<u>BRIEF EXPLANATION OF THE PATENT</u>

This method helps for calculating the available energy **ED**, in an electric battery **W**, with nominal capacity **CN**, nominal voltage **VN**, at temperature **Tn**, without discharging it, (using only a negligible % of its charge, in the test), subsequently finding its autonomy, its capacity, and remaining life.

We shall need a set of new and charged batteries, generically called **A**, of the same technology and nominal voltage as **W**, and which we will call equivalent because one of them, or one of intermediate capacity, will have an available energy **ED**, equivalent to that sought.

Of the batteries **A**, at least one must have a nominal capacity equal to **CN** of **W**, and the rest they will be of smaller and different nominal capacity from each other. The factory can provide the curves of discharge at constant intensity **I**, at temperature **Tn**, of each of the batteries **A**. These curves are represented on orthogonal cartesian axes, drawing the voltage on the ordinates, and the time on the abscissae.

Between the different discharge intensities, that each set of discharges, corresponding to each battery **A**, will include the one produced by the intensity **I**, that we will select, to which we will pay special attention. The initial value in amperes of **I**, is of the order of a third of the ordinal of the nominal capacity in Ah of **W. T**his value can be increased according to the results. All the sets of discharge curves of **A** will have a discharge intensity **I**, and if it were not like that, we will interpolate.

Now, we group only the discharge curves produced by the same discharge current **I**, which is between the curves of the different batteries **A**, and we obtain the new graph **GnI. T**he subscripts make it clear that the working temperature is **Tn**, and that the chosen current is **I.** It is clear that there may be other graphs **G** at different temperatures and intensities.

In these **GnI** graphs, each battery **A**, provides a single curve, precisely the one corresponding to the discharge current **I.** All these curves will have different starting points on the ordinate axis, because the response voltages come from the batteries **A**, which, being different, will have different electrical energy, function of their capacity. All these curves are interpolables.

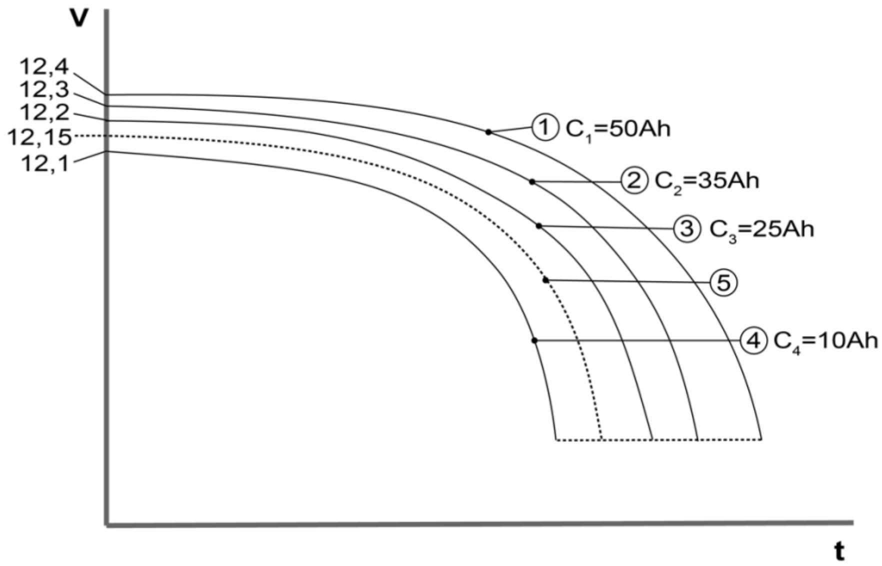
Following the method, we discharge the battery **W** at the same discharge current **I** above, giving us a response voltage **Vv**, which we look for on the ordinate axis of **GnI.** If this voltage does not coincide with an existing curve, we interpolate between the available discharge curves. That point of initiation of the new curve corresponds to that which a battery **Av** would produce when discharged with the same discharge current **I.** We know the available energy of battery **Av**, which will coincide with that of **W**, since, with the same discharge conditions **(Tn, I)**, the energy of both batteries produces the same response: **Vv**.

If the battery **W** is not at rest, we measure the existing current **I2** with the ammeter, and with a voltmeter the voltage **V2**, being able to go directly to **GnI2**, and obtaining the available energy. If **I2** is small, the curve corresponding to **V2** may give an unclear answer. In this case, we must add a new, higher discharge current, **I1**, leaving a total discharge of **I3** = **I1** + **I2**, which will produce, after a few seconds, a new response voltage **V3**, which we will look for in **GnI3**, and with it we find the energy available, at that moment, in **W**.

Therefore, if we have two systems (batteries of same chemistry and nominal voltage), one from which we know how it responds and another with unknown potential energy, if we subject them to equal discharge conditions, of temperature and intensity, and they respond in the same way, it means that the initial energies are equal.

The following example shows a simple data base to clarify the above.

Let there be a battery **B**, of which we do not have any data, of 12 V and 50 Ah nominal. We want to know, without discharging it, what is its remaining energy. According to the manufacturer, when **B** is new and freshly charged, if it is discharged with a current **I**=10 A, it produces curve 1. This discharge has started at 12.4 V.



In the same way, smaller batteries, with capacities C2, C3, C4, when discharged all with the same current **I**=10 A, produce curves 2, 3 and 4, each with their corresponding response voltages.

If we now apply the discharge **I** to the old battery **B**, it will describe, for example, curve 5, whose initial response voltage will have been 12.15V. The remaining energy of **B** would be equal to that of an intermediate battery between 3 and 4, which, in this case, has the half-sum of capacities, i.e. 17.5 Ah, since it can be interpolated or extrapolated. If the temperature is not 25 ºC, we will use the manufacturer's curves at that temperature. If, subsequently, we were informed that **B** was fully charged at the time of the test, we could conclude that 17.5 Ah is the capacity of **B.**

This equality of capacity between **B** and the new battery is momentary. Over time the two will diverge, with **B** decreasing more rapidly.