No. 725,990. PATENTED APR. 21. 1903.

A. L. RIKER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 16, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

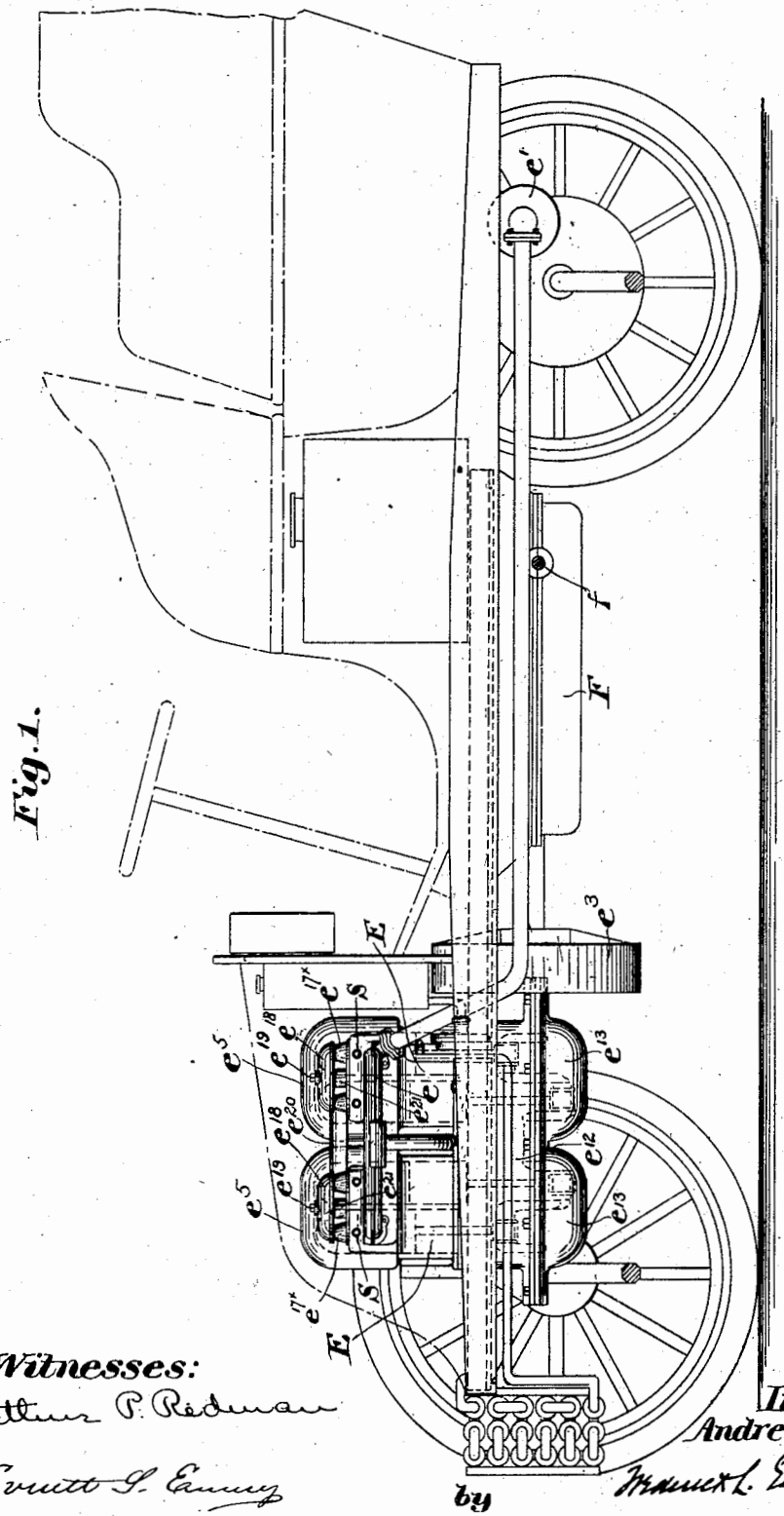

Fig. 1.

