123. INTERNAL COMBUSTION ENGINES,
Transmission mechanism.

197

No. 817,905. PATENTED APR. 17, 1906.

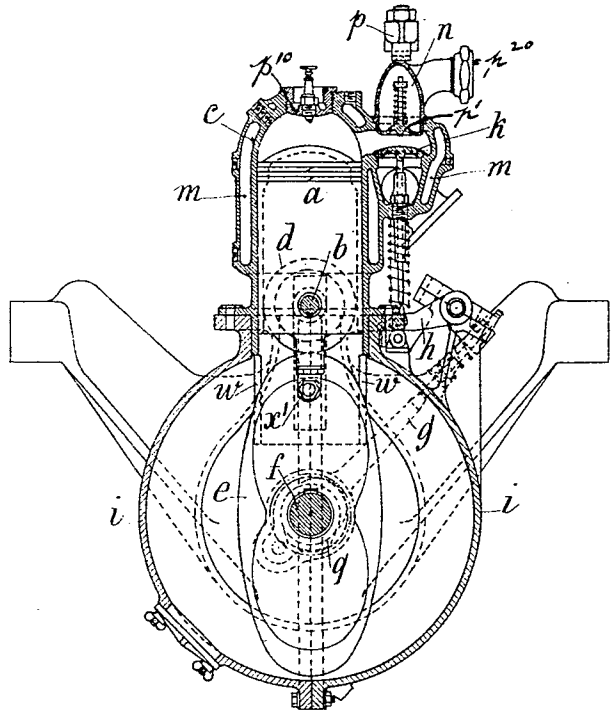
P. DANIEL.

MOTIVE POWER ENGINE.

APPLICATION FILED DEC. 8, 1902.

2 SHEETS—SHEET 1.

FIG. 1



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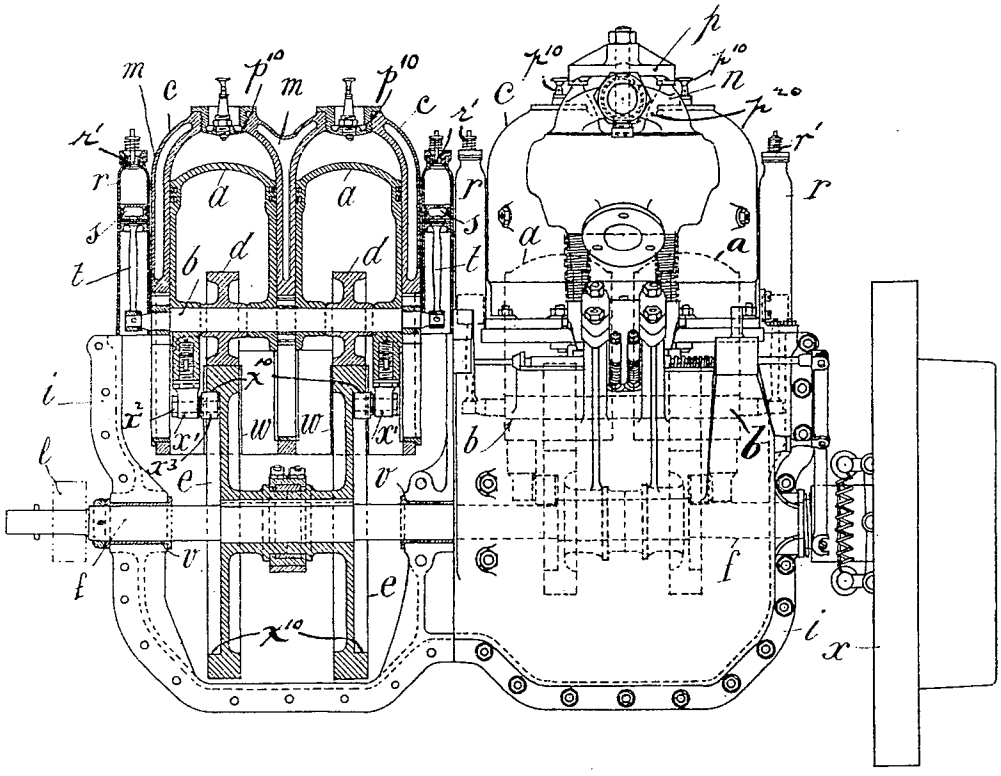
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2 SHEETS—SHEET 2.

FIG. 2



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UNITED STATES PATENT OFFICE.

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MOTIVE-POWER ENGINE.

No. 817,905. Specification of Letters Patent. Patented April 17, 1906.

Application filed December 8, 1902. Serial No. 134,364.

To all whom it may concern:

Be it known that I, PAUL DANIEL, a citizen of the Republic of France, and a resident of Levallois-Perret, near Paris, France, have invented certain new and useful Improvements in Motive-Power Engines Actuated by Petrol or other Light Hydrocarbons, of which the following is a specification.

My invention relates to motive-power engines actuated by petrol or other hydrocarbon and consisting of any number of sets of cylinders, each set consisting of two coupled or twin cylinders. The engine may, however, consist of a single cylinder; but I prefer the types having two or four cylinders, and in the example described below and represented in the accompanying drawings a type consisting of four cylinders is used.

In the accompanying drawings, Figure 1 is a transverse section of the engine, and Fig. 2 a longitudinal section.

