

CHAPTER 12

TOLL SWITCHBOARDS

12.1 INTRODUCTION

The complexity of toll switching probably can be attributed to exceptions and varieties rather than to its general nature. Stripped to its extreme simplicity toll switching involves suitable means for subscribers to reach toll operators, for toll operators to reach subscribers, and for toll operators to reach toll operators. The trunking arrangements for these basic problems of access become involved in detail, but not in principle. They become involved because of different types of switchboards and of central offices, because of the varying interplay of economic factors, and because improvements cannot attain immediate universal application. Toll switchboards, simple in their functions, become involved in detail because of the varieties of arrangements that various circumstances make desirable and often imperative in the rendering of good service at a reasonable cost. It is not within the scope of this chapter to penetrate very deeply into the many details of trunking and switchboard arrangements, but it is rather the intention to present a broad picture of the basic concepts.

The No. 3CL Toll Switchboard is the present standard in a long line of switchboards used for manual toll switching. This switchboard offers improved circuitry and wiring in comparison to preceding boards.

For purposes of this test, we shall consider the board as being representative of all toll switchboards and proceed to discuss its various features.

12.2 THE NO. 3CL SWITCHBOARD

The No. 3CL may be arranged for use as a Dial Systems "A" (DSA) switchboard, combined outward toll and DSA, and as an outward, through, inward or delayed call toll switchboard. Provisions are made to handle DSB traffic at a combined toll and DSA position; however, with the continued increase in the numbers of calls dialed directly by the subscriber or operator the need for DSB positions is rapidly disappearing.

A. TOLL SWITCHBOARD ONLY (WITHOUT DSA FEATURES)

When a subscriber wishes to place a toll call he dials a code or is connected manually to a toll operator known as an outward operator who takes the details of the call and attempts to complete it. This call may be completed without the aid of another toll operator, by the use of intertoll dialing facilities, or it may be necessary to enlist other toll operators to assist in completing this call. When the assisting toll operator is located at the toll center where this call terminates, she is known as an inward operator. If in completing this toll call it is necessary to connect two intertoll trunks together, it may be necessary to enlist the aid of an intermediate toll operator, known as a through operator to perform the switching function of connecting the two intertoll trunks together.

1. Outward Positions - The traffic at outward positions will originate over the recording trunks, recording completing trunks, community dial office trunks, manual lines, etc., and be completed over the intertoll trunks. These intertoll trunks may be selected directly in the multiple of the outward position or through a manual, step-by-step or crossbar toll tandem or via concentrating switches.

Assuming that the intertoll trunk selected terminates at the distant toll center serving the called subscriber and also that this intertoll trunk is of the ringdown type, the ringing signal following the seizure of the intertoll trunk brings in the answering lamp at an inward position at the terminating toll center and when the inward operator answers the outward operator passes the called subscriber's number orally. The inward operator then completes the call.

Since the outward operator is responsible for timing the call she must remain in on connections completed over ringdown intertoll trunks until conversation starts regardless of whether it is a station-to-station or person-to-person call. On calls completed over dial or key pulsing intertoll trunks, since called party switchhook supervision

is received by the outward operator, the timing can be started by observing the cord supervisory lamp on station-to-station calls. However, on person-to-person calls the outward operator must remain in on the connection to determine that the desired party is obtained.

If the intertoll trunk to the terminating toll center is of the dial or key pulsing type the outward operator dials or keys the necessary digits to select the called subscriber's line. Should the outward operator need to go to the terminating toll center for information work she will dial or key the information operator's code. After obtaining the called subscriber's number from the information operator, the outward operator releases the intertoll trunk and sets up the call again including the called subscriber's number. Switchhook supervision is received from the called subscriber by the outward operator and line or all trunks busy conditions are indicated by flashing supervisory lamps or by tone signals.

If in the process of completing a call it is necessary to switch together two intertoll trunks at some intermediate toll center, the outward operator can accomplish this without the aid of an operator at the intermediate point, provided the necessary dial equipment is available at the intermediate toll center and the intertoll trunk selected by the outward operator is of the dial or key pulsing type. The outward operator in this case dials or keys the additional directing digits where necessary, to accomplish the switching function. Also, if the intertoll trunk from the intermediate toll center to the terminating toll center is of the intertoll dialing type the two circuits in tandem will function as described for the direct circuit dial or key pulsing trunk. However, if the second link of the connection is a ringdown intertoll trunk the two circuits in tandem will function practically as described for a direct ringdown trunk. Also, if it is necessary to dial in an operator at the intermediate point to perform the switching function, the circuits in tandem will function practically as a direct ringdown trunk regardless of whether the second link of the connection is an intertoll dial or ringdown trunk.

2. Inward Positions - At the inward positions the traffic originates from the incoming intertoll trunks and is normally completed to subscribers over toll switching trunks. However in some cases toll subscriber's lines may appear in the multiple of the inward position and calls to these lines are completed directly to this multiple. The toll switching trunks may be of the straightforward type to "B" operators in the local manual or dial units or they may be of the dialing or key pulsing type to SXS, panel or crossbar dial units. In the case of the straightforward trunks the inward operator passes the called subscriber's number orally to the "B" operator. For the dialing or key pulsing toll switching trunks, the inward operator dials or keys the necessary digits to select the called subscriber's line. In either case the inward operator receives switchhook supervision from the called line and flashing or tone busy signals to indicate all trunks busy or line busy conditions. These toll switching trunks can be of the immediate ringing variety in so far as handling traffic from inward positions is concerned as there is no reason for the inward operator to delay ringing the called subscriber once the subscriber's line is seized. However, if the toll switching trunks at the inward positions are multiples of the toll switching trunks used by the delayed call positions, these toll switching trunks will be of the delayed ringing variety and in this case it will be necessary to have the inward position arranged to start the ringing automatically when the inward operator has finished dialing or keying or have the inward operator actually operate the ringing key on each call. It should be noted that where multifrequency key pulsing trunks are used the inward operator must always operate the ringing key.
3. Through Positions - For through positions the traffic originates over intertoll trunks and is completed to other intertoll trunks either directly in the multiple or through a toll tandem or No. 4 toll crossbar system. The incoming traffic may be from ringdown intertoll trunks or from dialing intertoll trunks over

which the through operator's code has been dialed. The through operator completes to ringdown and dial or key pulsing intertoll trunks in the same manner as described for the outward operator. Called party switchhook supervision and flashing busy signals are received by the through operator if the intertoll trunks to the called party are of the dial or key pulsing type. However, this supervision is not transmitted beyond the through operator's cord. If the incoming intertoll trunk from the originating operator is of the intertoll dialing type, the through operator receives answer and disconnect supervision from the originating operator and these two operators can recall each other by operating their ringing keys. Where the outgoing intertoll trunk is of the ringdown type no called party supervision is received. Likewise, no plug supervision is received by the through operator if the incoming intertoll trunk is of the ringdown type. Under this condition it is the responsibility of the outward operator to ring at the finish of conversation so that the through operator will know when to disconnect such a connection.

