H. H. SIMON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 22, 1909.

946,158.

Patented Jan. 11, 1910.

2 SHEETS—SHEET 1.

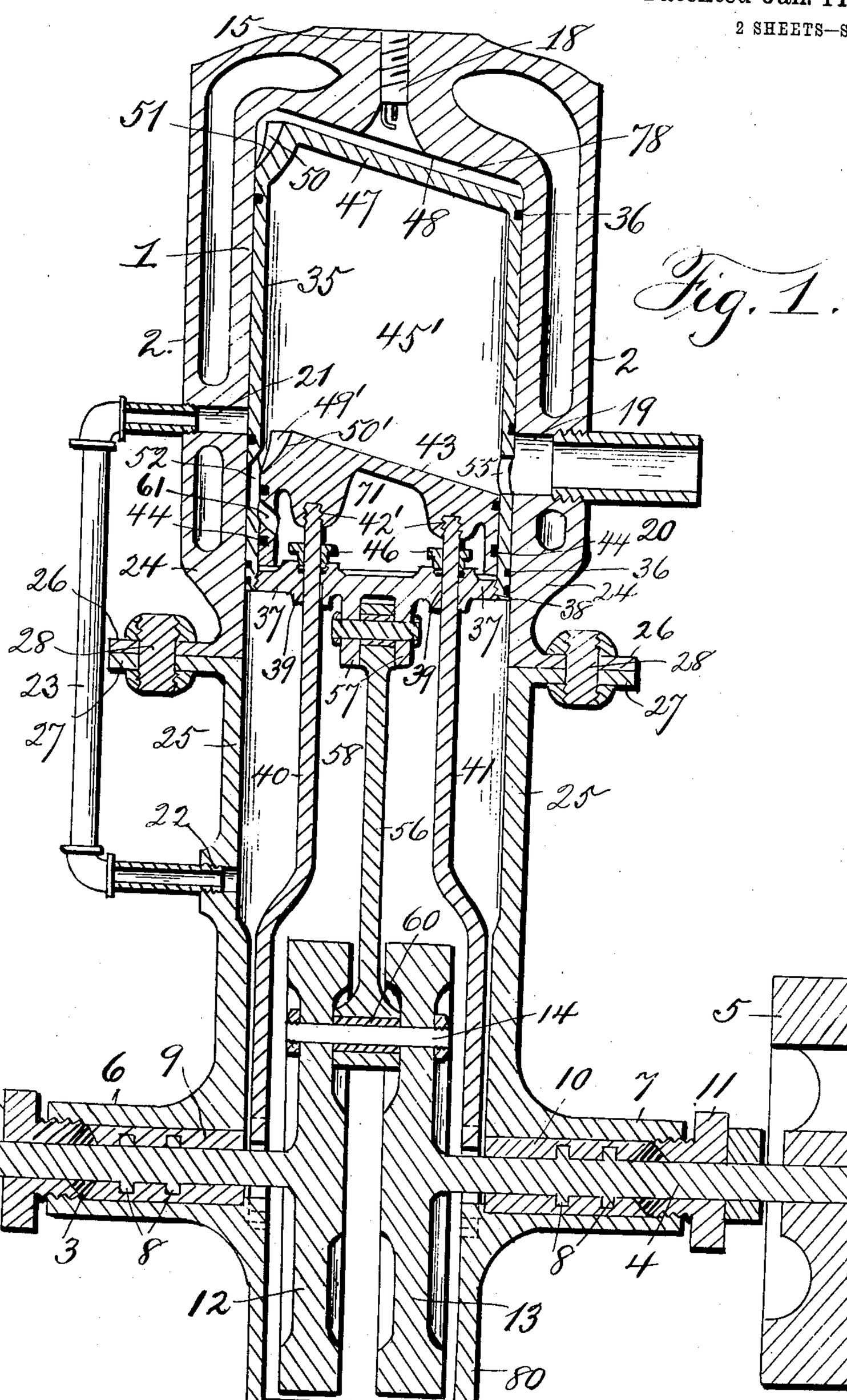

Fig. 1.

