

the valve (A) closes and the piston on the return stroke (figure 4) compresses the mixture in the cylinder and when near the top ignition takes place at (C). The piston now travels down on the working stroke (figure 5) and when approaching the lower end the exhaust valve (B) is opened. The exhaust valve is held open during the entire up-stroke (figure 6,) and the piston pushes the exhaust all out; or to be exact, not quite all for the clearance space at the top has always some gases left in, but you can see that it clears the exhaust far better than the two cycle does.

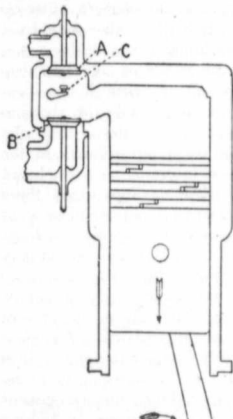
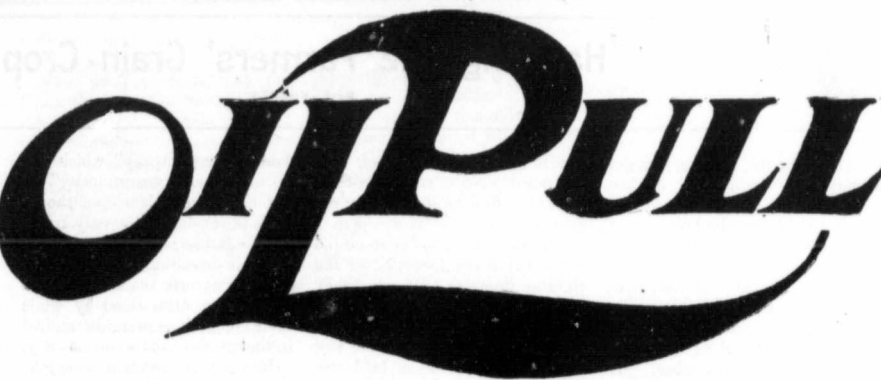


FIGURE V
Working Stroke 4 Cycle.

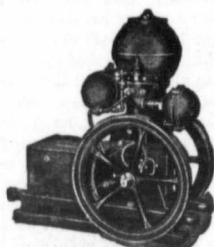
It may be explained more fully in another way. The four strokes two outward and two inward, constitute what is known as the cycle and as we have said before there is thus only one power impulse for every two revolutions of the fly wheel. This power stroke also continues while the crank is travelling through half a revolution or through an arc of 180°. It is also evident that the cam for operating the valve system of the cylinder revolves once for every two revolutions of the crank shaft with which it is geared. Thus is secured the opening of the charging or inlet valve and of the scavenging or exhaust at precisely the proper points in the cycle.

The operation of a four cycle engine may be understood more fully by figures 3, 4, 5 and 6. Supposing we have a four cylinder motor, the cranks of whose four pistons are so fixed that counting from figure 3 to figure 6 we have cylinders representing the four operations of the cycle; that is to say the suction or supply stroke, figure 3, the compression stroke, figure 4, the explosion or working stroke figure 5, the exhaust figure 6.

In such an engine the crank is turned by a steady impulse, since a new explosion would occur in each 90 degrees of rotation. At the aspirating or supply stroke, the outward movement of the piston, by creating a partial



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vacuum, causes the feed valves to open under atmospheric pressure, thus indicating that the pressure within is lower than that of the atmosphere without. At explosion the volume and temperature are raised, and at the end of the exhaust stroke the burned gases are expelled. The supply stroke being completed, and the feed valves closed by force of a spring, there is no considerable increase in volume and pressure due to contact with the hot cylinder walls, nor yet from the residuum of products in the clearance, although, owing to the tension of the valve spring, the pressure of the contained gases is below one atmosphere. The rise in pressure during the supply stroke is from a negative point to generally about 13.50 pounds to the square inch. So soon, however, as the compression stroke begins, the indicator tracing shows a steady rise to 65 or 70 pounds to the square inch, at the completion of the stroke, according to the compression ratio, as will be presently explained.

At the end of the compression stroke the gas mixture in cylinder has attained its greatest density, also its greatest pressure and temperature previous to combustion.

It is then ready for firing, which is generally accomplished very shortly before the piston begins the second out-stroke, the explosion serving to bring the gas to the maximum point for volume, pressure and temperature alike. In fact, the effect, as shown by thermometer and indicator tests,

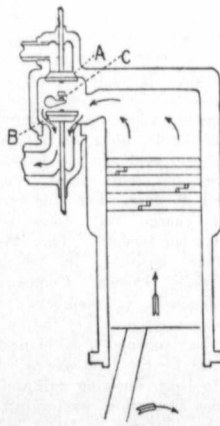


FIG. 6.
Exhaust Stroke 4 Cycle.

is that the temperature in a gas-engine cylinder rises during this

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stroke from between 500 to 700 degrees, absolute, as noted when the engine is running at good speed, to between 1,500 and 2,000 degrees, on the average, and the pressure from an indicated 65 or 70 pounds to 200 or 230 pounds per square inch. The fall in both particulars is equally rapid during the succeeding in-stroke, when the burnt gases, under impulse from the piston, are expelled through the open valves.

Regarding the time of firing practice differs considerably. Generally, as stated above, it is slightly before the beginning of

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