

UNIT-I

When two or more cells are connected together it is termed as battery. It is used for storage of charges and the stored charges can be used at the required time. The other names of battery are Secondary cell or Accumulator

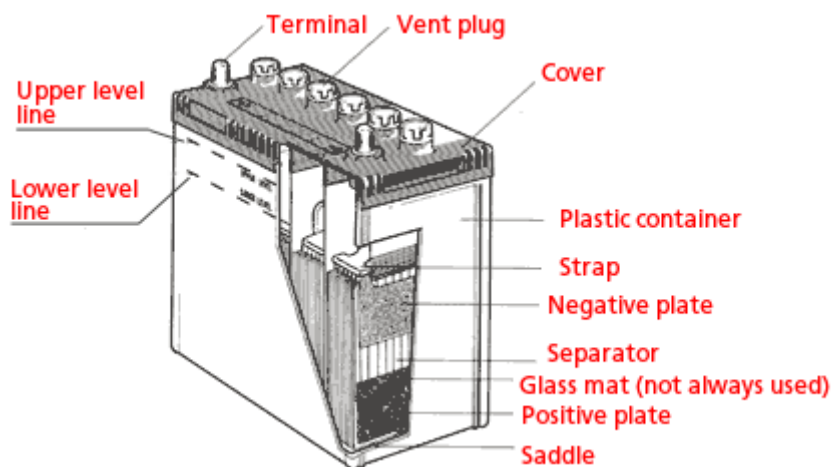
Types of Battery:

- Lead Acid Battery
- Nickel Iron Battery
- Nickel Cadmium Battery

Lead Acid Battery

The lead acid battery is the most common among these are used i automobiles.

CONSTRUCTION



There are two types of plates in Battery, They are i) Positive plates ii) Negative plates. These plates are placed across each other and are supported by a Rectangular grid. The Positive plates are made of Lead Pr Oxide(PbO_2) , the negative plates are made of Spongy lead and the grid is made of lead Antimony Alloy. Generally the no of negative plates are

more than the number of positive plates. For eg: for a cell made of 19 plates there will be 10 negative plates and 9 positive plates.

SEPARATOR

The positive plates and negative plates are Isolated with each other by a separator. The separator is made of isolating material like wood, paper, ebonite or rubber. These separators are perforated, so that the electrolytes can easily pass through the separators.

PLATE GROUP

The positive plates and the negative plates are welded to a strap which is made of lead antimony alloy. This strap is attached to a cylindrical post which is made to project outwards. There are called as terminals. Normally the dia of the positive plates is more than denoted by +ve sign and the dia of negative plates is small and is denoted by –ve sign.

CELL CONNECTOR

Each cell in the battery are connected in a series manner,i.e the positive terminal of a cell is connected with the negative terminal of other cell.

CONTAINER

This is made of rubber or thick plastic Bituminous. The container help in avoid leakage of charges and to prevent erosion. The inner part of the container is made into compartments in accordance to the number of cell, i.e for 6v battery there are 3compartments. Each compartment are separated by ribs. This ribs helps in avoiding short circuit during Breakage or corrosion of cells.

CELL COVER

This is used for covering the cell from the top. In this holes are made to connect the positive terminal and negative terminal of the Battery to the load, the other holes in these cell are used to pour electrolytes into cell.

SEAL COMPOUND

This is used to bind the cell cover and the container

VENT CAPS OR VENT PLUGS

These are used for opening and closing of vents in the cell cover. The vent caps has the following uses of battery

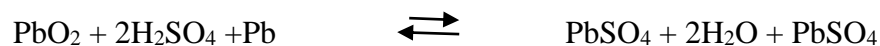
- ❖ They are used for pouring electrolyte into the battery
- ❖ They are used to discharge the H₂ gas that is evolved during charging of battery

ELECTROLYTE

This contains 1:3 proportion of con Sulphuric acid and water

BATTERY DISCHARGING

It is a process of using the charge stored in the battery to run the electrical components in the automobiles. During discharge the following chemical reaction take place



The following changes occurs in electrodes

- i) The positive plate changes from pale yellow to whitish colour. The negative plate changes from Grey to white colour
- ii) The specific **rarity** of electrolyte changes from 1.28 to 1.18

iii) The potential diff changes from 2.1 V to 1.8 V

BATTERY CHARGING

+ve and -ve to D.C

BATTERY TESTING

The battery can be tested by the following methods

1. Specific gravity test
2. Voltage test
3. Cadmium test

SPECIFIC GRAVITY TEST



The specific gravity of an electrolyte can be found out using Hydrometer. It consists of a rubber bulb at the top. A graduated float is placed inside this glass tube. The rubber bulb is attached to the top and a nozzle is attached to this bottom of the glass tube.

