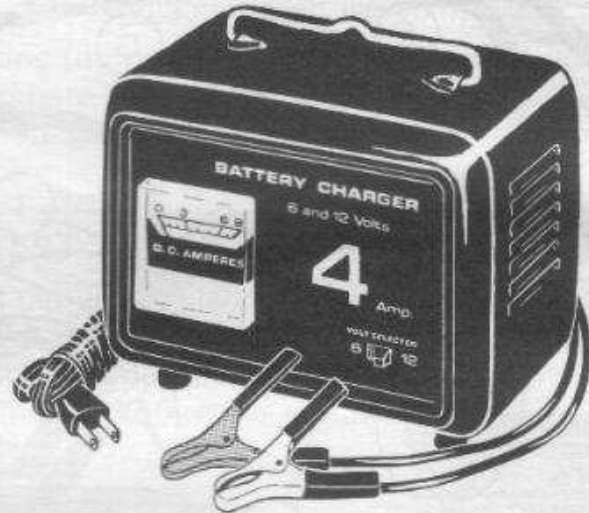
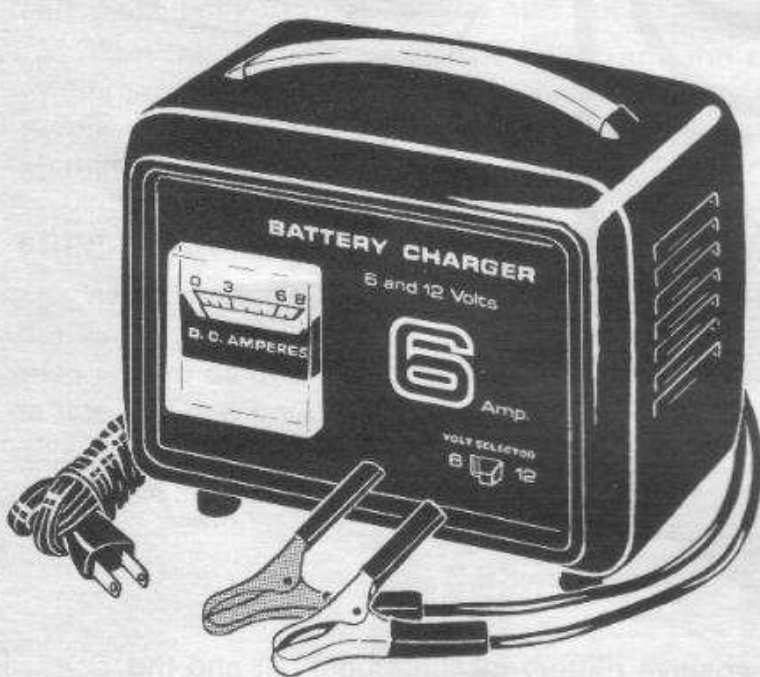
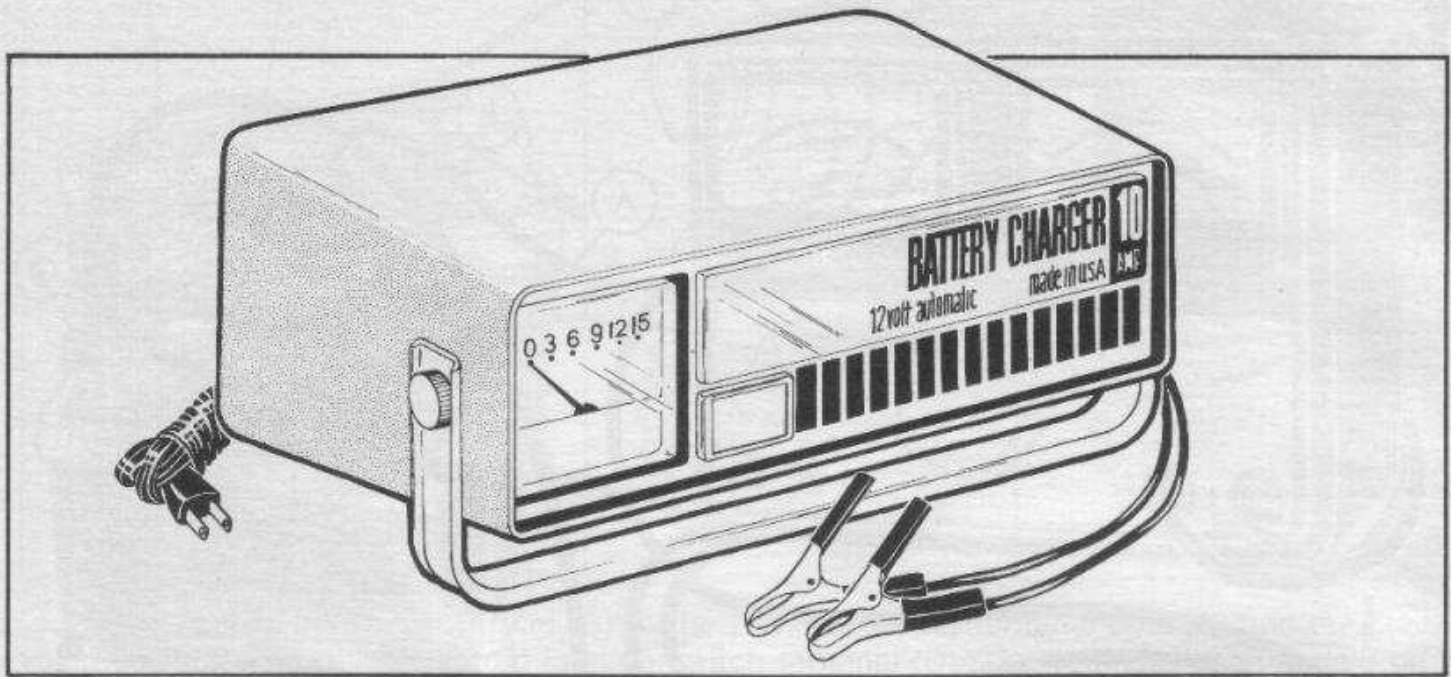


