

DIAGRAM NOVEL (ISSUE 1)

concerning

NZPO 31692, ISSUE C,

titled

UAX N.Z. 13 REMOTE M UNIT

DISCRIMINATING SELECTOR, LINEFINDER AND ALLOTTER

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6. CIRCUIT DESIGN NOTES.

1. GENERAL.

1.1 The diagram shows the circuit arrangement of the equipment used for the Discriminating Selector, Linefinder and Allotter circuits of a multi-party line unit UAX N.Z. 13RM. Six Discriminating Selector and Linefinder circuits are associated with one Allotter circuit.

1.2 The diagram should be considered in conjunction with the following diagrams:

- (a) NZPO 31691 Subscribers Line Circuit
- (b) NZPO 31693 Final Selector for Multi-party lines
- (c) GBW 13770 Revertive Call Relay Sets for 2 and 5 Party Lines
- (d) As applicable; Junction Relay Sets.

1.3 For the sake of convenience and clarity of description, the Linefinder and Allotter circuits will be described separately from the Discriminating Selector circuit.

2. FACILITY SCHEDULE.

2.1 Linefinder and Allotter.

2.1.1 Finding the calling line and connection to the associated Discriminating Selector.

2.1.2 Early seizure of the Discriminating Selector by the Allotter whilst Linefinder search is in progress in order to reduce the risk of premature dialling.

2.1.3 Pre-selection of a free Linefinder by the Allotter circuit.

2.1.4 Prevention of Allotter search when all Linefinders are busy.

2.1.5 Congestion metering when all Linefinders are busy.

2.1.6 Automatic busying when the associated Discriminating Selector fails to restore.

2.2 Discriminating Selector.

2.2.1 Access to -

- (a) Local M unit subscribers by dialling a distinctive digit (usually '5');
- (b) parent automatic or manual calls by dialling digits corresponding to those used at the associated parent; and
- (c) revertive calls by dialling '99', followed by the digit corresponding to the party required

2.2.2 Seizure of a junction to the automatic Parent exchange followed by the transmission of dial tone to the calling party.

2.2.3 Discrimination of the first digit dialled in order to distinguish between junction and local calls.

2.2.4 Repetition of further dialled digits over the junction when working to an automatic Parent.

2.2.5 Release of the junction and seizure of a Final Selector or revertive relay set on local calls.

2.2.6 Suspension of junction search until the first digit has been dialled when working directly to a Manual exchange.

2.2.7 Congestion metering and transmission of overflow tone when either all junctions, or all local outlets to final selectors or revertive relay sets are engaged.

2.2.8 Transmission of N.U. tone to the calling party when a barred or spare digit is dialled.

2.2.9 A transformer type transmission bridge.

2.2.10 Application of 'forced release' (under time pulse control) if the selector is held

(a) to a permanent loop (PG)

(b) on overflow tone (all outlets engaged), or

(c) on N.U. tone.

2.2.11 First party release, excepting on calls to a Parent Manual exchange which are subject to "Manual Hold" by the operator.

2.2.12 Automatic busying of the selector if -

(a) The selector fails to restore due to a mechanical defect, or

(b) The battery supply is disconnected (i.e., fuse blown).

3. OUTLINE CIRCUIT OPERATION.

3.1 Linefinder and Allotter.

3.1.1 Earth on the "Allotter Start" lead from the subscribers line circuit energises the Allotter control circuit and causes a Linefinder to search for and seize the calling line, switching it through to the associated Discriminating Selector and returning Dial Tone to the caller.

3.1.2 The Allotter is released when the calling line is seized by the Linefinder, and release is accompanied by automatic movement of the wipers, thereby causing pre-selection of the next disengaged link.

3.1.3 If a subscriber attempts to make a call when all links are busy, a selector congestion meter is operated by the allotter control circuit. The allotter then seizes the first link to become free.

3.2 Discriminating Selector.

3.2.1 When the linefinder selects the calling line, relays A and B operate. The uniselector (DS25) drives and selects a free O/G junction. The calling subscriber hears dial tone from the junction in the case of an automatic parent and from the discriminating selector in the case of a manual parent.

3.2.2 (If all junctions are busy the selector moves to an "all junctions busy" position and prepares to operate an overflow meter. Dial tone is still returned to the caller, however, as the caller may only require a local call.)

3.2.3 The subscriber dial, and the discriminating uniselector (DR25) steps accordingly. When dialling (of 1st digit) is completed, an appropriate discriminating relay is energised.

3.2.4 Should a junction call be required when all the junctions are busy, the dialling of the 1st digit will cause overflow tone to be returned to the caller and the junction overflow meter to be operated.

3.2.5 Should a digit corresponding to the parent exchange access be dialled for the 1st digit, the DS uniselector remains on the outlet selected. The calling subscriber is connected to the O/G junction relay set.

3.2.6 Should a digit corresponding to a revertive call be dialled for the 1st digit, the DS uniselector drives to the appropriate bank terminals and the calling subscriber is connected to the revertive R/S.

3.2.7 Should a digit corresponding to a local call be dialled for the 1st digit, the DS uniselector drives to the appropriate bank terminals and the calling subscriber is connected to the local final selector.

3.2.8 Should all the final selectors be busy, the selector switch wipers move to an "all final selectors busy" position. Overflow tone is then returned to the caller and the final selector overflow meter operated.

3.2.9 Should a digit corresponding to a spare level be dialled for the 1st digit, N.U. tone is extended.

3.2.10 Provision is made for 'forced release' when unallotted levels are dialled; on incompleting junction calls, local calls and revertive calls, as well as calling sub not release.

3.2.11 If the 13M unit is dependent on a Parent Manual Exchange instead of a UAX 13, position '0' (the "home" position) of the DS switch is used as a dummy junction position to suspend movement of the switch wipers until the first digit is dialled. This is to prevent unnecessary calling of the operator during local calls.

4. OPERATIONAL DETAILS - LINEFINDER AND ALLOTTER.

4.1 Seizure of a Free Linefinder. The Allotter circuit is so arranged that the Allotter wipers are normally standing on contacts associated with a free linefinder.

Relay ST operating to the earth extended on the common allotter start lead from the subscriber line circuit;

ST1	has no useful function at this stage
ST2	operates relay DK to earth at contact KF2 (Fig. 1), and the R4 resistance battery (Fig. 1) via wiper AL1, TJ springs 7-8, contact KF3, wiper DR5 (home position), contact KA2, wiper DS3 (home position) and contact KA5.

ST3 prepares an operate circuit for relay DR.

