UNIT-7

AUTO ELECTRICAL SYSTEMS

AUTO LIGHTING SYSTEM

In order to illuminate the roads and high ways sufficiently for safe night driving, the lightingsystem is generally used in motor vehicles. It is generally provided with two or more beamsproviding maximum illumination for night or darkness driving. For passing the other vehicles on the road, they are designed in such way as to deflect them to the ground as well as to theside of the road for minimizing glare. For the city driving, a third beam of low intensity is also used.

An auto lighting system consists of head lamp side, tails, stop and reverse lamps. In order to illuminate the passenger compartments instruments panels, direction indicators, flash lights are provided inside the vehicle body and special lights to illuminate the key holdsfor the ignition. Flashing light signals or traffic caters are also provided both at the front as well as the rear to indicate the other drivers, the direction in which the motors vehicles about to turn.

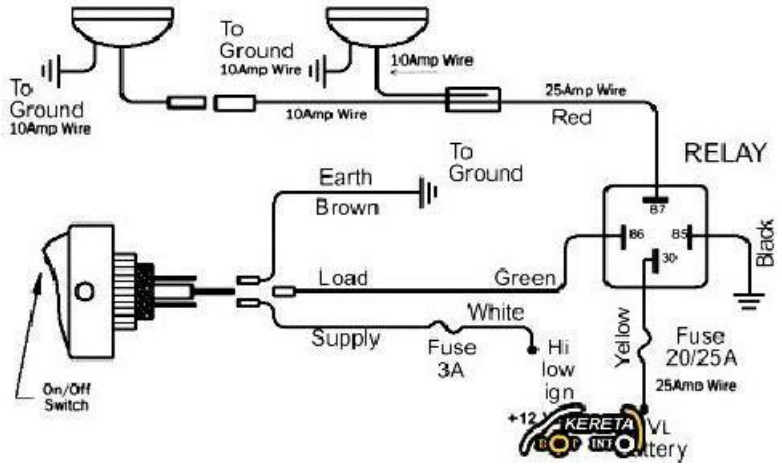


Fig.7.1 Lighting system

WORKING OF HEAD LAMPS

Head lamps are capable of providing a powerful light for safe night driving for early detection of the obstacles .It must also provide more widespread illumination at the road side for some distance ahead of the motor vehicle so that pedestrians stopping out from the kern could be picked out. It should also provided indication to driver about his position on the roadas well as provide lights for cornering, but this power main beam should not dazzle an oncoming driver. For this purpose a dipped beam is also provided for maintaining thereasonable speed with safety.

Fig.7.2: Head lights

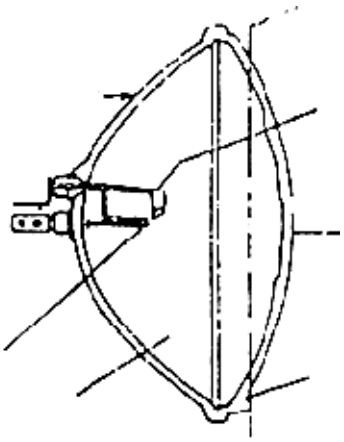


Fig.7.3: Sealed Beam unit

An electric lamp consist of cover reflector, bulb holder and lens. Now modern head lights are provided with sealed beams, which consist permanently sealed glass less and reflector containing two filaments, upper and lower. When the lighting switch is put 'ON' current from the battery flows into the lighting circuit and glows the lights. By means of dipper or beamcontrol switch, the driver can change form high to low beam of light to meet the required traffic conditions. While coming across a vehicle form opposite direction, the high beam filaments is put off and sitting down filaments glows for safe driving.

WORKING OF SIDE OR PARKING LIGHT

During night time, it is necessary that a motor vehicle must exhibit to the front a white light and to the rear a red-light warning to the approaching vehicles about the parking of a vehicle on the road side. A parking lamp is usually fitted about 30 cm form the outside edge of vehicle. It can be wired either through a detachable plug and socket.

