Edison Batteries

5. Charge:

The action which takes place in an Edison cell, both in charging and discharging, is a transfer of oxygen from one electrode to the other, or from one group of plates to the other, hence this type of cell is sometimes called an oxygenlift cell. In a charged cell the active material of the positive plates is superoxidized, and that of the negative plates is in a spongy or deoxidized state.

Initial Charge

Edison batteries usually are sent out in discharged condition, requiring an initial or forming charge. This consists of a twelve-hour charge at the normal rate, and in addition a repetition of this charge is required after every twelve or fifteen complete discharges, or an equivalent thereof, until four such overcharges have been given the battery. This forming process is important to insure proper capacity and long life. After this treatment is completed, the battery should be overcharged once every two months.

Normal Charging Rates

The normal charging rates, in amperes, for the various types of Edison Cells are as follows: B2-8; B4-16; B6-22.5; A4-30; A5-37.5; A6-45; A8-60; A10-75; A12-90. In vehicle service low charging rates, except at the end of a tapering charge, are not advised. Rates below normal will in no way injure the cell, but the voltage on subsequent discharge will be lower than when normal rates are used.

Boosting Charges

If the normal capacity of the cell is insufficient, short intermediate high rate charges can be given provided that the temperature of the electrolyte does not exceed 115° Fahr. These short charges are very efficient and cause no injury. Rates up to three times normal can be employed for periods of 30 minutes.

Amount of Charge

A full charge for any type of Edison cell consists of seven hours at the normal cell rate. In service the amount of charge given, should be governed entirely by the extent of the previous discharge. For example, if a battery is discharged one-half, a 3½ hour charge at normal rate should be given. If an ampere hour meter is used the hand should be set to operate 20% slow on charge. In operation the great tendency is to overcharge Edison Batteries unnecessarily. Overcharging wastes current and causes rapid evaporation of the water in the electrolyte, for these reasons it should be guarded against.

Tapering Charge Rates

If tapering rates of charge are to be employed an average of 1.67 volts should be maintained across the cell terminals throughout the entire charge. The current value at the start of charge will vary according to the amount of resistance in the circuit. If no resistance is used the starting rate will be about twice normal and the finishing rate about 40% of normal.

Toward the latter part of charge Edison cells gas freely. Under normal conditions, battery compartment doors or hoods should be removed or lifted while charging. Inasmuch as storage battery gases are explosive care should be taken to see that no open flame is held near the cells while charging.

Charging Voltage

As shown on upper curve (Fig. 33) the maximum average charging voltage range of an Edison cell charging at normal rate is from 1.5 volts to 1.85 volts. Under normal conditions a battery can be considered fully charged when voltage has remained constant at 1.85 per cell for thirty minutes. Charge voltage readings are not always a true indication of state of charge as they will vary considerably according to electrolyte temperature and density.

Efficiency

The efficiency of an Edison battery will vary according to the extent of discharge. Highest efficiencies and greatest advantages are obtained when a battery is required to give an output less than its rating; for instance a discharge taken that calls for four hours charge is more efficient than one that requires seven hours; also less frequent watering of cells is required, and the temperature rises comparatively little. In general this feature in practice is not taken advantage of to the extent that it should be; in many cases, after this has been properly explained to operating men, large savings in current consumption have been effected.

Excess Capacity

By overcharging, an increased capacity as high as 30% above the rating can be secured, but this practice reduces efficiency and is liable to cause high temperatures.

6. Discharge:

In discharging the positive plates deoxidize and the oxygen, with its natural affinity for iron, goes to the negative plates, oxidizing them. The normal discharge rates in amperes is the same as that given under "Charge" the time, however, being five hours. It is permissible to discharge continuously at any rate up to 25 per cent. above normal, and occasionally for short periods at rates up to six times normal. This limitation is based largely on experience, it having been proven, that when the normal discharge rate of the vehicle on the level exceeds this value, abnormal voltage drop on very steep grades will be encountered.

Temperature Effects

Low electrolyte temperatures will temporarily reduce capacity of a battery; during severe cold weather openings in the compartment should be closed tightly. This is easily accomplished, as explained under Battery compartment Sec. V, Art. 22. Best results will be obtained when charging is arranged so that the charge will be completed shortly before vehicle goes out, and in some cases it is advisable to give a warming charge when battery has been standing in a cold garage.

Life

The life of Edison plates is not definitely established, but long life is one of its strong features. Numerous records of batteries having covered forty thousand miles in service are available.

7. Electrolyte:

The electrolyte of Edison cells does not enter into chemical combination to perform the functions of the cell, but acts merely as a conveyer; it therefore does not change in specific gravity during charge and discharge other than through evaporation and changes in temperature.

