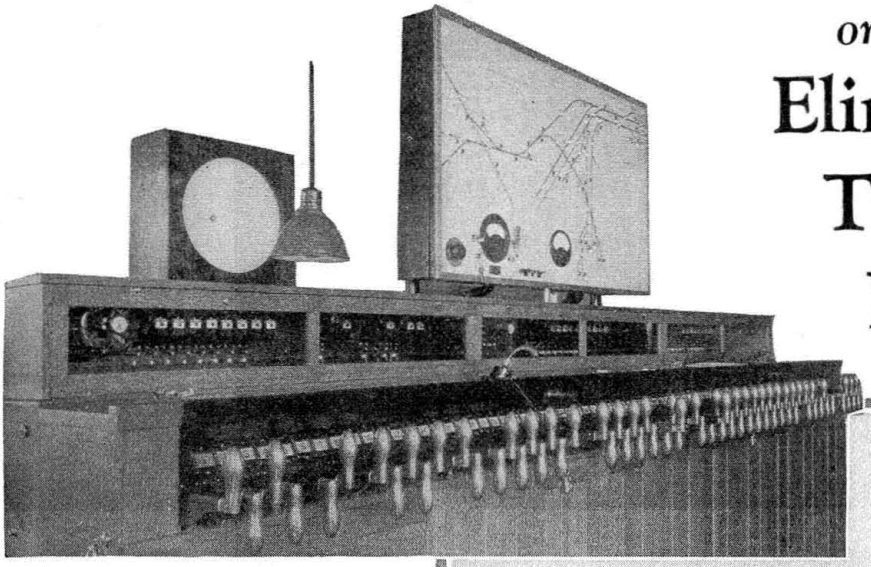
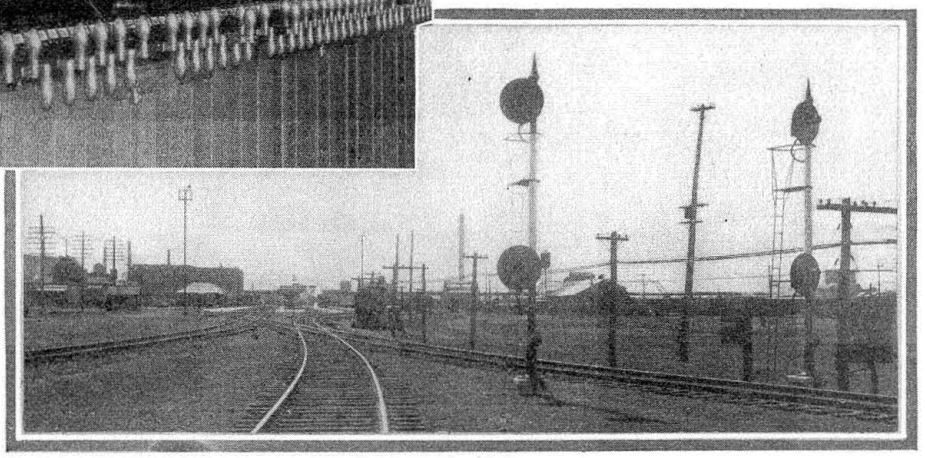
New Electric Interlocking on the Burlington Eliminates 160 Train Stops Per Day





Estimated savings will pay for plant in six years

By E. G. Wesson
Assistant Signal Engineer,
Chicago, Burlington & Quincy,
Lincoln, Neb.

A view from near the tower looking toward the station

THE Chicago, Burlington & Quincy completed and placed in service, on February 9, 1930, an electric interlocking plant that has proved itself to be economically sound and well justified. The installation is at the east end of the passenger and city yards in Lincoln, Neb. It culminates an estimated $1,300,000 construction program, started in 1927, which involved the rearrangement of tracks and the construction of new station facilities, with a view of providing modern facilities at Lincoln. In 1927, a three-story office and passenger station was erected, and, in 1928, all yard track changes were effected to provide a double-track entrance from the Omaha line into the station. Further track changes were made in the yard layout to provide better facilities for handling the city merchandise and freight-house business.