WORKING OF TAIL OR STOP LIGHTS

These are lights are at the tail of the vehicle which provide red signal for the vehicle coming behind. Tail lights are put on and off by a switch provided at the dash board and are keptglowing all the way while the vehicle is going in darkness.

Stop Lights

These provide s stop or slowing down signal and glows with the operation of foot brake. These lights are operated by means of a switch fitted at the outlet of master cylinder bythe brake pedal.

Dash Light

Electric lamps fitted at the dash board to provide light of visibility of different gauges andswitches are known as dash lights.

DIRECTION SIGNAL LIGHTS

The direction indicators permit the driver to signal his intension to make a right for left turn. Whenever the driver intends to take turn, an illuminated red arm will be shown on the side ofthe vehicle. A pilot light is provided on the instrument Panel light to indicate the working ofdirection indicators. In modern vehicles, the flash type of direction indicator is made of standard filaments the indicators lamp flashes will continue 'ON' and 'OFF' for 60 to 80 perminute till the direction indicator switch is closed.

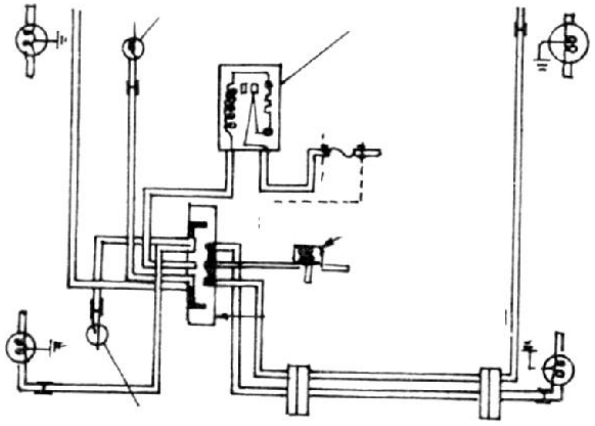


Fig.7.4: Direction Signal system

HORN SYSTEM

Horn is a sound creating device, mostly electrical horns are used in all the automobiles vehicles. When the horn is operated it creates load vibrating sound indicating that vehicle is coming so that the passengers or the other slow moving vehicles may clear off the path to pass it. Horn is used as calling bell to call the person when the vehicle is ready to start toclear the way

CONSTRUCTION AND WORKING OF HORN CIRCUIT

It consists of a armature, a diaphragm, a windings and a pair to contact points connected in series. When the horn button is pushed, it connects the horn winding to the battery. Then thecurrent passing through the winding produces the magnetic field which pulls the armature down, creating a loud click. The armature is attached to a diaphragm.

