UNITED STATES PATENT OFFICE.

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STARTING-PORT FOR VALVELESS TWO-CYCLE INTERNAL-COMBUSTION ENGINES.


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To all whom it may concern:

Be it known that I, CHARLES H. SHEASLEY, a citizen of the United States, and a resident of Franklin, Pennsylvania, have invented new and useful Improvements in Starting-Ports for Valveless Two-Cycle Internal-Combustion Engines, which invention is fully set forth in the following specification.

10 This invention relates to internal combustion engines and, more particularly, to internal combustion engines of the three-port two-cycle valveless type.

Engines of this character, particularly engines of large size, are hard to start by hand because the fuel-admission port is normally at the rear end of the piston stroke and the piston must be moved, against both the suction created in the pump chamber and the pressure developed in the combustion chamber, substantially its full stroke before the admission port is uncovered to admit a starting charge of fuel. In an engine having a piston diameter of 10", for example, the pressure to be overcome to open the fuel-admission port may amount to 5,000 pounds, whereby it is practically impossible for one man to start an engine of this type without the use of an auxiliary starting device.

It has herefore been proposed, in the patent to Amon No. 1,105,588, granted July 28, 1914, to provide the pump chamber of an engine of this type with an auxiliary port for admitting a starting charge of fuel and air to the pump chamber, a check valve being provided to prevent the building up of back pressure in the fuel pipe while the piston is making its fuel transferring stroke.

With this construction a starting charge may be drawn into the pump chamber by reciprocating the piston back and forth near the forward end of its stroke without exerting the force that would be necessary to move the piston to uncover the main fuel-admission port.

It has also been proposed, in the patent to Stolz No. 1,203,807, granted Nov. 7, 1916, to provide the engine cylinder with an auxiliary port for admitting a starting charge of fuel and air to the pump chamber, said auxiliary port being controlled by the forward end of the piston which also functions in part as a check valve. This latter type of structure, however, has the disadvantage that the auxiliary port must be positioned relatively close to the main fuel-admission port to prevent a large portion of the charge from being forced out through the auxiliary port when the piston is making its fuel transferring stroke after the engine is started, and this location of the auxiliary port relatively close to the main fuel-admission port facilitates expenditure of considerable effort in moving the piston, against the suction in the pump chamber and the pressure in the combustion chamber, to a position which uncovers said auxiliary port.

It is an object of this invention to provide an internal combustion engine of the type in question with a piston-controlled starting port which, does not possess the disadvantage above discussed, but it is so arranged that it may be uncovered for admission of a starting charge by a relatively small exertion of force.

Furthermore, the arrangements employed in both constructions herebefore suggested require the use of an additional port in the wall of the engine cylinder and an additional pipe from the fuel conduit thereto. It is a further object of this invention to eliminate this additional port in the engine cylinder and the additional pipe leading thereto.

Another object of the invention is to provide an internal combustion engine of the three-port two-cycle valveless type with a starting port whereby the engine may be easily started by one man without the disadvantages inherent in structures heretofore suggested. Other objects will appear as the description of the invention proceeds.

Stated broadly, the invention comprises, in a valveless two-cycle internal combustion engine, a cylinder providing pump and combustion chambers and having admission and transfer ports, and a piston coating with said admission and transfer ports to time the admission of fuel to the pump chamber and its transfer to the combustion chamber and also having intermediate its length a starting port which coacts with the admis-
sion port to admit a starting charge of fuel without the necessity of moving the piston to uncover the main fuel-admission port as during the normal operation of the engine. The invention is capable of receiving a variety of mechanical expressions, some of which are shown on the accompanying drawing, but it is to be expressly understood that the drawing is for purposes of illustration only and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose. In said drawing—

Figure 1 is a side elevation of an engine cylinder equipped in accordance with the present invention;

Fig. 2 is a partial longitudinal central section of said cylinder, the piston being shown in elevation;

Fig. 3 is a partial longitudinal central section of said cylinder and piston on a plane at right angles to the section shown in Fig. 2;

Fig. 4 and 5 are fragments of a cylinder and piston showing another embodiment of the present invention, the section of Fig. 5 being taken on the line V—V of Fig. 4; and

Fig. 6 is a fragmentary elevation showing still another embodiment of the present invention.

Referring in detail to the drawing, 1 is an internal combustion engine of the three-port two-cycle valveless type and may be of any suitable construction. As is conventional, 25 said cylinder is provided with a pump chamber 2 and a combustion chamber 3, a passage 4 terminating in a port 5 being provided for transferring the combustible mixture from the pump chamber to the combustion chamber. An exhaust port 6 is shown at 6. An admission port of any suitable construction is also provided; in the form shown, two separate ports for the admission of fuel and air respectively are employed, but it is to be expressly understood that a single port is within the purview of this invention. The air inlet port is shown at 7 and the fuel inlet port is shown at 8, fuel being supplied to the latter through a suitable conduit 9. All of said ports are controlled in their opening and closing by the movement of a piston 10 of any suitable construction, shown as of the trunk type.