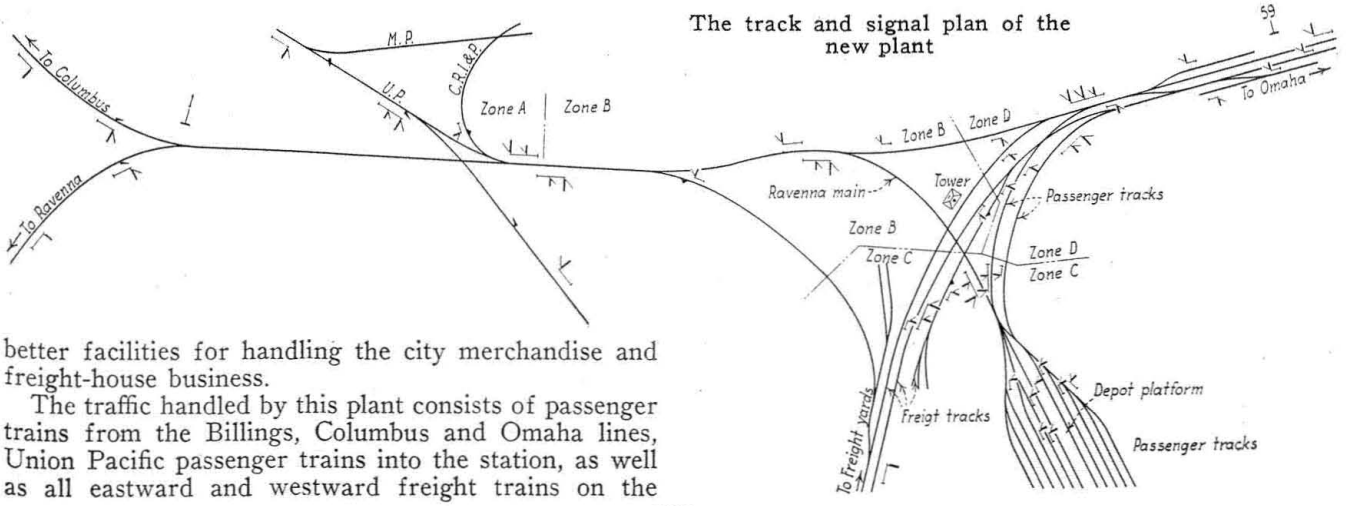
The traffic handled by this plant consists of passenger trains from the Billings, Columbus and Omaha lines, Union Pacific passenger trains into the station, as well as all eastward and westward freight trains on the Burlington and Union Pacific, and all of the switching and transfer moves incidental to the handling of the freight house and passenger station.

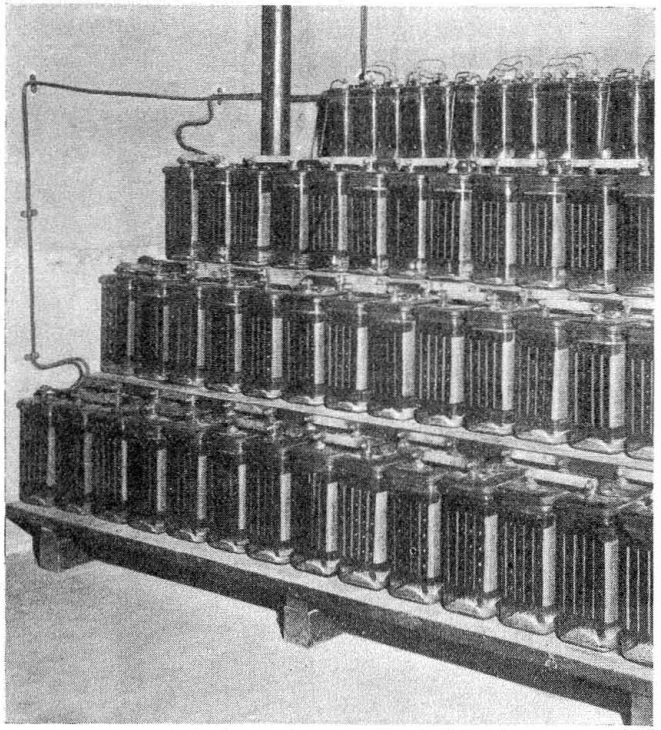
A General Railway Signal Company's Model-2 unit-lever type electric interlocking machine, with 78 working levers and 10 spare spaces, was installed. An illuminated diagram, placed over the machine, provides complete indication of track occupancy and repeats the signal indications.