Relay DK operating;

DK1 operates DR (slow-to-operate) to earth at contact KF2 (Fig. 1) via contact ST3.

Relay DR operating at the end of its slow-operate period;

DR1 extends earth via FK3, wiper AL2 and the LF dm springs to energise LF switch magnet, causing the LF switch wipers to rotate.
DR2 prepares the testing circuit (relay FK).
DR3 provides an alternative hold circuit for relay DR against the release of relay ST.
DR4 prepares an operate circuit for relay KF (Fig. 1).
DR5 energises and holds the AL switch magnet.
DR6 extends the R1 resistance earth via wiper AL4 and winding 2-1 of transformer TR1 (Fig. 1) to operate relay A in the selector circuit, causing it to operate relay B (see par. 5.1.1). Contact B1 prepares a holding circuit for relay KF. The linefinder (LF) switch wipers now rotate until the contacts associated with the calling line are reached.

Relay FK operating on its a-b winding to the marking battery on the P bank contact of the calling line;

FK1 disconnects the LF switch magnet circuit, completes a hold circuit for relay FK on its d-e winding to earth at contact DR1 and extends earth at contact DR1 via contact DR4 and wiper AL3 to operate relay KF (Fig. 1).
FK2 substitutes contact DR5.

Relay KF (Fig. 1) operating;

KF1 holds relay KF to earth at contact KA3 via contact B1.
KF2 disconnects its earth from relay DK and connects it to the line circuit P wire, causing the operation of relay K in the line circuit and the consequent removal of earth from the allotter start lead. It also short-circuits the a-b winding of relay FK, leaving it to hold on the d-c winding.
KF3 disconnects the "free linefinder" battery from the allotter T wire, so busying the linefinder and further disconnecting relay DK.
KF4&5) extends the line wires to relay A
KF5) and the transmission bridge.
KF6 prepares operate circuit for relay TM, earth at SW5 to "Line Pulse Start."
KF7 disconnects earth from the linefinder test jack LF tj, preventing the insertion of a link in the test jack from stopping the LF switch and disconnecting the call.

Relay ST releasing, due to the removal of the earth from the allotter start lead.

ST1)
ST2) See par. 4.2.1 (a) below.
ST3)

Relay DK releasing;

DK1 disconnects relay DR.

Relay DR releasing at the end of its slow-release period;

DR1 releases relay FK and leaves KF holding to earth at contact KA3 via contacts B1 and KF1.
DR2 disconnects the line testing circuit.
DR3&)
DR4) have no useful function at this stage.
DR5 leaves the AL switch magnet energised to earth at contact FK2.

Relay FK releasing;

FK1 has no useful function at this stage.
FK2 disconnects earth from the AL switch magnet circuit, causing the AL switch wipers to take one step (see par. 4.2 below).
The call is now switched through to the Discriminating Selector circuit, and the Linefinder and Allotter circuit takes no further part in the call.

4.2 Allotter "Step-on" Circuit. It will be noted that the DK lead is common to all Linefinder circuits. When a Linefinder and associated Discriminating Selector are unengaged, relay KF is normal and earth is extended to the common DK lead by contact KF2. There will, therefore, always be an earth on this lead as long as a free linefinder remains.

4.2.1 There are two conditions for Allotter "Step-On".

- (a) "Step-On" when relay ST is not operated. This follows from par. 4.1 above. Relay FK releasing enables the Allotter (AL) Switch wipers to move one step when contact FK2 breaks. If the Linefinder connected to the AL switch contacts on which the wipers are now standing is free, no further action takes place until the next call. If, however, the Linefinder is busy and a free Linefinder remains, earth is extended from the common DK lead via contact KF3 of the busy Linefinder, wiper AL1, contact ST1 and the AL dm springs to the AL switch magnet, causing the AL switch wipers to step. The Allotter wipers continue to step in this manner until the contacts associated with a free Linefinder are reached. Relay KF of the free Linefinder being unoperated, earth will not be extended to the AL switch magnet and consequently the Allotter wipers will come to rest on the contacts associated with the free linefinder. No further action takes place until the next call.

- (b) "Step-On when relay ST is operated. Should a call be originated directly following another one, relay ST may be operated when relay FK releases as described above. In this case, the method of hunting for a free linefinder is different. Contact FK2 breaking causes the AL switch wipers to move one step, as before. If the linefinder associated with the contacts on which the wipers are now standing is free, the call proceeds as in par. 4.1. If, however, the linefinder is busy and a free linefinder remains, earth from the common DK lead is extended via contacts ST3, DK1 and ST1 and the AL dm springs to the AL switch magnet, causing the wipers to rotate. When a free linefinder is reached R4 resistance battery is extended via contact KA5, wiper DS3, contact KA2, wiper DR5, contact KF3, wiper AL1 and contact ST2 to operate relay DK to earth on the common DK lead.

Relay DK operating quickly;

- DK1 cuts the Allotter drive circuit and operates relay DR. The call then proceeds as in par. 4.1 above. If all linefinders are busy when contact FK2 breaks, the wipers move one step and remain there until a linefinder becomes free. When this occurs, the Allotter wipers will at once move to the free Linefinder contacts as in (a) above. Should a call be originated when all Linefinders are busy, contact ST1 operating extends the AL switch magnet battery via the AL dm springs and contacts DK1 and DR3 to operate the Selector Congestion Meter, which locks via its own contact. If a Linefinder now becomes free, the Allotter wipers step to the free Linefinder contacts as in (b) and the meter is released. It will be noted that the Selector Congestion Meter can only be operated once in any "all busy" period.

4.3 Release of Linefinder. At the end of a call, the Discriminating Selector is released and contact B1 breaking causes relay KF to release.

Relay KF releasing;

- KF1 further disconnects the holding circuit of relay KF.
 KF2 disconnects the earth from the Line circuit PL wire, releasing K in the Subscribers Line circuit, and also reconnects earth to the common DK lead.
 KF3 re-connects battery to the T lead (assuming the selector to have restored correctly, see par. 5.1.6 (a)).
 KF4)
 &) disconnect the line wires.
 KF5)
 KF6 disconnects TM relay from "Time Pulse Start" or "Hold".
 KF7 re-connects earth to the LF switch test jack.

The circuit is now ready for another call. It will be seen that the Linefinder is of the non-bouncing type, and awaits the next call with the wipers resting in the position in which they were last used.

