

DETAILED DESCRIPTION

USES OF ROUTING INSTRUCTIONS

NO. 4A TOLL SWITCHING OFFICES

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1. GENERAL

1.01 This is one of a group of sections, all having the base number A828.121. These sections describe the detailed circuit operations of the No. 4A Toll Switching System.

1.05 If there is an alternate route, the routing instruction on the card for the last subgroup is card-to-relay (CR). When the decoder reads the card with a CR routing instruction, the decoder allows the

marker to read the information about the subgroup just as it does with CC routing instruction. However, the CR routing instruction indicates that at least one alternate route group is available. While the marker reads the information about the last subgroup, a route relay is operated to allow the decoder to check the first alternate route for a subgroup with an idle trunk. If the marker indicates that all trunks in the last subgroup of the first route are busy, then the decoder can present information to the marker about a subgroup, containing an idle trunk, in the alternate group by causing the translator to drop the card associated with that subgroup.

1.06 Route relays are assigned to groups which can be used as alternate routes. Of course, these groups can also be used as direct routes. The 3D or 6D card for the first subgroup of a group assigned a route relay contains relay-to-relay (RR) routing instruction. After reading the card the decoder proceeds to select a subgroup with an idle trunk through the operated route relay for the group. If all the subgroups are busy the decoder operates another route relay associated with the first alternate route and another check is made for an idle trunk. As soon as an idle subgroup is found, a translator card associated with that subgroup is dropped and the marker is allowed to test for and select an idle trunk.

1.07 The last subgroup of the last alternate route (a final group) is arranged so that it always appears to have an idle trunk when tested through a route relay. If no other subgroup is selected the decoder causes the card for this subgroup to be dropped and the marker is allowed to test for an idle trunk. The card contains FOF, FRO, or FMB routing instruction to guide the decoder in informing the marker what to do in case all the trunks in the last subgroup test busy.

2. TYPICAL APPLICATIONS OF CC, RR, FST, CR, FRO, FMB AND FOF ROUTING INSTRUCTIONS

(A) General

2.01 The following paragraphs give typical applications of CC, RR, FST, CR, FRO, FMB and FOF routing instructions. Calls are described with the use of Fig. 1, attached.

(B) Card-to-Card

2.02 As previously mentioned CC routing instruction is used on cards representing the first or intermediate subgroups in groups which are not used as alternate

routes.* This routing instruction is used on the following types of cards:

(a) Cards for the first or intermediate subgroups of the intertoll trunk groups from CSPs to toll centers (not CSPs). On Fig. 1, the outgoing trunk group from PO1 to TC3 illustrates this type of final group.

(b) Cards for the first or intermediate subgroups of toll switching groups from CSPs to local offices. The outgoing toll switching group from PO2 to local office No. 5 illustrates this type of group. (See Fig. 1.)

(c) Cards for the first or intermediate subgroups of terminal grade groups between CSPs. When there are both terminal and common grade intertoll trunks between CSPs, the terminal grade trunks are assigned to one group and the common grade trunks are assigned to another group. Since terminal grade trunks do not have the transmission characteristics required for use on built-up connections, these groups cannot be used as alternate routes. (No terminal grade groups are shown on Fig. 1.)

2.03 A call involving route advance, and therefore a call using card-to-card routing instructions, can be described by limiting the example to the outgoing trunk group from PO1 to TC3, described in (a) above and shown on Fig. 1.

2.04 Assume that PO1 and TC3 are in the same numbering plan area, that TC3 homes on PO1, and that the final trunk group from PO1 to TC3 contains two subgroups.

2.05 When an outward operator at PO1, desires to place a call for subscriber A to a subscriber reached via TC3, a toll tandem trunk and an incoming sender are seized at PO1. Since the call is to be completed within the home numbering area, only the national office code and the subscriber numerals are pulsed to the sender. A decoder and the home translator are seized and a 3D card is dropped by operating code bars under the control of the national office code (the first three digits pulsed to the sender) and the 3D (CG1 and CG4) and NVO signals.

2.06 While a marker is being seized, the decoder reads the trunk block information (connector and trunk block number) and the routing instruction which is card-to-card. When a marker has been seized and is prepared to read the card, the

*See paragraphs 2.24 and 2.32 for routing instructions on cards for last (or only) subgroup.

decoder informs the marker that it will hold until the marker signals the decoder that it has seized an idle trunk. The marker then receives the trunk block information for the first subgroup. The marker, after seizing the proper trunk block connector and trunk block, tests for an idle trunk. If an idle trunk is found the decoder is released, but if all trunks are busy the decoder is held and signals the card translator to restore the card with the CG1 and CG4 tabs (to indicate 3D) and to drop the next card.

2.07 The second card has tabs for the 3-digit national office code and has an NVO tab just as the first card but instead of a 3D indication (CG1 and CG4 tabs), the card has an RAL indication (CGO and CG1 tabs). The RAL indication signifies the decoder has caused the first route advance. In dropping the second card the decoder causes the CGO and CG1 and not the CG1 and CG4 code bars in the home translator to be operated. The marker releases the trunk block connector and trunk block associated with the first subgroup then receives the trunk block connector and trunk block number for the second subgroup from the RAL card.

2.08 The marker seizes a trunk block connector and again makes a test for an idle trunk. In this example, the group from PO1 to TC3 contains only two subgroups. For groups with the maximum of four subgroups, three route advances can be made and cards with CG- tabs indicating RAL, RA2 and RA3 can be dropped. These cards are dropped in the same translator as the 3D or 6D card which first indicated card-to-card routing instruction.

(C) Relay-to-Relay and Follow-with-Second Trial

2.09 Relay-to-relay routing instruction is punched on cards representing the first subgroup in trunk groups which can be used as alternate routes, i.e., those assigned route relays. This routing instruction is used on the following types of cards:

- (a) 3D or 6D cards representing the first subgroup of common grade trunk groups between CSPs, similar to the groups between PO1 and SC2 and PO1 and RC1 shown on Fig. 1.
- (b) 3D or 6D cards representing the first subgroup of trunk groups from CSPs to crossbar tandem offices, similar to the group from PO2 to the crossbar tandem office shown on Fig. 1.

2.10 RR routing instruction allows the decoder to check the subgroups available and to choose one with an idle trunk. The subgroup selected is then presented to the marker for testing. As mentioned

previously, this checking is done through route relays. Each decoder has a group of route relays, with one relay assigned to each trunk group that can be used as an alternate route. This group of relays is known as the decoder relay tree. The number of route relays is limited to 100 and they are numbered from 00 to 99. These numbers are known as alternate route pattern numbers.

2.11 The use of the pattern numbers and route relays is explained by a call which makes use of RR routing instruction.

2.12 On Fig. 1, assume that PO1 and PO2 are in different numbering areas and that they are also in different regions. Also assume that PO1 has no trunk groups to offices other than PO2 in the numbering area of PO2. When the outward operator at PO1 places a call for subscriber A to a subscriber served by automatic equipment in the toll center area of PO2, a toll tandem trunk to PO1 4A equipment is seized. After an incoming sender is engaged, the area code, the national office code and the subscriber numericals are pulsed to the sender. A decoder and home translator are seized and a 3D card is dropped by operating code bars under the control of the first three digits pulsed to the sender and the 3D (CG1 and CG4) and NVO signals.

2.13 The card dropped has information on it about the trunk block for the first subgroup in the group between PO1 and PO2, the alternate route pattern number 01 assigned to this group and relay-to-relay routing instruction. This information is read by the decoder and the route relay associated with the alternate route pattern number 01 on the card is operated. Through the operated route relay 01, the decoder can determine whether any of the subgroups have an idle trunk. While the decoder is making this test, a marker is seized. If the decoder finds that the first subgroup numbered 0 has an idle trunk, then the marker is allowed to use the trunk block information on the card already dropped to test and select a direct trunk to PO2.

2.14 If the first subgroup 0 is busy and the second subgroup 1 is found to have an idle trunk, the first 3D card is restored and the home translator drops another card to provide the marker with information about the second subgroup. This card is not dropped under the control of code bars for the digits from the sender input, but it is dropped under the control of code bars for the alternate route pattern number 01, the subgroup number 1 and an AR combination of CG- code bars (CGO and CG2).

2.15 In order for the card to be dropped, it must have tabs which match the code bars which have operated. The alternate route pattern number 01 and subgroup number 1 are indicated by tabs for the A,

B and C digits and in addition the card has CGO and CG2 tabs which classify it as an AR card. This type of card is referred to as an AR card since it is the type which is dropped in order to achieve alternate routing.*

2.16 The AR cards are always placed in home translators. An AR card is provided for each subgroup in those groups which are assigned route relays. It is necessary to use the CGO and CG2 tabs on these cards since the A, B and C digits on AR cards sometimes conflict with the codes on 3D cards or RA- cards in the home translator.

2.17 Since the A and B digits are used for the alternate route pattern number assigned to the route relay for the group, the numbers can be from 00 to 99. This explains why there can be only 100 route relays in each decoder. Thus only 100 trunk groups could be assigned to route relays in the decoder relay tree. Because of this limitation only those trunk groups which are used as alternate routes, i.e., groups to other CSPs and to crossbar tandem offices, are assigned route relays. Other trunks which cannot be used as alternates are not assigned route relays and are tested through the use of routing instructions other than relay-to-relay.

2.18 If the decoder, in testing the group between PO1 and PO2, finds all subgroups busy, a route relay (11) associated with the trunk group from PO1 to the distant SC2 is operated. Through this route relay the decoder can check the group to determine whether any of the subgroups have an idle trunk. If the first subgroup indicates that it has an idle trunk, the decoder causes the card translator to drop the 110AR card so that the marker can test and select an idle trunk.

2.19 In this example SC2 and PO2 are not in the same numbering area, therefore no digits can be skipped when the number is pulsed from PO1 to SC2. The 4A office at SC2 needs the area code in order to select a trunk from the final group to PO2 so that the call may be completed to a subscriber in the toll center area of PO2.

2.20 If all trunks in the high usage group from PO1 to SC2 are busy, route relay 21 is operated and the decoder tests for an idle trunk to RC2. If these trunks are busy, route relay 10 is operated and the high usage group to RC1 is tested. If these are busy, route relay 00 is then operated.

*AR cards are also used, as in the case described here, to select trunks in the 2nd, 3rd or 4th subgroup of the first choice route. In alternate routing AR cards are used to select trunks in all subgroups of the alternate route.

2.21 For the call from PO1 to PO2 there may be as many as five intertoll trunk groups or 20 subgroups available for testing, but only one of these subgroups is tested by the marker. The holding time of the common control equipment is kept to a minimum with the relay-to-relay method by allowing the decoder to check the available routes at the same time as the marker is being seized.

2.22 Because of this method of testing there is an unguarded interval from the time the decoder relay tree indicates a subgroup with an idle trunk until the marker actually tests this subgroup. If, by the time the marker gets to the trunk block, all the trunks are busy, the marker calls for a second trial. This is done since other routes may be available with idle trunks. When the decoder reads a relay-to-relay routing instruction from a 3D or 6D card, it changes the instruction to follow-with-second trial and sends this signal to the marker on calls where the first subgroup of the preferred route is to be tested by the marker. On calls where an AR card for an intermediate route is dropped, the AR card has follow-with-second trial routing instructions punched on it and the decoder sends this information on to the marker for use if the subgroup is busy.

2.23 As previously stated, the call from PO1 to PO2 may require testing of as many as five alternate groups. Even though PO1 may have a direct trunk group to the regional center (RC3) serving as national center, it is not used as an alternate on this call because the distant regional center (RC3) does not serve as a national center for calls from PO1. RC3 only serves as a national center for calls from other regional centers.

(D) Card-to-Relay

2.24 When CR routing instruction is punched on the card for the last subgroup in a group not assigned a route relay, the decoder allows the marker to test the group, but at the same time the decoder checks for an idle subgroup through route relays representing alternate routes. The CR instruction could be used on the card for the last subgroup in the following types of trunk groups:

- (a) Trunk groups from CSPs to toll centers (not CSPs) when an alternate route is available. On Fig. 1 the outgoing group from PO1 to TC2 illustrates this type of group. The group from PO1 to PO2 is the first alternate route.
- (b) Toll switching groups from a CSP to a local office where an alternate route is available through a crossbar tandem office. On Fig. 1, the group

from PO2 to local office No. 4 has an alternate route available through the crossbar tandem office.

(c) The terminal grade groups between two CSPs, since the common grade group between the CSPs can be used as an alternate route. No terminal grade trunks are shown on Fig. 1.

2.25 The cards for the first and the intermediate subgroups in the groups described above contain CC routing instruction while the card for the last subgroup contains CR instruction. If the group contains only one subgroup, CR instruction is punched on the card for that subgroup.

2.26 Using Fig. 1, the following is a description of a call using CR instruction. Assume that the group from PO1 to TC2 is a high usage group containing only one subgroup, i.e., 40 or less trunks, and that PO1 and TC2 are in different numbering areas and in different regions. Also assume that subscriber A desires to make a call to a subscriber in the toll center area of TC2. Subscriber A contacts the outward operator at PO1. This operator places the call to the subscriber in the TC2 area. A toll tandem trunk to the PO1 4A equipment is seized. An incoming sender is seized at PO1 and the distant area code, the national office code, and the subscriber numerals are pulsed to the sender.

