The Care of Storage Batteries.

How to maintain Car Batteries in a High State of Efficiency.

(By Howard Greene.)

The storage battery, used as a means of accumulating and releasing energy for the propulsion of commercial vehicles, is very responsive to proper treatment and good care. It has the property, however, of endeavouring, with amazing persistence, to continue to do its work and furnish current to the motors when, through neglect, accident, or what not, it is in no condition to do so, and the effort is at the cost of its own integrity—and, later, of many of its owner's dollars.

There is nothing mysterious about a storage battery, but many intelligent men hold a contrary belief, and therefore hesitate to give it proper attention. If a man of reasonable intelligence and common sense will *stick closely to instructions,* and when he encounters conditions that he cannot account for or meet with the knowledge at hand, will notify the battery expert at once and observe how the trouble is overcome, he will soon learn to recognise symptoms and apply corrective measures without outside assistance except in extreme cases. What the battery manufacturer dreads more than anything else is ignorant or negligent handling of batteries.

A phase of lead battery handling that is much underestimated and frequently ignored by drivers who take charge of their own batteries is the watching of the specific gravity of the electrolyte (dilute sulphuric acid) with which the jaws are filled. The fact is that the condition of the electrolyte, taken in conjunction with other evidence, is the surest guide to follow. Drivers are often actually dismayed by the mere sound of the term "specific gravity" and the scientific appearance of the hydrometer! but this is extremely foolish, for the test of specific gravity is easily made, the hydrometer scale is as simple to read as a thermometer, and nothing further than this in the way of a scientific education is required.

The hydrometer is a little tube of glass, sealed up air-tight after the air has been exhausted, and weighted at one end so that it will float in liquids in a vertical position, with its upper end above the surface. The upper part of the tube is marked off with a scale that looks something like the marking of a thermometer. Now, probably every one knows that any object that will float at all will float higher in a heavy liquid than in a light one. For instance, salt water is heavier than fresh water, and it is therefore easier for a swimmer to keep afloat in salt than in fresh water. To cite an extreme case, a piece of iron, which will not float at all in an ordinary liquid, will rest lightly on the surface of mercury. Therefore we can compare the weights—that is, the specific gravities—of various liquids by noting how high the hydrometer floats in them, the readings being taken at the point where the tube emerges from the liquid; the higher the hydrometer floats the higher the reading will be, because the scale reads downward. A heavy liquid will therefore be of "high" specific gravity, and a light liquid of "low" specific gravity. The standard of comparison is distilled water, which is zero on the scale.

To get back to our battery, the liquid constituting the electrolyte is a mixture of sulphuric acid and water. The acid being of higher specific gravity than water, the gravity of the mixture is, of course, higher than that of water and lower than that of sulphuric acid alone, the exact figure depending upon the proportion of each. Now, it is this very point that interests us in battery work, for the following reasons: During the discharge of a battery—that is, while current is being taken from it—acid is absorbed by the active material in the plates, and *vice versa,* during the charging process acid is driven out of the plates into the electrolyte. As it is only acid, and not water, that is thus passed back and forth, it follows that the electrolyte becomes weaker in acid (of lower specific gravity) as discharging progresses, and richer in acid (of higher specific gravity) while being charged. When a battery in *normal condition* is fully charged, the electrolyte is at its highest specific gravity and "pounding" (forcing current into a battery already full) will neither raise the gravity nor the voltage. This establishes the important point that when the gravity ceases to rise the battery is fully charged; and the voltage will cease to rise at the same time, the battery being in good condition.

As a means for ascertaining the condition of a lead battery and for ferreting out the causes of unsatisfactory service, the hydrometer is absolutely indispensable. Every two weeks, without fail, the battery should be given an overcharge, at the finishing rate, of an hour or an hour and a half; that is, the charging should be continued for that length of time after the battery is apparently up to full voltage. Then the electrolyte should be tested in each individual cell, reading the scale as closely as possible, and making a record of each reading in such a way that the gravity of any particular cell can be picked out without difficulty. If the variation between the different cells is not more than ten points, the test may be considered satisfactory. Should some of the cells read lower than this, the overcharge should be continued at the same low rate and the low cells tested again at the end of an hour. Ordinarily it will be found that the gravity will have risen somewhat and the "equalising" process should be continued until the gravity of the low cells ceases to rise.

If the gravity of the low cells stops rising before they have come up to or very near the low limit, or if some cells read so low as to indicate something radically wrong in the first place, such cells should be treated individually. Bring the terminals of two wires from the charging board and connect them directly to the straps of the cell to be treated, taking care that the rate of current flow is cut down to the proper point for a single cell. Of course, if two or more adjoining cells are in equally, or almost equally, bad condition, they may be charged together.

It is of the greatest importance that the positive or + supply wire be connected to the positive battery strap, and the negative or — wire, to the negative strap. Failure to make these connections correctly will mean the ruin of the cells that are wrongly connected.

Continued charging will, in most cases, bring the gravity up slowly. When it reaches the proper point—that is, when the separately treated cells read about the same as the average of the rest of the cells in the battery—and the gravity ceases to rise, the treatment may be discontinued. If, however, any cell fails to respond, and the gravity of the electrolyte remains low, it may be due to some of the liquid having been lost in some way other than by evaporation, as, for instance, by slopping over, or through a crack in the hard rubber jar, and the loss replaced by water. In such a case there will be a legitimate need for more acid, which may be supplied by drawing out a syringe-full of electrolyte and replacing it with the same quantity of 1.300 gravity electrolyte supplied by a reliable manufacturer. If this does not bring the gravity up to the desired point after thorough mixing has occurred, add more until the desired effect is produced. If a jar is leaking, it should be replaced at once.

Acid should never be added unless it is certain that it is really needed, which is not often the case. The cell contained the proper amount of acid, in solution, in the first place; the acid does not evaporate with the water to any appreciable extent, and it must, therefore, be somewhere in the cell, unless lost through leakage or sloppage. If it is in the cell and the hydrometer shows that it is not in the electrolyte, there is but one alternative: the plates must have absorbed it, and this is exactly what usually occurs. The formation of sulphate on the surface of the active material takes acid from the solution. Prolonged charging at a low rate breaks down the sulphate and drives the acid back into the electrolyte

During the process of bringing up the gravity of the electrolyte in a battery it is of importance that the temperature be carefully watched by means of a suitable thermometer. Under no circumstances—and this applies at all times, whether charging at high or low rate, or discharging—should the temperature exceed 100 degrees F. If it is not possible to keep the temperature below this point by lowering the charging rate, the battery expert should be called in to look for internal troubles, such as short circuits between plates.

It is real economy to call in an expert at any time when a trouble cannot be diagnosed, or when it is too serious to be handled by the simple methods here described. The expert will, of course, charge for his ounce of prevention, and it will be much better to pay for this man than to wait until it is necessary to pay for a pound or more of cure at a proportionately high figure. It is best, if possible, to obtain the advice of a man who makes a specialty of the particular make of battery needing attention. Nine times out of ten he will be glad to give advice and make helpful suggestions free, because they will assist in keeping in good condition a battery in whose success he is directly interested.

A new battery will sometimes be found to contain electrolyte which tests somewhat higher than the permissible maximum after a few days' use. In such a case, remove a little electrolyte from each jar and replace with water. It is not often, however, that this will have to be done. The normal strength of these batteries varies, the maximum of the specific gravities being between 1.300 and 1.270.

(To be continued.)