(No Model.) 2 Sheets—Sheet 1.

L. C. MANN.

ELECTRO HYDROCARBON ENGINE.

No. 511,855. Patented Jan. 2, 1894.

Fig. 1.

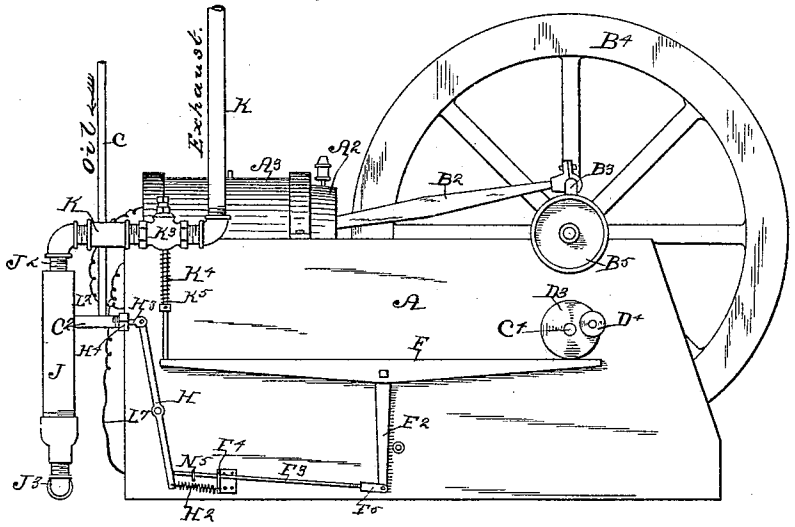


Fig. 2.

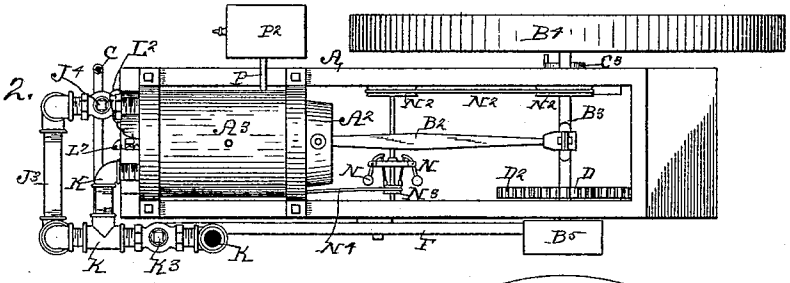
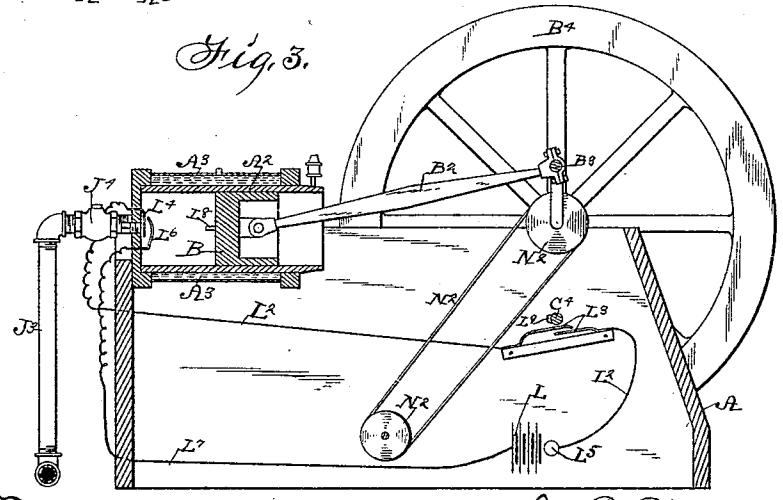


Fig. 3.



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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

L. C. MANN.

ELECTRO HYDROCARBON ENGINE.

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Fig. 4.

