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PROVISIONAL SPECIFICATION.

Improvements in the Scavenging of Two-stroke Internal Combustion Engines.

I, WILFRED HEYNES EDWARDS, of "Glenwood", Watford Road, Croxley Green, Watford, Herts, of British Nationality, do hereby declare the nature of this invention to be as follows:—

This invention relates to two-stroke internal combustion motors, and has for its object to provide improved means for effecting scavenging and also to ensure silencing.

According to the invention the motor is provided with an auxiliary cylinder and piston adapted to co-operate with one or more power cylinders and pistons in such manner that during the explosion or power stroke the piston of the auxiliary cylinder will create a vacuum which is caused to become operative with respect to the exhaust gases in the power cylinder or cylinders at the moment when the exhaust port or ports therein are open, thus permitting effective extraction of the exhaust gases which are expelled from the auxiliary cylinder during the compression stroke in the power cylinder or cylinders.

The invention may be applied according to various constructions. Thus, in a motor provided with a single power cylinder, the auxiliary cylinder may be set opposite thereto and in alignment and the auxiliary piston may be operated from a crank oppositely disposed with reference to the crank operating the power piston. In a motor provided with two power cylinders the auxiliary cylinder may have its axis disposed at an angle to the axis or axes of the power cylinders and be operated by a crank suitably positioned with respect to the cranks effecting the operation of the motor pistons, the auxiliary cylinder being of a capacity effectively to deal with the exhaust gases from the two power cylinders. The connection between the auxiliary cylinder and the power cylinder or cylinders may be effected simply by means of a conduit or passage exterior to the cylinders or formed in the walls thereof. The exhaust of the gases from the auxiliary cylinder may be effected through a valve provided in the auxiliary piston and permitting the exhaust gases to pass to an exhaust passage.

Alternatively, the exhaust valve may be provided in the head or wall of the auxiliary cylinder and the exhaust gases may be delivered either direct into the atmosphere or by way of suitable intermediate passages or silencing devices.

In carrying the invention into effect according to one particular construction of two-stroke motor, a single power cylinder is disposed co-axially with the auxiliary cylinder, and the crank shaft is provided with diametrically opposed cranks, one of which is connected with a suitable connecting rod to the power piston and the other by means of a suitable connecting rod to the auxiliary piston. The exhaust port of the power cylinder is directly connected by a suitable conduit or passage with an inlet port in the head of the auxiliary cylinder.

According to another construction of internal combustion motor provided according to the invention the auxiliary piston instead of being provided with a transfer port may be formed with a transfer chamber having an inlet closed by the valve and connected with a pipe or tube parallel with the axis of the cylinder and extending into the crank case, which pipe or tube is telescopically engaged with a corresponding delivery pipe or tube mounted in the crank case and leading to the exterior thereof. The auxiliary piston co-operates with the power piston for the compression of the air contained in the crank case.

The transfer valve of the auxiliary cylinder instead of being operated from the connecting rod thereof may be separately operated by suitable gearing driven from the crank shaft. Thus, in the construction employing the telescopic pipes or tubes before referred to, a sleeve valve may be provided in the pipe or tube mounted in the crank case, and such sleeve valve may be rotated by suitable gearing such as bevel gearing from the crank shaft, the gearing being so dimensioned and adjusted as to secure the opening of the sleeve valve at the desired point in the movement of the auxiliary piston.

It will be understood that the invention

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is not limited to the features of construction that are hereinbefore described, since these are given merely by way of example.  
Dated this 20th day of July, 1929.

EDWARD EVANS & Co.,

27, Chancery Lane, London, W.C.2,  
Agents for the Applicant.

### COMPLETE SPECIFICATION.

#### Improvements in the Scavenging of Two-stroke Internal Combustion Engines.

I, WILFRED HEYNES EDWARDS, of  
5 "Glenwood", Watford Road, Croxley  
Green, Watford, Herts, of British  
Nationality, do hereby declare the nature  
of this invention and in what manner the  
same is to be performed, to be particu-  
10 larly described and ascertained in and by  
the following statement:—

This invention relates to two-stroke  
internal combustion motors, and has for  
its object to provide improved means for  
15 effecting scavenging and also to ensure  
silencing, suitable for application to  
engines adapted for a wide range of pur-  
poses, such as motor cycles, outboard  
motors, and stationary work.