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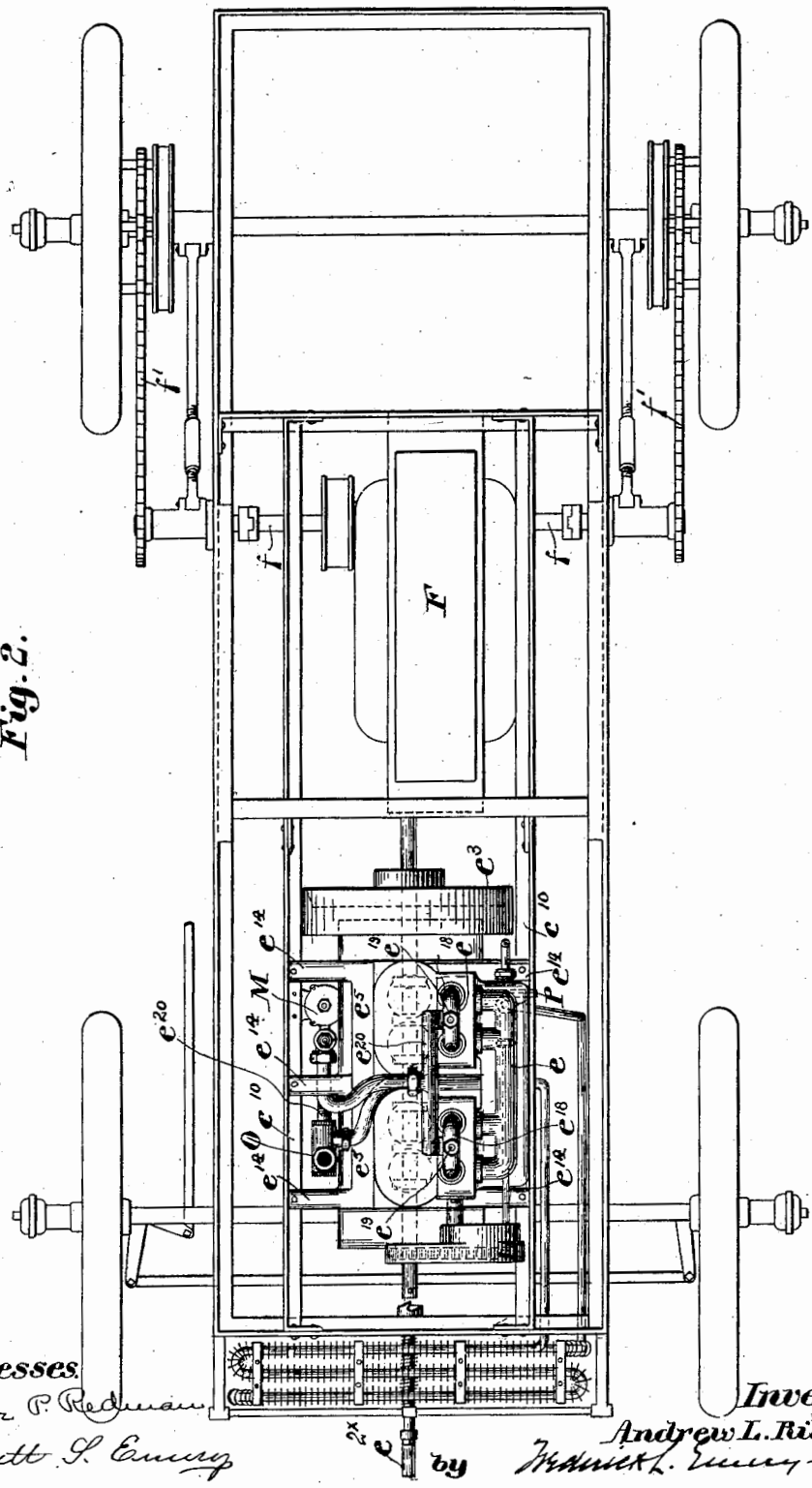
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