(No Model.)

C. VON LÜDE.

PETROLEUM OR SIMILAR MOTOR.

No. 435,439. Patented Sept. 2, 1890.

Fig. 1.

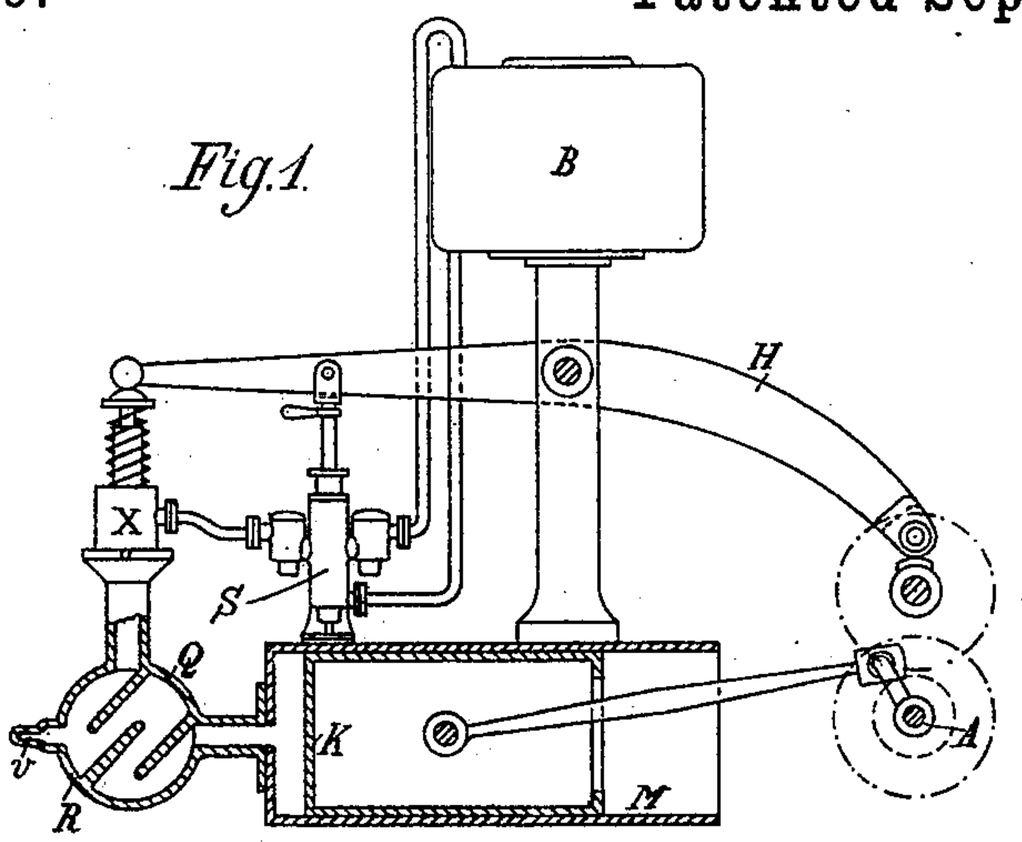


Fig. 2.

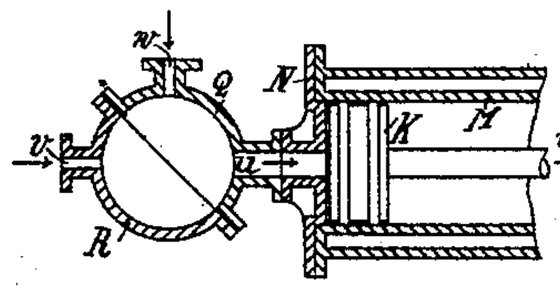


Fig. 3.

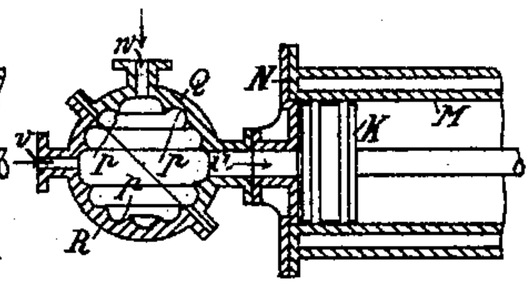


Fig. 4.

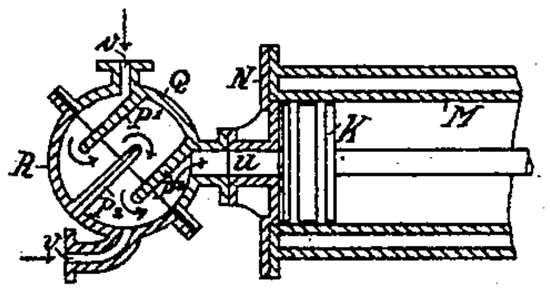


Fig. 5.

