

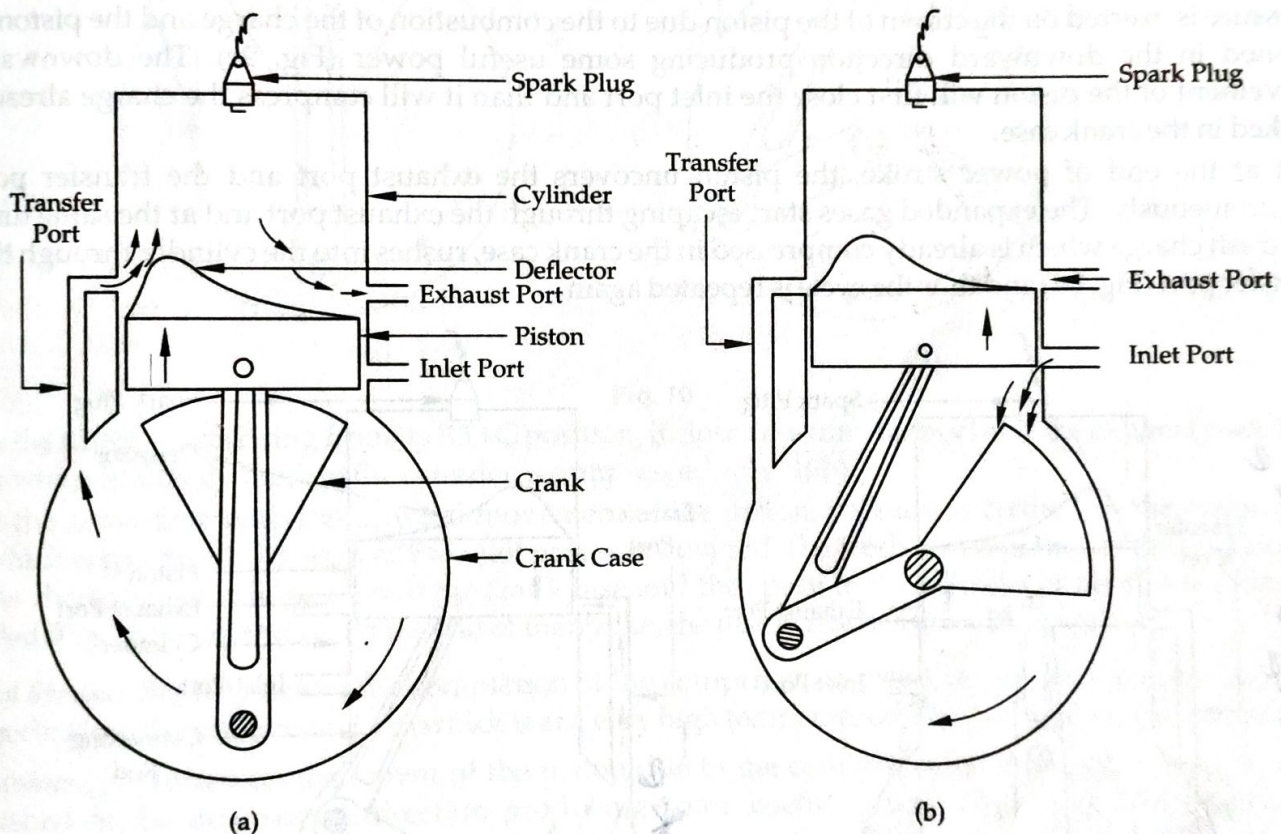
the rise in pressure of the gases. This high pressure rise drives the piston in the downward direction, thereby producing some useful work. This stroke is completed as the piston reaches its B.D.C position. It is the only stroke during which power is produced by the engine. This is why this stroke is also called power stroke. (shown in Fig. 8(c)).