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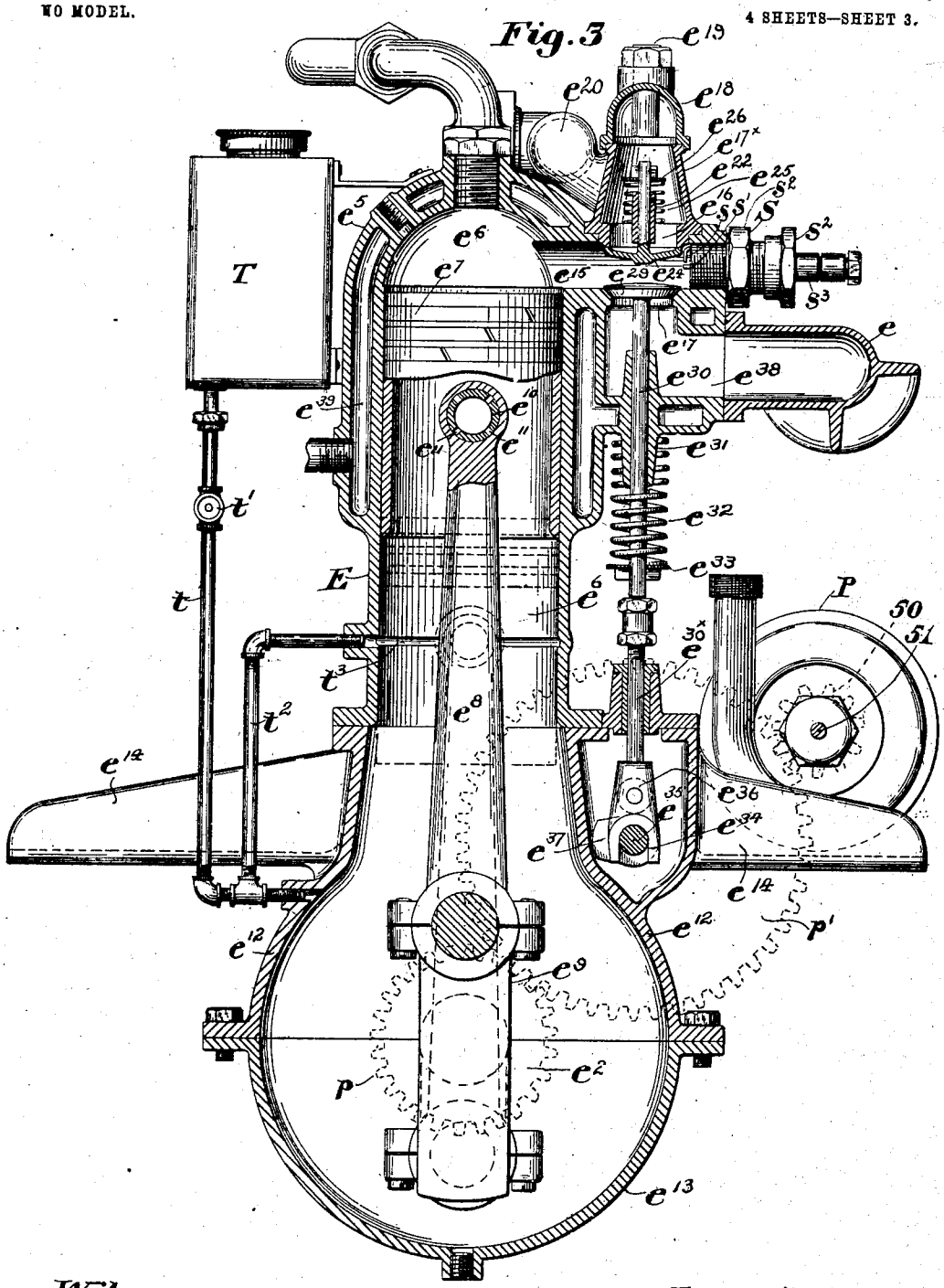
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3



