E. E. WICKERSHAM.

PROCESS OF TREATING LIQUID FUEL.

APPLICATION FILED JUNE 29, 1920.

1,376,180. Patented Apr. 26, 1921.

2 SHEETS—SHEET 1.

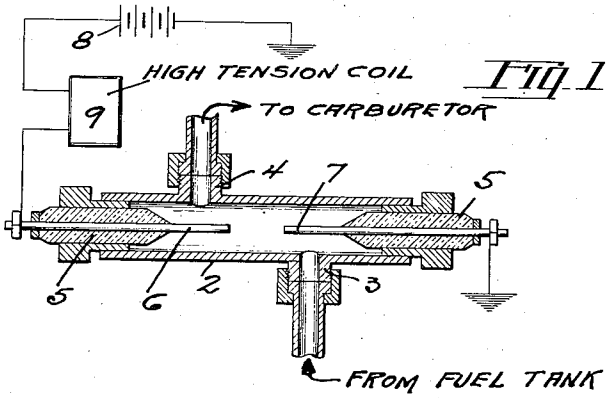


Fig. 1.

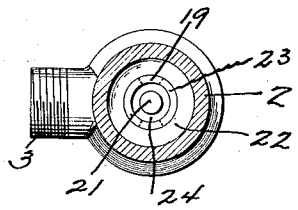


Fig. 4.

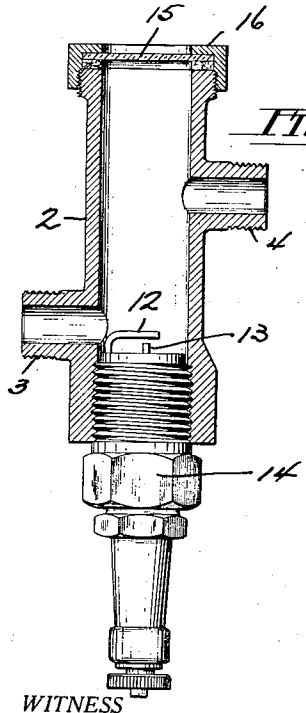


Fig. 2.

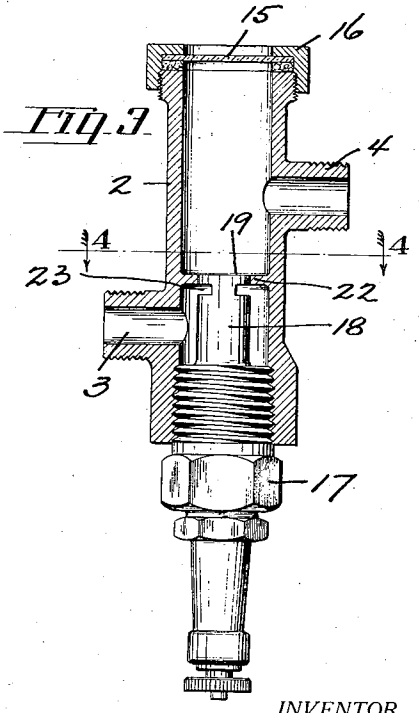


Fig. 3.

WITNESS

H. R. Sherburne

INVENTOR

E. E. WICKERSHAM

BY

White Frost + Evans

ATTORNEYS

E. E. WICKERSHAM.

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2 SHEETS—SHEET 2.

FIG. 5.

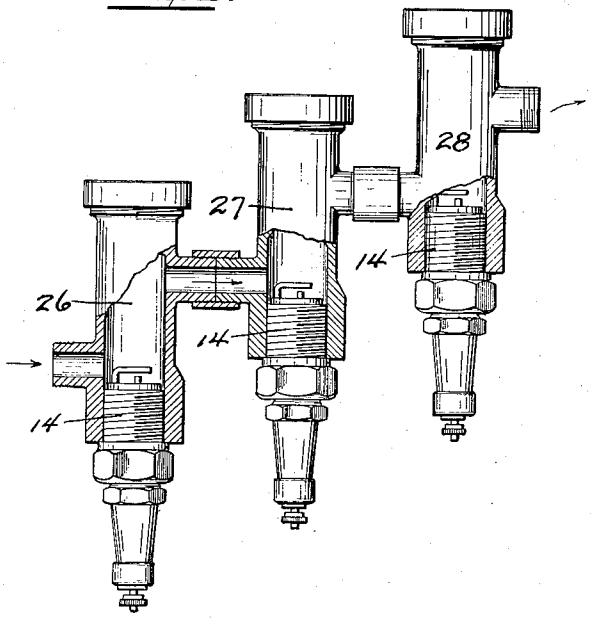
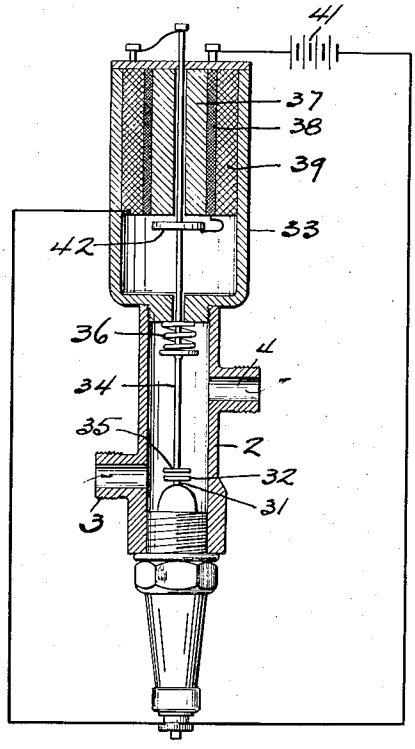