20 According to the invention the motor  
is provided with an auxiliary cylinder and  
piston adapted to co-operate with one or  
more power cylinders and pistons in such  
manner that during the explosion or  
25 power stroke the piston of the auxiliary  
cylinder will create a vacuum which is  
caused to become operative with respect  
to the exhaust gases in the power cylinder  
or cylinders at the moment when the  
30 exhaust port or ports therein are open,  
thus permitting effective extraction of the  
exhaust gases which are expelled from the  
auxiliary cylinder during the compression  
stroke in the power cylinder or cylinders,  
35 the auxiliary piston co-operating with the  
power piston or pistons for the compres-  
sion of a fresh charge in the crank  
chamber.

40 It is to be understood that the definition  
"auxiliary cylinder and piston" is in-  
tended to cover the use of a cylinder and  
piston expressly for scavenging purposes  
and distinct from the power cylinder and  
45 piston, and not to include the provision  
of two pistons mounted in tandem in the  
power cylinder, one of which pistons  
serves to extract the residue of the exhaust  
gases from the power cylinder or the pro-  
vision of a piston of two diameters oper-  
50 ating in a power cylinder of correspond-  
ing diameters and serving the said purpose  
of removing the residue of the exhaust  
gases in the power cylinder.

55 The invention may be applied accord-  
ing to various constructions. Thus, in a  
motor provided with a single power cylin-

der, the auxiliary cylinder may be set  
opposite thereto and in alignment and the  
auxiliary piston may be operated from a  
crank oppositely disposed with reference 60  
to the crank operating the power piston.  
In a motor provided with two power  
cylinders the auxiliary cylinder may have  
its axis disposed at an angle to the axis  
or axes of the power cylinders and be 65  
operated by a crank suitably positioned  
with respect to the cranks effecting the  
operation of the motor pistons, the  
auxiliary cylinder being of a capacity  
effectively to deal with the exhaust gases 70  
from the two power cylinders. The con-  
nection between the auxiliary cylinder  
and the power cylinder or cylinders may  
be effected simply by means of a conduit  
or passage exterior to the cylinders or 75  
formed in the walls thereof. The exhaust  
of the gases from the auxiliary cylinder  
is preferably effected by way of a sleeve  
valve which may be caused to operate  
either by rotational movement or by axial 80  
movement or by a combination of such  
movements and which may also serve for  
the opening and closing of an induction  
port or ports permitting the admission of  
gaseous mixture to the crank case. 85  
Alternatively, an exhaust valve may be  
provided in the head or wall of the  
auxiliary cylinder and the exhaust gases  
may be delivered either direct into the  
atmosphere or by way of suitable inter- 90  
mediate passages or silencing devices.

A construction of two-stroke engine in  
accordance with the invention is illus-  
trated in the accompanying diagrammatic  
drawing which is a sectional elevation. 95

In carrying the invention into effect  
according to the particular construction  
of two-stroke motor, as illustrated in the  
accompanying drawing, a single power  
cylinder *a* is disposed diametrically oppo- 100  
site to the auxiliary cylinder *b*, and the  
crank shaft *c* is provided with diametri-  
cally opposed cranks, one of which is con-  
nected with a suitable connecting rod to  
the power piston *a*<sup>1</sup> and the other by 105  
means of a suitable connecting rod to the  
auxiliary piston *b*<sup>1</sup>. The exhaust port of  
the power cylinder *a* is directly connected  
by a suitable conduit or passage *d* with an

inlet port  $b^3$  in the auxiliary cylinder.

A sleeve valve  $e$  is mounted in the auxiliary cylinder  $b$  in ball bearings and is rotated from the crank shaft  $c$  by means of gear comprising a bevel pinion  $c^1$  on the crank shaft and a bevel tooth ring or annulus  $e^1$  mounted at the inner end of the valve, the gear having a 2:1 ratio. The sleeve valve is provided with pairs of diametrically disposed ports  $e^2$ ,  $e^3$ ,  $e^4$  serving respectively to co-operate with the port  $b^2$ , two ports  $b^3$  and a port  $b^4$  provided in the cylinder. On the inward movement of the piston  $b^1$  a reduction of pressure is produced within the cylinder  $b$  and the valve  $e$  until the piston approaches the inner dead point when one of the ports  $e^2$  comes into register with the port  $b^2$ , with the result that the exhaust gases in the cylinder  $a$  are rapidly transferred to the cylinder  $b$ . The port  $b^2$  is then closed by the valve and on the outward movement of the piston  $b^1$  the ports  $e^3$  of the valve come into register with the exhaust ports  $b^3$  of the cylinder for the discharge of the exhaust gases. As the piston passes towards the outer dead point one of the ports  $e^4$  registers with the induction port  $b^4$  of the cylinder for the entry of a charge into the cylinder  $b$  in front of the piston  $b^1$ . This charge is compressed into the crank case between the pistons  $a$  and  $b$  on the next power stroke for transfer to the power cylinder  $a$ .

