Victoria Jubilee Bridge Protection

An Installation Containing Special Adaptation of Signals to Facilitate the View of the Engineman

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Early in July the Grand Trunk put into service new a. c. automatic signals across the Victoria Jubliee bridge and the approaches thereto, replacing the old Hall disc signals which had been in service for 14 years. The Victoria Jubilee bridge across the St. Lawrence River, which connects the Island of Montreal with the main land, is one of the largest bridges on the American continent—having accommodation for two steam and one electric railroad tracks and for a large roadway and footpath. The steel work is about 6,600 ft. in length. The new a. c. installation included the equipping of the double track from Point St. Charles on the Montreal end to St. Lambert on the south shore of the river—a distance of about 3½ mi. At the St. Lambert end the automatics tie into the new 64-lever G. R. S. all-electric interlocking plant. Four other railroads lease running rights from the Grand Trunk over this bridge, namely, the Central Vermont, the Delaware & Hudson, the Quebec Montreal & Southern and the Intercolonial. On account of extremely heavy traffic the length of the blocks was made comparatively short—ranging from 2,500 to 3,600 ft.

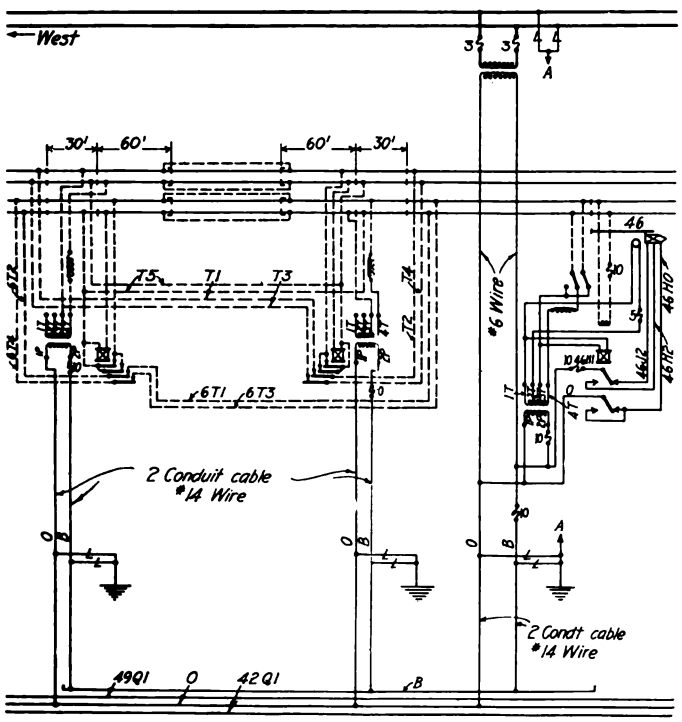


Fig. 1. Trap Circuit.

AUTOMATIC SIGNALS.

The installation in general follows the latest practice in a. c. signal work. The signals are Union Switch & Signal Company's top post, T-2 mechanism type, operated by a single-phase 110-volt, 60 cycle a. c. induction motor. The so-called wireless control circuits are used, employing the Union model 12 polyphase three-position relay; the local coils of these relays receive their energy at 12 volts from the track transformers. Track transformers also supply the energy for track circuits and electric signal lamps. All signals are electric lighted by two 2 c. p. 2½-watt 6-volt tungsten lamps burning in multiple. Dressel convertible R. S. A. lamps equipped with model 9 electric sockets are used.

The center span of the bridge has a steel floor system which necessitated the use of a trap circuit on which two vane type relays are used; the circuit employed is shown in Fig. 1.

All main line switches are equipped with Universal switch circuit controllers and Z-type switch indicators operating at 110 volts. The indicators are of the upper right hand quadrant, normally energized type, standing at 45 deg. when clear.

The high and low tension line wires are supported on a single cantilever crossarm, the two high tension wires being placed on the outside spaced 18 in. apart and the low voltage wires on the inside spaced 12 in. apart. On the bridge this cantilever crossarm is attached to the vertical bridge members, and on the bridge approaches, to the steel poles of the Montreal Light, Heat & Power Company, which run along the G. T. R. right-of-way. Due to the difficulty of providing double arms, a special forked bracket pin was used set on a single crossarm as shown in the upper corners of Fig. 2.

