NO. 5 CROSSBAR CENTREX SERVICE

GENERAL DESCRIPTIVE INFORMATION

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1. INTRODUCTION

GENERAL

1.01 This section describes in a general manner arrangements for using the No. 5 crossbar system as a combined PBX and central office switching system. Designated centrex, this concept enables serving a maximum of 100 PBX customers on a centralized basis instead of by conventional, individual-type PBX's.

1.02 Centrex is a complete communication service. The basic features include all those normally furnished with PBX services, such as intra-PBX calling, attendant transfer, and night closing arrangements. In addition, new service features are provided such as direct inward dialing (DID) to stations; automatic identification of outward dialed (AIOD) calls by centrex stations; and new cordless, pushbutton consoles with illuminated keys for attendant-handled traffic.

1.03 Centrex service can be provided in new or existing No. 5 crossbar wire-spring offices arranged for 100 classes of service. Standard arrangements are also available for providing centrex class of service features in existing No. 5 crossbar wire-spring offices arranged for 100 classes of service. Provision for centrex service in flat-spring offices is not contemplated.

PHASES OF DEVELOPMENT

1.04 Centrex for No. 5 crossbar offices has gone through three basic phases of development. These phases are defined in the following steps.

The names assigned to these phases will be used throughout this section.

(a) Phase I circuits contain centrex features developed with attendant transfer as the basic mode of operation and standardized on an add and maintain only (A&M) basis (Fig. 1).

(b) Phase II circuits were developed on a standard basis with improvements in service and maintenance features retaining attendant transfer as the basic mode of operation. Phase II has been rated A&M (Fig. 1).

(c) Phase III circuits were developed with dial transfer as the basic mode of operation, enabling more efficient operation and considerable savings over Phases I and II modified for dial transfer. Phase III circuits (Fig. 2) are for use only in new centrex offices or in existing No. 5 crossbar offices arranged for 100 classes of service that may be used to provide centrex service.

1.05 The new dial transfer feature is not intended to replace the present attendant transfer feature which requires the aid of a PBX attendant at a telephone console or switchboard to effect transfer. It will be provided optionally where desired and will be compatible in the same marker group with attendant transfer arrangements. A centrex customer will be provided with one or the other but not both of these features. Dial transfer can be provided only in offices arranged for 100 classes of service. Standard arrangements are also available for modifying existing Phase I and Phase II offices for dial transfer (Fig. 3).

FEATURES

1.06 The No. 5 crossbar centrex is capable of providing the following features. These features will be available in two basic packages to be known as centrex I generally referred to as basic centrex and centrex II generally referred to as deluxe centrex. In addition, many optional features are available.

Centrex I

(a) Direct inward dialing (DID) to PBX stations.

(b) AIOD with automatic message accounting (AMA).

(c) Intra-PBX calling — 4- or 5-digit intercom.

(d) TOUCH-TONE calling.

(e) PBX attendant facilities.

(f) Attendant transfer.

(g) Restricted service per PBX station (incoming and outgoing)

(1) Unrestricted.

(2) Fully restricted.

(3) Semirestricted.

(h) Intercept service — machine and attendant.

(i) Trunk answer from fixed station.

Centrex II (Centrex I Plus the Following)

(a) Dial transfer with private consultation followed by add-on. (Phases I and II modified for dial transfer and Phase III).

(b) Trunk answer from any station (Phases I and II modified for dial transfer and Phase III).

(c) Optional features available are:

(1) Attendant conference calls.

(2) Dial conference call (Phases I and II modified for dial transfer and Phase III).

(3) Two-way splitting (Phases II and III).

(4) Busy line and don't answer transfer.

(5) Supervisor's turret (Phases II and III).

(6) Lockout on attendant-handled calls (Phases II and III).

2. CENTRAL OFFICE EQUIPMENT

GENERAL

2.01 This part describes equipment which is normally in a No. 5 crossbar office and deals primarily with features of the equipment which must be changed or added to provide centrex service. Any features peculiar to a particular phase of centrex are indicated. Those features common to all phases of centrex are described with no reference to phase.

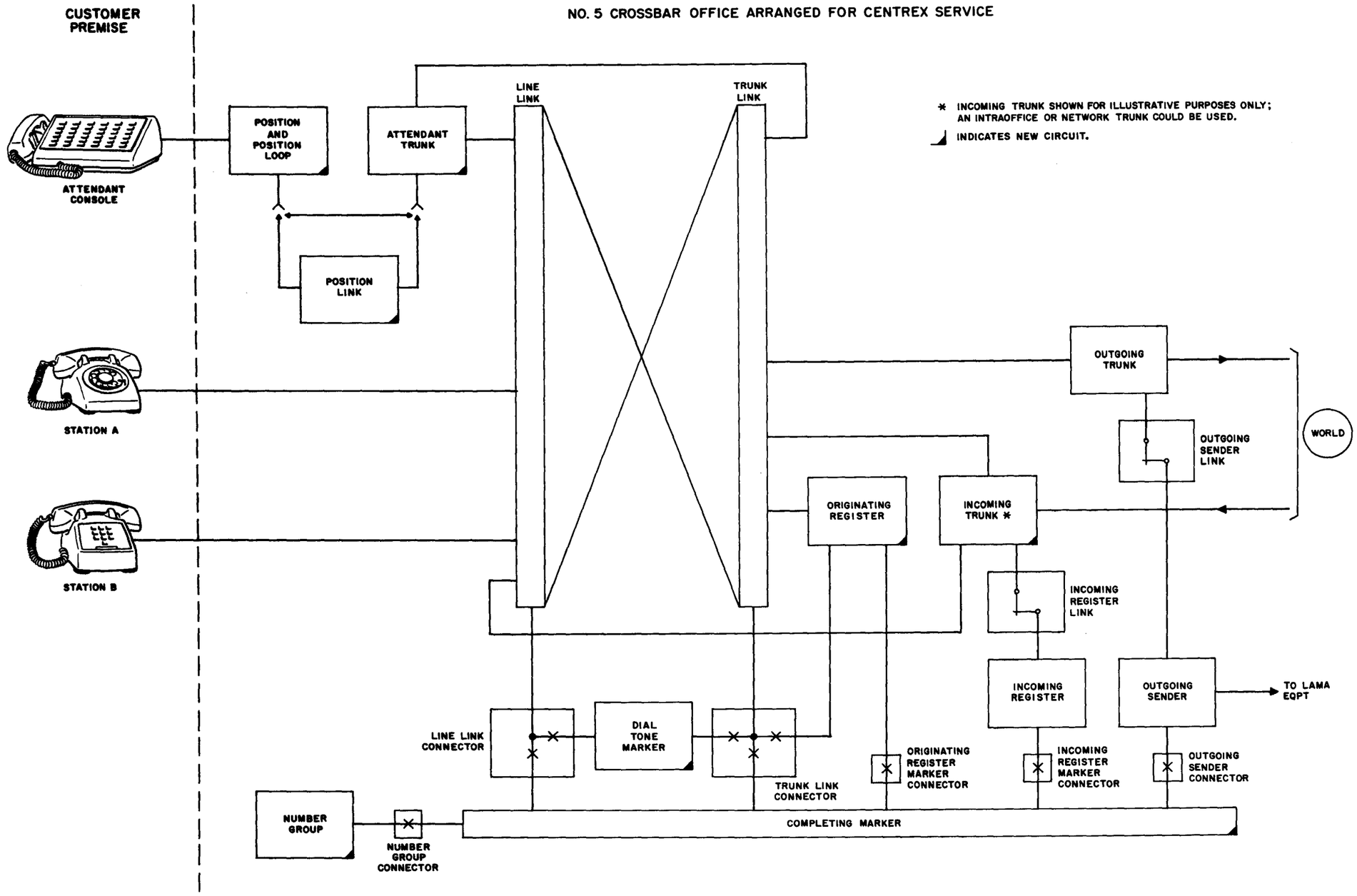

Fig. 1 — Phase I or Phase II Office — Attendant Transfer

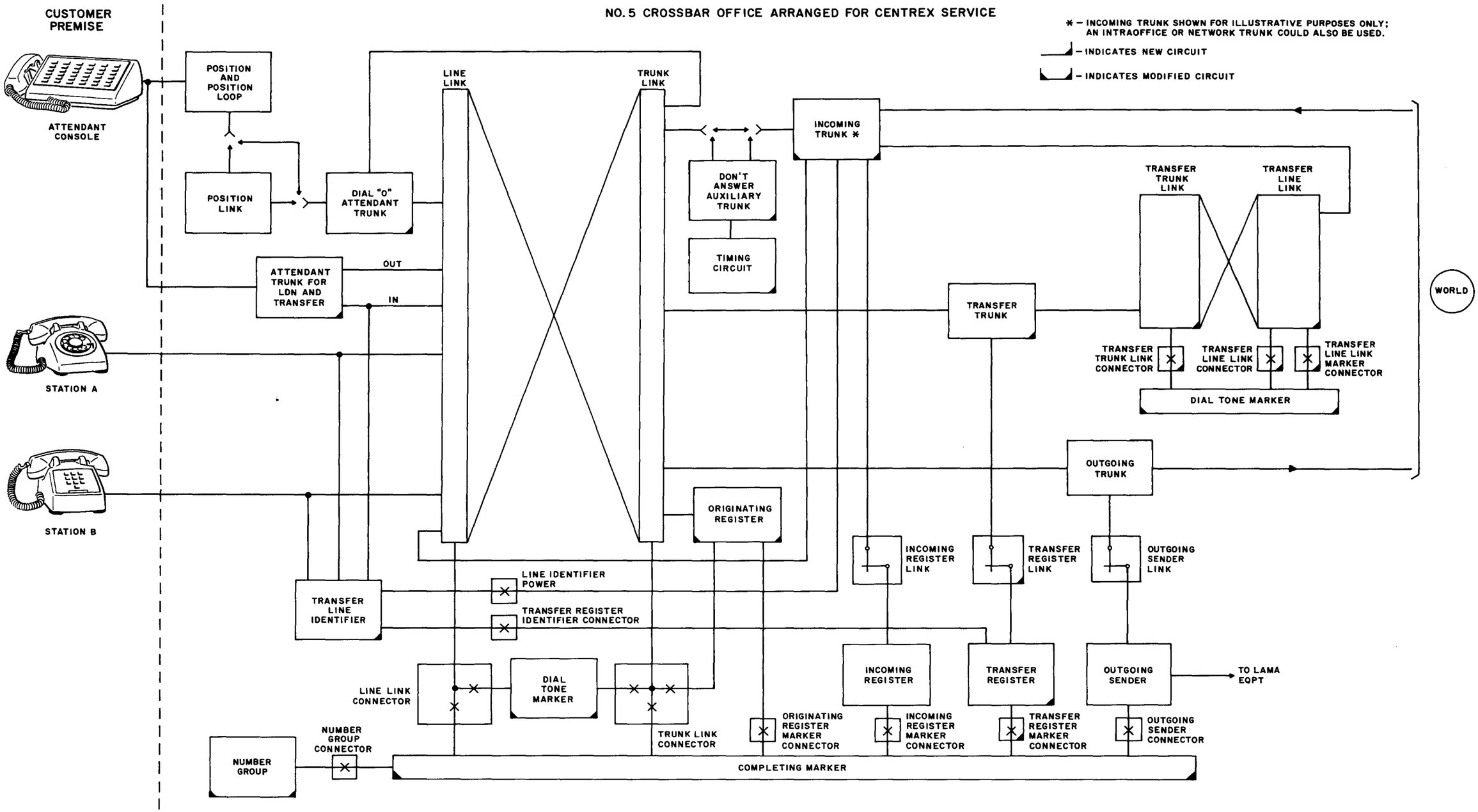

Fig. 2 — Phase III Offices

NO. 5 CROSSBAR OFFICE ARRANGED FOR CENTREX SERVICE

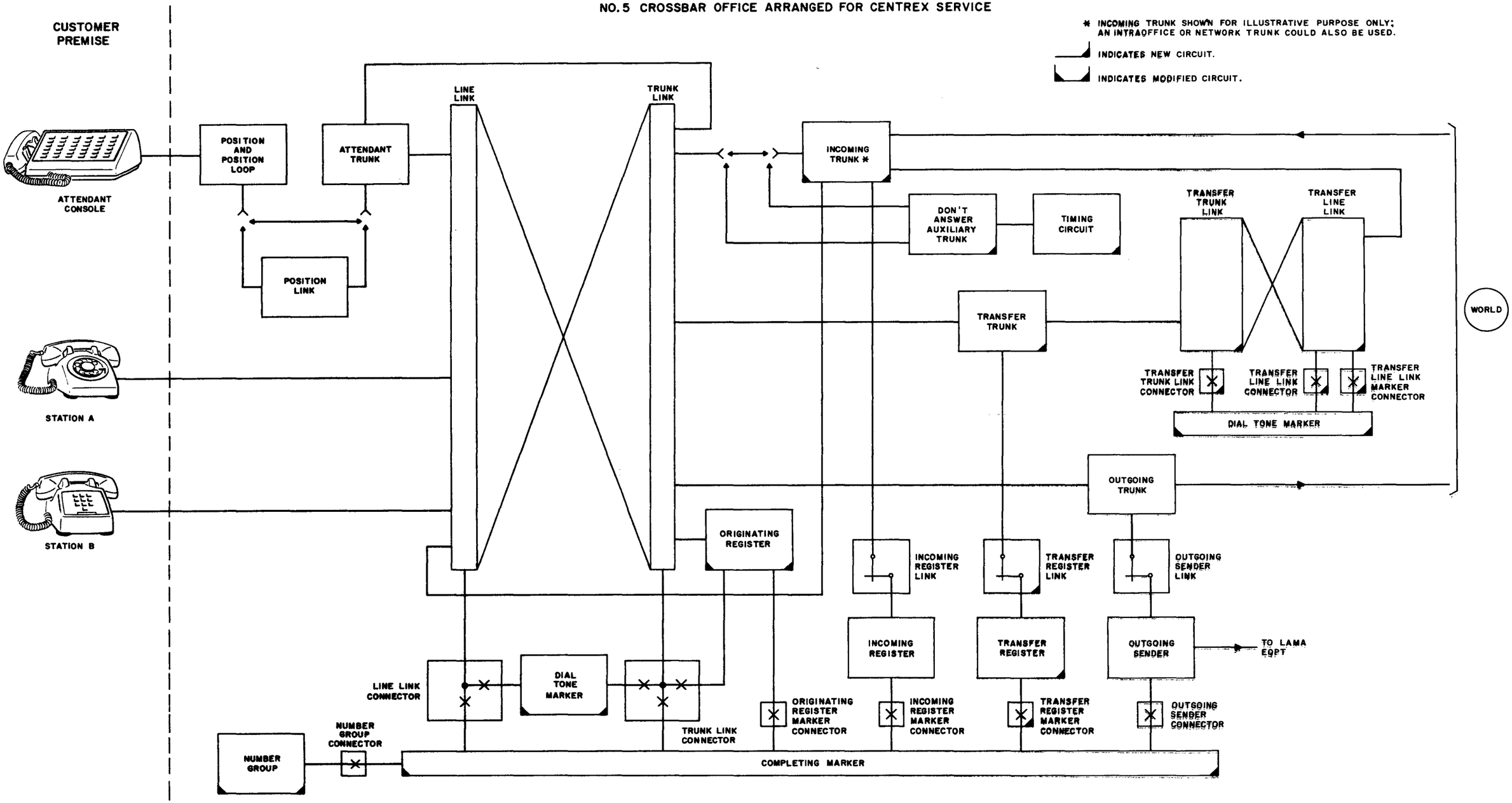

Fig. 3 — Dial Transfer Added to Existing Phase I or Phase II Office

LINE LINK FRAMES

2.02 Centrex requires a separate line link frame appearance for each of the following: (Numbers in parentheses indicate the number of appearances when more than one is required.)

(a) PBX station.

(b) Incoming trunks with transfer feature — Phases I and II.

(c) Tie lines.

(d) Attendant trunk — Phases I and II.

(e) Attendant trunk for dial zero calls — Phase III.

(f) Attendant trunk for listed directory number — Phase III (2).

(g) FX line.

(h) Conference circuit (5).

(i) Attendant line circuit.

(j) Two-way attendant access trunk (2).

(k) Other miscellaneous circuits.

Incoming trunks equipped for transfer in Phase III offices do not require line link frame appearances.

2.03 Sleeve leads are required for hunting groups and incoming trunks.

2.04 Line link frames may be arranged to operate with a specific group of originating registers or may be arranged for mixed operation. One (or as many as six) out of six originating register groups is selected on the basis of the vertical group in which a calling line is located. Thus, if TOUCH-TONE dialing is required, at least one vertical group must be assigned to use TOUCH-TONE originating registers on any line link frame requiring this type of dialing. However, since the TOUCH-TONE originating register is capable of receiving dial pulses, either dial pulse or TOUCH-TONE lines may be assigned in a TOUCH-TONE vertical group.

2.05 Certain centrex services use ground start rather than loop start operation and require assignment to those vertical files that have been wired for this feature.

2.06 The line link frames in all new centrex offices will be equipped for 100 classes of service and 20 rate treatments.

2.07 A feature which provides for class of service on a hold-magnet basis within a vertical file for line link pulsing or centrex pad control is also available. This feature permits as many as three vertical files to be arranged to identify class of service on a hold-magnet basis. Since each centrex customer group will be assigned an individual class of service, this feature will save line equipments and at the same time allow the lines of a particular PBX to be dispersed over several frames.

2.08 Listed directory number, transfer, conference, attendant, tie line, and other miscellaneous centrex calls may involve more than one switch through the line link and trunk link frames; therefore, estimates of the additional load involved are required for engineering of the line link frames.

TRUNK LINK FRAMES

2.09 Trunk link frames are unchanged for No. 5 crossbar centrex service.

MARKERS

A. Dial Tone Markers

2.10 Dial tone markers have been arranged to identify a maximum of 100 classes of service and 20 rate treatments and transmit this information to originating registers.

2.11 To provide for TOUCH-TONE and dial pulse originating registers, the dial tone markers must be equipped for at least two originating register groups. It is recommended, however, that the feature for six originating register groups be provided since it permits much more flexible arrangements for mixed TOUCH-TONE and dial pulse operation within the line link frames.

2.12 To provide proper supervision of tie line and attendant equipment associated with centrex service, the dial tone marker is arranged to provide the control to reverse tip and ring in the originating register. The control information is derived from the rate treatment.

B. Completing Markers

2.13 Completing markers have been arranged to provide the following features for centrex:

(a) 100 classes of service and 20 rate treatments.

(b) Up to 180 service relays and 120 service code points.

(c) The ability to handle 4- and/or 5-digit intra-PBX calls, listed directory number calls, and 1XX (tie line, FX, WATS, etc) calls.

Classes of Service

2.14 In a noncentrex No. 5 crossbar office, vertical files are assigned classes of service so that calls may be routed and charged in various ways to correspond to message rate, flat rate, party, or coin services. Centrex service in a No. 5 crossbar office not only requires the ability to route, charge, and deny calls, but also to indicate the customer group identity. It must also recognize either 4- or 5-digit intra-PBX calls and prevent completion if the called and calling numbers are not part of the same centrex customer group.

(a) For centrex, the class-of-service feature, therefore, is used to identify the particular customer group involved, while rate treatments are used to determine those calls which are allowed or denied in terms of charging or routing. Each line link vertical file causes two marks (class of service and rate treatment) to be registered in the marker.

(b) Each centrex customer requires a class-of-service designation, and each noncentrex customer also requires a class-of-service designation. However, these classes of service are limited to 20 rate treatments. Rate treatment assignments are described in 2.17 through 2.20.

2.15 Classes of service will be designated by the numbers 00 through 99. The recommended allocation of these classes of service is 00 through 29 for all noncentrex services and 30 through 99 for centrex customer groups. Unused numbers in the 30 through 99 series may be used for noncentrex service if required. It is necessary, however, to observe the following limitation. Equipment design permits the assignment of 00 through 29 to any combination of noncoin, coin, and centrex, whereas 30 through 99 must be all of one type in blocks of ten (30 through 39, 40 through 49, ... 80 through 89, 90 through 99). Classes of service are in four categories: coin, message register, centrex, and all other. The message register type is used only in No. 5 crossbar offices with message registers.

2.16 Where multiple-listed directory number arrangements are required, separate classes of service are required for each additional listing. (A separate group of attendant trunks for each listing also is required.)

Rate Treatment

2.17 A rate treatment restricts dialing access to one or a combination of route codes. A treatment may be used to limit dialing specific types of calls from selected telephones. There is a maximum of 20 rate treatments common to all customers (noncentrex and centrex) in a No. 5 crossbar marker group.

2.18 A centrex customer group may require certain dialing restrictions not usually provided in an office. Each dialing restriction requiring an additional treatment may be shared by other customers. If there are any variations in dialing restrictions, whether an addition or deletion, an additional treatment is required. A typical assignment of centrex rate treatments is shown in Table A.

2.19 All noncentrex service is assigned the same noncentrex rate treatment. The differentiation between the noncentrex services for charging and routing is made on the basis of class of service.

2.20 Incoming tie lines which complete to an attendant automatically upon seizure at the originating end require a separate treatment. Stations may be provided with this ability to reach an attendant upon receiver-off-hook by using this same treatment. In either case, a separate treatment is required for this type of service. This same treatment may be used under certain circumstances for manual originating service.

TABLE A

RATE TREATMENT	CLASSIFICATION	PERMITTED CALLING RANGE
00	Fully Restricted	Stations of same customer group only; denied access to exchange network and attendant.
01	Semirestricted	Stations of same customer group plus console attendant (dial zero); access to certain tie lines using 1XX codes; denied access to exchange network except through attendant.
02	Semirestricted	Stations of the same customer group plus console attendant (dial zero), local area, tie lines, and limited toll points.
03	Semirestricted	Same as 02 plus unrestricted DDD calling; denied certain 1XX codes.
04	Nonrestricted	Unlimited calling access.

ORIGINATING REGISTERS

2.21 The following additional features are required in the originating register to provide centrex service:

(a) Dial 9 with second dial tone.

(b) 4- or 5-digit dialing between extensions in the same centrex group.

(c) 4- or 5-digit dialing of intra-PBX calls by different customer groups in the same centrex marker group.

(d) 1XX access for special service such as tie lines, recorded telephone dictation, code calling, and paging.

(e) Provision for both regular and centrex customers.

2.22 With centrex, the initial digits 0, 1, and 9 are used to indicate types of calls. The digit 0 is used to reach the PBX attendant, 1 is used with 1XX special service codes, and 9 is used to set the originating register for a call outside the PBX. Customer groups using 4-digit dialing cannot have station numbers starting with 0, 1, or 9, thus they are limited to 7000 station numbers.

2.23 With 5-digit intra-PBX dialing, the maximum 40,000 numbers of the marker group are available for assignment (less requirements for trunk numbers) when more than one office code is assigned. These numbers would be obtained by the use of the 0, 1, and 9 thousands digit in the original number series in conjunction with the "C" digit of the central office code as the initial digit. For customers requiring more than 10,000 numbers, 5-digit dialing with different "C" digits in the central office code is mandatory. The "C" digit of the office code, however, cannot be a 0, 1, or 9.

2.24 Both 4- and 5-digit PBX's may be served by the same centrex office; however, any one PBX must use the same number of digits. Dial tone marker cross connections associated with the centrex customer class of service indicate the number of digits that are used.

2.25 To reach centrex tie lines or special service, 1XX codes are used. Where the A digit register is unable to translate these codes, a repetitive timing feature is provided to time for a variable number of digits that may follow. If a digit is received before the timing interval is completed, a second timing interval is started. This process continues until no digit is received and the originating register then bids for a completing marker. This permits the dialing of 1XX plus a variable number of digits. The maximum number being based on the type of trunk attached.

2.26 TOUCH-TONE originating registers are required for use by the console attendant and by any TOUCH-TONE stations. TOUCH-TONE originating registers require the same centrex features as the dial pulse originating registers.

