TELEPHONE ANSWERING SYSTEM
LINE CONCENTRATOR (J93022)-IDENTIFIER (J93021)
FOR USE WITH NO. 1 ELECTRONIC SWITCHING SYSTEM (NO. 1 ESS)
GENERAL DESCRIPTIVE INFORMATION

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1. GENERAL

INTRODUCTION

1.01 This section describes the 6-trunk Line Concentrator-Identifier (CI), SD-99449-01, Issue 1 or later and SD-95962-01, Issue 4AR or later, Telephone Answering System when used with a No. 1 Electronic Switching System (No. 1 ESS). This CI system permits a telephone answering bureau to serve a large number of subscribers located in the same or different geographical central office areas over a small number of trunks.

DESCRIPTION

1.02 The CI system provides originating equipment at the No. 1 ESS central office and terminating equipment at the telephone answering bureau which permits 40, 60, 80, or 100 subscriber lines to be concentrated and served by two, three, four, five, or six trunks. At the answering bureau, each subscriber line is associated with a switchboard line lamp and jack circuit which has associated subscriber ringup and line cutoff equipment at the central office.

1.03 The switchboard line lamp lights approximately 0.9 second after the ringing cycle has been detected by the ringup and line cutoff circuit. This permits the bureau attendant to count the number of rings and to answer on the first ring or any subsequent ring.

> ***Note:*** One ringing cycle has a time duration of 6 seconds. When the CI ringup and line cutoff circuits are connected to subscriber lines having both Code 1 and Code 2 ringing, one ringing cycle is defined as 2 seconds of ringing and 4 seconds of silence for Code 1 ringing; for Code 2 ringing, one ringing cycle is defined as 1 second of ringing, 1 second of silence, 1 second of ringing, and 3 seconds of silence. When a subscriber line is arranged for Code 2 ringing, it is possible for the subscriber's station set to ring two times while the bureau attendant is answering on the first ring at the bureau switchboard (Fig. 1).

1.04 The method of handling an individual subscriber's call is determined by mutual agreement between the subscriber and the answering bureau personnel. The bureau attendant may answer all calls or only those occurring at certain times. In some cases, the bureau attendant is instructed to answer calls only on the third or fourth ring, thereby allowing time for the subscriber to answer personally if desired.

FIELD OF USE

1.05 The purpose of the CI Telephone Answering System is to answer calls to subscribers such as business concerns, doctors, lawyers, etc, and other people desiring telephone answering service. This CI system has been designed to work with the 1A and 1B Telephone Answering Systems, foreign exchange lines, and the Occasional Service System J99317 (Fig. 2 and 3).

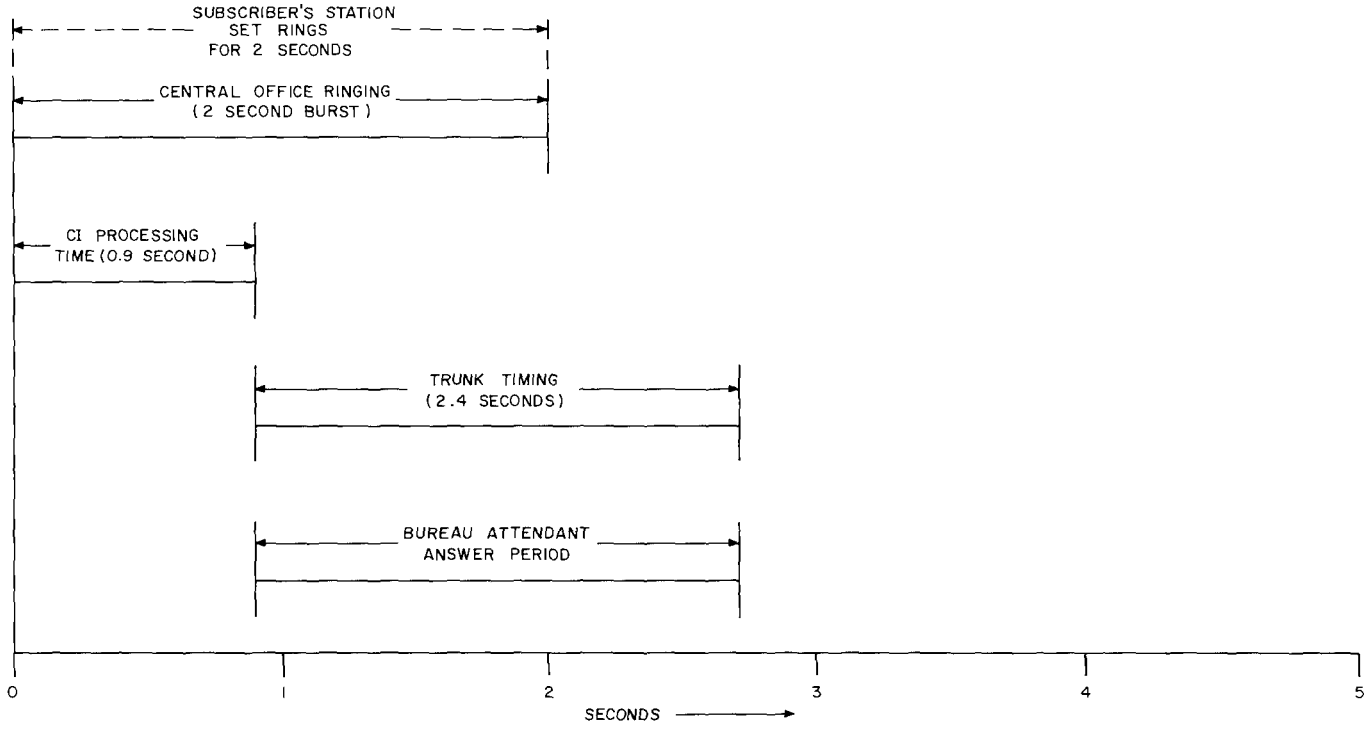
1.06 Without the CI system, each bureau subscriber would be required to have an individual pair of wires between the central office and the answering bureau. Under this condition, the answering bureau would be located as near as possible to the central office, reducing mileage costs.

1.07 With the CI system, the bureau subscriber and the answering bureau may be located in the same or different geographical central office areas.

