E. THOMSON.

OIL ENGINE.

APPLICATION FILED SEPT. 3, 1910.

1,105,047. Patented July 28, 1914

Fig. 1.

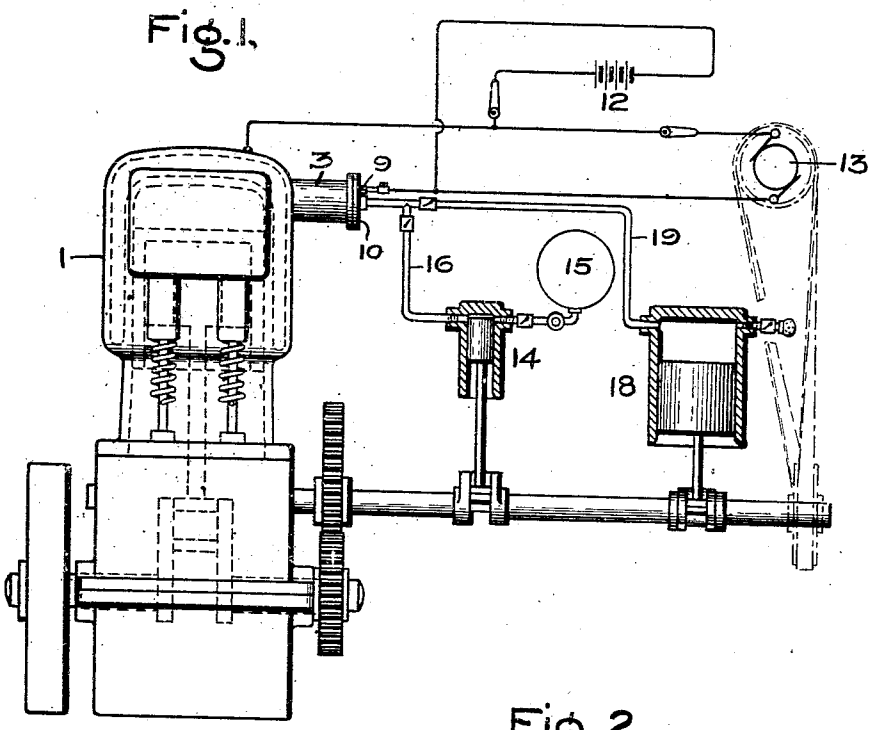
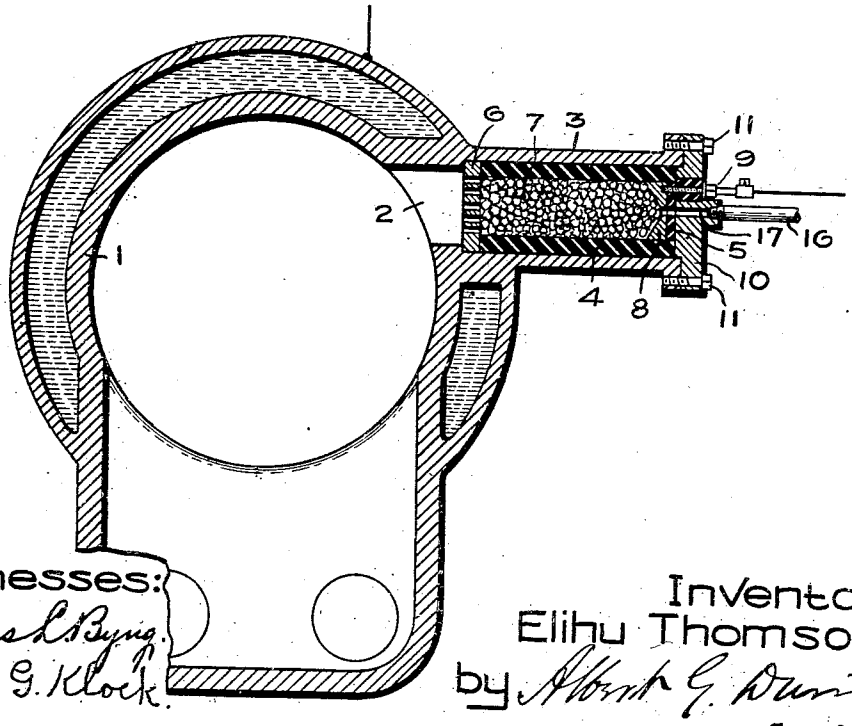


Fig. 2.