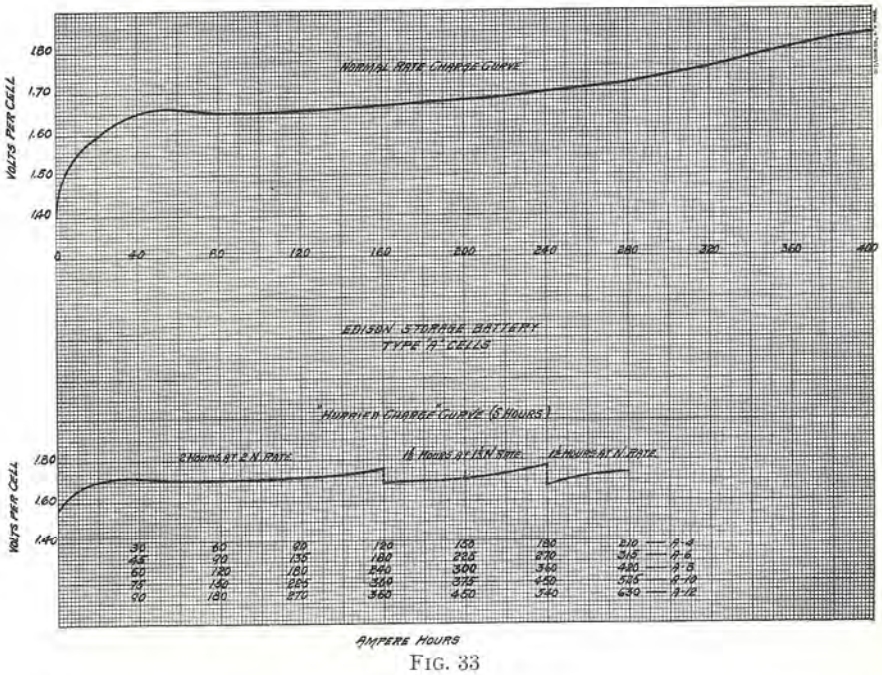
NORMAL RATE CHARGE CURVE
VOLTS PER CELL
1.80
1.70
1.60
1.50
1.40
0
40
80
120
160
200
240
280
320
360
400
EDISON STORAGE BATTERY
TYPE A CELLS
"HURRIED CHARGE" CURVE (6 HOURS.)
2 Hours at 2 N. Rate.
6 Hours at 1 N. Rate.
4 Hours at ½ Rate.
AMPERE HOURS

FIG. 33

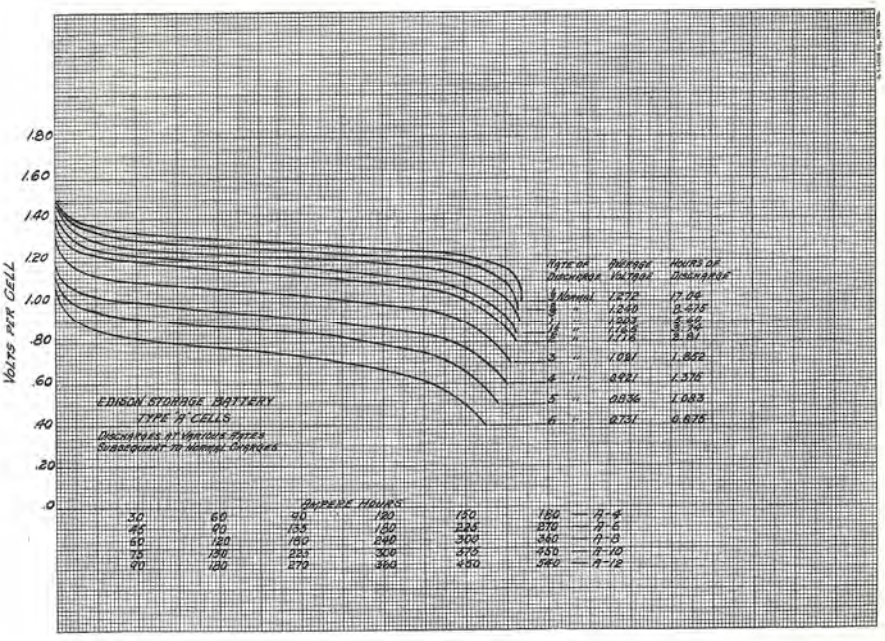
VOLTS PER CELL
1.80
1.60
1.40
1.20
1.00
.80
.60
.40
.20
.0
EDISON STORAGE BATTERY
TYPE A CELLS
Discharges at Various Rates
Subsequent to Normal Charges.
AMPERE HOURS

FIG. 34

Considerable variation in specific gravity is permissible, it having influence only upon battery efficiency. The recommended range of gravity is 1.196 to 1.156 at 80° F. electrolyte temperature, varying inversely .002 specific gravity with each 10° F. change in temperature. Gravity readings should be taken after a full gassing charge.

Purity of Electrolyte

Specific gravity is not necessarily a true indication as to the suitability of the electrolyte, since harmful impurities may get into the electrolyte when watering or otherwise. To guard against this possibility it is recommended to renew the electrolyte after eight or ten months' continual service, or equivalent thereof, with a solution furnished by the manufacturer. The solution is 1.260 specific gravity, or stronger than normal, to compensate for the considerable amount of weaker solution still left in the plates after the cells are emptied. It is advisable to completely discharge the battery before renewing the electrolyte, and to give it a twelve-hour charge, at the normal rate, after renewing.

Renewal of Electrolyte

Watering Cells

Cells must be watered carefully, using distilled water only, without slopping or filling too full. To insure against improper filling, the indicating electric filler (Fig. 28) made by the battery manufacturer should be used.