Testing :

The vent cap in the battery is opened and the hydrometer is placed inside the vent cap. The rubber bulb is pressed and released so that it sucks the electrolyte from the battery through the nozzle. During this process the graduated float will begin to float inside the glass tube. During this process, a part of the float will be immersed inside the electrolyte, which indicates the specific gravity of the electrolyte. The float is a measure of the specific gravity of the electrolyte. The electrolyte can be poured back into the battery after the testing is done.

The following table indicates the charge level of the battery.

Specific Gravity	Battery Charge Level
1.26 – 1.280	Fully Charged
1.230 – 1.250	3/4 Charged
1.200- 1.2200	1/2 Charge
1.170 – 1.190	1/4 Charged
1.110-1.130	Battery Discharge

The following factors should be considered when doing a specific gravity test:

- i.) The testing should not be done immediately after filling the electrolyte with distilled water.
- ii.) If the level of electrolyte is less than 10mm, the level has to be increased by pouring distilled water. In such cases the testing has to be done by operating the battery for a while after increasing the level.
- iii.) The S.A should not be tested when gas is evolved from the battery. When measurement is done at this instance it won't give accurate specific gravity.

Voltage test:

This test is used to check the terminal voltage of the battery when full load is drawn by electrical components in the automobile. This is done using high rate

Discharge Tester

It consist of two insulated metal jaws which are isolated from each other. In between the two jaws a high resistance and a voltmeter are connected

When these jaws are connected to positive and negative terminal of the battery, the charge flows through the discharge tester. During this process the voltmeter will gets deflected. The pointer in the voltmeter is calibrated for fully charged and discharged condition of the battery. If the potential **drop** between the ends. i.e 1.8v then there is defect in the battery.

Cadmium test

This is used to test the condition of the positive and negative plates of the battery. A cadmium tester is used for this purpose . when the cadmium tester is dipped in electrolyte and connected to positive terminal of the battery the potential drop should be less than 2.5V. If its less than 2.5V, it indicates there is a problem in positive plates of the battery. Similarly when the tester connect to negative terminal of the battery the potential drop should not more than 0.2V. If more than 0.2V it indicates there is a problem in negative plate of the battery.

Battery capacity

The amount of current discharge from the battery is called as battery capacity. This indicates the total time that a battery can discharge the specified quantity of time. The

capacity of a battery depends on the area of the plates, quantity of electrolytes and temperature.

Battery capacity = current x time

= Ampere x hr

For eg: if a battery has rating of 100ah, the battery can discharge 20A of current for 5hrs.

Normally for a 1000cc engine 40Ah battery for 1500-2000cc engine 43Ah to 50Ah for 3000cc engine 50Ah -70Ah batteries will be connected.

Battery rating

There rating of a battery can be done by four testing

- i.) 20-hr rate
- ii.) 20 minute rate
- iii.) 25 ampere rate
- iv.) Cold rate or Zero rate

20-Hr Rate

This rate used to test the performance of a battery at minimum load condition. In this the test is done after the battery has discharged the charges for 20hrs. After discharge of charge for 20hrs the potential of the cell should not be less than 1.75V on testing, the temperature should be at 26°C.

20Min Rate

This test is done to check whether a battery could be able to produce a potential of 1.5V continuously for 20min of time

25 Ampere test

At constant supply of charge at 27°C, the potential of the battery should be 1.75V

Cold test or Zero test

This test is done to identify the temperature taken by the battery to discharge 300Amp of current till its potential becomes less than 1V. The temperature of the battery should be brought 0°F (-18°C) before performance this test.

+ve 2.5V, 0.2V cadmium test

Battery Efficiency

Am-hr efficiency = $\frac{\text{Ah on discharge}}{\text{Ah on charge}} \times 100$ Watt hour efficiency = $\frac{\text{WHr on discharge}}{\text{WHr on charge}} \times 100$

RECHARGING METHOD OF BATTERY

A battery can be recharged by three methods

1. Constant current method
2. Constant voltage method
3. Trickle charging method

CONSTANT CURRENT METHOD

In this method a lamp charging board is used for charging of batteries. A carbon filament lamp is placed in this board which is connected in parallel to the input supply to the battery. A constant current can be supplied to this battery through this arrangement. In some cases, a variable resistance is placed instead of the carbon filament lamp. This

resistance can be varied in accordance with the ammeter reading and the required current can be passed into the battery.

