

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

### A-16 Searchlight Signal Mechanism

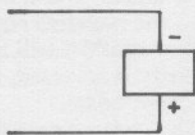
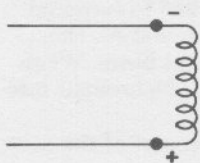
Approved November 1981

**Definition:** A three position operating mechanism which is electrically controlled to place a colored roundel, either red, yellow or green in front of a lamp. The light from the lamp radiates through the roundel to produce an aspect. Contacts operated by the mechanism open or close depending upon the position of the spectacle.

Connections from the internal contact are brought outside the housing to AAR terminals. Terminal connections are shown on a nameplate attached to the mechanism.

The proper aspect of a signal mechanism is displayed when the correct polarity of the controlling voltage is applied. The red roundel will be placed in front of the lamp when the controlling wires are absent of energy. The position of the red roundel is controlled by gravity.

**Symbol:** (see diagrams)



**Purpose and Application:** The searchlight signal mechanism is used in wayside signals. They are used in centralized traffic control, automatic block signaling, absolute permissive block signaling, interlockings and any territory where signals are necessary.

The searchlight signal is used to display the three aspects of red, yellow or green depending on the information to be conveyed.

**Description:** The searchlight mechanism shown in Figures 1 through 4 consists of contacts that are operated by the internal mechanism. The mechanism within the unit also operates a spectacle containing three roundels. The roundels are transparent and colored red, yellow and green. The unit is sealed in a one-piece plastic case fastened to an aluminum casting which carries the mechanism and the optical lens.

**General Information:** The searchlight signal mechanism is used very extensively on many railroads

(See Figures 1 and 2). The design of the unit enables three aspects to be displayed from a small physical component. The lamp in the unit once adjusted is suitable for all three aspects. The use of one lamp for three units is economical. Contacts operated by the mechanism that open or close depending on the action within the mechanism can be used to operate repeater relays or control other signals.

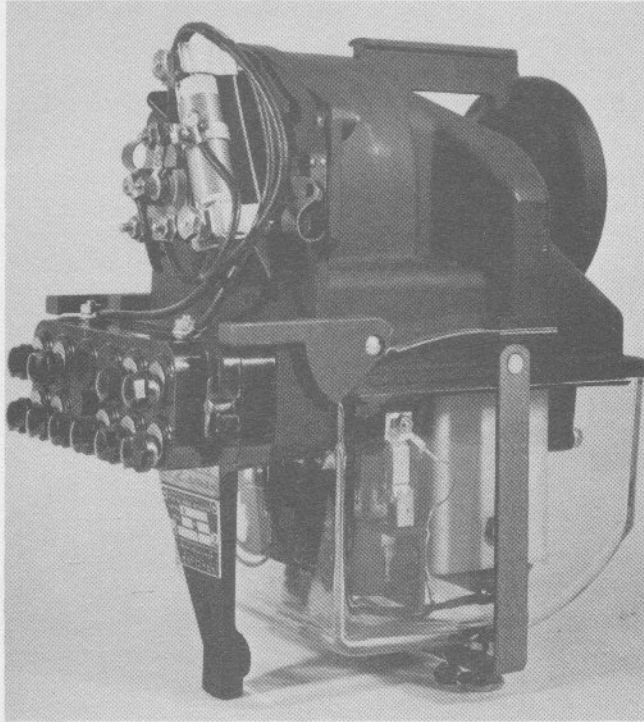


Figure 1 — Type SA-1 signal operating mechanism.

The small physical size is advantageous when two or more units are required on one mast.

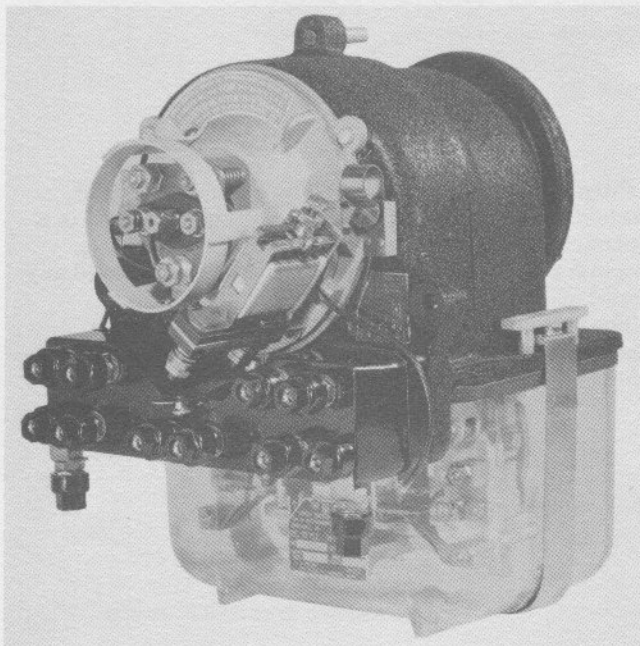


Figure 2 — Style H-2 signal operating mechanism.

