

I. C. C. Issues Rules, Standards and Instructions for Signaling

ON MAY 25, the Interstate Commerce Commission served an order on the railroads requiring compliance with a set of rules, standards, and instructions for the installation, inspection, maintenance, and repair of railroad equipment commonly termed signaling, with the exception of manual block signaling. These regulations were prepared under the direction of the I. C. C. Bureau of Safety. In view of the importance and widespread interest in this matter *Railway Signaling* is presenting herewith a complete transcript of the order as well as the rules, standards, and instructions. The effective date of the order is September 1, 1939. Compliance with certain sections of the order is explained in a footnote which reads as follows: "Sections 55, 93, 203, 204, 303, 304, 305, 309, 310, 321, 404 and 405 will become effective with respect to installations subsequently made; in order to bring existing installations into conformity with the requirements of the foregoing listed sections, a period of two years will be allowed unless further extension of time is granted by the Commission with respect to any of these sections upon application by individual carrier or carriers."

Order

Whereas, paragraph (c) of Section 26, of an Act of Congress approved August 26, 1937, entitled, "An Act* to require certain common carriers by railroad to install and

*Abstract of this Act was published on page 505 of *Railway Signaling* for September, 1937.

maintain certain appliances, methods, and systems intended to promote the safety of employees and travelers on railroads, and for other purposes," provides that "Each carrier by railroad shall file with the Commission its rules, standards, and instructions for the installation, inspection, maintenance, and repair of the systems, devices, and appliances covered by this section within six months after the enactment of this mandatory provision, and, after approval by the Commission, such rules, standards, and instructions, with such modifications as the Commission may require, shall become obligatory upon the carrier: Provided, however, That if any such carrier shall fail to file its rules, standards, and instructions the Commission shall prepare rules, standards, and instructions for the installation, inspection, maintenance, and repair of such systems, devices, and appliances to be observed by such carrier, which rules, standards, and instructions, a copy thereof having been served on the president, chief operating officer, trustee, or receiver, of such carrier, shall be obligatory: Provided further, That such carrier may from time to time change the rules, standards, and instructions herein provided for, but such change shall not take effect and the new rules, standards, and instructions be enforced until they shall have been filed with and approved by the Commission: And provided further, That the Commission may on its own motion, upon good cause shown, revise, amend, or modify the rules, standards, and instructions prescribed by it under this subsection, and as revised, amended, or modified they shall be

obligatory upon the carrier after a copy thereof shall have been served as above provided"; and

Whereas, the rules, standards, and instructions for the installation, inspection, maintenance, and repair of the systems, devices, and appliances covered by said section which were filed by a number of said carriers by railroad within the prescribed period of six months were incomplete and inadequate to carry out the purposes of the act, and other carriers failed to file their said rules, standards, and instructions within the prescribed period of six months; and

Whereas, rules, standards, and instructions as provided for by said section for the installation, inspection, maintenance, and repair of the systems, devices, and appliances covered by said section, except manual block signal systems, have been prepared by the Commission, and have been considered by representatives of the carriers and representatives of the employees of said carriers in conferences held on November 21, 1938, and January 17, 1939, and on April 7, 1939, said representatives of the carriers and of the employees have agreed to accept said rules, standards, and instructions,

Now, therefore, in pursuance of and in accordance with the provisions of said section 26 of said Act,

It is ordered, That the following rules, standards, and instructions for the installation, inspection, maintenance, and repair of the systems, devices, and appliances covered by said section, except manual block signal systems, which have been prepared by the Commission and have been agreed to by



Harris & Ewing

representatives of the carriers and by representatives of the employees be, and they are hereby, approved and prescribed, and from and after the first day of September, 1939, shall be observed by each and every common carrier subject to the said section 26 of the act as minimum requirements: *Provided*, That nothing herein contained shall be construed as prohibiting any carrier from enforcing additional rules, standards, and instructions not inconsistent with the said rules, standards, and instructions, tending to a greater degree of precaution against accidents;

It is further ordered, That a copy of this order shall be served upon each and every common carrier by railroad subject to said section 26 of the act.

Dated at Washington, D.C., this 13th day of April, 1939.

By the Commission, Commissioner McManamy.

W. P. Bartel, Secretary.

Interstate Commerce Commission Bureau of Safety

Rules, Standards, and Instructions

The railroad company is responsible for the installation, inspection, maintenance, and repair of block signal systems, interlocking, automatic train stop, train control and cab signal devices, and other similar appliances, methods, and systems used or permitted to be used on its line. It must know that all installations, inspections, tests, and repairs are made and reports are made and filed as required, and that all parts and appurtenances of the devices used are maintained in condition to meet the requirements of the law and these rules, standards, and instructions.

Rules and Instructions—All Systems General

1. The apparatus shall be so installed and maintained as to be safe and suitable for service.

2. Correct track layout plan, circuit plan, locking sheet, and dog chart, in good condition, shall be kept at each interlocking station and at each place where their use is required.

3. Maintenance and repair work which may interfere with safe movement of trains shall not be started until train movements have been fully protected. Temporary repairs or adjustments when required shall be made in such manner that safety of operation will not be impaired.

4. Defective apparatus or parts shall be promptly replaced and record made of such replacement.

5. Circuit shall not be opened or shunted or other action taken which may cause operation of signal or other apparatus at a time when such action may affect safety of train operation.

6. In case of severe storm, inspection shall be made as soon as practicable and any trouble corrected.

7. In case of an accident in which signal apparatus or other controlling device is concerned, a thorough examination shall be made immediately of all parts involved and record made of the results of such examination.

8. In case of failure or damage to apparatus which cannot be repaired immediately and which may affect safety of train

operation, signals or other controlling devices shall be arranged to provide protection until the condition is corrected.

9. In case broken rail, wide gage or other condition is discovered which may affect safety of train operation, steps shall be taken immediately to protect trains by flag, signals, or other controlling devices; record of the defect shall be made and the defect remedied as quickly as possible.

10. When rail is being laid or other track changes are being made which render the track unsafe for passage of trains, signals or other controlling devices shall be arranged to provide protection. The signals or other controlling devices shall not be restored to normal operation until tests have been made and it is known that they function as intended, and that the track is safe for the passage of trains.

11. Circuit shall be kept free of grounds which may interfere with proper operation.

12. Outside signal and instrument cases shall be locked except where it is established to be undesirable. Power interlocking machine cabinets, time releases, and electric locks shall be locked or sealed.

13. When repair, adjustment, change, or replacement is made in any part of the system that may affect the operation of the system, tests shall be made immediately to determine that proper operation is assured.

14. The normal functioning of any electrical device shall not be defeated by mechanical means, or by means of any other form of energy, without taking proper measures to insure safe operation of trains.

15. The apparatus shall be so installed and maintained that it will not constitute a source of danger to trainmen, other employees, or passengers.

Signals

21. Signal mast shall be vertical, securely fastened on suitable support, and signal alined to give the best possible indications for approaching trains. Signals shall be installed to avoid, so far as possible, liability of mistaking the indication of one signal for the indication of another signal, or confusion between signal and other lights.

