

Centralized Traffic Control Installed on the Alton

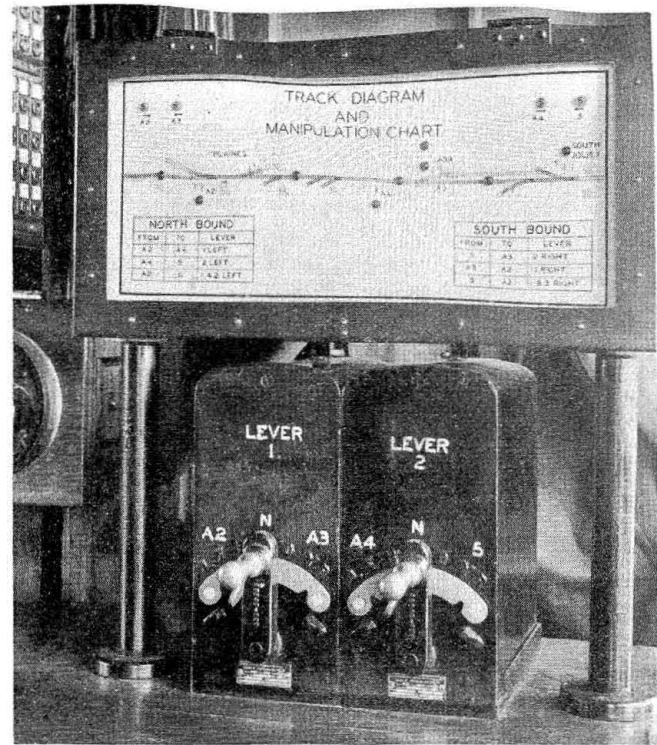
Simple control of signals to direct train movements facilitates traffic

BY installing centralized traffic control, consisting of an arrangement for directing train movements by signal indication on three miles of single track, the Alton has been able to improve train operation and effect a saving in operating expense.

Between Mazonia and South Joliet, 25 miles, the Alton has two single-track lines, the one via Pequot being a low-grade line used principally by through freight trains, while the more direct line is used principally by passenger trains. Between Pequot and Plaines, 16.1 miles, the freight line is parallel with the main line of the Santa Fe, and for a number of years the two single-track lines of the two roads have been used jointly for double-track operation. In this arrangement the eastbound Santa Fe trains returned to the double-track Santa Fe line at Plaines. Likewise, the eastbound Alton trains operated over its own single-track line between Plaines and South Joliet. On the other hand, westbound Alton freight trains were required to enter the Santa Fe double-track at Joliet, and operate on this line to Pequot. This operation was necessary because there was no westbound connecting track between the Alton and the Santa Fe at Plaines. Recently such a connecting track was constructed at Plaines, as shown on the plan below, and, therefore, the Alton can now run its westbound as well as its eastbound freight trains, on its own line between Joliet and Plaines.

The traffic now handled on this section of single-track includes about nine freight trains and one passenger train each way daily, in addition to a switching train which operates on this territory about one hour daily to serve the industries. Therefore, if this territory were operated as single track, under time tables and train order, numerous delays would result. It was, therefore, decided to install a simple arrangement for directing train movements in either direction by signal indication, thus constituting a centralized control system.

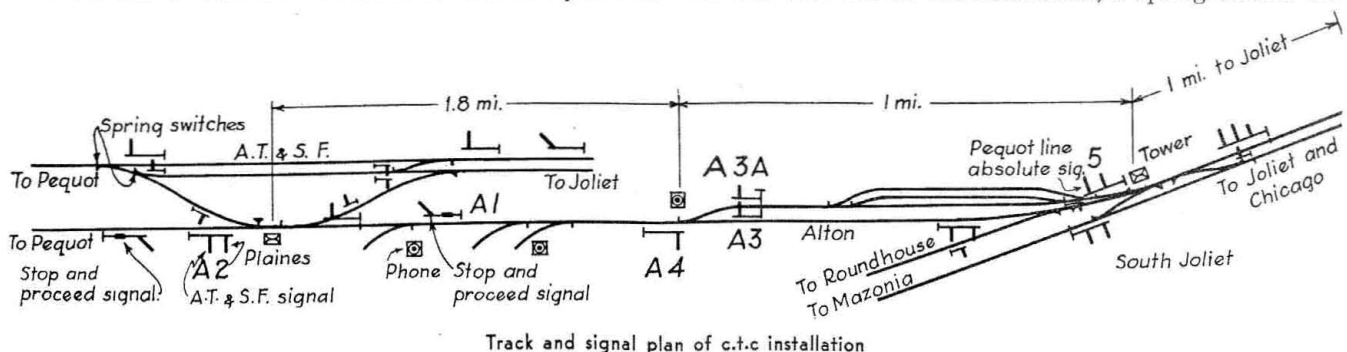
At the east end of this project, South Joliet, the Alton has a 28-lever mechanical interlocking, which includes the crossovers and switches for the junction



