch or like construction.

Another object is to provide an improved method and means for producing a high temperature oxidizing or non-reducing flame.

Another object is to provide an improved method and means for producing a high temperature flame whereby refractory material may be fused and/or melted and/or glazed without the introduction thereinto of impurities.

Another object is to provide an improved method and means for producing a high temperature flame for glazing refractory material and the like.

Another object is to provide an improved atomic hydrogen torch.

Another object is to provide an improved torch for utilizing the heat produced by the joint action of the electric arc and a combustible gas or gases.

Another object is to provide a method and means for rendering non-reducing or oxidizing, the flame produced by the atomic hydrogen torch.

Other objects will be apparent to those skilled in the art to which my invention appertains.

My invention is fully disclosed in the following description taken in connecton with the accompanying drawing.

Referring to the drawing, I have shown at 1 a fragmentary end portion of a handle, upon which the parts of the torch generally are supported, and by which the flame, to be produced by the torch, may be controlled and directed. Extending through the handle and outwardly from the end thereof are metal pipes 2 and 3, the inner ends, inwardly of the inner end of the handle not shown, being connected, or adapted to be connected, to a source of hydrogen gas under suitable pressure. Such means is well known in the art, particularly the art of atomic hydrogen torches, and need not be illustrated or described here.

The pipes 2 and 3 have connected thereto electric conductors 4 and 5 respectively, which extend inwardly through the handle and beyond the handle are connected, or are adapted to be connected, to a suitable source of current supply which may be controlled in any manner, such as by automatic apparatus to regulate the same in a manner well known in the use of atomic hydrogen torches.

The pipe 3 is formed with a large loop 6 to introduce a slight resilience therein, and the terminal end 7 of the pipe is secured to the rearward end of a nozzle 8, the pipe communicating with a duct 9 in the nozzle having an offset portion 10 and discharging from the forward end 11 of the nozzle at an orifice 12.

The pipe 2 is connected to a similar nozzle 15 having an electrode projecting forwardly therefrom as at 16 and a duct 17, communicating with the pipe 2, and a discharge orifice at 18. The nozzle 8 has an operating rod 19, pivotally connected thereto, as at 20, and extending rearwardly generally to the handle 1, and connected to an operation lever (not shown) well known in the art.

Normally the electrode tips 14 and 16 are held in engagement by resilience of the loop 6 and, upon pulling upon the rod 19, they may be separated to draw an arc therebetween and the length of the arc adjusted in operation by suitable movements of the rod 19 in a well known manner.

The torch, thus far described, is similar to, or may be identical with atomic hydrogen torches, as heretofore, constructed and used, and these parts in themselves constitute no essential part of my invention.

At 22 I have illustrated an annular tube, provided generally on upper portions thereof with a plurality of nozzles 23—23, terminating in discharge orifices 24—24. The nozzle pieces 23 are inclined inwardly and upwardly in a direction and for a purpose to be described. The tube 22 has communicating therewith a supply pipe 25, which joins with a conduit 26, extending through the handle 1. Beyond the inner end of the handle the conduit 26 is connected to, or adapted to be connected to, a supply of oxygen under suitable pressure, the supply and control of which may be effected in any suitable manner, such, for example as that employed in connection with the supply of hydrogen gas for the nozzles 8 and 15.

Indicated generally at 27 is an electric heater, surrounding a portion of the supply pipe 25, and having current supply wires 28 and 29, which may be conducted along the outside of the handle 1, or through suitable ducts, or conduits therethrough, to a source of current supply. The purpose of the heater 27 is to heat the oxygen flowing through the supply pipe 25 from the source to the annular tube 22.

As will now be understood, the oxygen supplied to the annular tube 22 will be discharged from the nozzle orifices 24. The inclination of the nozzle pieces 23, and the disposition of the corresponding orifices 24, are predetermined so, that the orifices 24 will be disposed in an annular series, the axis of which is preferably in the plane of the two electrodes 13 and 16, and approximately bisects the angle therebetween; and so that the line of discharge from the nozzle pieces 23 will all approximately converge at a point on the said axis and considerably above the apex of the angle between the electrodes, such a point being indicated at 30.

