What's the Answer

Signal Aspects During Blackouts

"Please furnish information concerning the operation of signal lamps during blackouts."

Use Hoods and Reduce the Intensity

The signal engineer of one railroad along our coast has inquired concerning methods with reference to the operation of light signals and lamps on semaphore signals during blackouts. In addition to the brief mention of this subject in an article on page 421 of the August, 1941 issue, correspondence with a railroad man in England as well as study and conversation with railroad men in America has brought out further information to be given in the comments below. Readers, who have developed other ideas on this subject, are requested to send their comments to the editor for publication in these columns.

During the earlier air raids in England, trains were stopped as soon as practicable, especially in terminal areas. Later, a speed limit of 15 m.p.h. was established, and more recently this was increased to 50 m.p.h. Evidently the conclusion in England has been that trains are to be kept moving during air raids, and it may be assumed that the same practice is to be followed in America. During the early part of the war, a test flight was made with an airplane of the Royal Air Force. At an elevation of about 6,000 ft., the colored lights of signals could be seen at night throughout a line of about 80 miles, thus providing excellent navigation lights which the enemy bombers could follow from the coast to London. This condition was corrected.

A first consideration is that if the lamps in a light signal are not to be lighted, no aspect can be displayed. Although the blade of a semaphore would display an aspect, the range would be too short during hours of darkness to permit the operation of trains at normal speeds; this being with the assumption that trains are to be operated with the headlights extinguished. Therefore, if trains are to be operated efficiently, the lamps must be lighted when needed to display aspects, in both the light types and in semaphore signals. Recognizing this necessity, some aids in the solution of the problem are: to provide hoods to conceal the lights from the view of pilots and observers in enemy aircraft overhead at a height at which they normally operate; reduce the intensity of the lights to the absolute minimum required for the display of aspects during darkness; and use automatic approach lighting control, or manual control at interlockings, so that the lamps will be lighted only when needed for the display of aspects when a train is approaching.

Shorten the Range

Many developments have been made to increase the range of signals, and the railroads have purposely located signals so that they can be seen a maximum distance when approaching. However, with three-aspect signaling, and the signals spaced full from stopping distance, an engineman always has an Approach aspect and track length in which to stop short of a signal indicating that he must stop. An exception would be an instance in which a switch might be thrown in a block to set a signal at the most restrictive aspect after a train has passed the signal in approach to the signal for that block. This leads to the thought that long-range aspects are not absolutely necessary except for the red aspect of signals for blocks in which switches are located less than emergency braking distance from the signal. From an engineman's standpoint, it is desirable that he see the aspect as soon as he can see the signal, but for the duration of the present

To Be Answered in a Later Issue

(1) What methods, other than those explained in an accompanying article, have been developed as a means of operating signal lamps during blackouts?

(2) In view of the fact that the limited supply of insulating materials and copper is needed in the war program, what methods and schemes have been developed to minimize the quantities of insulated wire and cable required in the maintenance, replacement and new construction of signaling facilities?

(3) In a crossing protection installation including flashing-light signals and short-arm gates, how long should be the pre-warning operation of the flashing-light signals and the gate lamps, prior to the time the gates start to move from the raised position? After a train clears the crossing, at what point in the operation should the signals and gate lamps be cut out?

If you have a question you would like to have someone answer, or if you can answer any of the questions above, please write to the editor. Answers to any of the questions above will be paid for in cash or by a subscripition to Railway Signaling.

emergency, no safety would be sacrificed by reducing the range on many signals.

Perhaps the most convenient means for reducing the upward angle of the beam from a lamp of a light signal is to tilt the signal, which, of course, would reduce the range at which the aspect could be seen from the track, as well as from aircraft. Where such means are not effective or practicable, the use of hoods is to be recommended.

From the standpoint of pure science, the blacking out of any portion of an optical system will reduce the intensity of a light signal but will not reduce the spread of the beam. Some inventions have been made, however, without knowledge of pure science, and, therefore, tests might well be made to determine the effects produced by using black paint on two areas of the lamp bulbs, lenses, reflectors and cover glasses.

Stove-Pipe Hoods

The short hoods now in service on many types of light signals were designed as an aid in minimizing the effects of external light, such as sunlight, as well as to prevent wet snow from being deposited on the cover glasses or lens. These hoods, however, do not affect the spread or direction of the beam, and presumably they will be of only a limited aid in concealing the light beam or light as seen from overhead.

No information is at hand concerning the details of the design of the hoods which have been applied to signals in England. However, the problem, from a somewhat different standpoint has been solved previously in the United States. For example, where highways cross railroad tracks at a small angle, the enginemen objected to the flashing red lights of the crossing signals, and the problem was solved by using a hood similar to a length of ordinary stove pipe on each unit of the flashing-light signals. These hoods confined the spread of the light beams to the area of the highway in approach to the respective signals.

