Southern Pacific Installs Interlocking at

Miniature control machine levers control both derails and signals. New specially designed 48-way drawbridge circuit controller is utilized

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NEAR Baldwin, La., approximately 105 miles west of New Orleans, La., the Texas & New Orleans (Southern Pacific Lines in Texas & Louisiana) has installed, over the Charenton Drainage and Navigation Canal, a new swing-type drawbridge, completely electrically controlled and operated, and an electric interlocking plant which controls the associated signaling facilities. The Charenton Drainage and Navigation Canal is an intracoastal canal between Grand Lake and the Gulf of Mexico, which is part of the Mississippi River Valley flood control project being sponsored by the War Department of the United States Government. The line involved at this bridge is the main line from New Orleans to Houston, Texas, and points west, and is double track over the bridge with 112-lb. rail. Train movements are governed by train orders and automatic block. The daily traffic over the bridge consists of 6 main-line passenger, 2 branch-line mixed and 10 regularly-scheduled freight trains, as well as extra trains as required. All train movements over this bridge are now subjected to a speed limit of 25 m.p.h., a temporary arrangement.

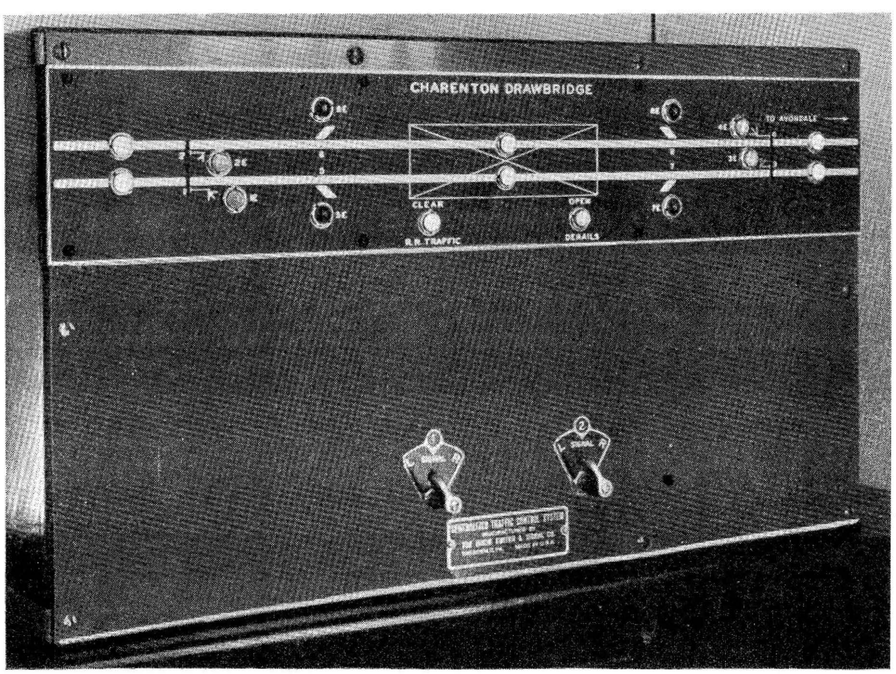
Interlocking Machine

The interlocking machine is located in the bridge house on top of the bridge superstructure, and is the miniature-lever type with no mechanical locking between levers, and with no electric lever locks, the interlocking being accomplished by electrical circuits. The machine consists of a track diagram and two three-position signals-derails levers. Lever No. 1 in the left position clears signals 1 and 3 and closes derails 5 and 7 on the eastbound main track. The same lever in the normal, i.e., the center position, places signals 1 and 3 at Stop, but does not open either of the respective derails. Lever 1 in the right position maintains the respective signals in the Stop position and opens the respective derails. Lever No. 2 in the left position clears signals 2 and 4 and closes derails 6 and 8 on the westbound track. The same lever in the normal, i.e., the center position, only places the respective signals at Stop, and in the right position, maintains the same signals at Stop and opens the derails.

On the track diagram a green light is located adjacent to each signal. These lights are normally illuminated, but when any signal is placed at Stop the respective green light is extinguished. Red transit lights are located adjacent to each derail on the track diagram, and are only lighted when the derail machine is in operation or is not in the position corresponding with that of the lever and properly locked. One white light at each end of the bridge on the diagram are used as derail indications. Only one of these lights is lighted at a time, one when all the derails are open or not properly locked, and the other when the derails are locked and closed. White lights are located on each track in approach to the home signals and on the track sections on the swing span. When any of these sections are occupied or a track relay is down, the respective track occupancy light is out.

