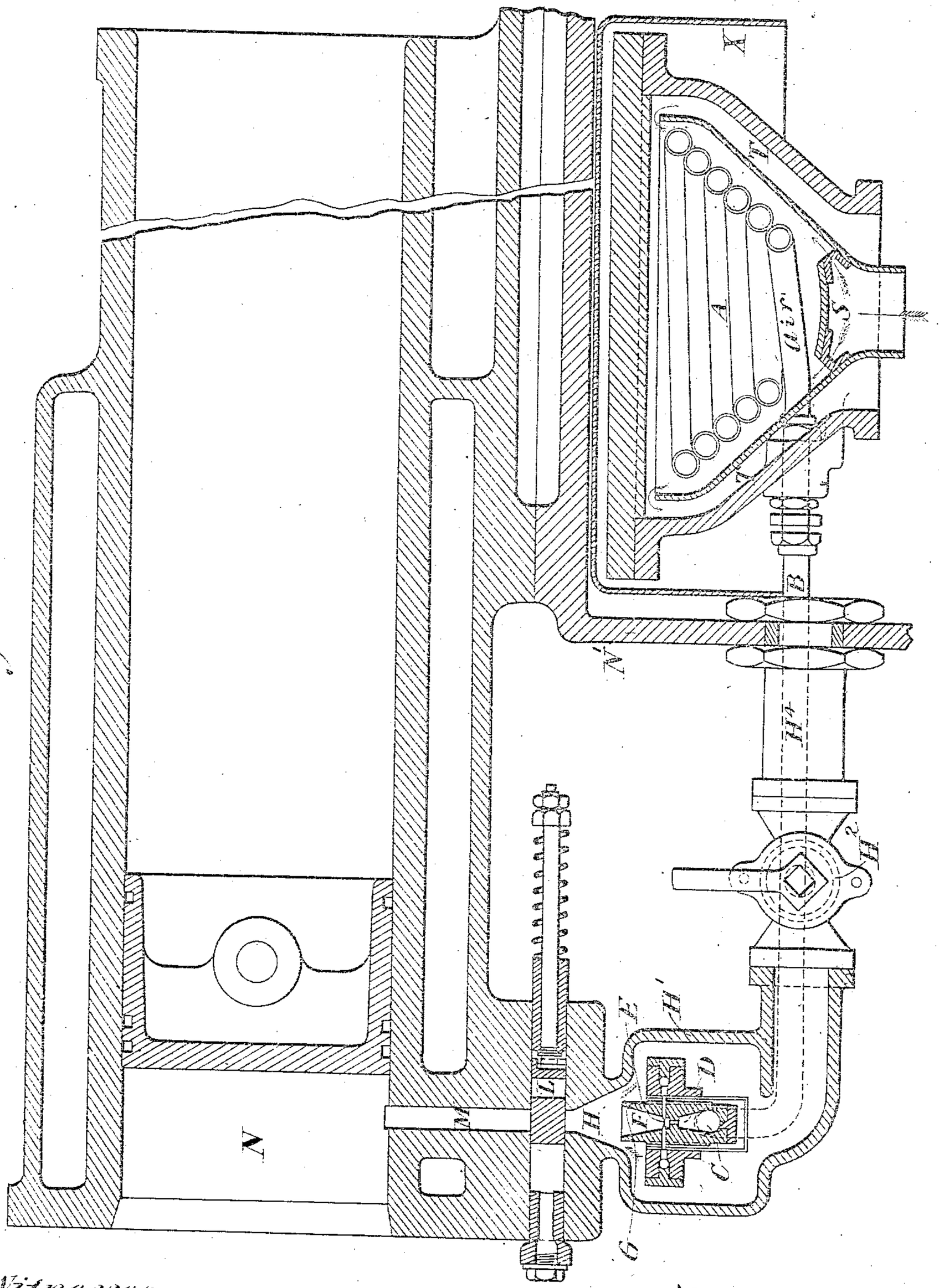
(No Model.) 4 Sheets—Sheet 1.

A. GRAY.

HYDROCARBON ENGINE.

No. 504,723. Patented Sept. 12, 1893.