2.27 After the impulsing of the first three digits, a decoder and a home translator are seized and a 3D card is dropped by operating the code bars under the control of the area code, the CG1 and CG4 (3D) signals and NVO signal. While a marker is being seized, the decoder reads the trunk block information and the card-to-relay routing instruction. As with card-to-card operation, the decoder informs the marker that it will hold until the marker signals that it has seized an idle trunk. The marker receives the trunk block information for the subgroup and after seizing the proper trunk block connector and trunk block, it tests for an idle trunk.

2.28 The card with card-to-relay routing instruction also has punched on it an alternate route pattern number. In this example the number is 01 and it represents the route relay for the first alternate route, which is the trunk group between PO1 and PO2. The decoder reads this number and operates route relay 01. While the marker is testing the subgroup (PO1 to TC2) the decoder causes the home translator to start restoring the 3D card.

2.29 Also, while the marker is testing the subgroup, the decoder begins to test the subgroups of the trunk group between PO1 and PO2 through the route relay

01. This testing may advance the groups to SC2, then to RC2, etc. as described in the call using relay-to-relay routing instruction. If the marker in the meantime finds an idle trunk to TC2, the decoder is signaled to release. If the marker fails to find an idle trunk, an all trunk busy signal is sent to the decoder. The decoder then selects the lowest subgroup having an idle trunk to PO2 or continues testing the remaining alternate routes, through the decoder relay tree, until a subgroup with an idle trunk is found.

2.30 Suppose that the third subgroup in the group between PO1 and PO2 is found to have an idle trunk. The decoder checks to see that the first card is restored and then causes the AR card associated with this subgroup to drop. (The card has CG0 and CG2 tabs (AR) and tabs for the digits 011.) This AR card gives trunk block information to the marker and after seizing a trunk block connector, the marker makes a test for a trunk. This AR card has follow-with-second trial routing instruction punched on it, to be used if the subgroup becomes busy during the interval between the decoder subgroup testing and the marker trunk testing.

2.31 In the call described above, it is assumed that the group between the PO1 and TC2 contains only one subgroup. If this high usage group contained two subgroups, the translator card for the first subgroup would contain card-to-card routing instruction. When the marker tests the trunks in the first subgroup and finds them busy the decoder route advances and the RAL card is dropped. This card represents the second and the last subgroup. It contains CR routing instruction and the alternate route pattern number for the first alternate route. If all trunks in the second subgroup are busy, the decoder selects a subgroup with idle trunks through the decoder relay tree.

(E) Advance to Reorder, Master Busy, and Overflow

2.32 The cards which represent the last or only subgroups of final groups always contain FRO, FMB or FOF routing instruction. Of course, these cards will not be dropped unless more preferred subgroups are busy. FRO, FMB or FOF is punched on the following types of cards:

(a) AR card - This card represents the last subgroup in a final group. On Fig. 1, the group from PO1 to SC1 represents such a group.

(b) RA- card - This represents the last subgroup in a group which does not have alternate routes. The group from PO1 to TC3 illustrates this type.

(c) 3D or 6D card - If the group contains only one subgroup and has no alternate routes, then FRO, FMB or FOF can be punched on this card.

2.33 The FRO, FMB or FOF routing instruction on the card guides the decoder in telling the marker whether to seize an overflow, master busy, or reorder trunk in case the last subgroup tests busy. These trunks are used to send three different types of interrupted signals to the calling operator. These signals indicate that the call has been held up because of a busy condition. By interpreting these signals, the operator can handle the call without making fruitless attempts to secure a trunk and without holding toll trunks out of service any longer than necessary. This is accomplished by permitting the overflow, master busy, and reorder signals to be used as follows.

2.34 When a call is held up because the outgoing intertoll trunks are busy at the first 4A office, the outward operator receives a slow flashing overflow signal (30 IPM). This indicates that the toll tandem trunk is connected to an overflow trunk in the 4A office where the call originated. The operator may hold the connection for a few minutes waiting for the overflow signal to change to a quick flashing reorder signal (120 IPM). The overflow trunk is so arranged that if an intertoll trunk in the final group becomes idle the overflow signal is changed to reorder. When the reorder signal is received the operator makes another attempt to complete the call.

2.35 If the progress of the call is held up because outgoing trunks are busy at an intermediate 4A office, it is undesirable to hold the intertoll trunk to the intermediate office out of service while waiting for the overflow condition to clear. Therefore the intermediate 4A office connects the incoming trunk to a master busy trunk. The master busy trunk circuit has a jack appearance at the No. 5 switchboard and it sends an irregular flashing signal (60 irregular flashes per minute) back to the outward operator. The outward operator upon receiving the irregular flash, rings and thereby signals the No. 5 operator at the intermediate 4A office. The No. 5 operator answers the signal by plugging in to the master busy trunk and then tells the outward operator the name of the office at which the overflow condition occurred. The call may then be placed in the hands of the No. 5 operator for completion, if desired.

2.36 When the progress of a call is stopped because the toll switching trunks at the terminating office are busy, the last 4A office connects the incoming trunk to a reorder trunk circuit and a rapid flashing reorder signal (120 IPM) is

sent to the calling operator. The operator then makes another attempt to complete the call. Since toll switching groups are heavily engineered, the call has a good chance of being completed when the operator makes the second attempt.

2.37 The translator, decoder and marker work together to determine whether an overflow, master busy, or reorder trunk is to be seized. An FRO, FMB or FOF routing instruction appearing on a translator card causes a decoder routing instruction relay to operate. The decoder may pass the instruction on or change the instruction before passing it on to the marker for use in case all the intertoll or toll switching trunks are busy.

2.38 The following paragraphs explain when FRO, FMB and FOF routing instructions are used on translator cards, how the decoder passes the routing information to the marker and how the marker seizes a reorder, master busy, or an overflow trunk.

2.39 A translator card that contains information about the last subgroup of the final group has either FOF or FRO routing instruction. If the subgroup is in an intertoll trunk group the instruction is FOF. If the subgroup is in a toll switching group the instruction is FRO. Provision is made to use the FMB instruction on cards representing the last subgroup of a trunk group. For normal routing it is not expected the FMB routing instruction will be used on translator cards, but it is provided for possible use on emergency routings and for special operation during holiday peaks.

2.40 The FRO, FMB or FOF routing instruction is read by the decoder when the translator card for the last subgroup of a final group is dropped. When FRO or FMB is read this instruction is sent on to the marker. However, when FOF is read, the instruction is sent on to the marker only if the incoming trunk is a toll tandem trunk from an outward switchboard. If the incoming trunk is an intertoll trunk (or tandem trunk from a through switchboard) the decoder sends an FMB signal to the marker.

2.41 When a marker tests the last subgroup of a final group and finds it busy, the marker attempts to seize a reorder, master busy, or overflow trunk in accordance with the instruction received from the decoder. Reorder and master busy trunks are not terminated on the same trunk blocks as the toll switching or intertoll trunks. When the trunks in the last subgroup are busy and FRO or FMB has been indicated by the decoder, the marker releases the trunk block connector and trunk block and seizes a connector and trunk block which has either master busy or reorder trunks. When the master busy trunks are found busy, the testing is advanced to the reorder trunks.

After releasing the connector and trunk block associated with the master busy trunks, the trunk block connector and trunk block which has reorder trunks is seized and a test for an idle trunk is made.

2.42 Overflow trunks are not terminated in the same way as reorder and master busy trunks. Four terminals are allotted for overflow trunks on the same trunk block as the last subgroup in a final intertoll group. If the last intertoll trunk is assigned to terminal 15 of the trunk block, four overflow trunks are assigned to terminals 16 through 19. When less than four overflow trunks are available, the unused terminals in the group of four must be made busy. With an FOF signal from the decoder, the marker is arranged to test and seize an overflow trunk if trunks 0 through 15 are busy.

2.43 The marker is designed so that if an attempt is made to seize an overflow trunk and the four overflow trunks are busy, the testing is advanced to the master busy trunks. This involves a release of trunk block connector and trunk block, and seizure of the connector and trunk block associated with the master busy trunks. If the master busy trunks are busy the testing is advanced to reorder trunks.

3. DETAILED DESCRIPTION OF CC, RR, FST, CR, FOF, FMB AND FRO ROUTING INSTRUCTION

(A) Card-to-Card Operation

General

3.01 The following paragraphs describe in detail the decoder and marker operations which occur when card-to-card routing instruction is punched on the 3D or 6D card dropped in a translator. As explained in Par. 2.06, the CC routing instruction indicates that the decoder is to present the subgroup represented by the 3D or 6D card to the marker for trunk testing. If all the trunks in this subgroup are busy the decoder then route advances in order to present the next subgroup to the marker.

3.02 This explanation describes the decoder and marker operations in the order in which they occur on a call. However, it is chiefly concerned with the route advance operations by which the decoder presents the subgroups to the marker for testing.

Dropping a 3D or 6D Card

3.03 When a toll tandem trunk or an incoming intertoll trunk to a 4A office is seized, an incoming sender is connected to the trunk and digits are impulsed to the sender. When the first three digits have been received, the sender seizes its decoder connector. The decoder connector

then selects a decoder as described in Section A828.121.2 and as shown on SC 113-1. The decoder then connects to the home translator and prepares the translator to drop a 3D card. The 3D card is then dropped under the control of the first three digits received by the sender plus a 3D (CG1 and CG4) and VO (or NVO) signal.

3.04 The 3D card dropped may have an NCA (no come again) punch and punches for card-to-card routing instruction. When this occurs the sequence of operations is extended from AB 126 on SC 113-1 to Fig. 2 on SC 117-1.

3.05 If the 3D card dropped has a CA6 (come again 6) punch, this indicates that a 6D card is to be dropped in a particular translator as indicated on the 3D card. If six digits have been registered in the sender by the time the decoder reads the CA6 instruction on the 3D card, no pretranslation is necessary and the sequence of operation is extended from AB 126 on SC 113-1 to Fig. 1 of Fig. 2 on SC 115-1.

3.06 If six digits have not been registered in the sender before the decoder reads the CA6 punch, pretranslation must take place before a 6D card can be dropped. When this occurs, the sequence of operation is extended from AB 126 on SC 113-1 to SC 114-1. The 3D card is then restored and the decoder connector and the decoder are released. When the sender has six digits registered, another decoder is seized in the same way as shown on SC 113-1. A 3D card like the one previously dropped (in the first decoder) is then dropped in the home translator. The sequence is then continued on SC 115-1.

3.07 When the 3D card indicates that the 6D card is to be dropped in a DFAT or an FAT, the operations are shown on Fig. 1 on SC 115-1. When the 3D card indicates that the 6D card is to be dropped in the home translator, the sequence is shown on Fig. 2 on SC 115-1. The method for the dropping of a 6D card is described in Section A828.121.4. When a 6D card with CC routing instruction is dropped the sequence is continued from Fig. 1 or Fig. 2 on SC 115-1 to Fig. 1 on SC 117-1.

Reading a 3D or 6D Card

3.08 The sequence of operations for reading 6D and 3D cards with CC instruction is shown on Figs. 1 and 2 on SC 117-1. When a card with CC instruction is read by the decoder, the RI4 and the RI7 (routing instruction) relays are operated in the decoder (OS 164-1). The operated RI4 and RI7 relays operate the CC relay as shown on OS 170-1. The CC relay operates from ground on the make contacts of the RIH and then through one of two paths depending on the type of call; through the operated NCA

relay for 3-digit translation; or through the operated R6D relay for 6-digit translation. This path is extended through the operated RI4 and RI7 relays to the winding of the CC relay.

3.09 As shown on SC 113-1, AJ 107, the RA relay operates on all calls when the decoder is seized. This path is through the operated CKG relay and then through the normal HBI, RA3, RA2 and RA1 relays (OS 170-1). When both the RA and the CC relays operate, the RA1 relay operates. As shown on Figs. 1 and 2 on SC 117-1, the decoder engages its marker connector and seizes a marker soon after reading the 3D or 6D card. The marker registers all necessary information for testing one subgroup with a maximum of 40 trunks. The MC relay in the decoder connector is also operated to connect the marker to the sender (OS 188-1 and 190-1).

3.10 The CC routing instruction indicates that there is more than one subgroup which can be tested, so the decoder operates the HLD (hold) relay in the marker to indicate that the decoder will hold to the marker until the marker determines whether a trunk can be seized. The marker HLD relay operates as shown on OS 170-1.

3.11 The decoder receives a signal on the RCK lead when the marker has received all information from the translator card and the decoder. Ground on the RCK lead operates the RCA (restore card and advance) relay which, in turn, operates the RCAL relay, releases the OC- (output control) relays (OS 163-1) and operates the ARC (automatic restore card) relay in the translator to restore the card (OS 170-1). The operated RCAL relay operates the DCB (disconnect code bars) relay. The DCB relay remains operated and opens the circuit for those CG- code bars which indicate 3D and 6D (OS 162-1). The DCB relay operates the DCB1 relay which in turn operates the DCB2 relay (OS 170-1). The RA (OS 170-1) and RI (OS 163-1) relays are released when the DCB2 relay operates. The normal RI relay releases the RI4, the RI7 (OS 164-1), and the RIH (OS 163-1) relays, causing the CC relay to release (OS 167-1).

