R. G. & V. E. NELSON.

GAS ENGINE.

APPLICATION FILED JAN. 25, 1907.

941,169.

Patented Nov. 23, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

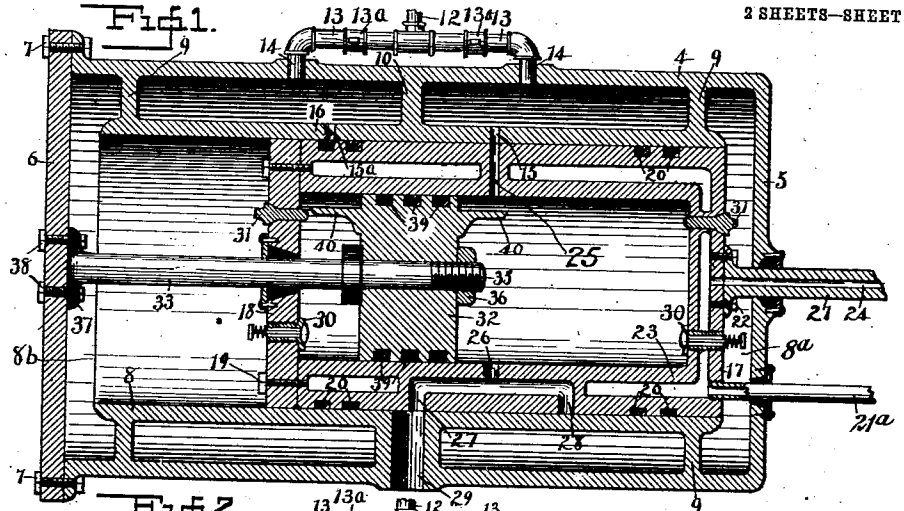


Fig. 2.

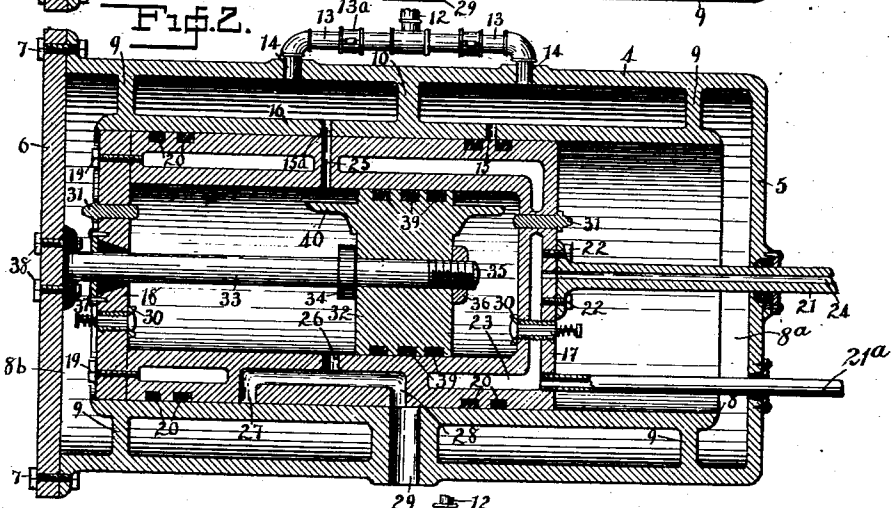
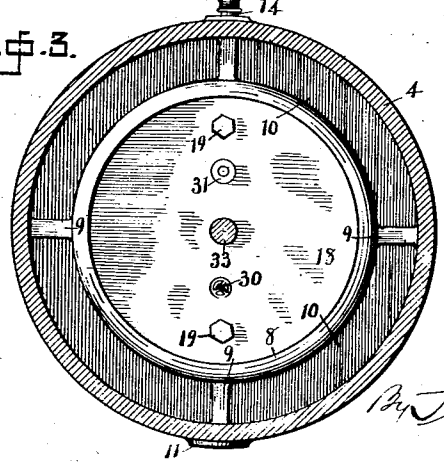


Fig. 3.



WITNESSES:

Mathew J. Marty

C. F. Bassett

INVENTORS

R. G. Nelson

V. E. Nelson

By Frederick Benjamin

ATT'Y.

R. G. & V. E. NELSON.

GAS ENGINE.

APPLICATION FILED JAN. 25, 1907.

941,169.

Patented Nov. 23, 1909.

2 SHEETS—SHEET 2.

Fig. 4.