Tower Arrangement

The interlocking tower is a three-story building with two and one-half stories above the ground line. The half-basement story houses a small work shop, battery

The track and signal plan of the new plant





The battery rack is built on the stair-step arrangement

racks, heating plant and coal storage bin. The first story is of reinforced concrete construction; the two upper stories are of pressed brick construction, with a concrete floor in the second story, and concrete and special insulated mastic floor in the operating room. The second floor houses the relay cabinet, the entrance terminal board and the rectifier charging panels. The upper floor is the control, or operating room, and houses the interlocking machine and telephone and telegraph apparatus. Some economy was effected in the building costs by building a flat water-proofed roof instead of the usual overhanding type.

Switches, Derails and Signals

The switches, derails and double-slip units in the plant are operated with the G-R-S Model-5A, 110-volt switch machines, which are provided with point detectors and lock rods.

Derail protection is provided at the main-line crossings of the Union Pacific and the Chicago, Burlington & Quincy line to Ravenna, and, also, where the yard switching lead crosses the main line to Ravenna. The use of derails at other points was dispensed with except at two switches, where Hayes derails were installed, to be operated with pipe connections directly from the switch.

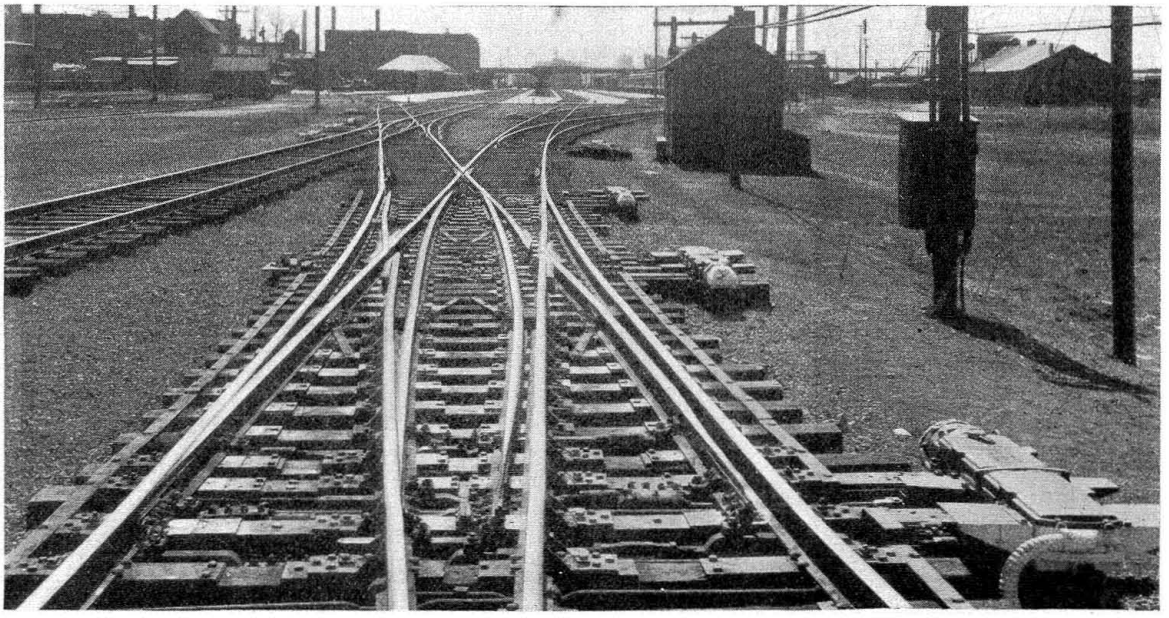
Type-SA signals are used throughout for all operative signals. There are three inoperative distant interlocking signals, of the semaphore type, continuously lighted with 3.5-volt, 0.12 amp. lamps, taking power from four cells of Edison primary battery.

All dwarf signals provide two indications, red and yellow. Restrictive speed signals, placed 8 ft. above base of the masts provide two indications, red and yellow. The upper signals on the same signal masts provide two or three indications, as required, being red and green or red, yellow and green. These signals are all a-c. lighted from the 11-volt transformer tap and are fitted with 14.4-watt bulbs, designed to operate on 11.6 volts. All of these signals are provided with d-c. reserve through a-c. power-off relays.

Low-Voltage Signal Supply

Four zones, designated in the track layout as Zones *A, B, C* and *D,* separate the plant into four low-voltage territories, each with independent controlling batteries. The plant is arranged for 11-volt operation of all signal and repeater circuits with only the switch operation on the 120-volt battery. Exide storage batteries are used, Type-EMG9 for switch machine operation and Type-KXHS7 for low-voltage signal and line circuits. Union Switch & Signal Company rectifiers are used throughout for the purpose of charging both the 120-volt and 11-volt batteries. Reserve units are available for charging purposes, and are so arranged that they may be switched into service in an emergency. Full control of battery charging is handled on the switchboards.