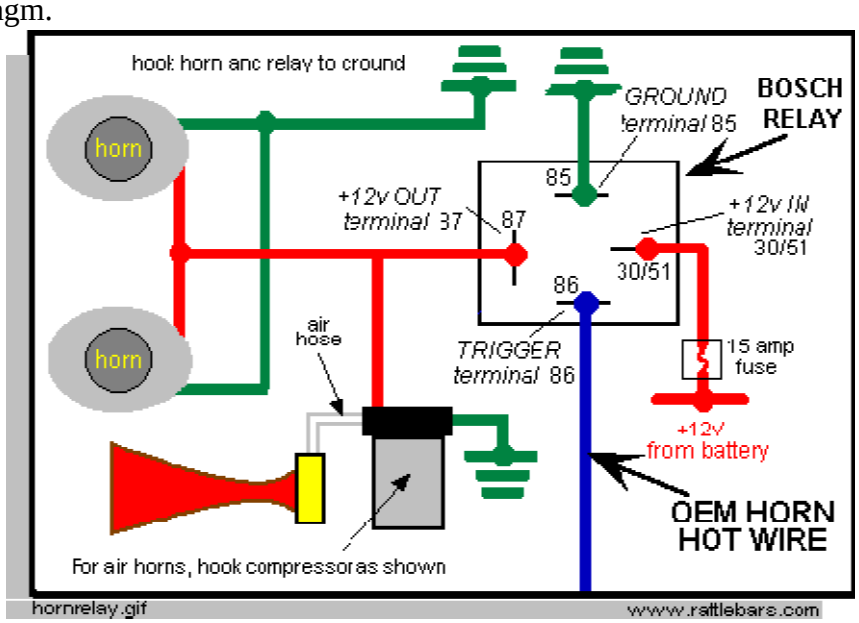


Fig.7.5: Horn Circuit

The movement of the diaphragm opens contact points, due to which the circuit is broken. Thecycle is repeated rapidly, this rapid movement of the diaphragm produces distinctive noise. The tone pitch of horn depends upon the size and shape of the diaphragm mostly. A relay is also used in some systems to avoid carrying heavy current required by the horn through the steering column and back. The relay closes its contact to connect the horn to the battery.

This way the voltage drop in the wiring from battery to horn is eliminated and higher voltageis available for operating the horn with better performance.

STARTER MOTOR

The starting system of an automobile is used to start the internal combustion engine. Both S.I.and C.I. engines cannot start by itself, these engines need to be cranked by a starting motor.

This motor is also called a starter or crank motor. Cranking of any engine means rotating its crank shaft. Rotation of crank shaft causes to piston to reciprocate. when the piston reciprocates, suction, compression, expansion, and exhaust strokes of engine are completed. Thus the engine completes the working cycle and it starts running.

CONSTRUCTION AND WORKING OF STARTING MOTOR

The piston engines are not self-starting. They are incapable of running below a certain minimum speed. Therefore, it is necessary to provide certain system in the

engine circuit,which should provide high starting torque to start the e n g i n e . Because of producing their peak torque under locking condition, invariably series motor are used as starters. The construction of starting motors is similar to the generator except that the conductors, brush gear and terminal are heavier to with stand the high current, of the order of 400-600 AMPS, flowing for very short duration.

Construction

The main parts of the starting motor are casing, armature, commutator, field winding, brushes, poles and terminals. A drive mechanism is provided at the end of the armature shaft.The starting motor uses either two field winding or four field winding.

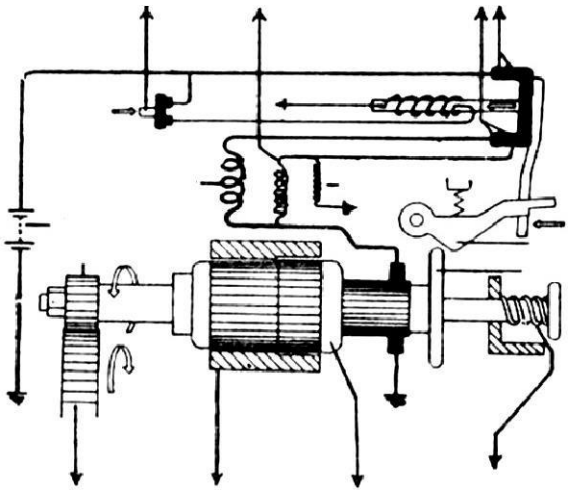


Fig.7.6: Starting Motor

The current from the battery divides when it enters the motor, each the branch leading to separate field winding. From the fields, the current is led to the commutator of the armature through the two insulated brushes. The current in the armature creates simultaneously four poles that adjacent to the four field poles to produce the attractive and repulsive forces that turns the armature. The armature current returns to the battery through the two grounded brushes.

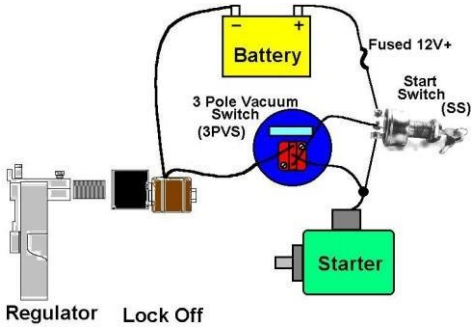


Fig.7.7: Starter Circuit

WIND SCREEN WIPER

These are used to provide adequate forward vision under all conditions of weather to ensure safe driving. Wiper makes the front and back screens of the vehicle dust free and to get clear view of the road when it is raining. All present-day vehicles are equipped with electrically operated wind shields wipers.

