DIAGRAM NOTES

concerning

DIAGRAM GBW.14670

titled

20 LINE P.A.B.X. - ENQUIRY CIRCUIT

1.0 GENERAL

This circuit is used by an extension engaged on an exchange line call, (1) to make an enquiry call to another extension, (2) to transfer the call to another extension, (3) to call in the attendant, or (4) to transfer the call to the attendant. The facilities of calling in the attendant, and transferring to the attendant are not available at night.

2.0 FACILITY SCHEDULE

Provision is made for:-

(1) Connecting an extension engaged on an exchange line call to the enquiry circuit (if free) by a single depression of the instrument push-button.
(2) Recalling the attendant should the enquiry circuit be already engaged when the button is operated.
(3) Extensions, having seized the enquiry circuit, to recall the attendant into circuit by dialling the digit '0'.
(4) Connection to the wanted extension by dialling the required number.
(5) Marking the called extension for transfer purposes and releasing the circuit when the transfer is completed.
(6) Recalling the attendant and releasing the enquiry circuit when a transfer is attempted to an extension that has not answered.
(7) Access to the circuit for testing with Routine Test Set GBW.13290.
(8) The connection of Ring Tone on operator re-call.

3.0 CIRCUIT DESCRIPTION

3.1 Outline

An extension, engaged on an Exchange Line call may, by a momentary single depression of the sub-set button and dialling the appropriate number make an enquiry call to another extension while holding the main exchange call. When the enquiry has been completed, the extension can return to the main exchange call, by once more momentarily depressing the sub-set button, or alternatively transfer the exchange call to the other extension.

To obtain the assistance of the attendant, the extension momentarily depresses the sub-set button once and then dials the digit '0'. The depression of the button connects the extension to the enquiry circuit. Dialling '0' steps the enquiry selector to the attendant's line.

In the event of the enquiry circuit being engaged, the first depression of the button causes the attendant to be recalled.

3.2 Detail

3.2.1 Enquiry Call. Enquiry Circuit Free

The extension momentarily depresses the sub-set button which connects an earth to the -ve line and operates the differentially wound relay DR in the exchange line circuit. The operation of the DR relay causes the ER relay, in the Exchange Line circuit, to operate to the earth extended over the ST lead. When the extension releases his sub-set button, relay DR releases and allows the EB relay in the Exchange Line circuit to operate over the H "IN" and TR leads to earth on the front of H changeover contact in the Exchange Line circuit. Relays ER and EB operated hold the main exchange call, and switch the extension through to the Enquiry circuit via the repeating Coil bridge in the Exchange Line circuit. Relay A operates to the repeating coil loop.

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Relay A operating

A1 operates relay B to ES switch battery via CD3 and R6.
A2 prepares operating circuit for relay Z.

Relay B operating

B1 prepares operating circuit of relay CD.
B2 prepares circuit to ES magnet.
B3 removes the earth on outlets 2 to 25 of ES1 bank and prepares part of operate circuit of relay E.
B4 connects dial tone to calling extension.
B5 prepares part of holding circuit for relay H.
B6 earths ring start lead and disconnects earth from ST lead.

Extension dials the first digit.

At the first release of relay A, relay CD operates to earth at TR6 in series with ES magnet.

Relay CD operating

CD1 disconnects the ES6 wiper.
CD2 disconnects an operate circuit for relay E.
CD3 disconnects R6.
CD4 disconnects the test circuit of relay H.
CD5 prepares a hold circuit for relay E.

CD and B hold during impulsing and the ES switch steps to the required contact, and at the end of impulsing relay CD releases.

If the first digit dialled was '8', the ES switch steps to Contact 3, and a circuit is completed to operate relay E from earth at B3 via NR5, DF3, CD2, Wiper and Bank ES8.

Relay E operating

E1 prepares test circuit of relay H.
E2 removes short circuit on relay H test winding.
E3 disconnects tone winding of A.
E4 holds E relay when CD is re-operated on second digit.
E5 ensures that circuit for ES magnet remains intact during dialling of second digit.

If the first digit dialled is '7', the ES switch steps to contact 4 and a circuit is completed to operate DF from earth at B3 via wiper and bank of ES8.