Witnesses

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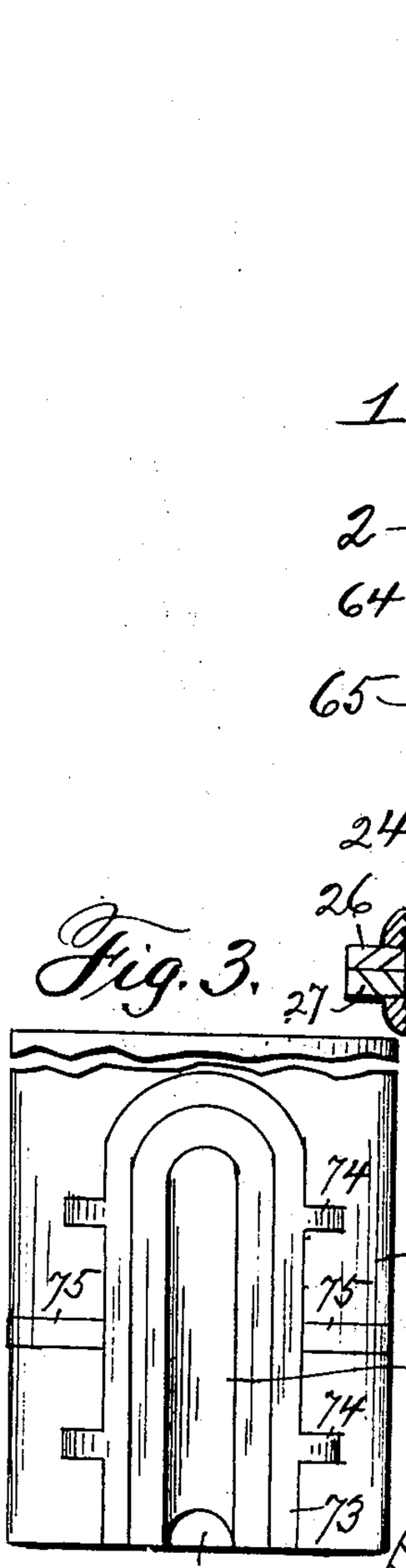

Fig. 3.

