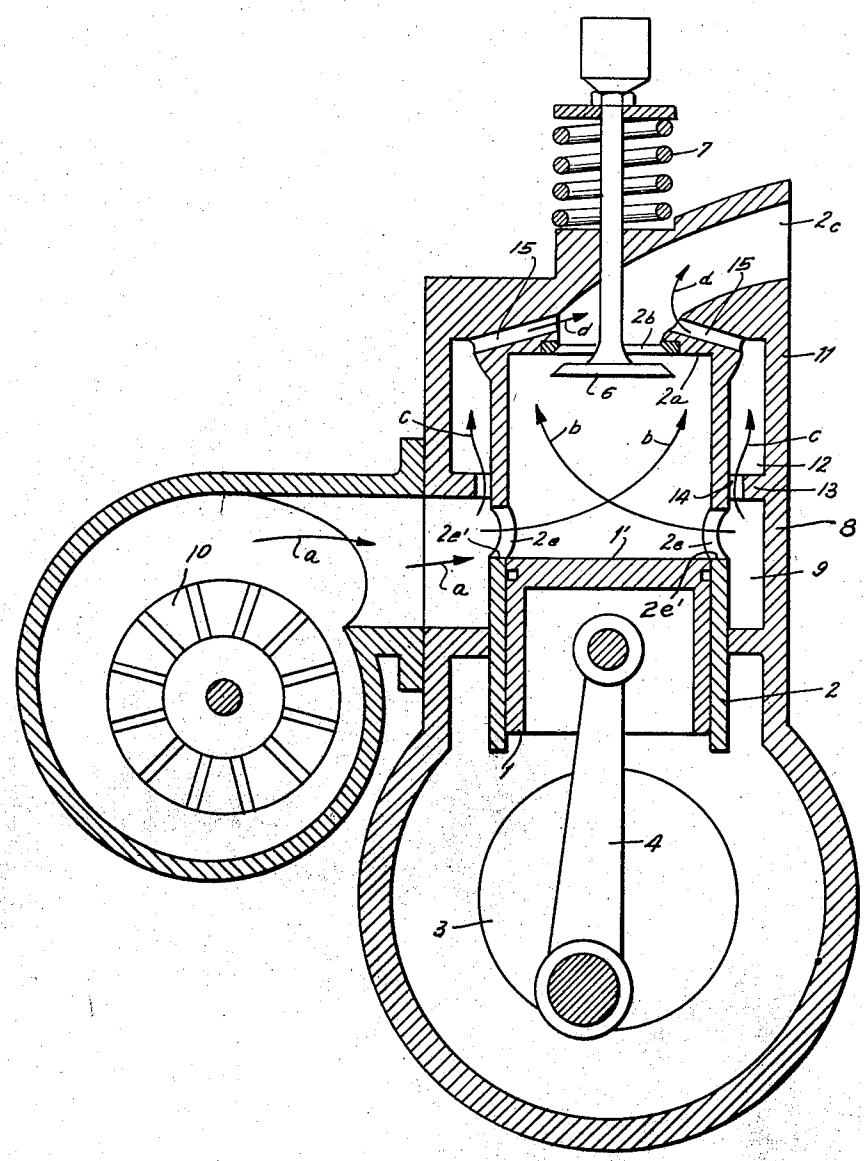
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INTERNAL COMBUSTION ENGINE

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INTERNAL COMBUSTION ENGINE

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The present invention relates to internal combustion engines.

More particularly, the present invention relates to a scavenged internal combustion engine in which burned gases are removed from a cylinder after a work stroke.

There exist scavenged internal combustion engines in which scavenger gas is supplied through the intake port or ports of a cylinder for the purpose of removing burned gases after a work stroke. The ports are controlled by the piston which reciprocates within the cylinder so that the ports are alternately closed and opened. In order to avoid excessive pressure fluctuations during operation of the engine due to the alternately open and closed cylinder ports, suitable venting means are sometimes provided through which gas supplied by a blower or other source of pressure may escape at such times as the cylinder intake port or ports are closed. Thus, the gas supplied by the source of pressure is wasted. Also, in such arrangements the gas located near the inlet port or ports is, during the time these ports are closed, relatively stationary and is therefore heated while waiting to enter into the interior of the cylinder. As a result only pre-heated gas enters the cylinder once the ports are open, thereby destroying any cooling effect which might otherwise be obtained from the scavenger gas.

It is therefore an object of the present invention to provide a scavenged internal combustion engine which overcomes the above disadvantages.

It is another object of the present invention to provide a scavenged internal combustion engine in which the scavenger gas is efficiently used for cooling purposes.