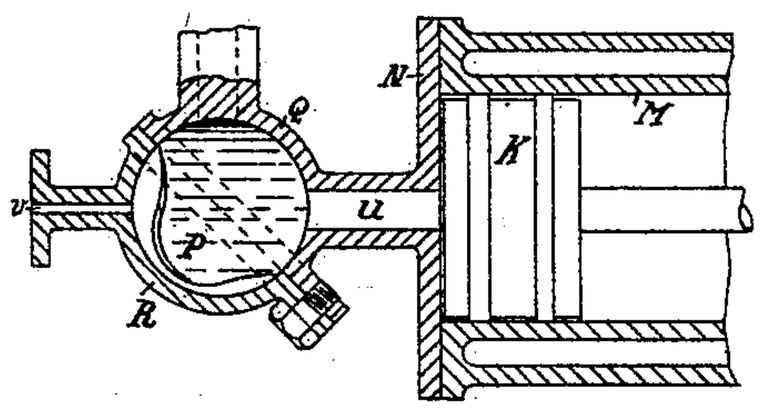


Fig. 7.

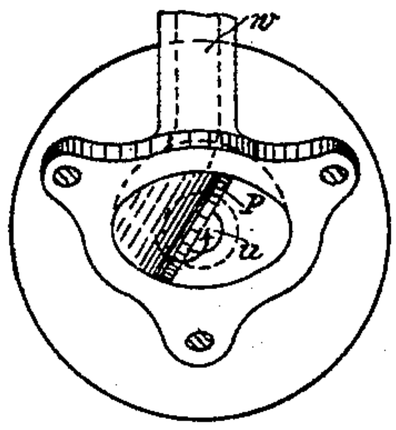


Fig. 6.

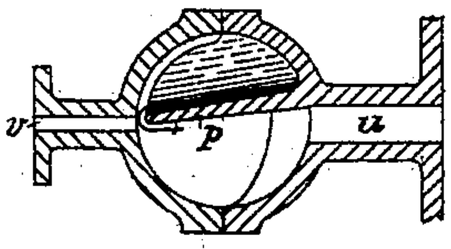
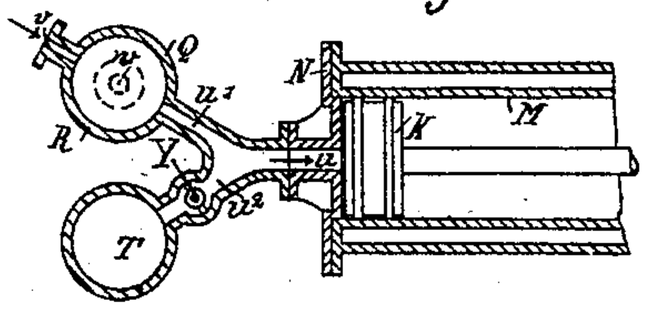


Fig. 8.



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UNITED STATES PATENT OFFICE.

CARL V. LÜDE, OF ARBON, SWITZERLAND.

PETROLEUM OR SIMILAR MOTOR.

SPECIFICATION forming part of Letters Patent No. 435,439, dated September 2, 1890.

Application filed January 22, 1890. Serial No. 337,693. (No model.) Patented in France May 8, 1889, No. 196,706; in Austria-Hungary August 16, 1889, No. 11,841 and No. 40,317; in Switzerland October 19, 1889, No. 715; in Belgium November 15, 1889, No. 88,229, and in Italy November 25, 1889, Nos. 26,345/68.

To all whom it may concern:

Be it known that I, CARL VON LÜDE, engineer, a subject of the King of Prussia and German Emperor, residing at Arbon, Switzerland, have invented certain new and useful Improvements in Petroleum or Similar Motors; 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.

Patents have been obtained for this invention as follows: in Belgium, No. 88,229, dated November 15, 1889; in Italy, Nos. 26,345/68, dated November 25, 1889; in Austria-Hungary, No. 11,841 and No. 40,317, dated August 16, 1889; in Switzerland, No. 715, dated October 19, 1889, and in France, No. 196,706, dated May 8, 1889.

The present invention relates to a motor to be driven by heavy hydrocarbons or heavy carburets of hydrogen in such a manner that the working of it should be simple and at the same time perfectly safe.

