

CENTREX SERVICE
STEP-BY-STEP CENTREX
USING
608A CORD SWITCHBOARDS WITH SINGLE AND
NORMAL CORD OPERATION AS THE ATTENDANT FACILITIES

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GENERAL

Centrex service for step-by-step P.B.X.'s where 608A cord switchboards arranged for single and normal cord operation are provided for the attendant facilities can be implemented with interim standard arrangements now available. These interim arrangements will be standardized at a later date but the operating features will, in general, remain the same. These arrangements permit direct inward dialing (DID) to the stations of the Centrex by trunking through a crossbar tandem, a No. 5 crossbar office equipped with tandem features, or from the selector levels in step-by-step central offices. It will be possible to route all outgoing traffic from the Centrex directly through a crossbar tandem arranged to handle the traffic, through the local central office as it exists today, or a combination of these two arrangements can be applied.

These interim arrangements use modified 701B P.B.X. facilities for the in-dialing train. They can be used in conjunction with existing 700C, 701A, 701B and 702A type P.B.X. systems to provide DID. These facilities can be used for new Centrex installations located on the customer's premises and for centralized Centrex arrangements located on Telephone Company owned or leased premises. The attendant position used with this system is the 608A cord switchboard.

CENTREX ARRANGEMENTS

The basic Centrex features of this system will be described briefly to present the overall picture. The major items of equipment and their functions will be described in detail under "Equipment Elements". The attendant switchboard will be described in Section 5 of these Notes. Figure 1 is a traffic schematic of the overall system.

DID Arrangements (Fig. 2)

A one-way incoming trunk group from the tandem or the step-by-step central office must be established in the Centrex for direct inward dialing (DID) to the stations. Both DID and listed number traffic can be routed over this trunk group. It is also possible to restrict this trunk group to DID traffic only.

An incoming switching train must be established at the Centrex. It can be arranged to receive either 3 or 4 digits from the originating office for DID traffic. This train consists of incoming 1st selectors, incoming 2nd selectors (if required) and incoming connectors. Under certain conditions, described in the "Equipment Elements", the incoming and local connectors can be combined into a common connector group. An indialing trunk circuit, arranged to return answer supervision to the originating office on called station answer, is associated with each incoming 1st selector.

This switching train is also utilized in completing listed number, DID transfer and other types of attendant completed traffic.

DID Transfer Arrangements (Fig. 3)

The indialing trunk circuit will recognize a switch-hook flash from the called DID station as a request for transfer and will route the call to the attendant. Attendant access is through a call distributor circuit which connects the indialing trunk to a jack termination on the switchboard. After the attendant has answered and obtained information to complete the call to the new station, she releases the switch train connection to the station originating the transfer request. She then proceeds to set up the connection to the new station, reusing the switch train for this purpose. Upon called station

answer, the attendant can release her position from the connection by removing the cord from the jack. The call distributor will also be released. The established connection will then be as if the call had been directly dialed initially. Subsequent transfers will be handled in a similar manner.

Listed Number Arrangements (Fig. 3)

The incoming trunk group from the tandem or the step-by-step central offices can handle both listed number and DID traffic. A separate listed number group directly from crossbar tandem can also be established. It is also possible to retain the listed number traffic in the local central office.

When the listed number traffic is combined with the DID traffic, a level of the incoming 1st selector will be assigned for the listed number calls. The selector will find all terminals busy and step to the 11th rotary position. The incoming trunk will hold the selector off-normal for a short interval to permit any additional digits received to be absorbed. It then sends a request to the incoming trunk to call for the attendant position. Connection of the incoming trunk to the attendant position is through the call distributor. The attendant completes the call to the desired station using the DID switch train for this purpose. The operation and final result is similar to the DID transfer call described above. Recalls by the station are the same as transfer requests.

The listed number calls can be routed over a separate trunk group from a crossbar tandem modified for P.B.X. translation (Fig. 3-b). Termination will be in a standard circuit available for this purpose arranged for jack termination on the switchboard. Completion is over the operator selector integrated in the DID train. The connection is retained on the switchboard for duration of conversation. Recalls will be a cord signal.

Listed number calls from the local central office can terminate at the Centrex on a new central office trunk associated with an incoming selector (Fig. 3-a). The connection to the attendant position will be through the call distributor if this arrangement is used. The associated selector will be integrated into the DID train and completion to the called station occurs as described for transfer calls. Recalls by the called station will be the same as DID transfer requests.