WORKING OF WIPER

The wind screen wiper is used to make the front and back screens of the vehicle dust free and to get clear view of the road when raining. In some automobiles where compressed air is available the wind shield wiper are operated with the help of it. However, practically all p r e s e n t -day automobiles are equipped with electrically operated wind shield wipers. The wind shield wiper is manufactured both in 12 and 24V. The diagram shows a compound wound motor wiper incorporate thermal with overlap trip. A thermostat type of circuit breaker is incorporated to safe guard the motor against severe over loading caused due to ice or hard snow. It also shows normal and fast speed operation position.

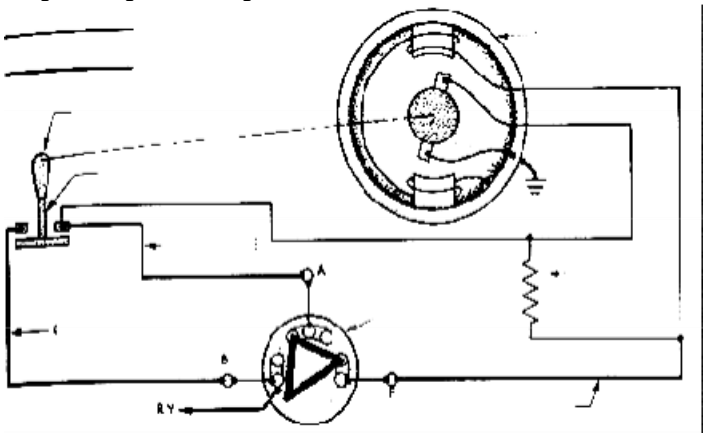


Fig.7.8: Wind Screen Wiper Circuit

IGNITION SYSTEM

Ignition process can be considered as initiation of burning a small spherical volume of air fuel mixture entrapped between the spark e l e c t r o d e s . Energy in the form of high intensity spark is supplied to this minimal volume. Thus, the basic requirements of the ignition system is to supply the necessary energy with in a small volume in a time sufficiently short to ensure that minimum energy is lost other than needed for the establishment of the flame under all conditions of operations.

BASIC IGNITION SYSTEMS

(i) Battery ignition system
(ii) Magnet ignition system
(iii) Electronic ignition system

(i) Battery ignition system

It consists of a battery, ammeter, switch, ignition coil, condenser, contact breakers, distributor and a spark plug. The primary ignition circuit starts at the battery and passes through the switch, ammeter, primary winding, contact breaker points. One end of the condenser is connected to the contact breaker arm and the other end is grounded. The secondary ignition circuit is not connected electrically to the primary ignition circuit. It starts from ground and passes through the secondary winding, distributor and spark plug to ground.

The ignition coil step up 6 to 12 V of battery to get high tension voltage about

20,000 volts to 30,000 volts required to jump the spark at the spark plug gap, which ignites the combustible charge in the cylinder. The rotor of the distributor revolves and distributes the current to the different cylinders. The purpose of condenser is to reduce arcing at the breakingpoints and there by prolonging their life.

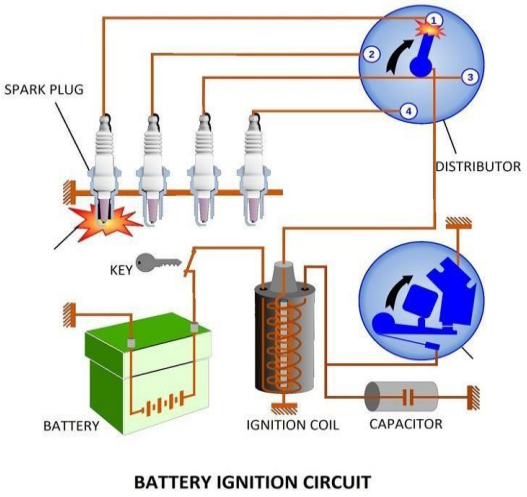


Fig.7.9: Battery Ignition Circuit

When the ignition switch is on, the current will flow from the battery to the primary winding. It produces magnetic field in the coil. When the contact points open, the magnetic field collapses and the movements of the magnetic field induces high voltage current in the secondary winding coil. Because the secondary winding has many more turns about 21,000 turns, the voltage increase up to 30,000. About 15,000 volts are necessary to make the spark to jump at 1 mm gap. The distributor directs this voltage to the proper spark plug, producing a spark which ignites the combustible mixture in the c y l i n d e r .