With a slot in the bottom to allow loose snow to fall out as well as to permit an engineman to get a closeup aspect, this stove-pipe hood idea might well be tried on searchlight type signals. Tests would be required to design hoods to meet the obvious requirements for different types of color-light signals with the separate units arranged in a vertical row or as a triangle. A hood designed to solve a special snow problem on the D. & R. G. W. is shown in an illustration on page 98 of the issue for February, 1938.

A 24-in. hood on an 8-in. lens will give a cut-off at 6,000 ft. in the air at 3.3 miles horizontal distance, assuming that the ground area is level. In territory known as flat, the light angle would actually have to be below horizontal to offset the curvature of the earth. This factor would be involved in only very long range of perhaps 80 miles, and the downward angle needed would be about ¾ deg. If a stove-pipe hood is to be used, the interior, especially at the bottom, should be painted dull black to prevent reflection of light at an upward angle.

Manufacturers of signaling equipment are considering the possibility of designing hoods which can be applied to different types of signals now in service.

The Semaphore Lamp Problem

With a semaphore, the first problem is to cover the light beam space between the lamp and the spectacle, which perhaps can be accomplished by using a hood made of flexible leather or canvas, attached to the lamp and pressing against the spectacle as tightly as practicable, and yet permitting motion of the spectacle. On the face of the spectacle and around each roundel, a separate hood would be required.

For use where freezing temperatures are experienced, the Southern Pacific is testing other means for preventing the light from semaphore lamps from penetrating at an upward angle. The upper half of the lamp lens as well as the ¼ in. below the center line, on a horizontal, is painted black. A piece of sheet metal or weatherproof cardboard, painted black, and cut to cover the upper half of each roundel is attached to the rear of the spectacles. This blinder is flat, i.e., not curved in to the surface of the roundel. This combination, of painting and blinders, obstructs the light from passing out at an upward angle. Although the amount of light is reduced about 20 per cent, the aspect is adequate for hours of darkness.

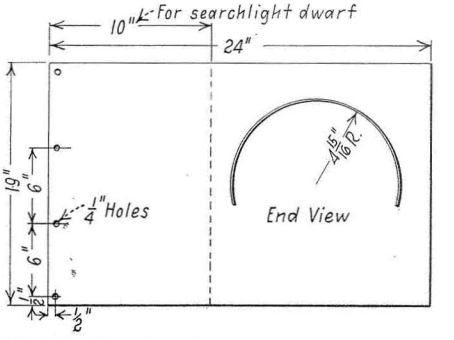
Where a limited amount of illumination is required for safety of pedestrians, such as in underpasses, blue lamps can be used, and hoods or shades can be arranged to prevent light from going out at an upward angle.

One suggestion received was to use purple instead of red as the most restrictive aspect for signals. Formerly purple was so used on dwarf signals at interlockings on many roads, but the practice was abandoned because the aspect could not be seen far enough. Even if the purple could be improved to give a longer range, the time required, to secure purple glass for thousands of signals, renders this idea impracticable, to say nothing of the objections of changing aspects.

Control For Off Or On

A fundamental in concealing the location of a railroad from the view of enemy air pilots is to extinguish signal lamps when not needed. At some interlockings this result can be accomplished by providing knife switches for the leverman to control. An automatic arrangement could include a relay to be energized or released when any signal lever is reversed. Such an arrangement could not easily be installed unless the signal lamps are fed from a separate circuit originating in the tower. Another idea might be to open the main plant switch at some types of interlockings.

Wherever automatic approach lighting control is not already in service, such controls should be installed,



Sketch of material for a hood being applied to searchlight signals on the Southern Pacific.

especially at locations where the desired result can be accomplished by a few changes in connections to extend lamp controls through contacts of track relays, or controllers as well as relays of opposite signals.

Reducing Intensity of the Lights

Any practice of reducing the intensity of signal lamps, introduces the problem that these aspects will be short range during fogs, however, you cannot have your cake and eat it.

In addition to the use of hoods to conceal the lamp itself and to confine the spread, a further problem is to minimize the intensity of the beam to the actual minimum required. Where electric semaphore lamps are fed from local primary batteries, the voltage at the lamp should be reduced so that the intensity is the minimum required for the display of aspects during hours of darkness. In order to provide adequate range in strong sunlight, light signals are designed to display much more intensity than is required during darkness, an objection in some in-

stances being that the lights are so strong at night that they blind the enginemen.

At some interlockings where the lamps are all fed from one circuit originating at the tower, arrangements have been made for the leverman to operate a "dimmer" switch which reduces the intensity of the lamps during the hours of darkness. Automatic time clock switches or sun relays could be installed to accomplish the same result.

