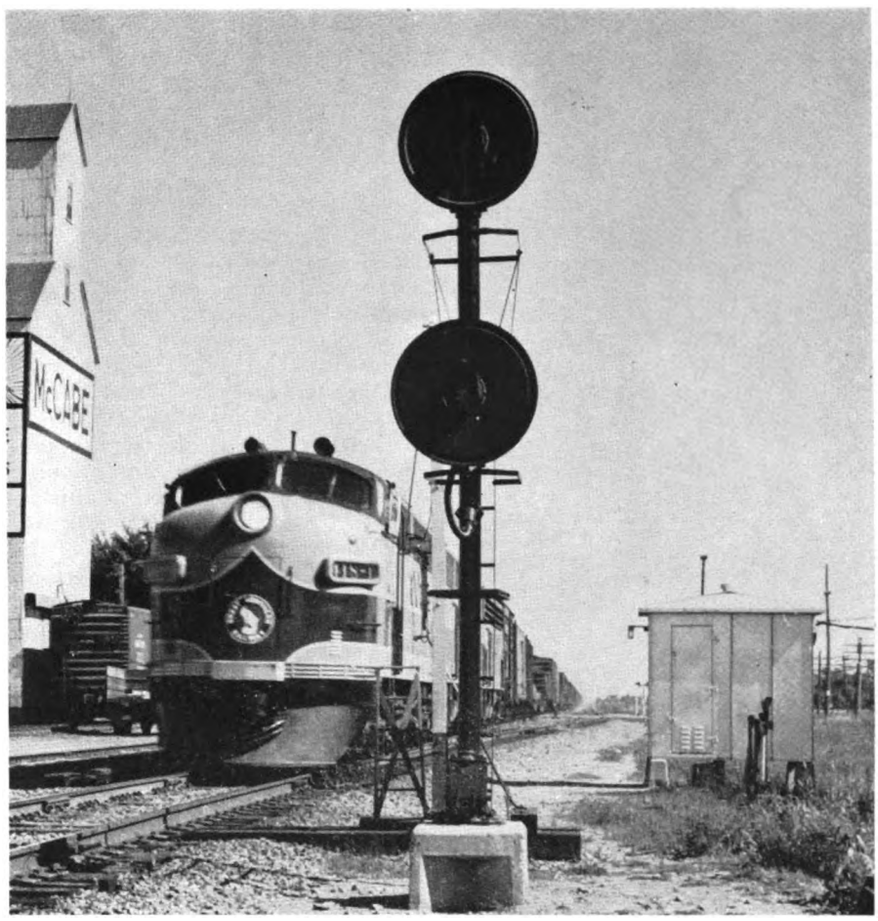


Westbound freight shown passing the end-of-double-track at Pennock. Signals between Willmar, Minn. and Breckenridge on the west are the searchlight type, and colorful signals are used between Willmar and Delano

GN CTC's 175 Miles of Mainline

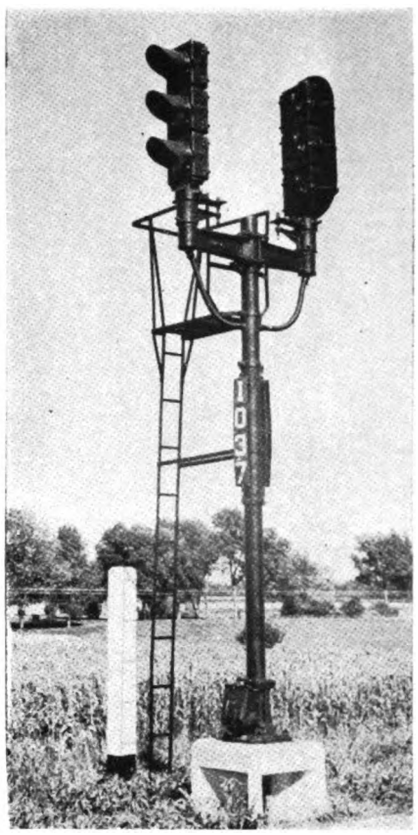
Project includes approximately 150 miles of single track with controlled sidings and 25 miles of double track signaled for either direction operation on each track. Other features are use of snow blowers on all power switches at controlled sidings, and electric locks on all main-track, hand-throw switches