3.12 While the card is being restored and the above operations are taking place, the marker sets up a connection to test the subgroup of outgoing trunks using information read from the 3D or 6D card. The marker has received a hold signal indicating that the decoder is waiting to present another subgroup of trunks for testing if the given subgroup is busy. The decoder expects either a signal over the TKS lead if the marker succeeds in selecting an idle trunk as described in Par. 3.13 or a signal over the ATB lead if all the trunks are busy as described in Par. 3.14.

Receiving TKS Signal from Marker (Fig. 4 on SC 117-1)

3.13 As shown on OS 201-1, when the marker seizes a trunk block connector and a trunk block, a circuit is closed to operate a K- (trunk selected) relay which, in turn, releases the TKE (trunk end) relay. Ground on the normal TKE through an operated K-relay operates the TKS (trunk seized) relay in the marker (OS 170-1). With the TKS and the HLD relays operated, the TKS lead is grounded to operate the TKS (trunk selected) relay in the decoder. As shown on OS 177-1, the operated TKS relay causes the operation of the RLT (release after translation) relay in the decoder. The RLT relay operating releases the decoder by releasing the CKG, CKG1, and CKG2 relays (OS 155-1) and by grounding the RLT lead to the decoder connector which causes it to release itself from the decoder (Fig. 4 on SC 117-1). The marker connector also releases, thus leaving the marker attached to the sender through contacts of the MC-relay in the decoder connector. The MC-relay locks in series with the CHK relay through contacts of the RLT relay (OS 177-1).

Receiving ATB Signal from Marker (Fig. 3 on SC 117-1)

3.14 If all the trunks in the first subgroup tested are busy, the ATB (all trunks busy) relay in the marker is operated as shown on OS 201-1. With the ATB relay in the marker operated, the TB (trunk busy) relay is operated (OS 202-1) and the locking circuit for the marker TC- relay is opened causing the TC- and the RCD relays in the marker to restore to normal (OS 191-1). The normal TC- relay releases the trunk block connector. The normal RCD relay restores all relays operated to register card information (OS 202-1, sheet 3). When the TC- relay in the marker releases the RCK relay also releases, removing ground from the RCK lead and releasing the RCA relay in the decoder (OS 170-1). In addition, a circuit is closed through all the normal TC- relays and the operated TB relay, to connect a ground on the ATB lead to the decoder. This indicates that the marker has found all trunks busy, is releasing all information pertaining to the first subgroup of trunks and is awaiting information about another subgroup.

3.15 When the decoder receives the ATB signal, the decoder ATB relay operates and opens one of the locking paths for the RCAL relay. When the RA and CC relays in the decoder release (see Par. 3.11), indicating that the decoder has released information read from the 3D card, the remaining locking paths for the RCAL relay are opened causing the RCAL relay to release. Release of the RCAL relay releases the DCB1 and DCB2 relays in the decoder and releases the HLD relay in the marker. The normal HLD relay releases the TB relay in

the marker (OS 202-1). This takes ground from the ATB lead to the decoder and releases the decoder ATB relay (OS 170-1). As shown on OS 191-1, the ATB relay in the decoder and the TB relay in the marker must be released before the marker TC- and RCD relays can be reoperated to register information about the next subgroup (OS 191-1).

3.16 When the RCA1 relay is released, and when the translator indicates by the release of the ARC relay that it is prepared to drop another card, the CCl-4 relays are reoperated to close the code bar leads to the translator (OS 161-1). As shown on OS 162-1, the circuit to CG- code bars associated with 3D and 6D is open because of the operated DCB relay, while the circuit for the CGO and CG1 (to indicate RA) code bars is closed through contacts of the normal RA and operated RA1 and CC2 relays.

Dropping RA1 Card

3.17 As shown on Fig. 3 on SC 117-1, the second card is dropped in the same translator as the first card with CC routing instruction. The card has CGO and CG1 tabs (to indicate RA1), tabs corresponding to the first three or six digits registered in the sender and possibly a VO or NVO tab. Trunk block information about the second subgroup and the routing instruction are also contained on this card. If there are no more subgroups in the group, this instruction is CR, FOF or FRO. If there is a third subgroup available, the instruction on the second card is CC. With the latter condition, the CC relay operates when the card is read by the decoder. As shown on OS 170-1, the CC relay operating causes the RA2 relay to operate through the contacts of the operated CKG relay, the normal HBI relay, the normal RA3 and RA2 relays, the operated RA1 relay, the normal RA and DCB2 relays and the operated CC relay.

3.18 When the marker has registered all information about the second subgroup, the RCK lead is grounded and the RCA and RCA1 relays are operated. The operated RCA relay again operates the ARC relay to start the restoration of the RA1 card. With the DCB relay locked operated through the CKG relay, the operated RCA1 relay operates the DCB1 relay and it in turn operates the DCB2 relay. The operation of the DCB2 relay releases the RA1 relay to ground the CG1 and CG2 leads and make possible the operation of the CG1 and CG2 code bars (to indicate RA2) if it is necessary to drop the card for the third subgroup (OS 162-1). While these operations are taking place, the marker seizes the proper trunk block and tests for an idle trunk. If an idle trunk is found, a TKS signal from the marker causes the decoder TKS (trunk selected) relay to operate (OS 170-1).

This in turn operates the decoder RLT relay in order to release the decoder (Fig. 4 on SC 117-1).

3.19 If all trunks are busy, an ATB signal from the marker causes the ATB (all trunks busy) relay to operate in the decoder (OS 170-1). The decoder again proceeds as described in Pars. 3.15 and 3.16, except that in this case, when the RA1 card is restored a circuit is closed to ground the CG1 and CG2 leads. The path is through normal contacts of the RA and RA1 relays and make contacts of the CC2 and RA2 relays (OS 162-1).

Dropping RA2 Card

3.20 If the third subgroup is the last in the trunk group, the RA2 card has CR, FOF or FRO routing instruction. However, if there is a fourth subgroup available, the RA2 card contains CC routing instruction. In this case, reading of the card causes the operation of the CC relay. This in turn operates the RA3 relay as shown on OS 170-1. The HLD relay in the marker is again operated and the marker tests the third subgroup for an idle trunk. While the marker is testing the third subgroup, the translator restores the RA2 card and the DCB2 relay operates and releases the RA2 relay. The release of the RA2 relay and the operation of the RA3 relay prepares the decoder to operate the CGO and CG4 code bars (to indicate RA3) in case the marker returns an ATB signal to the decoder. If this occurs a card with CGO and CG4 tabs is dropped. If the marker sends the decoder a TKS signal the decoder releases through the operation of the RLT relay.

Dropping RA3 Card

3.21 The RA3 card with CGO and CG4 tabs contains trunk block information about the fourth subgroup. Since only three route advances can be made, the fourth card cannot contain CC routing instruction. If there is an alternate route available the routing instruction is CR (card-to-relay). The operations involved when CR instruction is used are explained in Pars. 3.85 to 3.111. If there are no alternate routes, then the RA3 card contains FOF or FRO routing instruction. The explanation of operations involving the FOF or FRO instruction may be found in Pars. 3.112 to 3.145.

(B) Relay-to-Relay and Follow-with-Second Trial Operation

General

3.22 The following paragraphs explain in detail the decoder and marker relay operations involved when relay-to-relay routing instruction is used on the 3D or 6D card dropped in a translator. This explanation describes the operations in the order

in which they normally occur on a call. However, it is chiefly concerned with those operations by which the decoder selects a subgroup with an idle trunk through the decoder relay tree, then allows the marker to test the subgroup and seize an outgoing trunk. The subgroup selected may be in a group along a direct or alternate route.

Dropping a 3D or 6D Card

3.23 Seizure of a toll tandem trunk or an incoming intertoll trunk to the 4A office causes an incoming sender to be selected. When the sender is attached, digits are impulsed to the sender. When the first three digits have been received, the sender seizes its decoder connector which in turn selects a decoder. The methods for seizing a sender, decoder connector, and decoder are similar for all calls and are discussed in Section A828.121.2. The sequence of operations involved in decoder connector and decoder seizure is shown on SC 113-1.

3.24 When a decoder is seized, the CKG, CKG1 and CKG2 relays are operated (OS 155-1). The CKG1 relay causes the operation of the CK2 relay (OS 160-1). The CK2 relay operation causes an integrity check of sender-decoder leads to be made. If the leads from the sender and decoder connector are free of crosses and false grounds and if the leads pass a continuity check, the CK3 relay is operated.

3.25 While the integrity check of the sender and decoder leads is taking place, the decoder also makes a check to make sure that there are no crosses on the locking contacts of the RB- (route busy) relays. The decoder circuits involved in this check are shown on OS 173-1. When the decoder is seized, the CKG2 relay operates and closes a ground through the winding of the RLS relay to the locking contacts of all RB- relays. A cross on one of these contacts causes the associated RB- relay to operate and thereby prevent the subsequent operation of the associated CI- (ground supply cut-in) relay. This blocks the call by preventing the operation of the ARST relay (OS 171-1) which in turn prevents the operation of an R- relay. If all the RB- relays are normal, ground from the operated CK3 relay operates all of the CI- relays and the call proceeds as follows.

3.26 While the above checks are being made, operations shown on SC 113-1 connect the home translator to the decoder and prepare the translator to drop a 3D card. The 3D card is then dropped by the operation of code bars under the control of the first three digits pulsed to the sender and the 3D (CG1 and CG4) and VO (or NVO) signals (SC 113-1). When the 3D card is dropped, the COP1 and COP2 relays operate in the decoder. As shown on OS 171-1, the

operated COP1 relay closes a path to operate the ARST (alternate route start) relay from ground on the operated CKG2 relay, through the make contacts of all CI- relays, the normal contacts of relays CCA, CRK, GPL and the make contacts of the COP1 relay. The ARST relay locks to ground on the make contacts of the CKG2 relay. The ARST relay, like the CI- relays, operates on all calls but is used only when RR or CR routing instruction is used.

3.27 On SC 113-1, the operations after AB 126 do not concern a call which makes use of RR routing instruction. When the 3D card contains RR instruction and NGA (no come again) instruction, the sequence is extended from AB 126, SC 113-1 to Fig. 2 on SC 119-1.

3.28 When the 3D card has CA6 (come again 6) instruction, this indicates that an attempt is to be made to drop a 6D card. In this case the sequence at V122, SC 113-1 may be continued in a number of different ways.

3.29 If six digits have not been registered in the sender before the decoder reads the CA6 punch, the decoder and decoder-connector and decoder are released. When the first six digits have been registered in the sender the decoder connector and another decoder are seized. This operation is called pretranslation. The sequence for decoder and decoder-connector release is shown on SC 114-1. Seizure of the second decoder is similar to the sequence on SC 113-1. Pretranslation is described in detail in Part 2 of Section A828.121.4.

3.30 When six digits are available in the sender and a 3D card with CA6 instruction is dropped, an attempt is made to drop a 6D card in the particular translator designated on the 3D card. The sequence of operations for dropping a 6D card in either the DFAT or an FAT is shown on Fig. 1 on SC 115-1. The sequence for dropping a 6D card in the home translator is shown on Fig. 2 on SC 115-1. These operations are described in Part 2 of Section A828.121.4. When a 6D card with RR routing instruction is dropped, the sequence is continued on Fig. 1 on SC 119-1.

3.31 When a 6D card fails to drop in a translator, the call may be completed by using a principal city route providing the 3D card contains RR routing instruction. When this occurs, as described in Section A828.121.10, the sequence is extended from Fig. 1 or Fig. 2 on SC 115-1 to U101 on SC 116-1 and the original 3D card is again dropped. This 3D card with RR routing instruction is then read by the decoder.

3.32 When the DFAT or FAT has been made busy, the call may be completed by using the 3D card already dropped. This

can occur if the 3D card has RR routing instruction. On this type of call, the sequence of operations is as shown on Fig. 1 on SC 115-1.

3.33 Thus, any of the above means may be used in order to drop a 3D or 6D card with RR routing instruction.

Reading a 3D or 6D Card

3.34 RR routing instruction is indicated on the 3D or 6D card by the enlargement of the RIO and RI2 punches. The RIO and RI2 relays in the decoder are operated when the RIO and RI2 channel output detector tubes in the card translator have fired as shown on OS 164-1. The operated RIO and RI2 relays operate the RRP (relay-to-relay preference) relay (OS 171-1). The operation of the RIO and RI2 relays also cause the RR (relay-to-relay) relay to operate from ground on the make contacts of the RIH relay through one of three paths, depending on the type of call. If the call is one which requires 3-digit translation, the operated NCA (no come again) relay closes the circuit to the RR relay through the make contacts of the RIO and RI2 relays. If the call is one which uses principal city routing or 6-digit translation, the operated R6D (read 6 digits) relay closes the circuit instead of the NCA relay. If the call is one which requires 6-digit translation but the DFAT or the FAT is plugged busy and a principal city route is available, the operated TBY1 (FAT plugged busy) relay closes the circuit to operate the RR relay. The operated RR relay operates the RRA (RR auxiliary) relay (OS 171-1) and the GPL (subgroup lock) relay (OS 173-1).

