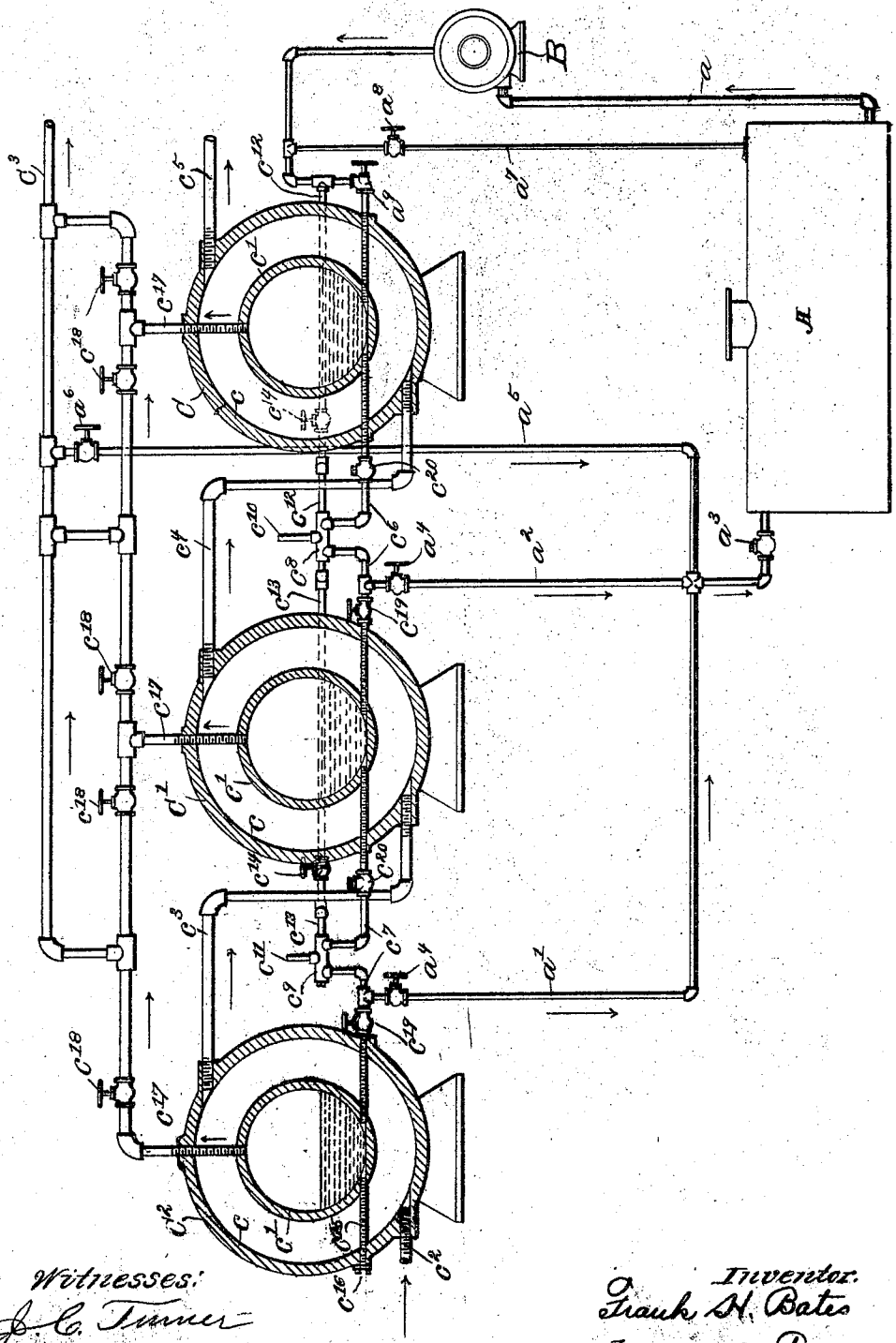
F. H. BATES.

METHOD OF GENERATING OIL GAS FOR EXPLOSIVE ENGINES.

