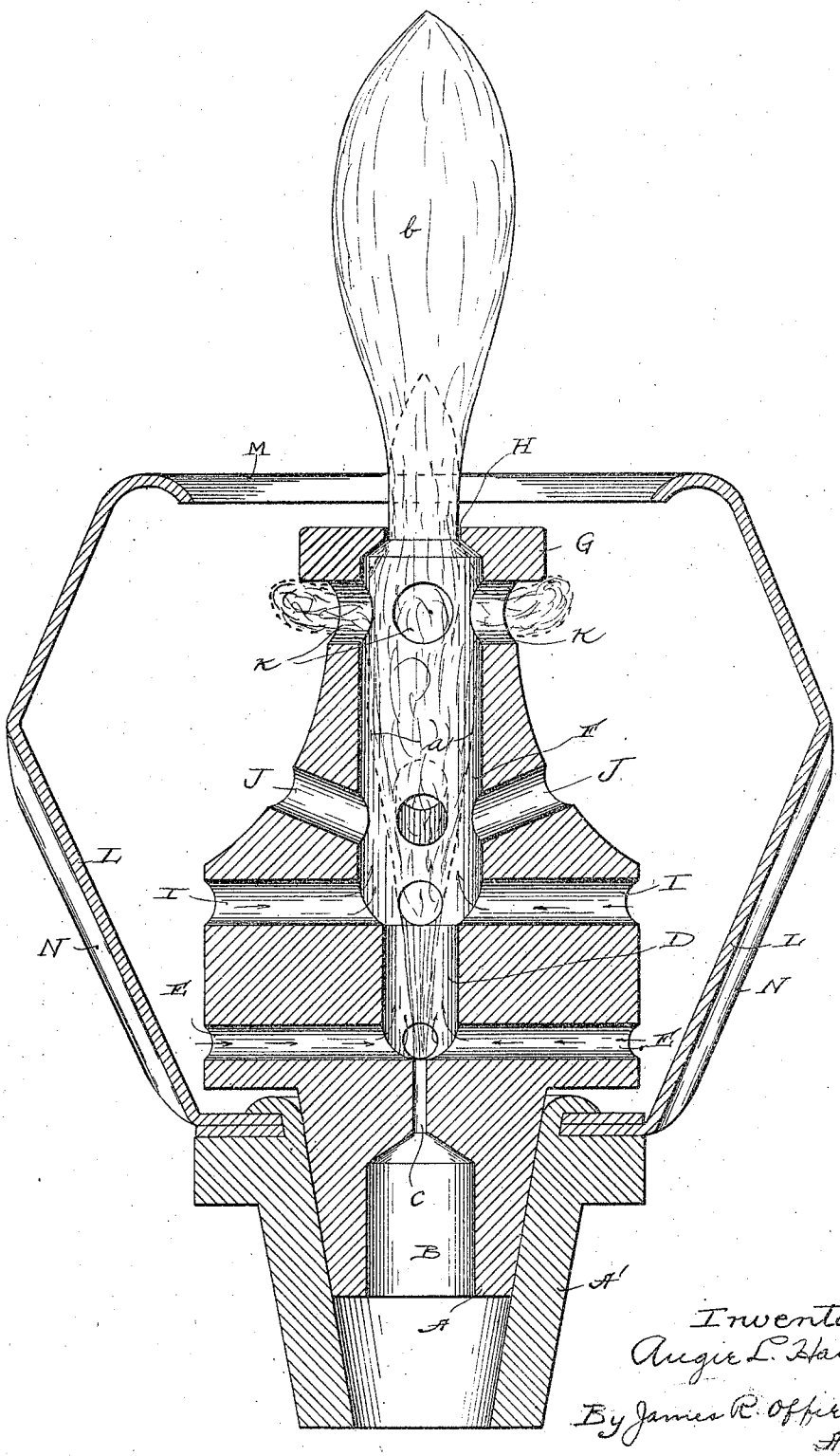
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BURNER TIP FOR ACETYLENE AND SIMILAR HYDROCARBON GASES

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1,296,506. Patented Mar. 4, 1919.



