H. H. SIMON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JULY 30, 1908.

928,405. Patented July 20, 1909.

Fig. 2

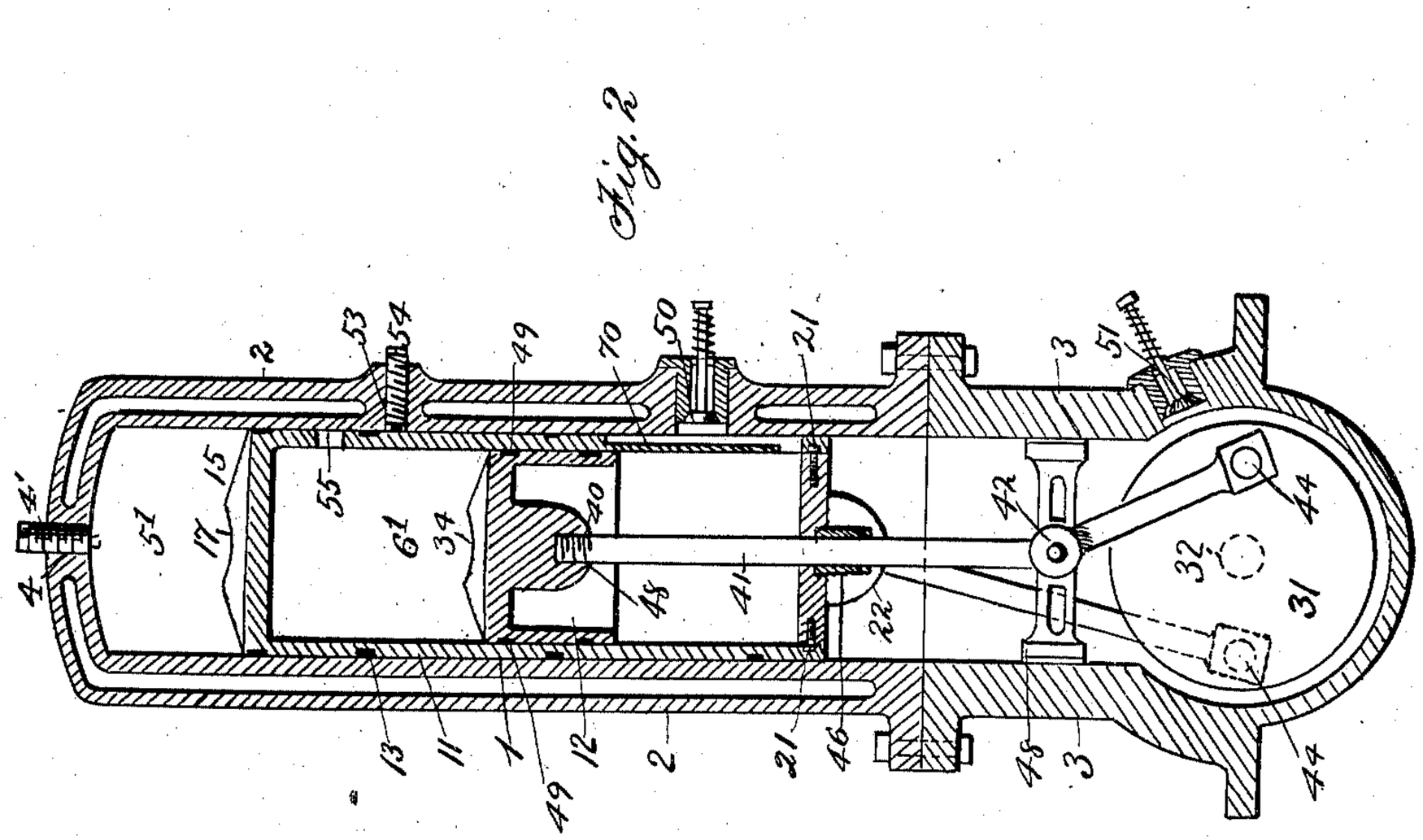
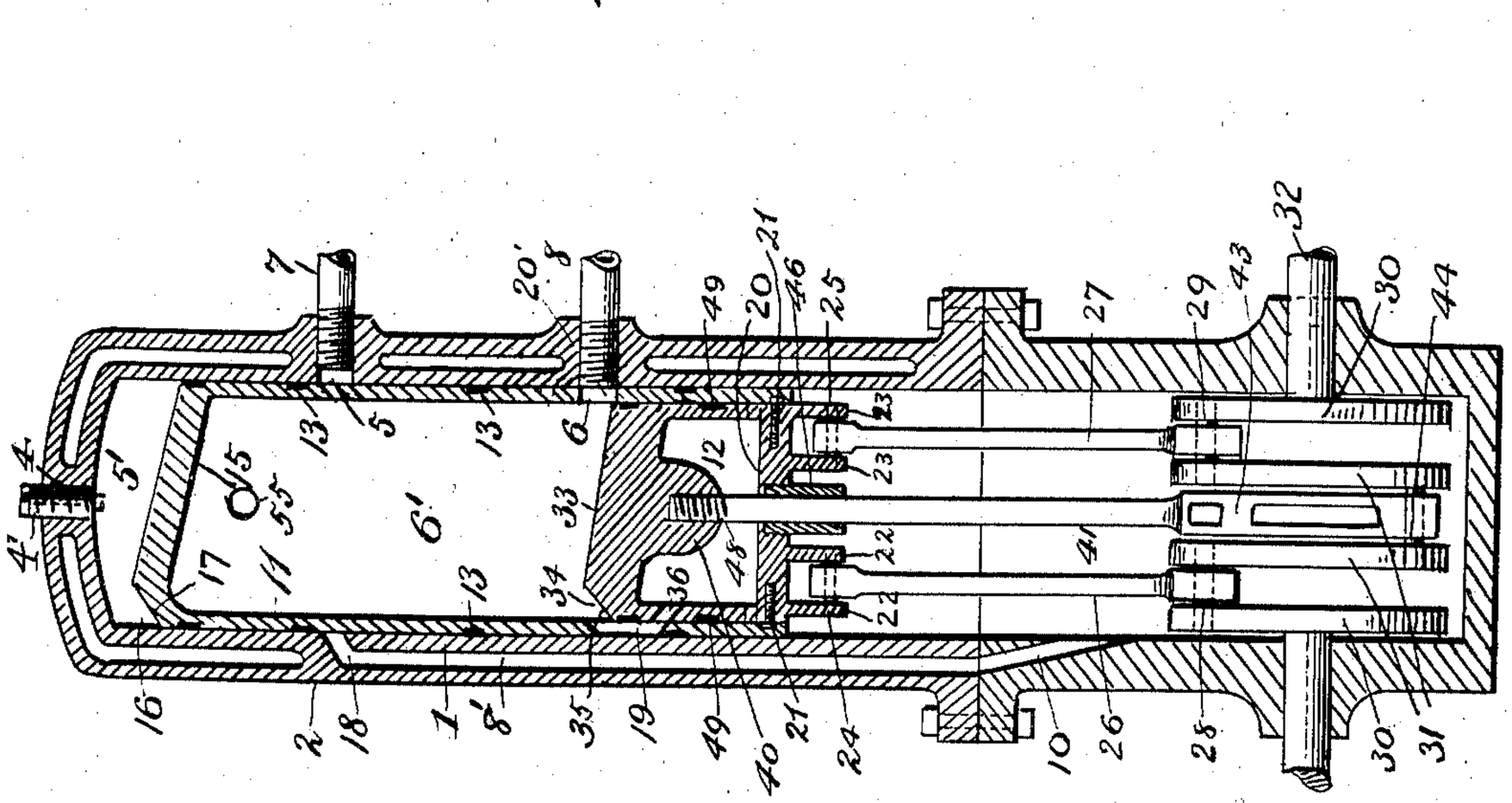