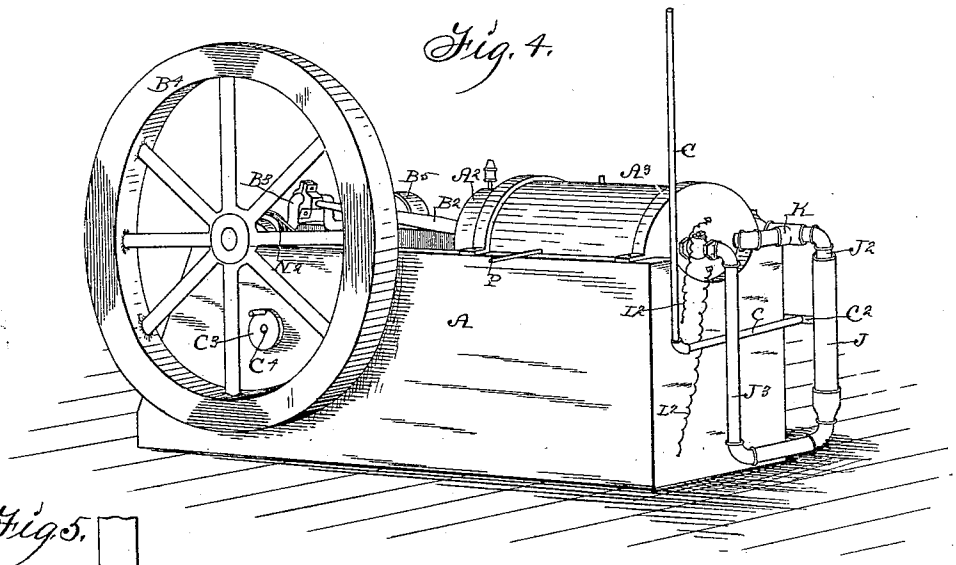


Fig. 5.

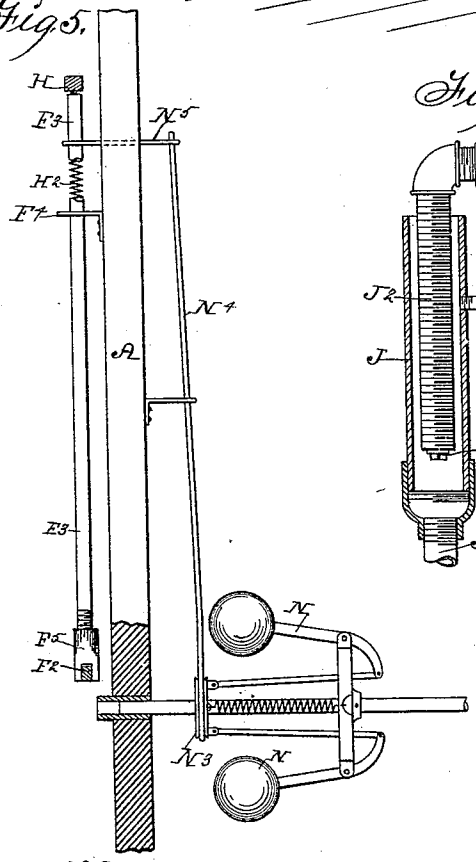


Fig. 6.

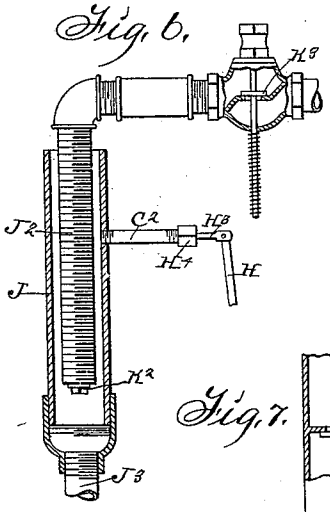


Fig. 8.

