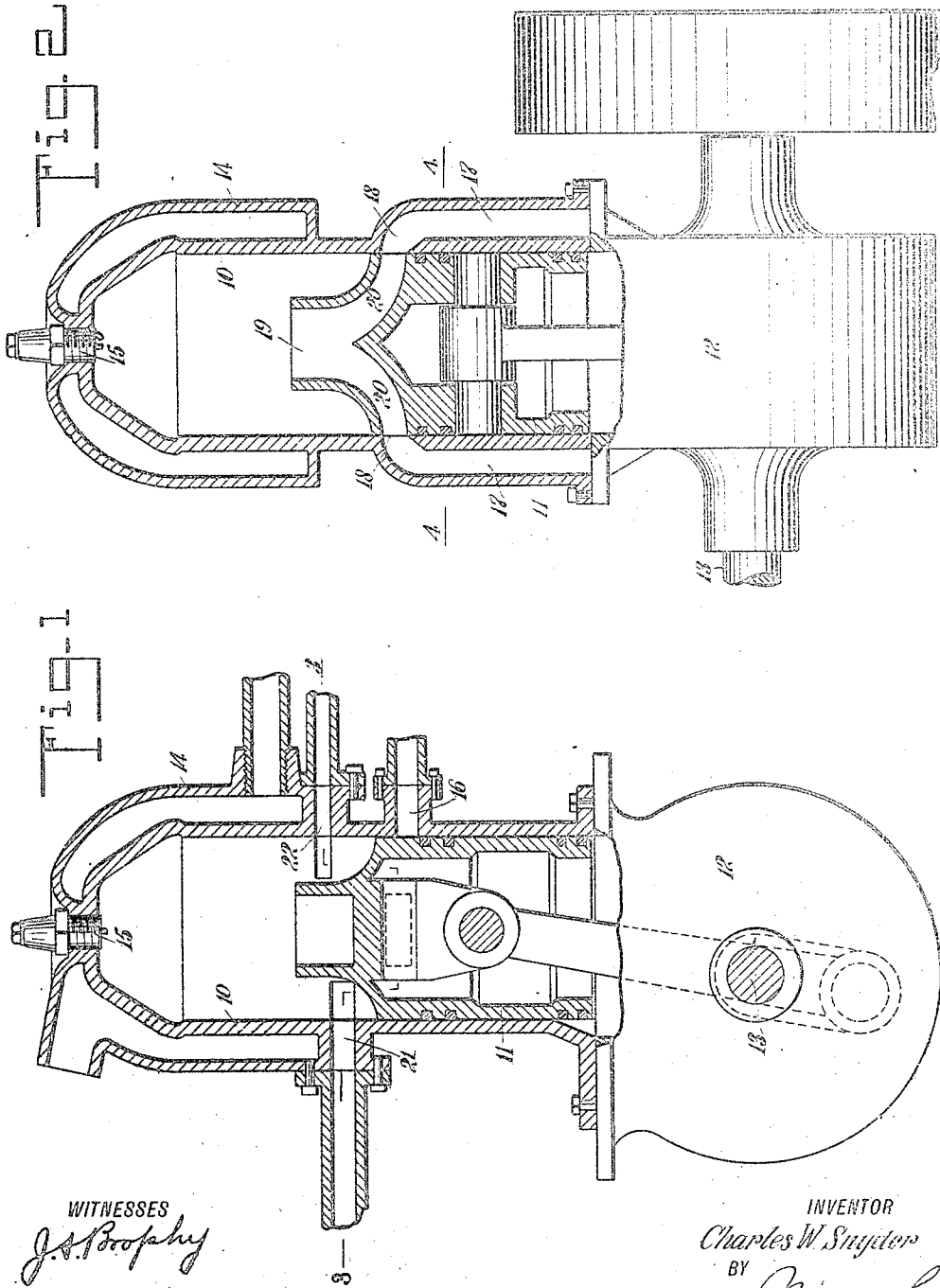


C. W. SNYDER.
INTERNAL COMBUSTION ENGINE AND METHOD OF SCAVENGING THE SAME.
APPLICATION FILED OCT. 14, 1909.

1,126,308.

Patented Jan. 26, 1915.
2 SHEETS—SHEET 1.