3.35 3D and 6D cards with RR routing instruction have an alternate route pattern number (00-99) indicated by the combination of enlarged ART₅² and ARU₅² punches. The channel output detector tubes associated with these punches are fired when the control gaps of these tubes have been broken down and when 130-volt battery has been applied to the signal channel leads (OS 185-1). The 130-volt battery is applied through the operated RCC (battery supply for alternate route pattern relays) relay (OS 164-1). As shown on OS 163-1, the RCC relay operates: (a) from ground through the operated NCA relay for 3-digit translation calls; (b) from ground through the operated R6D1 relay for 6-digit translation or principal city routing calls; or (c) from ground through the operated TBY1 relay on calls using principal city routing when the DFAT or FAT is plugged busy.

3.36 With the RRP, the ARST, ART₅², and ARU₅² relays operated, one of the ten RR- relays (OS 171-1) is operated. The

RR- relay which operates corresponds to the tens digit represented by the operated ART₅² relays. Ground connected through the operated ARU₅² relays and the one operated RR- relay causes the operation of a particular route relay (R00-99) in the decoder.

Subgroup Testing Through Route Relay

3.37 As shown on Fig. 2, attached, and on OS 173-1, the group busy chain relay circuits serve as a medium between the outgoing trunks and each decoder. One of these circuits is provided for each trunk group assigned a route relay. Each circuit is common to all decoders. In each group busy circuit, a GB- (group busy) relay is provided for each subgroup. Ground from the idle trunk circuits stands on the GB leads. Since the GB leads for each subgroup are strapped together at the TADF and then connected to the winding of a GB- relay, each GB- relay remains operated as long as one or more trunks in the associated subgroup remain idle. When a GBO (associated with the first subgroup) relay is operated, ground is connected to the EGO and OGO leads. The EGO leads are wired to all even numbered decoders. The OGO leads are wired to all odd numbered decoders.

3.38 When all trunks in the first subgroup are busy, the GBO relay is released and the ground is transferred to the EG1 and OG1 leads through the normal GBO relay and the operated GB1 relay. When all trunks in both the first and second subgroups are busy, the ground is connected to the EG2 and OG2 leads through the normal GBO and GB1 relays and the operated GB2 relay. Likewise, when all trunks in the first three subgroups are busy, ground is connected to the EG3 and OG3 leads. If the trunk group is a high usage group, ground is connected to the EGB and OGB leads through all the normal GB- relays when all the trunks in the group are busy (B option, OS 173-1). If the trunk group is a final group, the group busy chain relay circuit is wired so that the operated or released condition of the GB3 relay does not affect the connection of ground to the EG3 and OG3 leads. Thus, if all trunks in the group are busy, ground is connected to the EG3 and OG3 leads just as though there was an idle trunk in the fourth subgroup (A option, OS 173-1).

3.39 With all the CI- relays and one R- (route) relay operated, the EG- (or OG-) leads are closed through from the group busy chain relay circuit to the secondary windings of the GO, G1, G2, G3 and GB relays in the decoder. If ground is standing on the EGO (or OGO) lead, the GO (subgroup chain test) relay is operated. Ground on the EG1 (or OG1) operates the G1

relay. Likewise, ground on EGB (or OGB) operates the GB relay.

3.40 When one of the G- relays or the GB relay operates, a locking path is closed through the primary winding of operated G- or GB relay (OS 173-1). Closing the locking path operates the CO (trunk subgroup test cutoff) relay. The CO relay operated opens the EG- (or OG-) leads and thereby prevents any further operation of the G- relays or the GB relay even though ground on the EG- (or OG-) lead may be shifted by subsequent operation or release of one or more of the GB-relays. Thus, when one and one only of the subgroup chain test relays (GO, 1, 2, 3, or GB) is operated in the decoder, the CO relay operates to stabilize the decoder subgroup selection circuit.

3.41 If the GO relay is operated the call can be completed by allowing the marker to read information about the first subgroup from the 3D or 6D card already dropped as described in Par. 3.44.

3.42 If the G1, G2, or G3 relay is operated, this indicates that the second, third, or fourth subgroup has been selected as the lowest numbered subgroup with an idle trunk. The 3D or 6D card must therefore be restored and an AR card for the selected subgroup must be dropped in order for the marker to seize a trunk. These operations are described in Par. 3.61.

3.43 If the GB relay is operated when a high usage group is being tested, one or more additional route relays associated with the alternate routes for this call must be operated. In this way the decoder continues to look for a subgroup with an idle trunk as described in Par. 3.47.

Idle Trunk in First Subgroup (GO Operated)

3.44 The 3D or 6D card with RR routing instruction also has the trunk block punches enlarged. During the reading of the card a TCT- and two TCU- relays are operated in the decoder. Selection and seizure of a marker also takes place at this time on Figs. 1 and 2 (SC 119-1). When the TCT- and the TCU- relays have operated, and the GO relay has operated the CO relay, a path is closed to operate the RCD (read card) relay and a TC- (trunk block connector) in the marker. This path is shown on OS 169-1 and 191-1. The operation of a TC- relay permits the marker to start the seizure of a trunk block connector. The operated RCD relay operates the RCD1 and RCD2 relays in the marker to permit the remainder of the card items to be read by the marker.

3.45 When the RCD relay in the marker operates a path is closed to operate the FST (follow-with-second trial) relay

or the FRO (follow-with-reorder) relay in the marker (OS 191-1). The FST relay is operated if the RR relay is operated and the TR2A (decoder indicates second trial) relay is normal. If the RR relay and the TR2A relays are operated, then the FRO relay is operated in the marker.

3.46 When the marker has registered all of the necessary information from the decoder and is connected to the sender through the operated MC relay in the decoder connector, a path is closed to operate the RCK (read check) relay in the marker (OS 197-1). The operated RCK relay grounds the RCK lead and operates the RCD (restore card and disconnect decoder) relay in the decoder (OS 172-1). As shown on Fig. 3 on SC 119-1, the operation of the RCD relay causes the release of the decoder, the card translator (HT, DFAT or FAT) and the marker connector, leaving the marker connected to the sender through the decoder connector. The marker proceeds with its operations as described in Part 7 of Section A828.121.2.

Advance to Succeeding Route Relay

General

3.47 The operation of the decoder GB relay indicates that all subgroups in a first or intermediate group (not final group) are busy. The GB relay operates through the make contacts of a route relay. In order to continue looking for a subgroup with an idle trunk, the decoder must operate a succeeding route relay which represents an alternate route group of trunks.

3.48 As previously described, the first route relay is operated from the alternate route pattern number on the dropped 3D or 6D card. A succeeding route relay cannot be operated from a pattern number on a card. Instead, the particular succeeding route relay to be operated is determined by cross-connections between route relays. Of course these cross-connections must be made in accordance with a definite pattern since succeeding route relays represent alternate route groups. The testing of alternate route groups should progress in an ascending order for groups to distant primary outlets, sectional centers, regional centers, and possibly the national center, and then in a descending order for groups to home regional centers and home sectional centers. As shown on Fig. 1, R01 would be so cross-connected that when no trunks are available to a distant primary outlet, the circuit automatically progresses to R11 so that trunks to a distant sectional center may be tested. Similarly, the circuit can progress from R11 to R21, etc.

3.49 As shown on Fig. 2, attached, the cross-connections associated with the

route relays are made at the alternate route traffic control frame which is common to all decoders of a 4A office. These cross-connections permit the succeeding R- relay to operate when ground is applied to the RA- lead by the operated R- and RAV'- relays. For example, if all trunks represented by R01 are busy, the RAV'0 relay operates. Ground is thus applied through the cross-connections and normal contacts of the RT11 relay to operate the R11 route relay.

3.50 As indicated above, the advance to a succeeding route relay and thus to an alternate route is controlled by a ground supplied through the operated contacts of an RAV'- relay which is in one of the decoder ground supply circuits. Each decoder is arranged for a maximum of six ground supply circuits, each consisting of the following relays:

- (a) RAV- and RAV'- (Route advance to succeeding ground supply) relays.
- (b) CI- (Route relay ground supply cut-in) relay.
- (c) RB- (Route busy) relay (not shown on Fig. 2).

3.51 The 100 (maximum) route relays are ordinarily assigned to the six ground supply circuits in accordance with Fig. 3. Route relays in ground supply circuits 0, 1, 2, 3, 4 and 5 are respectively used with

trunk groups to primary outlets, distant sectional centers, distant regional centers, the national center, the home regional center, and the home sectional center. RM 3-8 shows this association between route relays for trunk groups to the various classes of CSP's and the ground supply circuits. RM 3-8 also shows how the route relays are cross-connected at the alternate route traffic control frame.

3.52 As described below all six of the ground supply circuits are not required at any particular office:

(a) At a primary outlet (Table I, RM 3-8), the national center is considered as a distant regional center, therefore ground supply 3 is not needed.

(b) At a sectional center (Table II, RM 3-8), ground supply 3 is omitted for the same reason described above and ground supply 5 is omitted since there obviously is no trunk group to a home sectional center.

(c) At a regional center (Table III, RM 3-8), ground supply 4 is omitted since there is no trunk group to a home regional center. Ground supply 5 is also omitted because ground supply 5 is used only with the route relay for a group to an SC on which a PO homes. Thus this ground supply is furnished at PO's only.

		CLASS OF CSP			
		PO	SC	RC	NC
DECODER GROUND SUPPLY CIRCUIT NO.	GS0	R01 - R09 R30 - R39 R50 - R59 R70 - R99	R00 - R09 R30 - R39 R50 - R59 R70 - R99	R00 - R09 R30 - R39 R50 - R59 R70 - R99	R00 - R09 R30 - R39 R50 - R59 R70 - R99
	GS1	R11 - R19 R40 - R49 R60 - R69	R11 - R19 R40 - R49 R60 - R69	R10 - R19 R40 - R49 R60 - R69	R10 - R19 R40 - R49 R60 - R69
	GS2	R20 - R29	R20 - R29	R21 - R29	R20 - R29
	GS3	GS3 NOT SUPPLIED AT A PO	GS3 NOT SUPPLIED AT AN SC	R20	GS3 NOT SUPPLIED AT THE NC
	GS4	R10	R10	GS4 NOT SUPPLIED AT AN RC	GS4 NOT SUPPLIED AT THE NC
	GS5	R00	GS5 NOT SUPPLIED AT AN SC	GS5 NOT SUPPLIED AT AN RC	GS5 NOT SUPPLIED AT THE NC

FIG. 3-TYPICAL ASSOCIATION OF ROUTE RELAYS (R-) WITH DECODER GROUND SUPPLY CIRCUITS AT VARIOUS CLASSES OF CSP.

Ground supply 3 is furnished at regional centers because each regional center will have a final route group of trunks to the national center.

(d) At the national center (Table IV, RM 3-8), ground supplies 3, 4 and 5 are not required since each of these ground supplies is reserved for route relays for groups to CSP's of higher order. For the national center there is no CSP of higher order.

3.53 The following explains the use of Table I of RM 3-8, which applies to the route relay arrangement at a primary outlet (PO1):

(a) Item 1 shows that a route relay associated with ground supply 0 is assigned to the trunk group to a distant center, PO2. This route relay is cross-connected to the route relay (in ground supply 1) which is assigned to the trunk group to a distant sectional center, SC2. SC2 is the first alternate route for a call to PO2. This route relay is in turn cross-connected to a route relay in ground supply 2 which is assigned to the trunk group to RC2, the second alternate route for PO2. Similarly the call advances to operate route relays in ground supply 4 and 5 representing the home regional and sectional centers if it is necessary to advance to the 3rd or 4th alternate routes. Any of the above route relays can also be operated directly from the card on calls to the trunk group represented by the particular route relay.

(b) Item (2) shows that a route relay in ground supply 0 is assigned to the trunk group to PO3 (in the same region as PO1 but homing on a different SC). This route relay is cross-connected to the route relay in ground supply 2 assigned to the trunk group to SC3, the first alternate route for PO3. If it is necessary to advance to the second or third alternate routes (RC1 and SC1 respectively) the associated route relays in ground supplies 4 and 5 are operated.

(c) Item (3) shows that a route relay in ground supply 0 is assigned to the trunk group to PO4 which homes directly on the home regional center. The first alternate route for PO4 is the home regional center RC1. Therefore, the route relay for the trunk group to PO4 is cross-connected to the route relay for RC1 which is in ground supply 4. The second alternate route for PO4 is SC1 which is assigned a route relay in ground supply 5.

(d) Item (4) shows the PO5 which homes on the same SC to the trunk group to PO1 is assigned a route relay in ground supply 0. This route relay is in turn cross-connected to the route relay in ground supply 5 which is assigned to the trunk group to SC1, the first and only alternate route for PO5.

3.54 Tables II, III and IV of RM 3-8 similarly illustrate the assignment of route relays at SC's, RC's and the NC.

Detailed Relay Operation

3.55 The following describes in detail the relay operations involved in using a ground supply circuit to provide ground to operate a succeeding route relay. The relays in the ground supply circuits of the decoder are shown on OS 173-1.