With the above objects in view, the present invention mainly consists in that improvement in a scavenged internal combustion engine which comprises a cylinder formed with spaced intake and exhaust port means, blower means for blowing gas in excess of the quantity required for scavenging, first flow guide means arranged exteriorly of the cylinder in the region of the intake port means and communicating with the blower means, and second flow guide means extending through that portion of the cylinder which is in the region of the exhaust port means thereof and communicating with the first flow guide means at a point downstream of the intake port means. As a result, when the intake port means are open gas blown by the blower means is blown into the cylinder, thereby scavenging the same, and when the intake port means are closed gas blown by the blower means is moved past the intake port means and through the above-mentioned portion of the cylinder in the region of its exhaust port means, thereby cooling this portion of the cylinder.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the

accompanying drawing, in which the figure is a sectional elevational view of an internal combustion engine incorporating a scavenging system according to the present invention.

Referring now to the drawing, there is shown a piston 1 slidably arranged within a cylinder 2 and connected to a crank shaft 3 by means of a piston rod 4. The cylinder 2 has an end portion including an end wall 2*a* formed with an exhaust port 2*b* which communicates with the exhaust 2*c*, a suitable valve seat 5 being provided for receiving a valve 6. The latter is constantly urged to its closed position by a spring 7, and a suitable cam mechanism (not shown) is provided for periodically moving the valve to its open position against the action of the spring 7.

The cylinder 2 also has a side wall 2*d* which is formed with intake ports 2*e* that are axially spaced from the end wall 2*a*. An annular housing portion or flow guide 8 encompasses the cylinder 2 in the region of the intake ports 2*e* so as to form an annular channel 9 which is in communication with a blower 10 so that gas blown by the blower will be directed toward and into the intake ports 2*e*, as shown by arrows *a*.

Another annular housing portion or flow guide 11 encompasses that portion of the cylinder 2 which is intermediate the intake ports 2*e* and the end wall 2*a* so as to form an annular jacket 12. The annular channel 9 and the annular jacket 12 are separated by a transverse wall portion 13 which extends but partway across to the cylinder 2, so that an annular slot 14 is formed the inner diameter of which is equal to the outer diameter of the cylinder 2. Thus, the lower end of the jacket 12 is in communication with the channel 9 by way of this slot 14, and inasmuch as substantially all of the gas blown by the blower 10 moves past the intake ports 2*e* before flowing through the slot 14, the latter is located downstream of these intake ports 2*e*. As a result, gas blown by the blower 10 is blown through the ports 2*e* when the latter are open as indicated by the arrows *b*, thereby scavenging the cylinder 2, whereas when the ports are closed by the piston 1, gas blown by the blower will be moved past the ports 2*e* and thence through the slot 14 into the annular jacket 12 as indicated by the arrows *c*, thereby cooling the outer surface of the intermediate portion of the cylinder 2.

The cylinder 2 is formed with additional conduit means 15 which extend through that portion of the cylinder which is in the region of the exhaust port 2*b*. The conduits 15 communicate at one end thereof with the upper end of the jacket 12 and at the other end with the exhaust 2*c*. Thus, gas flowing through the jacket 12 will pass through the conduits 15 and thence into the exhaust 2*c* as indicated by the arrows *d*. In this way, not only will the intermediate portion of the cylinder 2 but also that portion of the cylinder which is in the region of the exhaust port 2*b* be cooled.

By virtue of the above arrangement, gas is continuously moved past the inlets 2*e*, even when the same are temporarily closed by the piston 1. Consequently, the air will not be pre-heated during the time elapsed between the arrival of a mass of air at the intake ports 2*e* and the opening of the ports by the piston 1, so that only non-preheated gas is introduced into the interior of the cylinder 2 through the intake ports. In this way, a substantially greater cooling effect is obtained from the scavenger gases than in constructions wherein no means are provided for insuring the continuous flow of gases past the cylinder intake ports. Moreover, the continuous flow of gas past the intake ports prevents the accumulation of deposits on the cylinder 2 in the region of its intake ports.

Additionally, the use of scavenger gases to cool the exterior of the cylinder 2 greatly improves the efficiency of an internal combustion engine in comparison to constructions wherein in order to avoid pressure fluctuation of the scavenger gases the same are simply vented to atmosphere.

It has been found desirable to provide blower means capable of blowing a quantity of gas which is in excess of that quantity of gas required for scavenging the cylinder. This excess quantity of gas may then be used for cooling not only the exterior of the cylinder but also the interior thereof as well as the piston. Preferably, the quantity of gas should be so selected that the cylinder and the upper face 1′ of the piston will be cooled to the temperature normally prevailing in the cylinder at the beginning of the work stroke.

