WIDE AREA DATA SERVICE AND

4-ROW TELETYPEWRITER EXCHANGE SERVICE

STATION ARRANGEMENTS C, D, AND RECEIVE-ONLY

GENERAL DESCRIPTIVE INFORMATION

1. INTRODUCTION

1.01 All 4-row TWX and WADS stations operate at 100 wpm. The new 4-row keyboard arrangement shown in Fig. 1 is used. As is the case in 3-row TWX service, the alphabet characters are printed only in capital letters. Although eight bits are transmitted for each character and control code, only seven of the bits contain the intelligence; the eighth bit is discarded by the equipment. An 8-bit code was chosen for this service in order to permit the transmission of standard 8-hole computer tapes using regular teletypewriter equipment.

1.02 Start-stop operation is provided by the use of a single-bit start element and a double bit stop element; thus, 11 bits are transmitted for each character. The equipment operates at 110 bits (ten characters) per second.

1.03 Station arrangements provided for 4-row TWX service are restricted to originate-terminate station arrangements having a limited number of features. WADS stations, on the other hand, are available as originate-only, originate-terminate, and receive-only station arrangements. As will be seen later, some are capable of considerable amounts of automatic operation. This section discusses 4-row TWX stations and WADS station arrangements C, D, and receive-only (RO).

2. DESCRIPTION OF STATION EQUIPMENT

A. General Station Description

4-Row TWX and WADS Station Arrangement C

2.01 The block diagram of a typical 4-row TWX or WADS C station is shown in Fig. 2. It consists of 33- or 35-type teletypewriter equipment plus a built-in attendant set plus a data set 101C or 105A. The attendant set provides the keys, lamps, ringer, dial, speaker, and optional handset for operating the station. The data set converts the dc teletypewriter signals to carrier signals for transmission over telephone facilities.

2.02 The features available with 4-row TWX station arrangements and WADS C station arrangements are for all practical purposes the same. The main difference is that all WADS stations use pushbutton calling whereas 4-row TWX stations may use a regular dc dial. Pushbutton calling, ie, TOUCH-TONE operation, is available on 4-row TWX stations on an optional basis. Only originate-terminate station arrangements are offered. Although these stations are capable of receiving calls automatically, an attendant must be present when the station is sending traffic.

WADS Station Arrangement D

2.03 A block diagram for a typical WADS D station is shown in Fig. 3. These stations consist of originate-only and originate-terminate type teletypewriter

machines. In addition to a teletypewriter, an attendant set, and a data set, the D station arrangement is also equipped with a controller. It is possible to convert a C station equipped with a 35 ASR and 105A data set to a D station by simply disconnecting the two cords to the data set and interposing the controller between the teletypewriter and the data set. The controller has built-in logic circuitry which relieves the attendant from having to monitor calls. When originating a call from a D station, it is only necessary for the attendant to depress an originate key, and then a start key on a repertory dialer; the station controller then handles the call automatically. The attendant should remain within the audible range of the buzzer built into the teletypewriter machine which will be sounded if for any reason the message is not sent (eg, if a busy condition or a trouble is encountered , the buzzer will be sounded). In addition to the controller, the D station arrangement has a call progress tone detector which not only automatically returns the station to the on-hook condition if a call is not completed, but indicates on a lamp why the call was not completed.

2.04 The ability to monitor a call and thus free the attendant for other work is the main difference between C and D service. As discussed in D and F of this section, the availability of special teletypewriter features such as horizontal and vertical tab, ability to respond to sequence codes, etc, is not dependent on the class of station arrangement but rather on the type of teletypewriter machine used.

RO Stations

2.05 WADS RO stations do not have a keyboard, and therefore are not capable of sending messages.

2.06 In all other respects WADS RO stations have the same features as are available with WADS C station arrangements. A loudspeaker is not provided with RO stations. However, a handset is provided. The handset is required in this case because it is necessary to monitor for dial tone when the station is restored to service. See discussion under Out-of-Service Key in 2.11.

B. Data Sets

2.07 Two types of data sets are provided for 4-row service, the 101C and 105A. A simplified block diagram of these data sets is shown in Fig. 4. Both types can be used for 4-row TWX, WADS C, and RO service. Only the data set 105A can be used for WADS D service and for WADS C service when the start dial option is required, because only the 105A data set is arranged to permit the addition of a WADS D controller and the start dial and call progress tone detector units.

2.08 The data sets are designed to enable with a signal input of -50 dbm and to disconnect when the signal drops to 2 to 3 db below this value.

2.09 The establishing of a call including the exchange of f_1 and f_2 signals is discussed in Section 972-100-100. The necessary logic to recognize and time the various signals is accomplished in the data set. A description of all the data set timing functions is given in H.

C. Attendant Sets

2.10 The attendant sets used with 4-row TWX and WADS stations are built into the cabinet of the teletypewriter equipment. Their purpose is to provide the attendant with a means to dial and monitor the progress of a call. Following is a brief description of the keys and lamps provided with the various station arrangements:

4-Row TWX and WADS C Stations, Keys and Lamps

2.11 The following keys and lamps are provided with 4R TWX and WADS C stations. Fig. 5 is a typical layout of the C station controls furnished with a 33 KSR.

(a) Originate Key (ORIG)

This key is used to originate a call. Depressing this key causes the lamp in the key to light, the data set to go off-hook, and the send and receive circuitry in the data set to go into the originate mode; that is, to receive signals in the

f_2 band (2025 to 2225 cycles per second) and to send signals in the f_1 band (1070 to 1270 cycles per second).

(b) Clear Key (CLR)

This key is operated by the attendant to restore the station to normal from any other mode. The lamp in the CLR key enclosure lights during the disconnect cycle, whether the station is disconnected automatically or by depressing the CLR key.

(c) Answer Key (ANS)

The answer key is used to answer an incoming call when the station is in the LCL mode. Depressing the ANS key lights the ANS lamp and puts the data set in the terminating mode; that is, it sends signals in the f_2 band and receives signals in the f_1 band.

(d) Test Key (TST)

This key is operated when it is desired to connect the dc output of the data set to the dc input of the data set for maintenance reasons. The lamp in the key housing lights when the key is depressed.

(e) Local Key (LCL)

Depressing this key lights the lamp in the key enclosure and permits the typing unit to be driven from the keyboard without the data set going off-hook. This mode is used by the attendant to practice. Incoming calls will not be answered automatically, but the ringing indication will be present.

(f) Buzzer Release (BUZ-RLS)

This key is used to silence the audible alarm resulting from a low-paper condition. The lamp in the buzzer release key remains lit as long as a paper alarm condition exists.

(g) Out-of-Service Key (OUT-OF-SVC)

The OUT-OF-SVC key is operated whenever it is necessary to take a station out of service. When this key is operated, the OUT-OF-SVC lamp is lit, the station is held in the on-hook condition, the ringer is disconnected, and the teletypewriter motor or motors, as the case may be, are prevented from starting except when the local line feed key is depressed. To restore a station to service, the key should be operated to the RESTORE position just long enough to hear dial tone; the key will automatically return to the NORMAL position when it is released. The OUT-OF SVC lamp is extinguished when the key is in this position.

(h) Break Release Key (BRK-RLS)

This key is used to unblind the data set signal input previously blinded by the receipt of a break signal from the distant station. The lamp in the break release key lights when a break signal is detected and remains lit until the BRK-RLS key is depressed.

(i) Restrain Lamp (REST)

A high intensity lamp (REST) lights when a restraining signal is received from a 4-row to 3-row converter (see Section 972-205-100 for description of converter) used in transmission to 3R TWX stations on the DDD switching plan. The lamp remains lit until the restraining signal is removed. The purpose of this feature is to limit the sending speed from 4-row machines transmitting at 100 wpm to 3-row machines receiving at 60 wpm.

(j) Start Dial Lamp (DIAL)

The start dial lamp is provided on an optional basis. This option can only be provided on stations served from a central office equipped with the dial tone normally provided for TOUCH-TONE calling; that is, 350 and 440 cycles per second. When this option is provided, the start dial lamp lights whenever dial tone is present.

Receive-Only Stations

2.12 The keys and lamps provided for WADS receive-only station are the same as those provided for WADS C station except that the BRK-RLS key and lamp

and the REST lamp are omitted and the local key is disabled. The start dial lamp, of course, is not provided. The originate key is used for maintenance purposes only.

D Stations, Lamps

2.13 In addition to the basic controls and lamps listed under 4-row TWX and WADS C stations, WADS D stations are equipped with miscellaneous alarm and call progress tone lamps as follows (see Fig. 6 for layout of controls):

(a) Start Dial (DIAL)

As indicated above, this lamp will light whenever dial tone is present.

(b) Busy - Reorder (BY)

This lamp will light whenever a busy or reorder condition is encountered by a call routed over the WADS switching plan.