APPLICATION FILED JULY 6, 1908. RENEWED MAY 4, 1912.

1,046,541. Patented Dec. 10, 1912.



Witnesses:
J. C. Turner
Jno. F. Oberlin

Inventor.
Frank H. Bates
by J. B. Fay
Attorney.

UNITED STATES PATENT OFFICE.

FRANK H. BATES, OF ELYRIA, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO POWER PLANT ENGINEERING CO., A CORPORATION OF PENNSYLVANIA.

METHOD OF GENERATING OIL-GAS FOR EXPLOSIVE-ENGINES.

1,046,541. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed July 6, 1908, Serial No. 442,027. Renewed May 4, 1912. Serial No. 695,315.

To all whom it may concern:

Be it known that I, FRANK H. BATES, a citizen of the United States, resident of Elyria, county of Lorain, and State of Ohio, have invented a new and useful Improvement in Methods of Generating Oil-Gas for Explosive-Engines, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to the generation of gas or vapor for explosive engines, and is applicable to hydrocarbons generally. It is intended as an improvement over the process for which I was granted Letters Patent of the United States No. 748,687, dated January 5th, 1904, wherein two generators, each arranged with an inner or vaporizing shell and an outer or heating shell, were used reversibly; that is, one was used for the first stage of vaporization while the second completed the vaporization of what was formerly a fresh charge, then reversing, and so on. In the practice of gas or vapor generation for explosive engines, other than that for which Letters Patent have been granted me, oil is passed through a vaporizing chamber of a generator, generally by a tortuous path and in attenuated stream, its passage serving to expel, for use at the engine, the gas or vapor, leaving but a slight residue to flow out as waste product.

My present invention provides a process which applies equally to this type of generator and to those in which a body of oil is maintained at a fixed level in the vaporizing chamber. Such present invention is intended to provide an improved process for working the oil down closely so as to attain a maximum degree of economy while maintaining more or less constant conditions of gas production in the matter of rate of vaporization and of gas quality.

Since in the generation of gas or vapor for explosive engines, with generators of the class described, both pure oil gas or vapor, and oil gas or vapor admixed with air in the vaporizing chamber, are used, according to conditions, it is to be understood that hereafter in claiming the features of my invention I refer to and imply gas or vapor whether alone or mixed with air as a carrier.

To the accomplishment of the above and related objects, said invention then consists of the steps and embodies the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain mechanism and modes of operation exemplifying the invention, such disclosed means constituting however, but one of several ways in which the principle of the invention may be used.

In said annexed drawing:—The single figure there appearing represents in more or less diagrammatic fashion the general lay out of a plant for producing gas from oil, embodying my several improvements.

In such drawing A represents an oil storage tank which may be of any convenient size, the location thereof with respect to the rate of the apparatus being a matter of indifference. From such storage tank, or reservoir, the oil is designed to be raised through a supply line a to a series of gas generators C C′ C^2, by means of a pump B. These three generators are similar, being as shown, of the receptacle type, wherein is maintained a certain body of oil at all times. Each comprises an outer shell c and an inner shell c', the former affording between its inner side and the outer side of the inner shell, a passage for the heating medium, and the latter providing the receptacle proper for the oil to be vaporized. The outer passages for the heating medium thus formed in the respective generators, are adapted to be connected in series in the line provided for conducting the heated waste gases from the engine by means of pipes c^2 c^3 c^4 and c^5, such gases being received through pipe c^2 and discharged by way of pipe c^5. The oil supplied to the first of the series of generators through supply line a is likewise designed to be conducted serially through the inner chambers of the oil containing receptacles of the respective generators, but in a direction opposite to that in which such waste gases are conducted, and to this end connecting pipes c^6, c^7 are provided between generators C, C′, and C′ C^2, respectively. Such connecting pipes are respectively formed with loops c^8 c^9 by means of which a predetermined level of oil may be maintained in the chamber next preceding the same, said loops having air vents c^{10} c^{11} to prevent siphonic action. Stop valves c^{19}

and check valves c^{20} are also provided in the connections in question, the use of which will be obvious. By means of other connecting pipes c^{12} c^{13} either of generators, C or C′ may be cut out of the circulation as will be evident, suitable valves being provided in such lines for this purpose. The last generator C^2 of the series is provided with an outlet pipe c^{16} through which, when desired, the contents of such generator may be drawn.