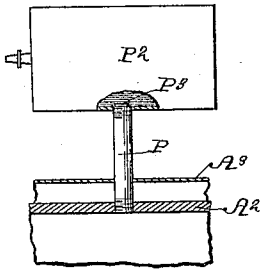
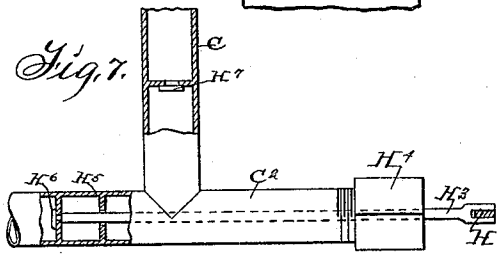


Fig. 7.



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UNITED STATES PATENT OFFICE.

LEE C. MANN, OF GLADBROOK, IOWA.

ELECTRO HYDROCARBON-ENGINE.

SPECIFICATION forming part of Letters Patent No. 511,855, dated January 2, 1894.

Application filed November 15, 1892. Serial No. 452,177. (No model.)

To all whom it may concern:

Be it known that I, LEE C. MANN, a citizen of the United States of America, residing at Gladbrook, in the county of Tama and State of Iowa, have invented an Electro Hydrocarbon-Engine, of which the following is a specification.

My invention relates to that class of hydro carbon engines in which gasoline, benzine, naphtha and the like are vaporized and the volative gas thus generated exploded within a power cylinder by means of an electric spark.

My object is first to provide means whereby a second explosion is made to follow immediately after the first to give a high pressure to the piston and partially overcome the shock to the engine caused by the first explosion, to prevent the partially spent gases from mixing with the good gases within the cylinder, and to aid in carbureting the volatile fluid.

A further object is to provide an improved injection pump whereby a certain predetermined quantity of gasoline or other hydrocarbon is injected in the carbureting chamber from a source of supply located either above or below the said pump.

A further object is to provide improved means whereby the products of combustion are released from the cylinder after each explosion and a portion of the terminal pressure caused by the explosion, stored, to be utilized for other purposes.

A further object is to provide simple and durable mechanism whereby all of the operative parts of the machine are actuated from one shaft.

My object is further to provide improved means for regulating the speed of the engine.

My object is further to produce improved electrodes to produce a spark within the cylinder, to explode the hydro-carbon gas therein, which electrodes are so arranged as to increase the lasting qualities of the springs from which they are formed.

My object is further to provide a cheap, simple, and durable cylinder inclosed by a water jacket.

My invention consists further in the construction and arrangement of a pipe relative to the cylinder which serves the purpose of an auxiliary explosion chamber and also a carburetor.

My invention consists further in the construction of an injection pump and its arrangement and combination relative to other parts of the device.

My invention consists further in the arrangement and combination with a cylinder of the means for releasing the products of combustion therefrom, and for storing a portion of the terminal pressure of the explosion for any suitable purpose.

My invention consists further in the construction, arrangement and combination of the mechanism for operating all of the operative parts of the device from one shaft.

My invention consists further in the construction and formation of the springs or electrodes within the cylinder.

My invention consists further in the construction of the cylinder and its inclosing water jacket, and in certain other minor details of construction and combination of parts as hereinafter more specifically set forth, pointed out in my claims and illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the complete device. Fig. 2 is a top view of the same. Fig. 3 is a vertical longitudinal sectional view of the complete device, in which the pressure reservoir is dispensed with. Fig. 4 is a perspective view of the complete machine. Fig. 5 is an enlarged detail view partly in section to show the speed controlling mechanism. Fig. 6 is an enlarged detail view partly in section to illustrate the vaporizing device and connective parts. Fig. 7 is an enlarged detail view showing the mechanism for controlling the admission of gasoline into the vaporizing chamber, parts being broken away to reveal operative mechanisms. Fig. 8 is an enlarged detail horizontal sectional view of the exhaust reservoir and connective parts.

Referring to the accompanying drawings the reference letter A is used to designate the base of the engine, and A^2 a cylinder supported upon said base and surrounded by a water jacket A^3. This cylinder and water jaeket are made as follows: first an open ended metal tube (preferably steel) is cut to the desired length, then an open ended sheet

metal jacket is placed concentrically therewith having a small space between them. They are then placed in a suitable mold and the ends are cast integral therewith, thus dispensing with a great portion of the labor required heretofore in constructing cylinders with water jackets. B designates a piston arranged to operate within the said cylinder and connected with a piston rod B^2.

