EXPLANATION OF DIAL SPEED AND SPOTTER PULSE TESTING CIRCUIT ACCESS FROM SELECTOR LEVEL H-85175

This circuit is a convenient device for testing the speed and spotter pulses of a subscriber's dial, either regular or SATT.

A test man may seize this circuit by dialing over the subscriber's line into a particular selector level. After seizing this circuit, the test man dials the digit "0" in order to test the dial speed. In response to dialing he will hear either one, two, or three splashes of dial tone, depending on whether the dial is slow, correct, or fast, respectively.

The test man may also dial the digit "2" to obtain access to the spotter pulse testing relays. On dialing the digit "2", a ground fault test is automatically made on the line. If a ground fault is found, it will be indicated by busy tone and other tests will be prevented; if no ground fault is found, a splash of dial tone will be returned, indicating that the line is clear.

In order to check the spotter pulses, the test man dials the party designation number of the subscriber. If the proper identification is made (from the spotter pulses), the circuit will return steady dial tone. If the proper identification is not made, busy tone will be returned and other tests will be prevented.

The Dial Speed Testing Circuit may be used without Spotter Pulse Testing Circuit. The Spotter Pulse Circuit must be used in conjunction with the Dial Speed Testing Circuit.

OPERATION

1. Dial Speed Testing Circuit (FIG. 1)

1.1 Seizure

Access to this circuit may be gained by dialing the selector level assigned for these particular testing purposes. Battery through #2CA on lead C marks this circuit idle to the associated selector. When seized, the transmission loop is closed over A. Relay A operates and closes B. Relay B operates, closes #2CA, and closes ground to lead C to mark this switch busy. Relay CA operates and prepares a circuit to the ROT. magnet and relays CB, CC, and #1CA.

1.2 Speed Test (Operated: Relays A, B and CA)

To test the speed of a dial, the speed at which dial pulses are registered on a minor switch is compared with the speed of pulses formed by prime mover relays PM1 to PM3. The prime mover registers its pulses in counting chain relays CH1 to CH0 at 10 pulses per second. If by the time the

eleventh prime mover pulse has been sent to the counting chain relays, a mark has not been made from minor switch MS1, the dial speed is slow. If the mark has been made before the ninth pulse of the prime mover, the dial speed is fast. If the mark is made after the ninth pulse, and before the eleventh pulse leaves the prime mover, the dial speed is correct.

In order to make this test, the test man dials digit "0". The first pulse opens A. Relay A restores and closes CB, PM1, #1CA and ROT. magnet. Relay CB operates, closes CC, and closes multiple circuit to PM. The Rotary magnet operates and steps the wipers to the first position. The ON springs operate and open #2CA. Relay CA remains operated on its #1 winding. Relay CC operates, removes dial tone from the transmission line and closes the locking circuit to CB. Relay A follows the dial pulses, opening and closing the circuit to the ROT. magnet. The ROT. magnet steps the switch on each ground pulse. The stepping will continue until the dialed position (tenth - for the purposes of this test) is reached.

When A first released, as mentioned above, it closed PM1. Relay PM1 operates, closed PM2. Relay PM2 operates, closes PM3. Relay PM3 operates, opens PM1. Relay PM1 releases, opens PM2. Relay PM2 releases, opens PM3. Relay PM3 releases, reoperates PM1 from B relay ground (since CB, now operated, has switched PM1 from pulsing ground at A to steady ground from B). Relays PM1, PM2 and PM3 continue to pulse, independent of A. This causes contacts 3-4 of relay PM1 to pulse the counting chain relays at 10 p.p.s. On the first pulse from PM1, relay CH1 operates. When PM1 releases, relay CHC operates in series with CH1. On the second pulse, CH2 operates. At the end of this pulse, CHB operates in series with CH2. When CHB operates, it opens the circuit of CHC and CH1. On the third pulse, relay CH3 operates, and at the end of this pulse CHA operates in series with CH3. When CHA operates, it opens CHB and CH2. In turn, relays CH4 through CH9 operate, and relays CHC, CHB, and CHA reoperate, each in turn, on every third pulse from PM1. On the tenth pulse, relay CHO operates. At the end of this pulse, relay CHD operates in series with CHO. Relay CHD, in operating, opens CHA and CH9. The latter restores and prepares the pulsing circuit to CH1. The next pulse starts another identical cycle. (CHC operates in series in turn with CH1, CH4 and CH7; CHB - with CH2, CH5 and CH8; CHA - with CH3, CH6 and CH9; CHD - with CHO.) While the prime mover relays are pulsing the counting chain, the pulses from the dial pulses are simultaneously stepping the minor switch MS1.