2.27 A separate group of dial pulse originating registers or a combined group of TOUCH-TONE and dial pulse originating registers may be provided to handle centrex groups.

(a) When separate groups of originating registers are provided, one group of registers serves only regular central office customers, while the other group of registers serves only centrex customers. In the group of registers serving centrex customers only, PBX tie line and special service codes are of the 11X type.

(b) When a combined group of registers is provided, all registers within this group are arranged for centrex service, and also serve regular central office customers. In this group, the centrex tie line and special service codes are of the 1XX type.

2.28 Centrex stations or attendants (attached to register with either arrangement) must dial or key a directing digit 9 prior to dialing any number outside their centrex group. When a regular customer is connected to a register also serving centrex groups, the directing digit 9 is operated by the dial tone marker, enabling the customer to follow a normal dialing pattern. Separate class-of-service indications enable the dial tone marker to distinguish between centrex and regular customers.

2.29 A second dial tone is returned to centrex customers after a directing digit 9 is dialed.

ORIGINATING REGISTER LINE MEMORY FRAMES

2.30 A new originating register line memory frame is required for centrex service. It is arranged to provide for 100 classes of service and 20 rate treatment indications. This design includes four new rate treatment units which, due to space limitations on the frame, reduce the number of trunk link frames working with the originating register line memory frame from seven to six.

NUMBER GROUP FRAMES

2.31 Tens block screening is used to provide more terminating class treatments individual to the called station such as listed directory number, busy line transfer, don't answer transfer, and the various restrictions on incoming service. Tens block screening can be used for regular as well as centrex customers. Tens block screening uses the number group and ten ringing combinations in conjunction with four tens block relays to provide four patterns of terminating class treatment.

2.32 The ten ringing combinations used are 02, 03, 04, 05, 09, 12, 13, 14, 15, and RFTN. Four TBS relays numbered 0 through 3 are added in each number group to operate with these ringing combinations. These four relays function with corresponding TBS relays in the marker. A tens block relay operates a TBS relay in the number group and also the corresponding TBS relay in the marker. The ten RC leads are connected to ten paired contacts of the marker TBS relay. One set of contacts provides the ringing combinations (not to be confused with the functions of the ten ringing combinations selected above) and the other set of contacts, the restrictive feature. The ringing combinations have a different meaning in each of the tens block relay combinations. These are predetermined, based on the requirements of the customers.

2.33 A tens block relay is assigned to a tens block as 0 through 9, 10 through 19, 20 through 29, etc, as required, and only one tens block relay may be assigned in a tens block. The six ringing combinations 01, 06, 07, 08, 10, and 11 may be assigned without regard for the tens block relay assignments.

2.34 With tens block screening, all number group terminals must indicate one of the four tens block signals to the marker. This may vary from a different signal for each tens block to one signal for the whole number group.

2.35 In new offices, the former standard ringing combinations will be used and centrex features will be attained by using tens block screening as described.

2.36 With tens block screening, new arrangements for 2-line incoming service groups are available which do not require a terminal hunting process; therefore, the need for SC- and TBA- relays for this feature is eliminated. The new arrangements, applicable only to wire-spring marker groups, require the use of the tens block screening feature which is provided where expansion of ringing combinations is necessary for additional terminating screening such as in centrex offices. Calls to either of two lines are capable of being rerouted to the other line when a busy condition is encountered on the called line. Only one reroute is possible per call and both lines must have appearances in the same number group tens block. One line may also serve as the alternate for several lines; however, all lines must appear in the same number group tens block. If desired, only one line of a 2-line group may have the ability to cause reroute. This is determined by the ringing combinations assigned to the two lines.

CONNECTORS

2.37 Three No. 5 crossbar connector frames have been affected by the addition of centrex service. These are the line link connector, the originating register marker connector, and the trunk link connector.

2.38 In each case, the reassignment of several leads and eight additional leads are required between the completing marker and every connector. This is required to transfer class-of-service information on a tens and units basis and provide for the new treatments.

INCOMING REGISTER LINK FRAMES

2.39 Dial pulsing (DP) or revertive pulsing (RP) incoming trunks arranged for transfer require the ability to have access to multifrequency (MF) incoming registers in Phase I and II offices only. An MF incoming register is used by the console attendant to complete to the desired extension. It is recommended that nonbylink trunks (RP and DP) have only one appearance in a combined incoming register link group. However, it is possible for these nonbylink trunks to have incoming register link appearances in two incoming register link groups. Dial pulse bylink trunks have appearances in two incoming register link groups because of the inefficiency of a reduced number of dial pulse incoming registers serving bylink trunks. MF incoming trunks require an appearance only in the MF incoming register link group.

2.40 The centrex combined incoming register link frame will serve 159 trunks with line link appearances and may be arranged for a maximum of seven DP or RP incoming registers and three MF incoming registers. Only one combined frame is associated with an incoming register link group.

3. EQUIPMENT PECULIAR TO CENTREX

3.01 This part describes additional equipment developed to provide centrex service in a No. 5 crossbar office. Any features peculiar to a particular phase of centrex are indicated. Those features common to all phases of centrex are described with no reference to phase.

POSITION AND POSITION LOOP CIRCUITS

3.02 The position and position loop circuits are located in the central office and connected by cable pairs to the console located on the customer premises. A maximum of six loop circuits may be provided per console. The position and position loop circuit is arranged to operate with attendant trunks, conference circuits, and attendant access trunks. The position and position loop circuit also has a line link appearance to allow the attendant to make outgoing calls only.

3.03 Attendant trunks may be connected directly to the position and position loop circuit or via a position link circuit.

3.04 With the attendant trunk connected, the position and position loop circuit is used to connect to the attendant on dial zero, listed directory number, and transfer calls.

3.05 A maximum of two conference control circuits generally will be assigned to a console. The attendant is connected through the position and position loop circuit to the conference control circuits for establishing conference connections.

3.06 When used with the attendant access trunk, the position and position loop circuit provides facilities for the attendant to set up connections on a delayed basis. Signals from console keys are passed through the position and position loop circuit to the attendant access trunk, thereby establishing connections, one at a time, to each of the two line link appearances of the attendant access trunk.

3.07 When the attendant is no longer required on the preceding connections, the position and position loop circuit is released from the associated trunk and becomes available for handling other calls.

POSITION LINK FRAMES

3.08 The centrex position link frame is provided to distribute calls from attendant trunks to position console loops. The attendant trunk is identified and then connected to the attendant position in the proper customer group. In offices equipped for centrex service, attendant trunks are used for dial zero, listed directory number, and transfer calls.

3.09 The centrex position link frame has a capacity for 5 customer groups, 20 attendant positions, 100 position loops, and 50 attendant trunks.

3.10 The centrex position link frame includes three primary switches associated with attendant trunks and five secondary switches associated with position loops.

3.11 The primary switches are split to provide five horizontal groups. Ten attendant trunks may be assigned to the levels of each horizontal group, providing a maximum of 50 attendant trunks per frame. All attendant trunks assigned to one horizontal group must be in the same customer group. One to five horizontal groups of a position link frame may be assigned to the same customer group. When the group requires more than 50 attendant trunks, it is extended to additional position link frames.

3.12 The secondary switch vertical provides access to 100 position loops associated with 20 position circuits. The assignment of position loops of a given console position should be distributed over the five secondary switches to achieve the most efficient use of the links.

3.13 When a customer group has less than five attendant trunks, the use of this frame is not recommended. Instead, each attendant trunk should be directly associated with a fixed position loop circuit of the console.

ATTENDANT FACILITIES

A. 608-Type Switchboard

3.14 This switchboard is used in a No. 5 crossbar centrex system as a dial auxiliary on a special basis without a dial station line multiple.

B. 1- and 2-Type Telephone Consoles

3.15 One- and two-type consoles are used in a No. 5 crossbar centrex. These consoles have a capacity of 12 (1-type) or 30 (2-type) loop or trunk keys and are equipped for TOUCH-TONE operation.

3.16 Each loop or trunk key has two associated lamps. The source lamp indicates the condition of the calling party and the destination lamp indicates the condition of the called party. The attendant may also recognize the type of incoming call by the type of flashing signal she receives on the source lamp.

3.17 One- and two-type consoles provide the following functions when used with No. 5 crossbar centrex:

(a) Trunk or loop pickup for the attendant.

(b) A means for the attendant to key the desired station number.

(c) Position busy to switched loop calls.

(d) A means for releasing a station from the attendant position circuit.

(e) A means for releasing a trunk from the attendant position circuit.

(f) A means for holding a call when the attendant temporarily leaves the connection.

(g) A means to release the attendant from a completed call and make her available for subsequent calls.

(h) Night service arrangement.

(i) Manual signaling in either direction on a call.

(j) A means for calling the supervisor for assistance.

(k) Line termination from the switching system to permit the attendant to make outgoing calls.

(l) A means to split the connection so that the attendant may talk to only one party at a time.

(m) Conference calling.

(n) A means for transferring incoming calls to a centrex station.

(o) Indication of calls waiting in the switched loop operation.

(p) Indication when an associated originating or incoming register is ready to accept pulses.

(q) A means of turning the audible tone on or off and controlling its loudness.

TRUNKS

A. Incoming and Intraoffice Trunks (Phases I and II Centrex)

3.18 There are several types of intraoffice and incoming trunks arranged for centrex service. Specific trunk types are covered in the trunk tables in Section AA240.020.

B. Incoming and Intraoffice Trunks (Phase III Centrex)

3.19 For Phase III centrex, these trunks will not require customer line link appearances, tandem trunk numbers, or customer group memory.

C. Attendant Trunks (Phases I and II Centrex)

3.20 This equipment is used to connect dial zero, listed directory number, and transfer calls to the console.

3.21 A separate group of these trunks is required for each customer group. Each circuit has both a trunk link and line link appearance and is connected directly, or via the position link frame, to the position and position loop circuits.

3.22 The trunk link frame location is used to connect to this trunk on dial zero, listed directory number, and transfer calls. The line link location is used when the attendant initiates a start-out call to a tie line, foreign exchange trunk, or outgoing trunk.

D. Attendant Trunks (Phase III Centrex)

3.23 Two types of attendant trunks are provided. One handles listed directory and transfer calls and has two line link appearances. The other is used for dial zero calls and has one line link and one trunk link appearance.

E. Attendant Access Trunks

3.24 The attendant access trunk provides facilities for connecting two stations on a call originated by the attendant; for example, a WATS call on a delay basis. This trunk has two line link appearances and is selected by a trunk key at the console.

F. Transfer Trunks

3.25 The transfer trunk gives the station initiating a transfer request access to a transfer register and provides a trunk link appearance for connection to the "transferred to" station in Phase I and Phase II offices modified for dial transfer or the "transferring station" in Phase III offices. The transfer trunk has a transfer trunk link, a transfer register link, a trunk link frame, and when used in Phase I and Phase II offices, a ringing selection switch appearance.

3.26 The transfer trunk is also arranged for connection to a low-loss conference circuit that is capable of providing the necessary amplification required on add-on calls.

G. Don't Answer Auxiliary Trunks

3.27 In offices with don't answer transfer, every trunk arranged for centrex operation must be associated with a don't answer auxiliary trunk. These trunks, under control of a common interrupter, provide a basic timing interval of 15, 30, 45, or 60 seconds chosen on a marker group basis. Consequently, all customer groups in a centrex marker group must have the same don't answer transfer timing interval.

3.28 When a time-out occurs, the don't answer auxiliary trunk signals the associated incoming trunk to initiate a don't answer transfer and route the call to the console where it will be treated as a listed directory number call.

H. Night Answering Trunks

3.29 Night answering trunks are available to provide a method for answering listed directory number calls from any station in a customer group when attendant facilities are made busy. This feature is referred to as trunk answer from any station.

I. Tie Trunks

3.30 Two basic types of tie trunks are available. Both types are arranged for pad control.

3.31 The first tie trunk is used when no more than 1XX plus 9 digits are expected. A dial pulse outgoing sender is always associated with this type of trunk.

3.32 The features of this tie trunk are:

(a) ***Dial Selected — Outgoing:*** This tie trunk may be selected by dialing a 1XX code. If automatic service is provided, a seizure signal is passed to the distant equipment which supplies an audible ringing signal. If dial repeating service is provided, all digits will be dialed into an originating register. Upon completion of dialing, the trunk will be selected and an outgoing sender attached. The digits will then be outpulsed as required.

(b) ***Line Terminated — Incoming:*** All incoming calls via this tie trunk are connected to a line link appearance. If automatic service is provided, this line link appearance will be given a manual class-of-service treatment. Seizure of this circuit causes it to be connected to an attendant trunk for completion by the attendant. If dial repeating service is provided, a second dial tone is returned by the originating register. When dialing has been completed, the call is screened and routed in the same manner as a call from a centrex station.

3.33 The second tie trunk is used when more than 11 digits (1XX plus 9) are expected. A TOUCH-TONE calling signal to dial pulse converter is always associated with this tie trunk. The features of this trunk are:

(a) ***Dial Selected — Outgoing:*** This trunk may be selected by dialing a 1XX code. If automatic service is provided, a seizure signal is passed to the distant equipment which supplies an audible ringing signal. If dial repeating service is provided, a second dial tone is supplied by the distant originating register or the local converter, if required. The remaining digits are then dialed.

(b) ***Manual Selection — Console — (Attendant Originated):*** When this circuit is manually selected, the attendant first keys the number of the local station. Upon satisfactory completion, she presses the advance key and pulses the desired number to the distant office. The attendant may then release herself from the connection.

(c) ***Manual Selection—Switchboard:*** This circuit may be manually selected from a 608-type switchboard modified for customer group service. Attendant action on this type of call follows normal switchboard operation.

(d) ***Line Terminated — Incoming:*** This circuit may connect incoming calls directly to a line circuit appearance. If automatic service is provided, this appearance is wired with a manual class. This seizure of the circuit causes it to be connected to an attendant trunk for call completion by the attendant. If dial repeating service is provided, a second dial tone is returned by the originating register. When dialing has been completed, the call is screened and routed in the same manner as a call from a local station.

(e) ***Key Terminated — Incoming:*** If the circuit provides automatic service and is key terminated on a console, the attendant receives the incoming signal (120-ipm flash on source lamp and an audible signal). She answers the call, pulses forward the desired number, and then releases from the connection. This call is then screened and routed in the same manner as a call from a centrex station.

(f) ***Jack Terminated — Incoming:*** If the circuit provides automatic service and is jack terminated on a 608-type switchboard modified for customer group service, the attendant receives the incoming signal. She uses the rear cord to answer the signal and the front cord to extend the call to the proper destination.

3.34 A TOUCH-TONE calling signal to dial pulse converter is required when a distant central office cannot accept TOUCH-TONE pulses. (Pulsing from the attendant and TOUCH-TONE stations is on a 4 x 4 TOUCH-TONE basis.) The converter is located in the local office and is attached to the tie trunk through a trunk finder circuit as required.

3.35 The converter makes a trunk test and supplies dial tone if the trunk is idle and the distant end is ready to receive digits. It will then accept and store TOUCH-TONE pulsing. The converter, which has a 13-digit storage capacity, outpulses the stored TOUCH-TONE digits as dial pulses. If the first digit is rotary dialed (dial pulses), the converter repeats the digit and then releases during the first interdigital interval. A converter is not required on trunks to central offices which will accept TOUCH-TONE pulsing.

J. Foreign Exchange Trunks

3.36 This circuit may be terminated on the jack multiple of a 608-type switchboard modified for customer group service or key terminated on a telephone console. It may also be dial selected outgoing with or without toll diversion. Incoming calls always signal the attendant upon seizure.

3.37 The features of this foreign exchange trunk are as follows:

(a) ***Dial Selected — Outgoing:*** This trunk may be selected by means of a 1XX code. After selection, a seizure signal is sent to the distant central office. When a distant register, sender, or line finder is attached, a local TOUCH-TONE signal calling to dial pulse converter will be seized. After the converter has made a successful trunk test, it supplies second dial tone to the calling station or attendant. Under certain conditions, a local converter may not be required. The originating station or attendant then receives second dial tone from the distant end. The remainder of the digits may now be keyed. If the toll diversion feature is activated, this trunk sets up a 120-ipm tone when a toll diverting signal is received from the distant central office. The attendant receives an indication that the trunk has been dial selected.

(b) ***Key Terminated on a Console — Outgoing:*** This circuit may be manually selected by pressing the associated talk key. The attendant first pulses the number of the local station. Upon satisfactory completion, the attendant pulses the desired number to the distant central office. The attendant may then release from the connection. Since this is a fixed loop-type operation, the console receives positive lamp supervision for the duration of the call.

(c) ***Jack Terminated on a 608-Type Switchboard Modified for Customer Group Service — Outgoing:*** This circuit may be manually selected by inserting a front cord into the CALL jack. After receiving dial tone, the attendant pulses the desired distant number.

(d) ***Jack Terminated on a 608-Type Switchboard Modified for Customer Group Service — Incoming:*** A seizure from the central office activates the ANS jack circuit. The attendant uses a rear cord to answer the signal and the associated front cord to extend this call to the desired destination.

(e) ***Key Terminated on a Console — Incoming:*** A seizure from the distant central office causes the source lamp to flash at 60 ipm. The attendant presses the talk key to answer the call. The call may be placed on hold or extended to the desired station. This call is screened and routed similar to a call from a local station. The attendant may then release from the call or place it on hold. If the local station flashes the switch hook after the attendant has released from the connection, the trunk causes the destination lamp to flash at a

120-ipm rate until the attendant reenters. The first station may now be released and the call extended to a new destination.

(f) ***Toll Ringback:*** On an outgoing call to a distant toll operator, a ringback will signal either the originating station (if trunk had been dial selected) or the attendant (if trunk had been manually selected).

ATTENDANT CONFERENCE CIRCUITS

3.38 These circuits provide facilities to connect a maximum of five conferees under control of an attendant. The conference control circuit may be used to receive a request for a conference or, under attendant control, to set up a prearranged conference. Five line link appearances are used to connect stations or trunks to a conference circuit. The first line link appearance is assigned a number and is arranged for originating and terminating service. The other four line link appearances are arranged for originating service only.

3.39 A customer may request a conference by calling the conference number. He will be connected to the first line of an idle conference control circuit and cause the attendant console conference lamp to flash at 120 ipm. The attendant will answer by operating the conference key on the console, obtain the number of the stations to be added to the conference, and using the four remaining line locations, initiate four start-out calls to cause the conferees to be connected one-by-one to the conference control circuit. As each individual conferee answers, the attendant will notify him of the conference and then operate the conference key to connect both the attendant and the called station to the conference circuit. When all conferees are connected, the attendant disconnects from the control circuit and may not reenter the conference except on recall from the first or second line of the conference control circuit.

3.40 The conference may be prearranged, in which case the attendant originates all connections to the conferees. To originate a prearranged conference, the attendant operates the conference key on the console. The attendant cuts through to the conference circuit to verify that it is in working order and then operates the start out key to be connected to the first line of the control circuit. Dial tone is received and the attendant keys the number of the first conferee to be connected. When the called customer answers, the attendant notifies him of the conference and then operates the conference key to connect both the attendant and customer to the conference circuit. Attendant announcement is made after cut-through to the conference circuit.

3.41 Each succeeding line link appearance is connected to the conference circuit in a method similar to the connection of the first line. The attendant operates the start out key to gain access to the line, pulses the number, waits until the party answers, and then operates the conference key to cut through to the conference circuit. When all conferees have been announced to the conference, the attendant disconnects from the conference circuit by operating the position release key.

DIAL CONFERENCE CIRCUITS

3.42 Dial conference circuits permit any centrex station except fully restricted stations (including tie line and satellite stations) to originate a conference connection involving a maximum of five additional conferees.

3.43 Dial conference circuits for offices with dial transfer features provide the following combinations of conference connections:

(a) Originator or assistant and five centrex stations.

(b) Originator or assistant, four centrex stations, and one central office trunk.

(c) Originator or assistant, four centrex stations, and one tie trunk.

(d) Originator or assistant, three centrex stations, and two tie trunks.

(e) Originator or assistant, three centrex stations, one centrex office trunk, and one tie trunk.

3.44 To utilize the dial conference feature, the customer group station dials (rotary or TOUCH-TONE) a 1XX or NNX conference code. Assuming that a conference circuit is idle, second dial tone is returned. The originator may then add another customer group station to the con-

ference by dialing the 4- or 5-digit extension number of the conferee. When the new conferee answers, the originator flashes his switch hook to transfer them both to the conference bridge. A subsequent switch hook flash by the originator obtains dial tone again. This process is repeated until all desired conferees, within the limits set forth above, are connected. If a called station within the customer group is busy, does not answer, or the originator otherwise wishes to abandon the call before completion, the originator flashes his switch hook. This action releases the call and connects the originator to the conference bridge. While the originator is involved in the process of adding conferees, the parties that have already been connected to the conference bridge may talk to each other. However, the originating station is not connected to the conference bridge until the new conferee answers and the originator flashes his switch hook or cancels the call.

TRANSFER LINE LINK AND TRANSFER TRUNK LINK FRAMES (PHASES I, II, AND III CENTREX WITH DIAL TRANSFER)

3.45 All centrex trunks with transfer features are provided with access to station dial transfer trunks via a 6-wire, 4-stage network comprised of the transfer line link and transfer trunk link circuits. These circuits function similar to that of regular line link and trunk link frames. The network is controlled by the dial tone marker. The transfer trunks, which appear on the trunk switches of the transfer trunk link, form a single trunk group. This arrangement provides full access between any incoming or intraoffice trunk and any transfer trunk.

3.46 Each basic transfer line link frame provides 90 centrex-type trunks with access to 100 junctors on the transfer trunk link frame. The number of trunks can be increased to 590 in 100-trunk increments by the addition of supplementary transfer trunk link frames. The assignment of trunks on the transfer line link frames must be such that all trunks assigned to a vertical file of ten must be located on the same trunk link frame.

3.47 Each transfer trunk link frame provides 100 junctors on its junctor switches with access to a maximum of 50 transfer trunks on its trunk switches.

3.48 Two arrangements are provided. One requires two transfer line link frames and two transfer trunk link frames. This combination provides a maximum of 1180 incoming trunks with access to a maximum of 100 transfer trunks. A second and larger arrangement provides for a maximum of 2360 incoming trunks and 200 transfer trunks. This arrangement consists of four transfer line link frames and four transfer trunk link frames.

3.49 Arrangements are provided to permit expansion from the two transfer line link and two transfer trunk link size to the four transfer line link and four transfer trunk link size.

TRANSFER REGISTER LINKS

3.50 Transfer trunks are provided with access to transfer registers via a transfer register link. This circuit functions in a manner similar to the regular incoming register link frame. A transfer register link frame serves a maximum of 99 transfer trunks in five horizontal groups with access to a maximum of ten transfer registers.

TRANSFER REGISTERS

3.51 The transfer registers are provided to receive dialing information from the transferring centrex station and to receive and store information required by the completing marker to establish a connection between a transfer trunk and a "transferred to" station.

3.52 Optional arrangements are provided to permit the use of this transfer register in new Phase III centrex offices that provide the dial transfer feature based on line identity. These options include:

(a) Provision of a TOUCH-TONE calling head.

(b) Means for the register to initiate a request for line identification via a transfer line identifier and connector circuit.

(c) Receipt and storage of information from the line identity equipment.

(d) Provision for transmitting line identity information to the completing marker.

TRANSFER LINE IDENTIFIERS

3.53 This new circuit is arranged to identify the line location of a station initiating a transfer request. It is also capable of transmitting this identity in terms of line link frame number, vertical group, horizontal group, and vertical file via a transfer register identifier connector to a transfer register where it will be passed to a completing marker. The completing marker will use this information to set up a new channel from the station initiating the transfer request to an idle transfer trunk.