3.56 Through contacts of the operated GB and CO relays and the operated route relay, battery is connected to operate an RB- (route busy) relay in the ground supply circuit associated with the route relay operated from the 3D or 6D card (OS 173-1). As shown on RM 3-8, if this route relay represents a trunk group to a distant sectional center, it would be associated with ground supply circuit number one and the RB- relay operated would be RB1. The operated RB1 relay releases the associated CI1 relay. The normal CI1 relay operates the RLS (check release of subgroup (CI-) relay. The RLS relay operated releases the CO and the GB relays. When these relays have released, the RAV1 relay in the associated ground supply circuit operates, closing a path to operate the RAV'1 relay in the same ground supply. The RAV'1 relay releases the RLS and the RB1 relays and grounds an RA- lead through the operated route relay to the cross-connecting field of the alternate route traffic control circuit. This RA- lead is cross-connected to a CR- punching which also connects to a transfer spring on the RT- (route transfer) relay associated with the next succeeding route relay.

3.57 The alternate route traffic control circuit provides means for switching the RA- lead from the winding of the succeeding route relay to the winding of an RAMB relay thus routing the call to a master trunk (OS 171-1). This is further discussed in Pars. 3.77 to 3.82.

3.58 In normal operation the ground placed on the RA- lead from the make contacts of the RAV'1 relay operates the succeeding route relay. As shown on OS 173-1 (and Fig. 4 on SC 119-1), the CI- relay associated with the first group is now released and the operation of a succeeding route relay connects the G0, G1, G2, G3

and GB relay windings to the EG- (or OG-) leads for the first alternate route group. Ground on one of these leads operates the GO, G1, G2, G3, or GB relay in the subgroup test circuit and it in turn operates the CO relay.

3.59 If the GB relay operates, a route relay associated with another ground supply is operated in the manner described above.

3.60 If the GO, G1, G2 or G3 relay operates, and the home translator is properly prepared, a card with CG- tabs indicating AR can be dropped as explained in the following paragraphs.

Preparing Home Translator to Drop AR Card

3.61 If the G1, G2, G3, or GB relay is operated through the first route relay, the 3D or 6D card with RR routing instruction must be replaced and the home translator must be seized in order to drop a card with a CG- combination indicating AR. In addition to operating the CO relay, the operated G1, G2, G3, or GB relay starts this action by operating the RCRR (restore card on RR operation) relay in the decoder. As shown on OS 173-1, the RCRR relay is operated from ground on the operated G1, G2, G3, or GB relay, the operated ARST relay, and the operated RR relay. OS 172-1 shows how the operated RCRR relay closes a path to operate the RCA (restore card and advance to next route) relay causing the 3D or 6D card with RR routing instruction to be restored. The operated RCA relay causes the operation of the RCA1 relay, releases the OC- (output control of card items) relays, and causes the operation of the ARC (automatic restore card) relay in the card translator. The ARC relay operating causes the card to restore, releases the CON relay in the translator, and grounds the ARC lead to the decoder to operate the HBI (home box indicated) relay (OS 172-1). The HBI relay operates through the operated ARC, HTK or TCK, CKG1, RCA1, and RR relays and through the normal DCB1 relay.

3.62 The card with RR routing instruction may be dropped in any type of translator. For those calls where the card with RR instruction is dropped in a DFAT or FAT, the operated HBI relay causes the pull-up magnets and the card support lift magnets to be energized in the home translator. When the pull-up magnets are energized the pull-up slave relays operate and cause the operation of the latches. For those calls where the 6D card is in a FAT, the operated HBI relay releases the P relay in the translator connector causing the C- connector relays to release. When the 6D card is dropped in a DFAT the operated HBI relay releases the DFTR causing the FC2-15 connector relays to release.

3.63 The sequence chart on OS 172-1 shows that with the C- relays of the translator connector released or the FC2-15 relays released, the TCK (FAT connector circuit) relay is released. The release of the TCK relay closes a circuit to operate the HTR (home translator connector) relay (OS 161-1) through make contacts of the RHC (restore home connector) relay. The RHC relay is operated on all calls using FAT's or DFAT's (6-digit translation calls). The operated HTR relay causes the HC1-16 (home connector relays) relays to operate. With the home connector relays operated the CON relay in the home translator operates thereby causing the operation of the pull-down magnets. In this way the home translator is seized and prepared to receive the necessary information to operate the code bars and drop an AR card. During this preparation the DFAT or FAT restores the 6D card and then is released from the decoder by releasing the C- or FC-connector relays (OS 172-1, sequence chart).

3.64 When the home translator is used to drop the 3D or 6D card with RR instruction, the operation of the ARC relay (as described above) causes the translator to restore the card. In this case the RHC relay (OS 167-1) is not operated and consequently the HTR relay (OS 161-1) remains operated to hold the home translator. When the 3D or 6D card is restored and the CBK relay is released, a path is closed to keep the latches, the card support lift magnets and the pull-up magnets from releasing. The home translator is thus held, and prepared to receive the necessary information for dropping an AR card.

3.65 On all calls using RR routing instruction, the operated HBI relay releases the RA relay (OS 170-1), causing the operation of the DCB (disconnect 3D and 6D code bar) relay (OS 172-1) from ground on the contacts of the operated CKG and HBI relays, the normal RA3, RA2, RA1, and RA relays, and the operated RR relay. As shown on OS 162-1, the operation of the DCB relay opens the operating path for the CG- code bars indicating 3D and 6D. Since the DCB relay locks to the CKG relay, no additional 3D or 6D card can be dropped. The operated DCB relay also operates the DCB1 relay which in turn operates the DCB2 relay (OS 172-1). The operation of the DCB2 relay releases the RI relay (OS 163-1). The normal RI relay releases the RIO and RI2 relays (OS 164-1) allowing the release of the RR relay (OS 171-1). The normal RR relay releases the RCA (OS 172-1) and the RCRR (OS 173-1) relays. As shown on OS 172-1 the normal RCA relay releases the RCA1 relay.

3.66 With the RCA1 relay released and the G1, G2 or G3 relay and CO relay operated, a path is closed to operate the ARS (alternate route selected) relay from

ground on the contacts of the operated CKG relay, through the normal RCA1 and RCRR relays, through the operated G1, G2, or G3, ARST, CO and HBI relays (OS 173-1).

3.67 When the decoder indicates that a subgroup has been selected by the ARS relay operation and when the home translator indicates that it is prepared to drop a card, the CCA (code connector alternate) relay is operated (OS 161-1). Ground from the home translator on the CC lead through the make contacts of the NRO, the 3D or 6D, the HTK, and the ARS relays operate the CCA relay. The operated CCA relay places ground on two code digit leads for digit A and two code digit leads for digit B through an operated CI- relay and the operated R- route relay (OS 162-1). These four leads are wired to the A_2^2 and B_2^2 ₅

leads to the home translator to agree with the alternate route pattern number of the operated route relay (OO-99). The C_2^2 ₅

leads to the home translator are grounded by the operation of the CCA relay through the contacts of the GO, G1, G2 and G3 relays so that the C digit agrees with the G- relay number and therefore the number of the selected subgroup. The CGO and CG2 (indicating AR) leads are also grounded through the contacts of the operated CCA relay.

3.68 The above grounded leads operate the CGO and CG2 code bars and code bars for the A, B and C digits in the home translator. These code bars operate corresponding code bar slave relays and when they are checked operated, the CBK (code bar check) relay is operated. As shown on OS 162-1, the path of operation for the CBK relay is through the operated SCGO and SCG2 slave relays, the normal SCG1 and SCG4 slave relays, two operated slave relays each for code digits A, B and C and all slave relays normal for the D, E and F code digits. When the CBK relay operates, the latches are allowed to release causing the release of the card support lift and pull-up magnets (OS 161-1). These home translator operations now permit the AR card to drop under the influence of the pull-down magnets.

Reading AR Card

3.69 The dropping of the AR card in the home translator results in the operation of the COP1 and COP2 (card operated indication) relays in the decoder (OS 163-1). As shown on Fig. 5 on SC 119-1, the operated COP1 and COP2 relays close paths to operate the MKR, the RI, and the CCM battery supply relays and the OC- (output control of card items) relays. The routing instruction on an AR card is FST unless the card represents the last subgroup of a final trunk group in which case the instruction is FOF or FRO.

3.70 The AR card contains trunk block information about the subgroup selected by the decoder. The decoder registers this information by operating one TCT- relay and the TCU_2^2 and TB_2^2 ₅ relays. Through these

operated relays, the RCD relay and a TC- relay are operated in the marker. The operated RCD relay allows the marker to read additional information about the subgroup. The TC- relay starts the seizure of the proper trunk block connector.

3.71 While the routing instruction and trunk block information is being read by the decoder, information is also being read to determine whether a no skip (NSK) or a skip 3 (SK3) signal should be sent to the marker. All cards except AR cards use the variable spill punches on the card for this purpose. On AR cards, the variable spill information is indicated in a different way and the variable spill punches (SK3, SK6 and NSK) are not used.

3.72 If the first three digits registered in the incoming sender do not comprise an area code, an NAC punch on the first 3D card dropped causes the NAC relay to operate and lock (OS 164-1). When the AR card is dropped, an AFA or AHA punch on the card causes the AFA or AHA relay operation. As shown on OS 176-1, ground on the make contacts of the NAC relay, through the operated AFA or AHA relay operates the NSK relay. This in turn operates the NSK relay in the marker.

3.73 If the first three digits registered in the sender comprise an area code, an AC punch on the first 3D card dropped causes the AC relay to operate and lock. This relay is held operated for use when the AR card is dropped. The code conversion punches on each AR card are enlarged to indicate the area code of the area in which the alternate route group indicated on the AR card terminates. When the AR card is dropped, the decoder matches the area code punched on the card with the area code pulsed to the incoming sender. If the two codes match, an SK3 signal is sent to the marker. If the two codes do not match, an NSK signal is sent to the marker. This method of variable spill control is called code matching and is shown on OS 176-1.

3.74 Code matching is started by the ARB (alternate route code bar operated) relay which operates when the ARB code bar slave relay operates in the home translator (OS 162-1). Ground is connected through the operated ARB and AC relays, the operated CCH_2^2 ₅, CCT_2^2 ₅, and CCU_2^2 ₅ relays to operate the TCD1 and TCD2 (transfer code digits leads to code matching circuit) relays (OS 176-1). Operation of the TCD1 and TCD2 relays connect the A, B and C leads from the sender to armatures of the CCH-, CCT-,

CCU- relays respectively. The area code punched on the AR card is now associated with the area code pulsed to the sender and matching can take place. All of the leads to the 3B contacts of the CCH-, CCT-, and CCU- relays are connected together to the NSK (no skip) relay. The 1B contact of each of the CCH- relays is connected through a 10,000-ohm resistor to the winding of the MCCH (match code conversion hundred) relay. The 1B contacts of the CCT- relays are connected through 10,000-ohm resistors to the MCCT relay while the 1B contacts of the CCU- relays are connected through 10,000-ohm resistors to the MCCU relay. The MCC- relays are marginal relays. To enable each of the three MCC- relays to operate, the two operated CCH-, CCT- and CCU- relays must correspond to the A-, B- and C- leads grounded by the sender. Thus, when the MCCH, MCCT, and MCCU relays operate, a code match is indicated. This means that the call is being directed to an area which is the same as the area in which the call is to terminate. The operated MCC- relays ground the SK3 lead to operate the marker SK3 relay. In turn the marker signals the sender to drop the area code when outpulsing.

3.75 When any one of the operated code conversion relays does not correspond with the operated A-, B-, or C- sender digit register relays, ground is connected through the 3B back contacts of one of the code conversion relays to operate the NSK relay in the marker. This indicates that the two codes do not match and that the call is being routed to an area different from the area in which the call is to terminate.

3.76 When the marker has operated either the NSK or SK3 relays, together with all other relays required to register subgroup information, the marker RCK relay is operated (OS 197-1) and the RCK lead to the decoder is grounded (OS 172-1). Ground on the RCK lead operates the decoder RCD (restore card and disconnect) relay. As shown on Fig. 5 on SC 119-1, the operated RCD relay causes the release of the decoder, the home translator, and the marker connector, leaving the marker connected to the sender through the decoder connector. The marker proceeds with operations to complete the call as described in Part 7 of Section A828.121.2.

Use of Route Transfer Circuits in Alternate Route Traffic Control Circuit

3.77 The alternate route traffic control circuit is arranged for common use by a maximum of ten decoders. Besides providing a cross-connecting field for directing the advance by the decoders to succeeding route relays, the alternate route traffic control circuit contains a maximum of 100 route transfer circuits. Each of the route transfer circuits (00-99) is

associated with the correspondingly numbered route relay in the decoders.

3.78 Each route transfer circuit has an RT- key and one or more route transfer relays depending upon the number of decoders in the 4A office. The route transfer relays operate when the RT- key is operated, blocking the advance to the correspondingly numbered route relays in the decoders (OS 171-1). The RT- relays block the advance to the like-numbered route relays in decoders 0 to 5. When a 4A office has more than six decoders, one or more additional route transfer relays are also provided to block the advance to the like-numbered route relays in the remaining decoders 6 to 9. Thus, when the decoder attempts to find an idle trunk in the alternate route trunk group associated with an operated RT- key the decoder will be unable to route the call to the alternate route.

