No. 885,903. PATENTED APR. 28, 1908.

E. H. AMET.

METHOD OF PRODUCING GAS.

APPLICATION FILED JAN. 21, 1907.

Fig. 1.

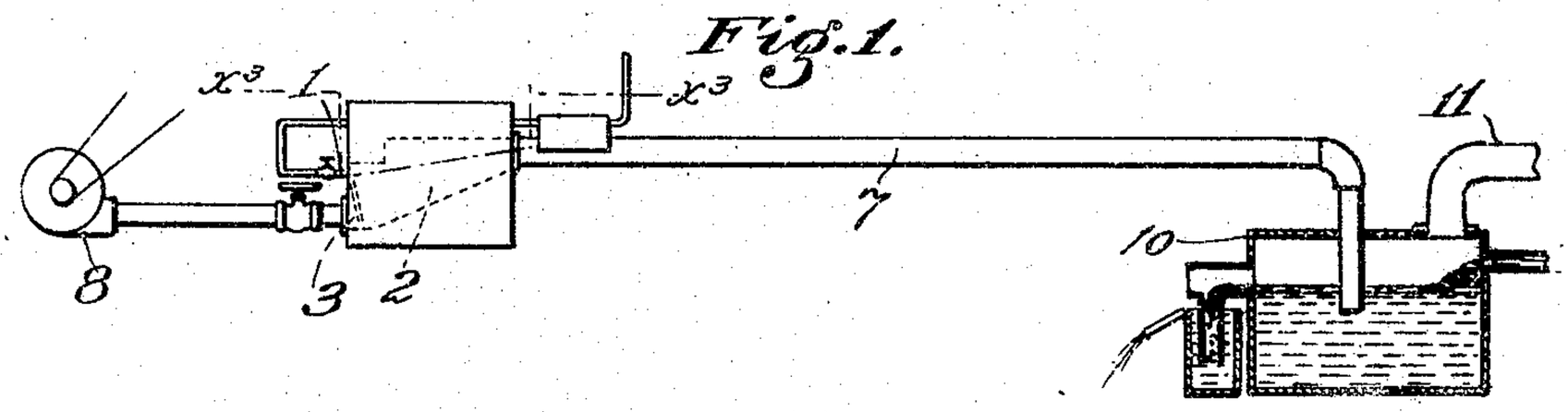


Fig. 2

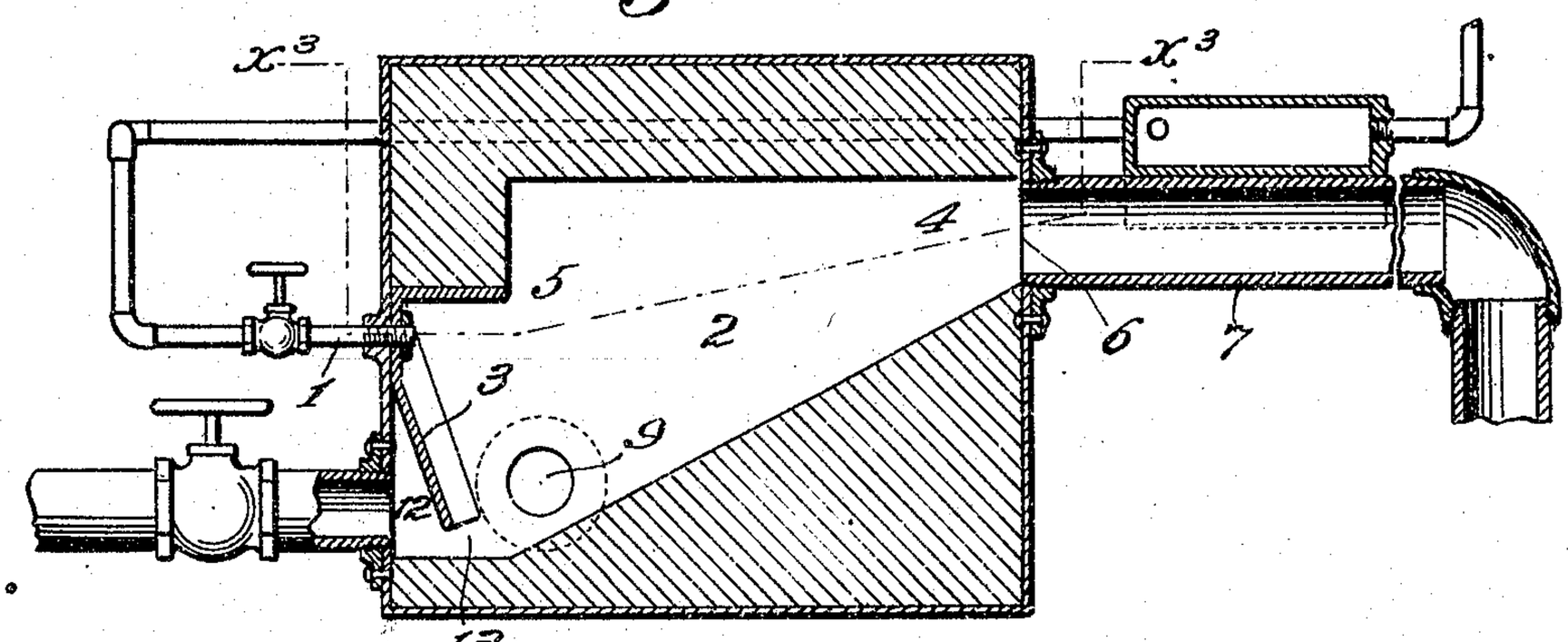
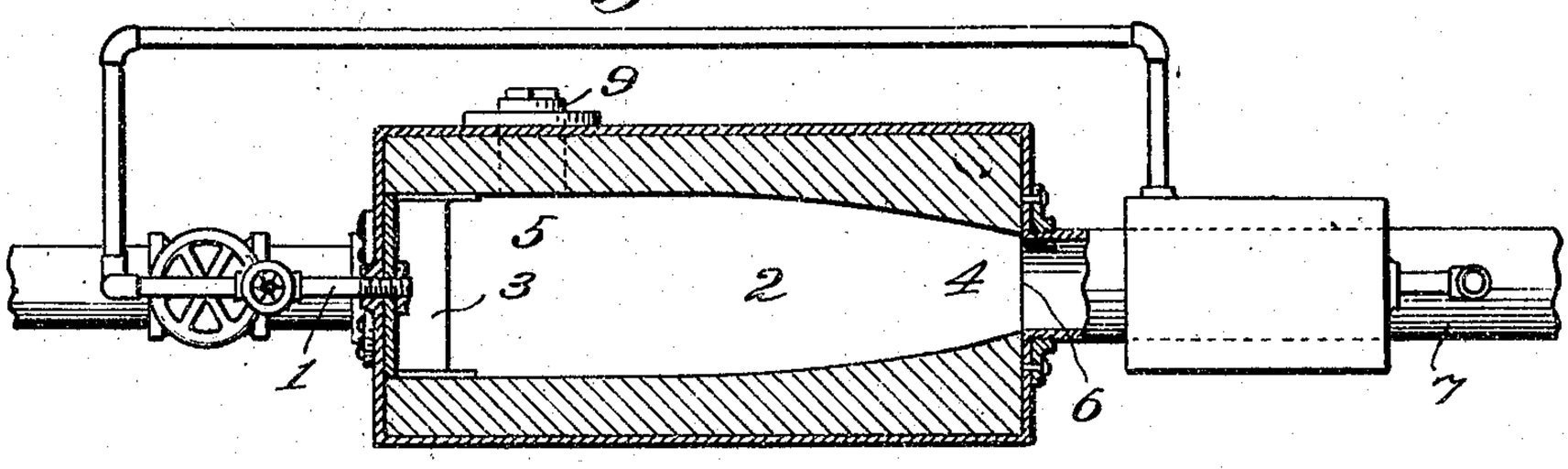


Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF PRODUCING GAS.

No. 885,903. Specification of Letters Patent. Patented April 28, 1908.

Application filed January 21, 1907. Serial No. 353,385.

To all whom it may concern:

Be it known that I, EDWARD H. AMET, a citizen of the United States, residing at Phœnix, in the county of Maricopa and Territory of Arizona, have invented and discovered a new and useful Method of Producing Gas, of which the following is a specification.

This discovery and invention relates to the production of a gas superior for power and heating purposes, which is made from crude petroleum or other hydrocarbons or gas-producing fuel, and which closely resembles natural gas in the character of its flame and is high in English thermal units in proportion to the heat units in the oil or other fuel consumed.