The illuminated track diagram and levers are mounted on the operator's desk

of its two single-track lines with the double-track line to Chicago, as well as switches leading to the yard and to the enginehouse. It was, therefore, convenient to locate the control machine for the C.T.C. system in the tower of this interlocking and have it operated by the leverman.

At the west end of the project, Plaines, there is an office with an operator on duty who operates the hand-throw switch, near the office, leading from the Alton track to the Santa Fe main line. A desk-lever control arrangement was also in service in this office for the control of the power-operated switch at the east end of the Santa Fe passing track, as well as to control the various signals. When the new westward connecting track between the Alton and the Santa Fe track was constructed, it was arranged for this operator to operate the hand-throw switch at the east end of this connection, as it was also located near the office. In order to prevent this switch from being reversed when a westbound Santa Fe train is approaching, an electric switch-lock was installed, the control of which extends for two full automatic blocks on the westbound Santa Fe tracks. At the west end of this connection, a spring switch was



Track and signal plan of c.t.c. installation

installed for the main line switch as well as for the Santa Fe passing-track switch.

With this track layout and means of operating the switches, the next problem was to arrange the signals for directing train movements. At South Joliet, westward interlocking signal No. 5 was previously used to direct trains on the main line. As this signal was properly located to be used for directing train movements, the top mechanically-operated arm was replaced by a motor-operated semaphore, and the controls were revised to include the C.T.C. control features required.

Another problem was introduced by the fact that a large percentage of the freight trains stop at the South Joliet yard to pick up and set out cars. Furthermore, the track just north of the main line in this yard is used as a passing siding. In view of these conditions, some arrangement was necessary to protect and to direct train movements when entering or leaving the main line via the switch at the west end of this yard. Therefore, as shown on the plan, an eastward and a westward absolute signal, as well as an absolute signal leading off of the passing track, were installed at this switch, the two westbound signals being located on a cantilever bridge. The use of these controlled signals results in the block between South Joliet and Plaines being cut in two sections, which has proved to be a decided advantage because a westbound train can be started out of South Joliet while an eastbound train is going from Plaines to the west switch. Trains can thus meet and pass under full automatic-block protection and with the movements directed by signal indication.

At Plaines, the eastward home signal *A2* has two arms, the top arm governing to the Alton single track, while the lower arm governs over the diverging route leading to the Santa Fe. In order to use the top arm of this signal to direct train movements as a part of the new C.T.C. system, the control was revised, the new feature being that the control of the proceed aspect depends also on the position of the C.T.C. lever at South Joliet.

It should be noted that all of the absolute signals used for directing train movements are semi-automatic, the control being selected through track circuits and switch circuit controllers in the usual manner, thus retaining the automatic safety features of control, onto which is incorporated the C.T.C. control of the proceed aspects.

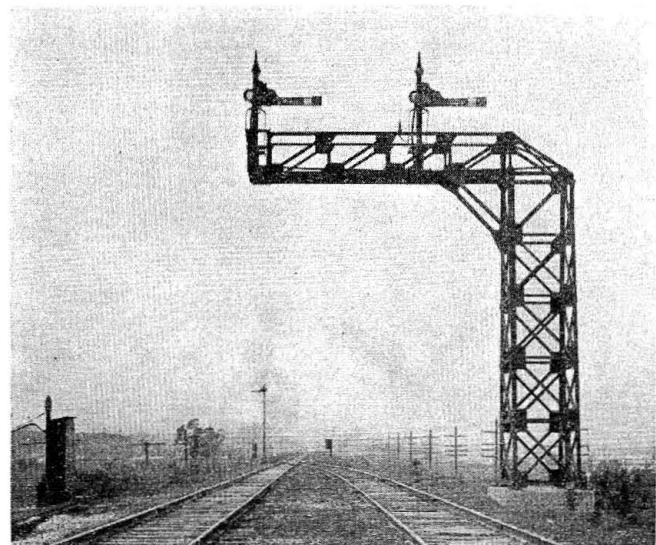
In order to accommodate the switching train, a telephone is located at each of the main spur-track switches. When a train leaves the main line to serve some industry, it cannot again return to the main line or throw a switch until the conductor calls the leverman at South Joliet and gets permission to do so.