22. Signal blade, lens, roundels, glass, and lamp shall be cleaned as often as necessary to insure good indications.

23. Lamp bracket shall be securely fastened and all parts of lamp shall clear spectacle not less than one-half inch.

24. Ladder, hand railing, and platform shall be kept in good condition and securely fastened.

25. Movable parts of signal shall move freely under all weather conditions which permit the operation of trains.

26. Semaphore spectacle casting shall rest against the stop provided for that purpose, allowing slot-arms and vertical connections to be free from downward pressure when in the most restrictive position.

27. Semaphore signal shall not be placed in service until bearings have been cleaned, and oil, dirt, and grease removed from the armature and poles of slot magnets and gears, all parts lubricated, and preferably after electrical torque tests have been made.

28. Bearings shall be lubricated and kept free from grit and dirt.

29. Mechanism shall be kept in proper adjustment. Excessively worn or defective parts shall be replaced.

30. Slot or equivalent device shall release when voltage is reduced to less than the release voltage for which such apparatus is designed.

31. Air gap between movable and fixed members of slot or retaining device shall be not less than the minimum for which the apparatus is designed to operate. Movable and fixed members of slot or retaining device shall be kept free from grease, oil, and dirt.

32. Electrical contacts shall be kept clean and in proper adjustment.

33. Wires shall be so arranged as not to interfere with operating parts of mechanism.

34. Buffing or snubbing of signal shall be effective to eliminate undue strain on mechanism. Buffers shall be cleaned and lubricated once each year, and repacked or refilled as often as necessary to maintain proper buffing.

35. Armature of signal motor shall not have excessive lost motion in bearings and the clearance between rotating and stationary parts shall be adequate to insure proper operation.

36. On signal employing a toggle arrangement, the slot toggle adjustment shall not be changed from its original setting. If adjustment of toggle changes due to wear, toggle or slot arm shall be replaced.

37. Slot magnet armature shall have sufficient end play to allow armature to seat firmly against pole face core pins under all conditions.

38. Slot armature side play measured at lower end of armature shall not exceed $\frac{1}{8}$ in.

39. Tooth disc on motor armature or pawl in retaining mechanism which has become worn or burred shall be replaced.

40. In signal of the searchlight type, the relay mechanism shall be maintained in accordance with sections 71 to 80, inclusive, insofar as such sections apply.

41. In light signal other than searchlight type, changes in the internal parts including the lamp receptacle shall not be made from their original settings, except where provision has been made for focusing.

42. Action shall be taken when necessary to prevent phantom indications from reflected external sources.

43. Deflecting prisms shall be assembled and maintained to spread the light in the proper direction.

Track Circuits

51. Track circuits shall, so far as possible, be so installed and maintained that the track relay will be in de-energized position whenever any of the following conditions exist, and the track circuit of an automatic train stop, train control or cab signal system will be de-energized in the rear of the point where any of the following conditions exist:

(a) A rail is broken or a rail or frog is removed.

(b) A train, engine, or car occupies any part of a track section including fouling section of turnout or crossover.

(c) Where switch shunting circuit is used—

1. A switch is misplaced or its points not in proper position.
2. A switch is not properly locked where facing point lock with circuit controller is used.

3. An independently operated fouling point derail equipped with switch circuit controller is misplaced or not in derailing position.

52. Where relayed cut-section is used, the track relay at cut-section shall, when in de-energized position, open the track energy supply for the adjacent track circuit, and in non-coded direct current territory shunt the adjacent track circuit.

53. At grade crossing with an electric railroad where tests indicate presence of foreign current, the electric energy for non-coded direct current track circuit shall be connected to feed away from the crossing.

54. The length of any track circuit, except trap circuit, shall be greater than maximum inner wheel base of any engine or car.

55. Where dead section exceeds 35 ft. or the shortest wheel base of an engine, special circuit shall be installed. (See footnote.)

56. Track circuit shall be so maintained that circuit will be properly energized during wet weather or minimum ballast resistance conditions, and during dry weather or maximum ballast resistance conditions the track circuit will not be over-energized to such an extent that shunting sensitivity will be decreased below a safe value.

57. Bonding shall be maintained in condition to insure low resistance.

58. Shunt wires, preferably in duplicate, shall provide adequate conductivity to insure effective shunting and shall be kept in place and in good condition.

59. Track connections and fouling circuits shall be so installed and maintained as to avoid breaks or undue resistance.

60. Switch circuit controller connected at the point to switch located in main track or in other track equipped with track circuit and not equipped with facing point lock shall be so maintained that when point is opened $\frac{1}{4}$ in. or more on facing switch and $\frac{3}{8}$ in. or more on trailing switch, track or control circuits will be shunted or opened or both. Switch circuit controller shall be securely fastened and contacts shall be kept clean, with minimum resistance, and with contact opening of not less than $\frac{1}{16}$ in. when open.

61. Circuit controller operated by switch and lock movement shall be so maintained that the contacts will remain closed or opened or both until the locking dog has passed through the lock rod.

62. Insulated rail joints shall be maintained in good condition, drainage provided, insulation in place, bolts tight, and ties properly spaced and tamped.

63. Circuits shall, so far as possible, be arranged to provide protection against broken-down insulation in insulated rail joints.

64. Insulation in pipe line, switch rod, tie rod, and gage plate shall be maintained in good condition.

65. Pipe line under rail shall clear base of rail at least $\frac{1}{2}$ in.

Relays, Slot Coils, Magnet Valves, Electric Locks and Indicators Controlling Circuits

71. Pick-up and drop-away values shall be maintained within limits which will insure reliable and safe operation.

72. Relay shall not be tilted or turned over to close contacts. Contacts of relay

or other controlling device shall not be bridged without taking proper measures to insure safe operation of trains.

73. Voltage at the local terminals of a two-element alternating-current relay shall be as nearly as possible the normal voltage at which the relay is designed to operate.

Pole Lines and Power Supply

81. Pole line carrying signal circuits shall be properly installed and maintained. The wires shall be securely tied in on the insulators, and broken insulators shall be replaced.

82. The clear space between the lowest overhead signal line conductor and the surfaces of track rails at points where freight cars are handled on top of which men are permitted shall be not less than 27 ft. at 60 deg. Fahrenheit, no wind.

83. Open wire transmission line operating at voltage of 750 volts or more shall be placed not less than 4 ft. above the nearest crossarm carrying signal or communication circuits.

86. Battery shall be installed in suitable housing, shall be of sufficient capacity for the service required, and shall be kept sufficiently charged or renewed as often as necessary to insure safe and reliable operation. Connections shall be kept clean and tight, and cracked or broken jars shall be replaced.

87. Transformer shall be of sufficient capacity for the service required and shall be suitable for the frequency and the voltage supply with which it is used.

88. Rectifier shall be of sufficient capacity for the service required and shall be used only with the voltage and frequency for which it is suitable.

89. Lightning arrester shall be properly connected and ground maintained with resistance to ground preferably of not more than 25 ohms.

