Sept. 10, 1929. H. BULLNHEIMER 1,727,697

DOUBLE ACTING TWO-STROKE GAS ENGINE WITH SLOT SCAVENGING

Filed Dec. 5, 1928 2 Sheets-Sheet 1

Fig. 1.

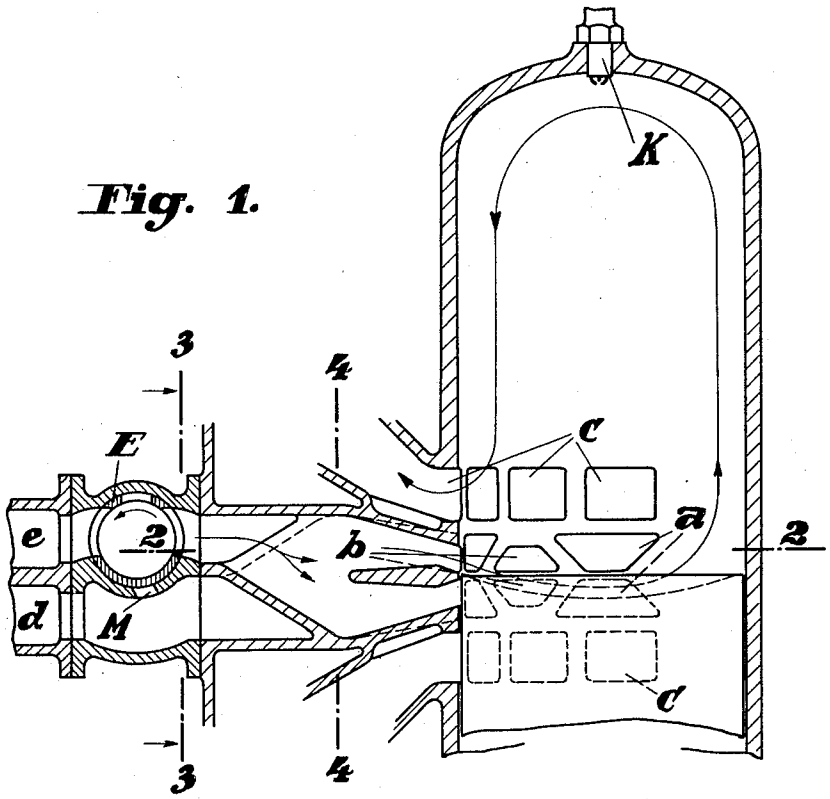
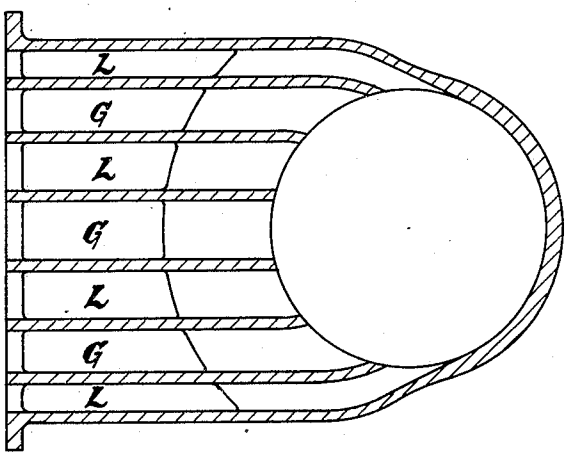


Fig. 2.

2-2



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Fig. 3.

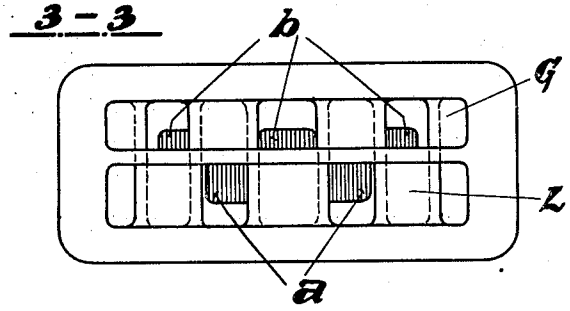
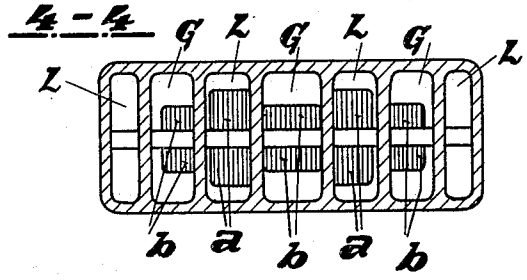


Fig. 4.



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UNITED STATES PATENT OFFICE.

