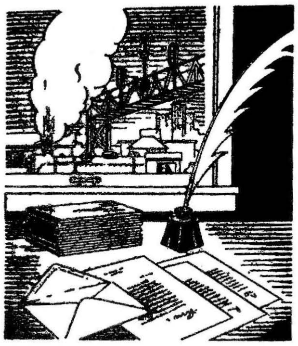

What's the Answer?

If You Have a Question That You Would Like to Have Someone Answer, Or If You Can Answer Any of the Questions Shown Below, Please Write to the Editor.

Circuit for Flashing Light Signals

What circuit arrangement can be devised for use at flashing-light crossing-signal installations so that, without the use of a power-off relay, the standby primary battery and rectifier are both on a normally-open circuit?

Lamps Normally Fed from Rectifier Permit Elimination of Power-Off Relay

E. Schroff
Signal Supervisor, New York, Chicago & St. Louis, Ft. Wayne, Ind.

Highway crossing accidents have occurred in which the warning signals failed to operate as a result of a power-transfer relay not functioning properly or the operating battery being exhausted. The recent advent of automatic heavy-duty full-wave signal rectifiers has made possible the use of control circuits for highway crossing signals which allow the rectifier to assume the entire load imposed by the crossing signals, thus making them independent of the reserve capacity of the stand-by battery excepting in cases of a-c. power interruptions.

In addition to this feature, use of a power-transfer relay can be eliminated entirely by so arranging the circuits that the signals are normally operated by rectified alternating current rather than by straight a-c. Such a circuit, in answer to the question as quoted, is shown in the accompanying diagram, the only normally-energized circuit being that feeding the operating relay XPR. Of course, this circuit must be normally energized in order to comply with the fundamental principle of signal circuit design whereby a control-circuit failure causes the signals to assume the most restrictive aspect.

To Be Answered in a Later Issue

1. *What is the most practical means of testing lead-acid storage batteries to determine in advance when the battery will need replacement?*

2. *Under what circumstances is it advisable to use a booster transformer in a signal power distribution line? In general, what are the limitations of this method of voltage adjustment?*

3. *What are the advantages of modern relays that can be used as an argument for replacing older types of relays now in service?*

4. *What arrangement can be used for operating long switch points so as to be sure that the points do not spring over, leaving the mid-section out of line?*

The operation of the circuit can be easily traced on the diagram. The usual arrangement of track circuits with an interlocking relay at the crossing is employed except that, rather than running operating circuits through the back contacts, the front contacts are used in series to control the separate flasher-operating relay XPR. This feature eliminates troubles resulting from failures of the interlocking relay caused by pitted contacts, such as failure of the locking arrangement, causing "back flashing" or "lock out." With this circuit arrangement, only one contact is required on each side of the interlocking relay. Therefore, a relay to meet these requirements could be constructed with only one coil on each side, and built more compactly than the present types, and units could be grouped as one relay where used for two or more tracks. The XP relay can be controlled over one or more interlocking relays, thus simplifying the circuits and reducing the amount of wiring.

Relay XPR should be equipped with heavy-duty back contacts. The front contacts should be replaced by dummy front compression springs which bear upon the contact fingers in the de-energized position to reduce arcing resulting from vibration.

The flasher relay should be of the type having all of the flasher contacts normally closed so that both lamps on one side of the crossing must be burned out before a complete failure of the signal, owing to failure of the flasher relay, can result. The rectifier must have sufficient capacity to assume the full load, the full-wave type being preferred.

