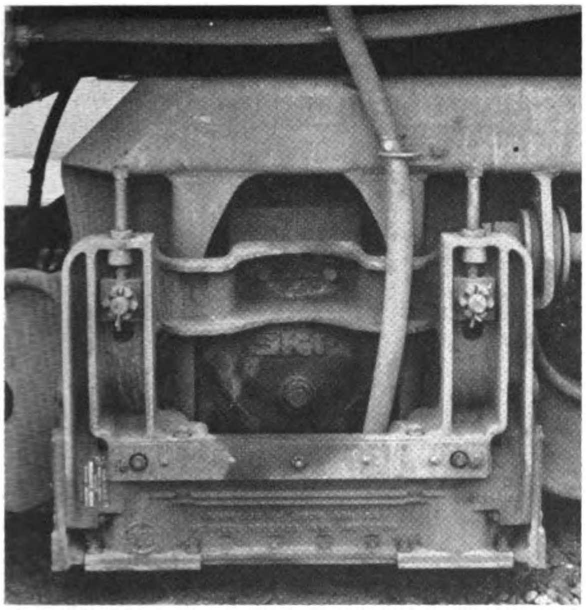
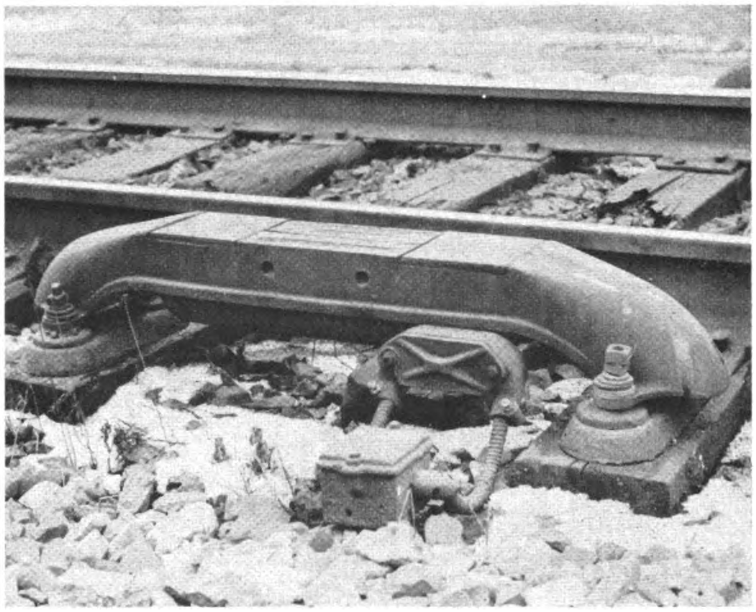


Electro-magnet on rear truck of car . . . .



. . . . rides over wayside inductor used also for automatic train stop

# Lehigh Valley Has Check-In-Check-Out

**System which operates independent of track circuit shunting, includes inductive equipment on train and at each wayside signal**

FOR MANY YEARS self-propelled cars were operated in passenger service on a run of 26 miles between Hazelton and Lehighton, Pa., on the Lehigh Valley. In previous years these cars were the Brill gas-electric type, powered by gasoline engines. Such a car, operated as a single unit, did not shunt the track circuits satisfactorily at all times. Therefore, to improve the shunting, an extra passenger car was trailed behind the power car, thus forming a two-car train, which shunted the track circuits properly.

In 1956 two new single-unit diesel-powered cars were purchased to replace the previous passenger train equipment on this run. Each of these cars operates as a single-unit train. Four of these trains are operated each way daily on the Hazelton-Lehighton run. The trains operate on the Hazelton Branch for 15 miles between Hazelton and MH Junction, and on the double-track main line for 11 miles between MH Junction and Lehighton. Automatic block-signaling is in service on the entire route. On the 15 miles between Hazelton and MH Junction, these single-unit trains are operated by absolute manual block. However, the use of manual block on the 11 miles between MH Junction and Lehighton was not practicable, because each of the four eastbound single-unit trains is scheduled just a few minutes ahead of a through passenger train. Thus passengers on the single-unit trains from Hazelton can change at Lehighton to the through trains for New York.