(c) Intercept (INCPT)

This lamp lights whenever a discontinued teletypewriter station or a wrong number code is dialed. It indicates to the attendant that a nonworking code has been dialed and a check should be made with the assistance operator.

(d) No Connection (NO CONN)

This lamp lights whenever the call is not completed because of a high and dry situation or when a busy or reorder condition is encountered over the DDD switching plan.

(e) Service (SVC)

This lamp lights whenever anything goes wrong while the call is actually in progress. Example: taut tape, controller power failure, answer-back not received, no transmission for 20 seconds, or a premature disconnect is encountered.

(f) Paper Alarm (PA)

This lamp lights whenever a low-paper or paper-out condition exists.

D. Other Control Keys

2.14 There are certain other control keys which are available to the attendant for use when communicating with other stations. They are:

(a) WRU Key

Depressing this key will cause a distant station equipped with an identification answer-back to send its multicharacter identity automatically.

(b) RU Key

As described in 2.24 this key is used in sequence with the identifying characters of a called station to obtain automatic confirmation that the station reached is the proper station.

(c) HERE-IS Key

Depressing this key will cause the station's multicharacter identification answer-back to be sent to the distant station.

(d) BREAK Key

This key is depressed when it is desired to stop the other station from continuing to send. The break signal consists of a timed spacing signal of approximately 200 milliseconds. Receipt of this signal will stop the transmitter distributor at the sending station and shunt the keyboard's output so that no signals are generated and, therefore, no local copy will be produced. The sending of a break will usually cause the generation of false characters at both the sending and the receiving stations. However, this should cause no hardship since the break signal should normally only be sent when the copy being received has already been garbled. If considerable garble is being received during a call, it is better to disconnect and set up another connection.

(e) Alternate Mode Key (ALT MODE)

There are not enough single character code combinations available to do all the things that are desirable at a station. As

discussed in Section 972-205-100, use of the alternate mode key followed by one or more characters can be used to control such devices as extention stations, the automatic sending of tape from a distant station even though no attendant is present at that station, etc.

E. Types of Machines

2.15 The 33 and 35 lines of teletypewriter equipment manufactured by the TELE-TYPE Corporation are used for 4-row teletypewriter service. The following machines are presently available:

(a) Keyboard Send and Receive
     (33 KSR and 35 KSR)

     (See Fig. 7 for picture of 33 KSR machine.)

(b) Automatic Send and Receive
     (33 ASR and 35 ASR)

     (See Fig. 8 for picture of 35 ASR machine.)

(c) Receive Only (33 RO and 35 RO)

     (See Fig. 9 for picture of 35 RO machine.)

(d) Receiving Only Typing
     Reperforator (35 ROTR)

     (See Fig. 10.)

(e) Receiving Only Nontyping
     Reperforator (35 RONTR)

33-Type Teletypewriter Equipment

2.16 The 33 line consists of low cost equipment designed for light duty service not to exceed about 50 hours per month. A simplified block diagram of the 33 ASR is shown in Fig. 11. It is not as flexible as the 35-type teletypewriter equipment and therefore its use is limited to 4-row TWX and WADS C type service. It can also be used for WADS RO type service wherever its limited life and its limited number of features will do the job. A comparison of the principal differences between the 33 and 35 machines is given in 2.21.

35-Type Teletypewriter Equipment

2.17 The 35 line of equipment consists of heavy duty equipment similar in design to TELETYPE Corporation's 28 line of equipment which is used for 3-row TWX and 3-row private line teletypewriter service. A block diagram of the 35 ASR is shown in Fig. 12.

2.18 Friction feed and sprocket feed typing units are available as standard units for the ASR, KSR, and RO machines. Form feed, horizontal, and vertical tabulation are standard on all sprocket feed units.

2.19 The 35 ASR is equipped with two 6-button control panels in addition to the 6-button control panel on the attendant set; one panel is for mode switching and motor control, and the other is for miscellaneous operating features (see Fig. 6). The buttons on the mode switch panel are used to select the desired mode of operation as follows:

(a) K (Keyboard)

     When this key is depressed, a message can be transmitted by typing on the keyboard without producing a perforated tape. A page copy is also obtained. The tape reader is inoperative.

(b) K-T (Keyboard-Tape)

     When this key is depressed, the keyboard or tape reader can be used to transmit a message. Page copy as well as a duplicate tape is also obtained.

(c) T (Tape)

     When this key is depressed, the keyboard can be used for perforating tape blind; that is, no local page copy will be prepared. Simultaneously, the rest of the station equipment can be used to receive and send messages. Page copy is obtained while sending and receiving traffic. The mode control will revert the K and K-T mode to the T mode on receiving a break or disconnect.

(d) TTR, TTS (Tape-to-Tape Receive and Tape-to-Tape Send)

These features are provided on an optional basis for receiving and sending of foreign tapes. The typing unit is blinded and therefore the stunt box is disconnected in these modes.

(e) MOTOR ON

The motor switch provides the attendant with the ability to keep the machine's motor on after a call disconnect has been received. In this way tapes can be prepared while using the rest of the station equipment to send or receive messages.

:.20 The buttons on the second control panel are used as follows:

(a) ROTR ON

This key is used to turn on an auxiliary receiving only type reperforator (ROTR) when one is provided.

(b) TD ON, TD OFF

These keys are used to turn the tape reader on or off by the attendant.

(c) TD CALL-IN

When this key is operated, the tape reader can be started upon receipt of a special prearranged code sent by a calling station.

(d) BREAK ⎰These keys,whose operation
⎱ was discussed in 2. 14, are
(e) HERE IS also contained on this panel.

Comparison of 33- and 35- Type Teletypewriters
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2.21 The following Table A summarizes the principal differences between the 33 and 35 teletypewriters:

TABLE A

COMPARISON OF 33- AND 35-TYPE TELETYPEWRITERS

Part or Use	33 Teletypewriter	35 Teletypewriter
Usage	Light Duty (Less than 50 hrs/mo)	Heavy Duty
Stunt box	Limited in size and flexibility (15 sensing positions; momentary, nonsequential operation of contacts only)	Large Capacity (42 sensing positions; optional sequential or nonsequential operation. Contacts may be arranged for momentary or locking operation.)
Auto transmitter start and stop upon receipt of proper codes	No	Yes
Sprocket feed	Not initially	Opt
Horizontal tab	No	Opt
Vertical tab	No	Opt
AC-DC motor for operation at dc locations or ac locations with poor ac power frequency stability	No	Yes
Auxiliary ROTR control from signals received over the line	No	Yes
Recommended maximum number of copies	2	8
Ability to prepare tape while sending or receiving traffic	No	Yes

Note 1: The stunt box is the brains of the TTY machine. It responds to stimuli of keyboard actions or line signals to control associated apparatus. Examples are carriage return, line feed, bell, etc.

F. Answer-Back Features

2.22 All 4-row stations capable of receiving calls are arranged for automatic answer, ie, they will answer automatically when called. Some are arranged to answer with a multicharacter identification type answer-back; others are arranged to respond with a confirmation type answer-back. The identification answer-back consists of a 17-character combination as follows:* carriage return, line feed, plus 1 to 12 characters selected by the subscriber, plus carriage return, line feed, and transmitter-on.

2.23 All stations equipped with the identification answer-back will also send their answer-back when they receive a "Who Are You" request.

2.24 Stations equipped with the confirmation type answer-back respond with a reverse slant symbol (\) followed by carriage return, line feed, and the confirmation (CNFM) code. Upon receipt of this CNFM answer-back, the calling station can automatically confirm that the station it has reached is the correct station by sending the RU request code plus the one to four arbitrary letters or numbers assigned to the called station. The called station, upon detecting these characters in its stunt box will again send its confirmation type answer-back. Upon detecting the CNFM code at this point, the calling station will send its message. Table B shows the responses that will take place between 4-row stations equipped with the multicharacter identification type answer-back and those equipped with the confirmation type answer-back as well as between 4-row and various 3-row stations.

* The answer-back drum actually consists of 21 slots. The first is used for timing purposes to delay the answer-back long enough for the sending station to send the rub-out character which always follows a WRU request code sent from tape. The number of identifying characters is restricted to 12 for directory reasons. In no case could it be more than 14 characters because one spare must be reserved for the selection of shift-up or shift-down, should this be the way upper and lower cases are selected in the future.

TABLE B

ANSWER-BACK RESPONSES

From	To	1st Trans from Called Station	Response to WRU	Response to RU
4-row Station	3- or 4-row station equipped with identification type answer-back.	ID AB[1]	ID AB[1]	None
"	4R station equipped with CNFM type answer-back.	CNFM AB[2]	None	CNFM AB[2]
"	3R station equipped with V-type answer-back.	V	None	None
"	Attended 3R station.	Manual	Manual	None

Note 1: ID AB = multicharacter identification answer-back which identifies the called station.

Note 2: The reverse slant symbol (\) is actually printed.