When storage battery is used, it can be trickle-charged through the adjustable resistor, which is cut out if primary battery is used. This resistor should be of low value and should be used only for fine adjustment of the trickle-charge rate. Resistance should not be included in the transformer leads as this tends to void the automatic voltage regulation. The output voltage should be adjusted by connecting to the proper

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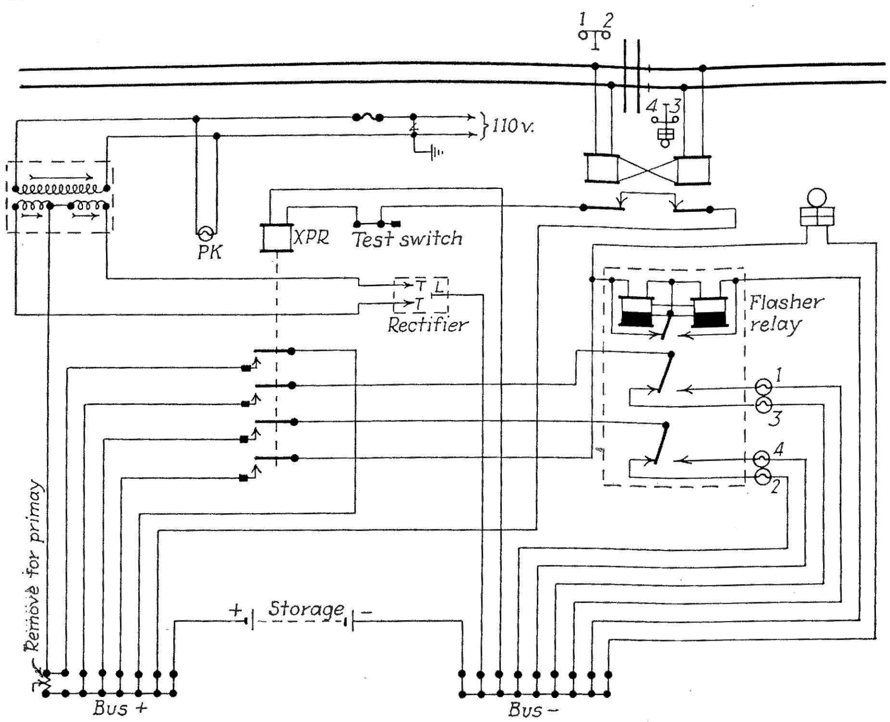

Circuit diagram using storage battery

transformer taps. An outstanding advantage of this scheme is that a completely charged storage battery stand-by is available regardless of the number of train movements.

The test switch shown in the XPR circuit should be placed outside the instrument housing together with a test record card, and frequent tests should be made by the signal maintainer, section foreman or track patrolman. The power indicator consists of a 1.0-watt neon lamp and a peep-hole cover from a flasher unit. The indicator is placed near the test switch so that if it is not burning the maintainer can be notified.

Certain operating tests were made under different conditions. With an a-c. floating storage battery stand-by and the circuits connected as shown, with a-c. power feeding and with the signal lamps burning, the bus voltage for the feed to the lamps was 11.6 volts, which was reduced to 10.8 volts when the a-c. power was disconnected. Reconnecting the a-c. power, thus returning the arrangement to normal, the battery was then disconnected, allowing the rectifier to carry the entire lamp load, and, under such conditions, the automatic features of the rectifier functioned to maintain adequate voltage on the buses to feed the lamps, so as to provide a satisfactory indication although not as intensive as under normal operation.

This same circuit scheme was tested on an installation, using 16 cells of 1,000-a.h. primary battery as a stand-by, but in this set-up the resistance unit was eliminated and the wiring changed so that the transformer and rectifier would normally be inactive. The XPR relay of 1,000 ohms was of the only normal load on the primary battery. When a train enters a control section, the XPR released, thus completing the circuit for the primary side of the transformer to feed the rectifier which furnishes rectified current to feed the lamps of the signals and the flasher relay. During this period of operation, the output voltage of the rectifier was in parallel with that of the primary battery, the output voltage of the rectifier being so adjusted as to carry the major portion of the load, the automatic feature of the rectifier functioning to maintain proper voltage on the buses above that of the primary battery. In such an arrangement the primary battery used should be of the high-amperage type so as to maintain adequate voltage on the lamps in case this full load is thrown on the battery during a power outage.

Under normal operation with the a-c. power on so that the rectifier and battery are connected to operate the signals, the following readings were made:

Secondary side of transformer	22.0 volts
Voltage on d-c. bus	13.6 volts
Voltage on the lamps	9.4 volts
Current full load	4.2 amp.
Current from rectifier	3.6 amp.
Current primary battery	0.6 amp.