Derails and Signals

The derails are the split-point and guard-rail type, two of which are right-hand turnouts and two of which are left-hand turnouts. The switch machines used for the operation of each derail are the M-2 type, equipped for operation on 20 volts, d-c. A concrete pedestal is located at each derail machine, upon which is set a cast-iron junction box, which is connected by 2 ft. of 2-in. flexible conduit to the entrance of the derail machine. Parkway cable terminates on Raco No. 390 terminals in this junction box. These



The interlocking machine is the miniature-lever type, and is equipped with a track diagram and a complete system of indication lights. The two-lever machine is located in the bridge-house

Drawbridge

Eastbound train No. 2, the "Sunset Limited," passing over the drawbridge and by westward home signals 3 and 4. The home signals are the H-2 searchlight type

terminals are connected with the terminals in the derail machine with No. 12-19 flexible insulated stranded copper wire.

One double-door high instrument case is installed on the pole line side of the tracks opposite each pair of derails, with the foundation bolts 7 ft. from the gage side of the nearest rail. Two concrete battery boxes cast with foundations for each of the double-door cases are also located at each derail location. These cases also shelter the equipment required for the operation of the nearby home signals. From each case to each of the derails there are two Parkway cables, one with five No. 10 conductors, and one with five No. 14 conductors.

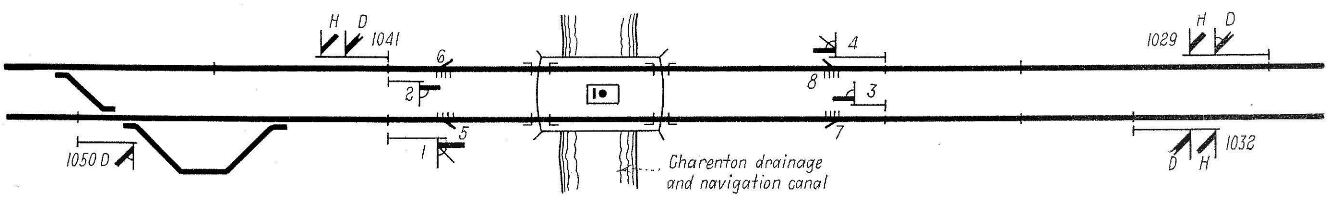


Diagram of tracks and signals at the drawbridge

The high and dwarf home signals are the H-2 searchlight type, equipped with 250-ohm operating coils for operation on 10 volts, d-c. The lamps used in these signals are rated at 11 volts, 11 watts. The high signals display either red, yellow or green, for Stop, Approach and Clear, respectively, and the dwarf signals display red or green for Stop and Slow-Clear, respectively. All signals are semi-automatic, non-stick, and the high signals are identified as such by the suffix "SA" being placed after the signal number on the mast.

Special Bridge Circuit Controller

A new type 48-way drawbridge circuit controller has been utilized on this new 240-ft. swing span, all signal circuits between the bridge and shore being broken through the controller. The circuit controller was manufactured by the T. George Stiles Company, according to plans and specifications compiled in the office of the signal engineer. The swing drawbridge will operate in either direction as convenient and may be operated continuously in one direction, which permits the bridge to be closed more quickly for a train following the passage of a boat. The table parts of the controller are mounted on the top of the concrete center bridge abutment or center pivot pier. The tables are set in the direction of each corner of the top of the abutment at about 45 deg. to the center lines of the top of this abutment, and about 11 ft. apart, the upper part of the collector, with plungers, is mounted on a bracket extending from the sub-structure girder of the bridge itself.