1.21 Fast Dial Speed

In the case of a fast dial the minor switch will have stepped to its tenth bank contact before relay CH9 operates (one of the relays CH1-CH8 will be operated). When the minor switch (MS1) wiper reaches its tenth bank contact, the circuit to PF is closed. Relay PF operates, locks and opens the pulsing circuit to counting relays. At the same time, relay A operates after the final pulse and opens CA, ROT. magnet and #1CB. Relay CA, being slow-to-release, finally releases, opens CC and closes TB from its 3-4 contacts. Relay TB operates, locks and closes TA, which also operates and locks. Relay CC, being slow-to-release, finally releases,

closes the circuit to the release magnet of MS1, and opens CB. Relay CB releases, closes the circuit to relay TE, and opens the circuit to the CH and PM relays. The CH and PM relays release. The RLS magnet operates and restores the switch to normal. The ON springs restore, opens the RLS magnet and close #1CA. Relay CA reoperates.

Relay TE, being slow-to-operate, finally operates, closes TD and TC, and restarts the prime mover (PM) relays. Relay TC operates. Relay TD operates, locks, and opens PF. Relay PF restores and closes pulsing circuit to CH relays. The counting chain relays operate in the same manner as before except that when relays CH2, CH5, and CH8 operates, a splash of dial tone is placed on the line, since CC is now released. In this manner three splashes of dial tone are placed on the line when the dial is fast. When relay CHO operates, it opens the holding circuit of TE, TA, TB. Relays TE, TA and TB release and open the circuit of the prime mover, counting chain relays and TC. The circuit is now prepared for the next test.

Relay TD remains operated to prevent the dial tone from being placed on the transmission line. On the first dial pulse of the next test, relay CB operates, closes CC and opens TD. Relay TD restores. Relay CC operates. This keeps the dial tone open. The rest of the circuit will function as described above.

1.22 Correct Dial Speed

If the dial is pulsing at the correct speed, relay CH9 or CHO will be operated when PF operates as the minor switch MS1 reaches the tenth bank contact. Relay PF stops pulsing by the prime mover as before. Relay CHO, if operated, closes its 3-4 contacts in the marking circuit, and closes the circuit to relay TC. Relay TC does not operate, since it is differentially excited at the present time. Relay CA, being slow-to-release, finally releases, opens CC, and makes its mark, closing the circuit to relay TA, instead of TB as before, when the dial was fast. Relay TA operates and locks. Relay CC finally releases, removing the mark, releases the minor switch MS1 as before, and opens CB. Relay CB restores, closes TE, and releases the counting chain relays as before. Relay TE operates, closes TD and TC, and reoperates the prime mover relays. Relay TC operates, opens any possible feedback circuit to TE. Relay TD operates, prevents dial tone from being closed to the line and opens PF. Relay PF restores and closes pulsing circuit to the counting relays. The counting cycle continues as before, except that a splash of dial tone is placed on the line when relays CH2 and CH5 operate. As relay CHO operates, stopping the cycling, the circuit is again ready for the next operation. In this manner two splashes of dial tone are placed on the line to indicate a correct dial speed.

1.23 Slow Dial Speed

The counting relays will complete one cycle (relays CH1 through CHO operating) before the tenth pulse from a slow dial is registered in MS1. When CHO operates in this first cycle, it closes ground to relay TC through break springs of CH1. Relay TC, being differentially energized, does not operate at this time. The next (eleventh) pulse closes CH1.

Relay CH1 operates and opens TC. While the opposing currents through #1 and #2 windings of TC are decreasing at different rates (slower in #2 winding), the difference between flux produced by #1 and #2 windings increases until the net flux produced is enough to operate its "X" contacts and close both windings of TC in series aiding. Relay TC operates fully.