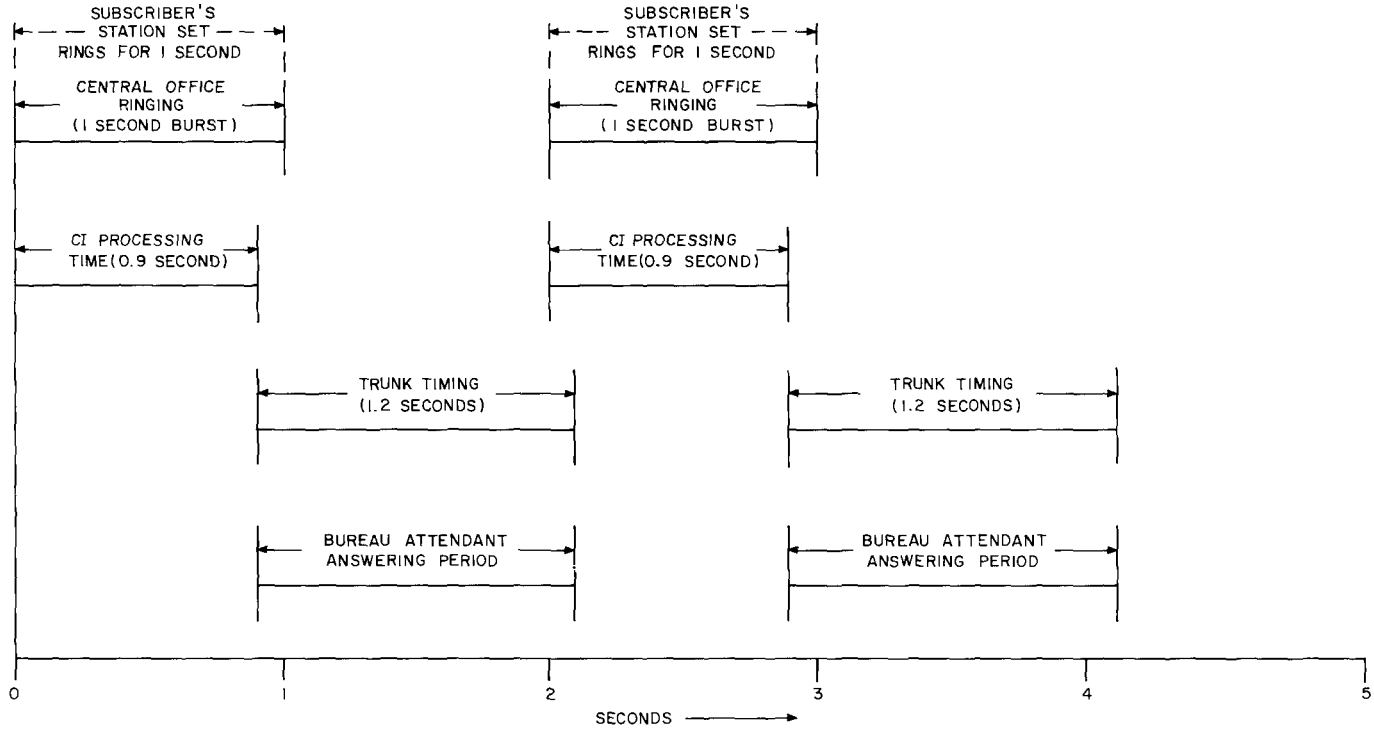
CAPACITY

1.08 The basic CI system is arranged to serve 40 individual and/or 2-party subscriber lines. Additional lines may be added in multiples of 20 up to a maximum of 100 subscriber lines. A minimum of two trunks plus one pulsing pair must be provided between the originating equipment at the No. 1 ESS office and the terminating equipment at the answering bureau. The number of trunks may be expanded to three, four, five, or six to handle increased volume of traffic. An auxiliary pulsing pair may be provided on an optional basis to increase the reliability of the system.

1.09 The capacity of one CI system when used with a No. 1 ESS office is 100 subscriber lines, six CI trunks, one primary pulsing pair, and one auxiliary pulsing pair.



