holes in the light units. Where peep holes are used or where the installation involves semaphore type signals, the tests may be made in less time.

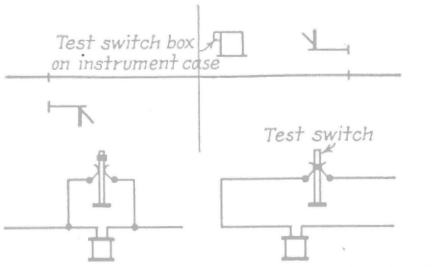
While several schemes may be provided for in the instrument housing at the crossing, such as switches and push buttons, which can be wired so as to duplicate tests made by shunt wires, I do not feel that such tests are reliable operating tests. Although it would take considerably less time for one man to check the plant, I believe that the time it takes to make tests by means of shunt wires is well spent whenever a test of an interlocking is necessary.

Provide Special Test Switches

E. J. Schaefer
Wilmington, N. C.

A very recent development is a small compact test switch box which is used to enable section masters to test highway crossing signals. This box has a maximum capacity of eight switches, which can be set "normally open" or "normally closed," and is so designed that the closing of the door restores all switches to their normal operating positions.

This box can be attached to the central instrument case of an automatic interlocking, and the switches so incorporated in the circuits that four switches will shunt the four approaches and two switches will shunt



Test switches arranged for series breaking and by-passing

the two sections between the home signals. One man can readily set up any conditions encountered in actual train movements, in a simple layout, without the use of external shunting devices, and without leaving his position at the crossing housing.

Lost Motion in Locking

"On your railroad, what limits of lost motion due to wear are permitted in the locking and operating connections of the locking on interlocking machines before replacements are made?"

New York Central Standards

F. B. Wiegand
Signal Engineer, New York Central, Cleveland, Ohio

The limits of lost motion due to wear permitted in the locking and operating connections of the locking on interlocking machines on the New York Central are as follows:

Locking bars and tappets must have full stroke as shown in the table. Latch block adjustment on mechanical interlocking machine:

Latch block must not lift more than 1/8 in. above top of quadrant.
Latch block lift to permit operation of lever must be not less than 3/4 in.
Mechanical locking under the loosest locking conditions must prevent lift of latch block more than:

(1) 5/16 in. where electric latch locks are used.
(2) 7/16 in. where electric lever locks are used.
(3) 7/16 in. on levers without electric locks.

Maximum movement of lever-latch block with tappet or longitudinal locking bar held stationary must not exceed 1/8 in.

Lever movement adjustment on G.R.S. Model-2 electric interlocking machines:

Mechanical locking under the loosest locking condition must not permit movement of lever from normal toward reverse position of more than 5/16 in., and from reverse toward normal of more than 9/16 in.
Maximum movement of tappet due to lost motion must not exceed 1/16 in.

Adjustment on G.R.S. Model-5 electric interlocking machines:

Mechanical locking under the loosest locking conditions must not permit tappet movement of more than 3/16 in.
Maximum movement of tappet due to lost motion must not exceed 1/16 in.

Longitudinal locking bar movement adjustment on U.S. & S. power interlocking machine:

Mechanical locking under the loosest locking condition must prevent movement of longitudinal locking of more than 3/32 in.
The maximum movement of the longitudinal locking bar due to lost motion must not exceed 1/64 in.

Longitudinal locking bar movement adjustment on U.S. & S., Style S-8 electro-mechanical interlocking machine:

Mechanical locking under the loosest locking condition must prevent movement of longitudinal locking bar more than 3/16 in.
The maximum movement of the longitudinal locking bar due to lost motion must not exceed 1/16 in.

LOCKING REQUIREMENTS FOR VARIOUS CLASSES OF INTERLOCKING MACHINES

Item	Type of Interlocking Machine	Type of Locking	Longitudinal Bar or Tappet (Length of stroke in inches)	Cross Locking or Locking Bar
A	Mechanical	S. & F.	1-3/4 in.	3/8 in.
B	Mechanical	Style "A"	1-1/16	7/16
C	Electro-mech'l	S. & F.	1-3/4	3/8
D	Electro-mech'l	S. & F.	*1-5/16	3/8
E	Electro-mech'l	S. & F.-Min.	Sig. 1/2, Sw. 1	3/16
F	Electro-mech'l	Style "A"-Min.	3/4	1/4
G	Power	Style "A"-Min.	3/4	3/8
H	Power (Fed.)	Stevens		
I	Power	S. & F.-Min.		
J	Table (GRS)	S. & F.-Min.	Sig. 1/2, Sw. 1	3/16
K	Table (US&S)	S. & F.-Min.		

*Stroke from center position

Rely on Forced-Drop Lever Locks

R. D. Moore
Signal Engineer, Southern Pacific, San Francisco, Cal.

Regarding the limits of lost motion, due to wear, permitted in the locking and operating connections of the locking on interlocking machine before replacements are made, on the Southern

(Continued on page 172)

Pacific we have installed lever locks of the forced-drop type and, therefore, maintain the locking such that the lock is actually in a forced-drop position before a conflicting lever can be moved.