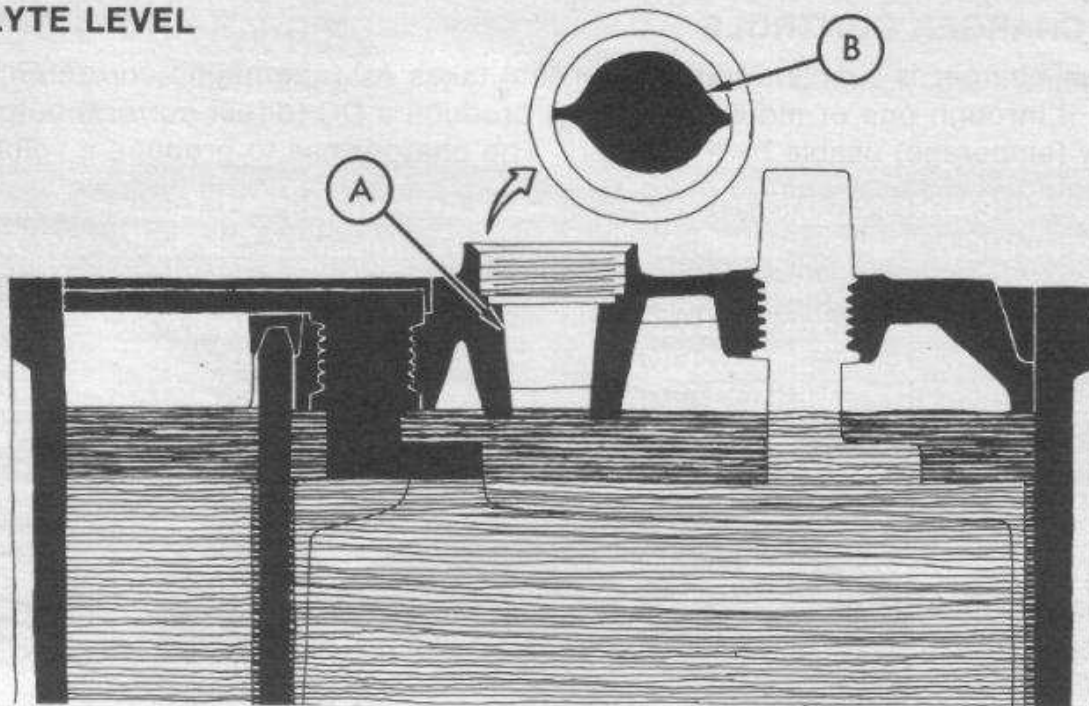
BATTERY CHARGER



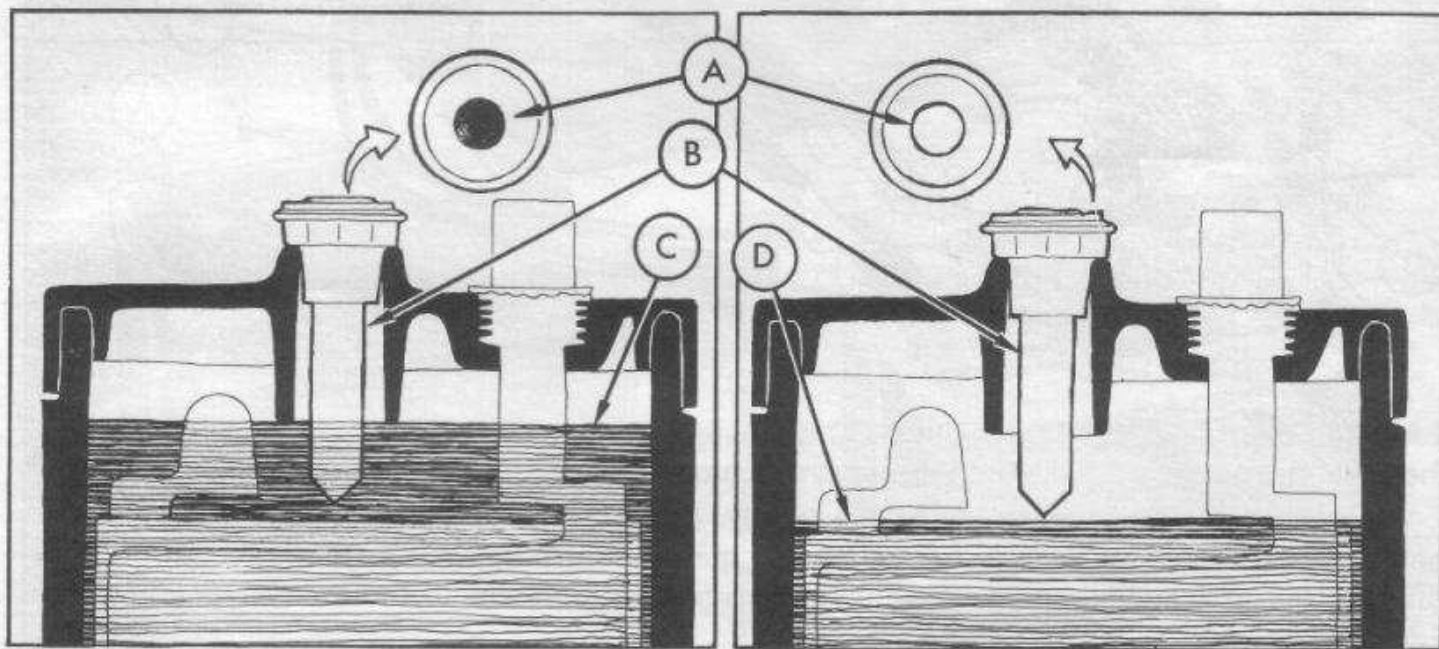
Although the battery charger is not strictly a piece of tune-up/test equipment, its use is required at times in conjunction with a battery hydrometer or battery-starter tester (see those chapters). Home battery chargers are available in a wide variety of amperage ratings and designs, most of which are quite satisfactory as long as they are used for the purpose they are designed for—keeping the battery safely charged under difficult service conditions.

Many discharged batteries, especially those that are sulphated, can be brought back to good condition by a slow charge. Sulphating is a battery condition that takes place when large areas of the plates become covered with heavy deposits of lead sulphate due to inadequate charging or old age. The chemical reaction between the lead plates and electrolyte acid changes some of the material into lead sulphate. If the battery is not charged enough to convert the compound back into usable materials, sulphating gradually takes place. As sulphated areas tend to harden permanently, their chemical convertability can be lost. A long, slow charge is the only means of completely displacing the acid from the sulphated areas and restoring the battery to its full capacity. A lesser charge will not remove the sulphate but it can return the battery to service temporarily.

