rangement for connecting the circuit controller rod to the switch point. This more or less interferes with the front rod, and in case of bent or broken parts, causes additional trouble for the maintainer in making replacements. The maintenance of the circuit controller connected to the switch point, when used for checking the safety of switch operation, is more difficult than when the controller is operated by the locking plunger, due to wearing of pins and jaws, shifting of timbers; lag screws becoming loose, and stock rail shifting out of alinement, all of which make it almost out of the question to maintain an adjustment close enough for a reliable indication without frequent failures. Again, the switch can be unlocked and remain unlocked after the indication has been received, which is surely an unsafe condition, and defeats the purpose for which the lock rod is employed. Furthermore, longer timbers are required in order that the controller may be placed outside the clearance line.

In interlocking work, the only way in which a circuit controller connected directly to the switch point serves a good purpose, is its use in connection with a mechanical switch and facing point lock, wherein the circuit controller in combination with an electric lock on the facing point lock lever and the circuit controller on the switch lever insures that the switch is in the same position as the switch lever before a signal lever can be released. This does not mean that the switch point is properly faced up, but merely means that the switch has followed the movement of the switch lever. The safe locking of the switch in such cases depends on the plunger operated by the lock lever, and if for some reason the pipe line operating the plunger should part or buckle without the plunger entering the lock rod, the switch would still be unlocked while the signal lever would be released to permit the passage of trains.

Therefore, in the final analysis, the circuit controller, checking the operation of the switch and/or controlling signal circuits should be operated by the locking plunger, so that if the switch is not locked properly upon being moved from one position to another, or if the plunger is withdrawn from the locked position at any time, signals cannot be cleared.

Two Switch Boxes Used

By W. L. Connors

Signal Engineer, Buffalo, Rochester & Pittsburgh, Rochester, N. Y.

WE use two circuit controllers on all interlocked switches, one operated by the locking plunger and the other connected directly to the switch point. The same circuits are broken through both of these controllers. If only one circuit controller were to be used, I would prefer that it be operated by the locking plunger rather than be connected directly to the switch point. Before a switch is safe for traffic it is important that the point not only fit properly against the stock rail, but that it be securely locked in that position, and I believe the operation of the circuit controller should be dependent upon the actual locking of the switch.

Obstruction Between Point and Rail Will Be Indicated if Switch Circuit Controller Be Connected Directly to Point

By M. A. Baird,

Signal Engineer, Erie, New York

I PREFER the switch circuit controller connected directly to the switch point. The reason for my preference is that if a switch is run through or some obstruction dragged in between the switch point and stock rail, forcing the point open, this condition would be indicated with the switch circuit controller connected directly to the switch point and a stop signal indication would result.

In the case of the plunger locking controller, the unauthorized opening of a switch point as above outlined would have no such effect on the plunger controller, leaving the selected signal intact for displaying a clear signal against the open switch point; assuming of course that there is no occasion for operating the switch between the time that the switch point is forced open and the signal referred to is cleared, which happens frequently, particularly at interlocking plants.

Arrangement of Color-Light Units

"What is your standard arrangement of units in vertical type color-light signals, i.e., is red at top, green next, and yellow at bottom, or what arrangement do you use? Is the standard arrangement the same for dwarf and high signals?"

With Hooded Units Red Should Be Placed at the Bottom

By C. A. Dunham,

Superintendent of Signals, Great Northern, St. Paul, Minn.

WE use an arrangement which we think is best—green at the top, yellow in the center and red at the bottom. The reason for this is that we use an individual hood over each unit and on account of the fact that the red is perhaps the most important it is placed at the bottom so that there will be nothing under it to cause snow or sleet to lodge and conceal the red unit. We use the same arrangement for dwarf signals as for high signals and for the same reason.

Nickel Plate Places Red Color-Light Units as Far Apart as Possible in Double Mounting Scheme to Diminish Blending

By J. H. Oppelt

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

OUR standard arrangement of lights in vertical units on two-light signals is as follows:

Top Unit	Red
	Yellow
	Green
Lower Unit	Yellow
	Green
	Red

The lights in the units are spaced on one-foot centers and the distance between the green in the top unit and the yellow in the lower unit is four feet. Thus, when presenting the stop aspect, red over red, the distance from center to center of lights is eight feet and the minimum distance between lights for all other aspects used is six feet. This arrangement permits a maximum separation of lights with a minimum distance between units.

It is desirable to have at least six feet separation between lights so that there will be no possibility of blending or running together. If the lights were arranged in the same sequence in each unit it would be necessary to use a higher pole and to separate the units farther, resulting in a greater difference between the maximum and minimum distances between lights for the different aspects.

Our standard dwarfs are position lights which were

adopted with the thought that they stand out distinctively when compared with switch lamps or other ground lights.

Missouri Pacific Uses Similar Order in Vertical Units

By P. M. GAULT

Signal Engineer, Missouri Pacific, St. Louis, Mo.

IT is our practice to install units in the order of red, yellow and green, reading up from the lower unit. We follow the same practice on dwarf signals except that we use purple instead of red. In my opinion, the matter is not of sufficient importance that would make it worth while attempting to standardize the arrangement of the units between different railroads. Our object in using red in the lower unit of a high signal is that this unit is usually more nearly on a line with the engineman's eye and he will thus get full advantage of the red indication, which is not always as distinct as the other colors.

Fred W. Bender, signal engineer of the Central R. R. of New Jersey, reports a similar arrangement of color-light units both for high and dwarf signals.

How to Locate Broken Bond Wires in Winter

"When tracks are covered with heavy packed snow, how would you locate broken bond wires which are causing trouble?"

Suggests Using Voltmeter or Ammeter to Locate Defective Bonds

By D. GUIGUE

Signal Maintainer, Canadian National, Montreal, Que.

A GOOD voltmeter is an effective aid in locating broken bond wires that cannot be readily inspected. If the resistance of the joint is considerably above normal there will be a reading on the voltmeter when shunting the joint, the reading being proportional to the resistance of the joint and the current flowing through the rail. With frozen ballast there is less leakage current from rail to rail and hence it is easier to locate broken or defective bonds with a meter. An appreciable voltage drop, even though very slight, indicates a defective joint because there would not be enough drop across a joint in good condition to deflect the pointer of the meter even if the voltage on the track circuit were above normal.

Also an ammeter is effective in locating broken bond wires. Owing to the small voltage drop across the joints, better results will be obtained with the use of a 150-ma. meter than with one having a 1.5-amp. scale. Care should be used in using a low-reading ammeter because in some track circuits the voltage drop across a defective joint may be high enough to damage the instrument.

If in looking for defective bonds, the track circuit is entered first at the relay end and an exceptionally low reading from rail to rail is obtained with a voltmeter, successive readings should be taken in the direction of the battery end of the circuit, say at every 10-rail lengths. If a sudden increase in the reading of the meter is noticed, it indicates that a bad joint has been passed. The bond trouble can then be localized by taking shunt readings more frequently between the points at which the last two readings were obtained.

If the track circuit is entered first at the battery or transformer end, it is best to determine whether the trouble is due to a shunted or an open circuit. This can be determined by taking a reading across the limiting resistance or reactance inserted in the track lead. An open-circuited track circuit will be indicated by a low reading across the limiting resistance or reactance, while a shunted circuit will be indicated by a relatively high reading. A bad short circuit near the energy end of the circuit will be indicated by a voltage drop reading very nearly equal to the voltage at the battery or transformer. As a check the voltage between rails at the energy end may be measured, a low reading indicating a shunted circuit and a high reading an open circuit. With a voltmeter bridged across the limiting resistance or reactance in the energy end of the circuit, the approximate location of the defective joints can also be found by watching the meter very carefully as a train passes over the track circuit from the relay to the battery end. Any sudden increase in reading will indicate that a bad joint has been passed.

Defective bonding trouble should never be overcome by increasing the voltage on the track, as this will lead to the possibility of false-clear failures.

Ammeter with a Low Reading Scale or a Voltmeter Shunted Across a 1-Ohm Resistance Unit Is Recomemnded for Locating Broken Bonds

A. W. FEHRENBACH, of the Pennsylvania signal department, Chicago, recommends the use of a d-c. ammeter, or a d-c. voltmeter shunted with a 1-ohm resistance and used as an ammeter, to locate broken bond wires when tracks are covered with heavy snow. By means of three-foot leads connected to a three-cornered file at each end, current readings from rail to rail should be obtained at uniform intervals by filing into the head of the rail. If the track circuit is entered from the battery end, the readings will decrease uniformly as successive readings are taken. Any appreciable change in the reading of the meter indicates that the broken wire is between the points at which the last two readings were taken. On a-c. track circuits it is of course necessary to employ an a-c. ammeter.

E. O. LaChance, leading signal maintainer, New York Central, at Utica, N. Y., also recommends the use of a low-reading ammeter to locate broken bonds. If a 1.5-amp. scale is used, it will be possible to detect changes in rail current of the order of a few milliamperes. He believes that tests are equally effective when carried out in the direction of the battery end of the circuit as when made in the reverse direction. In the first instance a uniform increase in meter reading will be noticed and in the other a similarly uniform decrease. He suggests that the exact location of the broken bond can then be found by shunting the ammeter across each joint between the points at which the last two readings were taken. A high current reading indicates broken or defective bonding.

H. Fairfield, signal maintainer, New York Central, at Sandusky, Ohio, suggests placing an ammeter in series with the track lead at the battery end of the circuit. Then by watching the ammeter during the progress of the first train over the track circuit an appreciable decrease in current will occur as the rear end of the train passes the broken bond wire. He also states that a voltmeter connected across the rail is useful in locating broken wires. A sudden decrease in the voltage reading would indicate a defective bond.