In the accompanying drawings the motor is represented in Figure 1 in its completed arrangement, while Figs. 2, 3, and 4 show the special construction of the gas-producer and modifications. Figs. 5, 6, and 7 show a form of construction for carrying out this gas-producer in a longitudinal and a transverse section and a front elevation. Fig. 8 shows this gas-producer with several chambers, which are to be eventually separated from one another.

As appears from the completed arrangement represented in Fig. 1 of the motor, the piston K, which moves in the cylinder M, provided, when necessary, with a cool jacket, is driven by the explosion of a mixture of air and gasified heavy hydrocarbons or heavy carburets of hydrogen, which is formed in the gas-producer R Q, the distributing-pump S determining the quantity of heavy hydrocarbons or heavy carburets of hydrogen which is to be supplied at every stroke from the reservoir B.

When setting up the new motor, the gas-producer is the most important detail of its construction, because the production of heavy hydrocarbons or heavy carburets of hydrogen for the purpose of driving motors offers in practice considerably greater difficulties than does that of light hydrocarbons—*i. e.*, benzine, naphtha, and crude petroleum. Refined lamp-petroleum must be looked upon as a representative of heavy hydrocarbons or heavy carburets of hydrogen. In order to apply this petroleum, (which has been deprived of its readily-volatile constituents and has a specific gravity of about 0.82 to 0.83, which can be employed for driving motors,) the compression and gas-producing chamber for the motor must be kept at a considerably higher temperature than is the case with machines of this kind which are fed with light petroleum. Moreover, the compression and gas-producing chamber of ordinary petroleum-motors consists in a direct elongation of the working-cylinder, whereby this elongation is either cooled or not from outside. The working-cylinder, however, is itself always provided with a cool casing.

Through the contact of the compression and gas-producing chamber with the cooled working-cylinder a considerable loss of heat takes place from the walls of the compression and gas-producing chambers to the walls of the working-cylinder, in consequence of which the temperature of this chamber is not maintained sufficiently high for the heavy kinds of petroleum, so that only a partial reduction into gas is effected, and with the explosion a deposition of soot takes place on the insufficiently-heated surfaces of the gas-producing and compression chambers, whereby, according to the nature of the motor, the efficiency of the motor suffers. These evils are obviated by the present invention by means of a concentration of the temperature due to the compression, the gas-producing chambers being formed in the shape of a ball, (since the ball combined with the smallest surface has the greatest capacity,) and which, as a protection against the heat being carried away from it to the working-cylinder, is separated from and only connected with the latter by one or more channels of relatively small cross-section. The inner surface of the ball may for this purpose be either smooth or diversely fluted,

or it may be provided with heating-plates in order to present to the spreading mixture of air and petroleum-spray as much surface as possible, which, heated by each explosion, partly give back the collected heat for the reduction of the petroleum into gas.

In the accompanying drawings, Figures 2, 3, 4, and 5 show different forms of construction of this gas-producer. In all of these forms the compression and gas-producing chambers are formed in the shape of a ball-shaped vessel R Q, which, to facilitate access to its interior, can also be divided. This compression and gas-producing chamber is connected with the work-chamber of the cylinder by a channel *u* or several channels of small cross-section, whereby the amount of metal connecting the hot gas-producing or combustion chamber with the cool working-cylinder is reduced to the minimum. This separation of the gas-producing and compression chamber from the working-space of the cylinder has this advantage, that the heating of this said chamber can proceed easily and without being injured by the cooling which is going on in the cylinder.

Fig. 2 of the accompanying drawings represents a vertical section through such a gas-producer. Here the piston K moves in such a manner in the cylinder M, which is provided with a cooling-jacket and which is joined to the gas-producer, that at the completion of its stroke it reaches as nearly as possible to the cylinder-cover N, and thus the clearance-space is reduced to a minimum. The compression and gas-producing chamber proper R Q, which is shaped like a ball, is joined to the cover N by a channel *u*, (or several of such channels.) The supply of the mixture of hydrocarbon with air takes place at *w*, while the ignition-flame is introduced at *v*.

The mechanism by means of which the supply of the mixture of hydrocarbon with the outer atmospheric air is regulated at *w* can be of any desired construction. In the drawing of the completed arrangement of the motor, Fig. 1, by way of an example, a double lever H is shown for this purpose, which is actuated from the crank-shaft A by the requisite gearing and operates the distributing-pump S, which serves for the supply of the heavy hydrocarbons or heavy carburets of hydrogen, and a valve X, which is placed over the gas-producing chamber for the supply of atmospheric air. When the machine is in motion, the explosions will maintain the heat in the compression and gas-producing chamber at the requisite elevation.

