M. ST. CLAIR.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED SEPT. 23, 1912.

1,145,814.

Patented July 6, 1915.

4 SHEETS—SHEET 1.

Fig. 1.

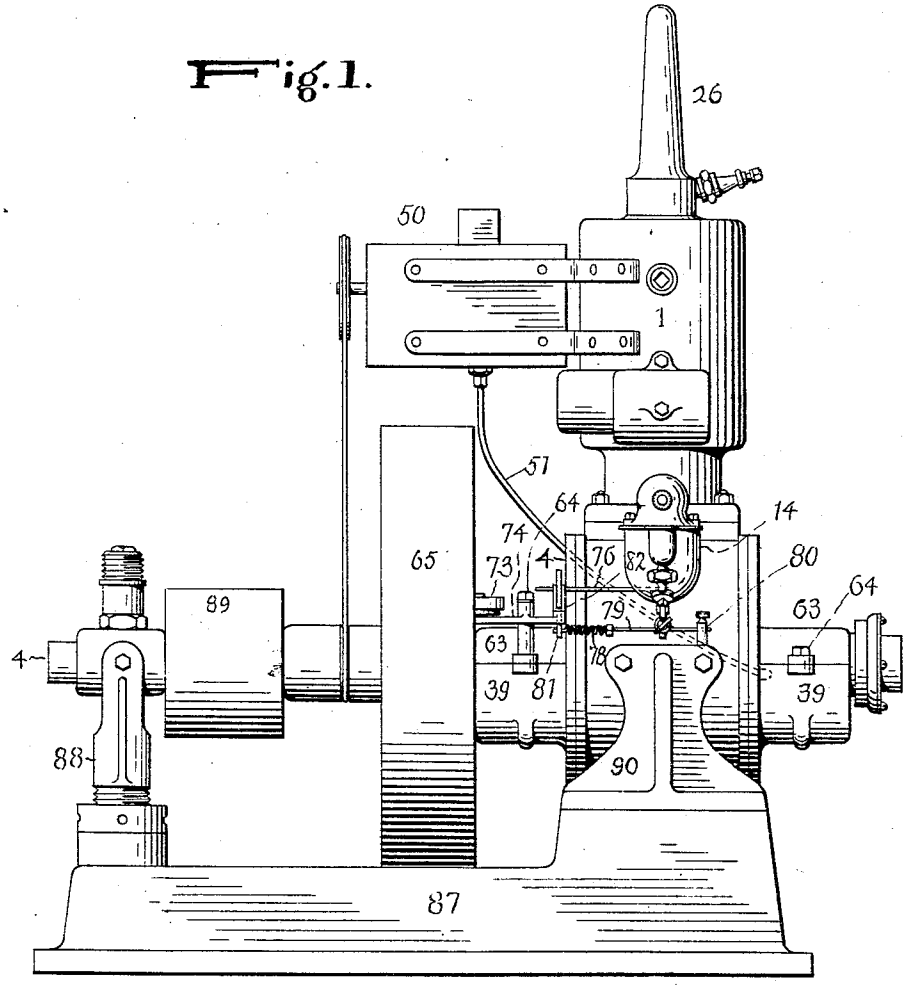
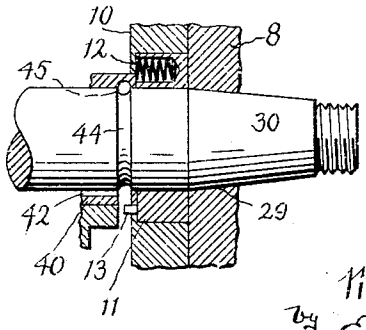


Fig. 4.



Witnesses

Stuart Hilder

Frances W. Anderson.

Inventor

Moffat St. Clair.

by E. W. Anderson & Son

his Attorneys

M. ST. CLAIR.

INTERNAL COMBUSTION ENGINE.

