R. H. WHITE.

PRODUCING AND BURNING COMBUSTIBLE HYDROCARBON MIXTURES.

APPLICATION FILED NOV. 7, 1907.

**974,730.** Patented Nov. 1, 1910.

2 SHEETS—SHEET 1.

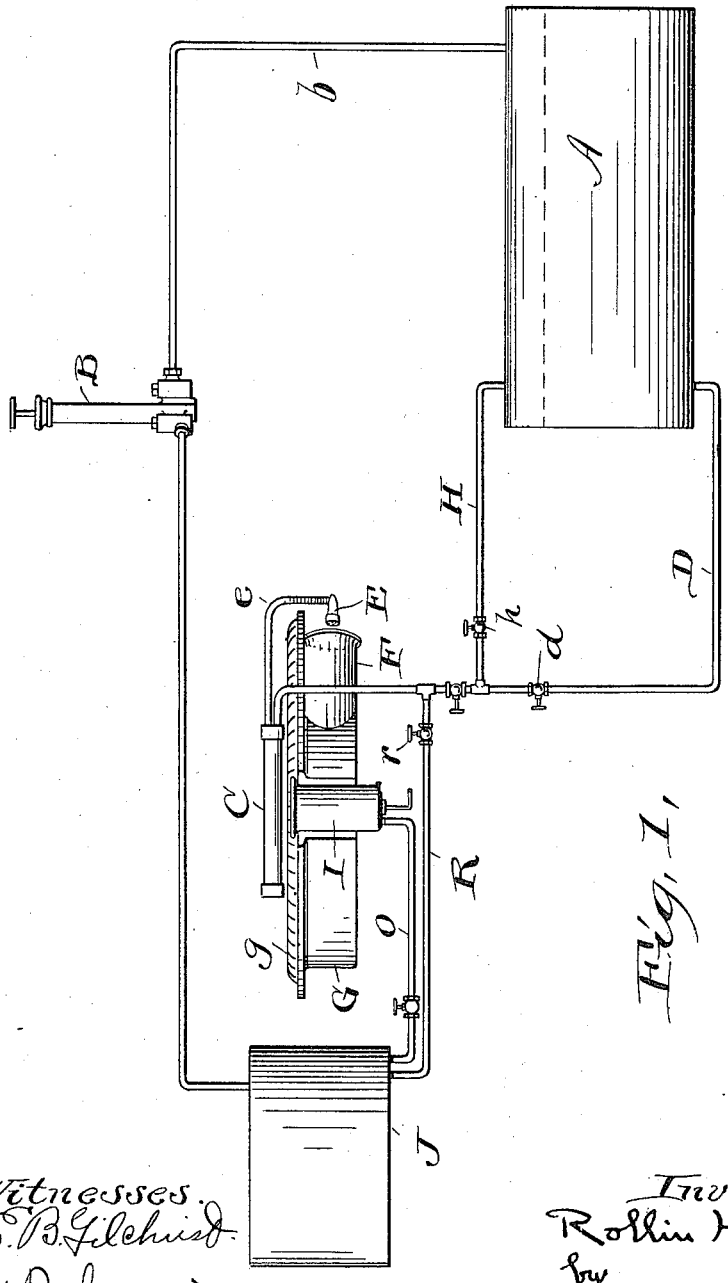


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

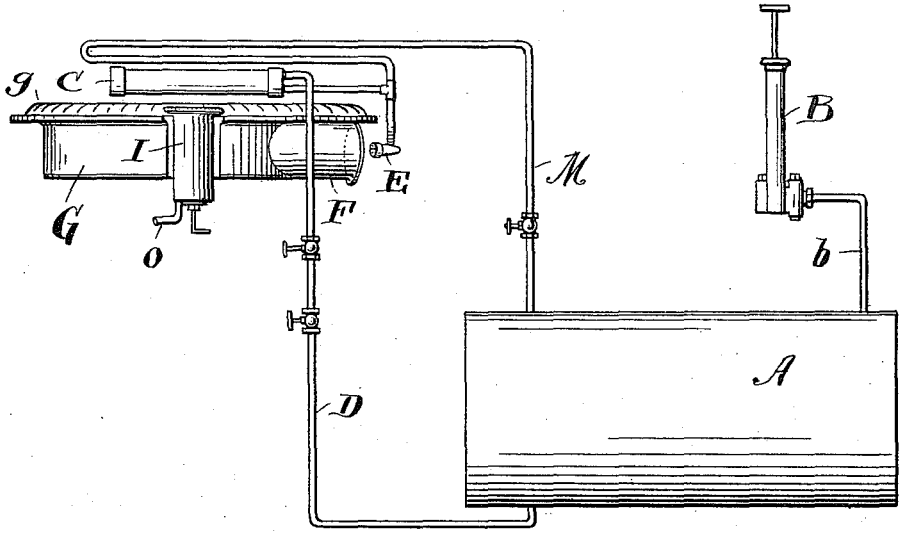
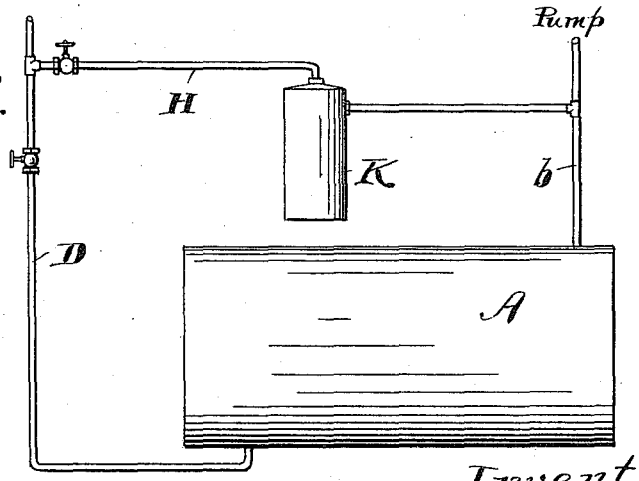



Fig. 3.

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# UNITED STATES PATENT OFFICE.

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## PRODUCING AND BURNING COMBUSTIBLE HYDROCARBON MIXTURES.

974,730. Specification of Letters Patent. **Patented Nov. 1, 1910.**

Application filed November 7, 1907. Serial No. 401,069.

*To all whom it may concern:*

Be it known that I, ROLLIN H. WHITE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Producing and Burning Combustible Hydrocarbon Mixtures, of which the following is a full, clear, and exact description.

The primary object of this invention is to permit the burning of the heavier hydrocarbons, especially kerosene, without producing any disagreeable odor and without leaving in the vaporizer any considerable deposit.

The apparatus as shown is constructed with special reference to permitting the practical use of kerosene as the fuel on steam driven motor vehicles. It will be understood, however, that there is no intention of limiting the use of the invention to motor vehicles, nor to kerosene, because it may be used in many other places where it is desired to produce heat from kerosene or from other hydro-carbons.

In the drawing, Figure 1 is a diagrammatic view of the apparatus in its most complete and satisfactory form, adapted for the practice of the described process. Fig. 2 is a diagrammatic view of a modified form of said apparatus; and Fig. 3 is a diagrammatic view of a modified form of a part of the apparatus.

