No. 720,752. PATENTED FEB. 17, 1903.

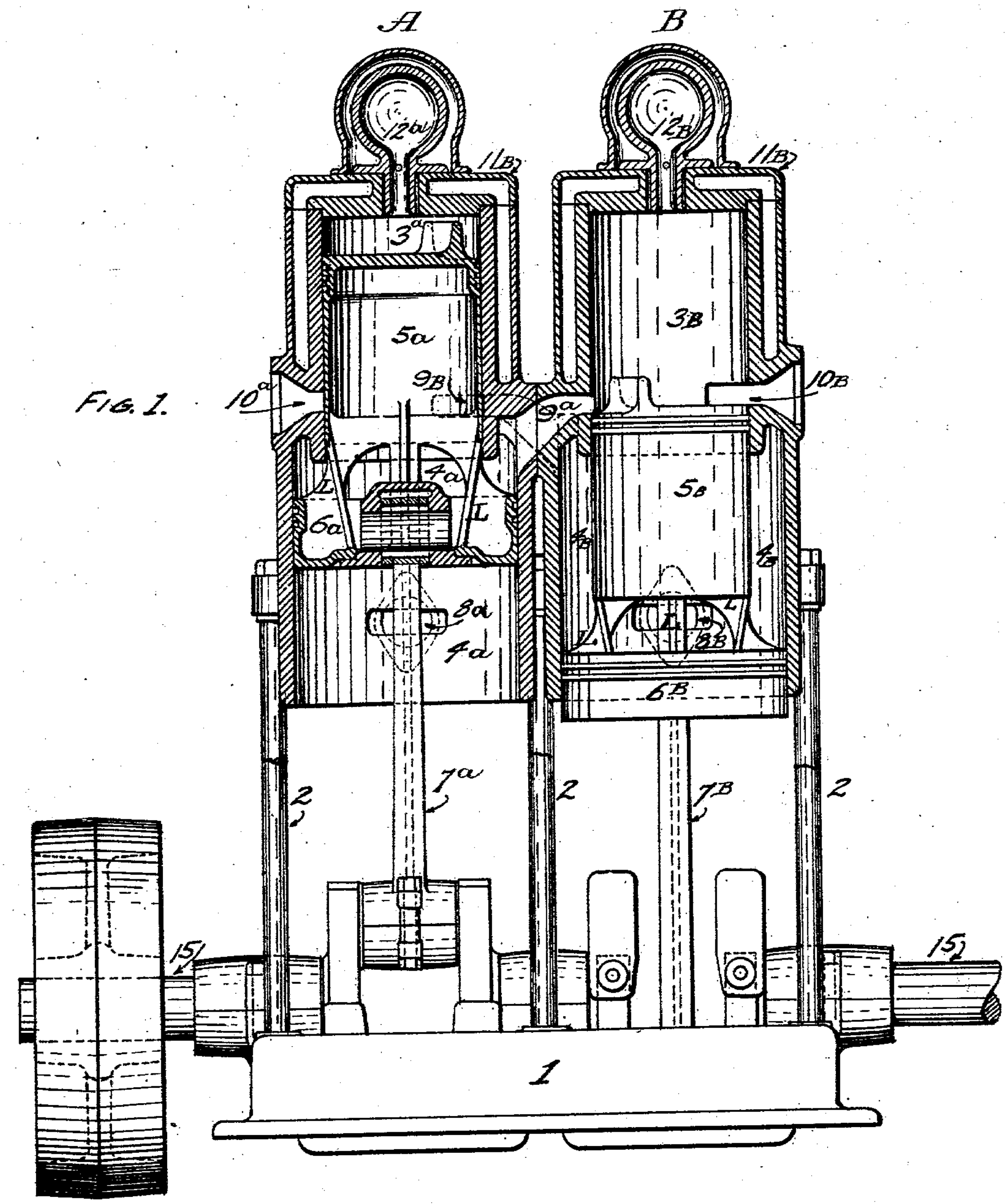
C. L. STRAUB.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 14, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:

Niels Adolf Nielsen

Charles W. Thickstun

Constantine Lee Straub INVENTOR

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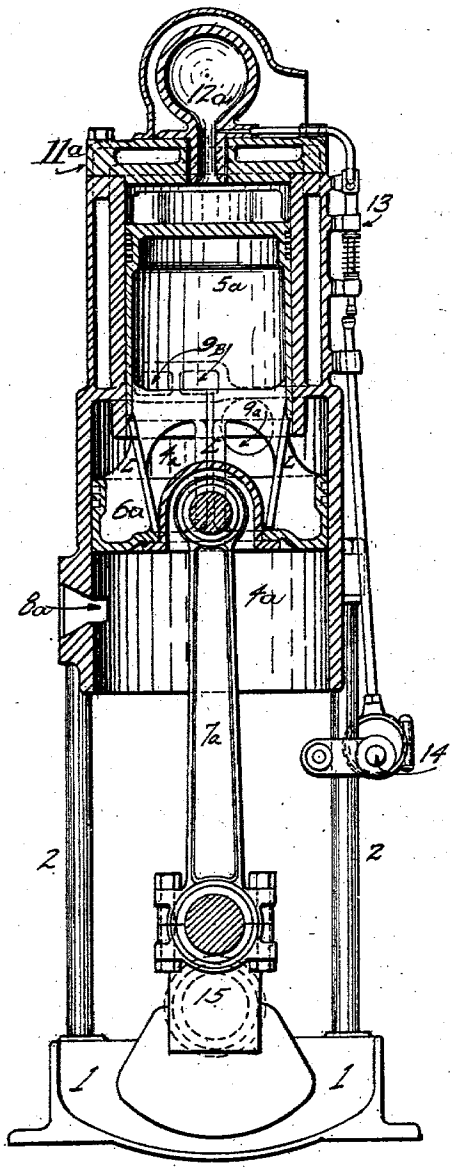
NO MODEL. 2 SHEETS—SHEET 2.

FIG. 2



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UNITED STATES PATENT OFFICE.

CONSTANTINE LEE STRAUB, OF PERTH AMBOY, NEW JERSEY.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 720,752, dated February 17, 1903.

Application filed March 14, 1902. Serial No. 98,252. (No model.)

To all whom it may concern:

Be it known that I, CONSTANTINE LEE STRAUB, a citizen of the United States of America, residing at Perth Amboy, in the county of Middlesex and State of New Jersey, have invented a new and useful Internal-Combustion Engine, of which the following is a specification.

My invention relates to engines, and while of notable utility when embodied in explosion or internal-combustion engines it will be understood that I contemplate the utilization of my improvements in any field to which they are adapted by their nature.

Among the factors which detract in large degree from the efficiency and economy of explosion-engines foremost may be reckoned the adulteration of the explosive charge by products of combustion residual in the working cylinder by reason of insufficient means of expulsion or scavenging. Waste of fuel accompanies the use of the explosive charge or the air constituting the excipient or fuel-vehicle of the explosive mixture as a scavenger after instead of before enrichment, since a portion of the charge escapes with the products of combustion through the exhaust and is lost. Energy is wasted in excessive compression of a quantity of air which is relatively small, and therefore proves insufficient to act effectively as a scavenger, for a large volume of air compressed slightly suffices to fill the working chamber quickly but not violently and expels the products of combustion without agitation of the same and admixture therewith. Complicated valves, pipe connections, casings, and igniting devices furnish avenues for escape of the explosive mixture, while their presence impedes the few repairs necessary to a properly-constructed explosive-engine and adds an unlimited amount to the repair list.

The object of my invention is to provide for complete scavenging of the working cylinder by a charge of pure air before enrichment thereof for explosion, obviating at one and the same time the above-recited adulteration of the explosive charge and waste of fuel, the large volume of scavenging air at low pressure being secured by compression thereof inside a hollow piston working in a differential cylinder, from which the charge is admitted directly to an adjacent cylinder through coöperating contiguous ports formed in the material of the cylinders, which act alternately as explosion-cylinders and coöperate to scavenge each other.

My improvements have been directed also to an open construction of frame, rendering easily accessible a removable hood carrying the connection between the pitman and the portion of the piston which serves as cross-head, so that it is the work of but a few moments to remove both pitman and piston, leaving the cylinder exposed. These, with the various other features of my invention, will be illustrated and described fully in the accompanying drawings and specification and pointed out in the claims.

In the drawings, Figure 1 is a longitudinal vertical section on the center line of an engine in the construction of which my improvements have been embodied; and Fig. 2 is a transverse vertical section of the same on the center line of engine A, as shown in Fig. 1.

In the embodiment of my invention selected for illustration and description to enable a ready and complete understanding of my improvements the parts designated by the reference-numerals 1 and 2 are respectively a bed-plate and columns forming the engine-frame, which may be of any suitable construction, preferably open, as illustrated, to afford convenient access to the working parts and to the differential cylinder-engines A and B. The latter comprise, respectively, cylinders having explosion or working chambers 3^a and 3^b and compression or pump chambers 4^a and 4^b, respectively, these cylinders containing the working pistons 5^a and 5^b, preferably of considerable length, and the compression-pistons 6^a and 6^b, preferably relatively large in diameter and shown as secured to the working pistons by legs L, forming therewith in each case a unitary structure, which may, if desired, be integral in character, as of cast metal. This piston device or structure is recessed to receive a charge of air for scavenging purposes, compressed within the hollow working piston by the action of the compression-piston on its upward stroke, the hollow compression-piston serving as a receptacle for oil to lubricate the wrist-pin of the pitman or connecting-rod