Fig. 1.



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HENRY H. SIMON, OF ATLANTA, GEORGIA.

INTERNAL-COMBUSTION ENGINE.

No. 928,405. Specification of Letters Patent. Patented July 20, 1909.

Application filed July 30, 1908. Serial No. 446,145.

To all whom it may concern:

Be it known that I, HENRY H. SIMON, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines, and the primary object of my invention is to provide an engine of the described character wherein two explosions are obtained at each revolution of the crank shaft.

A further object of my invention is to provide an engine of the described character wherein two coöperating pistons are employed both coupled to one crank shaft, thus reducing the number of parts to a minimum and greatly simplifying the general construction of the engine.

A further object of my invention is to provide an engine of the described character which shall be very compact and powerful and readily accessible and which shall be comparatively inexpensive in its construction.

With the above objects in view the invention consists in the novel construction, arrangement and combination of parts as hereinafter fully described, illustrated in the accompanying drawing and pointed out in the appended claims.

In the drawing: Figure 1 is a vertical sectional view of an engine constructed in accordance with my invention, showing the parts in the position they assume when the upper piston is at the end of its outer or compression stroke and the compressed charge ready to be ignited, the lower piston being at this time at the end of its power stroke. Fig. 2 is a similar view at right angles to Fig. 1 showing the pistons about midway of their respective strokes.

In carrying out my invention I provide a cylinder 1 having preferably cast integral therewith a water jacket 2. To the inner open end of the cylinder is bolted a crank case 3. The upper or outer end of the cylinder is closed and provided with a threaded aperture 4 to receive an igniter plug 4′. The cylinder is provided with exhaust ports 5 and 6 with which communicate exhaust pipes 7 and 8 respectively. The ports 5 and 6 are located at such distance apart as to serve their proper functions during the operation of the engine. The port 5 is for the exhaust of the products of combustion from the explosion chamber 5′ above piston 11 presently described, while the port 6 is for the exhaust of the products of combustion from the explosion chamber 6′ intermediate the piston 11 and the piston 12. The cylinder 1 is also provided in its wall with a port or passage 8′, the upper end of which leads into the interior of the cylinder at a point approximately on a line with the exhaust port 5 but not exactly so for a purpose presently explained. The lower end of the port 8′ communicates with a port 10 in the crank case which port 10 is in communication with the interior of said crank case.

11 and 12 indicate the pistons both fitted for reciprocation within the cylinder 1. The piston 11 is of hollow cylindrical form and of a length considerably greater than the piston 12. The piston 11 seats directly upon the inner wall of the cylinder and is provided with the usual rings 13 of which there may be any desired number. The end or head 15 of the piston 11 is preferably constructed on an incline and is cut away as at 16 to provide a deflecting surface 17 adapted to direct upwardly the charge of mixture flowing through port 8′ and out through the end 18 of said port and thus prevent said incoming charge from flowing directly across the cylinder and passing out through the exhaust port 5. The lower portion of the cylindrical wall of the piston 11 is cut away as at 19 forming a port or passage for the purpose of permitting the charge of mixture to pass from below the piston 12 into the explosion chamber above said piston when the said piston 12 is reaching the limit of its inner or downward stroke and until it has begun its upward or outer stroke. The piston 11 is also provided with a port 20′ adapted to register with exhaust port 6 when about at the end of its instroke. The lower end of the cylindrical portion of the piston 11 is closed by a dividing plate or disk 20 bolted as at 21 thereto, and said disk is provided with integral depending lugs 22, 23 to which are jointed by wrist pins 24, 25 one end of the connecting rods 26, 27, the opposite ends of which are mounted on crank pins 28, 29 carried by the crank disks 30, 31 on the crank shaft 32. The piston 12 is also of hollow cylindrical form and reciprocates upon the inner cylindrical wall of the piston 11 and

the head 33 of piston 12 is constructed upon an incline similarly to the head of the piston 11 and is cut away as at 34 to provide a deflecting surface 35. It is also provided with a port or pasage 36 adapted to communicate with the port 19 when the pistons are in the relative positions seen in Fig. 1, *i. e.* when the piston 11 is at the limit of its outstroke and the piston 12 is at the limit of its instroke.

To a boss 40 on the underside of the head of the piston 12 is suitably connected one end of a rod 41 which at the opposite end is jointed by pin 42 to one end of a rod 43 whose opposite end is pivoted upon crank pin 44 carried by the crank disk's 31. The connections of the pistons with the crank shaft are such that when the piston 11 is at the limit of its upper or outstroke the piston 12 is at the limit of its lower or instroke and vice versa, said pistons during the operation always moving oppositely to each other. I show the boss 40 as having a threaded aperture 48 into which screws the threaded end of rod 41, but any other suitable connection may be provided. The rod 41 passes through a suitable stuffing box 46 carried by the disk 20. The rod 41 is guided in its reciprocations by a cross-head 48 sliding on the inner wall of the crank case, said cross-head carrying the pin 42. The piston 12 is provided with the usual rings 49 of which there may be any desired number.