REDUCED OPERATING EXPENSES and increased flexibility of train operation were two of the Great Northern's major reasons for installing centralized traffic control between Delano, Minn., and Breckenridge. This 175-mile project is on the GN's mainline from the Twin Cities to North Dakota and on toward the Pacific Coast. CTC begins at the double crossovers two miles east of Delano, 36 miles west of St. Paul, and includes a 52-mile section of single track from Delano to Atwater, double track from Atwater through Willmar to Pennock (18 miles); single track for 98 miles from Pennock to end of double track at Doran. The double track extends from Doran, 6 miles, to Breckenridge. Also included in the CTC installation is an eastward freight track between Morris and Hancock, which was built several years ago to relieve congestion, thus leaving a 10-mile section of double track about midway between Willmar and Breckenridge. The line traverses generally level country with few curves, and grades are so slight as not to restrict the maximum permissible speeds of 79 mph for passenger trains and 50 mph for freight trains.

Scheduled trains total 22 per day, being divided as follows: three passenger trains each way, six through freight trains each way and two local freight trains each way. Extra trains are operated from time to time as traffic warrants, particularly during the heavy eastward grain movement each fall. Total number of trains may rise to 35 to 40 per day.

More Flexibility Needed at Night

One of the problems facing the GN in this section of the mainline was that of obtaining a greater flexibility of train operation, particularly during the night hours when many local operators are not on duty. For instance, two mainline passenger trains and two through freight trains make 14 meets in this territory between midnight and 8 a.m. Because of the relative scarcity of "open" offices



Double-track automatic signals have one head mounted to left of track it governs

during this midnight to 8 a.m. trick, the dispatcher had no means for changing train order soon enough to advance one train if some other trains lost time. As a result, freight trains often experienced considerable delay. This delay problem was further aggravated each fall by the heavy grain movement eastward. Thus to provide greater flexibility, relieve congestions and train delays enroute, the GN decided to install CTC on this important mainline section.

Double-Track CTC

When planning this CTC installation, a decision was made to retain existing sections of double main track between Atwater and Pennock, and Morris and Hancock, so that the dispatcher could use these sections to run faster trains around slower ones. During the heavy fall grain movement, this flexibility of operation is essential. However, to fully utilize these sections of double track, the GN installed reverse signaling on each track, which enables trains to run in either direction on either track. Furthermore, a double crossover was installed approximately three miles from the end of double track at Atwater. In the Morris-Hancock section, where an eastward freight main provides double track operation with the main line, double crossovers were installed at approximately the mid-point of this 10-mile section. At the east end of the project, double crossovers were installed two miles east of the end of double track at Delano. These crossovers and their associated signals are controlled by the dispatcher, which, in effect, provides him with another siding.

At the west end of the project, the end of double track was moved west from Campbell to Doran with enough main track left in place for a siding at Campbell. This move involved the retirement of about six miles of main track.

Controlled sidings have an average capacity of 165 cars on the east end of the project (Willmar to Delano); and 140 car capacity on the west end (Willmar to Breckenridge). Turnouts at controlled sidings are No. 20, designed for 35 mph operation.

The controlled signals on the east end, from Willmar to Delano, are the colorlight type, both high signals and dwarfs. Automatic signals are in pairs, these being colorlight signals. All signals are on pre-cast concrete foundations. On the west end, from Willmar to Breckenridge, the controlled signals are type SA searchlight, high signals as well as dwarf signals. Automatics are paired here, single and double track, and are the colorlight type.