5. OPERATIONAL DETAILS - DISCRIMINATING SELECTOR.

5.1 Parent Exchange - UAX 14.

5.1.1 Pre-Dialling Stage

Relay A operates to earth extended along the negative line wire from the Linefinder circuit (see par. 4.1);

- A1 operates relay B
- A2 prepares the outgoing loop

Relay B operating;

- B1 connects earth at KA3
- B2 breaks the DS switch homing circuit and prepares the local call "step-on" circuit.
- B3 prepares circuit for Junction Overflow Meter.
- B4 extends earth via wiper DR4 on the home contact to operate relay CD on its d-e winding.
- B5 maintains the connection of the R4 resistance battery on the T wire in case the linefinder and allotter circuit should still be in operation when the DS switch wipers move.
- B6 prepares the relay KD testing circuit.

Relay CD operating:

- CD1 prepares the testing circuit and energises the DS switch magnet via contacts K4 and KD1 and the DS dm springs, causing the DS switch wipers to rotate.
- CD2 disconnects the overflow tone circuit and prepares the dial tone circuit.
- CD3 has no useful function at this stage.
- CD4 prepares the DR switch magnet pulsing circuit.
- CD5 no useful function at this stage.
- CD6 further prepares the testing circuit.
- CD7 breaks the DS switch local call "Step-On" circuit.

Relays operated at this stage are - KF, A, B and CD. The selector (DS) switch wipers now rotate until (a) a free junction is reached, or (b) the all junctions busy position (No. 7) is reached.

(a) Free Junction Found.

When the DS switch wipers reach the bank contacts corresponding to a free junction;

Relay KD operates on both windings in series to battery extended from the junction relay set P wire via wiper DS6 and contacts NU4 and B6.

- KD1 switches relay K in series with the DS switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

- K1 no useful function at this stage.
- K2 prepares an additional holding circuit for relay KF against the operation of contact KA3.
- K3 further disconnects the DS switch "Step-On" and homing circuits.
- K4 prepares to hold relay K to an earth returned on the junction relay set P wire, and short circuits relay KD causing it to release slowly.
- K5 extends earth at contact B4 via wiper DR3 on the home contact to operate relay KA.
- K6)
- &)
- K7) extend the outgoing line loop to the junction relay set.
- K8 spare.

Relay KA operating;

- KA1 prepares hold circuit for relay SW.
- KA2 has no useful function at this stage.
- KA3 leaves relay KF dependent upon earth at contact K2.
- KA4 prepares the pulsing circuit for the DR switch magnet.
- KA5 has no useful function at this stage.
- KA6 holds relay KA to earth at contact B4.
- KA7 has no useful function at this stage.

Relay KD releasing at the end of its slow release period;

- KD1 has no useful function at this stage.

Dial tone is returned from the parent UAX and the circuit is now ready to receive the first dialled digit. With a free junction found, the relays operated are - KF, A, B, CD, K and KA.

(b) All junctions Busy.

The selector wipers pass over the busy junction contacts, and when position 7 is reached relay KD is energised by the R5 and R6 resistance battery connected thereto. The selector switch then ceases to hunt and relays K and KA operate as in (a). As there is of course no junction connected in position 7, contacts K6 and K7 have no useful function at this stage. Contact KA7 returns dial tone to the caller via wiper DS7 and contact CD2, and KA2 prepares the time pulse release circuit.

5.1.2 Dialling the First Digit to Automatic Parent.

(a) Free Junction.

On hearing dial tone, the caller proceeds to dial the first digit.
Relays operated at this stage - KF, A, B, CD, K and KA.

Relay A responding to the breaking and making of the dial springs;

- A1 repeats the pulses to the DR switch magnet in series with the low resistance a-b winding of relay CD.
- A2 repeats the pulses over the junction loop.

The DR switch wipers step to the contacts corresponding to the digit dialled.

Wiper DR4 moving from the home position causes the high resistance d-e winding of relay CD to be disconnected, and when the pulse train ends, relay CD is released. At the end of the pulse train;

Relay A holds to the subscriber's loop on the line wires.

- A1 holds relay B which being slow to release held during dialling.
- A2 holds the junction connection.

Relay CD releasing at the end of its slow release period;

- CD1 leaves relay K dependent upon the earth from the junction relay set.
- CD2 has no useful function at this stage.
- CD3 extends earth at contact B4 (via wiper DR2) to operate relay SW (for strapping details, see Diagram Note 2).
- CD4 breaks the DR switch magnet pulsing circuit.
- CD5 has no useful function at this stage.
- CD6 further disconnects the testing circuit.
- CD7 has no useful function at this stage.

Relay SW operating;

- SW1 has no useful function at this stage.
- SW2)
- &) positive and negative wires extended to the junction
- SW3) relay set by-passing TR1; releases relay A.
- SW4 provides advance forward loop to junction relay set.
- SW5 provides alternative holding earth for relay KF.
- SW6 provides holding earth for relay SW dependent on contact KA1.

Relay A releasing;

- A1 releases relay B.
- A2 has no useful function at this stage.

Relay B releasing;

- B1 disconnects K2 earth from relay KF; relay KF is now dependent on contact SW5 earth.
- B2)
- &) have no useful function at this stage.
- B3)
- B4 disconnects relay KA.
- B5 has no useful function at this stage.
- B6 disconnects relay K holding circuit; connects earth from the junction P wire holding relay SW independent of contact KA1.

Relay K releasing;

- K1 has no useful function at this stage.
- K2 leaves relay KF dependent on earth at contact KA3.
- K3)
- K4)
- &) have no useful function at this stage.
- K5)
- K6)
- &) disconnects SW4 short circuit from the junction
- K7) relay set.
- K8 spare.

Relay KA releasing;

- KA1 disconnects relay SW held circuit (SW holds on its d-e winding to earth in Junction relay set).
- KA2)
- KA3)
- KA4)
- KA5) have no useful function at this stage.
- KA6)
- KA7)

Further dialled digits from the subscribers loop are extended to the O/G junction relay set and thence to the parent exchange. Relays operated at this stage KF and SW.

(b) All Junctions Busy.

On hearing dial tone, the caller proceeds to dial the first digit. Relays operated at this stage - KF, A, B, CD, KD, K and KA.

Relay A responding to the breaking and making of the dial springs;

- A1 repeats the pulses to the DR switch magnet in series with the low resistance a-b winding of relay CD.
- A2 has no function at this stage.

The DR switch wipers step to the contacts corresponding to the digit dialled. Wiper DR4 moving from the home position causes the high resistance d-e winding of relay CD to be disconnected, and when the pulse train ends, relay CD is released. At the end of the pulse train;

Relay A holds to the subscriber's loop on the line wires;

- A1 holds relay B which being slow to release held during dialling.
- A2 has no function at this stage.