3.54 Arrangements are provided so that a positive identification signal may be applied to the sleeve of an established connection either at the transfer register or the transfer trunk. This signal will be transmitted via the transfer trunk, incoming trunk established channel, and line sleeve lead to the line identifier where the line location of the "transferring" station will be determined. A negative identification signal may be applied to the line identifier. The standard No. 5 crossbar 60-cycle, message register, tip party power supply is considered an adequate signaling source. It will not be necessary to simultaneously identify a multiplicity of transfer requests; one-at-a-time call processing will suffice.

3.55 Any six or less vertical groups on a line link frame may be made available for dial transfer service. Two patterns of vertical group assignments are provided. All line link frames using the same pattern must have the same six or less vertical groups available for dial transfer service. One terminal on each connector relay is connected to the pattern A or pattern B terminal on the associated connector relay to indicate which of two vertical group patterns is assigned to the associated line link frame. When the connector relays operate, ground is supplied through these relays to operate either the pattern A or pattern B relay. The operated pattern relay prepares paths for the translation of the sleeve number to vertical group and vertical file numbers.

3.56 The frame tens A and frame tens B terminals of each B connector relay are connected to the frame tens 0 through 3 terminals on the associated connector relay to provide the line link frame tens digit number on a 2-out-of-3 basis, allowing six combinations to identify six frame tens digits. The frame units A and B terminals on each LB connector relay are connected to the frame units 1, 2, 4, 7 terminals on the associated IB connector relay to provide the line link frame units digit number on a 2-out-of-5 basis, allowing ten combinations to identify one of ten frame units digits. When the LA and FA- line link identifier connector relays operate, the frame tens and frame units leads will be grounded to operate corresponding relays in the transfer register.

3.57 To identify the horizontal group, the LA and IA- connector relays operate and the 0 through 9 link horizontal diodes are extended to the horizontal group electron tubes. The positive identification signal source which appears on one of the horizontal group diodes is extended to a terminal on the corresponding horizontal group electron tube. When the off-normal relays operated, the negative identification signal source was connected to the windings of the horizontal group 0 through 9 relays and appeared as a negative potential at another terminal of the corresponding horizontal group electron tube. The difference of potential between the two terminals of the horizontal group electron tube, corresponding to the horizontal group in which the identification signal appears, will cause the horizontal group electron tube to break down and close a path to operate the appropriate horizontal group relay.

3.58 When the horizontal group relay operates, a path is closed through a 1-out-of-10 check circuit to operate the horizontal group check relay. The horizontal group check relay connects battery through the operated horizontal group relay to operate a corresponding horizontal group A or B relay in the line link frame and a corresponding horizontal group auxiliary relay in the identifier.

3.59 To make the link identification, the operated horizontal group B relay in the line link frame extends the ten links of the associated horizontal group through the operated connector relays to the 0 through 9 link diodes.

3.60 The positive identification signal source which appears on one of the link diodes is extended to a terminal on the corresponding 0 through 9 line link electron tube. When the off-normal relays operated, the negative identifica-

tion signal source was connected to the windings of the 0 through 9 line link relays and appeared as a negative potential on another terminal of the line link electron tube. The difference of potential between the two terminals of the line link electron tube corresponding to the link in which the identification signal appears will cause the line link electron tube to break down and close a path to operate the corresponding line link relay.

3.61 For sleeve identification, the operated horizontal group auxiliary relay in the identifier extends the 30 sleeve leads of the associated horizontal group through the operated connector relays to the 00 through 29 sleeve diodes. The positive identification signal source which appears on one of the sleeve diodes is extended to a terminal on the corresponding 00 through 29 sleeve electron tube. When the off-normal relays operated, the negative identification signal source was connected to the windings of the 00 through 29 sleeve relays and appeared as a negative potential on another terminal of the 00 through 29 sleeve electron tube. The difference of potential between the two terminals of the sleeve electron tube corresponding to the sleeve on which the identification signal appears will cause the electron tube to break down and close a path to operate a corresponding 00 through 29 sleeve relay.

3.62 The line identifier transmits line location to the transfer register by translating the horizontal group number from a 1-out-of-10 to a 2-out-of-5 code. The link number is identified on a 1-out-of-10 basis and translated to a 2-out-of-5 code. The sleeve number which is identified on a 1-out-of-30 basis is translated into a vertical group number on a 1-out-of-6 basis and into a vertical file number on a 1-out-of-5 basis. Vertical group numbers are cross-connected to agree with the line link frame pattern assignment as indicated by the operation of the pattern A or B relay.

3.63 As the translations are completed by the identifier, the information is transmitted to the transfer register via the transfer register identifier connector which was cut through when the transfer register initiated the line identification request.

CONNECTORS

A. Transfer Line Link Connector

3.64 A new transfer line link connector provides multiple leads required between the dial tone marker and the transfer line link frame.

B. Transfer Trunk Link Connector

3.65 This new connector provides multiple leads required between the dial tone marker and the transfer trunk link frame.

C. Transfer Line Link Marker Connector

3.66 This circuit provides the transfer line link frame with access to the dial tone marker.

D. Transfer Register Marker Connector

3.67 The transfer register marker connector provides the transfer registers with access to the completing markers.

E. Transfer Register Identifier Connector

3.68 A line identity connector provides the necessary leads between the line identity circuits and the transfer register.

TRAFFIC REGISTER

A. Registers on a Marker Group Basis

3.69 The following peg count registers are provided on a marker group basis:

(a) Total dial transfers.

(b) Total station-to-attendant transfers.

(c) Total attendant-to-station transfers.

(d) Total incoming listed directory number calls.

B. Registers on a Customer Group Basis

3.70 The following peg count registers are provided on a customer group basis. The traffic register translator circuit has the capacity to handle these registers. This circuit is arranged to record ten types of calls on ten separate message registers and allows a maximum of ten cus-

tomer groups in one marker group to be studied simultaneously.

(a) Total originating calls.

(b) Total incoming calls.

(c) Total 4- or 5-digit intra-PBX calls.

(d) Total dial zero calls.

(e) Total listed directory number calls. These calls will not be included in the total incoming calls and will be limited to customers having a console or switchboard as the attendant facility.

(f) Total station-to-station transfers.

(g) Total station-to-attendant transfers.

(h) Total attendant-to-station transfers.

4. METHOD OF OPERATION

GENERAL

4.01 This part contains operational block diagrams (Fig. 4 through 22) of No. 5 crossbar centrex. The manner in which various calls are handled is described diagrammatically.

4.02 The description is divided into three basic parts to show the differences in equipment, features, and method of handling calls in the three phases of centrex development. Dial tone connection is described separately so that it can be referenced and not repeated for each call.

4.03 The three parts treat Phase I and Phase II centrex with attendant transfer together, Phase I and Phase II modified for dial transfer together, and Phase III separately. When calls for the various phases of centrex are identical, the call is described once and referenced where applicable.

4.04 The progress of a connection is described in a flow pattern form, with paths numbered consecutively as they are used. In each figure, only those paths that are actually used for the call in progress are indicated. In some instances, basic centrex calls are referenced in the description of Phases I and II centrex with dial transfer and Phase III centrex.

DIAL TONE CONNECTION

4.05 When station A goes off-hook, a line relay operates and causes a line link frame to bid for a dial tone marker via the line link marker connector as shown in Fig. 4. The line link marker connector selects an idle dial tone marker and transmits to this marker the number of the line link frame, vertical group, and horizontal group of the calling line (1).

4.06 The dial tone marker initiates a bid for an idle originating register (2).

4.07 The dial tone marker selects an idle channel (line link, junctor, trunk link) from station A to the originating register.

4.08 Before the dial tone marker transfers control of the channel to the originating register (4), it records the vertical file number, customer group identity (class of service), rate treatment, and whether the customer has 4- or 5-digit intercom calling and transmits this information to the originating register (3). The originating register returns dial tone to station A.

CALLS FOR PHASES I AND II CENTREX WITH ATTENDANT TRANSFER

A. Intraoffice Call to a Centrex Station in the Same Centrex Group (Intra-PBX Call)

4.09 Station A goes off-hook. A channel is established to an originating register by a dial tone marker as described in 4.05 through 4.08 and shown in Fig. 5(1).

4.10 Station A dials a 4- or 5-digit number of station B. The originating register connects to a completing marker through an originating register marker connector and transfers all the information that is received (2). (See 4.08.)

4.11 The completing marker calls in the number group via the number group connector to translate the dialed digits into the line location and class of service of station B(3).

4.12 A 4- and 5-digit intra-PBX call is restricted to stations within the same customer group, thus the completing marker by using a matching circuit checks the class of service of station A with that of station B(4).

4.13 If the class of service match is successful, the completing marker seizes a trunk link frame via the trunk link connector and selects an idle intraoffice trunk (5). The terminating connection to station B is established first (6) so that if the called line is busy, the marker will immediately route advance to a tone trunk. After the terminating connection is established, the marker proceeds to set up the originating connection to station A (7). If the class of service match is unsuccessful, the marker route advances to a tone trunk or a recorded announcement.

4.14 When a channel has been established both between station A and the intraoffice trunk and station B and the intraoffice trunk, all common equipment (registers, markers, connectors) releases and only the ringing selection switch is retained. When the called station answers, the ringing selection switch releases and the talking channels remain.

4.15 Transfer is not provided on intra-PBX calls.

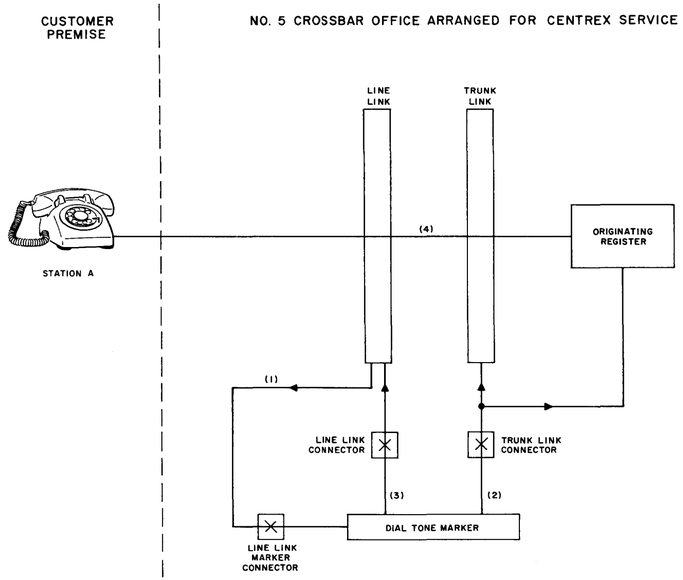

Fig. 4 — Dial Tone Connection

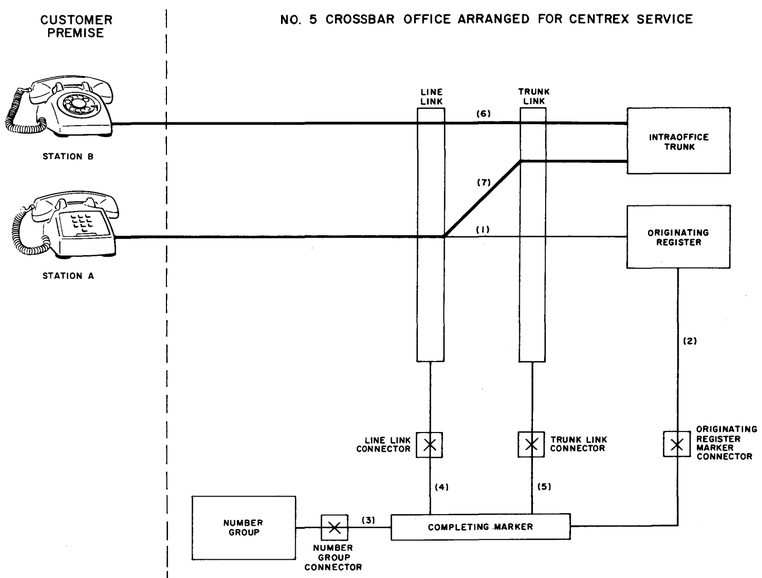

Fig. 5 — Intraoffice Call to a Centrex Station in the Same Customer Group

Fig. 4 and 5

B. Dial Zero for Attendant Call

4.16 Station A, needing the assistance of an attendant, goes off-hook. A channel is established to an originating register by a dial tone marker as described in 4.05 through 4.08 and shown in Fig. 6(1).

4.17 Station A dials "0". When no other digits follow, a manual class is recorded and the register calls for a completing marker through the originating register marker connector (2) and transfers all pertinent information it has received (the above information plus calling line link location, class of service, and rate treatment).

4.18 The completing marker, recognizing a dial "0" service request from a centrex station, sets up an outgoing call but routes the call by class of service to the trunk link appearance of an idle attendant trunk. The attendant trunk is connected to the position and position loop circuit either directly for fixed loop operation or through a position link circuit for switched loop operation (where a number of attendant trunks serve a number of attendants).

4.19 The completing marker establishes a channel from station A through the attendant trunk (3) and subsequently to the attendant console or switchboard.

4.20 When the attendant trunk seizes the position and position loop circuit, the attendant will be notified of the seizure by an audible signal and a 120-ipm flash on the source lamp. The destination lamp remains dark.

4.21 To answer the call, the attendant presses the talk key associated with the visual signal. The audible signal is silent and the source lamp lights steadily.

4.22 For extending the call outward, refer to the attendant originated outgoing call described in 4.29 through 4.33.

C. Station Originated Outgoing Call

4.23 Station A goes off-hook and a channel is established to an originating register by a dial tone marker as described in 4.05 through 4.08 and shown in Fig. 7(1).

4.24 Station A dials "9". The originating register, recognizing from the class of service and rate treatment that this is a centrex customer with dial out privileges, sets this digit aside and returns a second dial tone to station A. If "9" is not followed by any other digits, a register timeout occurs and the call is routed to a permanent signal tone trunk.

4.25 Station A dials the number of the called station (seven or ten digits) into the originating register. The originating register passes this information to the completing marker via the originating register marker connector (2), along with the calling line link location, class of service, and rate treatment.

4.26 The completing marker, using the office code, selects an idle outgoing trunk to the called destination and an available outgoing sender of the proper type (DP revertive, or MF). The outgoing sender is connected to the outgoing trunk via the outgoing sender link. The marker then gains access to the outgoing sender by means of the outgoing sender connector (3) and transfers all the information necessary for completion of a No. 5 crossbar outgoing call, plus class of service and rate treatment.

4.27 The completing marker establishes a channel from station A to the outgoing trunk and releases (4). The outgoing sender then makes trunk tests and if successful, transmits the called number to the connecting office and then disconnects itself and the sender link. The outgoing trunk maintains supervision of the call. If trunk test is unsuccessful, overflow is returned to the customer from the trunk.

4.28 Since the outgoing call may be a chargeable call, the outgoing sender calls in the local automatic message accounting (LAMA) equipment so that appropriate billing can be made.

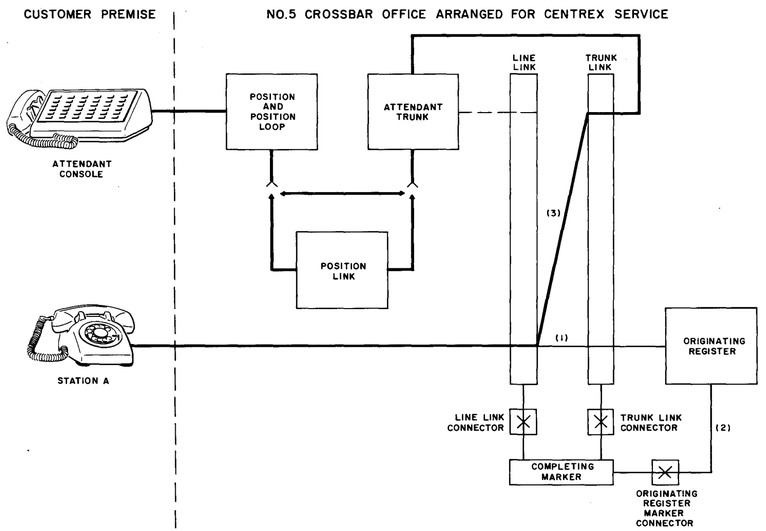

Fig. 6 — Dial Zero for Attendant Call

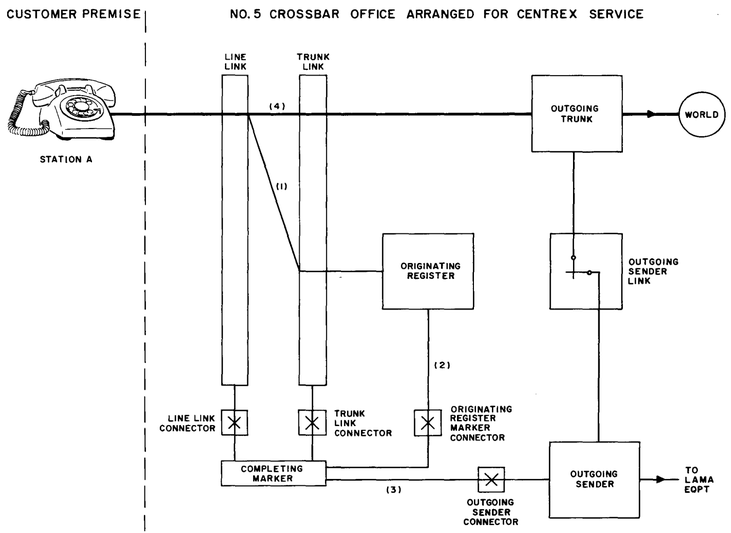

Fig. 7 — Station Originated Outgoing Call

D. Attendant Originated Outgoing Call

4.29 Station A reaches the attendant as described in 4.16 through 4.22 and shown in Fig. 8(1) and tells the attendant the desired number. (The call may be to a satellite location or the DDD network.)

4.30 The attendant extends the call outward via the line link appearance of the attendant trunk by operating the start out key at the console. This provides a ground start signal to the line link frame which in turn calls in a dial tone marker via the line link marker connector to establish a channel to the originating register (2). The originating register applies dial tone to the line and signals the attendant it is ready to receive pulses by lighting a ready lamp at the console.

4.31 The attendant touch dials the called number into the originating register and operates the end key to restore the key pulse portion of the position and position loop circuit to normal. If an originating register is not attached, the attendant recognizes the failure when the ready lamp does not light. The attendant must then press the end key which removes the request for the originating register in the attendant trunk and as described above, restores the position to normal. The attendant may then repeat the functions for an originating register request.

4.32 From this point, the call proceeds as a station originated outgoing call as described in 4.25 through 4.28 except the channel is established between the line link appearance of the attendant trunk and the trunk link appearance of the outgoing trunk (3). Audible ringing tone is heard by the attendant and by the calling party.

4.33 The attendant may release the position circuit from the loop she is handling before or after the destination answers (destination lamp lights steadily) by operating the position release key. If the attendant position is arranged for switched loop operation, the position loop remains connected until called supervision is returned. The destination lamp alerts the attendant if a line busy or overflow condition is encountered by flashing at the proper rate. On fixed loop operation, when the attendant releases the position circuit from the loop, the loop is not disconnected from the attendant position since a position loop is permanently associated with each attendant trunk circuit.

E. Delayed Call

4.34 Station A reaches the attendant as described in 4.16 through 4.21 and shown in Fig. 9(1), tells her he would like to be notified when the called party has been reached, gives her the called number and his own number, and hangs up.

4.35 The attendant selects an attendant access trunk by pressing the associated talk key at the console (2). The talk lamp lights to indicate a seizure. The trunk circuit provides facilities for attendant originated outgoing calls through two line link appearances to two customers. The attendant sets up the connection to the party in her own customer group first via the first line link appearance of this circuit and the customer outside her customer group via the second line link appearance of this circuit. These customers shall be referred to as source and destination customers, respectively.

4.36 The attendant presses the start out key and a channel is established between one of the line link appearances of the access trunk and an originating register as described in 4.29 and 4.30.

4.37 The attendant touch dials the "source" number and the required outgoing or intraoffice trunk is connected to the aforementioned line link appearance of the access trunk (3) as described in 4.25 through 4.27. When the "source" customer answers, the source lamp at the console lights and a talking path is established to the attendant.

4.38 The attendant may now proceed to establish the second leg of the call between the second line link appearance of the access trunk and the "destination" customer via the required trunk. She again operates the start out key but this time touch dials the number of the "destination" customer. The procedure is the same as above (4). When the "destination" customer answers, the destination lamp at the console lights.

4.39 After the attendant has talked to both parties and her services are no longer required, she presses the position release key to disconnect the position and position loop circuit from the access trunk. If the attendant encounters a busy or trouble condition on either the "source" or "destination" connection, she should press the appropriate release key (source or destination) reoperate the start out key, and proceed to reestablish the connection.

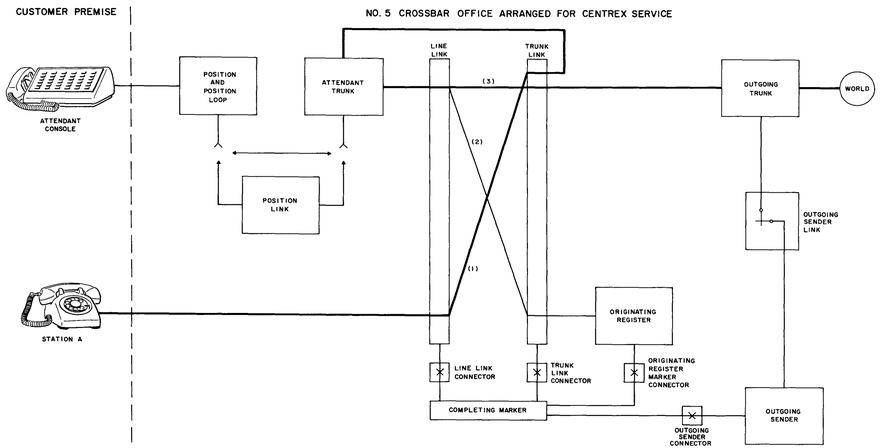

Fig. 8 — Attendant Originated Outgoing Call — Direct

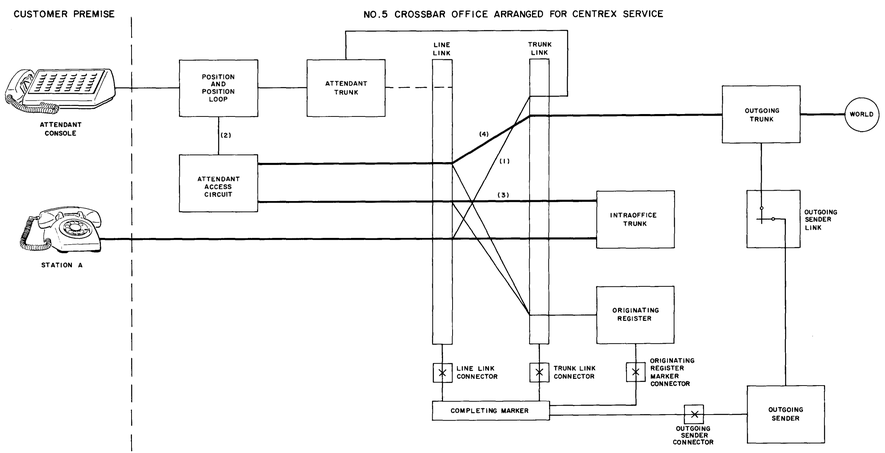

Fig. 9 — Delayed Call

Fig. 8 and 9

F. Station Originated Call for Tie Trunk or FX Line

4.40 Station A goes off-hook and a channel is established to an originating register by a dial tone marker as described in 4.05 through 4.08 and shown in Fig. 10(1).

4.41 Station A dials the 1XX code of the desired tie trunk or FX line. The originating register passes this information to the completing marker via the originating register marker connector (2), along with the calling line link location, class of service, and rate treatment.

4.42 The completing marker functions to seize the tie trunk or FX line, establishes a channel from it to station A, and releases (3).