Insulated Wires and Cables

91. Insulated wire shall be protected from mechanical injury to avoid interference with proper operation of apparatus. The insulation shall not be punctured for test purposes. Splice shall not be made in insulated underground wire when it can be avoided.

92. Insulated wire and cable used aerially shall be supported on insulators or suspended from messenger wire.

93. Wires shall be properly identified. Tags in instrument, mechanism, and terminal cases shall be made of insulating material and so placed that they will not interfere with moving parts of apparatus. (See footnote.)

Inspections and Tests—All Systems

101. Periodical inspection and test shall be made to insure that apparatus is in proper condition for service. The frequency of tests named below represents the maximum intervals between tests.

102. When making test of apparatus proper instruments shall be used, and it must be known that no unsafe conditions are set up by the application of testing equipment.

103. General inspection shall be made once every four years to insure good physical condition and operation, and that apparatus is installed in accordance with plans covering the installation.

104. Signal mechanism shall be inspected to insure that the apparatus is maintained in safe and suitable condition for service. Tests of the operating characteristics of all parts of the signal mechanism shall be made at periods specified by the carrier subject to approval by the Commission, but not less frequently than once every two years.

105. Switch circuit controller shall be inspected frequently and tests made quarterly to insure that it is in good condition and in proper adjustment.

106. Fouling circuit on switch shall be inspected frequently and tested quarterly to insure that fouling wires are intact and that fouling circuit shunts properly.

107. Insulated rail joints shall be inspected monthly to insure that they are in good condition.

108. Relay in service shall be tested every two years in accordance with tests specified by each carrier, subject to approval by the Commission. Relay which fails to meet requirements of specified tests shall be removed from service, subjected to thorough tests, and shall not be replaced in service unless its operating characteristics are in accordance with the limits within which such relay is designed to operate.

109. Lightning arresters shall be inspected frequently during the seasons of the year when lightning occurs, and gas and vacuum types tested annually and record made of date of tests.

110. Insulation resistance tests shall be made when wires, cables, and insulation are dry. Wires and cables, except wires connected directly to track rails, shall be tested in accordance with the following schedule; wires shall be given special attention and, if necessary, removed from service when the insulation resistance is found to be below the following values:

Description	Test Period	Minimum Allowable Resistance
Low voltage wires and cables, braided, rubber insulation, any part of which is underground or in trunking	5 yr.	1 Megohm
Low voltage aerial wires and cables, braided, rubber insulation, no part of which is underground or in trunking	8 yr.	1 Megohm
Lead sheathed wires and cables, parkway cables with lead sheath, trench lay and cables with metal sheath, carrying low voltage circuits	8 yr.	1 Megohm
Local signal wiring	8 yr.	1 Megohm
Lead-covered signal power cables	8 yr.	100 Megohms between sectionalizing switches
Underground signal power lines, not lead-sheathed	5 yr.	40 Megohms for voltages up to and including 500 volts for section tested. 100 Megohms between sectionalizing switches for voltages exceeding 500

111. Pole line shall be inspected once every two years to insure that it is in good condition.

112. Records of results of tests made in conformity with sections 104, 105, 106, 108, 110, 377 to 388, inclusive, 577, 586, 588, 589, 677, 679, and 680 shall be made on forms provided by the railroad, showing name of railroad, place and date, repairs, replacements and adjustments made, and condition

in which apparatus was left, and signature of employee making the test. The report shall be filed in the office of the proper supervisory officer of the carrier.

Automatic Block Signal Systems Standards

201. The apparatus shall, so far as possible, be so installed and circuits so arranged that failure of any part of the system affecting the safety of train operation will cause all signals affected to give the most restrictive indications which conditions require.

202. Signals shall be located preferably to the right of and adjoining the track to which they refer.

203. Signal indications shall be given by positions, by colored lights, or by both. A single white light shall not be used for a proceed indication. (See footnote.)

204. Signals shall be spaced at least stopping distance apart or, where not so spaced, an equivalent stopping distance shall be provided by two or more signals arranged to display restrictive indications approaching signal where such indications are required. (See footnote.)

205. Signals shall be automatically controlled by continuous track circuits on main track and on other track where medium speed is permitted.

206. Signals governing movements over switch shall be so controlled that proper restrictive indications will be displayed when such switch is not in proper position.

207. On track signaled for movements in both directions, signals shall be so arranged and controlled that proper restrictive indications will be provided to protect both following and opposing movements.

208. The circuits shall be so installed that:

(a) So far as possible, the failure of any part of a circuit affecting the control of a signal will not result in the signal displaying a more favorable indication than intended.

(b) When a train, engine, or car is in a block, a switch is misplaced or its points not in proper position, an independently operated fouling point derail equipped with switch circuit controller is misplaced or not in derailing position, or a track or the signal control relay is in de-energized position, each signal governing a train movement into the block will display its proper restrictive indication.

(c) When there is no train, engine, or car in a block, all switches and independently operated fouling point derails equipped with switch circuit controllers are in normal position, and all track and signal control relays in energized position, each signal governing a train movement into the block will display its proper indication for approaching train to proceed.

209. Signal control relay circuit shall not be broken through the contacts of switch, station, or tower indicator or annunciator in which the indicating element is attached to the armature.

210. The battery or power supply for signal control relay circuits shall be located at the end of the circuit farthest from the relay.

211. Signal control relay shall be controlled by track circuits extending through the entire block.

Rules and Instructions

226. The rules and instructions prescribed in sections 1 to 100, inclusive, shall apply to automatic block signal systems.

Inspections and Tests

276. The inspections and tests prescribed in sections 101 to 200, inclusive, shall apply to automatic block signal systems.

Interlocking

Standards

301. The apparatus shall, so far as possible, be so installed and circuits so arranged that failure of any part of the system affecting the safety of train operation will cause all signals affected to give the most restrictive indications which conditions require.

302. Signals shall be located preferably to the right of and adjoining the track to which they refer.

303. Signal indications shall be given by positions, by colored lights, or by both. A single white light shall not be used for a proceed indication. (See footnote.)

304. Approach and home signals shall be spaced at least stopping distance apart, or where not so spaced an equivalent stopping distance shall be provided by two or more signals arranged to display restrictive indications approaching home signal, the indication of which requires such restrictive indications. (See footnote.)

305. Track circuits shall be provided throughout interlocking limits, except when otherwise authorized by the Commission. (See footnote.)

306. Signals governing movements over switches, movable point frogs, and derails shall be so controlled that indications to proceed can be displayed only when such units are in proper position.

307. Mechanical locking to insure predetermined order of lever movement, or circuits to insure proper correlation of the units of the interlocking, shall be provided.

308. Except at automatic interlocking, signals which form a part of an automatic block signal system shall be controlled semi-automatically.

309. Approach or time locking shall be provided in connection with signals governing movements at high or medium speed. (See footnote.)

310. Electric switch locking shall be provided, except when otherwise authorized by the Commission. (See footnote.)

311. Facing-point lock or switch-and-lock movement shall be provided for mechanically operated switch, movable-point frog, or split-point derail.