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NO MODEL. 4 SHEETS—SHEET 4.

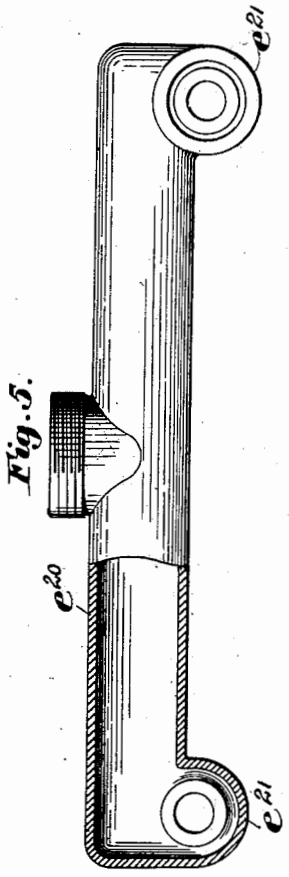

Fig. 5.

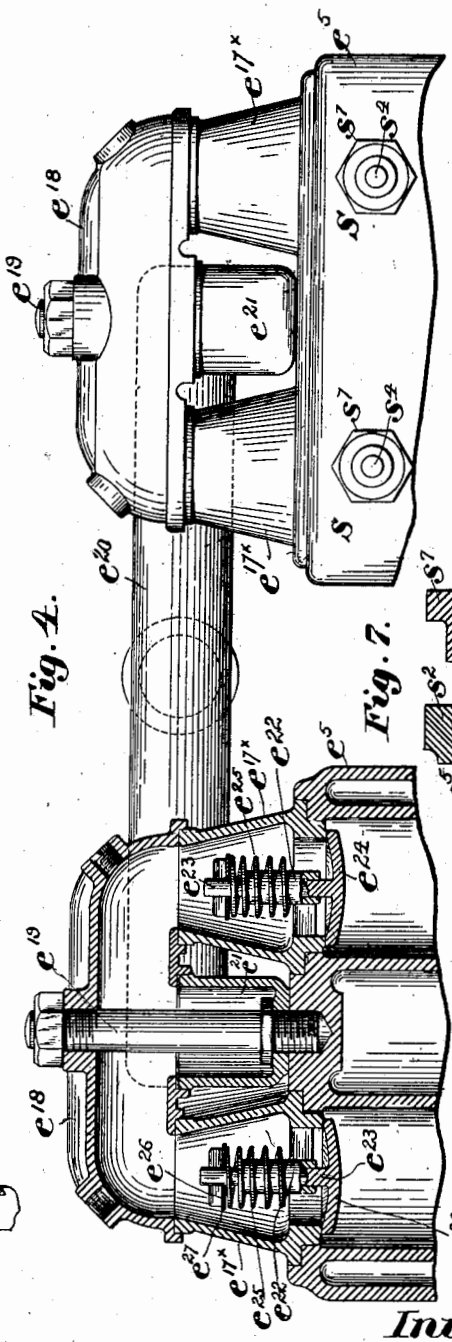

Fig. 4.

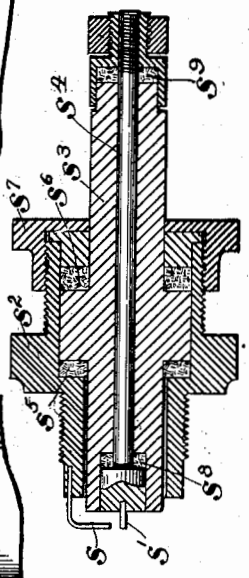

Fig. 7.

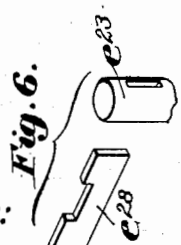

Fig. 6.

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UNITED STATES PATENT OFFICE.

ANDREW L. RIKER, OF SHORTHILLS, NEW JERSEY, ASSIGNOR TO THE "LOCOMOBILE" COMPANY OF AMERICA, OF NEW YORK, N. Y., A CORPORATION OF WEST VIRGINIA.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 725,990, dated April 21, 1903.

Application filed July 16, 1902. Serial No. 115,843. (No model.)

To all whom it may concern:

Be it known that I, ANDREW L. RIKER, a citizen of the United States, residing at Shorthills, in the county of Essex and State of New Jersey, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention has for its object to provide a novel and improved internal-combustion engine, and since the invention is particularly applicable to motor-vehicles I have herein illustrated and will describe said invention in connection with such a vehicle.

