Dec. 20, 1932. G. L. REICHHELM 1,891,446

METHOD FOR GASIFYING LIQUID FUELS

Original Filed Sept. 16, 1926 2 Sheets-Sheet 1

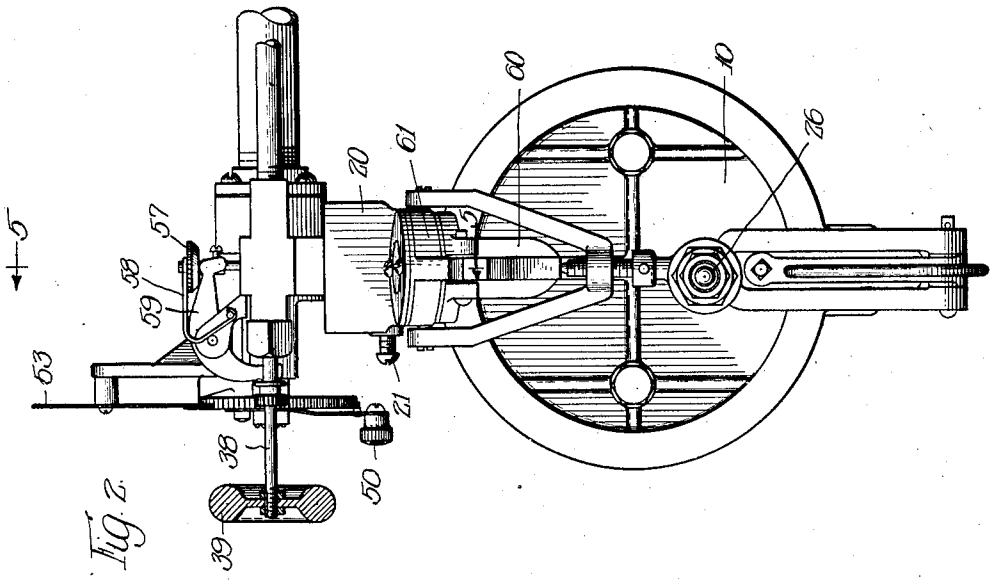


Fig. 2.

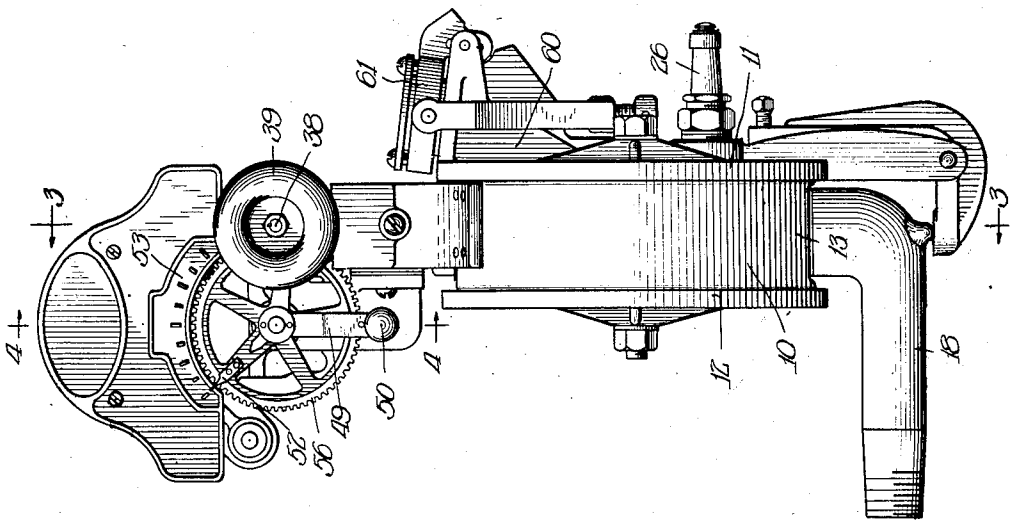


Fig. 1.

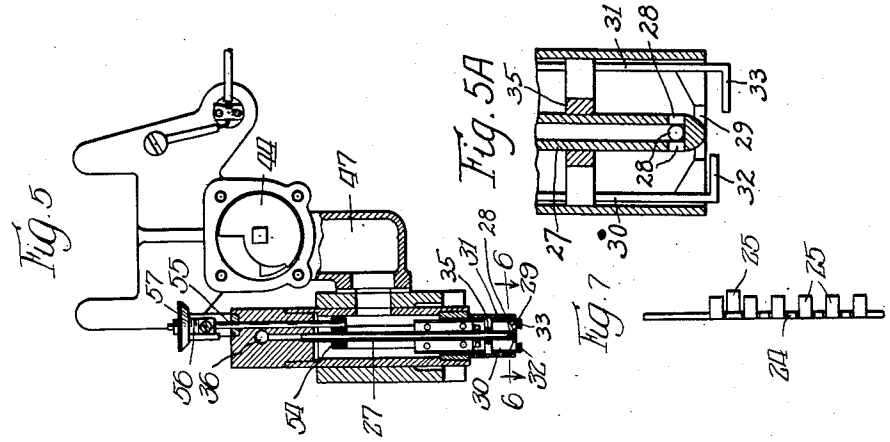
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R. Burkhardt

