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UNITED STATES PATENT OFFICE.

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GAS FOR BLOWPIPE USE.

No Drawing.

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To all whom it may concern:

Be it known that I, JOHN HARRIS, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Gases for Blowpipe Use, of which the following is a full, clear, and exact description.

This invention relates to gases adapted and intended to be employed with blow pipes or torches as for example in the welding or cutting of metals, and the general object of the invention is to produce a gas possessing high efficiency in operation and great economy in use.

It was originally proposed to employ hydrogen alone as the combustible element in blow pipe gases, but pure hydrogen offers certain disadvantages, one of which is its great intensity of combustion which concentrates the flame into a very small space. A further disadvantage is that all parts of the flame are colorless, thus rendering it impossible for any but the most skilled operator to adjust the flame with reference to the air or oxygen admitted, or to apply the same in proper position to the work performed.

It has been proposed to impregnate the hydrogen with certain hydrocarbons which by reason of their slower combustion should spread the flame more widely and which by reason of their visible combustion should define the position of the reducing cone and thus assist both the adjustment of the gas supply and in the application of the flame to the work. However the admixture of hydrocarbon entails two decided disadvantages: first, the very low flame temperature which most of them produce which impedes the operation of the torch or blow pipe even when used in a mixture with hydrogen; and second, their complicated molecular structure, which necessitates a great preponderance of oxygen in order to consume the same. For example ten cubic feet of hydrogen can be completely consumed by five cubic feet of oxygen at the same pressure; but ten cubic feet of methane (CH₄) at the same pressure will require twenty cubic feet of oxygen for its complete combustion; ten cubic feet of ethane (C₂H₆) will require thirty five cubic feet of oxygen; and ten cubic feet of benzene (C₆H₆) will

require seventy five cubic feet of oxygen for its complete combustion. However these gases can be used successfully in admixture with hydrogen if restricted to a sufficiently small percentage of the whole as by being previously mixed with a suitable combustible vehicle of low molecular complexity, small oxygen consumption and high flame temperature.

I have found that a mixture of hydrogen within from 10% to 50% of ordinary artificial illuminating gas will serve excellently well as a cutting gas and even to some extent as a welding gas where the requirements are not too severe. Such illuminating gas may be either that known as "coal gas" or that known as "impregnated water gas". The former is made by the destructive distillation of soft coal either in gas retorts or in by-product coke ovens; the latter is made by passing steam through incandescent coke, forming a mixture of hydrogen and carbon monoxide, and then carbureting or "impregnating" such mixed gases with hydrocarbon oils whereby the same is fitted to burn with a luminous flame. For cutting and welding purposes, the two gases are very similar in their properties as is shown by the following comparison:

	Water gas.	Coal gas.
C ₆ H ₆	.5	.5
C ₂ H ₂	11.8	4.3
CO.....	31.3	8.0
H ₂	36.1	47.0
CH ₄	12.6	36.0
C ₂ H ₆	2.3	0.0
O ₂	.4	.4
N ₂	2.3	2.2
Candlepower.....	23.7	16
Calorific value.....	670 B. t. u.	647 B. t. u.

The main divergence lies in the CO content, which, however, acts much the same as hydrogen, consuming the same quantity of oxygen and yielding approximately the same flame temperature.

I preferably mix these gases with hydrogen in the proportion of

Hydrogen..... 90% to 50%
Artificial illuminating gas
as above..... 10% to 50%

The gases may be mixed in the proportions stated before being compressed and stored for use, or the same may be admitted simultaneously into the torch from two sep-

arate receptacles or supply sources by adjusting the valves so as to pass the same at substantially the proportions indicated.

By using either of the two gases in the proportions specified, I am enabled to obtain a large flame volume and with the production of a correspondingly large number of heat units, the flame volume and heat units being proportional to the percentage of the gas mixed with the hydrogen. If at the low limit of 10%, the mixture of hydrogen with either of these gases enables me to cut and weld quickly, to preheat large metal masses, such as castings, in such manner as to compensate for the loss of heat due to conduction by such masses. Furthermore, as the amount of the gas mixed with the hydrogen is increased, the resultant flame is still better adapted for the purposes specified as well as for the cutting of deep slots in heavy masses of metal and the cutting of dirty or corroded metals.

Having thus described my invention what I claim is:—

1. A gas for cutting and welding purposes comprising a mixture of hydrogen with from more than 10% and not more than 50% of

carbureted water gas of substantially the following composition

C_6H_6 -----	.5	parts by volume.	30
C_nH_{2n} -----	11.8	" " "	
CO-----	31.3	" " "	
H_2 -----	36.1	" " "	
CH_4 -----	12.6	" " "	
C_2H_6 -----	2.3	" " "	35
O_2 -----	.4	" " "	
N_2 -----	2.3	" " "	

2. A gas for cutting and welding purposes comprising a mixture of hydrogen with from 15% to 50% of carbureted water gas of substantially the following composition

C_6H_6 -----	.5	parts by volume.	
C_nH_{2n} -----	11.8	" " "	45
CO-----	31.3	" " "	
H_2 -----	36.1	" " "	
CH_4 -----	12.6	" " "	
C_2H_6 -----	2.3	" " "	
O_2 -----	.4	" " "	50
N_2 -----	2.3	" " "	

In testimony whereof, I hereunto affix my signature.

JOHN HARRIS.