

(No Model.)

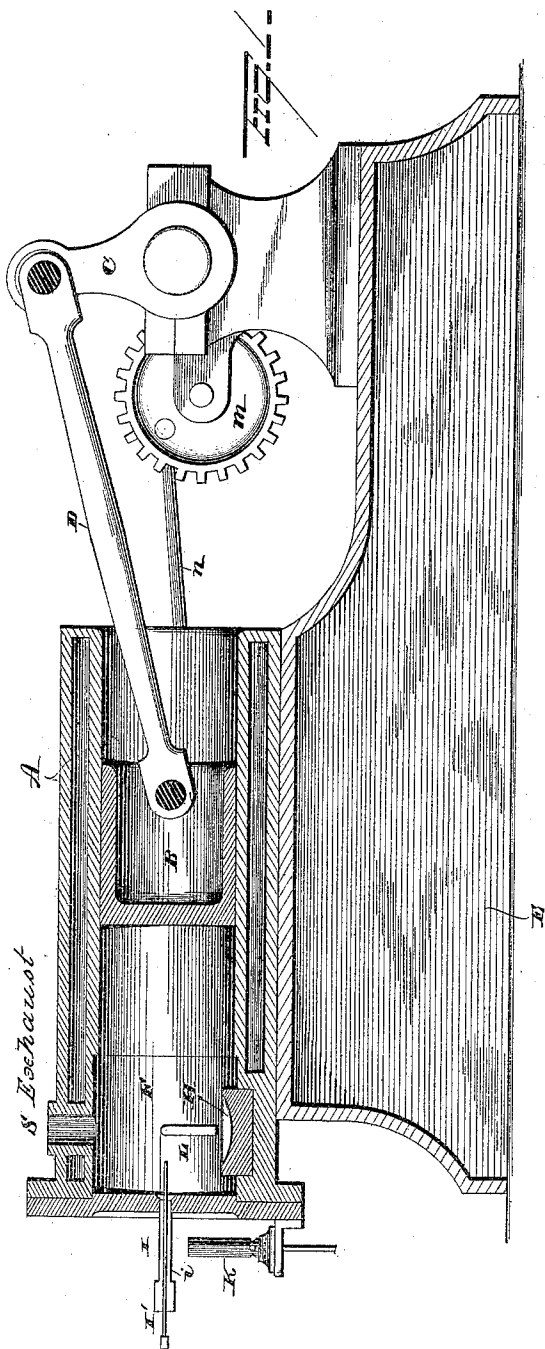
2 Sheets—Sheet 1.

A. K. RIDER.

HYDROCARBON VAPOR ENGINE.

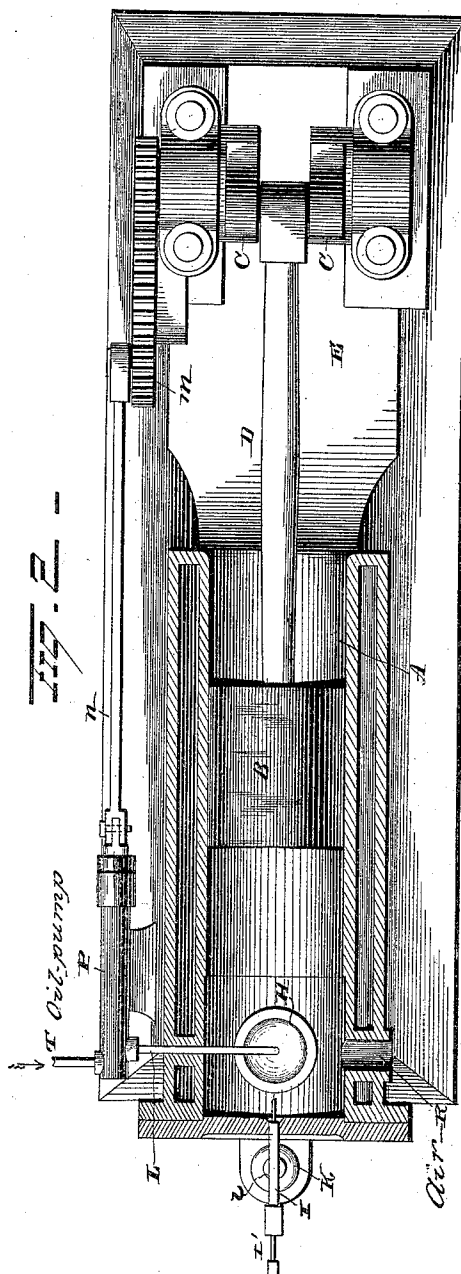
No. 335,629.