**4. Exhaust stroke:** This stroke starts with the piston at the B.D.C position. The inlet valve remains closed whereas the exhaust valve is opened. The upward movement of the piston pushes the burnt gases out of the cylinder through the exhaust valve. This stroke is completed as the piston reaches the T.D.C position. At the end of exhaust stroke, the exhaust valve is also closed.

These four strokes complete one cycle which may be repeated again and again to produce power (shown in Fig. 8(d)).

### 9.3 TWO STROKE CYCLE

The two stroke cycle petrol engine was invented by Sir Dugald Clerk in 1880 and diesel engine by Sulzer Brothers in 1907. In the four stroke cycle the suction, compression, expansion and exhaust are completed during the four stroke of the piston or during the two complete revolutions of the crankshaft.



**Fig. 9** Working principle of 2 stroke Petrol Engine

Whereas in the case of two stroke cycle, these operation are completed during the two strokes of the piston or during one complete revolution of the crankshaft.

In other words in the two stroke cycle, one working stroke is completed per revolution of the crankshaft. Thus theoretically, the two stroke engine should produce double the power as produced by the four stroke engine of the same size, but actually it is not possible due to number of losses which are difficult to eliminate in practice.



The two stroke engine does not possess the valves, but instead, it has inlet and exhaust ports cut in the cylinder wall and also a transfer port which connects the crank case with the cylinder as shown in Fig. 9. The crank case is made gas tight and the piston also acts as a valve, covering and uncovering the ports at the right movement.

### 9.3.1 Working principle of 2-stroke petrol engine

The working principle of a two stroke petrol engine is discussed below:

**1st stroke:** To start with let us assume the piston to be at its B.D.C position (Fig. 9a). The arrangement of the ports is such that the piston performs two job simultaneously.

As the piston starts rising from its B.D.C position, it closes the transfer port and the exhaust port. The charge (mixture of the air and petrol) which is already there in the cylinder, as the result of the previous running of the engine, is compressed (Fig. 9b). At the same time, with the upward movement of the piston, vacuum is created in the crank case (which is gas tight). As soon as the inlet port is uncovered; the fresh charge is sucked in the crank case. The charging is continued until the crank case and the space in the cylinder beneath the piston is filled (Fig. 9c) with the charge. At the end of this stroke, the piston reached the T.D.C position.

**2nd Stroke:** Slightly before the completion of the compression stroke, the compressed charge is ignited by means of a spark produced at the spark plug.

Pressure is exerted on the crown of the piston due to the combustion of the charge and the piston is pushed in the downward direction producing some useful power (Fig. 9c). The downward movement of the piston will first close the inlet port and then it will compress the charge already sucked in the crank case.

Just at the end of power stroke, the piston uncovers the exhaust port and the transfer port simultaneously. The expanded gases start escaping through the exhaust port and at the same time the fresh charge which is already compressed in the crank case, rushes into the cylinder through the transfer port (Fig. 9d) and thus the cycle is repeated again.