FIG. 6.



WITNESS

H. A. Sherburne,

INVENTOR

E. E. Wickersham,

BY

White Frost & Evans

his ATTORNEYS

UNITED STATES PATENT OFFICE.

ELMER E. WICKERSHAM, OF STOCKTON, CALIFORNIA.

PROCESS OF TREATING LIQUID FUEL.

1,376,180. Specification of Letters Patent. Patented Apr. 26, 1921.

Application filed June 29, 1920. Serial No. 392,663.

To all whom it may concern:

Be it known that I, ELMER E. WICKERSHAM, a citizen of the United States, and a resident of Stockton, San Joaquin county, State of California, have invented a certain new and useful Process of Treating Liquid Fuel, of which the following is a specification.

The invention relates to a process of treating hydrocarbon oil products, such as gasolene, kerosene, distillate, stove tops, crude oil and other hydrocarbon oil products.

Crude oil and liquid fuels, derived from crude oil, consist of a mixture of components having different boiling points and the end boiling point, or that temperature at which the last remaining liquid is volatilized, determines to a great extent the desirability of the use of the fuel for different purposes. For instance, in internal combustion engines, it is detrimental to employ liquid fuels having very high end boiling points, because all of the fuel is not vaporized, but flows down the cylinder walls, past the pistons, and mixes with the lubricating oil in the crank case, greatly impairing and often destroying its lubricating qualities. Lower intermediate boiling points also improve the quality of the fuel by rendering large proportions thereof volatile at lower temperatures. One of the great difficulties experienced today in the operation of motor vehicles, such as trucks, tractors and automobiles, is the high end boiling point of the fuel, which causes the contamination of the lubricating oil, and this is particularly true in tractors burning kerosene, distillate and other low gravity fuels.

An object of my invention is to provide a process of treating liquid fuel to lower the range of boiling points of the fuel, and to improve the burning qualities of the fuel.

Another object of the invention is to provide a process of treating hydrocarbon oil products to improve their qualities.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description where I shall outline in full, the process of my invention and that form of the apparatus which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings, I have shown several forms of apparatus of my invention, but it is to be understood that I do not limit myself to such forms, since the invention, as set forth in the claims, may be embodied in other forms.

Referring to the drawings:

Figure 1 is a longitudinal section through one form of apparatus for carrying out the process of my invention.

Fig. 2 is a vertical section through a form of the apparatus having certain practical advantages.

Fig. 3 is a vertical section through a modified form of apparatus.

Fig. 4 is a cross-section taken on the line 4—4, Fig. 3.

Fig. 5 is a vertical section of a form of apparatus for successively treating a stream of fuel.

Fig. 6 is a vertical section of a modified form of apparatus which is operative at low voltages.

In accordance with my invention, I submerge one or more pairs of electrodes in the fuel and pass a high tension interrupted or alternating electric current across the gap or gaps between the electrodes, so that the fuel is subjected to the action of the electric sparks passing between the electrodes. I am not familiar with the phenomena which occur in the fuel, due to the passage of the sparks, but the result is to reduce the temperature of the end boiling point of the fuel and also to reduce the temperature of the initial boiling point and intermediate boiling points and reduce the flash point of the fuel and increase the Baumé gravity of the fuel, making the fuel more adaptable for use in internal combustion engines or other uses. I have also found that the propagation of the flame in a compressed combustible mixture of the treated fuel is very rapid, and I have observed in operating an internal combustion engine, with the exhaust conduit open, that no flame is discharged through the conduit. When used on internal combustion engine fuels, I prefer to treat the fuel immediately before it enters the carbureter and to arrange the device for treating the fuel in the fuel conduit, so that when the motor is in operation fuel is flowing through the device, although the fuel may be subjected to treatment at the refinery, with equally advantageous results. The fuel capacity of the device used on internal combustion engines is small, so that only a small quantity of fuel is treated at a time, but is sufficiently large so that the

flow of the fuel therethrough is quite slow, thereby providing for a material time of treatment of the fuel. Eddy currents and agitation of the fuel in the device cause practically all of the fuel to be influenced by the spark.