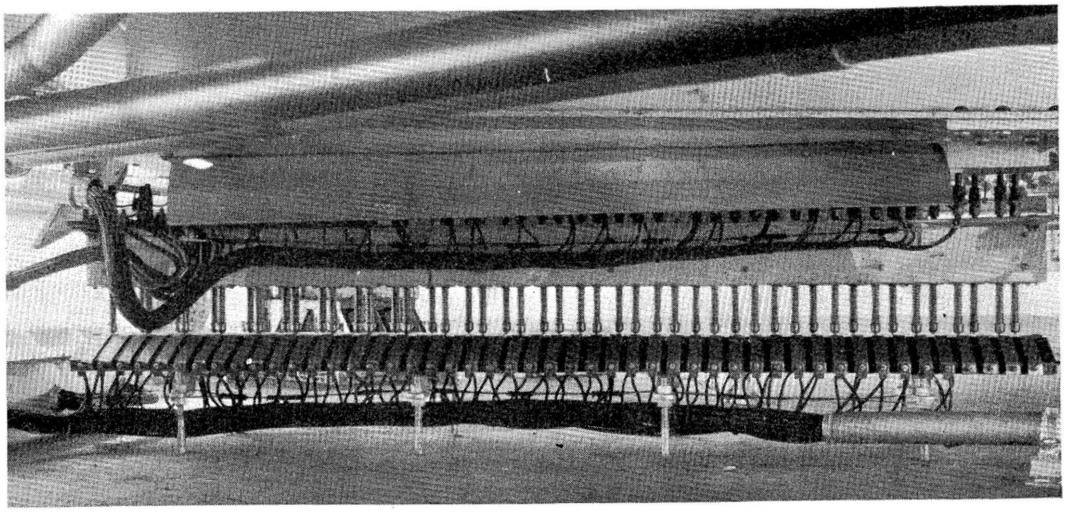
On the commencement of the opening of the bridge, the collector slides off the contact bands on the table. Upon closing the bridge in a 180-deg. movement, the collector unit will slide up the contact bands on the opposite table on the top of the pier. Upon the next movement of the bridge, the collector unit may complete the 360-deg. movement, thus returning to the original starting point.

The tables are formed by four base brackets covered with ⅜-in. steel plate and seam welded. This 8-ft., 2-in. table is covered with Bakelite, the Bakelite being machined to fit at the angles, and also grooved 3/16 in. deep for mounting the 48 monel metal contact bands with monel metal terminals at one end, attached to the Bakelite with monel metal screws. The Bakelite in turn is attached to the steel plate base with monel metal screws. The collector housing is 6 in. square, formed with 1-in. bakelite, with three ½-in. by 6-in. angle iron on each side, with 4 slots in the top face to hang the same on the bracket mounted on the bridge girder. The ¾-in. diameter body forged and finished monel metal plungers, each with four ¾-in. monel nuts, for adjustment, pass through bronze bushings on the top and the bottom of the housing. Mounted on each circuit controller plunger is a phosphor bronze compression spring. A sheet-metal hood is located over the top portion of the collector to protect the circuit controller from dripping oil, grease, water and brine.

Drawbridge Operation

Normally the drawbridge, as well as the rail locks, are operated by 440-volt a-c. motors, supplied by incoming power. If this power fails, an emergency generator driven by a gasoline engine is used to supply power for the motors. If this arrangement fails the bridge can be operated by hand-driven equipment. The motors for operating the bridge and the rail locks are controlled by a master bridge switch on the switchboard.

To swing the span, all home signals governing train movements over the bridge must be at Stop, with the corresponding signals-derails lever in the



View of the special bridge circuit controller from the top of the center pier under the bridge substructure. Note conduit and junction box at the left where submarine cables terminate on terminals

right-hand position, and all track circuits between home signals must be unoccupied. The master bridge switch can then be operated to withdraw the rail and span locks. If all the units indicate a complete normal operation, the bridge power control relay is energized, thus allowing the swing motors to operate as directed by the bridge captain.

When the span is closed, the bridge being properly in line and seated, and all power cut off from the motor controllers, the bridge rail and span locks are driven. Then the derails may be closed, thus allowing the signals to be cleared and trains operated.

As a means of releasing the bridge for operation to let a boat pass when a derail may not be properly locked open, four telephone type jacks are located on the side of the relay case in the bridge house. These merely form a by-pass circuit when a derail is not properly locked open, and permit the operation of the bridge. Should any other failure in the signaling facilities occur, besides a derail not being properly locked open, a master by-pass toggle switch is located adjacent to the interlocking machine, which will permit the operation of the bridge to let a boat pass without delay.