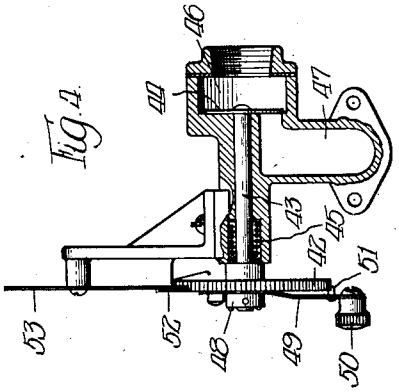
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Attys.

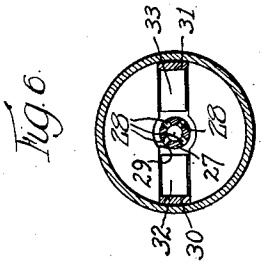
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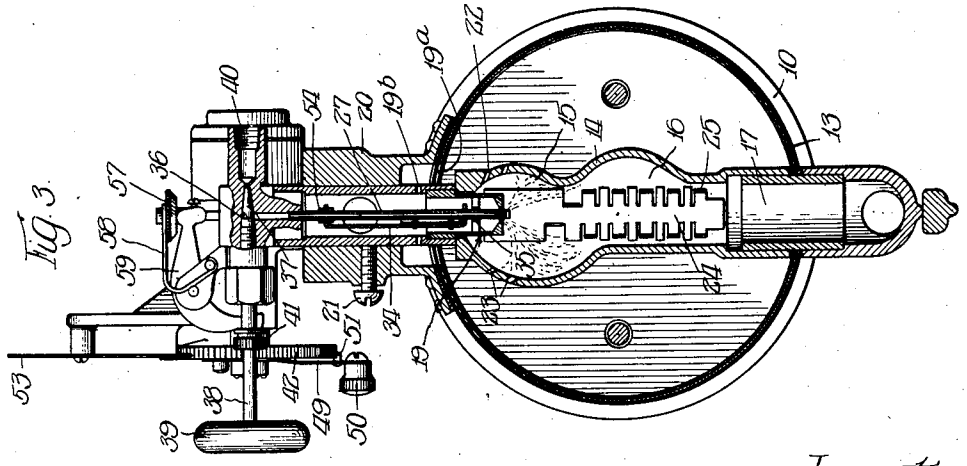
METHOD FOR GASIFYING LIQUID FUELS

Original Filed Sept. 16, 1926 2 Sheets-Sheet 2









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UNITED STATES PATENT OFFICE

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METHOD FOR GASIFYING LIQUID FUELS

Application filed September 16, 1926, Serial No. 135,794. Renewed August 5, 1932.

The present invention relates to methods for gasifying liquid fuels.

The present invention contemplates the utilization of a number of principles set forth in the Reichhelm application Serial No. 492,237, filed August 15th, 1921. Said application and the division thereof filed November 24th, 1924, and bearing Serial No. 752,049, describe means and methods for converting low grade fuels such as heavy fuel oil into a light highly combustible gas, which gas may be stored for future use or distributed through pipes, tubes, or gasifiers, without condensation. The means and methods described in said prior application contemplate the atomizing of the oil with a primary supply of air, projecting said atomized mixture and subjecting a portion of said mixture to a limited secondary supply of air adequate to form a completely combustible mixture, igniting said combustible mixture and burning same to gasify the remaining portion of the atomized fuel.

The present invention has for one of its objects the provision of an improved method for controlling the distribution of the oil whereby the capacity of the apparatus will be increased and whereby better regulation may be had than has heretofore been possible.

A further object is to provide an improved method for gasifying liquid fuel which will set up primary and secondary zones of atomized fuel.

Further objects will appear as the description proceeds.

Referring to the drawings—

Figure 1 is a view in side elevation of one embodiment of the present invention;

Figure 2 is a view in elevation taken at right angles to the view shown in Figure 1;

Figure 3 is a sectional view taken along the plane indicated by the arrows 3—3 of Figure 1;

Figure 4 is a sectional view taken along the plane indicated by the arrows 4—4 of Figure 1;

Figure 5 is a sectional view taken along the plane indicated by the arrows 5—5 of Figure 2;

Figure 5A is a view on an enlarged scale of part of the structure shown in Figure 5;

Figure 6 is a sectional view taken along the plane indicated by the arrows 6—6 of Figure 5; and

Figure 7 is a view in side elevation of a flame plate which may be used in the practice of the present invention.