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BURNER-TIP FOR ACETYLENE AND SIMILAR HYDROCARBON GASES.

1,296,506. Specification of Letters Patent. Patented Mar. 4, 1919.

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To all whom it may concern:

Be it known that I, AUGIE L. HANSEN, a citizen of the United States, and a resident of Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Burner-Tips for Acetylene and Similar Hydrocarbon Gases, of which the following is a specification.

My improved burner tip has been developed particularly for use with acetylene gas but it may be used in connection with other hydrocarbon gases and particularly those which are rich in carbon and with which carbonization presents practical difficulties.

My object is to provide a tip by which the flame if accidentally extinguished will be automatically and immediately relighted. A further object is to provide a tip by which a highly efficient illuminating flame may be secured having the property to a marked extent of resisting the tendency to become extinguished by sudden currents or more or less continuous drafts of air. A further object is to provide a tip that is simple and compact in construction and entirely certain and durable in operation. I have developed my improved tip particularly for use in connection with so-called acetylene miners' lamps. These lamps are small, light structures adapted to be carried on the caps of miners and provided with a carbid container supplied with about an ounce and a half of carbid, and with a water receptacle above the same by which water in very small quantity is fed to the carbid so as to generate acetylene gas, the latter being conveyed to a small burner surrounded by a reflector and located on the outside of the water receptacle. Although these miners' lamps are very small and compact and the conditions under which they operate are apparently unfavorable, they burn with astonishing regularity for from two to two and a half hours for each charge, generating the acetylene gas at a pressure of about an inch and a half of water, although sometimes the pressure varies quite widely from the normal figure. Other miners' portable lamps using calcium carbid of a larger type, adapted to be carried by hand or supported from the timbers of the mine, are used, operating on the same general principle but with larger charges of water and carbid so as to burn for a full shift of from ten to twelve hours. In mines where open flame lamps can be safely used the acetylene lamp has found a large field, owing to its lightness, convenience, safety, economy of operation and superior illumination. Owing, however, to the small pressures used the flames are relatively sensitive and in consequence whenever blasting takes place in the mines, the momentary increased pressure is very likely to extinguish the flames by backing up the gas in the tip. This necessitates re-lighting the lamps, which operation may sometimes have to be performed a great many times a day. Furthermore, in mine operations there are drafts and blasts of air constantly circulating due to opening and closing of air traps, the passage of trains and conditions arising from artificial ventilation and other causes, and these conditions also result in frequently extinguishing the flames, requiring re-lighting. With my improved tip I cause the burning gas to develop sufficient heat in a body of refractory material located sufficiently close to the gas stream as to cause the same to be ignited in case the flame has become extinguished. I am, of course, aware that so-called re-lighting devices have been heretofore suggested in which a body of refractory material has been located very close to the flame so as to become heated thereby and operate to relight the gas stream if the flame is extinguished, but such devices have not been commercially successful for the reason that the re-lighting device being out-side of the path of the gas stream fails to re-light the latter under ordinary conditions. With such a device it would be impracticable in the burning of acetylene or similar gas to locate the body of refractory material so close to the gas stream as to provide for effective re-lighting because in that case it would be located within the flame, which would cause it to be rapidly coated with carbon so as to impair its heating properties, and at the same time interfere with the illumination. If such an igniting device were in the form of a ring through which the flame projected it would soon become entirely closed by the accummulation of carbon. With my improved burner tip