CI TIMING INTERVALS – CODE 1 RINGING



CI TIMING INTERVALS – CODE 2 RINGING

Fig. 1—Concentrator-Identifier Timing Intervals for Code 1 and Code 2 Ringing

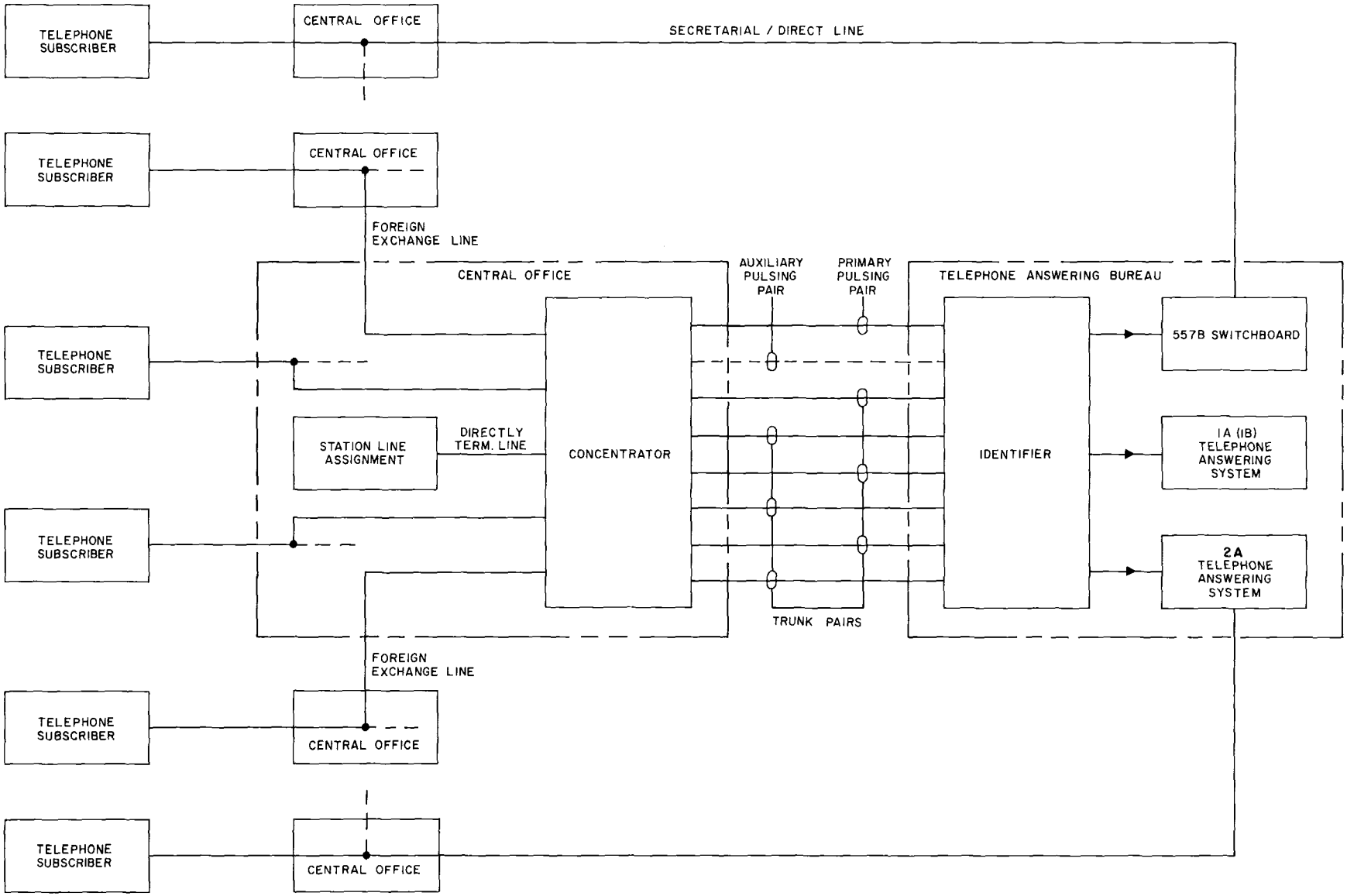


Fig. 2—Line Concentrator-Identifier Telephone Answering System When Used With Foreign Exchange Lines, 1A- and 1B-Type Telephone Answering System—Block Diagram

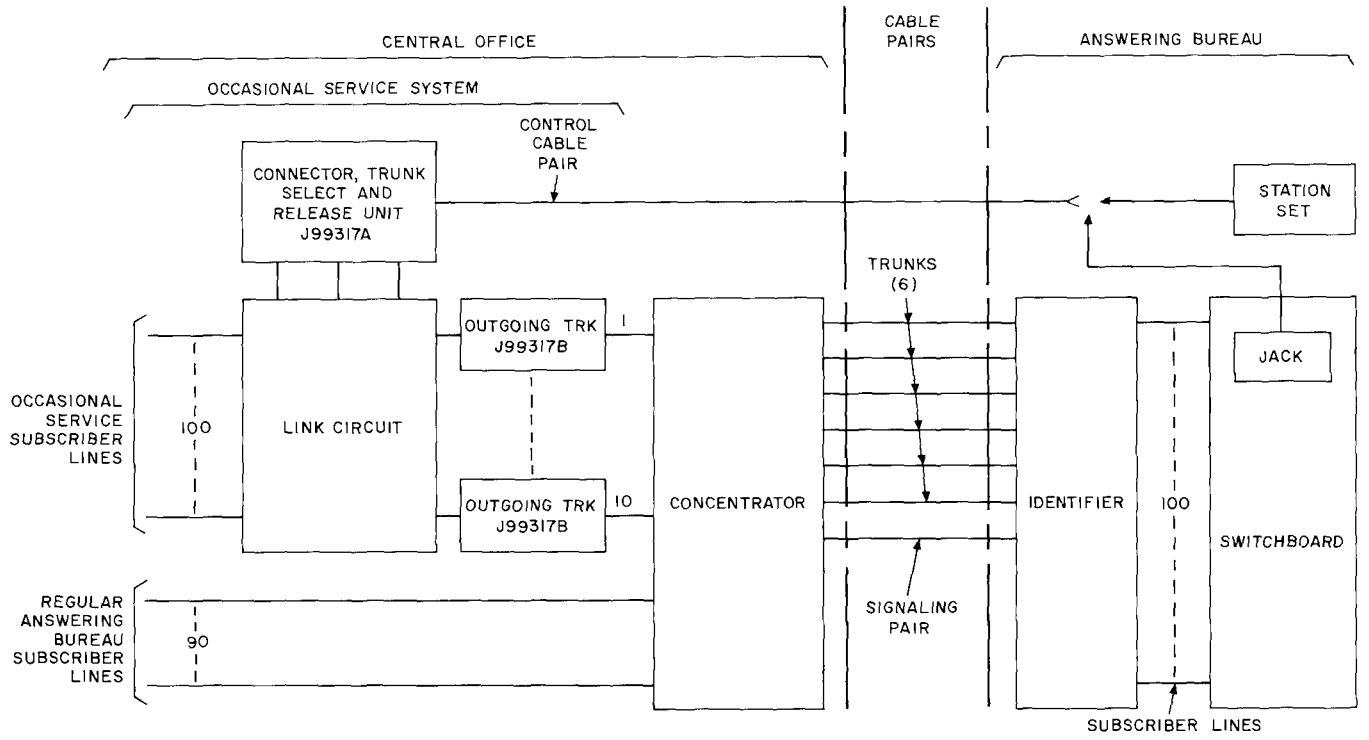


Fig. 3—Line Concentrator-Identifier When Used With Occasional Answering Service—Block Diagram

1.10 The CI originating equipment J93022 has been designed to work with terminating equipment J93021F (SD-95962-01, Issue 4AR or later). Originating and terminating trunks are operated only on an equal trunk-to-trunk basis. Unused trunks at the originating equipment must be removed from service by removing the connector plug from the spare trunk unit(s).

PRINCIPAL FEATURES

1.11 The principal features of the No. 1 ESS Line Concentrator-Identifier Telephone Answering System are the following.

(a) All trunk options are provided at the concentrator end either by frame cable wiring or by strapping at the trunk connector plug, thereby making all trunk units interchangeable.

(b) A control panel permits easy maintenance by providing steady lamp indications for normal call progress and 60-ipm lamp indications for all units which have been made busy.

(c) A jack is provided on the control panel for access to ac-dc ringing voltage for testing ringup and line cutoff circuits.

(d) The concentrator (originating equipment), located at the No. 1 ESS office, concentrates a maximum of 100 lines over two or more trunks (six maximum) to the answering bureau.

(e) The identifier (terminating equipment), located at the answering bureau, expands two or more trunks to a maximum of 100 line and jack appearances.

(f) Bureau subscriber lines are answered in the same manner as direct secretarial lines.

(g) All incoming calls are indicated by lighting switchboard line lamps during a calls-waiting condition.

(h) A calls-waiting lamp lights to inform the bureau attendant that all available trunks are in use and other calls waiting to be answered.

(i) The bureau attendant cannot monitor on a subscriber line since the attendant can connect to the subscriber line only during the ringing interval.

(j) Cabinets and mounting arrangements have been designed to reduce room noise created by the operation of the terminating equipment.

(k) A digit timing control circuit is provided to cause a system time-out when the CI fails to complete a call due to a trouble condition. After the system time-out has occurred, the digit timing and control circuit functions to make the defective unit busy.

(l) Switchboard line lamp display is independent of talking path availability. When all trunks are busy, the CI continues to light line lamps associated with other incoming calls during the ringing intervals.

(m) Plug-type connectors for adding additional trunk units and crossbar switches on an optional basis are provided at the originating and terminating equipment.

(n) A remote alarm release circuit is provided, permitting the release of time-out and alternate allotter alarms from a remote location via a spare subscriber line circuit.