It is one of the objects of this invention to produce gas by a direct and simple continuous process, and to avoid the necessity of large or expensive apparatus heretofore deemed necessary for the rapid production of large quantities of gas for power, light and fuel.

I have discovered that it is possible to produce from hydrocarbons large quantities of fixed combustible gas without the use of baffle walls, checker-work, spray nozzles, or other paraphernalia heretofore deemed necessary for the breaking up of hydrocarbons in such production of gas, and that instead of spreading out oil or its vapors over large heating surfaces as heretofore for fixing the gas, superior results with increased economy of cost of apparatus, space occupied, cost of operation and fuel consumed, will be secured by first dissociating the combustible elements in the presence of flame, and then immediately conducting said elements while in suspension and in flame form, through a restricted outlet which extinguishes the flame, and thence through a restricted passage wherein the elements may combine under the residual or continued contained heat thereof, to produce the gas.

The principle of this invention and discovery, so far as I have yet been able to determine the same, is that if carbonaceous substances such as crude petroleum, kerosene or other combustible gas-producing substance be subjected in a confined space to the action of heat at and above the ignition point, in the presence of comparatively large volumes of oxygen or of atmospheric air, such volumes being constantly supplied under a moderate pressure, dissociation of the elements of the substances within the confined space takes place, and after that a new union or combination can be effected by extinguishing the flame of the dissociated elements before complete combustion has taken place, then transferring the highly-heated dissociated elements from said space through a restricted passage of sufficient length to allow the residual heat to be utilized in the formation of a new gas, whereby the temperature of said elements and gas becomes reduced below the ignition point, the elements being constantly moved on and out toward final discharge; the new union and atomic arrangement resulting in a fixed gas with a loss of only a comparatively small percentage of the heat units in the original fuel.

This process is distinguished from all known processes in which the dissociation of the hydrocarbon or other gas-making material employed is caused by impinging against heated resisting surfaces such as checker-work or baffle walls, in that the dissociation is caused directly by the heat of combustion of the material itself while suspended and in flame form, and that while the dissociated elements are still suspended, the flame of such elements is extinguished without interrupting the initial flame or combustion by which the dissociation of newly-supplied material is continuously caused, the resida1 heat of elements from which the flame has been extinguished being retained by said elements for the formation of a new combination of said elements.

Among the advantages arising from this novel method, in addition to those above suggested, is that the usual purifiers are not required even where sulfurous substances are contained in the gas-making materials; and owing to the high efficiency of the method, a smaller proportion of free carbon in the form of lampblack as a by-product is produced, and there is an apparent superior efficiency of the gas when used in a gas engine, and which is not yet accounted for by any of the analyses I have been able to obtain, although I conjecture that the apparent gain is owing to elements of high thermal efficiency contained in the gas.

This method may be carried out by various appliances. I will now describe the production of gas by my newly-discovered

method, reference being had to the accompanying drawings in which

Figure 1 is a broken elevation of apparatus adapted for producing gas by this method. Fig. 2 is a broken longitudinal mid-section of the portion of said apparatus in which the dissociation and new union of elements take place. Fig. 3 is a broken plan section on line x^3—x^3, Figs. 1 and 2.

In carrying out my newly-discovered method, oil may be introduced through pipe 1, into a confined space or chamber 2 constituting the dissociating chamber, and distributed at one end thereof by means of a distributer 3 which may be the inclined surface of a plate or trough over which the oil may spread from the pipe 1. The end of the chamber at which the oil is thus spread may be of greater cross-sectional area than the other end 4 of the chamber, which chamber tapers from the induction end 5 to the eduction opening or outlet 6 where a long associating flue or gas uniting, combining or fixing tube 7 is provided through which the gas is to pass, and in which the new combination of atoms is to occur.

Atmospheric air applied under a moderate pressure from a suitable source, as blower 8, will be introduced into the chamber at its large induction end 5 underneath the film of oil flowing from the lower edge of the inclined spreader 3. When the air and oil are thus admitted to the chamber, ignition is caused by any common means as a torch,—not shown,—which may be applied directly at the lower end of the spreader, by unscrewing the plug 9, and thereupon the resulting blaze will cause an upward expansion of vapors, atmospheric air and products of combustion which will fill the enlarged end of the chamber, and a vent being afforded from the fixing tube 7, the contents of the chamber will rush to find egress therefrom the plug being replaced.

