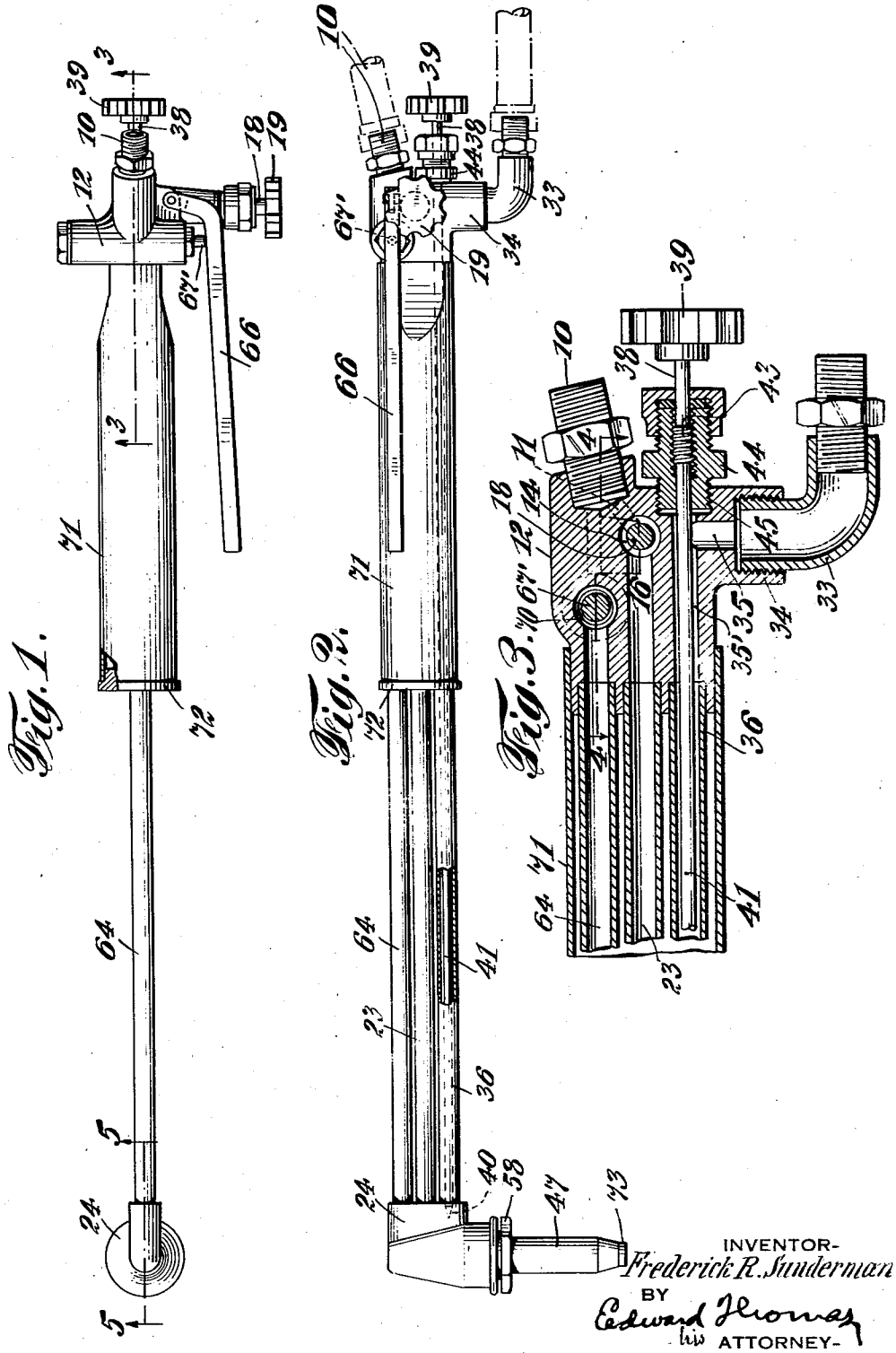
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TORCH

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TORCH

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Fig. 4.