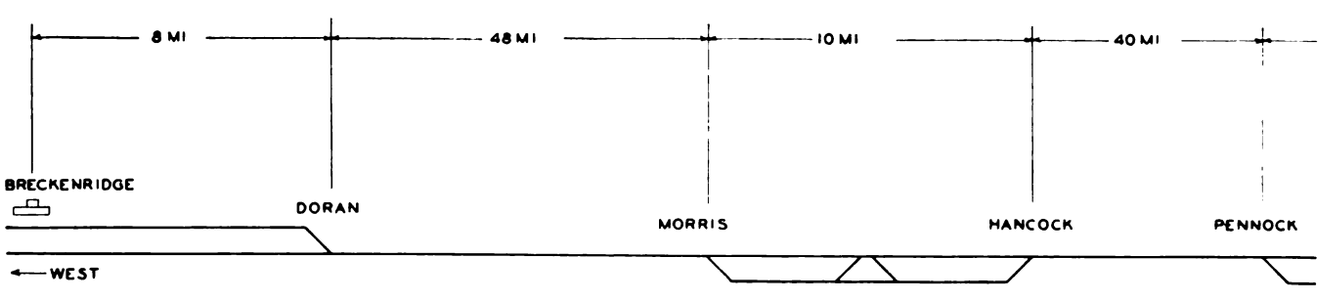
Searchlight leave-siding dwarfs on west end are on galvanized iron foundations

All high signals are mounted on precast concrete foundations, but the dwarf signals are on galvanized iron foundations, made by Line Material Company.

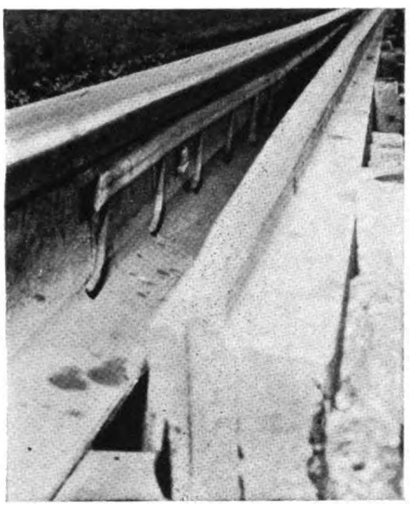
On the section of double track, the intermediate signal heads are mounted back-to-back on the same mast. This practice places the signal for the "left-hand" main to the left of the track governed. The GN secured relief from requirements of the ICC to do this, because with diesel locomotives, the engineer in the cab has a better view of the signal than if it were mounted on a bridge. Placing the signal light units back-to-back eliminated the necessity of erecting bridges.

Fighting Snow with Air

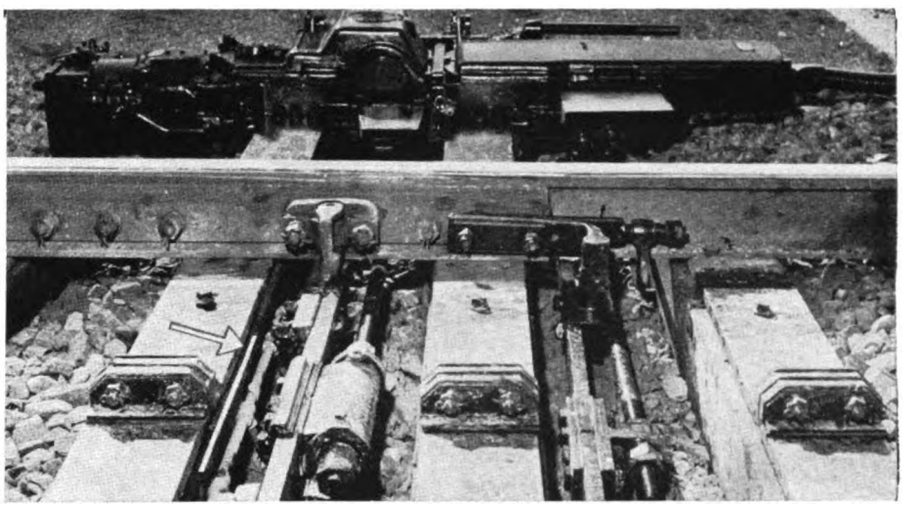
Snow is a perennial problem on this section of the GN's mainline which is effectively combatted, especially at power switch locations, by the use of Racor compressed air snow blowers. Air nozzles, approximately 14 in. apart, are mounted on the gage side of the web of the stock rails at each power switch. Also, nozzles on a branch pipe line are placed so as to blow snow away from the operating rod, the No. 1 switch rod and the adjustment