Since TC is operated, when the marking occurs, neither TA nor TB will operate. When the counting chain relays are recycled to send out splashes of dial tone, only one splash will be sent out. This occurs when relay CH2 operates. As before when CHO operates and TE restores, the circuit is again prepared for the next test. Thus, if a dial is slow, only one splash of dial will be placed on the line.

If a digit with less than ten dial pulses is dialed, the dial tone circuit will be closed after CC restores and continuous dial tone will be sent back to the test man.

1.3 Speed Check

A speed check of prime mover relays may be made by operating the SPEED CHECK key. This should be done with the cover in place. The operation of the key connects the lamp to contacts of CHO and closes TE. Relay TE operates, closes ground to lead C to mark this circuit busy and starts the prime mover relays. The prime mover relays operate and recycle in their normal manner so that relay CHO operates once each second. Relay CHO lights the lamp once each second at its 7-8 contacts. The pulses may be timed with a clock to determine whether their speed is correct. If the timing is off, it may be corrected by readjusting the PM relays according to the relay adjustment sheets.

2. Spotter Pulse Testing Circuits (Fig. 2)

This circuit is used in conjunction with Dial Speed Testing Circuit (FIG. 1).

2.1 Seizure

This circuit is seized by dialing digit "2" into the associated Dial Speed Testing Circuit. The Dial Speed Testing Circuit functions as described in sections 1.1 and 1.2 except, since only two pulses are received by the ROT. magnet, the MS1 wiper rests on the second bank contact upon completion of dialing, and when relay CB restores and relay CC is still operated (CC is slow-to-release), the circuit to SS is closed. Relay SS operates, locks, and transfers all incoming leads ("+", "-" and C) from Dial Speed Testing Circuit to Spotter Pulse Testing Circuit. This will restore all operated equipment in the Dial Speed Testing Circuit except relay SS.

Relay B is slow-to-release and will hold SS closed long enough for Spotter Pulse Testing Circuit to provide a holding circuit to SS. When this circuit is seized, the transmission loop is closed from battery through resistor R3 through #1A1, over lead -1 over the loop to lead +1, to the ground on contacts of relay DT. Relay A1 operates and closes BA. Relay BA operates, closes ground to lead L to keep SS operated, closes ground to lead C1 to keep this and associated circuit marked busy, closes LT, and prepares a pulsing path to switch MS2.

2.2 Testing for Line Faults (Operated: Relays A1, BA and SS) (FIG. 1)

When seized, this circuit automatically tests for line faults, and when found, prevents any further tests from being made.

Relay LT, being closed as mentioned above, operates and closes TS. Relay TS operates and closes LS and locking ground to #2A1. Relay LS operates, closes BT, switches LT from its operating circuit to the +1 and -1 leads and opens #1A1. Relay A1 remains operated on its #2 winding. Relay BT operates, opens TS, and removes the shunt from the adjustable resistor R1 on LT. Relay TS is slow-to-release and does not release immediately. If the ground fault is present, relays LT and BT remain operated. Relay BT will hold the circuit to the ROT. magnet open, thus preventing any further tests from being made, and when slow-to-release relays TS and LS restore, the LT and BT relays will hold the busy tone lead closed to lead -1, giving the indication of the line trouble to a test man.

If the line is clear of faults, relay LT restores, opens TS and closes DT. Relay DT operates, locks, opens #1LS, removes ground and places battery through #1A2 to the +1 lead, and transfers the circuit through #1A1 from battery through resistor R3 to spotter battery through resistor R2. This keeps A1 operated. Relay TS restores and opens LS. Relay LS restores and opens BT. When LS releases but slow-to-release BT is still operated, the dial tone is closed to the -1 lead to give indication to a test man that the line is clear of ground faults and the circuit is ready for the spotter pulse test. When BT restores, it removes the dial tone from the line.

2.3 Testing for Correct Spotter Pulses
(Operated: Relays A1, BA, DT and SS) (FIG. 1)

2.31 Four Party Identification (FIG. 2) ("X" wiring)

With relay DT operated the (+) line is connected through the shunt field relay to main battery and the (-) line is connected through relay A1 to spotter battery.