This traffic can also be routed from the local central office for direct termination on the cord

switchboard (Fig. 3-b). Standard central office trunk circuits are used for this arrangement. Completion is over the operator selector and the connection is retained on the switchboard for duration of conversation. Recalls will be a cord signal.

Outgoing Arrangements (Fig. 4)

Three arrangements are available to handle outgoing traffic from the Centrex. They are —

1. Route all outgoing traffic through the local central office. Normal central office trunks would apply.
2. Route all local, service code and DSA or toll operator traffic to the local central office. Establish a new outgoing trunk group to crossbar tandem for all DDD traffic.
3. Route all outgoing traffic through a crossbar tandem modified to accept it. An outgoing trunk to tandem is available for this purpose. Joint holding features are available on calls to the DSA or toll operators.

These arrangements can be dial selected by stations from the levels of the local 1st selectors. Attendant access will be from jack terminations of these trunks at the switchboard.

Intercepting Arrangements

It is recommended that all calls to vacant numbers in the block of numbers assigned to this type of Centrex as well as those to any vacant levels in the in-dialing train be routed to a recorded announcement with non-charge supervision provided. 7A record announcement facilities can be provided for this purpose.

Calls to changed numbers may be routed to either the recorded announcement, or, for a limited period, to the attendant for completion. When these calls are routed to the attendant, answer supervision must be returned to the originating office.

Night Closing Arrangements

With DID to the stations of a Centrex, there is no longer a requirement for night service connections to selected stations to provide them with incoming service. There is, however, a requirement on the part of most customers for some night arrangement to provide for the answer of any listed number calls after hours.

When both DID and listed number traffic are combined in the same incoming trunk group, the operation of the battery cut-off key at the switchboard does several things. These are —

Removes the busy from the terminals of listed number level on the incoming first selector, and allows a listed number call to stop on an idle terminal (Fig. 2). Each terminal, as required, is connected to a two-way attendant access loop normally associated with the 621A console. Each loop terminates on the keys of a telephone set modified for this purpose. The night "attendant" can answer the incoming call and extend it to any station since the levels of the associated loop selectors would be connected into the DID train. No recall of the night attendant would be possible after attendant hang-up has occurred.

The transfer feature of the in-dialing trunk is also disabled.

Operation of the battery cut-off key, when listed number traffic is routed over a separate trunk group from the local central office and the C.O. trunk with the associated selector is provided, results in another arrangement. It is—

Connects the incoming central office trunk directly to the keys of a key telephone set provided for this purpose. In this instance, the night "attendant" will be able to answer only. No completion of the call forward is possible. The transfer feature of the in-dialing trunk is disabled.

Direct completion from the local central office or crossbar tandem to jacks on the switchboard requires other arrangements. These are—

The central office trunks can be patched to special night telephones terminating on jacks at the switchboard. Regular cords are used and the Night-Thru Dial key is operated. No switching of incoming calls is contemplated.

The listed number trunks directly from crossbar tandem cannot be patched directly to the night telephones because the trunk circuits recognize a "loop closure" rather than "generator" as a signal to call in the attendant. An auxiliary line circuit normally used in Hotel-Motel service for completion from a selector level to a station line circuit must be bridged to each listed number trunk. These auxiliary line circuits are then connected to special night trunk jacks which are patched to the night telephones as described

above. The auxiliary line circuit would provide ringing current toward the night telephone on an incoming listed number call.

The transfer feature of the in-dialing trunk is also disabled.

EQUIPMENT ELEMENTS

Incoming DID Train (Fig. 2)

The in-dialing train includes the in-dialing trunk, the incoming 1st selector, incoming 2nd selector (if required) and the incoming connector. This train requires 4-wire switches to provide the attendant with visual indications of called station ring, overflow, and called station busy. If these visual supervisory indications are not required, 3-wire switches can be used. The attendant will receive tones only.

The **in-dial trunk** is arranged to return answer supervision to the calling office on called station or attendant answer. It recognizes a switch-hook flash from the called station as a transfer request and routes the call to the attendant. In this case, a three-way talking path is established between the calling party, called party and the attendant. It receives a signal from the incoming 1st selector on listed number calls and routes the call to the attendant. It controls the denial of specified levels of the incoming 1st selector, to incoming DID traffic, but will permit attendant completion to these levels. Audible ring is returned to the calling subscriber while waiting for an attendant answer. The transfer feature is disabled when the night closing arrangements are in effect. The trunk controls the established connection during conversation and will release the train upon calling subscriber disconnect.