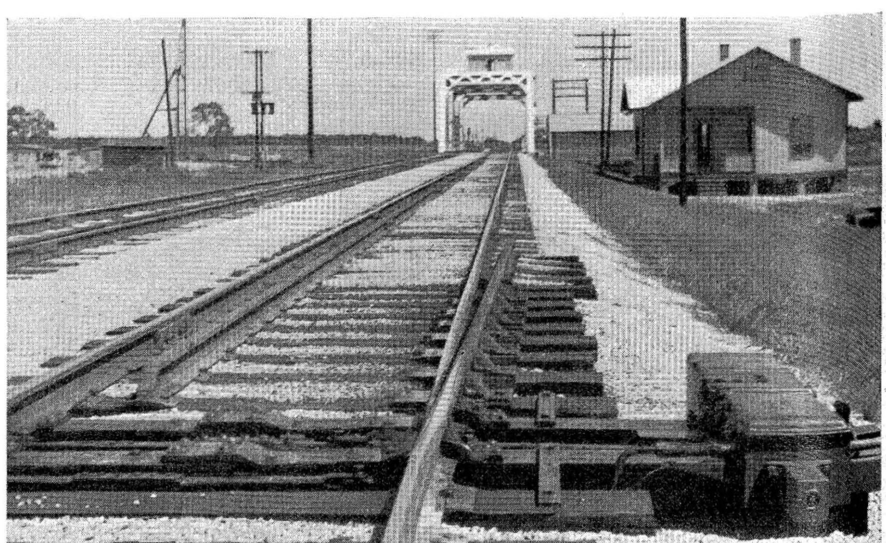
Bridge Wiring

From a terminal box with 24 lightning arresters on a pole line dead-end H fixture at the west end of the 65-ft. west girder span on the south side, the line circuits are run underground in a 33-conductor cable to the west end of the girder span, then across under this span and out to a single case on the pier at the west end of the swing span on the north side. This cable and a 33-conductor submarine cable terminate on terminals in this case. The submarine cable extends from this point to a junction box on the center pivot pier, and is laid in the same trench under the canal as the 440-volt, a-c. power cable. These cables are brought up through the center pier in 4-in. galvanized conduits. The same procedure is followed for the circuits leading to the 81-ft. east girder span from the center pier, thence to an H fixture on the pole line on the south side, opposite the east end of the east girder span.

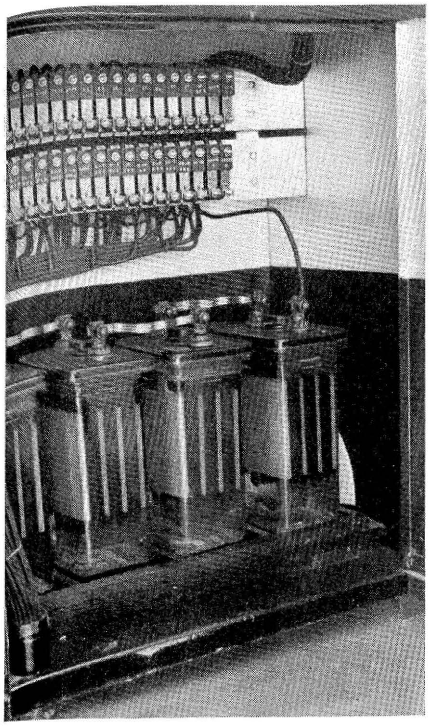
The submarine cables are terminated in a junction box on the center pivot pier after leaving the 4-in. conduit through the pier, entering the junction box through one end. Out of the other end of the junction box, No. 12 insulated stranded copper wires are cabled into the segment collector described previously. The two circuit controller collectors are connected together in multiple with No. 12 insulated stranded copper wire in 2½-in. galvanized steel conduit. Circuits from the collector on the bottom of the swing span to the bridge house on top of the bridge superstructure are on No. 12 insulated stranded copper wire in 2½-in. galvanized steel conduit fastened with pipe straps about every 4½ ft. This conduit is run parallel and next to the conduit which carries the power wires.

The relays, transformers, etc., are located in a special sheet-metal instrument case, 6 ft. by 8 ft. by 16 in., located on the floor in one corner of the bridge house. The storage battery is located under the interlocking machine in a separate sheet-metal case. The two 2½-in. conduits from the bottom of the swing span enter the relay case through cast holes in the house floor. One 1½-in. conduit extends from the relay case under the floor to the control machine and battery.

The main control battery, located in the bridge house, consists of four cells of Exide DMGO-7 storage battery rated at 72 a.h., on floating charge from an RX-10 copper-oxide rectifier. At derail locations, a set of 10 cells of Exide DMGO-7 storage battery, on floating charge from an RT-11 copper-oxide rectifier is used to feed the derail machines. A battery of 4 cells feeds the two signals. Each track circuit is fed by 1 cell of Exide DMGO-5 storage battery on floating charge



The split point derails are equipped with M-2 machines



The control battery is located in a case under control machine in the bridge house

from an R3X-104 copper-oxide rectifier.

The control relays on this installation are DN-12, DP-14 and DT-10 types.

This installation was made by the regular signal department forces under the supervision of D. W. Rosenzweig, signal supervisor, and under the direction of R. W. Meek, signal engineer, Southern Pacific Lines in Texas & Louisiana. The cables and wires on this installation are Kerite, and major items of signaling and interlocking were supplied by the Union Switch & Signal Company.

