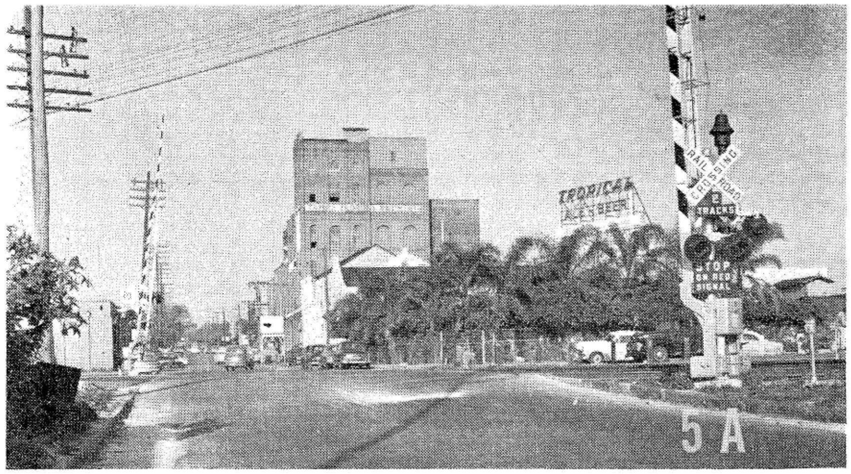
cuits of the Seaboard TC system which are in underground cable. These circuits, as well as several telegraph and telephone circuits, are on a two-conductor No. 10 copper cable that is buried about 2 ft. in the berm, approximately 1 ft. beyond the toe line of the ballast. This cable has two No. 10 copper wires which are twisted at a pitch of 5½ in. to keep the circuits balanced. The insulation and outer protective covering on cable installed in infested areas include bronze tape that prevents moles and pocket gophers from gnawing the insulation. This cable is placed 2 ft. in the ground by a special plow, pulled by a beam extending from a flat car in a work train. The Seaboard now has about 1800 miles of this cable in code line and other signal use, some of which has been in service for 9 years.

The two wires in this buried cable handle various circuits, including conventional d.c. codes for the TC controls; the coded carrier operating between 250 cycles and 2750 cycles for TC codes to sections beyond uses one channel of the three channel carrier; the two remaining channels handle 2 telephone conversations simultaneously, or as many as 18 printing telegraph circuits simultaneously for each channel.

In these TC territories, the Seaboard has applied modern coded track circuits for local signal controls, so that no local line wire circuits are required. Normally the track circuits are de-energized. They are "turned on" to feed through an entire siding-to-siding block, as a preliminary part of the controls when lining up to clear a signal.

The book of Operating Rules used on the Seaboard includes a special set of rules which are applicable on traffic control territory. For example Rule 543 reads in part as follows: "On portions of the road designated by time table or special instructions, train and engine movements may be authorized by block signals whose indications supersede the superiority of trains for both opposing and following movements on the same track and take the place of train orders, except Forms F, V, Slow Orders and Bulletin Orders. Such system will constitute a Traffic Control system and rules governing Traffic Control system will apply in such designated territory, in addition to all other operating rules not inconsistent therewith."



Gate 5A protects westbound traffic on Fifth Avenue

Gates at 21 Crossings

Safety increased and train movements expedited by automatically controlled system with special cut-outs, restarts and pre-warning

IN TAMPA, FLA., the Atlantic Coast Line has installed gates with flashing-light signals at 11 crossings, making a total of 21 consecutive crossings with this form of protection, within 3 miles, all in the metropolitan area.

The double-track main line of this railroad extends north and east from the Tampa Union station through a residential and industrial area. About 2 miles east of the station there is a wye junction with a single-track main line north through Vitis and Dunnelon. Within the 3 miles from the Union Station there are 21 street crossings at grade on the double track main line and three crossings at grade on the wye.

This terminal territory handles about 18 passenger trains daily, including switching movements as well as 20 or more transfer moves to the docks. Switching moves are underway much of the time. Because of the numerous street crossings, train speeds are limited to 20 mph maximum by city ordinance.

Manually-controlled pneumatic gates were in service at Twenty-second street prior to 1941, at which time automatic gates with flashing-light signals were installed at 9 consecutive crossings—Fifteenth street through and including Twenty-third street. Automatic gates and flashing light signals were installed at 50th street in 1948. In 1954 and 1955 gates with flashing-light signals were installed at Thirteenth street, Fifth avenue, Fourteenth street, Twenty-fourth, Twenty-fifth, Twenty-sixth, Thirty-first, Thirty-fourth, Thirty-fifth, Thirty-sixth and Thirty-ninth streets. Flashing-light signals were installed on the wye tracks at Thirty-sixth, as well as at two crossings on Seventh avenue. Thus, on the double track main line all the 21 crossings in the metropolitan area are protected by gates with flashing-light signals and bells, and the three crossings on the junction wye are protected by flashing-light signals with bells.