B^3 designates a crank shaft mounted in the base A and connected with the piston rod B^2. A fly wheel B^4 is fixed to one end of said crank shaft and a belt wheel B^5 is mounted on its remaining end.

C designates a pipe leading from a source of hydro-carbon supply to the injection pump C^2 which in turn empties into the carbureting chamber hereinafter described.

C^4 designates a rotatable shaft mounted in the base A directly beneath the crank shaft B^3. On one of its ends is a crank wheel C^3 from which motion may be imparted to any suitable machinery. D designates a gear wheel fixed to the said crank shaft and D^2 a like wheel fixed to the shaft C^4. These gear wheels are so graduated in size relative to each other, that the shaft C^4 is rotated once to every two revolutions of the shaft B^3. Mounted on one end of the said shaft is a disk D^3 which has a wheel D^4 attached eccentrically to its outer surface.

F designates a lever pivoted to the side of the base A. Its one end is in such proximity to the disk D^3 as to be depressed by the wheel D^4 each time the said disk is rotated.

F^2 designates an arm projecting downwardly from the lever F.

F^3 designates a rod resting in a carrier F^4 and pivotally connected with the arm F^2 by being screwed into socket F^5 which in turn is pivoted to said arm to allow a longitudinal adjustment of the rod F^3 for purposes hereinafter set forth.

B designates a lever fulcrumed to the side of the base A. Its lower end is adapted to be engaged by the rod F^3 and is normally held toward the said rod by means of the spring H^2. This rod is arranged to operate an injecting pump to force the gasoline into the carbureting chamber which comprises the following parts.

H^3 designates a smooth rod pivotally attached to the lever H and extended into the pipe C^2 through the stuffing box H^4 in the end of said pipe. The inner end of this rod is extended through a concentrically bored partition H^5 in which the said bore is large enough to allow a limited passage of fluid therethrough when the rod is in the bore.

H^6 designates a check valve within the pipe C^2 a short distance in advance of the partition H^5, and H^7 is a valve located in the supply pipe C in juxtaposition to the pipe section C^2.

The operation of this pump is as follows: As the rod H^3 is moved outwardly its displacement will draw a corresponding amount of fluid from a source of supply located either above or below the pump through the check valve H^7. Then as the said rod is again advanced a small portion of the fluid contained between the valves will be forced through the valve H^6 into the carburetor chamber, and it will be obvious that the amount thus injected may be regulated by turning the rod F^3 in its socket F^5 thus regulating the length of the stroke of the rod H^3. For the reason that the pump rod H^3 is operated by the rod F^3, and if said rod F^3 is shortened by being turned in its socket, it will not engage the lever H during all of its stroke.

In order to prevent the liquid from flowing through the valve H^6 by its gravity when the supply tank is placed above the pump the end of the rod H^3 normally rests against the inner side of the valve H^6.

The carbureting chamber consists of an outer open topped cylinder J and an inner rough surfaced tube J^2 said surface being formed by being screw-threaded or in various other ways in order to retain the gasoline until thoroughly carbureted.

Leading from the bottom of the cylinder J is a conducting pipe J^3 which is thence extended upwardly and enters the rear end of the cylinder A^2.

At or near the point of attachment of the conducting pipe is a check valve J^4 to permit the contents of the pipe to pass within the cylinder but not in the opposite direction.

