from the standpoint of minimizing the amount of body movement required of the dispatcher for his voice to be picked up properly by the microphone?"

On Adjustable Arm

By T. E. BINYON

Telegraph & Telephone Engineer
Pennsylvania, Pittsburgh, Pa.

CENTRALIZED traffic control type machines in block stations are equipped with a Type-50B transmitter arm, Type 635-B carbon transmitter and panel-mounted loud speaker. The Type-50B adjustable arm permits the transmitter to be placed in any desired position without obstructing the view and the operation of the C.T.C. machine.

UNUSUAL TROUBLE

"What is the most unusual case of signal or communication trouble which has come to your attention in recent months? Please explain the nature of the difficulties and how they were remedied."

Some Interesting Instances In Communications

By T. W. BURNS

Relay Manager & Wire Chief
Missouri Pacific, Poplar Bluff, Mo.

THERE are no unusual cases of communication trouble. As a wire chief of long experience, I have encountered practically every kind of trouble imaginable. The circumstances in connection with the trouble may be out of the ordinary, but the trouble itself is one of the "standard" causes. I would like that distinction to be emphasized.

To take nothing for granted, I was talking to Piedmont station one time on a simplexed message phone circuit when it went noisy. I told the operator at Piedmont to give me an open on the far side and say when. The noise cleared, and the operator at Piedomnt advised that he had the circuit open on the north or far side, with so little loss of transmission volume resulting that, if I thought at all, I assumed he was standing up and not close to his transmitter. I sent the lineman north from Piedmont, when actually the trouble was one side broken about 0.8 mi. south of Piedmont, with both ends lying on dry dead weeds. I failed to use the voltmeter in the simplex jack, in addition to making a listening test. How it talked clear, I still do not know.

At three different times, a Morse circuit would lose its battery in my office, this being over a period of a couple of weeks. I checked fuses, opened jacks, etc., and finally, in desperation, began tracing the wires in the circuit and pulling on every one I could get my hands on, eventually locating the trouble in a solder joint on a switchboard jack. The solder was solid, but there was a bubble inside the blob, and the wire was loose. It could be pulled away from the jack or returned without disturbing the appearance of the joint at all. On another occasion, I found a grasshopper-type fuse on a carrier repeater open without the fuse having extended itself when it blew. This was the one and only time I have known such fuses to act that way.

At another time, I had a bank of condensers on a dispatcher's phone circuit begin to go bad. The phone would function satisfactorily for perhaps an hour or so, then, when the dispatcher had to ring several stations one after the other—blewey. It was merely routine to determine the location of the trouble. Then, the way it acted indicated what it was. I had a similar case of trouble with a set of direct-point repeaters on a teleprinter circuit once. Until a coil in one of the polar relays became heated, the circuit was all right. After in use from 30 min. to an hour, false characters would come in. A test of the relays after the failure determined the defective one.

In another instance, lightning entered the office on a Morse circuit, blowing the 30-amp. main fuse and burning up a Morse relay on a local circuit, without blowing the 0.8 amp. fuse protecting that circuit. This comes as near being an unusual case of trouble as anything I can remember.

My policy is to believe that anything is possible, and that more than one test should be made with every case of trouble if at all possible, or make the one test in a different manner, so as to get a double check on the trouble, and you will stay away from difficulties. Looking for trouble means exactly that—not just glancing around. Take hold of the wire where it is soldered to the equipment. Actually touch the piece of equipment itself, and excess heat or lack of heat will locate the trouble in many cases. Just because a tube seems to be burning properly, do not fail to put it on test and be sure about it.

On Carrier Circuit

By R. M. LAURENSON

Communications Engineer
St. Louis-San Francisco, Springfield, Mo.

THE following case of trouble is one of those examples which, after the cause and cure are found, can be embarrassing to those involved. However, it does demonstrate one of the reasons why the installation of communication equipment is seldom dull.

The Frisco has installed a single-channel carrier from Tulsa, Okla., to Fort Worth, Tex., with back-to-back terminals at Francis, Madill and Sherman, and with a speech-plus-carrier printer channel superimposed on the voice circuit. The printer carrier bypasses Francis and Madill with a back-to-back printer drop at Sherman. Originally, the back-to-back connections were made on a two-wire basis. However, because of the number of hybrid coils, and also because of the separation filters necessary to divert the printer carriers, the over-all loss to voice transmission was more than could be tolerated. In order to eliminate that part of the loss, due to separation filters, it was decided to connect the speech-plus equipment on a four-wire basis, thus removing the separation filters from the two-wire voice circuit. During system line-up, a good talking circuit was obtained. However, when the printer carriers were added, it was found that they introduced considerable noise and distortion into the voice circuit. We went through the usual procedure of trying to localize the trouble and testing the multitude of components involved, and discovered that the printer carrier was arriving at the receiving terminal particularly at Tulsa, at such a very high level that the demodulator was badly overloaded. Further work showed the logical reason for this high level.

In lining up the system, we have made level adjustments on the voice circuit, which includes the loss from all hybrids. Since the printer carriers traverse the same amplifiers and level pads as the voice, but, being on a four-wire basis do not go through any hybrids, amplifier gains were too high for the printer carriers. Furthermore, because of dif-

(Continued on page 502)

*Other answers on this subject were published on page 115 of the February issue.—Editor.