As shown in Fig. 1 three crossings—13th Street, 5th avenue and 14th street—are all in one group. Traffic is heavy on 5th avenue and 13th street. These three crossings were protected by pneumatic gates controlled locally prior to 1954, at which time these old gates were replaced by modern short-arm gates with flashing-light signals, controlled automatically. The problem of locating gates to protect these crossings is complicated because the tracks are on a 3-deg. curve to the left looking west. The crossing

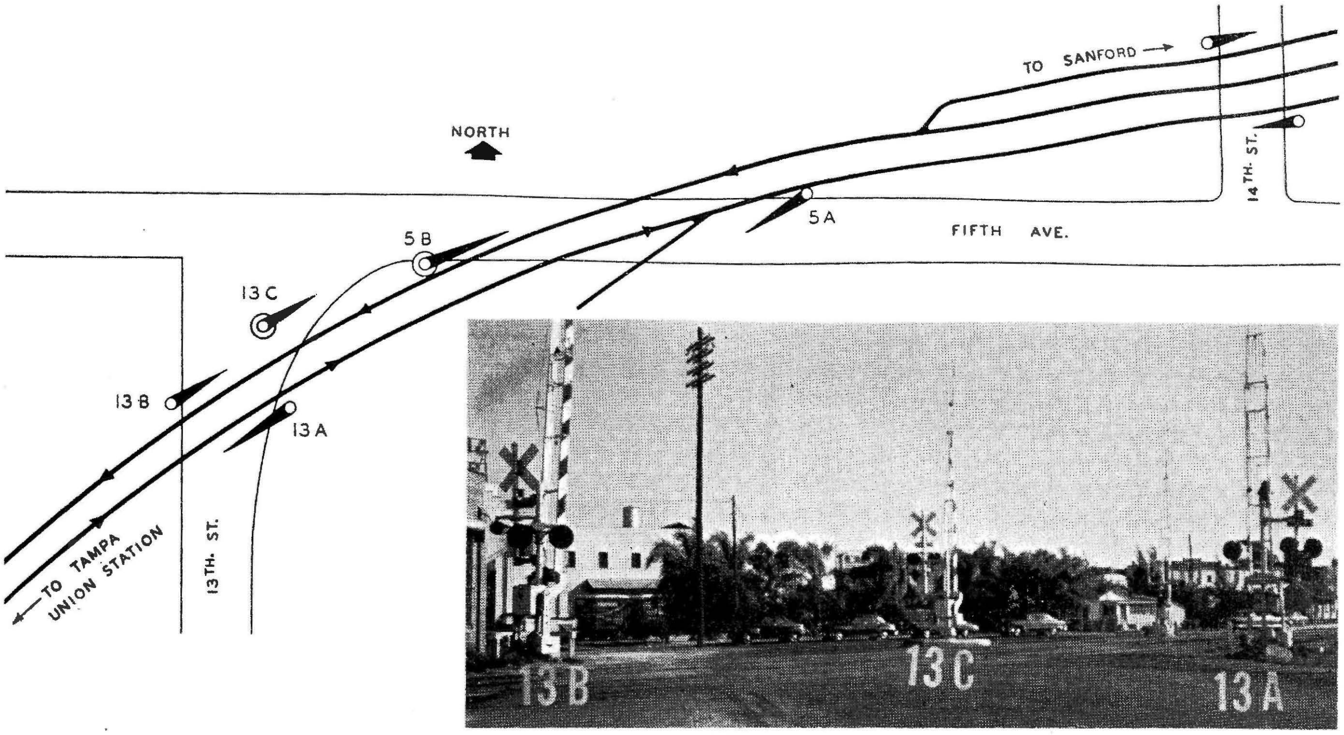


Fig. 1—Special problem on 13th Street was solved by using three gates as shown in drawing

planking for 13th street is about 95 ft. long. In addition to the regular north and south traffic over the tracks on 13th street, a long established practice provided for westward traffic on 5th avenue to turn left (southward) east of the actual line of 13th street, the entire area being street pavement. When installing the new automatic gates, the extra driveway could not be closed, and therefore an extra gate "13C" was required.

To prevent a highway vehicle from approaching close enough to damage the gate or signals, at location 13C, the mast is set on a special island about 1 ft. high, made of concrete. Gate 5B is also in a paved area, and is, therefore, protected by a barrier made of heavy gauge corrugated sheet metal, on posts made of sections of old rail. At other crossings in Tampa where gates were installed previously, barrier guards are made of sections of old discarded 54-in. locomotive tires, welded to posts made of discarded rail.