This idea of reducing the lamp voltage at night can be applied on some automatic signal territories where an a-c. power line is used to feed batteries on either the a-c. floating storage or the a-c. primary system, and with the signal lamps normally fed through transformers from the a-c. supply. For example, when automatic signals were installed on the Texas & Pacific in 1928, a sun relay was provided at the a-c. feed station to control an arrangement which during hours of darkness would reduce the distribution voltage from 440 to 380, and correspondingly would reduce the lamp voltage from a normal of 10 volts to a night voltage of 7.5 volts. Reduction of the line voltage, of course, reduced the charging rate on the storage cells, but this was compensated by adjustments taken care of during daylight hours.

Why Not Cut Off the Power?

This practice leads to the thought that during blackouts, sources of a-c. power may be cut off at the central stations of the utility companies, in which case the a-c. power distribution circuit for signaling would also be dead, so that the systems using a-c. floating storage or a-c. primary would cut over automatically to feed from battery. With reference to reducing the brilliancy of signal lamps, this outage of a-c. power is an advantage, not a handicap. By adjusting the resistance units in the feed circuits between the battery and the lamps, the brilliancy can be reduced as desired, and the only objection would be undesirable low brilliancy in daylight, if the a-c. power were cut off.

If the a-c. power is not to be cut off at the central power stations during blackouts, the signal forces can open their own power circuits. Obviously, a man could not be on hand during night hours at all such power feed locations, but it would be practicable for the maintainer to open the switches at his headquarters the last thing before leaving duty and to close them the first thing every morning. Clock-driven time switches or sun relays could be installed at outlying power feed locations.

The question, of what would happen to the battery on an a-c. floating storage system, has been answered. At various times in the past, the C. C. C. & St. L. has conducted tests in which the a-c. power was purposely cut off as a test of extended sections for a week at a time. Following the hurricane in New England a few years ago, a-c. power was cut off of some sections of a-c. floating storage territory on the Boston & Albany for a period of two weeks, and no failures occurred. It would seem logical, therefore, that the a-c. power could be cut off every night on a-c. floating territories of signaling, although adjustments of the charging rate may be required for charging during the day. As mentioned previously, this would afford a means of reducing the brilliancy of the lamp during night hours.

On straight a-c. signaling with either semaphores or light signals, experiments would have to be made to determine how much the voltage on the distribution line could be reduced, in terms of 110-volts at the signals, as a means of reducing the lamp intensity, without causing the relays and hold-clear coils from releasing. If the 110 volts could be reduced to 95 volts, the lamp intensity would be reduced considerably.

In areas where power is to be cut off at the central stations of utility companies, a limited amount of illumination may be required to permit operation of interlocking machines. If oil lamps and lanterns will not suffice, perhaps a few small electric lamps will have to be fed from battery.

In consideration of the protection afforded by automatic signals, numerous roads do not use switch lamps on hand-throw switches located within 500 ft. of a signal, and some roads omit the lamps on all switches in signal territory, especially on double track. If the switch lamps cannot be eliminated, the use of hoods should be investigated. The hoods being installed on switch lamps on the Southern Pacific are 4¾ in. long. In yards where trainmen might be injured by metal hoods, flexible hoods made of sections of automobile tires with the tread removed, have been installed.

For Future Consideration

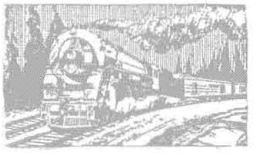
The various ideas for operation of signal and switch lamps explained above are of a nature that can be carried to completion quickly at this time. A method for future consideration is the display of signal lamp aspects by means of phosphorescent materials which have the characteristic of storing light when subjected to sunlight or "black" light and then releasing the light as a short ranged glow in darkness. The term short range as used here applies to distances adequate for signal aspects at night, but the range would not be enough to be seen from aircraft at elevations of a few thousand feet. Various forms of phosphorescent materials are available from the Continental Lithographing Corp., Cleveland, O., and devices for creating "black" light can be secured from various electrical and signaling manufacturers. Although this material and equipment is now on the market for use as emergency markers and lighting during blackouts, considerable time would be required to develop applications for signal lamps.

Minimizing Frost Trouble

"What successful means have been used to minimize the trouble which can be caused by frost on contacts and commutators in signaling apparatus?"

Various Methods Used

Following publication of the question above, a signal supervisor sent the editor a long letter including comments on the subject, but a request was made that the information not be published as coming from this supervisor. In order to analyze the subject of frost trouble from as many viewpoints as possible, the matter was discussed verbally with several railroad men, and a search was made through volumes of *Railway Signaling* for the last 20 years. This information, together with that received from the signal supervisor, is included in the following discussion, which may not cover all phases of the problem, and, therefore, readers who have developed other ideas are invited to send their comments to the editor for publication.



In general, no one method will eliminate frost trouble under all local cir-