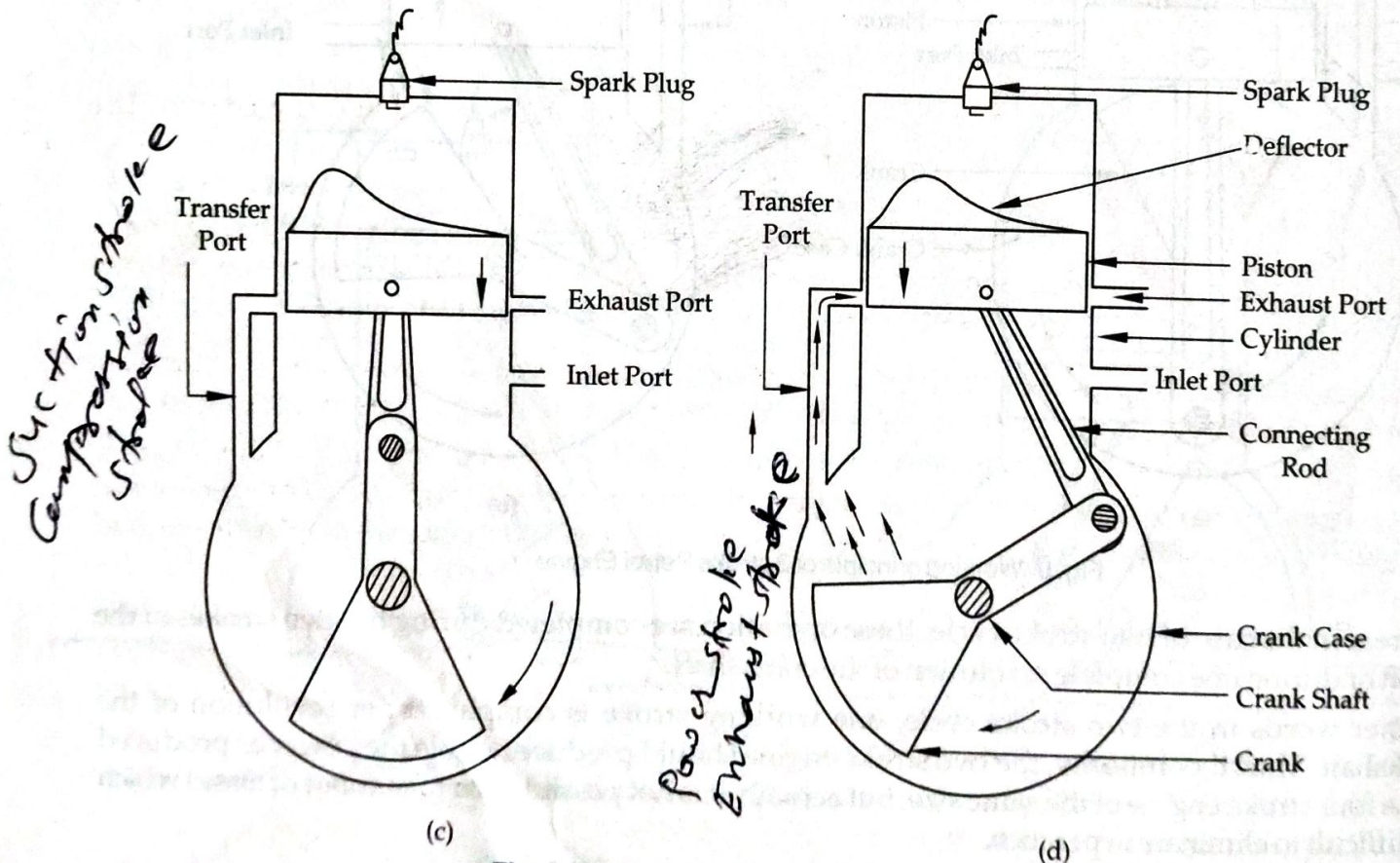


Fig. 9 Working principle of 2 stroke petrol Engine



The fresh charge, coming into the cylinder also helps in exhausting the burnt gases out of the cylinder through the exhaust port (Fig. 9d). This is known as scavenging.

### 9.3.2 Working principle of 2 stroke diesel engine

The working principle of a two stroke diesel engine is discussed below:

**1st stroke:** To start with let us assume the piston to be at its B.D.C position (Fig. 10a). The arrangement of the ports is such that the piston performs the two job simultaneously.

