



Signal Training Bulletin

COMMITTEE G: Education & Training Communication & Signal Section, AAR

B-10 Primary Battery Systems with Rectifiers

Approved January 1974

Definition: Primary Battery: A device for the direct transformation of chemical energy into electrical energy.

Rectifier: A device which converts alternating current into unidirectional current by virtue of a characteristic permitting appreciable flow of current in one direction only.

Symbol: None

Description: There are various types of primary battery systems which make use of automatic rectifiers for track and line circuit applications. The rectifier shown in Figure 1 is usually used in track circuit applications in multiple (parallel) with primary battery to supply most but not all of the current required by the load. Some small drain on the battery is required to keep it in active condition. The transformer used in the assembly is designed to cause the rectifier to automatically assume practically all of an increasing load current within the rated current limits of the rectifier.

The taps on the transformer, or a combination of transformer taps and a sliding core, permit adjustment to be made to obtain the desired division of load between the battery and the automatic rectifier.

There are also constant current rectifiers used primarily for line circuits. This type of rectifier, Figure 2, can be used to energize dc line relay circuits directly, which is the system generally employed when primary battery furnishes the reserve source of power.

Purpose and Application: Methods for using rectifiers shown in Figure 1 and Figure 2 are illustrat-

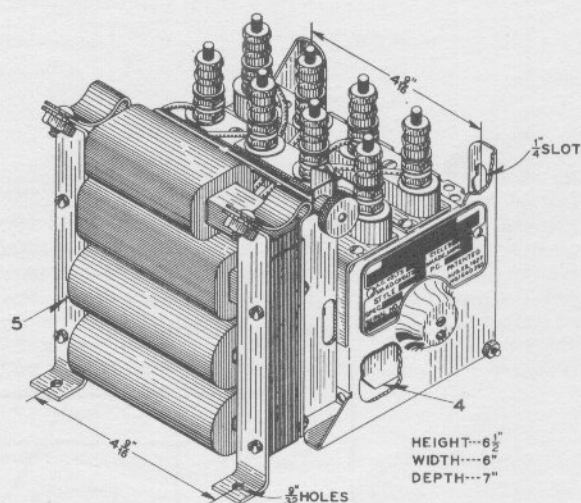


Figure 1

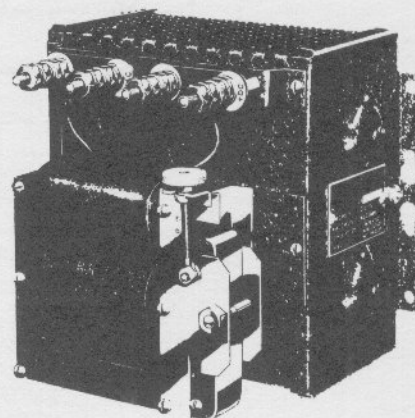


Figure 2

ed in schematic drawings, Figure 3 and Figure 4. The rectifiers are connected in multiple (parallel) with the batteries, the rectifier being adjusted to carry the normal connected load, thereby extending the service life of the battery.

General Information: Provision should be made to allow a few milliamperes of current to flow from the batteries under normal load conditions to maintain the battery in an active state. Generally, rectifiers designed for this application automatically adapt current output to the load requirements and when properly adjusted will supply all the load current except the few milliamperes which the battery must supply to keep it in an active state. For alternate method of keeping battery in active state, see Note 3, Figure 4.

Detailed Operation: Adjustment for type shown in Figure 3: This rectifier should be adjusted with the average ac voltage which occurs at that location applied to the rectifier ac terminals. Average voltage means the ac voltage which is approximately midway between the maximum and minimum line voltages which may occur at that location. Insert dc ammeters

of the permanent magnet type in both the battery and the load circuits, as shown by dotted lines in the diagram of Figure 3. (Caution: Do not open ac power supply after inserting the ammeter in the battery circuit or the ammeter may be damaged.) If the polarity of the ammeter in the battery circuit is as shown in the diagram, the current read will be that furnished by the battery to the track circuit. Loosen the clamping device at the top of the transformer until the sliding block may be shifted; however, keep sufficient pressure on the block to hold it in contact with the transformer core. The "in" position of the block corresponds to low line voltages, and the "out" position to higher line voltages. To adjust the track circuit current, connect a 12 ohm resistance unit across the track; vary this resistance and the series resistor of the track circuit while also shifting the block until the battery discharges at the value shown. Hold this adjustment of the block by tightening the clamping device, making certain that this tightening operation has not altered the battery output. The adjustment is now complete and the series resistor should be restored to its normal value and the track shunt removed. Check that battery is discharging at not less than 0.010 amp; then remove ammeters.