Thus while the oxygen is discharged from the orifices 24 in the form of individual jets or streams, the several jets define a conical surface of oxygen gas, and when the pre-heater 27 is employed and energized, a cone of preheated oxygen gas.

In the operation of the torch above described, an arc is struck between the electrodes 14 and 16 and the hydrogen gas discharge under pressure from the orifices 12 and 18 is ignited, thereby forming the atomic hydrogen flame indicated at 31, similar to that for atomic hydrogen torches, as heretofore constructed.

The oxygen is then admitted to the annular tube 22, preferably but not necessarily preheated by the heater 27 and thence outwardly through the orifice 24, forming the cone of oxygen gas above referred to. The cone of oxygen gas completely surrounds and covers the atomic hydrogen flame 31 and the surplus hydrogen is completely oxidized thereby, so that the resulting flame 32 is a molecular oxy-hydrogen flame, that is to say, a non-reducing or oxidizing flame.

I find, that by supplying an excess of oxygen to the molecular oxy-hydrogen flame 32, as hereinabove described, the reducing action of the atomic hydrogen flame 31 can be successfully counterbalanced.

The annular tube 22 and the nozzle pieces 23 are preferably formed from material resistant to the effects of the preheated oxygen and the heat, which may be communicated thereto, and I find, that fused silica is a suitable refractory material for this purpose. Whereas I have shown the heater 27 as disposed around the supply pipe 25, it will be clear, that it may be wound on portions of the tube 22, or the nozzle pieces 23, or the oxygen may be preheated in any other suitable manner.

To suitably dispose the annular tube 22 relative to the electrodes and discharge orifices of the nozzles 8 and 15, I support the tube 22 in fixed relation thereto by one or more rigid supports 35 connecting the annular tube with the pipe 2.

As will now be clear, the flame 32 may be projected upon any work or to perform any operation, when exceedingly high temperature is required, particularly where an oxidizing or non-reducing atmosphere is desirable, and thus the advantages of the atomic hydrogen flame may be enjoyed in uses, where it has hitherto been prohibited.

For example, I have found, that the atomic hydrogen flame, when employed to surface glazing of refractory ware, such as ware having a zirconium dioxide base, will discolor or darken the surface layer due to formation of lower oxides and even reducing the oxide to a metallic state and accompanied with corresponding brittleness and fragility and cracking. With the torch of my invention above described, however, such refractory oxides may be successfully glazed and do not show dark color, nor cracks, nor any other indications of lower oxides or metallic state.

Thus the flame produced by the torch of my invention may be employed to glaze refractory ware and other articles and refractory surfaces and to perform various sintering, fusing and melting operations in the various arts, particularly where it is desirable that such operations be performed without introducing into the work substances in the nature of impurities.

In my copending application Serial No. 671,148 filed May 15, 1933, I have described a process for making refractory articles from zirconium dioxide mixed with selected oxides. According to the method described in that application, such articles can first be molded from a granular or powdered mixture of the said oxides, and then the mass may be fused and melted to form a solid article; and as also described in that application, refractory material of superior qualities may be made by mixing together in granular or powdered form zirconium dioxide and one or more selected oxides, and the mass of granular or powdered material thus made may be fused and melted together into a mass of the refractory material, which may subsequently be used to make articles and ware.

In either of these processes of making articles, or of making the refractory material, the necessary heat may be provided by the torch described in this application, the oxidizing or non-reducing character of the flame rendering it ideal for this purpose, inasmuch as it is highly important, that the refractory material, or the refractory articles, be heated in a manner not to introduce thereinto any substance in the nature of impurities.

As an alternative mode of operation, the oxygen supplied to the nozzle pieces 23 may be charged with oxide or metal dust, which upon coming in contact with the flame is melted and may, by being directed upon the work, be spread or piled up in a molten layer where desired. Highly refractory oxide, such as zirconium dioxide, or compounds thereof, or dust made from the same material as the refractory being heated, may be employed in this manner.