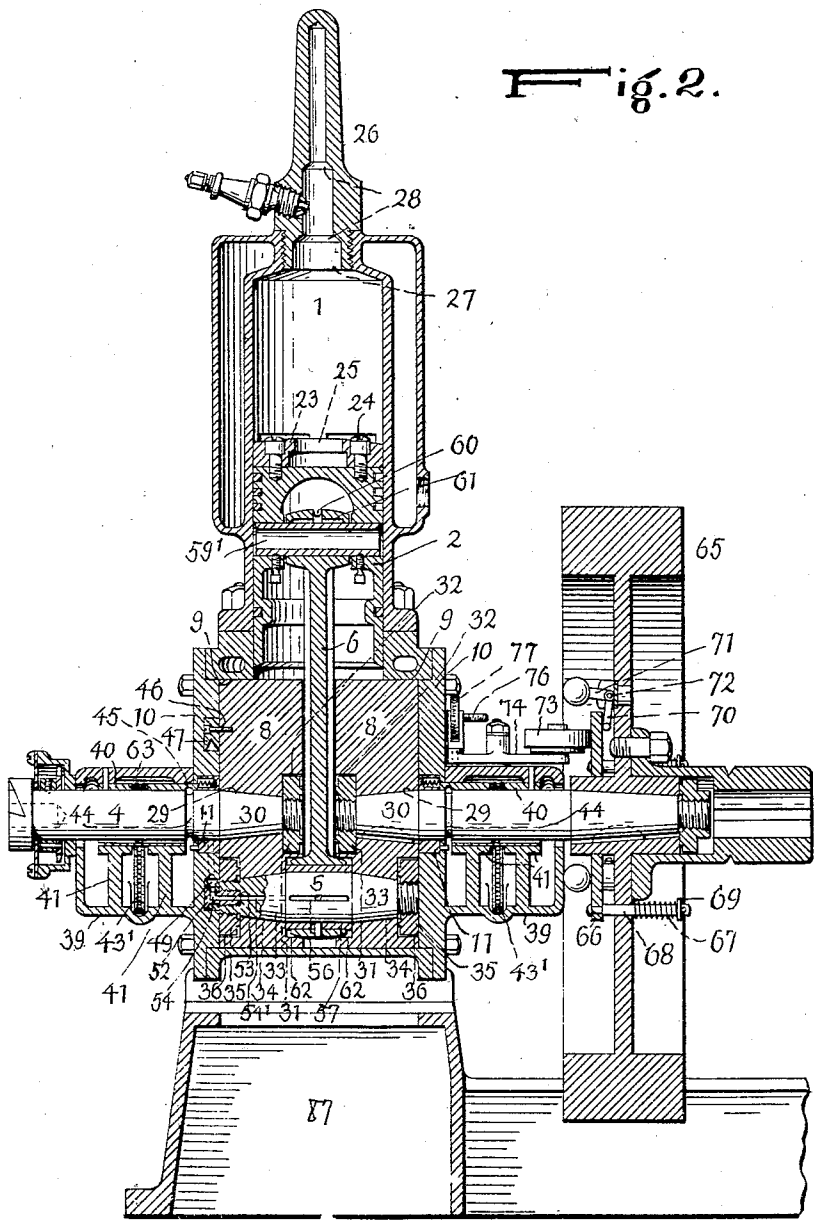
APPLICATION FILED SEPT. 23, 1912.

1,145,814.

Patented July 6, 1915.

4 SHEETS—SHEET 2.

Fig. 2.



Witnesses

Stuart Hilder.

Frances M. Anderson

Inventor

Moffat St. Clair,

by E. W. Anderson & Son

his Attorneys

M. ST. CLAIR.

INTERNAL COMBUSTION ENGINE.