4. Delayed Call Positions - When an outward operator encounters a delay in completing a call, the calling subscriber is dismissed (if waiting at the telephone) and the ticket forwarded for final handling to a team of operators whose function is to complete such calls. These operators have access to the same outgoing intertoll trunks and toll switching trunks as the regular outward operators and complete over these outgoing paths in the same manner. The switching trunks are arranged for controlled or delayed ringing to enable the operator to seize the subscriber's line but delay ringing his bell until the call has been completed to the called subscriber. Also some of these controlled ringing switching trunks are arranged for coin control to handle the delayed traffic to coin box lines.

The delayed call positions are also used for completion of incoming reverse charge calls to coin box lines. When the distant operator determines that the called line to which the call is to be charged is a coin box line (such information is obtained from the information operator at the terminating toll center) she reaches a delayed call operator at the terminating toll center and passes the details of the call. The delayed call operator then reaches the called line over a toll switching trunk arranged for coin control. The timing and collecting for such calls are the responsibilities of the delayed call operator.

On person-to-person calls, if the called party's line is available but the particular person cannot be reached, the calling party may request the outward operator to have the particular person call the calling party as soon as available. Under such conditions the outward operator leaves word for the wanted person to call a particular operator who is identified by a number preceded by the toll center name, such as "N.Y. Operator 11438." The number is the identity of the team of delayed operators to which the ticket has been forwarded. When the particular called party is ready to talk he places his call with his outward operator in the regular manner asking to be connected to the designated operator (N.Y. Operator 11438). The distant outward operator completes this call forward in the normal manner and requests connection to or dials or keys the code for the particular team of operators identified by the number. If the inward operator at the terminating toll center is involved she will complete the connection to the delayed call positions over an interposition or interoffice trunk. If the terminating toll center is served by SXS intertoll dialing system, a dial tandem or No. 4 toll system, the code dialed or keyed by the distant operator will automatically select a trunk to the particular team of delayed call operators. (These trunks are commonly known as "WH" or "TX" trunks.) The delayed call operator then reaches the calling party over a switching trunk and times the call in the usual manner.

An effort is now being made to reduce the work of the ticket operators by requesting the calling party to place the call again later rather than by having the originating operator offer to try again later as has been the practice in the past. This way the original ticket can be canceled and forgotten. On "leave word" calls, the person answering the called number is requested to have the called party call the originating toll center (OTC) operator and is also given the name of the calling party so that he can give complete details to the OTC operator who writes a new ticket without having to look for the original ticket. Eventually the new ticket with the complete call details is matched with the original ticket and the original ticket scratched. It is very desirable to reduce the amount of tickets required to a minimum since the new mark sending method of ticket writing involves the use of data cards which cannot be sent through present pneumatic ticket distributing systems, but must be distributed by messengers instead.

Mark sensing is a method of recording toll calls by means of marks on specially designed card-type tickets. Operators mark the tickets in designated locations which indicate route and dialing codes, called place, the central office, type of calling number, etc. Cards are then processed in a machine that punches a hole represented by each mark. Machines then compute, sort and print customer's toll statements.

Marking is done with a pencil, and the marks have the ability to conduct electricity. When mark sense cards are processed, electrical brushes move down over the bubbles in each column on the card, one in the center, and one near each end of the bubble. When the brushes reach a properly made mark, an electrical impulse passes through the mark between the center brush and either or both of the outer brushes. The machine then senses the mark and translates it into an appropriate punch which can be read by other machines.

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B. COMBINED TOLL AND DSA SWITCHBOARD

At a combined toll and DSA switchboard there is a certain amount of DSA traffic which originates over the recording-completing trunks in addition to the normal toll traffic originated by these trunks. This assistance traffic can be completed over the direct toll switching trunks which are available for handling the toll traffic. However, since direct toll switching trunks to all the local dial or manual units may not be available, facilities are usually made available to the combined toll and DSA operator which will permit the operator to use the normal completing paths used by the dial subscribers for completing this assistance traffic. These completing trunks, known as toll switching trunks, to local SXS selectors for SXS areas, operator's district junctors for No. 1 crossbar areas, operator's completing trunks for No. 5 crossbar areas or operator's districts for panel areas, are of the noncoin immediate ringing type.

In addition to the foregoing, facilities are usually provided at a combined toll and DSA switchboard for handling some or all of the following items of DSA traffic: intercept, verification, sender supervisory (sender monitor and permanent signal), trouble observation and test, coin supervisory, coin overtime, coin zone dialing, official PBX, business office lines, emergency completion to fire and police lines, emergency manual service for selected dial lines, route transfer arrangements and load control lamps. Since most of the above items require specialized handling, they are usually confined to one or two positions at the head end of the switchboard.

Facilities may also be provided for handling call distributing "B" traffic at the combined toll and DSA switchboard. If a separate DSB switchboard is provided, arrangements can be provided whereby the separate DSB switchboard can be closed down during the periods of light load and the light load DSB traffic handled at one or more combined toll and DSB positions along with the normal toll and DSA traffic. Also, if the DSB traffic requirements are too small to warrant a separate DSB switchboard, one or more positions equipped with DSB position equipment can be placed in line with the combined toll and DSA switchboard to provide exclusive DSB positions.

C. DSA ONLY SWITCHBOARD (WITHOUT TOLL FEATURES)

With a DSA only switchboard the toll traffic will be directed to the toll switchboard over the "110" or "211" channel and the assistance traffic to the DSA switchboard over the "0" channel. However, there will be a certain amount of station-to-station or A-B toll traffic which will originate over the "0" channel. This traffic is handled in the same manner as described for an outward operator. The completion of this traffic requires delayed or controlled ringing completing trunks (toll switching) and the method of operation is similar to that at a delayed call position. Assistance traffic and other DSA types of traffic are handled in the same manner as covered for the combined toll and DSA switchboard.

A certain number of calls on which the subscriber should have dialed the Long Distance code but dialed "0" instead, will reach the DSA operator over the "0" channel. These calls can either be turned back and the subscriber told to dial the Long Distance code or operator recording-completing cords and trunks can be provided at the DSA switchboard to extend these calls to the toll switchboard for final handling. The use of these operator recording-completing cords and trunks permits the switchhook supervision of the calling subscriber to be extended to the toll switchboard operator and also permits the toll switchboard operator to recall the calling subscriber without the aid of the DSA operator. Disconnect supervision is given the DSA operator when both the calling subscriber and the toll switchboard operator have disconnected.