The Control Machine

As shown in the illustration, the C.T.C. control machine, in the tower at South Joliet, consists of two G.R.S. desk levers and illuminated track and signal diagram. Each lever operates to three positions, being normally on center. When lever No. 2 is thrown to the left, it controls signal *A4* and when thrown to the right it controls opposing signal 5. Likewise, lever 1 controls signal *A2* and *A3*. The position of the west yard switch selects between the signal on the main line, *A3*, and the one on the siding, *A3A*. It should be noted that as a lever in one position controls one of two opposing signals, the interlocking between the two signals is thus accomplished automatically, because a lever, of course, can be in only one position at any one time. There is, therefore, no mechanical locking

or electric locks on the levers, the leverman being able to operate them at any time he sees fit. Direct stick locking is used; when a signal is cleared, a stick relay is dropped and if a train does not accept the signal, a time release, set at two minutes, must be operated to effect a release. The fact that the stick control is set up is indicated by the illumination of a small lamp marked "S," one such lamp being provided on the diagram for each signal. Each lamp has an arrow indicating the direction in which traffic is set up. As an indication that a signal has cleared, to correspond with the position of the lever, there is a small green lamp adjacent to the symbol representing each signal on the diagram.

When lining up for a westbound train, the interlocking must, of course, be lined up to clear signal 5, and lever No. 5 in the mechanical interlocking is reversed. However, the signal does not clear until the lever in the C.T.C. machine is thrown. Likewise, when



Signals located at west end of Alton passing track

an eastbound Alton train approaches Plaines, the operator at that station operates his lever, controlling signal *A2*. An approach light and annunciator is provided on the C.T.C. diagram so that the leverman at South Joliet is informed of the approach of the train so that he can also operate his C.T.C. lever and then signal *A2* will clear. The annunciator for the South Joliet board is selected through the controller on the switch at Plaines, so that only Alton trains are announced, provided the operator at Plaines has the switch lined up before the train enters the annunciator circuit. Telephone communication between the two offices is available to convey information, if necessary, when arranging for line-ups. In addition to track-occupancy lamps on the diagram and annunciators for all approaches, lamps are provided for all track sections between South Joliet and Plaines so that the leverman knows the location of all trains on the territory. The leverman at South Joliet keeps a train sheet to record the time each train passes South Joliet and Plaines.

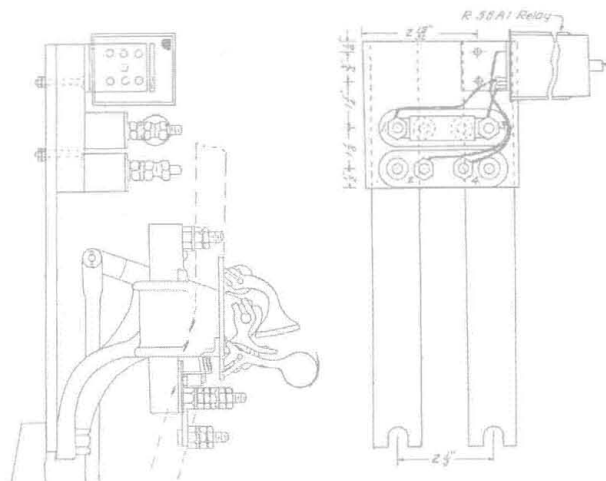
As a result of the construction of the new connecting track at Plaines and the installation of the C.T.C. for directing train movements, the Alton has not only reduced operating expenses but has also expedited the movement of its trains. One item of expense eliminated was the payment for the use of the Santa Fe track for westbound Alton freight trains between Joliet and

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battery was again renewed on August 21, 1933, thus rendering a life of 443 days.

Economies Effected

Based on the average of 280 days' life, the battery had delivered 47 per cent of its capacity when the test was started. The balance of the battery capacity—265 a.h., with the battery saving scheme in service, lasted 311 days—a daily average discharge of 0.852 a.h. On the basis of the best previous life of 314 days, which is a daily average of 1.592 a.h., the net saving per day due to the



Sketch showing mounting of special equipment on a base-of-mast Style-K signal

new arrangement is 0.74 a.h., or 270 a.h. per year, or 135 a.h. per signal per year. Neglecting labor, store expense, etc., and allowing a net material expense of renewal at \$1 per cell, the annual saving per signal when operated

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by an 18-cell battery is $\frac{135}{500} \times \$18 = \4.86 . For a sin-

gle location battery of 16 cells the annual saving is \$4.32.