ELECTROLYTE LEVEL



Most batteries are constructed with some kind of electrolyte level indicator. Conventional automotive batteries usually use a tube-shaped filler or vent (A) that extends down into the case. Some have slotted sides or a diamond-shaped bottom to mark the bottom of the vent well. When the electrolyte touches the vent well, its surface will appear distorted (B).



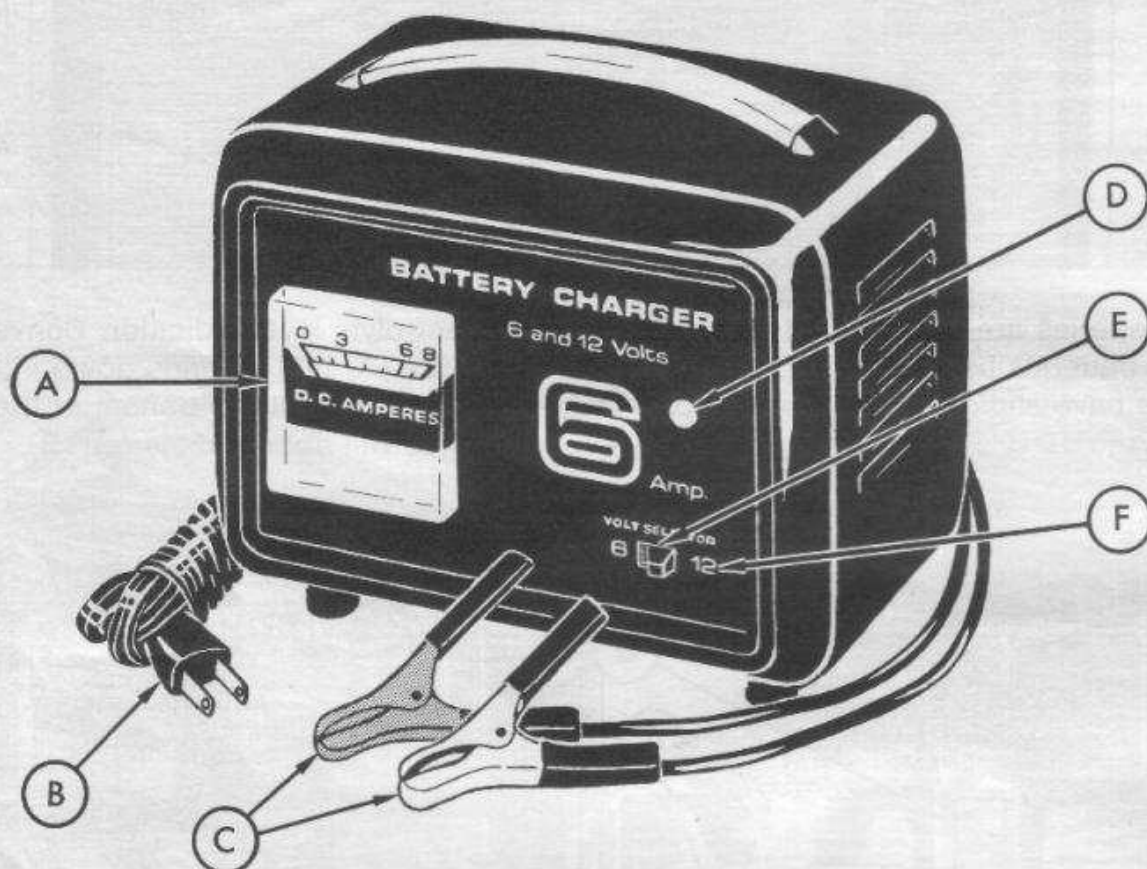
Delco Energizers use what is known as a Delco Eye (A). This specially designed vent plug has a transparent rod (B) extending through its center. When the electrolyte is at its proper level (C), it covers the lower part of the rod, giving the uncovered top part of the rod a dark appearance. If the electrolyte level is low (D), it falls below the tip of the rod, which then seems to glow.

CAUTION: BEFORE CHARGING YOUR BATTERY, MAKE SURE THAT THE ELECTROLYTE COVERS THE PLATES; IF NOT, ADD SUFFICIENT WATER TO DO SO.

Do not bring the level up to normal at this point, as charging tends to raise the electrolyte level, which could cause the battery to overflow. If more water is required, it should be added after the charging process is complete.