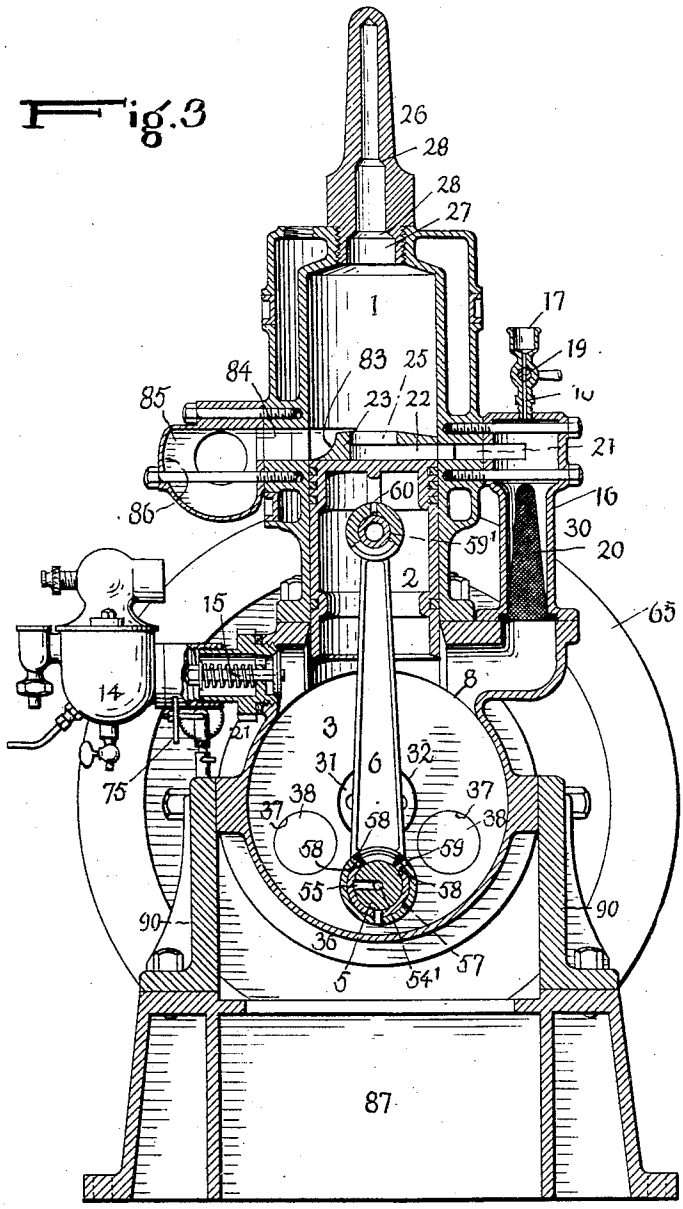
APPLICATION FILED SEPT. 23, 1912.

1,145,814.

Patented July 6, 1915.

4 SHEETS—SHEET 3.

Fig. 3



Witnesses

Stuart Hilder.

Frances M. Anderson

Inventor

Moffat St. Clair,

by E. W. Anderson & Son

his Attorneys

M. ST. CLAIR.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED SEPT. 23, 1912.

1,145,814.

Patented July 6, 1915.

4 SHEETS—SHEET 4.

Fig. 10.

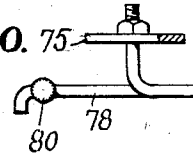


Fig. 11.

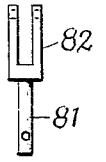


Fig. 12.

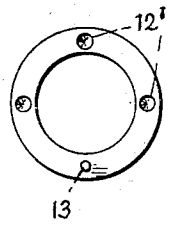


Fig. 5.

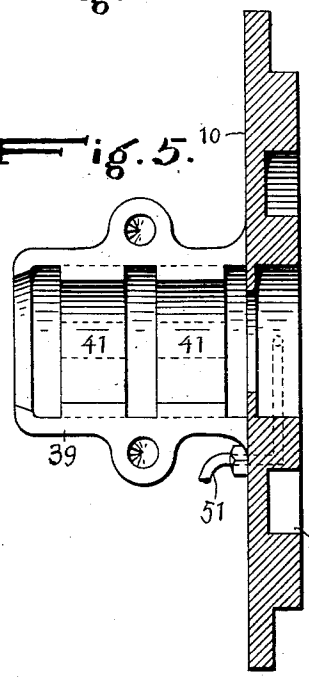


Fig. 7.

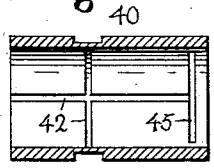


Fig. 8.

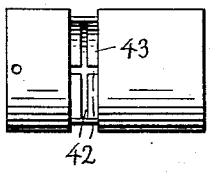




Fig. 6.

Fig. 9.

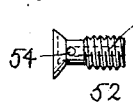


Fig. 13.