K designates an exhaust tube leading from the rear of the cylinder A^2. The carbureting tube J^2 is connected therewith and has a plug K^2, in its lower end. A short distance from the cylinder is a valve K^3 which same is opened by means of the rod K^4 which is connected with the lever F at the same time that the injection pump is operated, that is during the return stroke of the piston immediately after the explosion. This valve is normally retained closed by the coil spring K^5. The tube in the carburetor communicates with the cylinder at all times so that it will fill with the volatile gas in the cylinder which explodes immediately after the explosion in the cylinder proper and thereby prolong the explosion and applies a more uniform force to the piston and at the same time heats the tube in the carburetor to the more readily vaporize the hydro-carbon. As there is considerable length of pipe between the tube in the carburetor and the interior of the cylinder or explosion chamber, the explosion in the former must necessarily follow that in the latter although the interval between the two may be almost imperceptible. This will have the effect of prolonging the pressure upon the piston and overcoming the quickness of the shock to the engine and at the same time heat the tube in the carburetor to aid in carbureting the hydro-carbon therein.

I shall now describe the means for igniting the hydro-carbon gas in the cylinder at the proper interval.

L designates an open-circuit electric battery, L^2 a conducting or lead wire leading therefrom to a current breaker L^3 consisting of two electrodes in the form of leaf springs normally out of contact by reason of their resiliency, but adapted to be brought in contact upon each revolution of the shaft C^4 by means of a projection L^9 fixed to said shaft and adapted to engage the end spring. It will now be obvious that a spark will be produced within the cylinder each time that the circuit is completed by having both of the said sets of electrodes in contact simultaneously which will take place upon each alternating time that the piston is at the rearward limit of its stroke.

It has been found that the metal used in the construction of the springs within the cylinder, is rapidly worn away in the production of sparks and in order to make them last as long as possible the outer one is curved toward the inner one as clearly shown in the drawings, so that as the end of the outer one is worn away it will engage the other at a different point.

N designates a centrifugal ball governor of the ordinary kind geared to the crank shaft by means of the belt and pulley N^2 and is arranged to operate the sliding collar N^3 when the speed becomes too great. N^4 is a lever having its one end in an annular groove in the said collar pivotally attached to the base A near its central portion and connected with the rod which operates the induction pumps by means of the rod N^5 in such a manner as to cause said rod to miss the lever which actuates the valve stem and thereby cut off the supply of hydro-carbon to the engine until the speed had so lessened as to allow the balls of the governor to assume a normal position.

P designates an auxiliary exhaust tube leading from the approximate forward portion of the cylinder to a point slightly in the rear of the forward extremity of the piston so that the spent gases and other products of combustion in the cylinder may escape during a slight period in which the piston is at the forward extremity of its stroke. The terminal pressure which would otherwise escape through this tube P may be stored for various purposes in the reservoir P^2 which is connected with said pipe D and is reached through a check valve P^3 which prevents the return pressure.

In the practical operation of the engine it will be obvious that the two complete rotations of the crank shaft B^3 are made to each explosion. Assuming that the piston were in the rear of the cylinder and that the circuit was established to produce a spark and cause an explosion in the cylinder, this will move the piston rapidly forward and store power in the fly wheel B^4. As the piston is being moved backwardly the exhaust pipes are automatically opened and the spent gases and other products of combustion allowed to escape. During this movement also the hydro-carbon is injected into the carburetor chamber and upon the next forward movement of the piston the hydrocarbon gas is drawn into the partial vacuum caused by such movement. Then upon the next rearward movement of the piston the gas is compressed. The projection on the rear end of the piston engages said electrodes which when again released as the piston starts forward produce a spark which again explodes the gas.

Having thus described the engine, what I claim as my invention, and desire to secure by Letters Patent, is—

1. In a hydro-carbon engine, the combination of the following elements, to wit; a suitable cylinder or explosion chamber, a pipe leading therefrom and terminating in a rough surfaced pipe with the end closed so that said pipe will be heated by an explosion in said cylinder, an open topped cylinder surrounding said rough surfaced pipe, a pipe leading from the bottom thereof to the explosion chamber, and an injection pump to admit hydro-carbon to said rough surfaced pipe.

2. In a hydro-carbon engine, the following elements, to wit; a suitable carbureting chamber, a tube opening thereinto, a stuffing box in the outer end of said tube, a smooth, straight rod, passed through said stuffing box into the tube, a partition in said tube having an opening therein slightly larger than the diameter of said rod, for the purposes stated, a second partition in advance of the first, having a concentric opening smaller than the diameter of said rod and adapted to be closed by the end thereof, as set forth, a valve on the outer portion of said partition, and a pipe connected with a suitable source of hydrocarbon supply and inserted in said tube, substantially as and for the purposes, stated.