(o) A trunk timing alarm circuit is provided to bring in an audible and visual alarm when a trunk fails to complete its call function within the allotted time and/or an all-trunks-busy (calls-waiting) condition occurs.

(p) The system provides optional, audible, and visual alarm features at the bureau switchboard. This permits flexibility in alarm connections, as governed by local policies.

2. EQUIPMENT ELEMENTS

ORIGINATING EQUIPMENT

2.01 The originating equipment, located at the No. 1 ESS central office (Fig. 4 and 5), has been designed for a double-bay frame 7 feet high and 4 feet 4 inches wide. All circuitry is unitized on a functional basis, surface wired, and interconnected by local frame cable.

2.02 The optional trunk, ringup and line cutoff circuits, and trunk connector switches are equipped with plug-in connector cables to provide ease of installation and minimum installation time.

2.03 The central office originating equipment consists of the following five major units and circuits.

(1) ***Ringup and Line Cutoff Circuit:*** The ringup and line cutoff circuit, a solid-state ringing detector equipped with two relays per subscriber line, functions to detect ringing on the subscriber line. A printed circuit board containing five ringing detector circuits is shown in Fig. 6.

(2) ***Trunk Unit:*** Each trunk unit consists of a transmission path, a simplex path for trunk supervision and/or the transfer of alarm information to the terminating equipment, and a relay delay timer for trunk timing.

(3) ***Trunk Connector Unit:*** The trunk connector unit consists of five crossbar switch verticals per trunk, maximum three crossbar switches, to connect one or two trunk circuits to any subscriber line.

(4) ***Common Control Unit:*** The common control unit consists of the following circuits:

(a) A ***units identifier,*** which consists principally of ten relays corresponding to the units digit (0-9) assigned to a ringup and line cutoff circuit. Its function is to indicate to the system the units digit of the called line.

(b) A ***tens identifier connector,*** which consists of ten relays. Its function is to receive information from the ringup and line cutoff circuit and the units identifier, then to pass this information to the tens identifier.

(c) A ***tens identifier,*** which consists principally of ten relays corresponding to the tens digit (0-9) assigned to a ringup and line cutoff circuit. Its function is to indicate to the system the tens digit of the called line.

(d) Two ***controllers,*** which operate on alternate calls to pulse the line code number to the terminating equipment.

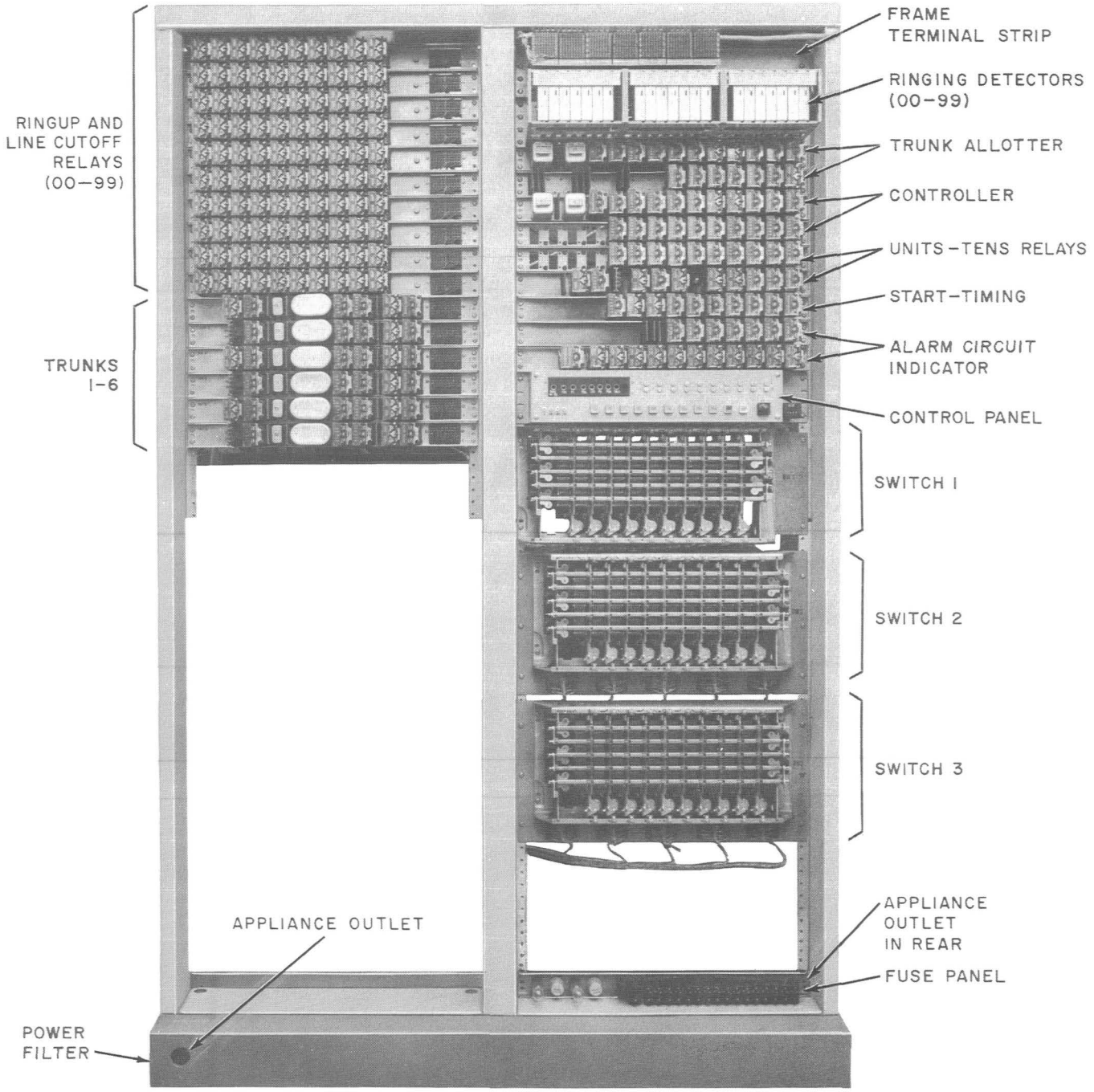


Fig. 4—Line Concentrator-Identifier Originating Equipment J93022—Front View

(e) A ***controller connector,*** which provides a means of transferring from one controller to another controller on successive calls.

(f) Two ***trunk allotters,*** one of which has access to all talking trunks. The alternate allotter connects only to the first trunk and is used when the concentrator fails to complete a call.