Therefore, rather than depend on track circuit shunting by the single-car diesel-propelled trains, on the 11 miles between MH Junction and Lehighton, the Lehigh Valley installed an inductive type check-in-check-out system for control of the signals, independent of the shunting of the track circuits. The check-in-check-out system was developed by the cooperative work of the signal department of the Lehigh Valley and the General Railway Signal Company, the equipment being furnished by the General Railway Signal Company.

Factors contributing to the practicability of making the necessary tests and developments were that: (1) only two of the single-unit trains are involved; (2) the territory extends on only 11 miles of double track including only nine wayside automatic signals; and (3) the cars and the wayside signal locations were already equipped with the GRS intermittent inductive train stop system, which is in service also on the 260 miles of the Lehigh Valley between Newark, N.J., and Sayre, Pa.

### Uses Train Stop Inductor

The check-in-check-out system uses part of the train-stop equipment. Therefore, brief explanation of the basic elements of the train-stop system is in order here.

As part of the intermittent inductive train-stop system, a wayside inductor is mounted on the ends of long ties at the right of the track about 75 ft. in approach to each signal. The center line of each inductor is 20 1/2 in. from the gauge of the rail.

On the right-hand side of the leading truck on each of the single-car trains, there is a receiver which is so mounted that it rides directly over the center line of each wayside inductor. Vertical clearance is about 1 1/2 in. If the wayside signal is displaying the Clear aspect, contacts, in a signal repeater relay, close a circuit (See Fig. 1) which includes the coil of the wayside inductor. No battery or other energy is connected in this circuit. When the train-stop receiver, on the leading truck, rides over a wayside inductor with the coil shorted, as stated above, no action takes place to ap-