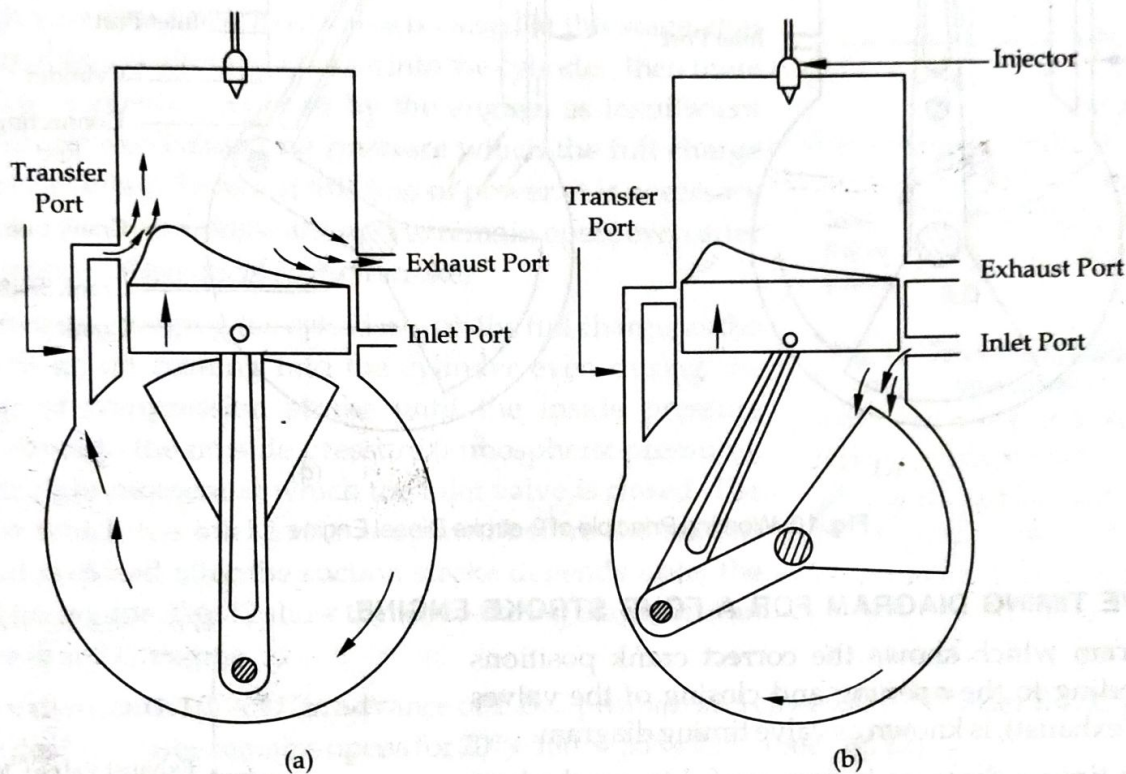


Fig. 10

As the piston starts rising from its B.D.C position, it closes the transfer port and the exhaust port. The air which is already there in the cylinder is compressed. (Fig. 10b).

At the same time with the upward movement of the piston, vacuum is created in the crank case (which is gas tight). As soon as the inlet port is uncovered, the fresh air is sucked in the crank case. The charging is continued until the crank case and the space in the cylinder beneath the piston is filled (Fig. 10c) with the air. At the end of the stroke, the piston reaches the T.D.C position.