50 and 51 indicate spring-pressed intake valves for the mixture, said valves operating to admit the mixture by the suction produced by the pistons. The valve 50 is located in the wall of the cylinder and the valve 51 in the wall of the crank case. The valve 50 is adapted to admit the charge to the space below piston 12 whence it flows through alined ports 19 and 36 into chamber 6′, and the valve 51 is adapted to admit the charge into the space below the dividing plate or disk 20 from which latter space it is led through ports 8′ and 10 into the explosion chamber 5′ above piston 11. The cylinder 1 is provided with a threaded aperture 53 into which screws an igniter plug 54. The piston 11 is provided with an aperture 55 which on the instroke of the piston 11 will come opposite the aperture 53, *i. e.* when the piston 12 is just about reaching the end of its upward stroke, whereby the spark from plug 54 will ignite the compressed charge between the two pistons.

I will now describe the operation of my improved engine: Supposing the parts to be in the positions seen in Fig. 1 with the charge of mixture compressed above the piston 11 within the space 5′, and the piston 11 just about reaching the end of its compression stroke, the piston 12 at this time just about reaching the limit of its instroke, and the charge being admitted through ports 19, 36 into the chamber 6′ intermediate the two pistons. The charge in the space 5′ being now ignited the piston 11 will be driven inwardly and at the same time the piston 12 moving upwardly or toward the piston 11 to compress the charge in chamber 6′. As soon as piston 11 clears the exhaust port 5 the exhaust will flow therethrough and as soon as the upper end 18 of port 8′ is uncovered the mixture drawn in by the outstroke of piston 11 will flow through ports 10 and 8′ into the space 5′ above piston 11, said incoming charge serving to drive out through the exhaust port 5 practically all of the exhaust gases that might otherwise remain within the chamber 5′. When the piston 11 has about reached the limit of its instroke and the piston 12 about the limit of its outstroke the aperture 55 will be in alinement with aperture 53 and the spark then occurring the compressed charge in space 6′ will be ignited and the explosion drives the pistons apart, and the operation is then again repeated as before. It will be observed that upon each outstroke of piston 11 mixture will be drawn in through inlet valve 51 and will fill the space below the disk 20, while upon the down stroke of piston 11 the mixture previously drawn in will be compressed and caused to flow through ports 10 and 8′ and into space 5′ as soon as the upper end of port 8′ is uncovered by the piston 11 in its downstroke. It will also be observed that upon each outstroke of piston 12 mixture will be drawn in through valve 50 and fill the space below piston 12 and when the latter moves inwardly it compresses the mixture and the same will flow into space 6′ as soon as ports 19 and 36 are in alinement. The deflecting surface on piston 12 causes the incoming charge to be directed upwardly and prevents it flowing across to the exhaust port 6 and it will be noted that the inflowing charges for both explosion chambers serve to drive out practically all exhaust gases that might still remain in said chambers.

The piston 11 is grooved as at 70 to provide a passage for the mixture admitted through valve 50 and permitting said mixture to flow into the space below the piston 12. By the hereinbefore described construction I am enabled to obtain two explosions for each complete revolution of the crank shaft and the engine is extremely compact, simple and inexpensive in its construction and not liable to get out of order.

It will be understood that instead of employing crank disks 30 and 31, I could employ the usual form of cranks.

The exhaust port 5 is so located relatively to the end 18 of port 8′ that said exhaust port will begin to be uncovered by the piston 11 on its instroke slightly before the end 18 begins to be uncovered, whereby the greater

part of the exhaust will have passed out through port 5 before the incoming mixture flowing through port 8′ will have entered the chamber 5′. Similarly the exhaust port 6 is so located relatively to port 19 that said exhaust port will begin to be uncovered by piston 12 on its instroke slightly before the port 19 begins to be uncovered by said piston 12.

