

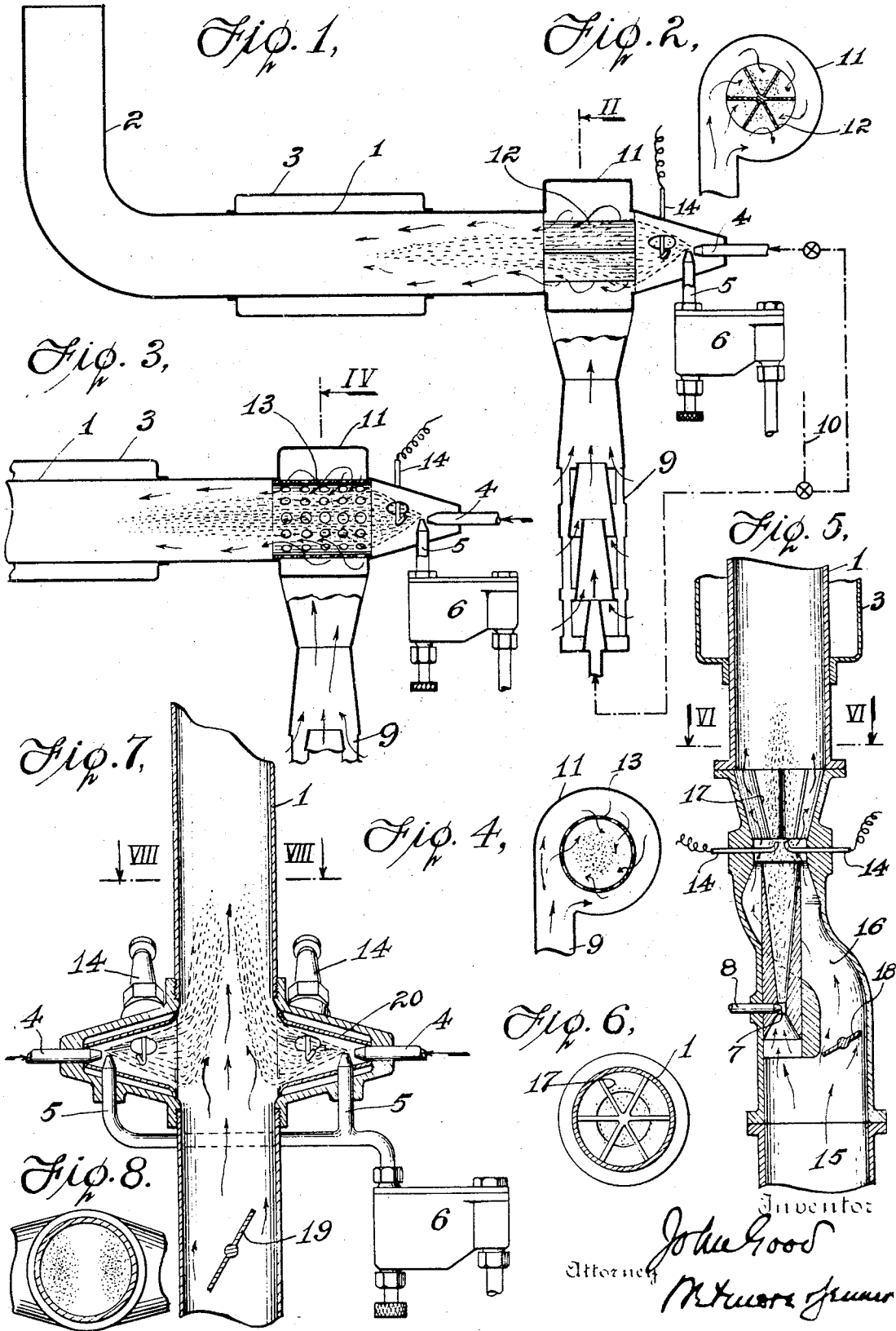
J. GOOD.

CONFINED COMBUSTION METHOD.

APPLICATION FILED JUNE 6, 1916. RENEWED JULY 19, 1919.

1,342,901.

Patented June 8, 1920.



Inventor:
John Good
Attorney:
McKee & Jones

UNITED STATES PATENT OFFICE.