In order to provide a perspective of the invention, it may be stated briefly that oil or other liquid fuel is subjected to air, preferably under pressure, and, with the air, projected in an atomized state into a gasifying chamber. The present invention contemplates the provision of means for projecting said atomized fuel in a manner to produce the best efficiency. Said fuel is preferably caused to take a tangential or swirling motion by means of jets of oxygen-bearing fluid, preferably air. The fuel is thereby prevented from impinging directly upon the wall of the chamber and at the same time a regulable supply of air is provided. During this swirling movement there is a very thorough mixture of the air with the superficial portion of the stream of atomized oil and air, and there is combustion at a high temperature which vaporizes the oil. Briefly stated, the oil is successively atomized, vaporized and gasified, the atomized oil being distributed in a manner to cause the efficient vaporization and gasification of a major portion of said oil.

Referring first to Figures 1, 2 and 3, the numeral 10 indicates a drum having a pair of side walls 11 and 12 and a circular band 13. Mounted within said drum is a housing 14. It is within this housing 14 that the oil is gasified and fixed in gaseous condition. Said housing 14 has curved walls providing a combustion chamber 15, a secondary or superheating chamber 16, and an outlet portion 17 which outlet portion leads to the outlet pipe 18.

Mounted upon the drum 10 and extending into said drum is the nozzle indicated as a whole by the numeral 19. Said nozzle is of novel construction and will be described in detail hereinafter. Said nozzle is rigidly supported within the bracket 20, which bracket 20 may be riveted or otherwise se-

cured to the drum 10. In the band 13 surrounding the nozzle 19 is the hole 19*a*, through which air is admitted to the drum 10 from the apertures 19*b* in the nozzle 19, as will be referred to further hereinafter. Said nozzle is held in adjusted position in the bracket 20 by means of the set screw 21 or by any other preferred means. The nozzle 19 forms a very important part of the mechanism for breaking up fluid oil into an atomized condition. The air which is used for atomizing the oil will be referred to in this specification as primary air. The atomized oil, that is—the oil which has been broken up into a spray or vapor and mixed with air, is projected from the nozzle 19 into the combustion chamber 15 of the housing 14. The air admitted to the drum 10 from the apertures 19*b* in the nozzle 19 is referred to in this specification as secondary air. The secondary air within the drum 10 is admitted to the combustion chamber 15 through orifices 22 and 23, as shown in Figure 3. Only a few orifices are illustrated in Figure 3, but it will be understood that other orifices will be provided in a number of planes. Said orifices 22 and 23 will preferably have their axes disposed in directions such that the jets emitted from said orifices into the combustion chamber 15 will set up a tangential or swirling movement of the fluid within said combustion chamber 15. It will be noted from an inspection of Figure 3 that the opening between the combustion chamber 15 and the superheating chamber 16 is not symmetrical with combustion chamber 15, but is so formed that it directs fluid from combustion chamber 15 downwardly into said superheating chamber 16. As illustrated, jets of secondary air emitted inwardly from orifices 22 will be projected in a direction to set up a swirling movement in chamber 15 in a counter-clockwise direction. This swirling movement will be aided by the jets emitted inwardly from orifices 23, the latter mentioned jets also tending to force the gases down into the superheating chamber 16. Mounted within the combustion chamber 15 and superheating chamber 16 is the flame plate 24, which flame plate is disposed adjacent to the side wall 12 of the drum 10. Said flame plate 24, as will be explained hereinafter, serves as a means for simplifying ignition, as well as stabilizing combustion after ignition occurs. Said flame plate 24, which may be composed of Q-alloy, nichrome, or other preferred material, is provided with a plurality of serrations forming tongues 25, which have the function of creating many individual eddies, each creating a baffle or flame zone near enough to the next to cause ignition of its neighbor. The constancy of the stream projected by the nozzle 19 is very easily controlled, by means which will be referred to hereinafter, whereby said stream may be readily ignited. As soon as small flamelets appear at the lower part of the flame plate 24, they readily impart heat to and ignite the oncoming superficial particles and successively ignite zones of higher levels until the flame reaches the combustion chamber 15, when the propagation and maintenance of combustion goes on. A spark plug 26 or other igniting device may be provided for igniting the mixture of oil and air adjacent to the lower extremity of the flame plate 24. The flame plate 24 has been referred to above as being composed of Q-alloy, nichrome (which are alloys of nickel and chromium), or other preferred material. Said flame plate may take the form of a screen made of high heat-resisting material such as granular quartz, granular alumina, porous fire brick, or the like, in which surface combustion is accelerated.