3.79 Each route transfer circuit has a lamp to provide visual indication, at the traffic supervisory rack, of the alternate routes for which calls are being transferred to master busy trunks.

3.80 Each route transfer circuit with its RT- key operated also grounds a lead to the miscellaneous circuit for the trouble recorder frame to indicate to the plant forces the alternate routes for which calls are being transferred to master busy trunks.

3.81 As shown on OS 171-1 and 173-1, there are three ways in which route relays can be operated. The following describes the way in which the operation of RT- keys affects the operation of route relays:

(a) When a 3D or 6D card indicates RR instruction, a route relay is operated from the alternate route pattern number on the card. The route relay is operated by grounding the RR- lead (OS 171-1). Since this lead does not go through contacts of an RT- relay, operating the corresponding RT- key does not affect the operation of a route relay that is to be used for testing the first route.

(b) When all trunks in the first route are busy and an alternate route is desired, the RAV'- relay operates and grounds an RA- lead to the cross-connecting field of the alternate route traffic control circuit (See Fig. 2). The RA lead is cross-connected to an RAG terminal. These terminals are used to group the corresponding RA- leads from all the decoders and which in turn is connected to the CR- punchings of the succeeding route relay of all decoders. The succeeding route relay is thus connected through the normal contacts of an RT- relay. If the RT-

relay is normal, the ground on the RA-lead from a decoder ground supply circuit operates the succeeding route relay. However, if the RT-relay is operated, ground on the RA-lead through the make contacts of the RT-relay operates the RAMB (route advance to master busy) relay in the decoder handling the call. Thus the decoder is prevented from selecting an idle trunk along an alternate route.

(c) When a 3D or 6D card indicates CR instruction, a route relay is operated from the alternate route pattern number on the card. A trunk is not selected from the alternate group represented by this route relay unless all trunks along the first route are busy. The route relay is operated by grounding the CR-lead. As shown on OS 173-1, the CR-lead is wired through the contacts of an RT-relay and the route relay is operated only when the RT-relay is normal. When the RT-relay is operated ground on the CR lead operates the RAMB.

3.82 In (b) and (c) above the operation of an RT-key, and thus the associated RT-relay results in the operation of the RAMB relay (OS 171-1) in any decoder which attempts to select the associated trunk group as an alternate route. The decoder operations continue as shown on the sequence chart on OS 172-1 until the RCAL and RCRR relays release. Then as shown on OS 173-1 a path is closed through make contacts of the GPL relay to operate the ROMB relay. As shown on OS 190-1, the ROMB and RAMB relay operated cause the MB relay in the marker to operate. With the MB or RO relay operated, the RCD relay in the decoder operates (OS 172-1).

3.83 The decoder RCD relay operation starts the dismissal of the decoder, the translator and the marker connector. The marker connector release is indicated by the release of the marker DE relay.

3.84 With the marker DE relay normal a path is closed to start the seizure of a master busy trunk by the marker. As shown on OS 202-1, ground on the back contacts of the DE relay, through the operated MB relay operates the marker MBR (master busy route) relay. The operated MBR relay operates a GS-, a GE-, a TC-relay and the marker RCD relay. The operated RCD relay closes a path to operate the TB-relays to set up a connection to test and seize a master busy trunk.

(C) Card-to-Relay Operation

General

3.85 The following paragraphs describe in detail the decoder and marker

operations which occur when card-to-relay routing instructions are punched on a 3D, 6D, or RA-card dropped in a card translator. As explained in Par. 2.27, CR routing instruction indicates that the decoder is to allow the marker to test the subgroup represented by the 3D, 6D, or RA-card. The CR routing instruction also indicates that at least one alternate route is available; therefore, while the marker is testing the above subgroup the decoder restores the 3D, 6D, or RA-card and selects an idle subgroup in an alternate route group through a route relay. If the marker fails to find an idle trunk in the subgroup from the card with CR instruction, the decoder allows the marker to test the alternate subgroup selected.

3.86 While this discussion explains the operations in the order in which they occur on a call, it is chiefly concerned with the operations described above.

Dropping a 3D, 6D, or RA-Card

3.87 When a toll tandem trunk on an incoming intertoll trunk to a 4A office is seized, an incoming sender is connected to the trunk. The sender then causes its decoder connector to seize a decoder which in turn causes the home translator to drop a 3D card. The sequence of operation for dropping the 3D card is shown on SC 113-1 and is discussed in Section A828.121.2.

3.88 Assume that the 3D card dropped contains an NCA (no come again) punch. As explained in Section A828.121.2, this indicates that the call is to be completed by 3-digit translation. In addition to the NCA punch, the card also has information about the first subgroup of a trunk group. Assume that the group contains only one subgroup and that no route relay is assigned to the group. In order for CR routing instruction to be used on the card, at least one or more alternate routes must be available. When these conditions exist, the decoder sequence of operations is continued from AB 126, SC 113-1 to Fig. 2 on SC 118-1 where the decoder reads the 3D card with CR routing instruction.

3.89 If the above trunk group contains more than one subgroup, the 3D card would contain CC routing instruction. Also, the RA-cards representing intermediate subgroups would contain CC routing instruction. CR routing instruction would be used on the RA-card for the last subgroup. Therefore, the sequence of operations on SC 113-1 would continue from V121 to Fig. 2 on SC 117-1. If all the trunks in the first and intermediate subgroups

are busy, the sequence would be continued from Fig. 3 on SC 117-1 to Fig. 2 on SC 118-1.

3.90 If the first 3D card dropped contains a CA6 (come again 6) punch, 6-digit translation is required and a 6D card must be dropped. If six digits have been registered in the sender by the time the decoder reads the CA6 instruction the sequence of operations is extended from V121, SC 113-1 to either Fig. 1 or Fig. 2 on SC 115-1. If six digits have not been registered in the sender by the time the decoder reads the CA6 instruction, pre-translation, as described in Section A828.121.4 and shown on SC 114-1, takes place and then the decoder sequence is continued on SC 115-1.

3.91 If the 3D card indicates that a 6D card is to be dropped in a DFAT or FAT translator, the operations are shown on Fig. 1 on SC 115-1. If the 3D card indicates that the 6D card is to be dropped in the home translator, the operations are shown on Fig. 2 on SC 115-1.

3.92 The 6D card dropped in a DFAT, FAT or home translator contains information about the first subgroup of a trunk group. If the group contains only one subgroup and cannot be used as an alternate route, but has one or more alternate routes available to it, CR routing instruction will be punched on the 6D card. When these conditions occur, the 6D card with CR routing instruction is read by the decoder as shown on Fig. 1 on SC 118-1.

3.93 If the 6D card represents the first subgroup in a group with more than one subgroup, and cannot be used as an alternate route, it contains CC routing instruction. The RA- cards for intermediate subgroups also contain CC instruction as shown on SC 117-1. If there is one or more alternate routes available, the RA- card for the last subgroup contains CR routing instruction. Thus if all trunks in the first and intermediate subgroups are busy the sequence of operation is continued from Fig. 3 on SC 117-1 to Fig. 1 on SC 118-1.

Reading a 3D, 6D, or RA- Card (Figs. 1 and 2 on SC 118-1)

3.94 When the decoder reads a 3D, 6D, or RA- card contains CR routing instruction, the RIO and RII relays are operated (OS 164-1). Through these operated relays, the CR and CRP relays are operated (OS 171-1).

3.95 A card containing CR routing instruction always has enlarged punches to indicate an alternate route pattern number. The method for operating the route relay associated with the alternate route pattern number is similar to that described for RR routing instruction except for one notable difference. When a card with RR instruction is used a route relay is operated from the alternate route pattern number by grounding an RR- lead. This RR- lead is wired directly to the route relay winding. As shown on OS 171-1, the operation of the route relay from a card with CR instruction is accomplished by grounding the CR- lead. The CR- lead is wired through the contacts of an RT- relay in the alternate route traffic control circuit. If the RT- relay is operated, the RAMB relay is operated immediately after the alternate route pattern information is registered in the decoder (OS 171-1). If the subgroup on the card is found busy the GPL relay operates which in turn operates the ROMB relay and thus routes the call to a master busy. This operation is described in detail in Pars. 3.77 to 3.81. However, if the RT- relay associated with the pattern number on the card is normal, ground on the CR lead operates a route relay in the decoder.

3.96 As in card-to-card operation, when the decoder reads the CR routing instruction, it sends an HLD signal to the marker to operate the HLD (hold) relay (OS 172-1). This indicates that the decoder will hold to the marker until it tests the subgroup and determines if there is an idle trunk. When all information about the subgroup has been registered in the marker, the RCK lead is grounded and the RCA relay is operated in the decoder. This causes the ARC relay in the translator and also the RCA1 relay to operate. The operated ARC and RCA1 relays close a path to operate the HBI (home box indicated) relay.

3.97 The card with CR instruction may be dropped in a home translator, a DFAT or an FAT. While the marker tests the subgroup represented by this card, the decoder prepares to select another subgroup in the event that the marker is unable to find an idle trunk. This preparation, which involves restoring the card with CR instruction, is started by the operation of the ARC (automatic restore card) relay.

3.98 If a DFAT or FAT is used for dropping the card, this translator must be released while the home translator is seized and made ready to drop an AR card which has CGO and CG2 tabs. When a DFAT or FAT is used, the operated HBI relay causes the operation of the CSL relay, CSL1 and 2 card support lift magnets, pull-up magnets and the pull-up slave relays in the home

translator. When the pull-up slave relays operate, the latches in the home translators operate.

3.99 When a DFAT is used, the HBI relay causes the release of the FC2-15 relays by releasing the DFTR relay (OS 161-1). When an FAT is used, the HBI relay causes the release of the translator connector by releasing the P relay (OS 183-1).

3.100 As shown on Figs. 3 and 4 on SC 118-1, the release of either the DFAT connector relays (FC2-15) or the translator connector relays (CO, C1, C2) releases the TCK relay. The normal TCK relay closes a path to operate the HTR (home translator connector relay) relay, which causes the HCl-16 relays to operate (OS 161-1). These home connector relays operate the CON relay which operates the pull-down magnets in the home translator. With the pull-up and card support lift magnets, the latches, and the pull-down magnets operated, the home translator is prepared to receive input signals to operate code bars and drop an AR card.

Receiving TKS Signal from Marker

3.101 During the time the card with CR instruction is being restored the marker tests the subgroup indicated on this card. If the marker seizes an idle trunk, it sends a ground signal to the decoder via the TKS lead (OS 172-1). This ground operates the TKS (trunk selected) relay which causes the operation of the RLT (release after translation) relay (OS 177-1). This action results in the release of the decoder, the marker connector, and the home translator leaving the marker connected to the sender through the decoder connector.

Receiving ATB Signal from Marker

3.102 If the marker fails to find an idle trunk in the subgroup tested, a ground signal on the ATB lead is sent to the decoder. Operation of the ATB relay then permits the decoder to proceed with dropping an AR card representing a subgroup selected from the route relay tree.

3.103 The selection of an idle subgroup in an alternate trunk group takes place as shown on OS 173-1. When a route relay is operated after reading the card, the GB- leads from the group busy chain relay circuit are connected to the windings of the G- relays. Ground on one of the GB- leads operates the corresponding decoder G- relay.

3.104 In CR operation the paths of operation for the GPL (subgroup lock) relay and the CO (trunk subgroup test cut-off) remain open until the ATB relay in the decoder is operated by an ATB signal from the marker. Until the GPL and the CO relays

operate, the G- relays remain under the control of the GB- relays in the group busy chain relay circuit (OS 173-1). Suppose that the G2 relay operates after the route relay has closed the GB- leads. If the third subgroup becomes busy, G2 releases and G3 operates. If the fourth subgroup becomes busy, the GB relay is operated. With the GB relay operated, the decoder can advance to the next route relay even though the GPL (subgroup lock) relay is not yet operated. The succeeding route relay is operated as shown by the sequence chart on OS 173-1. This route relay closes the GB- leads to GB- relays associated with another trunk group. The operation of a G- relay indicates that the associated subgroup has an idle trunk.

3.105 As soon as an ATB signal is received from the marker, the operation of the decoder ATB relay causes the operation of the GPL relay which locks the operated G- relay and operates the CO (subgroup test cut-off) relay. If the ATB relay should happen to operate the GPL relay at a time when the GB relay is operated, then the advance to the next route relay is continued so that the subgroup with an idle trunk can be selected and a G- relay operated. The method for such advance is the same as described in Pars. 3.47 to 3.60.

3.106 The decoder ATB relay also opens one of the locking paths of the RCA1 relay. When the HBI relay operates (Par. 3.96) the CR relay is released in a manner similar to that described for the release of the RR relay in Par. 3.65. The CR relay opens the other locking path for the RCA1 relay which then releases (OS 172-1).

3.107 With the RCA1 relay released and the CO and a G- relay operated, the ARS (alternate route selected) relay operates as shown on OS 173-1. When the home translator is prepared to drop an AR card and the ARS relay is operated, the CCA (code connector alternate) relay is operated (OS 161-1).