G. **Summary of Features Provided for C, D, and RO Stations**

2.25 Tables C, D, and E summarize the pertinent differences between the C, D, and RO stations. Except as noted in 2.05, the features provided for 4R TWX are the same as those listed for C stations.

TABLE C
SUMMARY OF ORIGINATING MODE
FEATURES PROVIDED FOR C AND D STATIONS

Originating Mode Features	C^1		D^2
	Orig-Term		Orig -Term Orig -Only
	33	35^3	35^3
1. Call Progress Tones detector and logic circuitry	No	No	Std
2. Ability to send WRU request from tape (ASR)	No	Std	Std
3. Ability to send RU request from tape (ASR)	No	Std	Std
4. Repertory Dialers	Opt	Opt	Opt
5. Auto. TD start on end of multicharacter identification type answer-back (XON Code)	No	Std	Std
6. Automatic TD start on receipt of confirmation code	No	Std	Std

Note 1: C stations will use 33 and 35 KSR- and ASR-type teletypewriters.

Note 2: D stations will use only 35 ASR-type teletypewriters.

Note 3: 35-type teletypewriters are equipped with a flexible mode switching arrangement which permits attendants at these stations to:

(a) prepare tape while sending and receiving traffic.

(b) transmit and receive foreign tapes, ie, tapes such as computer tapes which are coded in other than the standard 8-level format.

TABLE D

SUMMARY OF TERMINATING MODE FEATURES
PROVIDED FOR C, D, AND RO STATIONS

Terminating Mode Features	C		D		RO	
	Orig	-Term	Orig	-Term		
	33	35¹		35¹	33	35
1. Send multicharacter identification answer-back on answering.	Std	Note 2		Note 2	Std	Note 2
2. Send multicharacter identification answer-back in response to WRU.[3]	Std	Note 2		Note 2	Std	Note 2
3. Send confirmation answer-back (\).	No	Note 4		Note 4	No	Note 4
4. Auto. TD start upon receipt of proper codes.	No	Opt		Opt	No	No
5. Automatic control of auxiliary ROTR.	No	Opt		Opt	No	Opt
6. Terminal hunting group allotter arrangement (allotter to be located in CO).	Opt	Opt		Opt	Opt	Opt

Note 1: 35-type teletypewriters are equipped with a flexible mode switching arrangement which permits attendants at these stations to:

(a) prepare tape while sending and receiving traffic.

(b) transmit and receive foreign tapes, ie, tapes such as computer tapes which are coded in other than the standard 8-level format.

Note 2: Standard for stations equipped with the multicharacter identification answer-back.

Note 3: Originate-only D stations will be able to send multicharacter identification answer-back in response to WRU.

Note 4: Standard for station equipped with the confirmation type answer-back.

TABLE E

SUMMARY OF MISCELLANEOUS FEATURES
PROVIDED FOR C, D, AND RO STATIONS

Miscellaneous Features	C	D	RO
1. Basic controls not on keyboard (includes lamps)			
(a) Originate key (ORIG)	Std	Std [1]	Std
(b) Answer key (ANS)	Std	Std [1]	Std
(c) Clear key (CLR)	Std	Std	Std
(d) Local key (LCL)	Std	Std	No
(e) Test key (TST) (for loop around testing)	Std	Std	Std
(f) Buzzer Release (BUZ-RLS) (includes common alarm lamp)	Std	Std	Std
(g) Break Release (BRK-RLS)	Std	Std	No
(h) Out-of-Service Key	Std	Std [2]	Std [3]
(i) HERE-IS Key (No lamp)	Std	Std [2]	Std [3]
(j) BREAK Key (No lamp)	Std	Std	Std [3]
2. Lamps and alarm logic			
(a) Start dial (DIAL)	Opt	Std	No
(b) Low paper (PA)	Std	Std	Std
(c) Busy, Reorder (BY)	No	Std	No
(d) Intercept (INCPT)	No	Std	No
(e) No connection (NO CONN)	No	Std	No
(f) Service (SVC) (taut tape, controller power failure, AB not received, no transmission for 20 seconds, premature disconnect)	No	Std	No
(g) Restrainer (REST)	Std	Std	No
(h) Break Lamp (In BRK-RLS key)	Std	Std	No
(i) Common Alarm (CA) (In BUZ-RLS key)			
3. Loudspeaker	Std	Std	No
4. Handset	Opt	Opt	Std
5. Sprocket Feed [4]	Opt	Opt	Opt

Note 1: Answer key is disabled at originate-only stations.

Note 2: HERE-IS key disabled on stations equipped for RU answer-back.

Note 3: HERE-IS and BREAK feature provided under dial apparatus blank for test purposes only.

Note 4: Horizontal and vertical tabulation will be available, as required, with the sprocket feed (forms) option on 35-type machines. Sprocket feed without horizontal and vertical tab will be available in the future on 33-type machines.

H. Data Set Timing Intervals

2.26 In order to provide for more efficient use of station and central office facilities, the timing intervals applicable to 4-row teletypewriter operation have been substantially reduced from those used in 3-row operation. Following are the timing intervals applicable to 4-row TWX and WADS service.

SF Guard Interval (Delay in Return of F_2 Tone from the Called Station

2.27 The f_2 mark signal returned by the called station is delayed by 1.1 to 1.7 seconds. This delay is to permit the off-hook indication to be returned to the central office serving the calling station before the f_2 signal is applied.

Monitor Mark (Originating Station)

2.28 Immediately upon completion of dialing, the originating stations data set will monitor the line for the receipt of f_2 mark from the called station. After receipt of f_2 mark for 420 to 685 milliseconds the station will be enabled. The minimum time is determined by the fact that it takes about 400 milliseconds to disable any echo suppressor that may be in the connection. The f_1 tone cannot be sent until the echo suppressor is disabled because the presence of energy in the f_1 band would prevent the echo suppressor from being disabled.

Monitor Mark (Terminating Station)

2.29 The terminating station will enable after the receipt of the f_1 signal from the originating station for 210 to 375 milliseconds. This time cannot be reduced further, otherwise the called station would be apt to enable on noise impulses.

Monitor Space for Break Signal

2.30 In 3-row TWX stations, a double blank is used as a break signal. The double blank is detected in the 3-row machine's stunt box. On 4-row machines, blank (called null on 4-row machines) is just another character. The detection of a break signal on 4-row machines is accomplished in the data set which looks for a spacing signal of 91 to 195 milliseconds.

Send-Break Signal

2.31 The spacing signals sent as a break-signal is 200 to 250 milliseconds.

Monitor Space for Disconnect Signals

2.32 Normally, 4-row stations will disconnect by detecting the end of transmission (EOT) code. The EOT code will be followed by about 100 milliseconds of marking signal to keep the receiving station from generating a hit character while disconnecting. The data set is also arranged to disconnect if it receives a long space, which it will receive if the other station disconnects by depressing the CLR key. The data set will disconnect if it sees a loss of signal or a spacing signal for 275 to 525 milliseconds.

Send-Disconnect Signal

2.33 The spacing signal sent by the data set when the CLR key is depressed is 540 to 865 milliseconds.

Called-Station Time-Out

2.34 All TWX and WADS stations will disconnect after they are called, if they do not receive f_1 marking signal within 4 to 12 seconds. This feature is provided to prevent TWX and WADS stations from being tied up if they receive a call from a telephone customer or some other type of station which is not equipped with a compatible data set.

3. TYPICAL WADS D STATION CALL

A. Establishing the Connection

3.01 The handling of a call from a WADS C station or from a 4-row TWX station is relatively simple and has been covered in Section 972-205-100. The following is the procedure that would be followed at a WADS D station. For the sake of completeness, it is assumed that the D station is equipped with (a) sprocket feed instead of friction feed, (b) optional call progress tone detector, and (c) an auxiliary receiving-

only typing reperforator (ROTR).

(1) The attendant will normally prepare the message tape in advance and insert it in the transmitter.

(2) The ORIG key will be operated. This will cause (a) the station to go off-hook, (b) the originate (ORIG) lamp to light, (c) the station motor to start, and (d) a 60-second alarm timer to be activated. The optional start-dial circuitry in the data set will detect the dial tone and light the dial lamp.

(3) The attendant will dial the terminating station using the TOUCH-TONE dial or TOUCH-TONE card dialer. Each digit dialed will reset the 60-second timer. The dial lamp will go out as soon as the first digit is sent.

(4) Immediately after completing dialing, the station will automatically monitor the line for a period of 60 seconds for the return of f_2 mark signal from the called station.

(5) If, after completion of dialing, a busy or reorder signal is detected, the controller will (a) operate the common audible alarm buzzer, (b) light the common alarm lamp (CA), (c) light the busy lamp (BY), and (d) restore the station to the on-hook condition and extinguish the ORIG lamp. Momentary operation of the BUZ-RLS key will silence the audible alarm and extinguish the alarm lamps.