Relay CD releasing at the end of its slow-release period;

- CD1 releases relays KD and K.
- CD2 connects Overflow busy tone to TR1 via wipers DS7 in position 7.
- CD3 has no function at this stage (note that earth at contact KA2 short-circuits R11 battery via wiper DS3 in position 7, preventing relay SW operating).
- CD4 breaks the DR switch magnet pulsing circuit.
- CD5 has no useful function at this stage.
- CD6 further disconnects relay KD.
- CD7 has no useful function at this stage.

Relay TM will operate to contact SW5 earth via contact KF6 (see under par. 5.1.6 (d) 'Forced Release'). The junction overflow meter operates to earth at contact SW6 via wiper DR1, contacts B3, K1, NU7 and wiper DS8 in position 7. The caller hears overflow busy tone. Relays operated at this stage - KF, A, B, KD, K and KA.

5.1.3 Local Call.

(a) Free Junction.

The subscriber hears dial tone and dials the first digit corresponding to the local number.

At the end of the first digit pulses, the relays operated are - KF, A, B, CD (slow-releasing), K and KA and wipers DS4, 5 and 6 are on a free junction.

At the finish of CD slow-release period;

Relay CD releasing;

- CD1 leaves relay K dependent upon the earth from the junction relay set.
- CD2 has no useful function at this stage.
- CD3 extends earth at contact B4 to operate relay LC over wiper DR2 (for details of strappings, see Diagram Note 2).
- CD4 breaks the DR switch magnet pulsing circuit.
- CD5 has no useful function at this stage.
- CD6 further disconnects the testing circuit.
- CD7 prepares operating circuit for DS switch magnet.

Relay LC operating;

- LC1 prepares holding circuit for relay LC.
- LC2 prepares DS switch magnet drive.
- LC3 prepares relay SW operate circuit.
- LC4 has no useful function at this stage.
- LC5 provides alternative holding earth for relay KF.
- LC6 prepares circuit for relay CD.
- LC7 spare.
- LC8 disconnects and releases relay K.

Relay K releasing;

- K1 has no useful function at this stage.
- K2 disconnects earth and leaves relay KF dependent on contact LC5 earth.
- K3 completes drive for DS switch magnet to earth at contact B4, via wiper DR4 in position 5, wiper DS2 in position 0-7, and contacts LC2, CD7 and B2.
- K4 has no useful function at this stage.
- K5 provides alternative circuit for relay LC.
- K6)
- &)
- K7)
- K8 spare.

The DS switch wipers rotate until they leave position 7, when the magnet circuit is broken at wiper DS2. Then relay CD operates from earth at contact B4 via wipers DR4, DS2 in position 8, contacts RC2 and LC6.

Relay CD operates;

- CD1 prepares the testing circuit and energises the DS switch magnet via contacts K4 and KD1 and the DS dm springs, causing the DS switch wipers to rotate (if first outlet busy).

Relay CD operates; (Cont'd)

CD2 has no useful function at this stage.
CD3 provides holding earth from contact E4.
CD4 has no useful function at this stage.
CD5 provides alternative circuit for relay LC,
and further prepares the operate circuit
for relay SW.
CD6 further prepares the testing circuit.
CD7 breaks the DS homing circuit.

The selector (DS) switch wipers now rotate until a free local final selector is reached, or the all finals busy position (No. 14) is reached.

Relays operated at this stage are - KF, A, B, CD, KA and LC.

(b) Free Final Selector Found.

When the DS switch wipers reach the bank contacts corresponding to a free final selector;
Relay KD operates on both windings in series to battery extended from the final selector P wire via wiper DS6 and contacts NU4 and B6.

KD1 switches relay K in series with the DS switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

K1 has no useful function at this stage.
K2 provides a further hold circuit for relay KF.
K3 further disconnects the DS "homing" circuit.
K4 has no useful function at this stage.
K5 extends earth at contact B4 via wiper DR3 in position No. 5, contact CD5, LC3 rectifier MR3 to operate relay SW to R11 battery; holds relay LC via diode D2 and LC1.
K6)
&) extends a loop to the selected final selector.
K7)
K8 spare.

Relay SW operating;

SW1 has no useful function at this stage.
SW2)
&) positive and negative wires extended to final
SW3) selector, by-passing TR1; releases relay A.
SW4 provides advance forward loop to final selector.
SW5 provides alternative holding earth for relay KF.
SW6 provides earth for relay SW, dependent on contact KA1.

Relay A releasing;

A1 releases relay B.
A2 has no useful function at this stage.

Relay B releasing;

B1 disconnects K2 earth from relay KF; relay KF is now dependent on contact SW5 earth.
B2 prepares "homing" circuit for DS magnet.
B3 prepares "homing" circuit for DR magnet.
B4 disconnects relays KA, CD and LC.
B5 has no useful function at this stage.
B6 disconnects relay KD operate circuit; connects earth from the final selector P wire holding relay SW independent of contact KA1.

Relay LC releasing, performs no useful function at this stage.

Relay KD releasing,(due to earth on P from Final Selector and/or B6 dis);

KD1 has no useful function at this stage.

Relay KA releasing;

KA1 disconnects relay SW hold circuit (SW holds on its d-e winding to earth in final selector.
KA2)
KA3)
KA4) have no useful function at this stage.
KA5)
KA6 further disconnects holding circuit.
KA7 has no useful function at this stage.

Relay CD releasing;

CD1 releases relay K.
CD2)
CD3) have no useful function at this stage.
CD4)
CD5)
CD6 further disconnects the testing circuit.
CD7 has no useful function at this stage.

Relay K releasing;

K1 has no useful function at this stage.
K2 " " " " " " "
K3 prepares DS switch magnet "homing" circuit.
K4 has no useful function at this stage.
K5 " " " " " " "
K6)
&) disconnects the SW4 short circuit from wipers
K7) DS4 and DS5.
K8 spare.

Further dialled digits from the subscriber's loop go over the positive and negative wires to the selected final selector. Relays operated at this stage - KF and SW.

(c) Final Selectors Busy

Assume the subscriber has dialled the 1st digit corresponding to the local number, the DS switch wipers have rotated to position 7, relay CD has operated and the DS switch wipers are hunting for a final selector.

(c) Final Selectors Busy (Cont'c)

Relays operated at this stage - KP, A, B, CD, KA, A and LC. DS switch magnet steps to contact CD1 earth via contacts K4 and KD1.

Since there are no final selectors free, the DS selector switch steps to position 14 ('all finals busy position).

Relay KD operates on both windings in series to R5/R6 battery via wiper DS6 and contacts NU4 and B6.