Witnesses:
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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

OIL-ENGINE.

1,105,047. Specification of Letters Patent. Patented July 28, 1914.

Application filed September 3, 1910. Serial No. 580,338.

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Oil-Engines, of which the following is a specification.

This invention relates to internal combustion engines, and its object is to enable heavy oils to be utilized for producing the explosive mixture. Various schemes of this general nature have been heretofore proposed, some involving the use of a gas producer to make a fixed gas from the oil, others proposing to vaporize the oil, and still others to convert it into a spray mixed with air. The gas producer is necessarily heavy and cumbersome; the vaporizer involves an outside source of heat and is slow in getting under way, frequently requiring the employment of gas or gasolene or other more volatile oil to start it. To spray oil demands a high pressure air pump, because the fuel charge is not introduced into the cylinder until the compression of the air therein is about completed; this being done to allow high compression to be used without the danger of pre-ignition.

In my invention I use a vaporizer comprising a tortuous passage in a body of resistance material which can be suitably heated preferably by the passage of an electric current through said material, the oil being forced through said hot vaporizer and into the cylinder at or near the moment of greatest compression in said cylinder. There is no need of an igniter, as the oil vapor leaves the vaporizer in a superheated state and is self-ignited. The details of the preferred embodiment of my invention will appear in the following extended description, reference being had to the accompanying drawing in which—

Figure 1 is a diagrammatic representation of an internal combustion engine equipped with my fuel feeding devices, and Fig. 2 is a cross section of the engine cylinder and the vaporizer on a larger scale.

The invention is shown as applied to a single cylinder upright four cycle engine, but it is of course capable of use with multi-cylinder engines, and with those operating two cycle. In the upper part of the cylinder 1 is an opening 2 communicating with a tubular projection 3, preferably cast integral with the cylinder and forming the casing of the vaporizer. An insulating bushing 4 is inserted in the projection 3 composed of some refractory material such as mica or fused quartz. The bushing has an outer head 5 of similar insulating material, and an inner perforated head 6 of refractory metal, such as nickel. Between said heads is a filling 7 of granular conducting material offering high resistance to the passage of a current of electricity. It is preferred that this material have a negative temperature coefficient, and for this purpose silicon or boron or borid of carbon are well adapted. By the expression "negative temperature coefficient" is meant that the resistance of a material to the passage of a current of electricity decreases to a greater or less extent, as the material is heated. Inside the head 5 is an electrode or terminal 8 connected through said head to a binding post 9 which is mounted on a cap 10 secured to the outer end of the projection 3, as by the screws 11. One pole of a source of electric current is connected to said binding post, the other pole being connected to the head 6 through the cylinder 1. The electric current may be obtained from any suitable source, such as the battery 12, or a generator 13 driven by the engine, or both, the battery being used only for starting. If the engine is used to drive a generator for lighting or power purposes, a portion of its output, probably from 2 to 5 per cent., would be sufficient to heat the vaporizer. In any event, the supply of current must of course be regulated, so that the resistance material may not become overheated by standing with the circuit closed when the engine is not running. The current must be of sufficient voltage to raise the granular resistance material to a high temperature. If silicon granules are used, they may be about the size of small peas, and their working temperature will be a bright yellow heat.

The fuel is preferably a heavy oil, which is not only less expensive but is far safer to use than gasolene. It is forced by suitable means, such as the pump 14, operating in synchronism with the engine, from a tank 15 to a pipe 16 entering the cap 10 and

communicating by a port 17 with the tortuous passage formed by the granular material 7 or otherwise. In its passage through the highly heated filling 7 the oil is vaporized, superheated and fired, and it enters the cylinder through the perforations in the inner head 6 of the vaporizer. It is preferable to have the oil vapor issue from these perforations in various directions and not as a smooth jet, in order to insure its instantaneous and complete mixture with the air in the cylinder. To this end some or all of the perforations can be set obliquely to give the vapor a whirling motion.

In operation the parts are so timed that the piston of the engine makes the greater part of its compression stroke before any fuel enters the cylinder. But as soon as the air in the cylinder has reached very near the maximum pressure, the pump will send a small charge of oil through the vaporizer. Burning takes place while the oil is being forced in, the ignition of the explosive mixture of air and vapor taking place automatically by reason of the high temperature of said oil vapor.