4.43 After the selection of the tie trunk or FX line, a seizure signal is sent to the distant central office (CO). When a distant register, sender, or line finder is attached and: (a) it is necessary to convert local TOUCH-TONE pulses to dial pulses, a converter is seized by the tie trunk or FX line. After the converter has made a successful trunk test, it supplies a second dial tone to station A; (b) when a local converter is not required, station A receives second dial tone from the distant end.

4.44 Station A dials the called number and is connected.

G. Direct-Inward-Dialed Call

4.45 An incoming call for a centrex station from any point which reaches the No. 5 crossbar office via an interoffice trunk is routed directly to the centrex station.

4.46 The incoming call will cause the incoming trunk to select an incoming register of the proper type to handle the pulsing from the originating office as shown in Fig. 11(1).

4.47 The incoming register receives the pulsing from the originating office and initiates a bid for an idle completing marker (2) via the incoming register marker connector. The called station digits and the trunk location are transferred to the completing marker.

4.48 The completing marker calls in the appropriate number group to determine the line link location of station A (3). As soon as the marker determines the line link location from the number group, it seizes the proper line link frame, records the class of service of station A, and either establishes a talking channel between the trunk and station A (4) or sets up a busy condition.

4.49 The completing marker will also pass to the incoming trunk called customer class of service and if necessary, a dial transfer indication. If the called station has the don't answer transfer feature, the marker will set the don't answer auxiliary trunk circuit with this information.

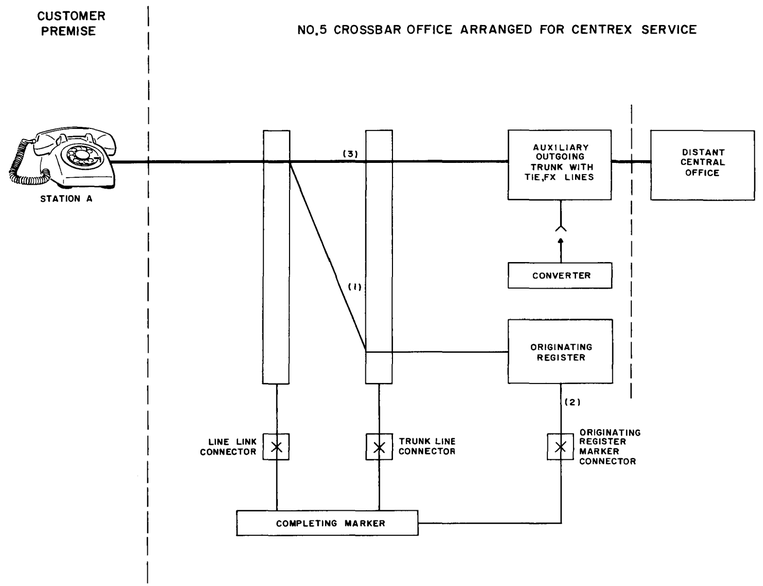

Fig. 10 — Station Originated Tie Trunk or FX Line Call

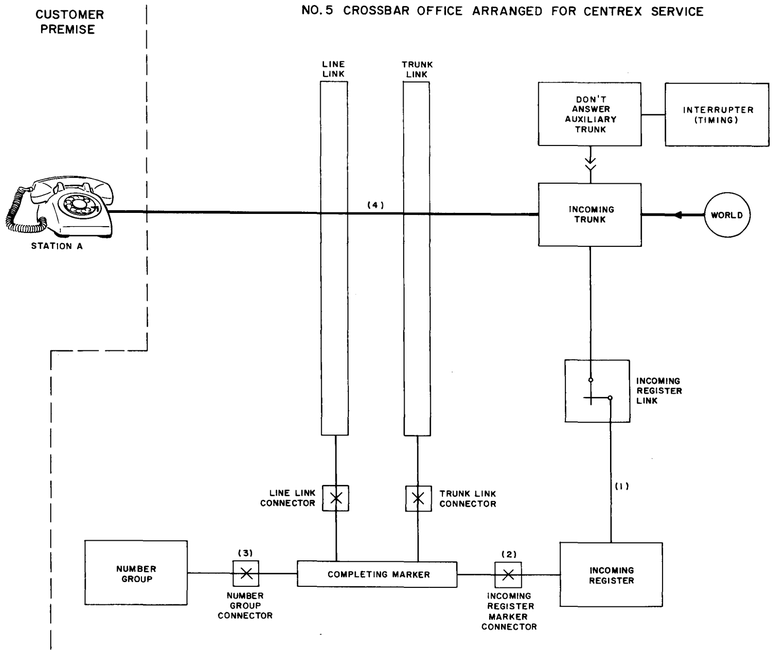

Fig. 11 — Direct-Inward-Dialed Call

Fig. 10 and 11

H. Attendant Transfer to Another Centrex Station in the Same Customer Group

4.50 A direct-inward-dialed (DID) call is established to station A as described in 4.45 through 4.48 and shown in Fig. 12(1). Station A wishes to transfer the call to station B.

4.51 Station A initiates the transfer by flashing his switch hook. The incoming or POTS intraoffice trunk arranged to recognize the switch hook flash as a transfer request calls in an MF register via an incoming register link. The register then summons a completing marker and passes to it the information necessary for completing the call, including the transfer class indication, the trunk link location, and the trunk number associated with the line link location of the trunk circuit. The marker then goes back to the trunk via the trunk link connector and reads out the customer group identity (class of service) of station A. This information was previously stored in the trunk in the event of a transfer request. The marker proceeds to select an idle attendant trunk of the proper group and establishes a connection between it and the line link appearance in the incoming or intraoffice trunk (2). Audible ring is returned to both the calling and called customer. The attendant receives a 120-ipm flash on the source lamp to indicate the transfer attempt. From this lamp indication, the attendant knows it is not necessary to answer with the company name.

4.52 The attendant answers, receives the number of station B and releases the destination (station A) by operating the release destination key. She then operates the start in key; a ready lamp lights when an MF incoming register has been attached. The attendant then touch dials the 4- or 5-digit number of station B. The incoming register seizes an idle completing marker via an incoming register marker connector and transfers the necessary information for completing the call.

4.53 The completing marker determines the line link frame location of station B from the number group and connects station B to the trunk. The attendant receives a visual indication of ringing by the destination lamp flashing at 30 ipm. If the called party answers, she can release from the connection by pressing the release key; if he does not answer, she can connect to station A by pressing the talk key and determining if he wishes to transfer to someone else. If he does, the attendant presses the release forward key and proceeds with the transfer. When station B answers, a talking channel is established from station B to the trunk (3). The transfer operation can be repeated as many times as desired for a single call.

4.54 When completing to station B, the marker reads out the class of service of station B and compares it with station A's class of service. If they match, the marker proceeds. If they do not match, the marker routes the call to overflow.

4.55 An intra-PBX call (4.09 through 4.15 and Fig. 5) cannot be transferred. Only calls from outside a specific customer group can be transferred after having been set up on an intraoffice basis. Intraoffice trunks equipped for transfer have a line link appearance.

I. Transfer to an Outgoing Tie Trunk or FX Line

4.56 A DID call is established to station A as described in 4.45 through 4.48 and shown in Fig. 13(1). Station A wishes to transfer the call to a distant point over an outgoing tie trunk or FX line.

4.57 Station A initiates the transfer by flashing his switch hook to reach the attendant as described in 4.51. The completing marker establishes a connection between the proper attendant trunk and the line link appearance of the incoming or intraoffice trunk (2).

4.58 The attendant answers, determines the number of the party to which the transfer is to be made, and releases the destination (station A). She then operates the start out key, gets a ready lamp when an outgoing register is attached, and touch dials the 1XX code of the desired tie trunk. The originating register bids for a completing marker through the originating register marker connector, and the marker establishes a channel to an idle tie trunk (3). The connection is from the originating customer to the incoming or intraoffice trunk, from the line link appearance of the incoming or intraoffice trunk to the trunk link appearance of the attendant trunk, and from the line link appearance of the attendant to the tie line on the trunk link frame.

4.59 After the selection of the tie trunk, a seizure is sent to the distant central office as described in 4.43.

4.60 The attendant touch dials the number of the party to which the transfer is to be made and on answer, releases her position from the connection. The attendant trunk, however, will be held up for the duration of the call.

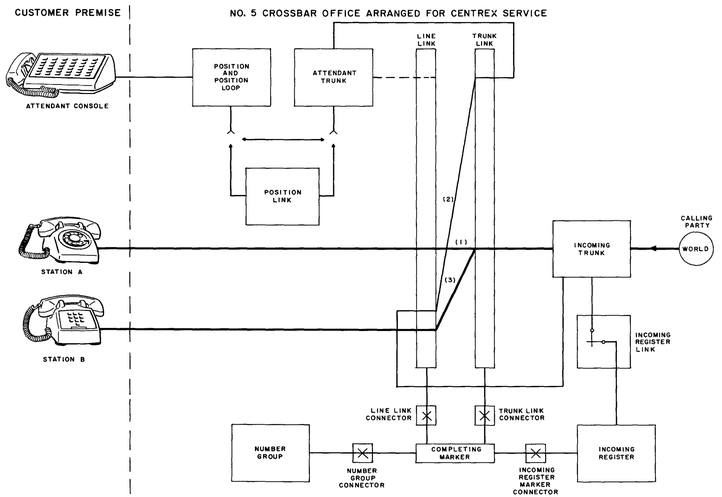

Fig. 12 — Attendant Transfer to Another Centrex Station in the Same Customer Group

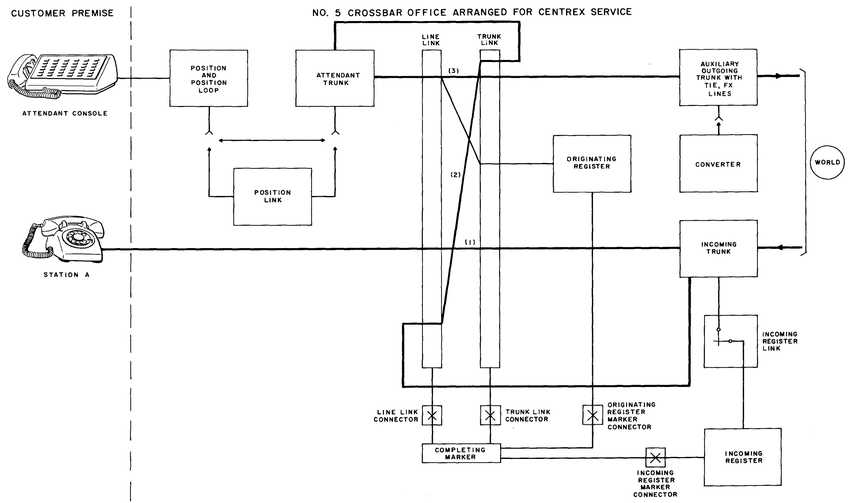

Fig. 13 — Transfer to an Outgoing Tie Trunk or FX Line

Fig. 12 and 13

J. Listed Directory Number Call Transferred to a Centrex Station and Night Answering from a Fixed Station

4.61 A DID call to the listed directory number of a centrex customer is handled through the incoming trunk, incoming register, and completing marker as described in 4.45 through 4.49 and shown in Fig. 14(1). However, when the completing marker goes to the number group frame, it will read out a listed directory number indication.

4.62 The completing marker will then automatically connect the line link frame appearance of the trunk to an idle attendant trunk (2). The attendant is alerted that this is a listed directory number call by a 60-ipm flash of the source lamp and should answer with the company name. Thus, a talking channel is established from the line link frame appearance of the trunk to the operator through the attendant trunk. The attendant receives the number of the called party, operates the start in key, gets a ready lamp when an MF incoming register is attached, and touch dials the 4- or 5-digit number of station A. The incoming register seizes an idle completing marker via an incoming register marker connector and transfers the necessary information for completing the call. The completing marker determines the line link frame location of station A from the number group and connects station A to the incoming trunk (3). The attendant receives a visual indication of ringing by the destination lamp flashing at 30 ipm and when station A answers, releases from the connection.

4.63 The listed directory number is assigned as a 2-line hunt group with line link frame assignments in separate frames. In case a marker encounters trouble with the line link frame associated with the first line, it can recycle and go to the line link frame of the second line to obtain the necessary customer group information. Since the listed directory number of the centrex customers has the hunt feature, it may be arranged for night answering from a fixed station feature.

4.64 The attendant initiates the night answering feature by operating a night key on her console which makes her position appear busy.

4.65 Upon encountering the console busy, the completing marker recycles and establishes that one line of the 2-line hunt group is idle. The completing marker establishes a connection from the line link location of the night station to the trunk link appearance of the incoming trunk.

4.66 A talking channel is established from the calling party through the incoming trunk to the night station. The night station is a predetermined station for night answering only. During the day when the night key is not operated, this night station is caused to appear busy in the hunt group.

4.67 Night answering from a fixed station is an automatic transfer to a predetermined station after the attendant console is found to be busy as the result of operating the night key.

K. Attendant Conference Call

4.68 Centrex station A wishes to originate a conference call to include stations B, C, D, and E. He lifts the receiver and dials "0" to reach the attendant (4.16 through 4.21 and Fig. 6). If the attendant is not seated at a position equipped with a conference circuit, she either takes his number and has the attendant at the conference position call him back for details or takes all the information for the conference call and passes this information to the attendant at the conference position.

4.69 The attendant operates the conference key for an idle conference control circuit. The associated conference lamp flashes at 30 ipm.

4.70 The attendant operates the start out key, dials the 4- or 5-digit number of station A and is connected to station A via the first line link appearance of the conference control circuit and an intraoffice trunk (4.10 through 4.14). When station A answers, the attendant reoperates the conference key and both she and the station are connected to the conference circuit (Fig. 15(1)). Stations B, C, D, and E are then connected in a similar manner (2), (3), (4), and (5) to each of the remaining line link appearances of the conference control circuit via intraoffice trunks. (See Fig. 15.)

4.71 The attendant may be recalled to enter a conference via switch hook flash on the first or second line of the conference control circuit only. The attendant, recognizing the audible and visual signal (the conference lamp flash changes from 30 ipm to 120 ipm) as a recall, operates the conference key and is connected to the conference. The visual signal again changes to 30 ipm.

4.72 If the attendant attempts to connect a conferee to the conference control circuit and all line appearances are busy, the conference lamp flash will change from 30 ipm to 120 ipm.

4.73 A customer may also request a conference by calling the conference number. He will be connected to the first line of an idle conference control circuit and the attendant will be signaled that there is a request for a conference. The attendant will then operate a conference key on the console and be cut through to the calling customer who will name the conferees to be added to the conference.

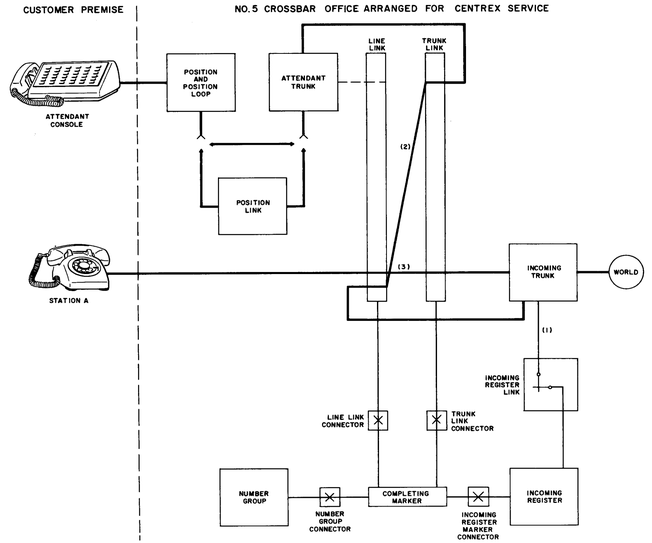

Fig. 14 — Listed Directory Number Transferred to a Centrex Station

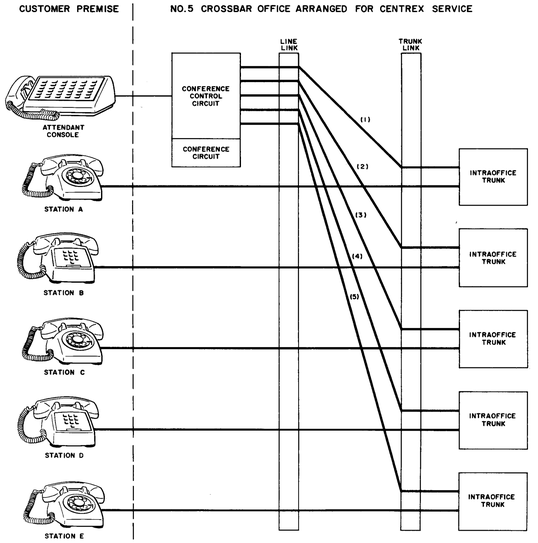

Fig. 15 — Attendant Conference Call

Fig. 14 and 15

CALLS FOR PHASES I AND II CENTREX WITH DIAL TRANSFER

A. Intraoffice Call to a Centrex Station in the Same Customer Group — (Intra-PBX Call)

4.74 This call is identical to the intraoffice call to a centrex station in the same customer group (4.09 through 4.14 and Fig. 5) for Phases I and II centrex with attendant transfer.

B. Dial Zero for Attendant Call

4.75 This call is identical to the dial zero for attendant call (4.16 through 4.22 and Fig. 6) for Phases I and II centrex with attendant transfer.

C. Station Originated Outgoing Call

4.76 This call is identical to the station originated outgoing call (4.23 through 4.28 and Fig. 7) for Phases I and II centrex with attendant transfer.

D. Attendant Originated Outgoing Call

4.77 This call is identical to the attendant originated outgoing call (4.29 through 4.33 and Fig. 8) for Phases I and II centrex with attendant transfer.

E. Delayed Call

4.78 This call is identical to the delayed call (4.34 through 4.39 and Fig. 9) for Phases I and II centrex with attendant transfer.

F. Station Originated Call for Tie Trunk or FX Line

4.79 This call is identical to the station originated call for tie trunk or FX line (4.40 through 4.44 and Fig. 10) for Phases I and II centrex with attendant transfer.

G. Direct-Inward-Dialed Call

4.80 This call is identical to the DID call (4.45 through 4.49 and Fig. 11) for Phases I and II centrex with attendant transfer.

H. Dial Transfer with Private Consultation Followed by Add-On

4.81 Assume a talking channel between station A and the calling party through the incoming trunk (Fig. 16(1)). Station A wishes to transfer the call to station B.

4.82 Station A initiates the transfer by flashing his switch hook for an interval greater than:

(a) 520 milliseconds after being off-hook for 1.9 to 2.8 seconds in Phase I circuits.

(b) 380 milliseconds after being off-hook 2.0 to 5.0 seconds in Phase II circuits.

4.83 The incoming trunk, recognizing the flash as a transfer request, causes a dial tone marker to connect the incoming trunk to a transfer trunk through a 6-wire, 4-stage network consisting of a transfer line link circuit and a transfer trunk link circuit. (An intraoffice or private network trunk with transfer features functions in the same manner as the incoming trunk.) The class of service of the transferring station is read out of the trunk by the dial tone marker and stored in the transfer trunk. The transfer trunk also stores the trunk link frame number of the incoming trunk.

4.84 The transfer trunk calls for and seizes an idle dial pulse and TOUCH-TONE combined transfer register and transfers to it the class of service and the trunk link frame numbers of both the transfer trunk and the incoming trunk (3). The transfer trunk then splits the connection and places the calling party on hold. The transfer register returns dial tone to station A and registers the 4- or 5-digit number of station B dialed by station A. The transfer register then calls for and seizes an idle completing marker and transfers to it the trunk link frame number of the transfer trunk, the customer's group identity (class of service), and the digits of station B's number (4).

4.85 The completing marker seizes a number group and determines the line link frame location of station B(5). The completing marker then establishes a connection between the trunk link appearance of the transfer trunk and the line link appearance of station B. At this point, ringing is applied to station B(6).

4.86 When station B answers, a talking channel is established between station A and station B with the calling party on hold. This is considered private consultation. Either station A or B can then add on the calling party for a 3-way conference by flashing his switch hook. This is considered add-on. Station A or B may hang up at this time and be free for other calls provided either has remained on-hook for 5 seconds.

4.87 Station A or B may hang up during consultation or conference. If station A hangs up, his linkage to the incoming trunk is released and station B remains connected to the calling party through the transfer and incoming trunks. If station B hangs up, his linkage to the transfer trunk is released and station A remains connected to the calling party through the incoming trunk.

4.88 If station B hangs up, station A can retransfer to station C as was done for transferring to station B(4.87).

4.89 If station A hangs up, station B can retransfer to station C. Station B flashes his switch hook to signal the transfer trunk to initiate a transfer request. The transfer trunk places the calling party on hold and seizes a transfer register. The transfer register returns dial tone via the transfer trunk, receives station C's digits, and seizes a completing marker. Using the line link location of station C from the number group, the marker establishes a connection from the trunk link appearance of the incoming trunk to the line link appearance of station C. Thus, station C is connected to the incoming trunk as was station A and has private consultation with add-on.

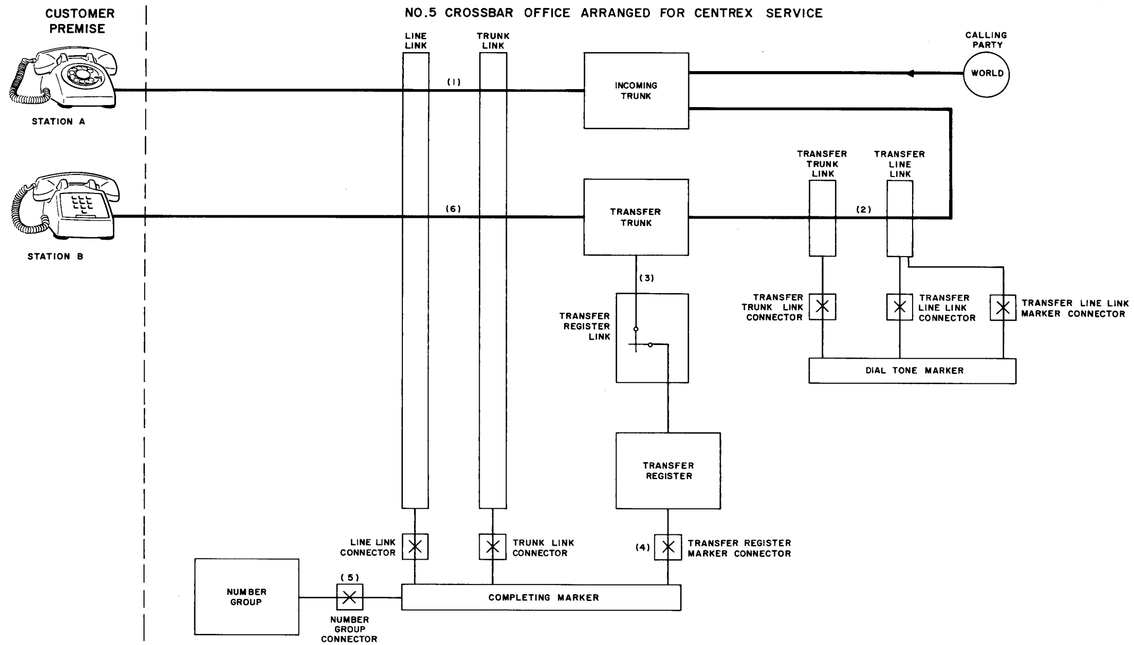

Fig. 16 — Dial Transfer with Private Consultation Followed by Add-On

I. Transfer to Attendant with a Console

4.90 This call is processed as shown in the dial transfer call (4.81 through 4.84 and Fig. 16) until the transfer register returns dial tone (Fig. 17(1)). Station A dials "0" into the register which then signals the incoming trunk that an attendant is required.