Double-track sections in centralized traffic control territory are signaled for either direction operation on each track. Sidings of 165 and 140-car lengths are located between these double-track sections



Snow blower nozzles are on stock rail

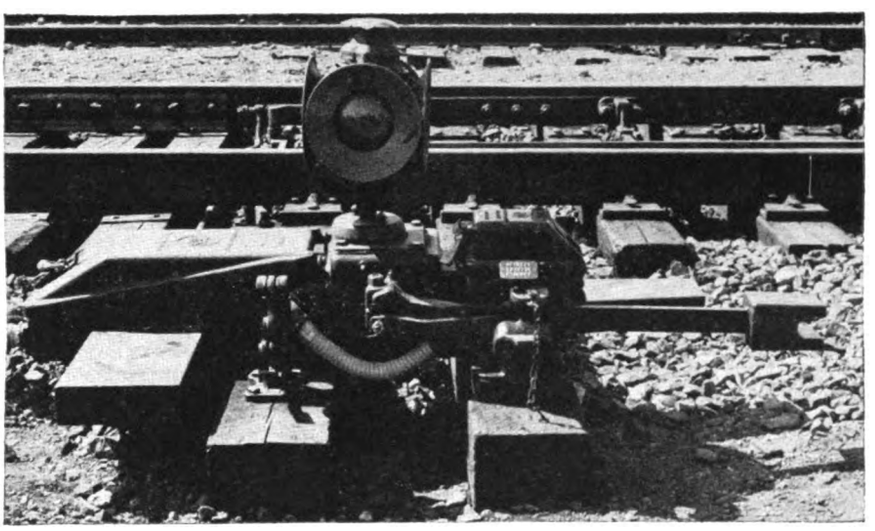


Pipe along line (see arrow) is blower to clear snow away from switch rods

basket. Compressed air at 90 psi is fed into these nozzles, and cycling is such that compressed air is "shot out" every 30 sec. The air is supplied by a compressor, capable of delivering 39.8 cu. ft. of air per minute. The compressor is driven by a 10-hp., 3-phase, 220-volt a.c. motor. These snow blowers are remotely controlled by the dispatcher at Willmar. He raises a toggle, and codes out to the remote location, which starts the compressor motor. When the blower is operating, an indication lamp is lighted on the dispatcher's board.

The compressor and motor are housed in an Armco Steelox, 10-ft. by 12-ft. house near the instrument housing at the end of the siding. To maintain proper operating temperatures in the compressor house (prevent overheating of the motor and compressor), thermostatically controlled ventilation is provided in opposite walls by use of an exhaust fan and intake damper. Commercial power for the snow blowers and related equipment is purchased from available utilities for delivery direct to the buildings.