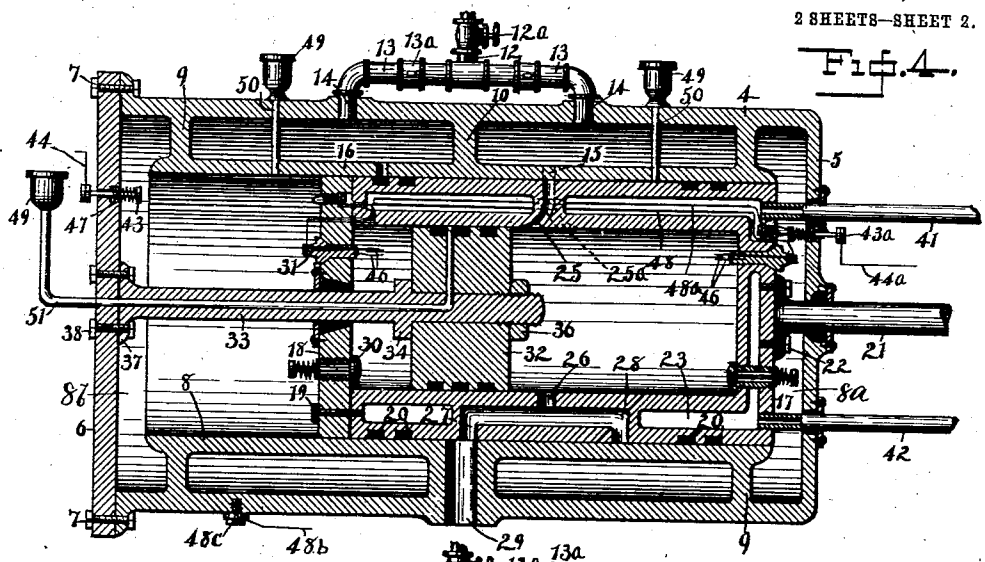
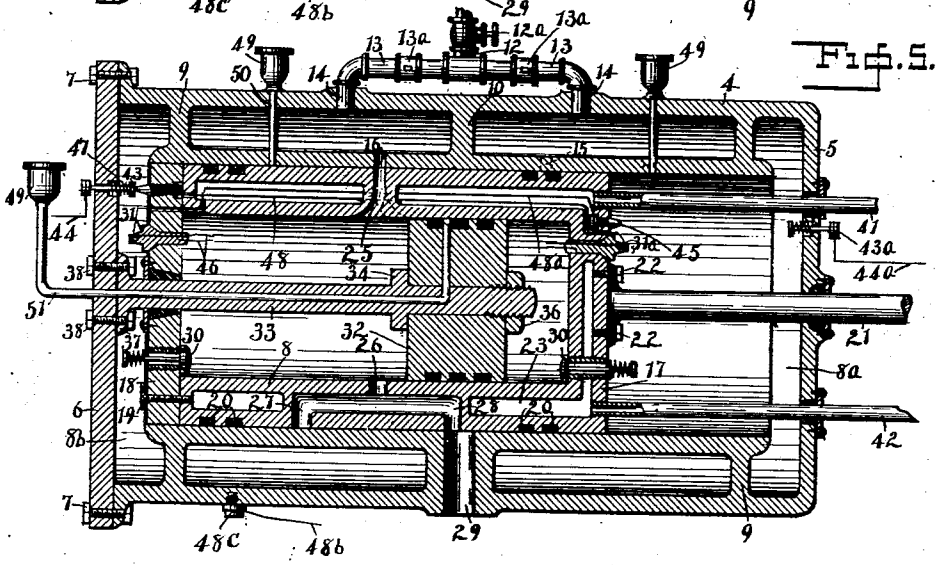


Fig. 5.



WITNESSES:

Mathew J. Marty

C. F. Bassett

INVENTORS

R. G. Nelson

V. E. Nelson

BY Frederick Benjamin

ATTY.

UNITED STATES PATENT OFFICE.

REYNOLD G. NELSON AND VICTOR E. NELSON, OF JOLIET, ILLINOIS.

GAS-ENGINE.

941,169. Specification of Letters Patent. Patented Nov. 23, 1909.

Application filed January 25, 1907. Serial No. 353,994.

To all whom it may concern:

Be it known that we, REYNOLD G. NELSON and VICTOR E. NELSON, citizens of the United States, residing at Joliet, in the county of Will and State of Illionis, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

Our invention relates to improvements in internal combusion engines and refers especially to explosive engines in which the piston is fixed and centralized while the power-impressed kinematic member is in the form of a hollow cylinder which reciprocates within a containing shell or casing.

The paramount objects of our invention are to produce a compact and highly efficient explosive motor, that will have a wide field of application; to conserve the available power so that the weight of the movable parts will bear a minimum relation to the energy evolved; to devise such a construction that the parts will be simple, easily formed and have the required strength and durability; to provide an explosive engine of such a design that the strains will be properly distributed, thus tending to preserve the integrity of the structure; to furnish a mechanism that will economize the application of the power; and to produce an efficient engine that can be manufactured at a reduced cost.

We accomplish the above and other minor objects by the use of the mechanical construction illustrated in the accompanying drawings which form a part of this specification certain results and advantages being more specifically pointed out in the appended claims.

In the drawings:—Figure 1 is a longitudinal sectional view showing one form of our improved explosive engine; Fig. 2 is a similar view with the reciprocating member at the opposite end of its stroke; Fig. 3 is a cross section through the external fixed shell just within the removable head, and Figs. 4 and 5 are longitudinal sectional views of an engine embodying various modifications the reciprocating member being shown at opposite ends of its stroke in the different figures.

Referring to the drawings, 4 indicates the body of an outer cylinder or shell provided with a permanently closed end 5 cast integral with the body. The opposite end of said shell is closed by a removable plate or head 6 and is secured to the body 4 by bolts 7, in the usual manner. Mounted concentrically with the shell 4 is a hollow cylinder 8 open at both ends, connected to, and supported by the shells by stay-posts 9 and a median annular partition 10. The shell 4 and cylinder 8 are preferably formed integral with each other through the medium of the said stay-posts and partition.

A supply pipe 12, having branches 13 and check valves 13^a, communicates with the interior of the shell through ports 14 which open into the said interior on opposite sides of the partition 10. In the wall 16 of the cylinder 8 are formed two ports or passages 15, 15^a, upon opposite sides of the partition 10 and at a determinate distance apart, said distance bearing a relation to the piston stroke. The piston is adapted to reciprocate within the cylinder 8 and is in the form of a hollow cylinder 17 machined to fit properly the bore of the cylinder 8 and dividing the interior of the shell into two compression chambers 8^a, 8^b. One end of this piston is permanently closed and the opposite end temporarily covered by a plate 18 secured to the piston wall by bolts 19. The periphery of the movable cylinder is furnished with packing rings 20, preferably arranged in groups near each end of the structure. To the permanently closed end of said cylinder a rod 21 is rigidly secured by bolts 22. The cylinder is provided with a double wall the intervening space 23 forming a chamber surrounding the part and adapted to perform the function of a cooling jacket, the water for that purpose being supplied through a duct 24 formed in the longitudinal axis of the piston rod 21 the circulation being maintained by an outlet pipe 21^a, inserted in the end of the movable cylinder 17, and passing through a stuffing box in the shell head.

In one side of the movable cylinder is located a passage 25, which connects alternately with the ports 15, 15^a, at each end of the stroke as shown in Figs. 1 and 2. Diametrically opposite the passage 25 is a port 26 having branches 27, 28, which connect alternately at each end of the cylinder stroke with an outlet 29 formed in an enlargement in the partition 10. The position of the port 26 relatively to its branches is such that when one branch is connected with the outlet port 29 the said port 26 is on one side of the partition 10 and when the opposite branch registers with said outlet the port is

on the other side of said partition. Thus at a predetermined location of the cylinder at each excursion the outlet ports 26 and 29 will be in communication in a manner common in such mechanism.

At either end of the cylinder 17 is located an automatic check valve 30 which may be used in connection with the ports 15, 15ª, or may be substituted therefor, the said ports being omitted. At some point in the end walls of the traveling cylinder 17 are placed spark plugs 31, connected by electric circuits in the manner hereinafter set forth.

Midway between the ends of the cylinder 17 is located a piston head 32, firmly secured to a rod 33, provided with a collar 34, and having threads 35 at the end. Said piston head is firmly held against the collar 34 by a nut 36. The said rod 33 passes through a stuffing box in the end plate 18 and is provided at its extremity with a flange 37 which is firmly fixed to the center of the removable cylinder head 6 of the outer cylinder by means of bolts 38. Packing rings 39 surround the piston-head 32 the cross section of which is cylindrical and the latter is finished to suitably fit the internal bore of the hollow piston 17.