3.108 The release of the RCA1 relay also releases the marker HLD relay (OS 172-1), which in turn releases the marker TB relay. The normal TB relay releases the ATB relay. With the ATB relay normal, the marker RCD relay and one of the TC- relays can be reoperated to register new information when the AR card is dropped (OS 169-1 and 191-1).

Dropping an AR Card

3.109 When the CCA relay operates, leads are closed to the home translator to operate the code bars for the A, B, and C digits and the CGO and CG2 code bars. As described in Par. 3.67, the A and B digits represent the alternate route pattern number of the trunk group while the C digit represents the number of the subgroup with

an idle trunk. When the CBK relay in the home translator has operated and the latches, pull-up magnets and card support lift magnets have released, the proper AR card is dropped.

3.110 The sequence of decoder operations for reading the card is shown on Fig. 5 on SC 119-1. The AR card contains FST routing instruction unless the card represents the last subgroup of a final group, in which case the instruction is FOF or FRO. In order to provide variable spilling control either an NSK or SK3 signal is sent to the marker. When the first three digits pulsed to the incoming sender are not an area code, an NSK signal is sent to the marker. When the first three digits pulsed to the incoming sender are an area code, this code is matched with the digits represented by the code conversion punches of the AR card. These code conversion punches on each AR card indicate the area code of the area in which the alternate group terminates. If this code matches the area code pulsed to the incoming sender, an SK3 (skip 3 digits) signal is sent to the marker. If the two codes do not match, an NSK (no skip) signal is sent to the marker. The above operations are described in detail in Pars. 3.71 to 3.76.

3.111 When the marker has received all the information about the subgroup on the AR card it grounds the RCK lead to the decoder to operate the RCD (restore card and disconnected decoder) relay. As shown on Fig. 5 on SC 119-1, the decoder, home translator and the marker connector are released. The marker remains connected to the sender through the MC relay of the decoder connector.

(D) Advancing to Reorder, Master Busy, and Overflow

General

3.112 The following paragraphs describe in detail the decoder and marker operations which occur when FRO, FMB and FOF routing instruction is used on a translator card. As explained in Part 1, one of these instructions is used on a card which represents the last subgroup of a group when no alternate routes are available.

3.113 FRO, FMB, or FOF routing instruction can be used on any type of translator card, i.e. 3D, 6D, RA-, or AR. The methods for dropping these cards have been discussed in the previous paragraphs of this part, therefore this discussion is chiefly concerned with the way in which the decoder and marker use FRO, FMB, or FOF routing instruction to seize a reorder, master busy, or overflow trunk.

Dropping a Card with FRO, FMB, or FOF

3.114 As mentioned above, a card which represents the last subgroup of a group for which no alternate routes are available, contains FRO, FMB, or FOF routing instruction. When such a card is a 3D card, it is dropped as shown on SC 113-1 and as described in Section A828.121.2. When the card is a 6D card, it is dropped as shown on SC 115-1 and as described in Section A828.121.4. When the card is an RA- card, it is dropped as shown on Fig. 3 on SC 117-1 and as described in Par. 3.17. When the card is an AR card, it is dropped as shown on Fig. 5 on SC 119-1 and as described in Par. 3.61.

Reading a Card with FRO

3.115 FRO routing instruction is used on any type of card which represents the last subgroup of a toll switching trunk group when no alternate route is available. FRO routing instruction is indicated by the RIO and RI4 punches (RM 3-5). When the decoder reads the card, the RIO and RI4 relays are operated (OS 164-1). As shown on OS 167-1, the operated RIO and RI4 relays close a path to operate the FRO relay.

3.116 In reading the card the decoder operates a combination of TCT₂² and TCU₅² relays to record trunk block connector information. With these relays operated and with the RI4 relay operated, a circuit is closed to operate the marker RCD (read card) relay and a TC- relay (OS 191-1). The operation of the RCD relay supplies battery to allow the decoder to pass the FRO routing instruction on to the marker. Thus as shown on OS 191-1, the operated FRO relay in the decoder operates the FRO relay in the marker.

3.117 OS 191-1 shows that there is still another way for the decoder to operate the FRO relay in the marker. On the second trial, the decoder is arranged so that if the routing instruction on the card selected is RR or FST, the FRO relay is operated in the marker through the operated TR2A relay.

Reading a Card with FMB

3.118 If the RI1 and RI4 punches are enlarged on a translator card, a follow-with-master busy routing instruction is indicated. When use is made of these punches because of special traffic conditions, the decoder FMB relay is operated when the card is read (OS 167-1). As shown on OS 191-1, the marker FMB relay operates when the marker RCD relay operates.

Reading a Card with FOF

3.119 When a translator has dropped a card which represents the last

subgroup of a final intertoll group, the decoder FOF relay is operated because of the RI1 and RI2 enlarged punches on the card (OS 167-1).

3.120 When a marker has been seized and the marker RCD relay has operated, the operated FOF relay closes a path to operate either the FOF relay or the FMB relay in the marker, depending on the condition of the decoder VO and NVO relays (OS 191-1). The VO and NVO decoder relays are controlled by the sender in the following way. After a sender is seized, signals on the KT1 lead from the incoming trunk circuit either operate the sender VO (via only) relay or cause it to remain normal (OS 121-1 and 134-1). The sender VO relay operates when the incoming trunk is either an intertoll trunk or a toll tandem trunk from a through switchboard, and grounds the VO lead to the decoder. The sender VO relay remains normal when the incoming trunk is a toll tandem trunk from an outward switchboard and grounds the NVO lead to the decoder.

3.121 After seizure of a decoder and home translator, ground on either the VO lead or NVO lead operates the VO or NVO code bar and code bar slave relay in the home translator through the CC2 (code cut-in) decoder relay (OS 162-1). The operated VO or NVO slave relay operates the VO or NVO relay in the decoder. The decoder VO or NVO relay remains locked through the operated CKG relay for the remainder of decoder seizure. In this way the operated VO decoder relay indicates that the 4A office is an intermediate switch point on the call. With the decoder FOF and VO relays operated, the FMB lead is grounded and the marker FMB relay is operated. The operated NVO decoder relay indicates that the call is being originated at the 4A office and when the decoder FOF relay is operated, the FOF lead is grounded through the operated NVO relay to operate the marker FOF relay.

3.122 When the marker has operated the FOF, FMB or FRO relay, as described above, and has registered all of the information about the subgroup to be tested for an idle trunk, a path is closed to operate the marker RCK relay (OS 197-1). The operated RCK relay grounds the RCK lead to operate the decoder RCD (restore card and disconnect) relay (OS 167-1). With all necessary information locked in the marker, the decoder is released.

Seizing a Reorder Trunk

3.123 With the marker FRO relay operated and other information about the selected subgroup registered in the marker, a connection is set up through a trunk block connector to test the subgroup and to select an idle trunk. However, if all

of the trunks are busy, the marker attempts to seize a reorder trunk. As shown on OS 201-1, when all regular trunks are busy, the ATB relay is operated through make contacts of the T- relays and the normal contact of the FOFA relay.

3.124 With the ATB relay operated, a path is closed through the normal FOF, FMB, MB, and RS3 relays, and the operated FRO relay to operate the RS3 (route switching) relay (OS 202-1). The operated RS3 relay in turn releases the RCD and TC relays. With the TC- relay normal, the trunk block connector is released and the TCK relay releases (OS 198-1).

3.125 When the TCK relay is normal indicating that the trunk block connector for the called (busy) trunk group has been released, the ATB relay releases and closes a circuit to operate the RS4 relay (OS 202-1). The RS4 relay in turn operates the ROR (reorder route) relay. The operated ROR and RS4 relays permit the marker to proceed with the operation of the RCD relay and a TC-, GS-, GE- relay and a TB- relay which direct the marker to the reorder trunk group. Cross-connections associated with the ROR relay as shown on OS 202-1 determine which TC-, TB-, GS-, and GE- relays are operated.

3.126 The marker tests the reorder trunks in the same way it tests other trunks (OS 201-1). An idle trunk is indicated by a normal T- relay. In seizing a trunk the marker operates the K- relay associated with the lowest numbered normal T- relay, then proceeds to connect the incoming trunk to the selected reorder trunk circuit.

3.127 The reorder trunk circuit sends a ground signal, interrupted 120 times a minute, to the calling end of the connection. The ground causes the cord lamp to flash, at the fast reorder rate, signaling the operator to disconnect the calling cord and to place the call again. If disconnection does not occur within 120 to 240 seconds, the reorder trunk circuit grounds a lead to light the trunk identification lamp at the sender make busy frame and to operate an audible alarm. This allows the maintenance force to determine whether a permanent signal exists.

3.128 If all of the reorder trunks are busy, the marker ATB relay operates and closes a circuit through the operated RS4 relay to operate the ROB (reorder busy) relay (OS 220-1). The ROB relay grounds the STRL (sender trouble release) lead to the sender. The ROB relay also releases the trunk block connector and TCK relay (OS 198-1), which in turn releases the ATB relay (OS 201-1). The ground on the STRL relay operates the TRL (trouble release) relay in the sender (OS 220-1),

this operates the sender MRL relay (OS 217-1) which releases the decoder connector and the marker by removing battery from the decoder connector start lead (OS 155-1). With the decoder connector normal, the ME relay in the sender releases which in turn releases the sender SP1 relay (OS 134-1). This causes the release of the sender, leaving the incoming trunk "high and dry". This means that the 4A office has been unsuccessful in finding an idle reorder trunk circuit to send a reorder signal back to the operator. The cord lamp on the switchboard remains lighted. In addition, the calling operator hears no ring to the telephone of the called subscriber, therefore she pulls out the calling cord and handles the call in accordance with traffic instructions.

Seizing a Master Busy Trunk

3.129 With the marker FMB relay operated and other information about the selected subgroup registered in the marker, a connection is set up to test and select a trunk. If all the trunks in the subgroup are busy, the marker operates the ATB relay as shown on OS 201-1 and then attempts to seize a master busy trunk. Through the operated ATB relay, the normal FOF relay, and the operated FMB relay, a circuit is closed to operate the RS1 (route transfer) relay (OS 202-1). The RS1 relay releases the TC- and the RCD relays which in turn release the trunk block connector and the relays used to gain access to the regular subgroup. When the trunk block connector releases, the TCK relay releases and opens the circuit for the ATB relay. With the ATB relay normal, the RS2 relay operates. The marker is now prepared to operate the relays which give access to the master busy trunks. The MBR (master busy route) relay operates through the operated ATB, RS2, and RS1 relays and through the normal RS3 and DE relays.

3.130 With the MBR, RS1 and RS2 relays operated, a path is closed to operate the RCD relay, a TC-, a GS-, and a GE-relay. The operated MBR and RCD relays operate the TB- relays to direct the marker to the trunk block on which the master busy trunks are terminated. The proper TC-, TB-, GS-, and GE- relays are determined by cross-connections as shown on OS 202-1. Testing for an idle master busy trunk is done in the same manner as for other trunks. In seizing a master busy trunk the marker operates the K-relay associated with the lowest numbered T-relay and then proceeds to connect the incoming trunk to the master busy trunk circuit.

3.131 The master busy trunk circuit sends a ground signal, interrupted irregularly 60 times a minute, to the calling end of the connection. The ground signal causes the cord lamp to flash at the

master busy rate, signaling the calling operator to ring on the trunk. If the outward operator rings on the connection, the IR and LU relays operate and bring in the lamp at the No. 5 incoming trunk switchboard of the 4A office where the call encountered a busy condition (OS 227-1). The No. 5 operator extinguishes the lamp by answering and assists in handling the call.

3.132 If the regular trunks and the master busy trunks are busy, the ATB relay is operated through the make contacts of all the T- relays and the normal contacts of the FOFA relay. In this situation the marker attempts to seize a reorder trunk. The RS3 relay is operated through the operated ATB, FMB, and RS2 relays, thereby causing the release of the MBR, RCD, and TC- relays. The normal MBR relay releases the GS- and GE- relays. The normal RCD relay releases the TB- relays. The normal TC- relay allows the trunk block connector associated with the master busy trunks to release. This done, the TCK relay (OS 198-1) and the ATB relay (OS 201-1) release closing a path to operate the RS4 relay and in turn the ROR relay. With the ROR and RS4 relays operated, the proper TC-, TB-, GS- and GE- relays are operated in order to seize a reorder trunk in the same way as described under reorder trunk seizure.

3.133 If all the reorder trunks are busy, the marker operates the ROB relay to send an STRL signal to the sender. The decoder connector, the marker, and the sender are released and the call is left high and dry as described under reorder trunk seizure.

Seizing an Overflow Trunk

3.134 With information about the selected subgroup registered in the marker and the FOF relay operated, the marker seizes the proper trunk block connector and trunk block and proceeds to test for an idle trunk. Because the subgroup being tested is the last subgroup in a final intertoll trunk group, four overflow trunks are ordinarily provided. These trunks are terminated on four terminals on the same trunk block and immediately following the regular trunks of the subgroup. When four overflow trunks are not provided, the remainder of the four terminals are made busy. The total number of trunks on the trunk block is limited to 40 therefore a subgroup of 36 regular trunks could be terminated on terminals 0 through 35, with the overflow trunks on terminals 36 through 39. There may be more than one subgroup terminated on a trunk block and overflow trunks may be provided with any or all of the subgroups.

