



#### TO BE ANSWERED IN A SUBSEQUENT ISSUE

(1) *How does the voltage of a track circuit battery (high or low) influence the shunting sensitivity of the circuit? What effect does its voltage have upon the degree of broken rail protection?*

(2) *At what minimum value of ballast resistance should track circuits be adjusted? Would it be safer to reduce the length of the track circuit and adjust each of the shorter circuits for a higher value of minimum ballast resistance?*

(3) *When using the enclosed type of storage cells (either nickel-alkaline or lead type), is it necessary to provide a separate room for the operat-*

*ing storage battery at interlocking plants; likewise is a separate housing or compartment required for this purpose in signal or relay cases in automatic territory? Why?*

(4) *At interlocking plants and on automatic signal installations, some roads run the solid conductor insulated wires direct to the terminal posts on relays and other instruments, while other roads take the solid wire to a terminal mounted in the case and extend a flexible jumper wire to the relay terminal post. Which practice do you follow and why?*

## Where Should Grade Signals Be Installed?

*"What limitations are placed on the application of 'grade signals,' permitting trains to pass automatic 'stop and proceed' signals indicating danger without stopping? What percentage of grade, and what maximum speed of trains governs the use of grade signals? Are they used on both single and double track?"*

### N. P. Employs Markers at Maximum Grades—No Light Is Necessary

By C. A. CHRISTOFFERSON

Signal Engineer, Northern Pacific, St. Paul, Minn.

ON the Northern Pacific, grade signals are used both on single and double track. All such signals have a 12-in. by 16-in. square marker placed 5 ft. below the blade, and this marker is painted yellow with a black border. No light of any kind is used on these markers and none is necessary. The rule for the installation of these markers requires that these signals must be placed on a maximum grade in that territory. The maximum grade might be four-tenths of one per cent, or it might be two per cent. As a general thing, percentage of grade has not much to do with it, because trains are loaded in accordance with the ruling grade. The rule for passing one of these signals, when it is at stop, is as follows:

"When a heavy passenger or heavy freight train approaches a block signal at stop having a 12-in. by 16-in.

square marker painted yellow with a black border and located to the right of the signal mast, about 5 ft. below the signal, and known as a tonnage signal, as designated by Rule 501-H of the "Transportation Rules," it may proceed without stopping at the signal at a rate of speed not exceeding 15 m.p.h."

As already stated, the percentage of grade has nothing to do with it whatsoever. We only permit a heavy loaded freight train or passenger train (a full tonnage train) to pass these signals, and then at a rate of only 15 m.p.h. through the block. This, we consider a good practice, as we do not believe it to be good policy to stop a heavily loaded freight or passenger train at a maximum grade in any block. We have followed the above practice for a number of years and have always found it to work out successfully.

Many railroads consider it necessary to place a light on these markers. I have always considered this unnecessary, inasmuch as they are only placed on a heavy grade, where trains come up the grade expecting to stop at the red light. When they are near enough to see this marker, which can be seen plainly with the headlight, they will see that it is a signal that they do not have to stop at (should the permissive signal indication be "stop"), and as they are only going at a very low rate of speed, it will not delay them any. Therefore, a light is not necessary.

Furthermore, an engineman will have to go over the line only once or twice and he will have every grade signal spotted, and I hardly think it would be necessary to provide the marker, if we printed in the time card, the numbers of these particular signals.

## 15 M. P. H. Speed Limit Established for Tonnage Trains

By W. M. POST

Assistant Chief Signal Engineer, Pennsylvania, Philadelphia, Pa.

ON the Pennsylvania, grade signals can be installed only when authorized by the regional vice-president. No limiting percentage of grade has been established. Where grade signals have been authorized, a circular disk, with a black letter "G" on a yellow background, is placed under the signal arms or lights and Rule 277 of the Pennsylvania Book of Rules applies. The indication and name under this rule are as follows:

"Indication—(For tonnage freight trains) Proceed not exceeding 15 m.p.h., expecting to find a train in the block, broken rail, obstruction or switch not properly set. (For other trains) Stop then proceed in accordance with Rule 509.

"Name—Grade signal."

A tonnage train is one where the engine is hauling 90 per cent, or over, of the rated tonnage capacity for the locomotive.

## D. & R. G. W. Uses Light-Type Grade Indicator on Grades of 0.5 Per Cent or More

By B. W. MOLIS

Signal Engineer, Denver and Rio Grande Western, Denver, Colo.

THE Denver and Rio Grande Western traverses a rather rugged mountainous territory and severe grades are encountered in our automatic signaled line. We have adopted the practice of equipping "stop-and-proceed" automatic block signals with an additional marker, termed a grade signal, where such signals are on a 0.5 per cent grade or more. We have so arranged the display of this grade light that it is displayed only for following movements, either on single or double track. Rule 510, which pertains to the observance of these grade signals reads:

"510—A grade signal is a 'stop-and-proceed' signal with an additional indication mounted below and to the right of the signal, and when illuminated will show the letter 'G' to modify the automatic block signal restriction. In the absence of the illuminated 'G,' which indication will appear only under certain conditions, the train will be governed by the 'stop-and-proceed' signal. When the 'G' is illuminated, freight trains may pass the 'stop-and-proceed' signal at a speed not to exceed 8 m.p.h. to the next automatic block signal, expecting to find a train in the block, a broken rail, obstruction, or switch not properly set. Passenger trains must stop even though the 'G' be illuminated, and be governed by the 'stop-and-proceed' signal."

On single track, and on double track, wherever signaled for normal and reverse direction, we have so arranged the circuits that, when a grade light is illuminated, the opposing signal will be at "stop."

## Speed Limited to 8 M. P. H., But No Tonnage Restrictions Are Specified

By J. H. SCHUBERT

Signal Engineer, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

THE Nashville, Chattanooga & St. Louis employs a cast-iron circular disk with the letter "G" painted thereon in yellow, as a special grade marker. The rule applying to this grade indicator reads: "When a grade indicator (yellow disk showing the letter G) is attached to an intermediate block signal mast, trains which could not start after stopping may pass the signal when it indicates stop, without stopping, and then proceed as prescribed by Rule 510 (c)."

Rule 510 (c) states that a train must proceed at slow speed (8 m.p.h.) expecting to find one or more of the conditions mentioned in Rule 510 (g):

"(a) train or obstruction in the block. (b) An open switch in the main track. (c) Opposite end of crossover in wrong position. (d) A car within fouling distance of the main track. (e) Broken rail. (f) Drawbridge open. (g) Failure of system."

We use grade signals on both single and double track. We do not place any restrictions as to the minimum percentage of grade on which grade signals may be used; neither do we specify any minimum tonnage for trains, but leave that up to the judgment of the engineman. We believe this avoids considerable confusion in the mind of the engineman and at the same time gives sufficient margin of safety.

## Local Conditions Govern

By C. A. TAYLOR

Superintendent of Telegraph and Signals, Chesapeake & Ohio

THE following rules govern the movement of trains in occupied blocks in automatic signal territory on the Chesapeake & Ohio:

"509-C When a train is stopped by a 'stop-and-proceed' signal, it may proceed at once at slow speed with caution, expecting to find a train ahead, a car on a siding fouling the main track, a misplaced switch or a broken rail, regulating speed so that train can be stopped within scope of the engineman's view.

"509-D When an automatic signal equipped with a letter 'G' indicates 'stop-and-proceed,' tonnage freight trains may proceed without stopping in accordance with Rule 509-C."

It will be noted that the same speed restriction is imposed in passing through occupied blocks where grade signals are used as where other automatic signals are used, the stop being eliminated only for the purpose of expediting train movements.

Grade signals are used only on ascending grades, but minimum percentage of grade, or minimum tonnage of trains are not the only factors used as a basis for determining the application of grade signals. Their application is based on local conditions in which the foregoing factors are taken into consideration, and tonnage trains are defined on the basis of percentage of grade, type of motive power in use and operating requirements. In some districts, freight trains of 10 or more cars are considered tonnage trains and are so defined under special instructions in the local division time table.

Grade signals are in use on both single and double track on ascending grades where local operating conditions warrant. I am of the opinion that flexibility in the rules governing the application of grade signals is desirable in order to obtain the most benefit from their use, and especially on a railroad having varying grades and special operating conditions.

## Used to Prevent Blocking Street Crossings

By J. H. OPPELT

Supervisor of Signals, New York, Chicago & St. Louis, Cleveland, Ohio

IT is our practice to use grade markers on both single and multiple tracks for two purposes: First, to avoid stopping freight trains on grades of 0.3 per cent or greater; second, to avoid stopping freight trains at points where one or more busy streets or highways would be blocked. All freight trains are permitted to pass these signals without stopping and to proceed at not exceeding 15 m.p.h. Passenger trains are required to observe the "stop-and-proceed" rule.

W. E. Boland, signal engineer of the Southern Pacific Lines, replies that, "Thus far we have not found it necessary or desirable to begin grade signal practice at any point on these lines."