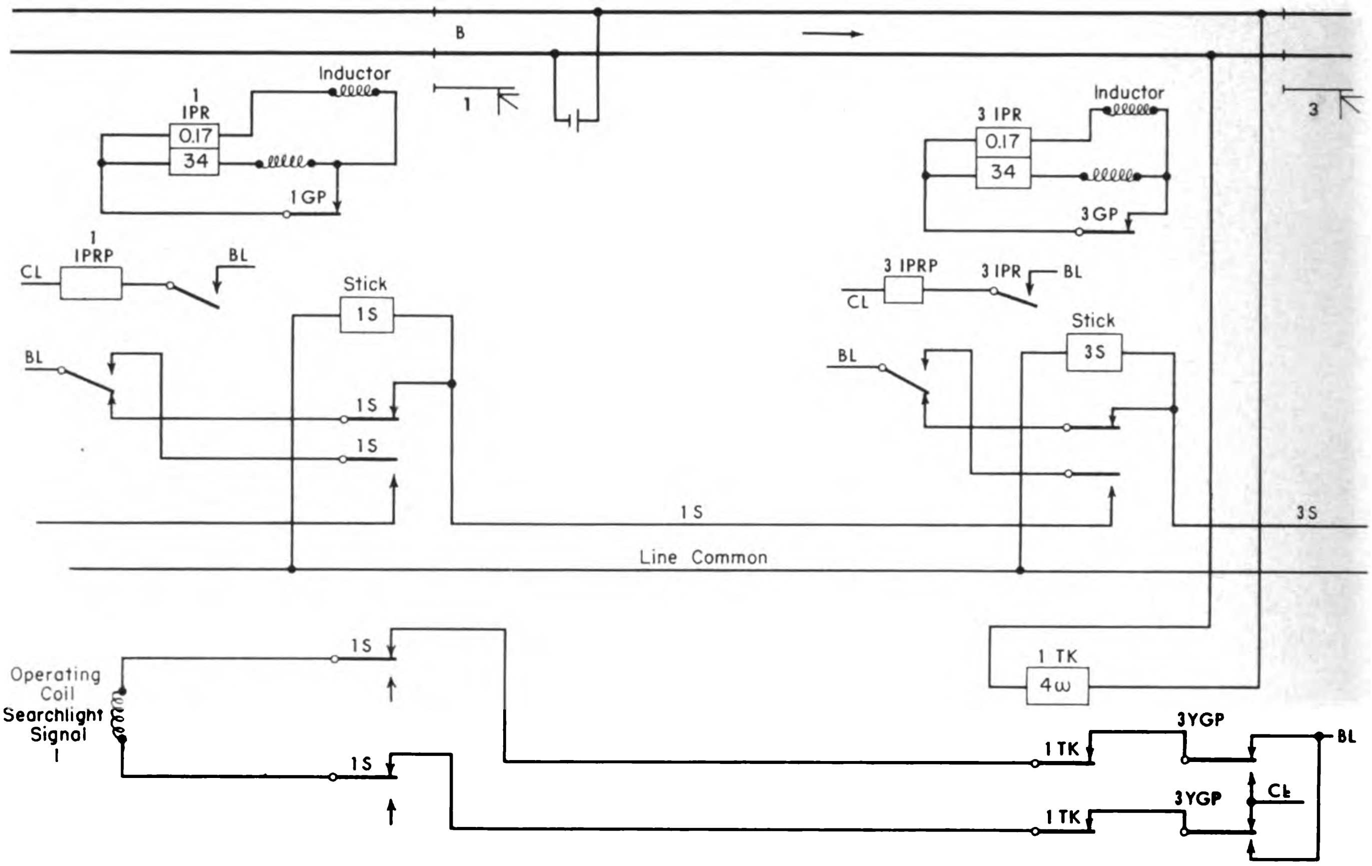



**Fig. 2—Diagram of scheme 1 using line wire for stick relay circuit**

ply the brakes. However, if the signal is displaying any aspect other than Clear, the circuit (Fig. 1) for the coil of the wayside inductor is open at the relay contact, and, as the receiver rides over the inductor, relays on the car are operated and the air brakes are applied, if the engineman does not operate the acknowledger when the receiver passes over the inductor.

When introducing the check-in-check-out system, additions were made in the circuit of the wayside inductor as shown in Fig. 2. Comparing Fig. 1 with Fig. 2, an inductor repeater relay IPR, a reactor and a new branch circuit have been added. This IPR relay has two coils, operating on the biased neutral basis. Both coils are normally de-energized. The upper, or .17-ohm coil, is always in the pick-up circuit for the relay. The lower, or 34-ohm coil, is only in the pick-up circuit when the GP relay is deenergized. This arrangement, using the 34-ohm coil and the reactor in series, is required to keep the train stop circuit still in effect with the addition of the IPR relay required for the check-in-check-out system.

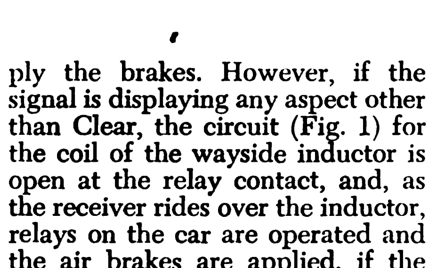



**Fig. 1—Previous inductor circuit**

## New "Receiver" on Rear Truck

As part of the new check-in-check-out system, an additional "receiver" was applied on the right-hand side of the rear truck of each of the single-car trains. The outward appearance of this rear truck "receiver" is the same as the train-stop receiver on the leading truck. However, the one on the rear truck is not a receiver, but rather is an electro-magnet, and will be so designated in the following discussion. The coil in this magnet has approximately twice the magnetic strength of the coil used in the regular train-stop system.