I have found that one of the results of the passage of the electric discharge through hydrocarbon oil products, is the liberation and precipitation of the base from the product, that is, asphalt in the case of asphalt base oils, and paraffin in the case of paraffin base oils. This is true not only with the lighter products, such as gasolene and kerosene, but is also true with the heavier products, such as lubricating oils.

The device shown in Fig. 1, which is illustrative of my invention, comprises a metallic casing 2, preferably cylindrical in form, having a threaded nipple 3 on one side to which the fuel conduit is connected and having a threaded nipple 4 on the other side to which the carbureter or a conduit leading to the carbureter is connected. The nipples are also preferably spaced apart longitudinally so that the fuel travels longitudinally of the casing. Secured in the ends of the casing and insulated therefrom by insulating bushings 5 are electrodes 6 and 7 which are spaced apart to form a spark gap between them, the gap occurring between the nipples. A high tension interrupted current is applied across the spark gap so that sparks in rapid succession occur at the spark gap. The high tension current may be taken from the ignition system of the engine which may comprise a battery 8 and a high tension coil 9 or which may comprise a magneto. When magneto ignition is employed, it is advisable to provide a magneto having a greater number of contacts than there are engine cylinders and connect the extra contacts to the spark electrodes. I have found that good results are obtained by using an eight cylinder engine magneto on a four cylinder engine and connecting every other magneto contact to a spark electrode, the other electrode being grounded. The magneto employed delivered current at 18,000 volts, but I believe a higher voltage, for instance 50,000 volts, will be more effective.

In Fig. 2, I have shown a form of device for use on internal combustion engines, in which the electrodes comprise the sparking points 12—13 of a standard spark plug 14. This produces a cheaper construction and one which may be readily repaired by merely renewing the spark plug. The inlet nipple is preferably arranged adjacent the sparking points and the outlet nipple 4 is arranged above the sparking points and the spark plug is preferably inserted at the bottom of the casing so that the gas liberated, due to the passage of the sparks through the fuel, will rise and flow from the casing and will not collect at the electrodes. The casing may be closed at the top by a glass disk 15 held secure by the annular cap 16. The casing is sufficiently large so that the fuel flows slowly therethrough, thereby permitting practically all of the fuel to be acted on by the sparks.

In Figs. 3 and 4 I have shown a construction in which all of the fuel is constrained to pass between the electrodes. This construction embodies a spark plug 17 having a hollow cylindrical metallic body 18, the end 19 of which forms one electrode, and a disk 21 concentric with the end 19 and lying in substantially the same plane and forming the other electrode. The casing is provided with an annular shoulder 22 into which the end of the body 18 fits rather snugly and the body 18 is provided with apertures 23 through which the fuel may pass into the interior of the body. The inlet nipple 3 occurs below the shoulder and the outlet nipple 4 occurs above the shoulder, so that all fuel must pass into the body 18 and through the annular passage 24 between the electrodes 19 and 21, where it is subjected to the action of the electric sparks.

In Fig. 5, I have shown a form of the apparatus in which a plurality of spark plugs 14 or pairs of electrodes are employed, the fuel passing the successive pairs of electrodes successively and being acted on by the sparks at the successive electrodes. The fuel enters the chamber 26, wherein it is subjected to the action of the spark therein, thence flows into chamber 27, where it is again treated and then flows into chamber 28 where it is again treated. Any desired number of pairs of electrodes past which the fuel flows may be employed and, by employing a large number of pairs of electrodes, the fuel may be flowed quite rapidly, so that large amounts thereof may be treated. This, or other comparable forms of apparatus, may be employed at refineries or central stations for treating fuel in large volume. While I have shown an apparatus employing spark plugs, it is to be understood that pairs of electrodes of any desired form or construction and in any desired number, may be employed.

In Fig. 6, I have shown a form of the apparatus which operates to treat the fuel successfully at comparatively low voltages, such, for instance, as 275 volts. In this form of construction, one of the electrodes is vibrated or oscillated, moving into and out of contact with the other electrode and producing the formation of a fat spark as the electrodes are moved apart. This apparatus comprises a casing 2, having inlet and outlet ports 3 and 4. Screwed into the bottom of the casing and insulated therefrom is an electrode 31 having a disk head 32.