It has also been found desirable to mount the piston in such a manner that when it occupies its lowermost position (which is the position shown in the figure) the upper face 1′ of the piston is substantially flush with the lowermost edges 2e′ of the intake ports 2e. In this way, the scavenger gases entering through the ports 2e will flow along the upper face 1′. This cooling effect may be enhanced by providing at least two diametrically opposite intake ports 2e.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of scavenged internal combustion engines differing from the types described above.

While the invention has been illustrated and described as embodied in an internal combustion engine with a separate scavenger gas blower, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention. For example, the crankcase compression of the cylinder or any other suitable pressure source may be used to move the scavenger gases.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a scavenged internal combustion engine, in combination, a cylinder having an end wall formed with exhaust port means and a side wall formed with intake port means axially spaced from said end wall; blower means; first flow guide means arranged exteriorly of said cylinder in the region of said intake port means and communicating with said blower means; and second flow guide means extending through that portion of said cylinder which is in the region of said exhaust port means thereof, encompassing said cylinder throughout substantially that portion of its length which is intermediate said intake port means and said end wall and communicating with said first guide means at a point downstream of said intake port means, whereby when said intake port means are open gas blown by said blower means is blown into said cylinder thereby scavenging the same, and when said intake port means are closed gas blown by said blower means is moved past said intake port means, along the outer surface of said portion of said cylinder which is intermediate said intake port means and said end wall and through said portion of said cylinder in said region of said exhaust port means thereof, thereby cooling both of said portions of said cylinder.

2. In a scavenged internal combustion engine, in combination, a cylinder having an end wall formed with exhaust port means, a side wall formed with intake port means axially spaced from said end wall; and an exhaust portion adjacent said end wall and formed with an exhaust communicating with said exhaust port means; blower means; flow guide means arranged exteriorly of said cylinder in the region of said intake port means and communicating with said blower means; an annular jacket encompassing that portion of said cylinder which is intermediate said intake port means and said end wall, said jacket communicating at that end thereof which is near said intake port means with said flow guide means; and conduit means extending through that portion of said cylinder which is in the region of said exhaust port means thereof, said conduit means communicating at one end with the end of said jacket which is near said end wall, and at the other end with said exhaust which is in communication with said exhaust port means, whereby when said intake port means are open gas blown by said blower means is blown into said cylinder thereby scavenging the same, and when said intake port means are closed gas blown by said blower means is moved past said intake port means and through said jacket and said conduit means into said exhaust, thereby cooling both of said portions of said cylinder.

3. In a scavenged internal combustion engine, in combination, a cylinder having an end wall formed with exhaust port means and a side wall formed with intake port means axially spaced from said end wall; and an exhaust portion adjacent said end wall and formed with an exhaust communicating with said exhaust port means; blower means; flow guide means arranged exteriorly of said cylinder in the region of said intake port means and communicating with said blower means; an annular jacket encompassing that portion of said cylinder which is intermediate said intake port means and said end wall, said jacket being formed at that end thereof which is near said intake port means with an annular slot the inner diameter of which is substantially equal to the outer diameter of said cylinder so that said jacket is in communication with said flow guide means by way of said annular slot; and a conduit means extending through that portion of said cylinder which is in the region of said exhaust port means thereof, said conduit means communicating at one end with the end of said jacket which is near said end wall, and at the other end with said exhaust which is in communication with said exhaust port means, whereby when said intake port means are open gas blown by said blower means is blown into said cylinder thereby scavenging the same, and when said intake port means are closed gas blown by said blower means is moved past said intake port means and through said jacket and said conduit means into said exhaust, thereby cooling both of said portions of said cylinder.

4. In a scavenged internal combustion engine, in combination, a cylinder having an end portion formed with exhaust port means and a side wall formed with intake port means axially spaced from said end portion; blower means operatively associated with said cylinder for blowing a quantity of gas through said intake port means thereof which is approximately so much in excess of the quantity of gas required for scavenging said cylinder that said cylinder is cooled by gas blown by said blower means to the temperature normally prevailing in said cylinder at the beginning of the work stroke; first flow guide means arranged exteriorly of said cylinder in the region of said intake port means and communicating with said blower means; and second flow guide means extending through said end portion of said cylinder and encompassing said cylinder throughout substantially that portion of its length which is intermediate said intake port means and said end portion and communicating with said first guide means at a point downstream of said intake port means, whereby when said intake port means are open gas blown by said blower means is blown into said cylinder thereby scavenging and cooling

the same, and when said intake port means are closed, gas blown by said blower means is moved past said intake port means, along the outer surface of said portion of said cylinder which is intermediate said intake port means and said end portion and through said end portion of said cylinder in said region of said exhaust port means thereof, thereby cooling both of said portions of said cylinder.

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