JOHN GOOD, OF BROOKLYN, NEW YORK, ASSIGNOR TO GOOD INVENTIONS CO., OF
BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

CONFINED-COMBUSTION METHOD.

1,342,901.

Specification of Letters Patent.

Patented June 8, 1920.

Application filed June 6, 1916, Serial No. 101,887. Renewed July 13, 1919. Serial No. 312,106.

To all whom it may concern:

Be it known that I, JOHN GOOD, a citizen of the United States, residing in Brooklyn, New York, have invented certain new and
5 useful Improvements in Confined-Combustion Methods, of which the following is a full, true, and complete specification.

The improvement consists of a method of quickly obtaining high temperatures by
10 burning kerosene and like or heavier fuels within closed flame casings of narrow compass, being particularly suited for heating or preheating the fuel vaporizing parts of automobile engines burning kerosene or the
15 relatively non-volatile fuels. The invention, however, is useful in other relations where heat is required but open flames are not desired or are dangerous, and it can be carried into effect for such purposes by a wide variety of forms of apparatus, several of which
20 are indicated in the accompanying drawings in illustration of the principles of the invention.

Figure 1 illustrates the method as carried
25 out in one very simple form of apparatus, indicated in longitudinal section and more or less diagrammatic;

Fig. 2 is a cross-section of Fig. 1 on line II—II thereof illustrating the relation of
30 the air and fuel spray streams;

Fig. 3 illustrates the same method in a different form of apparatus;

Fig. 4 is a cross-section of Fig. 3 illustrating the air and fuel streams in that figure.

35 Fig. 5 illustrates the same method in still another form of apparatus.

Fig. 6 being a cross-section to illustrate the relation of the air and fuel streams in such form.

40 Fig. 7 is a longitudinal section of a duplex apparatus also adapted to perform the invention, and Fig. 8 is a section thereof on line VIII—VIII.

The method consists in preparing an ignitable stream of mixed fuel and air and projecting it under pressure difference into the confined combustion chamber which will be herein termed the flame casing, igniting it therein and introducing into contact with
50 said fuel stream and immediately in advance of its point of ignition, a stream of air, also under a difference of pressure, and causing said air-stream to flow initially alongside of said ignited stream but without immediate
55 mixture therewith, thereby permitting igni-

tion while obtaining continued and forced combustion within the casing with a maximum temperature development at a point somewhat forward of the point of first union of the two streams. The flame casing above
60 referred to may be assumed to be any closed-wall, metallic and relatively narrow passageway, such as a pipe or the chamber of an engine vaporizing apparatus, and may be connected by its outlet end with an exhaust
65 pipe of the size ordinary in automobiles and of any length necessary to discharge the exhaust at a safely remote point. The resistance or back pressure such a pipe offers to the escape of the combustion products does
70 not influence the combustion process carried out according to the present invention, and such pipe may therefore be as long as necessary to reach the desired place of discharge, and the flame casing itself may be tortuous
75 or of any of the shapes which are most convenient for the vaporization of liquid fuel in automobile power plants, being most effective when involving a change in direction and impingement of the burning gases upon
80 the object to be heated.

In the drawings, the reference 1 designates the flame casing, 2 the exhaust pipe and 3 a box surrounding the casing and representing the engine vaporizer or the
85 object to be heated. The stream of mixed fuel and air, projected into the flame casing, is produced in Figs. 1 and 3 by means of an air nozzle 4 in atomizing relation to a liquid fuel nozzle 5, the former nozzle being
90 supplied with air or other fluid pressure medium under suitable pressure and the fuel nozzle being supplied with kerosene or other fuel oil from a constant-level or constant pressure supply chamber 6, which may be
95 float-controlled or otherwise. In Fig. 5 the spray producing means is constituted by a Venturi tube 7, supplied with air from a suitable air source (not shown, but of lower pressure than needed for the nozzle 4) and
100 supplied with liquid fuel from an oil spray nozzle 8 opening from a suitable supply chamber such as 6 into the throat of the Venturi tube 7, whereby the local depression and high velocity in the latter sucks the
105 oil into the tube finely atomizing it with the air, and projects the mixture centrally into the flame casing 1. Other means for producing finely atomized fuel mixtures of a character to ignite within the closed flame
110