It will be understood that somewhere in the projected stream of atomized oil, between the densest portion of the stream and the outer layer of superficial particles, a homogeneous explosive mixture will be found. The heated flame plate will cause what is known as contact catalysis to accelerate the combustion, and the zoned or stratified condition of the stream produces the result that the flame plate becomes a very efficient catalyst, which becomes more efficient as the temperature is increased, not only by the process of contact catalysis, but also by virtue of the fact that said flame plate radiates its light rays directly into and across the path of the main stream. It will be understood that the location of said flame plate may be chosen as desired, and that if preferred said flame plate may take the form of a lining for the interior of the housing 14, not being limited to one side thereof.

The means for governing the projection of oil and air into the housing 14 will now be described. As pointed out above, the nozzle 19 is supported upon the drum 10 in a position to project oil and air in an atomized condition into the combustion chamber 15. Mounted within said nozzle 19 is the tube 27, which tube is closed at its lower extremity but is provided near its lower extremity with apertures 28 for directing oil or other liquid fuel radially from said tube 27. Said nozzle 19 is closed at its lower extremity except for a diametrical aperture or slot indicated in Figure 5 by the numeral 29. The tube 27 is preferably symmetrically disposed with respect to the diametrical aperture 29 at the lower extremity of the nozzle 19. Disposed within said diametrically disposed aperture 29 are the control members 30 and 31, which control members are provided with the control fingers 32 and 33, respectively. Said control fingers 32 and 33

are disposed in parallel planes substantially at right angles to the axis of the tube 27, but the control finger 32 is closer to the extremity of the tube 27 than is the control finger 33, which structure has decided advantages, as will be pointed out hereinafter. Said control fingers 32 and 33 are preferably movable as a unit in a direction axially of the tube 27. For the purpose of providing adjustability of the control fingers 32 and 33, a holding plate 34 is provided, which has its extremities bent at right angles to the major portion of the member 34, which extremities are suitably apertured to receive the tube 27. The control members 30 and 31, including the control fingers 32 and 33, are secured by rivets or otherwise to the supporting member 34. Rigidly secured to the tube 27 near its lower extremity is the spider 35 for setting up eddies in the flow of air through nozzle 19 exteriorly of the tube 27. Communication to the tube 27 is had through conical passageway 36, which is controlled by the conical valve 37, said valve 37 being directly connected to the stem 38, which is adapted to be rotated by the handle 39. Movement of said handle in one direction will cause the opening of the valve 37 and movement of said handle in the opposite direction will cause the closing of said valve 37. Said valve 37 controls the inflow of oil or the liquid fuel through the inlet 40. Mounted upon the stem 38 is the pinion 41 adapted to mesh with the gear 42. The gear 42 in the illustrated embodiment of the present invention is immovable in an axial direction, whereas the pinion 41, being mounted upon the stem 38, is movable axially. The axial dimensions of the pinion 41 and gear 42 should be chosen such that during the complete range of movement of the valve 37 demeshing of the pinion 41 and the gear 42 will not occur. The gear 42 is mounted upon the stem 43, but is adjustable thereto in a circumferential direction through means which will be referred to hereinafter. The stem 43 has non-rotatably mounted thereon the valve 44, said valve 44 being pressed against its seat by means of the spring 45. Said valve 44 controls the inflow of air through the inlet 46. Air from the inlet 46 may pass the valve 44 in varying amounts (depending upon the position of the valve 44) into the inlet passageway 47, whence said air passes into the nozzle 19 in position to surround the tube 27. A portion of said air will be projected from the lower extremity of the nozzle 19, which portion has been referred to as "primary air". The remaining portion passes out through the apertures 19*b* and through the opening 19*a* into the drum 10. Said remaining portion of the air has been referred to above as "secondary air." It will be noted that the supply of oil through the inlet 40 and the supply of air from the inlet 26 are controlled in synchronism by manipulation of the handle 39. It will be understood, of course, that the handle 39 is shown for illustrative purposes only, it being within the scope of the invention to operate the valves by any preferred means, either manual or automatic.

Adjustment of the valve 37 relative to the valve 44 may be accomplished by any preferred means. According to the illustrated embodiment of the present invention, the stem 43 has fixed thereto the collar 48, having attached thereto the spring 49 provided with the finger hold 50. The gear 42 is rotatably mounted upon the stem 43, but is constrained to rotate with said stem 43 by reason of the connection between the spring 49 and said gear 42, said connection being provided by the stud 51 projecting from the spring 49, which stud is adapted to fit between adjacent teeth of gear 42. It will be obvious that by moving the spring 49 so that the stud carried thereby is drawn out of engagement with the gear 42, the stem 43 may be rotated independently of gear 42 and pinion 41 to effect the desired adjustment between valve 37 and valve 44. The gear 42 carries the pointer 52 adapted to cooperate with the scale 53, whereby to give a visual indication of the adjustment of the parts.