Referring to the parts by letters, A represents a supply tank for holding a liquid hydro-carbon.

B is an ordinary air pump, by means of which air under pressure may be forced into said tank through pipe *b*.

C is a vaporizer which is arranged above the burner G so that said burner may be utilized as the means for heating the vaporizer.

I is a sub-burner or pilot light which projects up through the main burner beneath the vaporizer so as to be adapted to initially heat the same. Preferably this sub-burner will be adapted for the burner of gasolene and will receive its supply of vapor from an independent tank J through pipe O,—said tank to contain air under pressure introduced by air pump B or other suitable means.

E is a multiple jet nozzle which is connected with the discharge end of the vaporizer by a pipe *e*.

The burner has preferably an imperforated bottom, and numerous slit-like openings *g* in its top. F is the induction tube of this burner.

The pipe D connects the lower part of the tank A with the inlet end of the vaporizer.

All of the above mentioned parts may be of any suitable construction. As said parts are shown in Fig. 1 of the drawing, they, with the exception of the independent tank J, are like the corresponding parts which have been used for several years past on the White steam car.

The pipe H connects the top of the tank A with the pipe D at some convenient point. It is, therefore, apparent that the pressure in tank A will not only force the liquid hydro-carbon or kerosene from the tank into pipe D, but will also force air into pipe H, from which it will be discharged into pipe D; and the mixture of kerosene liquid and air will pass from pipe D into the vaporizer. The kerosene will be vaporized as it is passing through the vaporizer, and the mixture of vapor and hot air will be discharged in the form of jets into the open end of the induction tube F.

