Military Railway

Cpl. T. D. Murphy, Wabash, Neb., M. P., left and Cpl. M. C. Emery, La Junta, Col., A. T. & S. F., work on mechanism and circuit controller, respectively, of a semaphore home signal at Tower "X" interlocking

ALLIED FORCE HEADQUARTERS, ITALY —The Military Railway Service of the Transportation Corps, U. S. Army, under the command of Brigadier General Carl R. Gray, Jr., in collaboration with the Italian State Railways, has installed an electric interlocking at a junction point and end-of-double-track layout somewhere in Italy. Designated as "X" interlocking, the plant includes hand-throw switches, semi-automatic signals, interlocking machine, and allied control apparatus. The interlocking was installed for the principal purpose of increasing the safety of operation of train movements through the layout, which was formerly handled by switch tenders, and through which train movements were governed by hand, flag and lamp signals.

Hand-Throw Switches

All switches in the layout, namely *w, x, y* and *z,* at "X" interlocking are operated by hand-throw switch stands, and are provided with key-type mechanical locks and switch circuit controllers. One lock and key, as well as one circuit controller, is provided for each position of a switch, namely, Normal and Reverse, except for switch *w,* which is provided with a Normal position lock only. The locks on the switches are located on the outside of the running rail webs in line with the ends of the switch points. The keys must be removed from the switch locks on the switch points, in accordance with the position of the switches, and inserted in their respective key spaces in the interlocking machine before the associated semi-automatic signals can be cleared.

Interlocking Machine

The interlocking machine is made up of unit-type signal control levers and key spaces. The machine, which is the standard type of the Italian State Railways for such installations, consists of four signal control levers of the handle type, controlling six high home signals and two dwarf signals, as well as one handle-type lever for electric release locking between "X" and "Y" interlockings to prohibit the clearing of opposing signals simultaneously, such as Signals 5 at "Y" interlocking and Signal 4L at "X" interlocking. In addition to the signal control levers, the machine includes seven key spaces and one spare key space.

The signal control levers are the three-position type, Normal, Left and Right. Levers in the Left and Right positions control home signals governing train movements in the corresponding directions. The levers, when moved, operate circuit controllers in the machine, which open and close various electrical circuits corresponding to the lever positions. Generally, the circuits are closed and opened over double contacts as an extra safety feature. All signal control levers are provided with an electric lock and two lock indication lamps, arranged vertically above the lever.

In clearing a signal, providing the interlocking track sections are unoccupied, and other circuit conditions permit doing so, the lever is moved to the left or right indication position, at which time the top light is lighted, indicating that the lever has been unlocked by this movement, and may be moved to the full Left or Right position to clear a signal or grant a release to "Y" interlocking. In restoring a lever to the Normal position, the lever, similarly, is moved from the full Left or Right position to another indication position, which, if the track sections are unoccupied and other circuit conditions permit, will result in the lower lock indication lamp being lighted, indicating that the locking has been released, and that the lever may be restored to the Normal position. Thus it can be seen, that once a signal has been cleared and accepted by a train, the lever cannot be restored to the Normal position until the train has cleared the track section and other circuit conditions permit doing so. However, once a signal has been cleared for a train movement but not accepted, the signal may be restored to the normal position by breaking the

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Service in Italy Installs Electric Interlocking

Hand-throw switches are locked with keys which are inserted in interlocking machine to release signal levers

seal on the lever lock and picking the lock. With this type of Italian interlocking machine, time releases are not used.

The key spaces of the interlocking machine are used in providing the necessary safety features between the signal control levers, signals and switches, since there are no direct physical connections, either electrical or mechanical, between the interlocking machine and the track switches to effect locking of the switches other than the key-type mechanical locks and keys. The key space circuit controllers in the interlocking machine function by insertion of the keys and turning the same instead of by a lever handle as in the case of signal control levers. The key spaces have two positions, namely, Normal, with the keys out of the interlocking machine and in the switch locks, and the Reverse position, when the keys are in the lever spaces of the interlocking machine and rotated, thus guaranteeing the positions of the switches to which the keys correspond, and also in which positions the switches are locked. The key spaces are provided with electric locks, prohibiting removal of the keys from the spaces when switches and track sections are occupied, etc.