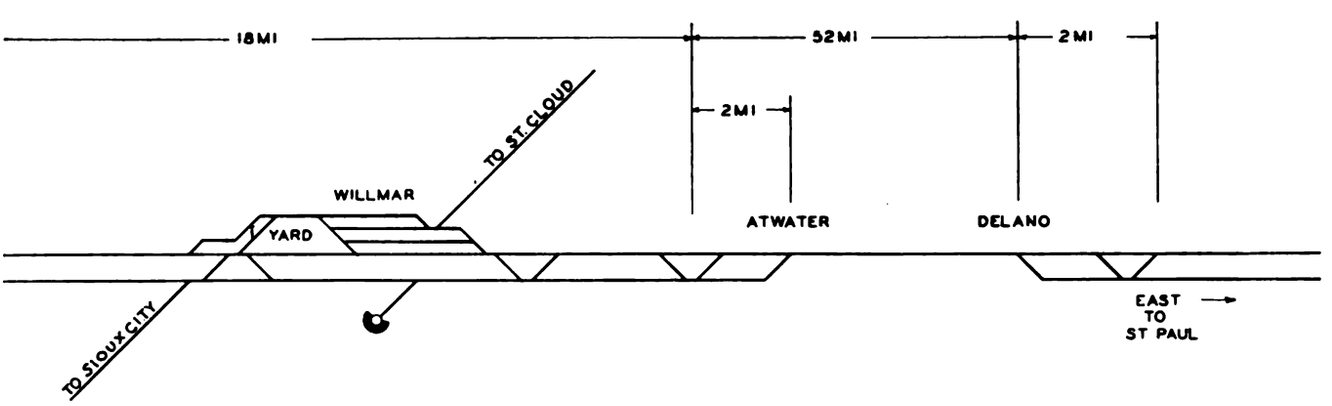
The switches in this CTC project have 30-ft switch points, and the machines are dual-control, low voltage, model 5D having electric heaters in the contact motor and brake compartments. After the machines were installed, the switch plates were painted with Rust-Oleum paint, and the riser plates covered with Dixon's No. 1954 solution. Switch machine battery at each end of a siding is 12 cells of 60-a.h. capacity. Local signal and line batteries include three sets of six cells of 80-a.h. lead storage battery. One cell of 80-a.h. battery is on the OS track circuit. Other track circuits are the conventional d.c. type, having three cells of 500-a.h. primary battery.

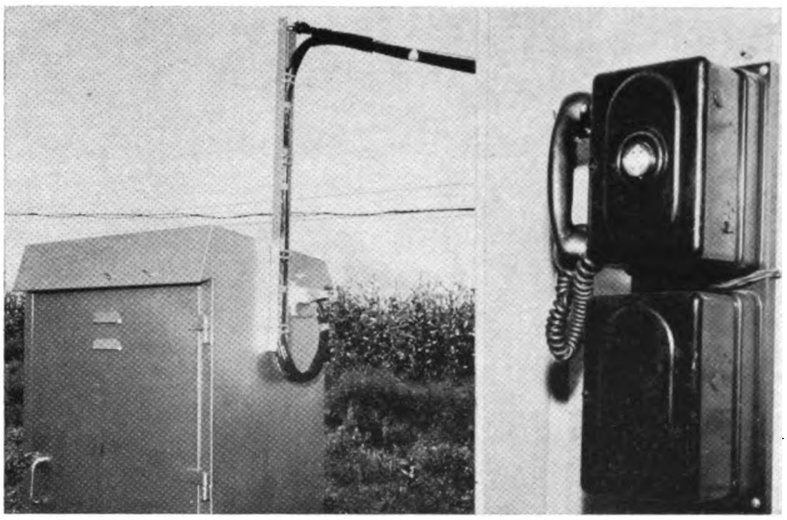


Model 9 hand-throw switch machines were used at some house and industry tracks

Electric Locks on All Hand-Throw Switches

Unlock for the hand-throw switch at an industrial siding, spur or house track is obtained by oc-





Relay case at electric lock location

Phones used at sidings and locks

Recorder for dispatcher's conversations

cupancy of a 100-ft. track circuit in approach to the switch. Model 9B electric locks are used, power being supplied by four cells of lead storage battery. Small steel relay cases are used at electric lock locations, and a 30-in. section of angle iron is bolted vertically to one end of the case. The drop-wire messenger is fastened to the top of this angle bracket and to the pole, thus affording support for the drop wires. These wires come to the top of the bracket, then down the inside of the angle and into the case. They are fastened to the bracket by zinc straps.