In this method, one or more batteries can be charged by connecting them in series [generally 6A-10A current is passed for 10hours for charging of batteries through this method. The temperature should be maintained less than 45°C during charging of batteries by this method]. Since this method takes more time for charging, the life time of battery also gets increased by this method.

CONSTANT VOLTAGE METHOD

In this method, the battery is charged by passing constant voltage to the battery. In this method the batteries are connected in parallel for charging. During charging of battery by this method ,initially during charging the voltage will be low and current will be high. Later some times the current is reduce and the voltage becomes high. Since the charging time is less by this method, this type of battery is also less than when charging is done by this method.

TRICKLE CHARGING METHOD

If the charged battery is kept idle for long time, the battery get discharged, to avoid this trickle charging method is used. In this method a metal rectifier is used for continuous supply of D.C supply to this battery.

Symptoms of good charged Battery

If the battery is fully charged, oxygen gas is evolved from +ve plate and H₂ is evolved from –ve plates of this battery. This process is called as gasing

The potential in the battery will be 2.1V

The positive plates will be pale yellowish and Negative plate will be grey in colour

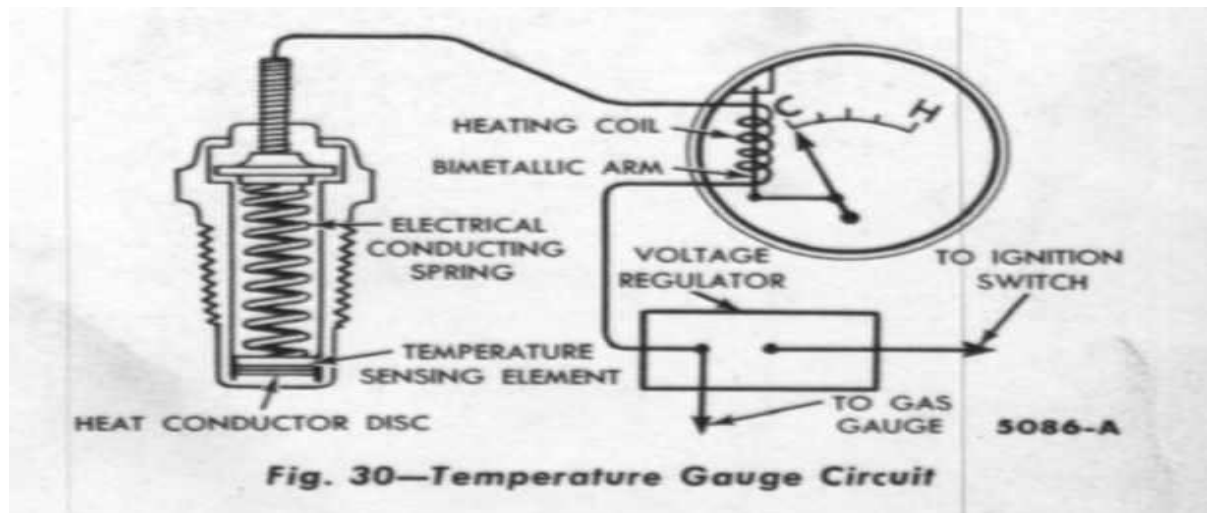
MAINTENANCE OF BATTERY

1. The electrolyte should not get spilled out from the top of this battery
2. The electrolyte should be maintained at a level of 2cm above the plate
3. The charging and discharging of batteries should be done at regular interval
4. Then vent caps should be removed during recharging of batteries
5. The terminal of the battery should be coated with petroleum jelly
6. Tools like spanner, screw driver should not be placed on batteries
7. The discharge battery should not be kept on vehicle for long time
8. While servicing battery the negative terminal should be removed
9. The air vent in the vent cap should be kept clean
10. The vent cap should be removed during charging of battery.