The signals are the standard lower left-hand quadrant semaphore type of the Italian State Railways, with the exception of Signals 2 and 5, controlled from "Y" interlocking at B,

Above—Sgt. C. K. Boyles, left, of Boone, Iowa, formerly with the C.&N.W., and Cpl. T. D. Murphy, of Wabash, Nebr., formerly with the M.P., shown testing cables with a megohmmeter at a junction and terminal box at Tower "X". Left—Pvt. R. J. Gallaher, left, Parma, Idaho, formerly with the U.P., and Pvt. W. T. Suttie, Rensselaer, N. Y., formerly with the N.Y. Power & Light Corp., check a switch circuit controller (directly under hand of Pvt. Gallaher) key-type, mechanical lock (in front of switch circuit controller), and switch point

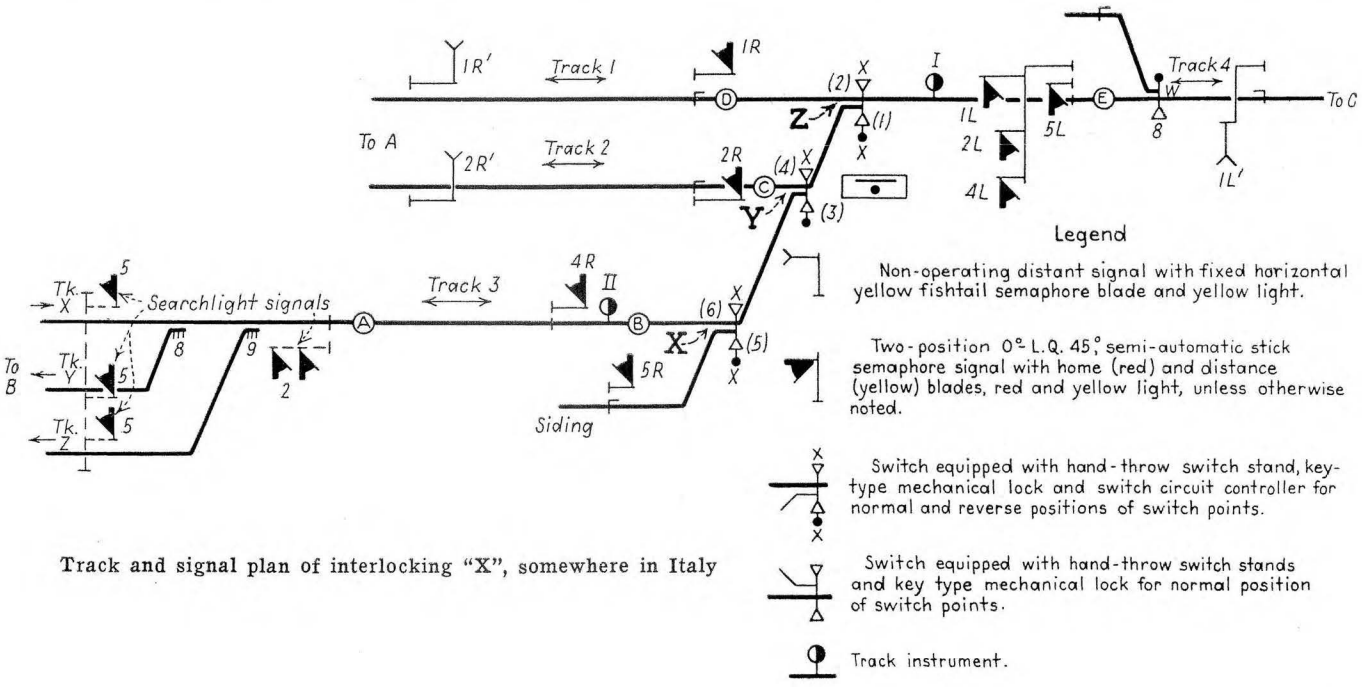
which are the continuously-lighted color-light searchlight type. Home unit arms are painted red with a white stripe, and distant unit arms are painted yellow with a white stripe. The backs of both home and distant signal arms are painted white with a black stripe. Generally, when home and distant signals are mounted together they are not placed one above the other, but they are placed behind each other on the same mast, the distant arm being behind and visible only when the home arm is cleared. Dwarf Signals 5R and 5L at "X" interlocking are the standard target type of the I.S.R. All signals, that is the semaphore and target signals are provided with two 15 watt, 150 volt lamps. Arrangements are provided to convert each signal to oil lighting in a period of two minutes per signal.