Relay DF operating

DF1 operates relay E.
DF2 completes a drive circuit for the ES switch from earth at B3 via NR5, DF2, outlets 2-13 of bank and ES1 wiper, TJ11-12, H7 and to ES interrupters.
DF3 locks relay DF to earth at B3.

The ES switch drives until contact 14 is reached when the drive circuit is broken.

Relay E operates and its contact functions are as already described.

The second digit can now be dialled. The first impulse again operates relay CD and at CD4 completes the circuit to operate relay NR.

NR1 further prepares the test circuit of H.
NR2 prepares operating circuit for relay CD under transfer conditions.
NR3 not effective.
NR4 prepares 'ring' tone or 'busy' tone circuit.
NR5 locks relay NR to earth at B3, prepares to hold relay F, and releases relay DF.

At the end of the digit relay CD releases and at CD5 breaks the holding circuit of relay E. During the release time of relay E, the H relay tests the called extension's line via wiper and bank of ES5, and if it is free, relay H will operate to the battery from the extension's line circuit.

Relay H operating

H1 applies interrupted ringing to the extension's -ve line.
H2 applies ring return to the extension's +ve line.
H3 prepares to apply ring tone to the calling extension's line.
H4 provides locking circuit for relay H.
H5 earths the called extension's H lead, thereby busying the outlet.
H6 disconnects the impulsing circuit from the ES switch.
H7 disconnects homing circuit of the ES switch.

Relay E releasing

E1 disconnects relay H testing circuit.
E2 short-circuits test winding of relay H.
E3 applies ring tone to tone coil of relay A.
E4 further disconnects holding circuit for relay E.
E5 further prepares operating circuit for relay CD under transfer conditions.

When the called extension answers relay F operates to called extension's loop.

F1 disconnects hold circuit of H (see operation of D).
F2 disconnects ring tone circuit.
F3 removes ringing, and closes -ve line to D relay.
F4 locks relay F to B3 earth by removing short circuit.
F5 disconnects the earth on the ring start lead.
F6 removes ringing return, and closes +ve line to D relay.

The D relay operates to the called extension's loop.

Relay D operating

D1 provides an alternative hold for relay H, which is made slow to release by reason of the short-circuit applied to its a-b winding by contact E2. Relay H holds until above hold circuit has been established.
D2 prepares a locking circuit for relay Z.
D3 prepares a locking circuit for relay TR.
D4 provides alternative hold circuit for relay B.

The connection is now complete, and the circuit is also prepared for transfer if required.

3.2.2 Called Extension Busy

In this case, when the H relay tests the H lead during the release time of relay E, relay H does not operate as there is an earth returned on the H lead from the busy connection. Busy tone is returned to the caller via contact H3.

3.3 Extension reverts to the original exchange line call

When the extension has completed the enquiry call it is possible to revert to the exchange line call by once more momentarily depressing the sub-set button. Depressing the button operates the exchange line DR relay as described in 3.2.1. Earth from the exchange line circuit is fed via the DR lead to the enquiry circuit and operates relay Z via A2 and Z3.

Relay Z operating

Z1 connects the RP lead to the B relay causing it to release under short circuit conditions and releasing the circuit, should the called extension fail to clear
Z2 earths the Ring Start lead.
Z3 locks Z to earth at D2 (if the called extension has not cleared) or to earth extended from the exchange line circuit over the TR lead (if the called extension has already cleared).
Z4 disconnects the alternative hold circuit for relay H.

Z5 further disconnects the ringing to the -ve lead.
Z6 removes holding earth for relays EB and ER in the exchange line circuit on the H 'in' lead, and holds relays EB and ER to earth on DR lead until relay DR releases.

The release of relays EB and TR in the exchange line circuit follows the release of the press button and restores the calling extension's +ve and -ve lines to the exchange lines and releases relay A.

When the called extension clears relay D releases.

Relay D releasing

D1 releases relay H.
D2 releases relay Z (slow release).
D4 releases relay B.

If the called extension does not clear, the Release Pulse from the Pulse Circuit short circuits the B relay.

Relay B releasing

B3 completes the drive circuit of ES, which drives to the home position, and releases NR and F.
B5 releases relay H.

With Z released and the ES switch in the home position the circuit is released and is ready to accept another call.