Collison at Automatic Interlocking

On December 19, 1940, a side collision occurred between a passenger train of the Seaboard Air Line and a freight train of the Atlantic Coast Line, at an automatic interlocking, at Zephyrhills, Fla., which resulted in the death of 1 employee and the injury of 17 passengers and 2 employees. An abstract of the report of the Bureau of Safety follows:

In the vicinity of this accident, both the A. C. L. and S. A. L. are single-track lines. On the S. A. L., trains are operated by timetable, train orders and a manual block system for first-class trains or trains carrying passengers following first-class trains or trains carrying passengers. On the A. C. L., trains are operated by timetable and train orders, there being no block system in use. On both roads, timetable directions are north and south, however, according to compass directions, the S. A. L. track extends from northwest to southeast and the A. C. L. track extends from northeast to southwest, these tracks intersecting at an angle of 53 deg. 29 min. Movements over the crossing are governed by an automatic interlocking. The home signals are of the two-position, 2-arm, upper quadrant, semaphore type, approach lighted, the bottom arms of which are fixed. The distant signals are of the one-arm, semaphore type, inoperative and fixed in a 45-deg. position with yellow reflex lenses. Each home signal normally displays a Stop aspect and clears automatically upon the approach of a train, providing the route is clear. The maximum speed over the crossing which is authorized by the S. A. L. for passenger trains is 60 m.p.h., and by the A. C. L. for all trains is 20 m.p.h.

Description

The weather was clear at the time of the accident, which occurred about 7:21 a.m. According to the evidence, southbound S. A. L. passenger train No. 305, consisting of five cars, was approaching the crossing at a speed of 30 or 35 m.p.h., its home signal having been at Proceed. Southbound A. C. L. freight train No. 213, consisting of 45 cars, was moving at an estimated speed of 3 to 15 m.p.h. when it entered upon the crossing immediately ahead of the S. A. L. train. Evidence was produced that the S. A. L. train entered its approach circuit before the A. C. L. train entered its circuit, the two circuits being 4,623 ft. and 4,230 ft. in length, respectively. The speed of the S. A. L. train was about 15 m.p.h. through Zephyrhills and it had been increased to about 30 or 35 m.p.h. just before the accident occurred. The speed of the A. C. L. train was 40 or 45 m.p.h. when it was approaching Zephyrhills, 30 or 35 m.p.h. at the station, and from 3 to 15 m.p.h. at the time of the accident. The fireman of the S. A. L. train saw the home signal on his line change from Stop to Proceed, and the fireman and the front brakeman of the A. C. L. train stated that their home signal displayed Stop from the time they first saw it until their engine passed the signal. However, the engineman of the A. C. L. train first called his home signal as Proceed, but later when his fireman called the indication as Stop, the engineman observed that the signal was displaying Stop. The normal position of each home signal is Stop, and, since no defect in the interlocking was disclosed, the A. C. L. home signal would remain at Stop during the time the S. A. L. train was on its circuit. The approach indication received by the A. C. L. train at its distant signal required that the train be prepared to stop short of its home signal. According to the engineman, when he realized that the home signal was at Stop, he made an emergency application of the brakes, but failed to stop the train short of the crossing because the brake pipe was not fully cleared. However, other members of the A. C. L. crew thought that only a service application of the brakes was made. The fireman and the front brakeman thought that after their engineman was warned there was sufficient distance in which to stop the train if a heavier brake-pipe reduction had been made.

Signal Supervisor Lackey of the Atlantic Coast Line stated that he has supervision over the interlocking involved. All the damage to the signal equipment was within the limits of the home signals, and when this damage had been repaired, he, and a Seaboard Air Line signal supervisor, conducted a test of the interlocking signals and found them to be functioning as intended. Trainmaster Pace of the A. C. L. stated that he conducts frequent surprise tests to check the observance of crossing signals by enginemen. In numerous tests made during the past year the performance of the A. C. L. engineman on No. 213 in the observance of speed restrictions and signal indications at crossings was satisfactory.

The Commission's order of April 13, 1939, prescribing rules, standards and instructions for installation, inspection, maintenance and repair of interlocking and other signal systems, which became effective September 1, 1939, specifies that at automatic interlockings when the authorized train speed between the home signals exceeds 20 m.p.h., operative approach signals shall be provided. Since the Seaboard Air Line authorized its trains to be operated at a much higher rate of speed than 20 m.p.h., and since the approach signal was inoperative, it follows that this operation of its trains was in violation of the Commission's order. If the maximum speed between home signals on the S. A. L. had been not in excess of 20 m.p.h., it is possible that this accident might have been prevented, and, in any event, the consequences of the accident would have been considerably lessened. The cause of the accident was the failure of the Atlantic Coast Line train to obey interlocking signal indications.