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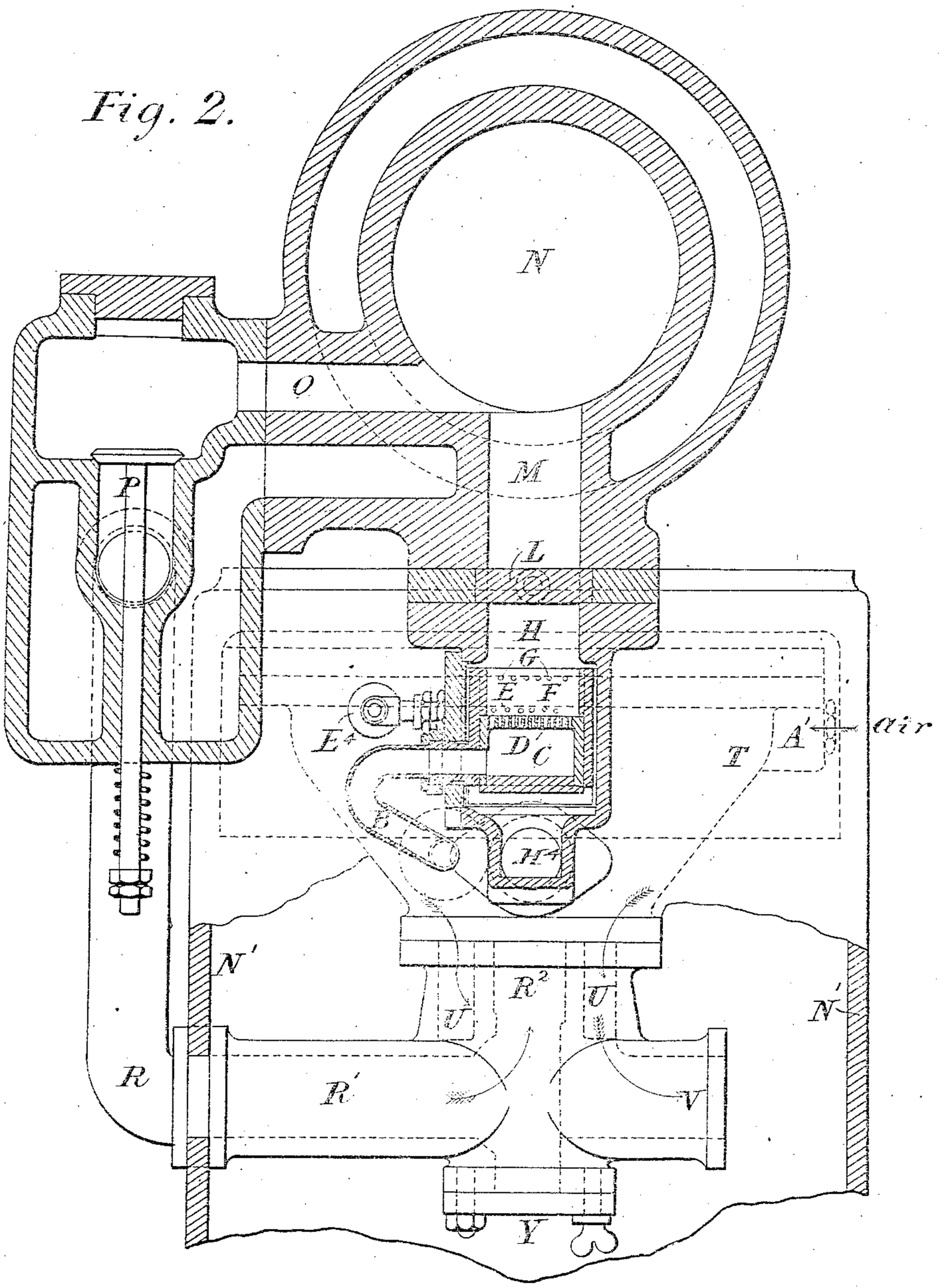
HYDROCARBON ENGINE.

No. 504,723. Patented Sept. 12, 1893.

Fig. 2.



