with a capacity of 20 gal. is located in the compartment with the engine-generator.

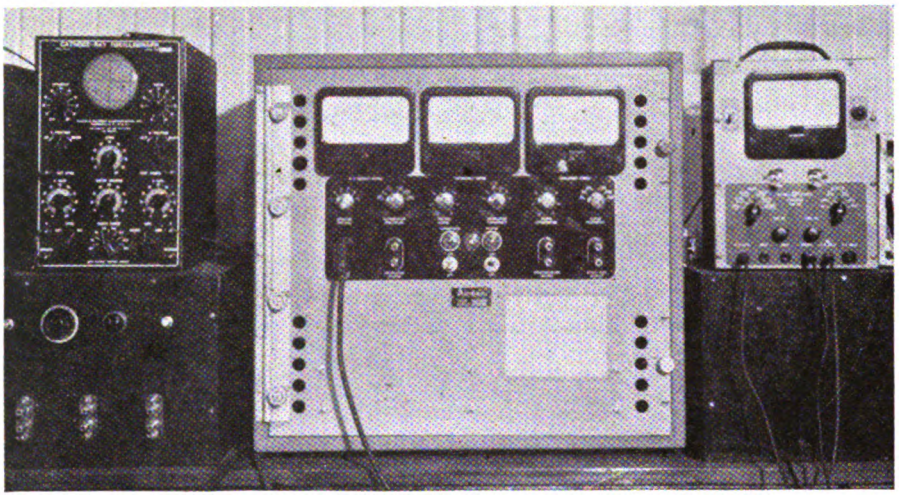
Power Required

The train communication system requires only 250 watts while standing by or receiving, and only 400 watts while sending. The engine-generator has a capacity of 3,000 watts, which allows plenty for other purposes. Electric lamps of various ratings from 25 watts to 60 watts are located at: the conductor's desk; over the air gage in the cupola; and on the ceiling for general illumination of the interior of all of the caboose.

On the roof, at each end of the car, there is an enclosed reflector unit known as a "back-up" lamp, which is used to illuminate the track when backing up or to inspect the track from the rear of the train when running along at night. Alongside each of the four steps on the caboose there is a special lamp unit with a lens arranged to illuminate the steps as a means of improving safety when alighting from or boarding the caboose at night. These various lamp circuits can be turned on or off by switches in a cabinet on the wall in the gangway of the car.

Marker lamps are equipped with 50-watt bulbs. Cords extend to plug-in outlets near each lamp bracket. This circuit has power at all times when the engine-generator is in operation. With all the electric lamps lighted on a caboose, the consumption is 950 watts. The 100-watt back-up lamps are turned on but rarely, and, under normal operations, only one would ever be used at a time. Thus the ordinary maximum demand for lighting would not exceed 200 watts, and the train communication 400 watts, totaling about 600 watts, which is well under the 3,000 watts capacity of the generator.

The locomotives in use were previously equipped with steam-turbine-driven d.c. generators, rated at 1000 watts, 32 volts. From such a machine, on each locomotive, power is taken to drive two dynamotors. One dynamotor, which is in operation continuously, generates 300 volts, d.c., which feeds the radio receiving equipment. When the engineer presses his push-to-talk switch on his handset, a second dynamotor, in series with the other one, is started to increase the overall voltage to 600 volts to feed the transmitting equipment. This machine starts so quickly that no first syllables are lost.



The test equipment includes the meters and a cathode ray oscillograph

Maintenance of Train Communication

The train communication equipment on this installation was furnished by the Aireon Corporation. The installation and maintenance of the train communication system is under the jurisdiction of the superintendent of telephone, telegraph and train communication. In order to insure continuity of service, a systematic program of inspection and maintenance has been established. Every two months the radio apparatus on each locomotive and caboose is changed out and taken to the shop for test. This shop includes special electrical instruments such as voltmeters, ammeters, cathode-ray oscillograph and tube testers to make complete detail inspections and adjustments. Each tube is tagged to show the date installed and the dates tested. If not up to a certain standard, it is replaced with a new one. As a result of this program of preventive maintenance, failures of the train communication on the road are rare. The equipment in wayside offices is checked every three months.

False Clear Signal

An accident on the Illinois Central at Leverett Jct., near Champaign, Ill., on April 19 was caused by a train entering a crossover at a high rate of speed, as a result of approach and home signals of an interlocking displaying false proceed indications. This statement, as well as the following discussion, was abstracted from the report on this accident issued by the Bureau of Safety, Interstate Commerce Commission.

In brief, when the southbound train on the southward main track was approaching the interlocking, the distant signal displayed the Clear aspect, green, and the home signal displayed the Clear aspect, green-over-red, although the north switch of a facing-point crossover between this southward main track and the northward main track was in the reverse position.

The interlocking is controlled remotely by a four-lever machine in the yard office at Champaign about three miles away. The indication lamps on the machine were installed to operate so that if the lever which controls the crossover is in position for the switches to be lined normally, and either switch is not normal, a continuous yellow light is displayed on the track diagram.

The investigation disclosed that during a period of about 2 hr. 40 min. immediately prior to the accident a signal maintainer and a signal testman were engaged in replacing the switch-control-lever repeating-relay and the switch repeating-relay in the circuit of the north crossover switch of the interlocking at Leverett Jct. These relays were in an instrument house located about 280 ft. south of the north crossover switch. After the relays were replaced, the maintainer called the operator at Champaign by telephone and instructed him to place the lever in control of the crossover switches in position for the switches to be lined normally. At that time the lever was in position for the crossover switches to be lined normally, but the yellow indicator-lamp on the track-diagram panel of the control machine was illuminated. This indicated that the crossover switches were not in correspondence with the control lever, and the operator so informed the maintainer.