The **incoming 1st selector** is controlled in many of its features by the incoming trunk. This selector provides switching access to the balance of the DID train. It can be arranged to deny specified levels to DID traffic. A busy tone will be returned to the calling subscriber when these denied levels are reached. It will signal the incoming trunk when a listed number call is routed to the assigned level (this will generally be level "0"). The terminals of this level will be busy to incoming traffic. However, two-way attendant loops, normally associated with the 621A console, connected to a key telephone modified for this purpose may be terminated on these terminals. When the night closing features

are in effect, the terminals of the listed number level will be used to route the listed number calls to the night telephones. The selector also has been arranged to absorb the initial digit for attendant completion in 3-digit systems, since a 4-digit station number will generally be supplied to her.

The **incoming 2nd selector** is similar to local 2nd selectors except for the modification to 4-wire operation.

The **incoming connector** is arranged for terminal hunting as required. It will return audible ring to the calling party and a 30 IPM "wink" to the attendant position while the called station is being rung. It will return a busy tone to the calling subscriber on DID calls if the called station is busy. It is also arranged to "camp-on" a busy station on attendant completed calls and a 60 IPM flash and busy tone is returned to the attendant. She then operates the CAMP-ON key on her position. If another call is not already camped-on the busy station, the busy tone is removed and the camp-on feature is in effect. The 60 IPM flash is retained on the attendant position an indication to the attendant that camp-on is in effect and that subsequent reports are required if the busy condition continues for any duration. The connection will be cut through and called station rung when the station disconnects from the previous call. If another call is already camped-on, the tone will not be removed when the CAMP-ON key is operated, and camp-on is denied. This feature is controlled over the "sleeve" connection and may be provided in 3-wire systems. However, the operation is not as satisfactory since no visual indication of the busy will be received at the attendant position. Busy tone will be heard, however, and will be removed when camp-on is allowed.

An overflow in the switching train will return a busy tone to the calling subscriber and, on attendant completed calls, a 120 IPM flash to the attendant position. Busy tone only, no flash, will be returned to the attendant if 3-wire systems are used.

Call Distributor

Two call distributors are available with this system — (1) a distributor which applies when more than one Centrex customer is to be served and (2) a distributor which applies when only one customer is to be served.

The following trunk equipments can be connected to these call distributors:

In-dialing trunk arranged for transfer

Incoming central office trunk (with associated selector) used for listed number calls only

Incoming central office trunk (with associated selector) used as FX lines

These call distributors are described in detail in Section 5-d.

Register Sender and Register Sender Link

The attendant completes calls routed to her by dialing the desired termination. Her position can be equipped with a pushbutton dial instead of a rotary dial. Pushbutton dial operation requires the association of a register sender with the position to receive, store, and output the digits keyed. The position is connected to a register sender through a register sender link circuit. The attendant operates her start (ST) key to request a register sender. A register sender attached indication (lighting of START lamp) is received to indicate the register sender is attached and that pulsing can start. The attendant always operates the END key to indicate the end of pulsing.

The **register sender link** can serve a maximum of 10 register senders and 20 positions. It is divided into a preference unit and 4 group and select units. One group and select unit will be required for the first 5 attendant positions, another for the next 5 positions or a portion thereof, and so on. Each group and select unit provides access to a maximum of 10 register senders. The register senders are multiplied to other group and units as required. The group and select unit uses a 100 point 6-wire crossbar switch to connect the position and the register senders. The register senders are on the horizontals of the switch. The positions are on the verticals and require 2 verticals per position. The register sender link connection is held under control of the position circuit. The position circuit releases the link connection when the register sender has completed its functions.

The **register sender** is arranged to receive 2-out-of-5 DC pulsing from the attendant's pushbutton dial. It can store a maximum of 7 digits at one time. It will start outputting the digits on a dial pulse basis after the 1st digit has been received. If

more than 7 digits are required to complete the call, the register sender will again re-cycle to permit storage of the digits over 7 in those digit locations which have been outpulsed. The register sender can out-pulse dial pulses on a 10 pps basis or on a 20 pps basis. Twenty pps pulsing is applicable on outgoing calls to the central office only.

The register sender equipment can be shared by the attendant teams of more than one Centrex customer.