4.91 The incoming trunk seizes an idle incoming register which then seizes an idle completing marker (2).

4.92 The completing marker processes the call as an attendant transfer call (4.53 and Fig. 12) and establishes a connection from the line link appearance of the incoming trunk to the trunk link appearance of the attendant trunk. A talking channel is established from station A through the incoming and attendant trunks to the attendant (Fig. 17(3)). There is no private consultation feature on such calls involving the attendant. Consequently, when the attendant answers, all three parties are connected together.

J. Listed Directory Number Transfer Call

4.93 The listed directory number call and its transfer to a centrex station in Phases I and II centrex with dial transfer is identical to that in Phases I and II centrex with attendant transfer (4.61 through 4.63 and Fig. 14).

K. Trunk Answer from any Station

4.94 The operator establishes a night connection by operating the night key on her console. After office hours, an incoming listed directory number call will be routed through an incoming trunk and an incoming register to a completing marker which establishes a connection from trunk link appearance of the incoming trunk to the line link appearance of the night answering trunk (Fig. 18(1)).

4.95 Auxiliary ringing in a central location is provided. Assume that the night watchman chooses to answer the call at station A and goes off-hook. He receives dial tone from an originating register and dials special answering code 1XX. The originating register seizes an idle completing marker and transfers to it the night answering code and station A's customer group (class of service) (2). The marker establishes a connection from the line link appearance of station A to the trunk link appearance of the night answering trunk. Thus, a talking channel is established between station A and the calling customer via the night answering and incoming trunks.

4.96 If it is desired to transfer the call to another station, the watchman will flash his switch hook and set into motion the basic dial transfer call (4.81 through 4.87 and Fig. 16).

L. Busy Line Transfer Call

4.97 Busy line transfer is applicable to any station in a customer group that is allowed to receive DID calls and does not have a conflicting terminating treatment such as line link pulsing, listed directory number, or 2-line incoming service group. When 2-line incoming service group is provided, busy line transfer can be applied only to the last line.

4.98 On busy line transfer calls, the completing marker proceeds to set up the call to the called centrex station in the normal manner as described in 4.45 through 4.49 and Fig. 11. The marker determines from a number group the equipment location of the called station and whether or not the called station is associated with a busy line transfer customer group. The number group terminals of all stations in a customer group arranged for busy line transfer features are cross-connected via the tens block screening field to a busy line transfer feature relay.

4.99 After the number group translation is completed, the completing marker tests to determine if the called station is busy or idle. Regardless of the condition of the called station, the marker operates a line route relay associated with the class of service of the called station.

4.100 If the marker finds that the called centrex station is busy and that busy line transfer is required, it recycles and the operated line route relay generates a 4- or 5-digit number associated with the listed directory number of the customer group. The marker then consults the number group associated with the listed directory number, and from this point on transfer to the PBX attendant continues on a regular listed directory number basis as described in 4.61 through 4.63 and Fig. 14.

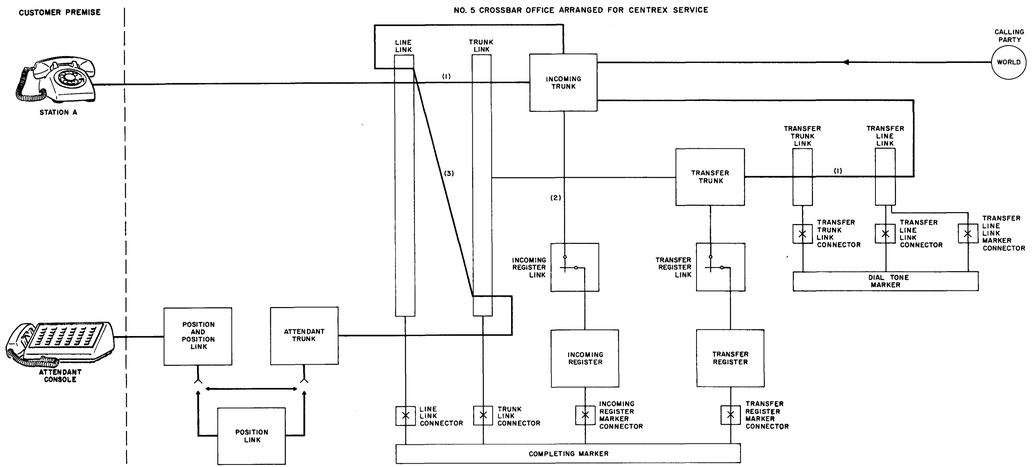

Fig. 17 — Transfer to Attendant with Console

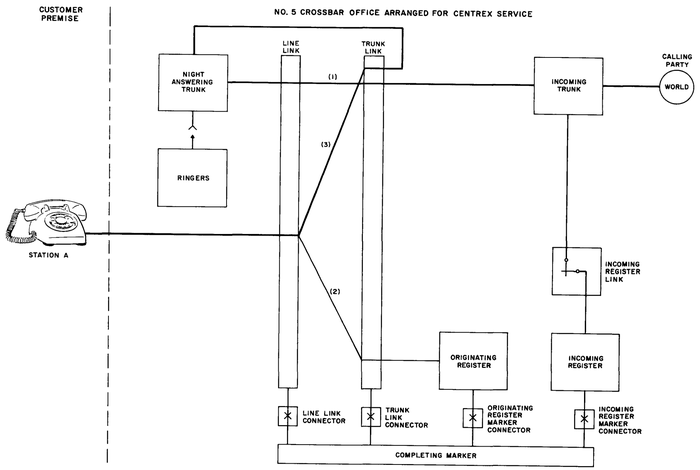

Fig. 18 — Trunk Answer from any Station

Fig. 17 and 18

M. Don't Answer Transfer Call (Fig. 19)

4.101 Don't answer transfer is applicable to any station in a customer group that is allowed to receive DID calls and does not have a conflicting terminating treatment such as line link pulsing, listed directory number, or 2-line incoming service group. When 2-line incoming service group is provided, don't answer transfer can be applied only to the last line.

4.102 When the don't answer transfer feature is provided in a No. 5 crossbar office arranged for centrex service, every centrex trunk in the office arranged for incoming call transfer requires a don't answer auxiliary trunk circuit. This circuit provides timing of ringing and initiates a transfer call upon completion of timing with no answer. Timing is controlled by a common interrupter circuit that has a maximum capacity of 24 counter circuits. One counter circuit is required per 100 centrex trunks in the office. Each counter circuit may be cross-connected to provide a timed interval of 15, 30, 45, or 60 seconds. However, all counter circuits must be cross-connected for the same timed interval so that all centrex stations with the don't answer transfer feature in the office will have a uniform timing of ringing interval. The don't answer transfer feature functions similarly to the busy line transfer feature in that tens block screening is used to operate a don't answer transfer feature relay.

4.103 An incoming call to a centrex station with don't answer transfer is handled as described in 4.45 through 4.49 and shown in Fig. 11 up to the point that ringing is applied to station A. The marker establishes a channel to station A, signals the don't answer auxiliary trunk to start timing when the incoming trunk cuts through ringing to the called station, and drops out (Fig. 19(1)). Any don't answer auxiliary trunk requesting timing when the interrupter circuit is timing another call will be locked out. All trunks that have been locked out will start timing simultaneously at the start of the next interrupter timing cycle.

4.104 When time-out occurs, the don't answer auxiliary trunk signals the incoming trunk to initiate a don't answer transfer. A mark is generated to simulate the listed directory number, and the incoming trunk calls in an incoming register (2). From this point, the call is identical to a listed directory number call (4.61 through 4.63 and Fig. 14(3)).

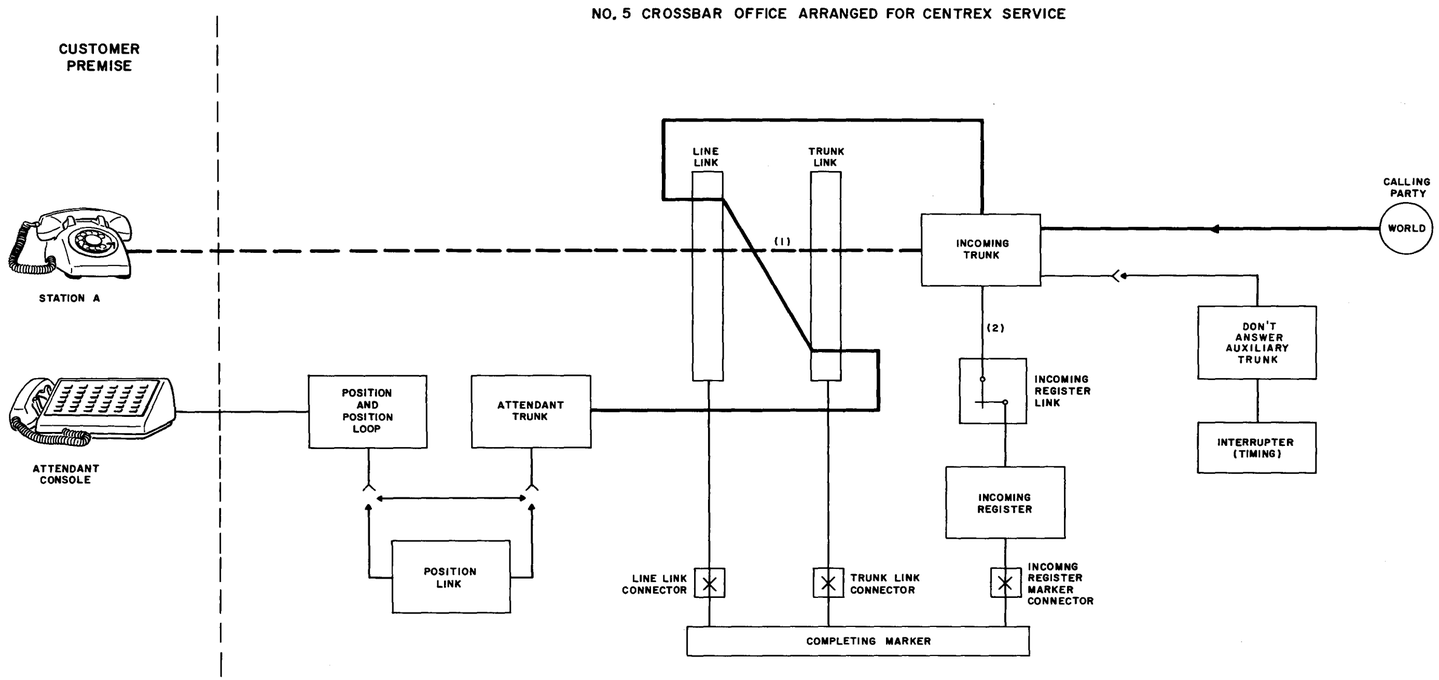

Fig. 19 — Don't Answer Transfer Call

N. Dial Conference Call (Fig. 20)

4.105 Station A wishes to establish a conference call to include stations B, C, D, E, and F. Station A goes off-hook and receives dial tone from an originating register. Station A dials conference circuit code 1XX which is transferred from the register to an idle completing marker.

4.106 The completing marker recognizes the conference code and establishes a connection between station A and the trunk link appearance of the station controlled conference circuit. The seizure of the station controlled conference circuit causes the line link appearance of line No. 1 of the conference control circuit to be made busy to incoming calls and also connects station A to the conference bridge. Connection to the conference bridge causes station A to be connected to the first line link appearance of the conference control circuit. This calls in an originating register which returns dial tone to station A.

4.107 Station A proceeds to dial station B's number into the register which then transfers it to a completing marker. The marker establishes a connection between station A and station B via an intraoffice trunk and the first line link appearance of the conference control circuit as shown in an intra-PBX call to a centrex station in the same customer group (4.09 through 4.11 and Fig. 5).

4.108 When station B answers, both he and station A are transferred to the conference bridge, at which time station B can be informed of the conference and instructed to remain off-hook. Optionally, when station B answers, station A can inform him of the conference and station A must flash his switch hook to be connected to the conference bridge.

4.109 After stations A and B are connected to the conference bridge, station A extends the call to station C by flashing his switch hook, receiving dial tone from an originating register, and dialing station C's number. A completing marker called in by the register establishes a connection between stations A and C via an intraoffice trunk and the second line link appearance of the conference control circuit. After stations A and C are connected to the conference bridge, station A flashes his switch hook and extends the call to stations D, E, and F in the same manner as for B and C. Six parties, including the originator, are maximum on one conference call. As each station is added to the conference bridge, he can talk with the other conferees as station A completes the call.

4.110 If in process of extending the call station A receives a no answer, line busy, or overflow, he flashes his switch hook and is connected back to the conference bridge to confer with the other conferees or to extend the call.

4.111 Conferees outside the centrex customer group are connected to the conference connection through an attendant with a console or switchboard if available. Station A on a line of the conference control circuit dials his attendant and informs her that he wishes to include the outside party in a conference call. The attendant completes the connection to the outside conferee through her console or switchboard. The outside conferee is held on one of the attendant locked loops for his duration in the conference.

4.112 If an attendant console or switchboard is not provided, the first line of the conference control circuit is used for a single outside conferee. From the point that station A receives dial tone on the first line of the conference control circuit, the call to the outside conferee is identical to a station originated outgoing call (4.23 through 4.28 and Fig. 7) to the point that the outside conferee answers. After he answers, the call is handled as was done after stations B and C answered in the conference call.

4.113 The dial conference call releases when station A goes on-hook and all other conferees have disconnected or when station A goes on-hook and only one other conferee is still connected.

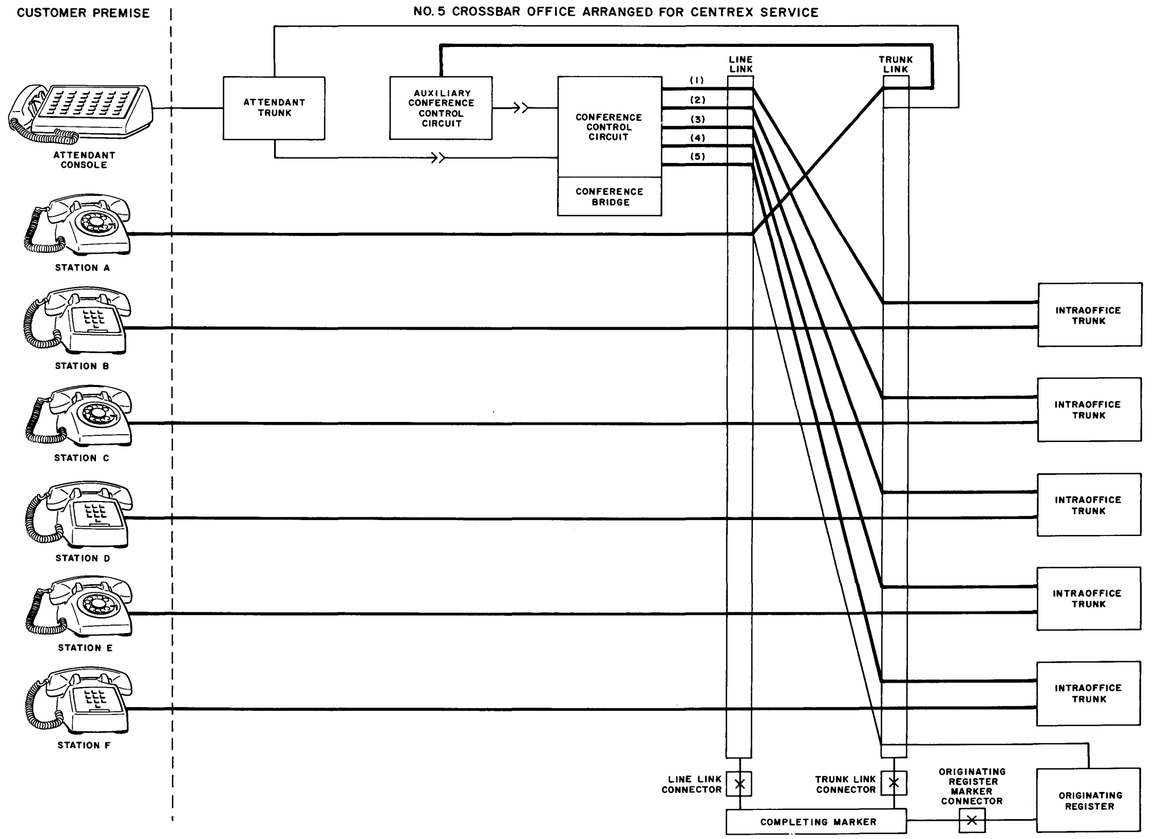

Fig. 20 — Dial Conference Call

O. Incoming Conference Call

4.114 The incoming conference call feature requires a fixed station to be assigned as an incoming conference control station for use by a conference assistant. An attendant console may serve as this station.

4.115 An outside customer wishes to establish a conference call to stations A, B, C, and D which are in the same centrex customer group. The outside customer dials a conference number through an incoming trunk into an incoming register which transfers the number to a completing marker (Fig. 21(1)). The marker establishes a connection between the first line link appearance of the conference control circuit and the trunk link appearance of the incoming trunk (2). This connection causes all accesses to the conference control circuit to appear busy and causes the incoming conference control station to ring.

4.116 The incoming conference control station answers and determines from the outside customer the stations which he wishes in the conference. The incoming conference control station then acts as the originator, flashes her switch hook, which connects the outside customer to the conference bridge, and receives dial tone through the second line link appearance of the conference control circuit. From this point, the call is identical to the dial conference call (4.105 through 4.113 and Fig. 20) with the incoming conference control station serving as station A (originator). For each station added, the incoming conference control station must flash her switch hook to connect herself and the new conferee to the conference bridge.

4.117 When the incoming conference control station receives a no answer, line busy, or overflow, she can flash her switch hook and be connected back to the conference bridge.

4.118 The incoming conference control station can connect four conferees in addition to the outside customer. Dial tone will not be returned on the fifth conferee attempt and a switch hook flash will return the incoming conference control station to the conference bridge. When all conferees are connected to the conference bridge, the incoming conference control station can drop out by going on-hook. She can be recalled by the first called centrex customer station flashing his switch hook. The conference control circuit shall release when the incoming conference control station and all but one leg of the conference has disconnected.

4.119 The incoming conference control station allows any incoming call to be converted to a conference call. A DID call can be converted to a conference call by the called centrex station transferring the outside calling customer through the first line link appearance of the conference control circuit to the incoming conference control station.

CALLS FOR PHASE III CENTREX

A. Intraoffice Call to a Centrex Station in the Same Customer Group — (Intra-PBX Call)

4.120 This call is identical to the intraoffice call to a centrex station in the same customer group (4.09 through 4.11 and Fig. 5) for Phases I and II centrex with attendant transfer.

B. Dial Zero for Attendant Call

4.121 This call is identical to the dial zero for attendant call (4.16 through 4.22 and Fig. 6) for Phases I and II centrex with attendant transfer.

C. Station Originated Outgoing Call

4.122 This call is identical to the station originated outgoing call (4.23 through 4.28 and Fig. 7) for Phases I and II centrex with attendant transfer.

D. Attendant Originated Outgoing Call

4.123 This call is identical to the attendant originated outgoing call (4.29 through 4.33 and Fig. 8) for Phases I and II centrex with attendant transfer.

E. Delayed Call

4.124 This call is identical to the delayed call (4.34 through 4.39 and Fig. 9) for Phases I and II centrex with attendant transfer.

F. Station Originated Call for Tie Trunk or FX Line

4.125 This call is identical to the station originated call for the tie trunk or FX line (4.40 through 4.44) for Phases I and II centrex with attendant transfer.

G. Direct-Inward-Dialed Call

4.126 This call is identical to the DID call (4.45 through 4.49 and Fig. 11) for Phases I and II centrex with attendant transfer.

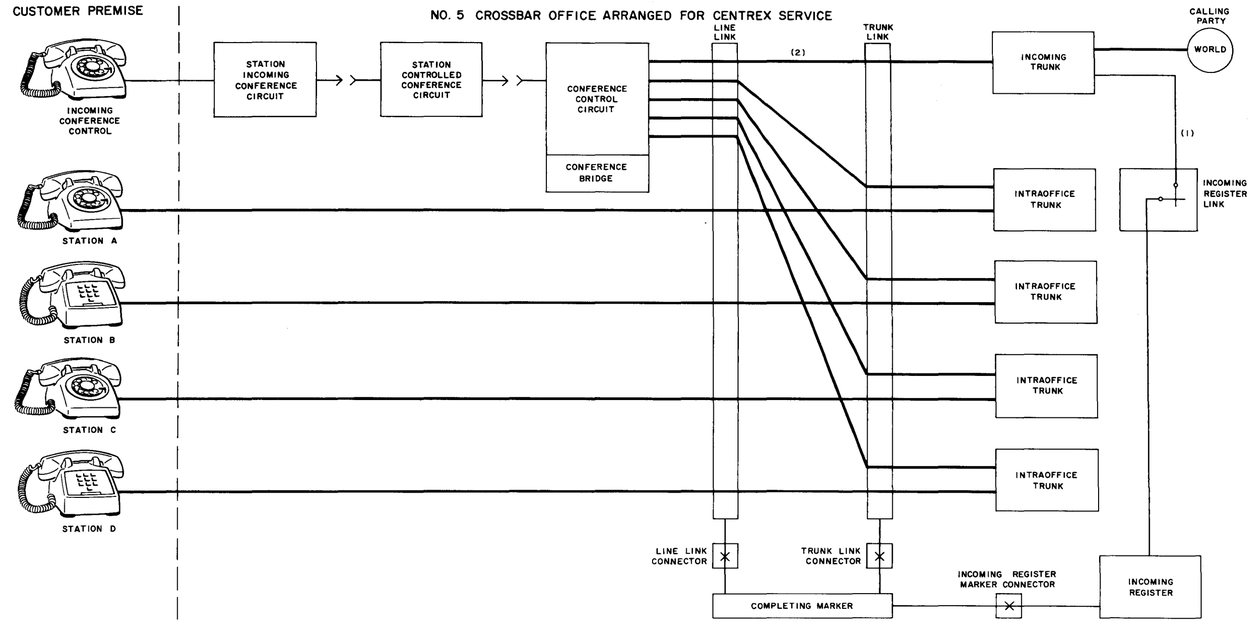

Fig. 21 — Incoming Conference Call

H. Dial Transfer with Private Consultation Followed by Add-On

4.127 Assume a talking channel between station A and the calling party through the incoming trunk (Fig. 22(1)). Station A wishes to transfer the call to station B. Station A initiates the transfer by flashing his switch hook for an interval greater than 380 milliseconds and less than 2.0 seconds after being off-hook for 2.0 to 2.4 seconds.

4.128 The incoming trunk, recognizing the flash as a transfer request, causes a dial tone marker to connect the incoming trunk to a transfer trunk through a 6-wire, 4-stage network consisting of a transfer line link circuit and a transfer trunk link circuit (2). (An intraoffice or private network trunk with transfer feature functions in the same manner as the incoming trunk.) The transfer trunk stores the trunk link frame number of the incoming trunk.

4.129 The transfer trunk calls for and seizes an idle DP and TT combined transfer register and transfers to it the trunk link frame numbers of the incoming trunk (3). The transfer trunk link frame number is passed to the transfer register link. The transfer register then calls for and seizes a transfer line identifier (4), which sends an identification signal through the transfer trunk to the incoming trunk which connects the signal to the sleeve of the connection via the trunk link appearance of the incoming trunk and the line link appearance of station A. The transfer line identifier transfers the line link location of station A to the transfer register.

4.130 The transfer register calls for and seizes an idle completing marker and transfers to it the trunk link number of the transfer trunk and the line link location of station A(5). The marker releases the initial connection between the line link appearance of station A and the trunk link appearance of the incoming trunk. The marker then establishes a connection between the line link appearance of station A and the trunk link appearance of the transfer trunk (6). While setting up this linkage, the marker reads out and passes station A's class of service and the type transfer feature available to station A to the transfer trunk and transfer register. The completing marker also indicates whether it is a 4, 5, or no-digit call. The no-digit call indicates attendant transfer. The completing marker then releases.