(6) If a nonworking number is reached, the intercept tone will be returned. Detection of this tone by the call progress detector will cause the controller to (a) operate the common audible alarm buzzer, (b) light the common alarm lamp (CA), (c) light the intercept lamp (INCPT), and (d) restore the station to the on-hook condition and extinguish the ORIG lamp. Momentary operation of the BUZ-RLS key will silence the audible alarm and extinguish the alarm lamps.

(7) If, after completion of dialing, the call is not answered (DA condition) or is left high and dry, the controller will time for 60 seconds, then (a) operate the common audible alarm buzzer, (b) light the common alarm lamp (CA), (c) light the no-connection lamp (NO CONN), and (d) restore the station to the on-hook condition and extinguish the ORIG lamp. Momentary operation of the BUZ-RLS key will silence the audible alarm and extinguish the alarm lamps.

(8) When the called station answers in normal manner on an unattended basis, its data set will turn on the motor at the called station and return the f_2 mark signal (2225 cps) to the calling station.

(9) The calling station, upon receipt of the f_2 mark signal, will connect its data set to the teletypewriter machine, reset the alarm timer in the controller for a 5-second timing interval, return the f_1 mark signal (1270 cps) to the called station and wait for answer-back.

(10) The called station, upon receipt of the f_1 mark signal, will transmit its answer-back. The answer-back sent to the calling station will either be a multi-character identification type answer-back or a single character confirmation type answer-back. Reception of any transition from mark to space at the calling station will be interpreted as an answer-back and a 5-second timer will be activated. The timer will be reset each time a character is received. The transmitter will start after 5 seconds of marking signal is received. If no answer-back is received, the calling station will (a) operate its common audible alarm buzzer, (b) light the common alarm lamp (CA), and (c) light the service lamp (SVC). Operation of the BUZ-RLS key will silence the audible alarm and extinguish the CA lamp. The attendant will determine why answer-back was not received and then send by keyboard or start the transmitter by pushing the TD-ON button if tape is available. Resumption of transmission will extinguish the SVC lamp.

(11) If the normal answer-back is received from the called station and includes the transmitter start (XON) code or confirmation (CNFM) code, the transmitter will start immediately.

(12) An idle line alarm indication will be initiated any time there is no transmission from either station for 20 seconds. The timer will (a) operate the common audible alarm, (b) light the common alarm lamp (CA), and (c) light the service lamp (SVC). The connection will remain established. Operation of the BUZ-RLS key will silence the audible alarm and extinguish the CA lamp. Resumption of transmission will extinguish the SVC lamp.

B. Miscellaneous Controls

3.02 Various functions and operations will occur when certain control codes or characters are transmitted. Assuming that tape transmission is in progress and the control codes are punched in the tape, the following operations will occur when the various codes are detected:

(1) Request for Answer-Back (WRU)

The calling station transmitter will stop after sending the character (rub-out) immediately following the WRU code. The alarm timer will be reset for a 5-second timing interval. Receipt of the WRU code will cause the called station to send its multicharacter identification answer-back. The calling station, upon receipt of the XON code at the end of the answer-back, will restart its transmitter and reset the timer for a 20-second timing interval.

(2) The RU Confirmation Request

A calling station transmitter will stop after sending the following sequence: RU, 1-4 characters, X OFF, rub-out. The alarm timer will be reset for a 5-second timing interval. The receiving station will transmit its confirmation answer-back (reverse slant, carriage return, line feed, and CNFM code). The calling station will detect the CNFM code and restart its transmitter. If the CNFM code is not received at the calling station, the transmitter will not restart but instead the controller will (a) operate

the common audible alarm buzzer, (b) light the common alarm lamp (CA), and (c) light the service alarm lamp (SVC). The connection will remain established. Operation of the BUZ-RLS key will silence the audible alarm and extinguish the CA lamp. The attendant can manually silence the alarm and restart the transmitter by operating the TD-ON button. This action will also automatically extinguish the SVC lamp.

(3) Form Feed

The sending station transmitter will stop after sending the character (rub-out) immediately following the form feed code. The sending and receiving stations will perform a form feed function. Upon completion of the form feed function, the sending station transmitter will automatically restart.

(4) ROTR Cuton and Cutoff Features

Receipt of the tape-on (TAPE) code at an originating-terminating station or at a receiving-only station that has an associated selective ROTR will cause the ROTR to automatically unblind. Receipt of the tape-off (TAPE) code will blind the ROTR. The sending station transmitter will not be interrupted. If the ROTR is in the unblinded condition when a WRU request for answer-back is received, it will be blinded so that the answer-back is not punched in the tape.

(5) End of Transmission (EOT) Code

When the EOT code is sent from the sending station (keyboard or tape), the following will occur:

(a) If sending from tape, the transmitter will stop after sending the character (rub-out) immediately following the EOT code.

(b) Upon detecting the end of transmission (EOT) code, the originating station will disconnect and form feed. Upon disconnecting as a result of detecting the EOT code, the data set will send 100 milliseconds of marking signal prior to going on-hook. This is done to prevent the printing of false characters at the other station.

(c) If the EOT code is not sent and the tape runs out of the transmitter, the tape-out pin will come up and initiate a disconnect sequence in which the data set sends 1 second of spacing signal to disconnect the other station. Depressing the clear key will also cause the station to disconnect and then send the disconnect spacing signal. Disconnecting by having the tape run out or by using the clear key should be discouraged because it will cause the printing of a false character at the other station and, because of the built in premature disconnect logic built into the D station, the buzzer to sound.

(6) Premature Disconnect

If the transmission facility fails or if the receiving station sends a disconnect signal while the sending station is transmitting, the sending station will (a) disconnect, (b) sound the audible alarm buzzer, (c) light the common alarm lamp (CA), and (d) light the service lamp (SVC). Operation of the BUZ-RLS key will silence the audible alarm and extinguish the CA and SVC lamps.
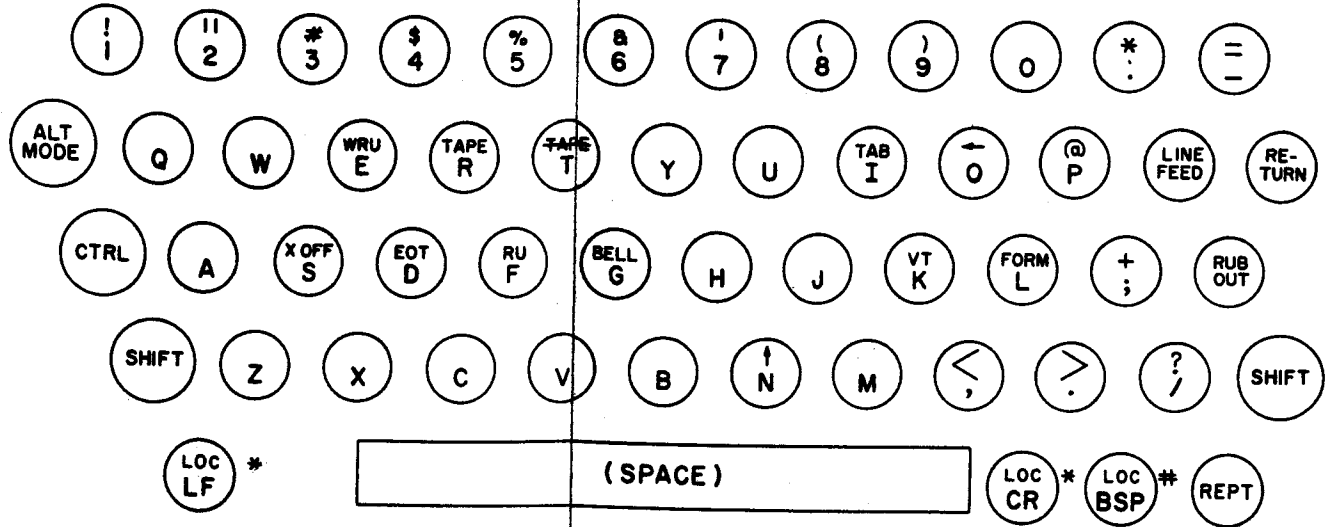
SPECIAL KEY TOPS FOR
AUXILIARY CONTROL FEATURES