Attendant Loops

This circuit is used as a connecting link between the 608A cord switchboard and incoming trunks associated with the call distributor for DID transfer requests and listed number traffic. The attendant loop, when seized, will alert the attendant by sounding an audible alarm and by lighting the trunk lamp. The trunk lamp will be steady on listed number calls and flashing at 120 IPM on transfer requests.

The attendant loop is arranged for operation with the back cord only (single cord operation). The incoming signal and the audible alarm are retired by inserting the back cord of an idle pair (with TALK key operated) into the associated jack. The attendant associates the position rotary or pushbutton dial with the cord by operating her DIAL BACK key. The camp-on feature applicable to busy stations is included with these arrangements. The supervisory signals received on the back cord are—

- a. Station ring—30 IPM wink
- b. Station busy—60 IPM flash and busy tone
- c. Camp-on in effect—60 IPM flash and no tone
- d. Camp-on denied—60 IPM flash and busy tone
- e. Switchtrain overflow—120 IPM flash
- f. Called station answer—dark
- g. Station recall (cord in jack)—120 IPM flash

To disconnect from the cord circuit, the attendant can operate the RLS key or a TALK key associated with another cord. To release the connection from her position after called station answer, the attendant removes the cord from the jack. This releases the call distributor and the attendant loop. The established connection to the called station will then be similar to a DID call. The attendant is recalled by a switch-hook flash from the called station and the connection is re-established as if it were a transfer request.

Splitting for announce calls is achieved by the operation of the SPLIT key with the TALK key operated. The condition is released and the connection bridged through by re-operation of the SPLIT key, operation of the RLS key, or another TALK key. Splitting is an optional feature.

The Release Forward (RLS FWD) key is used to restore to normal any established switch train connection associated with the attendant loop. The cord cannot be removed and re-inserted as with normal cord operation since removal of the cord releases the loop from the position.

Recall of a toll operator connected to an attendant loop on an incoming call can be accomplished with the RING BACK key.

Only single cord operation is possible with these attendant loops. Completion from these loops to FX or tie lines, even though these lines appear in the station multiple, must be on a dial selection basis through the incoming DID 1st or the incoming FX or central office trunk selectors. The connection can then be released from the position on called station answer.

Completion of an incoming listed number call or transfer request on the attendant loop for a conference connection can be accomplished in the following manner (Fig. 1)—

1. Assign an attendant (dial 0) trunk to a terminal of the listed number level of the DID 1st selector with a multiple appearance on the zero level of the incoming FX or central office trunk selector. This level on both selectors would be available on attendant originated calls only.
2. Terminate this attendant trunk on the switchboard multiple.
3. The attendant who answers the loop initially can extend the call to the conference attendant by dialing "0". She releases her cord and position on conference attendant answer. The incoming trunk is now connected directly to the conference attendant.
4. The conference attendant can establish the desired connections using normal cord operation.

Connections to RD tie lines are accomplished in a similar manner from another level. These tie lines are not arranged for selector level termination.

Incoming FX or Central Office Trunk with Selectors (Fig. 1)

This circuit is arranged for incoming operation in its application within this system. It can be used for foreign exchange trunks or for listed number trunks from the local central office. A selector is associated with each trunk to provide access to the stations and tie trunks. Access to the attendant is provided through the call distributor. Completion is through the associated selector into the DID train. Audible ring is returned to the calling subscriber until the attendant answers on incoming calls. Answer supervision is returned to the originating office on attendant answer. Calling party control is also provided. The called station can originate a transfer request and the attendant can be re-connected through the call distributor.

Operator Selector and Out-Dial Trunk (Fig. 1)

An operator selector is associated with an out-dial trunk circuit terminated on a jack at the switchboard. The selector is intergrated into the indialing train. All incoming calls, except those on the attendant loops, can be extended to stations within the Centrex on a dial completion basis over these trunks. Conference connections to stations are completed over these circuits. Splitting, camp-on, and cord supervisory signals similar to those on attendant loop calls will be received. Normal two-cord operation is provided with these arrangements and the connections will remain on the switchboard for duration of conversation.

Other Trunk Circuits

Standard **central office trunks** can be used for outgoing central office calls. These can be both dial selected from stations and jack terminated on the switchboard. Two-way or one-way operation can be

provided when these circuits are used to terminate incoming listed number trunks or foreign exchange trunks directly on the switchboard.