4.131 The transfer register then returns dial tone to station A and registers the 4- or 5-digit number of station B dialed by station A. After dial tone is returned, the transfer trunk splits the connection and places the calling party on hold. The transfer register then calls for and seizes an idle completing marker and transfers to it the trunk link frame number of the incoming trunk, the customer's group identity (class of service), and the digits of station B's number (7). The completing marker seizes a number group and determines the line link location of station B(8). The completing marker then establishes a connection between the line link location of station B and the trunk link appearance of the incoming trunk. At this point, ringing is applied to station B.

4.132 When station B answers, a talking channel is established between stations A and B through the incoming and transfer trunks with the outside calling party on hold (9). This is considered private consultation. Either station A or B can then add on the outside calling party for a 3-way conference by flashing his switch hook. This is considered add-on (10). Station A or B may hang up at this time and be free for other calls.

4.133 Station A or B may hang up during either consultation or conference. In this event, the linkage between station A and the transfer trunk or station B and the incoming trunk is released. The remaining station will remain connected to the calling party via the incoming trunk if station B only remains on the connection or via the transfer and incoming trunks if station A only remains on the connection.

4.134 If station A hangs up, station B can retransfer to station C. This is done exactly as was done when station A transferred to station B.

4.135 If station B hangs up, station A can retransfer to station C. This is done exactly as was done when station B transferred to station C in the dial transfer call for Phases I and II modified for dial transfer (4.89 and Fig. 16).

4.136 In comparing Fig. 16 and 22, the trunk link connections of stations A and B in one are reversed in the other. In Phase III, this allows the transfer equipment to release when station A hangs up after reaching station B.

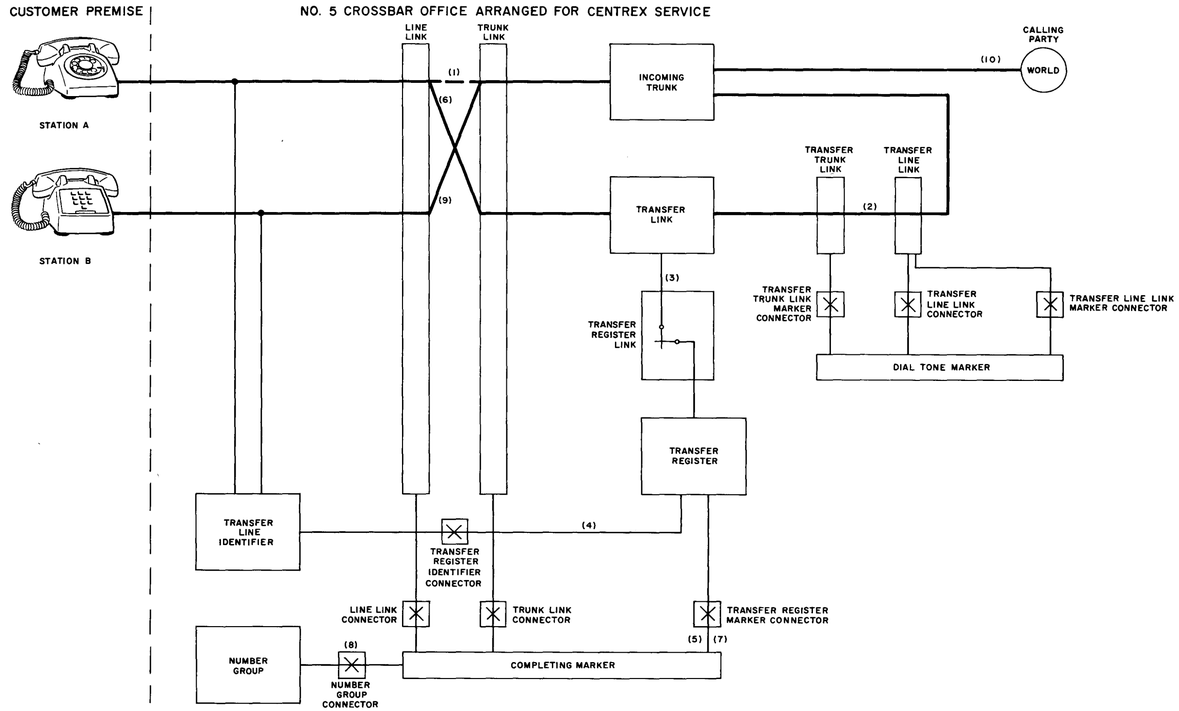

Fig. 22 — Dial Transfer Call with Private Consultation Followed by Add-On

I. Transfer to Attendant Call

4.137 Station A wishes to transfer the outside calling party to the attendant. This call is processed exactly as a dial transfer call to station B (4.127 through 4.131 and Fig. 22) until dial tone is returned from the transfer register. At this point, station A dials "0."

4.138 The transfer register seizes an idle completing marker and transfers to it the customer identity, trunk link frame number of the incoming trunk, and the digit 0. The marker then generates the 4- or 5-digit listed directory number and calls in a number group to determine the line link location of the attendant trunk. The marker establishes a connection from the trunk link appearance of the incoming trunk to the line link appearance of the attendant position. This establishes a talking channel which includes station A, the attendant, and the outside calling party. There is no private consultation.

J. Attendant Transfer in Phase III Centrex Offices

4.139 A transfer request from a station in a customer group with attendant controlled transfer capability is processed exactly as shown in the dial transfer call (4.127 through 4.130 and Fig. 22) until the completing marker has released the initial connection from the trunk link appearance of the incoming trunk to the line link appearance of station A and established the connection from station A to the transfer trunk. The marker passes an attendant controlled transfer class mark to the transfer register and then drops out.

4.140 The transfer register does not return dial tone to station A, however, but seizes another idle completing marker. The transfer register transfers to the marker the trunk link frame number of the incoming trunk, the customer group identity, and a digit 0 which the register generates. With the digit 0, the completing marker generates the 4- or 5-digit listed directory number and translates it. The marker then establishes a connection from the trunk link appearance of the incoming trunk to the line link appearance of the attendant trunk. Station A is then connected via the transfer and incoming trunks to the attendant along with the outside calling party. The attendant can transfer the call as shown in the transfer to attendant call (4.137 and 4.138).

K. Listed Directory Number Transfer Call

4.141 This call is processed as a DID call (4.45 through 4.49 and Fig. 11) with the attendant as station A and the listed directory number as station A's number. The attendant can transfer the call as in the dial transfer call (4.127 through 4.136 and Fig. 22) with the attendant serving as station A.

L. Trunk Answer from any Station

4.142 This call is identical to the trunk answer from any station call (4.94 through 4.96 and Fig. 18) for Phases I and II centrex modified for dial transfer.

M. Busy Line Transfer Call

4.143 This call is processed as shown in the busy line transfer call (4.97 through 4.100) except that the listed directory number call reference shall be to the listed directory number call for Phase III centrex (4.141).

N. Don't Answer Transfer Call

4.144 This call is processed as shown in the don't answer transfer call (4.101 through 4.104) until the don't answer auxiliary trunk signals the incoming trunk to initiate a don't answer transfer. This results in a mark which is similar to station B flashing his switch hook. Regardless of whether the customer group has attendant or dial transfer class, the call is treated as an attendant transfer call (4.139 and 4.140) except that it appears on the console as a listed directory number call.

O. Dial Conference Call

4.145 This call is identical to the dial conference call (4.105 through 4.113 and Fig. 20) for Phases I and II centrex modified for dial transfer.

P. Incoming Conference Call

4.146 This call is identical to the incoming conference call (4.114 through 4.119 and Fig. 21) for Phases I and II centrex modified for dial transfer.

5. MAINTENANCE FEATURES

GENERAL

5.01 Standard No. 5 crossbar test equipment must have new circuits added and standard circuits modified to test centrex features. The features which are peculiar to centrex service are described in this section. No. 5 crossbar maintenance will be covered only to the degree necessary to provide maintenance for centrex service.

5.02 Testing arrangements are covered in two major treatments. The first of these covers Phase II centrex with attendant controlled transfer and the latter covers Phases I and II modified for dial transfer and Phase III centrex with notations to indicate any differences in testing requirements for the three phases.

5.03 The standard testing arrangements developed for Phase II centrex service circuits permit automatic routine testing from the originating office. Circuits that fail repeatedly under test are referred to the local centrex office where tests are initiated from the master test frame. This also applies to offices arranged for dial transfer features.

5.04 One or more of the following items of test equipment is used for tests from the distant office:

(a) No. 5 crossbar offices:

(1) Automatic progression trunk test (APTT) frame.

(2) Master test frame (MTF), office test frame (OTF), and manual outgoing trunk test frame (OGT).

(b) Panel, step-by-step, No. 1 crossbar, crossbar tandem, and No. 4-type offices:

(1) Automatic outgoing trunk test frame.

(2) Manual outgoing trunk test frame.

The master test frame is used at the centrex office for testing. When the centrex office is equipped with an APTT, it is used for automatic trunk testing.

PHASE II CENTREX OFFICES

A. Common Control Tests

Dial Tone Marker Test from MTF

5.05 ***Class of Service and Rate Treatment Feature:*** A dial tone class of test simulates a marker seizure by a line on an LL frame and causes the marker to set up a connection to the originating register. When used in conjunction with a trouble recorder, a record may be taken to check the class of service and rate treatment of a particular line.

Completing Marker Test from MTF

5.06 ***Zero Call Feature:*** This test simulates a dial zero call from a centrex station to an associated attendant. This tests the marker route relay cross connections for customer group attendant trunks.

5.07 ***Incoming Call Feature:*** This test simulates seizure by an incoming register connected to an incoming trunk on a call to a customer group station. This tests the marker ability to read class of service and register it in the incoming trunk.

5.08 ***Intraoffice Call Feature:*** This test simulates a DID intraoffice call to a customer group station. This tests the marker ability to read class of service and register it in the intraoffice trunk arranged for transfer.

5.09 ***Transfer Call Feature:*** This test simulates seizure by an incoming register connected to a transferred incoming or intraoffice trunk to be routed to an attendant. This tests the marker functions on a customer group transfer call.

5.10 ***Listed Directory Number Call Feature:*** This test simulates seizure by an incoming register connected to an incoming trunk on a call to a listed directory number. This tests the marker ability to set transfer into the incoming trunk.

5.11 ***Attendant Call Feature:*** This test simulates seizure by an incoming register connected to a transferred incoming or intraoffice

trunk that has received a start-in signal from the attendant. This tests the marker ability to recognize an attendant class of call.

Register Test — Originating and Incoming

5.12 ***Master Test Frame:*** The MTF checks the dial 9 and 1XX tie line code features checked in the originating registers. The incoming register test checks the ability of the register to recognize the transfer signal given by the trunk. These are additional tests added to the regular register tests.

Automatic Monitor, Register, and Sender Test (AMRST)

5.13 The AMRST checks the input and output pulsing of originating registers and incoming registers in the same manner as presently used. The automatic monitor is not arranged to monitor TOUCH-TONE calls.

5.14 ***Test Sets:*** Pulsing tests of a particular register are made by means of portable test sets in conjunction with the MTF control circuit on a manual basis if provided. No additional features are needed for centrex service.

Sender Tests — DP, MF, and RP

5.15 The senders are tested with equipment similar to that used for testing registers. Input and output pulsing are tested in the present standard manner.

B. Noncommon Control Tests

5.16 The trunk test procedures are arranged for both manual and automatic testing facilities. These are based upon modification of the master test frame and automatic progression trunk test circuits to accommodate centrex facilities. New associated test lines and test trunk circuits necessary to implement the overall test arrangements are provided.

New or Modified Test Circuits

5.17 ***Test Incoming Trunk Circuit:*** The test incoming trunk is arranged to check the pulsing path of the attendant trunk on a start-in basis in addition to all other signals passed between the incoming and attendant trunk.

5.18 ***MTF Trunk Test Circuit:*** The MTF trunk test circuit is modified to include two additional terminating test line appearances for testing centrex features from the local office. These line appearances have the same class of service as that assigned to the test attendant trunk. The test line assigned as a centrex listed number is similar to the present terminating test line and provides for manually testing the pretrip and trip of the trunk terminating to this line and answer supervision of the trunk when the answer key is operated. After a 2- or 5-second initial delay, the manual reoperation of the answer key in the trunk test circuit simulates a switch hook transfer request and the connecting transfer trunk is signaled accordingly. A second line appearance is provided for testing the centrex listed directory number feature. A test call directed to the listed directory number test line is treated in a manner similar to that of regular centrex listed directory number calls and provides an automatic transfer request. A transfer request from a centrex test line, whether manual or a listed directory number transfer, is routed to the associated test attendant trunk.

5.19 ***Incoming Trunk Test Line:*** Two synchronous-type incoming trunk test line circuits are provided for testing regular telephone and centrex features of the incoming trunks from a distant office on both an automatic and manual basis. A separate centrex class of service is assigned to these lines which provides for testing both regular extension and listed directory numbers. The circuit is arranged to give long and short closures to the incoming trunk so as to synchronize with the operation of an automatic incoming test circuit. The regular extension test line circuit is arranged to first automatically test the ringing, pretrip, trip, and supervisory relay of the trunk under test and then provide an automatic transfer request after a 5-second minimum delay. The listed directory number test line circuit is treated as other centrex listed directory number calls; that is, it causes an automatic transfer request. All transfer requests are routed from the line link frame appearance of the incoming trunk arranged for transfer to the trunk link frame appearance of the incoming trunk test line. A special tone and flash circuit is associated with this trunk link appearance of the test line and has the same class of service assignment. The distant office originating the test receives both an

audible tone for a progress indication when making manual tests and flashing signals for automatic test equipment to indicate successful completion of the test.

5.20 ***Test Attendant Trunk Circuit:*** The attendant trunk used as a test trunk should be one of the regular trunks assigned to the same class of service as the centrex terminating test line and used for test purposes. This trunk is associated with a test position circuit on a fixed loop basis. A transfer path arranged in all attendant trunks to switch between a customer or a test console requires a wiring or cross-connection option to disable this switching path.

5.21 ***Modified Incoming and Intraoffice Trunks:*** All incoming and intraoffice trunks arranged to recognize a transfer request are arranged for a 2- to 5-second initial delay after answer supervision before a transfer request can be recognized. This feature is required to permit automatic testing of these trunks.

5.22 ***Test Position and Test Telephone Console:*** A test position circuit and a test telephone console are provided to simulate a regular customer group. The test telephone console is used for checking proper lamp indications and signals passed through the central office equipment. The telephone console is also provided with a test access through the customer's position circuit to permit testing particular loops through the position link circuit.

Attendant Access Trunks (Fig. 23)

5.23 These trunks provide access to a test position and test telephone console for the purpose of initiating a test call. A key operated relay in the trunk cuts the trunk through to the test position and test telephone console. The test telephone console is used to originate both legs of the connection on a start-out basis. The first leg of the access trunk is connected through an intraoffice (IAO) trunk to a test line termination associated with a free number. This prevents a customer from being charged falsely when a test call is made. The call is monitored to ensure that the

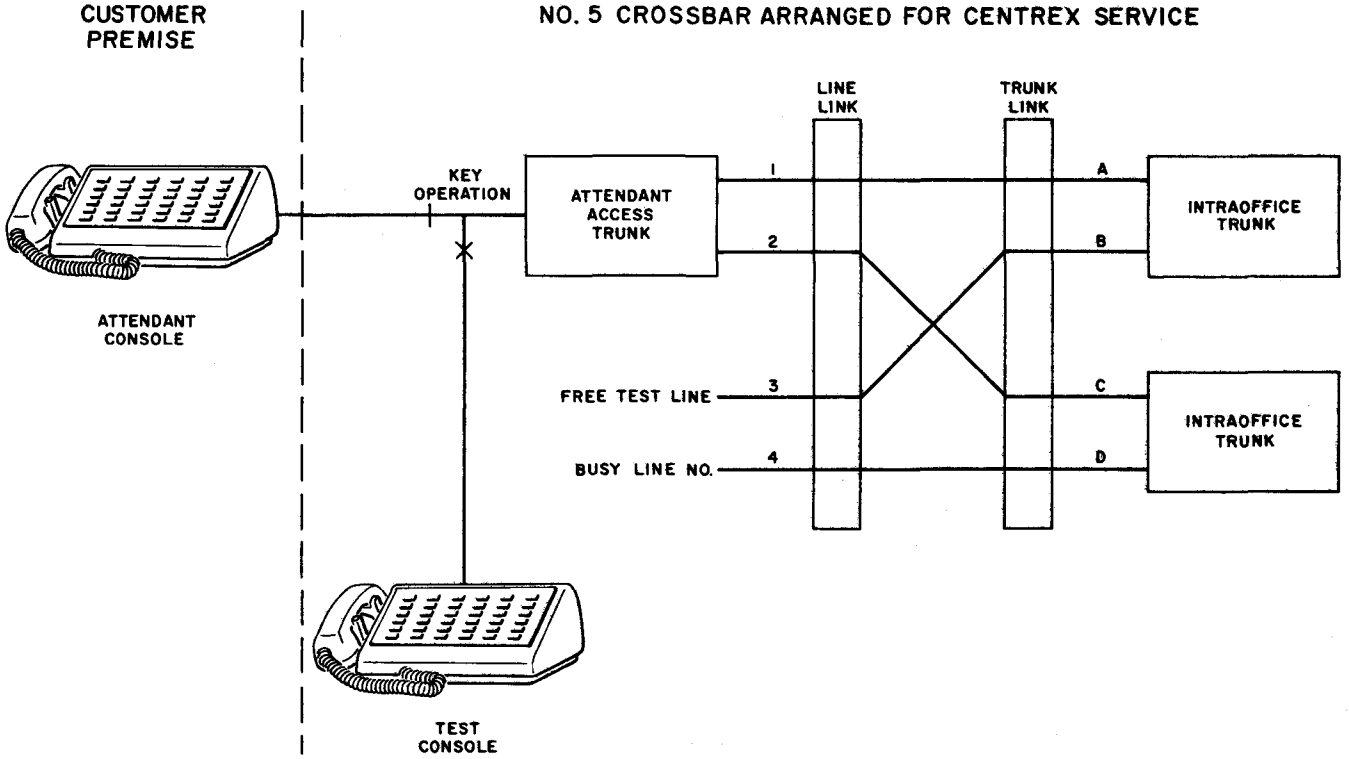

Fig. 23 — Attendant Access Trunk Test

calling customer will not hear the second connection being set up. Either regular IAO trunks or IAO trunks arranged for transfer will be used if provided (LL-1 to TL-A and TL-B to LL-3). The second leg is connected through a different IAO trunk and terminated to a busy line number (LL-2 to TL-C and TL-D to LL-4). After both legs are established and interconnected, the line busy tone indicates successful completion of the test.

Conference Control (Fig. 24)

5.24 This circuit provides access to a test position and test console which will initiate test calls. The operation of the conference key at the test console causes the conference control circuit to be cut through to the attendant and test console when the circuit becomes available. The test console is used to originate test calls to each individual conference circuit port on a start-out call basis. The first line port of the conference control circuit is connected through an IAO trunk to a test line termination in a similar manner as described in 5.23 (from LL-1 to TL-A and TL-B to LL-6). The reoperation of the conference key or operation of the advance key permits the test console to initiate another test call over the second line circuit. This then establishes a connection through a different IAO trunk which will be terminated to a busy line number as described in 5.23 (from LL-2 to TL-C and TL-D to LL-7). A line busy tone will be heard as described in 5.23. Individual conference ports should be tested from the first line circuit port and no more than two ports should be connected at one time.

Attendant Trunks (Fig. 25)

5.25 Each group of attendant trunks is directly associated with a particular centrex customer group and the class of service assigned to that customer. These trunks have both line link and trunk link frame appearances which provide access to the positions and telephone consoles associated with a particular customer group. A means for switching a test console in place of the regular customer telephone console is provided. The test console has access to the attendant trunk from either a test position or a regular customer position.

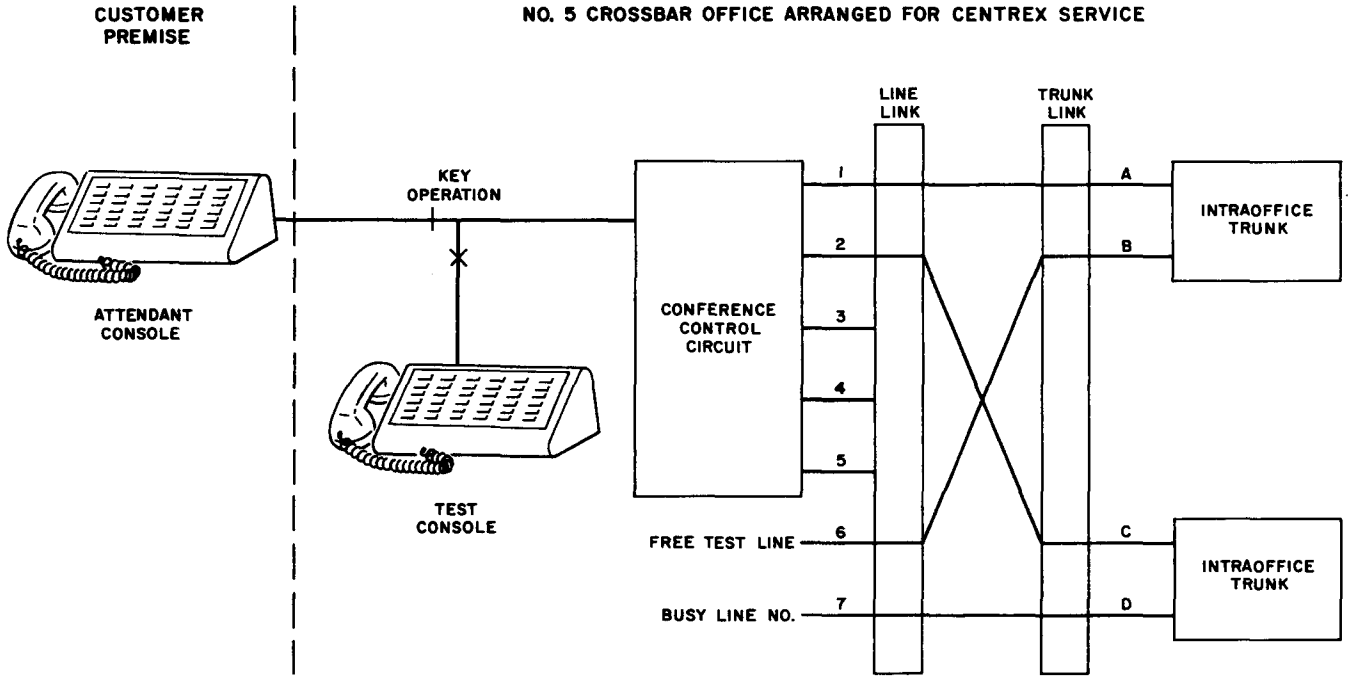

Fig. 24 — Conference Control Test

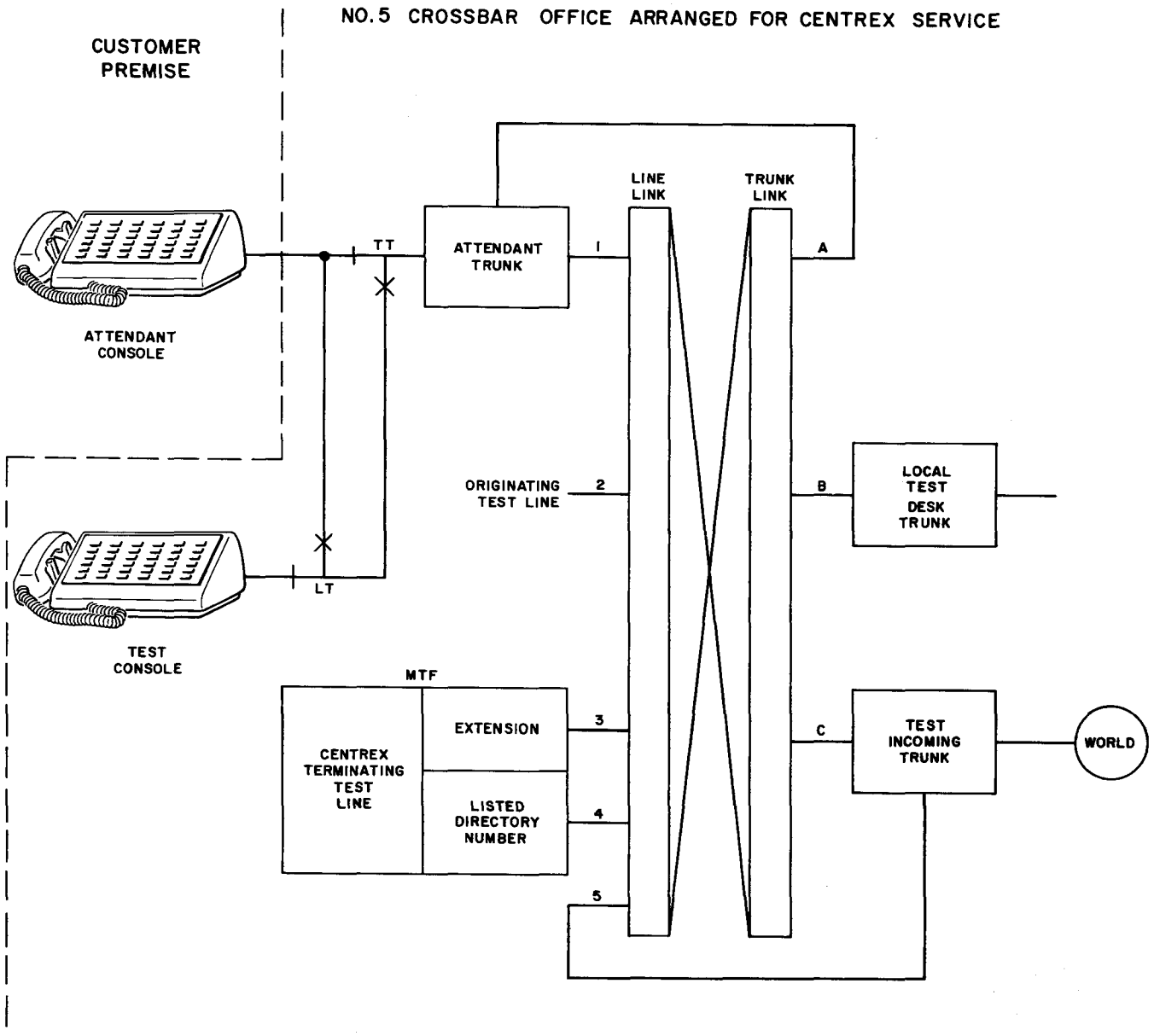

Fig. 25 — Attendant Trunk Test

5.26 ***Dial Zero Call:*** An OGT test is initiated at the MTF and the originating test line is connected to the preselected attendant trunk (from LL-1 to TL-A). The test console is used to check for the proper signals and lamp indications.