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4 Sheets—Sheet 3.

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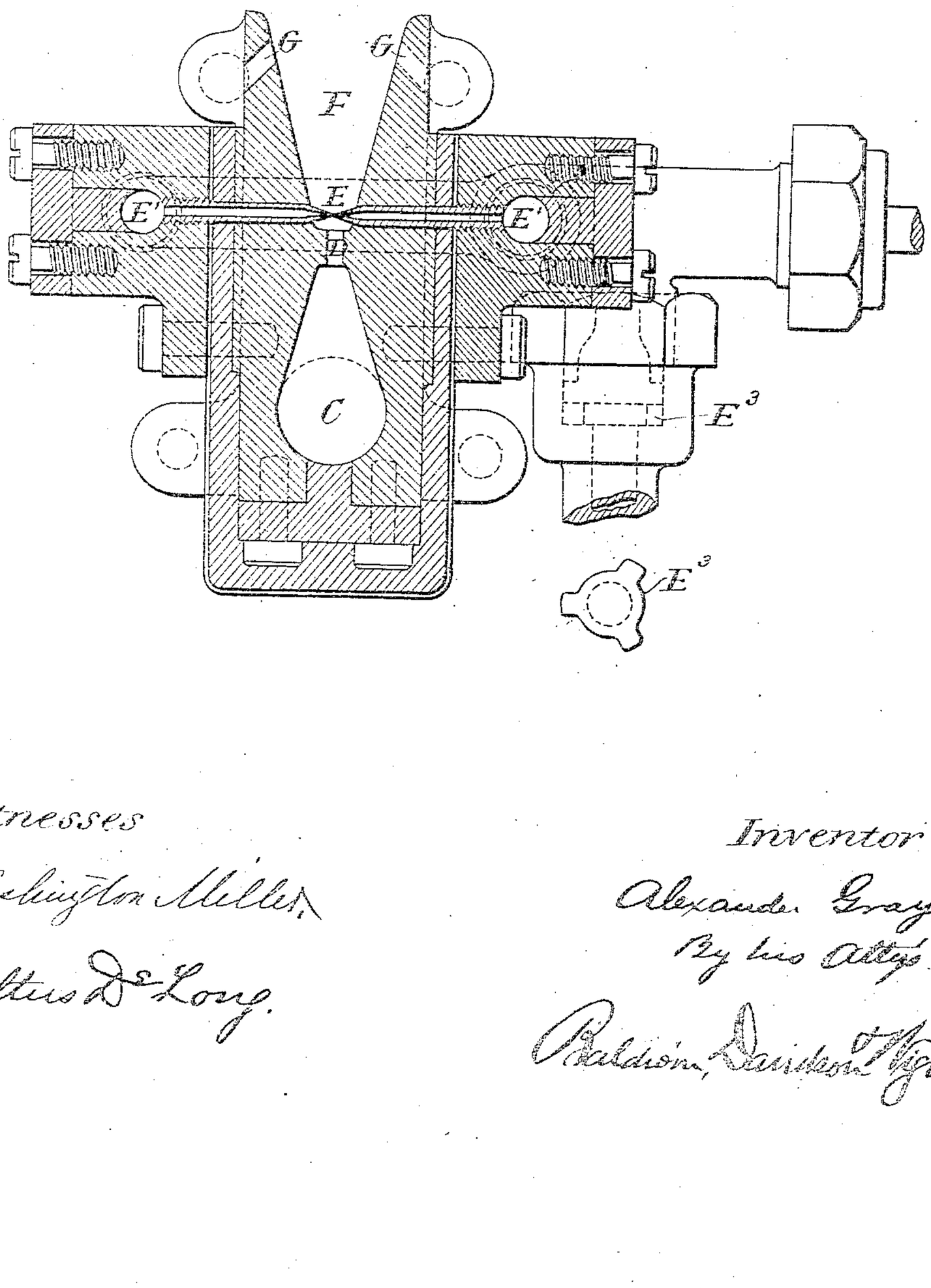
HYDROCARBON ENGINE.

No. 504,723. Patented Sept. 12, 1893.

Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

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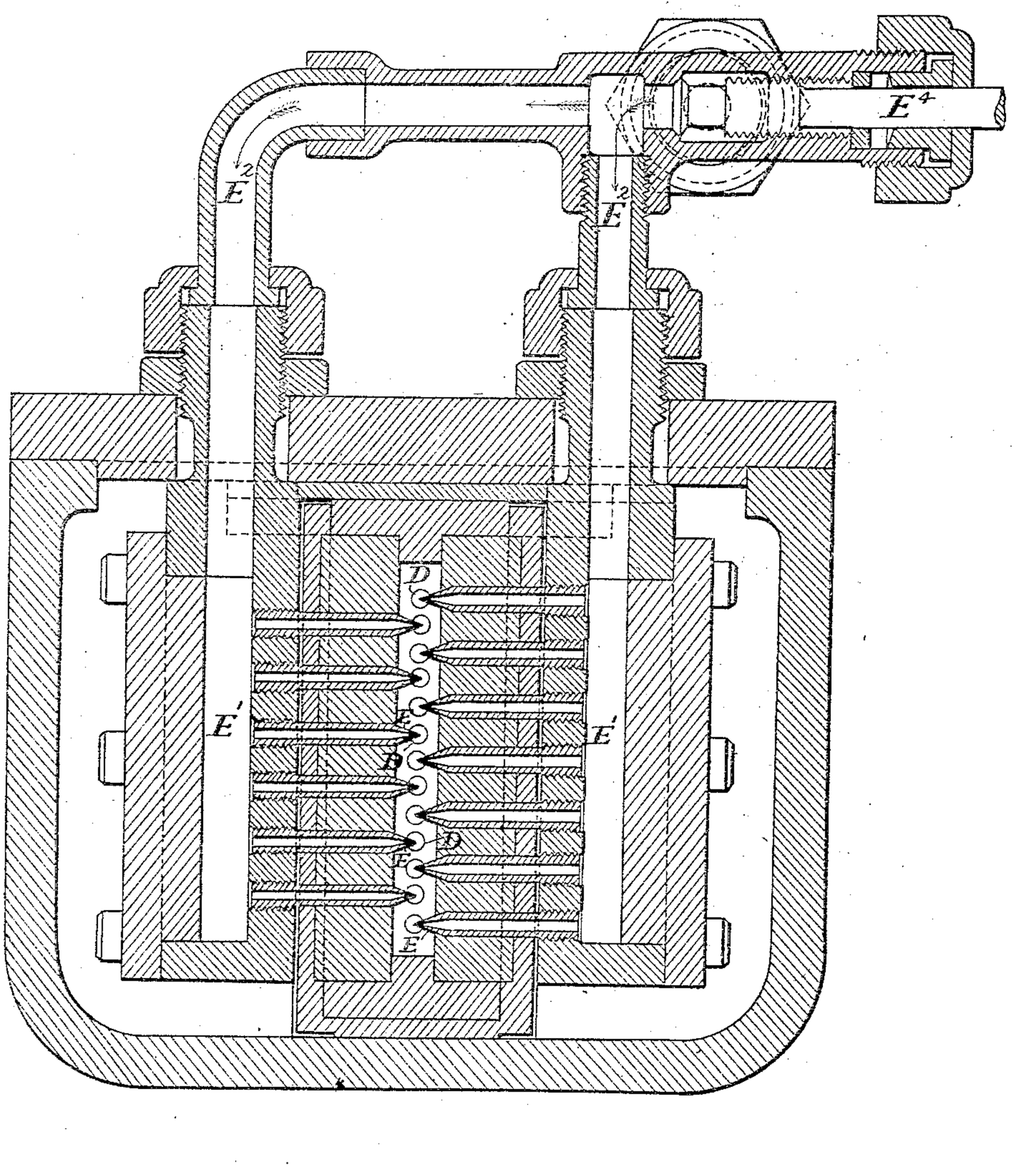
HYDROCARBON ENGINE.

No. 504,723. Patented Sept. 12, 1893.

Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

ALEXANDER GRAY, OF LONDON, ENGLAND.

HYDROCARBON-ENGINE.