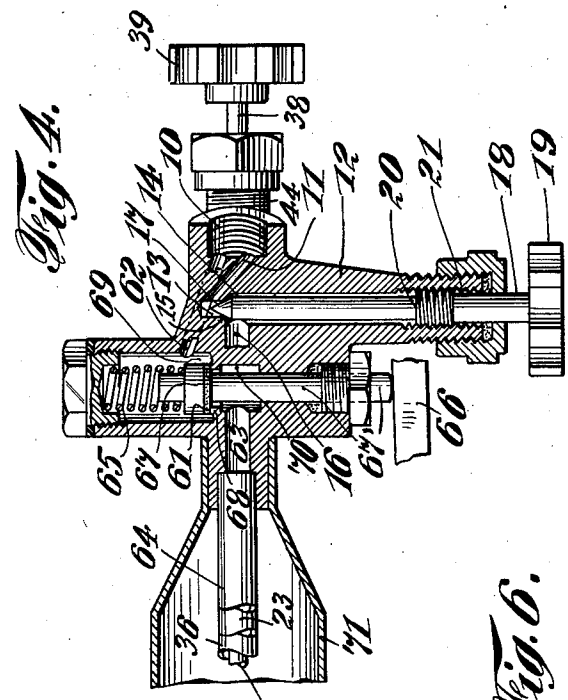


Fig. 6.

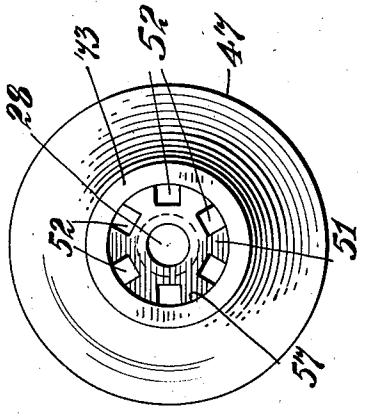
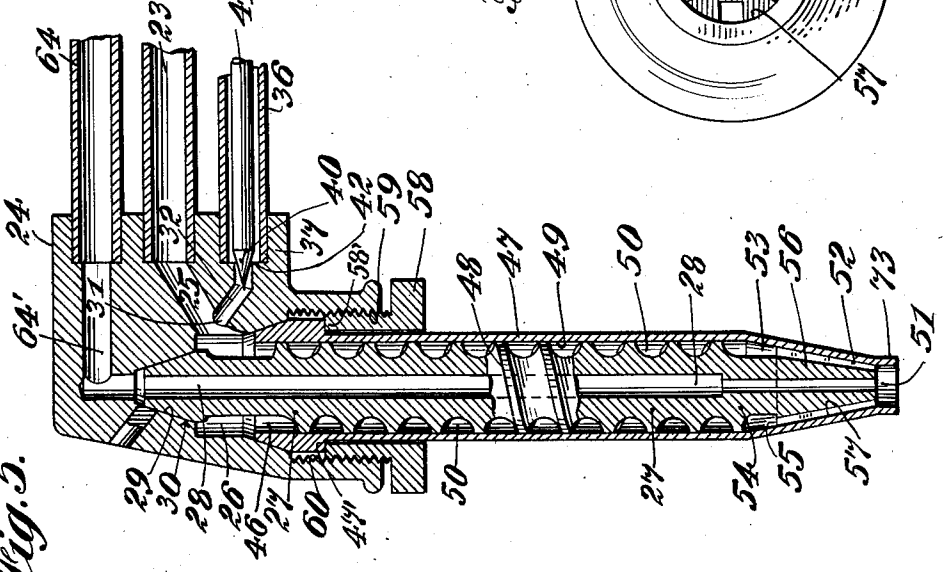


Fig. 5.



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1,991,638

TORCH

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Application April 27, 1932, Serial No. 607,733

8 Claims. (Cl. 158—27.4)

This invention relates to torches suitable for metal cutting, and is herein illustrated as embodied in a torch adapted to cut iron by means of acetylene or gasoline, vaporizing the gasoline, when that is used, and burning it with oxygen. By using the torch head or nozzle of the present invention it has been found possible to so burn with fairly high pressure oxygen, a mixture of oxygen and liquid hydrocarbon vapor, gasoline vapor, that a flame is obtained having substantially all the advantages of the oxy-acetylene flame, thus avoiding the expense of acetylene and also avoiding the use of such a highly explosive material as the acetylene. Moreover the torch of the present invention provides a gasoline flame cheaper than and more efficient than acetylene.