12.3 NO. 3CL SWITCHBOARD CIRCUITS

With the exception of the DC key set and MF key set circuits the existing No. 3C switchboard circuits have been retained for use with the No. 3CL switchboard.

A. CORD CIRCUIT

The cord circuit which functions with a common position circuit is a two relay switchboard cord circuit. One relay operating under control of the Talk key controls the switching of the tip, ring, sleeve and lamp leads to the position circuit. (If a dial or key set circuit is used the tip and ring

leads are carried through the dial or key set circuit to the position circuit.) The other relay, which operates under control of the Ringing key switches a separate set of tip and ring leads to the position circuit which are used for ringing and coin control purposes.

With the cord circuit keys normal, the tip and ring leads are connected straight through the circuit without intervening apparatus, and the sleeve circuit consists of 24 volt battery fed in parallel through 1/2 of a 1000 ohm resistor and the respective cord supervisory lamp to the sleeve of the cord. When the cord is connected to a trunk circuit, the sleeve of the cord is connected (in the trunk) through an 1800 ohm winding (or resistor) to ground. The 1800 ohm winding may or may not be shorted to ground through an 85 ohm winding (or resistor). When the 85 ohm winding is connected, there is sufficient current flowing in the cord sleeve circuit to light the supervisory lamp to give "on hook" (lighted lamp) supervision. When only the 1800 ohm winding is connected there is insufficient current in the sleeve circuit to light the lamp and we have "off hook" (dark lamp) supervision. Both the 1800 and 85 ohm windings are usually found on one double wound sleeve relay, although occasionally separate relays are used and also sometimes either may be replaced by a resistor.

B. POSITION CIRCUIT

The position circuit functions with the cord, dial or keyset and grouping circuits. This circuit provides for connecting the cords to the telephone circuits and for performing certain functions with respect to supervision, ringing, splitting, dialing, key pulsing, coin control, transfer, tone removal and number checking. The various individual functions are associated with a particular cord by the operation of the listening key of that cord to the talking position in conjunction, where necessary, with the proper common key.

C. GROUPING CIRCUIT

The grouping circuit for the 3CL switchboard is connected between the position circuit and the operator's telephone circuit. This circuit is arranged for successive grouping of positions within the same line of switchboard from left to right regardless of direction of growth of the

switchboard. By means of a key located in the miscellaneous key and lamp mounting space at the top of the multiple, any position may be grouped with the adjacent position on the right. Any number of positions may be grouped and the telephone set jacks of any one position in the group are effective. This enables an operator to handle more than one position during periods of light load.

D. OPERATORS TELEPHONE CIRCUIT

The operators telephone circuit provides means whereby the toll operator may communicate with subscribers or other operators or monitor on established connections. It is also arranged to permit the toll operator in panel areas to communicate on a number checking trunk and monitor on the regular connections at the same time.

E. KEY SET CIRCUIT

Three key set circuits are available for use with the 3CL switchboard. These are for use where DC key pulsing, MF key pulsing or combined MF-DC key pulsing are required. The 3CL switchboard positions are universally wired such that they may be equipped for any of the above types as required. Thus, it is possible to initially equip a position for DC key pulsing and later convert it to combined MF-DC key pulsing with a minimum of effort and expense.

The DC key set is used where pulsing into DC key pulsing senders is required while the MF key pulsing set is used when pulsing into multifrequency key pulsing senders or when pulsing over outgoing MF key pulsing trunks. Where it is necessary to pulse into both DC key pulsing senders and MF pulsing senders or over outgoing trunks arranged for MF pulsing, the combined DC-MF key set is used. With the combined MF-DC key set, the key set is normally in a DC key pulsing position. When connection is made to a trunk requiring pulsing into MF key pulsing senders or over outgoing trunks arranged for MF pulsing, a mark on the trunk automatically switches the keyset to the MF condition. This trunk mark is 1000 ohms or less to ground on the ring of the trunk.

MF key pulsing trunks that are arranged for operation with MF-DP senders cannot be used with combined MF-DC keysets since these trunks lack the mark necessary to condition the combined keyset to the MF condition.

The tip and ring leads of both front and rear cords which normally connect to the position circuit are looped through closed contacts of relays in the keyset (or dial) circuits to the position circuit. When either the front KP or rear KP key is operated the corresponding relay operates to transfer the tip and ring leads of the associated cord to the keyset circuit as well as a number of control leads to the position circuit. This prepares the circuit for use as soon as a sender attached signal is received on the appropriate lamp.

F. DIAL CIRCUIT

Dialing is provided in small offices only and is arranged for repeated dialing. The No. 3CL switchboard dial circuit is suitable for both local and intertoll dialing. A start dialing lamp is provided in each position when dialing is furnished. This lamp functions as a dial pilot in simple dial operations and as a start dialing signal in connection with intertoll dialing and certain community dial arrangements. A dial key is used to connect the dial circuit with either the front or rear cord on which the operator is working.

G. OPERATOR RECORDING-COMPLETING CORD

Provision has been made for equipping each outward position of the 3CL switchboard with either one or two operator recording-completing cords. These cords are used in conjunction with operator recording-completing trunks for extending mobile radio or other special traffic originating at one operating unit to the mobile service or other operator at another operator unit for final handling.

The operator recording-completing cord circuit is equipped with a single supervisory lamp and a talking key. The two lamps and two talking keys for the two cords per position are mounted on a single "G" type key base located at the left of the position. No provision is made to omit one lamp and one key in those cases where only one cord is provided. The talking key is integrated with the other talking keys on the same 3CL switchboard position so that only one talking key will be effective regardless of how many talking keys are operated.

The operator recording-completing cord is arranged to provide the following supervisory features:

- (a) Supervision from the calling subscriber prior to the answer of the mobile service operator.
- (b) Through supervision from the calling subscriber to the mobile service operator after the mobile service operator answers.
- (c) Flashing and disconnect supervision from the mobile service operator.

H. TEST CORDS (TEST LINES)

Provision has been made for mounting test cords in the head end position, foot end position and in the space assigned to cords Nos. 1 and 2 in the regular outward positions when these cords are not equipped. The test cords, except those located in the blank end position, can be equipped with supervisory lamps if desired. Test trunks are used to connect toll switchboard circuits to the testing equipment at the local test desk or at the toll test board used in locating trouble. The test trunks can also be used to connect toll switchboard circuits to transmission measuring equipment in order to provide facilities for making transmission measurements.