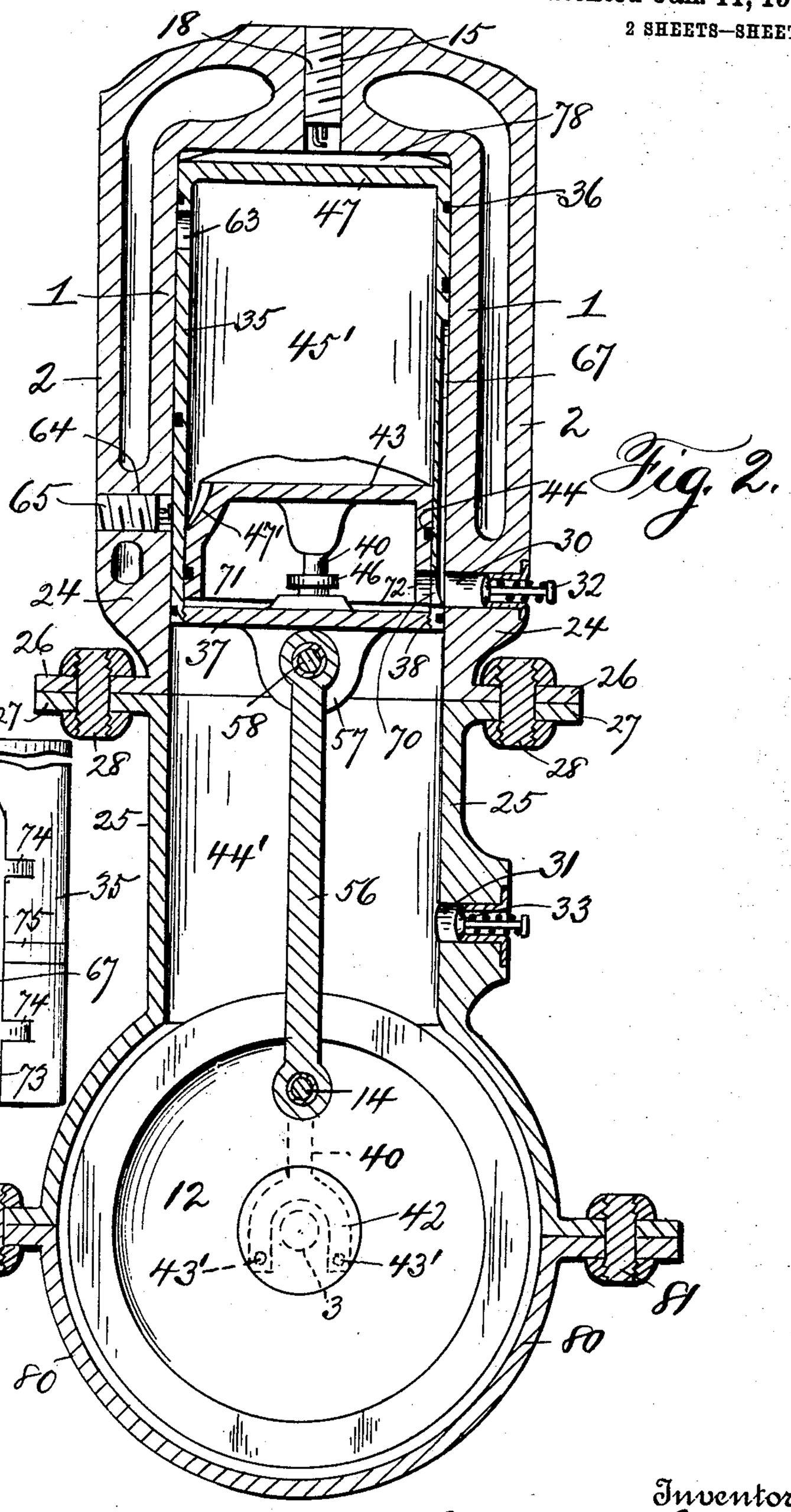

Fig. 2.

Witnesses

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UNITED STATES PATENT OFFICE.

HENRY H. SIMON, OF ATLANTA, GEORGIA.

INTERNAL-COMBUSTION ENGINE.

946,158. Specification of Letters Patent. Patented Jan. 11, 1910.

Application filed March 22, 1909. Serial No. 485,071.

To all whom it may concern:

Be it known that I, HENRY H. SIMON, 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 among the objects in view is to provide an engine of the described character which will be extremely simple and compact in construction, inexpensive to manufacture, and wherein two power explosions are obtained in each cylinder employed at each revolution of the crank shaft.

Other objects and advantages of the invention will appear from the following description when taken in connection with the accompanying drawings.

The invention consists in the novel construction, arrangement and combination of parts as hereinafter fully described, illustrated in the drawings and pointed out in the appended claims.

In the drawings:—Figure 1 is a vertical sectional view of my improved engine, showing the movable piston at about the limit of its outward or upward stroke and the compressed charge about to be exploded, Fig. 2 is a central vertical sectional view of Fig. 1. Fig. 3 is an elevation of the piston, partly broken away.

While I have shown in the drawings and will hereinafter describe a single cylinder engine yet it will be understood that I may employ any number of cylinders combined with a common crank shaft for imparting power thereto. It will also be understood that I may construct the engine of any desired power capacity. Furthermore while I have shown my invention applied to a water-cooled engine it is equally well adapted for application to air-cooled engines.

1 indicates the cylinder of my engine having an integral water jacket 2.

The crank shaft is preferably constructed in two sections 3, 4, and upon one section as 4 a fly wheel 5 is mounted.

For the purpose of properly mounting the crank shaft sections and maintaining a tight bearing to prevent escape of any of the compressed charge from within the cylinder or the blowing through of any of the charge immediately after ignition, I provide the cylinder with lateral tubular extensions 6, 7, through which the sections of the crank-shaft extend and said sections each having integral flanges or collars 8, of which there may be any desired number.

The sections 3, 4, revolve in bearing metal 9, 10 of any usual or preferred character, said metal being driven or otherwise inserted and firmly seated in the extensions around the sections 3, 4.

Suitable stuffing boxes 11 are provided, through which the crank-shaft sections extend and by means of which boxes a preferably tight joint around the shaft sections may be maintained.

12, 13 are crank disks which may be integral with or suitably secured to the inner adjacent ends of the crank-shaft sections and said disks are coupled together by means of a pin 14. I preferably use crank disks as by their use I am enabled to more or less fill up the interior space in the lower end of the cylinder, as is usual in this class of engines, but it will be understood that I could use the ordinary form of crank if desired.

The cylinder is provided in its upper end or head with a threaded aperture 15 for the reception of any ordinary spark plug 18. The cylinder is further provided in its cylindrical wall at a predetermined point with an exhaust port 19 with which communicates an exhaust pipe 20. The cylinder is further provided with ports 21, 22, in constant communication with each other by any suitable means, as for instance a pipe 23. Said ports 21, 22 and pipe 23 therefcre constitute a duct or passage for a purpose presently apparent.

I preferably construct the cylinder in two sections as 24, 25, the lower section 25 constituting a crank case or chamber. The two sections 24, 25 are flanged as at 26, 27, and bolted together as at 28. The crank case has a section 80 detachably secured to section 25 as by bolts 81.

30, 31, are intake ports for the charges of explosive mixture, spring-controlled intake valves 32, 33, being arranged within said ports to control the admission of the charges.