All home signals are semi-auto-stick in operation, and are located on the left-hand side of the track in conformity with Italian practice, left-hand operation being in effect in Italy. Signals 2R and 2R′ are exceptions, since space limitations between tracks prohibited the placement of signals in conformity with this practice.

Aspects and Indications

Three distinct indications are conveyed by various aspects. The aspects and indications are shown on the accompanying diagram, and include Stop, Restricting and Approach, Fig. 1, 2 and 3, respectively. The Stop signal is an absolute Stop signal. The Restricting signal authorizes a train movement at restricted speed, proceeding prepared to stop short of a train, obstructions, or anything that may require the speed of the train to be reduced. The approach signal authorizes a train movement, approaching the next signal prepared to stop, but not exceeding 30 kilometers (18 miles) per hour.

Signal 1R governs train movements from Track 1 to Track 4, normally displaying Stop, Fig. 1a, and Approach, Fig. 3a, when cleared. Distant Signal 1R′ governs train movements on Track 1 up to Signal 1R. This signal normally displays Approach, Fig. 3b, and is fixed in that position. Signal 2R governs from Track 2 to Track 4, normally displaying Stop, Fig. 1a, and Approach, Fig. 3a, when cleared. Signal 2R′ governs train movements on Track 2 up to Signal 2R, and normally displays Approach, Fig. 3b, being fixed in that position. Signal 4R governs train movements from Track 3 to Track 4, normally displaying Stop, Fig. 1a, and Approach, Fig. 3a, when cleared. Signal 5R governs train movements from the siding, through interlocking limits, to Track 4. This signal normally displays Stop, Fig. 1d, and Restricting, Fig. 2b, when cleared. Signals 4L and 2L are mounted at equal height to the left of Signal 1L, which is the highest mounted signal on the bridge. Signal 1L governs from Track 4 to Track 1, Signal 2L to Track 2, and Signal 4L to Signal 2 on Track 3, near B.

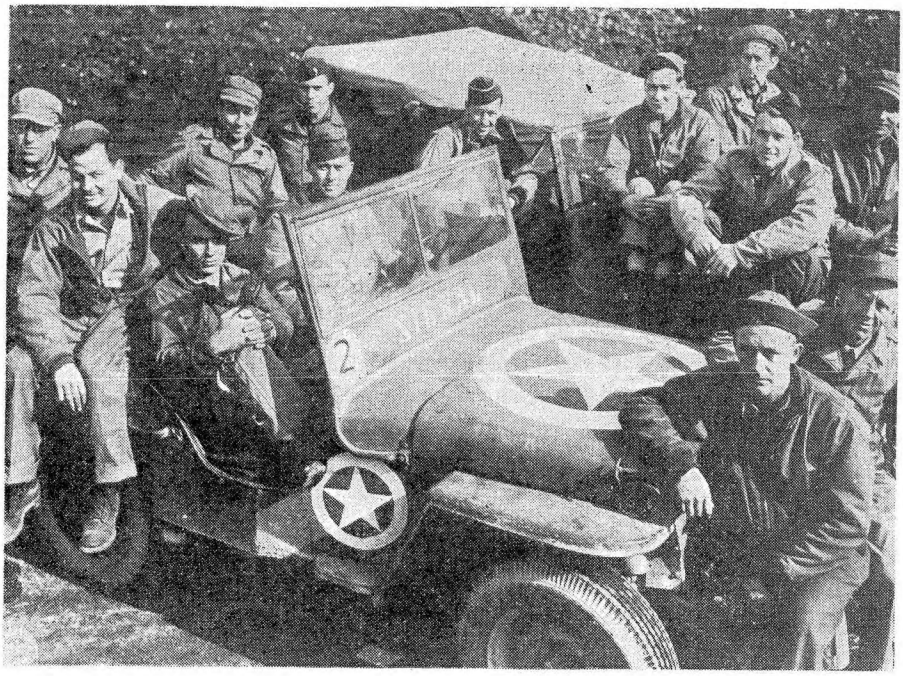


Track and signal plan of interlocking "X", somewhere in Italy

Pfc. M. J. LeMire, left, of St. Paul, Minn., formerly with the W.U.T. Co., and Cpl. M. C. Emery, of LaJunta, Colo., A.T. & S.F., terminating cable

Normal Stop Aspect

All these signals normally display Stop, Figure 1a, and Approach, Fig. 3a, when cleared. Only one of these three signals on the bridge can be cleared at a time. Signal 1L′ is mounted on a cantilever bridge and governs train movements up to Signals 1L, 2L and 4L. Signal 1L′ normally displays Approach, Fig. 3b, being fixed in that position. Signal 2, although not controlled from A interlocking, governs train movements