During the normal operation of the engine, the admission port is uncovered when the piston 10 is at substantially the rear end of its stroke, and a charge of fuel and air is then drawn into the pump chamber 2 owing to the vacuum created in said chamber during the rearward stroke of the piston. As the piston moves forwardly the admission port is closed and the charge compressed in the pump chamber 2 and passage 4. Just before the piston reaches the forward end of its stroke it uncovers the exhaust port 6 and, immediately thereafter, the transfer port 5, whereby the products of combustion are discharged from the combustion chamber and a fresh charge of combustible mixture transferred from the pump chamber to the combustion chamber. During the return stroke of the piston the charge is compressed in the combustion chamber and as the piston completes its stroke said charge is exploded.

In accordance with the present invention, the piston is provided with a starting port which registers with the admission port at an intermediate point in the stroke of said piston. In the form shown in Figs. 1, 2 and 3 said starting port is provided as an aperture 11 in the wall of the piston 10 and is arranged to register with the fuel inlet port 8 at a suitable position in the stroke of the piston, which position may be at a point 35 from 1/3 to 1/3 of the length of the stroke toward the combustion end of the cylinder. In order that air may also be drawn into the pump chamber with the starting charge of fuel the connection 12 of the pipe 9 to the port 8 is shown as provided with an auxiliary air-inlet port 13 which is controlled by a manually-adjustable valve 14.

The starting port in the piston and the auxiliary air valve for supplying air thereto may be provided in a variety of ways other than that shown in Figs. 1 to 3. In Figs. 4 and 5 the starting port is shown in the form of a short channel or groove 16, in the outer cylindrical face of the piston, which may be brought into communication with the fuel-inlet port 8 by moving the piston toward the combustion end of the cylinder. In the form here shown, the connection 12 between the pipe 9 and port 8 is provided with an auxiliary air-admission pipe 16 having therein a check valve 17 and a hand-controlled valve 18, and the fuel pipe 9 is also provided with a check-valve 17. By use of the check valves shown at 17 and 17' fuel will not be forced out through the open auxiliary air valve 18 when oscillating the piston to draw in a starting charge, nor will a back-pressure be created in the fuel pipe.

In the embodiment shown in Fig. 6 the starting port 19 is provided with an elongated groove 20 in the outer face of the piston whereby the period during which fuel may be drawn through said port 19 120 from the fuel-admission port 8 may be extended.

When starting the engine the air valve 14 or 18 is opened to admit a suitable quantity of air, and the piston is moved toward 125 the combustion end of the cylinder until the starting port 11, 15 or 19 is brought into communication with the admission port. The piston is then reciprocated back and forth (by turning the fly wheel backwardly...
and forwardly) to draw in a sufficient charge of fuel and air, whereupon the engine may be started. When the engine starts, the auxiliary air admission valve 14 or 18 is closed and the engine operates as usual.

While a check valve in either or both of the auxiliary air-admission port and the fuel pipe has been illustrated as employed only in the embodiment of Figs. 4 and 5, it is to be expressly understood that either or both of these check valves may be employed in any other embodiment of this invention to prevent escape of the fuel when moving the piston forwardly or to prevent the creation of a back pressure in the fuel pipe, or both.

It will therefore be perceived that an engine of the three-port two-cycle valveless type has been provided with a starting port which, by eliminating the necessity of moving the piston against the suction in the pump chamber and the pressure in the combustion chamber to a point where the main fuel-admission valve is uncovered, enables the engine to be started by one man without the expenditure of great effort. At the same time, owing to the present invention, the provision of an additional port in the wall of the cylinder, together with piping leading thereto, is avoided. Additionally, a starting port in accordance with the present invention may be positioned as near the forward end of the piston as desired without material loss of the fuel through the auxiliary air valve since, by the use of an aperture in the piston, a puff of fuel into the pump chamber occurs each time the starting port is brought into registry with the admission port but, as the period during which the two ports are in registry as the piston is reciprocated back and forth is very short, there is little opportunity for escape of the fuel. The period of registry with the admission port may, however, be lengthened by the use of the groove extending to the end of the cylinder as shown in Figs. 4 and 5, or by the use of a groove on one or both sides of the aperture in the piston as shown in Fig. 6, or by other suitable expedient.

While the embodiments shown on the drawing have been described with considerable particularity it is to be expressly understood that this invention is not limited thereto. Reference is to be had to the appended claims for a definition of the limits of this invention.

What I claim is:

1. In a valveless two-cycle internal combustion engine, a cylinder providing pump and combustion chambers, said engine having an air inlet, a fuel admission port and a transfer port, a piston reciprocating in said cylinder and coacting with said admission and transfer ports to time the admission of fuel to the pump chamber and its transfer to the combustion chamber, a starting port in the wall of said piston communicating with said pump chamber and coacting with said admission port at an intermediate point in the stroke of the piston whereby said piston may be manipulated to admit a starting charge to the pump chamber without moving the piston to its normal fuel-admitting position, and an air-valve for admitting air to said starting port when starting the engine.

2. In a valveless two-cycle internal combustion engine, a cylinder providing pump and combustion chambers and having an air-inlet port, a fuel-inlet port and a transfer port, a piston in said cylinder coacting with said ports to time the admission of combustible mixture to the pump chamber and its transfer to the combustion chamber, a starting port in the wall of said piston coacting with said fuel-inlet port at an intermediate point in the stroke of the piston whereby said piston may be operated to admit a starting charge without moving the same to its normal mixture-admitting position, and a manually-operable air valve communicating with said fuel-inlet port.

In testimony whereof I have signed this specification.

CHARLES H. SHEASLEY.