casing are equivalent means for producing the fuel stream contemplated by this method and above described. By selecting the proper degree of atomization and a proper relation of the spray to the igniting agent and to the combustion supporting air, kerosene, solar oil, common fuel oil and other heavy oils can be ignited instantly and caused to burn steadily even though in an initially cold condition and by means of an electric spark, and without preheating the apparatus or preliminarily vaporizing the fuel. The best relationship for this purpose can be found by setting the igniter in operation, emitting a continuous series of sparks at about the position indicated in the drawings and then varying the pressure at the atomizing nozzle until flame results, or by also shifting the location of the igniter while varying the pressure at the nozzles, until the correct location of the igniter,—a critical position,—is determined.

The fuel mixture at this point, which thus ignites cold, is a mixture too rich to burn of itself, in the closed casing, being a non-explosive mixture, and although entering with considerable velocity is not capable of inducing sufficient flow of the needed combustion-supporting air into the casing. Air to support the combustion is therefore introduced under pressure difference and brought into junction with the fuel spray in the casing sufficiently forward of the ignition point to continue the combustion and in sufficient amount to establish explosive proportions within the casing, which causes complete combustion therein. The combustion-supporting air, however, must be so introduced into the confined casing as to flow alongside of the liquid fuel stream without initially or immediately mixing therewith to such extent as to form an explosive mixture so near to the spark as to be ignited by it; that is to say, the process of actual mixing of the streams of air and fuel particles must be delayed so that, although the proportions are those of an explosive mixture, as just stated, the two streams will not immediately become so commingled and homogeneously intermixed as to result in explosion on contact with the spark or fail to ignite. This manner of introduction above described involves the formation of a point or zone in the non-homogeneous mixture within the casing where the proportions of fuel spray and air are locally over-rich in spray, richer than would produce complete combustion if no other air were available, and where also, the velocity of flow is less than the rate of flame propagation. The critical position of the igniter, above referred to, is the said point or zone. By virtue of the existence at this point of the two conditions stated, ignition occurs readily and the flame spreads non-explosively

throughout the whole mixture stream, burning steadily and completely and with an intensely rapid development of heat. A velocity at the rich point substantially exceeding the rate of flame propagation will prohibit ignition. The dotted lines in the drawing are intended to indicate, though necessarily in a rather crude manner, the relation of the fuel spray and air streams whereby the point of ignitable velocity and proper over-richness is established, such point coinciding with the position of the spark gap of the igniter. In Fig. 1, the combustion-supporting air is supplied from a source of air pressure constituted by an air injector 9 of common type and in such proportions as above stated, as will make the total proportions of air and fuel flowing through the casing, give complete combustion therein and result in exhaust-gas products at the outlet, which contain substantially no free oxygen or fuel. As illustrated in Fig. 1, pressure fluid from the supply line 10, serves the atomizing nozzle 4 and also the injector, and the air injected by the latter, under a pressure sufficient to supply the requisite quantity against the resistance of the flame casing and its open exhaust, enters said casing through an annular inlet chamber 11 and also tangentially as shown in Fig. 2. A star-shaped partitioning device 12 centrally placed in the casing and inlet chamber 11, and just in advance of the point of ignition, serves to direct the tangentially entering air and give it direction parallel with the spray, so that both the spray, ignited, and the air, begin their course through the casing flowing alongside of each other or not immediately mixing together. The partitioning member or star piece also, by the heat it absorbs, serves to vaporize such liquid fuel particles as encounter it after ignition has taken place, thereby preparing the fuel for its more instantaneous union with the air in the region of maximum temperature development. While Fig. 1 illustrates the use of a single source of pressure for operating the spray-producing means and supplying the supporting air, it will of course be understood that various instrumentalities known to the art are suitable for these purposes.

In Figs. 3 and 4 the supporting air from the annular inlet chamber 11, is admitted to the spray through the holes in a cylindrical partitioning member 13 and thus distributed into the spray on all sides.