The outlet from the dissociating chamber is of less cross-sectional area than said chamber, and the acceleration of the elements consequent upon the reduced passage through which the elements pass, prevents further combustion without reducing the temperature to a degree below that at which ignition would otherwise take place. In fact, tests show that the highest temperature of the gases at any time in the process, may occur within the flue just outside the chamber. The result is that a new combination of elements occurs in the contracted passage and the character of the gas thus produced depends upon the length and character of the tube through which the elements are emitted. I have found in practice with a dissociating chamber twenty-six inches long, four and one-half inches wide and twenty-one inches deep at the inlet end and four inches deep at the outlet end, that by constructing such apparatus with a fixing and combining tube of approximately twelve feet in length and four inches in diameter, a soot will at first form in said tube, and that as the operation proceeds the soot in that portion of the tube nearest the outlet from the dissociating chamber 2 will become transformed into a coke coating inside of the tube, while the coating at the extreme end will be in the form of a soft lamp black, and the intermediate coating will merge from coke into lamp black as the outlet end of the tube is approached.

The tube may open directly into the air, or it may be connected with a gas scrubber and washer, not shown, or the gas may be used immediately as it issues from the tube, or the tube may be shorter or longer or of greater or less diameter than that shown, without departure from the broad principle of this invention.

Analysis of the resultant gas has hitherto been ineffective to determine the make-up of the gas, but I have been able with an apparatus of the above dimensions to produce from two to five thousand cubic feet of fuel gas per hour, using but two and one-half gallons of oil per thousand cubic feet, the British thermal units of such gas being from 267 to 300.

In practical operation the elements in the dissociating chamber 2 form an incandescent body constantly renewed from below and from the front by the ingress of air under the spreader, and by the expansion of the carbonaceous material fed thereto; and as the elements approach the associating or combining tube 7 they are gradually condensed and brought into more intimate relation under increasing temperature, and in connection with flame until the elements enter the tube where the flame becomes extinguished at the point of highest temperature, and from that point the temperature of the elements gradually diminishes possibly in part owing to the absorption of heat by the formation and expansion of the new gas, and the elements possibly take on the spiral motion usually generated in bodies of gas moving through tubes, and the elements are brought into intimate relation for a considerable time without any destructive breaking-up action, thereby leaving the atoms free to combine to an extent not possible where the course of the elements is broken by forcible contact with abutting surfaces.

In actual practice the operation throughout is carried on mildly without explosive or other sudden disruptive action.

I have demonstrated that the incandescence of heated surfaces in the apparatus is not necessary to produce the fixed combustible gas as I have produced such gas and taken the same from the cold apparatus in forty-five seconds after the oil had been first

ignited in the dissociating chamber, starting with the chamber cold.

The character of the gas produced by any given apparatus will depend upon the relative proportions of air and carbonaceous material admitted to the dissociating chamber. The operator can determine the proportions necessary by noting the by-products. In case too much oil is admitted, free oil will be discharged from the overflow of the scrubbing apparatus not shown. From this point the oil may be cut down gradually, the operator noting the escape of lamp-black from the scrubber and washer, and also noting conditions of flame in test-burner, until the quality of the gas is maximum and the escape of by-products minimum.

The process thus described of producing fixed gas may be regarded as including a process analogous to tempering the mass of products issuing from the dissociating chamber, giving the atoms and molecules sufficient time to arrange themselves in a stable form from which they will not break up under the subsequent cooling, washing and scrubbing processes so that there is practically no loss from sudden chilling.

In the apparatus I have used the walls of the dissociating chamber are refractory and adapted to retain heat, and the flue is an iron pipe, which as the process proceeds, becomes heated, sufficiently to char paper held in contact therewith for ten or fifteen minutes more or less, and tests show a gradual reduction of temperature in the gas in said tube from approximately 1800° Fahrenheit at the chamber to 400° or 500° Fahrenheit at the outlet end of the tube.