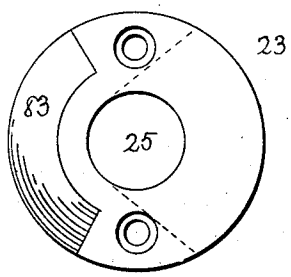
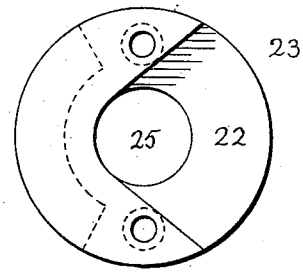


Fig. 14.



Witnesses

Stuart Hilder.

Frances M. Anderson.

Inventor

Moffat St. Clair,

by E. W. Anderson & Son

his Attorneys

UNITED STATES PATENT OFFICE.

MOFFAT ST. CLAIR, OF GALT, ONTARIO, CANADA.

INTERNAL-COMBUSTION ENGINE.

1,145,814. Specification of Letters Patent. Patented July 6, 1915.

Application filed September 23, 1912. Serial No. 721,782.

To all whom it may concern:

Be it known that I, MOFFAT ST. CLAIR, a citizen of the Dominion of Canada, resident of Galt, in the Province of Ontario, Dominion of Canada, have made a certain new and useful Invention in Internal-Combustion Engines; and I declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it appertains to make and use the invention, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Figure 1 is a side view of the invention. Fig. 2 is a central longitudinal section of the same. Fig. 3 is a transverse section of the same taken centrally through the cylinder. Fig. 4 is a detail sectional view of one of the rings seated in perforations of the crank shaft heads. Fig. 5 is a detail sectional view of one of the crank chamber heads, showing the oil chamber in plan view. Fig. 6 is a detail sectional view of the annulus seated in a groove of one of the crank chamber heads. Fig. 7 is a detail sectional view of one of the bushings of the crank shaft. Fig. 8 is a detail plan view of this bushing. Fig. 9 is a detail side view of the screw connecting said annulus with the wrist pin. Fig. 10 is a detail plan view of the lever for regulation of the throttle of the carbureter, and of the parts in immediate connection therewith. Fig. 11 is a detail side view of the fork in which is seated the adjusting nut of the rod through which the throttle lever has connection with the throttle. Fig. 12 is a detail face view of the compression ring. Fig. 13 is a detail top plan view of the gas receiver and exhaust deflector. Fig. 14 is a detail bottom plan view of the same.

The invention has relation to internal combustion engines, having for its object to provide an improved two-cycle motor of increased efficiency and durability.

Other objects and advantages will hereinafter appear.

In the accompanying drawings illustrating the invention, the numeral 1, designates the cylinder; 2, the piston in said cylinder; 3, the crank chamber; 4 the crank shaft; 5, the wrist pin, and 6, the connecting rod between the wrist pin and the piston.

The crank shaft is divided by the crank chamber, and the opposing ends of said shaft are provided with cylindrical heads 8, 8, working in the crank chamber and spaced apart by an interval, preferably about equal to the width of the connecting rod. These heads rotate in close bearings 9, 9, of the crank chamber, and serve to reduce the size of the crank chamber and the space wherein the gas charge may be compressed to increase such compression; to prevent escape of the gas charge from the crank chamber; and further to assist in the compression of the charge through their momentum in rotating.

The shell of the crank chamber is closed at the ends by heads 10, 10, perforated for passage of the crank shaft, and seated in the perforations are rings 11, 11, which are bored out somewhat larger than the shaft. Each compression ring is pressed inward against the head or disk 8 by coil springs 12, having engagement with recesses 12′ of said ring, a pin 13 being provided to hold each ring stationary. In this way an effectual seal is provided against the entrance of oil from the lubricating means hereinafter described, to the crank chamber.

The explosive mixture of air and gas is admitted to the crank chamber from the carbureter at 14, past an inlet valve 15, and passes from said chamber to the cylinder through a pipe 16, with the upper end of which a priming cup 17 has connection by a small passage 18, controlled by a valve 19. A perforated cone screen 20 is also located in this pipe 16, below the priming cup, gasolene from the priming cup falling upon and running down over this screen.