(g) A ***start timing and trunk test unit,*** which provides the overall timing for the

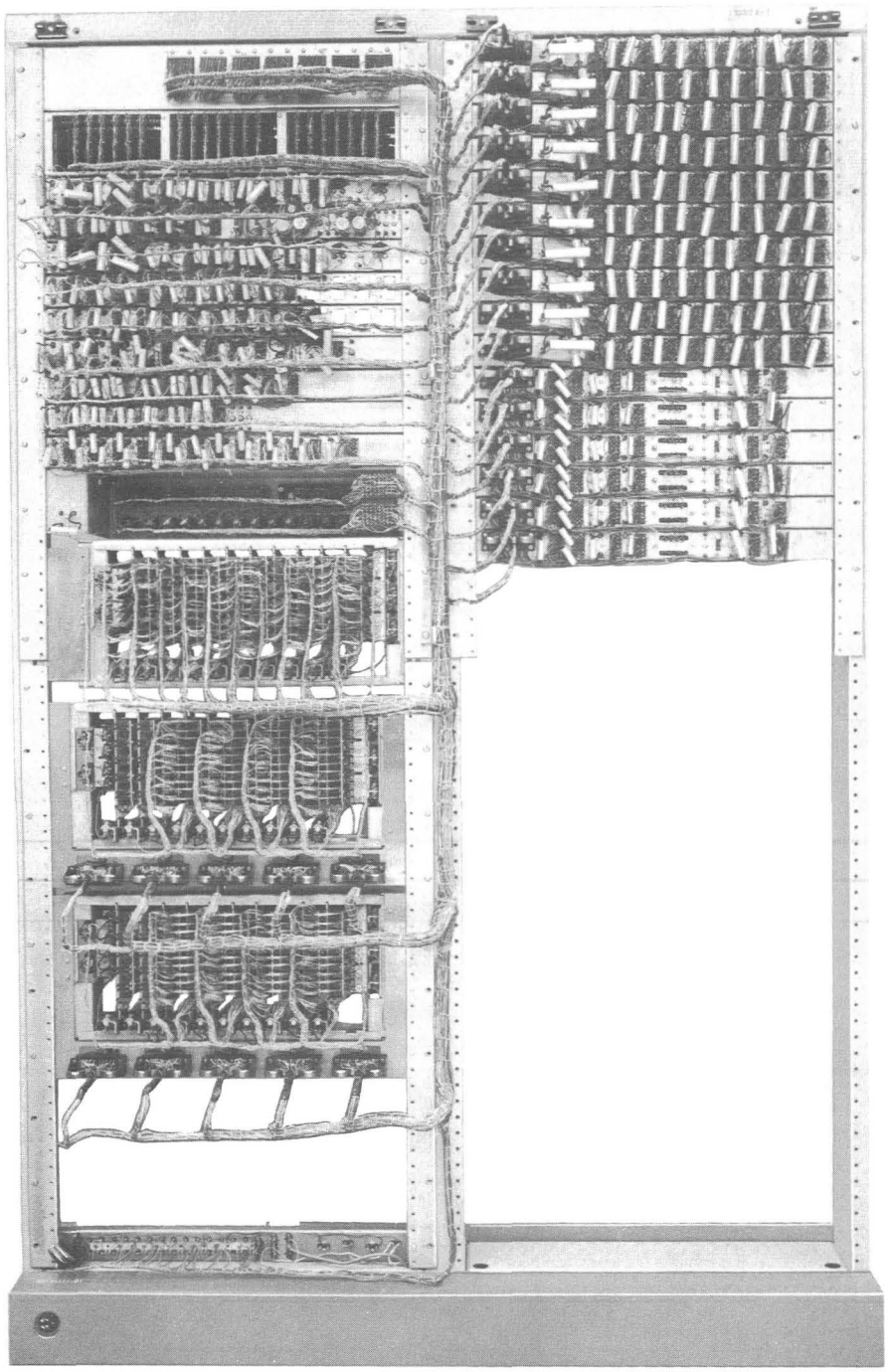


Fig. 5—Line Concentrator-Identifier Originating Equipment J93022—Rear View

originating equipment and checks the trunk timing of all trunk units.

(h) An ***alarm and power unit,*** which supplies alarm information to the central office (No. 1 ESS) and interfacing for the use of local battery.

(i) An ***indicator control,*** which provides visual indications as the calls are processed by the originating equipment.

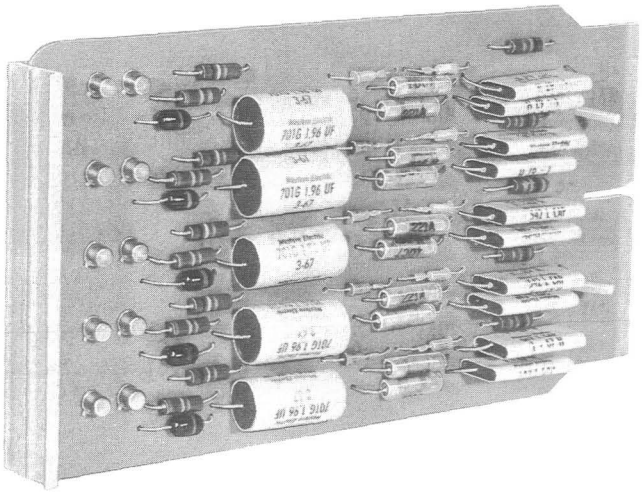


Fig. 6—Ringing Detector Circuit Pack Equipped With Five Ringing Circuits—Front View

(5) ***Control Panel:*** The control panel consists of lamps, keys, jacks, and equipment necessary for normal maintenance. The control panel jack, key, and lamp designations are shown in Fig. 7.

ORIGINATING EQUIPMENT CIRCUIT OPTIONS

2.04 The circuit options shown in Table A are provided with the No. 1 ESS originating equipment.

TERMINATING EQUIPMENT

2.05 The secretarial answering bureau equipment (Fig. 8) is mounted in one floor-supported cabinet 2 feet 2-1/4 inches wide by 1 foot 5 inches deep by 6 feet 11-7/8 inches high. The cabinet is supplied with an olive gray finish and has built-in soundproofing to reduce room noise created by the operation of the equipment. Cabinet circuitry is unitized on a functional basis, surface wired, and interconnected by local cabling.

2.06 All trunk units and the trunk connector unit are set up to be equipped on a plug-in basis via the use of connector cables. Space is available in the cabinet for local storage batteries when specified. The batteries may be charged from the central office or by a local externally mounted rectifier.

2.07 The cabinet is provided with holes in the four corners of the base assembly for fastening the cabinet to the floor. Fastening to the floor will be determined by customer installation requirements.

2.08 Whenever central office battery with exposed feed metallic ground is used for charging the storage battery, it will be necessary to locally insulate the cabinet framework from contact with the building iron work.

2.09 The answering bureau terminating equipment contains the following units:

(a) Two, four, or six ***trunks,*** each consisting of a transmission path and a simplex signal path.