Though the oil tube 27 may be non-adjustably disposed relative to the nozzle 19, the present invention contemplates adjustability of the control fingers 32 and 33 with reference to the nozzle 19. In order to provide this adjustability, the supporting member 34 is carried by the bracket 54, which bracket is carried at the lower extremity of the stem 55, which stem is movable in a direction parallel to the axis of the oil tube 27. Said stem 55 is provided at its upper extremity with the bushing 56, which bushing is externally screw-threaded for adjustably supporting the nut 57. The numeral 58 indicates a spring member anchored upon any convenient part of the gasifier, which spring member exerts a downward force upon the adjusting nut 57, urging the stem 55, supporting member 34 and control fingers 32 and 33 downwardly. In order to control the position of stem 55 and accordingly the positions of the control fingers 32 and 33, a bell crank lever 59 is provided pivotally mounted in any preferred manner upon the frame of the gasifier. One extremity of the bell crank lever 59 is adapted to abut against the under side of the adjusting nut 57. The other extremity of the bell crank lever 59 is adapted to abut against the right-hand side of the pinion 41 as the parts are viewed in Figure 3. It will be obvious that as the control handle 39 is turned in a direction to move the valve 37 toward the closing position, the bell crank lever 59 will be swung in a counter-clockwise direction, raising the stem 55 and control fin-

gers 32 and 33. Conversely, if the handle 39 is rotated in a direction to open the valve 37, the bell crank lever 59 will be allowed to swing in a clockwise direction under the influence of the spring 58, whereby to permit the lowering of the stem 55 and control fingers 32 and 33. It will be obvious, therefore, that in addition to the double function of controlling the oil valve 37 and air valve 44, the handle 39 has the added function of controlling the positions of the the control fingers 32 and 33 synchronously with the control of the oil and air valves.

Preferably, one of the control fingers 32 and 33 is disposed in closer proximity to the extremity of the tube 27 than is the other of said fingers. As illustrated, the control finger 32 is disposed in closer proximity to the extremity of the oil tube 27. than is the control finger 33. Said fingers 32 and 33 are disposed in position to intercept the flow of the mixture of air and oil, which mixture is produced by contact of the incoming air with the oil emitted from the apertures 28—28 in the lower extremity of the tube 27. Said control fingers 32 and 33 intercept part of the oil spray and reduce its velocity to a rate below the rate of flame propagation, whereby this intercepted part may be burned. The control finger 32, being closer to the oil tube 27, serves to divert a part of the spray at a relatively obtuse angle, whereby to prevent the projection of such part of the heavy spray directly into the combustion chamber 15. The finger 33, which is further from the oil tube 27, diverts part of the stream at a more acute angle, that is—more nearly parallel with the oil tube 27. Said finger 33 is disposed near the flame plate 24, which construction is of advantage in simplifying ignition of the spray, as well as stabilizing the combustion after ignition has occurred. As the atomized stream of oil and air descends, the superficial particles thereof are intercepted by the tongues on the flame plate 24, creating many individual eddies, each creating a baffle or flame zone near enough to the next to cause ignition of its neighbor.

The cover plate 11 of the drum 10 is provided with the peep-hole 60, having the window portion 61 through which conditions within the housing 14 may be observed.

By reason of the construction wherein the control fingers 32 and 33 are disposed at different distances from the extremity of the oil tube 27, which is to say in effect—at different distances from the diametrical aperture 29 in the nozzle 19, a plurality of zones of spray are produced.