In experimenting with the apparatus shown I have made a series of small holes (not shown) along the top of the pipe 7, thus giving access to the interior of the flue. As the operation with the apparatus proceeds, the holes will rapidly clog with solid carbon, which at the end near the dissociating chamber 1 is in the form of coke, such form changing gradually at the successive holes from the coke form to the form of soft lamp black, which will be deposited along the pipe at the outlet end thereof. While the holes are open, jets of gas will issue therefrom and the gas of the jets nearest the dissociating chamber is in an incandescent condition and said incandescence gradually decreases as the distance from the chamber increases. Said jet may be ignited by application of flame outside the tube, but otherwise will flow off without ignition. Gas from the jets nearest the dissociating chamber may be partially condensed and will yield a small quantity of free oil, a portion of the gas only being in a fixed condition; but as the distance from the dissociating chamber increases the amount of oil which may thus be obtained from the issuing gas becomes less and less and the proportion of fixed gas becomes greater until at the farther end of the tube a gas issues, none of which can be condensed into oil. This latter gas carries a small proportion of lamp black in suspension and as the gas passes through the necessary scrubbers and washers, not shown, such lamp black is removed in the usual way, but the proportion of lamp black relative both to the amount of oil consumed and to the amount of gas produced is much less than occurs with any former process with which I am acquainted, and no tar or other liquid by-products are obtained from the gas. When the holes above mentioned are left without external interference, they soon become clogged; those nearest the dissociating chamber filling up with hard coke and the hardness of the deposit diminishing as the distance from said chamber increases, the holes farthest away from said chamber filling with lamp black. At night when the holes before mentioned are kept open the issuing jets take on an appearance of incandescence gradually diminishing in luminosity as the distance from the chamber increases. The heat of such jets nearest the chamber is such that a sheet of paper rapidly passed thereover will be burned in two almost instantaneously and the rapidity with which the burning takes place at successive holes, receding from the chamber grows less and less until the temperature of the issuing gas becomes too low to burn a hole through the paper. I have found that by removing the tube 7 that the product of the partial combustion occurring in the chamber comprises fixed combustible gas, unburned vapors, and soot and will burn with a flame when ignited. By confining such product in the tube and moving the same therealong, the residual heat thereof transforms the vapor into fixed gas.

By means of the elongated contracted tube or flue through which the products of the dissociating chamber are compelled to pass, such products are held against lateral expansion, the only expansion that can occur being endwise along the tube toward the outlet.

In ordinary practice the ultimate outlet for the fixed gas is beyond a water seal 10 from whence the fixed gas passes through an outlet 11 to the washers and scrubbers, not shown. The pressure within the fixing tube or flue 7 may be a few ounces more or less depending on the differential existing between the initial pressure of the air supply, the frictional resistance of the walls of the tube, the depth of the water seal 10, and the pressure required to raise the gas holder, not shown; the aim being to overcome said resistance and afford the requisite pressure for combustion in the burners, not shown. It will be understood that under the usual law the higher the pressure in the apparatus the better will be the quality of the final gas. Such

pressure is determined by the depth of the water seal.

The oil-distributer or spreader preferably extends entirely across the dissociating chamber 2, leaving an air chamber 12 and an air slot 13 which extend across the chamber and through which slot the air issues in the form of a sheet below the distributer. The oil comes onto such sheet from above, and consequently, the initial combustion occurs from below while the oil is gently upborne, and combustion takes place without explosions or sudden disruptive action, and an even mingling of air with the carbonaceous substances is accomplished.

What I claim is:—

1. The method of producing gas set forth, which consists in dissociating gas-producing material by the direct heat of the flame of its own combustion while in motion and in flame form without breaking up by impingement, then extinguishing the flame, and then associating and combining said elements in the form of a fixed combustible gas, said operation being continuous and without varying the supply of the gas-making material or interrupting the initial flame and flow of the gaseous substances.

2. The method of producing gas which consists in continuously dissociating the elements of a hydrocarbon in the presence of a flame and air, extinguishing the flame, intermingling said elements, and combining the same, gradually decreasing the temperature and producing a fixed gas substantially as set forth.

3. The method of producing gas which consists in continuously supplying to a chamber a sheet of inflowing air and continuously supplying carbonaceous material to the top of such sheet and igniting the same, thereby suspending said material and products thereof in the chamber in a state of combustion; withdrawing the resultant products from the chamber without interrupting such suspension and then arresting the combustion.

4. The method of producing gas which consists in continuously supplying to a chamber a sheet of inflowing air, and continuously supplying carbonaceous material to the top of such sheet and igniting the same, thereby suspending said material and products thereof in the chamber in a state of combustion; withdrawing the resultant products from the chamber without interrupting such suspension then arresting the combustion, and then holding the products in combination until the residual heat has effected the fixing of the gas.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 3rd day of January 1907.

EDWARD H. AMET.

In presence of—
JAMES R. TOWNSEND,
JULIA TOWNSEND.