12.4 MONITORING ARRANGEMENTS

The foot end position of a 3CL switchboard lineup can be arranged as a monitoring position. The monitoring circuit provides means whereby an observer may monitor on the telephone circuit of any supervisor or operator. It also provides means for checking the keying accuracy of toll operators completing calls by key pulsing or the dialing accuracy of toll operators completing calls by dialing. This circuit may also be used to check the accuracy of the toll operators in counting incoming calls, more familiarly known as peg count.

The tip and ring leads of the observed telephone circuits are connected in position monitoring jacks at the monitoring position. One jack is provided for each telephone circuit on which monitoring is required.

To observe on a position the observer at the monitoring position inserts the monitoring cord plug into the position monitoring jack desired. This connects her telephone set across the T & R leads of the operator's telephone set.

A. PEG COUNT CHECKING

Peg count checking facilities are available if desired. The arrangement consists of a lever type key, a lamp and a message register mounted in the lower part of the last panel of the switchboard. The other position of the lever type key is used for keyset observing when required. When the observer connects to a line as described above, she hears the verbal operating at the position under observation. When the operator's positional peg count key is operated the observer's peg count lamp lights for the duration of this operation. If the operator's peg count key is properly operated, the observer's register will score along with the regular position peg count register.

B. POSITION KEY MONITORING

Key set observing facilities are generally provided for all 3CL switchboards so that operator keying performance can readily be obtained. With keyset observing, the keyed digits are displayed in front of the observer on a group of indicators located in the last panel of the board. When the lever type key mentioned in the previous paragraph is in the KM position and the monitoring cord inserted in the position monitoring jack, the digits keyed by the operator are displayed on the indicators. All displayed digits remain locked in until the observer restores the key to its normal position or removes the cord from the position monitoring jack.

Each indicator plate has a capacity of four digits. Thus if a maximum of 11 digits were to be keyed, three indicators would be necessary.

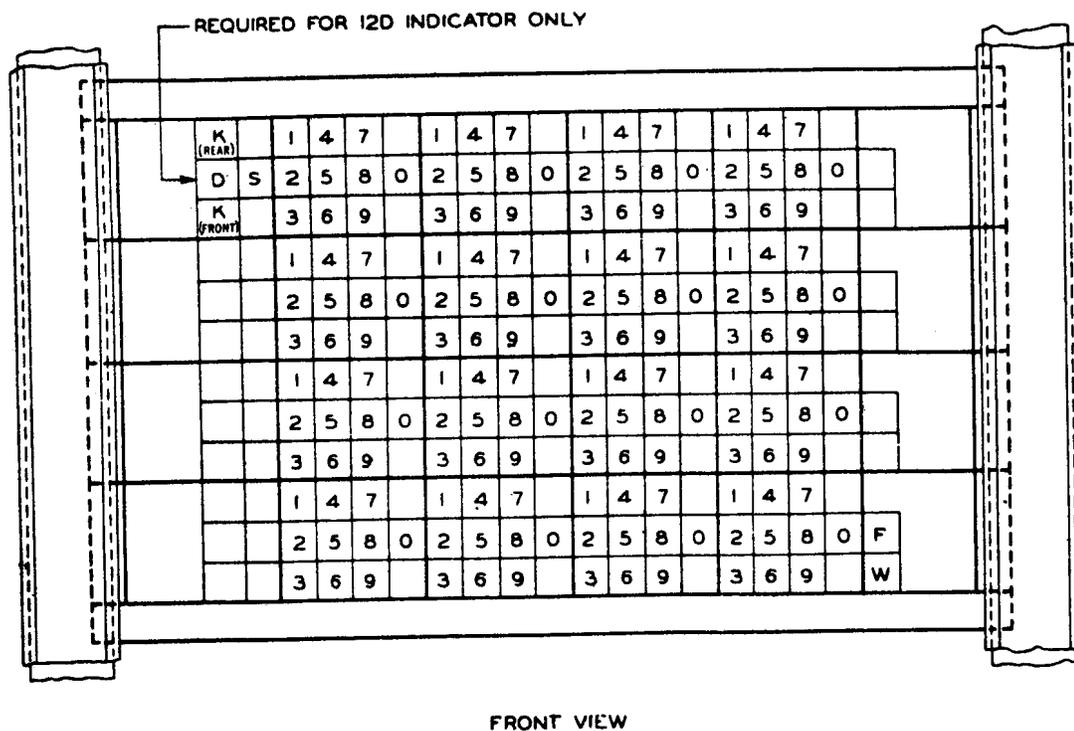
A four indicator arrangement for toll use and a two indicator arrangement for combined DSA and DSB use is shown in Figure 12-1. In the four indicator arrangement, the lamps designated with letters at the left of the top indicator function as follows. The "K" lamps indicate the operation of front or rear KP key as designated, "S" is the sender lamp and D is a number checking lamp. The digits keyed by the

operator start at the left of the top indicator and proceed from left to right across the indicator and then from left to right across the next indicator below and so on until all digits keyed have been displayed. At the right of the bottom indicator are two lamps designated by letters "F" which indicates the operation of the start key and "W" which shows registration complete.

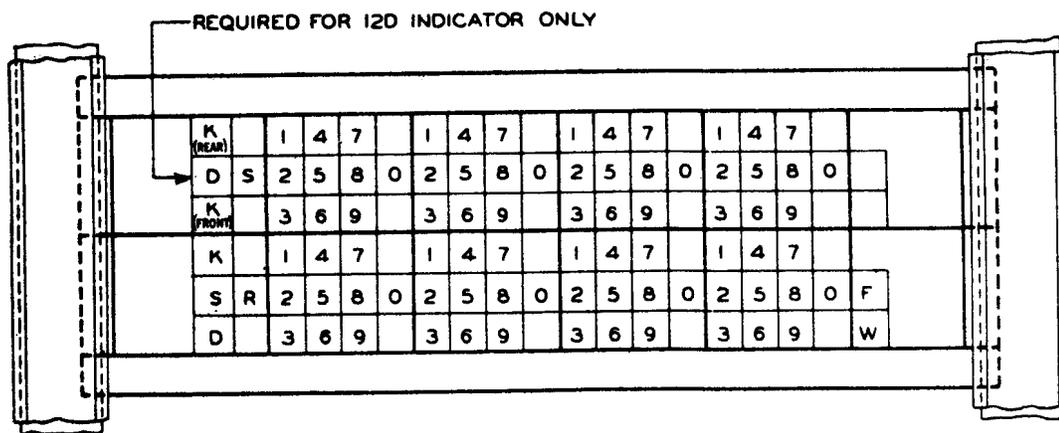
In the two indicator arrangement shown when used for DSA keyset observing, the indicators function exactly as described above except the maximum digit capacity is eight digits. For DSB keyset observing, the lamps designated with letters at the left of the bottom indicator have the following functions. "K" shows a call has been connected, "S" is the sender lamp, D indicates operation of the position disconnect key and "R" indicates operation of the reset key. The four digit lamps in the bottom indicator from left to right shows the thousands, hundreds, tens and units digits of the called number and the "W" lamp indicates registration complete. If a "B" office code is required, the extreme right digit of the top indicator is used for this purpose.