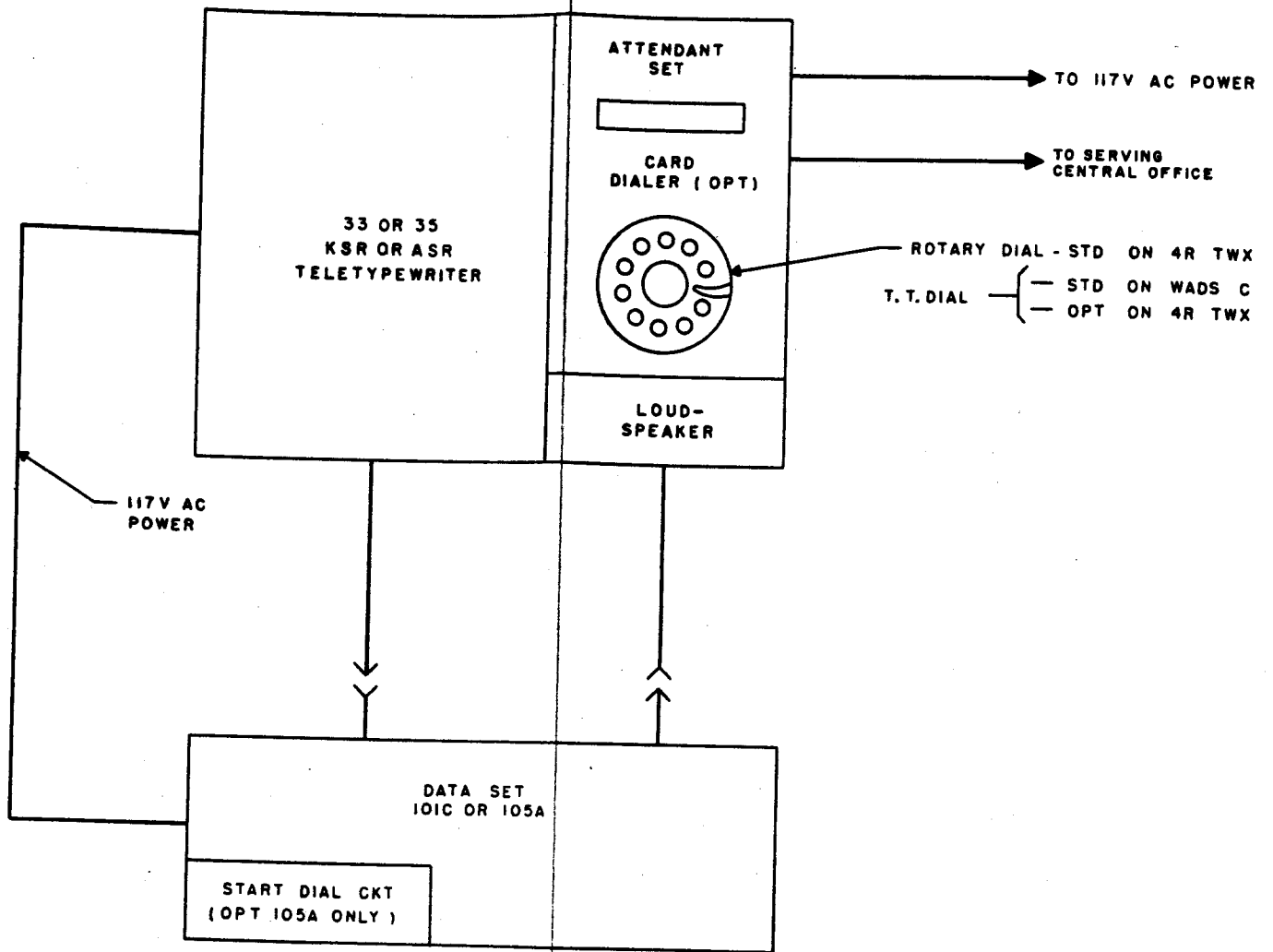* 35 TYPE ONLY
\# 35 ASR ONLY

Fig. 1 - 4-Row Keyboard Arrangement

ATTENDANT
SET

TO 117V AC POWER

CARD
DIALER (OPT)

TO SERVING
CENTRAL OFFICE

33 OR 35
KSR OR ASR
TELETYPEWRITER

ROTARY DIAL - STD   ON 4R TWX

T. T. DIAL — STD   ON WADS C
            — OPT   ON 4R TWX

LOUD-
SPEAKER

117V AC
POWER

DATA SET
101C OR 105A

START DIAL CKT
(OPT 105A ONLY)

Fig. 2 - Block Diagram of Typical 4-Row
TWX or WADS C Station
Arrangement
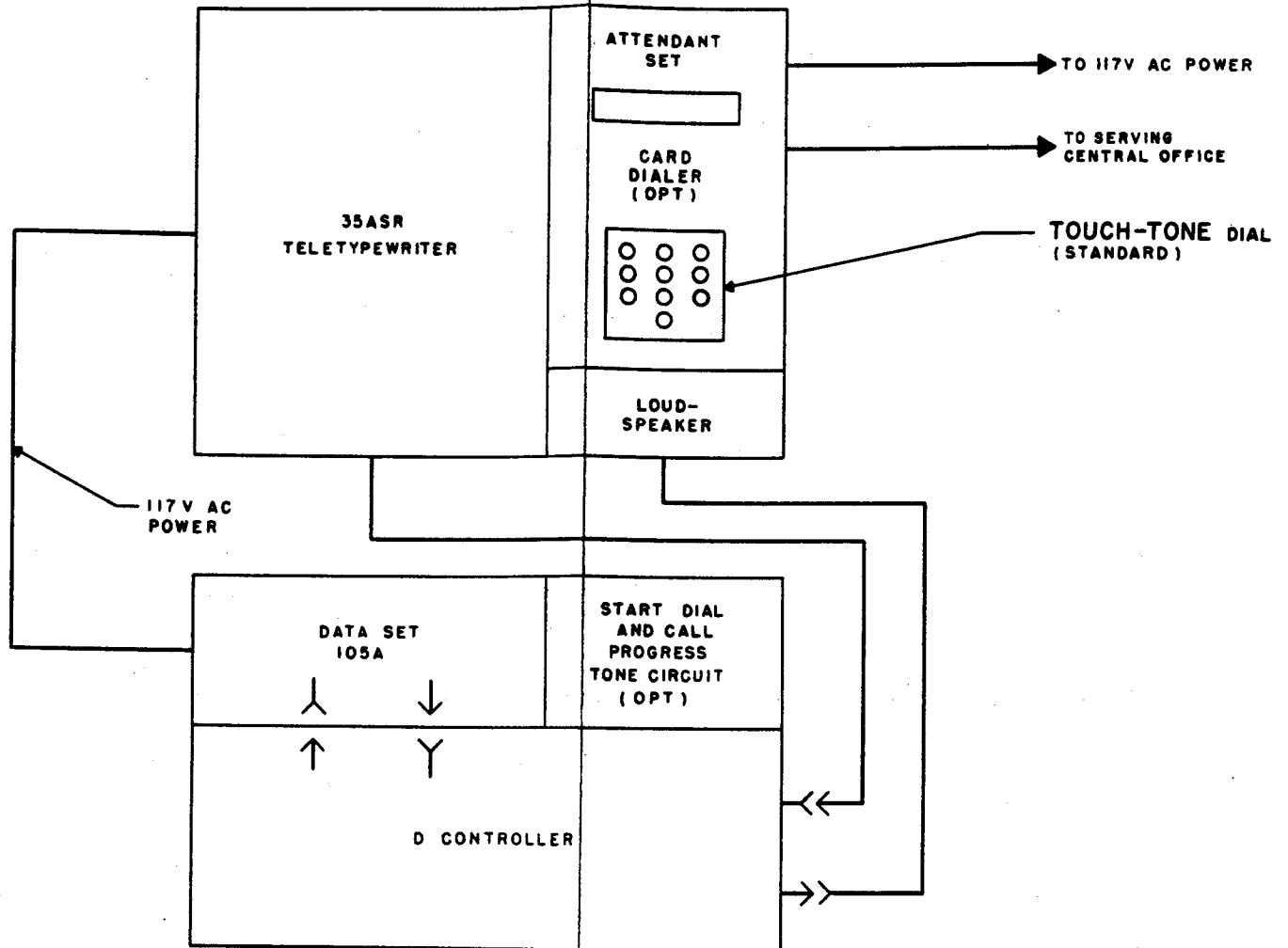
Fig. 3 - Block Diagram for Typical
WADS D Station
Arrangement

Fig. 4 - Data Sets 101C and 105A,
Simplified Block Diagram

NOTE 1: DIAL TONE AND CALL PROGRESS
TONE DETECTORS NOT AVAILABLE
WITH 101C DATA SET.