7^a and 7^b, which passes through each compression-piston, being attached thereto by a hood or wrist-pin bearing member, which closes the aperture through which the pitman passes. The compression-piston acts as a cross-head, and the pressure of the charge within the piston structure tends to force the oil into the wrist-pin bearing at the exposed ends of the pin and through the piston. The pump-chambers have ports 8^a and 8^b, through which air is drawn, compressed, and forced through inlet-ports 9^a and 9^b into the working cylinder of the opposite engine by the alternate reciprocating movement of the pistons, (cranks being shown as set at one hundred and eighty degrees,) the cylinders being preferably adjacent, as shown, with the mouths of their ports contiguous. The ports 9^a and 9^b are situated, preferably, at or near the crank end of the stroke of the working pistons 5^a and 5^b to be alternately covered and uncovered by their respective pistons and open at a suitable region of the opposite working cylinder, while the exhaust-ports may be situated, as indicated, at 10^a and 10^b to be similarly operated, so that the scavenging charge under compression in the recessed piston structure, which acts as an auxiliary compression-chamber, will be liberated toward the end of the compression-stroke to clear out the opposite explosion-chamber at the end of its working phase.

As one convenient form of igniting device I have shown vaporizing and igniting bulbs 12^a and 12^b, into the necks of which fuel is forced by the pump 13, (see Fig. 2,) operated by an auxiliary rocker-shaft 14, which receives its motion from the main shaft 15 by an eccentric and rod. (Not shown.)

The heads 11^a and 11^b may and preferably will be water-jacketed, as indicated.

Operation: Starting with engines in position as shown in Fig. 1, the igniting-bulbs 12^a and 12^b are heated by means of a kerosene-torch to about 800° Fahrenheit. Pump-cylinder 4^b is in communication with free air. As piston 6^b moves upward it closes port 8^b and slightly compresses air in cylinder 4^b until piston 5^a has uncovered ports 9^b and 10^a at the crank end of its stroke. The compressed air in cylinder 4^b rushes in and is deflected upward in cylinder 3^a by piston 5^a and forces burned gases out through exhaust-port 10^a. Meanwhile piston 6^a has uncovered port 8^a and has filled pump-cylinder 4^a with free air. As the motion of the pistons reverses the confined pure air in working cylinder 3^a is gradually compressed into the combustion-space and bulb 12^a, and at any desirable point of compression, usually when starting, after the maximum point of stroke has been reached, the fuel is forced through a suitable opening into the heated bulb 12^a, where it is vaporized and exploded by the action of the heat of the bulb. This operation is carried out alternately in each cylinder, with the result of two impulses every revolution of the crank-shaft.

Having thus fully illustrated and described my invention and a suitable construction for carrying the same into effect, it will be understood that I do not limit myself to the specific devices illustrated and described, nor in general otherwise than as set forth in the claims read in connection with the specification.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in an internal-combustion engine, of two differential cylinders and pistons, having their lower, or pump pistons, secured to their upper or working pistons by means of open legs, and provision made whereby, at every upward stroke, the pump-pistons can charge and compress into their respective pump-cylinders and working pistons a certain amount of air, preparatory to forcing it into the opposite working cylinder, through ports which are uncovered by the downward movement of their respective working pistons, at or near the end of their crank-stroke, substantially as described and for the purpose specified.

2. An explosion-engine, comprising an explosion-cylinder and a compression-cylinder and a piston recessed to form a compression-space auxiliary to said compression-cylinder, but separate from said explosion-cylinder, to receive a scavenger charge of large volume and low pressure from said compression-cylinder, and means to cause delivery of said charge to said explosion-cylinder toward the end of the compression-stroke of said piston to replace therein the products of combustion quickly but without violent agitation thereof or admixture therewith.

3. An explosion-engine comprising a plurality of cylinders each having an explosion-chamber and a compression-chamber, and pistons in said cylinders recessed to receive scavenger charges respectively from said compression-chambers of said cylinders in which said pistons operate, and means to cause delivery of said scavenger charges to said explosion-chambers of respectively opposite cylinders, substantially as described.

4. An explosion-engine comprising a plurality of adjacent differential cylinders having respectively working pistons, compression-pistons and ports operated by said pistons, said working pistons being recessed to receive a scavenger charge from said compression-pistons, the inlet-ports for the respective explosion-chambers in said cylinders having mouths contiguous to the discharge-ports in said compression-chamber of the adjacent cylinder, to receive directly therefrom said scavenger charge, substantially as described.

5. A piston device for engines of the class described, comprising a working piston and a compression-piston forming together a unitary structure recessed to receive and store a

charge during the compression-stroke, and arranged to deliver said charge toward the end of said stroke, substantially in the manner and for the purpose set forth.

6. A piston device for engines of the class described, comprising a working piston, a compression-piston of relatively large diameter forming with said working piston a unitary structure recessed to receive a charge and acting as a cross-head, and a wrist-pin carried by a hood or closure member connected removably to said compression member, and arranged to close said recess.

7. In a piston device, a piston recessed to receive a bath of oil and having a central aperture to permit passage of a pitman through said piston, a wrist-pin hood or bearing supported in said aperture and closing the same, and a wrist-pin carried by said bearing and exposed to the action of said bath of oil, said oil being exposed to the pressure of the compressed charge which tends to force it into said bearing and through said piston, substantially as described.

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Witnesses:
NIELS ADOLF NIELSEN,
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