The low-voltage switchboard, made and assembled on the ground, is so arranged that all charging current measurements, voltage readings, and current consump-



One of the double-slip layouts

tion measurements can be made with the switches and instruments on the board. Switches are provided on this board to place emergency charging apparatus in service and place an emergency battery set into service whenever such action is necessary; this arrangement eliminates delay in handling emergency conditions since everything can be handled directly by switches.

Track circuit operation in each of the four zones is arranged with a single 6-volt battery bus line, handling the individual track circuits through from 14 to 19 ohms resistance in the track leads. Edison primary battery is used for track circuit operation outside of home interlocking limits, except on the main line toward Omaha, which is in automatic block signal territory. Special Union Switch & Signal Company's rectifier units with a charging rate up to 5 amp. are provided for charging the 6-volt track battery.

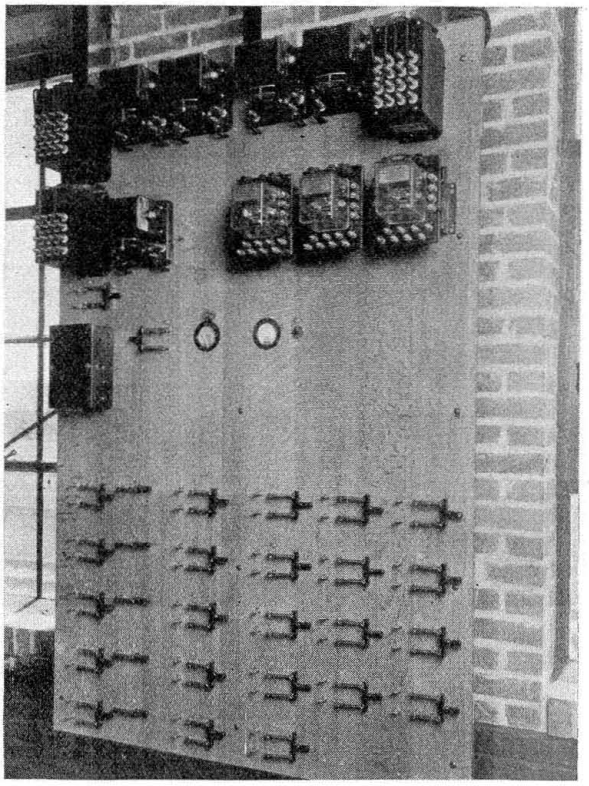
Cable Arrangement

Parkway cable is used throughout for track circuit conductors and all cross connections to signals and switch machines. At the signals the parkway is carried into sealing boxes and, from there, single-conductor wires are carried to the signal units that are located on poles. At dwarf signals the parkway cable is sealed and parkway conductors extend to the mechanism; similarly, parkway is sealed and conductors run direct to terminals in all switch machines.

Track circuit rail connections are made in accordance with company standard design which provides that No. 8 BWG soft-drawn bars of copper wire shall be joined to the parkway conductor and that the end of the parkway and the joint shall be sealed with R.S.A. parolite in a bootleg casing, the joints being taped with both friction and rubber tape after being soldered.