(b) A ***controller connector,*** which provides a means of transferring from one controller to another controller on successive calls.

(c) Two ***controllers*** (A and B), which operate alternately to receive the digits pulsed by the originating end and to energize the indicating equipment at the terminating end.

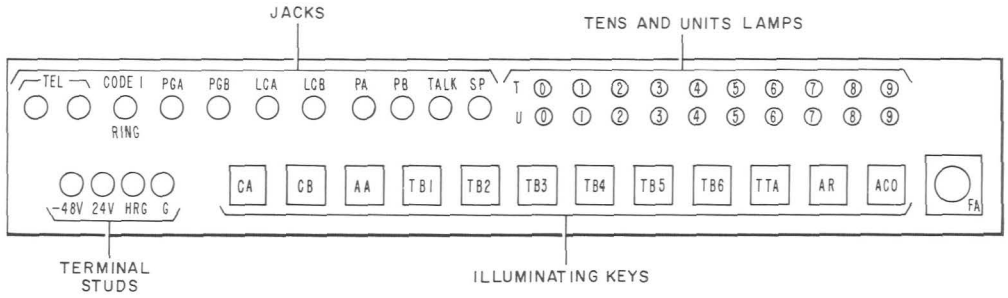


Fig. 7—Control Panel—Jack, Key, and Lamp Designations—Front View

TABLE A

SERVICE OPTIONS

DESCRIPTION OF OPTION	OPTION DESIGNATION	CIRCUIT AFFECTED
Tip and ring reversal for single party or ring party of 2-party line	Z	Ringup and Line Cutoff Circuits
Tip and ring reversal for tip party of 2-party line	Y	
Decrease trunk timing for code 2 ringing subscriber lines	X	
Switch pulsing pair and for addition of auxiliary pulsing pair	W	Controller and Controller Connector Circuit
Release of alarms remotely and for addition of remote alarm release	16	Alarm and Power Circuit
Tip and ring reversal for single party or ring party of 2-party line for remote alarm release	T	
Tip and ring reversal for tip party of 2-party line for remote alarm	S	
Alarm registration and releasing for terminating end	R, Q*	Trunks 1 and 2
Makes trunks 3-6 busy respectively	N, M, K, J*	Trunk and Trunk Allotter
For unabridged directory-type lines	V	Ringup and Line Cutoff Circuits

* Option prewired in frame cabling; central office records need not be maintained.

(d) An ***indicator control,*** which selects one of the indicator timers.

(e) Two ***indicator timers*** (1 and 2), which control an associated indicator for each call and determine the length of time the switchboard lamp is lighted.

(f) Two ***indicators*** (1 and 2), which light the proper switchboard lamps through the indicator connector.

(g) Two ***indicator connectors,*** each consisting of two verticals of two crossbar switches which close the crosspoints, lighting the selected line lamps.

(h) A ***trunk connector,*** which consists of 24 verticals of three crossbar switches which close the crosspoints to complete the transmission path from a trunk to the switchboard jack.

(i) Three ***unit selectors,*** which are part of the three crossbar switches and determine the level at which the crosspoints are to be closed by both the trunk connector and the indicator connector.

SWITCHBOARD EQUIPMENT

2.10 The 557-type PBX switchboard and the 1A and 2A Telephone Answering System consoles are used with the CI system. Optional switchboard features, to be ordered and installed by the telephone company on a job basis, are:

- Alarm indication lamps

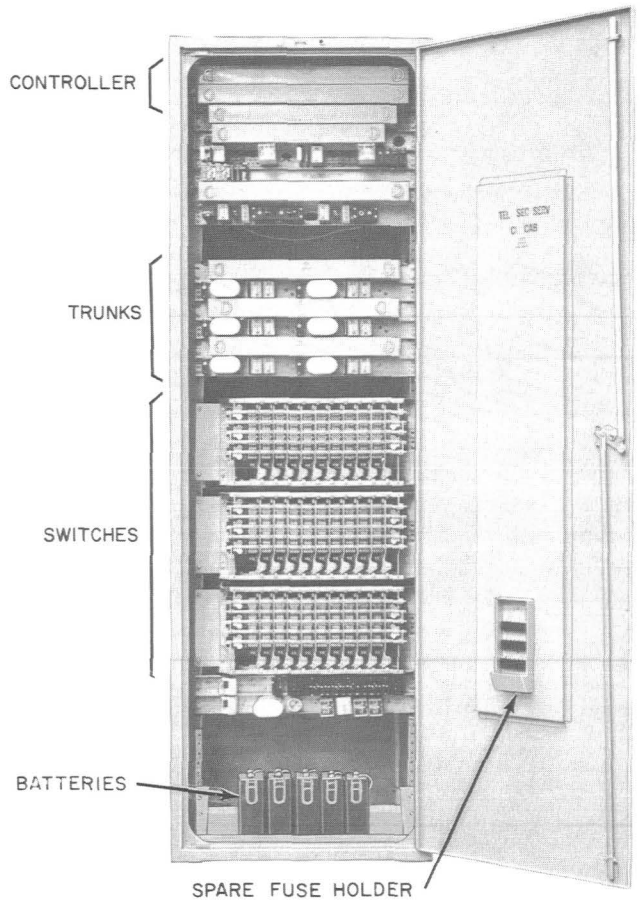


Fig. 8—Line Concentrator-Identifier Terminating Equipment J93021F—Front View

- Auxiliary alarm buzzer
- Calls-waiting lamp
- Fuse alarm lamp
- Time-out lamp.

BATTERY CHARGING EQUIPMENT

2.11 The batteries located at the answering bureau terminating equipment may be charged by cable pairs from a nearby central office or by a local wall or rack mounted metallic rectifier charger.

INTERCONNECTING FACILITIES

2.12 Simplex-type trunk facilities are used to connect the originating equipment to the terminating equipment. Two, three, four, five, or six trunks may be provided, depending upon the volume of traffic.

2.13 A primary pulsing pair is required for signaling. The called line number is pulsed over the ring side of the pulsing pair (identification channel); receipt of this information is verified over the tip side of the pulsing pair (verification channel). An auxiliary pulsing pair is provided on an optional basis.

3. METHOD OF OPERATION

3.01 The CI equipment (Fig. 9) operates for each ringing interval of an incoming call to one of the answering bureau subscriber lines. Each subscriber line is bridged across to the originating equipment by a pair of wires at the central office main distributing frame (MDF). This MDF pair terminates in a ringup and line cutoff circuit. Each ringup and line cutoff circuit is assigned an arbitrary 2-digit number from 00 through 99. Each digit of the 2-digit identifying number consists of three pulses as shown in Table B. Ringing on a called subscriber line causes the ringup and line cutoff circuit to operate, energizing a start, timing, and alarm circuit which calls in a units and tens identifier circuit.