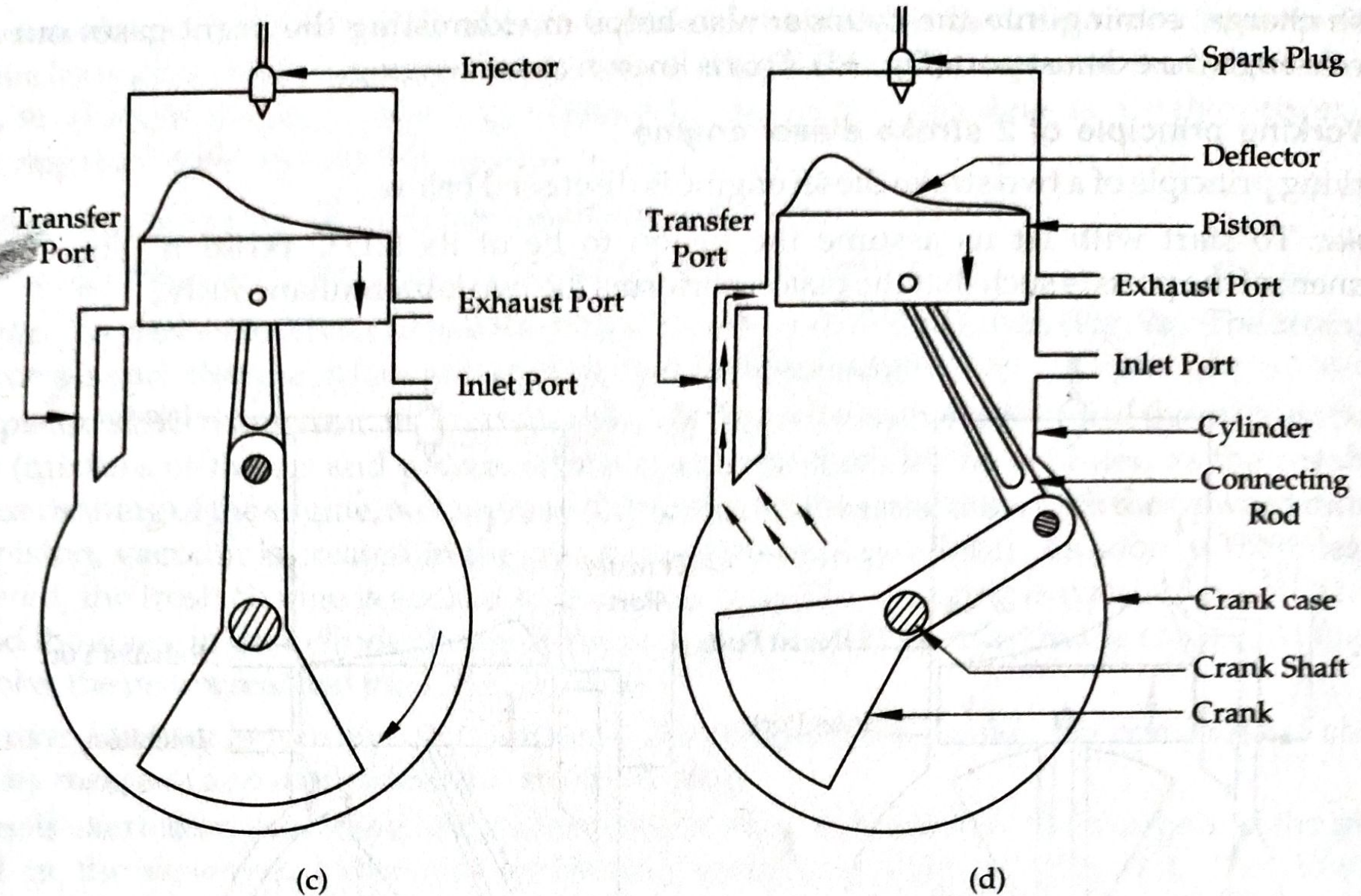
**2nd Stroke:** Slightly before the completion of the compression stroke, a very fine spray of diesel is injected into the compressed air (which is at a very high temperature). The fuel ignites spontaneously.

Pressure is exerted on the crown of the piston due to the combustion of the air and the piston is pushed in the downward direction producing some useful power. (Fig. 10c). The downward movement of the piston will first close the inlet port and then it will compress the air already sucked in the crank case.

Just at the end of power stroke, the piston uncovers the exhaust port and the transfer port simultaneously. The expanded gases start escaping through the exhaust port and at the same time the fresh charge which is already compressed in the crank case, rushes into the cylinder through the transfer port (Fig. 10d) and thus the cycle is repeated again.

The fresh air coming into the cylinder also helps in exhausting the burnt gases out of the cylinder through the exhaust port (Fig. 10d). This is known as scavenging.





**Fig. 10** Working Principle of 2-stroke Diesel Engine