KD1 switches relay K in series with the DS switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

K1 completes Final Selector Overflow Meter circuit at earth on SW6, via wipers of DR1 in position 5, contacts B3, NU7 and wipers DS8 in position 14.
K2 provides a further hold circuit for relay KP.
K3 further disconnects the DS "homing" circuit.
K4 has no useful function at this stage.
K5 has no useful function at this stage; (Note that earth at contact KA2 short-circuits R11 battery via wiper DS3 in position 14 preventing relay SW operating).
K6)
&)
K7)
K8 have no useful function at this stage
K8 spare.

Relay TM will operate to contact SW5 earth via contact KP6 (see under "forced release"). The Final Selector Overflow Meter has operated (and remains operated until the subscriber hangs up). The caller hears overflow busy tone via DS7 wiper in position 14, KA7 and NU2 contacts.

Relays operated at this stage - KP, A, B, CD, K, KA and KD.

(d) Junctions Busy.

The subscriber hears dial tone and dials the 1st digit corresponding to the local number. At the end of the 1st digit pulses, the relays operated are - KP, A, B, CD (slow-releasing), KD, K and KA, and wipers DS4, 5 and 6 are on the "all junctions busy" position. At the finish of CD slow-release period;

Relay CD releasing;

CD1 releases relays KD and K.
CD2 has no useful function at this stage.
CD3 extends earth at contact B4 to operate relay LC over wiper DR2 (for details of strapping, see Diagram Note 2).
CD4 breaks the DR switch magnet pulsing circuit.
CD5 has no useful function at this stage.
CD6 further disconnects relay KD.
CD7 has no useful function at this stage.

Relay LC operating;

LC1 prepares holding circuit.
LC2 prepares DS switch magnet drive.
LC3 prepares relay SW operate circuit.
LC4 no useful function at this stage.
LC5 provides alternative holding earth for relay KF.
LC6 prepares circuit for relay CD.
LC7 spare.
LC8 no useful function at this stage.

Relay KD releasing;

KD1 no useful function at this stage.

Relay K releasing;

K1 has no useful function at this stage.
K2 disconnects earth and leaves relay KF dependent on contact LC5 earth.
K3 completes drive for DS switch magnet to earth at contact B4, via wiper DR4 in position 5, wiper DS2 in position 7, and contacts LC2, CD7 and B2.
K4 has no useful function at this stage.
K5 completes holding circuit for relay LC to contact B4 earth.
K6 disconnects TR 4-7 from wipers DS4 and DS5.
K7 " " " " " " " " "
K8 spare.

The DS switch wipers rotate from position 7 to position 8, where the magnet circuit is broken at wiper DS2. Then relay CD operates from earth at B4 via wipers DR4, DS2, contacts RC2 and LC6.

Relay CD operates and the circuit functions as explained in par. 5.1.3 (a) (Free Junction.)

5.1.4 Revertive Call. The subscriber hears dial tone and dials the first digit corresponding to the local revertive number. At the end of the 1st digit pulses, the relays operated are - KF, A, B, CD (slow-releasing), (KD if DS wipers in "all junctions busy" position 7), K, KA and wipers DS4, 5 and 6 on a free junction (or in position 7).

At the finish of CD slow-release period;

Relay CD releasing;

CD1 leaves relay K dependent upon the earth from the junction relay set (or releases relay KD and K in "all junctions busy" position).
CD2 has no useful function at this stage.
CD3 extends earth at contact B4 to operate relay RC over its a-b winding via DR2 (for details of strapping see Diagram Note 2); and relay LC via DR2 and diode D3.
CD4 breaks the DR switch magnet pulsing circuit.
CD5 has no useful function at this stage.
CD6 further disconnects the testing circuit (and relay KD if in "all junctions busy" position).
CD7 prepares operating circuit for DS switch magnet (or has no useful function if wipers in "all junctions busy" position).

Relay LC operating;

LC1 prepares holding circuit.
LC2 prepares DS switch magnet drive in DS wiper positions 0-7.
LC3 prepares relay SW operate circuit.
LC4 has no useful function at this stage.
LC5 provides alternative holding earth for relay KF.
LC6 prepares circuit for relay CD.
LC7 spare.
LC8 disconnects and releases relay K (or, has no useful function if wipers in "all junctions busy" position).

Relay RC operating;

RC1 prepares holding circuit.
RC2 prepares DS switch magnet drive in DS wiper position 8.
RC3 prepares DS switch magnet drive in DS wiper positions 9-14.
RC4)
&) have no useful function at this stage.
RC5)
RC6 provides alternative circuit.
RC7 provides alternative holding earth for relay KF.
RC8 has no useful function at this stage.

Relay K releasing;

K1 has no useful function at this stage.
K2 disconnects earth and leaves relay KF dependent on earths on contacts LC5 and RC7.
K3 completes drive for DS switch magnet to earth at contact B4, via wiper DR4 in position 1, wiper DS2 in position 0-7, and contacts LC2, CD7 and B2.
K4 has no useful function at this stage.
K5 provides holding circuit for relay LC and RC.
K6)
&) disconnects TR4-7 from wipers DS4 and DS5.
K7)
K8 spare.

The DS switch wipers rotate until they leave position 7, when the magnet circuit is broken at wiper DS2. In position 8, the DS switch magnet receives a drive from contact B4 earth, wipers DR4 in position 1, wipers DS2 in position 8, contacts RC2, LC2, CD7, B2 and K3 to drive the DS wipers to position 9. In position 9, the DS switch magnet receives a drive from contact B4 earth, wipers DR4 in position 1, wipers DS2 in position 9, contacts RC3, RC2, LC2, CD7, B2, and K3 to step the DS wipers to position 15. Then relay CD operates from earth at contact B4 via wipers DR4, DS2 and contacts LC6.

Relay CD operates;

CD1 prepares the testing circuit and energises the DS switch magnet via contacts K4 and KD1 and the DS dm springs, causing the DS switch wipers to rotate (if the first revertive relay set is busy).
CD2 has no useful function at this stage.
CD3 provides holding earth from contact B4.
CD4 has no useful function at this stage.
CD5 provides alternative circuit for relay LC and RC, and further prepares the operate circuit for relay SW.

CD6 further prepares the testing circuit.
CD7 breaks the B3 homing circuit.

The selector (DS) switch wipers now rotate until (a) a free revertive relay set is reached, or (b) the "all relay sets busy" (No. 24) is reached.

Relays operated at this stage - KF, A, B, CD, KA, LC and RC.

(a) Free Revertive Relay Set.

