(v) Can run for longer duration.
(vi) Adaptable to stationary works.
(vii) Not affected by weather.
(viii) Speed of operation varies considerably.
(ix) Timeliness of operation.

Disadvantages of Tractor Power

(i) High initial cost.
(ii) Requires skill of operation.
(iii) Repairs and maintenance needs technical knowledge.
(iv) Creats problem of fuel storage.
(v) Lay up of the tractor will stop the work.
(vi) Limited overload capacity.

(B) Electric Power:

One of the major inputs adopted by the Indian farmers for modernization of agriculture in irrigation pumps. The irrigated area has increased from 21 million hectare during 1950 to 1955 million hectares in 1997 as shown in Table. The population of electric motor-operated pumps has incrased from 1.6 millions in 1970 to 12 million in 1997 and the diesel engine pumps from 1.7 to 5.5 million as shown in Table 1.1.

Advantages of Electric Power:

(i) Cheapest cost of operation per unit energy.
(ii) Highest efficiency.
(iii) Can work at stretch.
(iv) Maintenance and operating cost is very low.
(v) Requires lesser space for installation.
(vi) No maitentance is required when not in use.
(vii) Not affected by seasons.
(viii) Adaptable to varying speeds.

Disadvantages of Electric Power:

(i) Higher initial cost.
(ii) Limited over load capacity.
(iii) Requires costly transmission system.
(iv) Risky if not handled carefully.
(v) Requires good amount of technical knowldege.

1.4. Other sources of power: Besides, animate (human and animal) and inanimate (mechnical and electric), Renewable energy is also used as power

Chapter 8
Ignition System of I.C. Engine

8.10 Introduction

Ignition system is an arrangement of different components to ignite fuel inside the cylinder. The ignition has to be performed at a pre-set timing. If it is not done a appropriate time, engine may not produce sufficient power or may run of erretically or may run at all.

8.2. Requirement of an Efficient Ignition System: The following are the main requirements of efficient ignition system:

(i) Spark must occur continuously at appropriate time.

(ii) These should not be any misfire.

(iii) The spark should be strong enough to ignite the charge.

(iv) The ignition should be simple cheap and contained as a compact unit.

(v) The system should be operated at all engine speeds.

(vi) The maintenance, repair and servicing of the ignition system should be easy and convenient.

8.3 Classification of Ignition System: The following system are used for igniting the fuel in various internal combustion engine:

(i) Open flame system

(ii) Hot surface system or ignition by hot tube or hot bulb.

(iii) Compression ignition system or ignition by heat of combustion.

(iv) Electric spark system.

Only the last two are important methods for modern engines.

8.4 Compression Ignition System: Compression ignition is the chief characteristics of diesel engines, due to which they are often termed as compression ignition (C.I.) engines. It utilizes the heat developed due compressing the charge to a very high compression ratio. A pressure of nearly 3000 to 3500 kPa is developed by a compression ratio of 15:1 to 17:1 producing a temperature of 450 to 550°c, which is high enough to explode the fuel.

SUBJECTIVE QUESTIONS:

1. Define the terms: (i) Ignition system (ii) Spark advance (iii) electrolytes
2. What are the different systems of ignition in an I.C. engine? Describe the principle of ignition by heat of compression.
3. What do you mean by battery ignition system? Describe the working of this system with the help of neat sketch.
4. What are different components of lead-acid battery?
5. What is the function of an ignition coil? How does it work? Explain its working with neat sketch.
6. Describe with a neat sketch the working of magneto ignition system.
7. How does ignition taken place in a diesel engine? How does it differ from spark ignitions engine?
8. Why the compression ratio of diesel engine is higher than that of petrol engine?
9. What is the difference between hot and cold plug?
10. What are the functions of the spark plug?

MULTIPLE QUESTIONS

1. In. I.C. engine, the spark plug electrode gap setting varies from
   (a) 1.0 to 1.2 mm (b) 0.5 to 0.85 mm
   (c) 0.1 to 0.2 mm (d) 1.5 to 1.8 mm
2. A cold spark plug disappears the heat through
   (a) short path (b) big path
   (c) both (d) none of the above
3. The main function of distributor of ignition of system of engine is, to
   (a) open the primary circuit (b) close the primary electrical circuit
   (c) both (d) none of the above
4. The primary winding of ignition coil is made of mm dia of copper wire
   (a) 1.0 mm (b) 1.5 mm
   (c) 0.8 mm (d) none of the above
5. The function of condenser in battery igntion system is, to
   (a) produce a quick collapse of magnetic field in the coil
   (b) produce a high voltage
   (c) both
   (d) none of the above
6. The common type of battery used in tractor i
   (a) lead-acid battery (b) dry battery
   (c) both (d) none of the above

between this fin. The core is composed of a large number of individual air cells which are surrounded by water. Because of its appearance the cellular type is usually known as honey comb radiator, especially when the cells in front are hexagonal shape. The different forms of cellular cores are shown in Fig. 9.7.

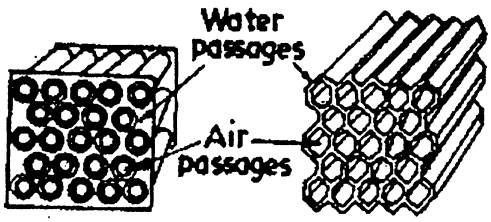

Fig. 9.7. Cellular Type Core

Radiators are usually made of copper and brass because of their heat conductivity.

9.7.2. Water Pump:

A coolant pump is necessary for forced circulation type engine cooling system. The pump is mounted at the front end of the engine and is driven from the crank shaft by means of a V' belt. Centrifugal type pump is the one which is used for this purpose. Fig. 9.8 shows the centrifugal type coolant pump. The coolant from the radiator enters the pumps at the centres where inlet is located. The flow of the coolant depends upon the pump speed which is proportional to engine speed. The scroll is connected in front of the engine to direct the conduct to the block. For 'V' engine the coolant pump has two outlet one for each bank of cylinder.

The main parts of the pump are a casing and shaft mounted impeller having a number of vanes. The impeller shaft is mounted on bearing while the real serve to prevent the leakage of the coolant around the shaft.

When the impellar rotates, the coolant between the vanes is thrown due to the centrifugal force, thus forcing the cooled coolant at the periphery with a force depending upon the speed of rotation of the pump spindle which itself is proportional to the engine speed. This water leaving the periphery of the impeller tangentially and having maximum Kinetic energy, then outers the involute, which is smoothly curved passage cast in the casing, whose cross-section gradually increases towards the outlet port. Thus, the scroll converts the kinetic energy of the coolant to pressure energy.

In this way a coolant pressure created at the pump outlet that forces he coolant through the cooling system.