3.4 Extension transfers call to enquiry extension

Having obtained the required enquiry extension (see para. 3.2.1) the originating extension may transfer the call by simply replacing the receiver.

In this case the earth at B5 in the enquiry circuit continues to hold the EB and ER relays in the exchange line circuit via the H 'in' lead.

The following sequence of relay operations takes place in the exchange line circuit and the enquiry circuit.

When the extension replaces the receiver, the LS relay in the exchange line circuit is released thereby operating relay A in the exchange line circuit, which opens the line loop and releases relay A in the enquiry circuit. The release of relay A operates relay CD from earth at TR6 to 125 ohm battery at R2. In the exchange line circuit relay B releasing, releases relays CA and H. The release of relays CA and H prepare the drive circuit of the EF switch. The release of relay H opens the +ve and -ve lines to the originating extension and removes the earth from the H lead, thus releasing the originating extension. A contact of relay H removes the earth from the TR lead and connects this lead to the ST relay. Battery at the ST relay operates TR in the enquiry circuit, as CD relay, previously operated, removes the short-circuit on relay TR at CD5.

Relay TR operating

TR1 disconnects an alternative hold circuit for relay H.
TR2 prepares to connect a 1050 ohm battery to the J lead on release of relay CD, via R4, ES6 wiper, and bank contact, and disconnects the AS and BS lead.
TR3 closes locking circuit of relay TR.
TR4 disconnects the RP lead to the B and TR relays.
TR5 disconnects earth from relay D thereby leaving a 1000 ohm earth connected, this is in order to ensure the operation of relay LS in the exchange line circuit on transfer.
TR6 short circuits relay CD which releases slowly.

On release of relay CD an earth from B5 is applied to the TR lead, via CD5, and ST relay in the exchange line circuit is operated. Relay ST operating completes the drive circuit of the EF switch, which drives until the contact marked on the J (EF2) bank by a 1050 ohm battery from the enquiry J (ES6) bank is reached. Relay ET in the exchange line circuit operates to the 1050 ohm battery and cuts the drive circuit of the EF switch. Relay LS re-operates in the exchange line circuit to the extension's loop and releases relay A which re-connects the loop to the enquiry circuit, operating relays A and Z in that circuit. Relay Z operating disconnects the holding earth from relay H, which releases, thereby releasing relay D. Relay D releasing, releases relay TR and Z, contact TR5 disconnects earth from the ER and EB relays in the exchange line circuit and they release. The loop to the enquiry circuit being disconnected releases relay A, thereby short-circuiting relay B which in turn releases and completes the driving circuit of the ES switch which is then driven to the home contact.

3.5 Attendant Re-call

An extension may recall the attendant by momentarily pressing the sub-set button once, waiting for dial tone from the enquiry circuit and then dialling '0'. Pressing the button once seizes the enquiry circuit as described in 3.2.1. Dialling '0' steps the ES switch to the 11th contact. A circuit is now completed to place an earth on the CR lead from earth at B3 via NR5, DF3, CD2, ES8 wiper and bank contact 11, NA operated (during day-time only) which operates the CR and OR relays in the exchange line circuit. Contacts of these relays connect flicker earth to the line lamp on the attendants cabinet, and release the EB relay in the exchange line circuit, thereby releasing the enquiry circuit as already described in para. 3.3. Ring Tone is returned to the caller. The attendant answers by operating the speak key associated with the calling exchange line circuit, and the CR and OR relays are released. The attendant, after having dealt with the query, may retire from the call by restoring the speak key, leaving the extension still connected to the main exchange call. If, however, the extension wishes the attendant to deal with the call, on replacing the receiver, the exchange line circuit relay LS releases, causing relay CR to re-operate and release relay H, which opens the originating extension's loop, allowing the extension to release. The attendant can then proceed with the connection of the call as requested by the main exchange extension.

3.5.1 If an attempt is made to re-call the attendant at night the extension receives busy tone as the NR relay is operated directly ES switch steps to the 11th contact of ES8 from the earth at B3.

3.5.2 If an attempt is made to transfer a call to an extension who has not answered, the enquiry circuit extends an earth via the CR lead to operate the exchange line circuit CR and OR relays and the attendant is called in as described above.

It should be noted that an exchange line call is not lost by either of these mis-operations.

END