C. DIAL MONITORING

Observing is accomplished for positions having dialing features by recording the digits dialed by the operator on a pen register rather than the indicator used for observing key pulsing. When the observed plugs the monitoring cord into a position monitoring jack and operates a dial monitoring key, the digits dialed by the operator under observation are registered on the tape of the pen register which can be read by the monitoring operator.



FOUR INDICATOR ARRANGEMENT FOR TOLL BOARD



TWO INDICATOR ARRANGEMENT FOR COMBINED DSA & DSB BOARD

FIG. 12-1 NO. 3CL SWITCHBOARD KEYS ET OBSERVING INDICATORS

12.5 COIN CONTROL ARRANGEMENTS

The 3CL switchboard is arranged for positional coin control. The operator depresses the positional collect or return key and then connects the correct coin potential to the line or trunk by operating the ringing key associated with the cord which is plugged into the line or trunk. This permits coin potential to be applied to either cord. A typical circuit is shown in Figure 12-2.

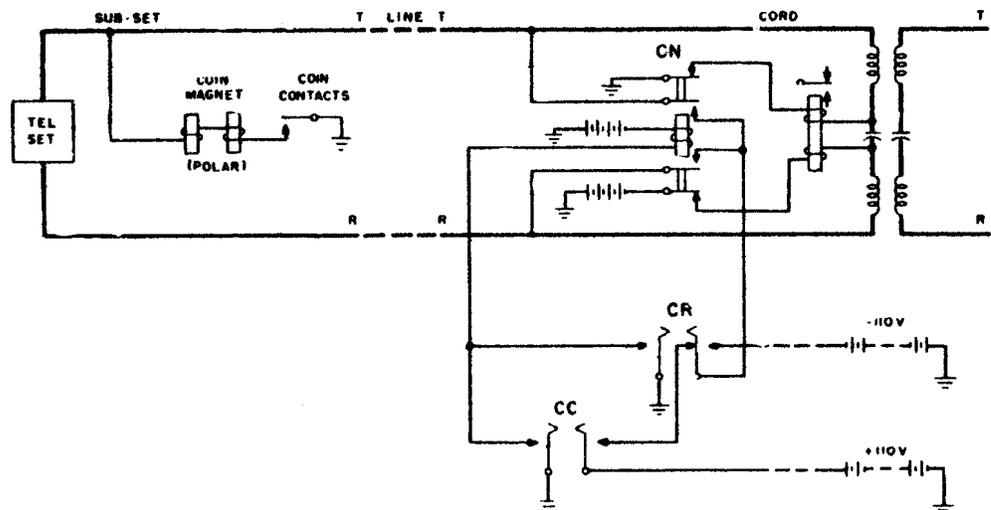


Figure 12-2 Coin Collect and Return Circuit

12.6 MISCELLANEOUS 3CL SWITCHBOARD FEATURES

A. SERVICE ASSISTANT CALL CIRCUIT

The service assistant call circuit provides a means for calling a service assistant. A key is located in the piling rail and a white beehive lamp above the multiple. Operation of the key lights the lamp as an indication to the supervisor handling that position that assistance is required.

B. ROUTE TRANSFER AND MAKE BUSY ARRANGEMENTS

In periods of light traffic it may be desirable to reroute toll traffic originating in a panel, crossbar or SXS office from positions normally handling this traffic to other positions which may be in the same or a distant building. In a panel or crossbar system this is accomplished by operating a key which operates a route relay in the decoder or marker of the panel or crossbar office. The route relay informs the decoder or marker to reroute traffic from the normal toll switchboard to the light load or night position. In a SXS office the operation of the key operates a transfer relay causing groups of trunks to be transferred when idle. The transfer keys are located in the first panel of the switchboard of the office normally handling toll traffic from the local offices involved.

Trunks which are not transferred in a SXS office can be made busy by the operation of a make busy key. Thus, these trunks test busy when they are idle.

C. LAMP TRANSFER AND MAKE BUSY

The Lamp Transfer and Make Busy circuit is used to transfer the lamp leads of one or more groups of circuits to a night or a light load position and when necessary for making busy other groups that are not transferred.

D. NIGHT ALARM CIRCUIT

The night alarm circuit provides an audible and visual signal at a switchboard position when a signal is received on an associated circuit such as an alarm circuit. It is intended for use during light load periods when the maintenance force is at a minimum. The night alarm key, located in the first panel above the multiple, when operated causes an audible and visual signal at the switchboard when any of the associated circuits receive a signal.

E. FUSE ALARM CIRCUIT

A fuse alarm circuit is furnished for the 24 volt and 48 volt battery fuses mounted in the rear of each switchboard position. A lamp is located above the multiple in each position to indicate a failure in that position. A fuse alarm pilot lamp located above the multiple in the first panel signals a failure in any position.

F. LINE AND TRUNK LAMP AND ALARM CONTROL CIRCUIT

Where it is desired to provide for call storing arrangements a line and trunk lamp and alarm control circuit is provided. The control key for this circuit and its associated pilot lamp as well as the alarm key are located in the first panel of the head end position for 7 panel multiple switchboards; in the cable turning section for 6 panel multiple switchboards or above the multiple for 6 panel multiple 6'2" height switchboards.

This circuit is intended for use during periods of heavy traffic load. It provides means for alternately permitting the lighting of all trunk and line lamps associated with waiting calls and then preventing the lighting of any more trunk or line lamps until all calls in the first group have been answered, thereby assuring that no call will be overlooked because of the heavy traffic load.

G. DOOR OPENING CIRCUIT

A door opening circuit may be provided at a position in the toll switchboard lineup by means of which the operator can open the door leading to the operating room. Operation of a key located in the piling rail releases the door latch.

H. EMERGENCY RINGBACK CIRCUIT

An arrangement is available to permit a DSA operator to ring back a calling customer over a recording completing or special service trunk in case of an emergency where the calling number has not been obtained. The circuit is primarily intended for calling back on a line which has originated an emergency call for the police, fire department or an ambulance and then abandoned the call without identifying either the calling station or person.

A nonlocking key located in the piling rail is provided at each position for this purpose. The operator operates this key in conjunction with her regular cord ringing key.