Thus by suitably directing the flame upon previously formed refractory articles, their surfaces may be glazed, or layers may be deposited thereon, or shapes may be built up by the deposited layers.

My invention is not limited to the exact details of construction of the apparatus described above nor to the exact steps of process described herein. Many changes and modifications may be made without departing from the spirit of my invention nor sacrificing its advantages and within the scope of the appended claims.

I claim:

1. In an apparatus for producing high temperature flames, means for producing an electric arc, means for blowing hydrogen over the arc to ren-

der it atomic and to produce a flame, and means for encircling the flame with an excess of oxygen to render it oxidizing or non-reducing.

2. An apparatus for producing high temperature non-reducing flames comprising means for producing a joint atomic hydrogen and electric arc flame, and a flame encircling layer of oxygen.

3. An apparatus for producing high temperature non-reducing flames comprising means for producing a joint atomic hydrogen and electric arc flame and a flame envelope of oxygen.

4. An apparatus for producing high temperature non-reducing flames, means for producing a joint atomic hydrogen and electric arc flame and means for mixing oxygen with the flame and for enveloping the flame with oxygen.

5. In an apparatus for producing an oxidizing or non-reducing flame of high temperature, means for blowing hydrogen through an electric arc to produce a reducing flame and means for blowing oxygen into the flame thus produced and around the flame to envelop it to render the flame non-reducing.

6. In an apparatus for producing high temperatures, a pair of nozzles and a pair of electrodes, means for producing an arc at the electrodes, the nozzles being disposed to direct hydrogen supplied thereto under pressure, through the arc to produce a flame, a plurality of nozzles disposed to direct oxygen supplied thereto under pressure from the nozzles in a plurality of jets to envelope the flame.

7. In an apparatus for producing high temperatures, a pair of nozzles and a pair of electrodes, means for producing an arc at the electrodes, the nozzles being disposed to direct hydrogen supplied thereto under pressure, through the arc to produce a flame, a plurality of nozzles encircling the hydrogen nozzles disposed to direct oxygen supplied thereto under pressure from the nozzles into the flame.

8. In an apparatus for producing high temperatures, a pair of nozzles and a pair of electrodes, means for producing an arc at the electrodes, the nozzles being disposed to direct hydrogen supplied thereto under pressure, through the arc to produce a flame, a plurality of nozzles disposed to direct oxygen supplied thereto under pressure from the nozzles in a plurality of jets to form a generally conical envelope around the flame.

9. The process of fusing and melting refractory material which includes forming an electric arc between a pair of electrodes, effecting a flow of hydrogen through the arc to produce an atomic hydrogen flame, concurrently effecting a flame enveloping flow of oxygen to render the flame oxidizing or non-reducing, and applying the heat thereof to the material.

10. The process of fusing and melting refractory material composed of zirconium dioxide or a mixture of zirconium dioxide and other oxides in an oxidizing atmosphere without introduction of any substantial amount of impurities, which includes forming an electric arc between a pair of zirconium metal electrodes, effecting a flow of hydrogen through the arc to produce an atomic hydrogen flame, concurrently effecting a flame enveloping flow of oxygen, thus counter-balancing the reducing action of the atomic hydrogen, and applying the heat thereof to the material.

11. The process of fusing and melting a refractory material comprising an oxide or mixture of oxides and in an oxidizing atmosphere and without introduction of any substantial amount of impurities which includes subjecting the material to the heat of an atomic hydrogen flame in combination with an oxygen blast encircling the flame so as to counter-balance the reducing action of the atomic hydrogen flame.

12. The process of fusing and melting a refractory material composed of an oxide or a mixture of oxides and in an oxidizing atmosphere and without introduction of any substantial amount of impurities which includes subjecting the material to the heat of an atomic hydrogen flame or flames in combination with a stream or streams of hot oxygen thus counter-balancing the reducing action of the atomic hydrogen.

13. The method of producing a high temperature flame which includes forming an arc between a pair of electrodes, blowing hydrogen over the arc to render it atomic and enveloping the atomic hydrogen flame in oxygen to render the molecular hydrogen flame oxidizing and non-reducing.

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