The various features of my invention will best be understood from a description of one embodiment thereof shown in the accompanying drawings, wherein—

Figure 1, in side elevation, illustrates in outline a typical motor-vehicle equipped with an engine containing my invention; Fig. 2, a top or plan view of Fig. 1; Fig. 3, an enlarged vertical sectional view through one of the cylinders of the engine; Fig. 4, an enlarged detail illustrating the mounting of the inlet-valves for the various cylinders of the engine, the view being partially in section; Fig. 5, a detail, partially in section, showing the Siamese connection for supplying the combustible mixture to the engine; Fig. 6, a detail in perspective, showing the means for seating the spring at the end of an inlet-valve stem; and Fig. 7, an enlarged sectional detail showing one form of spark-plug that may be employed.

In the embodiment of my invention selected for illustration herein and shown in the drawings, referring particularly to Figs. 1 to 3, inclusive, my improved engine is shown as a four-cylinder engine, the four cranks being set one hundred and eighty degrees apart, whereby perfect balance is obtained. Obviously my improved engine may have any number of cylinders, less or more than four, if desired. In the engine shown the cylinders are in pairs, each pair being formed within a single casting E, (shown best in Figs. 1 and 3,) the said casting being formed at its upper end to present a dome-like portion e^5, (see Fig. 1,) each of which includes two of the cylinders. As the cylinders, the contained pistons, valves, &c., are similar, a detailed description of one will suffice for all. Referring, therefore, to Fig. 3, the casting E has formed within it the vertical cylinder e^6, which contains the single-acting piston e^7. This piston, as is common in single-acting engines, is made of sufficient length to serve as its own guide in its reciprocations in the cylinder and, like pistons of this type, is made hollow or cup-shaped to receive the end of the connecting rod or piston e^8, which is connected at its lower end with the crank e^9 and at its upper end with the wrist-pin e^{10}, fixedly positioned in the piston. The wrist-pin e^{10} is here shown as tubular from end to end to permit oil to enter therein, the oil escaping through a series of lateral exit-passages e^{11} to the bearing-surface between the said pin and its connecting-rod. The casting E rests upon the supporting or intermediate casting e^{12}, here shown as embracing both pairs of cylinders, and which extends downward to about the axis of the crank-shaft and has detachably secured to its lower end the bottom or well casting e^{13}. The intermediate or supporting casting e^{12} is provided at its opposite sides with a plurality of supporting-arms e^{14}, here shown as six in number, which rest upon a suitable portion of the frame, herein the longitudinal angular supporting members c^{10}. Thus the bottom or well casting e^{13} may be detached to expose the interior parts of the engine without disturbing the engine-supports, which is a matter of great convenience. Furthermore, the engine-supports being located above the detachable bottom casting are brought nearer to the center of gravity of the engine, furnishing more stable support therefor. The upper or closed end of the cylinder is shown as bell-shaped to produce a sufficiently strong structure to resist the igniting action of the mixture within the cylinder and also to provide sufficient clearance, the said clearance or cup-shaped end portion having an inlet exhaust-port e^{15}, shown as cylindrical in shape and closed at its end by the sparking means, shown as a spark-plug S, which may be of

any suitable or desired construction. The spark-plug indicated in Fig. 3 is shown in detail in Fig. 7 and comprises the two contacts s s', the former being mounted in the end of the bushing s^2, adapted to be screwed into and to close the end of the port e^{15} and receiving within it the insulation-plug s^3, containing the pin s^4, carrying at its end the other contact s'. The insulation-plug s^3 is suitably packed within the bushing s^2 by front and rear packings s^5 s^6 and clamped in position by the nut s^7, and the pin s^4 is likewise suitably packed within the plug s^3 by packings at s^8 s^9.

Referring again to Fig. 3, the inlet exhaust-port is provided at its top and bottom, respectively, with inlet and exhaust ports e^{16} e^{17}. The inlet-port e^{16} is formed in the conical tubular bonnet $e^{17\times}$, detachably seated in the casting E.

Referring to Fig. 4, the bonnets $e^{17\times}$ for each pair of cylinders are clamped in position by a single hollow yoke e^{18}, secured by a single clamping-bolt e^{19}, tapped into the cylinder-casting, so that release of the said bolt, permitting removal of the yoke, permits also removal of either or both of the valve-bonnets $e^{17\times}$, forming a ready means of access to the said bonnets whenever the valves contained therein need attention.