Patented Feb. 9, 1886.



WITNESSES

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C. J. Nottingham
Geo. F. Downing.



INVENTOR

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(No Model.)

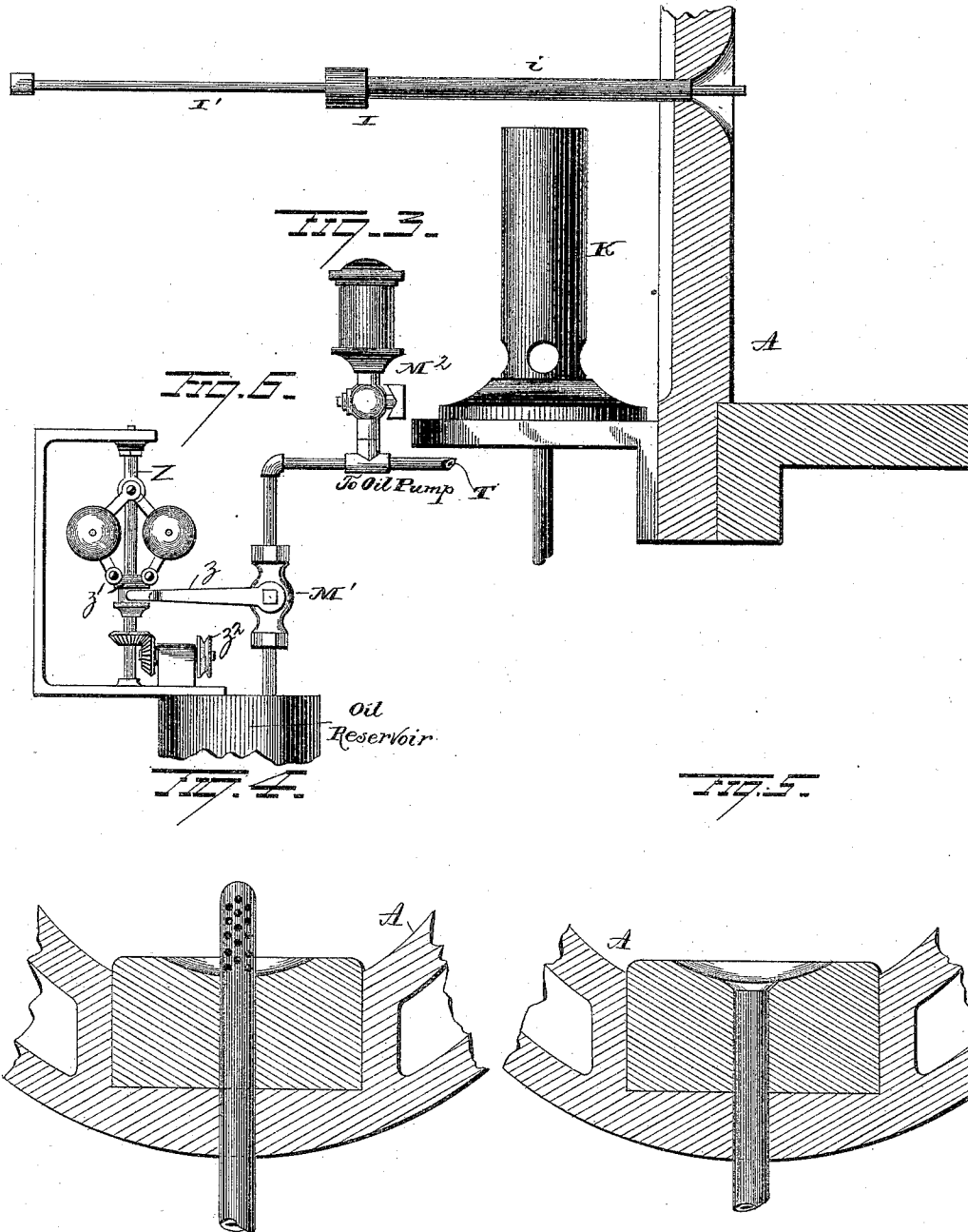
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WITNESSES

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UNITED STATES PATENT OFFICE.