There are two distince advantages due to the use of the described construction: First, the passage of air with the kerosene through the vaporizer results in the substantially complete vaporization of said kerosene; second, by discharging into the induction tube, jets of a mixture of air and hydro-carbon vapor, a greater quantity of vapor can be burned in a given time.

The builders of steam cars have heretofore been restricted in the horse power capacity of cars which they could build, because of their inability to increase, beyond a definite limit, the quantity of fuel which could be burned. Given a burner as large as can be used on an automobile, the size of the induction tube is limited. There is a practical limit of the number of jets which can be discharged into said tube, and there is a practical limit to the cross sectional area which each jet may have. Up to a certain limit, each jet is able to induce the flow into the induction tube of enough air to support its combustion; but if the size of the jets is increased beyond that limit there is not a

corresponding increase in the volume of air drawn in, wherefore the combustion is incomplete. With the process above described, when a mixture of hydro-carbon vapor and combustion supporting gas is discharged in jets into the induction tube the size of the jet openings may be very considerably increased. In fact, they may be so increased as to considerably increase, the volumetric flow of the hydro-carbon vapor. While these larger jets do not induce a proportionately increased flow of air into the induction tube, they do increase the flow some, and in fact so increase it that the air, whose flow is so induced, plus the air which is mixed with the vapor, will promote the complete combustion of an increased quantity of vapor.

The complete combustion of the vapor generated in the manner herein described is probably assisted by the fact that the air drawn into the burner is heated more nearly to the temperature of combustion than is air when it is all drawn into the induction tube by the inductive action of the vapor jets.

It is, of course, desirable to properly proportion the hydro-carbon liquid and the air flowing to the vaporizer. For this reason the valves *d* and *h* are put into pipes D and H respectively, although perhaps one of them could be dispensed with. In fact, the pipes could be made of the proper relative size. But in view of the fact that various hydro-carbons may be used with the apparatus, and that all may require a different proportioning of air and liquid, the valves are preferred. It is not possible to give any exact directions adapted for all cases. The experiments heretofore carried on seem to indicate that there should be about three times as much kerosene as air forced into the vaporizer to get the best results.

Numerous modifications of the apparatus whereby some, but not all, of its advantages may be realized, may be made. For example, it is not necessary to take the air from the top of the tank A. It may be forced from an independent tank K, shown in Fig. 3, and forced into the vaporizer with the kerosene. It is not necessary that air be employed as any other combustion supporting gas may be substituted. In fact, it is possible to use, in place of the air, alcohol or any other easily vaporized fluid, whose vapor is a supporter of combustion, and this may be stored under pressure in tank K shown in Fig. 3.

It is not absolutely essential that the air pass through the vaporizer with the hydro-carbon, to obtain results which are better than those produced by the present practice. In fact, as shown in Fig. 2, a pipe M may independently connect a tank containing the combustion supporting fluid, as tank H, with the nozzle or with the pipe which connects the nozzle with the vaporizer, as shown in Fig. 2. By employing this construction, however, one loses the advantage above pointed out which comes from passing the air through the vaporizer. There is, however, a distinct gain, as against the older construction, in connecting the air pipe M with the nozzle, more especially if the pipe M is carried over the burner so as to be heated thereby, as shown in Fig. 2; because thereby the jet openings in the nozzle may be greatly enlarged so as to really increase the volumetric flow of vapor from them.

The described apparatus as an entirety has certain desirable characteristics when used on a steam driven motor car. For example, if the driver of such a car prefers to use gasolene in the old way, he may fill his tank with it and turn off the valve *h*. If he should use all of the fuel in tank A, he may turn off valve *d'* in pipe D, and may open the valve *r* in pipe R, which connects the gasolene tank J with the pipe D,—and so long as the gasolene in said tank holds out it can be used.

Having described my invention, I claim:

The combination of a burner having an induction tube, a sub-burner projecting through the burner first mentioned, a vaporizer arranged over both the main burner and the sub-burner, a jet nozzle connected with the discharge end of the vaporizer and arranged to discharge into said induction tube, with a fuel tank, two pipes which respectively connect the top and bottom of said tank with the inlet end of the vaporizer, a valve in both pipes, a second fuel tank, a pipe connecting it with the sub-burner, another pipe containing a valve connecting the last mentioned tank with the inlet end of the vaporizer, and means for putting air, under pressure, into both of said tanks.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

ROLLIN H. WHITE.

Witnesses:
E. L. THURSTON,
E. B. GILCHRIST.