I. PERMANENT SIGNAL CORD

Those positions handling calls coming in on trouble observation and test trunks and permanent signaling holding trunks are equipped with a permanent signal cord. This cord, when plugged into the TST jack of the above trunks, permits the operator to talk, apply standard 20 cycle ringing, reversed 20 cycle ringing or nongrounded 20 cycle ringing to the line. Howler tones can also be applied to the line if so desired. If the howler feature is equipped, a busy lamp is provided with each cord to indicate when the common office howler supply is in use by another permanent signal cord. A supervisory lamp is also provided to furnish subscriber switchhook supervision.

J. NUMBER CHECKING

1. SXS - The regular 3CL cord circuit is used for number checking in SXS areas. The "dial-back" method of number checking is used in conjunction with number checking trunks. The recording completing trunk number and the subscriber's number are dialed over a number checking trunk outgoing to a number checking selector in the SXS office. The number checking selector returns a visual signal to the toll operator indicating whether or not a successful check has been made.
2. Panel - The straightforward number checking arrangement is used for calls from panel areas. It requires the use of separate number checking cord. The toll operator reaches the DSA operator at the panel office over a number checking trunk and verbally requests a check of the number. The DSA operator can then set up a "check" or "no check" condition which returns visual signals to the toll operator.
3. Crossbar Areas - A separate number checking cord is also used for calls originating in crossbar offices. Two methods of number checking tolls from crossbar areas are available.

If the subscribers number being checked is in a crossbar office being served by a call distributing "B" board, the toll operator

reaches the "B" operator over a number checking trunk via the number checking cord and verbally requests the "B" operator to key the number.

If the subscribers number can be reached by using MF pulsing, the operator operates the front key of her keyset and upon receiving a lighted "sender ready" lamp, keys the subscriber's number over the number checking trunk. A visual signal is returned to the toll operator indicating a "check" OK or "no check" condition. The MF-KP arrangement can be used either where the 3CL switchboard and the crossbar unit are in the same or distant buildings. An arrangement is also available, which enables an operator to DCKP the number checking calls in the same building only. Where combined MF-DC keysets are furnished in the switchboard, DCKP is used for number checking to crossbar units in the same building and MF-KP for crossbar units in other buildings.

Since the 3CL switchboard scheme of number checking requires that the talking key of the regular cord used to answer the recording completing trunk and the talking key of the number checking cord be operated at the same time, the operators telephone circuit is connected in the monitoring condition across the regular cord and in the talking condition across the number checking cord. This enables the 3CL operator to pass the calling subscribers number verbally on straightforward calls or to attach the key set to the number checking cord by operating either KP key and at the same time monitor the regular connections.

K. NUMBER CHECKING LAMP SIGNALS

The lamp signals for number checking as received at the toll switchboard are shown in Table 12-1.

Table 12-1 Number Checking Lamp Signals

Condition	Number Checking Cord Lamp			
	Straight Forward	Dialing	Key Pulsing DCKP	MFKP
1. Plug In	Lighted	Dark	Lighted	Dark
2. Sender Attached and Ready to receive pulses		Lighted	Lighted	Lighted
3. Keying or Dialing		Lighted	Lighted	Lighted
4. Dial Key Released - Key Set Released - (ST) Key Operated		Lighted	Lighted	Lighted
5. O.K. Check	Dark	Dark	Dark	Dark
6. Failure to Check	Flashing	Flashing	Flashing	Flashing

12.7 CENTRALIZED SUPERVISORY CONSOLE

A centralized supervisory console has been developed to permit one supervisor to handle a maximum of 70 operator positions. Two consoles can be multiplied to serve the same 70-position unit. If more than 70 positions are to be served by the centralized facilities, the incoming circuits can be multiplied to two consoles so that each console can answer 140 operator positions. However, each of the consoles can originate calls to a maximum of 70 positions. The new facilities will enable the telephone companies to use supervisor time more efficiently and at the same time provide the supervisors with more attractive and effective equipment.

A supervisor will use a console which will permit her to:

- (a) Answer calls from operators or customers.
- (b) Originate calls to any of the 70 operator positions.
- (c) Monitor on any of the 70 operator positions.
- (d) Originate dial calls over a dial central office line circuit.
- (e) Originate nondialable calls over a toll subscriber line.

Figure 12-3 shows the new supervisory console.

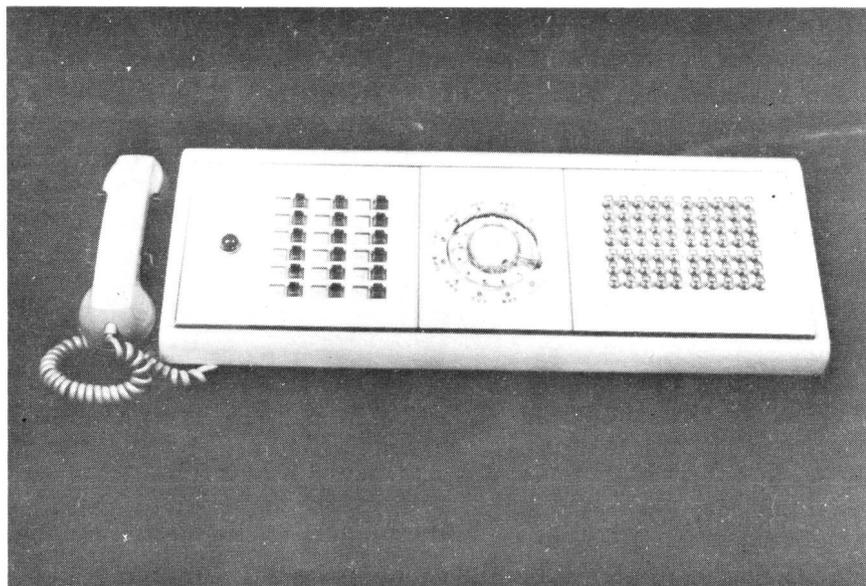


Figure 12-3 Centralized Supervisory Console

12.8 TRUNKS ASSOCIATED WITH TOLL SWITCHBOARDS

Because of the numerous listings of trunks associated with the 3CL switchboard, we shall consider these circuits in groups and give detailed attention to only a few typical circuits. There are several ways in which the trunks can be grouped, such as:

- (a) By direction of Traffic (incoming, outgoing and 2-way).
- (b) By type of traffic (toll, local).
- (c) By type of circuit (toll switching, recording-completing, intertoll, etc.).

A. INTERTOLL TRUNKS

These trunks can be divided into three subgroups consisting of ringdown, automatic, and intertoll dialing trunks. The circuits used in completing a toll call are of two general types known as intertoll trunks and toll connecting trunks. The intertoll trunks are used for that portion of the call extending between Toll Centers (TC) and the toll connecting trunks for the portion of the call between the local office line circuits and the toll switching equipment in the Toll Center which may be of either the manual (switchboard) or machine switching (dial) type.