ALEXANDER KIRK RIDER, OF WALDEN, NEW YORK.

HYDROCARBON-VAPOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 335,629, dated February 9, 1886.

Application filed September 9, 1885. Serial No. 176,585. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER KIRK RIDER, of Walden, in the county of Orange and State of New York, have invented certain new and useful Improvements in Hydrocarbon-Vapor Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in hydrocarbon-vapor engines, or internal-combustion engines, in which petroleum or other liquid hydrocarbon is used as the fuel and motive power.

The objects of the invention are to provide an engine of such construction that the hydrocarbon oil used therein shall be converted into and burned in the form of vapor or steam, instead of in the form of a liquid spray, as has been the ordinary custom heretofore; further, to provide means for thoroughly vaporizing the hydrocarbon oil within the engine, and intimately mixing and commingling therewith a predetermined proportion of air prior to the ignition of the charge; further, to provide simple and efficient means for igniting the explosive mixture of hydrocarbon vapor and air at proper intervals of time to operate the engine; further, to produce an engine embodying certain features of construction, and of such availability in use as will permit of its employment under conditions and circumstances which would preclude the use of the ordinary gas or steam engine.

With these ends in view my invention consists in certain improved features of construction in an engine for vaporizing liquid hydrocarbon therein; also, in improved means for vaporizing liquid hydrocarbon and mixing therewith a proportionate quantity of air; also, in improved means for igniting the explosive mixture, and also in certain other features of construction and combinations of parts, as will hereinafter be described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section of one form of engine provided with my improvement, some of the parts of the engine, such as the inlet and exhaust valves, valve-gearing, governor, &c., not being shown, in order to simplify the de-

scription. Fig. 2 is a horizontal section. Fig. 3 is an enlarged detached view of the igniter, and Figs. 4 and 5 are modifications of the oil-inlet pipes, and Fig. 6 is a detached view of the oil-regulating governor.

A represents the cylinder provided with a water-jacket; B, the piston; C C, the cranks; D, the connecting-rod, and E the frame or bed-plate. All these parts may be of any approved construction or type.

I have represented the improvement as applied to an engine of the "alternate" type—that is to say, an engine making one effective power stroke for each alternate revolution of the shaft. At the outer end of the cylinder is located the combustion-chamber F, which is simply an extension of the main cylinder, forming a chamber in which an explosive mixture is ignited. Within the combustion-chamber is placed the vaporizer H, which may consist of a circular block of pumice-stone or other porous material, preferably hollowed out or made concave on its upper surface and fitted into a recess in the lower portion of the combustion-chamber. That portion of the cylinder adjacent to the vaporizer is not provided with a water-jacket, in order that the heat stored in the cylinder or that portion thereof near the vaporizer may be imparted to the latter and retain it in a heated state. It is not absolutely necessary that the vaporizer shall be inserted within a recess in the cylinder, as shown, as it may be secured within the combustion-chamber at any distance above its lower portion or wall, in which case it might be furnished with a thin ring or hoop having projecting ears for fastening it in position.