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DOUBLE-ACTING TWO-STROKE GAS ENGINE WITH SLOT SCAVENGING.

Application filed December 5, 1928, Serial No. 323,908, and in Germany July 4, 1927.

This invention relates to internal-combustion engines of the two-cycle type in which the cylinder walls are provided with slots for the admission of a scavenging medium and of fresh gas and for the exhaust of the waste gas.

One object of the invention is the provision of an engine of this character having gas slots for the admission of fresh gas to the cylinder, and having scavenging slots for the admission of scavenging medium to the cylinder, the gas slots and the scavenging slots being arranged alternately adjacent one another with the scavenging slots extending further towards the adjacent end of the cylinder than the gas slots so that the scavenging slots are opened by the piston substantially before the opening of the gas slots.

Another object of the invention is the provision of a two-cycle engine having adjacently arranged gas slots and scavenging slots and having a controllable valve in the gas-inlet passages through which gas is supplied to the gas slots for placing the gas passages in communication with the scavenging passages which communicate with the scavenging slots, so that, before stopping of the engine, gas may be expelled from the gas passages between the valve and the gas slots.

Further objects and advantages of the invention will be apparent from the following description and from the accompanying drawing in which—

Fig. 1 is a vertical sectional view of an engine cylinder embodying the present invention and showing the various conduits or passages for the slots in the cylinder.

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1;

Fig. 3 is a vertical section on the line 3—3 of Fig. 1, taken through the gas and scavenging passages; and

Fig. 4 is a section on the line 4—4 of Fig. 1 through the gas and scavenging passages.

This invention is herein shown as applied to a double-acting two-cycle engine having slots in the cylinder walls arranged to provide for scavenging of the burnt gases from the combustion chamber. Preferably the scavenging slots *a* and the exhaust slots *c* are arranged in adjacent planes transversely of the cylinder and adapted to be controlled by the piston movements so that the scavenging slots *a* are opened after the opening of the exhaust slots *c*, these slots being provided on adjacent portions of the cylinder wall to create a reverse scavenging flow, the scavenging medium being deflected from the top of the piston along the opposite side of the cylinder wall, reversing then and flowing down the cylinder wall above the exhaust slots and then passing out through the exhaust passages.

The scavenging slots *a* through which scavenging medium, such as air is admitted to the cylinder are arranged adjacent to and alternating with gas slots *b* through which gas is admitted, as shown, and the various scavenging slots *a* are in communication with the scavenging passages L adjacent which are gas-inlet passages G in communication with the gas-inlet slots *b*. To provide a flow of scavenging medium through the scavenging slots *a* before the gas slots *b* are opened by the piston the scavenging slots are elongated towards the adjacent end of the cylinder as shown in Fig. 1, and the scavenging medium in flowing into the combustion space before the admission of the fuel provides a separating stratum of scavenging air between the burnt exhaust gases and the supply of fresh mixture which later flows in through the inlet slots *b*. Preferably although not necessarily the scavenging slots are of trapezoidal shape and the gas slots *b* are also of trapezoidal shape, the width of the scavenging slots increasing towards the adjacent cylinder end and the gas slots *b* decreasing in width towards the adjacent cylinder end, so that the initial opening of the scavenging slots will be comparatively large as compared to the subsequent initial opening of the gas slots. In this manner a considerable flow of scavenging air may flow into the cylinder before the inlet slots are effectively opened by the piston, and the extent of the separating air stratum between the exhaust burnt gases and the incoming fuel mixture is augmented. It is to be understood that the engine may have any suitable number of cylinders, which are

preferably provided with suitable igniting means such as the spark-plug K.

The various gas passages G through which the gas is supplied to the gas slots *b* all communicate, during normal engine operation, with a common supply passage or conduit *e* through which fresh gas is supplied. Scavenging air or other medium is supplied in any suitable manner to a common scavenging conduit *d* which communicates with the various scavenging passages L for the supply of scavenging air through the scavenging slots *a*. Means are provided to disconnect the various gas passages G from the supply passage *e* before the engine stops so that fresh mixture which might remain in the gas passages G adjacent the gas slots might be ejected to prevent the creation of an undesirable explosive mixture at this time. To accomplish this a valve, herein shown as of the rotary type, is provided in the fuel mixture supply passage *e*, this valve being indicated at E. With the valve in the position indicated in Fig. 1 an uninterrupted supply of fuel may pass through the valve to the various gas passages G and communication between the gas supply passage *e* and the scavenging air supply passage *d* is cut off. However upon rotating the valve approximately 90° from the position shown, the solid part of the valve interrupts communication from the fuel supply passage *e* and at the same time the fuel passages G between the valve and the various fuel inlet slots *b* are placed in communication through an opening or slot M with the scavenging air supply passage *d*. Thus during the time that the machine is stopping the valve may be so controlled, in this manner, to provide for a flow of scavenging air or other medium through the passage M and through the normal gas passages G to clear all explosive mixture and fuel from these gas passages and prevent the creation of an explosive mixture. The engine thus stops with the combustion chambers filled with scavenging air and free from fuel gases. During normal operation of the engine however it will be understood that the valve E is positioned as shown in Fig. 1 so that there is at that time no communication between the passages *e* and *d*.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What I claim is:

1. A two-cycle engine of the class described comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, piston-controlled scavenging slots for the admission of scavenging medium to the cylinder, and piston controlled exhaust slots arranged adjacent thereto in the cylinder wall to provide for reverse scavenging flow, the gas slots and scavenging slots being arranged alternately around a portion of the cylinder wall and both having portions lying in the same transverse plane, the scavenging slots extending further towards the end of the cylinder so as to open substantially before the opening of the gas slots.

2. A double-acting engine of the class described, comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, and piston-controlled scavenging slots arranged on one side of the cylinder for the admission of a scavenging medium to the cylinder, and exhaust slots arranged in the cylinder wall on the same side of the cylinder as said scavenging slots to provide for reverse scavenging flow, the gas slots and the scavenging slots being arranged alternately around a portion of the cylinder wall and both having portions lying in the same transverse plane, the scavenging slots extending further toward the adjacent end of the cylinder so as to open substantially before the opening of the gas slots.

3. A two-cycle engine of the class described, comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, and piston-controlled scavenging slots for the admission of scavenging air to the cylinder, the gas slots and scavenging slots being arranged alternately around a portion of the cylinder wall, the gas-inlet slots being arranged so as to open after the opening of the scavenging slots, the scavenging slots having widths increasing towards their respective cylinder end and the gas inlet slots having widths decreasing towards their respective cylinder end.

4. A two-cycle engine of the class described comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, and piston-controlled scavenging slots for the admission of scavenging medium to the cylinder, the gas slots and scavenging slots being arranged alternately around a portion of the cylinder wall adjacent one another, passages for supplying scavenging medium to the scavenging slots, passages for supplying gas to the gas slots, and means operable to connect the first-mentioned passages to the second-mentioned passages for supplying scavenging medium to both the gas slots and the scavenging slots.

5. A two-cycle engine of the class described comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, and piston-controlled scavenging slots for the admission of scavenging medium to the cylinder, the gas slots and scavenging slots being arranged alternately around a portion of the cylinder wall adjacent one another, the scavenging slots ex-

tending further towards the end of the cylinder so as to open substantially before the opening of the gas slots, passages for supplying scavenging medium to the scavenging slots, passages for supplying gas to the gas slots, and means operable to connect the first-mentioned passages to the second-mentioned passages for supplying scavenging medium to both the gas slots and the scavenging slots.

6. A double-acting engine of the class described comprising a cylinder, the walls of the cylinder having piston-controlled gas slots for the admission of gas to the slots, and piston-controlled scavenging slots for the admission of a scavenging medium to the cylinder, and exhaust slots arranged in the cylinder wall to provide for reverse scavenging flow, the gas slots and the scavenging slots being arranged alternately adjacent one another with the scavenging slots extending further toward the adjacent end of the cylinder so as to open substantially before the opening of the gas slots, gas passages for supplying gas to the gas slots, scavenging passages for supplying scavenging medium to the scavenging slots, and a rotary valve in said gas passages adapted to be operated to place said gas passages in communication with said scavenging passages so that before stopping of the engine gas in said passages between said valve and said gas slots is expelled.

7. A two-cycle engine of the class described comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, and piston-controlled scavenging slots for the admission of scavenging medium to the cylinder, passages for supplying scavenging medium to the scavenging slots, passages for supplying gas to the gas slots, and means operable to connect the first-mentioned passages to the second-mentioned passages for supplying scavenging medium to both the gas slots and the scavenging slots.

8. A two-cycle engine of the class described comprising a cylinder having piston-controlled gas slots for the admission of gas to the cylinder, piston-controlled scavenging slots for the admission of scavenging medium to the cyclinder, and piston controlled exhaust slots arranged adjacent thereto in the cylinder wall, the gas slots and scavenging slots being arranged alternately around a portion of the cylinder wall and both having portions lying in the same transverse plane, the scavenging slots extending further towards the end of the cylinder so as to open substantially before the opening of the gas slots.

In testimony whereof I have affixed my signature.

HANS BULLNHEIMER.