Standard **attendant trunks** can be provided for dial "O" attendant access. They can also be used for conference operator and RD tie trunk access (See Attendant Loops).

All standard **tie line trunks** available for step-by-step P.B.X. application can be terminated on this board. Dial access to the attendant should be provided from levels of the DID first selector and the incoming FX or C.O. trunk selector (See Attendant Loops).

Standard **outgoing trunk to crossbar tandem** can be used for all outgoing traffic, or can be used for DDD traffic only if desired. Dial selection by stations and jacks terminations for the attendant can be provided.

Standard jack terminated **conference circuits** are available. For access to conference operator on incoming calls on attendant loops see "Attendant Loops".

Access to a **busy verification** train can be jack terminated on the switchboard if required by the customer.

Traffic Registers

All traffic registers available with standard 701B PBX equipment are applicable with these facilities. In addition, Peg Count registers may be associated with the indialing trunks arranged for transfer to score individually (1) total DID calls, (2) total listed number calls, and (3) total transfer calls. Peg Count and ATB registers can be associated with the 2-way central office trunks (with selectors)

ENGINEERING RECOMMENDATIONS

Engineering recommendations for this Centrex system are covered below for all items of equipment involved.

<u>Item</u>	<u>Recommendation</u>
1. Incoming trunk group—DID and Listed Number	Table 20
2. " " " —DID only	Table 20
3. " " " —Listed Number only	Table 20
4. Incoming second selectors (if required)	Table 10
5. Incoming connectors	Table 10
6. Combined group of local and incoming connectors	Table 10
7. Register Sender Link— (10 register senders and 20 pos. max.) Group and select units	1/5 pos.
8. Register Senders	
1 pos (BH requirement)	1 reg. sender
2 pos " "	2 " "
3 pos " "	2 " "
4 pos " "	3 " "
5 pos " "	4 " "
6 pos " "	5 " "
7 pos " "	5 " "
8 pos " "	6 " "
9 pos " "	7 " "
10 pos " "	8 " "
9. Attendant trunks	Table 20
10. Foreign Exchange Trunks (jack terminated)	as req'd.
11. Tie trunks—all types	as req'd.
12. Outgoing trunks to central office	Table 20
13. Outgoing trunks to crossbar tandem	Table 20
14. Operator selectors and out trunks	Table 10
15. Attendant loops	
(a) associated with single customer call distributor	one/TF
(b) associated with multi-customer call distributor (see Sec. 5-d for loop HT)	Table 10
16. Local train equipment will be engineered as specified in the T.E.P. for 701 type P.B.X.'s	
Attendant position requirements will be covered in Section 5 of these Notes	