P is an oil-pump, the cylinder of which has connected therewith the induction-pipe T and delivery-pipe L, the latter extending through the cylinder and terminating over the vaporizer H. A connecting-rod, *n*, connects the pump rod or plunger with a wrist-pin on the gear *m*, which meshes with a gear on the main shaft, said gear in the type of engine shown making one revolution to two revolutions of the main shaft, while in engines making an effective power stroke at each revolution the connections for transmitting motion to the pump would of course be connected with and worked from the main shaft. At each effective stroke the pump operates to deliver a small

quantity of oil onto the vaporizer. On the induction-pipe T of the oil-pump is located an oil-supply-regulating cock or valve, M', by means of which the supply of oil from the oil-reservoir M³ to the pump may be regulated. To the valve M' is attached an arm, z, the free end of which is bifurcated and connected with the sleeve z' of the governor Z, which latter is operated by means of a belt engaging the pulley z² and extending around a pulley on the engine-shaft. By means of the governor the position of the valve is automatically controlled so as to regulate the speed of the engine by varying the supply of oil delivered to the combustion-chamber. On the induction-pipe T is also placed a tight or pressure oil-cup, M², to contain benzine or other light hydrocarbon which is used to start the engine before the vaporizer has been sufficiently heated to vaporize the heavier hydrocarbon supplied to the pump for actuating the engine.

R represents an air-inlet, preferably located at the side of the cylinder and so situated that the air entering the cylinder will spread over the vaporizer and produce a very complete and intimate mixture of the air and hydrocarbon vapor. S is an exhaust opening located at the upper part of the combustion-chamber and over the vaporizer, which is the preferable position for the exhaust, as it insures a rapid and effectual clearance of the products of combustion. Both the air-inlet R and the exhaust-passage S are provided with valves having suitable connections for their automatic operation at proper intervals of time, although the valves and their operating mechanism are not shown, as many different forms of construction and arrangement of such parts might be used, and hence I do not confine myself to any particular means for operating the valves.

I is the igniter, and consists of a platinum tube, i, secured to the cylinder-head, the tube having inclosed therein a platinum wire, I', which is constructed and adapted to be reciprocated within the tube so as to be projected into the combustion-chamber to ignite the explosive mixture or charge contained therein and then to be retracted into the tube again for reheating and retained therein out of the way until the proper time for the ignition of the next succeeding charge. The tube and wire are maintained above the igniting temperature by a Bunsen burner, K, or any other source of heat that may be found adapted for the purpose. Wire I' is reciprocated at proper intervals of time by suitable connections on the engine, although no special mechanism for this purpose is shown, as it is obvious that many contrivances might be devised for imparting the proper motion to the igniting-wire.

Instead of supplying the oil through a pipe, L, as arranged in Figs. 1 and 2, the pipe may project upwardly through the vaporizer, as represented in Fig. 4, and extend above the same and terminate in a perforated head, j,

through which the oil is delivered upon the surface of the vaporizer. In Fig. 5 is illustrated another arrangement of oil-supply pipe, the latter extending upwardly through the vaporizer and terminating flush with the upper surface thereof or slightly below the surface.

Instead of constructing the vaporizer of pumice-stone, it may be made of metal with a roughened or serrated surface or with ribs or projections, or of thin metal plates, or of metal wire, platinum sponge, iron chips confined in a suitable cup, or, in fact, any material or substance affording the proper amount of heating and evaporating surface to properly and rapidly vaporize the oil that may be used.

The igniter-tube may be made of porcelain or other refractory material, instead of being made of platinum. Instead of employing a platinum wire to ignite the charge, a small portion of the explosive charge can be forced through the heated tube, and thus ignite the charge in the combustion-chamber.

Having described the construction and relative arrangement of the different parts of my improvement, I will now briefly describe its operation.

The Bunsen burner K is first lighted, and the platinum tube and wire heated to the igniting-temperature, care being taken that the wire is well within the tube. Next the oil-cup, containing benzine and communicating with the induction-pipe, is opened to allow a very small quantity of benzine to flow into the oil-pump, and then the oil-cup is again closed. The engine is then turned by hand half a revolution, which will be sufficient to operate the pump and force a drop or two of benzine onto the vaporizer, which will at once by vaporization fill the combustion-chamber with an explosive mixture. As the stroke of the pump is closely followed by the introduction of the heated platinum wire of the igniter, the charge will be fired and the engine regularly started. The small quantity of benzine in the oil-supply pipe will keep the engine going for a few revolutions and cause the vaporizer to become sufficiently heated to vaporize the heavy oil used for operating the engine. In the regular operation of the engine the oil-pump delivers a minute quantity of oil onto the vaporizer at each effective stroke of the engine. The vaporizer has, by the continued and successive explosions of the charges in the engine, a sufficient amount of heat stored therein to instantly vaporize the oil as it is discharged thereon by the pump. This quickly-formed vapor in the engine-cylinder encounters the incoming charge of fresh air, and becomes instantly and intimately mixed therewith, the law of the rapid diffusion of vapor through air favoring the operation greatly. This charge is then exploded by the igniter, as has been explained.