For conducting the vapors arising from the several generators to the explosive engine, each is provided with a pipe c^{17} adapted to be connected to a common line C^3, wherein such vapors are intermixed before they thus reach the engine. This line C^3 is branched, and the connection of the respective generators therewith so arranged, that by means of suitable valves c^{18} a generator when not in use may be readily cut off from the line in question. The generating chambers or receptacles corresponding with generators C C′, in addition to being connected in the manner just described with the reservoir supply line a, are provided with discharge lines, a' a^2 leading to reservoir A, so that if desired at any time, a circulation of oil through either or both of said generators may be maintained. A check valve a^3 in the common portion of these return lines and stop valve a^4 in each of the same respectively, afford means for regulating or cutting off such return flow entirely; the latter as will be presently explained is designed to be the normal arrangement. These discharge or return lines a' a^2 are furthermore connected with the gas suction line C^3 which leads as has just been set forth, to the gas intake at the engine; by a pipe a^5 controlled by a valve a^6; by this means the pressure within such pipe line and the vaporizing chambers of respective generators are equalized. This is desirable for the reason that the pressure in line C^3, and hence in the generators C C′ C^2, is liable, under certain working conditions, to be lower than atmospheric. The equalization of pressure secured in the manner just described, will enable the oil to flow freely toward the lower check valve a^3, until a sufficient amount has accumulated to open the same and allow passage into the tank A. The supply line a is also provided with a branch a^7, having a stop valve a^8 therein and leading directly to storage tank A whereby not only may the oil supplied through the pipe be in part diverted to the tank without passing through the generator at all, but also the proper back pressure be secured to effect a uniform operation of the stop valve a^9 in the portion of the supply line between such branch and the generator whereby the amount of oil admitted to the generator is regulated.

Having thus described the general construction, and incidentally the operation of certain portions of my improved gas generator apparatus, the general mode of operation exemplified therein, may be readily set forth. As has been explained, such apparatus is designed primarily to handle heavy oils such as those having an asphaltic base. In such instances then, the oil is pumped into and through the first generator C at a rate dependent on a setting of the control valve a^9 in line a. This oil when passed through such generator will lose its lighter constituents, these passing out to the gas line C^3. The now slightly impoverished oil is admitted into the second generator C′ in which a higher temperature is maintained, and wherein the oil in its course through the vaporizing chamber parts with more of its vapor, such vapor passing out through the gas line also, and mingling with that from the first generator. Finally the oil passes through the last generator C^2, which latter being heated to a still higher temperature, causes the oil to give up its remaining vapor or gas. With certain classes of fuel the oil will here be evaporated to dryness, the rate of supply of the oil to the first generator of the series being regulated to bring about this result. The gas from this last generator likewise is admixed with that from the preceding generator in the common gas line. At suitable intervals this last generator may be cut off or by-passed as it were, by closing valves c^{18} c^{19} so as to permit the removal of dry residual matter, the plate c^{16} normally covering the outlet opening to the generator chamber being removed for this purpose. No provision is made for by-passing the exhaust, since it is seldom necessary to inspect the exhaust passage.

When it is desired to clean the vaporizing chamber of any generator, for example generator C′, such generator is simply cut out of the series by closing the corresponding valves c^{18} and c^{19}, and opening valve c^{14} in by-pass c^{13}; under this arrangement the two remaining generators will be operated in series just as before, save that the reduction or evaporation of the oil will not be so gradual. However, it should be explained that the number of generators need not be limited to three, for with certain light, volatile oils only two might be needed, whereas with a heavy oil of asphaltic base from four to six would be required; and whatever the number found to give the best results, an extra one may be included in designing the plant to provide for cleaning or other like exigencies reducing the number in actual use.