(ii) Magnet Ignition System

In magneto ignition system uses magneto instead of a battery, which produces and supplies current to the primary winding. The remaining arrangement in this system is the same as that in the battery coil ignition system. Here the magneto consists of a fixed armature having primary and secondary windings and a rotating magnetic assembly which is driven by engine power. When the magnet rotates, the current flows in the primary winding. The secondary winding gives high voltage to the distributors, which distributes it to respectivespark plug.

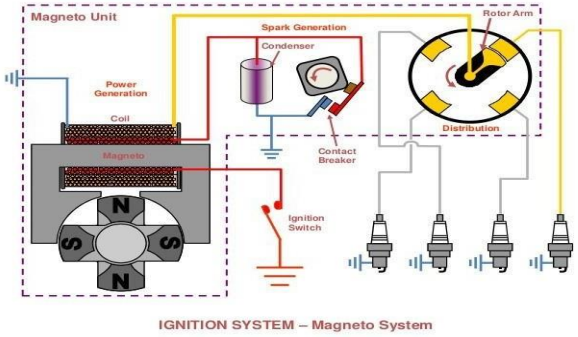


Fig. 7.10: Magnetic Ignition System

(iii) Electronic Ignition System

This ignition system is more suitable to racing cars due to their very high rate of engine running. This system can partly overcome the electrical limitations of the conventional method. The problem of contact ware and erosion are avoided but the mechanical problems, like heel wear and bounce associated with the contact breaker at very high speeds are still left. For developing an improved system of ignition which must be able to provide a constant sparking rate per sec. the first step should be elimination of the contact breaker.

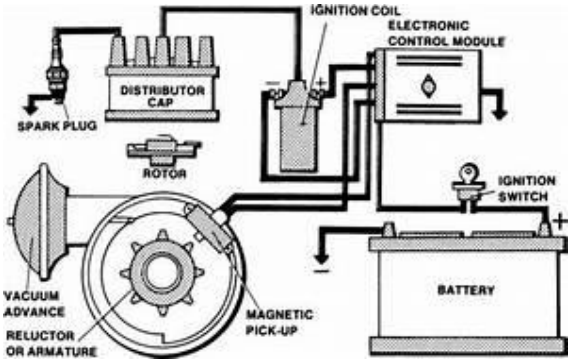


Fig.7.11: Electronic Ignition system

CHECKING AND REPLACEMENT OF FUSES

Depending on the fuse design, it is sometimes possible to tell whether it has blown by holding it up against a light; a break in the wire inside may be visible. Another clue is blackening of the glass cover. If there is no visible sign, check by fitting another fuse of the same rating; if that cures the trouble, then the fuse was to blame.

However, it is always advisable to check the circuit also, in case a fault in it caused the fuse to blow. For example, failure of an electrical component or damaged insulation on a cable can cause a short circuit, resulting in a sudden massive increase in current.

If the cable overheated, there could be a fire. The fuse prevents that happening, because its thin wire will melt and break the circuit long before the cable itself can heat up and burn.

Some cars have only two fuses. One rated at about 30-50 amps protects components wired through the ignition switch — flashers, wipers, heater-motor and instruments. The other, probably rated at about 20-30 amps, protects components not wired through the ignition— horns, interior lights and the cigarette lighter.

Where a single fuse protects a number of circuits and keeps blowing, each circuit must be checked individually to discover which one is faulty.