As a result of the success of the test, authority has been issued to equip all of the signals of this type on the system, and it is estimated that the average saving per signal for the system will be \$4.66. The battery saver unit has been designed for shop assembly and very little labor in the field is required for installation. The total cost of equipping a signal is approximately \$8.49. This nets a ratio of saving to investment of 54.8 per cent.

Equipment Required

During the development and testing of this system of battery saving an Automatic Electric Company Type-R58A1 telephone-type relay was used with satisfactory results. The resistor is a Ward Leonard 500-ohm unit. The relay, resistor and a porcelain-based terminal are mounted on a piece of wood $\frac{3}{4}$ in. thick, 4 in. wide and $3\frac{7}{8}$ in. high. This block is supported by two strap iron brackets $\frac{1}{4}$ in. thick, $1\frac{1}{4}$ in. wide and $10\frac{5}{8}$ in. long. These strap brackets are set in behind the cast-iron bracket, which holds the circuit controller on the top of the signal mechanism, it being necessary to replace the old cap screws with new ones $1\frac{1}{4}$ in. long.

The idea of using a slow-release telephone-type relay is being incorporated in battery saving arrangements for application to other types of signaling equipment, and these other arrangements will soon be ready for test.

C. T. C. on the Alton

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Plaines. Furthermore, under the previous arrangement, cars in the South Joliet yard, that were to be sent westward, had to be handled by a switch engine back to Jackson Street yard in Joliet. On account of the adverse conditions of track layout and grades, as well as delays occasioned by getting through the interlockings, a westbound Alton freight train usually lost about 30 min. in picking-up and setting-out cars at the Jackson Street yard. With the new arrangement, cars can be set-out and picked-up at the South Joliet yard in about 10 min. Thus a saving of about 20 min. is made for each westbound Alton freight train. Furthermore, the transfer of cars back and forth between South Joliet and the Jackson Street yard has been eliminated.

The operation of trains by signal indication under the C.T.C. arrangement has been highly satisfactory, the system being so flexible as to permit movements to meet conditions as they arise with a minimum of delays.

The line control circuits for this installation are simple; a two-wire circuit extends from the tower to Plaines to control the HD relay of signal A2, and another such circuit is used to control each of the HD relays for signals A4 and A3. The diagram lamps indicating the position of each of these signals is controlled through a G.R.S. Type-W relay at the South Joliet tower connected in series with the line circuit. A line circuit operating a retained-neutral polar relay is used to convey indications of the approach of Alton trains at Plaines, as well as the indication of track occupancy between Plaines and the west yard switch.

Between Plaines and the west switch, these circuits are in open lines, using No. 10 Copperweld wire with weather-proof covering. Between the west switch and South Joliet tower, a 16-conductor Okonite aerial cable was installed, this being carried on the pole line and suspended by Western Railroad Supply Company cable straps from a stranded messenger. All cable wires coming into the tower are terminated on Premier No. 3 W.R.S. Co. arresters.

At the time the C.T.C. was installed, the wiring of the South Joliet interlocking was overhauled and all the relays and battery were located in a new cabinet in the lower floor of the tower. The relays are of the wall type with spring suspension.

A set of five cells of Exide EMGO-5 lead storage cells is used for the C.T.C. line circuit. As a part of the reconstruction, a new central battery of 6 cells of Exide EMGO-7 type battery was provided for operation of all of the electrically-operated semaphore signals on the mechanical interlocking. This idea of using one battery for this purpose, with No. 6 copper wire to the various signals, eliminates the necessity for a separate battery at each home signal location, and also effects economies in charging.

In order to charge the batteries mentioned, a new Union Type-W-20 transformer was installed, together with Union RX-11 rectifiers. Each storage-battery circuit is fused to protect the battery in case of an accidental short circuit.

The desk levers used for the C.T.C. control, as well as the signals and relays on this installation, are of General Railway Signal Company manufacture. The illuminated track diagram was made by the Alton signal department, using Western Electric No. 13 switch-board lamp sockets, equipped with No. 2 lamp and lamp caps. The installation was planned and constructed by the signal forces of the Alton.