The code line is No. 8 Copperweld with Duraline insulation and has 40 per cent conductivity. The signal line circuits are No. 10 insulated Copperweld with 30 per cent conductivity.

Trencher "Digs In"

The Great Northern found that there is an easier and more economical way to dig trenches than by hand. They purchased a Barber-Greene model 702 trencher, and it more than paid for itself on this one project in trenching for underground cable at the power switch locations. Digging a trench 6 in. wide and 40 in. deep, the trencher "shoveled" along at a rate of up to 300 ft. per hr. in the sand and loam soil. Kerite multiconductor cable, with a bronze tape covering, was buried directly, the trench being backfilled by hand.

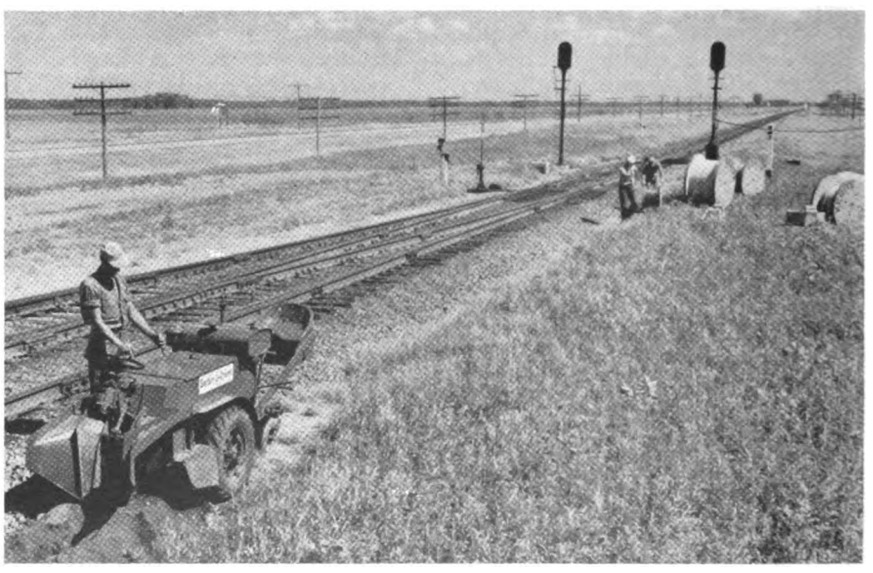
Interlockings Now CTC Controlled

Two interlockings, one at each end of Willmar yard, which includes the junction switches and signals for lines going to Sioux City, Iowa and St. Cloud, Minn., were formerly locally controlled interlockings from separate desk-type machines in the dispatcher's office at Willmar. The control of these interlockings has been incorporated into the new CTC project, and their switch and signal levers and indication lamps are in the new CTC control machine.

An electronic power pack, which operates from commercial power, delivers d.c. to the code line for the west end of the CTC. Should the commercial power fail, an alternator in the machine operates off batteries to supply 115 volts a.c. for the electronic power pack. The code line for the east end is fed by conventional code line battery.

To have a record of the dispatcher's conversations with trainmen and others using the track, such as motor car operators, the GN installed a Soundscriber tape recorder which is connected to the dispatcher's line. The recorder tape is 4 in. wide and one reel lasts 24 hr. The recorder tape is held at division headquarters for about a week, then sent to St. Paul for erasure and re-use. In one instance, playing back the recording resolved a misunderstanding between the dispatcher and a crew out on the line.

Engineering and installation for this CTC project was performed by the GN signal department under the jurisdiction of R. A. Johnson, superintendent of signals. Field work was directed by H. Ottoson, signal supervisor, F. E. Linhoff and R. A. Lehrke, assistant signal supervisors. General Railway Signal Company supplied the signal equipment.



Trencher was used extensively to dig in underground cable at power switch sites