It is energized by a d.c. voltage of 64 volts, reduced by a resistor to adjust the current to about 5 amp.

When such an electro-magnet on the rear truck of a single-car train rides over a wayside inductor, the field of the magnet cuts the field of the coils in the wayside inductor, thus generating a sudden surge of current that energizes inductor repeater relay IPR for a very short time, then it releases. While this relay IPR was up, a circuit through its front contact energized repeater relay IPRP which has three 1,000-mfd condensers connected across its coils to make it a very slow release, (about 3 seconds). As shown in Fig. 2, when 1IPRP picks up, a circuit is opened to release stick relay 1S. As long as this relay 1S is down, the line wire circuit for signal 1 is open, thus holding that signal to display the Stop aspect. This condition continues until the electro-magnet on the rear truck of the single-car train rides over the wayside inductor at the next signal, No. 3. At that time, due to actions similar to those previously explained, the stick relay 3S at signal 3 is released, thus closing a contact which feeds back on the line wire to again energize relay 1S, which holds up through back contact of 1IPRP. With 1S up, contacts are closed in the line circuit for signal 1, so that if the track relays for that block are up, the signal will operate to change the aspect from Stop to Approach. When the train clears the next block, and signal 3 operates to the

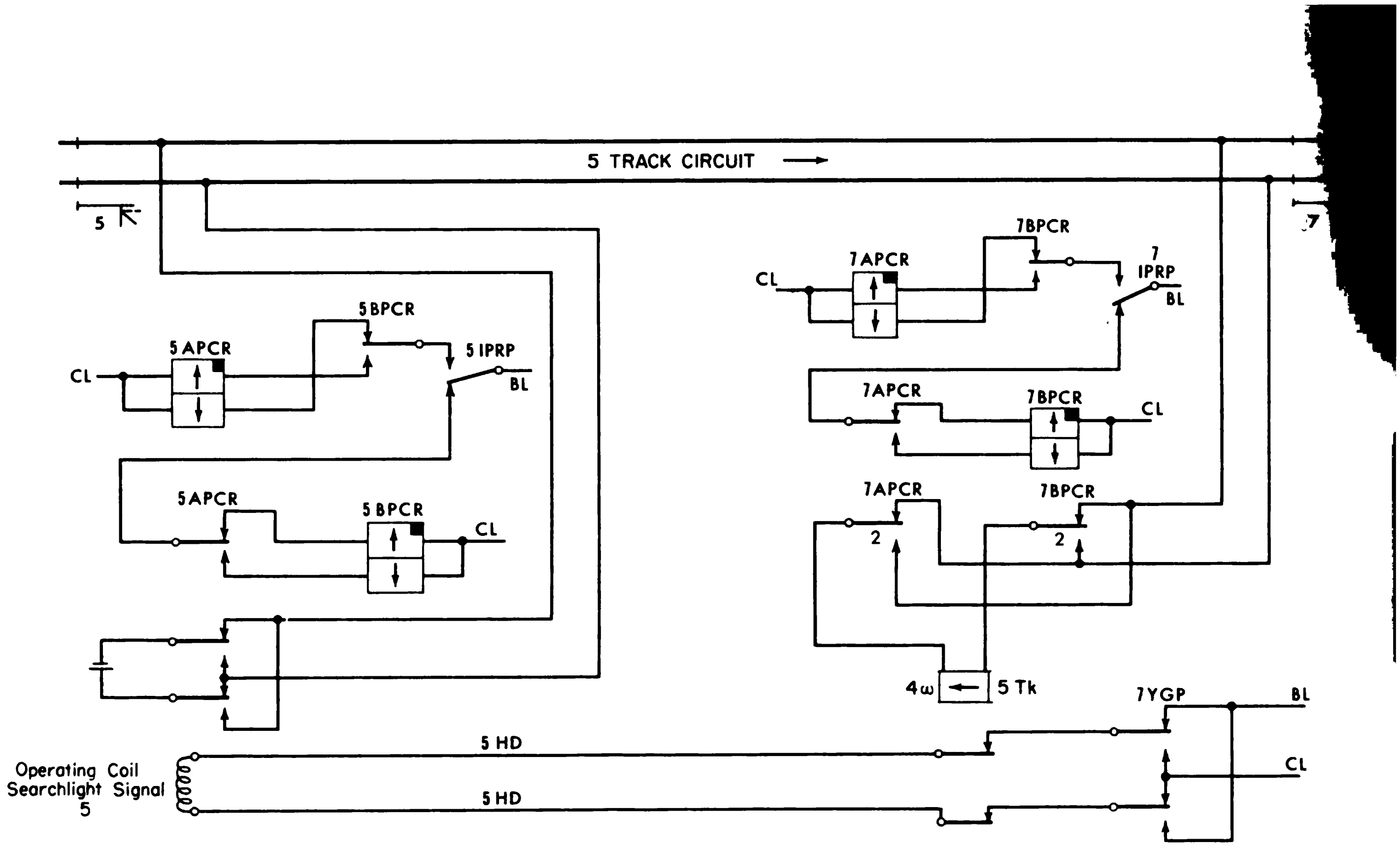



**Fig. 3—Diagram of scheme 2 using track control**

yellow aspect, the relay 3YGP is picked up which changes the polarity of the line circuit so that signal 1 operates to display the Clear aspect, these controls being conventional.

The circuit for the control of each stick relay, such as 1S, requires an additional line circuit to the signal ahead, i.e. signal 3. This is a single wire for the positive battery side of the circuit, with connection through to common line wire for the negative.

