the dynamic indication is used, it indicates the switches that have a weaker indication.

We are also using the recording meter for obtaining the current flow from batteries operating a number of relays at an interlocking, to obtain a continuous record for 24 hr., and from this record it can be determined whether the charging rate of the battery is sufficient to keep the battery fully charged. As we continue to use the recording instrument, we find it more valuable; it develops a permanent record and the charts can be kept for future references. When tests are made during low temperatures, it is necessary to locate the meter in a box that can be kept at a temperature high enough so that the ink will flow freely.

It would seem that by the use of recording instruments, we can determine more accurately the energy being used for the operation of the various devices, also any irregularities that may occur while the instrument is connected.

[See also article on page 54 of February issue.]

What Protection at Drawbridges?

"At drawbridges do you provide interlocking protection between the bridge mechanism (wedge-driving apparatus and turning mechanism) and the interlocking machine? If so, what kind of checks are used and how is a conflict in the operation of the bridge mechanism and interlocking machine prevented?"

Electric Lock on Bridge Wedges Furnishes Adequate Protection

By W. A. Hoffman

Signal Engineer, Florida East Coast, St. Augustine, Fla.

At all our drawbridges we provide interlocking protection between the mechanical bridge lock and the electric circuit which operates the signals. This is accomplished by providing an electric lock on the bridge wedges, or bridge lock, which requires an electric release providing no trains are approaching the drawbridge, and a manual time release should a train be approaching the bridge from either direction.

The signals protecting our drawbridges are of the color-light, three-indication type, and where drawbridges are not operated very frequently, our signals are set normally clear over the drawbridge. When it is desired to open a bridge, the operator sets all signals in stop position and places the smash signal over the track.

Master Lever Prevents Conflict

By D. R. Graves

General Signal Inspector, Texas & Pacific Ry., Dallas, Tex.

At our largest drawbridge, a 176-ft. vertical-lift span, protection is afforded by an all-electric interlocker, which has a master lever to prevent a conflict between the manipulation of the interlocker and the bridge mechanism. This master lever, when reversed, closes a circuit for an enclosed automatic circuit breaker, through which the motor-generator set operates in lifting and lowering the span, and is locked reverse by an electric lever lock. The lever lock is released through contacts of the "fully closed" indicator circuit controllers. This releases the lever, when the span is fully seated on the pier.

On the trunnion type of bascule bridge, a mechanical interlocking provides protection. This has a rail lock operated by an interlocking lever, which locks the rail when reversed, and in the normal position closes the circuit for the bridge operating motor, through a circuit controller attached to this lever. The smaller hand-operated turn-type bridges are protected by mechanical interlockings, which operate a plunger lock through a special hand-operated rail connecting the wedge and the rails. The locking is operated by a lever which also works the bridge lock, both of which will be inoperative unless the bridge and rails have been properly wedged.

Electric Interlock Is Devised Between Lever in Machine and Rail Lock Controller

By B. L. Smith

Signal Engineer, Chicago, South Shore & South Bend, Michigan City, Ind.

We provide interlocking protection at our drawbridges between the interlocking system and the bridge. There is one lever on the interlocking machine which is used to operate a solenoid dwarf mechanism, this lever is locked against all other levers on the locking bed. When all interlocking levers are restored to normal, this lever can be pulled out. When this is done, it picks up the solenoid dwarf mechanism. There is a foot switch beside this dwarf, which is slot locked in the dwarf, and controls the positive battery to the controllers. When this solenoid is picked up, the operator can step on the foot switch, and close the circuits to the controllers. He must then operate his rail lock controller. When the rail locks are completely open, they close the circuits for the bridge wedges. The rail locks also operate the bridge circuit controllers for the interlocking system. After this move, the operator can raise the bridge wedges and when they have completed their movement, the lock at the end of the bridge is released and the "swing" circuit is cut in. In returning the bridge to normal, the lock at the end must close before the wedges can be restored, the wedges must be fully "home" before the rail locks can be closed, and the rail locks must be in position, before the foot switch can be restored. After this is done, the lever can be restored to normal, and the interlocking system placed in service.

Rail Locks on Drawbrige Are Checked by Levers in Interlocking Machine

By Philip P. Ash

Chief Signal Draftsman, Louisville & Nashville, Louisville, Ky.

On our drawbridges we use a type of lift rail at either end of the draw, known as the Nomlas rail lock. Briefly, the Nomlas rail lock consists of a short movable section of rail, which is mechanically locked to the stationary rail, when the bridge is lined for traffic, and which lifts laterally and vertically as the wedges are withdrawn. These lift rails are checked for alignment by detector locks, (modified form of plunger lock) which are operated by the interlocking machine.