1. Ringdown Trunks - Ringdown intertoll trunks are the type which, previous to the advent of intertoll dialing, carried practically all intertoll calls. The name "ringdown" derives from the fact that the earliest circuits actually rang down drops located in the switchboards. On present day circuits the ringing current actuates relays which in turn light line lamps to signal the called operator. Either the called or calling operator can signal the other operator during the progress of a call by ringing, in which case the recall signal appears on the cord circuit supervisory lamp and at the end of a call the originating operator again rings as a disconnect signal. Auxiliary trunks can be connected to ringdown trunks to permit intertoll dialing trunks to complete calls to points served only by manual means.
2. Automatic Trunks - Automatic trunks are those trunks which automatically signal the called operator upon seizure by the originating operator. They are mainly used in transferring calls between toll switchboards in the same area and are generally used in pairs, one of which is arranged for rering and the other to repeat the ringing signal. The use of these trunks is restricted mainly to those situations where an outlying toll office does not have access to a full complement of the intertoll trunks appearing in the main toll office. The circuit arranged for rering is used at the outlying office and the one arranged to repeat the ringing signal is used

at the main office. Either operator may recall the other operator by replugging. The use of these circuits has become greatly reduced in recent years since most toll centers, large enough to have more than one toll office, are now equipped with either toll crossbar, crossbar tandem, or #5 crossbar toll offices; and can be reached over tandem trunks from the outlying office, thus enabling the outlying office to have access to all trunks appearing in the automatic office. There are a few other applications of automatic trunks which do not warrant consideration in this text.

3. Intertoll Dialing Trunks - Intertoll Dialing Trunks are those trunks in which the routing of the call is controlled by some type of pulsing. Only those intertoll dialing trunks with an appearance in the toll switchboard itself will be considered in this chapter. The most commonly used circuits are those which have their outgoing appearance in the switchboard and the incoming appearance in the automatic switching equipment. These circuits can also be used for outgoing traffic from the automatic switching equipment where this equipment is serving as a tandem point. These circuits can be either of the dialing DC key pulsing or MF key pulsing type on the switchboard end but must be dial pulsing incoming for use with SXS type intertoll dialing equipment. Trunks which are incoming on an MF pulsing basis must terminate on crossbar toll switching equipment, crossbar tandem or #5 crossbar equipment; those calls directed to the switchboard reach it through auxiliary or incoming trunks or are routed directly to answering jacks in the case of the #5 crossbar office. These trunks are reached by means of outgoing tandem trunks to the crossbar equipment for calls outgoing from the switchboard. The outgoing tandem trunks make all outgoing or two way intertoll trunks, terminated in the crossbar office, available to the switchboard operators.

Incoming traffic is only routed to the switchboard where the called party cannot be reached on a dial basis (manual office's, some CDO's and some nonassociated areas), on TX calls and reverse charge calls or where additional information is required. The bulk of the incoming calls are completed on a dial basis; as a result, the inward traffic on toll switchboards has fallen off greatly in recent years and will decrease still further as more and more offices are made available to the intertoll dialing network.

In some cases the trunks are used on a temporary manual (automatic or straightforward) basis when they are used with manual areas not equipped with incoming automatic switching equipment. If the distant manual board is equipped for dialing, these trunks can still be used for incoming calls on a dialing basis.

Most intertoll dialing trunks use E and M lead (CX) signaling although there are a few circuits of the loop signaling type available for use on short haul circuits.

There are a few cases where trunks are used to manual offices which are not arranged for pulsing or where for other reasons the incoming calls must be on an automatic signaling rather than on a dialing basis. In these cases the incoming end of the intertoll trunk is connected to the switchboard incoming trunk through an auxiliary circuit.

B. TOLL SWITCHING TRUNKS

Toll switching trunks are a subgroup of a larger group of trunks known as "Toll Connecting Trunks." Toll connecting trunks are those trunks which are used between the toll switching equipment (manual or automatic) and the local equipment to which toll calls can be connected. The main trunks in this group are the toll switching and recording completing trunks although there are others such as toll subscribers lines, trunks to some desks, etc. These are the trunks which must have at least a 2db loss in offices operating on a VNL basis.

CH. 12 - TOLL SWITCHBOARDS

Toll switching trunks are used primarily in completing incoming toll calls to the local subscribers, as well as delayed outward calls and incoming TX calls. Those trunks operating on a dialing basis (or key pulsing) may connect to either toll or local trains in the local office. Where toll trains are used the toll switching trunks are usually arranged for controlled ringing. Where local trains are used, the ringing is always on an automatic basis; that is, the ringing is automatically applied by the local office equipment as soon as the called line is seized.

Where toll switching trunks are used on a manual basis, the ringing is always controlled by the toll operator and is repeated by the toll switching trunk in the local office both on the initial ring and on a rering is required. The toll switching trunk also repeats the subscribers switchboard supervision to the toll operator. Once such a manual toll switching connection is established, the local toll switching operator receives no further supervision on the call until she receives a disconnect signal from the toll operator.

When the toll office is located in the same building with a SXS local office, the toll switching trunks are usually of the 4 wire type connected directly to toll incoming selectors in the local office rather than to the more expensive toll transmission selectors, which are required with 2 wire toll switching trunks. The 4 wire trunks can be arranged for either controlled or automatic ringing but if controlled ringing is used with DC key pulsing trunks they must be in a sender class arranged for 20 cycle ringing simplex. Reverse battery switchhook supervision is over the T & R leads. The S lead is used to hold the switches under control of the operator and with the C lead controls the ringing.

When the toll office is in the same building with a #5 crossbar local office, the toll switching trunk is an integral part of the #5 crossbar trunk which cross connects direct to outgoing trunk jacks in the switchboard and to idle indicating chain relays, group busy circuits or busy indicating relays as may be required. These are MF pulsing circuits from the switchboard. There is one other group of trunks which are handled on very much the same basis.

These are called "Marker Pulse Conversion Trunks" and are used when a switchboard on an MF key pulsing basis must complete some calls on a dial pulse basis to SXS or CDO offices. The marker pulse conversion trunks are furnished as a part of the local #5 crossbar office and cross connect to the switchboard jacks. The equipment in the local office converts the MF pulsing to dial pulsing and routes the call to the desired office.

With the exceptions noted in the preceding two paragraphs all toll switching trunks are provided on a 2 wire basis. Mention has been made of connection to either local or toll trains. Presently automatic ringing local trains are being predominately used with no local trains being provided in addition to existing offices or in new offices. In line with this it can be readily seen that the practice of handling delayed calls must be discouraged.

Toll switching trunks of the dialing, or key pulsing types can also be used with auxiliary trunks to complete incoming intertoll dialing calls. Also 2 wire toll switching trunks of the dialing or key pulsing types can be used as verification (SXS) or No test (X-Bar or Panel) trunks. This is a DSA service which will be covered later.