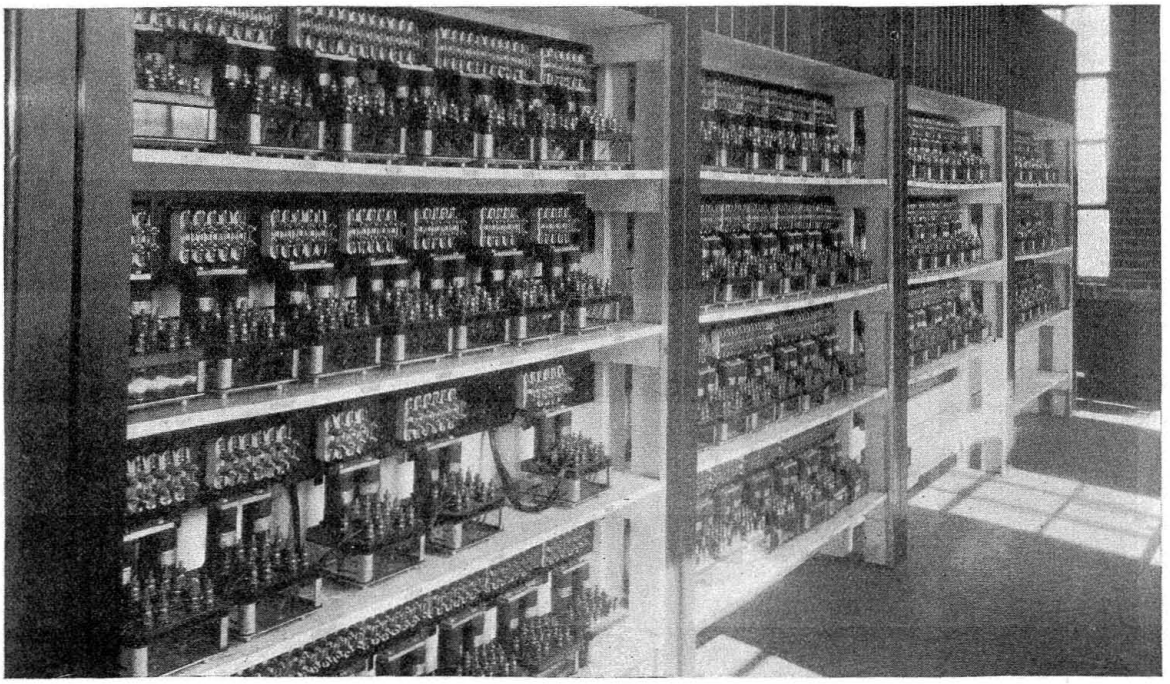
Metal bootlegs with porcelain outlets, as furnished by the Midwest Signal Company, were used to protect the joint and seal the parkway, the two No. 8 wires being passed through porcelain blocks to the rails. A few wooden bootlegs, made of 4 in. by 4 in. creosoted lumber were also used for track connections.

All conductors from the tower to the switches and signals were placed in aerial cables of various sizes, which are suspended from messengers carried on a pole line. Since the cable was terminated in wooden junction boxes, it was necessarily cut or dead-ended, and from these boxes the parkway cable cross connections were run to the switches or signals. All cables entering these boxes were sealed in a sealing box with R.S.A. parolite. The Okonite Company furnished all of the parkway cable, aerial cable and single conductor wire for this installation.



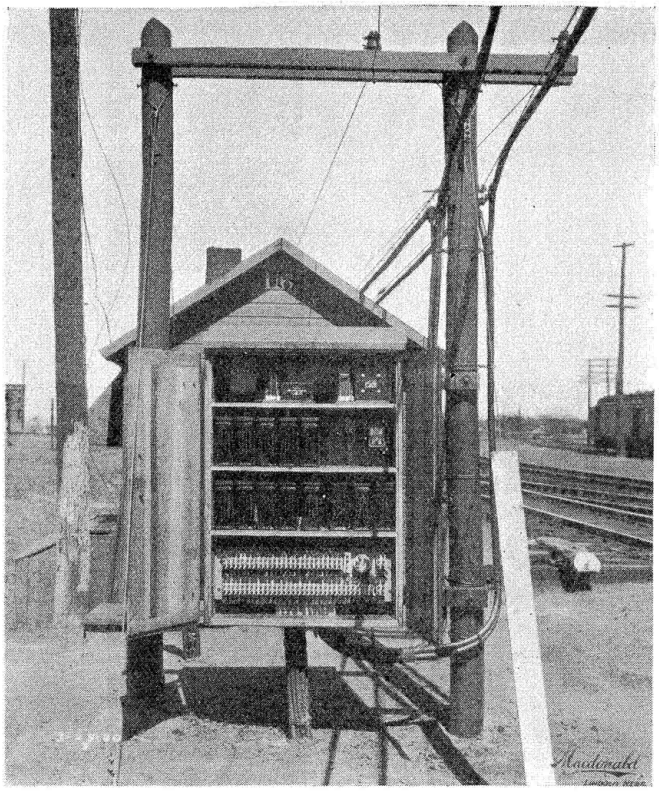
The low-voltage switchboard

The power supply at this point is taken from a 220-volt single-phase a-c. line consisting of two No. 6 triple-braid weatherproof wires, which are placed on a short arm at the top of the cable-line pole. The four



The relay cabinet in the tower

lines are separately and independently operable from the tower, there being four switches on the tower terminal board to disconnect any one line at the option of the maintenance force.