### Scheme No. 2 On Rails

For use in territory where line wire was not available to control the stick relay in the check-in-check-out circuits as discussed above, the Lehigh Valley developed arrangements for using the track circuits on rails to accomplish the results desired. In this scheme, No. 2, shown in Fig. 3, the inductor-repeater relay is operated by the passage of an electro-magnet over a wayside inductor, the same as previously discussed. However in this No. 2 scheme, using rails, the pick up of the IPRP relay controls two biased-neutral relays, 5APCR and 5BPCR as shown in Fig. 3. Operation of relay 5APCR from the "up" to the "down" position, changes the polarity of battery feeding east on the track circuit 5 from signal 5 to signal 7. This change of polarity causes biased-neutral track relay 5TK, at signal 7, to open the line wire control circuit for signal 5 as shown in Fig. 3.

Thus, while the train is going from signal 5 to signal 7, signal 5 remains at the Stop aspect, regardless of whether the track circuit is shunted by the train.

When the electro-magnet on the car rides over the receiver at signal 7, the receiver repeater relay, 7IPR, and its repeater, 7IPRP are picked up for a short time. Pick up of 7IPRP closes the circuit to feed battery BL through front of 7IPRP, front of 7BPCR to lower coil of 7APCR to negative battery CL. This throws the contacts of 7APCR down. Then, when inductor-repeater 7IPRP releases, battery BL feeds through back contact of 7IPRP and back of 7APCR through lower coil of 7BPCR and to CL. This throws contacts of this relay to the "down" position. This operation of contact 2 in 7APCR and contact 2 in relay 7BPCR, from the "up" to the "down" position, thereby changes the polarity of the track circuit to the coil of biased-neutral track relay 5KT. This synchronizes the pole changing at signal 7 to correspond with that then existing at signal 5, so that the coil of biased-neutral track relay 5KT is fed in the correct direction to pick up its contacts. This closes the contacts in the 5HD line circuit for signal 5, causing it to change its aspect from Stop to Approach.

Departure of the eastbound train, as discussed above, would leave the pole-changer relays 7APCR and 7BPCR at signal 7, and relays 5 APCR and 5BPCR at signal 5, in the "down" position. When the next eastbound train goes through, the pole-changer relays would be left in the "up" position, see Fig 3.