Short Arm Gates

Two gates are provided at each crossing, one being located at the right of the pavement for each approach to the tracks. Each gate arm is long enough so that when it is in the lowered position, it will reach just a little more than half way across the pavement, thus obstructing the normal right-hand lane of approach to the tracks. At the same time, motor vehicles are not penned in on the crossing, but are free to depart. Each gate mast is equipped with a standard flashing-light signal, with back-to-back mounting, and one of the two masts at each crossing has a locomotive-type crossing bell.

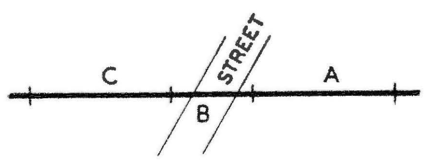


Fig. 2—Sticks for receding control

When a train is approaching a crossing, the gate lamps, the flashing-light signals and the bell are set in operation for a pre-warning period of about five seconds, at the end of which the gates are released and are lowered to the down position in about 10 to 15 seconds. The pre-warning period allows adequate time for vehicles, which are closely approaching the tracks, to proceed on across. The combination of the pre-warning, together with the comparatively slow lowering operations, allows drivers to see the gate, thus warning them of the location to which it is being lowered.

As soon as the gates are all the way down, the bell stops ringing, but the gate lamps and flashing light signals are continued in operation. After the rear of a train clears the crossing, the gates are raised in 8 to 12 seconds depending on gate length.

The Control is Automatic

The controls are accomplished automatically by trains on track circuits. The approach control sections are sufficiently long so that, when trains are operated at the maximum permissible speed, the pre-warning starts at least 25 seconds before an approaching train arrives at the crossing, and likewise, therefore the gates are always down several seconds before a train arrives.

The controls, to cut out the signal operation and clear the gates when the rear of a train passes a crossing, are accomplished by stick relays. On each track over each crossing an individual track circuit extends the width of the pavement and a rail length or two beyond in each direction. Referring to the sketch, Fig. 2, when an approaching train occupies track circuit A, the signals are set in operation, the gates are lowered, and a stick relay is picked up by a circuit through back contact of track relay A. The stick holding circuit is through a back contact of track relay C. By direct control through contacts of track relay B, the signals operate and the gates

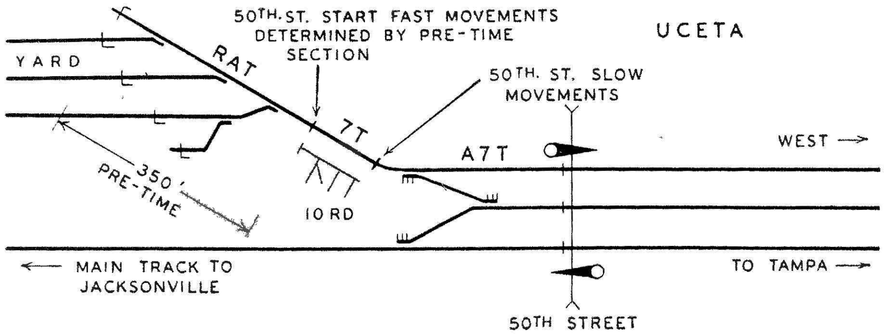


Fig. 3—Pre-timing control at 50th Street

stay down as long as the crossing track circuit B is occupied. After the rear of the train clears track circuit B, the control set up by the stick relay, causes the gates to clear, and signals to cut out, while the receding train is occupying track circuit C. After the train clears track circuit C, the stick relay is released and thus the controls are returned to normal.

With this arrangement of the control, there is no combination of moves by any train or trains which would cause the gates to be clear when a train approaches a crossing. For example, if a switch engine occupies track circuit C, then a through train enters track circuit A, then the switch engine gets in the clear on a siding, the crossing protection would not be cut out by this combination of moves as might be the case if interlocking relays were used.

The automatic approach track circuit controls are effective for train movements in either direction on both main tracks. In instances where side tracks or industry tracks extend over crossings, each such track is equipped with a track circuit extending the width of the street and one or two rail lengths beyond in each direction. Therefore, when making switching moves on such a side track, the protection is set in operation whenever such a track circuit is occupied.

