

-28- The temperature becomes higher than the ignition point of the fuel.

(C) Combustion Stroke (See Figure 2-3) With the intake valve S and exhaust valve E closed, as the piston (P) approaches the end of the compression stroke, that is, slightly before the crank reaches top dead center, high-pressure fuel is injected in a mist from the fuel injector. This fuel ignites spontaneously upon contact with the high-temperature air. The fuel undergoes explosive combustion within the cylinder, and the rapid expansion force of the combustion gas pushes the piston down, which in turn becomes the rotational force of the crankshaft via the connecting rod. This stroke is called the combustion stroke or power stroke.

(D) Exhaust Stroke (See Figure 2-3) With the exhaust valve E open, as the piston rises past bottom dead center, the combustion gas is discharged into the atmosphere, and is completely exhausted when the piston reaches top dead center. In the combustion stroke, slightly before the piston (P) reaches the bottom dead center of the crank, the cam opens the exhaust valve E.

#### Figure 2-4 Indicator Diagram of 4-Stroke Engine

As described above, the crankshaft makes two rotations during the piston's (P) four strokes (two reciprocations), and the power stroke during this period occurs only once.

Figure 2-4 shows the indicator diagram (PV diagram) of a 4-stroke engine. When gas is introduced into the cylinder and the piston is pushed in from position A to position B, or conversely, when the piston is pushed from position B to position A by the expansion force of the gas, the pressure is generally represented by P on the vertical axis and the volume is represented by V on the horizontal axis in order to show the change in the state of the gas in the cylinder. The relationship between the two (the change in gas volume and pressure in the cylinder) is shown in the diagram.

If the volume when the piston is at A is  $V_1$  and the pressure is  $P_1$ , then the volume when the piston is at B is  $V_2$  and the pressure is represented by  $P_2$ . This diagram is called the PV diagram or indicator diagram.