If the block between two signals includes two or more track circuits a pair of biased-neutral relays are used at the cut section to polarize the battery being fed on to the next track circuit, see Fig. 4.

If a single-car train passes signal 5, thus reversing the polarity in track circuit 5, and then backs out of the circuit, the track relay would not pick up, and therefore signal 5 would continue to display the Stop aspect. In such an instance the maintainer is called, and he restores the controls to normal by reversing the position of a double-pole, double-throw knife switch located in the signal relay case.

When an eastbound single-car train on the Hazelton branch "checks in" at the home signal at MH Junction, a buzzer in the interlocking tower starts to operate, and continues to operate until the leverman pushes a button. Thus, the fact that the check-in system is working, is checked by the towerman. In a similar manner a check is made when each westbound train passes through the interlocking just west of the station at Lehighton.

Each of the single-car diesel

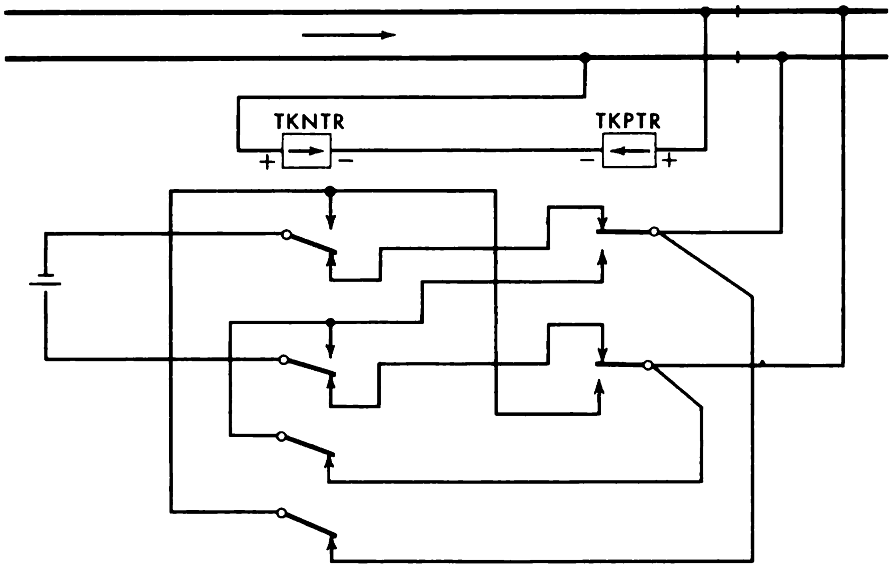
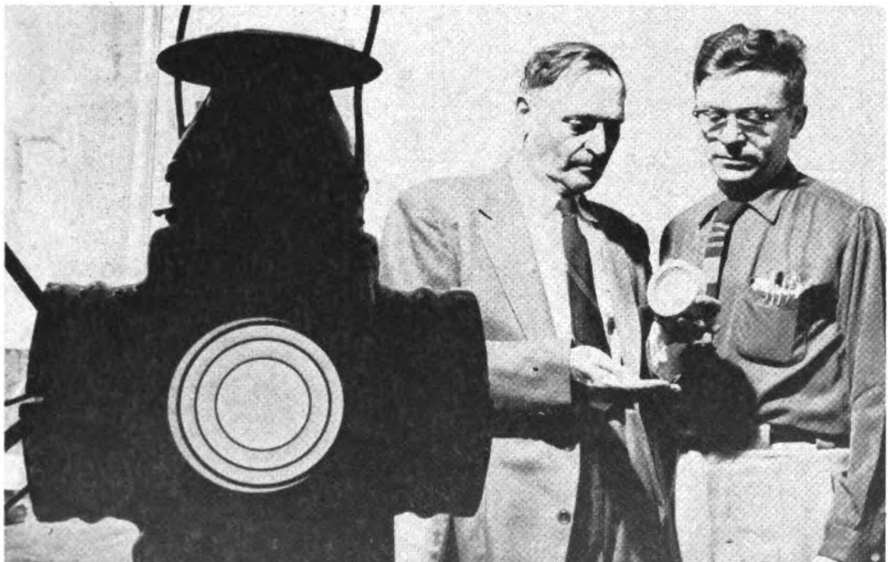