In describing the plant, reference has been made to the return pipe a' a^2, whereby a circulation of oil may be maintained through all but the last of the series of generators, either singly or together, should this method be found temporarily desirable. This means

of temporary operation by a continuous circulation of the oil through the generator and oil storage system has been made the subject of a separate application filed June 22, 1908, Serial No. 439,727 and so need not be further discussed here.

The advantages attained by the use of a series of generators connected and operated in the manner hereinbefore described, can be conveniently shown by referring to the results had where but a single generator is employed. Considering an oil having an asphaltic base as being pumped into the vaporizing chamber of such generator and there heated at first only sufficiently to throw off the lighter vapors, with a generator of moderate capacity this distillation would be complete within a few minutes, at the most; following this the temperature would have to be increased in order to continue the distillation of the now slightly impoverished oil, and this stage would be followed by another of higher temperature, and so on until the oil had been distilled to a state of impoverishment such as would make it advisable to discharge it from the generator as a waste product. The disadvantages of such a system would be excessive labor, and the necessity of skilled attendance to properly judge as to conditions; also, inability to give a gas sufficiently uniform in quality to permit of regular and efficient operation of the explosive engine. On the other hand, by my improved process, great nicety of operation can be obtained with increased economy in the consumption of gas at the engine by reason of a more uniform product. Each generator being constantly maintained at its proper fixed temperature, which need not be varied, the product of the several generators will, on proper mixing in the line leading to the engine, be of uniform quality and quantity. Even the interruption that may be occasioned by cleaning the several generators, occupying but a few minutes once a day, will not seriously affect the uniformity of results thus secured.

While the process has been herein described as preferably utilizing different degrees of temperature it will be understood that the reasons for this are chiefly practical and economical, and not basic, in character. In other words the same temperatures, if given enough time, may suffice to drive off the heavier vapors as well as the lighter ones and by a proper arrangement of generators be thus adapted to supply the constant volume of gas having a uniform explosive character which it is the object of my invention to produce.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the process and apparatus herein disclosed, provided the steps or means stated by any of the following claims or the equivalent of such stated steps or means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. The method of producing gas from oil, which consists in heating simultaneously a plurality of bodies of oil having different degrees of impoverishment, mixing the vapors thus produced, and maintaining the degrees of impoverishment of the respective bodies substantially uniform.

2. The method of producing gas from oil, which consists in heating simultaneously a plurality of bodies of oil having different degrees of impoverishment mixing the vapors thus produced, and transferring oil from one body to another so as to maintain the degrees of impoverishment thereof, respectively, substantially uniform.

3. The method of producing gas from oil, which consists in heating simultaneously a plurality of bodies of oil having different degrees of impoverishment, mixing the vapors thus produced, and gradually transferring the heavier constituents from the first body to the second, and so on, whereby the degrees of impoverishment of the respective bodies is maintained substantially uniform.

4. The method of producing gas from oil, which consists in heating a body of oil, and simultaneously adding lighter oil to, and withdrawing heavier oil from, such body, whereby the degree of impoverishment of the latter is kept substantially uniform.

5. The method of producing gas from oil, which consists in causing the oil to flow serially through a plurality of generators of the receptacle type, adding lighter oil to the body of oil in each generator, whereby the degree of impoverishment of such body is kept substantially uniform, and then mixing the vapors thus produced in the several generators.

6. The method of producing gas from oil, which consists in causing the oil to flow serially through a plurality of generators of the receptacle type operating at successively higher temperatures, adding lighter oil to, and withdrawing heavier oil from, the body of oil in each generator, whereby the degree of impoverishment of such body is kept substantially uniform, and then mixing the vapors thus produced in the several generators.

Signed by me this 30th day of June, 1908.

FRANK H. BATES.

Attested by—

CHRISTINE ABLS,

JNO. F. OBERLIN.