BATTERY CHARGER CONTROLS

A battery charger is simply a transformer that takes AC (alternating current) line voltage and passes it through one or more rectifiers to produce a DC (direct current) output at a current flow (amperage) usable by the battery. The charger has to produce a voltage higher than the battery in order to charge the battery. Thus the ability of the charger to produce voltage determines how much current it can force into the battery during the recharging process. A high-power unit will produce seven volts to charge a six-volt battery and 14 volts to charge a 12-volt battery. Since smaller units cannot produce that much voltage, their charging capacity is limited. Because of the simplicity of operation, battery charger controls are minimal.



Each charger is equipped with a DC ammeter (A) on its front panel, although some of the very inexpensive "trickle" chargers (three amps or less) may not use one.

Battery chargers that are adjustable for six- or 12-volt operation will have a voltage selector switch (E), with each position clearly marked on the panel (F). The present trend in charger design (other than professional shop equipment) seems to be in the direction of 12-volt-only units.

Recent models may include a reverse polarity light (D) to indicate incorrect charger lead connections to the battery.

CAUTION: IF THE POLARITY LIGHT COMES ON, REVERSE THE LEAD CONNECTIONS. THE LIGHT MUST BE OFF BEFORE THE UNIT CAN BE OPERATED WITHOUT DAMAGE TO THE BATTERY OR CHARGING SYSTEM.

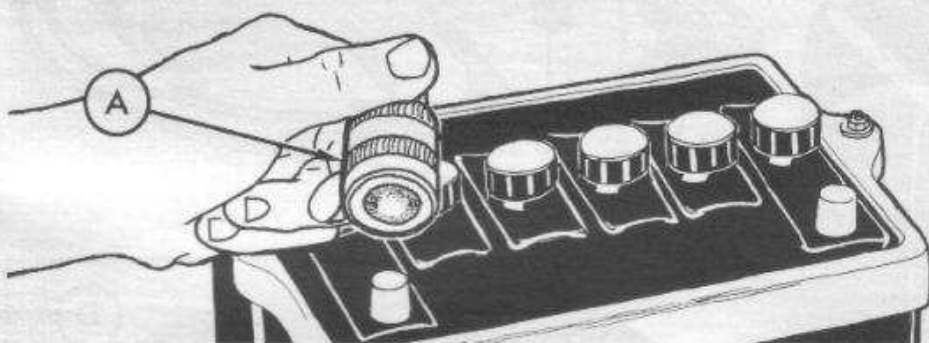
Twin leads (C) connected permanently to the charger are used to connect it to the battery. These are usually equipped with scissor-type spring return clamps and have color-coded (positive = red; negative = black) insulation for ease in making the proper connections.

An attached AC line cord (B) is used for connecting the charger to a power source.

PREPARATION FOR CHARGING

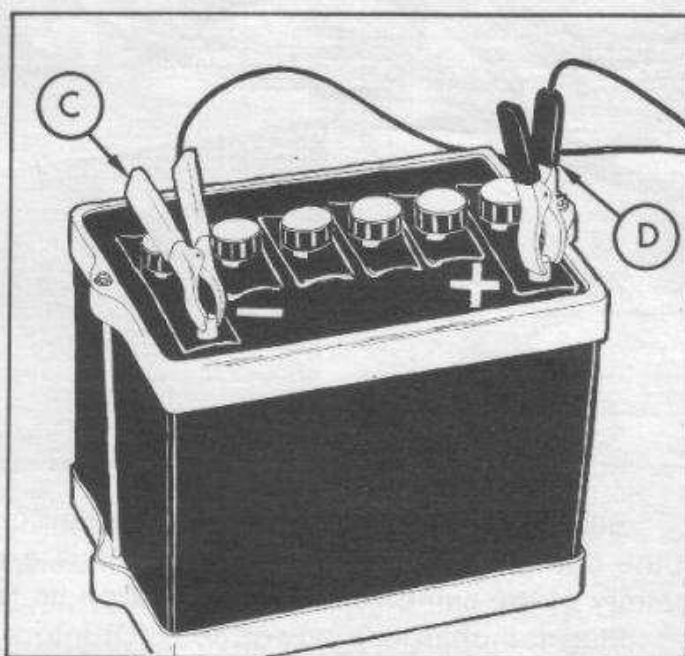
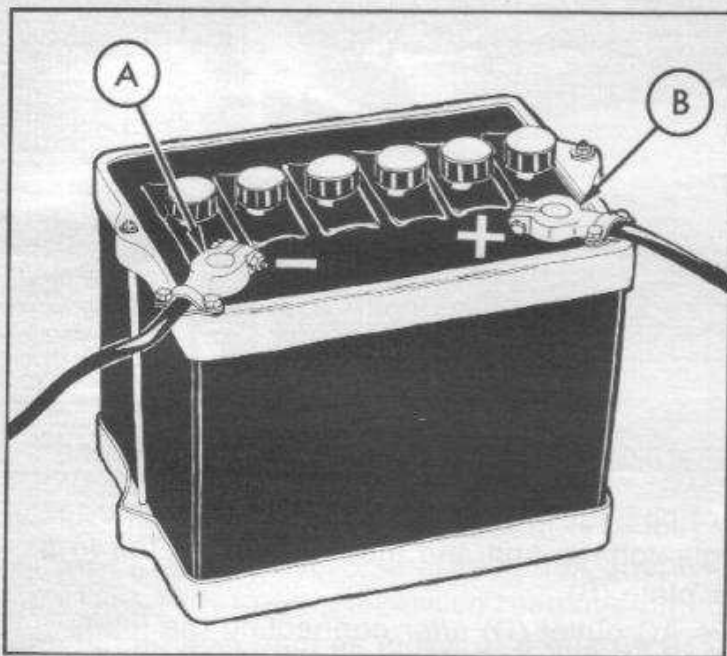
Loosen or remove the filler/vent caps. A six-volt battery has three caps, while a 12-volt battery has six caps.

WARNING: A HIGHLY EXPLOSIVE GAS MIXTURE (HYDROGEN) FORMS IN EACH CELL DURING CHARGING, SO BE SURE TO USE PRECAUTIONS WHEN WORKING AROUND A BATTERY THAT IS UNDER CHARGE. DO NOT SMOKE, CREATE SPARKS OR BRING AN OPEN FLAME NEAR THE BATTERY. TO PREVENT AN ELECTRICAL ARC THAT COULD CAUSE AN EXPLOSION, ALWAYS CONNECT THE AC POWER CORD TO A LINE OUTLET *AFTER* THE CHARGER LEADS ARE CONNECTED, AND DISCONNECT THE POWER CORD *BEFORE* DISCONNECTING THE LEADS.



Check, clean and tighten both battery cables. If the battery is to be charged with its cables removed, clean the terminal posts thoroughly with a wire post cleaner (A). Worn or defective cables should be replaced.

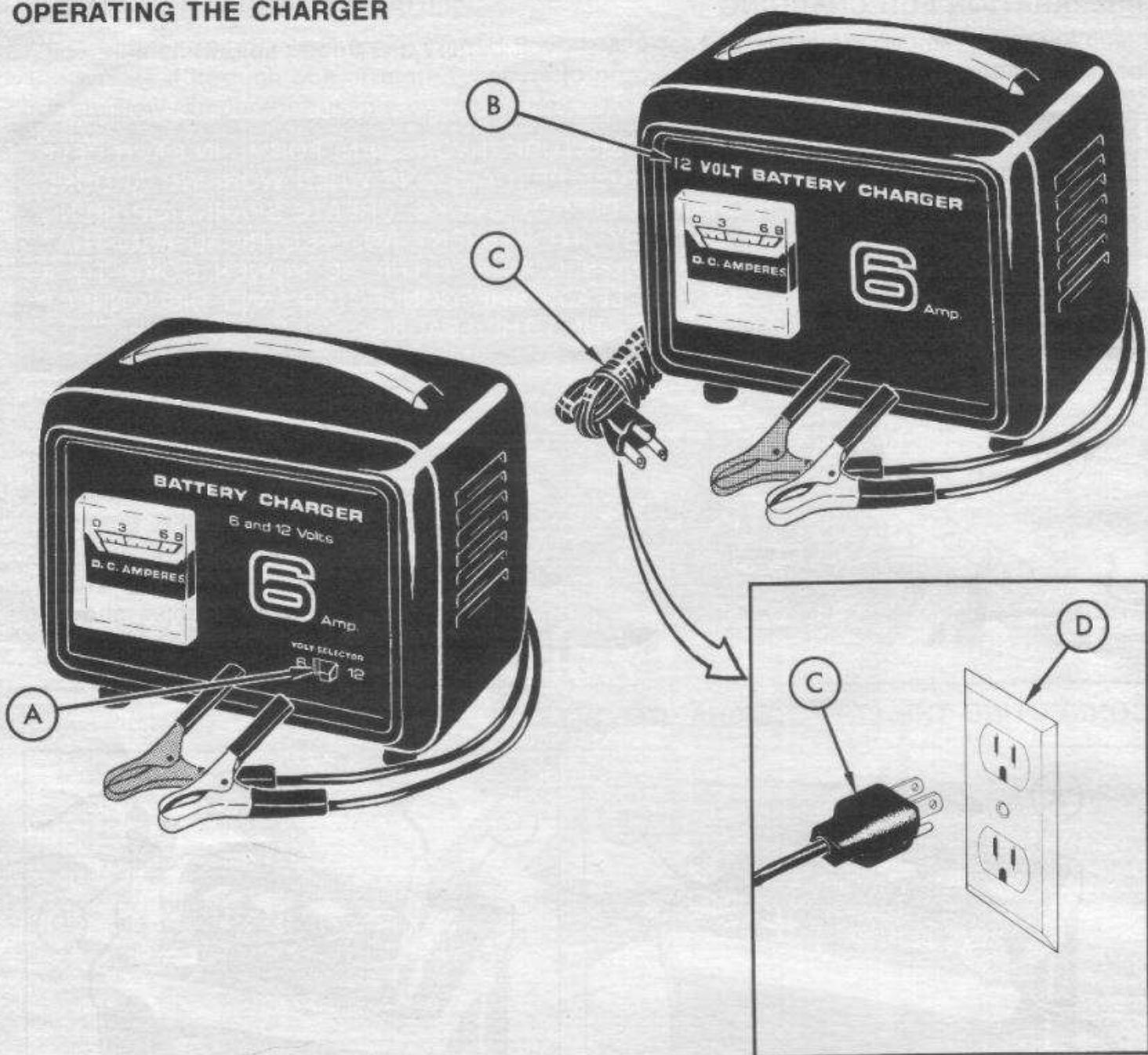
CONNECTING THE BATTERY CHARGER



The charger should *always* be connected to the battery *before* it is plugged into an AC outlet. Disconnect the battery cables on alternator-equipped cars before connecting the charger. This will prevent accidental damage to electronic components from reverse polarity.

Remove the positive or "hot" cable (B) first, then the negative or ground cable (A). Now connect the red charger lead (D) to the positive battery terminal and the black lead (C) to the negative battery terminal. Rock the leads back and forth to assure a good connection. Double-check the connection sequence by making certain the reverse polarity light is off. On chargers without this warning light, if the connections are incorrect, sparking may take place when clamping the leads to the battery terminal posts and the ammeter will read upscale.