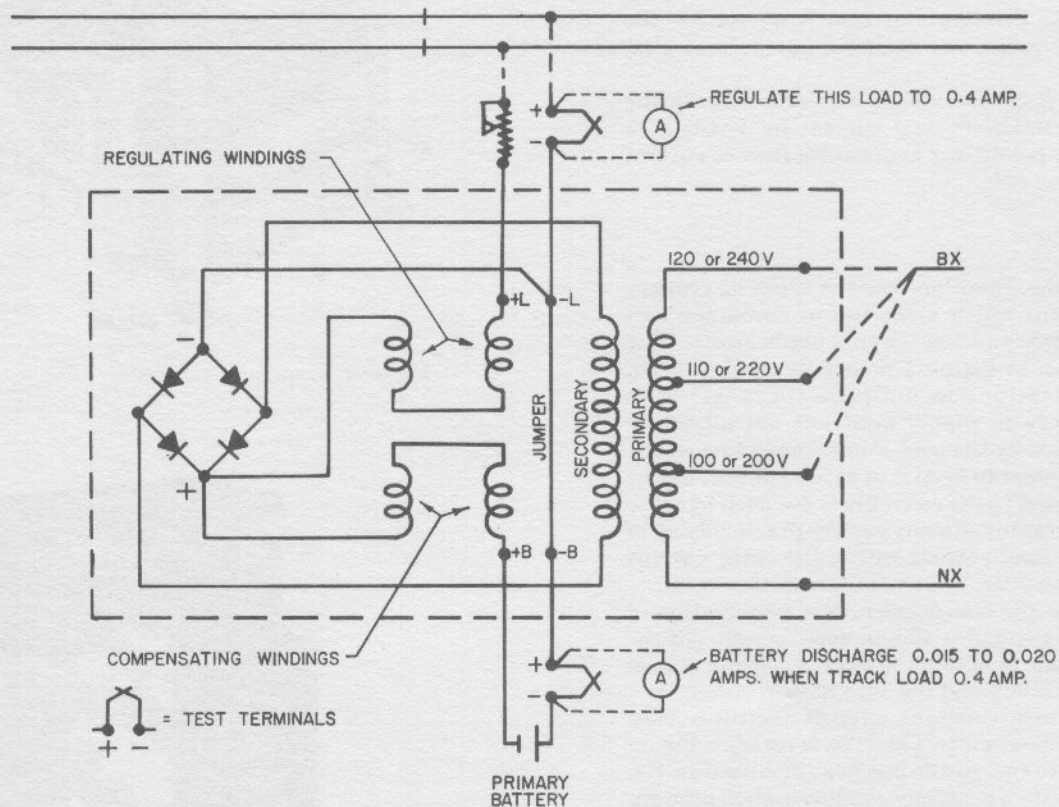


Figure 3 shows automatic rectifier for track circuits.

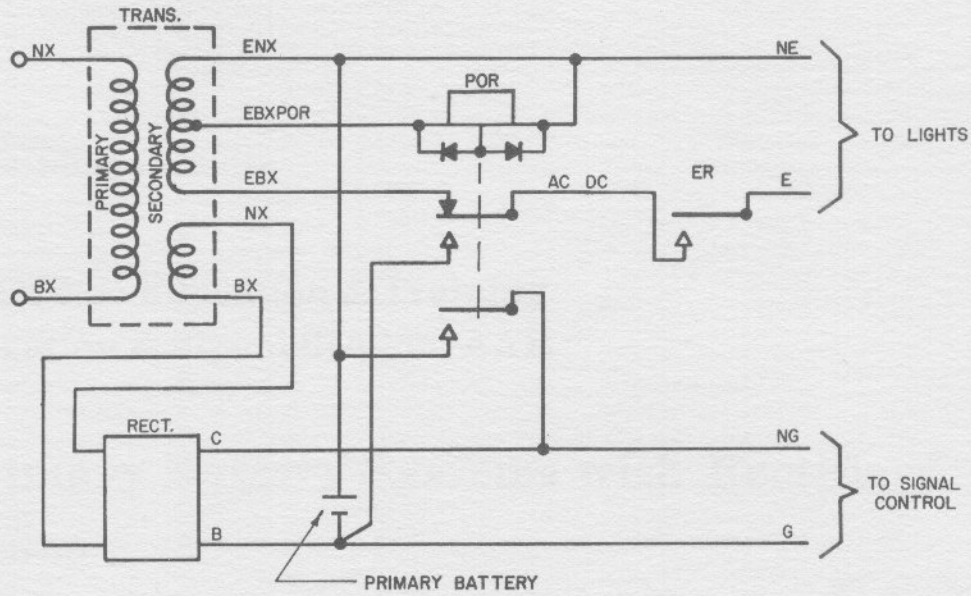


Figure 4 shows primary battery system with rectifier—a typical power arrangement for light-type signals using primary battery.

Note: (1) Adjust transformer to provide 10 volts ac on terminals of "POR" when ac supply voltage is at normal high level. (2) Rectified voltage is to be adjusted in field to a potential (within 2 volts) of adjacent line batteries using same common wire, but not less than 10 volts with normal load. (3) Place a restrictive shunt of approximately 0.5 ohm across battery for 10 minutes each 30 days to keep battery in active condition. An alternate method is to connect a 125 ohm fixed resistor across the battery to provide a minimum constant drain to keep battery active.

Notes: