



# SC SIGNAL

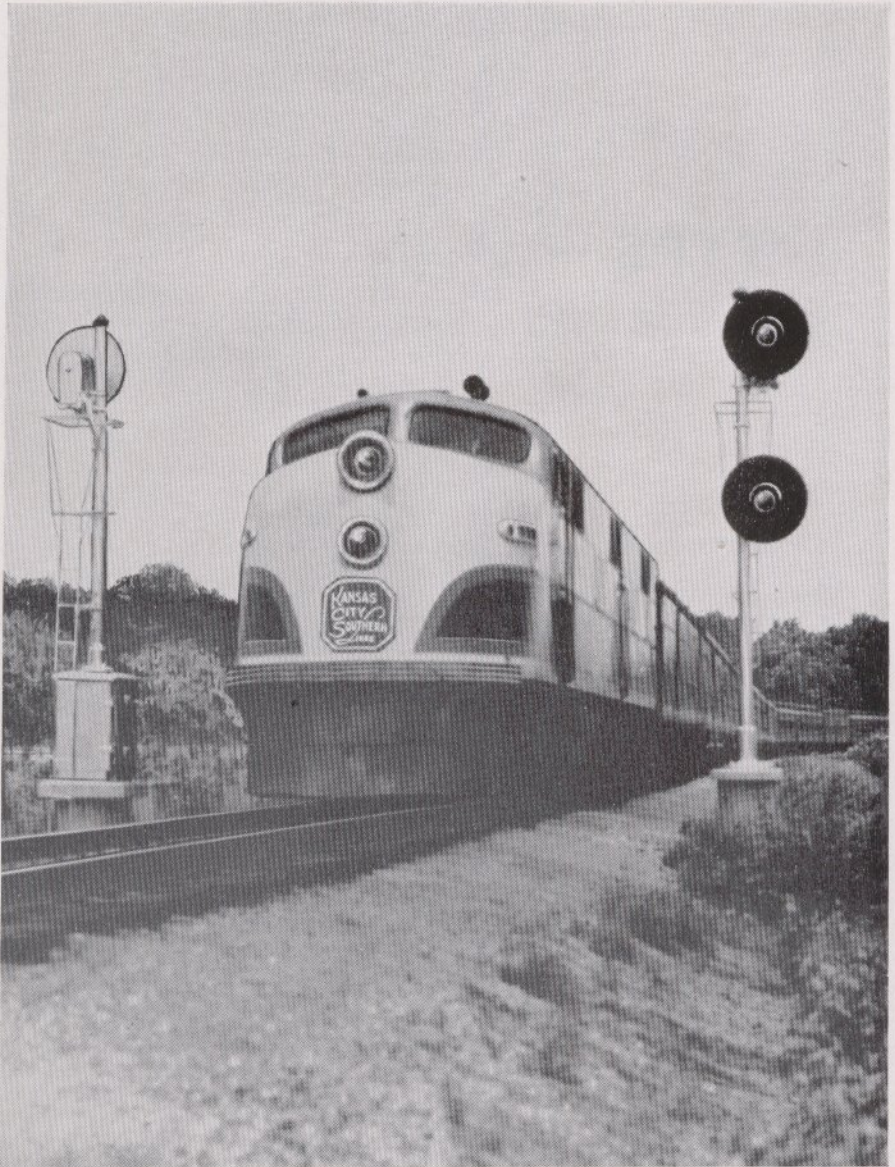
G-R-S BULLETIN 176

**TYPE**

**SC**

**A VERSATILE SIGNAL**





Type SC signals on the Kansas City Southern Lines

# G-R-S

**COLOR-LIGHT**

# SIGNAL

**Searchlight Type**

BULLETIN 176  
OCTOBER 1947

**GENERAL RAILWAY SIGNAL COMPANY**  
ROCHESTER 2, N. Y.



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Signal Company  
Rochester, N. Y.



Type SC high signal

Printed in U. S. A.

# DEVELOPMENT

The G-R-S Type SC searchlight signal has been specifically designed to provide features not available in other types of searchlight signals. These new features have been incorporated only as they contribute directly to increased efficiency and economy of signal operation.

The Type SC signal did not spring fully developed from the mind of any one engineer, nor did it take final shape in a single session at the drawing board. Like most successful developments in the field of railway signaling, it was gradually evolved in a series of steps.

First, a tabulation was made of the many practical features that could be included in the design of a searchlight signal.

Second, an exhaustive study was made of earlier types of successful searchlight signals, noting their advantages, their weaknesses, and their possibilities for improvement.

Third, a comprehensive analysis was made of all standard signaling circuits to determine the signal mechanism characteristics that would best fit each circuit.

Fourth, the features shown to be desirable in the preliminary investigations were built into experimental model signals.

Fifth, these experimental models were then subjected to a comprehensive series of laboratory tests. Changes were made as the tests indicated, and the final model was again tested.

Sixth, the laboratory-approved model was given rigid field tests under actual service conditions. Results were noted, and changes were again made and tested until the final design was approved for actual production.

Seventh, early installations were carefully checked and further changes were made to eliminate the undesirable features which develop under service conditions. Thus the Type SC has emerged as a thoroughly tested signal.



# FEATURES

**TRACTIVE-ARMATURE RELAYS**—an HG (yellow) and a DG (green) relay position the spectacle and operate the contacts. HG is a neutral relay and may be normal or slow-acting. DG may be neutral or polar.

**LARGE CONTACT CAPACITY**—as many as 12 dependent front-back contacts available to cut external wayside relays to a minimum.

**PROGRESSIVE ASPECTS**—red to yellow to green and vice versa without going through red when changing from yellow to green.

**BRILLIANT OPTICAL EFFICIENCY**—9 factory-locked precision adjustments obtain maximum beam from low-wattage lamps. Slanting color discs ban beam dilution. Lamp renewals do not disturb focus.

**AVAILABLE IN ALL TYPES FOR EVERY USE**—side or top of mast, one- and two-arm dwarfs, bridge, and fixed-indication signals.

**SIDE-HINGED OR BOTTOM-HINGED HOUSING DOOR**—your choice of either type. Side-hinged door can be altered in field for left- or right-hand opening.

**GENEROUSLY PROPORTIONED HOUSING**—ample space for two terminal boards, plenty of room for wiring, and a choice of wire inlets.

**SHOCK-ABSORBING MOUNTING BRACKETS**—minimize wearing effects of roadside or bridge vibrations on operative mechanisms. The relay structure is also mounted on shock-absorbing springs within the mechanism frame.

**PLUG-IN MECHANISM**—can be inserted or removed without disturbing wiring or precision of focus.

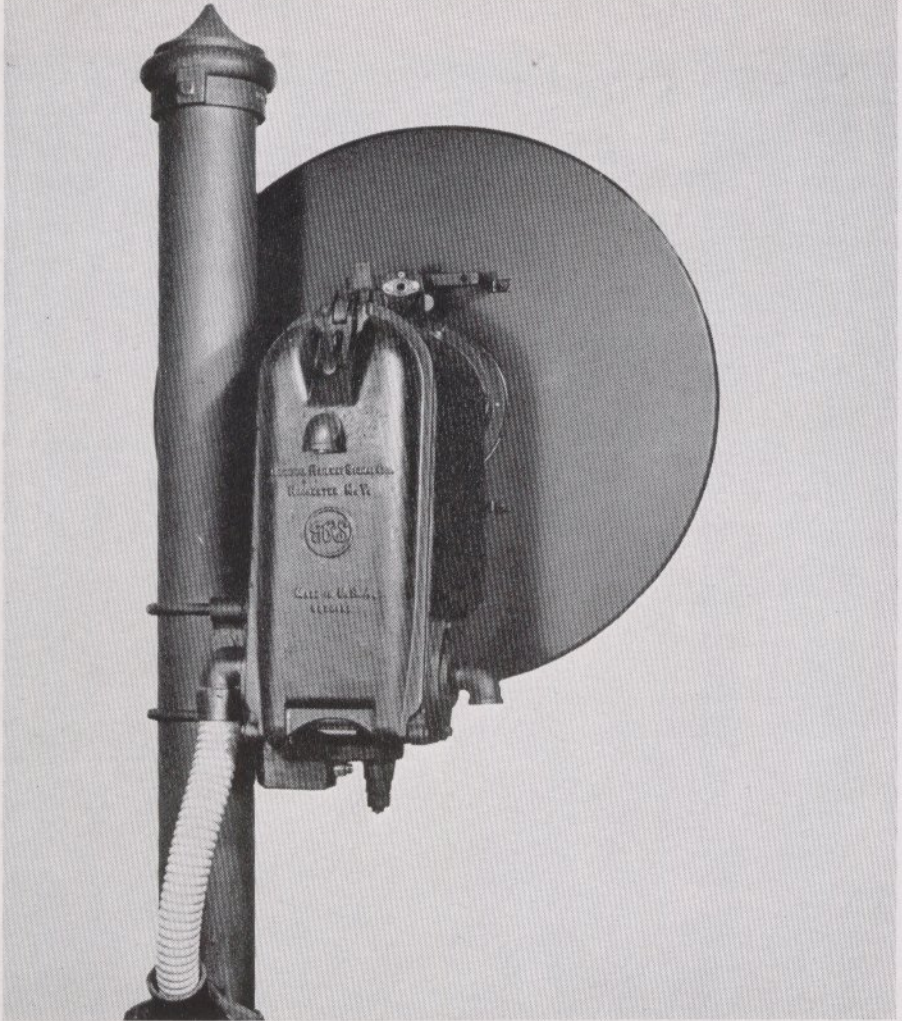
**CONSTANT-PRESSURE NEEDLE BEARINGS**—automatically compensate for wear and maintain the spectacle arm and armatures in their proper relative positions at all times. Mechanism needs no lubrication.







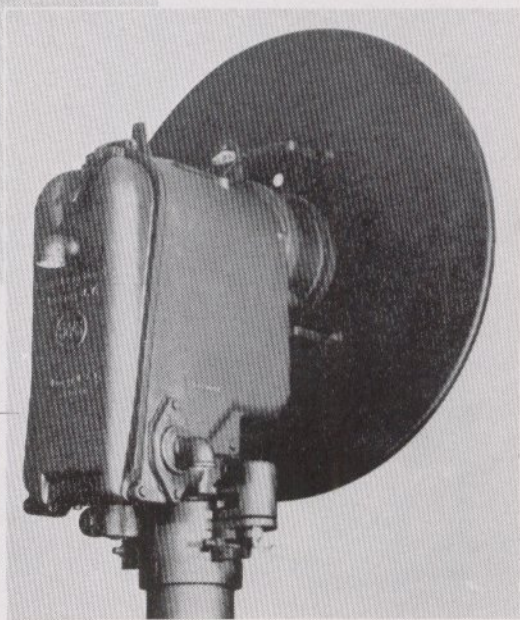
# SIDE-OF-MAST SIGNAL



This rear view of the side-of-mast high signal shows the housing door hinged at the bottom. Side-hinged housing doors are also available as shown on page 16.

Height above top of foundation may vary according to the standards of individual railroads.

# TOP-OF-MAST SIGNAL



The top-of-mast high signal is provided with an additional wire inlet in the bottom of the housing, as shown on page 23, so that the field wiring may be brought up inside the mast if desired.

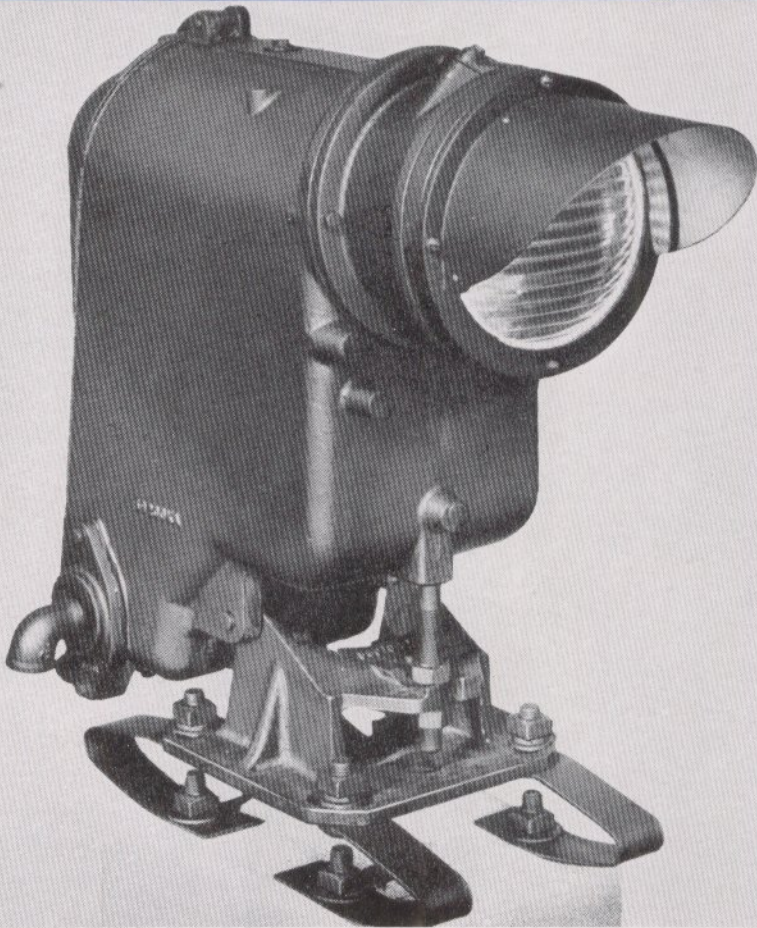


# BRIDGE SIGNAL



Type SC bridge signals may be mounted on the top or side of a short mast as shown on the preceding pages, or they may be supplied with a resilient mounting as shown here bolted directly to a bridge plate.

# ONE-ARM DWARF

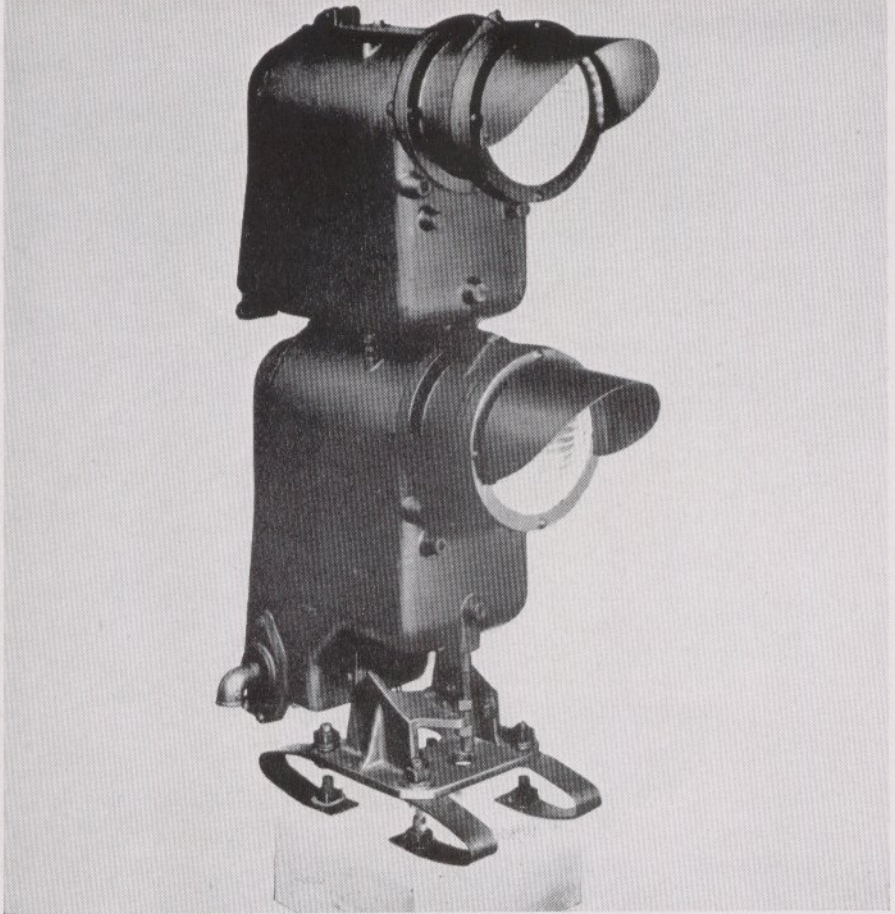


The one-arm dwarf signal is the same as the bridge signal except that background and sighting device are omitted, and a shorter hood is used. As shown, a deflecting outer roundel has been added to deflect the aspect upward to the engineman.

An inclined flat deflecting roundel can be furnished for special locations or to meet railroad requirements. A Phankill unit with mounting ring is also available for mounting between the outer lens and the deflecting roundel, if desired.



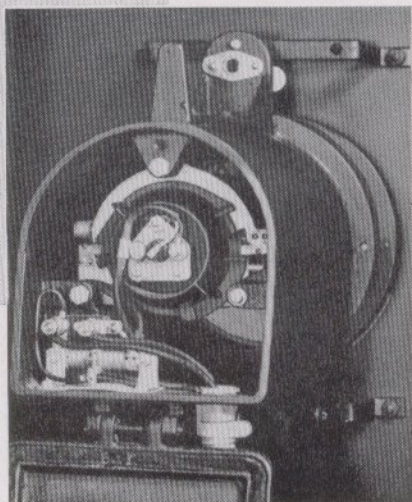
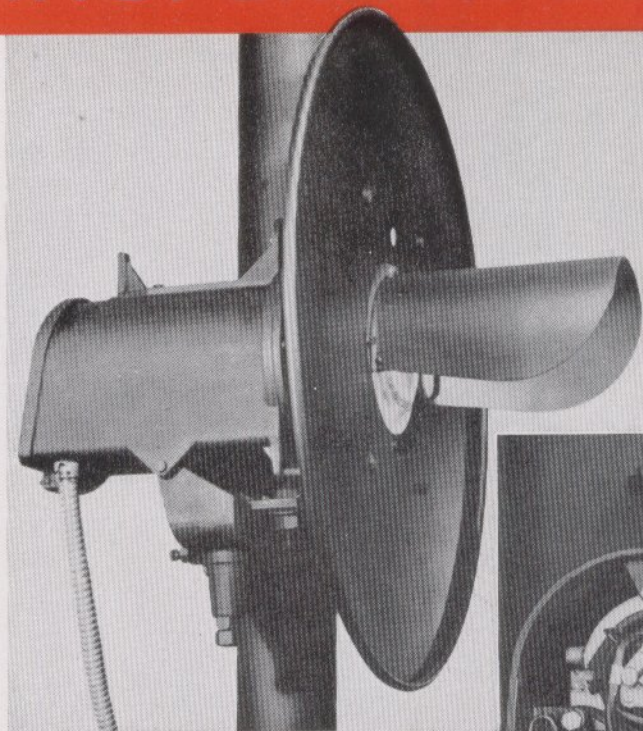
# TWO-ARM DWARF



The two-arm dwarf is the same as the one-arm dwarf except for the addition of another, shorter housing for the top arm and the use of heavier mounting springs.

The lower arm is a standard SC housing. The upper arm is a specially shortened housing designed for this purpose only. The plugboard in the upper housing is wired to a terminal board in the lower housing through a concealed weatherproof passage provided between the two housings where they are fastened together.

# INOPERATIVE UNIT



Optically, the inoperative unit is exactly the same as the three-indication signal except that its single color disc is permanently fastened in place.

As shown in the rear view, a terminal board and adjustable lamp resistor are conveniently located within the housing. The lamp may be changed out, the same as in the operative mechanisms, without disturbing the focus.

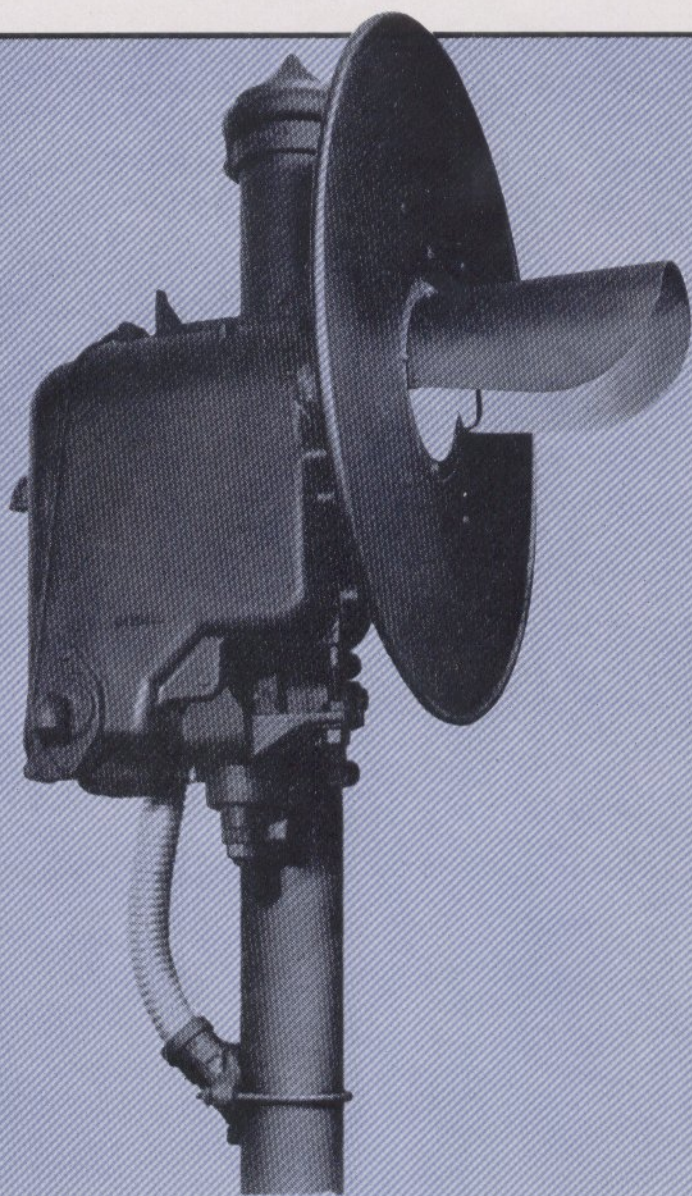
Coupling is provided for a  $\frac{3}{4}$ -inch flexible conduit or for park-way cable in the diameter required.

The bracket is not resilient, as there are no operative parts to be protected from vibration.

This signal is not recommended for use when the unit is extinguished for certain indications.

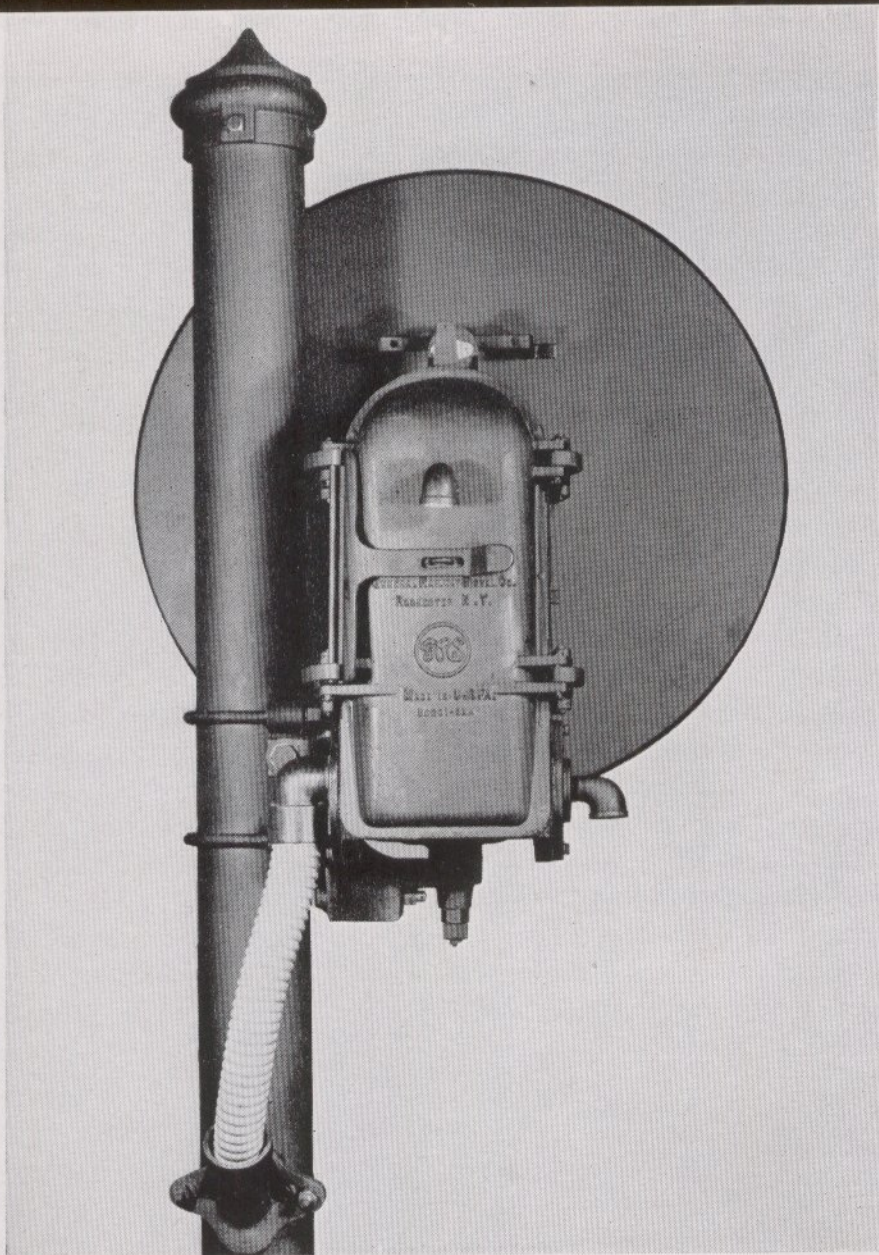


# THE HOUSING





# TYPE SC SIGNAL





## REAR VIEW

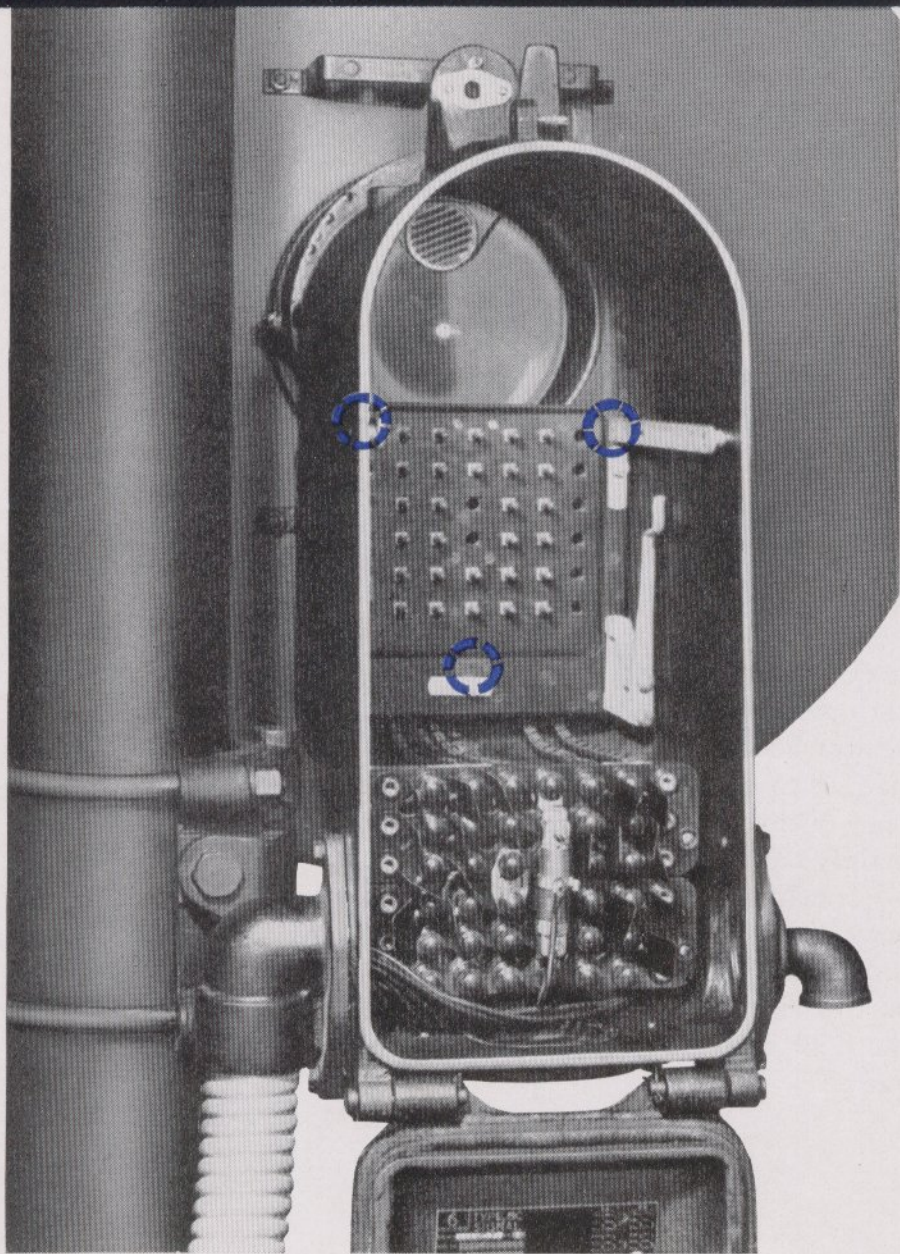
The Type SC signal housing is substantially made of cast iron and is thoroughly weather-proofed. The door is securely gasketed with heavy, resilient wicking material to insure water-tight closure, and all stationary metal-to-metal joints are sealed with a special non-hardening cement. Two screened ventilators are supplied with each housing. One may be used on the side of the housing and one on the door, as shown in the accompanying illustration. This arrangement of the ventilators provides a proper circulation of air within the housing.

As shown in the accompanying illustration, a 2-inch flexible conduit is bolted to the side of the housing. The mast coupling is equipped with a gasket to seal it to the mast and is so designed that the connection between the conduit and the mast coupling can readily be waterproofed with oakum and waterproof sealing compound.

If parkway cable is to be used instead of flexible conduit, couplings are also available to accommodate this type of cable in various diameters. Either flexible conduit or parkway cable may be attached to the side of the housing as shown, to the opposite side, or to the bottom of the housing. Page 23 shows an interior view of the housing wherein the various conduit openings can be plainly seen.

The housing door may be supplied with its hinges at the bottom, as shown on the following page, or it may be supplied as shown here with the hinges at the side. The hinges and the catch on this side-hinged door may be transposed in the field to make the door either left-hand opening or right-hand opening as required.

# TYPE SC SIGNAL





# INTERIOR OF HOUSING

## Door Open and Mechanism Removed

The hair-line sight visible at the top of the housing makes it easy to direct the signal beam at any point along the track.

In the compound-lens signal (shown here) a small 40-degree deflecting roundel is provided inside the housing to deflect a portion of the light downward at 40 degrees so that enginemen may obtain a close-up indication if stopped near the signal. The roundel is adjustable through an opening provided in the lens barrel as shown on page 37.

The plugboard is integral with the housing and consists essentially of one solid piece of plastic with plugs protruding at right angles from the surface against which the mechanism bears. On this surface, there are three molded pads (encircled) which butt against the mechanism plugboard to insure accurate positioning.

Supported in slots near the top of the plugboard at one end and attached to the sides of the housing at the other, can be seen the two tracks on which the mechanism slides. Below these tracks are the long leaf springs which hold the mechanism tightly against the plugboard when the carrying handle is in the "locked" position.

The plugboard is positioned with a master mechanism and locked in the housing before leaving the factory. This insures that mechanisms shall be interchangeable and yet give equal optical performance.

# AMPLE HOUSING SPACE

The generously proportioned housing provides plenty of room for external wiring, even when a considerable number of wires are required by the associated signaling circuits. This feature reduces the time and effort required in wiring a signal and facilitates subsequent tests and inspections.

The accompanying illustration shows how internal operating parts are visible through the glass case for rapid, thorough visual inspection without removing the mechanism. Armatures, air-gaps, contacts, coils, residual stops, and spectacle drive are all located where they can be seen.

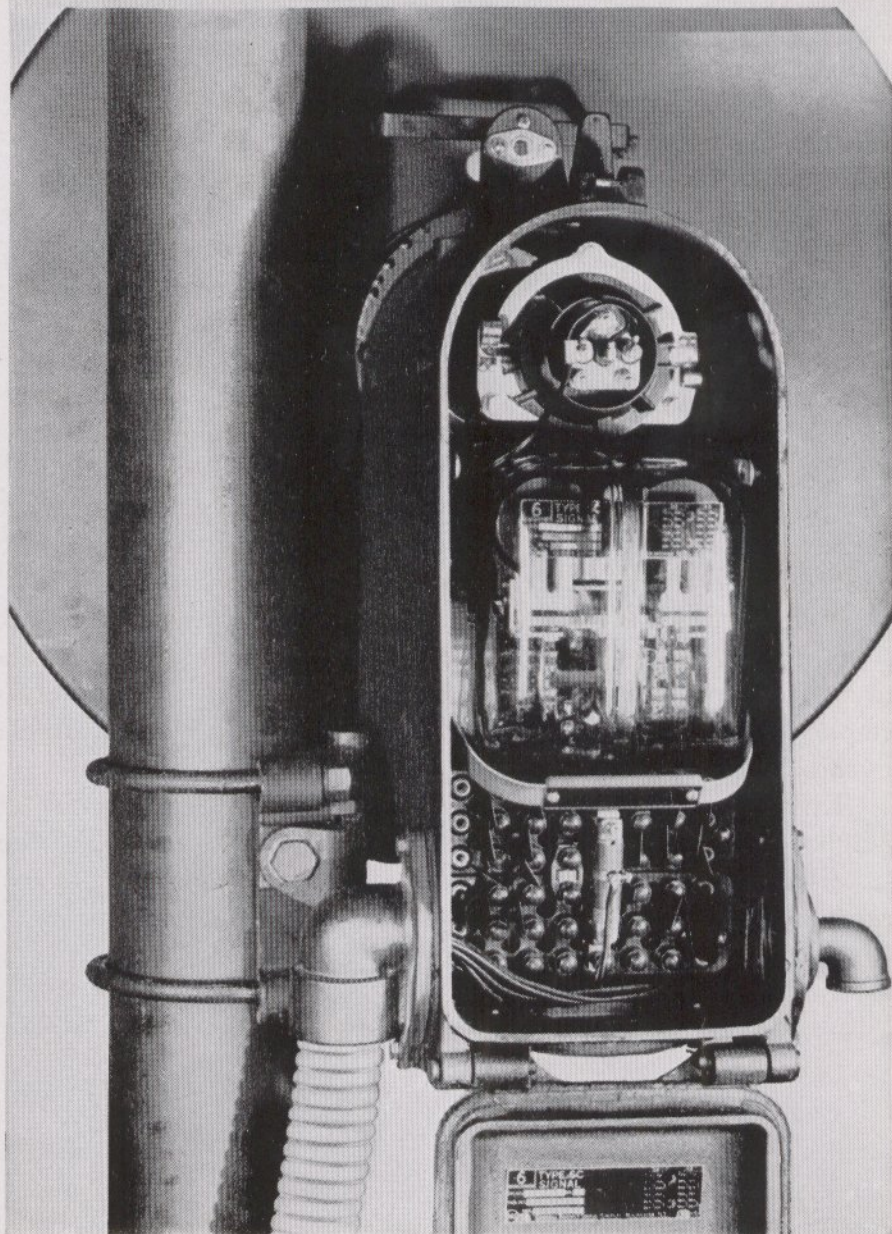
The plugboard to which the signal operating mechanism plugs is permanently wired to terminal boards (or a terminal board) in the lower part of the housing. Polar-neutral mechanisms, as shown here, require two terminal boards. A single terminal board is used with neutral-neutral mechanisms.

The terminals are no. 14 screws with 24 threads per inch. They are provided with fully insulated heads. Openings are located in the terminal board near each terminal so that the external wires can be brought in behind the terminal board and out through the openings. The wires can then be fitted with identifying tags and fastened to their respective terminals. This permits neat, workmanlike wiring and makes it possible to locate individual wires easily and quickly for testing without disturbing the other wires.

The terminal board also provides room for mounting an adjustable lamp resistor and a replaceable shunt gap lightning arrester, which is connected across the windings of the mechanism. Lightning arresters are provided with all polar-neutral signals.



# ACCESSIBLE TERMINALS



# 4

## WIRE INLETS

In designing the Type SC searchlight signal, particular attention has been paid to making the signal conveniently adaptable to various methods of bringing external wiring into the signal housing, regardless of whether the signal is located on the top of the mast, on the side of the mast nearer the track, or on the side of the mast farther from the track.

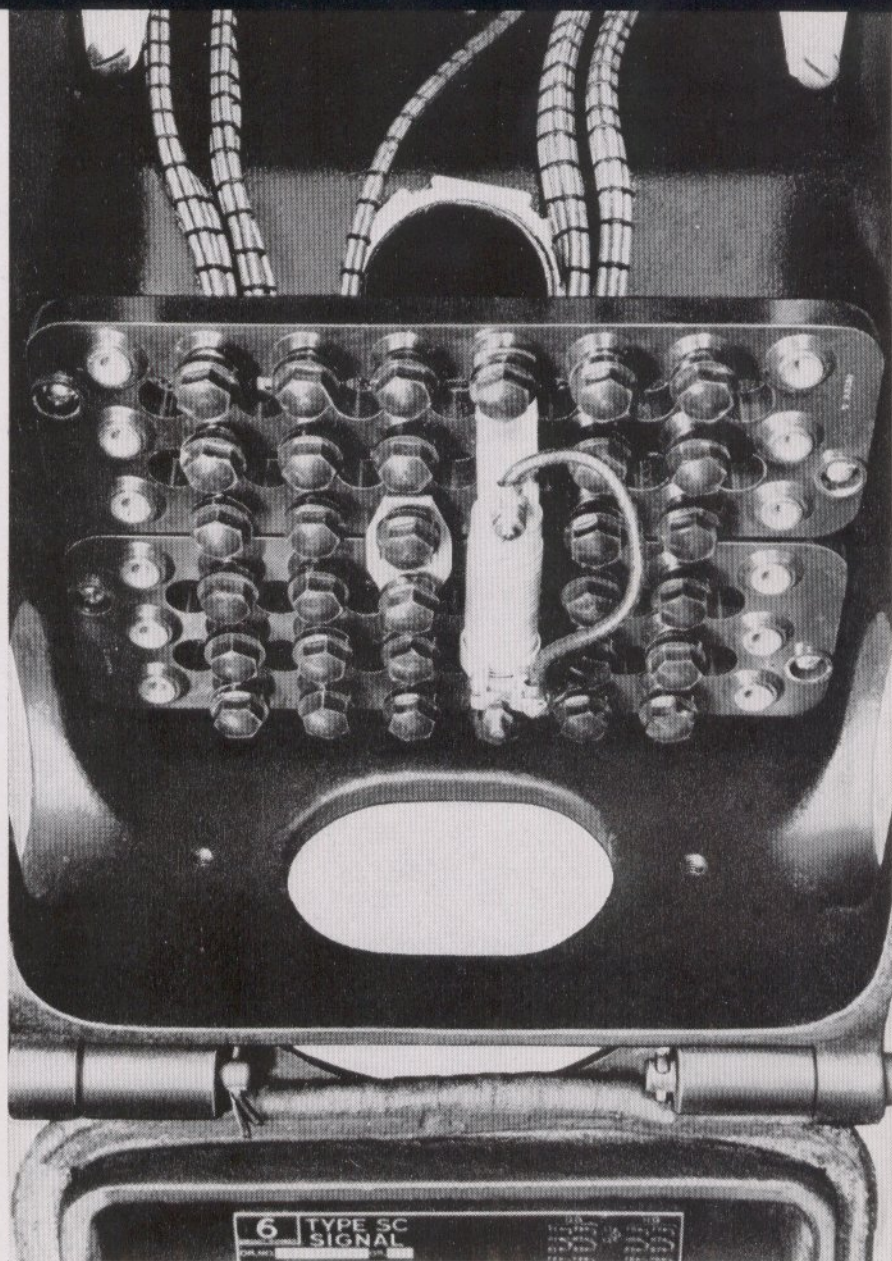
The accompanying illustration shows the interior of the signal housing. The covers have been removed from all of the wiring inlets so that their locations are clearly visible. As may be seen, there are four wiring inlets: one on the bottom of the housing, one on each side, and one on the 45-degree slope near the bottom of the housing. This last wiring inlet, which may be seen just above the terminal board, is provided only in top-of-mast signals and permits external wiring to be brought up inside the mast and into the housing in back of the terminal board.

When flexible conduit is to be used for the external wiring, a coupling is provided to fit 2-inch conduit. This makes it possible to utilize a considerable number of wires of large diameter and to employ to full advantage the large number of contacts available in the Type SC signal operating mechanism.

This view also shows the connections between the housing plugboard and the terminal blocks. This wiring is installed at the factory and is neatly corded into cables, well out of the way of any external wiring.



ARE AVAILABLE



# OPERATIVE SIGNALS ARE

To provide maximum protection to the signal operating mechanism and to make it possible to mount the signal in the most convenient location, regardless of vibrational movements that may be encountered, all Type SC signals equipped with operative mechanisms are resiliently mounted.

The mountings illustrated here are provided for all mast-mounted signals whether they are mounted on the top or on the side of the mast. The parts shown in solid red are stationary, and the parts shown in a lighter shade of red are resiliently mounted. Although the top-of-mast resilient mounting is necessarily designed somewhat differently from the side-of-mast mounting, the general principle is the same in both cases. The illustration of the side-of-mast mounting probably shows the operating principle more clearly.

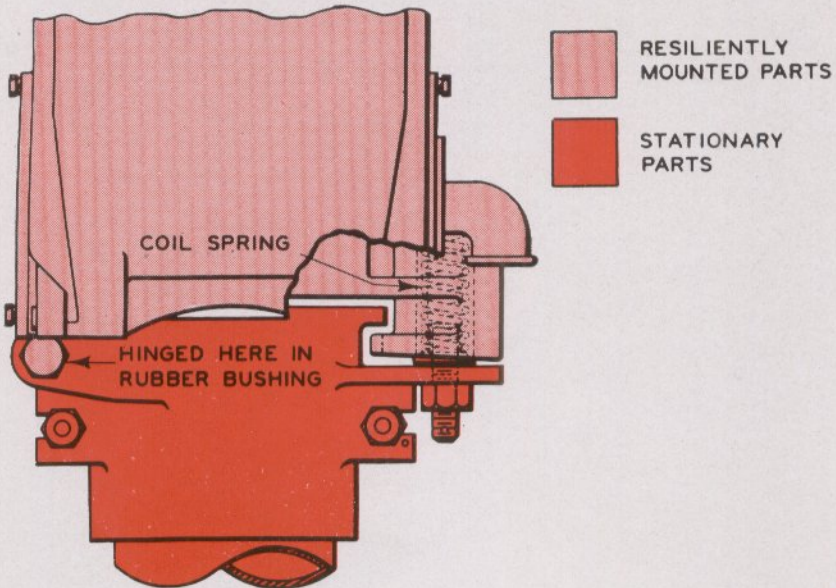
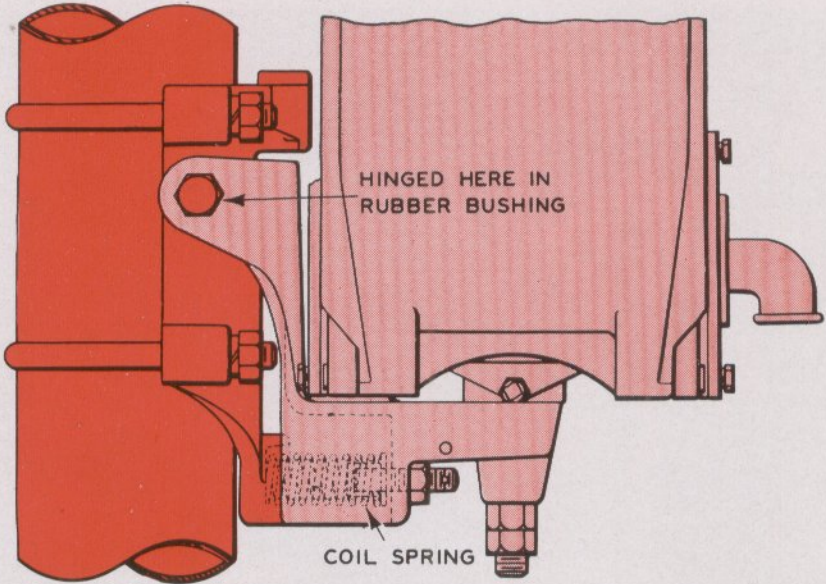
This mounting is fastened to the mast by U-bolts in the usual manner. The weight of the signal is supported by an arm which is hinged in live-rubber bushings at the point indicated and cushioned by an adjustable coil spring at the bottom.

Floated thus on the spring and on rubber bushings, the signal operating mechanism is protected from much of the wearing effects of roadside vibrations. This simple yet effective mounting means longer signal life, more dependable signal operation, and greater maintenance economy.

Foundation-mounted signals, such as dwarf signals and bridge signals which are fastened directly to bridge plates, are provided with sturdy elliptical spring mountings. These are illustrated on pages 10 through 12.

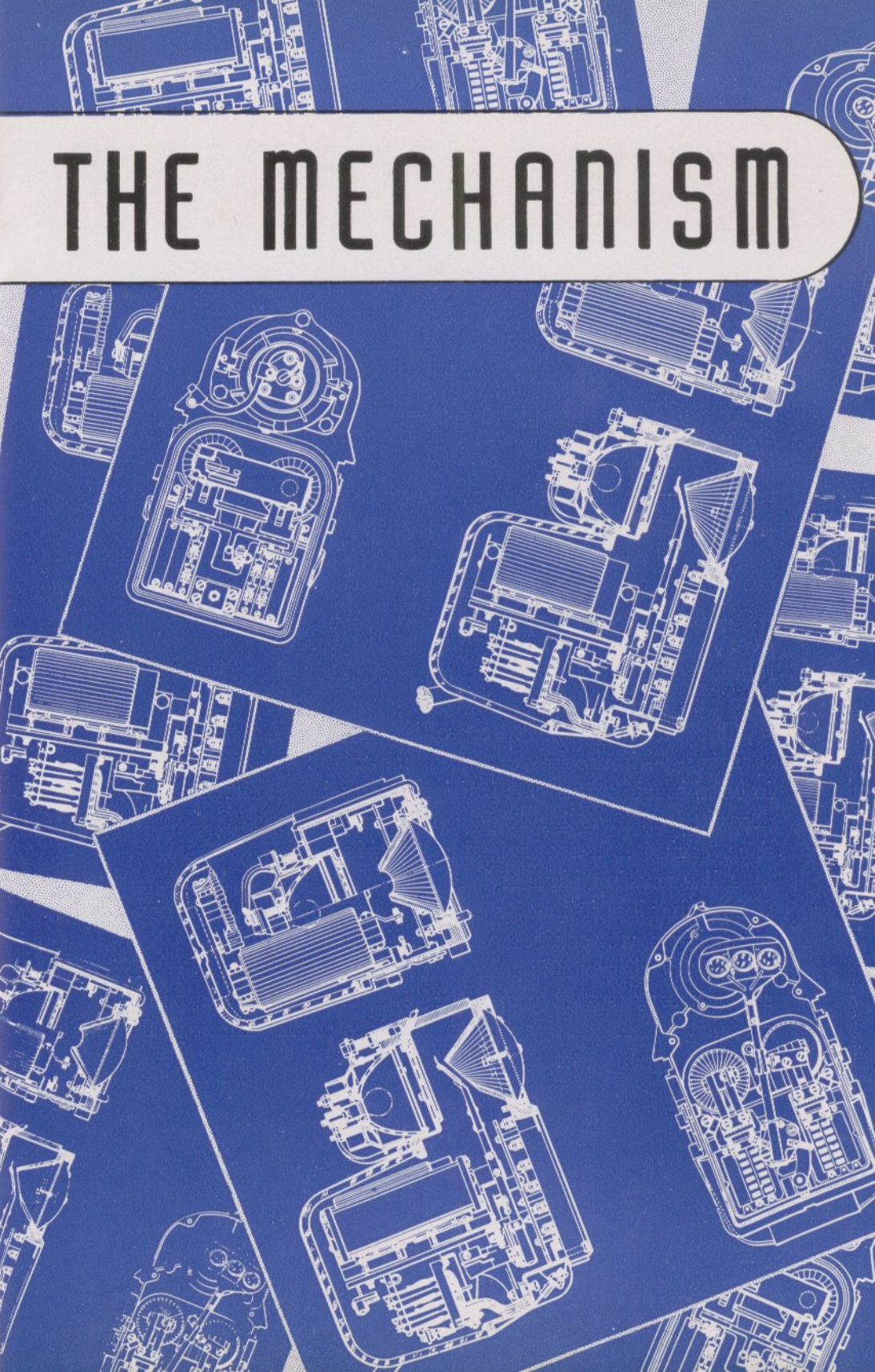


# RESILIENTLY MOUNTED





# THE MECHANISM





# SC MECHANISM

The Type SC signal operating mechanism is shown here with its glass cover removed to give a clearer view of the internal parts. The reflector unit, which also carries the lamp and lamp socket, may be seen in its normal position near the top of the mechanism. The reflector unit is held latched firmly in place by two spring clamps, one on either side. By turning the reflector unit clockwise, it can easily be removed for cleaning the reflector or replacing the lamp—without disturbing any electrical connections or altering the factory-sealed focus of the optical system.

Just below the reflector unit are the relay coils, the tractive armatures, the spectacle-beam drive link, the contacts, and the locking bail or carrying handle. The particular mechanism shown here has four front-back contacts operated by each relay. Each relay can operate a maximum of six front-back contacts when required.

The entire relay structure is mounted on shock-absorbing springs within the frame of the mechanism. This spring mounting, in combination with the resilient mounting of the signal housing described on page 24, doubly protects the Type SC signal against the wearing effects of roadside vibrations.

All operating parts are protected from dust, fumes, dampness, and mechanical injury by a gasketed transparent glass cover. The operating parts require no lubrication.

The locking bail is used to lock the mechanism in place inside the housing, as shown on page 46. It also provides a comfortable carrying handle and can be locked into a convenient position for this purpose.





# SC MECHANISM

The accompanying illustration shows the signal operating mechanism as viewed from the plugboard end. The mechanism shown is for use in a compound-lens signal. It carries the inner plano-convex lens of the compound-lens optical system. The stepped-lens mechanism is similar except that it is equipped with a plain flat cover glass instead of a lens.

A serrated black cone, located directly behind the lens, effectively dissipates any light which might enter the signal from external sources. This feature is described in detail on page 41. As shown here, the serrations of the cone are somewhat distorted by the optical effect of the powerful plano-convex lens.

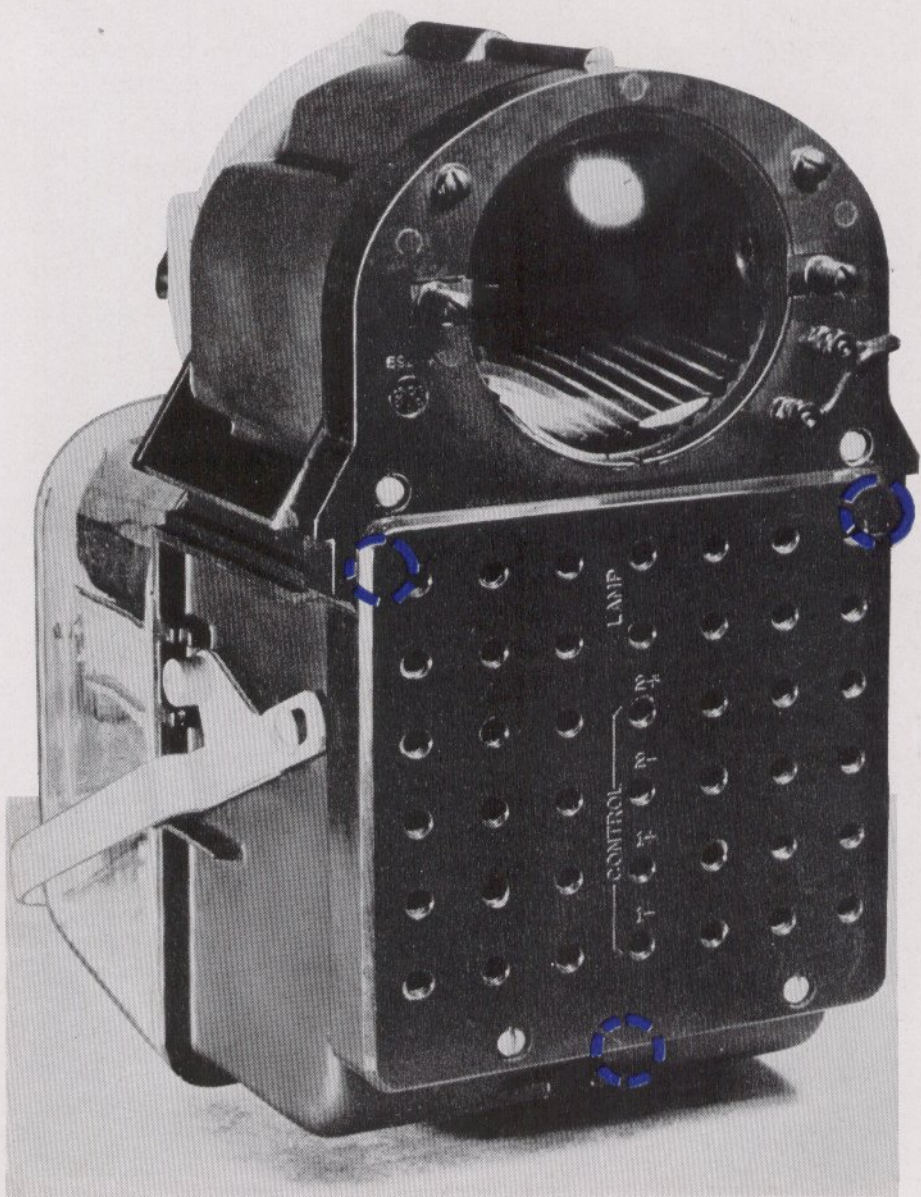
Studs projecting from the surfaces at each side of the lens serve to protect the lens from injury if the signal mechanism should accidentally be set down on a rough or abrasive surface.

Below the lens is the mechanism plugboard. The plug portion of the coupler is permanently mounted in the signal housing and wired to terminal boards. To insure accurate positioning of the mechanism within the housing, three molded pads on the housing plugboard (shown encircled on page 18) bear against the smooth plane surface of the mechanism plugboard at the three points shown encircled here.

The receptacles on the mechanism plugboard are wired to the coils and contacts. Note that the receptacle holes for the control and lamp wires are plainly labeled with raised letters molded on the plugboard to simplify testing of the mechanism.

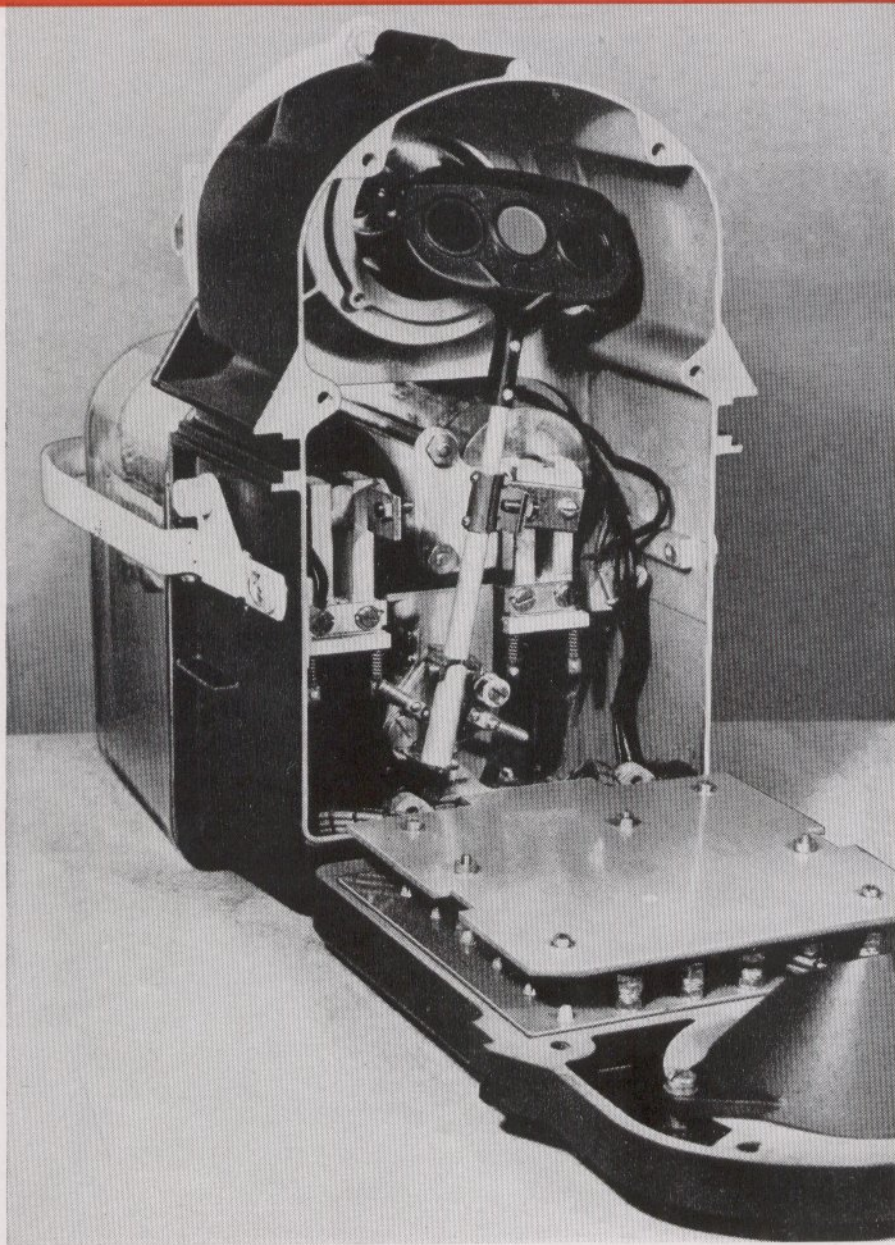
The plugboard is securely fastened to the mechanism frame with six screws and is sealed to guard against unauthorized opening of the mechanism.

# PLUGBOARD END





# SC MECHANISM



# PLUGBOARD REMOVED

Here the mechanism is shown with plugboard removed to expose the internal parts. The frame of the mechanism is die cast of aluminum alloy, a method of manufacture which produces strength, lightness, and a high degree of dimensional accuracy.

The spectacle arm is made of tapered aluminum tubing. A sleeve of tough, fibrous material protects the spectacle arm from metal-to-metal contact with the front and back stops. The stops, which are adjusted and locked into place at the factory, insure proper positioning of the color discs in relation to the light source.

As can be seen in this view, the color discs are slanted toward the lamp. This slanting of the color discs minimizes dilution of the projected light beam by reflection from external light sources. A more complete explanation of this feature will be found on page 41.

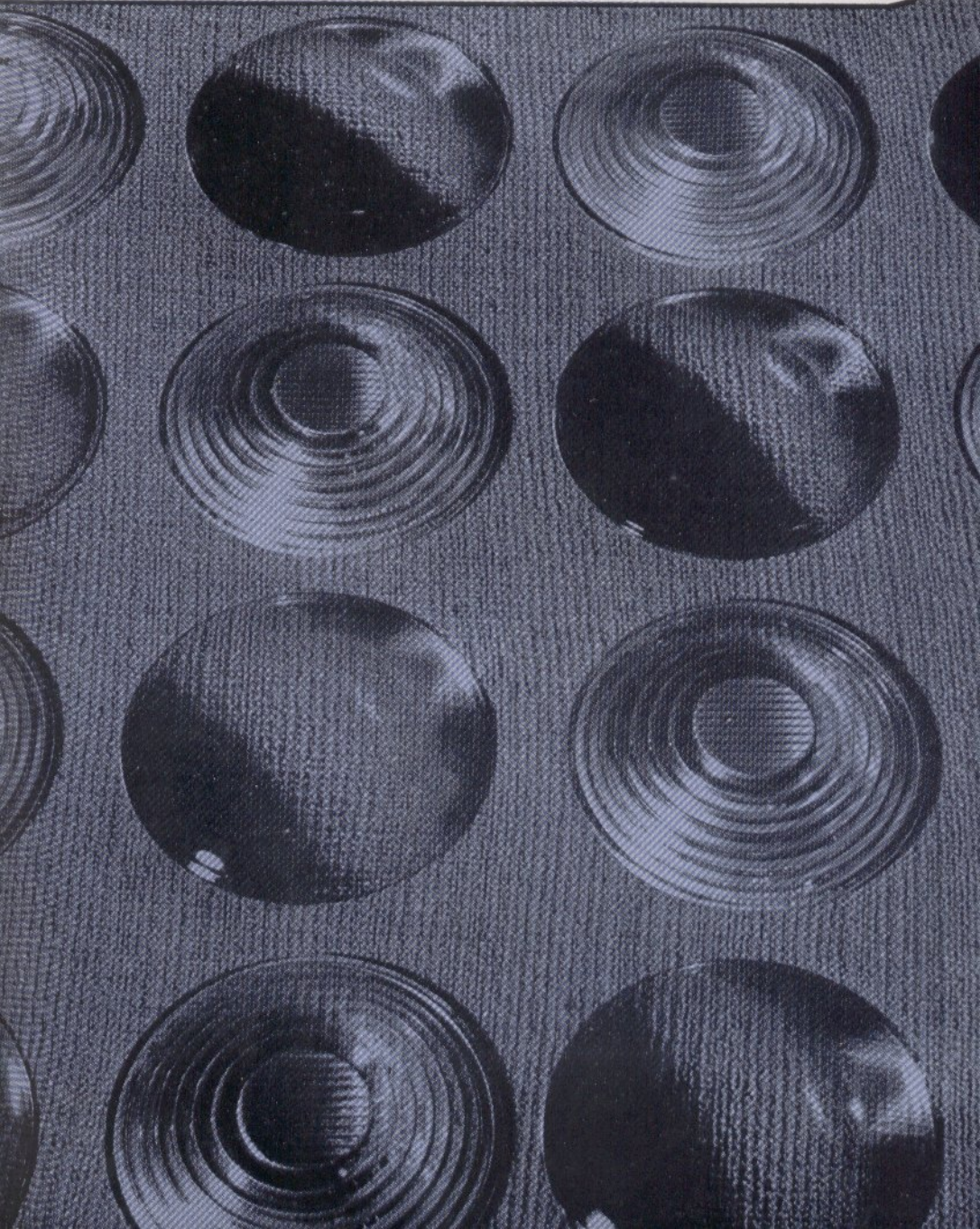
The ledges, which may be seen projecting from either side of the mechanism frame, fit upon tracks provided within the signal housing. These ledges support the mechanism within the housing and, in combination with the tracks, facilitate its easy insertion or withdrawal.

The springs shown just below the ends of the relay armatures maintain constant pressure on the armature bearings. These constant-pressure needle bearings are also used on the spectacle drive beam. They automatically compensate for wear and maintain the spectacle and the armatures in their proper relative positions at all times. Bearings of this type were selected for use in the Type SC signal operating mechanism after thoroughly proving their worth on such constantly moving parts as the armatures of the code-following relays used in coded track circuits.

Wires from coils and contacts are permanently connected to the plugboard underneath a phenolic insulating plate.

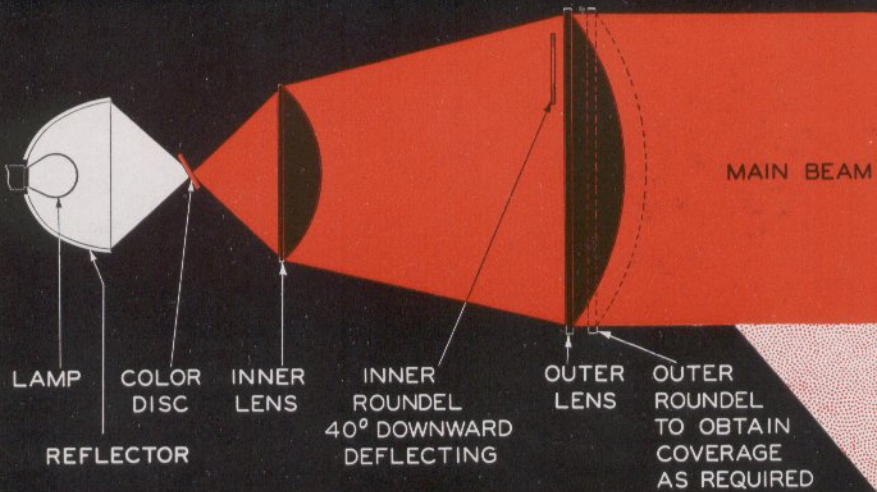


# LENSES

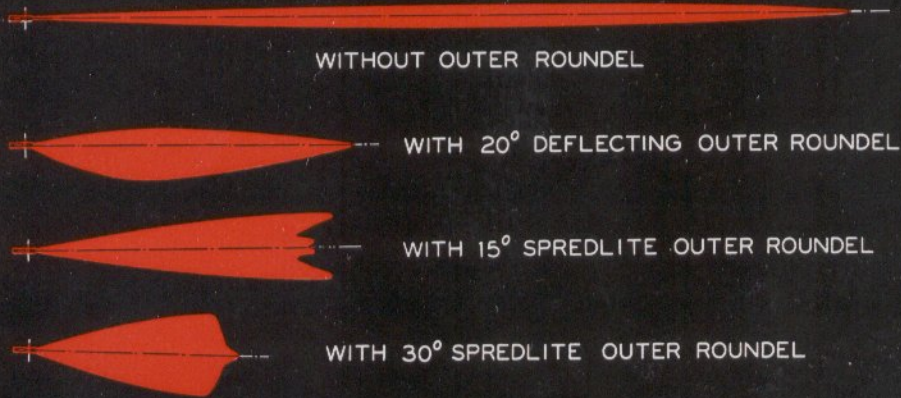




# SC SIGNAL WITH



PART OF BEAM DEFLECTED 40° DOWNWARD BY INNER ROUND EL





# COMPOUND LENS

The optical system of the compound-lens SC signal consists of:

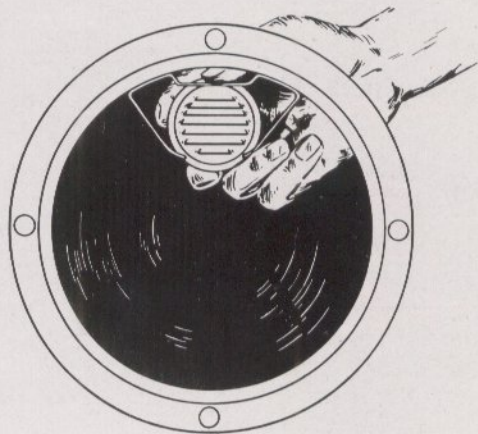
1. Lamp.
2. Reflector unit.
3. Color discs; red, yellow, and green, or other standard signal colors as required.

In the illustration on page 36, the lens system is shown viewed from side of signal; beam coverages shown looking down on track.

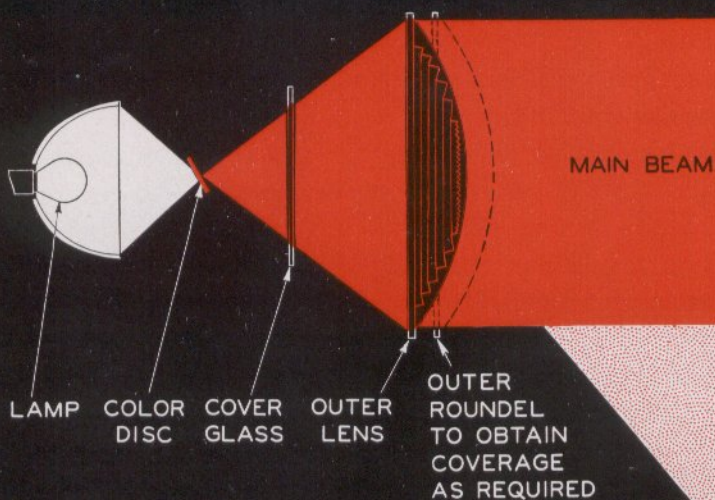
For the same wattage lamp, the compound-lens signal projects a longer beam than the stepped-lens signal. It is particularly effective with 8- or 10-volt, 5-watt lamps operated from primary battery, but is also frequently used with higher wattage lamps fed from storage batteries.

Outer roundels may be added as required to shape the beam to suit the curvature of the track approaching the signal. For a description of the various applications of the optical combinations available with the Type SC signal, see G-R-S Pamphlet 530, "How to Select the Proper Optical Combination for Any Given Condition."

An inner roundel, shown here, deflects part of the beam forty degrees downward for close-up aspects. It can be adjusted as shown.



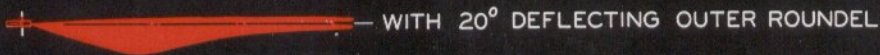
# SC SIGNAL WITH



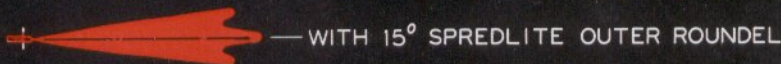
PART OF BEAM DEFLECTED  
40° DOWNWARD BY CENTER  
PORTION OF OUTER ROUND



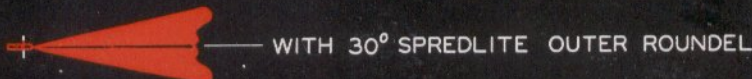
WITHOUT OUTER ROUND



WITH 20° DEFLECTING OUTER ROUND



WITH 15° SPREDLITE OUTER ROUND



WITH 30° SPREDLITE OUTER ROUND



# STEPPED LENS

The optical system of the stepped-lens SC signal consists of:

1. Lamp.
2. Reflector unit.
3. Color discs; red, yellow, and green, or other standard signal colors as required.
4. Cover glass (has no optical function; serves as a protective covering).
5. Outer lens with smooth convex outer surface and concentric circular steps on the inner surface.

The center portion of the outer lens is modified to divert part of the main light beam forty degrees downward for a close-up aspect. This part of the light beam can be adjusted as required by rotating the lens in the desired direction after loosening the outer bezel ring.

In order to cover adequately the many operating and topographical conditions encountered in railroad practice, various outer roundels are available which fit over the outer stepped lens. These roundels spread or deflect the light beam into various patterns, some of which are shown here. The lens system is shown viewed from side of signal; beam coverages shown looking down on track.

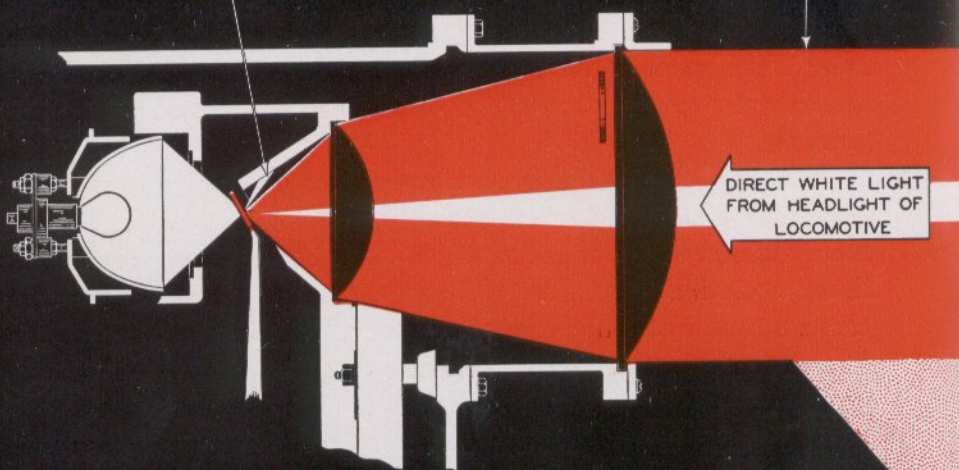
The outward appearance of the stepped-lens signal is similar to that of the compound-lens signal except that the lens barrel, which may be seen bolted to the housing shown on page 46, is omitted, as the stepped lens is mounted directly on the housing.

For descriptions of the many applications of the optical combinations available with the Type SC signal, see G-R-S Pamphlet 530, "How to Select the Proper Optical Combination for Any Given Condition."

# WHY THE COLOR DISCS

REFLECTED WHITE LIGHT IS DISSIPATED  
IN CONE HERE, THUS CANNOT DILUTE  
COLORED LIGHT BEAM

UNDILUTED COLORED  
LIGHT BEAM  
TO ENGINEER



DIRECT WHITE LIGHT  
FROM HEADLIGHT OF  
LOCOMOTIVE



# ARE SLANTED

Users of the earlier types of searchlight signals occasionally reported that under certain conditions the beam of colored light projected by a signal would appear to be diluted in color intensity. The aspect did not seem weaker in intensity of light, but it seemed paler than normal in color.

Experiments conducted in the G-R-S photometric laboratories indicated that the cause of this apparent beam dilution was reflection from the color discs, which are located at the focal point of the lens system. It was found that a powerful white light, such as that projected from the headlight of a locomotive, entered the signal and concentrated on the mirrorlike surface of the color discs. From this point, the white light was reflected back to the engineman, along with the normal colored beam being projected from the signal, thus diluting the beam.

To dissipate this undesirable white light before it reflected back out of the signal was the obvious solution to the problem. In accordance with this idea, the color discs were slanted toward the lamp, as shown in the accompanying illustration. The effect was immediately apparent. With white light shining into the signal, the color discs were slowly slanted to throw the reflected white light upward into the serrated cone. It was as though a curtain were being raised and the pure, undiluted beam was released in all its brilliancy of color.

As a result of this experiment, all Type SC signals, including the inoperative unit, are equipped with color discs set at the proper slant to avoid dilution of the aspect by reflected light.

# FACTORY SEALED

Optical precision in the light system of the Type SC signal is insured by accurate alignment of the optical units by skilled craftsmen using specially designed photometric equipment. The lamp socket, lamp filament, reflector, and lenses are precisely aligned and the adjustments locked into place so that each SC signal is shipped ready to display an aspect of maximum brilliancy without adjustment other than the aligning of the signal housing. THE LAMP FILAMENT must be in proper relation to the base of the lamp. Only  $\frac{1}{64}$  of an inch maximum variation is tolerated in G-R-S signal lamps.

THE LAMP SOCKET is adjusted at three points where the lamp socket is fastened to the reflector unit to exactly position the lamp filament on the optical centerline and at the filament focal point of the ellipsoidal reflector. The incandescent lamp used for this adjustment is especially selected for precise location of its filament.

THE REFLECTOR is positioned within the reflector unit by three adjustments so that the centerline of the reflector exactly coincides with the optical centerline of the system.

THE REFLECTOR UNIT is adjusted at three points where the ring carrying the complete reflector unit is attached to the mechanism proper. These adjustments exactly align the focal point of the reflector on the centerline of the optical system and position the focal point of the reflector so that it coincides with the focal point of the inner lens on the compound-lens signal or with the outer stepped lens on the stepped-lens signal.

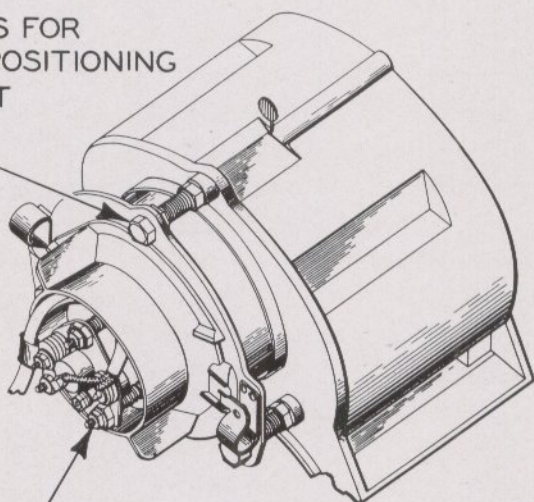
THE COLOR DISCS carried by the movable spectacle are positioned at the conjugate focal points of the reflector and the inner (or stepped outer) lens, so that all of the light from the lamp must pass through a color disc before it reaches the outer lens system.



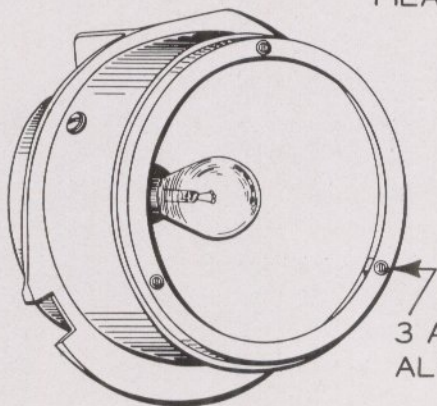
# OPTICAL PRECISION

THE INNER LENS carried by the mechanism of compound-lens signal is exactly positioned in relation to the outer lens by the factory-adjusted plugboard in the housing. In like manner, the reflector is properly spaced from the single lens which is mounted in the housing of the stepped-lens signal.

3 ADJUSTMENTS FOR  
ALIGNING AND POSITIONING  
REFLECTOR UNIT

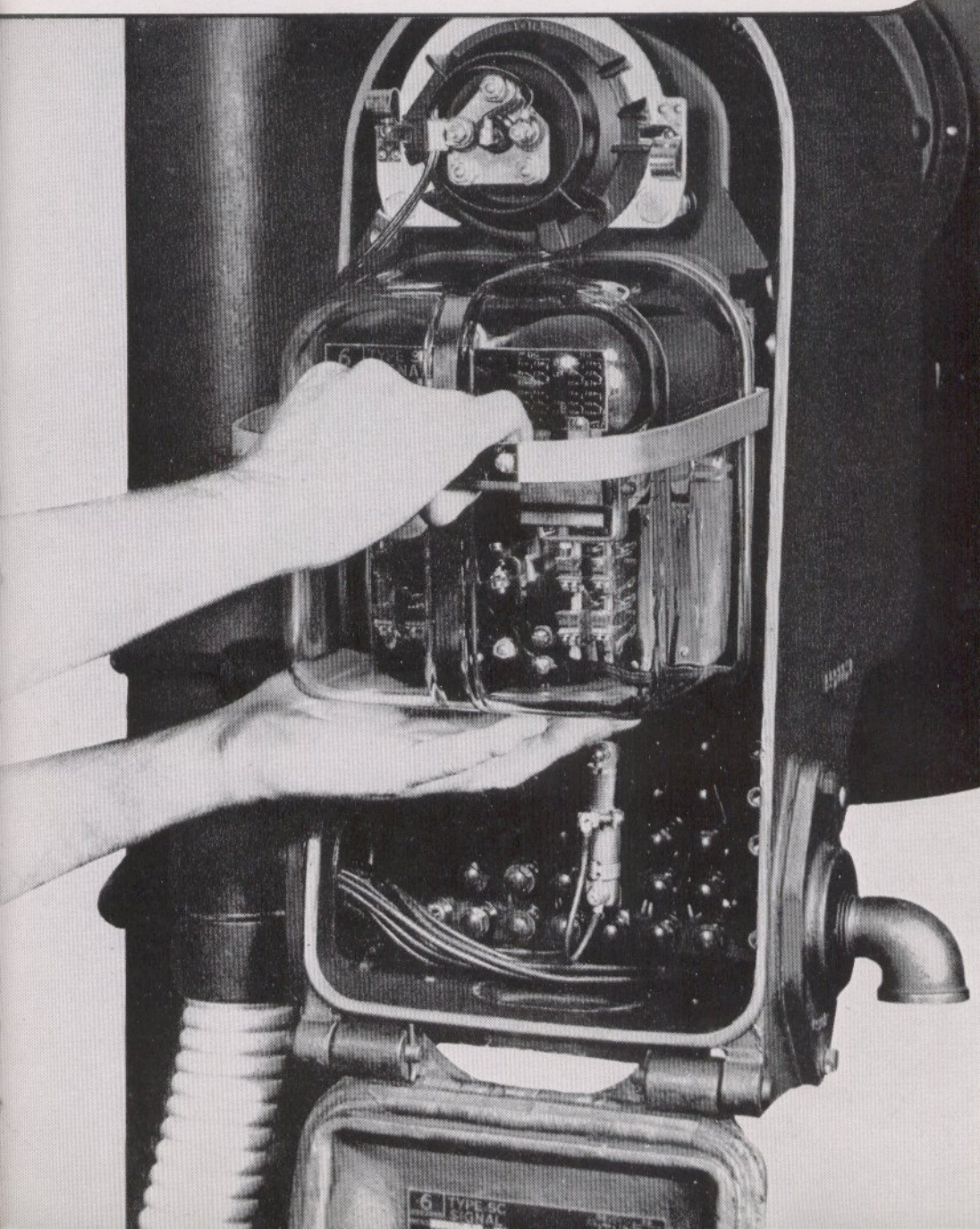


3 ADJUSTMENTS FOR  
CENTERING AND POSITIONING  
FILAMENT



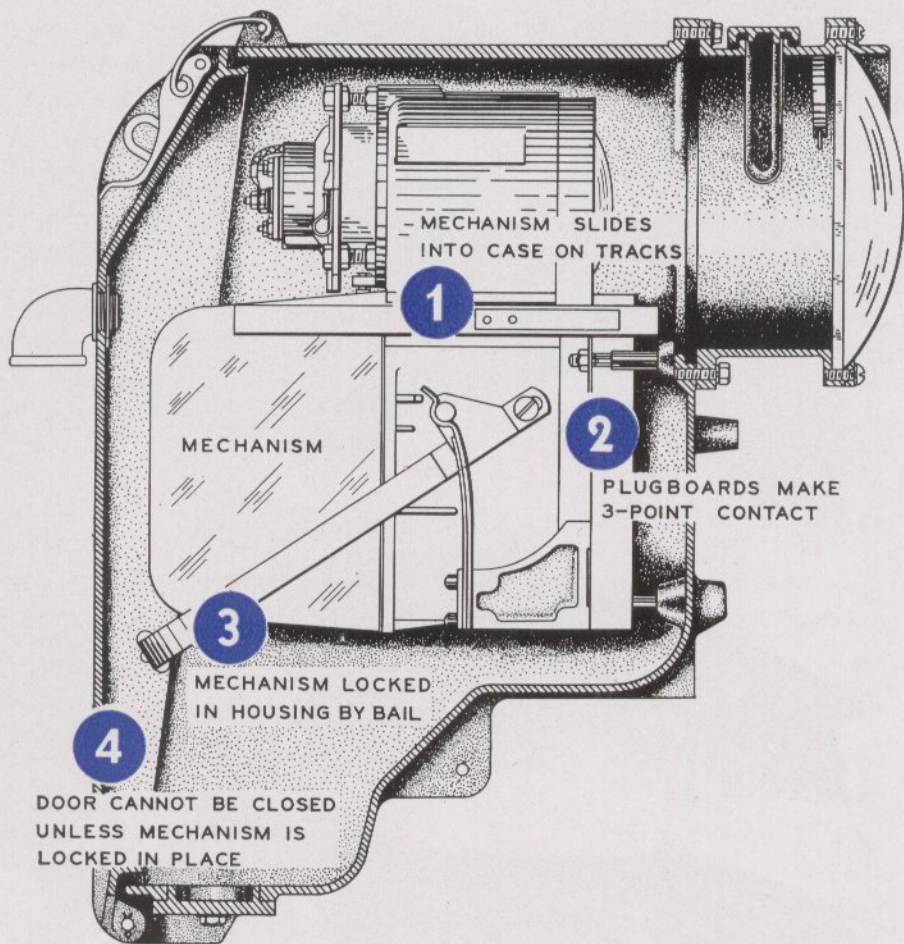
3 ADJUSTMENTS FOR  
ALIGNING REFLECTOR

# PLUG COUPLING





# MECHANISM SLIDES



# INTO CASE ON TRACKS

Each operative Type SC signal is so constructed that the signal operating mechanism can be quickly installed or removed as a single unit, without disturbing any of the wiring in the signal housing or altering the focus of the signal in any way. This plug-coupling feature answers the demand for faster, simpler installations of signal operating mechanisms and eliminates possibilities of incorrect connections. Time-consuming mistakes cannot occur with the Type SC plug-in mechanism.

- 1.** To insert the signal operating mechanism into the housing, lift the mechanism onto the guide tracks within the housing and thrust the mechanism into the housing as far as it will go.
- 2.** The mechanism plugboard will make contact with the housing plugboard at the three points shown encircled on pages 18 and 31 as the plugs projecting from the housing plugboard enter and make positive connections with the spring contacts in the mechanism plugboard.
- 3.** Pull the locking bail downward as far as it will go. This locks the mechanism into the housing and applies the pressure of the long leaf springs to keep the plugboards in firm contact.
- 4.** The door of the housing cannot be closed unless the signal operating mechanism is properly locked inside the housing.



The plug-coupler contacts employed in the Type SC signal are specially designed to accomplish two important results. They provide positive, low-resistance connections that are maintained under constant, well distributed pressure; and they can be connected or disconnected quickly, simply, and with a minimum of effort.

These desirable results are, in a large part, due to the design of the contact springs shown enlarged in the accompanying illustration. Made of beryllium copper, these springs are slotted so that each spring is, in effect, six separate pairs of springs. Each pair of springs grips the plug in a different place with a pressure of one and a half pounds. Thus there is a total of twelve points of contact well distributed on the surface of each plug.

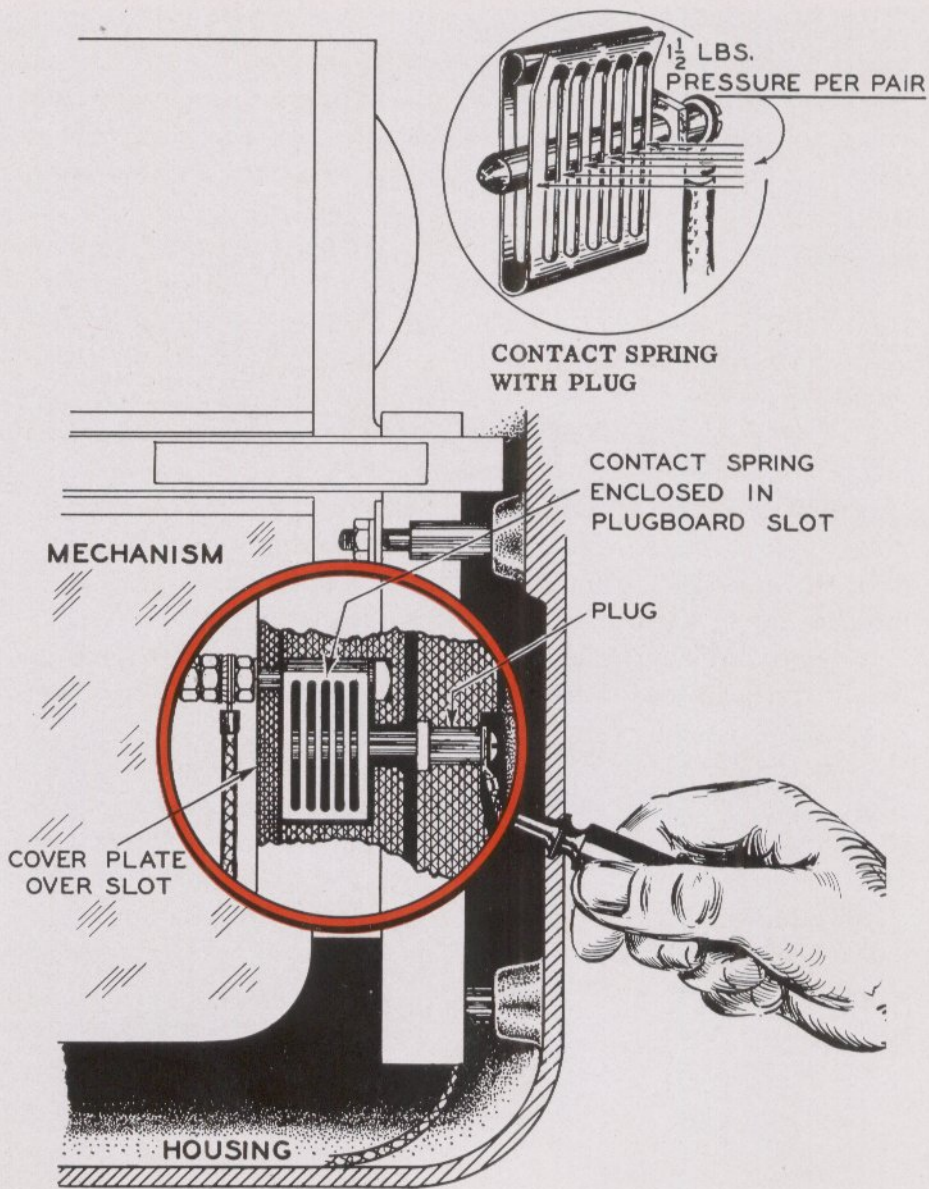
The square-cut edges of the slots exert a cleaning action on the plugs each time the mechanism is inserted into or withdrawn from the housing. This cleaning action maintains bright, clean, metal-to-metal connections.

The contact springs are enclosed in slots molded in the plug-board, and a cover plate is placed over the slots so that the springs receive a maximum of protection.

The ends of the contact plugs are tapered, as shown in the illustration, and they enter easily into the contact springs. The plugs are installed on a plugboard located well inside the housing where they are safe from accidental mechanical injury.

In general, the plug-coupling arrangement is simple, durable, and troublefree. It requires neither lubrication nor maintenance attention.

# CONTACT PER PLUG



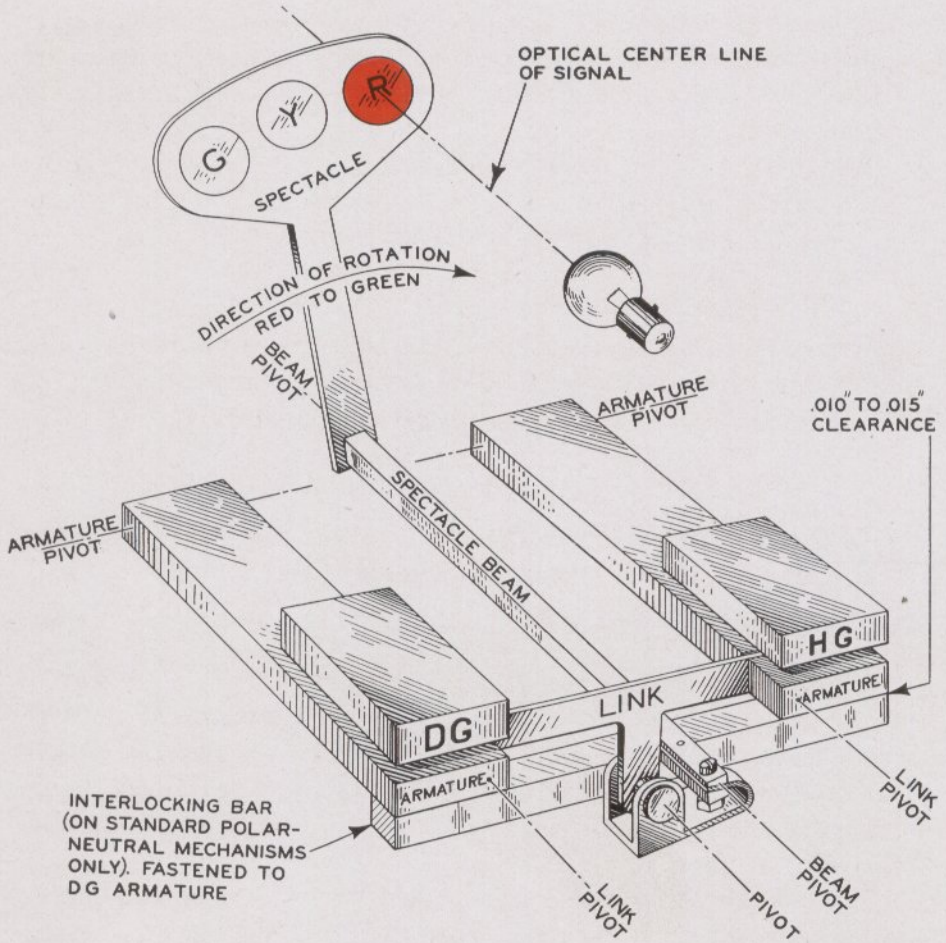


# OPERATION





# MECHANICAL





# OPERATION

As shown in the accompanying simplified illustration, the spectacle beam is rotated by two relays with horizontal tractive armatures. When the HG armature is picked up, one end of the link is raised, imparting a clockwise motion to the spectacle beam, thus moving it just far enough to the right to place the yellow color disc on the optical centerline of the signal, squarely in front of the lamp.

When the DG armature is picked up, the opposite end of the link is raised, imparting a further clockwise rotating motion to the spectacle beam and moving the spectacle farther to the right to place the green color disc on the centerline of the signal, squarely in front of the lamp.

If the DG armature drops away and the HG armature remains picked up, the spectacle beam is rotated counterclockwise to position the yellow color disc in front of the lamp.

## POLAR-NEUTRAL RELAY ARRANGEMENT

With this arrangement, the HG (yellow) relay will pick up when energized at either polarity. The DG (green) relay will pick up only when energized at the polarity predetermined to give the green aspect.

In the polar-neutral arrangement, both relays are energized by the same control circuit. The HG relay is controlled through a full-wave rectifier to permit changing the polarity of its control circuit without opening its front contacts. The HG relay only drops its armature upon deenergization, in which event the DG relay also drops.

When both the HG and DG relays are deenergized and energy is then applied with polarity calling for a green aspect, the HG (yellow) relay must always pick up first, before the DG (green) relay can pick up. This is accomplished by either of two methods, depending on whether or not the particular signaling circuit requires a slow-acting HG relay.

# MECHANICAL OPERATION

If a slow-acting HG relay is required, control of the DG relay is interlocked through make-before-break contacts on the HG relay so that the two halves of the DG coil oppose each other, preventing pick-up of the DG armature until the HG front contacts are closed.

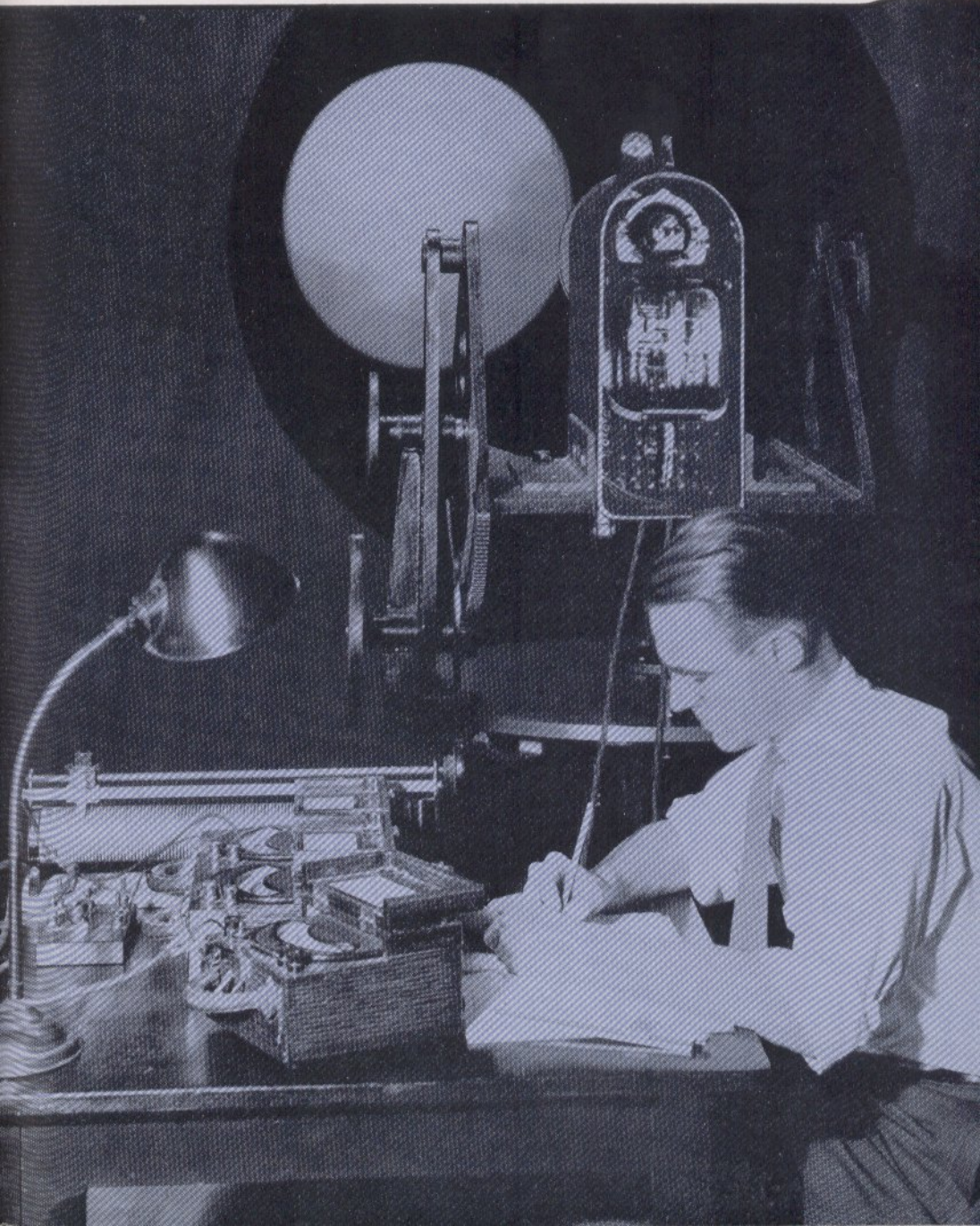
If the HG relay need only be sufficiently slow-acting to hold its front contacts closed during pole changing of the control circuit, an interlocking bar (shown on page 52) is attached to the DG armature to prevent it from closing its front contacts before the HG armature has picked up.

## NEUTRAL-NEUTRAL RELAY ARRANGEMENT

With this arrangement, the control of the DG (green) relay is broken through front contacts of the HG (yellow) relay. Thus, a green aspect cannot be displayed unless the HG relay is energized.



# TECHNICAL DATA





# ELECTRICAL DATA

Type SC signal mechanisms are supplied for operation on all standard signaling voltages. The following tables give some typical examples of operating values. Mechanisms are also available with specifications other than these typical examples.

## POLAR-NEUTRAL ARRANGEMENT, VALUES FOR HG, DG, AND RECTIFIER

For a constant value of current, the resistance of the rectifier decreases with an increase of temperature. In the SC polar-neutral signal, the total resistance remains practically constant during temperature changes owing to the compensating effect of the rectifier resistance and the coil resistance.

Rated current and resistance values as shown here are nominal figures, as the resistance of the rectifier decreases with an increase of current.

Type of Relays	Rating		Res. Ohms	Max. Pickup & Working		Min. Full Release	
	Volts	Amps.		Volts	Amps.	Volts	Amps.
Regular	8.0	0.029	275	6.8	0.026	2.75	0.008
HG slow-release, 1 sec.* min. at 0.035 ampere. Slow pickup, 1.5 sec. min. at 0.045 ampere.	10.0	0.048	225	7.5	0.035	2.8	0.0095

\*After energizing at least 10 seconds.

## NEUTRAL-NEUTRAL ARRANGEMENT

Type of Relays	Relay	Rating		Res. Ohms	Max. Pickup & Working Amps.	Min. Full Release Amps.
		Volts	Amps.			
Regular	DG	10.0	0.0143	700	0.011	0.0038
	HG	10.0	0.0164	610	0.0132	0.0038
HG slow-release, 1.5 sec. min. at 0.0275 ampere.	DG	10.0	0.0143	700	0.011	0.0038
	HG	10.0	0.0364	275	0.0275	0.0047



# PHYSICAL DATA

Each relay has a maximum capacity of 6 dependent front-back contacts,\* arranged in vertical rows of two front-back contacts each. Relay armatures drive contacts through insulated pushers.

Front contacts are silver to silver-impregnated carbon; back contacts are silver to silver.

	Nominal Contact Pressure Ounces	Contact Opening Inches	Contact Resistance Ohms
Front	1.75	0.050	0.04
Back	0.9	0.050	0.02

Minimum contact crossover opening is 0.020 inch.

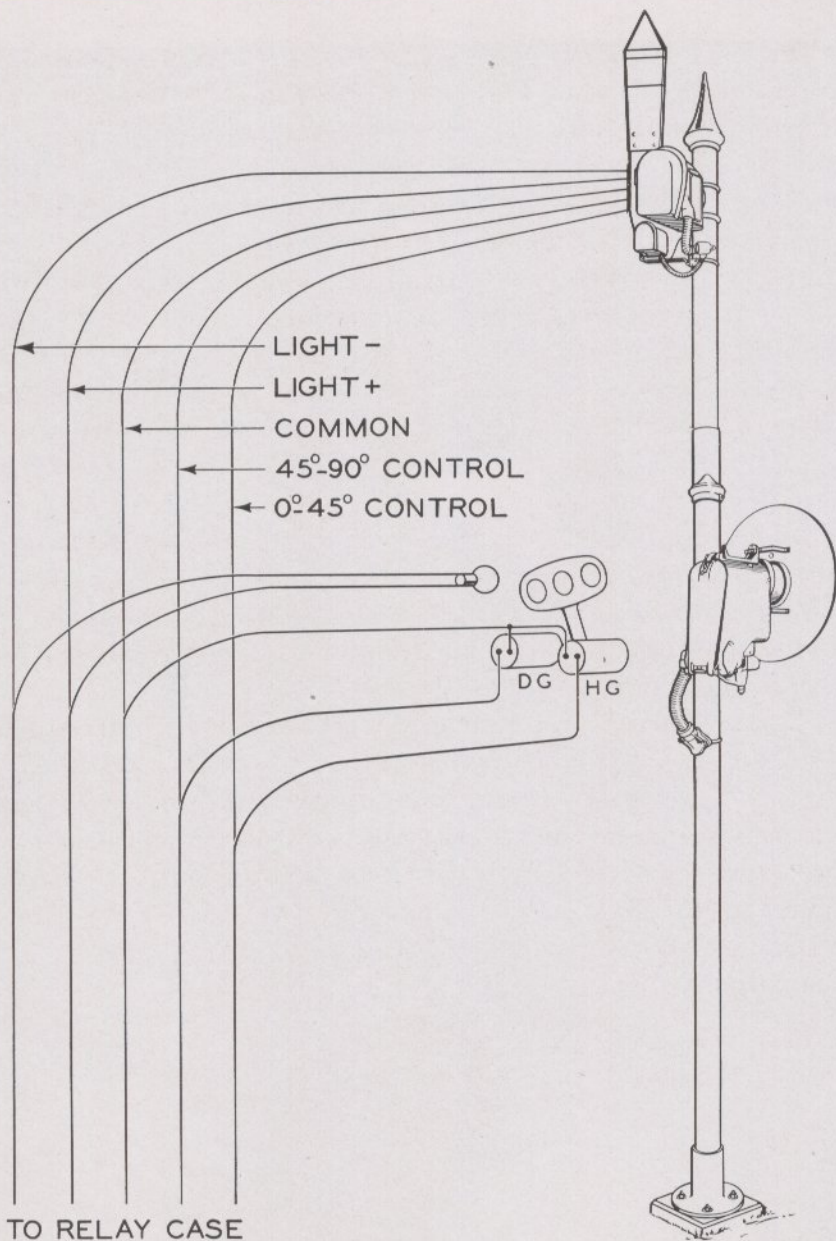
The armature release torque is 40 ounce-inches. The torque on the spectacle-carrying member is 15 ounce-inches at the green position and 10 ounce-inches at the yellow position.

*\*Note:* In polar-neutral mechanisms with slow-pickup and slow-release HG relay, 2FB contacts on the HG relay are required by the mechanism circuit and are not available for external circuits.





# REPLACE SEMAPHORES



# WITHOUT REWIRING

The Type SC signal is well suited to replace obsolete or worn-out semaphore signals. One of the most important results to be gained by such conversion is the substantial savings in maintenance costs, as Type SC signals require only a small fraction of the maintenance time that must be devoted to semaphore signals.

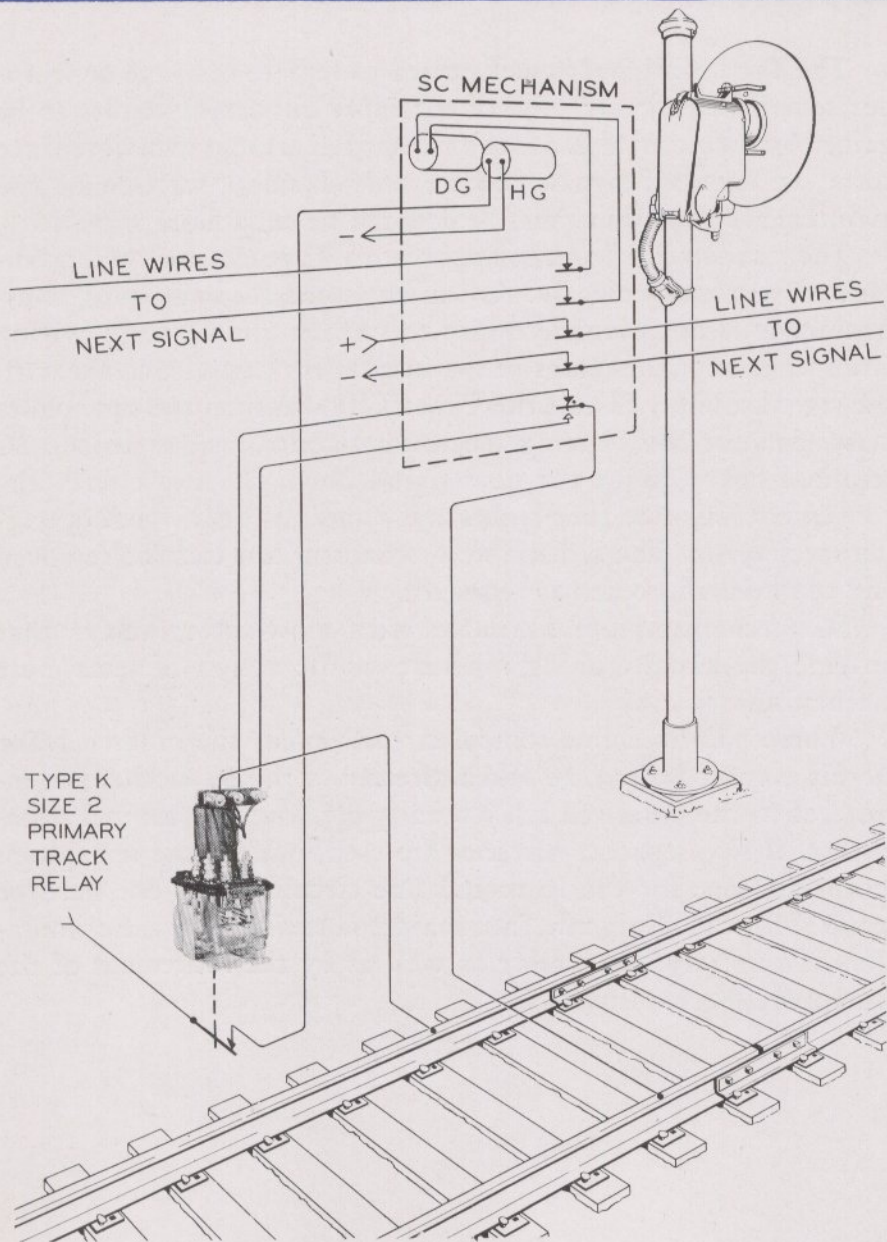
The changeover from semaphore to Type SC can be accomplished very conveniently. As shown in the accompanying illustration, it is not even necessary to change the existing wiring arrangements or the relays in the instrument case associated with the signal. Simply install the Type SC housing on the semaphore mast, connect the existing mechanism control wires to the SC terminal board, sight the new signal down the track with the convenient hair-line peep sight, and plug in the SC signal operating mechanism. The semaphore mechanism can then be removed and the mast shortened as required.

SC mechanisms are available with slow-acting relays that provide the circuit timing inherent in the action of semaphore mechanisms.

Where polarized line control circuits exist, the polarized line circuit may, if desired, be taken directly to the SC mechanism instead of to the polarized relay usually employed to control semaphores. If two separate batteries are used, one for the semaphore motor and one for the lamp and line circuits, only one need be retained for the SC signal. Thus maintenance is cut by the elimination of a battery and a relay as well as by the retirement of the semaphore mechanism itself.



# PRIMARY - SECONDARY



# TRACK CIRCUITS

The SC signal mechanism makes it possible to provide the advantages of a primary-secondary track circuit without using additional relays.

As shown in the circuit diagram, a Type K, Size 2 track relay is so connected to the HG (yellow) relay in the SC mechanism that it picks up with its entire winding in the track circuit. The HG relay is energized through a front contact of the track relay, and a make-before-break contact on the HG relay cuts out part of the track relay's winding, substituting a resistor to compensate for the winding cut out. The effect is to make the track relay more sensitive to shunting by reducing the number of ampere turns in its windings.

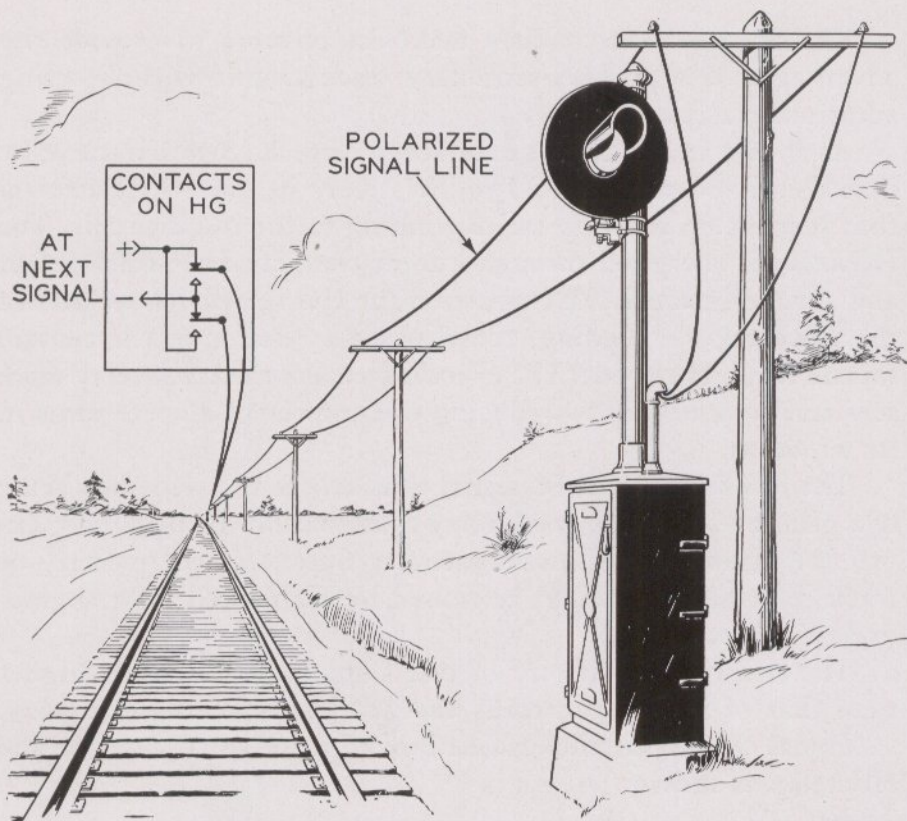
The HG relay in the SC signal thus acts as the secondary relay of a primary-secondary track relay combination. Being slow-pick-up, it is unable to follow momentary flutters of the primary or track relay such as might be caused by high-speed light engines or gasoline cars.

The shunting sensitivity of this combination is much higher than that of any single steady-energy closed-circuit track relay.

Signal control circuits can be broken through contacts on the HG relay as shown.



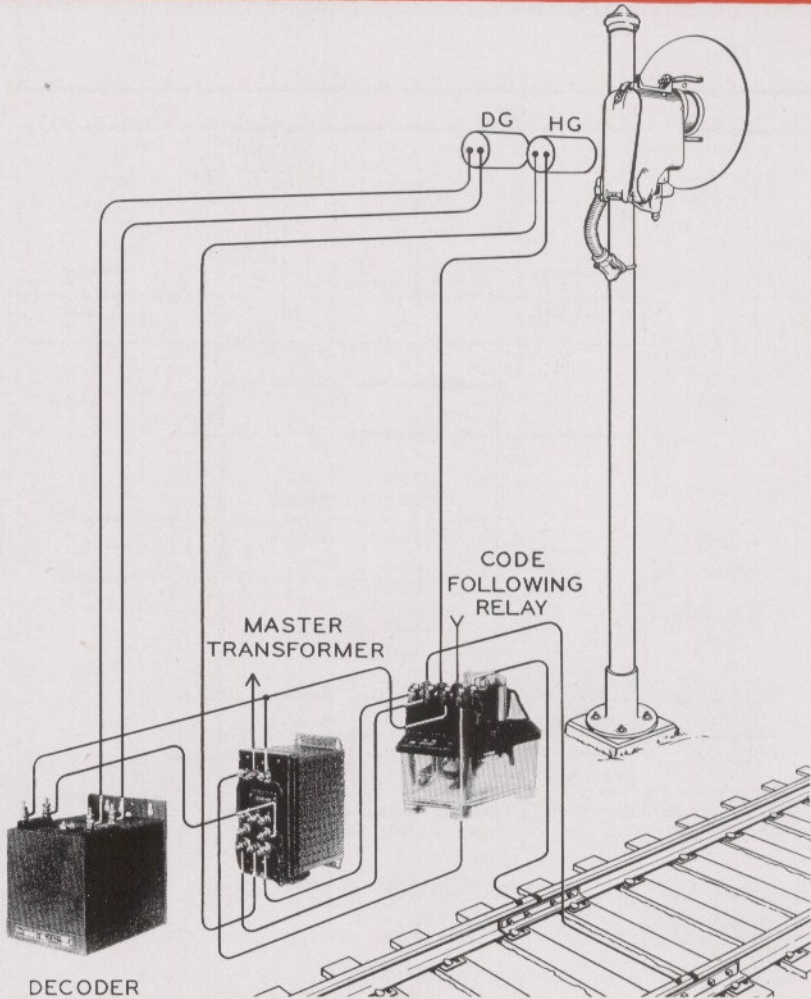
# POLARIZED CONTROL



The DG (green) relay in the polar-neutral SC mechanism, described on page 53, responds only to energization at a pre-determined polarity; while the HG (yellow) relay is a neutral relay. Thus the SC signal is admirably suited for operation from a polarized signal line.

Furthermore, the line can be polarized directly from the SC mechanism itself as shown in the accompanying illustration. The contact capacity and the two-position relays of the SC signal make this possible without the use of any additional external relays.

# CODED TRACK CONTROL

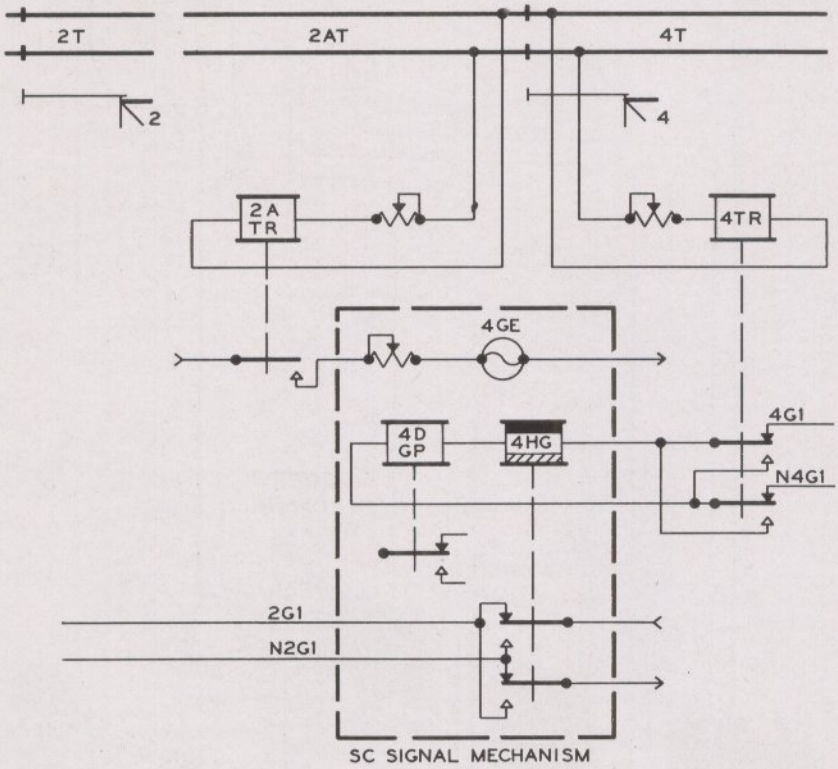


The Type SC signal also effects an economy in relays when used with coded track circuit control.

Ordinarily an H and a D relay are used in conjunction with the decoding apparatus to control the signal. The SC signal provides these two relays within its mechanism. They can be connected directly to the coding apparatus and thus effect a saving of two relays at each signal location.

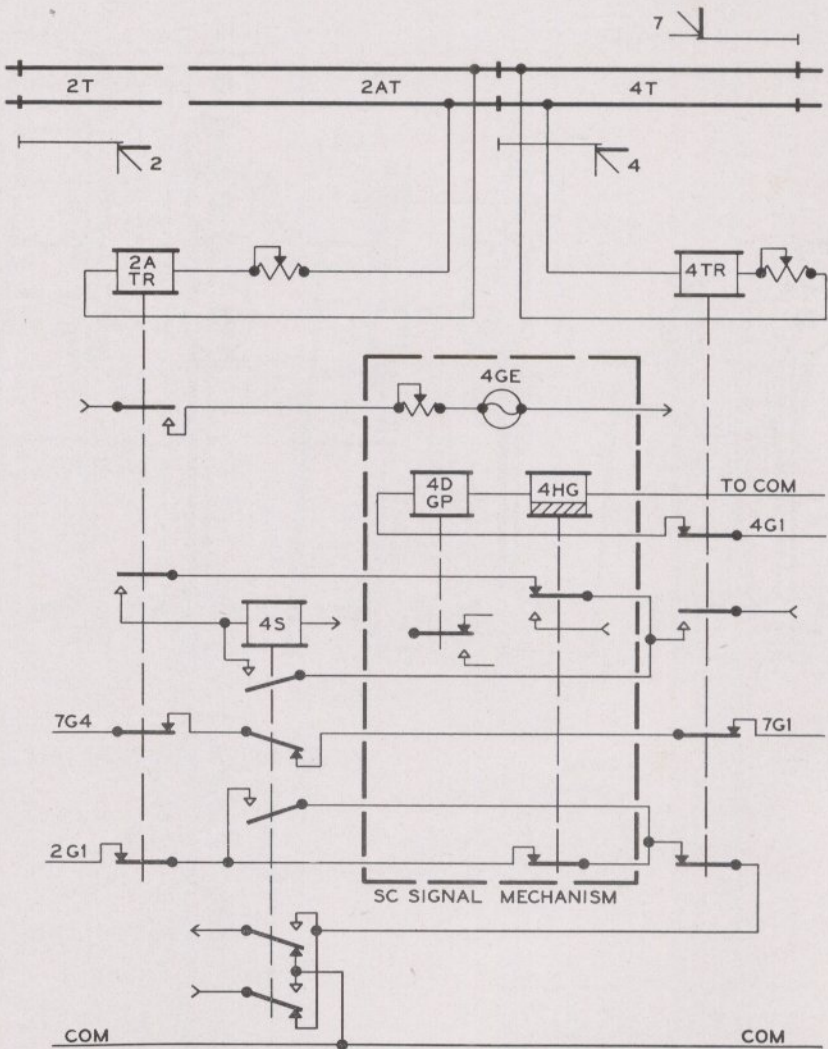


# FOR DOUBLE TRACK



Typical Circuit: Double Track Application, Polarized Line Control Providing Three Aspects.

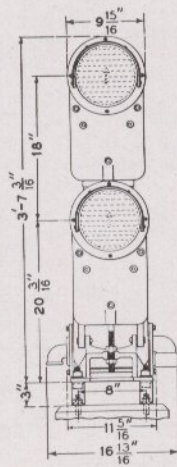
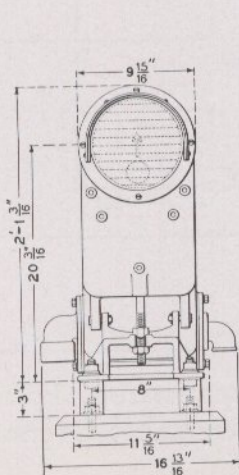
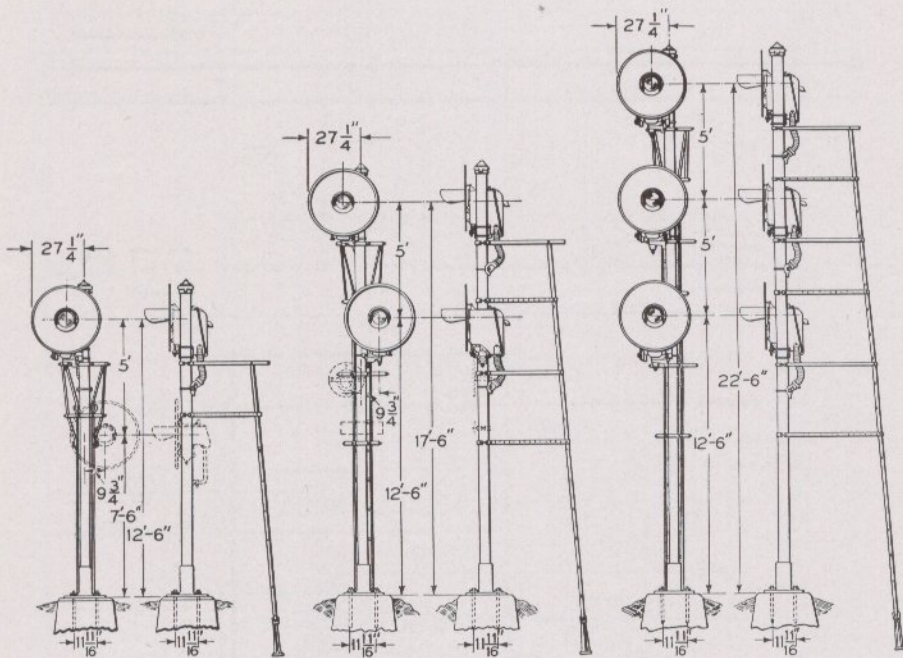
# FOR SINGLE TRACK



Typical Circuit: Single Track Application, Polarized Line Control Providing Three Aspects. Permanent Overlap Between Intermediate Signals.



# CLEARANCE DIAGRAMS



Thousands of Type SC signals have already been supplied to railroads both in the United States and abroad. Investigate the possibilities of the Type SC, a truly versatile signal, for new construction or for modernization of your present signaling system.

As always, your nearest G-R-S District Office is ready to help you plan signaling that will give you the maximum return on your investment. Let us have your request for further information. G-R-S consultation service does not obligate you in any way.

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