Most of the draws are power operated by a gasoline engine, and by the means of a suitable gearing, etc., the wedge apparatus, Nomlas lift rails, and turning mechanism are operated. A clutch lever thrown in one position operates the lift rails and wedge mechanism, and in the other position turns the draw. By bolt locking this clutch lever, in neutral, with the interlocking machine, a mechanical interlock is effected which prevents conflict with the operation of the interlocking apparatus and bridge mechanism. This is accomplished by the above mechanical interlock, between the last lever to be thrown on the interlocking machine, when lined to open the draw and the clutch lever.

Interlocking between the bridge machinery and interlocking machine is designed to prevent the following conflicts. Before withdrawing the wedges and operating the lift rails and turning the draw, it is necessary that the plungers in the detector locks be withdrawn, also the circuit controller and the bridge coupler be disconnected.

The previous practice to secure interlocking protection between the draw machinery and interlocking machine was to break the ignition circuit of the gasoline engine, through the circuit controller contact, which is made by the full stroke of the last lever pulled when the draw is opened. This did not meet with favor, for it is always desirable to be able to run the engine, without being necessary to have to throw the levers for opening the draw.

To prevent the interlocking apparatus from being operated, when the draw is open, a butterfly plunger lock is provided on the last lever pulled in opening the draw. This also prevents improper manipulation of this apparatus, which would result in fouling of the interlocking apparatus, when the draw is swung into the closed position.

Is Indication Locking Needed?

"What advantages accrue from the elimination of indication locking on switch control levers? Are there any serious disadvantages?"

Absence of Indication Locking Speeds Up Lever Manipulation

By C. D. Cronk

Assistant Signal Engineer, Cleveland Union Terminals Company, Cleveland, Ohio

The advantages from the elimination of indication locking on switch control levers of power interlocking machines are several, some of these being referred to in the article "Elimination of Lock Rods," page 33 of the January, 1929, issue of *Railway Signaling*. In addition, the elimination of indication parts speeds up the setting up of routes, as the switch levers are operated to full-stroke position, thus releasing the mechanical locking and permitting the operation of the signal levers. The signal clears when the switches in the route are in proper position. The actual time for the switch to operate is all that is required, before the signal will clear, thus reducing the operation to an automatic status. With the indication locking, the clearing of the signal is dependent on the operator going over the route to be set up, and taking up the indication, or awaiting the receipt of each indication, before proceeding with the set up.

There are no serious disadvantages, for as referred to in the article in the January, 1929, issue of *Railway Signaling,* the only function that indication locking performs is to derange the mechanical locking, pending the operation of the switch. Therefore, in summing up the problem we find the following advantages:

(1) Speeds up operation.

(2) Eliminates costly maintenance of indication locking parts.

(3) Eliminates delay and divided responsibility for signal clearing, as between operators and maintainers.

Unless the Possibility of Grounds Is Removed, Indication Locking Should Not Be Eliminated

By Max M. Knight

Signal Maintainer, Wabash, Decatur, Ill.

One of the most recent developments in the trend towards the simplification of signaling facilities is the proposition of eliminating indication locking on switch control levers. I do not feel that it is a safe step to take. If the signal department can truthfully say that a method has been found that eliminates all possibility of ground trouble, then only is it safe to remove indication locking. With the switch control lever in full normal, or full reverse position, and the track switch fouled in a dangerous position, a grounded signal control wire between the indication relay and the signal might cause disastrous results. Despite the practice of selecting the signal control circuits through the switch circuit controllers at the track switch, the possibility of a false-clear signal is not entirely eliminated. At electric plants, where the train movements are numerous, the switch indication locking plays an important part because it notifies the maintainer immediately, whenever any switch is not functioning as it should.

W. S. Henry, service engineer, of the General Railway Signal Company briefly states his view:

"The advantages that accrue from the elimination of indication locking on switch control levers are a somewhat simplified interlocking machine, with greater ease and rapidity in manipulation. Some additional relays and circuit connections have to be added to compensate for the omission of indication locking. There appear to be no disadvantages."

How to Cure Ground Trouble

"What are some of the best ways to ferret out troubles from grounds at an electric interlocking plant and on automatic signal circuits?"

Outlines Two Methods of Hunting for Grounds at Electric Interlockers

By T. G. Inwood

Signal Supervisor, New York Central, Chicago

At electric interlockings, when testing for negative grounds, we first set the ground switches on "positive battery" and on ground. Second, we operate the various functions, observing the ground light to see which, if any, of the functions affect the light, and if, when operating any particular function, we notice the light dim, or go out, indicating that the function being operated is grounded, we disconnect the control wires of that function and check the insulation resistance with a magneto or megger. If the control wires are found to be clear, we check the motor and field circuits. This usually gives us the desired results.

If, when operating the various functions, they do not materially affect the ground light, indicating that there are possibly a number of light grounds, or a ground between the operating switchboard and battery, we insert an ammeter between the positive battery and ground connection and disconnect the negative return wires for each function, one at a time. In doing so, we watch the ammeter, until we find those which are grounded, as these, when dis-