312. Power switch operating and locking mechanism at manually-operated interlocking shall be provided with means to indicate on interlocking machine or to the operator when movement is completed and unit is locked. Circuits shall be provided to insure proper correlation of the units of automatic interlockings.

313. Indication locking or equivalent shall be provided for approach signals of the semaphore type and power-operated home signals at manually-operated interlockings.

314. At automatic interlocking, the cir-

uits shall be so arranged that when trains enter approach circuits simultaneously, proceed indications of home signals on conflicting routes cannot be displayed at the same time.

315. Approach signals shall be installed at automatic interlocking. When authorized train speed between home signals exceeds 20 m.p.h., operative approach signals shall be provided.

316. Automatic interlocking shall be so arranged that when home signal has been cleared and route has not been used, if there is a train on approaching sections of such route, home signal for conflicting route can be cleared only after the expiration of a predetermined time interval.

317. The proceed control circuits for home signal at automatic interlocking shall be broken through relays for all track circuits between home signals on the same and intersecting tracks, and through signal mechanism contacts or relay contacts repeating stop signal indications for conflicting routes and through normal contacts of time releases for conflicting routes.

318. At automatic interlocking, the controlling apparatus, except manually-operated time release, shall be located at a distance from the tracks for the purpose of avoiding damage. Manually-operated time release shall be located adjacent to the tracks at a point where employee who has occasion to operate it will, so far as possible, have an unobstructed view of each route.

319. When movable bridge is protected by interlocking, provision shall be made to insure that movements of the bridge devices succeed each other in a predetermined order, and that the movable span, tracks, and switches within interlocking limits are locked in proper positions.

320. Movable bridge shall be equipped with mechanism to surface and align bridge and track accurately and fasten them securely in position.

321. One-inch pipe or larger, or equivalent, shall be used for connection to switch, derail, movable-point frog, lock, bridge operating and locking devices, and mechanically operated signal. Pipes shall be screwed into coupling until ends abut and shall be properly riveted. Pipe line shall be in alinement, properly compensated, and supported on carriers spaced not more than 8 ft. apart on tangent and curve of less than 2 deg. and not more than 7 ft. apart on curve of 2 deg. or more. With lever in any position, couplings in pipe line shall not foul carriers. (See footnote.)

322. In new installations and in making replacements, lever locks on interlocking machines shall be of the forced-drop type or equivalent.

Rules and Instructions

326. The rules and instructions prescribed in Sections 1 to 100, inclusive, shall apply to interlocking, and in addition the following:

327. Interlocking or control machine, switch movements, and other appurtenances shall be kept in good condition, free from excessive lost motion, rust, grease, and dirt. Levers and locking shall be kept clean. All bearing parts shall be kept lubricated but excessive lubrication

should be avoided. Bolts and dowel pins shall be kept tight, cotters properly spread, and sufficient tension in latch springs. Contacts shall be clean and properly adjusted.

328. When mechanical locking of interlocking machine is to be changed or removed from machine, or locking becomes disarranged or broken, proper measures shall be taken to protect train movements until plant is restored to normal operation.

329. Switch shall be so maintained that it cannot be locked when $\frac{1}{4}$ -in. rod is placed between stock rail and switch point 6 in. back from point of switch. Locking edges shall be kept square.

330. Cranks, compensators and other mechanical connections shall work freely, but shall not have excessive lost motion in moving parts. They shall be kept clean, properly centered, lubricated, and in alinement.

331. Holes in lock rod shall have square edges and be not more than $\frac{1}{8}$ -in. larger than plunger.

332. Plunger of facing-point lock shall have at least 8 in. stroke and when its lever is in normal position the end of plunger shall clear lock rod 1 in. The end of the plunger shall have square edges.

333. Bolt lock shall be so maintained that signals governing movements over switch or derail cannot be cleared when derail is in derailing position, or when switch point is open $\frac{1}{4}$ in. or more when bolt lock is used in lieu of facing-point lock, and $\frac{1}{2}$ in. or more when switch or derail is otherwise protected. Signal bar shall be against the stop when signal lever is normal. Notches shall have square edges.

334. Driving bar of switch-and-lock movement shall travel, both normal and reverse, so that locking dog will pass through lock rod $\frac{1}{2}$ in. or more.

335. When necessary to disconnect switch, derail, or other unit, it should be done at the crank nearest the unit.

336. Air distribution system shall be so maintained that leakage in any section of the plant will not exceed one pound in one minute from normal pressure with all apparatus connected and at rest.

337. Air strainer used between air distribution system and air apparatus shall be cleaned frequently enough to avoid air pressure reduction.

338. Valves and cylinders shall be inspected and tested in service by application of air pressure with apparatus at rest. This shall be done frequently enough to insure that parts are clean, packing tight, air supply unrestricted, and apparatus functioning efficiently.

339. When necessary to repair switch and signal valves and cylinders, they shall be removed from service and the work performed in a shop.

340. Condensers, tanks, reservoirs, and air distribution lines shall be drained frequently enough to avoid overflow of condensation into branch lines and apparatus. Means of draining condensation out of distribution system shall be provided and maintained at low points.

341. Overload relay and magnet brake on electric switch-and-lock movement

shall be checked frequently enough to insure proper operation.

342. Lock and point detector rod connections shall be maintained with a minimum of lost motion, inspected and tested frequently, and maintained in proper adjustment.

343. Corner edges of locking dogs and rods of switch-and-lock movement or facing point lock shall be maintained with not more than $\frac{1}{16}$ in. wear.

344. Pole-changer on electric switch operating mechanism shall be maintained to insure that switch mechanism follows movement of lever.

345. Point detector shall be so maintained that when switch mechanism is locked in normal or reverse position, contacts cannot be opened by manually applying force at the switch points in either direction. Contacts shall remain open with $\frac{1}{4}$ in. obstruction between switch point and stock rail, approximately 6 in. from point, where latch-out device is not used, and $\frac{3}{8}$ in. obstruction where latch-out device is used.

346. Mechanical locking shall be maintained to insure that it is effective, and that levers cannot be operated except in proper sequence.

347. Driving pieces, dogs, stops, and trunnions shall be maintained to insure that they are properly secured to locking bars. Swing dogs shall have full and free movement. Top plate shall be kept in place and tight.

348. The various parts of the locking bed, locking bed supports, and tappet stop rail shall be rigidly secured and properly alined to insure free and effective operation.

349. Locking dogs and notches shall be examined for wear; locking faces shall fit squarely against each other with a minimum engagement when locked of at least one half the designed locking face.

350. Locking shall be in accordance with locking sheet and dog chart currently in effect.

351. When lever or latch which is locked can be moved more than shown below, excessive lost motion shall be removed:

(a) Mechanical machine.
1. Latch-operated locking. When lever latch block can be raised to within $\frac{3}{8}$ in. of top of quadrant.

2. Lever-operated locking. When lever latch block can be moved more than $\frac{3}{8}$ in. on top of quadrant.

(b) Electro-mechanical machine.