I have discovered that it is possible to burn acetylene gas in two distinct but connected zones, the first being used for heating the re-lighting element without carbonization so that it may be located as a ring through which the gas stream passes, and the second providing for the necessary illumination. In other words, with my improved burner tip I cause the gas to be first burned as a non-illuminating, non-carbonizing blue flame which comes into contact with the re-lighting device made of refractory material so as to heat the same, and from there on the gas is burned as a luminous flame corresponding substantially to those now employed. This method of burning acetylene is claimed in my co-pending application Serial No. 133,316, filed November 25th, 1916. I prefer to construct my improved burner tip of so-called lava or other refractory material having a very fine orifice through which the gas stream projects and in advance of which is a heating chamber formed with an opening at its extreme end considerably larger than the gas orifice. Between the heating chamber and the gas orifice the bore is somewhat increased over the latter, and intakes are provided to feed to the gas a limited supply of air to produce a Bunsen effect. The resulting blue flame is thereupon projected through the heating chamber and escapes through the opening at the end thereof. I also prefer to provide the walls of the heating chamber with openings by which an additional supply of air may be introduced therein and which appears to combine with the blue flame within the heating chamber so as to increase the heating effect. I find by actual experiment that if an added supply of air is not introduced to the blue flame within the heating chamber the heating effect is not so pronounced as when this is done, and there is also danger of carbonization around the mouth of the tip, particularly if the gas pressure is low. The outer end of the tip is preferably formed as a bead or button which becomes highly heated by the blue flame and which constitutes the re-lighting device and serves to strengthen the tip. In practice I find that this enlargement at the end of the tip frequently becomes red hot so as to glow and it operates very effectively to relight the flame should it become extinguished. Preferably I form a series of openings in the wall of the heating chamber immediately below this enlargement which openings by restricting the paths of heat conduction permit the enlarged end to be heated more effectively. Under some conditions very small tongues from the blue flames are forced out through these latter openings in operation so as to increase the heating effect.

In order that my invention may be better understood, attention is directed to the accompanying drawing, showing a sectional view on a greatly enlarged scale of a burner tip suitable for a miner's lamp, and embodying my present improvements. Although the tip illustrated in the drawing has been designed particularly for use with an acetylene miner's lamp, it should be understood that it may be employed for other purposes, and that the tip may be suitably modified and changed in proportions according to the use to which it is to be put, and the character of the hydrocarbon or other gas to be burned therein. The tip is made of any suitable refractory material, preferably the so-called lava, of which gas tips are now made.

It comprises a nipple A by which the tip is frictionally carried in a tapered bushing A′, the latter being supported frictionally in the usual way within the outer end of the gas pipe. The nipple is formed with a bore B and with a very small gas orifice C, the diameter of which determines the capacity of the tip. Above the orifice C is a larger passage D into which lead the air openings E, E to supply a limited amount of air to the gas stream projected through the orifice C, thus producing a so-called Bunsen effect, the gas stream being ignited immediately above the mouth of the enlargement D. The main portion of the tip comprises the heating chamber F having tapered walls as shown so as to be as strong as possible, and at the extreme end is formed with a bead or button G. The outer end of the heating chamber is contracted as shown, forming an opening H, through which the blue flame projects and above which the luminous flame is formed. An additional supply of air is introduced within the heating chamber through openings I and J, which may be located in any suitable way; and immediately below the bead or button G, I form other openings K which serve the purpose of restricting the path for the escape of heat from the bead or button so that the latter is more effectively heated and also permit small tongues from the blue flame to be forced out around the bead or button so as to increase the heating effect.

In the drawing I illustrate the blue flame in dotted lines by the letter *a*, and the luminous flame in full lines by the letter *b*. The indication of the blue flame is not intended to be precisely exact, because its conditions appear to be constantly changing according to the variations in pressure. Sometimes the blue flame appears to exist as a very thin pencil of substantially the same diameter throughout, located centrally in the heating chamber, and at times when the pressure is low it appears to swell outwardly so as to occupy the entire bore of the forward portion of the heating chamber and small tongues are forced out through the

openings K and it varies between these two extremes.