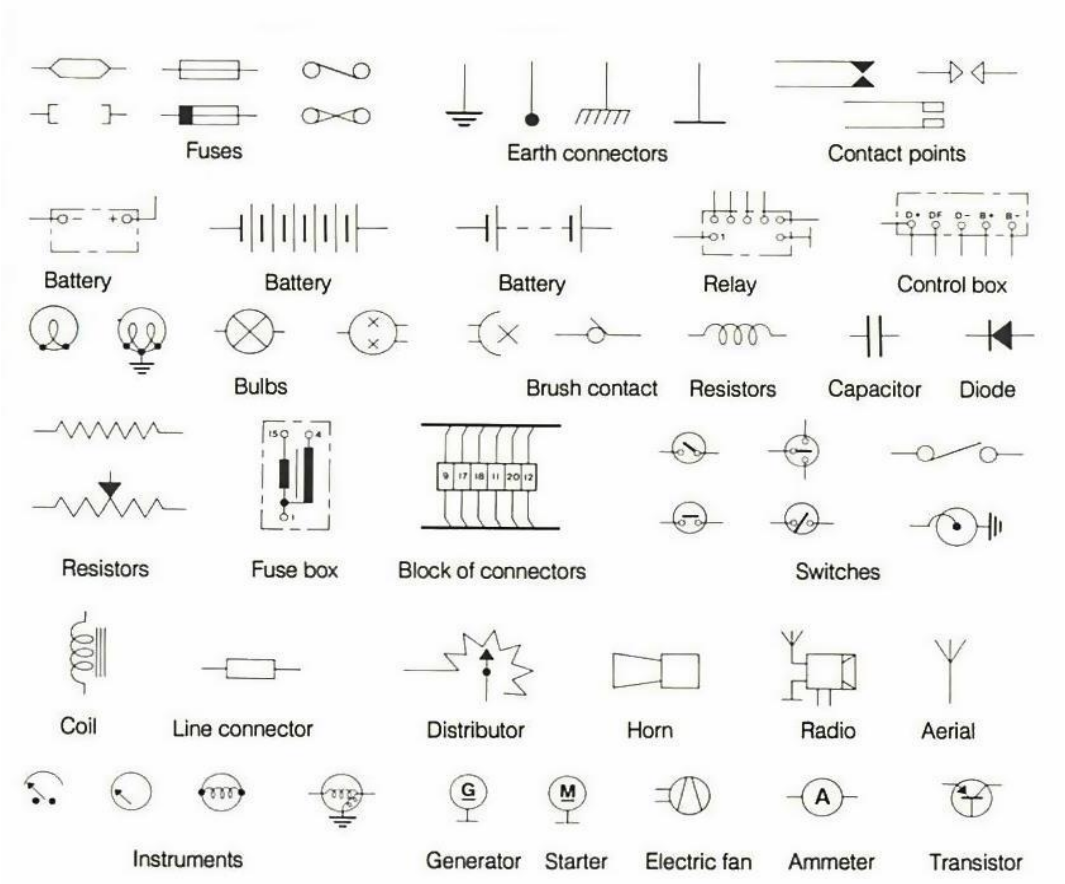
To find the faulty one, fit a sound fuse while all the relevant components are switched off. Now switch them on one at a time - the circuit with the fault will blow the fuse. Always replace a fuse with one of the same rating. Replacing, say, a 10amp fuse with a 30amp one could result in considerable damage.

The 10-amp fuse would normally protect a circuit carrying 7 amps: a 30 amp fuse would allow a 30 amp current to flow through, with possibly a disastrous effect on the unit or cable it was supposed toprotect.

Changing a fuse

In most fuse boxes, the fuses simply push into a pair of spring-clip contacts. Pull out the suspect fuse and, using fine emery paper, clean off any dirt or corrosion from the inside contact surfaces of the clips. Make sure the new fuse has the correct amp rating for the circuit. use fine emery paper to brighten the metal caps at each end.

ELECTRICAL SYMBOLS



Short Answer Questions

1. Write the purpose of lighting system in automobile.
2. Write the purpose of wiper.
3. Write the types of ignition systems.
4. Explain changing a fuse.

Long Answer Questions

1. Explain the auto lighting system with sketch.
2. With sketch, explain construction and working of horn circuit.
3. Explain the construction and working of starting motor with sketch.
4. Draw the circuit and explain the battery ignition system.