OPERATING THE CHARGER

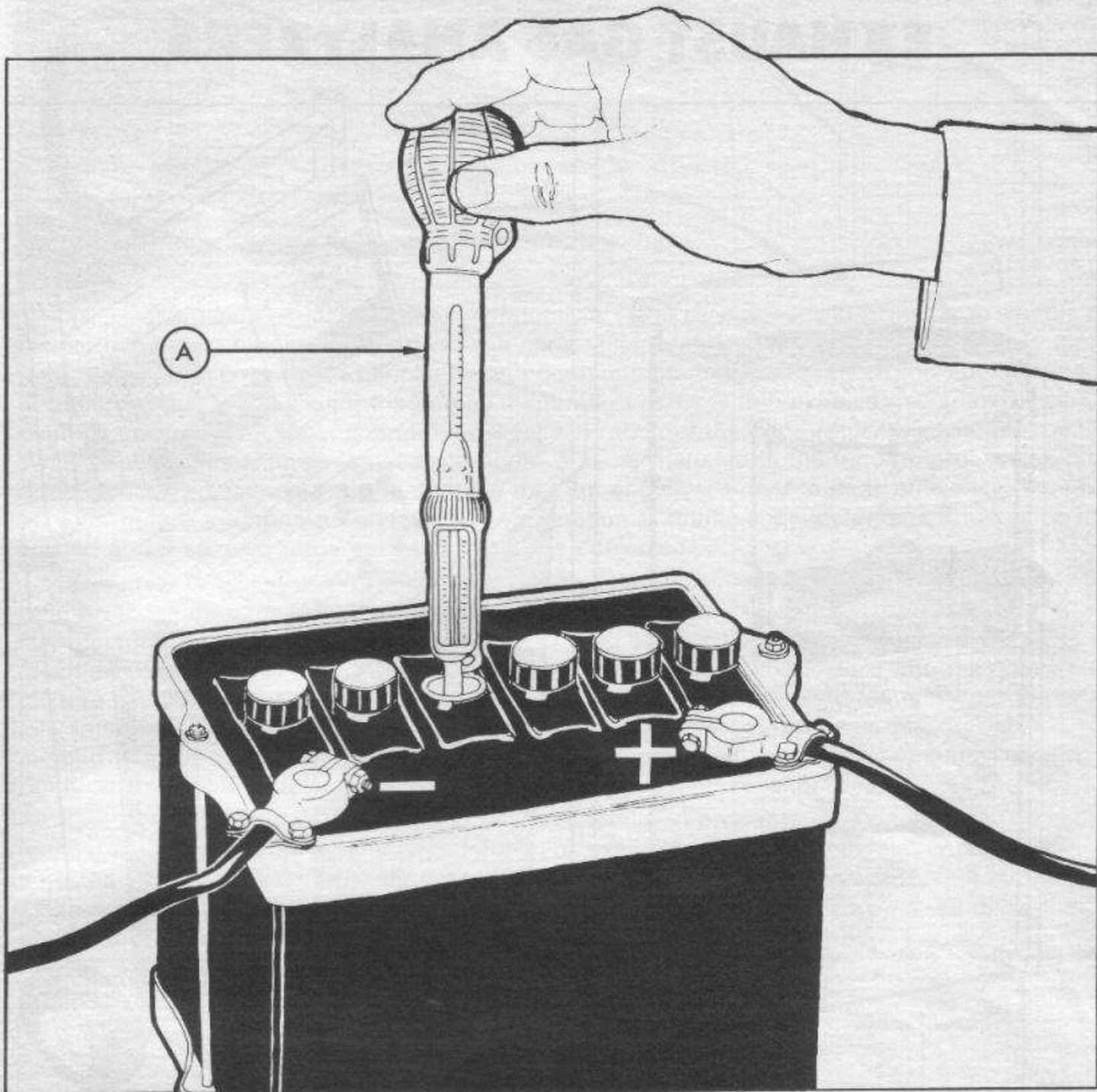


Set the voltage selector switch to the correct position (A) for the battery under charge. If the charger has no selector switch, it is a single-voltage unit and must be connected to a battery of the same voltage specified on its face plate (B).

Plug the charger's power cord (C) into a live AC outlet (D) *after* connecting the leads to the battery. The ammeter on the charger panel should now indicate the amount of charge current. If it does not, rock the charger lead/battery post connections; if the ammeter still does not read, check the AC line outlet to make sure that it is live.

The charging current will automatically adjust its rate to the battery condition. In the case of a warm, discharged battery, the current starts well upscale on the ammeter and decreases as the charge continues; on a cold or partially charged battery, it starts lower on the scale but decreases less. When the battery is fully charged, the charger's automatic sensing circuit will reduce the charging rate to a level sufficient only to replace battery self-losses.

Chargers without this automatic sensing circuit will also reduce their charging rate but not as low, and any prolonged connection to the battery can result in an overcharge and eventual damage to the battery.



You can determine when a battery is fully charged by taking specific gravity readings (A) with a battery hydrometer (see that chapter). When the specific gravity remains unchanged on three successive readings an hour apart and all cells are gassing, the battery has accepted as much of a charge as it can hold. To determine the actual specific gravity, it is necessary to let the battery sit off-charge for an hour and then take a battery hydrometer reading, as readings taken while the battery is gassing will not be correct. They will only tell you whether or not the battery is charging.

CHARGING TIMES

The length of time required to fully charge a battery depends upon several internal conditions. An old battery will need up to 50% more ampere-hour charging than a relatively new one. A completely discharged battery needs twice the ampere-hour charge of one that is only half discharged. A 70-ampere-hour battery requires twice as much of a charge as a 35-ampere-hour battery, and charging at temperatures below 80° F will require more time. Specific gravity readings taken with the battery off-charge are the only sure way of telling when a battery has accepted a sufficient charge.