In Figs. 5 and 6 the spray from the Venturi-tube 7 is ignited by a spark from the electrodes 14 placed just beyond the end of the tube, and the air from the pipe 15—the delivery pipe of a blower for instance—flows through the passage 16 and joins the spray as an envelop just beyond the igniter,

the total proportions being those of an explosive mixture. The flame casing in this form is also formed as a Venturi tube having its throat or point of narrowest cross-section in a position where the static (Venturi) pressure depression will tend to assist the discharge from the Venturi spray-producing means. The star-shaped member 17 in this form assists in preserving and continuing the separation of the streams but more particularly its function here is as a vaporizer for particles of liquid. The valve 18 serves to adjust the fuel and air proportions.

Referring now to Figs. 7 and 8 the construction whereof will be recognized without description, the fuel stream or streams here are formed by two spray-producing means like that of Fig. 1, both discharging into the flame casing 1 in positions opposed to each other but in such manner as to avoid the formation of an explosive mixture in igniting proximity to the spark substantially as in the forms above described. The supporting air enters under pressure as before, and under the control of a valve or throttle 19 from a blower, for instance, joining with the two spray streams initially in about the manner indicated by Fig. 8, where the dots represent the spray. In this form, I have illustrated a thin metal lining 20 in the nozzle caps of the spray-producers, which quickly heat up and aid combustion by immediately vaporizing any drip from the nozzles. Ignition in this form takes place as before and maximum heat development occurs at about the same place as in the other examples.

The exhaust outlet for the flame casing it will be observed is an open outlet in each of the cases above described, so that only an inconsiderable back pressure is opposed to the free forward flow of the air and fuel spray streams, and this fact, it should be explained, enables the said streams to establish instantly the proper proportions in a non-homogeneous condition, as above described, adapted to ignite and burn steadily and without popping or explosions and it is characteristic of this invention that reliable ignition is secured in the manner stated in the absence of any considerable pressure in the ignition chamber.

The structural features of this invention are also disclosed in my copending application Serial No. 94,865, filed May 2, 1916, and in my copending Patents No. 1207897 issued December 12, 1916, and No. 1231152 issued June 26, 1917.

Having described the principle of my invention and the best methods by which the same can be carried out, the following is claimed:

1. A method of obtaining instant and con-

tinuous forced combustion of kerosene and other liquid fuels in confined passages of narrow compass, consisting in projecting a finely atomized spray stream of such liquid into said confined passage in an initially unvaporized condition and against a negligible back pressure, igniting said liquid stream by a spark directly intercepting the same close to its entrance to said passage, introducing a stream of combustion-supporting air into said passage in proportions suited to complete combustion therein and joining said stream with said spray without forming an explosive mixture therewith in igniting proximity to the spark, whereby ignition and combustion take place non-explosively within said passage.

2. A method of obtaining instant and continuous forced combustion of liquid fuels in confined passages of narrow compass, consisting in producing an air-atomized spray stream of liquid fuel against a negligible back pressure in said confined passage, igniting the same by a spark directly intercepting said spray stream, introducing close to the spark a stream of combustion-supporting air into said passage in proportion suited to complete combustion in the passage and gradually joining the same with said spray stream so as to avoid forming an explosive mixture therewith in contact with the spark.

3. A method of obtaining instant and continuous forced combustion of liquid fuels in confined passages of narrow compass, consisting in producing an air-atomized spray stream of liquid fuel against a negligible back pressure in said confined passage, igniting the same by a spark directly intercepting said spray stream, and uniformly enveloping said stream with a stream of combustion-supporting air close to the spark but without immediately mixing therewith to an extent producing explosion.

4. The method of instantly obtaining steady combustion of liquid fuel in a confined passage having an open exhaust outlet which consists in causing to flow into said passage against a moderate or negligible back pressure therein a stream of atomized liquid fuel and a stream of combustion-supporting air in the relative proportions of an explosive or completely combustible mixture, forming of such streams a non-homogeneous mixture containing a zone or point where the local proportions are too rich in fuel to support complete combustion and the flow velocity is less than the rate of flame propagation, and initiating combustion of the said flowing mixture by igniting the same at said rich point.

In testimony whereof, I have signed this specification.

JOHN GOOD.