The gaseous mixture is drawn into the cylinder through a lateral opening 21, in the cylinder wall, said opening communicating with a radial passage 22, of a gas receiver and exhaust deflector 23 at the upper or outer end of the piston, to which it is secured in any suitable manner, preferably by screws 24. The radial passage communicates with a central opening 25, of the part 23, leading to the cylinder chamber.

26 is an ignition or combustion tube, closed at the sides and at its outer end, and open at its inner end at 27, which is in communication with the cylinder. The bore of this tube is considerably less in diameter than that of the cylinder and decreases in diameter

toward its outer end, preferably in an abrupt manner at intervals, whereby shoulders 28, are provided.

The crank shaft heads or disks 8, are preferably formed of solid metal and with tapered central perforations 29, which engage the opposing tapered ends 30, of the crank shaft, nuts 31, engaging the threaded terminations of these opposing shaft ends and being located in recesses 32 of said disks. The heads or disks 8, form the means of connection between the shaft and the connecting rod, the wrist pin 5, being also formed with tapered ends 33, which engage tapered seats 34, eccentric of said disks, nuts 35, engaging threaded ends of said wrist pin and being located in recesses 36, of the disks, which are bored out at 37 to counterbalance the connecting rod and piston, wooden plugs 38 being located in the bored recesses to fill the same.

Means are provided for lubricating my engine as follows: The alined sections of the crank shaft have supporting bearings in lateral extensions 39, preferably forming part of the crank chamber heads, and being adapted for the reception of the oil or lubricant. Bushings 40, surround the shaft and rest upon intermediate supports 41 of said receptacles or extensions to take the wear, said bushings having internal oil conducting grooves 42. The bushings are slotted at their upper central portions at 43, and an oil conducting chain rests loosely upon the crank shaft in the slot of each bushing, said chain, numbered 43′, depending in the oil chambers, and serving to bring the oil to the top of the shaft, from whence it finds its way into the bushing grooves. In order to stop the passage of the lubricant lengthwise of the shaft and to cause it to return to the receptacle, an annular groove 44 is formed in the shaft at the inner side of each said receptacle, said groove being located adjacent to the end of the bushing, which is provided with an internal groove 45 in register with the shaft groove and open at the bottom to allow the oil to drop back into the receptacle. One of the crank disks or heads 8 has secured thereto at 46 an annulus 47, located in a groove 48 of the crank chamber head, said annulus having an internal annular oil conducting groove 49, to which oil is supplied from the mechanical oiler 50 by a pipe 51. The oil from this groove finds its way into a central passage of the screw 52, carried by the annulus, and having threaded engagement with an end of the wrist pin 5, said screw bridging the joint between the disk 8 and the wrist pin, and the passage 53 of the screw having a branch 54 leading inward to the groove 49. The central passage of the screw registers with a central oil conducting passage 54′ of the wrist pin, a radial passage 55 communicating with the inner end of the passage 54′, and conducting the oil to the exterior groove 56 of said pin. The connecting rod 6, is provided at its lower end with a bushing 57, surrounding the wrist pin to take the wear, this bushing having radiating oil conducting grooves 58 in register with similar grooves 59 of the rod end proper, to allow the oil to escape outward into the crank chamber between the two crank disks, wherein it will in the rapid movement of the parts be carried or splashed around and upward to effectually lubricate the parts. The upper end of the connecting rod engages a bushing 59′ of the piston, said upper end having a radial groove 60 in communication with the internal cavity or recess in the lower end of the piston, said radial groove leading to a longitudinal groove 61 internal of said upper piston end, to lubricate the bearing at this point. The outer or lower end of the connecting rod extends laterally into engagement with inner lateral recesses 62 of the crank disks, so that if the bushing should become worn the connecting rod cannot come in contact with the wrist pin with consequent injury, nor can it become loose and drop down. The oil chambers 39, are provided with removable tops 63, bolted thereto at 64.