In order to insure keeping the temperature of the inner chamber of the ball R Q as high as possible, this inner chamber may be constructed in different forms, as represented in Figs. 3, 4, and 5. In the arrangement of Fig. 3 this inner chamber has a kind of undulatory cross-section, instead of which may be used ribs *p* on the circumference, running in any direction.

For the arrangement represented in Fig. 4 a number of partitions P′ P² P³ are used, which, like the ribs *p* in Fig. 3, are connected with the walls of the ball-shaped body R Q by a heat-conducting connection or are cast solid with the ball. These ribs also permit the hydrocarbon which is introduced into the ball-shaped body R Q to make a longer path, whereby it is brought into contact with the hot surfaces for a longer time, so that the gasifying ensues almost without deposit of soot. Figs. 5, 6, and 7 show the same arrangement as in Fig. 4; but, instead of the number of cross-ribs shown in Fig. 4, a single intersecting partition P is arranged in a slanting direction in the gasifying and compression chamber. The arrangement of gas-producer described may also serve to produce a higher temperature when actuating such a motor than would be due to the normal explosion which serves for driving it. For this purpose it is only necessary to divide the volume of the compression-chamber, which is required to be of a certain size in proportion to the cylinder, into two (or more) chambers in such a manner that one of these chambers can sometimes be shut off from the other chambers—*i. e.*, the principal gasifying-chamber. Fig. 8 illustrates this arrangement, in which, for example, two compression-chambers are arranged, which are represented in the drawings in a horizontal section. One of these is the already-described ball-shaped gasifying and compression chamber R Q, which is connected with the cylinder of the motor, which also is connected with a second chamber T, which can be formed in any desired manner. This connection, which ensues through the channels *u′ u²*, can be removed by a closing device Y, so that when the machine is set in motion the compression and gasifying chamber R Q is warmed, and in this principal gasifying-chamber, on account of its small capacity, a higher temperature is obtained in a short time for the purpose of the gasification. At the same time the air in the explosive mixture is burned in a chamber of smaller dimensions and a higher temperature produced, which facilitates the working of the machine. When this result is obtained, both (or all) the compression-chambers are again joined together, so that the normal working conditions recur.

The division of the volume of the compression and gasifying chamber R Q can (as already mentioned) be extended over more than two chambers; also, the manner of effecting the cut-off at Y, by which the different parts of the compression and gasifying chamber are separated from one another, can be varied according to fancy, and the motion of the valve or equivalent device may either be effected by hand or by the starting parts of the machine or even automatically. When adding the requisite small quantity of heavy hydrocarbons or heavy carburets of hydrogen for the explosion, one must take care that this

quantity be measured exactly, which, on account of the small quantity of the same, would be very difficult to carry out but for an arrangement which each time only delivers this small quantity from the heavy hydrocarbon or heavy carburets of hydrogen-reservoir. This quantity of heavy carbureted hydrogen, or heavy hydrocarbons, or heavy carburets of hydrogen, which has to be measured out exactly and to be regulated by the action of the distributing-pump S, is introduced with the atmospheric air through the valve H, entering through the channel *w* into the gas-producer. There it is ignited and caused to explode, and the gas which is thus generated is allowed to pass through the channel or channels *u* into the cylinder M, assisted by the action of the piston K, and the transference of force to K takes place in the usual manner.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim, and desire to secure by Letters Patent in the United States, is—

1. The combination, with the cylinder of a gas-engine, of a globular combustion-chamber and a short pipe of very small area connecting said chamber to the cylinder, whereby the amount of heat-conducting material between the said hot combustion-chamber and the comparatively cool cylinder is reduced to a minimum, substantially as set forth.

2. A globular combustion-chamber for a gas-engine, formed in two parts secured together and provided with a short pipe for connecting it to the gas-engine cylinder, substantially as and for the purpose set forth.

3. A globular combustion-chamber for a gas-engine, provided with internal ribs or partitions forming a tortuous passage for the hydrocarbon-spray and affording an extended vaporizing-surface, and a short pipe for connecting said chamber to the gas-engine cylinder, substantially as and for the purpose set forth.

4. A globular combustion-chamber for a gas-engine, provided with an extended internal vaporizing-surface, and a short pipe for connecting said chamber to the gas-engine cylinder, substantially as and for the purpose set forth.

5. A combustion-chamber for a gas-engine, consisting of a series of globular vessels connected together by passages provided with cut-off valves, one of the said vessels being provided with a short pipe for connecting it to the gas-engine cylinder and with apertures for the inlet and ignition of the combustible charge, substantially as and for the purpose set forth.

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

CARL V. LÜDE.

Witnesses:

ADOLPH SAURES,

W. HENRY ROBERTSON,

JAMES HUBER.