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INTERNAL COMBUSTION ENGINE.

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1,046,863.

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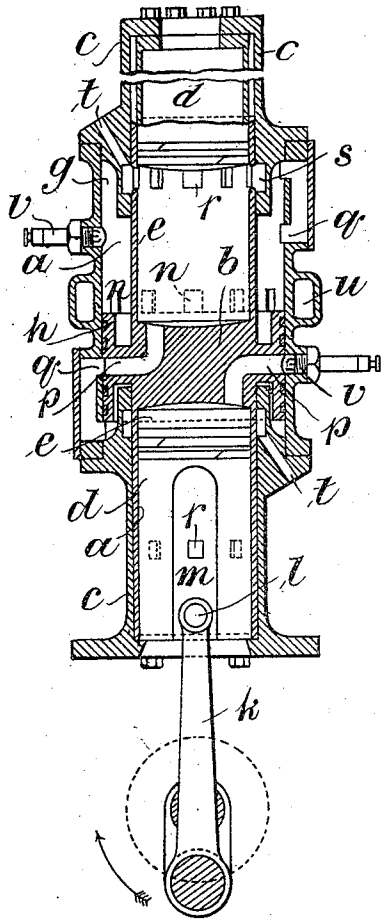


Fig. 1.

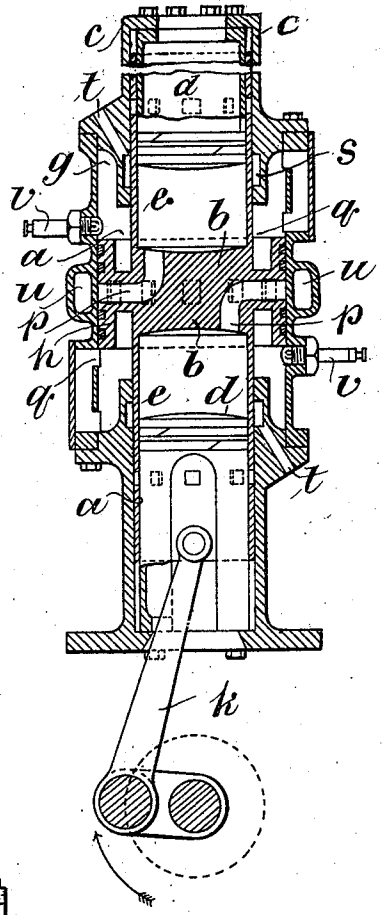
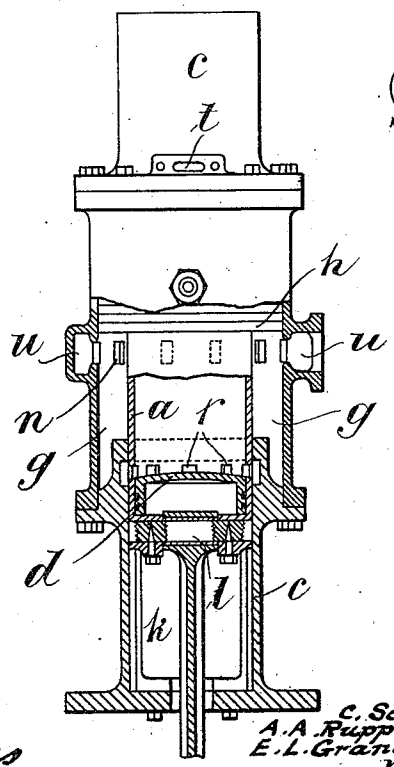


Fig. 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

1,046,863. Specification of Letters Patent. Patented Dec. 10, 1912.

Application filed June 5, 1911. Serial No. 631,415.

To all whom it may concern:

Be it known that we, CHARLES SAUNDERS, ALWIN ALBERT RUPPRECHT, and EDGAR LEICESTER GRANT, subjects of the King of England, residing at London, England, have invented certain new and useful Improvements in Internal-Combustion Engines; and we 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in two-stroke cycle internal combustion engines and more especially to double acting internal combustion engines of the type in which a sleeve having a central partition is adapted to reciprocate over two stationary pistons arranged one at each end of a stationary cylinder and in spaced relation thereto so as to leave annular spaces to receive the ends of the said sleeve.

One object of the present invention is to devise an engine of the above type capable of transmitting an impulse every stroke, and having means whereby the combustible charge can be subjected to a preliminary compression before entering and being subjected to a secondary compression in each combustion chamber, and also whereby the entry of the charge to each of said chambers is effected at one end thereof, while the exhaust gases are escaping at the opposite end, to insure thorough scavenging, said controlling means being of such form as to dispense with the necessity for puppet and like valves.

According to the present invention the central portion of the engine cylinder is enlarged so as to form in conjunction with the sleeve an annular chamber which is utilized as a compressor chamber, the partition of the sleeve being enlarged to form a piston for working therein, so that a double acting compressor is thereby provided, the suction and delivery ports of which are adapted to be controlled by the compressor piston, so that the combustion chambers before each compression stroke are alternately supplied by the compressor with compressed charge.