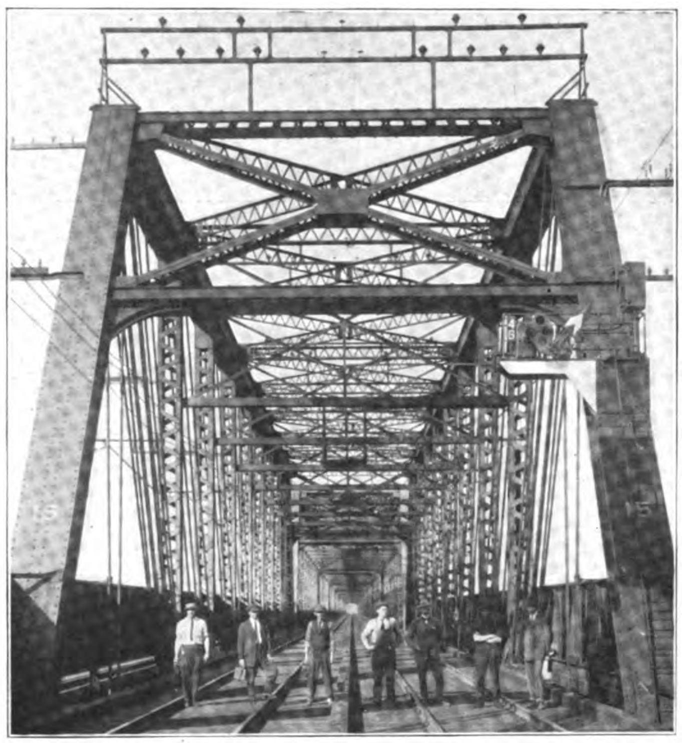


Fig. 2. Reading from Left to Right: J. Faas, Div. Sig. Foreman, G. T. R.; W. S. Lee, Foreman U. S. & S. Co.; H. Davis, U. S. & S. Co.; G. Riley, U. S. & S. Co.; R. F. Morkill, Sig. Eng., G. T. R.; J. Burns, U. S. & S. Co.; B. Wheelwright, Insp. Signals, G. T. R.

No. 6 B. & S. gage hard-drawn D. B. W. P. insulated copper wire was used for the high tension line. Dossert solderless cable taps were used to connect the leads running from the high tension line to the transformer primaries. No. 10, B. & S. gage 40 per cent copper clad wire with D. B. W. P. insulation, was used for the low voltage line. MacIntyre copper line sleeves were used throughout in making all joints in line wire.

On the bridge proper all wires are enclosed in sherardized conduit with condulet fittings so that in no case are wires exposed. No wooden trunking whatever is used on the