In order to vary the feed of gas to the carbureter in accordance with the speed at which the engine is run, the following means are provided: The fly wheel 65 is provided with an annulus 66, surrounding and laterally movable upon the hub thereof, said annulus being normally held in inward moved position by springs 67, surrounding pin extensions 68 of the annulus, said pins engaging perforations of the web of said wheel, and said springs bearing at one end against said web and at the other end against bearings 69. The annulus is normally separated from the wheel web by an interval wherein are located arms 70, of ball-carrying governor-levers 71, said levers being pivoted to the fly wheel at 72, and serving in their movement outward to actuate the ring 66, and therebv through anti-friction roller 73, the lever 74, which is fulcrumed to the top of one of the oil chambers, preferably upon the bolt connection of said top, and at its opposite end has pivotal connection with the throttle lever 75 of the carbureter. The connection of the lever 74 with the throttle lever is made through the medium of a rod 76, carrying an adjusting nut 77, threaded thereupon, whereby the movement of the throttle lever may regulated. The throttle lever is moved by the governor levers against the tension of a spring 78 secured at one end to the end of a rod 79, having a stationary connection with the frame at 80, said spring at its opposite end having

connection with the pivotal stem 81 of the fork 82, between the branches of which works the adjusting nut. In this way the spring 78 will move the lever 74 and the throttle lever reversely as the governor balls move inward upon slackening of the speed.

In starting the engine, on the upstroke of the piston, the gaseous mixture is drawn into the crank chamber from the carbureter. On the downstroke of the piston, the gas is compressed in the crank chamber, and at the end of the downstroke the radial passage 22 of the gas receiver and exhaust deflector comes in register with the opening in the cylinder wall leading to the pipe 16, and an inrush of the compressed charge takes place to the cylinder. On the upstroke again, this charge is compressed in the ignition or combustion tube, and at the proper time the charge is exploded by the sparking device to force the piston down again, and at the end of the down stroke a new charge will be admitted to the cylinder in the same way. Furthermore, at the end of the downstroke, a lateral notch 83 in the margin of the part 23 will come into register with an exhaust opening 84 in the cylinder wall, the exhaust gases being deflected by the wall of this notch into and out of said opening and into an enlargement 85 of the exhaust passage, said enlargement having an inclined wall 86, preferably of a curved or arcuate nature, whereon at one end the exhaust gases will strike and be thrown around to the opposite end in a whirl, creating a suction or vacuum to increase the rapidity of the exhaust.

The exhaust opening 84 of the cylinder has its outer wall advanced along the cylinder with relation to the outer wall of the inlet opening 21, whereby the arcuate corner notch 83 of the part 23 will partially uncover the exhaust opening 84 befor the gas inlet to the cylinder is started.

My engine has proven in practice to be very durable and capable of being easily operated. The pressure of the charge in the cylinder is under all conditions higher than that of the exhaust, whereby the efficiency of the engine is largely increased, there being a high compression of the charge and lessened friction of the moving parts, owing to decrease of carbon deposits due to more complete combustion.

The piston acts as a sliding valve, and when it reaches the extreme of its movement in one direction, the exhaust port is one half open before the intake of the new charge starts, the pressure of the exhaust being in this way reduced for a free admission of the new charge.

On the compression stroke, the charge is forced into the combustion tube, and the charge being highly compressed, the combustion thereof is rendered more perfect. A compression of the charge of about 150 pounds to the square inch in an engine developing five horse power is obtained. The compressed gas is fired near the inner or mouth end of the tube by an ignition device timed so that the charge starts to expand just before the working piston is going over dead center.

The timing of the ignition is important, and is adjusted or changed according to the load upon and the speed of the engine, to avoid preignition.

The thickness of the walls of the combustion tube is such that said walls will not retain too much heat or radiate heat too quickly as the load changes, the proper heat in the tube being of importance, to act as a balance or pressure equalizer when the load changes. The length of the combustion tube being the same as the length of the stroke of the piston, the impulse of the compressed ignited charge in said tube is given up gradually to the piston.

When running idle on a friction load, the exhaust is little or nothing, being more like steam than gas, the hydrocarbon gases being substantially perfectly consumed. The heat in the cylinder is reduced to a minimum, as but small volumes of gas are used, and these are burned perfectly at all loads and speeds.