(Continued from page 500)

ferences in impedance, it was necessary to insert step-up matching transformers in each modulator pass, which further increased printer levels. The cure, of course, was to readjust the printer carriers and insert pads at by-pass points, in order to maintain reasonable printer-carrier levels. This trouble emphasizes a point which communication men know, but know so well that they may sometimes forget, namely that a complex communication system must be coordinated and adjusted as a whole, and that if changes are made, the complete system must be examined and tested for possible conflicting requirements.

On Local Phone and Radio Remote Control Line

By W. I. NORTH
Telephone Supervisor
Atlantic Coast Line, Jacksonville, Fla.

THE most unusual case of trouble I have experienced recently in the communications field, was on a local yard line here at Jacksonville. This line, for the most part, consists of a bracketed pair of No. 9 copper wires, which is used for both local telephone service and as a remote land line for a yard radio installation. The line originates at Moncrief yard office, where it is used for telephone service, and where the radio transmitter control is located. The line extends northward 0.5 mi. to Moncrief tower, where it is cut in for telephone service and test. From there, the line extends northeastward 1.5 mi. to Composite Junction, where it is arranged for test and telephone service in a booth, thence 1 mi. eastward to F. & J. Junction, where an overhead crossing legs into the tower for telephone service, and then eastward for another mile to Export yard office, where the line terminates for both telephone service and the remote radio control. From Moncrief tower to F. & J. Junction, the line is overbuilt or parallelled by a three-phase 66-kv. line with separation of from 25 to 100 ft. On the same poles with this line, various telegraph, printer and clock-wires parallel for short sections. The remote radio control unit at Export operates the talk-listen relay on the transmittter at Moncrief over the simplex to ground with 300-volt d.c. battery.

This line recently went to a swinging noise, like a very light ground, when the transmit key was operated, placing battery on the line, but only at times when the wind was in the south or southeast. The noise was quite strong when the transmit key was operated, but would clear almost at once when the simplex battery was removed by release of the key. By opening the line at test points, the trouble was soon placed between Export yard office and Composite Junction. However, due to irregularity of the time the trouble, it was impossible to place a closer test. It was also impossible to get a West test set location on the trouble, or a bridge location of the trouble. No ground or foreign battery could be read on the line, other than the balanced 60-cycle a.c. induced in the line from the 66-kv. line, which was normal. After there had been no trouble for several days, it again showed up—at a time when the wind was in the southeast, and mist to rain weather conditions. In the meantime, the line had been carefully patrolled on a motor car, then on foot several times, looking for a side cross or piece of hair wire in the line. This time, when the trouble came in steady, we were able to get a definite location on the trouble, placing it at the terminal pole at F. & J. Junction.

We found that the twisted-pair drop was slack enough to sway in the wind and, when the wind was in the south or southeast, it would blow the twist against the pole bracket, causing the insulation to be chafed. A new down guy had been placed on the pole recently by another user of the line, and the top end of the guy was wrapped around the pole and the pole bracket, grounding the bracket. A new drop was installed, pulling straight from the tower to the pole, and carried in screw eyes up to the line in the standard manner. No further trouble has been experienced since.

On Track Circuits

By JOHN O'CONNOR
Signal Maintainer, Retired
Chicago, Milwaukee, St. Paul & Pacific
Madison, Wis.

IN six different towns, on a division where we had highway crossing signals, but no automatic block, we had several cases of unusual trouble on track circuits, caused by an outside source of power. One supervisor, at first, thought it was caused by gas-electric cars in use on the division at that time. Others thought it was caused by lightning and, at the present time, there are some maintainers who still think it was caused by lightning.

In the small towns involved, the coal dealers use electrically-powered elevating machines to load the coal in their trucks and storage bins from the hoppers under the railroad cars on the sidings, one end of the machines resting on the rails under the cars. When the insulation on the power cables for these machines became worn, defective, and touched the frame of the machines, 220 volts went down the siding rails to the main-track rails, and thence to the battery end of the approach track circuit for the highway crossing protection. As a result, the resistance unit at the battery was burnt out, which opened the track circuit, and caused the crossing signals to start operating. If there was a cut-out and restart at the location, the signals cut-out after 80 sec., remaining so until the trouble was discovered.

After discovering the source of this trouble, we prevented recurrence thereof by installing two insulated rail joints at the fouling point on each siding where coal-elevating machines were used. An 8-ft. by ½-in. Copperweld ground rod was also driven at each fouling point, and the siding rails bonded to it with two 46-in. Copperweld plug-type cable bonds.

SIGNAL CABLE RING SPACING

"What factors are involved in determining the proper spacing of hangers, straps, rings or wire ties on a messenger for suspension of aerial-type signal cables from the messenger? Please explain."

A.A.R. Standards

By R. C. WALDRON
Engineering Department
Okonite Company, Passaic, N. J.

THE only published data with which we are familiar is contained in the A.A.R. standards for installation practice of signal cables, which include the table for recommended ring spacing shown herewith. This table disregards the weight but, for signal cables, this is probably not important, as the varation in weights

(Continued on page 504)