With no trains in the control track circuits, the a-c. power was cut off, under which circumstance the primary battery was feeding the bus at 13.6 volts with a discharge of 0.022 amp. When the signal operation was started, the bus voltage was 9.8 volts with a discharge of 3.6 amp., the voltage on the lamps being 6.5 volts, resulting in a fair indication of the signals. It might be well to mention that primary cells with no normal or "gas" voltage would be better adapted to this scheme of operation because there is too much difference between

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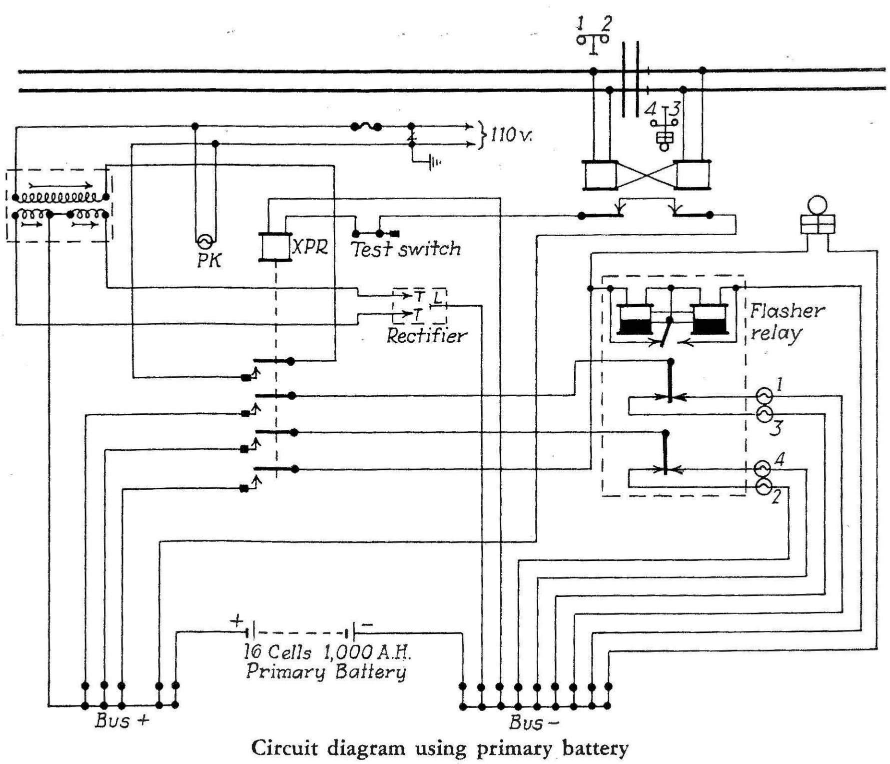

Circuit diagram using primary battery

the normal voltage of 13.6 volts and the operating voltage of 9.8 volts.

The a-c. power was switched on again to return the arrangement to normal; then the battery was disconnected, leaving the rectifier to feed the circuits. Under this condition, the normal voltage on the bus was zero. When a train entered a control circuit, the transformer and rectifier were cut in to provide 10.2 volts on the bus with 3.8 amp. discharge, the voltage on the lamps being 7.0 volts which provided a fair indication.

Primary Batteries in Cold Weather

"Have you found it desirable to use any special arrangements to keep primary battery 'alive' during extremely low temperatures and what means can be used to accomplish this purpose?"

Bleeders Utilized

J. P. Muller
Signal Engineer, Boston & Maine
Boston, Mass.

During the past winter, we have installed on all of our highway-crossing and automatic-signal primary batteries in both open and closed circuits a 1,500-ohm resistance with three 500-ohm taps causing a drain of approximately 10 m.a. on each set of primary batteries.

This seemed to keep the battery fairly active at low temperatures, the result being that we have had no inactive primary cells due to low temperatures during the past winter. This test will be continued through next winter. The batteries are installed in shallow concrete shelters and instrument cases.