The torch nozzle is shown as so constructed that no separate flame is needed for preheating the burning mixture if gasoline is used. When the nozzle is in use it becomes very hot from the heat reflected from and radiated from the highly heated metal which is being worked on, and the hot nozzle effectively heats the gasoline-rich mixture with the result that maximum efficiency is obtained. Preheating is unnecessary because there is a tortuous or spiral passage in the burning nozzle in which the vapor or gas, still not a burning mixture, remains a relatively long time and is turbulent, though not superheated. The form of nozzle illustrated includes a solid member having a central bore and having on the outer surface of the solid member a deep-cut screw thread so that an acetylene-rich or a gasoline-rich mixture flows through the spiral passage formed between the threads and the outer cylindrical member of the nozzle against which the summit of the screw thread bears. The outer cylindrical member of the nozzle is shown as terminating in a skirt which projects beyond the solid member and surrounds the base of the issuing flame. The torch is light, easily assembled, and the nozzle is well adapted to be rapidly replaced and sold separately.

Other features and advantages will hereinafter appear.

In the accompanying drawings:

Figure 1 is a top or back view of one form of torch handle and adjacent parts.

Figure 2 is a side view of the parts shown in Figure 1.

Figure 3 is an enlarged sectional view of part of Figure 2, taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged sectional view on the line 4—4 of Figure 3.

Figure 5 is a sectional view of the nozzle and some adjacent parts.

Figure 6 is a face view of the end of the nozzle.

In the form of the invention herein illustrated oxygen gas comes from a high pressure main 10 connected to any suitable source, as a cylinder, not shown. The oxygen flowing from the high-pressure main 10 enters a bore 11 in the casting 12 and is led from the bore 11 through a side bore 13 into the side of a small chamber 14 which opens at 15 into the side of the low-pressure oxygen feed passage 16.

To reduce the pressure the opening 15 may be nearly closed by the conical head 17 of a valve stem 18. The stem 18 is provided with a knurled head 19 adapted to turn the threaded part 20 of the stem 18 in a thread 21 in the casting 12, so that the flow of oxygen past the conical head 17 may be controlled or it may be shut off, if desired. Thus high pressure oxygen entering at the main 10 may be low pressure as it leaves the opening 15, and also may be low speed as compared with the high speed of the oxygen in the main 10.

The feed passage 16 leads the oxygen, to a low speed oxygen pipe 22, threaded into the casting 12 and terminating in a passage 23 in an angle casting or head 24. The passage 25 is shown as leading angularly downwardly at 25 to a circular chamber 26 surrounding a solid copper tip member 27.

The member 27 is provided with a central bore 28 through which comes high speed oxygen, in a manner to be later described, and is provided with a conical face 29 which fits against a conical face 30 in the angle casting 24.

Just before the low pressure oxygen leaves the downwardly sloping passage 25 it is shown as passing the open end 31 of an upwardly sloping gasoline conduit 32 where it picks up gasoline as vapor. To provide the supply of gasoline at this point there is provided in the casting 12 a gasoline inlet elbow 33 threaded into a socket 34 with a central passage 35 opening into the side of a gasoline supply passage 35' in the casting 12. The gasoline flows through the passage 35 under high pressure into the end of a tube 36 which extends to the casting 24 and is there swaged into a socket 37 of the casting 24 so that the gasoline coming through the tube 36 flows directly into the sloping conduit 32.

To control the flow of gasoline in the conduit 32 so that it issues as an atomized fog there is shown mounted in the casting 12 a rotatable valve

stem 38 having a wheel 39 adapted to shift the conical head 40 of the valve stem or rod 41 toward or from the shoulder 42 at the base of socket 37 with the result that the flow of gasoline in the conduit 32 is checked or runs freely.

To effect this adjustment of the valve stem the rod 41 is shown as provided with a thread 43 threaded into a long cap 44 which in turn is threaded into a socket 45 in the casting 12 at the end of the passage 35, so that the straight stem 41 extends from the handle 39 to the conical end 40, rendering adjustment accurate and conveniently located at the handle away from the torch head. At the same time no large pool of gasoline exists between the valve seat and the vaporizing point.

The low-pressure oxygen, carrying gasoline vapor flows from the chamber 26 through a short annular opening 46 between the member 27 and a heavy copper shell 47, toward the tip until it meets an inverted half round thread 48, shown as cut 4 to the inch on the member 27, and engaging the cylindrical interior 49 of the shell 47, with the result that the low pressure oxygen is carried, in the unobstructed spiral passage 50 formed by the thread 48, several times around the member 27. As a result the gasoline carried in the low-pressure oxygen is thoroughly mixed ready for combustion and vaporized by a little heat it absorbs from the shell 47, member 27 and thread 48, which are somewhat heated by the heat of the flame at the flat faced end 51, and by the heat radiated from the work pieces against which the flame impinges.