C. RECORDING AND RECORDING COMPLETING TRUNKS

In the past when most telephone switching was on a manual basis and a subscriber wished to make a toll call, the call had to be passed by the local operator to the toll operator and when the toll operator was located at a separate switchboard, recording trunks were used for this purpose. Since the local cord circuit would not pass supervision between the toll operator and the subscriber it was necessary for the toll operator to obtain the call details from the subscriber, request the subscriber to hang up and then recall the subscriber over a toll switching trunk when she was ready to proceed with the call. For this reason recording trunks were simple one way incoming trunks at the toll switchboard. In present day practice, recording trunks are used mainly for situations where a simple incoming trunk is required such as trunks to the toll switchboard from information desks.

With the development of machine switching central offices it was possible to provide trunks that would enable a subscriber to dial a special code that would connect the subscriber directly to the toll operator. Since these trunks gave the toll operator subscriber's switchhook supervision, it was possible to complete the toll call over these trunks providing the call could be completed immediately. The new trunk was therefore called subscribers recording completing trunks.

There is another recording completing trunk known as an operators recording completing trunk that is used when it is necessary to transfer a call from one toll board to another for special handling, such as to a mobile radio position. The operator at the first toll board must have a recording completing toll cord on her position which she uses to connect between the subscribers recording completing trunk on which the call originated, and the operators recording completing trunk, which in turn connects to another subscriber's recording completing trunk terminated at the desired special service position. The special service operator then has complete control of the call. These arrangements can be furnished on a coin or noncoin basis.

There is also available a recording completing switching trunk for use between a 3CL switchboard and a manual tributary office for both the loop signaling and composite or simplex signaling condition. Outgoing calls to the manual tributary office are handled on a straight-forward basis and these calls can originate from the switchboard and also from the switches of a dial tandem or an intertoll dialing system in the same building. Incoming calls from the tributary office can terminate at the 3CL switchboard or in the dial tandem or intertoll dialing system.

A 3 wire recording completing trunk is generally used when the toll office is in the same building with a SXS local office, with a fourth wire added when tone identification is required.

D. OPERATOR OFFICE TRUNKS

An operator office, for the purpose of this discussion, is an office equipped with a toll and DSA switchboard that serves the operators of one or more community dial offices (CDO). Of course, any office with operators is an operator office, but the term, as such, need be considered only in its narrower meaning. A community dial office, is a dial office in an outlying or distant town, having no switchboard of its own and which must, therefore, obtain the required operator services from some other point. Both the size of the CDO and it's distance from the operator office, vary widely. Some CDO's may exceed 5000 lines in capacity and the distance located from the operator office is limited only by the cost of line facilities to the operator office, as compared to the cost of providing operator facilities at the CDO. Occasionally, a CDO may be used as a tandem point to reach other CDO's.

Most CDO traffic is handled over two-way trunks on an automatic ringing noncoin basis. These trunks may be the dialing or the DC key pulsing type and either can be arranged for loop or CX signaling.

If the volume of traffic warrants it, separate incoming and outgoing trunk groups may be used exclusively, or in combination with 2 way trunk groups. Standard toll switching and recording completing trunks are used for the one way trunk groups. Regardless of the type of trunks used, the operator has full supervision over all calls. Facilities are available for connecting operator office trunks to any standard intertoll dialing system so that incoming intertoll dialing calls can be completed direct to the CDO subscribers.

E. TRUNKS FOR DSA SERVICE

There are many types of trunks used for DSA (dial switching assistance) traffic. While some are the same circuits used for toll traffic, others are for DSA traffic exclusively.

When a dial subscriber wants assistance and dials the operator, the dial line is connected to a trunk known as a zero level trunk, so called from early SXS days when

these trunks were connected to the zero level on a SXS switch. Standard recording completing trunks are used for this service (when toll positions are used for DSA service) and operate as previously described.

Completing trunks are used to complete assistance calls when necessary. Generally, standard toll switching trunks are used on combined toll and DSA switchboards where the volume of DSA traffic to be completed is small in relation to the toll traffic. Where the volume of DSA traffic is heavy and for DSA switchboards only there are a considerable number of completing trunks available. The selection of the proper circuit for any individual case depends on the type of local office involved and the type of pulsing required. Since completing trunks connect only to local trains, ringing and coin control features are not required, but otherwise these trunks function substantially as previously covered under toll switching trunks.

F. NO-TEST TRUNKS

No-test (verification) trunks are used to determine whether a particular line is actually busy or whether it tests busy due to trouble conditions. Standard toll switching trunks are generally used for this service, although here again, there are other circuits available for specific applications where their use is more economical. The circuits provided in the DSA (or toll) office connect to equipment in the local office which is designed to connect to the called line without making a busy test (hence no-test).

G. INTERCEPT TRUNKS

Intercept trunks are used, as their name implies, to intercept calls. Regular intercept trunks are used to intercept calls to vacant number, vacant levels, to subscribers denied service or whose number has recently been changed. Trouble intercept is used with a plugging up circuit to intercept calls to or from lines in trouble or where it is necessary to monitor the call for any reason. Until recently there were a great many different intercept trunks available but most of them have now been replaced by three standard circuits which cover regular, trouble or machine intercepting on most any combination of desks and switchboards.

The preferred present day practice is for vacant code (or level) and vacant number intercepting to be handled by the recorded announcement machine which states that a wrong number has been dialed and requests the customer to recheck the number and dial again. After a predetermined number of announcements the call is routed to an operator if the customer is still on the line. Calls to changed or denied service numbers are classed as regular intercept and routed to a desk operator. Trouble calls are always routed to switchboard position so that they can be completed where possible. In smaller offices the recorded announcement machine and even the desk may be omitted and all intercepted calls routed to the switchboard. All three types of calls are usually handled over the same trunk group and the routing is controlled by marks on the tip or ring leads. The large number of intercept trunks required in the local office end are usually concentrated on a small number of trunks to the toll or DSA office by means of concentrating switches usually called trunk finders.

Verification request trunks provide a connection to a toll switchboard operator from terminating circuits in SXS, panel, manual or crossbar offices for receiving verification request calls.

H. SENDER MONITOR TRUNKS

Sender monitor trunks are available for use with panel and #1 crossbar senders when they are located in the same building with the 3CL switchboard. If the subscribers senders in the #1 crossbar have been modified for automatic time release, sender monitor trunks are not required. All #5 crossbar senders are arranged for automatic time release. The purpose of these trunks is to give an indication when a sender stays attached to a subscribers line beyond a specified time. If the local dial unit is in a building separate from the switchboard this service must be handled at the sender make busy frame.