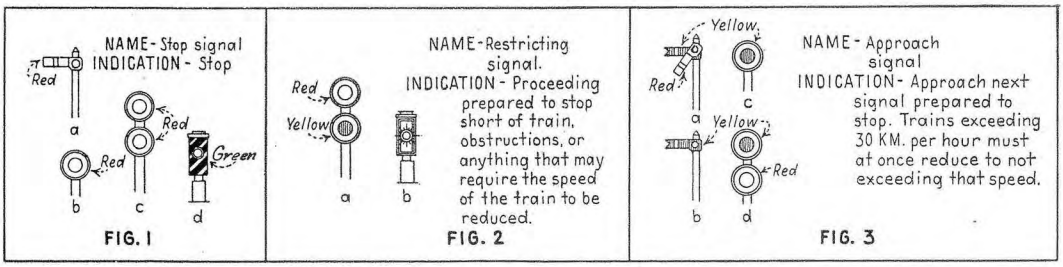
Signal gang which participated in the installation of Tower "X" interlocking. From left to right, Pvt. O. K. Reynolds, Newark, N. J., C.R.R. of N.J. and N.Y. & L.B.; Pvt. W. S. Miles, Boone, Iowa, C. & N.W.; Cpl. M. C. Emery, La Junta, Colo., A.T. & S.F.; Pvt. C. E. Head, Fostoria, Ohio, N.K.P.; Lt. J. B. Smythe, Merion, Pa., P.R.R.; Capt. S. H. Dean, Ft. Madison, Iowa, A.T. & S.F.; Sgt. C. K. Boyles, Boone, Iowa, C. & N.W.; Pvt. L. A. Barham, Estelline, Texas, F.W. & D.C.; Pvt. W. T. Suttie, Rensselaer, N.Y., N.Y. Power & Light Corp.; Cpl. T. D. Murphy, Wabash, Nebr., M.P.; Cpl. R. L. Neikirk, Indianapolis, Ind., I.U.; Pvt. R. J. Gallaher, Parma, Idaho, U.P.; and Cpl. M. J. LeMire, St. Paul, Minn., W.U.T. Co.

over Switches 8 and 9 from Track 3 to tracks *X, Y* and *Z* at *B*. The top arm governs train movements to Track II or Track III, and the lower arm to Track I against the normal direction of traffic. This signal normally displays Stop, Fig. 1c, and Approach, Fig. 3d, or Restricting, Fig. 2a, when cleared. This signal is controlled from interlocking at *B*. Signal 5 governs train movements from Tracks *X, Y* and *Z*, over Switches 8 and 9, and up to Signal 4R at *A*, normally displaying Stop, Figure 1b. When cleared, this signal displays Approach, Fig. 3c. This signal is also controlled from *B*. While Signal 2 is not controlled from "X" interlocking the aspects and indications are mentioned as of interest. With Switch 8 or 9 in the Reverse position, this signal displays Approach, Fig. 3d, when cleared for a train movement to either Track *Y* or *Z*. When cleared for a train movement to Track *X*, with Switches 8 and 9 in the Normal position, this signal displays Restricting, Fig. 2a, such a movement being against the normal direction of traffic on this track.