Near the upper side of the piston head 32 each face is furnished with a projecting shelf or deflector 40 which projects from each face to a sufficient distance to be below the passage 25, when the latter is in connection with the port 15 or its corresponding port 15ª.

In Figs. 4 and 5 are shown modifications in the shell movable cylinder, piston and other portions of the engine. The duct 24 is omitted from the piston rod 21 and communication is established with the water-jacket 23 by means of duplicate pipes 41, 42, which pass through stuffing boxes in the shell head and are inserted in the fixed wall of the movable cylinder 17, the upper pipe 41 serving as the inlet and the lower pipe 42 as the outlet for said water jacket 23.

In the shell heads are placed electric contact buttons 43, 43ª, to which are connected electric wires 44, 44ª, which lead to any available source of electric motive force. Located correspondingly to the said contact buttons 43, 43ª, are contacts 45, situated in the ends of the reciprocating cylinder and adapted to contact with said buttons at the end of each stroke. The plugs 31, 31ª, previously described and located in the cylinder ends, are furnished with suitable spark producing electrodes which project from the inner ends of said plugs, into the piston cavity. To insure proper connection between the said contacts 45 and the buttons 43, 43ª, at the end of the piston stroke the buttons are furnished with springs 47, which prevent the shock which would result if the ports were not yielding. Circuits are made between the contact 45 at one end of the piston and the spark plug at the other, in order that the explosion shall take place on the proper side of the abutment 32. Thus it will be observed on inspection of Figs. 4 and 5, that the spark plug 31ª is connected by a wire 48, properly insulated, with the contact 45 of the opposite end of the piston. Conversely the spark plug 31 is in circuit with the contact 45 of the opposite end by means of the wire, also insulated, 48ª. The metal parts of the engine are in circuit through a wire 48ᵇ, connected to a binding post 48ᶜ fixed to the cylinder 4 at any convenient point.

The lubrication of the surfaces in contact between the movable cylinder and the surrounding wall 8 is provided for by oil cups 49 which connect with tubes 50, the latter leading to the surface to be lubricated. A similar cup 49 is connected to a tube 51 which connects with a duct formed in the longitudinal axis of the rod 33 and is then led upward to register with a duct in the piston head 32. The inlet pipe 12 is furnished with a control valve 12ª.

The straight inlet passage 25, shown in Figs. 1 and 2 is omitted and instead of a single passage, two inlets 25ª are provided leading from the compression chambers to the explosion chambers. These inlets are out of alinement with each other and the two ports 15, 15ª, are so located that one of said inlets 25ª will register with the port 15 at one end of stroke, and the other inlet will register with the port 15ª at the opposite end of the stroke. In the drawing only one of these inlets 25ª is shown in full, since but one inlet would be cut by the section plane, the other being designated by dotted lines. These inlets are curved in opposite directions so that when the gas under pressure enters the explosion chamber the current of inflowing gas will be directed toward the sparking device. This curving of the ducts renders the deflectors 40, shown in Figs. 1 and 2, as extensions from the abutment faces, unnecessary and they are for that reason omitted in Figs. 4 and 5. The two passages are located in a plane transverse to the direction of piston movement, and the ports 15, 15ª, are so located as to register therewith at alternate positions of the piston cylinder 17 during its stroke. When the piston makes its initial movement or stroke a charge of gas will be drawn by said piston action through pipe 12, and its branch 13, passing check valve 13ª and entering one of the compression chambers. The return stroke of the piston will compress the charge so drawn into the compression chamber, and as soon as the port 15 or 15ª connects with the passage 25, the gas will be forced therethrough into the interior of the piston chamber upon one side of the abutment. Another stroke of the piston

compresses the charge within the piston until a circuit is completed between the contact 45 and the button 43, causing ignition, and the consequent explosion then forces a return stroke of the piston until port hole 26 connects with outlet 29 by one of its branches, allowing the charge to exhaust before the passage 25 registers with the port 15 or 15ª to allow a fresh charge to enter the piston cavity. This cycle of operations will be repeated, an explosion taking place at the end of each stroke thus constituting the device a double-acting two-cycle engine.