The mode of operation of the above described embodiment of the present invention is substantially as follows. In order to start the gasifier, the handle 39 is turned in a direction to open the valve 37 to permit the inflow of oil through the oil inlet 40. By reason of the engagement of the pinion 41 with the gear 42, the opening of the valve 37 will be accompanied by the opening of the air valve 44, whereby air will be admitted through the air inlet 46. Ignition of the incoming mixture of oil and air is accomplished by the spark plug 26, or any other preferred means, combustion being expedited by the flame plate 24. The air from inlet 46 will pass down through the nozzle 19 and will atomize the oil projected through the apertures 28 near the lower extremity of the oil tube 27. The atomized oil strikes the control fingers 32 and 33, which action still more finely divides the oil. The streams of finely divided oil and air are projected on both sides of the fingers 32 and 33 in a manner indicated by the arrows in Figure 3. The higher the air fingers are disposed, the more nearly horizontal will be the direction of these streams up to the point where the fingers recede into the aperture 29 at the lower extremity of the nozzle 19. By reason of the connection of the control fingers 32 and 33 with the oil valve 37 and air valve 44, when only a small quantity of oil is being delivered to the machine the control fingers 32 and 33 will be in rather close proximity to the aperture 29 at the lower extremity of the nozzle 19. As the supply of oil is increased, the fingers 32 and 33 will synchronously be moved further from the oil tube 27 and the aperture 29 in the nozzle 19, whereby the paths of the atomized streams will take a direction more nearly vertical, thereby avoiding the danger of choking out the flame within the combustion chamber 15. Moreover, because of the fact that the velocity of the streams is very greatly reduced by reason of the projection of said streams against the control fingers 32 and 33, it is possible to burn the superficial particles of said air streams even though said streams are projected through the nozzle 19 at speeds far beyond the rate of flame propagation. This advantage is gained by reason of the fact that the atomized stream is caused to change its direction. Part of said stream will come to zero velocity or near zero velocity, and combustion will take place in such portion having the reduced velocity referred to. On account of the contour of the combustion chamber 15 and by reason of the jets of air projected through the orifices 22 and 23, a swirling motion is set up, so that the superficial particles of the stream, having their combustibility increased by admixture with the air jets from the orifices 22 and 23, will be highly combustible throughout the entire range of the capacity of the gasifier. When the gasifier is cold, it may be necessary to allow the control fingers 32 and 33 to protrude more than after the gasifier has become heated. This, as described above, permits the streams to travel in a direction more nearly vertical. By reason of the difference

in the spacing of the control fingers 32 and 33 from the outlet of the nozzle 19, the atomized oil is divided into zones, one rarefied and one rich in oil spray content. The finger 33 intercepts and causes the major portion of the oil spray to form one zone. The finger 32 causes a leaner mixture to form a leaner zone, and in addition finger 32 causes this leaner mixture to take a path relatively obtuse to the axis of the nozzle 19. The secondary air supply emitted through the orifices 22 and 23 mixes with the oil spray in the latter mentioned zone, thereby increasing the amount of combustion possible in the combustion chamber 15.

It will be understood, of course, that the axes of orifices 22 and 23 may be chosen as desired, and that if preferred air jets emitted from said orifices may oppose the flow of the stream diverted by the control fingers 32 and 33, thereby reducing the velocity of flow of said streams.

The ratio of air to oil will be controlled by adjusting the air valve 44 relative to the oil valve 37, the spring 49 with its stud 51 being set to permit relative movement between the valve 44 and the gear 42 to bring air valve 44 and oil valve 37 into the desired relationship. The relationship of the fingers to the settings of the oil valve 37 and air valve 44 may be adjusted by turning the nut 57. The results of the combustion within the housing 14 may be observed through the peep-hole 60.

Only a limited supply of air will be admitted, sufficient for combining with the superficial part of atomized fuel. The heat created by the combustion of the air and said part of the fuel will gasify the remainder of said fuel. Due to the contour of the housing 14 and the action of the jets issuing from the orifices 22 and 23, the mixture of air and fluid fuel will be caused to take a circuitous or swirling motion, resulting in a complete commingling of air and fuel. Combustion will be with a blue flame, leaving no deposit of carbon. A reasonable explanation for this phenomenon seems to be that as soon as the gasifier is heated, the product issuing from the nozzle 19 is projected throughout the entire combustion chamber, and the air jets issuing from the orifices 22 and 23, at low velocity relative to the velocity of the streams issuing from the nozzle 19, combine at once with the superficial portion of said product, resulting in a blue flame.

The air admitted through the apertures 22 and 23 unites with the superficial portion of the stream of atomized oil and air to form a combustible mixture around the core of the stream of atomized oil and air, the core of said stream being non-combustible because of insufficient air. Said core is made up largely of atomized oil and air projected directly from the oil tube 27 and in part by atomized oil projected against the lowermost control finger. Part of the atomized oil projected against the upper control finger may also form part of said core. The core of the stream projecting from the nozzle 19 is therefore surrounded by an envelope of flame, which penetrates to a certain extent and commingles with the main stream, whereby it is vaporized and gasified. The velocity of flow of the core may be greater than the rate of flame propagation, but due to the fact that the air supply through the orifices 22 and 23 is at a lower rate of flow than the rate of flame propagation, combustion is maintained in this space surrounding said core, which ignites the outer layer of the core.

There is no deposit of carbon or soot due to the fact that if some of the carbon and hydrogen bonds should break down, the products of combustion will form a mixture with the released carbon, so that the products of combustion serve as a conveyor for the released carbon, thus keeping it in a suspended state.