WITNESSES
J. S. Prophy
C. W. Fairbank

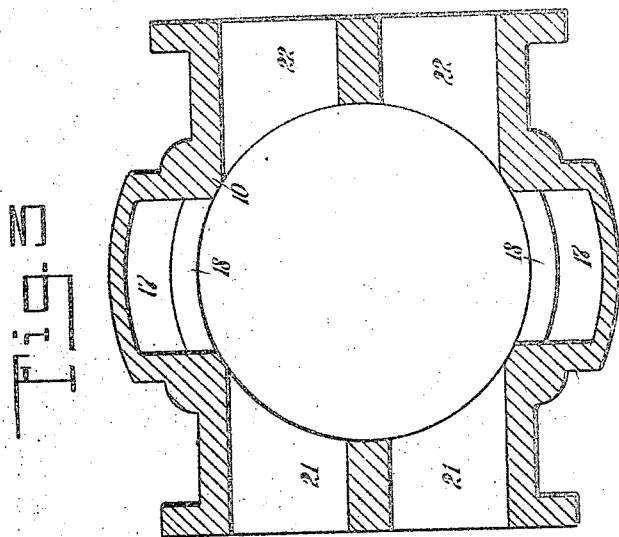
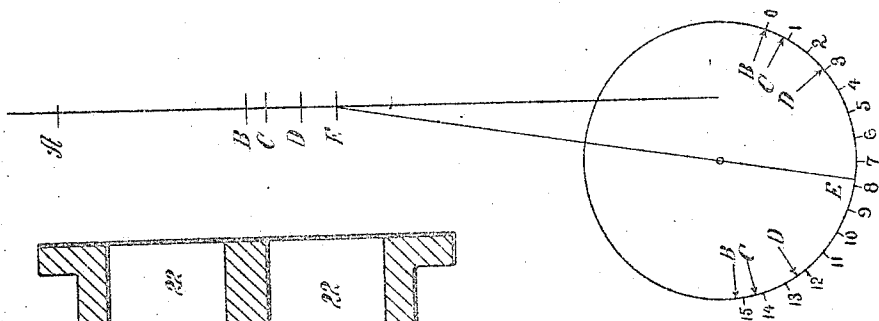
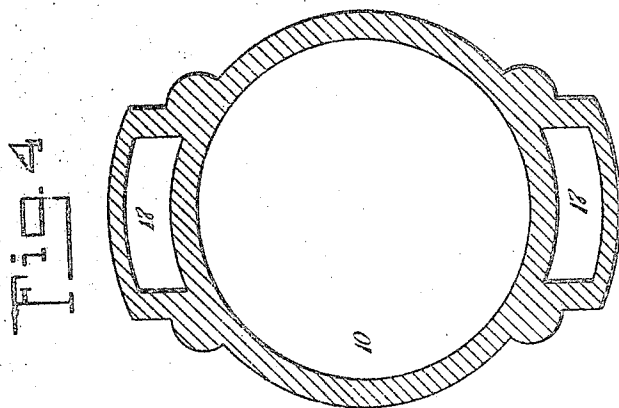
INVENTOR
Charles W. Snyder
BY *Munn & Co*
ATTORNEYS

C. W. SNYDER.
INTERNAL COMBUSTION ENGINE AND METHOD OF SCAVENGING THE SAME.
APPLICATION FILED OCT. 14, 1909.

1,126,308.

Patented Jan. 26, 1915.

2 SHEETS-SHEET 2.



WITNESSES
J. H. Propoy
C. W. Fairbank

INVENTOR
Charles W. Snyder
BY *Mumfles*
ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES W. SNYDER, OF HUDSON, NEW YORK.

INTERNAL-COMBUSTION ENGINE AND METHOD OF SCAVENGING THE SAME.

1,126,308.

Specification of Letters Patent.

Patented Jan. 26, 1915.

Application filed October 14, 1909. Serial No. 522,573.

To all whom it may concern:

Be it known that I, CHARLES W. SNYDER, a citizen of the United States, and a resident of Hudson, in the county of Columbia and State of New York, have invented a new and Improved Internal-Combustion Engine and Method of Scavenging the Same, of which the following is a full, clear, and exact description.