BATTERY TROUBLES

1. Self discharge: → by self → 1%/day → Normal
3 or more % → Serious defect
2. Loss of water
3. Cracking of container mech sufer cracks outer water
4. Corrosion of battery terminal changes
5. Deterioration of plate high charging/discharge of plate
6. Internal short circuiting
7. Discolouring of electrolyte
8. Sulphatrom

TEMPERATURE GAUGE



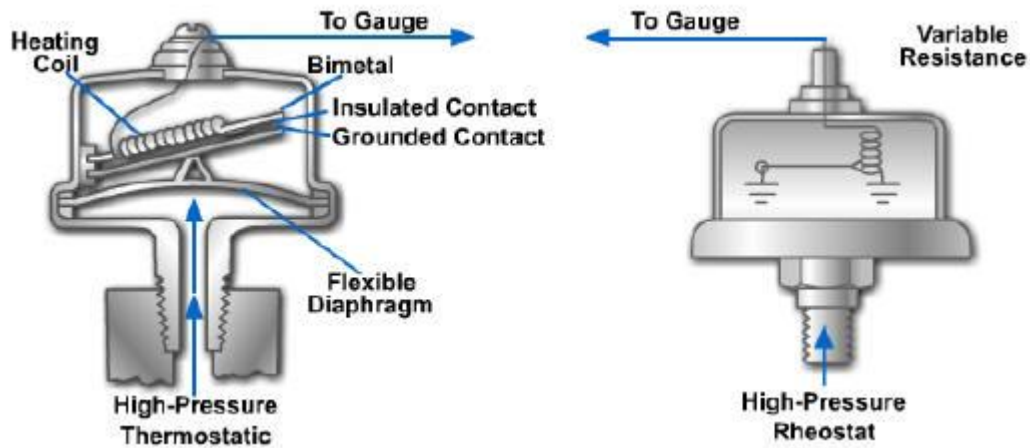
This is used to check the temperature at the coolant used in the engine. Based on the construction and functioning the entire part of the gauge can be separated into two sections. They are temperature plug and temperature gauge.

The temperature plug is immersed inside the coolant that is stored in the water jacket. The temperature gauge is fixed in the dashboard of this vehicle.

The temperature gauge consists of two coils, a pointer and a resistance. When the temperature of the engine gets increased, the temperature of the coolant will also increase. Due to this increase in temperature the resistance value decreases, so more current is passed through the coil. The magnetic fields produced due to this current try to pull the pointer towards the right. When this temperature reduces the above process is reversed and the pointer will move towards the left.

OIL PRESSURE GAUGE

The schematic diagram for the oil pressure gauge is shown in the figure. It consists of two units. They are



- Dashboard Unit
- Oil tank gallery unit.

The dash board units consist of a pointer which indicates the pressure of the oil inside the tank. This pointer is placed in between two magnetizing coils. One end of this coil is connected to the battery through the ignition switch and the other side connected to the variable resistor.

The oil tank gallery unit consists of a diaphragm, a slider and a small vent. The slider is placed over the diaphragm. The pressure from the oil tank is given to the diaphragm through the small vent.

When the oil level in the tank is full the pressure inside the tank will be high. Due to this the diaphragm is pushed upwards. The slider which makes the contact between the diaphragm and the variable resistance is moved to the right end of the variable resistance. The resistance of the circuit at this condition will be less so more current flows through the coil. The magnetic field produced around the coil will make the pointer in the dashboard to move to the right end. When the oil level gets decreased this process is reversed and the pointer moves to the left end.

EARTHING SYSTEM IN AUTOMOBILES.

There are two types of earthing system followed in automobiles. They are

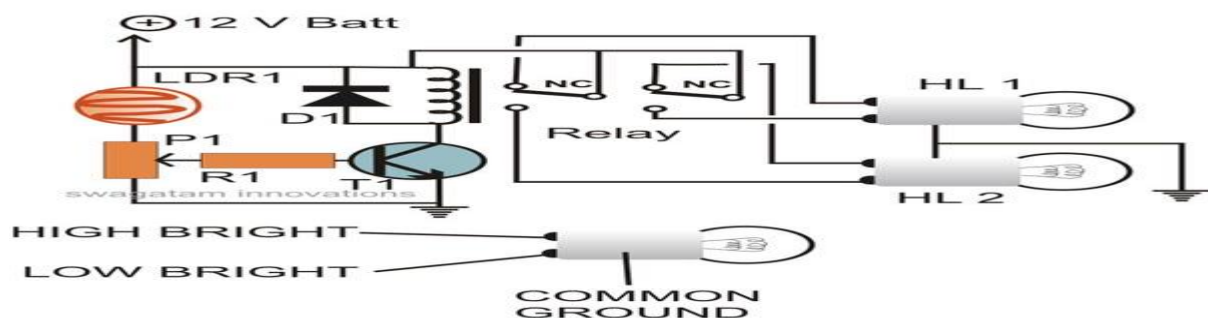
- Positive Earthing System
- Negative Earthing System

In earlier days Negative earthing system was followed. This has many drawbacks. These drawbacks are overcome by using the positive earthing system

The advantages of positive earthing system are

- Corrosion in the central spark plug electrode is avoided
- Erosion of battery terminals are avoided
- Effective firing of fuel by spark plug.