From the above explanation it will be clear that according to the apparatus and method described the efficient gasification of oil or other liquid fuel may be accomplished efficiently throughout a wide range of operation. Moreover, the present invention provides a means whereby the superficial particles of the vaporized fuel may be burned regardless of high velocity of the remainder of said fuel, whereby relatively large quantities of fuel may be gasified and fixed.

Though a preferred embodiment of the present invention has been described for the purpose of illustrating the invention, said embodiment should be considered only in an illustrative sense and not in a limiting sense. Many modifications will occur to those skilled in the art, and it is intended to cover all modifications that fall within the scope of the appended claims.

What is claimed is—

1. A method of gasifying oil fuel, which consists in atomizing said fuel, projecting same, diverting a portion of said projected atomized fuel at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation to form a superficial layer, supplying air to said superficial layer to swirl said projected atomized fuel and to form a combustible mixture, and burning said superficial layer to gasify the remainder of said liquid fuel, whereby all of said projected atomized fuel is subjected to the flame action of said burning superficial layer.

2. A method of gasifying oil fuel, which consists in projecting a stream of atomized fuel, intercepting a part of said stream to divert same at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation and to create zones of different degrees of combustibility, supplying air to swirl said projected fuel, and burning

said diverted portion to gasify the remaining portion of said stream, whereby all of said projected atomized fuel is subjected to the flame action of said burning superficial layer.

3. A method of gasifying oil fuel, which consists in projecting said fuel in atomized condition and intercepting a portion of said fuel at spaced regions to divert said portion, said interception occurring at a sufficiently small angle to reduce the speed of said portion to a value to permit flame propagation and to separate said fuel into different zones, and admitting definite amounts of air to certain of said zones to totally consume said diverted portion.

4. A method of gasifying oil fuel, which consists in projecting said fuel in atomized condition, intercepting said fuel at spaced regions to divert said fuel and separate same into different zones, said interception occurring at a sufficiently small angle to reduce the speed of part of said fuel to a value to permit flame propagation, and delivering air to one of said zones to raise the combustibility of the fuel within the last-mentioned zone and to set said fuel in a swirl, whereby upon burning the fuel within said last-mentioned zone the remainder of said fuel will be gasified.

5. The method of gasifying oil fuel, which consists in atomizing said fuel and projecting same at a velocity greater than the velocity of flame propagation of the atomized fuel, diverting a part of said projected atomized fuel to reduce the velocity of said diverted part to less than said velocity of flame propagation, directing air to said diverted part to form a combustible mixture and to cause said fuel to swirl, and igniting said mixture to gasify the remainder of said fuel.

6. The method of gasifying oil fuel, which consists of atomizing said fuel and projecting same at a velocity greater than the velocity of flame propagation of the atomized fuel, diverting a part of said projected atomized fuel to reduce the velocity of said diverted part to less than said velocity of flame propagation, supplying air to said diverted part to increase the combustibility thereof, burning said diverted part to gasify the remainder of said fuel, and causing the unburned portion of said fuel to pass through the flame caused by the burning of said diverted part.

7. The method of gasifying oil fuel, which consists in projecting said fuel in atomized condition, diverting a part of said projected fuel, said diversion occurring at a sufficiently small angle to reduce the speed of the diverted fuel to a value to permit flame propagation, mixing said diverted part with sufficient air to form a combustible mixture, burning said combustible mixture to gasify the remainder of said atomized fuel, and causing the unburned portion of said fuel to pass through the flame caused by the burning of said diverted part.

8. The method of gasifying oil fuel, which consists in projecting said fuel in atomized condition, diverting a portion of said atomized fuel, said diversion occurring at a sufficiently small angle to reduce the speed of the diverted fuel to a value to permit flame propagation, supplying same with sufficient air to provide a combustible mixture, directing said combustible mixture in ignited condition against a catalyzing member to gasify the remainder of said atomized fuel, and completely burning said diverted portion with a blue flame to gasify the remaining portion of said fuel.

9. The method of converting an oil fuel into a combustible gas, which consists in atomizing said fuel with a primary supply of air, projecting said atomized mixture in a spray, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propogation, subjecting said diverted portion of said spray to a limited secondary supply of air adequate to form a completely combustible mixture between said secondary air and the outer portion of said spray, and igniting and completely burning said mixture formed by said secondary air and said outer portion of said spray to gasify the remaining portion of said spray.

10. The method of converting a heavy oil fuel into a combustible gas, which consists of supplying air to said fuel to form a spray, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, subjecting said spray to a transversely directed secondary supply of air, and igniting the diverted particles of said spray to gasify the unignited particles.

11. The method of converting a heavy oil fuel into a combustible gas, which consists in causing said fuel to form a downwardly directed spray with a limited amount of air, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, igniting said diverted portion of the spray, and imparting a swirling movement thereto to cause heat from the combustion thereof to gasify the remainder of said spray.