Recommendations of a Manufacturer

F. S. Stallknecht
General Sales Engineer, Thomas A. Edison, Inc., Bloomfield, N.J.

The need for keeping primary cells in their most active state, while sometimes more pronounced in extremely cold climate is, we feel, a common problem in all climates and sections of the country. The same method of keeping them active in warm climates will keep them active in cold climates, though the need for so doing increases as solution temperatures decrease. Particularly is the latter statement true if the cells used under low-temperature conditions are somewhat overloaded and therefore actually inadequate for the current demands imposed upon them.

In view of the above interpretation of the question at issue, the following remarks may be of interest:

Edison primary cells are used in railway signal service in all parts of the world, the type of housing and type of cell being matched to the particular service condition, solution temperature, extent and duration of discharge, etc. Types of cells being used vary from the relatively low current S-500 (three-plate) type progressively upward to the HA-1000 (eleven-plate) type, built for heavy current rates.

As a general rule, deep battery wells are used for housing the cells in the coldest climates, while shallow tubs and boxes are used in the central portion of the United States, with signal cases used extensively in the southern portion. The better the cells are protected from the cold the less expensive type of cells may be used. If straight primary is used, and the cells need be renewed rather frequently, it is considered economical to purchase a warm housing, making it possible to use a less costly renewal. Where the cells last for years as is the case where the a-c.-primary system is used, cheaper housings are many times economical even though their use makes higher-priced cells absolutely necessary.

Assuming that the proper type cell is being used for any given service condition, the following statement for getting the cells off to a good start applies equally to cells used under all climatic conditions; it is quoted from our booklet entitled "Instructions for Setting-Up or Renewing Edison Primary Batteries:"

"When cells are used on open circuit, or extremely low-discharge work, each element (with the exception of HA types) should be short-circuited before inserting in the hot solution. The short-circuit should be left on for not more than two minutes after the element has been immersed. If the cells are to go on continuous discharge at once, the element may be inserted in the hot solution immediately after being set up. For such service, short-circuiting is not necessary."

The technical reasons for this particular maintenance suggestion are: The copper plates of Edison elements are made of copper-oxide. Copper-oxide, which is black in color, is not a good conductor of electric current. For this reason a metallic copper surface having good conductivity is processed on the plates before they leave the factory. When the assembled elements are put into a hot solution and the newly set up cells left standing idle, as in open-circuit service, the hot caustic solution sometimes partially oxidizes this metallic-copper conducting surface. Partial oxidization also occurs when elements have become wet in transit, or have been stored in damp places for longer than normal periods. Short-circuiting neutralizes the effects of the hot solution and, in cases where moisture has removed the metallic surface, will go a long way towards restoring it.

As a matter of fact, short-circuiting all cells is an excellent practice. Properly done, it is in no way harmful, and assures the cells being in prime operating condition when they first go into service. It also prevents black spotted oxides which generally indicate that the metallic surface was not in good condition when the cells were originally set up.

When short-circuiting cells it is important that each cell be short-circuited individually. The following is a simple method for doing this: Make up all the solutions and then attach each element to its cover by means of a hex nut. Connect the free end of the negative lead wire to the positive terminal by means of a wing nut. Immerse each element in its respective solution and just before two minutes have elapsed remove the short circuits by releasing the negative lead wires with as little delay as possible. The cells are then ready to connect to the circuit.

When carrying out these suggestions remember that cells used in open-circuit or light-duty service should always be short-circuited when set up in hot solution. Also, that it is not harmful but a rather good practice to short-circuit all cells, except HA types, regardless of the service. Leaving the short circuit on for any appreciable length of time beyond two minutes should be avoided as this may cause scaling of zinc plates. The oxide plates of HA elements have a special surface which should never require short-circuiting.

As can be gathered from the above, it is believed that cells properly set up will give a good account of themselves throughout their entire life provided they are in other than open-circuit service. Where they are used in open-circuit service our literature suggests keeping the cells active by