SPECIFICATION forming part of Letters Patent No. 504,723, dated September 12, 1893.

Application filed November 24, 1891. Serial No. 412,925. (No model.) Patented in England January 5, 1891, No. 191; in France November 9, 1891, No. 217,298, and in Germany November 13, 1891, No. 64,339.

To all whom it may concern:

Be it known that I, ALEXANDER GRAY, a subject of the Queen of Great Britain, residing at The Mansion Frognal, London, England, have invented certain new and useful Improvements in Hydrocarbon-Engines, (for which I have received Letters Patent in Great Britain, No. 191, dated January 5, 1891; in France, No. 217,298, dated November 9, 1891, and in Germany, No. 64,339, dated November 13, 1891,) of which the following is a specification.

My invention relates to that class of engines which are actuated by the explosion of a mixture of air with vapor of petroleum, or other hydro-carbons, or of tar, creocote or other liquids, which, when heated, are more or less volatile and the vapor of which, when mixed with air, forms an explosive mixture.

In my improved apparatus highly heated air is used to convert the liquid into spray and to simultaneously convert it more or less into vapor; the mixture of air, spray and vapor thus produced is mixed with a further quantity of cooler air to form an explosive mixture, which is compressed in the cylinder of the engine and exploded by any suitable means.

The advantages of this improvement on the usual method of using cold air to form the spray and then heating the spray by passing it through heated pipes or chambers are the following: First, the liquid is volatilized by the heat imparted by the air instead of by heated metal surfaces, thus avoiding the charring of the heavier liquids which often ensues when they are in contact with hot metal for some time; second, the unvolatilized portion of the liquid is the residue of the particles of spray from which the more volatile portions have been removed; it is consequently in a state of very fine division which conduces to its perfect combustion; third, the pipes or channels through which the spray passes into the cylinder are short, direct, and expose but little surface on which the unvolatilized liquid may be deposited and on which the most easily condensed portions of the vapor may be condensed. The air used to form the spray should be heated to from 400° to 600° Fahrenheit or even higher according to the class of liquid used. Preferably I heat the air by the exhaust gases, passing from the engine as hereinafter described but other means of heating the air may be adopted.

I arrange the mechanism for mixing the air and oil close up to the inlet valve of the engine cylinder, so that when the valve is open, the mixture passes directly from the mixing mechanism into the cylinder. I first vaporize the oil by mixing it with highly heated air, and then subsequently add cooler air. The advantage of this is that the highly heated air (say from 400° to 600° Fahrenheit) first vaporizes the oil and then the mixture is cooled by the cooler air. If the oil were never submitted to a higher temperature than that at which the mixture ought to enter the cylinder, none of the oil would be vaporized and there would not be a sufficiently intimate mixture of air and oil to produce a readily explosive compound, and therefore, the heavy oils have not been used in engines of this kind. If, however, the oil has been once vaporized by mixing it with highly heated air, and the mixture is then cooled, any of the vapor which then condenses will be in a very minutely divided form and very intimately mixed with the air, as in a fog or mist, and consequently, the mixture can be exploded at a much lower temperature.

The subject-matter deemed novel is specifically set forth in the claims at the end of this specification.

In the drawings annexed Figure 1 is a longitudinal section of an engine fitted with an atomizer and air heating appliance for supplying heated air to the same in this manner. The main portions only of the engine are shown as the engine may be of any ordinary construction. Fig. 2 is an end view partly in section of the same. Fig. 3 is a vertical section on a larger scale of the atomizer and Fig. 4 is a horizontal section of the same.

N is the cylinder of the engine. N' is a hollow stand on which it is mounted.

O (see Fig. 2) is the exhaust passage from the cylinder N.

P is the exhaust valve opened in the ordinary manner at the required times by parts of the engine not shown in the drawings.