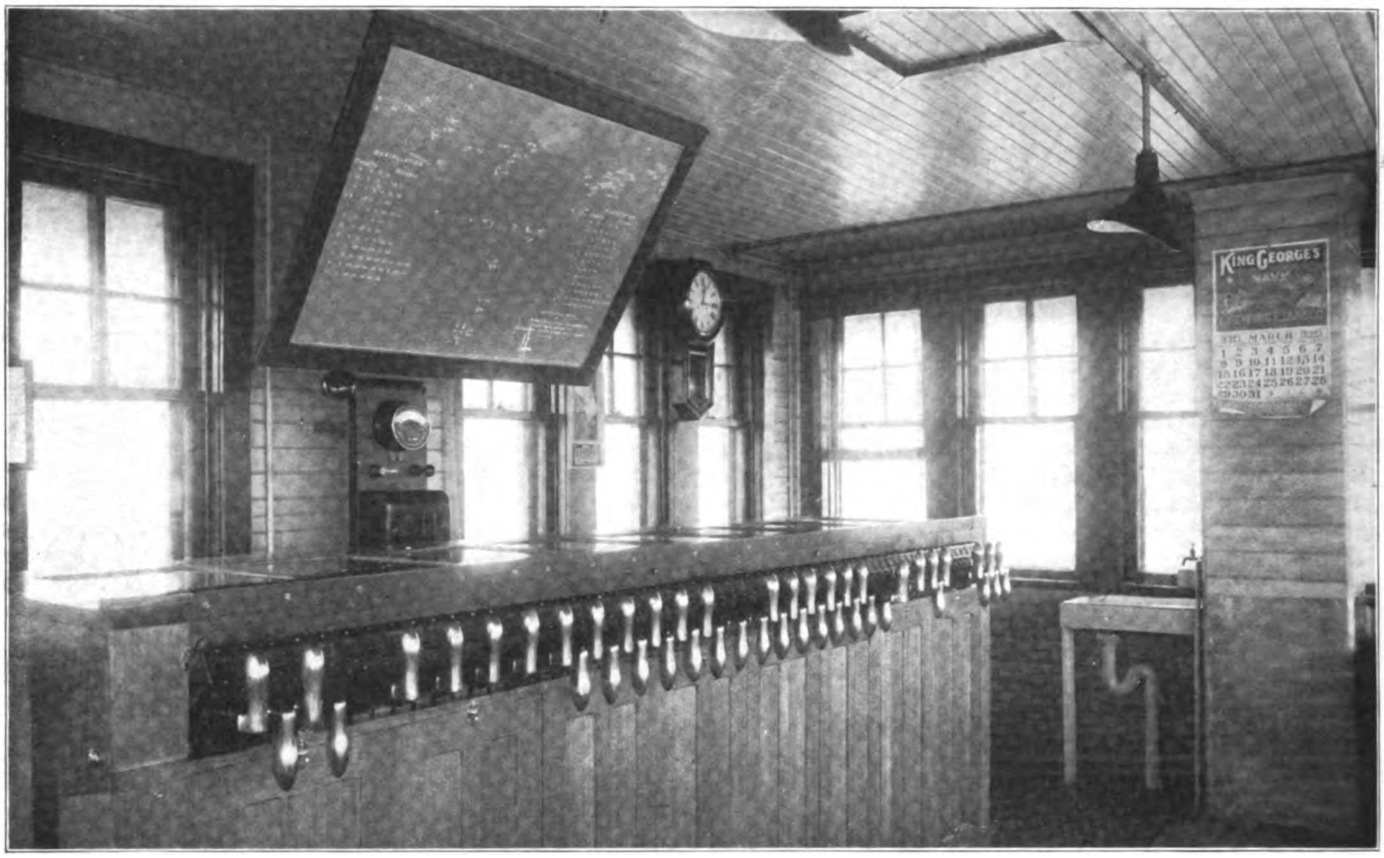


Fig. 5. Interior of St. Lambert Interlocking Tower.

bridge structure. Fig. 3 shows the general idea of how the conduit work was installed.

On the bridge structure proper great difficulty was experienced in getting the necessary clearance for the signal blade without placing it so high as to have it obscured from the engineman's view by the steel work. The difficulty was overcome by using a style T-2 dwarf signal mechanism set on a steel cantilever platform which was rivetted to the end post of the truss. The spectacle casting was a special design with the blade attached to the bottom of the casting so as to give the maximum clearance and best view, yet arranged so that

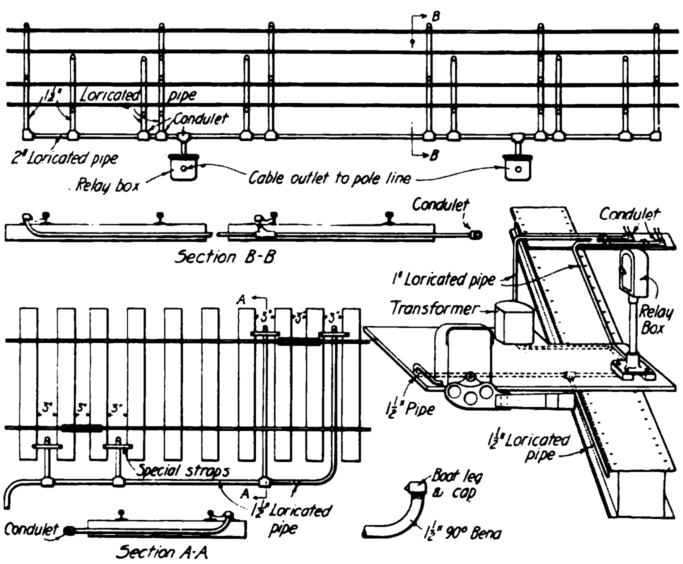


Fig. 3. Arrangement for Installing Conduit and Bootleg on Bridge.

as it moved from the stop to clear positions, the clearance would at no point be decreased over that of the blade in the stop position. The platform, signal mechanism, and spectacle are clearly shown in Fig. 2. On this same platform is mounted an ordinary relay post and box in which are placed the relays, track transformer, reactances, and low voltage lightning arrestors. The line transformer and high voltage lightning arrestors are also mounted on the platform.

