

Course in Gas Engineering

This Course will consist of a series of practical talks on the theory and practice of the gas, gasoline and oil engine. They will be simple, illustrated where necessary, and of such a nature that the gas engine owner may easily adapt them to his daily engine work.

LESSON III.

The Meaning of Cycle in a Gas Engine

In the practical operation of a gas engine there are several stages, each characterized by a particular event. The cylinder is charged by an outstroke of the piston, creating a vacuum behind it

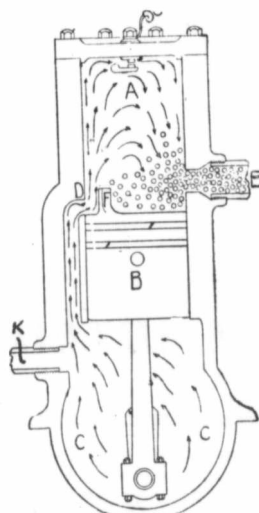


FIGURE I
Theoretical Condition of Gas, 2 Cycle.

and drawing in a mixture of air and gasoline gas formed in the carburettor or mixer. The charge is then compressed by the return stroke of the piston which act secures complete carburization of the contained air, and reduces the mixture to the proper condition, to be kindled by the igniting spark or other source of firing. This causes it to explode or to expand suddenly and with great effect and drive the piston outward again. The fourth stroke which is the one immediately following the explosion is known as the exhaust stroke, from the fact that the piston moving back again in the cylinder, expels the products of combustion through the exhaust valve. This process completed, the parts are in position for a repetition of the process, the valves for admitting gasoline to the cylinder then being opened again.

The word cycle is somewhat of a misnomer. We speak of two cycle and four cycle engines, but if we were to be exactly correct, we should say two stroke cycle or four stroke cycle, meaning that it takes two and four strokes respectively to perform the operation of suction, compression,

working and exhaust. In other words, the two cycle engine administers an impulse to the piston at every complete revolution of the fly wheel, while on a four cycle engine the impulse is administered only once in two revolutions.

It is quite a common matter for one to mix up cycle and stroke. They do not mean the same by any means, for the word cycle means all that has to be done in the cylinder to make the engine work, viz., suction, compression, working stroke and exhaust. Where a great many get mixed up

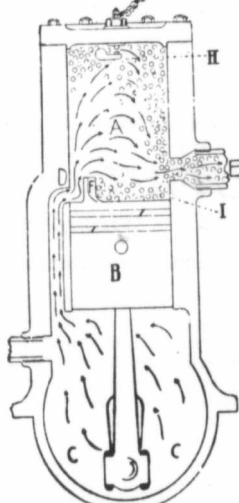


FIGURE II
Actual Condition of Gas, 2 Cycle.

is in thinking that stroke and revolution mean the same thing. Take for example, a four cycle engine and turn it over so that the piston is at the back end of the cylinder. Now turn it over so that the piston is at the front end and you will see that that is one stroke, but remember that you have only turned the crank half way around. When you turn it back to where it started from you will see that the piston has gone to the back end of the cylinder, which is another stroke. This piston has thus made two strokes, while the crank has only made one revolution.

Referring to figure (1) you will see just how the two cycle engine works. If the piston (B) were at the top of the cylinder, it would come down on the working stroke and at the same time put a light compression on the mixture in the base or crank case (C) which is made air tight. As the piston gets toward

the end of its stroke it uncovers the exhaust port (E) and the exhaust rushes out through it as the piston keeps travelling down and back again until the port is covered. In the meantime, after the exhaust port is opened the piston uncovers the inlet port (D) and the charge which was under compression in the base rushes in and is turned towards the top of the cylinder by the deflector (F) and by this means helps to force out more of the exhaust. The piston travels by closing ports, draws into the base a fresh mixture through the pipe (K) to which is attached the mixer or carburettor, having a check valve so as to hold the charge in the base. The piston on the rest of the way up compresses the charge in the cylinder and when near the top ignites it and starts down on the working stroke again.

You may ask the question, why are not two cycle engines in more general use? The one answer to this seems to be that they are not as economical in the use of fuel

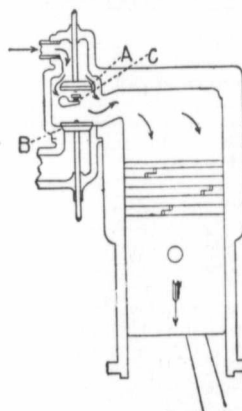


FIGURE III
Suction Stroke 4 Cycle.

as the four cycle type. This may be explained somewhat as follows. By referring to figure (1) you will see that the arrows stand for the new charge and the circles for the exhaust, and you will also see just how nicely the new charge is pushing out the exhaust. If it worked out in just this way the two cycle engine would be just the thing, but it does not. What really happens is like figure 2; and you can see how things get mixed up, some of the new charge going out with the exhaust and some of it mixing with what is left. So it does not make a good burning mixture and uses more gasoline to do the same amount of work

than a four cycle would. Figure 1 is what it shows out to on the drawing and figure 2 is how it acts when at work.

A prominent gas engine authority remarks, "The two cycle engine at best is the next thing to an impossibility." By this statement he means that the act of admitting inflammable fuel into the mixture already flaming with gas, without igniting it, involves something closely approaching a contradiction in physical conditions. Were it not for the fact that the burning gases actually exhaust faster than the new mixture is admitted under impulse to their inherent expansion, ignition of the new charge would seem to be nearly inevitable. By deflecting the incoming mixture to the rear end of the cylinder, it follows the rapidly expanding exhaust coming into contact with it only when the expansion has so far reduced the temperature that the danger of pre-ignition is averted. It may be readily seen, however, that the danger of such interference or at best of a contamination of a new charge to a point rendering it unignitable, must result if the speed be increased beyond a certain moderate rate.

Despite statements to the contrary, there have been a number of two cycle gas engines placed upon the market that have met with a fair degree of success and the time may not be far distant

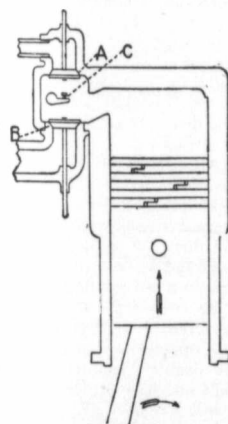


FIGURE IV
Compression Stroke 4 Cycle.

when the gas engine designer will perfect something that will work.

The four cylinder engine works as follows: The piston travels down on the suction stroke through the inlet valve (A) in figure 3. When the piston reaches the lower end of its stroke