Screwed into the upper end of the casing is a casing 33 from which the electrode 34, having a disk head 35, extends into the casing 2. The electrode 34 is movable vertically to separate the heads 32 and 35 to produce a spark between them, the heads being in contact when at rest, and being held in contact by a spring 36. Arranged in the casing 33 is an induction coil comprising an iron core 37, a primary winding 38 and a secondary winding 39. The primary winding is connected in series with the battery 41 and the electrodes so that when the electrodes are in contact or when a spark exists between them, current will flow in the primary winding, inducing a current in the secondary winding, the opposite ends of which are connected to the two electrodes. Secured to the movable electrode is an armature 42. When the battery circuit is closed, the upper electrode 34 will vibrate vertically, causing the production of sparks between the electrodes. This arrangement will produce a high tension discharge, but when desirable, only one coil may be employed, instead of the primary and secondary coils and the battery connected in series with the coil and the electrodes. The inductive kick of the coil, due to the separating of the electrodes caused by energizing the coil, will cause a fat low tension spark to form between the electrodes. The voltage of the spark may be as low as 275 volts.

The passage of the sparks through the fuel produces an evolution of gases which consists mainly of hydrogen, oxygen, carbon monoxid and carbon dioxid, in substantially the following proportion by volume; hydrogen 86 parts, oxygen 5½ parts, carbon monoxid 5 parts, and carbon dioxid 3½ parts. I find also that nitrogen and sulfurous acid are liberated from the fuel due to the action of the electric discharge. The sulfurous acid is probably formed by a combination of nascent hydrogen and oxygen with sulfur in the fuel. The evolution of the gas is free and in considerable quantity, and a large proportion of it is oxygen, indicating the presence of oxygen in the fuel. This oxygen is either chemically combined with the fuel or is present as moisture or is dissolved in the fuel and treatment by my process deoxidizes the fuel. I am of the opinion that the presence of oxygen in the fuel is detrimental, and I believe that when a mixture of air and oxygen containing fuel vapor is heated and compressed that combination of the oxygen with the hydrogen of the fuel occurs, producing water vapor or steam which retards the propagation of the flame through the compressed mixture. By treating the fuel in accordance with the process of my invention, the oxygen is removed and the combustible mixture is more rapidly combustible.

I claim:

1. The process of lowering the end boiling point of liquid fuel, which comprises passing a plurality of electric sparks through the fuel.

2. The process of reducing the boiling points of the constituent parts of liquid fuel, which comprises passing a plurality of electric sparks through the fuel.

3. The process of treating hydrocarbon oil products for the purpose set forth, which comprises passing a plurality of electric sparks through the product.

4. The process of treating hydrocarbon oil products, which comprises subjecting the product to the action of an electric current to liberate oxygen from the product.

5. The process of treating hydrocarbon oil products, which comprises liberating oxygen from the product, by passing electric sparks therethrough.

6. The process of treating hydrocarbon oil products, which comprises deoxidizing the product.

7. The process of treating liquid fuel, which comprises passing the fuel through a casing and subjecting the moving fuel to the action of a plurality of electric sparks, whereby oxygen is liberated from the fuel.

8. The process of treating liquid fuel, which comprises passing the fuel through a casing and passing electric sparks through the fuel while it is passing through the casing.

9. The process of treating liquid fuel to lower its end boiling point, which comprises flowing the fuel through a passage in which electric sparks are produced in rapid succession.

10. The process of treating hydrocarbon oil product for the purpose set forth, which comprises subjecting the product to the action of rapidly recurring high tension electric sparks submerged therein.

11. The process of treating liquid fuel, which consists in subjecting the fuel to the action of an electric current to liberate hydrogen from the fuel.

12. The process of treating liquid fuel which consists in subjecting the fuel to the action of an electric current to liberate hydrogen and oxygen from the fuel.

13. The process of treating liquid fuel which consists in passing an electric spark through the fuel whereby hydrogen is liberated.

14. The process of treating liquid fuel which consists in passing an electric spark through the fuel whereby hydrogen and oxygen are liberated.

15. The process of treating hydrocarbon oil products to improve their qualities, which comprises subjecting the product to the action of an electric discharge therein.

16. The process of treating hydrocarbon

oil products to improve their quality, which comprises passing the product through a conduit and subjecting the moving product to the action of an electric discharge passing through the product.

17. The process of treating hydrocarbon oil products to improve their quality, which comprises passing rapidly recurring high tension electric discharges through the product.

18. The process of treating hydrocarbon oil products, which comprises subjecting the product to the action of an electric current to precipitate the base from the product.

19. The process of treating hydrocarbon oil products, which comprises subjecting the product to the action of an electric discharge therein, whereby the oil base is precipitated from the product.

20. The process of treating refined hydrocarbon oil products, which comprises subjecting the product to the action of a high tension electric discharge passing therethrough.

In testimony whereof, I have hereunto set my hand at San Francisco, California, this 17th day of June, 1920.

ELMER E. WICKERSHAM.

In presence of—
H. G. PROST,
W. W. HEALEY.