Power for operating the signals is obtained from a single-phase, 60-cycle, 2,200-volt transmission line. Under normal conditions power is purchased from the Montreal Light, Heat & Power Company. The a. c. transmission line is sectionalized at two points, so that a transmission-line failure will not necessarily tie up the entire installation. General Electric Company double-pole, form P, outdoor type oil switches are used for this purpose. At the east end of the bridge the switch is mounted on the transmission pole line. The pole is provided with steps and painted white so as to facilitate finding it at night in case of a failure. The sectionalizing switch at the west end of the bridge is mounted on a steel platform attached to a large "A" frame

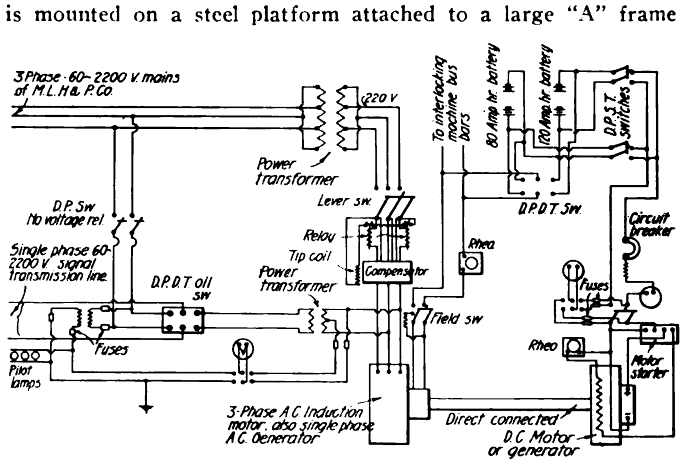


Fig. 4. Wiring Diagram for Tower Apparatus.

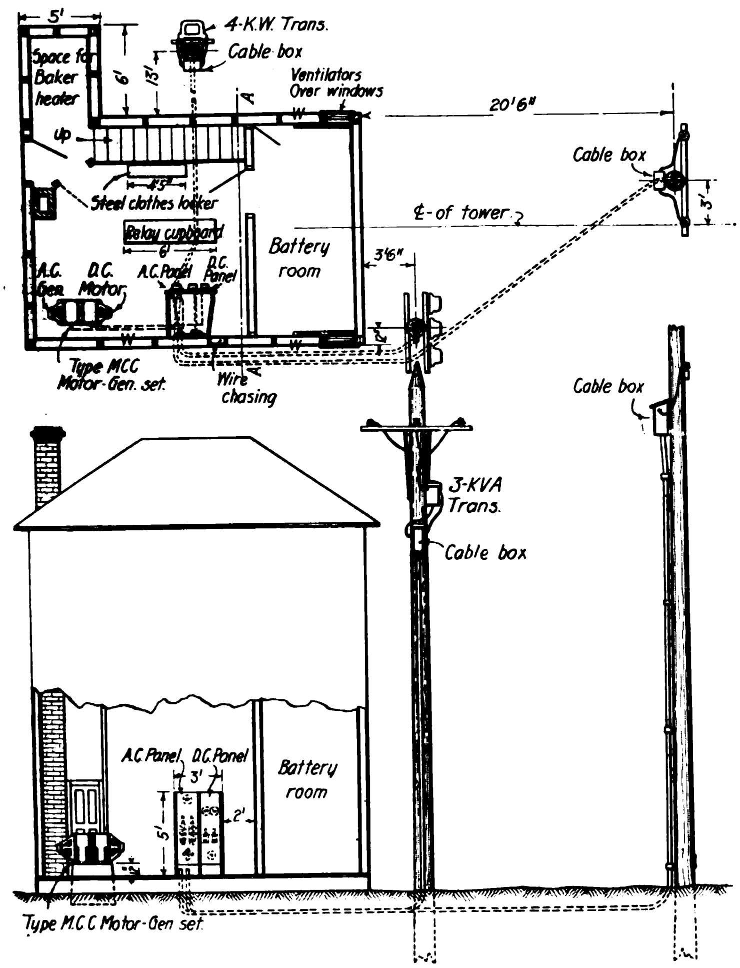
steel transmission line support of the Montreal Light, Heat & Power Company.

General Electric Company multigap type, form F2, lightning arrestors, enclosed in asbestos-lined weatherproof wooden boxes, are used to protect the high tension transmission line. Two of these are placed at every transformer location. On the bridge approach No. 3 Paragon ground cones set in coke were used for high tension lightning arrestor grounds. On the bridge structure both the high and low tension lightning arrestors were grounded to the steel work of the bridge. A bare No. 6 B. & S. gage, 40 per cent. copper clad line wire was strung the entire length of the bridge and grounded at each end through a No. 3 Paragon ground cone set in coke. At each signal or transformer location the bridge structure was connected to this ground wire. On the bridge approach the low-tension lightning arrestors were grounded through a coil of 12 turns of No. 6 B. & S. gage bare copper wire placed one foot below the concrete foundation. Low-voltage lightning arrestors were used in all wire leads to either line or track.

