

## B-5 Secondary Battery Nickel-Cadmium-Alkaline Storage-Type

**Definition:** (a) Secondary Battery: A combination of two metals or metalloids immersed in an electrolyte which in itself will not produce electrical energy without first having the metallic portion of the element decomposed by passage of electric current.

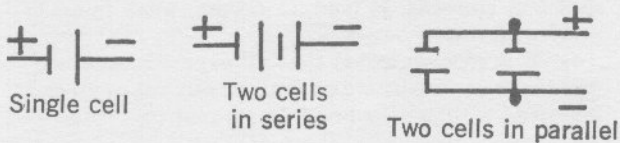
(b) Storage Cell: A secondary cell for storing electrical energy at one time for use at another time.

(c) Charging: The process of putting energy into a battery.

(d) Discharging: The process of taking energy out of a battery.

(e) Electrolyte: The fluid surrounding the elements of the battery.

**Symbol:**

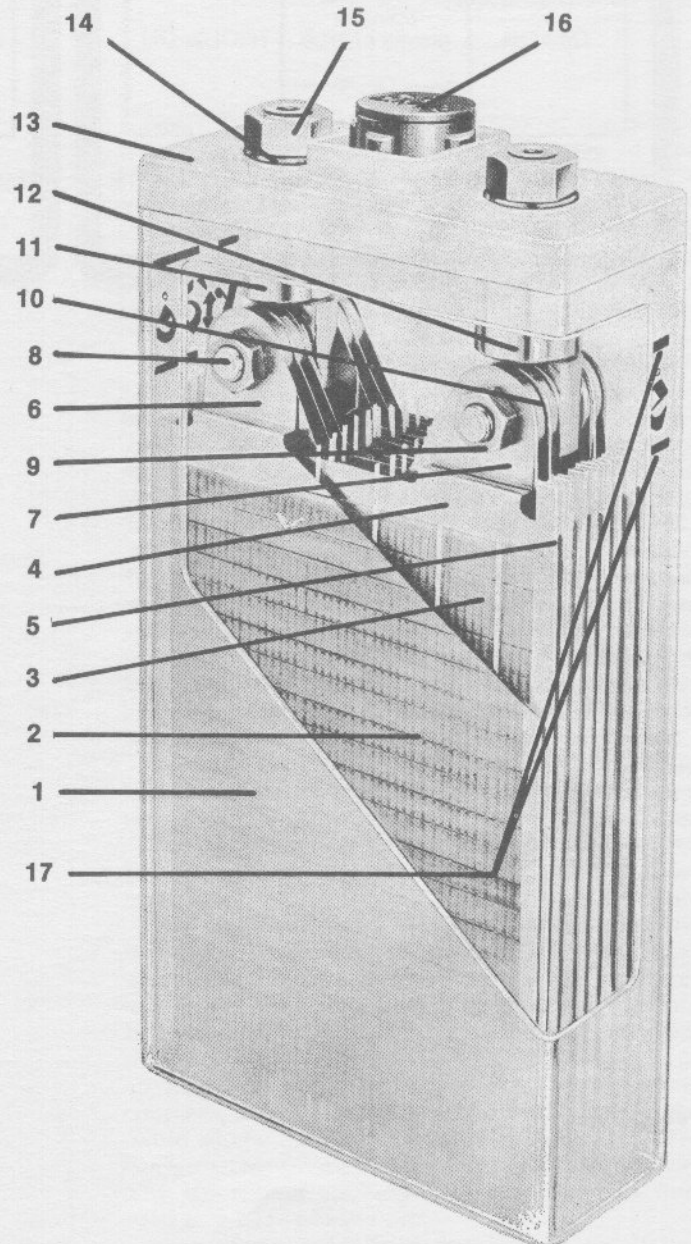


**Description:** The plates of the nickel-cadmium battery are of the pocket type. The active material is contained in steel pockets made from finely perforated nickel plated strips formed into channels. A perforated steel cover strip is crimped into place to form a permanent envelope for the active materials. The pockets are interlocked, cut to length and placed in a steel plate frame for extra strength. The plate groups are insulated and inserted in either steel or high impact resistant plastic containers. The electrolyte is a solution of potassium hydroxide in water. See Figures 1 and 2.

**Purpose and Application:** The nickel-cadmium storage battery is used as a dc power source at locations where an ac charging source is available. It can be used for track circuits, signals, highway crossing protection or any railway signal appliance or circuit that requires direct current.

**General Information:** Nickel-cadmium battery is especially adaptable where rough handling may be encountered.

One important advantage of the nickel-cadmium battery is that it can be stored almost indefinitely without attention. The rugged construction of the cells contribute substantially to their long life. Thus shedding of active materials from the plates is virtually impossible.



**Figure 1** components are: (1) Polystyrene container; (2) Positive pocket (Nickel hydrate); (3) Negative pocket (Cadmium sponge); (4) "Hairpin" type plastic plate insulator; (5) Plastic edge insulator; (6) Positive plate; (7) Negative plate; (8) Steel connecting rod; (9) Steel connecting nut; (10) Steel spacing washer; (11) Positive terminal pole; (12) Negative terminal pole; (13) Plastic cell cover (bonded to container); (14) Terminal pole packing washer; (15) Seal nut; (16) Vent cap; (17) Electrolyte minimum and maximum level indicators.