In order to protect the tip, especially when it is used with the miner's lamp, I prefer to make use of a guard as shown made of stamped metal and formed with two arms L, L, secured in any suitable way to the bushing A′ and with an integral ring or annulus M located slightly beyond the outer end of the tip as shown. The arms L are preferably stiffened by forming the metal into ribs N so that the entire guard constitutes a rigid strong skeleton frame by which the tip may be handled so as to be placed in position or removed and also protected from injury.

In operation assuming such a tip as I have described to be used with a miner's lamp and that gas under slight pressure is being forced through the minute orifice C, the gas stream will be ignited about the level of or slightly above the mouth of the enlargement D so as to burn as a blue flame within the heating chamber. When supplied with an additional amount of air, as described, the heating effect is very pronounced and in a short time the heating chamber will become very hot and the bead or button G will be intensely heated, sufficient to re-ignite the gas in case it becomes extinguished. The flame projects through the aperture H and beyond the tip it will burn as a luminous flame of great intensity, corresponding in all respects to the flames now used. I am not able to state positively what chemical action takes place in burning acetylene gas as I have above described in two distinct zones. It is possible that the combustion taking place in the heating chamber is an incomplete combustion which is completed outside of the tip to form the illuminating flame *b*. On the other hand, it is possible that a certain amount of unconsumed acetylene is carried with the blue flame through the tip and becomes ignited on the outside of the tip to form the luminous flame, or that both of these actions take place. Whatever may be the explanation of the phenomena, I find that I am enabled to obtain within the heating chamber a blue flame having little or no tendency to carbonization, which is sufficiently hot to raise the re-lighting device to the proper temperature and that after leaving the tip an illuminating flame is secured substantially corresponding in intensity and length to the usual standards.

In practice I have found that the best results are secured with a device having the features shown in the drawing; but obviously the tip may be varied to meet varying conditions of gas pressure, etc. It is desirable to contract the discharge from the heating chamber as shown, because in this way the best heating effect is secured. I find, however, that if the opening H is enlarged somewhat sufficient heating may be secured to re-light the flame. The size of this opening depends upon the gas pressure and the size of the flame desired, and should be small enough to secure a slight retardation of the flame within the heating chamber and not too large as to be ineffectively heated. The size and dimensions of the heating chamber also determine the heating effect and I have found by experiment that if the heating chamber is made too short it will be ineffectively heated. In actual practice I have made tips for acetylene miners' lamps embodying the present improvements only one-half of an inch in length from the discharge of the gas orifice C to the end of the tip and in which the length of the gas chamber is only three-eighths of an inch from its inner end to the end of the tip. Even with such small tips as these suitable for use with acetylene miners' lamps, but obviously capable of other use, the operations take place very perfectly and the flame re-lights immediately and automatically whenever it is extinguished. Not only does the improved tip provide means by which the flame will be automatically and immediately re-lighted if it becomes extinguished, but by causing the flame to be divided into two zones as shown and by confining the heating zone within a more or less closed chamber, the flame as a whole is effectively protected from blasts and drafts of air. In other words, I find that with a tip such as described when subjected to blasts of air, the flame instead of being immediately extinguished as is the case with present tips, is not only protected by the walls of the heating chamber, but may actually burn from one or more of the openings I, J, or K on the side of the tip opposite to the direction of the blast.

The tip could be made of other materials but is preferably of material which is heat retentive but which will not readily conduct heat. Material, commercially referred to as lava, and already mentioned herein, has these properties and is very desirable. In tips constructed of this material in accordance with my invention the head or bead becomes so hot and the heat is so retained that the gas will be re-ignited several seconds after extinguishment of the flame, whereas the base of the tip remains so cool that a match applied thereto will not ignite. This will prevent heating of supports or fixtures in which the tips are used.