The gaseous mixture which furnishes the motive power is received from the supply-pipe through a Siamese connection e^{20}, Fig. 2, provided at its ends with a pair of heads e^{21}, having outlets at their upper sides, which communicate with openings in the under sides of the yokes e^{18}.

The joints between the bonnets $e^{17\times}$, the cylinder-casting, and yoke are ground, so that the tightening of the bolt e^{19} effectively clamps all the joints and renders the same tight, and, conversely, release of the said bolt releases all the said joints and permits any or all the parts to be removed.

The bonnets $e^{17\times}$ (see Figs. 3 and 4) are provided with internal tubular guides e^{22}, which receive the stems e^{23} of the inlet-valves e^{24}, said valves being normally lifted and seated against the bottom faces of the said bonnets $e^{17\times}$, which constitute the valve-seats, by springs e^{25}, encircling the said guides e^{22} and acting at their upper ends against washers e^{26}, in turn seated against notched keys e^{28}, (see Fig. 6,) inserted through the slotted upper ends of the stems e^{23}. These inlet-valves e^{24} are opened against the action of their respective springs by the suction or vacuum created within the respective cylinders by the movements of the pistons therein, as will be hereinafter described.

Referring again to Fig. 3, the exhaust-outlet e^{17} at the bottom of the inlet exhaust-port e^{15} has its surrounding valve-seat normally closed by a valve e^{29}, the stem e^{30} of which extends downward through a suitable guide e^{31}, formed in the cylinder-casting, and is surrounded below said guide by a spring e^{32}, seated at its upper end against the casting and at its lower end upon a washer e^{33}, keyed to the said stem, said spring maintaining said valve normally seated. The lower end of the valve-stem e^{30} is acted upon by a lift-rod $e^{30\times}$, provided at its upper end with a suitable adjusting-nut, the said lift-rod at its lower end e^{34} being forked to straddle the cam-shaft e^{35}, which latter thus serves as a guide for the lift-rod in its vertical movements. Just above the cam-shaft e^{35} the lift-rod is provided at one side with a roller or other stud e^{36}, which is acted upon by a cam e^{37} upon the said shaft and which at each rotation of the latter raises the valve-stem and the exhaust-valve e^{29}. There are of course four such cams e^{37}, one for each cylinder, each cam being properly timed to raise its exhaust-valve to permit exhaust of its cylinder at the proper time. The cam-shaft e^{35} is driven from the crank-shaft by suitable means, as the gears p p'. (Shown in dotted lines, Figs. 2 and 3.) The exhaust after passing the valve e^{29} enters the exhaust-passage e^{38}, escaping thence through the conduit $e^{4\times}$ the rear of the vehicle, Fig. 1, thence outward through the muffler e'.

The several cylinders of the engine are surrounded by a cooling-jacket space e^{39}, formed in the cylinder-casting and through which water or other cooling fluid is circulated in suitable or usual manner, as from a rotary pump P on the shaft 51, Fig. 3, driven by a pinion 50 in mesh with the cam-shaft-driving gear p'.

The operation of the engine so far as described is as follows: In starting the crank-shaft of the engine is given a turn manually by the handle $e^{2\times}$, Fig. 1, applied to the extended front end of the crank-shaft. This causes the descending pistons within the cylinders to create a vacuum therein, which automatically opens the inlet-valves thereof and causes such cylinders to fill with combustible drawn by the vacuum from a usual mixing chamber or device—such, for instance, as indicated at M, Figs. 1 and 2. The engine shown is what is of the four-cycle type—that is, the first downward movement of the piston creates a vacuum therein, which at once fills with combustible, drawn thereby past the inlet-valve of the said cylinder. The return stroke of the piston compresses the mixture thus drawn into the said cylinder, and at the close of the return stroke ignition occurs to impel the piston again downward, and upon the second return stroke the exhaust-valve is lifted from its seat to permit the exhaust to escape, as described, thus completing the cycle of operation of the engine, the next succeeding down-stroke of the piston beginning a new cycle and drawing in a new supply of combustible, as before.