In order to clear the granular filling of any unvaporized oil or unburned oil vapor, and at the same time help in a measure to keep up the temperature of the same, I provide an air pump 18, whose piston is timed to follow each compressive or injective stroke of the oil piston, so that immediately following the injection of the oil a stream of air is forced through a pipe 19 into the pipe 16 and so through the granular mass, sweeping before it all the oil vapors and unconsumed material and thus keeping the granular filling from clogging. This puff of air also serves to stir up the contents of the explosive chamber in the cylinder so as to make the combustion quite complete.

The advantage of using the granular material having a negative temperature coefficient is that when the mass is cooled by the vaporized oil it increases in resistance and thereby assists in the delivery of energy, besides giving a regulating action. It would naturally be the case that that portion of the granular mass nearer the oil pipe inlet would become cool to a greater extent than that farther from the oil pipe inlet, but if the effect of cooling is to increase the resistance of the material then an increased delivery of energy takes place at the part so cooled, which tends to secure a balance of delivery.

It should be remarked that the drawing accompanying this specification is merely illustrative, and no attempt has been made to show a commercial machine, or to preserve the proper relative sizes of the cylinders of the engine and pumps.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In combination, an internal combustion engine having a cylinder and piston, the latter being arranged to compress pure air in the cylinder on one of its strokes, a vaporizer opening into the cylinder and comprising a mass of material containing a plurality of passages through which the fuel passes and is finely divided, said material being a relatively poor conductor of electricity, means for passing a current of electricity through said material to heat it to a relatively high temperature, a pump timed to force a charge of fuel through the passages into the cylinder when the piston has partially completed its compression stroke, and a second pump timed to force a charge of air through said material to assist in forcing fuel into the cylinder.

2. The combination with an internal combustion engine, of a vaporizer for oil comprising a mass of granular resistance material located in the path of said oil, means for passing an electric current through said mass, means for forcing the oil through said electrically heated mass, and means for forcing air therethrough also.

3. The combination with an internal combustion engine, of a vaporizer for oil comprising a tube of refractory material, a filling of granular resistance material, heads of refractory material confining said granular material, an oil pipe communicating with one end of said tube, and a source of electric current in circuit with said resistance material.

4. The combination with the cylinder of an internal combustion engine, of a tube of refractory material communicating with said cylinder, a mass of granular resistance material in said tube having a negative temperature coefficient, retaining heads in said tube, an oil pipe entering the outer end of said tube, and a source of electric current in circuit with said resistance material.

5. The combination with the cylinder of an internal combustion engine, of a tubular projection from said cylinder, a lining of refractory material in said projection, a filling of granular resistance material in said lining, an inner perforated head for said lining, an outer head having an inlet port, an oil pipe communicating with said port, and a source of electric current in circuit with said resistance material.

6. The combination with the cylinder of an internal combustion engine, of a tubular projection from said cylinder, a lining of refractory material in said projection, a filling of granular resistance material in said lining, an inner perforated head for said lining, an outer head having an inlet port, an oil pipe communicating with said port, a source of electric current in circuit with

said resistance material, a pump for forcing oil through said pipe, means for operating it in synchronism with the engine, and means for sending a puff of air through said pipe after each injection of oil.

7. The combination with an internal combustion engine, of a vaporizer connected with its cylinder, and means for sending oil and air in succession through said vaporizer.

8. The combination with an internal combustion engine comprising a piston and cylinder, of a vaporizer located in close proximity to said cylinder and comprising a mass of material having high electrical resistivity and affording a tortuous passageway for oil, a source of electric current in circuit with said mass, a pump driven by the engine for forcing oil through the vaporizer into the cylinder after the piston has started its compression stroke, and means for forcing air through the vaporizer between successive pump strokes.

9. The combination in an internal combustion engine, of means for injecting fuel into the cylinder when the piston has partially completed its compression stroke, said means comprising a vaporizer connected to the cylinder having a mass of granular resistance material therein, means for passing a current of electricity through said material to heat the same, and means for forcing first a charge of liquid fuel and then a blast of air into the vaporizer.

In witness whereof, I have hereunto set my hand this 1st day of September, 1910.

ELIHU THOMSON.

Witnesses:
CHARLES A. BARNARD,
FRANK G. HATTIE.