NOTE 2: LOGIC PROVIDES RELAY SWITCHING
OF OPERATIONAL MODES OF ALL
BLOCKS.
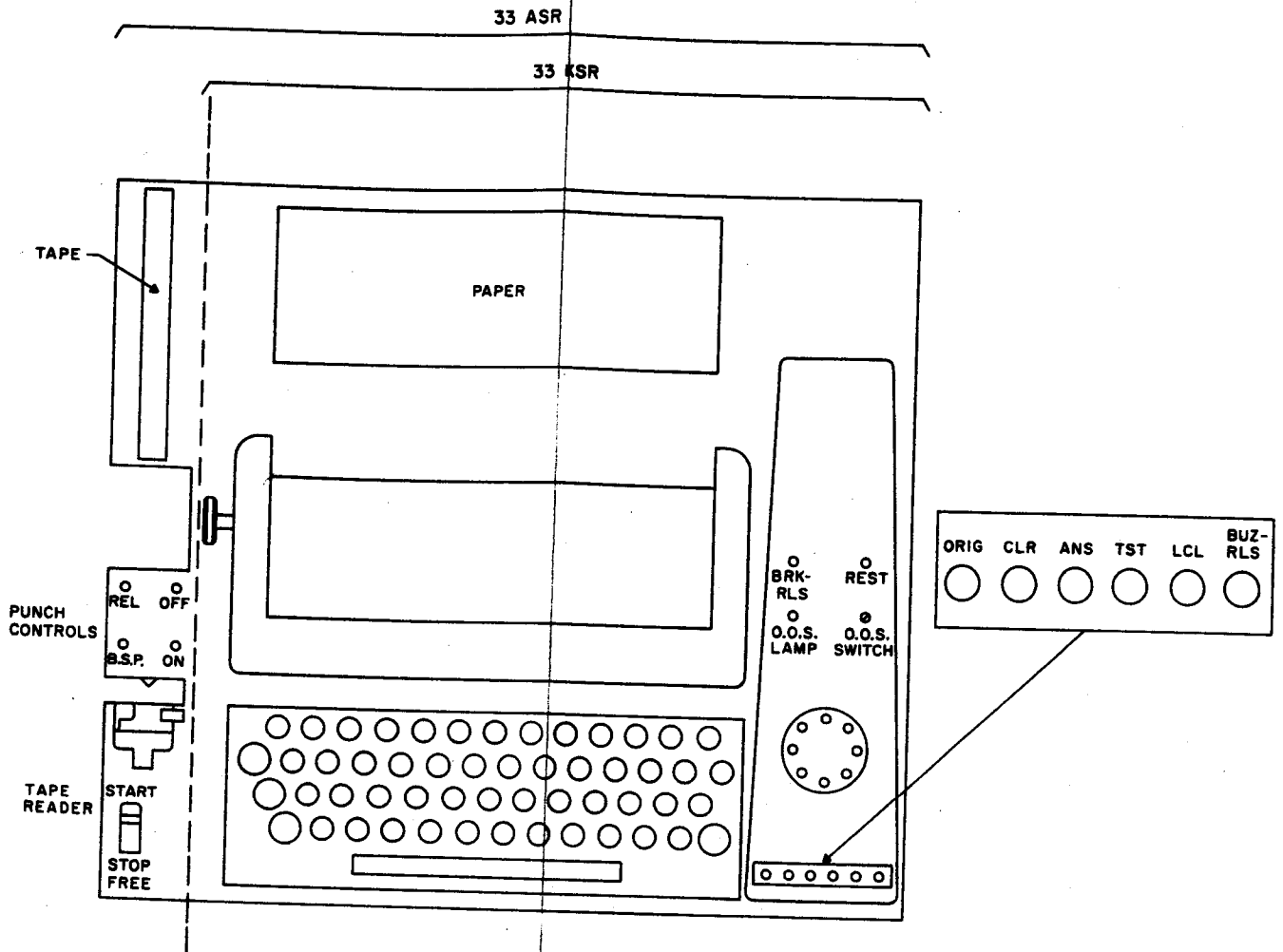
Fig. 5 - Typical Layout of 4R TWX Station Controls Furnished with a 33 Teletypewriter