1. Lever moving in horizontal plane. When lever can be moved more than $\frac{3}{16}$ in. when in normal position or $\frac{7}{16}$ in. when in reverse position.

2. Lever moving in arc. When lever can be moved more than 5 deg.

(c) Power machine.

1. Latch-operated locking. When lever latch block can be raised to within $\frac{7}{32}$ in. of top of quadrant.

2. Lever moving in horizontal plane. When lever can be moved more than $\frac{5}{16}$ in. when in normal position or $\frac{9}{16}$ in. when in reverse position.

3. Lever moving in arc. When lever can be moved more than 5 deg.

352. In electro-mechanical interlocking machine, locking between electric and mechanical levers shall be maintained to

insure that mechanical lever cannot be operated except when properly released by electric lever.

353. Latch shoes, rocker links, and quadrants of Saxby and Farmer machines shall be maintained so that locking will not release if the foot is used on the rocker while lever is in mid-stroke position.

354. Rail lock on movable bridge shall be maintained so that it cannot be locked with the rail displaced $\frac{1}{4}$ in. or more from its proper position.

355. Bridge lock on movable bridge shall be maintained so that it cannot be locked unless the movable members are within 1 in. of their proper positions.

356. Circuit controller operated by surfacing devices on movable bridge shall be so maintained that the circuits will not be completed unless locking bars are within 1 in. of their proper positions.

Inspections and Tests

376. The inspections and tests prescribed in sections 101 to 200, inclusive, shall apply to interlocking, and in addition the following:

377. Mechanical locking in interlocking machine shall be tested when new locking is placed in service or change in locking is made. At periods specified by the carrier, subject to approval by the Commission, but not less frequently than once every four years, complete test shall be made to determine that locking is in accordance with plans currently in effect, and in condition to insure proper functioning.

378. Approach locking shall be tested annually, to insure that after a signal has been cleared, the position of any switch, derail, or movable point frog in the route governed by that signal cannot be changed with the approach circuit open, until after the expiration of a predetermined time interval.

379. Time locking shall be tested annually to insure that after a signal has been cleared, the position of any switch, derail, or movable point frog in the route governed by that signal cannot be changed until after the expiration of a predetermined time interval.

380. Switch locking. Section, route, or other type of switch locking shall be tested quarterly to insure that a switch, derail, movable-point frog, or facing-point lock cannot be operated with a train occupying any portion of the protecting track circuit.

381. Indication locking shall be tested annually on semaphore signals, annually on switch or lock levers, and every two years on light signals, as follows:

(a) Lock on signal lever: to insure that lever or latch cannot be placed in normal position until the corresponding home signal indicates "Stop" and approach signal indicates "Approach."

(b) Lock on switch or lock lever:

1. When movement is operated, locked, and indicated by the same lever: to insure that lever and switch or switches or other operated units are in corresponding positions and locked before lever stroke can be completed and mechanical locking released.

2. When locked and indicated by lock lever: to insure that operating lever and

switch or switches or other operated units are in corresponding positions before lock lever can be operated and mechanical locking released.

382. Traffic locking shall be tested annually to insure that levers or units for changing the direction of traffic on a section of track cannot be manipulated while a signal is displayed for a train to proceed into that section or with any part of the section occupied.

383. Switch obstruction test shall be made quarterly to insure proper maintenance and adjustment of switches.

384. In electro-pneumatic interlocking, valve locks on valves of the non-cutoff type, valves and magnets shall be tested quarterly to insure that apparatus and circuits are in proper condition.

385. Cross protection shall be tested quarterly to insure that protective devices operate properly to prevent movement of switches, signals, and other units when current is improperly applied to the circuits.

386. Time releases and timing relays shall be tested quarterly and the timing shall be maintained within 10 per cent of the predetermined time interval.

387. Restoring feature on power switches shall be tested quarterly to insure that power will be applied and will restore switch movements to full normal or full reverse position.

388. Movable bridge locking shall be tested at periods specified by the carrier, subject to approval by the Commission, but not less frequently than once each year, to insure that rail locks, bridge locks, bolt locks, circuit controllers, and electric locks are in good condition and are functioning properly.

Centralized Traffic Control Systems Standards

401. The apparatus shall, so far as possible, be so installed and circuits so arranged that failure of any part of the system affecting the safety of train operation will cause all signals affected to give the most restrictive indications which conditions require.

402. Signals shall be located preferably to the right of and adjoining the track to which they refer.

403. Signal indications shall be given by positions, by colored lights, or by both. A single white light shall not be used for a proceed indication.

404. Signals shall be spaced at least stopping distance apart or, where not so spaced, an equivalent stopping distance shall be provided by two or more signals arranged to display restrictive indications approaching signal where such indications are required. (See footnote.)

405. Signals shall be automatically controlled by continuous track circuits on main tracks and on other tracks where medium speed is permitted, and in addition at controlled point by control operator, and at manually operated interlocking manually in cooperation with control operator. (See footnote.)

406. Signals at a controlled point shall be so interconnected that they cannot be clear for opposing or conflicting movements.

407. Signals at adjacent controlled

points shall be so interconnected that they cannot be clear for opposing or conflicting movements.

408. Signals governing movements over switches shall be so controlled that indications to proceed can be displayed only when such switches are in proper position.

409. On track signaled for movements in both directions, means shall be provided for establishing, maintaining, and changing direction of traffic.

410. A track diagram or other means shall be provided at control station to indicate occupancy of track sections at controlled points.

411. Approach or time locking shall be provided.

412. Means shall be provided to insure that after a signal has been cleared it cannot be restored manually to "Stop" by the operation of any lever other than its controlling lever.

413. Section or route locking shall be provided where switches are power-operated.

414. Means shall be provided to indicate on the control machine when power-operated switch has completed its movement and is locked.

415. Hand-operated switch electrically locked in normal position shall be operative only after release has been given, after signals protecting such switch display the most restrictive indications the condition requires, and either after a predetermined time interval or, with approach locking, when approach section is unoccupied.

Rules and Instructions

426. The rules and instructions prescribed in sections 1 to 100, inclusive, in addition to those in sections 327 to 375, inclusive, insofar as they are applicable, shall apply to centralized traffic control systems.

Inspections and Tests

476. The inspections and tests prescribed in sections 101 to 200, inclusive, in addition to those in sections 377 to 400, inclusive, insofar as they are applicable, shall apply to centralized traffic control systems.

Automatic Train-Stop, Train-Control, and Continuously Controlled Cab-Signal Systems

The following rules, standards, and instructions, sections 501 to 700, inclusive, supersede specifications and requirements for automatic train-stop, train-control and continuously controlled cab-signal devices and systems which have been heretofore prescribed by the Commission.

Automatic Train-Stop and Train-Control Systems Standards

501. The following features may be included, separately or in combination, in automatic train-stop or train-control systems:

(a) Automatic train stop:

(1) Without manual control by the engineman, requiring the train to be stopped; after which the apparatus may be restored to normal condition manually

and the train permitted to proceed; or

(2) Under control of the engineman, who may, if alert, forestall the application of the brakes by the automatic train-stop device and control his train in the usual manner in accordance with hand signals or under limits fixed by train order or prescribed by the operating rules of the company.