3.135 After seizure of the trunk block, testing of the trunks takes place as shown on OS 201-1 and as described in

detail in Part 7 of Section A828.121.2. The testing path is through the T- (testing) relays specified by the group start and group end information from the translator card. If any of the T- relays are normal, indicating idle trunks, then the K- relay associated with the lowest numbered T- relay is operated and the call is set up. However, if all the T- relays are operated, this indicates that all the regular trunks are busy. With the FOFA relay operated, the marker proceeds to test the four overflow trunks. The test path is connected through the operated GE- relay, through the operated FOFA relay, back through the operated GE- relay, then through the T- relays associated with the four overflow trunks.

3.136 On second trial calls the regular trunks are tested in reverse order (from GE- to GS-). When all the regular trunks are busy, the testing path for the four overflow trunks is through the operated GS- relay, the operated FOFA relay, the operated GE- relay, then through the T- relays associated with the overflow trunks. The overflow trunks on both first and second trial calls are tested in the same direction, causing the operation of the lowest numbered K- relay associated with a normal T- relay. An operated K- relay releases the TKE relay (OS 201-1) and operates the OF relay (OS 202-1). The TKS (trunk selected) relay operates through the normal TKE relay and sends a TKS signal to the sender. The marker then sets up a connection between the incoming trunk and an overflow trunk in the same way as described in Part 7 of Section A828.121.2 for a regular call.

3.137 An overflow control circuit is associated with each group of four overflow trunks. The control circuit provides a means for sending either an overflow or a reorder signal to the outward operator unless a delay quote patch has been made at the supervisory panel associated with the No. 5 switchboard. This type of patch is made so that the calling operator is connected to a delay quote operator at a No. 5 switchboard as described in Section A828.121.12.

3.138 With no delay quote patch, an overflow, signal (30 IPM) is sent to the calling operator as long as all of the intertoll trunks in the final group remain busy. However, the overflow control circuit is arranged to change the overflow signal to reorder (120 IPM) when a trunk in the group becomes idle (OS 226-1). For groups which have a route relay assigned, group busy relays (one GB- relay per subgroup) are used to indicate the condition of the trunks to the overflow control circuit. These are the same relays, shown on OS 173-1, which are used to indicate the condition of intertoll trunks to the decoder when card-to-relay and relay-to-

relay routing instruction is used. For a final group which is used without a route relay in the decoders, only one group busy relay (GBT) is used to indicate the condition of the trunks. If when an overflow trunk is seized all GB- relays (or the GBT relay) are normal, indicating that all trunks are still busy, relay A operates and an overflow signal is sent to the calling operator (OS 226-1). If a trunk in the group becomes idle, one of the GB- relays (or the GBT relay) is operated releasing the A relay and the signal is changed to reorder. These operations are further described in Section A828.121.12.

3.139 When the calling operator receives a slow flashing overflow signal, she holds the connection. If the signal changes to a fast flashing reorder signal, she disconnects and places the call again. If the overflow signal doesn't change to reorder within a few minutes, the operator disconnects. If the calling subscriber wishes to have the call completed on a delayed basis, the outward operator calls a delayed call operator in her own office. A call order is then placed with this operator and she completes the call when a circuit becomes available.

3.140 If the marker finds that both the regular trunks in the last subgroup of the final group and the overflow trunks are busy, then the marker attempts to seize a master busy trunk. As shown on OS 201-1, when all T- relays associated with regular and overflow trunks are busy the ATB (all trunks busy) relay is operated. With the ATB relay operated, ground is connected through the operated ATB and FOF relays and the normal RS2 relay to operate the RS1 (route switching) relay. As shown on the sequence chart of OS 202-1, the operated RS1 relay releases the RCD relay, the TC- relay and the FOFA relay. The normal RCD and TC- relays release all the marker relays which were operated to register subgroup information, except the FOF relay, the odd and even preference relays, and the first or second trial relays.

3.141 When the trunk block connector has been released, the TCK relay releases and in turn releases the ATB relay. As shown on OS 202-1, the normal ATB relay closes a path to operate the RS2 (route switching) relay. With both the RS1 and RS2 relays operated and with the DE relay normal (indicating decoder release from the marker), the MBR (master busy route) relay is operated.

3.142 The MBR relay operated completes a path to operate a TC-, a GS- and a GE- relay and the RCD relay. As shown on OS 202-1 the operated RCD relay closes a path to operate the proper TB- relays so that the marker can test and seize a master busy trunk if one is idle.

When the incoming trunk is connected to the master busy trunk circuit, the calling operator is signaled by the irregular flashing of the cord lamp. As previously described, this master busy signal indicates that the operator is to ring on the trunk, thus signaling an operator at the No. 5 switchboard. In this case (FOF operated) the DSA operator is connected to a No. 5 operator in the same office. The No. 5 operator gives instructions as to how the call is to be handled.

3.143 If the marker finds the regular, the overflow, and the master busy trunks busy, the marker attempts to seize a reorder trunk. With all the T- relays associated with master busy trunks operated, the marker ATB relay is operated and a path is closed, through the operated RS2 relay and the normal RS4 relay, to operate the RS3 relay (OS 202-1). The operated RS3 relay releases the MBR, TC-, and RCD relays. The normal RCD relay releases the TB- relay and the normal MBR releases the GS- and GE- relays. Following the

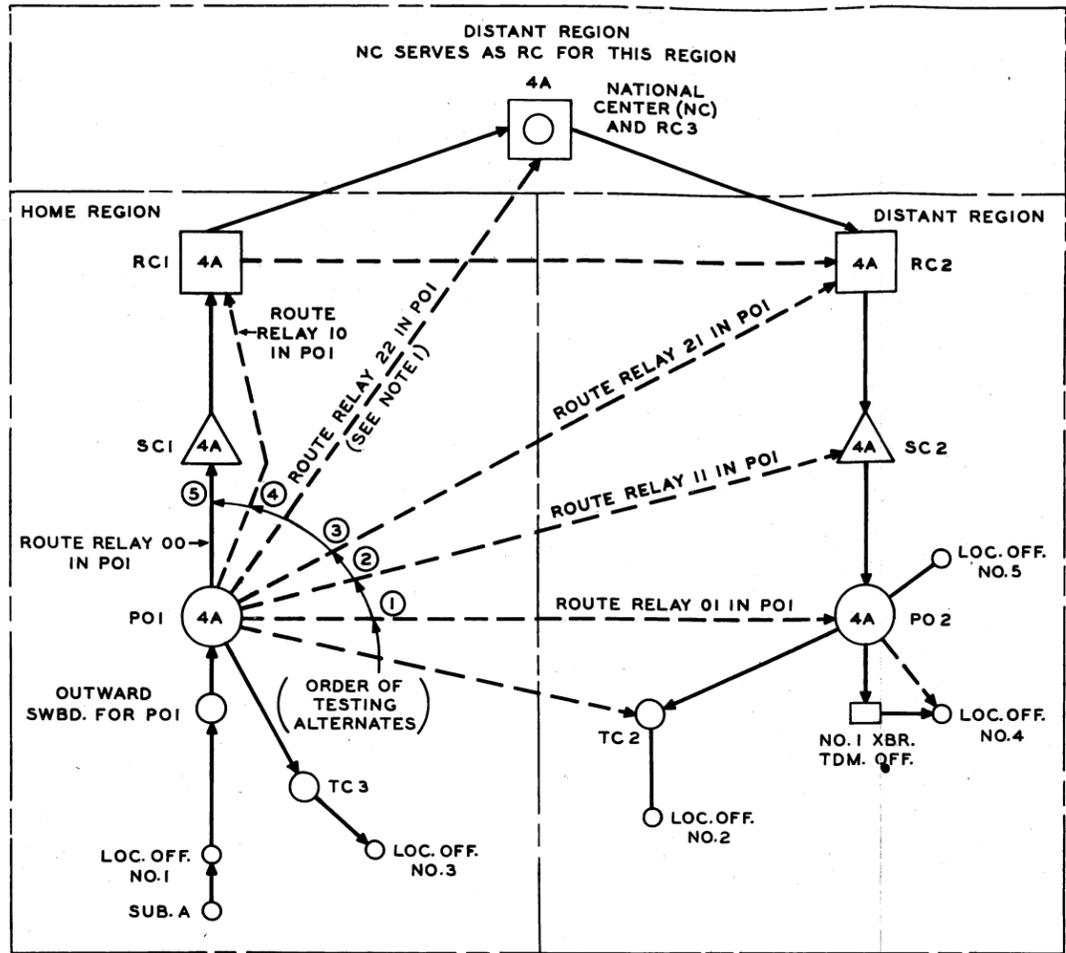
release of these relays, the TCK and ATB relays release.

3.144 The normal ATB relay and the operated RS3 relay close a path to operate the RS4 relay. As shown on OS 202-1, this causes the operation of the ROR (reorder route) relay. With the ROR relay operated, the proper TC-, TB-, GS-, and GE- relays operate to allow the marker to test for a reorder trunk. When a reorder trunk is seized and is connected to the incoming trunk, the calling operator is signaled, by the flashing of the cord lamp at 120 IPM indicating that the call is to be made again.

3.145 If all of the reorder trunks are busy, the ROB relay is operated to send an STRL signal to the sender. The decoder connector, the marker, and the sender are released and the call is left high and dry as described under reorder trunk seizure.

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Attached:
Figs. 1 and 2



- NOTES:
1. POI-NC GROUP IS ONLY USED FOR DIRECT TRAFFIC TO THE NATIONAL CENTER OR TO THE REGION OF THE NC. IT IS NOT USED AS AN ALTERNATE FOR TRAFFIC FROM POI TO THE REGION OF RC2.
 2. WITH THE TRUNK LAYOUT SHOWN AT LEFT, A CALL FROM POI TO DISTANT TC2 WOULD HAVE 5 ALTERNATE ROUTES.
 3. ——— INDICATES A FINAL TRUNK GROUP.
- - - - - INDICATES A HIGH USAGE TRUNK GROUP.
 4. PO'S, SC'S, RC'S, AND NC ARE 4A INSTALLATIONS AND ARE CONTROL SWITCHING POINTS (CSP'S.)
 5. A DECODER ROUTE RELAY IS ASSIGNED TO EACH TRUNK GROUP BETWEEN CSP'S AND BETWEEN CSP'S AND XBR. TANDEM OFFICES.
 6. HOLD - THIS MEANS THAT THE MARKER WILL HOLD THE DECODER UNTIL TRUNKS HAVE BEEN TESTED. IF ALL TRUNKS IN SUBGROUP TESTED ARE BUSY, DECODER WILL FURNISH THE MARKER ADDITIONAL ROUTING INFORMATION.
- FOF - FOLLOW WITH OVERFLOW
 FMB - FOLLOW WITH MASTER BUSY
 FRO - FOLLOW WITH REORDER
 FST - FOLLOW WITH SECOND TRIAL
 CC - CARD TO CARD
 CR - CARD TO RELAY
 RR - RELAY TO RELAY
7. IN ADDITION TO THE 3D OR THE 6D CARD, AN AR CARD IS PROVIDED FOR THE FIRST SUBGROUP. THIS AR CARD CONTAINS FST ROUTING INSTRUCTION. WHEN IT IS USED, THE MARKER RECEIVES FST INSTRUCTION ON FIRST TRIAL AND FRO ON SECOND TRIAL.

TABLE I
 EXAMPLES OF ROUTING INSTRUCTIONS, 4A TOLL SYSTEM
 (ASSUMING TRUNK GROUPS CONTAIN 2 SUBGROUPS)

TRUNK GROUP	SUB-GROUP	TYPE OF TRANSLATOR CARD	ROUTING INSTRUCTION ON CARDS AT POI OR PO2	INSTRUCTION FROM DECODER TO MARKER TO BE USED IF ALL TRUNKS TESTED ARE BUSY
POI TO TC3	1ST	3D OR 6D	CC	HOLD
	2ND	RAI	FOF	FOF-NVO INCOMING; FMB-VO INCOMING
POI TO TC2	1ST	3D OR 6D	CC	HOLD
	2ND	RAI	CR	HOLD
POI TO PO2	1ST	3D OR 6D	RR (SEE NOTE 7)	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
	2ND	AR	FST	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
POI TO SC2	1ST	3D OR 6D	RR (SEE NOTE 7)	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
	2ND	AR	FST	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
POI TO SCI	1ST	3D OR 6D	RR (SEE NOTE 7)	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
	2ND	AR	FOF	FOF-NVO INCOMING; FMB-VO INCOMING
PO2 TO LOC. OFF. NO.4	1ST	3D	CC	HOLD
	2ND	RAI	CR	HOLD
PO2 TO NO.1 XBR. TDM.	1ST	3D	RR (SEE NOTE 7)	FST IF FIRST TRIAL - FRO IF SECOND TRIAL
	2ND	AR	FRO	FRO
PO2 TO LOC. OFF. NO.5	1ST	3D	CC	HOLD
	2ND	RAI	FRO	FRO

FIG.1 - BASIC SWITCHING PLAN NO. 4A TOLL SYSTEM