The following conditions are required to clear each home signal. To clear Signal 1R, Switch *Z* must be Normal, track circuits *B, C, D* and *E* unoccupied, and Signals 2R, 4R, 5R, 1L, 2L, 4L and 5L at Stop. To clear Signal 2R, Switch *Y* must be Normal, Switch *Z* Reverse, track circuits *B, C, D* and *E* unoccupied and Signals 1R, 4R, 5R, 1L, 2L, 4L and 5L at Stop. Switches *Y* and *Z* must be Reverse and Switch *X* Normal, track circuits *B, C, D* and *E* unoccupied, Signals 1R, 2R, 5R, 1L, 2L, 4L and 5L at Stop, before Signal 4R can be cleared. To clear Signal 5R, Switches *X, Y* and *Z* must be Reverse, track circuits *B, C. D* and *E* unoccupied, and Signals 1R, 2R, 4R, 1L, 2L, 4L and 5L at Stop. To clear Signal 4L, Switches *Y* and *Z* must be Reverse, Switch *X* Normal, track circuits *A, B, C* and *D* unoccupied, Signals 1R, 2R, 4R, 5R and 5 (*"Y"* interlocking at *B*) at Stop, as well as be released from adjacent *"Y"* interlocking at *B*. Switch *Z* must be Reverse, Switch *Y* Normal, track circuits *B, C* and *D* unoccupied, Signals 1R, 2R, 4R and 5R at Stop, before Signal 2L can be cleared. To clear Signal 1L, Switch *Z* must be Normal, track circuits *B, C* and *D* unoccupied, and Signals 1R, 2R, 4R and 5R at Stop. To clear Dwarf Signal 5L, Switches *X, Y* and *Z* must be in the Reverse position, track circuits *B, C* and *D* unoccupied, and Signals 1R, 2R, 4R and 5R at Stop. Switches 8 and 9 at *"Y"* interlocking at *B* must be in the proper position before any of the Signals 5 can be cleared as well as the track sections between Signals 5 and 2 and track circuit *A* unoccupied, and Signals 2 (B) and 1L, 2L and 4L *(A)* at Stop, and released from *A* interlocking. While Signal 2 at *"Y"* interlocking is not controlled or affected by *"X"* interlocking, the clearing conditions are mentioned as a matter of interest. To clear the upper arm of this signal, Switch 8 or 9 must be in the Reverse position and the allied track circuits unoccupied. To clear the lower arm, both Switches 8 and 9 must be in the Normal position and the allied track circuits unoccupied.

Track Circuits

Five track circuits are involved in the interlocking layout, namely, *A, B, C, D* and *E*. All the track circuits are the single-rail alternating-current type, with the exception of *A* and *B* track circuits extending between Signals 4R (*"X"* interlocking) and 2 (*"Y"* interlocking) and between Signals 1R, 2R, 4R, 5R and 1R′, respectively. Attention is called to the fact that 500 meters is the maximum length for single-rail track circuits in accordance with standard Italian practice. Track circuits exceeding the above mentioned length are the dou-



Aspects and indications of signals

ble-rail type. All track circuits, regardless of whether they are double-rail or single-rail, are fed through a variable resistance by a 150—6-8-10 volt step-down track transformer at the exit end of the track section. The track relays are the F.S. (Italian State Railways) d-c neutral type, being connected to the opposite end of the circuit with a variable resistance, 4-8 volt and 8-16 volt step-up transformer and rectifier in series.

Hydro-electric treadle-type track instruments I and II, on track circuits *D* and *B*, respectively, are used in addition to the track circuits in connection with the release of the lever locking.

The rails are of 36 kilograms per meter stock. Rail joints are bonded with stranded copper-conductor weld-type railhead bonds, plug-type rail head bonds with stranded copper conductor and a 10mm plug, as well as with 4mm galvanized bond wire with 8mm single galvanized iron channel pins.

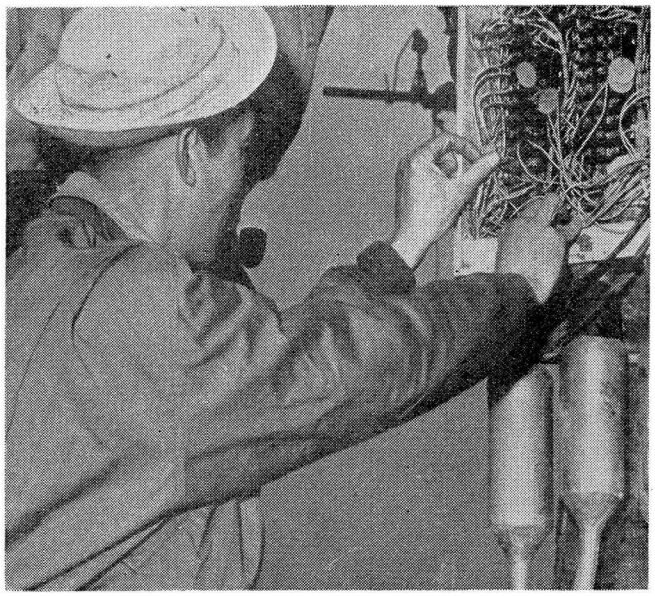
Power Supply

The storage battery for stand-by at the interlocking is the Italian State Railways' Type-A, generally used for car lighting purposes, and consists of three units on charge from a copper-oxide rectifier. One battery, for signal operation, consists of 72 lead-acid cells, rated at 144-volts, 125-130 a.h. A second battery, also of the lead-acid type, consists of 24 cells, rated at 48 volts, 125-130 a.h. This battery is used for lever locking circuits. A third battery, likewise of the lead-acid type, consists of six cells, rated at 12-volts, 125-130 a.h., used for signal control and other relay circuits.