3.02 The identifier circuit identifies the 2-digit number of the line being called and passes this number to a controller circuit. The controller circuit first checks for pulsing path continuity and then pulses the identified line number forward over the ring side of the signaling pair to the terminating equipment.

3.03 Simultaneous with the forward pulsing, the controller circuit causes a trunk allotter to hunt for an idle trunk talking path. If an idle trunk talking path is available, a talking path is closed via a crossbar switch at each end of the trunk for the duration of the ringing interval.

3.04 The terminating equipment, having received the units and tens pulses, selects an indicator timer and indicator circuit which will light the switchboard line lamp associated with the called line number and connect a trunk talking path to the switchboard jack of the line being called. If no trunk talking path is available, the bureau attendant may plug into the answer jack, but must wait until a trunk talking path is available before the call will be cut through.

3.05 The attendant can answer and complete the talking path only during a 2.4-second period when Code 1 ringing is provided or a 1.2-second period when Code 2 ringing is provided. Should the attendant plug an answering cord into the line jack when the line lamp is dark, the talking connection will not be completed until the next line identification and a second trunk closure have occurred.

3.06 Called line lamp display is independent of trunk talking path availability. When all trunk talking paths are busy and another call requests service, indicated by the lighted switchboard calls-waiting lamp, the equipment will continue to display the line lamps associated with other calls.

3.07 The terminating equipment is able to display a maximum of six calls every 6 seconds, with a maximum of two line lamps displayed at any one time. Each call is displayed by a lighted line lamp corresponding to the ringing interval on the line. During the silent ringing interval, the line lamp is extinguished. The ringup and line cutoff circuit prevents a call from being indicated a second time during any one ringing interval (one ringing interval equals 2 seconds for Code 1 ringing and 1 second for Code 2 ringing. The CI is arranged so that during periods of heavy traffic, when more than six calls are being offered within a 6-second period, all calls will be indicated once before any calls are repeated.

3.08 When the attendant disconnects by removing the plug from the switchboard answering jack, the trunk is restored to normal and is available for regular sequence allotment.

3.09 The called line number is pulsed by the originating equipment over the ring side of the pulsing pair and its receipt is verified and pulsed back by the terminating equipment over the tip side of the pulsing pair. A simplex signaling channel is employed for trunk supervision. In case of failure of either the identification or verification channel, the equipment will bring in a central office audible and visual time-out alarm and transfer from the primary pulsing pair to the auxiliary pulsing pair, if provided.

3.10 A digit timing and control circuit in the originating equipment provides 1.6 seconds for pulsing the units and tens digits. If pulsing takes longer than 1.6 seconds, the circuit will function to bring in an audible and visual alarm, release the digit register in the terminating equipment by sending a +130 volt release signal on the simplex leg of trunk one, and lock up the CI originating equipment so that the U-, T-, TB-, and CA or CB lamps can show the progress of the call to the point of time-out. The circuit will also function to light the TO lamp at the terminating equipment. The controllers at both the originating and terminating equipment, the indicator timer, and the indicator at the terminating equipment which was in service at the time the trouble condition occurred will also be removed from service. If another equipment time-out occurs, before the alarm release (AR) key at the originating equipment has been operated, the terminating equipment will function to cause the terminating circuits previously locked out of service to be released and tried again. The alarm circuits at the originating equipment remain energized until the AR key is operated.

3.11 A system alarm may be manually released by operating the AR key at the central office originating equipment if the equipment is located in an unattended office by calling a subscriber line associated with the remote alarm release circuit. An alarm may be cut off audibly, but is not released by manual operation of the alarm cutoff (ACO) key located at the answering bureau switchboard.

3.12 If a call is originated and the trunk allotter cannot allot an available idle trunk due to a trouble condition, the system will call in an alternate allotter. This alternate allotter will take the regular allotter out of service and force all calls to use trunk number one.

3.13 A transistor timer is provided to control the time a trunk is available for seizure. The maximum trunk available time is set at 2.4 seconds for Code 1 ringing and 1.2 seconds for Code 2 ringing. During heavy traffic conditions the trunk timing is reduced. The amount of reduction depends upon the type of ringing applied to the subscriber lines; however, it cannot be reduced to less than the CI processing time, which is approximately 0.9 second.

3.14 If a trunk timer fails due to a short or open circuit, the originating equipment will detect this trouble condition and cause a trunk timing alarm to occur.

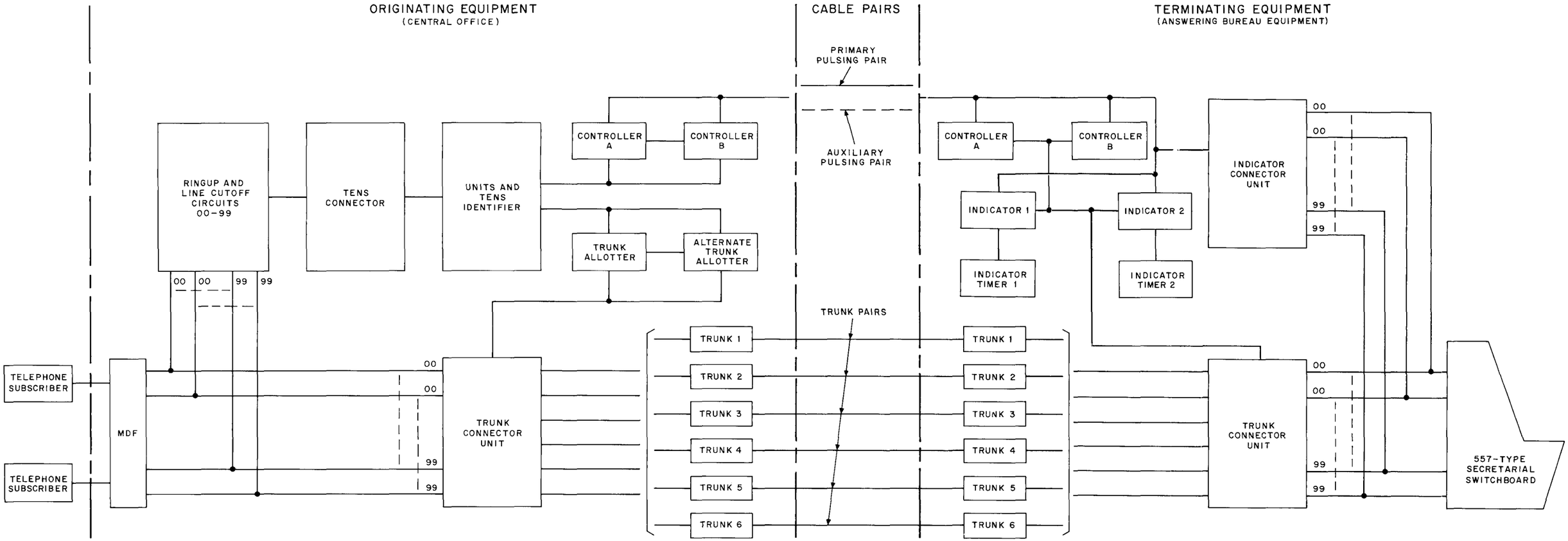


Fig. 9—Line Concentrator-Identifier for Secretarial Answering Service—Block Diagram