Cut-Outs for Switching Moves

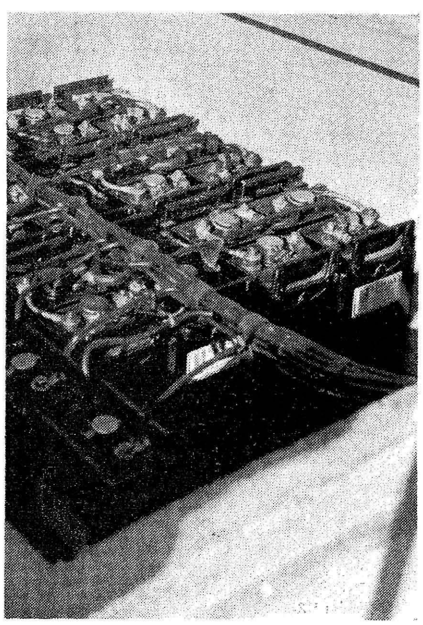
Numerous turnouts from the two main tracks lead to freighthouses and various industries. When setting out or picking up cars on these spur tracks, the switch engine may make various moves on the main line which will not cross certain streets. Special cut-out controls were provided, so that when a switching train is occupying an approach control track section, the controls can be cut out and the gates as well as flashing-light signals will be cleared. This result is accomplished by several different methods. In some cases if a switching engine occupies an approach track circuit, and thereby puts the gates down at a crossing, and then continues to occupy the same section without approaching the crossing, for a period of time, depending on local conditions, automatic controls are affected to raise the gates and cut out the flashing-light signals so that highway vehicles can cross the crossing.

If cars are to be left on the main track at some locations in this territory and the switch engine is to make a move over a turnout or a crossover, when the switch is thrown, a controller connected to the switch operates contacts which pick up a stick relay, the front contacts of which cut out the control of the track circuit which is occupied. Thus the gates are raised and the signal ceases operation.

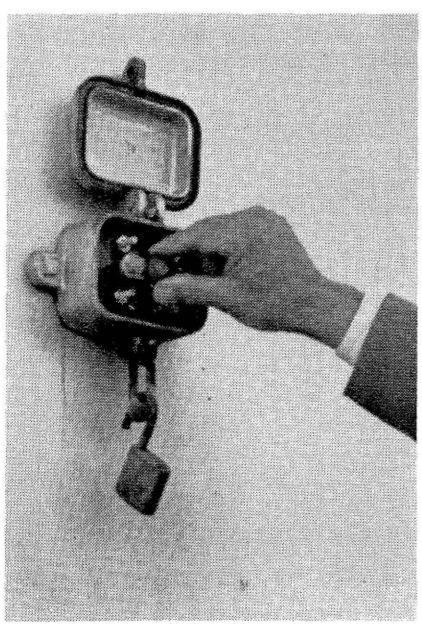
Another method used to raise gates and cut out signals when an approach track section is occupied by a switch engine, is for a trainman to use a standard switch padlock key in a controller box at the crossing. A separate controller is provided for each track, the controller for the eastward main track being on the south side of the tracks, and the controller for the westward track being on the north side.

The result of cutting out the signals and raising the gates with the approach track circuit occupied, is accomplished by inserting a key in the controller, turning the key and leaving it turned for two seconds. The action of turning the key, closes a contact which causes a stick relay to be energized. As long as this stick relay is picked up, the track circuit which is occupied is cut out of the controls. The relay sticks up through the track relay down, therefore, when the train departs and the track relay picks up, the stick relay is released; thus, the control is returned to the normal condition. If, while a cut-out control is in effect on one track, a train enters one of the other approach control sections on the other track, the signals would operate and the gates would be lowered.

Having cut-out the signal and raised the gate, if the switch engine is to move over the crossing, it approaches at slow speed until it occupies the individual track circuit which includes the width of the crossing and a rail length on each side. When this track circuit is thus occupied, the signals operate and the gates are lowered. Then the train can proceed over the crossing, and the gates are raised and the signals cease operation when the rear of the train passes the crossing.



Battery at Fifth Avenue



Operations tested by controller

A special automatic pre-timing enters into the control of the gates at 50th street, as shown in Fig. 3. When a westbound freight train or transfer cut makes a movement out of the west end of Uceta yard, the length of time pre-timing circuit RAT is occupied, as determined by time element relays, will cause the gates to go down when section 7T is occupied (for a fast movement) or not until A7T is occupied (for a slow movement) thereby preventing the gates to be down unnecessarily long. With this arrangement, unnecessary operation of the gates is prevented when a slow reverse switching movement is made from the yard which requires an engine to pull out so that section 7T is occupied.