General Specifications

J. S. Gensheimer
Engineer, Telegraph & Signals, Pennsylvania, New York, N.Y.

The requirements given below are the result of my experience with various types of interlocking machines, meet our system specifications, and are universally used in the field.

Inspections are made annually on all types of interlocking machines. Limits of lost motion permitted vary on different types of machines as follows:

(1) Mechanical machines (having the latch operate the locking): When lever latch block can be raised not exceeding 5/16 in. of top of quadrant.

(2) Electro-mechanical machines: When movement of electric lever does not exceed three degrees.

(3) Power Machines: When operating lever (signal or switch) can be moved a distance not exceeding three degrees from any fully-operated or normal position.

Accuracy of Timing Relays

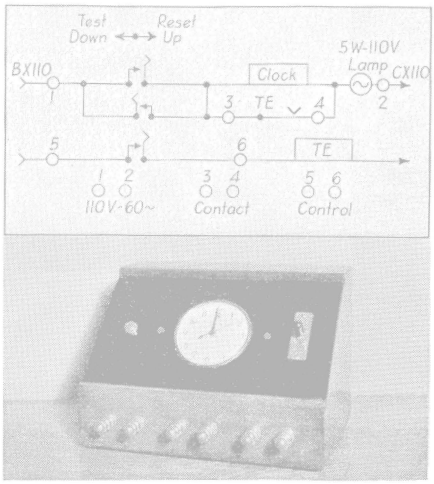
"At an interlocking equipped with time-element relays, how frequently should the accuracy of each timing function be checked? How do you measure these time intervals?"

An Electric Timer

A. Davis Moore
Signal Shop, Philadelphia Rapid Transit, Philadelphia, Pa.

An electric timer to check accurately the time interval of time-element relays has been constructed by the signal shop of the Philadelphia Rapid Transit. It consists essentially of a self-starting synchronous electric clock, a lever key and an indication lamp, mounted on a bakelite panel. The clock, a standard Telechron with a square moulded case, is secured to the back of the panel with a brass strap, a hole in the panel allowing the bezel ring to be flush with the face of the panel. An indication lamp is mounted to the left of the clock and a three-position lever key on the right side of the panel. The panel is set at an angle of 45 deg. in a small wooden case equipped with a hinged door in the back to provide access to the lamp, etc. Six A.R.A. terminals are mounted on the case below the panel.

The operation of the device is as



This set is designed for accurate timing of apparatus

follows: 110-volt 60-cycle current is connected to the terminals designated; the control for the relay under test is connected in series with the terminals marked "Control" and a front (normally-open) contact of the relay is connected to the posts marked "Contact." The normal position of the lever key is on center. Moving the key "up" energizes the clock only, and is used to reset the second hand to any desired starting point, usually "12 o'clock." The hour hand has been removed; the minute hand may be reset by means of the usual reset knob on the back of the clock. Moving the lever key "down" simultaneously starts the clock and closes the control circuit of the relay. When the front contacts of the relay close, at the expiration of the time interval, the clock is short-circuited and the indication lamp is illuminated. The elapsed time may then be noted.

As may be seen by the circuit diagram, the clock operates in series with the lamp, but this does not affect the accuracy of the clock, as the clock speed is independent of voltage. The impedance of the clock winding is too high to allow sufficient current to pass to illuminate the lamp.

Very accurate results are possible with this device, as the human element is entirely eliminated. As it is readily portable, it has proved particularly valuable in checking thermal relays used in C.T.C. installations, and for setting relays used for speed-control signals.

Should Be Tested Monthly

W. H. Dutton
Signal Inspector, Missouri-Kansas-Texas, Denison, Tex.

The accuracy of time-element relays should be checked at least once a month. It is an easy matter to check the time interval with your watch when checking the performance of the time element relay.

These relays require much more attention than an ordinary relay. The best results will be obtained by following the manufacturer's service specifications.

Ordinary Watch Is Sufficient

O. R. Unger
Signal Supervisor, Missouri Pacific, Nevada, Mo.

Our time-element relays are checked once a month. If they are set for two minutes, or whatever the time may be, we simply start the apparatus and time it by an ordinary watch. If the time interval varies slightly from that intended, in the first test, a second test is made to verify the inaccuracy before adjustments are made. We have never experienced any difficulty with time-element relays thus far.

Grounded Line Circuits

"On a double-track automatic block signal system using common line wire, an intermittent ground was causing the line control relay to be falsely energized. If you have had similar experience please explain methods used to locate the cause of trouble as it occurred on your territory."

Two Grounds Required to Energize Relay

E. E. Dickie
Signal Maintainer, Chicago, St. Paul, Minneapolis & Omaha, Fairchild, Wis.

On a double-track block signal system using common line wire, and operated by primary battery, a line control relay cannot be falsely energized by a single ground. There must be two or more leaks to ground, on which

The above article was published in *Railway Signaling* in February, 1935, in the Kinks department. It is reproduced here for the benefit of readers, owing to its significance as an answer to the question as quoted.—*Editor.*