Having thus described our invention what we claim is:—

1. An internal combustion engine, including an external shell inclosing a cylinder open at each end, an internal slidable cylinder, a water jacket arranged in said slidable cylinder an immobile piston within said slidable cylinder dividing the interior into two chambers, inlet pipes and valves for transmitting the motive fluid into said chambers, and means for igniting the motive fluid alternately in said chambers.

2. An internal combustion engine, including an external shell, an open-ended cylinder suspended from the side wall of said shell, an annular partition connecting said shell and cylinder, a closed cylinder adapted to slide within said open-ended cylinder and dividing the interior of the external shell into two compression chambers, a fixed piston in the internal closed cylinder dividing the latter into two explosion chambers, inlet pipes and passages provided with suitable valves arranged to transmit the motive fluid into the said compression chambers, and the explosion chambers, and means for igniting the motive fluid alternately in the said explosion chambers.

3. An internal combustion engine, including a casing composed of an external shell and an internal open-ended cylinder, a closed cylinder adapted to reciprocate in said open-ended cylinder, a piston for said closed cylinder, a piston rod for said piston passing through one head of said closed cylinder and secured to said external shell, a water jacket for said closed cylinder, supply pipes for said water jacket passing through said casing, inlet conduits and valves for introducing the motive fluid into said shell and the closed cylinder, means for igniting the motive fluid in the closed cylinder, and exhaust passages for the burned gases.

4. An internal combustion engine, including an external shell inclosing a cylinder open at each end, a median partition connecting the external shell and inclosed cylinder an internal movable cylinder adapted to reciprocate in said open end cylinder and dividing the interior of said shell into two compression chambers, a fixed piston head dividing the interior of the movable cylinder into two explosion chambers, said piston head being secured to one head of the inclosing shell by a rod passing through a stuffing box in one head of the movable cylinder, a water jacket for said movable cylinder supplied through a conduit secured to said movable cylinder and passing through a stuffing box in one head of the inclosing shell, inlet and exhaust conduits and valves for controlling the flow of the motive fluid through the chambers, and electric means for igniting the explosive charge alternately in the said explosive chambers.

5. An internal combustion engine, including an external shell, an internal slidable cylinder, a tubular slideway for said internal cylinder, a piston rod secured to said cylinder and projecting through a stuffing box in said external shell, a water jacket for said internal cylinder supplied by a plurality of conduits slidable in stuffing boxes in said external shell, a piston head fixed to the said shell and dividing the interior of said cylinder into two chambers, inlet and exhaust valves and ducts for controlling the flow of the motive fluid, and means for igniting said fluid in the said chambers.

6. An internal combustion engine, including an external shell, a tubular slide-way, an annular partition connecting said slide-way with the shell, a cylinder adapted to reciprocate in said slide-way, an operating rod fixed to said cylinder and projecting through the external shell, a piston head fixed to the shell by a rod passing through one head of said cylinder, said piston head dividing the interior of the cylinder into two chambers, a water jacket for said cylinder supply conduits for said water jacket passing through stuffing boxes in said shell, inlet passages for transmitting the motive fluid into the outer shell and cylinder chambers, means for deflecting the current of fluid when passing into said chambers, means for igniting the motive fluid in said chambers, and means for exhausting the burned gases.

7. An internal combustion engine, including an external shell, a tube open at each end and supported upon said shell by an annular partition, a cylinder adapted to reciprocate in said tube and arranged to divide the interior of the said shell into two compression chambers, said cylinder inclosing an abutment attached by a rod to the external shell, said abutment arranged to divide the interior of the cylinder into two explosion chambers, a water jacket arranged within said cylinder means for controlling the flow of the motive fluid through said compression and explosion chambers, and means for igniting the motive fluid alternately in the explosion chambers.

8. An internal combustion engine, including an external shell inclosing a tubular slide-way, a cylinder adapted to reciprocate

in said slide-way, and dividing the shell into two compression chambers, a water jacket arranged within said cylinder, a fixed piston head in said cylinder and dividing the interior into two explosion chambers, means for introducing the motive fluid alternately into the said compression chambers, means for introducing the motive fluid alternately into the said explosion chambers, means for causing the ignition of the motive fluid alternately in said explosion chambers, said ignition means consisting of electric terminals located in said shell and the cylinder, respectively, and electric conductors connecting said terminals with a source of electric energy.

In testimony whereof we affix our signatures in presence of two witnesses.

REYNOLD G. NELSON.
VICTOR E. NELSON.

Witnesses:
F. BENJAMIN,
WM. BENNETT MOORE.