The motor, which is a four-cycle one, is characterized by the production of an impulse at each revolution. This result is obtained in the following manner: Each two pistons *a* are fitted with a long transverse shaft *b*, which passes through them and slides in guides formed in the sides of the cylinders *c*, Fig. 1. Each shaft carries two rollers *d*, arranged inside the pistons and which roll upon two elliptical cams *e*, fixed upon the driving-shaft *f*. If the shaft is turned, it will be seen that the rollers acting upon the shafts *b* of the pistons force the latter to move in the cylinders in the same way as an ordinary motor, so as to give a four-cycle result. Only since in an ellipse the vector radius passes through two maximums and two minimums it is very evident that during a single revolution there will be two up and down movements of the pistons, these two movements producing the complete four-cycle action of the motor. It follows, therefore, that great simplicity is obtained. These cams in my improved motor are mounted directly upon the driving-shaft *f*, which is straight. They operate the exhaust-gear *g*, Fig. 1, carrying inside a roller which runs upon the cams, so as to reduce the friction to a minimum. This gear acts in turn upon levers *h*, Fig. 1, which are mounted upon the side of the case *i* and which raise the exhaust-valves *k*, Fig. 1. The case containing the ignition device *l*, Fig. 2, is also carried directly upon the driving-shaft, as mentioned above. It can oscillate round this shaft, so that the ignition can either be hastened or retarded. The cylinder and the covers are in a single piece and are water-jacketed at *m*.

p^{10} represents electric igniter-plugs.

p' represents the inlet-valves for the cylinders, said valves being arranged in chambers *n*, to which the explosive charge is fed through inlet-pipe p^{20}.

The operation of the ellipses and rollers is as follows: It was pointed out above that an ellipse when it revolves forces the corresponding roller to roll on it, taking with it the piston in a straight stroke from the bottom to the top. The stroke from the top to the bottom—that is to say, the downstroke of the piston—is obtained, as explained below, in two entirely different ways.

First. In work this downward stroke takes place automatically, the cams *q* of the valves of two twin cylinders being so fixed that there is always an explosion in one of the cylinders at the time that the second cylinder is drawing in its charge.

Second. To obviate the inconvenience which will arise from a failure of ignition, a non-explosion, the breakage of a valve or the like, each set of cylinders is provided outside with two tubes *r*, closed at their upper ends by an automatic inlet-valve *r'*, and in which two small pistons *s* have metallic-packing work. These pistons are fixed at the end of two rods *t*, which fit on the ends of the spindle *b*, which passes through the motor-pistons *a* and the rollers *d*. These cylinders draw in a quantity of air which at the return stroke is compressed by the pistons and forms an elastic buffer.

Third. Each motor-piston carries a spindle *x'*, into which is screwed a transverse axis x^2, carrying a small roller x^3, which runs on a surface or track x^{10} provided on the elliptical cam. This roller insures the downstroke of the piston at starting when the engine is at work, the downstroke taking place automatically, as has been already explained.

The cylinders are fixed upon a case or chamber, the ends of which carry bearings *v*, in which the driving-shaft *f* revolves, upon which the ellipses *e* are fixed. This case contains the necessary oil for lubrification. The elliptical cams as they revolve throw this oil over the cams which operate the valves upon the bearings carrying the driving-shaft and finally upon the rollers and the pistons, pass-

ing across the lower part of the cylinders, which have openings for the purpose, as shown at *w* in Fig. 1.

The fly-wheel *x* is arranged outside the case, and the variable ignition device is situated at the other end of the shaft.

General considerations.—It will be noticed that in the improved motor the point where the force transmitted by the piston *a* is applied, Fig. 1, is farther from the center of rotation than when the crank and connecting-rod is used, and the work of the moving parts is therefore more effective.

Second. That the absence of connecting-rods prevents the inconvenience of oscillating parts, which are always very difficult to balance.

Third. That the suppression of the intermediate spindle for driving the valves leads also to the suppression of all toothed gear in the motor.

Fourth. That the absence of a cranked shaft means a very great economy in construction by doing away with a part very expensive and difficult to make. Moreover, the substitution of a straight shaft, which may be made hollow, allows a considerable reduction in weight, that of a crank-shaft being considerable and its shape requiring very great strength to resist the different stresses to which it is exposed.

Fifth. That the substitution for the connecting-rod for a roller *d*, running freely on an ellipse *e*, allows the automatic regulation in the piston *a* of the play which results from wear, which takes place on the top of even the best-fitted connecting-rods and occasions shocks very prejudicial to the proper working of the motor.

I claim—

In an engine of the character described, the combination with a plurality of cylinders arranged side by side, pistons therein, a shaft passing through the pistons and slidable within the cylinders, rollers arranged upon the shaft, one within each piston, a driving-shaft and elliptical cams mounted as described upon the driving-shaft and bearing upon the rollers, two tubes arranged exteriorly of each set of cylinders, an automatic inlet-valve closing each tube at its upper end, a piston working in each tube, and rods carrying the pistons and mounted on the shaft which passes through the first-mentioned pistons, a spindle *x'* carried by each of the power-pistons, a transverse shaft screwing into each spindle and a roller mounted upon each of said transverse shafts, and running upon a bearing-surface on each elliptical cam in the manner described.

In testimony that I claim the foregoing I have hereunto set my hand this 26th day of November, 1902.

PAUL DANIEL.

Witnesses:
HENRY BARETT,
EDMOND LECOUTURIER.