Before entering the passages 52 in the member 27, by which the gasoline-laden low-pressure oxygen issues, the gasoline-laden oxygen enters an equalizing chamber 53 between the end 54 of the thread 48 and an inner abutment 55 on the member, 27, where it is swirled around, and then issues through the six heating passages 52 which lie within the head 56 formed by the abutment 55 and the end 51 of the head, and converge at a considerable angle, from about $\frac{3}{8}$ inch to about $\frac{5}{32}$ in $\frac{7}{8}$ of an inch, in the nozzle shown, so that the vapor is in close contact with hot metal.

The passages 52, are shown as square grooves cut in the tapering head 56, while the rest of the tapering head fits close against the internal face of the tapering head 57 of the shell 47. The passages 46 of the device shown are about $\frac{1}{32}$ inch square, and together they have about one-fourth the gas feeding capacity of the spiral passage 50, the latter being found satisfactory if half round and $\frac{5}{8}$ inch in diameter.

To hold the member 27 in place its head 56 fits close against the interior of the head 57 when the latter head is brought into place by screwing down a nut 58 threaded at 59 on its periphery so as to screw into the threaded opening 60 of the casting 24. When the nut 58 is screwed down, its end 51' thrusts upon a shoulder 47' of the shell and thrusts and seats the conical end 29 of the shell against the cone face 30 of the casting which extends from the circular chamber 26. The parts are so proportioned that the cone end 29 of the member 27 and the cone end 56 of the shell 47 seat themselves closely and simultaneously.

The high speed oxygen comes to the bore 28 from the high pressure main 10 through a spring-closed valve 61 lying between a passage 62 from the main 10 and the high speed oxygen passage 63 which resembles the passage 36 and delivers oxygen through the tube 64 to a right angled passage 64' in the casting 24, which in turn terminates at the cone face 30 so that the oxygen enters the bore 28. The bore 28 has been found satisfactory if $\frac{1}{8}$ inch diameter, for the major part of its length and terminating in a passage $\frac{1}{8}$ inch diameter for a considerable length. This passage was in a copper member 27 having a body about three inches long and $\frac{7}{8}$ inch diameter from the outside of thread 48 to outside of thread 48.

The valve 61 is normally held closed by a spring 65 and is adapted to be opened by a pivoted pressure lever 66 adapted to lift the piston 67 which seats on an annular floor 68 around the chamber 69 through which passes a piston rod 67' by which the lever 66 actuates the piston. When thus lifted the oxygen flows from the main 10 through the passage 62, chamber 70 and tube 64. The lever 66 is adapted to be grasped by the hand of the operator which is holding the torch by a hollow casing 71 surrounding the tubes 64, 36 and 23 for a convenient distance, and which may be suitably supported by closely fitting the casting 12, and engaging a shouldered plate 72 slipped on to the passage tubes 64, 36 and 23. It is found satisfactory to screw the tubes 64, 23 and 36 into the casting 12 and braze them into the casting 24.

The shell 47 of the tip may be extended as a hot cylindrical final vaporizing skirt 73 projecting from its cone shaped end so as to surround the base of the flame or oxygen and vapor or gas as it issues from the passages 52 in the copper member 27.

A skirt 73 one-eighth inch deep has been found to cause the torch flame to be more of a blue color than is obtained by a nozzle without the skirt.

It is found that excellent cutting results are obtained when the gas in the low-speed line carries about 60% oxygen and 40% gasoline vapor.

Under standard conditions a given tip of the present invention cut thirty inches of a $\frac{5}{8}$ steel plate in a minute, as against a cut of eighteen to twenty inches with a prior acetylene torch. The torch of the present invention was found to be a universal torch, adapted to burn acetylene, and under the same conditions the torch burning acetylene cut twenty five inches of the same steel in a minute. Under these conditions, even after steady use for hours, the head of the torch, including much of the tip is cool enough to be handled.