When the DS switch wipers reach the bank contacts corresponding to a free relay set -
Relay KD operates on both windings in series to battery extended from the relay set P wire via wiper DS6 and contacts NU4 and B6. KD1 switches relay K in series with the DS switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

K1 has no useful function at this stage.
K2 provides a further hold circuit for relay KF.
K3 further disconnects the DS "homing" circuit.
K4 has no useful function at this stage.
K5 extends earth at contact B4 via wiper DR3 in position No. 1, contacts CD5, LC3, rectifier MR3 to operate relay SW to R11 battery.
K6)
&) extends a loop to the selected revertive relay set.
K7)
K8 spare.

Relay SW operating;

SW1 has no useful function at this stage.
SW2)
&) positive and negative wires extended to the relay set,
SW3) by-passing TR1; releases relay A.
SW4 provides advance forward loop to revertive relay set.
SW5 provides alternative holding earth for relay KF.
SW6 provides holding earth for relay SW, dependent on contact KA1.

Relay A releases;

A1 releases relay B.
A2 has no useful function at this stage.

Relay B releases;

B1 disconnects K2 earth from relay KF; relay KF is now dependent on contact SW5 earth.
B2 prepares "homing" circuit for DS magnet.
B3 prepares "homing" circuit for DR magnet.
B4 disconnects relays KA, CD, LC and RC.
B5 has no useful function at this stage.
B6 disconnects relay KD operate circuit; connects earth from the revertive relay set P wire holding relay SW independent of contact KA1.

Relay KB releasing (due to earth on P from revertive relay set and/or BG dis);

KB1 has no useful function at this stage.

Relay KA releasing;

KA1 disconnects relay SW alternate hold circuit (SW holds on its d-e winding to earth in relay set).
KA2 has no useful function at this stage.
KA3)
KA4) has no useful function at this stage.
KA5)
KA6 further disconnects holding circuit.
KA7 has no useful function at this stage.

Relay CD releasing;

CD1 releases relay K.
CD2)
CD3) have no useful function at this stage.
CD4)
CD5)
CD6 further disconnects the testing circuit.
CD7 has no useful function at this stage.

Relay K releasing;

K1 has no useful function at this stage.
K2 " " " " " " "
K3 prepares DS switch magnet "homing" circuit.
K4)
K5) have no useful function at this stage.
K6)
K7) disconnects TR 4-7 from wipers DS4 and DS5.
K8 spare.

Relay LC releasing;

LC contacts have no useful function at this stage.

Relay RC releasing;

RC contacts have no useful function at this stage.

Further dialled digits from the subscriber's loop go over the positive and negative wires to the selected revertive relay set. Relays operated at this stage - KP and SW.

(b) All Revertive Relay Sets Busy.

Assume the subscriber has dialled the 1st digit corresponding to the local revertive relay set number, the DS switch wipers have hunted for a revertive relay set and have now stepped to position 19 ("all relay sets busy" position). Relays operated at this stage - KP, A, B, CD, KA, LC and RC. DS switch magnet will continue stepping to earth at CD1, via contacts K4, KB1, DS dm until position 24 is reached..

Relay KD operates on both windings in series to R5/R6 battery via wiper DS6 and contacts NU4 and B6.

KD1 switches relay K in series with the DS3 switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

K1 completes Revertive Overflow Meter circuit at earth on SW6, via wipers of DR1 in position 1, contacts B3, NU7 and wipers DS8 in position 24.
K2 provides a further hold circuit for relay KF.
K3 further disconnects the DS "homing" circuit.
K4 has no useful function at this stage.
K5 has no useful function at this stage (note that earth at contact KA2 short circuits R11 battery via wiper DS3 in position 14, preventing relay SW operating).
K6)
&)
K7)
K8 spare.

Relay TM will operate to contact SW5 earth via contact KF6 (see par. 5.1.6 (d) 'Forced Release'). The Revertive Overflow Meter has operated (and remains operated until the subscriber hangs up). The caller hears overflow busy tone.

Relays operated at this stage - KF, A, B, CD, K, KA, KD, LC and RC.

5.1.5 Dialling Barred or Spare Digits. On hearing dial tone, the caller proceeds to dial the 1st digit. The DR switch wipers step to the contacts corresponding to the digit dialled. Relays operated at this stage - KF, A, B, CD (slow-releasing) K, (KD if "all junctions busy") and KA.

At the finish of CD slow-release period;

Relay CD releases;

CD1 releases relay K (and Relay KD if "all junctions busy").
CD2 has no useful function at this stage.
CD3 extends earth at contact B4 to operate relay NU via DR2 (for details of strapping, see Diagram Note 2).
CD4)
CD5)
CD6)
CD7)

Relay NU operates;

NU1 provides holding circuit to earth at contact B4 independent of wiper DR2.
NU2 extends NU tone to TR1.
NU3 provides alternative holding earth for relay KF.
NU4 opens P wire circuit.
NU5 spare.
NU6 operating and holding earth for relay TM.
NU7 has no useful function at this stage.
NU8 spare.

Relay K releasing: disconnects the DS4 and 5 wipers from the junction relay set at contacts K6 and K7.

Relay EK will operate to contacts K13 and N06 (see par. 5.1 (d) 'forced release'). Relays operated at this stage - KF, A, B, KA and NU.

5.1.6 Release. When Calling Party (see final selector circuit) release is provided on all calls (excepting those to a manual board, see par. 5.2.5 (b)).

(a) Calling Party release from a Successful Call, (Automatic Parent).

Relays operated at this stage - KF and SW.

When the calling subscriber hangs up, the loop extended to the junction relay set by wipers DS4 and DS5 is removed, causing the earth on the P wiper DS6 to be disconnected.

Relay SW releasing removes the negative and positive wires from wipers DS4 and 5 and reconnects the A relay to the wipers LF1 and 2.

Contact SW5 removes the holding earth for relay KF.

Contact SW6 provides the earth to drive the DR switch magnet via DR1 wiper off normal and contact E3. When DR drives to the normal position (0 or 12), the same earth at contact SW6 drives the DS3 switch magnet and wipers to their normal position (0), via wipers DR1 in position 0 or 12, wipers DS1 off normal, contacts E2 and K3.

Once the KF relay releases, earth at contact KF2 is placed on the common DK lead signifying that the Linefinder and associated Discriminating Selector are free. And when wipers DS3 return to normal, R4 battery is restored on the 'T' lead to the Allotter. It will be noted that unless both switches are in the home position, the R4 resistance battery will not be extended to the T wire by wipers DS3 and DR5. This prevents the seizure of the selector and linfinder by the allotter if the switches fail to restore.