TABLE B

UNITS AND TENS DIGITS PULSES

UNITS OR TENS DIGITS	FIRST PULSE	SECOND PULSE	THIRD PULSE
0	CC—*		
1	CC—	CC—	CC+†
2	CC—	CC—	CC—
3	CC—	CC+	CC—
4	CC—	CC+	CC+
5	CC+		
6	CC+	CC—	CC+
7	CC+	CC—	CC—
8	CC+	CC+	CC—
9	CC+	CC+	CC+

* (— 130 volts dc)
† (+ 130 volts dc)

4. ALARMS

4.01 The line CI system provides optional audible and visual alarm features at the answering bureau switchboard position and lamp signals at the originating equipment to indicate the progress of a call. The optional alarm features are ordered and installed by the telephone company on a job basis. This permits flexibility in alarm connections as governed by local policies.

4.02 The optional alarm features which are available are the alarm indication lamp, auxiliary alarm buzzer, calls-waiting lamp, calls-waiting register, fuse alarm lamp, and time-out lamp.

4.03 The system is arranged so that a system alarm can be released at the originating equipment by manually operating the alarm release (AR) key, or if the originating equipment is located in an unattended office, by calling a subscriber line associated with the remote alarm release circuit. An alarm may be cut off audibly, but is not released by manual operation of the alarm cutoff (ACO) key located at the answering bureau switchboard.

4.04 When the CI system fails to complete a call due to a trouble condition, the following alarm(s) may occur:

(a) Time-out

(b) Alternate allotter

(c) Trunk timing

(d) Fuse.

5. SIGNALING

5.01 Signaling between the originating equipment and the terminating equipment is accomplished over the simplex legs of trunks one and two and a separate pulsing pair. Table C shows the signaling functions that take place and the signaling channel involved.

6. MAINTENANCE FEATURES

6.01 The CI system has been designed and arranged for testing with standard portable test sets and other facilities at time of installation.

6.02 A control panel containing the following keys, lamps, and jacks has been provided for centralization of visual lamps and equipment for normal maintenance functions.

(a) ***CA Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted CA key indicates that controller A is being used to serve a call in progress. A flashing CA key (60 ipm) indicates that controller A has been made busy by operation of the key.

(b) ***CB Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted CB key indicates that controller B is being used to serve a call in progress. A flashing CB key (60 ipm) indicates that controller B has been made busy by operation of the key.

(c) ***AA Key:*** An illuminating push-to-lock, push-to-unlock key. A steadily lighted AA key indicates that the alternate allotter is being used to serve a call in progress. A flashing AA key (60 ipm) indicates that the alternate allotter has been made busy by the operation of the key.

TABLE C

SIGNALING FUNCTIONS AND ASSOCIATED CHANNELS

ORIGINATING EQUIPMENT	SIGNALING CONDUCTOR	TERMINATING EQUIPMENT
Transmits a signal of a call to be served	Ring lead of pulsing pair	Receives signal of a call to be served
Receives signal to start pulsing the units digit	Ring lead of pulsing pair	Transmits a signal to start pulsing the units digit
Transmits the units digit	Ring lead of pulsing pair	Receives units digit
Transmits a signal to seize corresponding trunk	Simplex leg of allotted trunk	Trunk seized
Transmits a signal units pulsing is completed	Tip lead of pulsing pair	Receives signal and performs digit check
Receives signal to start pulsing the tens digit	Tip lead of pulsing pair	Transmits signal to start pulsing the tens digit
Transmits the tens digit	Ring lead of pulsing pair	Receives tens digit
Transmits the end of tens digit	Tip lead of pulsing pair	Receives end of tens digit
Receives signal to trip ringing	Simplex leg of allotted trunk	Attendant answers and sends a signal to trip ringing
Receives signal to release trunk	Simplex leg of allotted trunk	Attendant disconnects and sends a signal to trip ringing
Transmits signal to indicate time-out alarm	Simplex leg of trunk one	Receives alarm signal
Transmits signal to indicate time-out alarm released	Simplex leg of trunk two	Receives alarm release signal

(d) ***TB-1 through TB-6 Keys:*** Illuminating push-to-lock, push-to-unlock keys. Steadily lighted keys indicate the trunk(s) being used to serve a call in progress. A flashing TB- key (60 ipm) indicates the trunk(s) made busy by operation of the associated TB- key.

(e) ***TTA Key:*** An illuminating nonlocking key which, when steadily lighted, indicates that a trunk-timing alarm has occurred.

(f) ***AR Key:*** An illuminating nonlocking key which, when steadily lighted, is used to release a system alarm.

(g) ***ACO Key:*** An illuminating nonlocking key which, when steadily lighted, indicates the key has been operated to cut off the audible alarm signal.

(h) ***U-0 through U-9 Lamps:*** A steadily lighted lamp which indicates the units digit of the ringup circuit being used by the call in progress.

(i) ***T-0 through T-9 Lamps:*** A steadily lighted lamp which indicates the tens digit of the ringup circuit being used by the call in progress.

(j) ***FA Lamp:*** Fuse alarm lamp.

(k) ***TEL Jack:*** Used for talking circuit between originating and terminating equipment.

(l) ***Code 1 RING Jack:*** Supplies Code 1 ringing (–48 volt dc, 88-volt ac rms) on ring side of line for testing ringup circuits.

(m) ***PGA Jack:*** Used when adjusting the pulse timing relay in controller A.

(n) ***PGB Jack:*** Used when adjusting the pulse timing relay in controller B.

(o) ***LCA Jack:*** Used when adjusting the pulsing pair line current (K and KA resistors) of controller A.

(p) ***LCB Jack:*** Used when adjusting the pulsing pair line current (K and KA resistors) of controller B.

(q) ***PA Jack:*** Used for monitoring the pulse generator of controller A.

(r) ***PB Jack:*** Used for monitoring the pulse generator of controller B.

(s) ***TALK Jack:*** Used for talking circuit within the No. 1 ESS office.

(t) ***SP Jack:*** Spare jack.

(u) Also provided are battery and ground terminals (–48 volt dc and 24-volt dc), high-resistance ground (HRG), and ground (GRD) terminals.