A 110-volt a.c. power distribution circuit extends through the territory. Normally the lamps in the flashing-light signals as well as the gate lamps are fed from a low-voltage transformer, but if the a.c. power is cut off, a power-off relay operates to switch the lamp feed to a set of nine cells of storage battery which normally is used only to feed control relays. The d.c. motors on the two gates at each crossing are fed from a set of ten cells of storage battery. The storage batteries are of the Edison B6H type rated at 120 a.h. on an 8-hr. discharge rate.

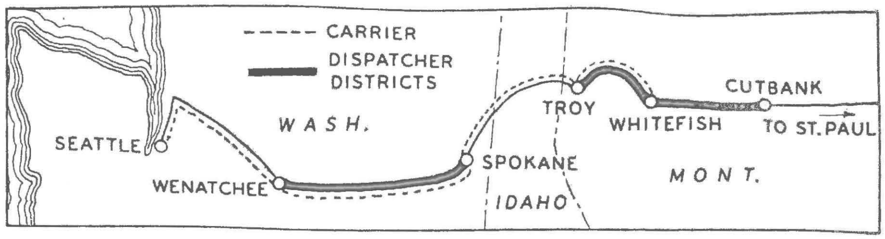
Each track circuit is fed from two cells of 500 a.h. Edison primary battery, across which is connected an automatic rectifier that takes all but about 20 m.a. of the discharge, this 20 m.a. being taken from the battery.

The lamps on the gate arms are rated at 10 volts, 18 watts, those in the flashing-light units are rated at 10 volts, 10 watts.

Test Controllers

At each crossing a T. Geo. Stiles test controller is mounted on the case. Periodically the maintainer pulls the handle of this controller, which sets the signals in operation and lowers the gates. He then observes that all the lamps are in operation. If he neglects to push the controller to normal position, it will be so pushed when he closes the door of the case.

The project was planned with the cooperation of representatives of the State of Florida, the City of Tampa and the railroad. The engineering and construction were handled by the signal department forces of the ACL under the jurisdiction of J. S. Webb, chief engineer, communication and signaling.



When Dispatchers Move . . .

Carrier Saves Wire Pair

IN A RECENT CONSOLIDATION of operating divisions on the Great Northern, the mainline from Spokane east to Cutbank is now known as the Kalispell division with headquarters at Spokane. The mainline west of Spokane is part of the Cascade division with headquarters at Seattle, Wash. As part of this consolidation, dispatchers at Spokane which worked the mainline from there west to Wenatchee were transferred to Seattle. Dispatchers now at Spokane are working the mainline from Whitefish east to Cutbank and Whitefish west to Troy, this dispatching formerly being handled by men at Whitefish.

As a result of these moves, the GN was faced with the problem of providing voice circuits from Seattle to the Spokane-Wenatchee physical dispatcher's circuit, and from Spokane to Whitefish to pick up the physical dispatching circuits there. Voice circuits could be obtained by either of two methods: (1) string a wire pair, or (2) install carrier channels. The latter was chosen because it was more economical than stringing a wire pair.

Ringing and Selection Unmoved

To connect the Spokane-Wenatchee physical circuit to the dispatcher at Seattle, one channel of a Rycom CFD-5 carrier system was used with terminal equipment at Seattle and Spokane. This carrier was installed on an existing through physical circuit (transposed for 3 kc) which includes five voice repeaters. Terminating the carrier at Spokane, rather than stopping at Wenatchee eliminated the need for moving the dispatcher's selector and ringing equipment from Spokane to Wenatchee.

A feature of this CFD-5 carrier system is that it has a normally suppressed carrier, to provide ringing, the 3½ cycle ringing was inserted between existing channels, west to east, using a frequency of 8.8 kc. This carrier equipment was furnished by Railway Communications Inc.

Two Voice Channels to Whitefish

Because two dispatchers at Spokane work the mainline east and west out of Whitefish, two voice circuits were required to pick up the physical circuits at Whitefish. For this installation, the GN used two channels of the Lenkurt Electric Co. type 32E carrier. The carrier terminal equipment was installed at Spokane and Whitefish, with two carrier repeaters being required for this 273-mile haul. This too, is installed on existing physical circuits transposed for 3 kc. The type 32E has a normally suppressed carrier. However, the GN transmits the carriers on the two dispatchers' channels to provide 3½ cycle ringing. Also, the dispatchers' selector and ringing equipment was left at Whitefish.

According to C. H. Wesman, assistant superintendent of communications, inside plant, "by using carrier for this installation where dispatchers were moved, we saved a considerable amount of money when required to provide additional voice circuits. In fact, this is an economical and time saving method of providing additional voice circuits." No outside work was done in connection with this project, such as stringing wire or transposing existing line wires.

Mr. Wesman engineered this installation, which was under the jurisdiction of A. H. Fox, superintendent of communications.