Having now described my invention, what I claim as new therein and desire to secure by Letters Patent is as follows:

1. A burner tip for acetylene or similar hydrocarbon gas having a contracated orifice through which a gas stream is projected under pressure, and provided with a body

of refractory material with which the gas stream comes into contact or close proximity, air openings for supplying to the gas stream a limited supply of air so as to result in the production of a non-illuminating, non-carbonizing flame which heats the refractory body to the ignition temperature, the pressure being sufficient to force the flame beyond the heated refractory body where it is supplied with additional air so as to become luminous, substantially as set forth.

2. A burner tip for acetylene or similar hydrocarbon gas having a contracted orifice through which a gas stream is projected under pressure, and provided with an annular body of refractory material through which the gas stream is projected so as to come in contact with or close proximity thereto, and means for causing the flame as it projects through the annular refractory body to heat the same to the ignition point without substantial carbonization, as and for the purposes set forth.

3. A burner tip for acetylene or similar hydrocarbon gas having a contracted orifice through which a gas stream is projected under pressure, and provided with an annular body of refractory material through which the gas stream is projected so as to come in contact therewith or close proximity thereto, air openings for supplying to the gas stream a limited supply of air so as to result in the production of a non-illuminating, non-carbonizing flame which heats the annular refractory body to the ignition temperature, the pressure being sufficient to force the flame through and beyond the heated refractory body where it is supplied with additional air so as to become luminous, substantially as set forth.

4. A burner tip for acetylene or similar hydrocarbon gas comprising a burner in which the gas is supplied with a limited amount of air to produce a non-carbonizing flame, a heating chamber which will be heated thereby to the ignition temperature and a discharge from the heating chamber through which the flame is projected and beyond which it is supplied with additional air so as to become luminous, substantially as set forth.

5. A burner tip for acetylene or similar hydrocarbon gas comprising a burner in which the gas is supplied with a limited amount of air to produce a non-carbonizing flame, a heating chamber which will be heated thereby to the ignition temperature, air openings in the wall of the heating chamber to supply additional air to the flame therein and a discharge from the heating chamber through which the flame is projected and beyond which it is supplied with additional air so as to become luminous, substantially as set forth.

6. A burner tip for acetylene or similar hydrocarbon gas, having a contracted gas orifice through which a gas stream is projected under pressure, a heating chamber within which combustion of the gas stream begins and an enlarged button or bead at the end of the heating chamber and having an opening therein through which the flame projects and beyond which it is supplied with air to become luminous, substantially as set forth.

7. A burner tip for acetylene or similar hydrocarbon gas having a contracted gas orifice through which a gas stream is projected under pressure, a heating chamber within which combustion of the gas stream begins, an enlarged button or bead at the end of the heating chamber and having an opening therein through which the flame projects and beyond which it is supplied with air to become luminous, and a series of holes in the heating chamber adjacent to said button or bead, substantially as set forth.

8. A burner tip for acetylene or similar hydrocarbon gas having a contracted gas orifice through which a gas stream is projected under pressure, a heating chamber within which combustion of the gas stream begins, a plurality of air openings in the heating chamber for supplying air to the flame therein, an enlarged button or bead at the end of the heating chamber and having an opening therein through which the flame projects and beyond which it is supplied with air to become luminous, substantially as set forth.

9. A burner tip for acetylene or similar hydrocarbon gas, comprising an elongated chamber, the walls of which are made of refractory material, a contracted gas orifice leading into the heating chamber at one end and supplied with gas under pressure, means for supplying a restricted amount of air around the gas stream whereby a blue flame is secured on the surface of the stream of gas to thereby heat the walls of the heating chamber to ignition temperature and a discharge from the heating chamber through which the flame projects and beyond which it receives additional air so as to become luminous, said discharge being so proportioned as to conform approximately to the shape and size of the blue flame at the point where it leaves the heating chamber, as substantially set forth.

In witness whereof I hereunto subscribe my name this 22nd day of November, A. D. 1916.

AUGIE L. HANSEN.