INTERLOCKING.

In the St. Lambert interlocking plant there was installed an auxiliary power supply set, consisting of a storage battery, d. c.-a. c. motor generator set and step-up transformer, together with the necessary switching apparatus. This auxiliary plant has sufficient capacity to operate the interlocking plant and a. c. signal system for about 5 hours. Due to the extremely heavy traffic over this installation, absolute continuity of signal service was essential, and therefore an auxiliary power supply was installed. The Montreal Light, Heat & Power Company brings energy into Montreal over six independent power lines, and in addition has a large reserve steam plant so that a power failure lasting more than 5 hrs. should be a very rare occurrence.

The former power equipment at the St. Lambert all-electric interlocking plant was enlarged and changed to provide both the d. c. energy for the all-electric interlocking plant, and in cases of emergency, a. c. energy for the a. c. signal system.



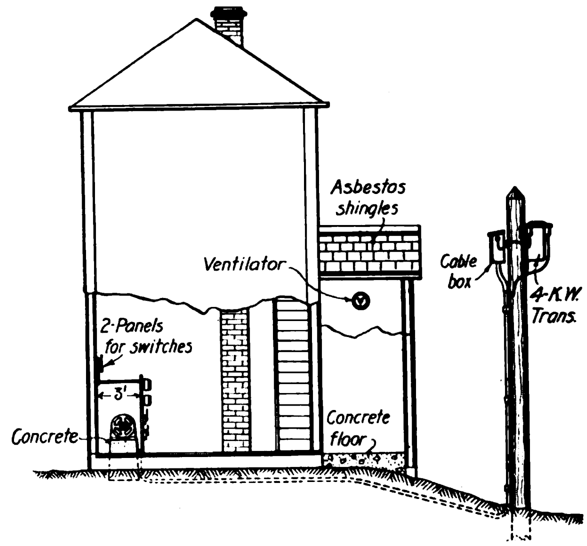


Fig. 6. St. Lambert Interlocking Tower, showing Motor Generator Set Installation.

Fig. 4 shows diagrammetically the arrangement of this apparatus. Normally, 3-phase, 60-cycle energy at 2,200 volts is purchased from the Montreal Light, Heat & Power Company. This is stepped down to 220 volts by three single-phase, outdoor type transformers mounted on a pole outside the tower. This 220-volt energy is then lead to a special 3-phase a. c. induction motor, which drives a d. c. generator. This generator is used to charge two storage batteries—one of 80 A. H. and one of 120 A. H. capacity. Switchboard equipment is such that any one of the following combinations can be arranged: (a) Charge both batteries at the same time; (b) charge either battery separately; (c) charge one battery and have the other supplying energy for the all-electric interlocking plant; (d) have one battery supplying energy for the all-electric interlocking plant and the other supplying energy to operate the d. c.-a. c. motor generator set; (c) have either battery supply energy to the all-electric interlocking plant.

Normally the a. c. signal transmission line is fed directly from one phase of the 2,200-volt, 3-phase a. c. line entering the St. Lambert interlocking tower. Should this energy fail, a circuit breaker would automatically open. The auxiliary power set would then be started up, the 200 A. H. storage battery supplying the energy necessary to operate both the a. c. signal system and the d. c. all-electric interlocking plant. The d. c. generator is run as a motor and the special 3-phase induction motor is operated as a single-phase a. c. generator supplying a. c. 60-cycle energy at about 200 volts. This is then stepped up to 2,200 volts and fed out on the a. c. signal transmission line.

The d. c.-a. c. motor generator—generator motor—set is mounted on a concrete foundation. Beside this are mounted the two switchboard panels and beyond is the storage battery room. The general layout is shown in Fig. 6. On the wall are mounted the disconnecting switches and fuse blocks. All transformers are of the outdoor type and located on poles outside the tower. All wire leads between pole line, transformers and tower are in cable enclosed in sherarized conduit.

This installation is the first of its kind in Canada. All signal apparatus was manufactured and installed by the Union Switch & Signal Company. Switchboards and power equipment were purchased from the General Electric Company and installed by the Grand Trunk forces.

SMOKE ABATEMENT.—It may be of interest to know that at a recent meeting of the sub-committee of one of the committees of the R.S.A. not one of the members present smoked.