**Detailed Operation:** The operating mechanism is essentially a three position dc motor type relay having an operating coil (armature) and a permanent magnetic field. The moving element is the armature which rotates approximately  $13\frac{1}{4}$  degrees each way from the center position. When de-energized the armature will assume the centre position due to a counterweight, and the red roundel will be in front of the lamp.

When current flows through the armature coil in one direction, it rotates the armature against a stop bringing the yellow roundel into the light beam. When current passes through the armature coil in the opposite direction, the green roundel is brought into the light beam.

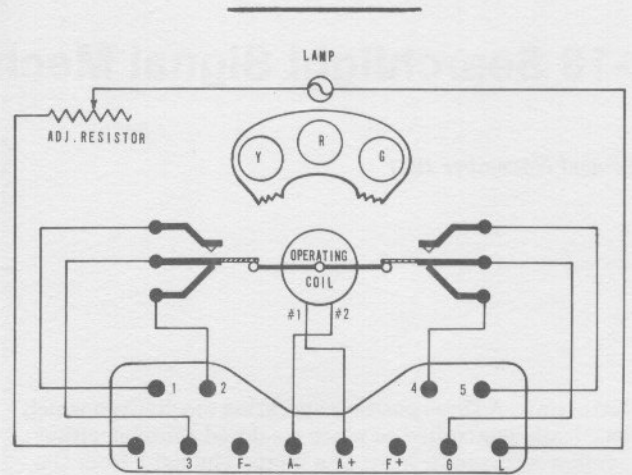


Figure 3 — Internal wiring of H-2 searchlight signal operating mechanism.

Figure 3 illustrates the internal wiring of the H-2 mechanism. When positive energy is applied to terminal A +, the negative energy is applied to terminal A -, the yellow roundel will be rotated into the light beam. When polarity is reversed, the green roundel will be brought into the light beam.

The contacts are operated by the movement of the armature and are used in external circuits to operate repeater relays. Note that the contacts *do not* control the position of the signal mechanism, rather it is the movement of the armature which determines the position of the contacts.

The magnetic structure of a searchlight signal mechanism is shown simplified in Figure 4 to illustrate the operation of this type SA-1 mechanism. The permanent

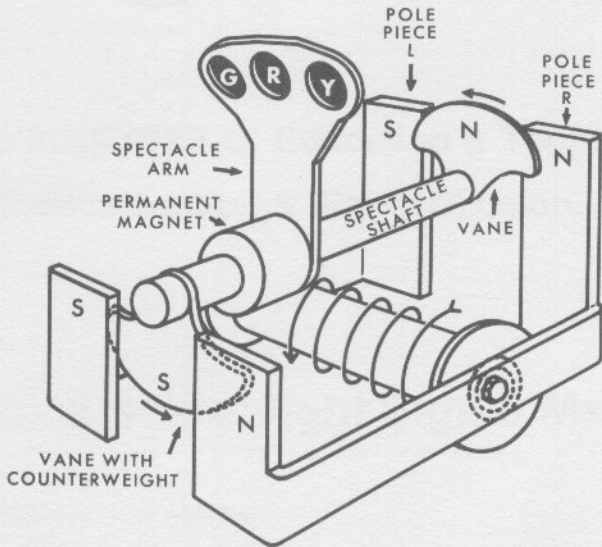


Figure 4 – Simplified diagram of the SA-1 searchlight signal mechanism.

This is due to the electromagnetic action of the operating coil.

Because unlike poles attract and like poles repel, it can be seen that the upper vane will be attracted to pole piece L and repelled by pole piece R. The lower vane would be attracted by pole piece R and repelled by pole piece L. The resulting movement of the spectacle shaft would position the yellow roundel in the light beam.

If the direction of current through the coil is reversed, the spectacle shaft will rotate in the opposite direction positioning the green roundel in the light beam.

Reversing or removing the energy in the control circuit will cause different aspect to be displayed by the mechanism. This information must be conveyed to the signal circuits.

The direction of current flow in the control circuit of a signal mechanism determines which direction the spectacle arm will rotate and in turn whether the green or the yellow aspect is displayed. When energy is removed from the control circuit, a counterweight on the spectacle arm returns the mechanism to the centre position and the red aspect is displayed.

Electrical contacts attached to the spectacle arm by a mechanical linkage are inserted in a circuit to control signal repeater relays which are utilized in external

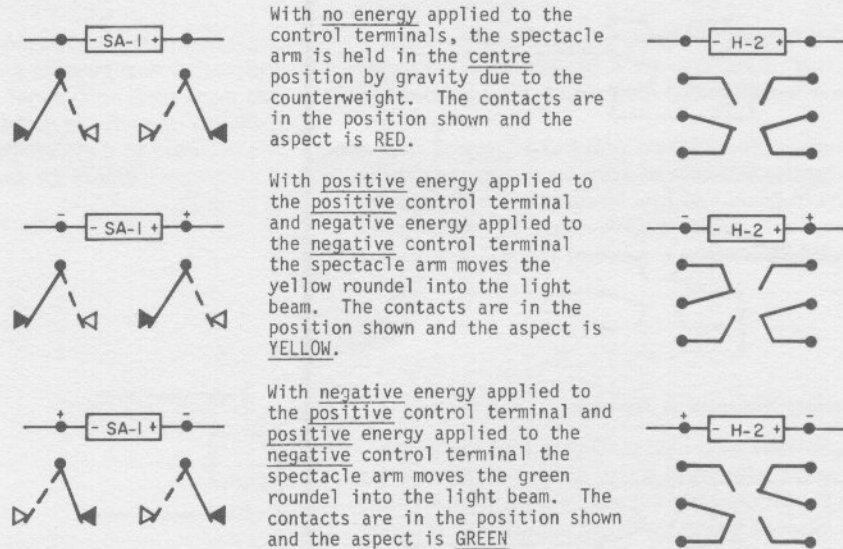


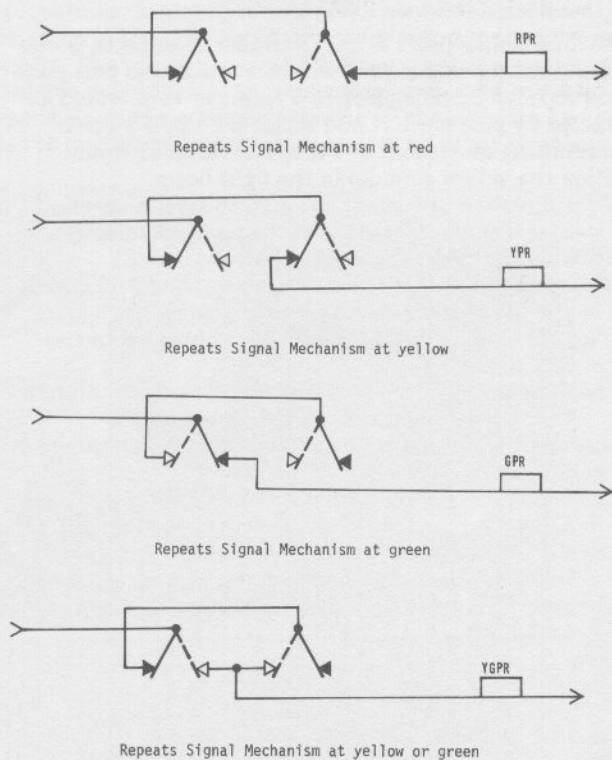
Figure 5 – Contacts of Type SA-1 and Style H-2 searchlight signal mechanisms. The contact positions for the SA-1 and H-2 searchlight mechanisms are shown in symbolic form.

magnet mounted on the spectacle shaft polarizes the upper vane as a north pole, and the lower vane (counterweighted) as a south pole. The direction of current flow through the operating coil (shown below the spectacle shaft) determines magnetic polarity of pole pieces.

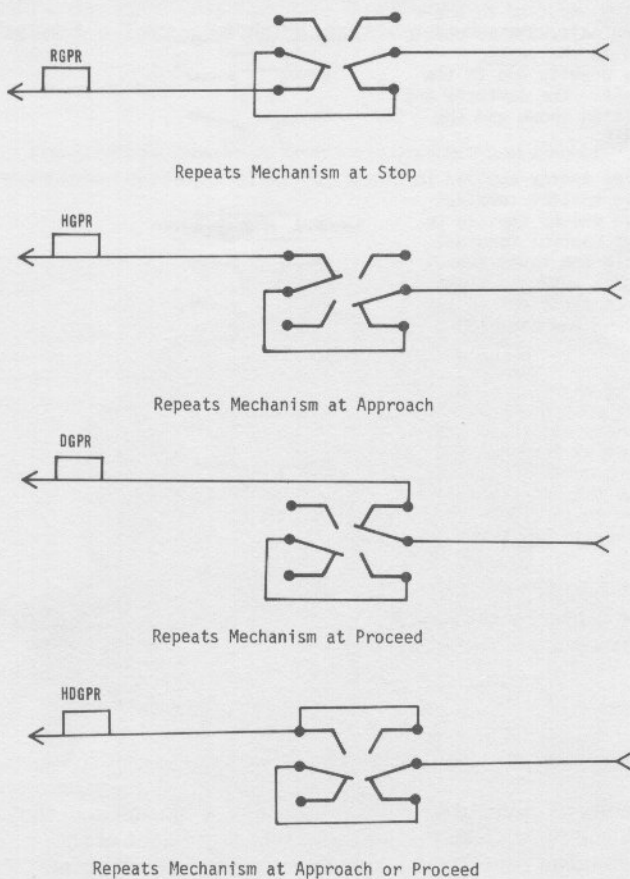
When energy is applied to the operating coil in the direction indicated in Figure 4, pole piece L will become a south magnetic pole and pole piece R will be a north pole.

circuits to indicate whether the signal mechanism is in the red, yellow or green position. Because movement of the mechanism contacts depends directly on the position of the spectacle arm, it follows that the position of the repeater relays is a very reliable check on the signal aspect displayed.

Notes:



**Figure 6** – Searchlight signal mechanism SA-1 showing contact positions.



**Figure 7** – Searchlight signal mechanism H-2 showing contact positions.