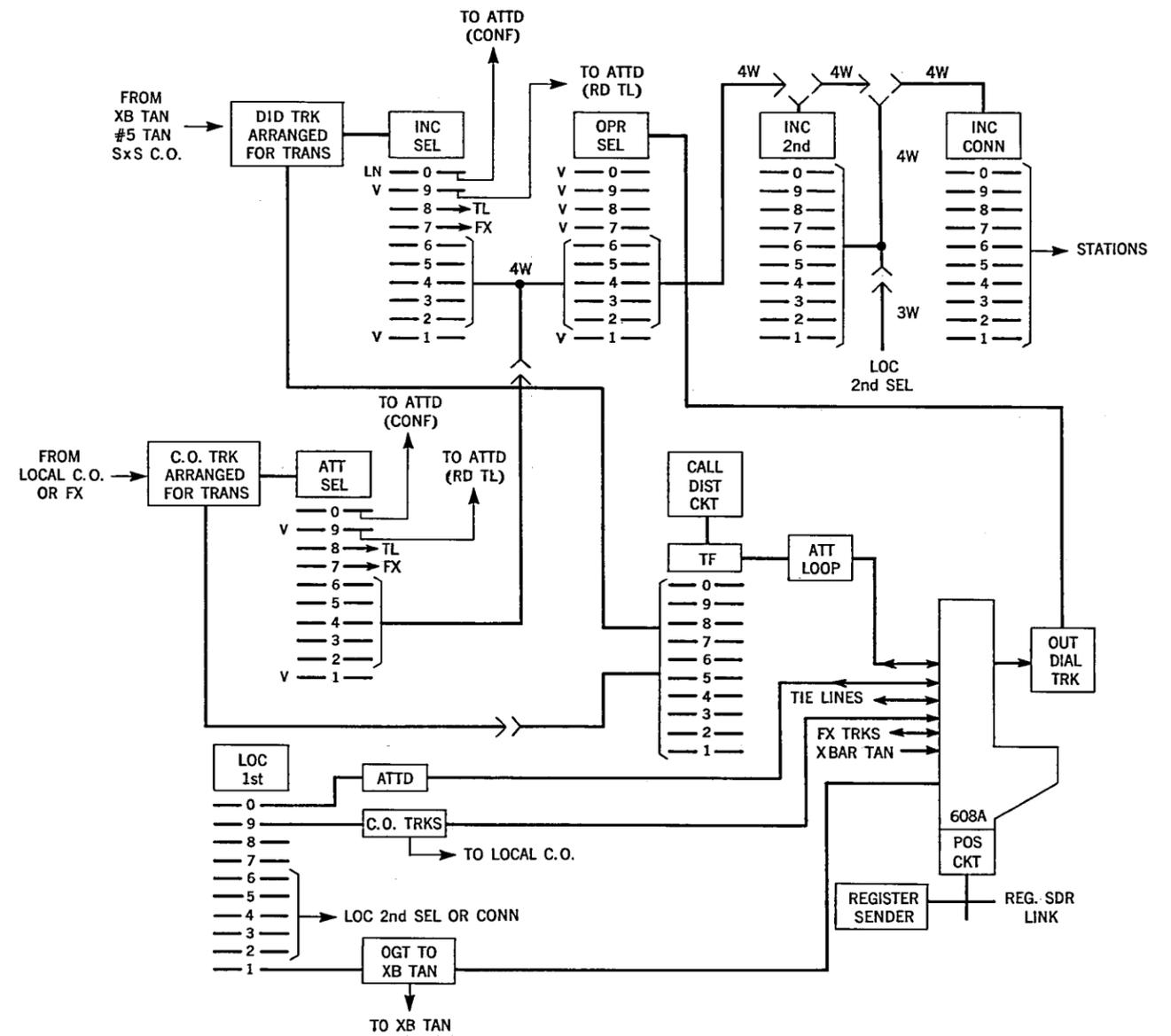


FIG. 1
 STEP-BY-STEP CENTREX
 608A CORD SWITCHBOARD WITH SINGLE & NORMAL
 CORD OPERATION FOR ATTENDANT FACILITIES