Having described one embodiment of my invention and its operation, it will be evident that many changes might be made in the con-

struction and relative arrangement of the parts without departing from the spirit of my invention, and hence I would have it understood that I do not restrict myself to the particular construction and arrangement of the parts shown and described.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

10 1. In a hydrocarbon-vapor engine, the combination, with a vaporizer, consisting, essentially, of a block or piece of porous material constructed to receive the oil and adapted to be heated by the explosive charges, of a pipe
15 for discharging oil onto the block, an opening for admitting air, and a device for igniting the combined air and vapor.

2. The combination, with an engine-cylinder and a combustion-chamber forming a continuation of the latter, of a vaporizer, consisting, essentially, of a block or piece of porous material constructed to receive the oil and adapted to be heated by the explosive charges located within the combustion-chamber, a pipe
25 for discharging oil into the vaporizer, an air-opening for admitting air, and an igniter located above the vaporizer.

3. The combination, with a cylinder, a combustion-chamber, and a vaporizer located within the combustion-chamber, the said vaporizer consisting, essentially, of a block or piece of porous material constructed to receive the oil and adapted to be heated by the explosive charge, of a pipe for discharging oil
35 onto the vaporizer, an air-inlet pipe, and an escape-outlet for the products of combustion.

4. The combination, with a cylinder and combustion-chamber, and a vaporizer consisting, essentially, of a porous or absorbent material formed with a concave surface, located within the combustion-chamber, of a pipe for discharging oil onto the vaporizer, an air-inlet, and an igniter located above the vaporizer,
40 substantially as set forth.

5. The vaporizer located within the cylinder or combustion-chamber connected therewith, and an oil-pump for delivering oil upon the vaporizer, substantially as set forth.

6. A vaporizer consisting of porous or ab-

sorbent material formed with a cupped or concave surface, substantially as set forth. 50

7. A vaporizer consisting of a porous or absorbent material adapted to be heated by the explosive charge, located in a recess formed in the engine-cylinder or combustion-chamber connected therewith, substantially as set forth. 55

8. A vaporizer located in the lower portion of the engine-cylinder or combustion-chamber, an air-inlet at the side of the cylinder, and an outlet at the upper end of the cylinder, substantially as set forth. 60

9. In a hydrocarbon-vapor engine, the combination, with a combustion-chamber, a vaporizer, substantially as described, located therein, a pipe for supplying oil to the vaporizer, and an air-inlet, of an igniter, consisting, essentially, of a tube of refractory material adapted to be heated, and a wire adapted to be moved in and out of said tube. 70

10. In a hydrocarbon-vapor engine, the combination, with a combustion-chamber, a vaporizer, substantially as described, located therein, a pipe for discharging oil with said vaporizer, and an air-inlet, of a tube made of refractory material, serving as a medium for conveying heated substance or material to the explosive mixture, and a burner for heating said tube, substantially as set forth. 75

11. In a hydrocarbon-engine, the vaporizer located within the cylinder or combustion-chamber, an oil-pump for delivering oil upon the vaporizer, and a supplemental oil-reservoir communicating with the oil-inlet pipe, substantially as set forth. 80

12. In a hydrocarbon-engine, the vaporizer located within the cylinder or combustion-chamber, a pump for forcing oil to the vaporizer, and a governor for automatically controlling the supply of oil delivered to the pump, substantially as set forth. 85

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALEXANDER KIRK RIDER.

Witnesses:

WILLIS C. STEVENS,
C. W. SADLER.