(b) Automatic train control or speed control:

(1) Automatic stop, after which a train may proceed under low-speed restriction until the apparatus is automatically restored to normal or clear condition by reason of the removal of the condition which caused the stop operation.

(2) Low-speed restriction, automatic-brake application under control of the engineman, who may, if alert, forestall application at a stop-indication point or when entering a danger zone and proceed under the prescribed speed limit, until the apparatus is automatically restored to normal or clear condition by reason of the removal of the condition which caused the low-speed restriction.

(3) Medium-speed restriction, requiring the speed of a train to be below a prescribed rate when passing an approach signal or when approaching a stop signal or a danger zone in order to forestall an automatic-brake application.

(4) Maximum-speed restriction, providing for an automatic-brake application if the prescribed maximum speed limit is exceeded at any point.

502. An automatic train-stop device shall be effective when the signal admitting the train to the block indicates stop, and, so far as possible, when that signal fails to indicate existing danger conditions.

503. An automatic train-control or speed-control device shall be effective when the train is not being properly controlled by the engineman.

504. An automatic train-stop, train-control, or speed-control device shall be operative at braking distance from the stop-signal location if signals are not overlapped, or at the stop-signal location if an adequate overlap is provided.

505. The automatic train-stop or train-control device shall meet the conditions set forth in sections 502, 503, and 504, applicable to each installation.

506. The apparatus shall be so constructed as to operate in connection with a system of fixed block or interlocking signals, if conditions so require, and so interconnected with the fixed-signal system as to perform its intended function (a) in event of failure of the engineman to obey the signal indications; and (b), so far as possible, when the signal fails to indicate a condition requiring an application of the brakes.

507. The apparatus shall be so constructed that it will, so far as possible, perform its intended function if an essential part fails or is removed, or a break, cross, or ground occurs in electric circuits, or in case of a failure of energy.

508. The apparatus shall be so constructed as to make indications of the fixed signal depend, so far as possible, upon the operation of the track element of the train-control device.

509. The apparatus shall be so constructed that proper operative relation between the parts along the roadway and the parts on the train will be assured under all conditions of speed, weather, wear, oscillation and shock.

510. The apparatus shall be so constructed and installed that the brakes cannot be released after automatic application until a reset device has been operated, or the speed has been reduced to a predetermined rate, or the obstruction or other condition that caused the brake application has been removed. If reset device is used it must be so constructed that the brakes cannot be released until the train has been stopped, or it must be so located that it cannot be operated by engineman without leaving his accustomed position in the cab.

511. The train apparatus shall be so constructed that, when operated, it will make an application of the brakes sufficient to stop the train or control its speed.

512. The apparatus shall be so constructed as not to interfere with the application of the brakes by the engineman's brake valve or to impair the efficiency of the air-brake system.

513. The apparatus shall be so constructed that it may be applied so as to be operative when the engine is running forward or backward.

514. The apparatus shall be so constructed that when two or more engines are coupled together, or a pushing or helping engine is used, it can be made operative only on the engine from which the brakes are controlled.

515. The apparatus shall be so constructed that it will operate under all weather conditions which permit train movements.

516. The apparatus shall be so constructed as to conform to established clearances for equipment and structures.

517. The apparatus shall be so constructed and installed that it will not constitute a source of danger to trainmen, other employees or passengers.

518. The apparatus shall be so constructed, installed, and maintained as to be safe and suitable for service. The quality of materials and workmanship shall conform to this requirement.

Rules and Instructions—Roadway

526. The rules and instructions prescribed in sections 1 to 100, inclusive, insofar as they are applicable, shall apply to automatic train-stop and train-control installations.

527. When a roadway element is displaced or cannot be adjusted to proper height, its controlling circuit disarranged, or for any other reason it is not in condition to function as intended, the signal associated with such roadway element shall be placed in condition to display its most restrictive indication until the roadway element and its controlling circuits have been restored to proper operative condition.

528. Insulation resistance between roadway element winding and ground shall be maintained at not less than 10,000 ohms.

529. When a non-interlocked switch is open, the restrictive condition of automatic train-stop or train-control devices

of the continuous type on an approaching locomotive shall not be removed at a distance greater than 300 ft. from the points of the switch.

530. Inductor of intermittent inductive automatic train-stop device of the inert roadway element type shall be maintained with the inductor pole faces at a vertical distance above the plane of the tops of the rails, and with its inner edge at a horizontal distance from the gage side of the rail, as specified by the carrier, subject to approval by the Commission.

531. Ramp of intermittent electrical contact automatic train-stop and train-control devices shall be maintained with its contact surface at its highest point at a vertical distance above the plane of the tops of the rails, and with its center line at a horizontal distance from the gage side of the rail, as specified by the carrier, subject to approval by the Commission.

532. Trip arm of automatic train-stop device of the mechanical trip type when in stop position shall be maintained at a height above the plane of the tops of the rails, and at a horizontal distance from its center line to gage of rail, as specified by the carrier, subject to approval by the Commission.

533. Except when authorized by the Commission, strap iron inductor, short ramp, or other design of roadway element intended primarily for test purposes shall not be used on track where medium speed is permitted.

534. Track magnet located between the rails of a track shall not extend above the plane of the tops of the rails.

Locomotive

551. The voltage of power supply shall be maintained within 10 per cent of rated voltage.

552. Insulation resistance between wiring when dry and ground shall be not less than 1 megohm.

553. Seal or lock shall be maintained on apparatus by means of which device can be cut out pneumatically, except double-heading cock.

554. The equalizing reservoir or brake pipe reduction during an automatic brake application shall be at a rate not less than that which results from a manual service application.

555. Receiver coil which has been repaired or rewound shall have the same electrical characteristics which it possessed originally or as currently in effect for new equipment.

556. The electrical characteristics of relays, coils, and other electro-magnetic apparatus shall be maintained in accordance with the limits within which the apparatus is designed to operate.

557. Change in adjustment of relays shall not be made in the field except when receiver coils, valve magnet, or other essential part of the equipment is changed. Irregularities in power supply voltage or other variable factors in the circuit shall not be compensated for by adjustment of the relay.

558. Receiver of intermittent inductive automatic train-stop device of the inert roadway element type shall be maintained with bottom of the receiver at a

vertical distance above the plane of the tops of the rails, and with its outer edge at a horizontal distance from the gage side of the rail, as specified by the carrier, subject to approval by the Commission.

559. Contact face of shoe of intermittent electrical contact automatic train-stop and train-control devices shall be maintained at a height above the plane of the tops of the rails, and with center line of shoe at a horizontal distance from the gage side of the rail, as specified by the carrier, subject to approval by the Commission.

560. Receiver of intermittent magnetic inductive automatic train-stop devices shall be maintained with lower surface of receiver at a vertical distance above the plane of the tops of the rails, as specified by the carrier, subject to approval by the Commission.