The aforesaid reciprocatory sleeve, in conjunction wih the stationary pistons and the aforesaid central partition, forms two combustion chambers, and it is provided near each end with exhaust ports adapted to be uncovered and covered during the reciprocatory movements of the sleeve, and in such sequence, that the inlet of compressed charge to each combustion chamber begins while the corresponding exhaust ports are open whereby thorough scavenging is assured.

Ignition of the charge compressed in each combustion chamber is effected at the correct time by suitable means, but in the preferred form of the invention sparking plugs are arranged in suitable positions and are adapted to be placed alternately in firing connection with the respective combustion chambers by means of ports in the aforesaid partition as the sleeve approaches the end of each stroke.

The accompanying drawings illustrate by way of example one form of engine according to the invention, Figures 1, and 2, being similar front sectional elevations illustrating the sleeve at different positions of the crank. Fig. 3, is a side elevation half in section.

In the form of the invention illustrated a sleeve *a*, divided by a central partition *b*, reciprocates within a stationary cylinder *c*, having a stationary piston *d*, arranged at each end and in spaced relation thereto so as to leave annular spaces to receive the end portions of the sleeve *a*. Two combustion chambers *e*, are thereby formed within the sleeve and between the stationary pistons *d*, and the partition *b*.

The central portion of the engine cylinder *c*, is enlarged so as to form in conjunction with the sleeve *a*, an annular compressor chamber *g*, the partition *b*, being enlarged to form a compressor piston *h*, to work in said chamber *g*, and form therewith a double acting compressor. The sleeve *a*, is connected to any suitable mechanism for transmitting its motion, for instance it is connected to a crank *i*, by means of a connecting rod *k*, having the usual form of gudgeon pin *l*, the lower stationary piston *d*, having slots *m*, to permit of the free reciprocation of the pin *l*.

Carbureted air or other suitable combustible fluid is drawn into the compressor chamber *g*, through suction ports *n*, surrounded by an annular inlet chamber *u*, and after being subjected to a preliminary com-

pression in the chamber g, by the piston h, is allowed to enter the combustion chambers e, by way of ports p, in the partition b, when said ports are brought into register with ports q. The sleeve a, is provided with a set of exhaust ports r, near each end, adapted to be brought periodically into register with annular exhaust passages s, leading to the atmosphere by ports t.

Ignition of the charges compressed in the combustion chambers is effected by sparking plugs v, adapted to be alternately brought into sparking connection with their respective chambers by the ports p, in the partition b, when the latter approaches the end of each stroke.

The cycle of operations is as follows:— Assuming the sleeve a, to be in the position indicated in Fig. 1, a compressed charge in the lower combustion chamber e, is just about to be ignited by the respective sparking plug v, the corresponding port p, placing it in connection with said combustion chamber. In the meantime the compressor piston h, will have created a partial vacuum in the upper part of the compressor chamber g, and also uncovered the inlet ports n, so that a fresh supply of carbureted air will enter the said upper part of the chamber g. Simultaneously with this action the charge previously compressed by the compressor piston h, in the lower part of the compressor chamber g, will pass through the respective ports q, and p, into the upper combustion chamber e, and the previously exploded charge therein will exhaust through the upper exhaust ports r. Upon combustion occurring in the lower chamber e, the sleeve a, will move upwardly, the various ports p, n, and r, being closed as indicated in Fig. 2, so that the charges in the upper part of the chamber g, and upper chamber e, are subjected to a preliminary and secondary compression respectively. When the sleeve a, approaches the end of its upward stroke, the same conditions obtain at the upper end as described above with reference to Fig. 1, in respect of the lower end of the stroke, that is to say the charge compressed in the upper combustion chamber e, will be ignited by the upper sparking plug v, which will be placed in connection with the said chamber by the respective port p, while the burnt gases in the lower chamber e, will begin to escape through the lower exhaust ports r, and the fresh charge compressed in the upper part of the compressor chamber g, will enter the lower combustion chamber e, through the upper port q, and respective port p. At the same time a fresh supply of combustible fluid will enter the lower part of the compressor chamber g, through the ports n. The sleeve a, will then move downwardly, the various ports n, p, and r, being then closed, as will be understood on reference to Fig. 2. It will thus be understood that an impulse is obtained for every stroke of the sleeve a, or two impulses for every revolution of the crank. Efficient scavenging of the combustion chambers is insured, as the preliminary compressed charge enters each chamber at the end remote from the exhaust ports. As the compressor is double-acting an adequate induction and compression of fresh combustible fluid are effected and an adequate supply of compressed fluid is provided for each combustion chamber. These advantages are obtained by the use, within the engine proper of only one moving part, namely the sleeve a, irrespective of the connecting rod and like parts for transmitting the motion of the sleeve, no puppet valves or the like moving parts being necessary.