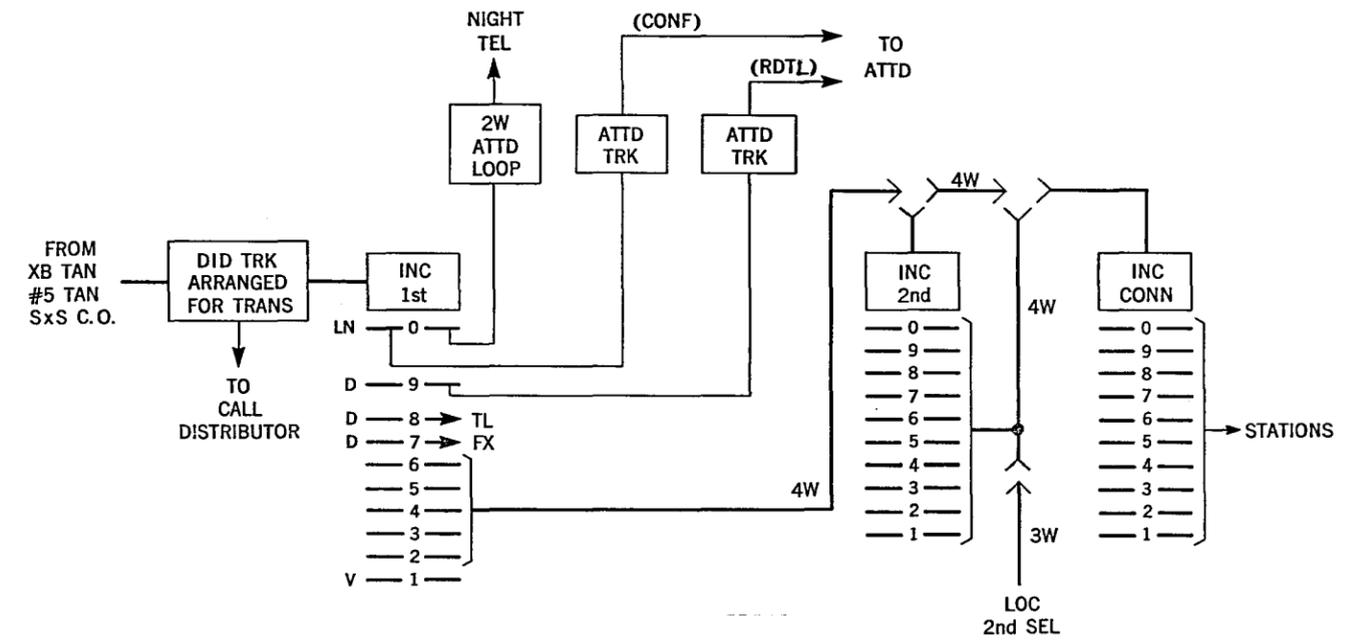


FIG. 2
DIRECT INDIALING TRAIN

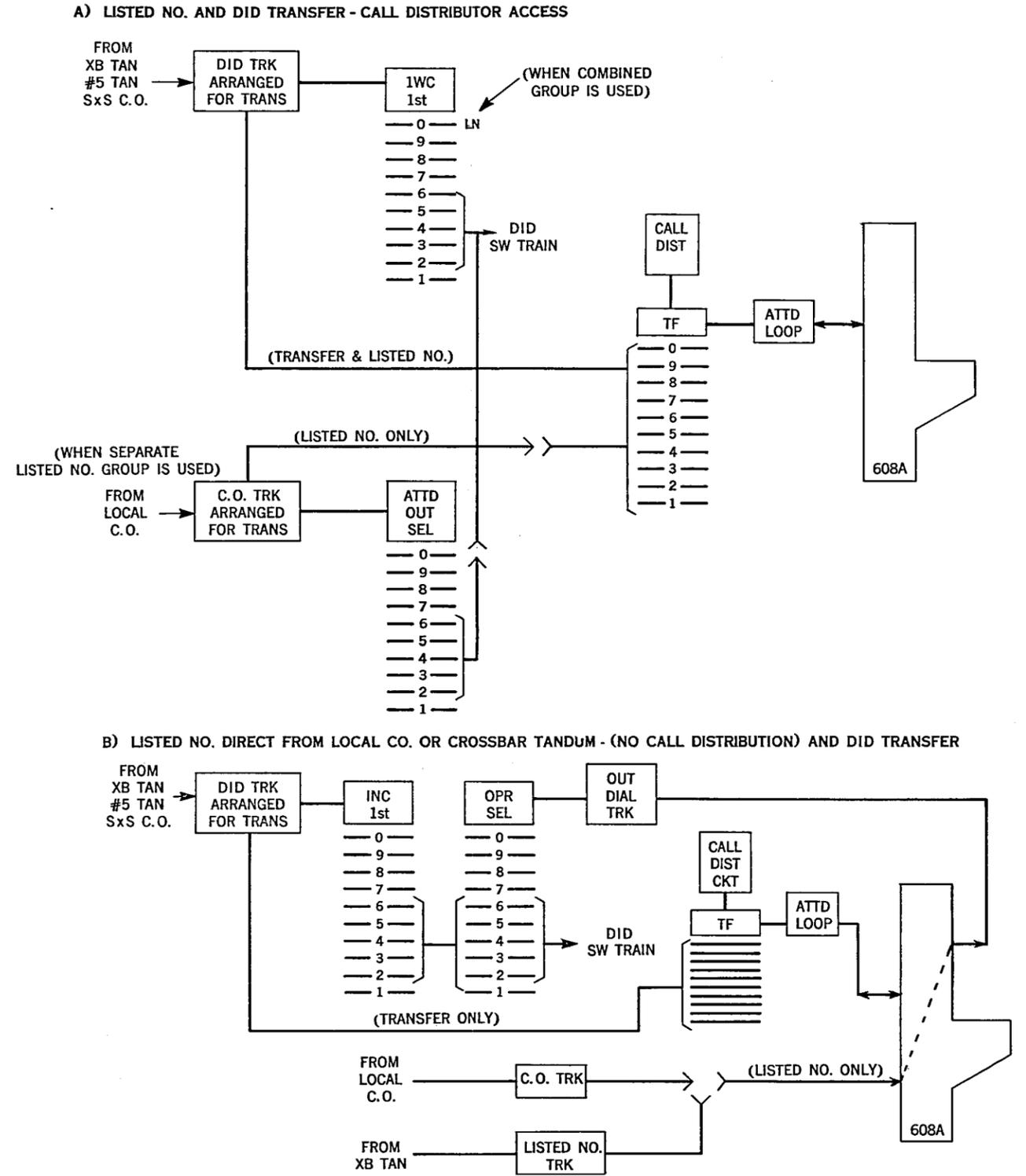
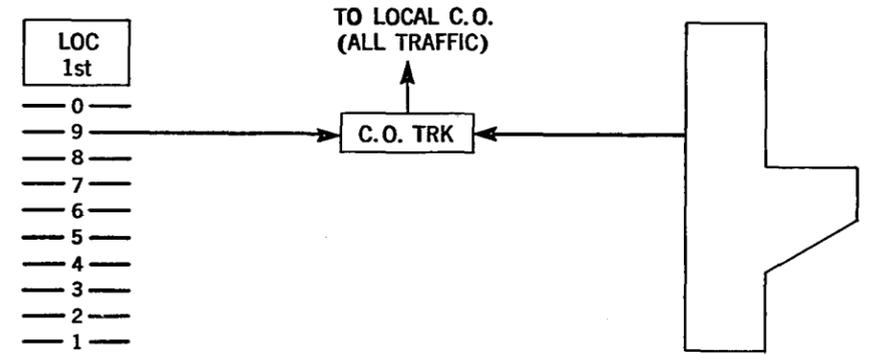
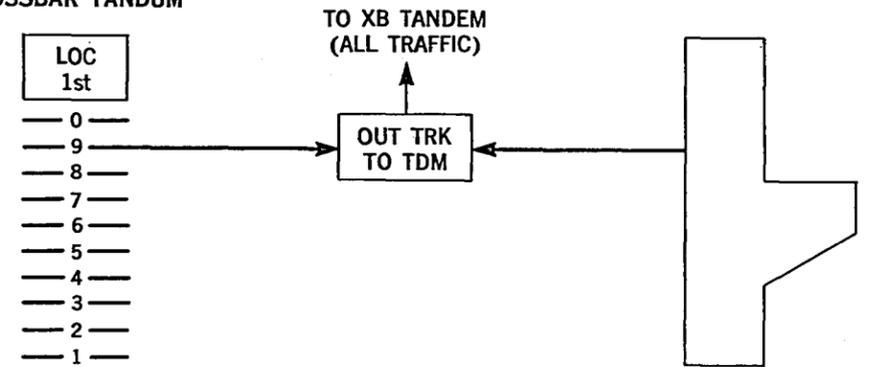