10 In designing internal combustion engines, it is customary to so proportion the parts that when the gaseous products of combustion have operated to force the piston through the major portion of its working stroke and the exhaust port has opened, said gases will be under a pressure somewhat higher than that of the atmosphere. Therefore, when the exhaust port is opened either by the movement of the piston or by the movement of a separate valve member, the gases tend to expand and partially escape through the exhaust port. It has been discovered that immediately following this expansion and outrushing of the gases and prior to the admission of the fresh charge, the pressure in the cylinder drops below the pressure of the outside atmosphere. This partial vacuum in some instances, may be caused by the sudden drop in temperature and the resulting contraction following the escape of a considerable portion of the gas through the exhaust port, and in other instances, it may be caused by the inertia of the exhaust gases traveling through the exhaust conduit. These gases leave the exhaust port at a rather high velocity and tend to retain that velocity even after the pressure in the cylinder drops to the pressure of the atmosphere. This continued movement of the exhaust gases causes a suction in the cylinder, which tends to draw the remaining exhaust gases therefrom. This drop in pressure may, in some instances, be due partially to both of these causes.

45 Without regard for the cause of this partial vacuum, it is the object of my invention to utilize this vacuum in inducting air from the outside atmosphere into the engine cylinder to scavenge the same prior to the admission of the fuel charge. Air admitted in this manner prevents the return movement of exhaust gas through the exhaust port into the cylinder, it permits the exhaust gas to continue moving out the exhaust conduit, and to thus replace by air, a portion of the exhaust gas normally remain-

ing in the cylinder at this time. The engine is much more effectively scavenged, and in case the engine is a two-cycle one and the explosive charge is admitted under compression, a much richer and smaller quantity of charge may be delivered, and the air in the cylinder utilized for diluting the incoming charge to the desired strength. Compressed air may be admitted from the crank case or other compressor, to finish the scavenging action, and liquid fuel may then be admitted, or the cylinder may be supplied with this charge in any other manner known in the art. It is only essential to my invention that the drop in pressure in the engine cylinder following the escape of the exhaust gas, be utilized for inducting into the cylinder, scavenging air from the outside atmosphere.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures, and in which—

Figure 1 is a longitudinal section through an engine constructed to operate in accordance with my invention; Fig. 2 is a longitudinal section on a plane at right angles to the plane of the section shown in Fig. 1; Figs. 3 and 4 are transverse sections through the cylinder and taken on the line 3—3 and 4—4, respectively, of Figs. 1 and 2, the piston not being shown; and Fig. 5 is a diagram showing the position of the piston at the time the several ports open and close.

The specific form of engine illustrated discloses merely one embodiment which my invention may assume. This engine is a two-cycle engine, in which the crank case is used as a compression chamber and in which the piston operates to uncover and open the exhaust port and the by-pass or inlet port from the crank case. The source of the compressed charge and the manner of opening and closing the several ports, are not essentials and may be varied at will.

The engine shown has a cylinder 10, a piston 11, a crank case 12, and a crank shaft 13. The cylinder is cooled by a water jacket 14, and the charge is ignited by a spark plug 15. The piston serves to control the admission of explosive charge from the carbureter to the crank case through an inlet port 16, and the charge after being compressed in the crank case is delivered through two by-passes 17, 17 to two inlet

ports 18, 18, both controlled by the piston. Preferably, the piston is provided with a central upwardly-directed nozzle 19, having two passages 20, 20 leading from the outer or peripheral wall of the piston to the nozzle. These passages come into registry with the ports 18, 18, when the piston is at the lowermost portion of its stroke, so that the compressed charge may flow from the crank case through the by-passes 17, 17, the inlet ports 18, 18, and passages 20, 20 to the nozzle 19, and thence axially of the cylinder toward the opposite end. The crank shaft is preferably offset, that is, it is at one side of the axis of the cylinder, as illustrated in Fig. 1 and diagrammatically in Fig. 5. All of these features are old in the art either in the form shown or in very similar form, and constitute no essential portion of the present invention.

The important feature of the engine illustrated, that is, the means permitting the inducting of the air into the cylinder by the vacuum following the escape of the exhaust gas, involves an inlet port 21, so disposed that it will be opened after the opening of the exhaust port 22 and before the opening of the charge inlet ports 18, 18. These three ports, that is, the exhaust port, the air inlet port and the charge inlet port, are arranged along the length of the cylinder in the order named, and are all controlled by the piston and are opened in succession, and closed in the reverse order at the time of their opening. The exhaust port 22 is preferably diametrically opposed to the air inlet port 21, while the two charge inlet ports 18, 18 are diametrically opposed to each other and midway between the exhaust port and the air inlet port.