In order to test a particular spotter dial, the test man now dials the "party" designation number of the subscriber's telephone. For each loop pulse a minor switch MS2 is stepped one step, choosing a different testing path for each of the five parties on the line. Dialing the digit 1 causes testing for the proper pulses from "party #1", dialing digit 2 causes testing for "party #2", etc. In this manner the spotter dial of any of the five parties on a party line may be tested.

Example: If the test man dials digit 4 on a party 4 dial, four loop pulses and three spotter pulses are to be received by this circuit. The first loop pulse opens A1. Relay A1 restores and closes CAA and the ROT. magnet of the switch MS2 in multiple. The ROT magnet operates and steps the wiper to the first bank contact. The ON springs operate and close relay ON. Relay CAA operates and closes CBB. Relay ON operates and prepares the circuit to the RLS magnet. Relay CBB operates and opens further the circuit to BT to prevent the busy tone from being placed on the line upon comple-

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tion of dialing. The next loop pulse steps the wiper of the switch MS2 to the second bank contact. Next a spotter pulse is received. This closes #1A2. Having both of its windings energized (#2A2 has been closed by BA, but relay A2 does not operate on its #2 winding alone), relay A2 operates, and closes S1. Relay S1 operates, locks, and prepares the circuit to L1.

Next a loop pulse is received, stepping the minor switch to its third bank contact and operating relay L1. When the interrupter srpings of the minor switch open, relay L2 operates in series with relay L1. Relay L2 prepares the circuit for the next spotter or loop pulse. When the next spotter pulse is received, it operates relay S2. Next, the last loop pulse is received, operating relays L3 and L4 and stepping minor switch MS2 to its fourth bank contact (where the test for the party 4 dial is made). The final spotter pulse operates relay S3. After pulsing, relay CAA releases, placing a testing ground through the contacts of relays S1, S2, and S3 to relay SC. If relay SC operates, the dial has identified itself properly and relay SS will be released, switching (+), (-) and C lines back to relay A. This sends continuous dial tone back to the test man to indicate that the proper spotter pulses have been sent by the dial.

For testing parties 1, 2, 3, and 5, digits 1, 2, 3 and 5, respectively, are dialed and the proper relays operate to connect a marking path to relay SC.

If the proper spotter pulses are not received, relay SC will not operate when relay CAA releases (as before). But instead when CAA and CBB release, a circuit will be closed to relay BT. When relay BT operates, it locks and sends busy tone to the test man. This indicates that an incorrect identification has been made and prevents further tests from being made.

2.32 Five Party Identification (FIG. 3) ("Y" wiring and app.)

The functions of Fig. 3 are the same as described for FIG. 2. Using the same digit as described in the example above, the test man dials the digit 4. The first and second loop pulses operate relay CAA and step the minor switch to the second contact. Next a spotter pulse is received and operates SA. Relay SA operates, locks, and prepares a circuit for the next loop pulse. Next a loop pulse is received, stepping the minor switch to the third bank contact, and operating SB. Relay SB prepares a circuit for SC. At the end of the loop pulse, a short is removed from SC. Relay SC operates in series with SB and opens the operating path of SB. (The party 4 spotter dial is missing the center lobe for spotter pulses so there will not be a spotter pulse at this time.

Next, the last loop pulse advances the MS2 wipers to bank contact four. On the next spotter pulse, relay SD will operate. After pulsing, relay CAA releases, places a testing ground through the contacts of relays SE (not operated) and SD to SC. If relay SC operates, the dial has identified itself properly and relay SS will be released, switching the (+) and (-) lines back to relay A. This sends continuous dial tone back to the test man to indicate that the proper spotter pulses have been sent by the dial.

For testing parties 1, 2, 3, and 5, digits 1, 2, 3 and 5, respectively, are dialed and the proper relays operate to connect a marking path to relay SC.

If the proper spotter pulses are not received, relay SC will not operate when relay CAA releases (as before). But instead relay CAA will close a circuit to relay BT. When relay BT operates, it locks and sends busy tone to the test man. This indicates that an incorrect identification has been made and prevents further tests from being made.

(7) MRK:kf