CALL PROGRESS TONE AND ALARM LAMPS
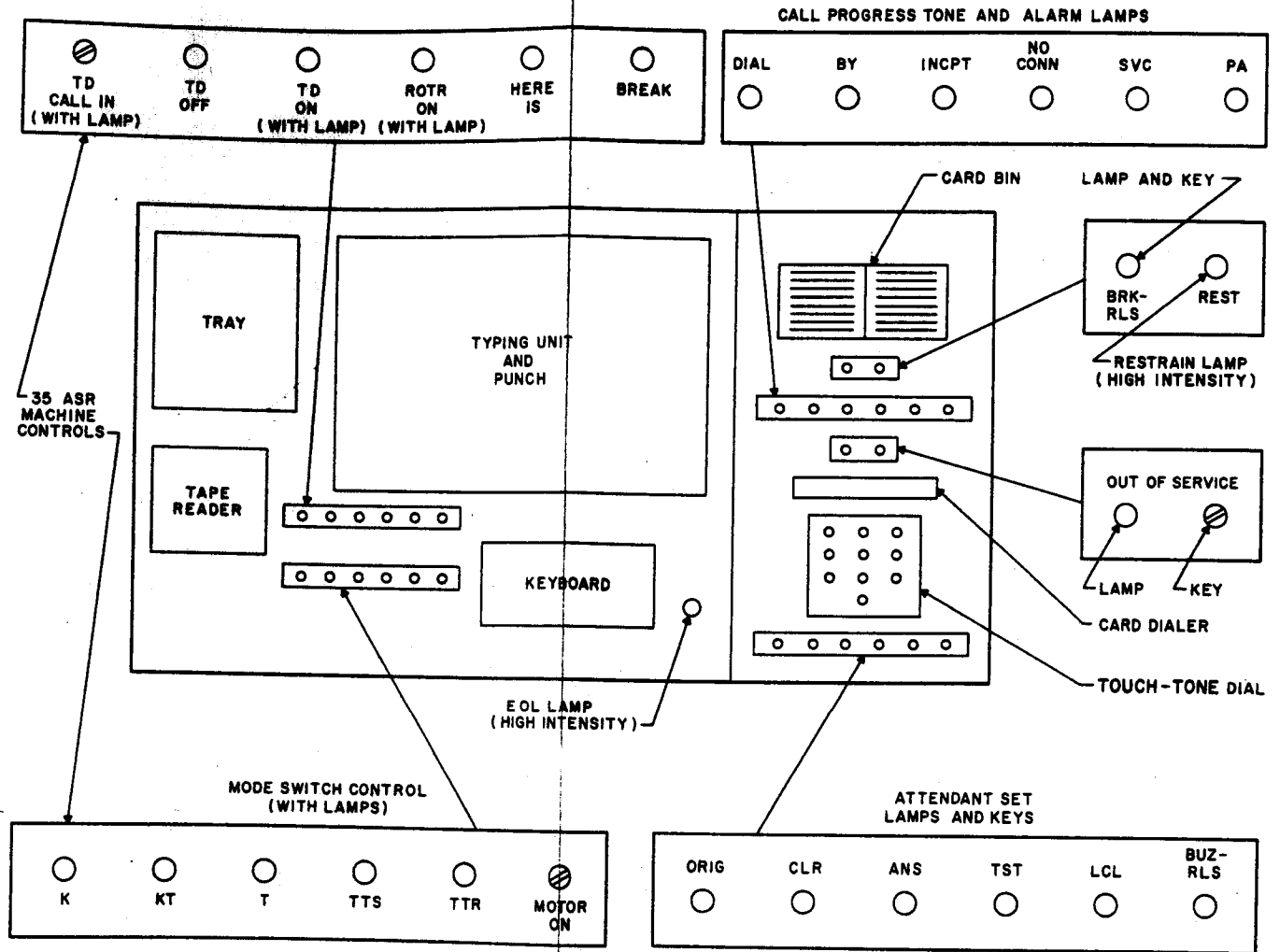
Fig. 6 - Layout of Controls,
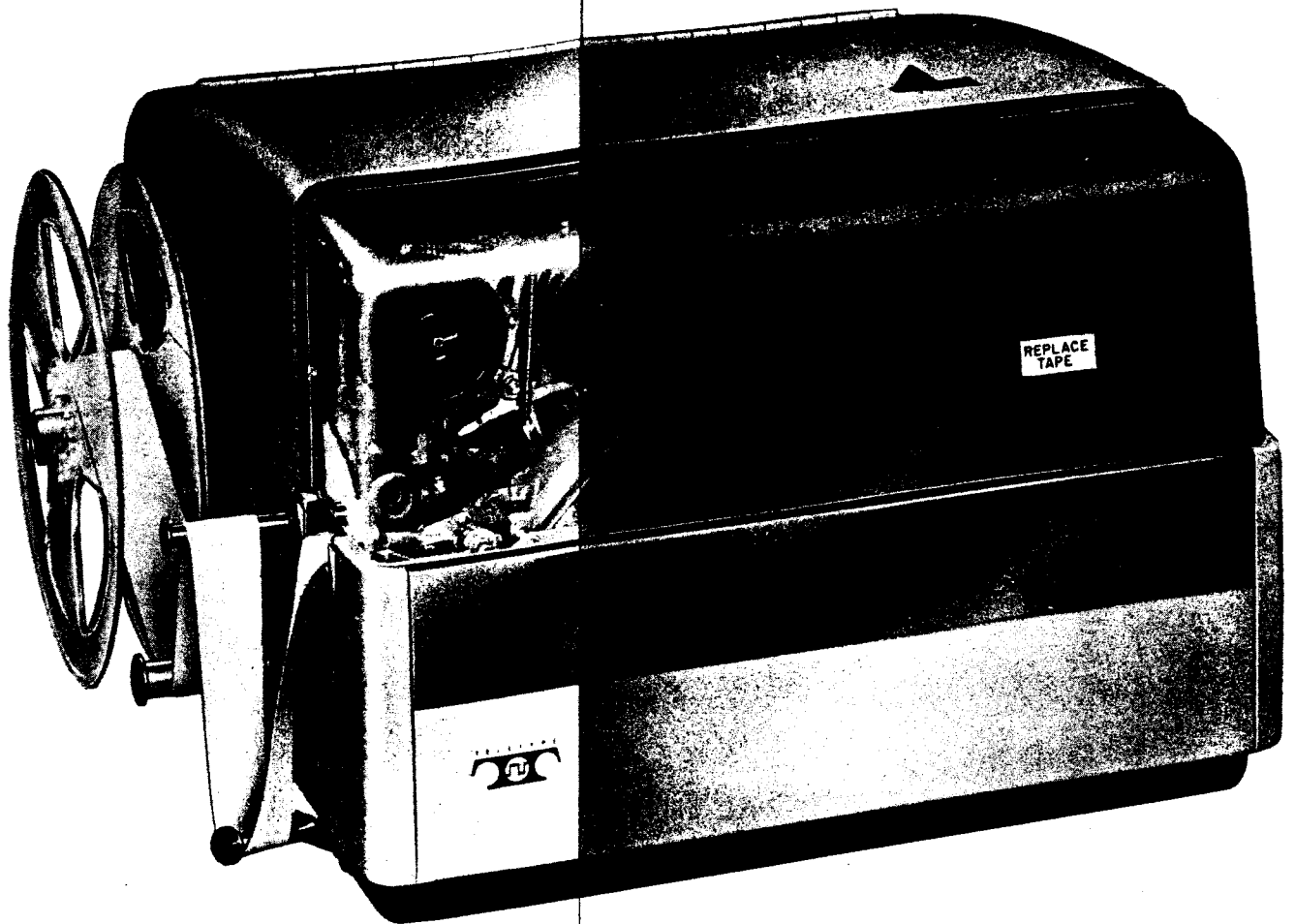WADS D Station
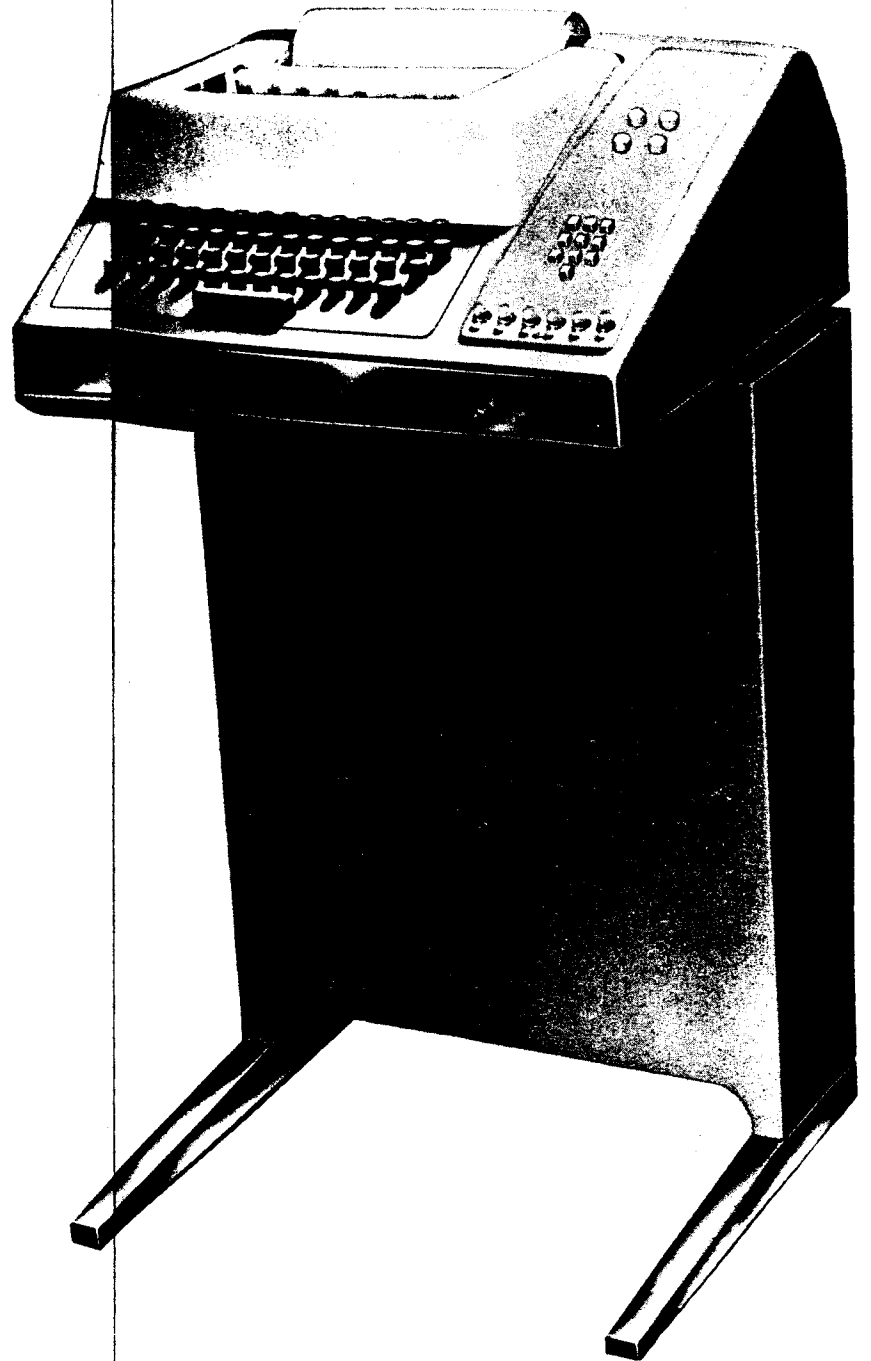
Fig. 7 - 33 KSR Set
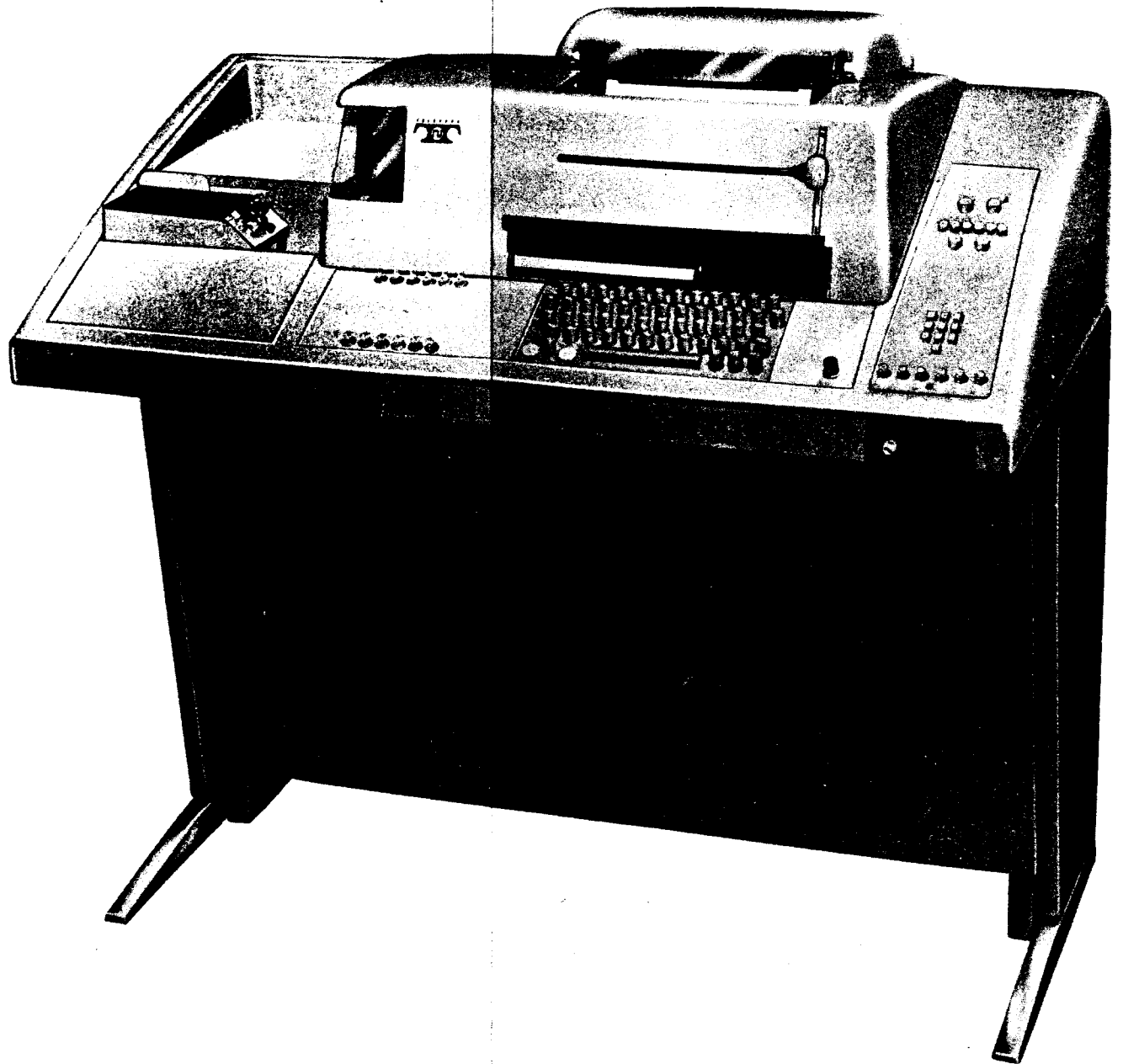
Fig. 8 - 35 ASR Set