We claim:—

1. In a combustion engine of the character described, the combination of a cylinder provided with an enlarged portion to form a compression chamber and a gas receiving chamber, the latter having openings which communicate with the compression chamber, said cylinder having an exhaust port, a piston supported in the end of the cylinder and spaced from the walls thereof, a sleeve having a partition and a flange, the latter operating in the compression chamber, said sleeve operating in the cylinder and over the piston and forming with the latter a combustion chamber, said sleeve having an exhaust port near its open end, the partition having a port located to admit a charge to the combustion chamber from the compression chamber after the flange has compressed said charge in said compression chamber and when the exhaust port in the sleeve communicates with the exhaust port in the cylinder, and means for igniting the charge in the combustion chamber through the port in the partition.

2. In a double acting internal combustion engine, a cylinder having a stationary piston at each end in spaced relation to the cylindrical surface thereof, a reciprocatory sleeve having a central partition, said sleeve being disposed on said pistons so as to form therewith two combustion chambers, an annular double acting compressor chamber surrounding said sleeve and having a compressor piston which is carried by said sleeve, and means for alternately connecting the compressor chamber on each side of the compressor piston with the combustion chamber which is remote from said side, substantially as and for the purpose hereinbefore set forth.

3. In a double acting internal combustion engine, a cylinder having a stationary piston at each end in spaced relation to the cylindrical surface thereof, a reciprocatory sleeve having a central partition, said

sleeve being disposed on said pistons so as to form therewith two combustion chambers, an annular double acting compressor chamber surrounding said sleeve and having a compressor piston which is carried by said sleeve, means for alternately connecting the compressor chamber on each side of the compressor piston with the combustion chamber which is remote from said side said connection being effected at one end of said combustion chamber, and means for conducting away the burnt gases from the opposite end of said chamber simultaneously with said connection being effected, substantially as and for the purpose hereinbefore set forth.

4. In a double acting internal combustion engine comprising a cylinder having a stationary piston at each end in spaced relation to the cylindrical surface of said cylinder, and a sleeve adapted to reciprocate on said pistons, said sleeve having a central partition, the combination of a central double acting compressor chamber surrounding said sleeve and a compressor piston therefor on said sleeve, the compressor chamber having suction and two delivery ports, controlled by the compressor piston, and the sleeve having inlet ports on opposite sides of the partition adapted to register alternately with the delivery ports of the compressor chamber, the sleeve also having exhaust ports near its ends, adapted to be uncovered by the reciprocation of the sleeve simultaneously with the registration of the aforesaid ports, substantially as and for the purpose hereinbefore set forth.

5. A double acting two stroke cycle internal combustion engine comprising in combination, a cylinder having a stationary piston at each end in spaced relation to the cylindrical surface thereof, a reciprocatory sleeve disposed on said pistons and having a central partition dividing it into two combustion chambers, a double acting compressor surrounding said sleeve and provided with delivery ports and having a compressor piston on the sleeve, and two sparking plugs on the walls of the compressor the partition of the sleeve having two ports communicating with the aforesaid combustion chambers, and adapted on reciprocation of the sleeve to be brought alternately into register with the respective delivery ports of the compressor and with the aforesaid sparking plugs, substantially as and for the purpose hereinbefore set forth.

6. In a double acting internal combustion engine, a cylinder having a stationary piston at each end in spaced relation to the cylindrical surface thereof, a sleeve adapted to reciprocate on said pistons and having a central partition, an annular double acting compressor chamber surrounding the central part of said sleeve, a compressor piston on the sleeve adapted to reciprocate in said chamber, a gudgeon pin in the lower end of said sleeve, a crank shaft, and a rod connecting said gudgeon pin and the crank of said shaft, the stationary piston at the adjacent end of the cylinder being slotted to permit of the reciprocation of the gudgeon pin, substantially as and for the purpose hereinbefore set forth.

7. In combination with the cylinder of an internal combustion engine, a stationary piston at each end of said cylinder and in spaced relation to the cylindrical surface thereof, a sleeve slidable on said stationary pistons, a compressor chamber having delivery ports at the ends thereof, a ported division wall in said sleeve and forming separate combustion chambers on each side thereof, said ports leading from opposite sides of said division wall to communicate only at and near the end of each working stroke with one of the delivery ports from said compressor chamber, said cylinder having exhaust passages which are uncovered by the sleeve at the time the ports in the division wall communicate with the delivery ports from the compressor.

8. In a two stroke cycle internal combustion engine, the combination of a working cylinder having a compression chamber formed with inlet ports, stationary pistons fixed on the ends thereof in spaced relation to the cylinder, the working cylinder having exhaust passages, a sleeve having a partition, said sleeve operating over the pistons and adapted at the outer end of each stroke to uncover one of the exhaust passages, a compressor on the sleeve, said compressor operating in the compression chamber and uncovering the ports therein when one of the exhaust ports is uncovered, the partition having inlet passages for admitting a compressed charge upon each complete reciprocation of the sleeve and at a time when the inlet ports are uncovered.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHARLES SAUNDERS.
ALWIN ALBERT RUPPRECHT.
EDGAR LEICESTER GRANT.

Witnesses:
R. WESTACOTT,
H. D. JAMESON.