Charging Equalizer for 24 V Vehicles

The problem is evergreen.
Two 12 V batteries connected in serial can never be charged equally. One of them could accept lower
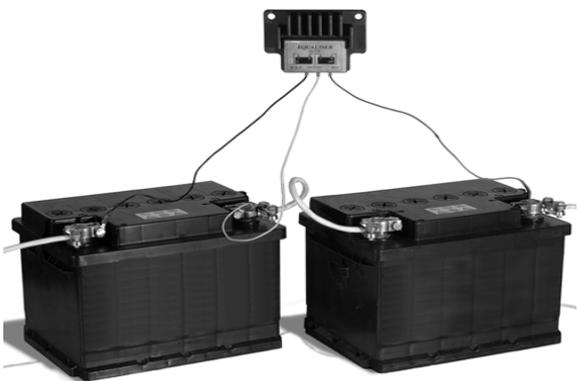(e.g.13.6 V), the other one higher (15.2 V) charging voltage at the same charging current.

Consequence:
 This imbalance is self progressive and shortens the life of both batteries, due to
- sulphating (caused by undercharging)
-   drying up (caused by overcharging)

Solution: EQUALIZER

(Pat. Pend)

Operating principle:

The EQUALIZER measures the total charging voltage (e.g.
28.8 V) and calculates its middle value (e.g. 14.4 V) then
directs a part of charging current from the battery of which
voltage is higher more than 0.1 V measured from the
middle, to the other one being lower state of charge.
The EQUALIZER has no effect on the total charging
voltage and operates only at higher voltage than 26 V,
practically when the batteries are being charged.
The maximum current is about 1 A that flows when there is
a 0.5 Volt difference between the batteries.
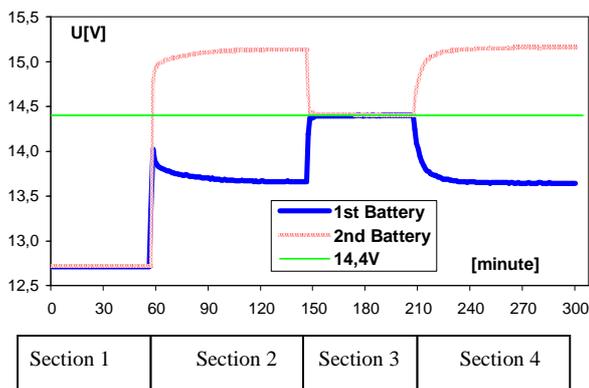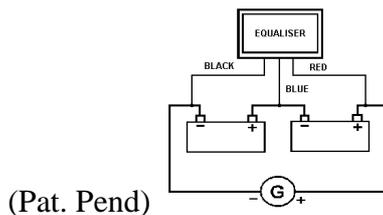
Just to demonstrate the effect of our equalizer we
connected two new batteries in serial and measured the
voltages at their terminals, when:

Section 1: They were not connected to charger and
EQUALIZER. (OCV: **12.72V** and **12.71V**)
Section 2 : They were connected to 28.8 V constant voltage
charger without EQUALIZER
(**13.6V** and **15.2V**)
Section 3: They were connected to charger and
EQUALIZER. (**14.38 V** and **14.42 V**)
Section 4: They were connected to charger without
EQUALIZER again. (**13.6 V** and **15.2 V**)

Results:
-   decreasing voltage on the overcharged battery
-   increasing voltage on the undercharged battery
-   increased starting current because of equal state of charge
-   increased battery life

Application:
-   trucks, buses
-   wheel chairs, cleaning machines
-   anywhere where 12 V batteries are connected in series