(b) Calling Party release of Unsuccessful Call.

If a caller fails to extend a call past the selector, overflow or NU tone is returned.

Relays operated at this stage - KF, A, B, KA and NU. When the handset is replaced, relays A and B release. Relays KA and NU release at contact B4, followed by relay KF at contact NU3.

The two switch magnets "home" as in 5.1.6 (a) above.

(c) Called Party Release.

Should the called party restore first, (in the case of the Final Selector being strapped for either party release) or 'forced release' takes place in the final selector, revertive relay set or junction relay set, the discriminating selector is released as below.

Relays operated at this stage - KF and SW.

Relay SW releases when the earth is removed from the P wire by the release of the final selector, revertive relay set or junction relay set. Relay KF releases and the two switch magnets "home" as in (a) above. The calling party's line circuit reverts to the "P.G." condition.

(d) Forced Release.

Arrangements are made to release the circuit by time pulse when the following conditions have lasted between 60 and 260 secs:

- (i) Selector seized, but no dialling has taken place:
Contact KFG operated, earths tag "a" of relay TM (see par. 5.1.1).
- (ii) Overflow tone is being returned:
Contact KFG operated, earths tag "a" of relay TM (see par. 5.1.1 (b), 5.1.3 (c) and 5.1.4 (b)).
- (iii) NU tone is being returned:
Contacts KFG and NUG operated, earth tag "a" of relay TM (see par. 5.1.5).

The first time pulse to arrive on the start lead after one of these conditions has been set up, will operate relay TM.

(Time pulse start pulses occur once every 198 secs. approximately.)

Relay TM operating;

TM1 enables relay TM to hold to the "hold pulse".
TM2 completes the time pulse release circuit.

60 secs after the operation of relay TM, the release pulse (earth) and relay B is short-circuited, causing it to release. The whole selector circuit then releases as in par. 5.1.6 (c) and the subscriber's line circuit reverts to the "P.G." condition. Relay TM releases as soon as relays KF or NU are released.

5.2 Parent Exchange-Manual Board.

5.2.1 Pre-dialling. When a 13M unit is entirely dependent upon a Manual exchange for its junction traffic, it is desirable to suspend seizure of a junction until the digit "0" is dialled. Note 3 on the diagram details straps to be connected. When the selector is initially seized, the R5 and R6 resistance battery is extended via contact RC8, strap 62-64, wiper DS6 on the home contact and contacts NU4 and B6 to operate relay KD (both windings in series) to earth via contacts CD6 and CD1.

Relay KD operating;

KD1 removes the short-circuit from across relay K, which operates.

The seizure of a junction is thereby prevented until dialling occurs. Relays operated at this stage - KF, A, B, CD, KD, K and KA. The caller dials an initial digit indicating (a) a junction call (digit "0" dialled) or (b) a local or revertive call. Barred or Spare Digits are dealt with as in par. 5.1.5.

5.2.2 Dialling the 1st Digit.

(a) Junction Call.

Relays operated prior to dialling - KF, A, B, CD, KD, K & KA. The DR switch wipers step to position 10 when the digit "0" is dialled. The circuit operation during dialling is as described in par. 5.1.2.

Relay CD releasing; (at the end of its slow-release period).

CD1 disconnects relays K and KD.
CD2 has no useful function at this stage.
CD3 operates relay RC via strap 30-32 (see Diagram Note 3), wipers DR2 in position 10 to contact B4 earth.
CD4)
CD5) have no useful function at this stage.
CD6)
CD7)

Relay K releasing;

K1)
K2) have no useful function at this stage
K3)
K4 prepares DS switch magnet stepping circuit.
K5 provides holding circuit for relay RC.
K6)
K7) have no useful function at this stage.
K8)

Relay KD releasing;

KD1 further prepares DS switch magnet stepping circuit.

Relay RC operating;

RC1 hold circuit for relay RC.
RC2)
RC3) have no useful function at this stage.
RC4)
RC5 completes operating circuit for relay CD via strap 24-22 (see Diagram Note 3), contacts LC4 and K5 to earth at contact B4.
RC6 provides alternative circuit
RC7)
RC8) have no useful function at this stage.

Relay CD operating;

CD1 prepares the testing circuit and energises the DS switch magnet via contacts K4 and KD1 and the DS dm springs causing the DS switch wipers to rotate
CD2)
CD3)
CD4) have no useful function at this stage.
CD5)
CD6 further prepares the testing circuit.
CD7 has no useful function at this stage.

Relays operated at this stage - KF, A, B, CD, KA and RC.
The selector (DS) switch wipers now rotate until a free junction is found, or the all junctions busy position (No. 7) is reached.

(b) Free Junction Found.

When the DS switch wipers reach the bank contacts corresponding to a free junction.

Relay KD operates on both windings in series to battery extended from the junction relay set P wire via wiper DS6 and contacts NU4 and B6.

KD1 switches relay K in series with the DS switch magnet, thereby operating relay K and preventing further operation of the switch magnet.

Relay K operating;

K1)
K2) have no useful function at this stage.
K3)
K4 prepares to hold relay K to an earth returned on the junction relay set P wire, and short-circuits relay KD causing it to release slowly.
K5 disconnects relay CD and operates relay SW via a-b winding, MR3, RC6, and CD5, wipers DR3, contacts K5 to earth at contact B4.
K6)
&) extends the outgoing line loop to the junction relay set.
K7)
K8 has no useful function at this stage.

Relay KD releasing; has no useful function at this stage.

Relay SW operating;

SW1 prepares relay SW holding circuit.
SW2)
&) positive and negative wires extended to the
SW3) junction relay set by-passing TR1; releases relay A.
SW4 provides advance forward loop to junction relay set.
SW5)
&) have no useful function at this stage.
SW6)

Relay CD releasing;

CD1 leaves relay K dependent upon the earth from the junction relay set.
CD2)
CD3)
CD4)
CD5) have no useful function at this stage.
CD6)
CD7)

Relay A releasing;

A1 releases relay B.
A2 has no useful function at this stage.

Relay B releasing;

- B1 disconnects K2 earth from relay KF; relay KF is now dependent on contact SW5 earth.
- B2)
 - &)
 - B3)have no useful function at this stage.
- B4 disconnects relays KA and RC.
- B5 has no useful function at this stage.
- B6 disconnects relay K holding circuit; connects earth from the junction P wire holding relay SW independent of contact KA1.