35 indicates a piston of hollow cylindrical form arranged for reciprocating within the cylinder, and is provided with any desired

number of spring rings as 36 adapted to maintain close contact with the inner wall of the cylinder. The lower end of the piston is closed by means of an end head or plate 37 having detachable connection with the piston, as by screw threads 38. The plate 37 is provided with two apertures 39 through which loosely pass rods 40, 41. The latter are forked at their lower ends as at 42 and said forked ends loosely embrace the crank-shaft sections and are suitably secured, as for instance by bolts 43′.

The upper ends of the rods 40, 41 have suitable connection, as by screw-threads 42′, with a stationary abutment 43 arranged within the lower or inner end of the piston and provided with spring rings 44 maintaining close contact with the inner wall of the piston. Suitable stuffing boxes 46 are employed to maintain a sufficiently tight joint where the rods 40, 41, pass through the plate 37.

The outer end or head 47 of the piston 35 is on an incline, while the outer end of the cylinder is also constructed to provide the inclined face 48. The piston is cut away as at 50 to provide a deflecting surface 51 for directing upwardly the charge of mixture flowing through port 21 and prevent said incoming charge from flowing directly across the cylinder and passing out through the exhaust port 19.

The lower portion of the cylindrical wall of the piston is cut away to form a passage 52 to permit the charge of mixture to pass from below the abutment 43 into the compression chamber 45′ above said abutment when the piston is about reaching the limit of its outward stroke and until it has begun its inward stroke, as seen in Fig. 1. The wall of the piston adjacent its inner or lower end is provided with a port 55 adapted to register with exhaust port 19 when the piston is about at the end of its outstroke.

The plate 37 has pivotal connection with one end of the connecting rod 56, as by providing depending lugs 57 on the plate and passing therethrough wrist pin 58 which latter also passes through the end of the rod 56, a suitable bushing 59 being provided around the wrist pin, as usual. The opposite end of the connecting rod is pivotally mounted on the crank pin 14, a suitable bushing 60 surrounding the pin to receive the wear.

The abutment 43 is adapted to coöperate with the piston in the manner presently explained and is cut away at one side as at 47′ to enable the spark from spark plug 65 to reach the charge in chamber 45′ when the piston is at the end of its instroke.

The abutment is provided below the point where it is cut away, as at 49′, with a port 61 adapted to register with the port 52 when the piston is about at the limit of its outstroke. The deflecting surface 50′ serves to direct upwardly the charge while being admitted through the ports 61 and 52.

The piston is provided adjacent its outer or upper end with an aperture 63 which on the instroke of the piston will come opposite the threaded aperture 64 in the cylinder wall, in which aperture a spark plug 65 is located, whereby the spark from said plug will ignite the compressed charge within the chamber 45′. The piston is provided in its cylindrical wall with a longitudinal groove 67. This groove should be of such length that it will always be in communication with the intake port 30 during the entire stroke of the piston, and the piston adjacent its lower end is provided with a port 70 which is at all times in communication with the space 71 below the abutment, the latter being provided with a port 72 to insure such communication when the piston is at the limit of its outer or upstroke, as seen in Fig. 2, the port 72 at such time registering with the port 70. Within a suitable groove in the outer face of the piston and surrounding the groove 67 is a U-shaped spring band 73 having short lateral tongues 74, adapted to maintain close contact with the inner wall of the cylinder and a spring ring 75 is also provided, the ends of which abut against the band 73, the whole being for the purpose of preventing escape of compressed mixture around between the piston and the cylinder.

The abutment is preferably so constructed that its upper face will be on an incline as shown.

I will now describe the operation of my improved engine:—Supposing the parts to be in the positions seen in Fig. 1 with a charge of mixture compressed above the piston within the space 78 and the piston just about reaching the end of its outer or compression stroke, and a charge of mixture being admitted through ports 52 and 61 into the space 45′ between the piston and the abutment. The charge in the space 78 being now ignited by spark from plug 18 the piston will be driven inwardly or toward the abutment to compress the charge in chamber 45′. As soon as the piston clears the exhaust port 19 the exhaust will flow therethrough and as soon as the port 21 is uncovered by the piston the mixture drawn in by the previous outstroke of the piston through intake valve 33 into the space 44′ below the head 37 of the piston will flow through port 22, pipe 23 and port 21 into the chamber 78 above the piston, said incoming charge serving to drive out through the exhaust port practically all of the exhaust gases that might otherwise remain within the chamber 78. When the piston has about reached the limit of its instroke

the aperture 63 will register with aperture 64 in which is located the spark plug 65 and a spark then occurring the compressed charge in chamber 45′ will be ignited and the explosion drives the piston outwardly. The outstroke of the piston will draw in a charge of mixture through intake valve 33 into the space 44′ while the instroke of the piston will compress the charge in space 44′ and cause it to flow through port 22 pipe 23 and port 21 as soon as port 21 is uncovered by the piston on its downstroke.