Underground Cables

All outside circuits in the interlocking are in underground cables run in pre-cast-concrete cable troughs. This cable consists of 2, 4, 8, 12 and 16 conductors, covered, from inside to outside, with a lead sheath, gum as a protection against electrolysis action on the lead sheath, and jute on the outside. The conductors have a diameter of one millimeter, which is standard on the Italian State Railways for 12-144-volt circuits extending up to 2,000 meters from the point of origin.

This interlocking was placed in service under the direction of Colonel Benjamin H. Crosland, Chief Engineer of the Military Railway Service, and formerly division engineer of the St. Louis-San Francisco at Fort Scott, Kan. The circuits and plans for the interlocking were prepared in the office of division signal engineer of the Italian State Railways, in collaboration with the office of Major F. J. Murphy, Signal and Communications Engineer of the Military Railway Service. Major F. J. Murphy, formerly assistant signal supervisor on the Sopkane division of the Great Northern at Seattle, Wash., was assisted in his work by 2nd Lt. Maurice Peacock, Jr., Wyncote, Pennsylvania, formerly associate editor of *Railway Signaling*, Sgt. Joseph A. Chesmar, Bronx, New York, formerly a maintainer on the New York Central at Harmon, N. Y., Sgt. Buhler L. Ellis, Opheim, Mont., formerly a signalman on the Spokane division of the Great Northern at Seattle, Wash., and Cpl. Theodore C. Seifert, Jr., Chicago, formerly with the Western Railroad Supply Co. Interlocking construction and installation work was carried out by the regular division signal personnel of the Italian State Railways and the regular Signal Section forces of the 713th Railway Operating Battalion, under the supervision of Captain S. H. Dean, Assistant Engineer, Signals, 703rd Railway Grand Division, and Lt. J. B. Smythe, Signal Supervisor, 713th Railway Operating Battalion. Captain Dean, of Ft. Madison, Iowa, was formerly with the Atchison, Topeka & Santa Fe, while Lt. Smythe, of Merion, Pa., was in the office of general manager, Eastern region, of the Pennsylvania, at Philadelphia, Pa.



Pvt. W. T. Suttie, Rensselaer, N. Y., formerly with the N.Y. Power & Light Corp., works on terminal box at Tower "X" interlocking

Signal Men in 713th Battalion

Other members of the 713th Railway Operating Battalion who participated in the installation and construction of this interlocking include 2nd Lt. James T. O'Neil, Signal Officer, of Topeka, Kan., formerly a division lineman for the Santa Fe; Sergeant Charles K. Boyles, of Boone, Iowa, formerly in the signal department of the Chicago & North Western on the Iowa division; Robert L. Neikirk, of Indianapolis, Ind., formerly a maintainer in the signal department of the Indianapolis Union; and Cpl. Madison C. Emery, of La Junta, Colo., formerly in the signal department of the Santa Fe at Clayton, New Mexico. Other participants in the work include Cpl. Thomas D. Murphy, of Wabash, Neb., who was with the Missouri Pacific before entering the army; Cpl. M. J. LeMire, of St. Paul, Minn., formerly with the Western Union Telegraph Company on equipment installation; Pvt. Ray J. Gallaher, of Parma, Idaho, Wyoming division of the Union Pacific; Pvt. William S. Miles, Boone, Iowa, West Iowa division of the Chicago & North Western; and Pvt. Ellsworth Martin, Troy, N.Y., Western Electric.

Men from Various Railroads

In addition to these are Pvt. Mark D. Furnas, of Joliet, Ill., who prior to entering the army, was with the signal department of the Elgin, Joliet & Eastern; Pvt. William T. Suttie, Rensselaer, N.Y., New York Power & Light Coropration; Pvt. Orville K. Reynolds, of Newark, New Jersey, who prior to his going into the army, served in the signal department of the Central Railroad of New Jersey on the Southern sub-division and the signal department of the New York & Long Branch; Pvt. Leon A. Barham, of Estelline, Tex., Fort Worth & Denver City; and Pvt. Carl E. Head, of Fostoria, Ohio, who was with the New York, Chicago & St. Louis before entering the army.