Relay K releasing;

- K1 has no useful function at this stage.
- K2 leaves relay KF dependent on earth at SW5
- K3)
 - K4)
 - K5)have no useful function at this stage.
- K6)
 - &)
 - K7)disconnect SW4 short circuit from the junction relay set
- K8 has no useful function at this stage.

Relay KA releasing;

- KA1 disconnects relay SW hold circuit (SW holds on its d-e winding to earth in junction relay set).
- KA2)
 - KA3)
 - KA4)
 - KA5)
 - KA6)
 - KA7)have no useful function at this stage.

Relay RC releasing; contacts have no function at this stage. Relays operated at this stage are KF and SW. The call is now switched through to the manual exchange via the junction relay set and the operator has control of the call (Manual Hold facility, see Junction relay set).

(c) All Junctions Busy.

When the DS switch wipers reach the "all junctions busy" position 7, relay KD is energised by the R5 and R6 resistance battery connected thereto. The selector switch then ceases to hunt and relays K and KA operate as in (b) (Free Junction Found) above. As there is of course no junction connected in position 7, contacts K6 and K7 have no useful function at this stage. Contact KA7 returns Overflow busy tone to the caller via wiper DS7 and strap 19-27 (see Diagram Note 3). Relay TM will operate to contact SW5 earth via contact KF6 (see par. 5.1.6 (d) "forced release"). The junction overflow meter operates to earth at contact SW6 via wiper DR1, contacts B3, K1, NU7 and wiper DS8 in position 7. The caller hears overflow busy tone. Relays operated at this stage - KF, A, B, KD, K and KA.

5.2.3 Local Call. The wipers of the DR switch step to the local digit position in response to the dial pulses. Relays operated at this stage (end of digit) - KF, A, B, CD (slow releasing), KD, K and KA. Relay CD releases and relay LC operates via wiper DR2 (for strapping, see Diagram Note 2) when CD3 restores.

Relay LC operating;

LC1 prepares holding circuit.
LC2 prepares DS switch magnet drive.
LC3)
LC4) have no useful function at this stage.
LC5)
LC6 prepares circuit for relay CD.
LC7)
&) have no useful function at this stage.
LC8)

Relays K and KD release due to contact CD1 and 6 restoring.

Relay K releasing:

K1)
K2) have no useful function at this stage.
K3 completes drive for DS switch magnet to earth at contact B4, via wiper DR4, wiper DS2 in position 0, and contacts LC2, CD7 and B2.
K4 has no useful function at this stage.
K5 completes holding circuit for relay LC to contact B4 earth.
K6)
K7) have no useful function at this stage.
K8)

The DS switch wipers rotate from position 0 to position 8 where the magnet circuit is broken at wiper DS2. Then CD operates from earth at B4 via wipers DR4, DS2, contacts RC2 and LC6. Contacts CD1 and 6 connects earth to prepare the testing circuit and the DS switch magnet. The DS switch wipers search for an idle final selector as described in 5.1.3.

5.2.4 Revertive Call. The wipers of the DR switch step to the revertive digit position in response to the dial pulses. Relays operated at this stage (end of digit) - KF, A, B, CD (slow-releasing), KD, K and KA. Relay CD releasing operates relay RC over its a-b winding via DR2 (for strapping see Diagram Note 2) and relay LC via DR2 and diode D3 to contact B4 earth via contact CD3.

Relay LC operating;

LC1 prepares holding circuit.
LC2 prepares DS switch magnet drive in DS wiper positions 0-7
LC3)
LC4) have no useful function at this stage.
LC5)
LC6 prepares circuit for relay CD.
LC7)
LC8) have no useful function at this stage.

Relay RC operating;

RC1 prepares holding circuit.
RC2 prepares DS switch magnet drive in DS wiper position 8.
RC3 prepares DS switch magnet drive in DS wiper positions 9-14.
RC4)
RC5)
RC6) have no useful function at this stage.
RC7)
RC8)

Relays K and KD releases due to contact CD1 and 6 restoring.

Relay K releasing;

K1)
&) have no useful function at this stage.
K2)
K3 completes drive for DS switch magnet to earth at contact B4, via wiper DR4, wiper DS2 in position 0, and contacts LC2, CD7 and B2.
K4 has no useful function at this stage.
K5 completes alternative holding circuit for relays RC and LC to contact B4 earth.
K6)
K7) have no useful function at this stage.
K8)

The DS switch wipers rotate until they leave position 7, when the magnet circuit is broken at wiper DS2.
The circuit functions now as described in par. 5.1.4.

5.2.5 Release.

(a) Local Call.

Release of a local call is as described in par. 5.1.6.

(b) Dial "0" call (Manual Hold).

When a call is made to a directly connected manual exchange, an additional earth is maintained on the P wire in the junction relay set. The junction relay set (and thus the selector) cannot then be released by the caller removing the loop from the A relay in the relay set. The call can only be released by the manual operator, who causes the circuit to restore as in par. 5.1.6 (c).

5.3 Busyng. See Note 7 on the diagram.

6. CIRCUIT DESIGN NOTES.

6.1 Relay A. The high speed relay used has an improved operate-to-release current ratio, permitting a relatively low minimum value of line leakage resistance.

6.2 Relay B. Made slow-to-release to enable it to hold during pulsing of relay A.

- 6.3 Relay CD. Made slow-to-release to enable it to hold on its a-b winding during pulsing of relay A.
- 6.4 Relay DR. Made slow-to-operate to ensure complete saturation, this producing an adequate release lag.
- 6.5 Relays LC and RC. Made slow-to-release to enable them to hold during the transit period of contact K5.
- 6.6 Rectifier MR1. Increases the release lag of relay B to enable it to hold more satisfactorily during pulsing of relay A.
- 6.7 Rectifier MR2. The non-linear resistance characteristic of rectifier MR2 assists in preventing double switching.
- 6.8 Rectifier MR3. Prevents the undesirable holding of relay CD, LC to earth on contact SW6.
- 6.9 Rectifier MR4. Prevents a linefinder holding earth, or a forced release priming earth, from being extended back into the circuit.
- 6.10 Diode D1. Prevents the reoperation of relay CD until the restoration of contact K5.
- 6.11 Diode D2. Prevents the premature operation of relay SW to earth at contact B4.
- 6.12 Diode D3. Prevents operation of relay RC on local calls, whilst allowing operation of relay LC on revertive calls.
- 6.13 Design Line Limits. The loop CR on entry is 1, 122 ohms. Subscriber line Insulation Limits. The insulation resistance must not be less than 50,000 ohms from either wire to (a) any other wire or, (b) to earth.

END OF DIAGRAM NOTES