It will be observed that upon each instroke of the piston mixture will be drawn through intake valve 32 and through the groove 67 and ports 70 and 72 into the space 71 below the abutment where it will be compressed between plate or head 37 and the abutment when the piston again moves outwardly, and the compressed mixture will flow into space 45′ when the ports 52, 61 come into register.

It will be noted that the inflowing charges for both explosion chambers 45′, 78, serve to drive out practically all exhaust gases that might still remain in said chambers.

While I have shown and described a pipe, as 23, as providing a connection between the ports 21, 22, it will be understood that I do not restrict myself to the employment of a pipe but could provide a longitudinal port in the wall of the cylinder communicating with the ports 21, 22 and obtain the same results, as will be readily understood.

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

It will be observed that while I employ but one moving piston I obtain two explosions at each revolution of the crank shaft making my engine exceedingly powerful, besides being very compact and simple in its construction.

What I claim is:—

1. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage, and said piston being provided with a port adapted to register with the exhaust port when at the limit of its outstroke, and also provided with a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston, and also forming a chamber between said abutment and the inner end of the piston, and said abutment being provided with a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, igniter plugs arranged and adapted to ignite the charges of compressed mixture in the explosion chambers, and means for reciprocating the piston.

2. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage, and said piston being cut away to provide a deflecting surface 51, and having a port adapted to register with the exhaust port when at the limit of its outstroke, and also provided with a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston and also forming a chamber between said abutment and the inner end of the piston, and said abutment being provided with a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, igniter plugs arranged and adapted to ignite the compressed charges of mixture in the explosion chambers, and means for reciprocating the piston.

3. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage and said piston being provided with a port adapted to register with

the exhaust port when at the limit of its outstroke, and also provided with a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston and also forming a chamber between said abutment and the inner end of the piston, said abutment having a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, and being cut away to provide a deflecting surface as described, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, igniter plugs arranged and adapted to ignite the charges of compressed mixture in the explosion chambers, and means for reciprocating the piston.

4. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends, and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage, and having a port adapted to register with the exhaust port when at the limit of its outstroke, and also having a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston and also forming a chamber between said abutment and the inner end of the piston, said abutment having a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, rods connected with said abutment and passing through the inner end of the piston and serving to hold said abutment stationary, igniter plugs arranged and adapted to ignite the charges of compressed mixture in the explosion chambers, and means for reciprocating the piston.

5. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends, and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage, and having a port adapted to register with the exhaust port when at the limit of its outstroke, and also having a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston and also forming a chamber between said abutment and the inner end of the piston, and said abutment having a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, rods detachably connected with said abutment and passing through the inner end of the piston and serving to hold said abutment stationary, igniter plugs arranged and adapted to ignite the charges of compressed mixture in the explosion chambers, and means for reciprocating the piston.

6. In an internal combustion engine the combination with a cylinder provided with an exhaust port, two valved mixture intake ports, and a duct or passage communicating at its ends with the interior of the cylinder at different points longitudinally of the latter, of a hollow piston closed at both ends, and arranged within the cylinder and forming an explosion chamber between it and the outer end of the cylinder, said piston being adapted to uncover the exhaust port when at the limit of its instroke and at the same time uncover the upper end of the said duct or passage, and having a port adapted to register with the exhaust port when at the limit of its outstroke, and also having a port 52, a stationary abutment arranged within the piston and forming an explosion chamber between it and the outer end of the piston and also forming a chamber between said abutment and the inner end of the piston, and said abutment having a port adapted to register with the port 52 in the piston when the latter is about at the limit of its outstroke, the said piston being provided with a duct which communicates with one of the intake ports and the chamber between the abutment and the inner end of the piston, rods connected with said abutment and passing through the inner end of the piston and serving to hold said abutment stationary, stuffing boxes arranged to maintain a tight joint at the points where the said rods pass through the inner end of the piston, igniter plugs arranged and adapted to ignite the charges of compressed mixture in the explosion chambers, and means for reciprocating the piston.

7. In an internal combustion engine, the combination of a cylinder, a single reciprocating piston therein, and a fixed abutment

arranged within the piston, said cylinder being provided with a single exhaust port and with two intake ports, and the spaces above the piston and between the latter and the abutment constituting explosion chambers, all constructed and arranged for coöperation as described.

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

HENRY H. SIMON.

Witnesses:
WM. E. BOULTER,
MARY W. DARG.