It will be observed that the ports 8′ and 10 really constitute a single port or passage affording communication between the interior of the cylinder and the interior of the crank case and while I preferably provide the crank case with the port 10 yet it will be understood that the lower end of the passage 8′ could be readily made to communicate with the interior of the crank case without requiring the provision of the port 10.

While I have not shown or described any means for lubricating the engine, since such matters do not form any part of my present invention, it will be understood that any suitable lubricating means could be employed.

My present improvements while shown as applied to an engine of the water-cooled type, are equally as well adapted for use with air-cooled engines.

What I claim and desire to secure by Letters Patent is:

1. In an internal combustion engine, the combination with a cylinder and a crank case, said cylinder being provided with two exhaust ports arranged as described, and a longitudinal port 8′ communicating at its end 18 with the interior of the cylinder, and the crank case being provided with a port 10 communicating at one end with the port 8′ and at the opposite end with the interior of the crank case, of a piston arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder and adapted to uncover one of the exhaust ports when such piston is at the limit of its instroke and at the same time uncover the end 18 of the port 8′, said piston being also provided with a port 20′ adapted to register with the other exhaust port when such piston is about at the end of its outstroke and said piston also having a port 19 arranged as described, a second piston reciprocating within the first piston and forming an explosion chamber between them and being provided with a port 36 adapted to register with the port 19 and said second piston at the same time being adapted to uncover the port 20′ in the manner set forth, a disk closing the inner end of the first piston, inlet valves for the mixture arranged as described, a crank-shaft, connections between said shaft and said pistons whereby to cause the latter to move oppositely to each other, and igniter plugs arranged to ignite the mixture in the explosion chambers, all arranged and combined for coöperation substantially in the manner and for the purpose specified.

2. In an internal combustion engine, the combination with a cylinder and a crank case, said cylinder being provided with two exhaust ports arranged as described, and a longitudinal port 8′ communicating at its end 18 with the interior of the cylinder, and the crank case being provided with a port 10 communicating at one end with the port 8′ and at the opposite end with the interior of the crank case, of a piston arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder and adapted to uncover one of the exhaust ports when such piston is at the limit of its instroke and at the same time uncover the end 18 of the port 8′, said piston being also provided with a port 20′ adapted to register with the other exhaust port when such piston is about at the end of its outstroke and said piston also having a port 19 arranged as described, a second piston reciprocating within the first piston and forming an explosion chamber between them and being provided with a port 36 adapted to register with the port 19 and said second piston at the same time being adapted to uncover the port 20′ in the manner set forth, a disk closing the inner end of the first piston, inlet valves for the mixture arranged as described, a crank-shaft, crank-disks carried by the crank-shaft, rods having jointed connection at their ends with the crank disks and the said closure disk, a rod 41 secured at one end to the second piston, and a rod jointed at one end to the rod 41 and at the other end to two of the crank disks, all arranged and combined for coöperation substantially in the manner and for the purpose specified.

3. In an internal combustion engine, the combination with a cylinder and a crank case, said cylinder being provided with two exhaust ports arranged as described, and also being provided with an aperture 53 and with a longitudinal port 8′ communicating at its end 18 with the interior of the cylinder, and the crank case being provided with a port 10 communicating at one end with the port 8′ and at the opposite end with the interior of the crank case, of a piston arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder and adapted to uncover one of the exhaust ports when such piston is at the limit of its instroke and at the same time uncover the end 18 of the port 8′, said piston being also provided with a port 20′ adapted to register with the other exhaust port when such piston is about at the end of its outstroke, and said piston also having a port 19 arranged as described, and an aperture 55 adapted to register with the aper-

ture 53 in the cylinder as described, a second piston reciprocating within the first piston and forming an explosion chamber between them and being provided with a port 36 adapted to register with said port 19 and said second piston at the same time being adapted to uncover port 20′ in the manner set forth, a disk closing the inner end of the first piston, inlet valves for the mixture arranged as described, a crank-shaft, connections between said shaft and said pistons whereby to cause the latter to move oppositely to each other, and igniter plugs, one located in the aperture 53 arranged to ignite the mixture in the explosion chambers, all arranged and combined for coöperation substantially in the manner and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY H. SIMON.

Witnesses:

ALVINE W. LYON,

WM. E. BOULTER.