Having thus described certain embodiments of the invention, what is claimed is:

1. A torch having a tip member adapted to vaporize and burn gasoline, a handle remote from the tip, a head including three passages and holding the tip and adapted to receive a burnable liquid through one of said passages, a low pressure oxidizing gas through another of said passages, a high pressure oxidizing gas through the third of said passages, tubes connecting the passages with the handle, a valve in the head for closing the first said passage, a shell around the tip, screw threads on the tip forming helical passages closed at the top by the shell and bounded by the screw threads. and a finger piece in the handle for operating the valve.

2. A liquid fuel torch having a burner nozzle provided with a longitudinal passage for a cutting gas, and a spiral liquid fuel vaporizing conduit surrounding the longitudinal passage, and a series of discharge passages grouped about the discharge end of the longitudinal passage and communicating with the discharge end of the spiral conduit, the combined cross-sectional area

of said discharge passages being materially less than that of the vaporizing conduit.

3. A liquid fuel torch having a burner nozzle provided with a longitudinal passage for a cutting gas, and a spiral liquid fuel vaporizing conduit surrounding the longitudinal passage, and a series of discharge passages grouped about the discharge end of the longitudinal passage and communicating with the discharge end of the spiral conduit, the combined cross-sectional area of the discharge passages being materially less than that of the vaporizing conduit, and an equalizing chamber located between and connecting said spiral vaporizing conduit with the discharge passages.

4. A liquid fuel torch comprising a head having an opening and three inlet passages communicating with the opening, a burner nozzle fitted in the opening and provided with a longitudinal passage communicating with one of the passages of the head, and also provided with a vaporizing conduit communicating with the two other inlet passages of the head, one of said last named passages being a liquid fuel passage and provided with a valve seat, a handle connected to and remote from the head, a needle valve in the liquid fuel passage and cooperating with the valve seat therein, valve means provided upon the handle for controlling a supply of oxidizing gas to the other two passages in the head, and means on the handle for adjusting the needle valve.

5. A burning nozzle for a liquid fuel torch including a base member having an opening to receive an oxidizing gas, and having a second opening to receive a liquid fuel, and also having a third opening having a frustro-conical face, a tip member with a frustro-conical face and having a passage within it and lying in the third opening in the base member so as to fit its passage to the first opening, a shell having a frustro-conical face fitting over the tip member in the third opening and surrounding the tip to form an unbroken passage between it and the tip extending from the second opening to the end of the tip, the tip member forming with the shell a continuous tortuous passage of substantially uniform area a shoulder on the shell, and a removable device screwed down against the shell for holding the shell in place.

6. A burning nozzle for a liquid fuel torch including a shell adapted to be heated by radiation from a work piece being worked on, and a tip member within the shell and provided with a circular series of separated straight grooves at the discharge end of the nozzle each adapted to project a separate stream gas to be burned, said tip member carrying ribs, forming with the shell a continuous tortuous passage of substantially uniform area with a cross-section larger than the sum of the areas of the straight grooves and occupying substantially the periphery of the tip, so that all the gas travels through tortuous passage and is somewhat heated by the radiated heat transmitted by the shell, and said ribs terminating short of the straight grooves, and an equalizing chamber for the gas between the discharge end of the tortuous passage and the inlet ends of the straight grooves.

7. A burning nozzle for a liquid fuel torch including a shell adapted to be heated by radiation from work-pieces being worked on, and a tip member within the shell and provided with a circular series of separated straight grooves at the discharge end of the nozzle each adapted to project a separate stream of gas to be burned, said tip member also having a screw thread forming with the shell a passage having an area larger than the sum of the areas of the straight grooves and occupying substantially the periphery of the tip but terminating short of the straight passages, and an equalizing chamber between and communicating with the thread and the straight passages, so that gas is heated and droplets in the gas are vaporized to gas in the screw passage and then the gas is projected through the straight passages.

8. A torch for cutting and welding metals and the like comprising a circuitous vaporization chamber formed with an outer cylindrical wall, means for supplying and metering liquid fuel to said chamber, means for supplying oxygen to said chamber to be mixed with said fuel during vaporization thereof to produce a uniform combustible mixture, said fuel metering means being adjacent said chamber, a burner head for said torch in metallic connection with the outer wall of said chamber, a tip positioned within said head, the walls of said head surrounding and extending beyond said tip, means for delivering a stream of oxygen for cutting purposes, and means for delivering said combustible mixture to said tip, said head serving to conduct heat from the flame to the outer wall of said vaporization chamber.

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