FIG. 3
CONNECTIONS TO ATTENDANT POSITION FOR LISTED NUMBER AND DID TRANSFER CALLS

A) ALL TO LOCAL C.O.



B) ALL TO CROSSBAR TANDUM



C) SPLIT

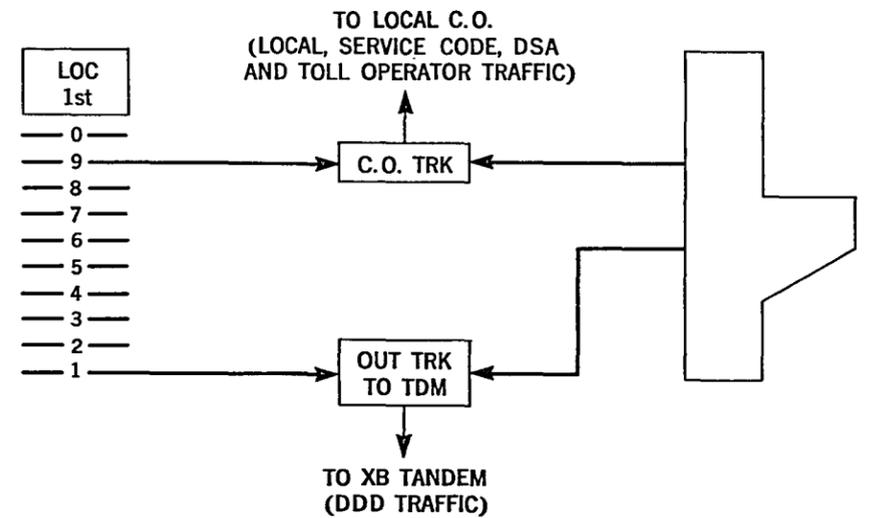


FIG. 4
OUTGOING ARRANGEMENTS