5.27 ***Flash and Recall:*** A call is initiated to the test console from the originating test line as in 5.26. From the test console a start-out call is initiated by keying up the code that will reach the local testboard. This routes through a local test desk trunk which should be capable of passing the flash and rering signals (from LL-2 to TL-B). This test will require the aid of the local test deskman to return the flash signals to the test console.

5.28 ***Transfer:*** This test requires the use of the incoming test trunk arranged for transfer. The T jack of the test trunk is patched to the ITT jack on the RR frame in a manner similar

to the test procedure for setting up an incoming trunk, no pulsing (ITNP) class test. The test connection is similar to an outgoing trunk, tandem subclass (OGT-TAN) class test and has a new test indication attendant trunk (ATNT) test. The connection established is from the line link appearance of the test incoming trunk to the trunk link appearance of the attendant trunk to be tested (from LL-5 to TL-A). The master test control circuit simulates an incoming register on this test and passes the trunk number of the test incoming trunk to the marker. The trunk number is cross-connected in the number group to return to the marker the line link frame location of the test incoming trunk plus a transfer (TRF) signal signifying a transfer call. The marker routes the test call to the selected attendant trunk as determined by the information set on the frame selection and trunk selection keys at the MTF. The selected attendant trunk is connected to the test position and test telephone console where the signals and lamp indications are monitored and further tests of the trunk are originated.

5.29 ***Listed Directory Number:*** This test requires the use of the incoming test trunk, which is patched to the MTF as described in 5.28. The test connections are established in the same manner as described for a transfer call with the exception that the marker should be given a customer directory number signal in addition to the TRF signal to signify a listed directory number transfer. The signal and lamp indications are monitored as in 5.28.

Incoming Trunks Arranged for Transfer

5.30 ***Manual and Automatic Testing from the Distant Office (Fig. 26):*** Connecting systems such as step-by-step, No. 1 and No. 5 crossbar, panel, crossbar tandem, and No. 4 toll use manual test methods and test frames such as the outgoing trunk test frame (OGT), automatic progression trunk test frame (APTT), and automatic outgoing toll connecting trunk test frame (AOTC) where provided. Test calls are directed to the test termination covered in 5.19. A uniform 4-digit line number assignment within the connecting office area is provided for both the extension test line number and the listed directory test line number. The type of pulsing provided by the connecting system is either dial, multifrequency, or revertive pulsing. Where automatic test frames are provided, they are arranged to respond to the call progress flashes returned. Tone will also be returned for manual testing and for future automatic testing when test frames are arranged to respond to tone. The call is directed to the listed test number of the centrex incoming trunk test line over the incoming trunk being tested (from TL-A to LL-1 and from LL-3 to TL-B). This test should be similar to that described in 5.19 when connected to the incoming test line. Test calls directed to the listed directory number of the incoming test line are used only to check the ability of the incoming trunk to recognize a listed directory number transfer request (from TL-A to LL-2 and LL-3 to TL-B).

5.31 ***Manual Testing (ITNP Test) at Local Office (Fig. 27):*** Provisions for automatic testing of incoming trunks with the APTT are not required since incoming trunks will be routined from the distant office. A manual ITNP class test initiated from the MTF should be terminated on the centrex terminating test line associated with the MTF trunk test circuit (from TL-A to LL-1). The incoming trunk should be tested similar to that described in 5.28. The terminating test line class of service stored in the incoming trunk is associated with a test attendant trunk. When a transfer request is initiated, the marker receives the stored class information and routes the call to the test attendant trunk and terminates to a test telephone console. The test telephone console will be monitored for the proper lamp indication. A test call directed to the listed directory number of the terminating test line should be used only to check ability of the trunk to recognize a listed directory number transfer request (from TL-A to LL-2 and LL-3 to TL-B).

5.32 ***Manual Testing (Service Basis) at Local Office (Fig. 27):*** A manual test is initiated to test the incoming trunk on an operational basis. This tests the pulsing features of the trunk as well as the other features normally tested. The test is set up from the MTF via the office belt line. The T jack of the incoming trunk is patched to an X jack added for simulated OGT access to incoming trunks. This permits a sender to pulse the desired number into the incoming register. The call is directed to the centrex terminating test line arranged for manual transfer (from TL-A to LL-1). All other phases of this call will proceed as described in 5.31.

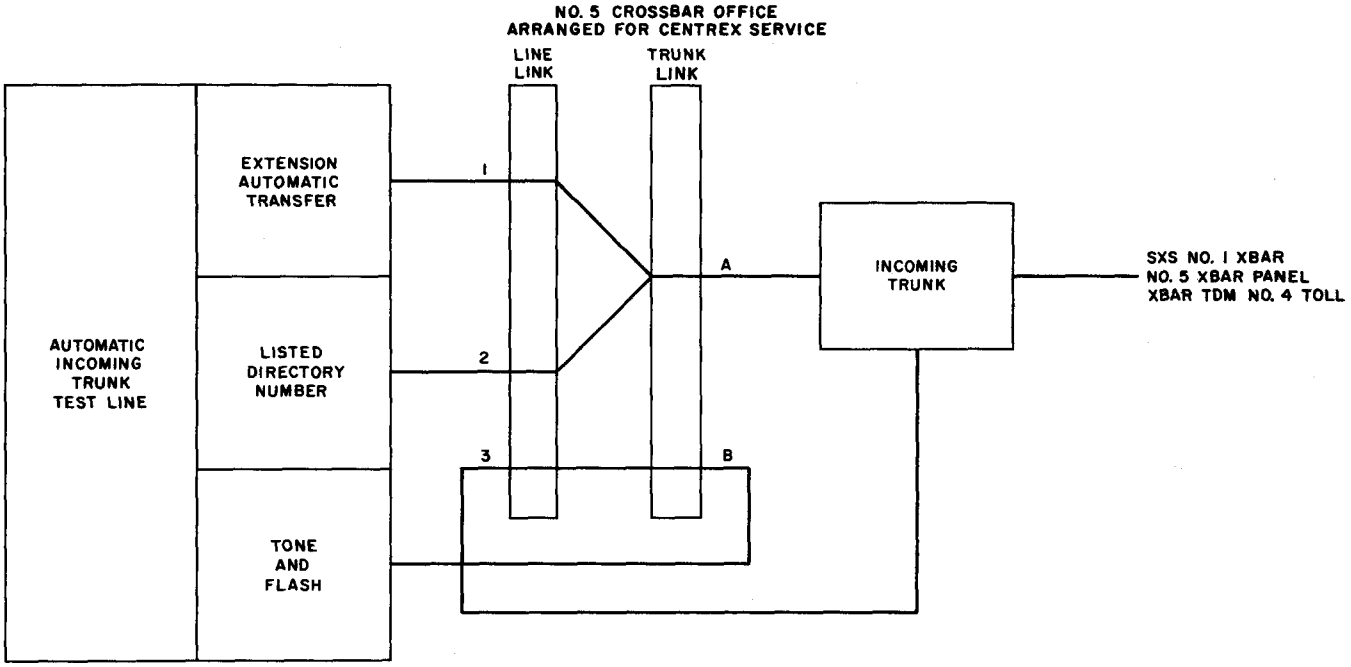

Fig. 26 — Incoming Trunk Test from Distant Office

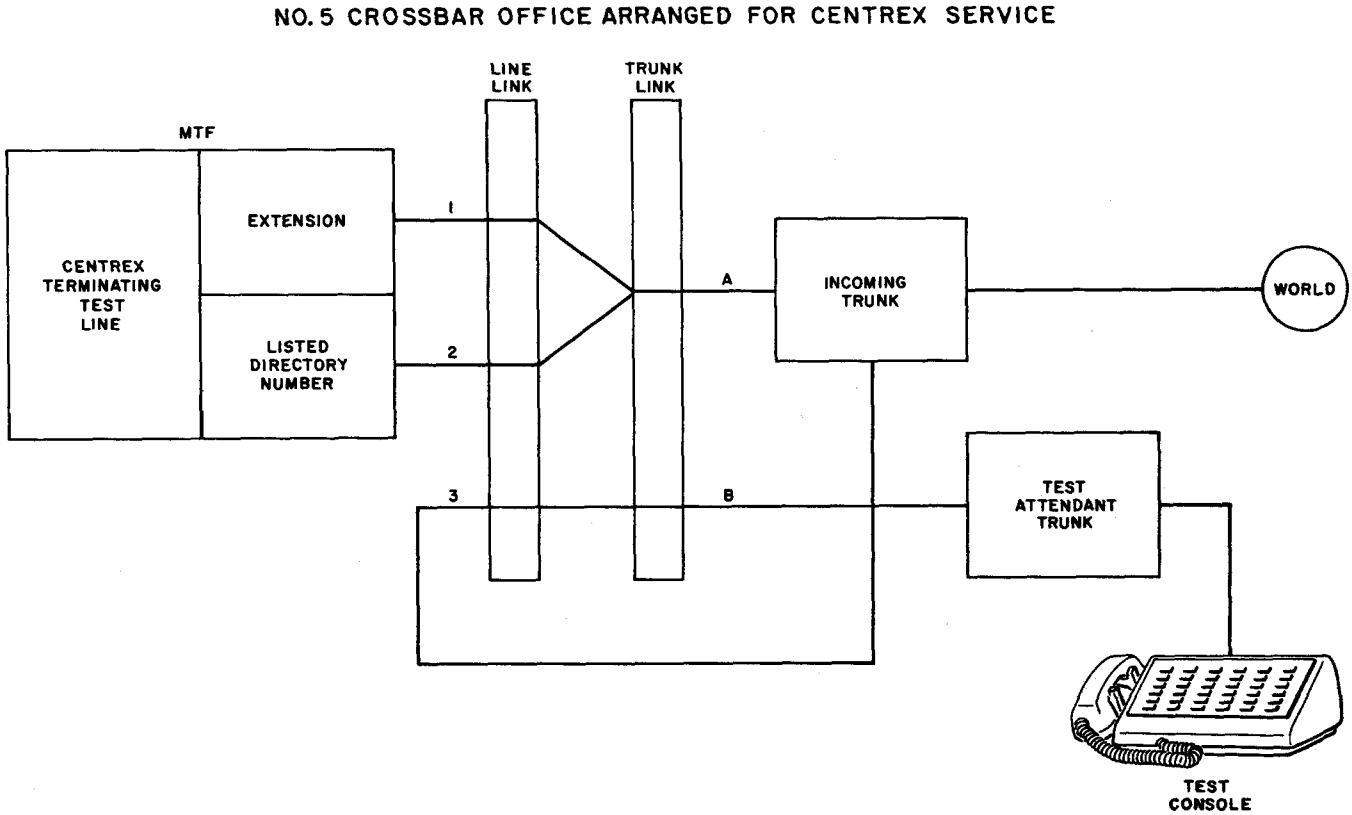

Fig. 27 — Incoming Trunk Test from Local Office

Intraoffice Trunks Arranged for Transfer

5.33 ***Automatic Testing Using the APTT (Fig. 28):*** The APTT is arranged to test centrex IAO trunks equipped with the transfer feature. A new class of test is required and wiring or cross-connections added to the APTT to provide automatic testing of ring, pretrip, trip, and answer supervision (from LL-2 to TL-A and from TL-B to LL-4). After a minimum 5-second delay, an automatic transfer request is generated and the call is completed similar to that described for the incoming trunk test line in 5.19 (from LL-1 to TL-C). The LDN call directed through the IAO trunks is tested on a manual basis.

5.34 ***Manual Testing at MTF (Fig. 29):*** This test connects the MTF originating test line to the preselected IAO trunk under test. The call terminates to the centrex terminating test line arranged for manual transfer (from LL-2 to TL-A and TL-B to LL-3 or LL-4 for LDN or extension calls, respectively). The IAO trunk is tested similar to that described in 5.18. When a transfer is generated, the marker routes the call to the test attendant trunk and terminates to a test telephone console (from LL-1 to TL-C). The test telephone console is monitored for proper lamp indications.

Intraoffice Trunks Arranged to Repeat Supervision

5.35 ***Automatic Testing Using the APTT (Fig. 30):*** The APTT is arranged to recognize answer supervision (reversal) when returned from the IAO trunk. A regular IAO class of test is initiated and completed to the terminating test line of the APTT that provides ring, pretrip, trip, and answer supervision (from LL-1 to TL-A and from TL-B to LL-2).

5.36 ***Manual Testing at MTF (Fig. 30):*** This test is initiated in the same manner as described in 5.34 (from LL-3 to TL-A and from TL-B to LL-4). When answer supervision is returned by the test line and repeated through the IAO trunk, a PK lamp associated with the originating test line lights, indicating a reversal and successful completion of the test.

PHASE I, II, AND III CENTREX OFFICES WITH DIAL TRANSFER

5.37 The maintenance features described in this part apply to Phase I, II, and III centrex offices with dial transfer, busy line transfer, and

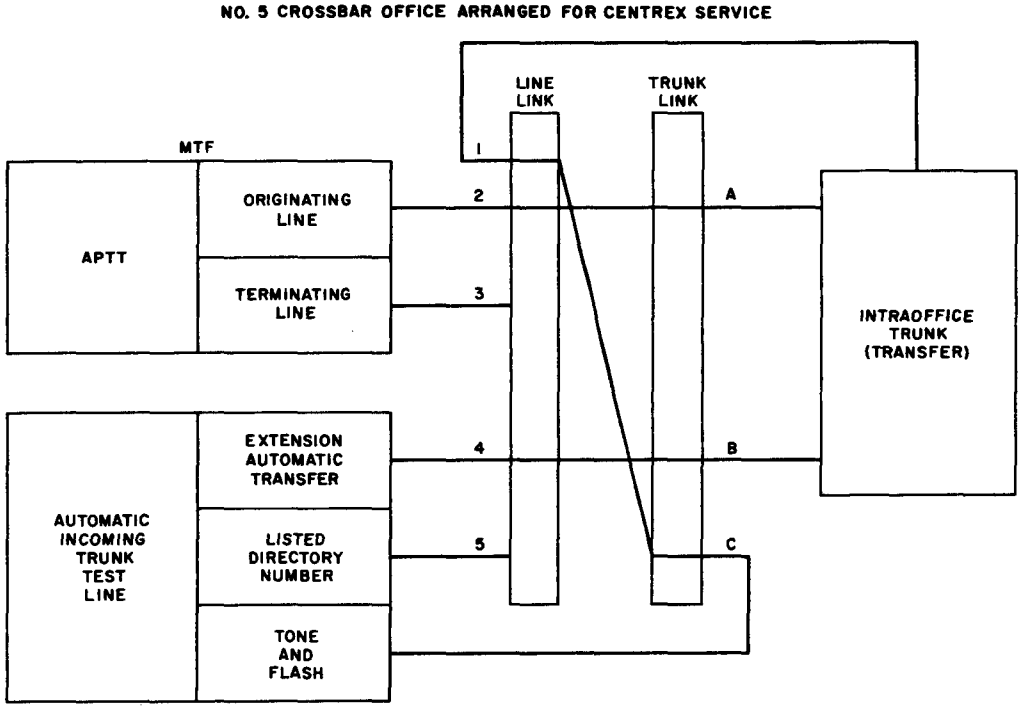

Fig. 28 — Automatic Test of Intraoffice Trunk Arranged for Tranfser

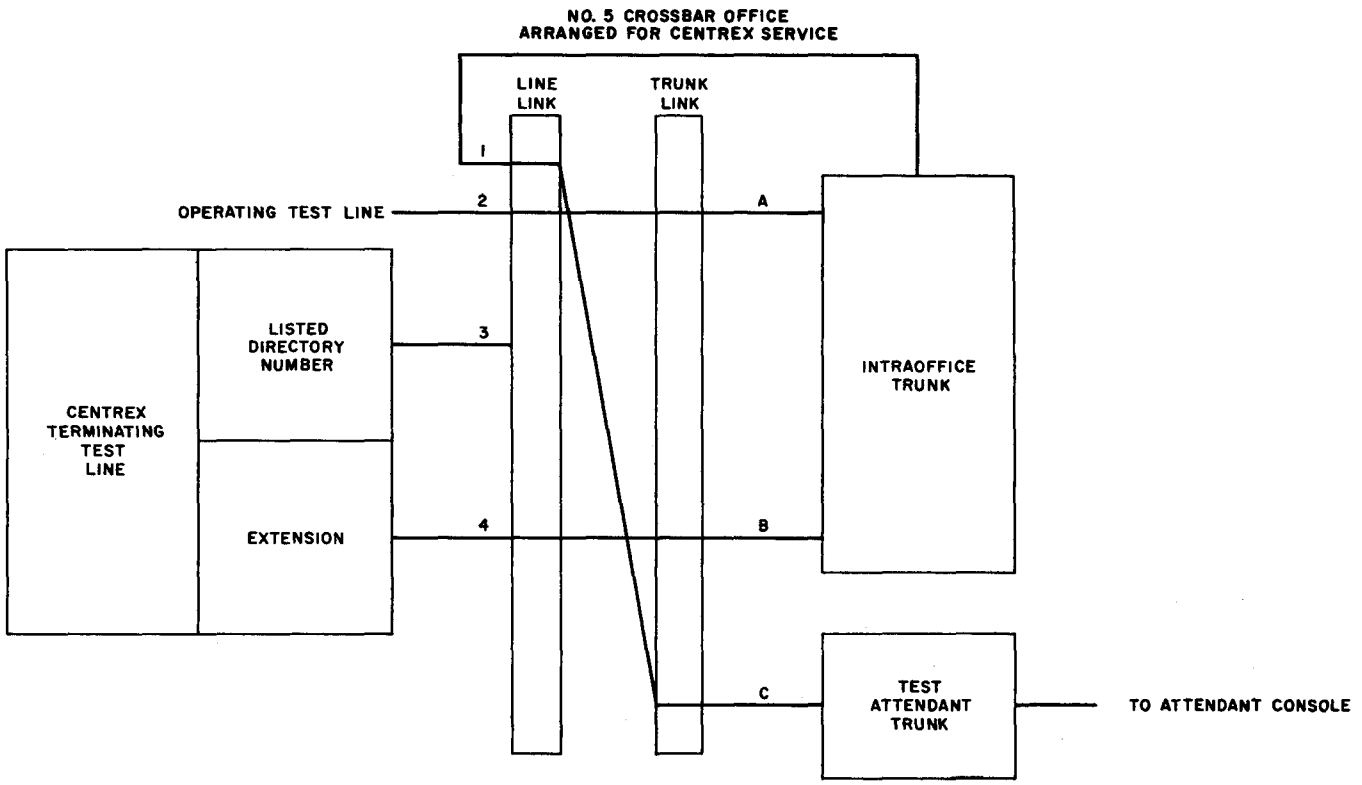

Fig. 29 — Manual Test of Intraoffice Trunk Arranged for Transfer

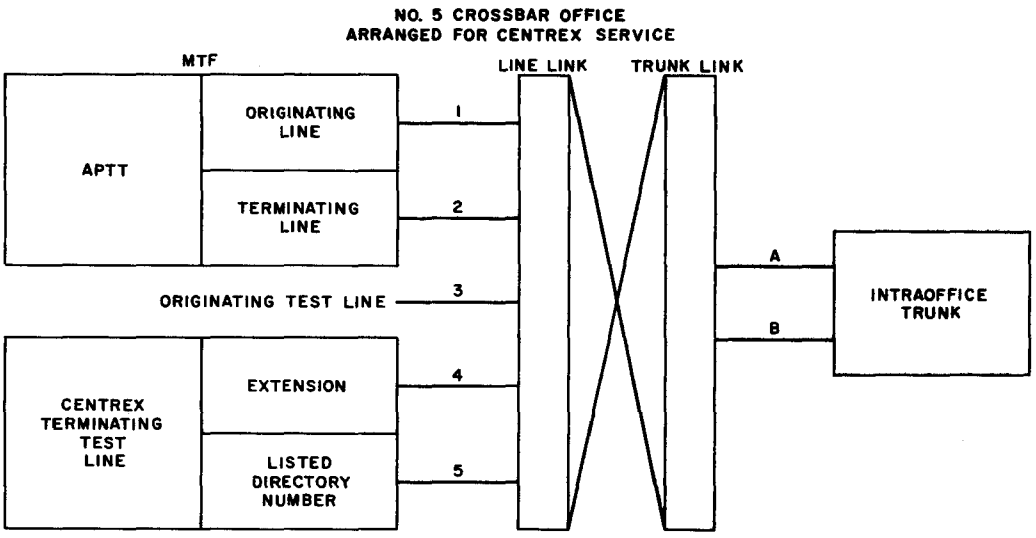

Fig. 30 — Test of Intraoffice Trunk Arranged to Repeat Supervision

don't answer transfer. In Phase I, the transfer feature of trunks is not tested automatically until the thermistor timer limitation in the trunk circuit is removed. Figures 31 and 32 show test and service equipment connections used with dial transfer arrangements.

A. Incoming Transfer Trunks

Testing From Distant Office

5.38 It is possible to direct a call from any of the test apparatus in 5.04 over a trunk arranged for transfer to a modified synchronous test line in the centrex office.