- (e) Avoid flames or sparks around battery since discharged gases might explode.
- (f) Keep vent plugs in place and tight.
- (g) Check terminal nuts at regular intervals and tighten if necessary.
- (h) Keep terminals coated with grease as specified by railroad maintenance instructions.
- (i) The electrolyte is alkaline and is injurious to skin and clothing. If contact occurs, wash immediately with water.

**Detailed Operation:** The nickel-iron battery has

a nickel oxyhydrate positive plate, iron sponge negative plate and potassium hydroxide electrolyte. When the battery is discharged, the positive plate is reduced to a lower oxide and the iron negative plate is oxidized. The reaction is mainly an oxygen iron transfer between plates. The specific gravity of a new cell is 1.160 to 1.190 at 25C (77F) and at normal solution level. As no constituents of the electrolyte combine with the active material of the plates, the specific gravity does not change appreciably during charge or discharge, and therefore it does not indicate the state of charge or discharge.

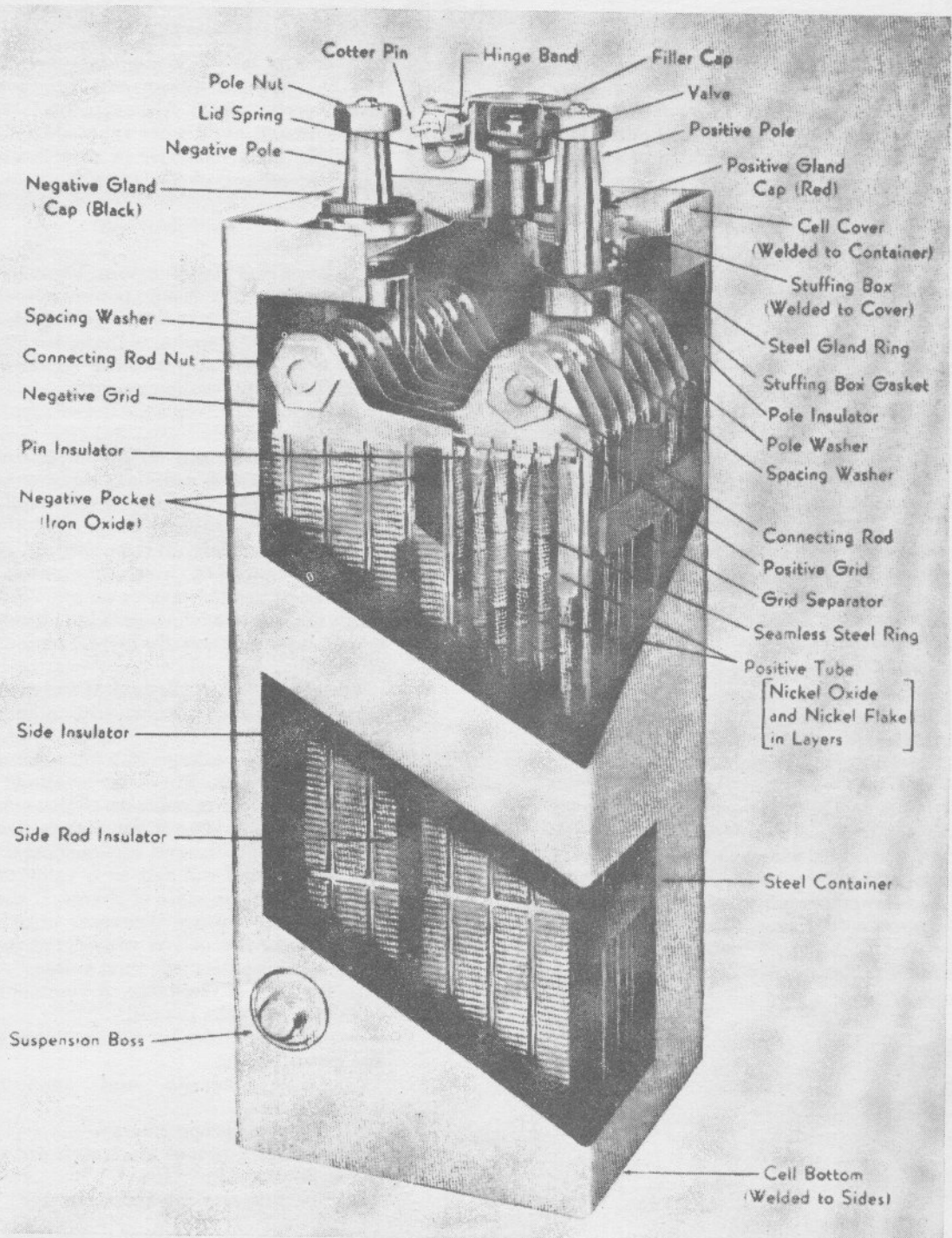


Figure 1 is a Nickel-Iron-Alkaline Storage Cell