Head Light



The schematic diagram for the head light is shown in the figure. It consists of a bulb and a concave silvery polished reflector. The bulb contains two filaments. They are dim and dip filaments. A dipping device is used to alternate between the dip and the dim options. The

reflector is used to reflect the lights incident on it. These reflectors are adjusted with the screws provided at the left and the right end of the head light.

Head Light Dazzling

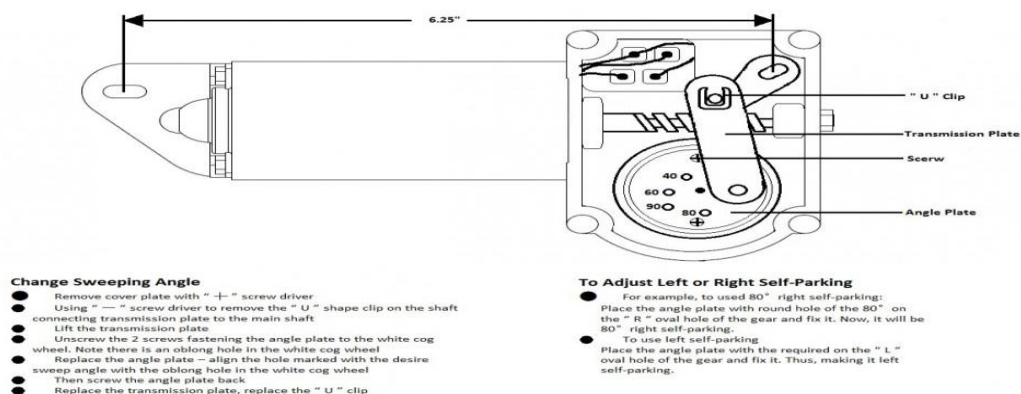
Head light Dazzling is nothing but the brightness which cause interference to the vision. The various factors which governs the dazzling are

- Brightness
- Contrast
- Angle subtended by the bright area in the eye.

Dazzle can be prevented by

- Reducing the brightness of the headlights in Vehicle
- Stopping high intensity light from entering the eyes
- Reducing contrast between surrounding area and the headlight of the vehicle.
- By using appropriate dipping device at the appropriate places.
- By using bifocal lamp.

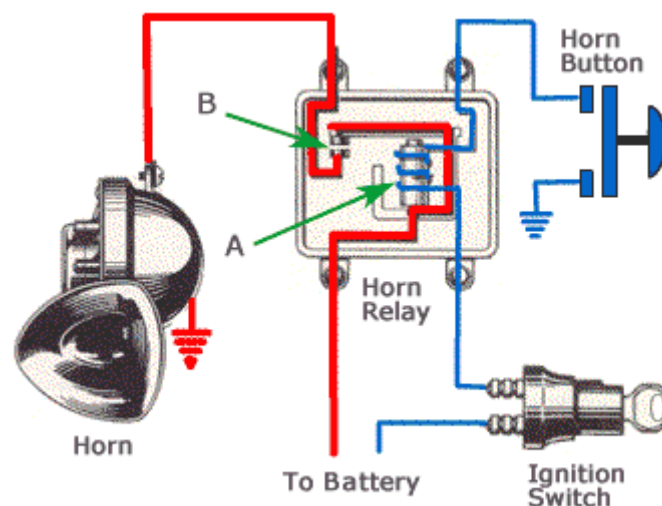
WIPER SYSTEM



The wind shield wiper aids the driver to operate the vehicle during rainy seasons. It consists of one or two rubber blades. These blades are operated by the compound field motor. The motor shaft is connected to the worm shaft. The worm gear is connected to the crank. The other end of the crank is connected to the cable rack. A pinion gear is placed at the bottom of the wiper arm.

When the motor gets rotated, the rack is moved in the forward and in the reverse direction. This makes a rotation in the pinion. Due to this the wiper and the blades also get rotated. This makes the wiper blades to move in the forward and in the reverse directions. This motion of the wiper blades will wipe off the water from the wind shield.

HORN



The schematic diagram of a horn is shown in the figure. It consists of field coils. The field coils will receive the current from the battery. The field coils are placed near the field armature and to the armature a diaphragm is connected. When the horn switch is pressed, the field coils will draw some quantity of current from the battery. Due to this current a magnetic field is produced around the field coil. This field will make the diaphragm to vibrate and the vibrations of the diaphragm are reflected as sound.