It will be understood that any desired arrangement of the ports in the cylinder  $b$  and in the valve  $e$  may be adopted according to the requirements and the gear ratio adopted for effecting the rotation of the sleeve valve, or the manner and extent of the axial movement given to the said valve.

It will be understood, also, that the sleeve valve forms no part of the combustion chamber and thus does not come into contact with the exhaust gas until the said gas has been cooled by its passage between the power cylinder and the scavenging cylinder.

According to another construction of internal combustion motor provided according to the invention the auxiliary piston may be formed with a transfer chamber having an inlet closed by the valve and connected with a pipe or tube parallel with the axis of the cylinder and extending into the crank case, which pipe or tube is telescopically engaged with a corresponding delivery pipe or tube mounted in the crank case and leading to the exterior thereof.

The transfer valve of the auxiliary cylinder may be operated from the connecting rod thereof or it may be separately

operated by suitable gearing driven from the crank shaft. Thus, in the construction employing the telescopic pipes or tubes before referred to, a sleeve valve may be provided in the pipe or tube mounted in the crank case, and such sleeve valve may be rotated by suitable gearing, such as bevel gearing, from the crank shaft, the gearing being so dimensioned and adjusted as to secure the opening of the sleeve valve at the desired point in the movement of the auxiliary piston.

It will be understood that the invention is not limited to the features of construction that are hereinbefore described, since these are given merely by way of example.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A two-stroke internal combustion engine provided with means for scavenging, comprising an auxiliary cylinder and piston adapted to co-operate with one or more power cylinders and pistons in such manner that during the explosion or power stroke the piston of the auxiliary cylinder is caused to create a reduced pressure or vacuum which becomes operative to withdraw the exhaust gases from the power cylinder or cylinders at the moment when the exhaust port or ports therein open, thus permitting extraction of the exhaust gases into the auxiliary cylinder whence they are expelled during the compression stroke in the power cylinder or cylinders, the auxiliary piston co-operating with the power piston or pistons for the compression of a fresh charge in the crank chamber, substantially as hereinbefore described.

2. A two-stroke internal combustion engine according to claim 1, wherein the auxiliary cylinder is provided with a ported sleeve valve co-operating with ports in the auxiliary cylinder, substantially as hereinbefore described.

3. A two-stroke internal combustion engine as set forth in claim 1, wherein the auxiliary piston is provided with a through port closed by a valve for the purpose and substantially as hereinbefore described.

4. A two-stroke internal combustion engine according to claim 1, wherein the auxiliary piston is provided with a valved transfer chamber, substantially as hereinbefore described.

5. A two-stroke internal combustion engine as set forth in claim 1, wherein the auxiliary cylinder is provided with a transfer valve operated from the crank

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shaft through gearing provided for the purpose, substantially as hereinbefore described.

5 6. A two-stroke internal combustion engine according to claims '1 and 2, having an auxiliary cylinder with piston and sleeve valve located at an angle to the power cylinder in which the auxiliary piston co-operates with the power piston  
10 for the induction of a fresh charge into the crank chamber by way of a suitable port or ports in the sleeve valve, such charge being equal in volume to the sum of the displacements of the two pistons  
15 during their entire outward travel, substantially as hereinbefore described.

7. A two-stroke internal combustion engine according to claim 6, in which an  
20 auxiliary scavenging cylinder contains a sleeve valve which times the induction

from the carburetter to the crank chamber, the communication between the scavenging cylinder and the power cylinder exhaust port, and the discharge of the exhaust from the scavenging cylinder to the atmosphere, and which sleeve valve forms no part of the combustion chamber and does not come into contact with the exhaust gas until the said gas has been cooled by its passage between the power  
25 cylinder and the scavenging cylinder.

8. Two-stroke internal combustion engines provided with means for scavenging, substantially as hereinbefore described. 30 35

Dated this 17th day of April, 1930.

EDWARD EVANS & Co.,  
27, Chancery Lane, London, W.C.2,  
Agents for the Applicant.

*[This Drawing is a reproduction of the Original on a reduced scale.]*