R is a pipe by which the exhaust gases are

led to a pipe R′ which is within the hollow stand. At the inner end of this pipe is a vertical portion R^2. The upper end of this portion of the pipe is surrounded by an annular chamber U. Around the upper end of this chamber is a flange to which is secured a flange which is at the bottom of a closed chamber T. The top of the vertical pipe R^2 is connected to the lower end of a funnel shaped lining S (see Fig. 1) which is within the chamber. The exhaust gases from the engine therefore pass up as shown by the arrows in Fig. 1 into the funnel S and from its open top pass downward between the funnel and the chamber T and through openings in the bottom of the chamber to the annular chamber U from which they pass into a pipe V by which they are conveyed away.

A is a coil of pipe within the funnel shaped lining S. Its upper end is carried out through the chamber T at A′ (see Fig. 2.) Its lower end is also carried through the chamber and is attached to a pipe B which leads to the hollow chamber C of an atomizer or spray producer.

X is a cap covering the chamber T so that air passing into the upper end of the coil at A′ is taken from within this cap and would therefore be to some extent heated. From the chamber C the air passes through a number of small passages D to the coned outlet F of the atomizer. As the air issues from the passages D it impinges on the ends of nozzles E. These nozzles have liquid hydrocarbon supplied to them through the pipes E′ from a supply of liquid hydrocarbon which is always kept at the same level, or by other suitable means. The nozzles have a very fine bore and are tapered off at the end. The air impinging upon them converts the oil issuing from them into spray and the heat of the air vaporizes more or less of the oil. The hot spray and vapor thus formed pass upward through F where they are mixed with a further small quantity of air passing through the holes G. On issuing from F they pass into a coned passage H where they receive a further admixture of air and the explosive mixture so formed passes through the valve L and port M to the cylinder of the engine where after being compressed it is exploded. If desired the hot spray and vapor before receiving this further admixture of air might be still further heated by being passed through a heated passage. I however prefer that they should at once receive this further admixture of air as above described. The coned passage H leads from a jacket H′ by which the atomizer is surrounded. Air is supplied to this jacket through a pipe H^4 which passes from the interior of the hollow stand N′ on which the cylinder of the engine is mounted. In the arrangement shown in the drawings the air would be drawn through the atomizer and into the cylinder by the action of the piston of the engine each time that the valve L opened but if desired it might be forced into the cylinder by pumps.

The supply of oil is regulated partly by the size of the nozzles E and partly by the valve E^4 and it is prevented from returning by the valve E^5 during that period of the revolution of the engine when no oil is passing through the atomizer. The supply of hot air is regulated partly by the size of the holes D and partly by a ferrule (not shown) in the pipe B. The supply of air through the jacket around the atomizer is regulated by the cock H^2.

When starting the engine the coil is heated by a lamp placed under it. The door Y is turned aside and the products of combustion pass from the lamp into the chamber T and around the coil. When the coil is hot enough the lamp is removed and the door Y closed. The engine is now started and the heat of the coil is maintained by the exhaust gases from the engine passing through the chamber T.

What I claim is—

1. A motor engine comprising a cylinder, a piston working therein, an inlet valve for admitting an explosive mixture to the cylinder, an outlet valve for the escape of the exhaust gases, nozzles in close proximity to the inlet valve to which a liquid hydro-carbon is supplied, nozzles through which streams of highly heated air are projected across the first nozzles, and means for supplying a further quantity of cooler air to the heated mixture of air and vapor coming from the nozzles before it enters the cylinders, substantially as described.

2. A motor engine comprising a cylinder, a piston working therein, an inlet valve for admitting an explosive mixture to the cylinder, an outlet valve for the escape of the exhaust gases, a nozzle or nozzles in close proximity to the inlet valve to which a liquid hydrocarbon is supplied, a nozzle or nozzles through which a stream or streams of highly heated air are projected past the first nozzles so as to produce spray and means for supplying a further quantity of cooler air to the heated mixture of air and vapor coming from the nozzles before it enters the cylinder, substantially as described.

3. A motor engine comprising a cylinder, a piston working therein, an inlet valve for admitting an explosive mixture to the cylinder, an outlet valve for the escape of the exhaust gases, mechanism for intermingling a stream or streams of highly heated air and a stream or streams of hydrocarbon oil in close proximity to the inlet valve and means for supplying a further quantity of cooler air to the heated mixture just as it enters the cylinder, substantially as described.

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