561. Contact element of automatic train-stop device of the mechanical trip type shall be maintained at a height above the plane of the tops of the rails, and at a horizontal distance from the gage of the rail, as specified by the carrier, subject to approval by the Commission.

562. Safety chains or safety hangers used with continuous inductive automatic train-stop or train-control devices shall clear receivers 1 in. or more.

563. The minimum rail current required to restore the locomotive equipment of continuous inductive automatic train-stop or train-control device to normal condition (pick-up) shall be within limits specified by the carrier, subject to approval by the Commission.

564. Delay time shall not be of such duration (preferably not more than 6 seconds) as to prevent train from being stopped from maximum authorized speed within braking distance provided.

Inspections and Tests—Roadway

576. The inspections and tests prescribed in sections 101 to 200, inclusive, insofar as they are applicable, shall apply to roadway installations of automatic train-stop and train-control systems, and in addition the following:

577. Roadway elements shall be inspected frequently enough to insure that they are in good condition. They shall be gaged monthly for height and alignment, and shall be tested semi-annually to insure that they are in condition for reliable and safe operation. Roadway elements found to be defective shall be replaced with elements known to be in good condition.

Locomotive

586. The automatic train-stop or train-control apparatus on each locomotive operating in equipped territory shall be inspected and tested daily or after each trip, except when otherwise authorized by the Commission, and the results recorded on a form provided for that purpose. The form shall show the name of the railroad, the place and date of inspection and test, the initial and number of the locomotive, defects if any, and the signature of the employee making the inspection and test. Necessary repairs shall be made and indicated on the form, together with written explanation for

defects reported which were not repaired before the locomotive is returned to service. The form shall then be approved by the designated employee of the railroad company and filed in the office of the railroad company at the place where the inspection and test are made.

587. Departure test over track elements or test circuits, except locomotives and multiple unit cars equipped with mechanical trip stop, shall be made by an employee assigned to perform such tests, on departure from initial locomotive terminal or before entering equipped territory, to insure that the device is in service and is functioning properly. If departure test is made by employee other than engineman, record of operative condition shall be made on a form provided for that purpose. Locomotive shall not be dispatched from locomotive terminal for movement over equipped territory when device is not in proper operative condition, except locomotive used as helper from which brakes are not controlled or operated and except when authorized by the Commission. If engineman takes charge of locomotive en route in equipped territory, he shall know whether or not the device is in service.

588. Periodic tests shall be made quarterly or at every third monthly inspection, and on multiple unit cars as specified by the carrier, subject to approval by the Commission, to insure that the device is adequately maintained and that the characteristics of the electrical and pneumatic equipment are within limits and values currently in effect, to insure proper operation.

589. Once every four years each relay shall be removed from service, subjected to thorough test, necessary repairs made, and shall not be replaced in service unless its operating characteristics are in accordance with the limits within which such relay is designed to operate.

590. Pneumatic automatic train-stop or train-control apparatus shall be inspected at regular intervals and cleaned every 6 months.

Automatic Cab-Signal Systems Continuously Controlled

(Without Automatic Train-Stop or Train-Control)

Standards

601. The automatic cab-signal system shall function to display a cab-signal indication which constantly corresponds with conditions in advance in the controlling section.

602. The automatic cab-signal system shall be so arranged that a change of conditions affecting train movement which occurs within braking distance in advance will result immediately, regardless of the location of the locomotive in the controlling section, in a change of cab-signal indication corresponding with these changed conditions.

603. The automatic cab-signal system shall be so arranged that when a locomotive enters and is within a block in which there exists a condition causing a restrictive indication the cab-signal will display the most restrictive indication required by that condition.

604. The automatic cab-signal system shall be so arranged that when the cab signal changes to display a more restrictive indication an audible cab indicator will sound and continue to sound until acknowledged.

605. The automatic cab-signal system shall be so interconnected with the fixed-signal system that the cab signal will display indications consistent with the indications of the fixed signals, except when a fixed signal displays a less restrictive indication than is required or warranted by existing conditions.

606. The cab signals shall be plainly visible to members of the locomotive crew when they are in their accustomed stations in the cab.

607. The cab indicator shall have a distinctive sound which will be clearly audible to members of the locomotive crew under all operating conditions when they are in their accustomed stations in the cab.

608. The automatic cab-signal system shall be so constructed that the cab signal will, so far as practicable, display its most restrictive indication if an essential part fails or is removed, or a break, cross, or ground occurs in electric circuits, or in case of a failure of energy.

609. The apparatus shall be so constructed that proper operative relation between the parts along the roadway and the parts on the locomotive will be assured under all conditions of speed, weather, wear, oscillation, and shock.

610. The apparatus shall be so constructed as not to interfere with the application of the brakes by operation of the engineman's brake valve or to impair the efficiency of the air-brake system.

611. The apparatus shall be so constructed that it may be applied so as to be operative when the locomotive is running forward or backward.

612. The apparatus shall be so constructed that it will operate under all weather conditions which permit train movements.

613. The apparatus shall be so constructed as to conform to established clearances for equipment and structures.

614. The apparatus shall be so constructed and installed that it will not constitute a source of danger to trainmen, other employees, or passengers.

615. The apparatus shall be so constructed, installed, and maintained as to be safe and suitable for service. The quality of materials and workmanship shall conform to this requirement.

Rules and Instructions—Roadway

626. The rules and instructions prescribed in sections 1 to 100, inclusive, insofar as they are applicable, shall apply to continuously controlled automatic cab-signal installations.

627. When a non-interlocked switch is open, or unlocked where facing point lock is used, the restrictive cab-signal indication on an approaching locomotive shall not be removed at a distance greater than 300 ft. from the points of the switch.

Locomotive

651. The voltage of power supply shall be maintained within 10 per cent of the rated voltage.

652. Insulation resistance between wir-

ing when dry and ground shall be not less than 1 megohm.

653. The electrical characteristics of relays, coils, and other electro-magnetic apparatus shall be maintained in accordance with the limits within which such apparatus is designed to operate.

654. The minimum rail current required to obtain a clear cab-signal indication (pick-up) shall be maintained within limits specified by the carrier, subject to approval by the Commission.

655. Safety chains or safety hangers shall clear receivers 1 in. or more.

Inspections and Tests

676. The inspections and tests prescribed in sections 101 to 200, inclusive, insofar as they are applicable, shall apply to continuously controlled automatic cab-signal systems, and in addition the following:

677. The automatic cab-signal apparatus on each locomotive operating in equipped territory shall be inspected and tested daily or after each trip except when otherwise authorized by the Commission, and the results recorded on a form provided for that purpose. The form shall show the name of the railroad, the place and date of inspection and test, the initial and number of the locomotive, defects if any, and the signature of the employee making the inspection and test. Necessary repairs shall be made and indicated on the form, together with written explanation for defects reported which were not repaired before the locomotive is returned to service. The form shall then be approved by the designated employee of the railroad company and filed in the office of the railroad company at the place where the inspection and test are made.