The base 87, is provided at one end with a standard 88, for the extension shaft bearing, to take the belt pull from the engine bearings, the belt pulley 89, being located between said standard and the fly wheel. At its opposite end this base is provided with upright brackets 90, which are bolted to the sides of the crank chamber casing.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent is:—

1. In an internal combustion engine, a working cylinder having an exhaust opening, and an inlet opening materially advanced along the cylinder with relation to said exhaust opening, a working piston in said cylinder operating to open the exhaust about one-half before the intake starts, a combustion tube in line with the cylinder and having closed side walls exposed to the atmosphere, a closed outer end and an open inner end in communication with the cylinder, and an igniting device located near the open inner end of said tube, said piston having movement close to the end of said tube to compress the charge therein.

2. In an internal combustion engine, a working cylinder having an exhaust passage, and an inlet passage materially advanced along the cylinder with relation to said exhaust passage, a working piston in said cylinder having a cap provided at one side with a passage registering with said inlet passage and at its other side with a marginal notch registering with said exhaust passage, said piston operating to open

the exhaust before the intake starts, said exhaust passage having an enlargement provided with an arcuate wall of approximately one hundred and eighty degrees in extent to set up a whirl in the exhaust gases and increase the rapidity of the exhaust, a combustion tube in line with the cylinder and having closed side walls exposed to the atmosphere, a closed outer end and an open inner end in communication with the end of the cylinder, and an igniting device located near the open inner end of said tube, said piston having movement close to the end of said tube to compress the charge therein.

3. In an internal combustion engine, a cylinder, a piston, a crank chamber, a shaft in said chamber having an operating connection with said piston, a valve gas inlet to said chamber, a connecting passage from said chamber to the cylinder, a combustion tube in line with the cylinder and having the same length as that of the stroke of said piston, said tube having a tapered bore of increasing size toward its inner or mouth end, solid closed side walls exposed upon the outer sides thereof to the atmosphere, a closed outer end, and an open inner end in communication with the end of the cylinder, and an igniting device located near the open inner end of said tube, said piston having movement close to the end of said tube to compress substantially the entire charge therein.

4. In an internal combustion engine, a cylinder, a piston, a crank chamber, a shaft in said chamber having an operating connection with said piston, a valved gas inlet to said chamber, a connecting passage from said chamber to the cylinder, a combustion tube in line with the cylinder, said tube being of a diameter considerably less than that of the cylinder, having closed sides, a closed outer end, and an open inner end in communication with the cylinder and having a bore composed of portions of a diameter decreasing outwardly and provided with shoulders between said portions and presenting toward the cylinder, and an igniting device located near the open inner end of said tube, said piston having movement close to the end of said tube to compress the charge therein.

5. In an internal combustion engine, a cylinder having an exhaust opening and an inlet opening, the outer wall of the exhaust opening being materially advanced along the cylinder with relation to the outer wall of the inlet opening, a piston, a gas inlet and exhaust deflector carried by the piston and having a passage adapted to register with the gas inlet to the cylinder, and a marginal notch adapted to partially uncover the exhaust opening from the cylinder before the gas inlet to the cylinder is started, an exhaust passage having an enlargement provided with an arcuate wall of approximately 180 degrees in extent and of greater diameter than and one end of which is located in line with the exhaust opening and whereon the exhaust gases are adapted to strike and be deflected around to the opposite end thereof to set up a whirl and increase the rapidity of the exhaust.

6. In an internal combustion engine, a cylinder having an exhaust opening and an inlet opening, the outer wall of the exhaust opening being materially advanced along the cylinder with relation to the outer wall of the inlet opening, a piston, a gas inlet and exhaust deflector carried by the piston and having a passage adapted to register with the gas inlet to the cylinder, and a marginal notch adapted to partially uncover the exhaust opening from the cylinder before the gas inlet to the cylinder is started, an exhaust passage having an enlargement provided with an arcuate wall of approximately 180 degrees in extent and of greater diameter than and one end of which is located in line with the exhaust opening, and whereon the exhaust gases strike and are whirled around to the opposite end thereof, a combustion tube in line with and having a diameter comparatively small with relation to the diameter of the cylinder, and an igniting device located near the open inner end of said tube, said piston having movement close to the end of said tube to compress the charge therein.

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

MOFFAT ST. CLAIR.

Witnesses:

MARIAN BROWN,

JAMES MUIR JAMIESON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents. Washington, D. C."