Fig. 4—Biased neutral relays are used to feed track circuit through cut-section

propelled trains is equipped with an engineman's compartment at both ends, so that the car can be operated in either direction. Accordingly there is a train-stop receiver and a check-in-check-out electro-magnet for each direction. The ones that are in operation are on the right-hand side of the car when facing in the direction of motion. The train-stop receiver is always on the leading truck and the check-in-check-out electro-magnet on the rear truck. A Struthers-Dunn rotary switch automatically cuts in the receiver and magnet for the proper direction as soon as the car starts. On each single-car train, the circuit through the coil of the electro-magnet on the rear truck is energized all the time that the car is in service. If this circuit fails, a relay is released which sounds a buzzer, lights a lamp to warn the engineer, and automatically applies the brakes.



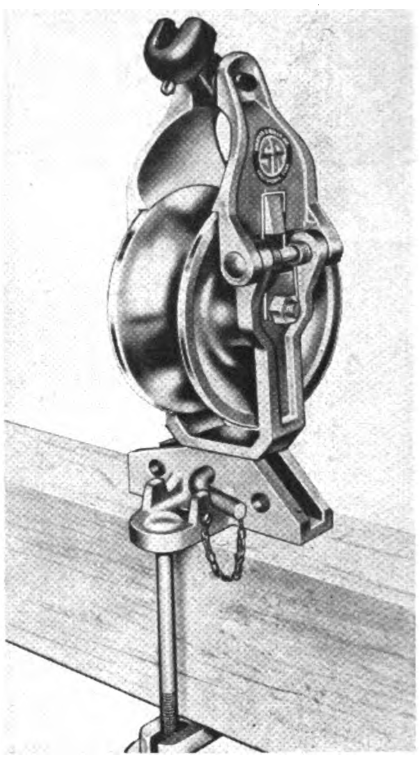
Ray McBrain, Rio Grande director research, and James Love, metallurgist, demonstrate atomic lamp—Photo by the Denver, Colo., Post.

ATOMIC SWITCH LAMPS, which will last for 10 years without maintenance, are being tested on the Denver & Rio Grande Western, the development being a joint project with U. S. Radium Corp. In this atomic switch lamp, the krypton isotope 85 beta ray reacts with phosphorous to produce a self-luminous glow. The krypton has a half life of approximately 10 years, requiring no maintenance or fuel. The unit can be restored at any time to full luminous power by refilling it with the krypton isotope gas. The gas is inert, and the lamp can be used with safety. The use of such lamps must be licensed by the Atomic Energy Commission.

# PRODUCT NEWS

### Stringing Sheave

An improved Sherman & Reilly stringing sheave features greater ease and speed of mounting, positive locking and light weight.



Known as model XS-100, the improved adjustable aluminum alloy bracket accommodates all crossarms 5 in. wide or smaller, and mounts securely on either roofed or flat crossarms. The XD XS-100 features a drop-forged connector, recessed sheave (to prevent conductor damage), positive locking head pin and spring loaded hinge plate. This sheave is grooved for cable through 1¾ in. diameter. The sheave is 7 in. diameter, 3 in. wide and mounted on two shielded ball bearings. The block has a safe working load of 2,500 lb. Total weight is 10 lb. For more information write Dept. RSC, Sherman & Reilly, Inc., First & Broads streets, Chattanooga 2, Tenn.

### Parallel Line Wire

The Ansonia Wire & Cable Company, Ashton, R. I., has announced that its new plant is now producing parallel line wire with two Copperweld conductors insulated with the