3. In a hydro-carbon engine, the following elements in combination, to wit; a suitable cylinder or explosion chamber, a piston in the cylinder and a piston rod connected therewith, a crank shaft operated by said piston, a rotatable shaft geared to said crank shaft to be rotated once each time the crank shaft is rotated twice, a disk fixed to one end of said rotatable shaft and a wheel pivoted eccentrically to said disk, a lever F pivoted to the side of the base A, a lever F^2 fixed to the aforesaid lever F, the means substantially as shown and described for operating an injection pump by said lever F^2, the means substantially as shown and described whereby an exhaust pipe is opened by the lever F, a circuit breaker L^3, and a projection L^9 fixed to the shaft C^4, to establish a current through said circuit breaker, substantially as set forth.

4. In a hydro-carbon engine the combination of the following elements, to wit; a carbureting chamber, an injection pump substantially as set forth communicating with said chamber, a lever pivoted to a stationary support and pivotally attached to the rod H^3 of said pump, the spring H^2 to normally hold the lower end of said lever forwardly, the rod

F^3 to engage the lower end of said lever and press it forwardly, the screw-threaded socket F^5 adapted to admit said rod F^3, to provide means whereby the stroke of the rod H^3 within the pump may be controlled and the amount of fluid injected into the carbureting chamber be regulated, and means for operating the rod F^3 at the proper period.

5. In a hydro-carbon engine, the following elements in combination, to wit; a suitable cylinder or explosion chamber, a carbureting chamber connected therewith, an injection pump to admit a certain predetermined quantity of hydro-carbon into the carbureting chamber, a lever H connected with the pump to actuate it, a yielding pressure device to normally hold the lever in position with the piston in the pump, a rod F^3 arranged to be operated regularly by the machine to engage the lever H and cause the pump to operate, a centrifugal ball governor operated by the machine, a lever H^4 pivotally connected with a suitable support, and having its one end connected with the sliding roller of the said governor, a link N^5 attached to the other end of the lever N^4 and to the arm F^3 so that if the speed becomes too great the arm F^3 will be drawn out of engagement with the lever H, for the purposes stated.

6. An improved hydro-carbon engine, comprising the following elements in combination, to wit; the cylinder with an inclosing water jacket constructed in the manner set forth, a piston within the cylinder and a piston rod connected therewith, the open-topped carbureting chamber having therein a closed rough surfaced auxiliary explosion chamber connected with the main explosion chamber for the purposes stated, an injection pump for admitting hydro-carbon into the carburetor, the main exhaust pipe leading from the cylinder or explosion chamber, a spring closed valve in said exhaust pipe, a source of electrical supply, the current breaker and the electrodes within the cylinder, the means shown and described whereby a current of electricity is established through the said current breaker, the injection pump operated and the valve in the exhaust pipe opened at the proper intervals by means of power derived from one shaft, as set forth, the speed controlling device as set forth, and the auxiliary exhaust pipe leading from a point at the forward end of the cylinder so that the piston will pass beyond it during a portion of its stroke, an air tight reservoir connected with said pipe and a check valve therein, all arranged and combined substantially in the manner set forth, for the purposes stated.

7. In a hydro-carbon engine, the combination of the following elements, to wit; a rotatable shaft C^4, having a wheel D^3 fixed to one of its ends, a wheel D^4 pivoted eccentrically to said wheel D^3, a lever F pivoted to a suitable support and having a downwardly projecting arm F^2, the arm F^3 pivoted to the arm F^2, a suitable injection pump, a lever H connected with the piston thereof and adapted to be engaged by said arm F^3, an exhaust pipe leading from the cylinder or explosion chamber of the engine, a spring-actuated check valve in said pipe, and a rod K^4 to actuate said valve, for the purposes stated.

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