To oil the engine, I have provided an oil-reservoir T, Fig. 3, having an outlet-pipe t, controlled by a valve t', which pipe enters the oil-chamber within the engine-casing near the bottom thereof. This casing is maintained normally partially filled with oil, so that ro-

tation of the cranks and other parts therein will serve to scatter the oil to the various bearings within the casing, which it is necessary to maintain properly lubricated. The escape of oil from the reservoir T may be so gaged as to supply gradually sufficient oil to make up for the loss due to the running of the engine, or instead it may be used merely to replenish at intervals the supply within the engine-casing. A branch pipe t^2 from the pipe t leads upward to the lower end of the cylinder and enters the cylinder opposite an annular groove t^3 therein, which groove is so located that in the downward stroke of the piston the hollow wrist-pin thereof will reach a position opposite it. Thus any surplus oil thrown upon the interior surface of the cylinder flows or is pushed downward to and into the annular groove t^3, and as the wrist-pin reaches a position opposite such groove a portion of the oil therein escapes or is taken off into the said wrist-pin, through which and the outlet-passages e^{11} therein it escapes to lubricate the wrist-pin bearing. The surplus oil escapes through the pipe t^2 downward into the main body of the oil in the reservoir or well below.

The means for producing at the required intervals the sparking or other means of ignition of the combustible within the cylinders is not described herein, since any suitable or well-known means may be employed for the purpose.

In the engine described the formation of the various ports, valve-seats, and jackets in a single casing reduces the element of workmanship and final cost to a minimum and at the same time largely eliminates the necessity for repairs. There are practically only three castings in the engine—the cylinder-casting, the intermediate or supporting casting, and the detachable well-casting—and the construction described whereby the inlet-valves and their seats may be quickly removed without even disconnecting or displacing the inlet or supply conduit e, Fig. 5, enables said valves and seats, which require most frequent attention, to be readily gotten at for cleaning.

In Figs. 1 and 2 I have shown my improved engine arranged in a typical motor-vehicle, the engine crank-shaft driving through suitable or usual transmission mechanism at F to the jack-shaft f, thence by usual chains f' to the rear or driving wheels of the vehicle.

My invention is not limited to the particular embodiment thereof here shown and described, for obviously the same may be varied without departing from the spirit and scope of the invention.

I claim—

1. An internal-combustion engine provided with a suitable inlet-port, a supply-conduit, clamping means to clamp and place said conduit in communication with said inlet-port, and a detachable inlet-valve seat removable on release of said clamping means without displacement of said conduit.

2. An internal-combustion engine having a detachable inlet-valve seat, a valve-bonnet, a supply-conduit having an exit-opening at the side of said valve-bonnet, a connecting-conduit to connect said supply exit-opening with said valve-bonnet, and means for clamping the same in its connecting position.

3. An internal-combustion engine provided with a plurality of detachable inlet-valve seats, a common inlet-yoke for said valve-seats, and means to clamp said yoke and seats in operative position.

4. An internal-combustion engine provided with a plurality of detachable inlet-valve bonnets, a common inlet-yoke holding the same in position, and means to secure said yoke.

5. An internal-combustion engine provided with a detachable inlet-valve bonnet, an independently-movable inlet-head, and means simultaneously to clamp said bonnet and head in operative position and to release the same.

6. An internal-combustion engine provided with a plurality of inlet-valve seats, a single inlet-head therefor, and common means for securing said valve-seats and head in position, which when released will permit removal of either of said valve-seats or head without the others.

7. An internal-combustion engine provided with a combustible-supplying conduit, and a valve-seat and its valve, controlling exit of combustible from said conduit, said valve-seat being removable independently of said conduit.

8. An internal-combustion engine provided with independently-removable combustible-supplying conduit and inlet-valve bonnet, and a removable connection between the two.

9. An internal-combustion engine provided with normally communicating but independently-removable supply-conduit and inlet-valve bonnet, and means to secure the same in position.

10. An internal-combustion engine provided with a plurality of inlet-valve bonnets, a supply-conduit therefor and normally in communication therewith, said bonnets being removable independently of said conduit.

11. An internal-combustion engine having a supply-conduit, and one or more inlet-valve seats controlling admission to said engine from said conduit and removable independently thereof.

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

ANDREW L. RIKER.

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