In carrying out my improved method in the engine illustrated, the first charge is drawn from the carbureter through the port 16 into the crank case, compressed therein and delivered through the by-passes 17 and inlet ports 18 to the cylinder in the ordinary manner. After the compression of the charge in the working cylinder and the igniting of the compressed charge, the piston is forced lengthwise of the cylinder and travels from upper dead center marked A in Fig. 5 to the point B. At this latter point the exhaust port opens and the gaseous products of combustion in the cylinder instantly expand and a large portion of said gases rushes out through the exhaust port. The action of these gases is very rapid and the velocity in the exhaust conduit is comparatively high. While the piston is traveling from the point B to the point C, the exhaust gases continue to travel out through the exhaust conduit and the pressure in the cylinder continues to decrease. By the time the piston reaches the point C, the pressure in the cylinder has de-

creased to or below the pressure of the outside atmosphere, and a partial vacuum is formed in the cylinder. At this instant, the piston passes the point C and the air inlet port 21 is opened. If there be a partial vacuum in the cylinder at this time, the fresh outside air rushes in from the atmosphere without interfering with the continued travel of the exhaust gas in the exhaust conduit, and without causing the return of any of the exhaust gas from the conduit to the cylinder. Even if the pressure in the cylinder should not drop below atmospheric pressure but only to atmospheric pressure, the opening of the cylinder to the atmosphere permits the exhaust gas to continue moving in the exhaust conduit, and permits the exhaust gas remaining in the cylinder at this time, to follow on out through the exhaust conduit by the action of the inertia of the moving gases in said conduit. Thus, in any event, air is inducted into the cylinder, and the greater portion, if not all, of the gaseous products of combustion in the cylinder, is caused to leave through the exhaust conduit. The piston continues its travel to the point D, where the charge inlet ports 18 open and the charge compressed in the crank case is delivered to the engine cylinder to displace the gas in the cylinder, but as this gas in the cylinder is now largely air, the charge will not become diluted by exhaust gas. As the admission of the air has cooled the interior of the cylinder, the charge will not become highly heated the instant it is forced into the cylinder, and thus it will not expand and partially escape through the exhaust port. The piston continues its movement to the point E, that is, to dead center, and immediately returns closing the several ports in the inverse order in which they were opened.

It is evident that the specific engine shown embodies only one means whereby air may be inducted into the cylinder immediately after the escape of the exhaust gas and by reason of the movement of the exhaust gas or the drop in pressure following said movement.

Various changes may be made in the engine illustrated and within the scope of the appended claims, without departing from the spirit of my invention.

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

1. An internal combustion engine comprising a cylinder, a piston therein, an exhaust port in the cylinder wall in position to be uncovered by the piston during the relative motion of the latter when making its outward stroke, an air inlet port in the cylinder wall, on the side opposite the said exhaust port, and located beyond the said exhaust port in the direction of the motion

of the piston, said air inlet port also being designed to be uncovered by the piston, and means for admitting fuel to the cylinder subsequent to the opening of the said air inlet port, whereby a supply of scavenging air will be drawn into the cylinder by the products of combustion expanding below atmospheric pressure, prior to the admission of the next fuel charge.

2. An internal combustion engine comprising a cylinder, a piston therein, an exhaust port in the cylinder wall in position to be uncovered by the piston during the relative motion of the latter when making its outward stroke, an air inlet port in the cylinder wall, on the side opposite the said exhaust port, and located beyond the said exhaust port in the direction of the motion

of the piston, said air inlet port also being designed to be uncovered by the piston, and ports and passages in the cylinder and piston for admitting fuel to the cylinder, said ports and passages registering subsequent to the opening of the said air inlet port, whereby a supply of scavenging air will be drawn into the cylinder by the products of combustion expanding below atmospheric pressure, prior to the admission of the next fuel charge.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES WIGHT SNYDER.

Witnesses:

EDWARD F. M. LANSING,
BURGESS SPEED.