678. Departure test over test circuits shall be made by an employee assigned to perform such tests, on departure from initial locomotive terminal or before entering equipped territory, to insure that the device is in service and is functioning properly. If departure test is made by employee other than engineman, record of operative condition shall be made on form provided for that purpose. Locomotive shall not be dispatched from locomotive terminal for movement over equipped territory when device is not in proper operative condition, except locomotive used as a helper from which brakes are not controlled or operated and except when authorized by the Commission. If engineman takes charge of locomotive en route in equipped territory, he shall know whether or not the device is in service.

679. Periodic tests shall be made quarterly or at every third monthly inspection, and on multiple unit cars as specified by the carrier, subject to approval by the Commission, to insure that the device is adequately maintained and that the characteristics of the electrical and pneumatic equipment are within limits and values currently in effect, to insure proper operation.

680. Once every four years each relay shall be removed from service, subjected to thorough test, necessary repairs made, and shall not be replaced in service unless its operating characteristics are in accordance with the limits within which such relay is designed to operate.

681. Pneumatic automatic cab-signal
(Continued on page 341)

these hand-thrown switches. In this respect the application is in line with the recommendations of men who use them.

"One of the derails was placed in its present location primarily to protect a track leading to an industry which has not been used for many years. The second will no longer be necessary for the reason that the signal used in conjunction with it is to be relocated. The third is a back-up derail which protects the Seaboard track when occasional back-up movements are made over that track. The fourth is a back-up derail which testimony shows is improperly located and likely to cause a train to foul adjacent tracks if the derail is run through.

"The general testimony of employee witnesses is to the effect that the safety of operation through the plant will be increased by all of the proposed changes, including the removal of the derails. A witness for the Southern testified that a net saving of not less than \$4,650 annually would be realized through improved operating conditions under the proposed plan and that there will be no reduction in labor forces. This witness and others testified that the plan will result in a more efficient operation of their trains and urged that the safety will be increased.

"One witness for protestants gave testimony relating particularly to that part of the petition pertaining to the removal of derails. In his opinion the removal of main-track derails decreases the safety of operation generally, and he believes that the derails at Howell should not be removed. This witness produced a number of exhibits based on accident investigations and reports, which he urged support his testimony. These show that derails ordinarily may be expected to function as intended, and that accidents at interlocking plants sometimes occur when crossings are protected by derails and also when they are not so protected, but the exhibits taken as a whole do not assist materially in arriving at a conclusion in this case.

"Testimony with respect to conditions at the interlocking plant here considered, including the traffic involved, physical characteristics of the track, and the type of equipment used, is convincing that the proposed plan will not decrease the safety of operation, but may reasonably be expected to promote safety."

The conclusion of the report was, "We find that the petition of the Southern for approval of the proposed modification of the Howell interlocking plant should be granted, and an order will be entered."

I. C. C. Rules

(Continued from page 332)

apparatus shall be inspected at regular intervals and cleaned every 6 months.

Dragging Equipment and Slide Detectors and Other Similar Protective Devices

Standards

901. Devices used to provide protection against rock or landslides, dragging equipment, burned bridges or trestles, and wash-outs, shall be so installed and maintained that failure of any essential part will, so far as possible, cause the associated signals to display the most restrictive indications which conditions require. Such devices and signals controlled by them shall be so located that, when actuated, restrictive signal indications will be displayed at adequate stopping distance from the area protected.

902. Where these devices are installed in automatic block signal territory, they shall be arranged to operate in conjunction with the automatic block signal system.

Rules and Instructions

926. The rules and instructions prescribed in sections 1 to 100, inclusive, insofar as they are applicable, shall apply to devices of this type.

Inspections and Tests

976. The inspections and tests prescribed in sections 101 to 200, inclusive, insofar as they are applicable, shall apply to devices of this type.

Other Similar Appliances, Methods, and Systems

1001. Rules, standards, and instructions prescribed herein, so far as applicable, shall be observed in the installation, inspection, maintenance, and repair of other similar appliances, methods, and systems.

Definitions

For purposes of these rules, standards, and instructions the following definitions will apply:

Approach Signal. A fixed signal used in connection with one or more signals to govern the approach thereto.

Automatic Block System. A series of consecutive blocks governed by block signals, cab signals, or both, actuated by a train, or engine, or by certain conditions affecting the use of a block.

Automatic Cab Signal System. A system which provides for the automatic operation of the following:

(a) Cab signal, a device, located in the cab, which, when locomotive and roadway apparatus are in operative relation, displays indications of conditions in advance, and

(b) Cab indicator, a device, located in the cab, which indicates a condition or a change of condition of one or more elements of the system.

Automatic Interlocking. An arrangement of signal appliances which functions automatically as distinguished from an interlocking whose functions are controlled manually.

Automatic Train Control System. A system or an installation so arranged that its

operation will automatically result in either one or the other or both of the following conditions:

First. Automatic train stop; the application of the brakes until the train has been brought to a stop.

Second. Automatic speed control; the application of the brakes when the speed of the train exceeds a prescribed rate and continued until the speed has been reduced to a predetermined and prescribed rate.

Block. A length of track of defined limits, the use of which by trains is governed by block signals, cab signals, or automatic train control.

Block System. A term used to denote any method of maintaining an interval of space between trains as distinguished from the time interval system. A series of consecutive blocks.

Cab. A compartment occupied by engineer, fireman, or motorman, of the engine, motor car, or multiple unit car from which the propelling power of the train is controlled.

Centralized Traffic Control System (C. T. C.).—A term applied to a system of railroad operation by means of which the movement of trains over routes and through blocks on a designated section of track or tracks is directed by signals controlled from a designated point without requiring the use of train orders and without superiority of trains.

Continuous Control. A type of control in which the locomotive apparatus is constantly in operative relation with the track elements and is immediately responsive to a change of conditions in the controlling section which affects train movement.

Controlling Section. A length of track of one or more track circuit sections by which the track elements governing approach to or movement within a block are controlled.

Engine. See locomotive.

Home Signal. A fixed signal at the entrance of a route or block to govern trains or engines entering and using that route or block.

Interlocking. An arrangement of signal appliances so interconnected that their movements must succeed each other in a predetermined order. It may be operated manually or automatically.

Interlocking Limits. The tracks between the home signals of an interlocking.

Locomotive. A self-propelled unit of equipment used in train service. An engine.

Medium Speed. A speed not exceeding one-half authorized speed.

Operating Characteristics. The prevailing conditions that affect operation; when applied to electrical apparatus, the measure of electrical values at which the apparatus operates (Drop-away, pick-up, working value, etc.).

Roadway Element. That portion of the roadway apparatus of automatic train-stop, train-control, or cab-signal devices, such as a ramp, magnet, inductor, or electric circuit, to which the locomotive apparatus of the automatic train-stop, train-control, or cab-signal device is directly responsive.

Trip. A movement of a locomotive over all or any portion of automatic train-stop, train-control, or cab-signal territory between the terminals for that locomotive; a movement in one direction.