12. The method of converting a heavy oil fuel into a combustible gas, which consists of causing said fuel to take the form of a spray with air mixed therewith, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation and to separate said spray into inner and outer zones, directing jets of air against said spray at the outer zone thereof to promote combustion of said outer zone, and igniting said outer zone to thereby gasify the inner zone of said spray.

13. The method of converting an oil fuel into a combustible gas, which consists of projecting said fuel in the form of a spray mixed with air into a chamber, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, preventing said spray from impinging directly upon a wall of said chamber by means of jets of oxygen-bearing fluid in different planes transversely to the spray which direct a part of said spray into a circuitous path, and igniting and burning the diverted portion of said spray to gasify the remainder of said spray.

14. The method of converting an oil fuel into a combustible gas, which consists of projecting a sprayed mixture of oil and air, diverting a portion of said sprayed mixture at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, directing the course of said mixture by means of a series of transverse fluid baffles, and igniting and burning the diverted portion of said sprayed mixture to gasify the remainder of said mixture.

15. The process of converting an oil fuel into a combustible gas, which comprises forming a stream of oil atomized with air, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, subjecting the diverted portion of said stream to transverse streams of secondary air to unite therewith to form a combustible mixture around the core of said stream, and igniting said combustible mixture to gasify the atomized stream.

16. The process of converting a liquid fuel into a combustible gas, which comprises forming a stream of oil atomized by air, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, directing secondary air transversely against said diverted portion, and igniting the mixture of said diverted portion and said secondary air to gasify the inner portion of said stream which is unconsumed in said converting process.

17. The process of converting an oil fuel into a combustible gas, which comprises projecting downwardly a stream of primary air and oil particles, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, commingling said diverter portion with secondary air jets, igniting said commingled part of the stream into secondary air to produce a blue flame, and generating heat thereby to gasify the unconsumed oil particles.

18. The process of converting an oil fuel into a combustible gas, which comprises projecting a main stream of air and oil, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, impinging against said diverted portion of said stream secondary air jets at a lower velocity than the velocity of said stream, igniting the mixture formed by said secondary air and the impinged portion of the stream to consume said diverted portion of said stream with a blue flame, and generating heat thereby to convert the rest of the stream into a combustible gas.

19. The process of converting an oil fuel into a combustible gas, which comprises forming a stream of oil atomized with air, predetermining and simultaneously synchronizing the proportions of air and oil, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, subjecting the diverted portion of said stream to sufficient air to form a combustible mixture therewith, and igniting said combustible mixture to gasify the unconsumed portion of said stream.

20. The method of converting an oil fuel into combustible gas, which consists of projecting said fuel in the form of a spray mixed with air, diverting a portion of said spray at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, subjecting said diverted portion of said spray to transversely directed combustion-supporting fluid, and igniting said portion of said spray to gasify the remainder of said spray.

21. The process of converting an oil fuel into a combustible gas, comprising projecting a main stream of air and atomized oil at a velocity higher than the rate of flame propagation, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, impinging thereon transverse secondary air jets at a velocity lower than the rate of flame propagation to maintain combustion, and igniting and burning the mixture formed by the secondary air and the impinged portion of the stream in the form of a blue flame to gasify the remaining part of said stream.

22. The process of converting an oil fuel into a combustible gas, which comprises forming a stream of oil atomized by air, diverting a portion of said stream at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, igniting a portion of said stream to gasify the unconsumed portion of said stream, and varying the volume of air and oil according to the volume of combustible gas desired while maintaining the relative proportions of air and oil.

23. The process of converting an oil fuel into a combustible gas, which comprises forming a stream of oil atomized with air, diverting a portion of said stream at a suffi-

ciently small angle to reduce the speed thereof to a value to permit flame propagation, subjecting a superficial portion of said stream to secondary air to unite therewith to form a combustible mixture, igniting said combustible mixture to gasify the atomized stream, and varying the volume of said primary air, oil and secondary air in synchronized proportions according to the volume of combustible gas desired.

24. The method of converting an oil fuel into a combustible gas, which consists of supplying oil atomized by air through a nozzle projecting into a chamber, diverting a portion of said atomized oil at a sufficiently small angle to reduce the speed thereof to a value to permit flame propagation, and igniting a portion of said atomized oil surrounding said nozzle to convert the remaining portion of said atomized fuel into a combustible gas.

25. The method of converting oil into a combustible gas, which consists of supplying oil atomized by air through a nozzle projecting into a chamber, and completely burning a portion of the atomized fuel surrounding said inlet nozzle in the presence of a catalyzer located in the zone of flame to convert the remaining portion of said atomized fuel into a combustible gas.

Signed at Short Beach, Connecticut, this 11th day of September, 1926.

GEORGE L. REICHHELM.