An outdoor instrument case with cable runs

The KR, or switch repeater, relays are all 500-ohm G.R.S. Type-K polar, a regular 3-wire polarized circuit being used, with the point detectors as the controlling apparatus. All track repeating, and signal-normal indication relays are located in the tower. Since every outside function is repeated in the relay track, it is not necessary to check any circuits on the outside through a switch controller or track relay. Therefore, every wire controlling a switch or signal runs directly from the tower to the function that the circuit controls.

The signals are controlled through a KS relay which is checked through the KR relays in the proper position, through the track repeaters, and picks up through the lever normal. This KS relay, being stick selected, forces a lever operation each time the corresponding signal is passed by a train.

Lever Locking Circuits

Approach and route stick locking are provided where signals are approached by trains at high speed. These approach and stick-locking circuits are designed to release automatically behind a train, to permit the restoration of the lever at any time after a train has passed a given track section. The circuit also will restore the lock relay if no train has entered the approach circuit before the signal lever is placed in the normal position.

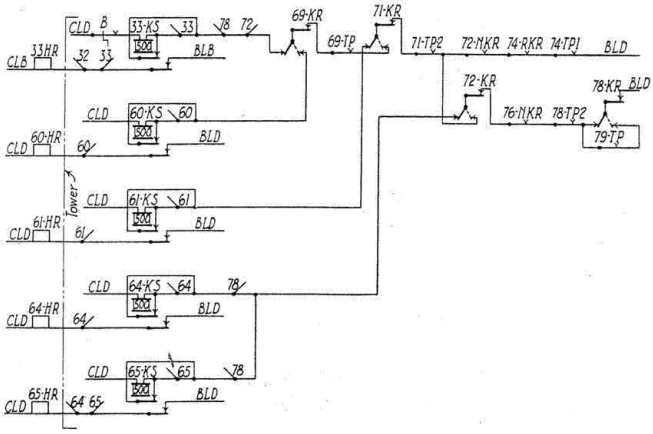
The relay cabinet or rack, housing the tower apparatus was built in place by company forces and is so designed that all wire is concealed in wire chases, the wires terminating on the relay shelves, over and back of the relays.

One track switch, in the check zone between plant sections *C* and *D*, is equipped with an outlying electric switch lock. The circuit for this lock normally provides that all signals governing trains over the piece of track in which the switch is located, must be in the normal position before the lock can operate; when a crossover or switch is reversed, to lead traffic to some other track, a release may be operated to energize the lock. A push button in front of the machine controls this electric lock. A lock-repeating relay provides that the lock must be normal in order to clear a signal over the switch, and a low-wattage lamp, in series with the lock circuit, informs the leverman when switching or train crews are receiving the unlock.

A trap circuit is in effect at the crossing of the Ravenna main line with the three freight tracks; a feature in connection with this trap circuit is the sealed pick-up button placed in the machine to restore the trap stick relay in case track forces or any outside party should shunt the track and thus drop the stick relay without the presence of a train to pick up the end sections.

Statement of Economies Effected

This interlocking plant eliminated the use of switch tenders at two points and relieved all trains of crossing stops. Prior to this installation 6 Columbus line trains each 24 hr. had operated a hand-throw switch, setting the mechanical signal for protection; 4 Union Pacific trains each 24 hr., in going to and from the passenger station, operated hand-throw switches for movement over connection track, and copied orders for authority to go to and from the station; 12 C. B. & Q. and 10 U. P. trains each 24 hr. stopped at the crossing of their main lines; 16 U. P. and C. B. & Q. trains stopped each 24 hr. on the Ravenna main line at the crossing with the freight lines; 16 freight trains and about 100 switching and light-engine moves were stopped each 24 hr. on the freight line at the crossing with the Ravenna main.



A diagram showing signal control circuits

A total of about 164 train or engine stops each 24 hr. were eliminated by the installation of this plant. These stops were all incidental to hand-throw switches or crossings. Further benefit was gained in that inbound freight trains now clear important grade crossings, and outbound westward freight trains clear the interlocking, more quickly. Other than these savings, greater speed is maintained in handling the switching of cars and trains in passenger stations and handling transfers to the Rock Island and the Missouri Pacific.

The estimate, as established when the authority was requested for this expenditure, shows that approximately $20,855 per year will be saved by the new interlocking plant, the estimated cost of which was $120,000.

This plant was constructed by the signal department forces of the Burlington.