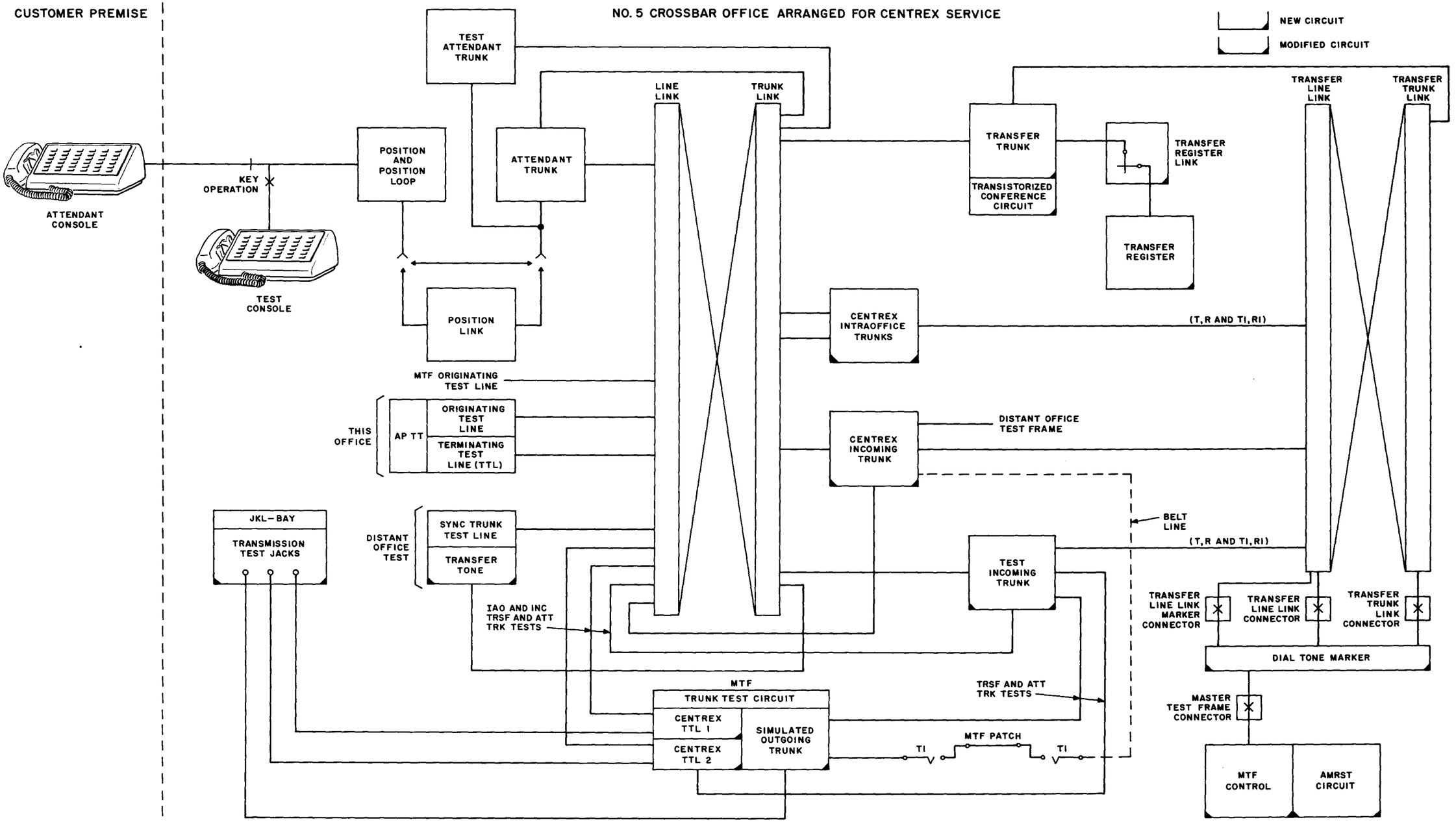

Fig. 31 — Dial Transfer in Existing Phase I and II Offices — Testing

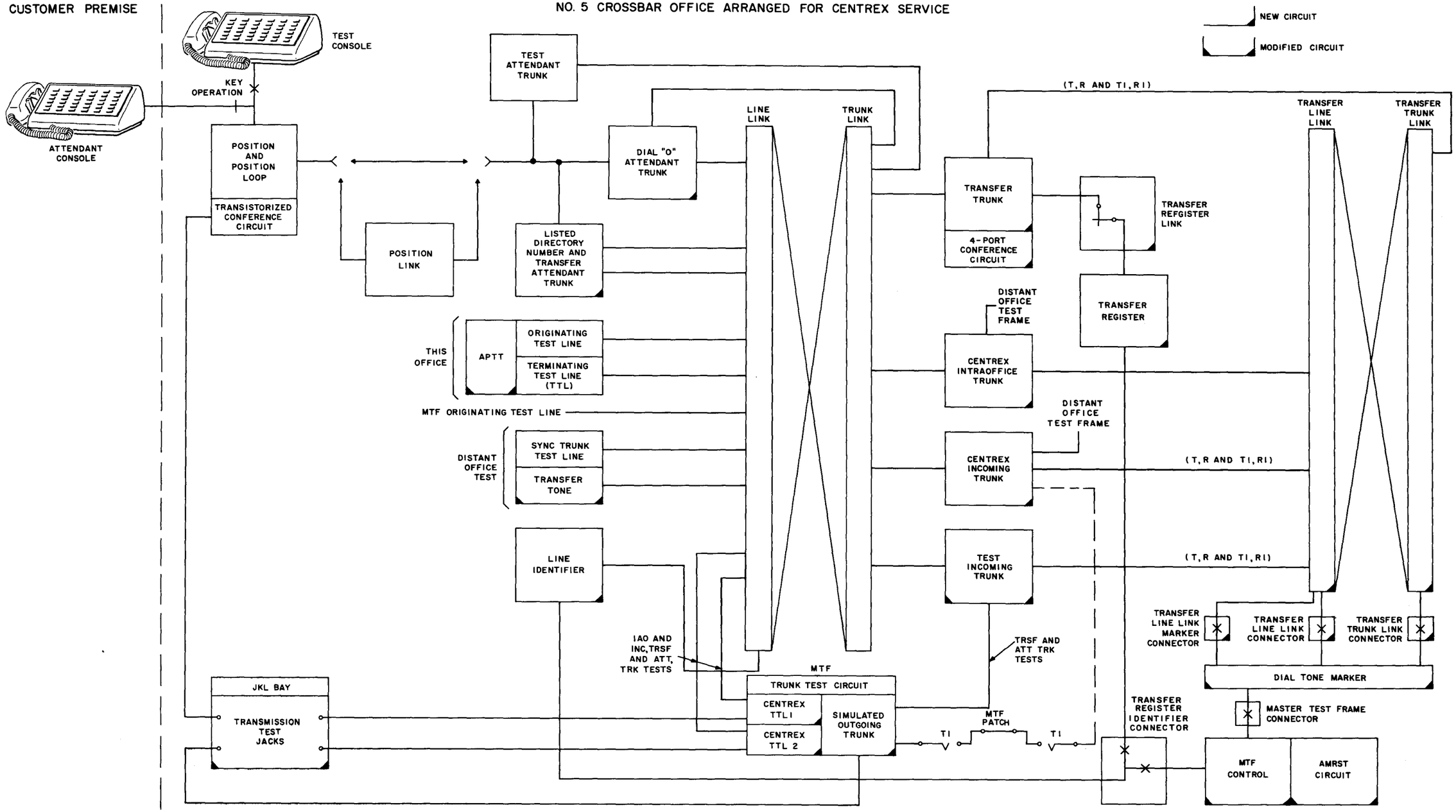

Fig. 32 — Dial Transfer in Phase III Office —Testing

5.39 The modified synchronous test line used with transfer-type trunks requires a distinctive class of service and a particular directory number for terminating distant office tests. It is arranged to sequentially test the ringing, continuity, pretrip, trip, and supervisory features and then the transfer features of the trunk under test (transfer feature test applicable to Phases II and III only).

5.40 Upon satisfactory completion of the supervisory relay test, the modified synchronous test line is arranged to time for a minimum of 5 seconds and then simulate a switch hook flash by producing a minimum 280-millisecond on-hook signal that will automatically initiate a transfer request.

5.41 Once the transfer request has been initiated, the dial tone marker is arranged to forward the test class indication so that a "transferred to" connection can be established to the trunk link frame appearance of a tone circuit which is an integral part of the modified synchronous test line in the Phase II centrex. The modified synchronous test line circuit returns a successful transfer indication consisting of tone bursts to the distant office. Failure to complete the transfer is indicated by: (1) A new "centrex class" mark on the printout of the automatic test frame in addition to a visual signal arrangement, and (2) absence of tone signals where test calls are originated manually.

5.42 The modified synchronous test line for Phase III operation requires a separate line link frame appearance for the "transferred to" part of the test line. A "transferred to" connection is established to this appearance for return of a successful transfer tone indication.

Testing From Near End Office

5.43 There is a more comprehensive testing arrangement at the near end since these tests are initiated primarily on trunks that fail repeatedly under test from the distant office. Means are provided at the MTF to test the following features:

(a) Ringing, continuity, pretrip, trip, and supervisory relay functions.

(b) Transfer to an attendant by dialing 0.

(c) Transfer to a station by dialing four or five digits, including retransfer and ability to cancel a transfer request and reconnect to a simulated calling party.

(d) Listed directory number call.

(e) Busy line transfer and don't answer transfer.

Two centrex terminating test lines are provided at the MTF. One is the same as the present centrex terminating test line with provision for switching in a telephone set at the master test frame. The other has only a line appearance with provision for switching in a telephone set. Each has a separate directory number but is assigned the same class of service.

5.44 The centrex incoming trunk arranged for transfer is connected to a simulated outgoing trunk at the MTF trunk test circuit via multiple (belt line) arrangements so that an incoming trunk, no pulsing (ITNP) class test can be initiated. The MTF directs a test call to its associated first centrex terminating test line which will test regular No. 5 crossbar features, such as ringing, pretrip, trip, etc. When this test has been completed, it is possible to simulate a switch hook flash by operating the answer key on the MTF. This will set the basic dial transfer scheme in motion and return dial tone to the telephone set associated with the first centrex terminating test line. At this point, the maintenance man is able to transfer the call either by dialing four or five digits and being connected to the second terminating test line or by dialing 0 and being connected to a test attendant trunk.

5.45 Means are also provided at the MTF to initiate tests of the retransfer, listed directory number, busy line transfer, and don't answer transfer features.

B. Intraoffice Transfer Trunks

From MTF

5.46 The master test frame is used to direct a call from the originating test line over the intraoffice trunk under test to the same terminating test lines and the test should proceed in the same manner as that described in 5.43 through 5.45.

From APTT

5.47 Means are provided for automatic testing intraoffice transfer trunks from the APTT frame. The APTT performs the same tests on these trunks as it did when used at the distant office for testing incoming trunks arranged for transfer as described in 5.38 through 5.42.

C. Transfer Trunks

5.48 The MTF is used to make operational and transmission tests of specific transfer trunks. The APTT and automatic transmission measuring set are not arranged to test transfer trunks.

Transfer Trunk Selection from MTF

5.49 The MTF control circuit is arranged to direct a marker to select a particular transfer trunk. To test the transfer trunk, the MTF trunk test circuit must gain access to it through a test incoming trunk.

5.50 The present test incoming trunk used in the Phase II centrex system for testing attendant trunks can be modified for dial transfer with a transfer line link appearance. New test incoming trunk circuits are needed for Phases I and III centrex systems equipped for dial transfer.

5.51 Changes are also required in the master test control and the dial tone marker to control the class information set in the transfer trunk.

Transfer Trunk Tests

5.52 Operational tests include the ability to:

(a) Split the connection.

(b) Place a hold on a simulated calling party.

(c) Pass digital information to the transfer register.

(d) Apply ringing features where applicable.

(e) Recognize a switch hook flash, cancel the split, and add on a simulated calling party.

(f) Initiate a new transfer request.

(g) Process a transfer call to the attendant or a station.

(h) Under key control, produce a trouble record of the test call.

5.53 Transmission loss measurements are made to test the 4-port conference circuit associated with the transfer trunk circuit. This test requires:

(a) MTF selection of the transfer trunk under test as described in 5.49 through 5.51.

(b) Provision for test jack access at the MTF-JK bay for measuring the loss between any two of the three ports used in the conference connection. The fourth port is always terminated since it is never used in this circuit application.

D. Attendant Trunks

5.54 The present standard arrangements for testing attendant trunks in Phases I and II centrex offices are not affected by the addition of dial transfer features.

5.55 The Phase III centrex system uses a new mode of operation which divides the present attendant trunk function between two new trunk circuits. A further change incorporates a 4-port Feiner circuit with each position and position loop circuit working with the attendant trunk groups.

Testing from MTF — Phase III Centrex

5.56 The new dial zero attendant trunk circuit is preselected by the MTF and connected to the originating test line for an OGT test. This is identical to the Phase II attendant trunk test and uses a test telephone console to check proper signals and lamp indications. Flash and recall situations can be simulated by the test console using a trunk to the local test desk.

5.57 The new listed directory number transfer attendant trunk circuit is selected for test from the MTF. This test will require the use of a new test incoming trunk arranged for transfer. The selected attendant trunk should be connected to the test position and test telephone console where the signals and lamp indications can be monitored and further tests of the trunk can be originated in the same manner as done in the Phase II centrex system.

Transmission Testing — Position and Position Loop Circuit

5.58 In Phase III centrex, a 4-port Feiner conference circuit is associated with each position and position loop circuit. Transmission loss measurements are made to test the three ports used in a conference connection. The fourth port is always terminated. This test requires:

(a) Master test frame selection of the position and position loop circuit under test.

(b) Provision of test jack access at the MTF-JK bay for measuring the loss between any two of the three ports used in the conference circuit.

E. Transfer Line Identifier Circuits (Phase III Only)

5.59 A new class of test is provided at the master test frame to check the line identification equipment on an individual line test basis. A test call is directed to the line under test similar to a line verification test call. Means of simulating the incoming trunk and transfer register functions are required. The output of the identifier is received at the MTF which, when matched against the line location, verifies the information.

F. Testing Markers and Registers — General

5.60 Arrangements are provided for testing all new features in the dial tone and completing markers from the MTF and the transfer registers and incoming registers from the automatic monitor and register sender test circuit (AMRST). Provision is also made for testing registers in offices using test set type testing.

Dial Tone and Completing Marker Tests from MTF

5.61 The master test frame is arranged to initiate dial tone and completing marker tests of the dial transfer features. A test of the busy line transfer and don't answer transfer features in the completing marker is also provided. Marker tests cover line route (LR-) relays and tens block screening features which are used in the busy line transfer and don't answer transfer applications.

Transfer Register Tests

5.62 The transfer register is essentially a modified version of the standard combined dial pulse and TOUCH-TONE originating register. Consequently, the standard operational and marginal register tests are required. In addition, arrangements are provided to test the dial transfer, busy line transfer, and don't answer transfer features.

Incoming Register Tests

5.63 Arrangements are provided for manually testing the busy line transfer and don't answer transfer features from the master test frame using an automatic monitor register and sender test circuit or test set circuits.

Busy Line and Don't Answer Transfer Tests

5.64 Busy line transfer tests use present centrex test facilities to terminate a test call to a busy line and transfer to the test telephone console. Testing of the don't answer transfer feature uses the master test control circuit to prime the marker and operate the DAAT relay in the trunk circuit under test. This transfers a test call automatically after a specified interval to the test telephone console. Automatic operational testing of the don't answer auxiliary trunk will be accomplished by using a new don't answer auxiliary trunk test line at the centrex office and the APTT at the far end office.

6. GLOSSARY

6.01 The following is a glossary of terms used in this section.

Add-On Conference. That feature which permits a station user involved in a telephone conversation to add one or more parties to the connection, thus permitting a regular telephone connection to grow to a conference connection.

Attendant Access Trunks. Provides means (2 line link appearances) of connecting two stations on a call originated by the attendant.

Attendant Console — See console.

Attendant Controlled Conference. A conference connection that is established and supervised by the attendant.

Attendant Loop. One of a group of circuits that provides access between the switching network and attendant console(s).

Automatic Identified Outward Dialing (AIOD). That feature which provides for identifying the station number and making it available to the charge recording.

Automatic Message Accounting (AMA) System. An equipment arrangement for recording and processing on continuous paper tapes the data required for computing telephone charges on customer-dialed calls and on calls handled by operators where provision is made for treating these calls in a similar manner. The system may include provision for compiling all charges and credits which affect the customer's bill and the automatic printing of the bill.

Busy Line Transfer. That feature which transfers to the attendant any direct-inward-dialed calls to the busy lines.

Central Office Trunk. See PBX trunk.

Centrex. A telephone service to business customers which provides direct inward dialing, identified outward dialing, station-to-station dialing, and attendant transfer.

Channel. A combination of a line link, a junctor, and a trunk link which by crosspoint closures forms a path to connect a line with a trunk, or a trunk with a trunk.

Class of Service. The commercial term applying to the subgrouping of customers for the sake of rate distinctions. This subgrouping may, for example, distinguish between the following: individual and party; business, residence, and coin; flat rate and message rate; restricted and extended scope; and centrex and non-centrex customers. Each centrex customer must have a separate class of service. For centrex, the class of service feature is used to identify the particular customer group involved while rate treatments are used to determine those calls which are allowed or denied in terms of charging or routing. (See Rate Treatment.)

Common Control Equipment. All switching equipment exclusive of line link frames and trunk link frames.

Common Control System. A switching system which makes use of common equipment which is not part of a switching connection but is used to establish a connection and then becomes available to establish other connections.

Console. A key operated switchboard that may be placed on the surface of a desk or table for use by a PBX attendant.

Customer, Regular or Noncentrex. All customers other than centrex customers served by a No. 5 crossbar central office arranged for centrex service.

Customer, Centrex. A customer who subscribes to centrex service and is served by a No. 5 crossbar central office arranged for centrex service.

Customer Group. The commercial term applying to the subgrouping of customers according to service bought. Customer groups are distinguished by class of service.

Destination. The called party or the equipment associated with the called party.

Dial. Specifically, a calling device which, when wound up and released, generates dc pulses for establishing telephone connections. The term dial is sometimes used in a broader sense to designate any calling device which generates signals (ac or dc) for establishing telephone connections.

Dial Pulsing (DP). A system of dc pulsing in which the digits are transmitted by the interruption of the dc circuit a number of times, one to ten interruptions corresponding to the digits 1 through 0 on the dial.

Dial Tone. A tone used in dial telephone systems to indicate that the equipment is ready for the dialing operation.

Dial Transfer. That feature which permits a station user to transfer a call to another telephone without attendant assistance by dialing the number of the station to which the call is to be transferred.

Direct Distance Dialing (DDD). The completion of long distance calls by customer dialing from the originating location.

Direct Inward Dialing. That feature which permits a customer outside of a PBX to reach a PBX extension without attendant assistance.

Don't Answer Transfer. That feature which transfers to the attendant direct-inward-dialed calls encountering a don't answer condition.

Foreign Exchange Trunk. A central office trunk connecting a PBX with any central office other than the one normally serving that PBX.

Frame. A metal framework, such as a relay rack, on which equipment is mounted.

Inward Restriction. That feature which prevents a PBX station from receiving any incoming calls from the central office.

Line Link Pulsing. That feature of some No. 5 crossbar central offices which provides direct inward dialing to PBX's over trunks terminated on the No. 5 crossbar line link frame.

Listed Directory Number (LDN). The full complement of digits required to designate a customer in the directory.

Local Automatic Message Accounting (LAMA) System. See AMA system.

Loop. See Attendant Loop.

Loudspeaker Paging. That feature which provides for voice signals spoken into a telephone set or other transmitter to be radiated from one or more loudspeakers for reception at a distance.

Master Test Frame (MTF). A unit of equipment which provides for the testing of the equipment units of a marker group.

Master Test Frame Connector. A connector by which markers and other equipment obtain access to the master test frame.

Night Answering from a Fixed Station. That feature which causes a LDN call to be automatically routed to a fixed station when an attendant has established a night connection.

Off-Hook. The condition that indicates the active state (loop closed) of a station line or other circuit. When a telephone handset is removed from its switch hook, the loop is closed and the line is in the off-hook condition.

On-Hook. The condition that indicates the idle state (loop open) of a station line or other circuit. When a telephone handset is resting on its switch hook, the loop is open and the line is in the on-hook condition.

Outpulsing. The process of transmitting digital information over a trunk from one system to another.

PBX. See Private Branch Exchange.

PBX Trunk: A subscriber line used as a trunk between a PBX and the central office which serves it. ***Note:*** When taken from a PBX point of view the term "central office trunk" may be used in a synonymous sense.

Plain Ordinary Telephone Service (POTS). Used to imply noncentrex service.

Position and Position Loop Circuit. Central office equipment used to connect to the attendant on dial zero, LDN, transfer, conference, and delayed calls.

Private Branch Exchange (PBX). A switching system providing internal telephone communications between stations located on a customer's premises as well as between these stations and the exchange network.

Rate Treatment. Restricts dialing access to one or a combination of route codes which permits separate stations of a centrex customer to have different calling services.

Recorded Telephone Dictation. That feature which permits a station user to connect to and control the operation of a dictating machine by dialing from his station telephone.

Source. The calling party or the equipment associated with the calling party.

Splitting. That feature which permits the attendant to talk to either the source or destination of a call without the other half of the call being in the connection.

Supervision. An action or operation that performs a service of inspecting or directing other actions or operations.

Switched Loop (Attendant) Operation. A method of operation in which calls are switched to an attendant console when attendant handling is needed and can be automatically released from the console when work on the call is completed.

Switching System. An integrated and self-contained arrangement of interconnecting and control elements used for the controlled establishment of changeable communication paths.

Telephone Dictation. See Recorded Telephone Dictation.

Terminal Hunting. The function performed by the switching equipment in a dial office in searching for an idle line in a PBX or other terminal hunting group.

Tie Trunk. A trunk for direct voice communication between two PBX's.

Toll Diversion. That feature which permits PBX station users to reach a central office trunk and dial outgoing calls to local points but prevents him from reaching toll points.

TOUCH-TONE Calling (TTC). A station arranged for TOUCH-TONE calling is provided with a telephone set equipped with ten pushbuttons corresponding in digits and letters to the ten finger holes in the rotary dial. The station user places his call by operating the buttons.

Transfer Line Identifier. Phase III centrex circuit arranged to identify the line location of a centrex station initiating a transfer request and to pass this information to a transfer register.

Transfer Line Link and Transfer Trunk Link Frames. Six-wire, 4-stage network which provides full access between any incoming or intraoffice trunk and any transfer trunk.

Transfer Line Link Connector (T-LLC). Provides access to the transfer line link frame from the dial tone marker.

Transfer Line Link Marker Connector (T-LLMC). Provides access to the dial tone marker from the transfer line link frame.

Transfer Register. Receives dialing information from the transferring centrex station that is needed by the completing marker to establish the transfer.

Transfer Register Identifier Connector. Provides access between the line identifier and the transfer register.

Transfer Register Link. Provides access from a transfer trunk to a transfer register.

Transfer Register Marker Connector (TRMC). Provides access to the completing marker from the transfer register.

Transfer Trunk. Provides connection to the transfer register and trunk link frame from the transferring centrex station through the transfer line link and transfer trunk link frames.

Transfer Trunk Link Connector. Provides access to the transfer trunk link frame from the dial tone marker.

Translate. To change information from one form of representation to another without significantly affecting the meaning.

Trunk Answer. A feature by which incoming listed directory number calls can be answered from any nonrestricted station by dialing a special 1XX code. Such calls can be transferred to another station by using the dial transfer feature. This feature is activated by the attendant operating the night (NITE) key on the console.

Trunk Circuit. A circuit of a switching system which may be required to supervise a connection within the system and/or to associate the system with a transmission facility or other switching entity.