Then the signalman observed that the polar contacts of the switch repeating-relay were in reverse position, which condition indicated that the north switch was lined for entry to the crossover. The signalmen er-

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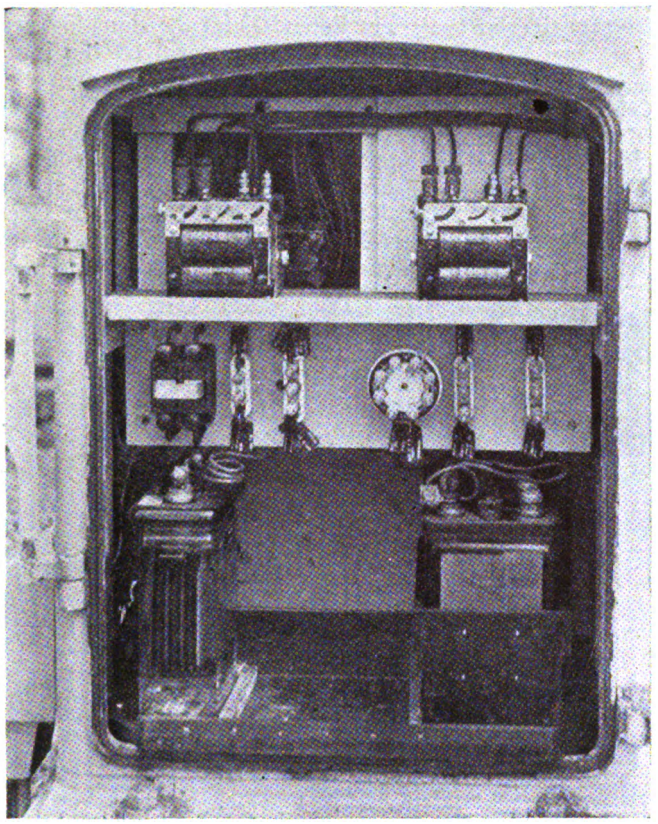
charge storage batteries. Each track circuit is fed by one cell of 80-a.h. storage battery. At each power switch location there is a set of 12 cells storage battery which feeds the switch machine and the line code equipment.



Case containing a track battery and battery for an electric lock and circuits at hand-throw switch

At each intermediate signal location there is a set of 5 cells of battery. All this storage battery is the 9-plate chloride accumulator type, rated at 80 a.h.

The signal lamps are normally lighted through transformers from the a.c. supply. If the a.c. fails, the power-off relay cuts the lamps over to feed from battery but in such an instance, the lamps are lighted on approach control rather than constantly.

At each power switch location the relays, code equipment and storage batteries are in a 6-ft. by 9-ft. concrete house. From the factory these houses are shipped to our signal shop at Aurora where the shelves, wiring and apparatus is installed complete. Then the houses are shipped out to their respective final locations and set in place by a power crane in a work train. Then the outside wires or cables were brought into the houses and connected.

Placed in Service in Sections

As the power switches and signaling at the ends of a siding were completed, this layout under control by the dispatcher was placed in service as a remote control interlocking. With the timetable and train orders being continued for authorizing train movements, the dispatcher used the corresponding levers to control the switch and the signals at a given end of siding just as at any ordinary remotely-controlled interlocking. This practice was continued until reaching a station at which operators were on duty 24 hr., so that train orders could be issued for the territory beyond to the west. Then the section from there back to Flag Center was bulletined in service as centralized traffic control, the only difference being that the train movements were then authorized by the indications of the signals rather than by timetable and train orders. Thus the C.T.C. between Flag Center and Savanna was bulletined in service in three sections. One advantage of this procedure is that the dispatchers and the enginemen had an opportunity to become acquainted with the new signaling gradually. Another advantage is that the signal forces can check and place in final service each of the siding switch layouts as a single unit, rather than being required to change over a great many such units at a predetermined time.

This C.T.C. was engineered and constructed by the signal department forces of the Burlington, the major items of equipment, such as power switch machines, and control machine, being furnished by the General Railway Signal Company.

False Clear Signal

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roneously thought that this condition was the result of their having made incorrect connections to the coil terminals of this relay, and they transposed the coil wire connections. After this change was made, the polar contacts were in normal position, and the control-panel indicated that the positions of the crossover switches were in correspondence with the position of the control lever, and the signalmen thought the north crossover switch also was in normal position. After completing further tests, the signalmen proceeded to the yard office at Champaign to test the interlocking machine. Before leaving the vicinity of the crossover, they did not examine the north crossover switch to determine whether this switch was in the position corresponding with the position of the control lever of the interlocking machine, and they did not look at the signal to determine if this signal was displaying a proper indication. The last test of the interlocking machine was conducted by the signalmen about five minutes prior to the time the accident occurred, and they observed no unusual condition.

In tests after the accident it was found that an error had been made in making the connections to the switch-control-lever repeating-relay. As a result of this condition, together with the transposing of the connections of the switch repeating-relay, the north crossover switch was in position for entry to the crossover when the lever in control of this switch was in normal position, and false proceed indications were displayed by the signals.

It is found that this accident was caused by a train entering a crossover at a high rate of speed, as a result of approach and home signals of an interlocking displaying false proceed indications.

By the Commission, Commissioner Patterson.