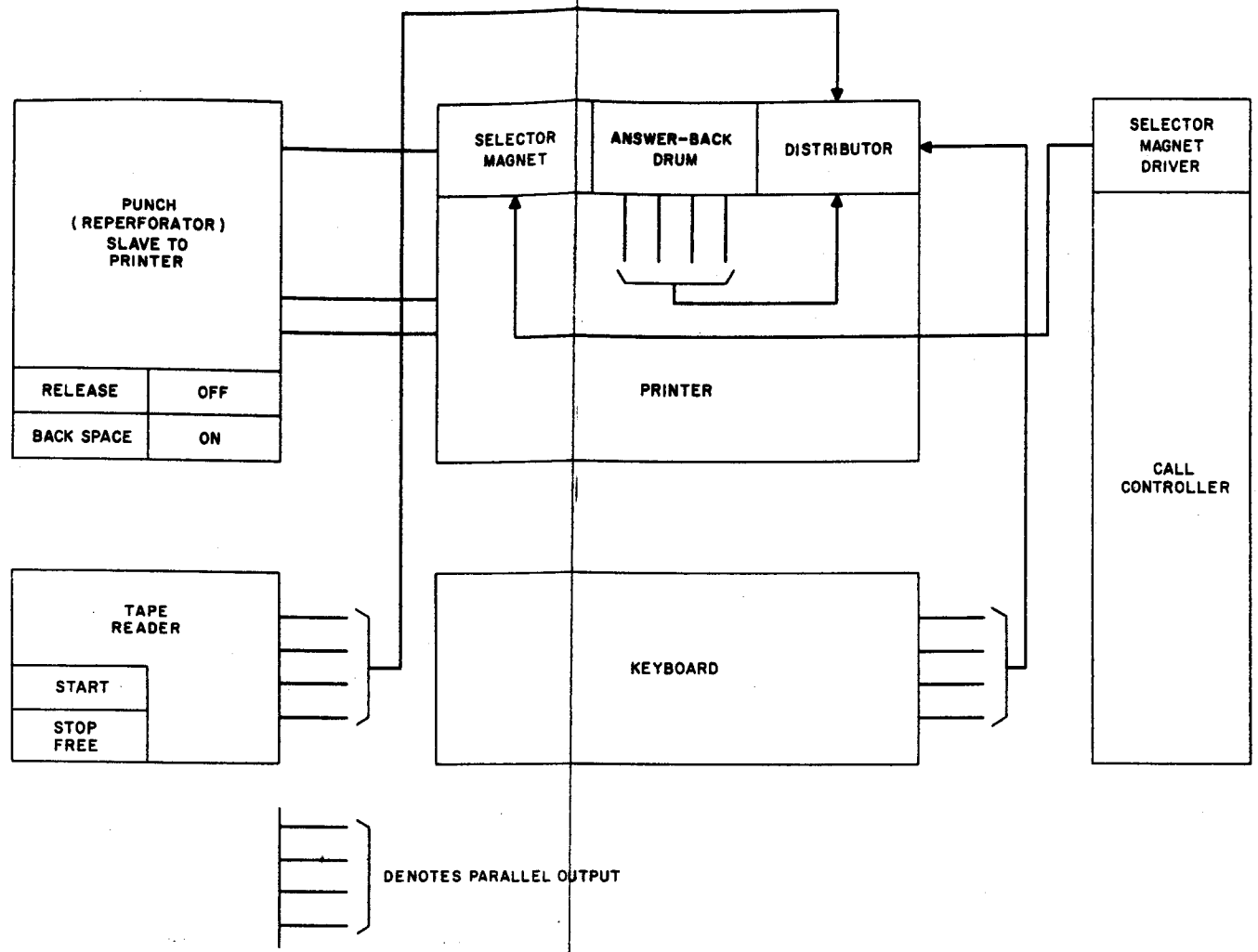Fig. 9 - 35 RO Set
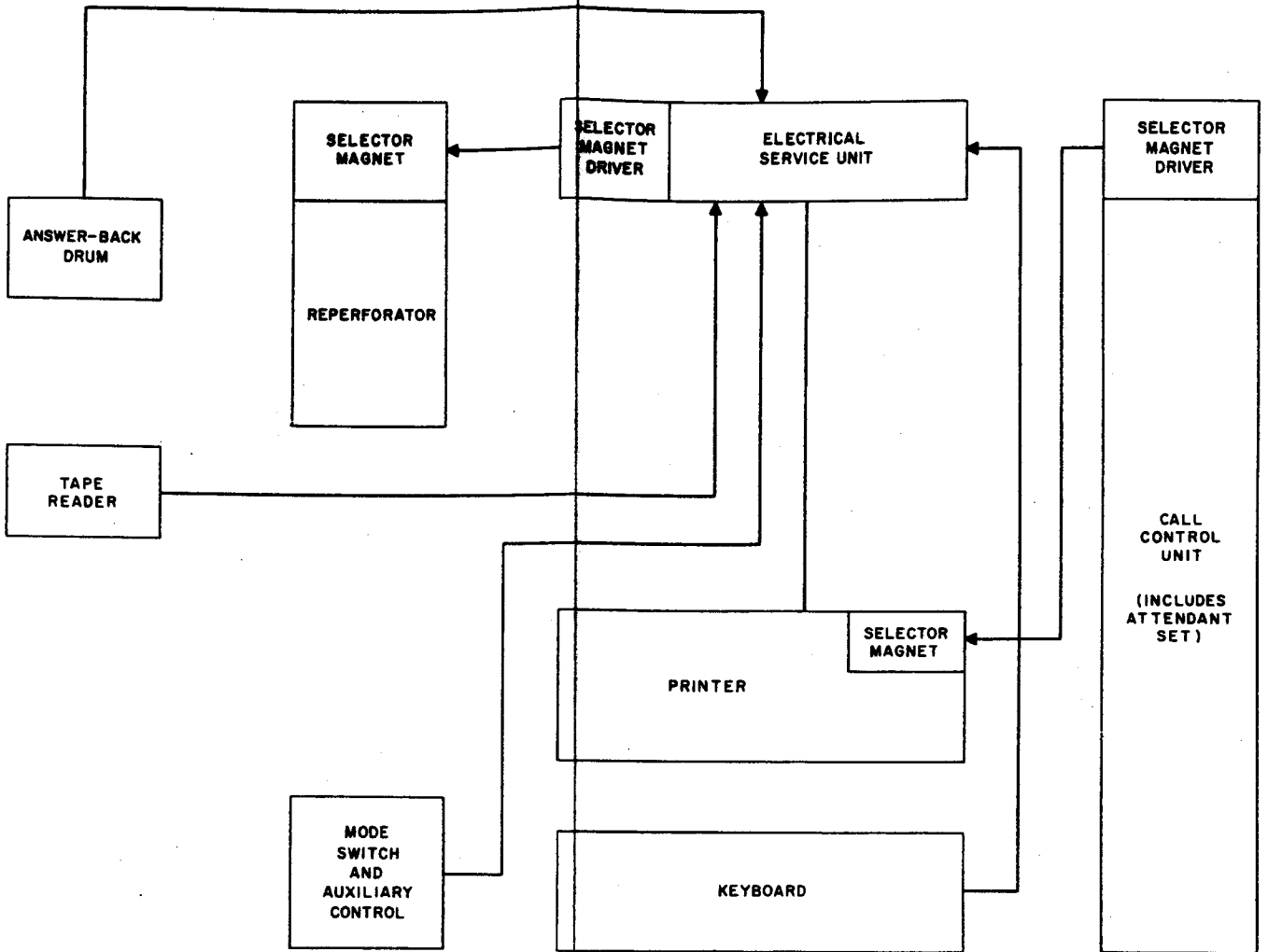
REPLACE
TAPE
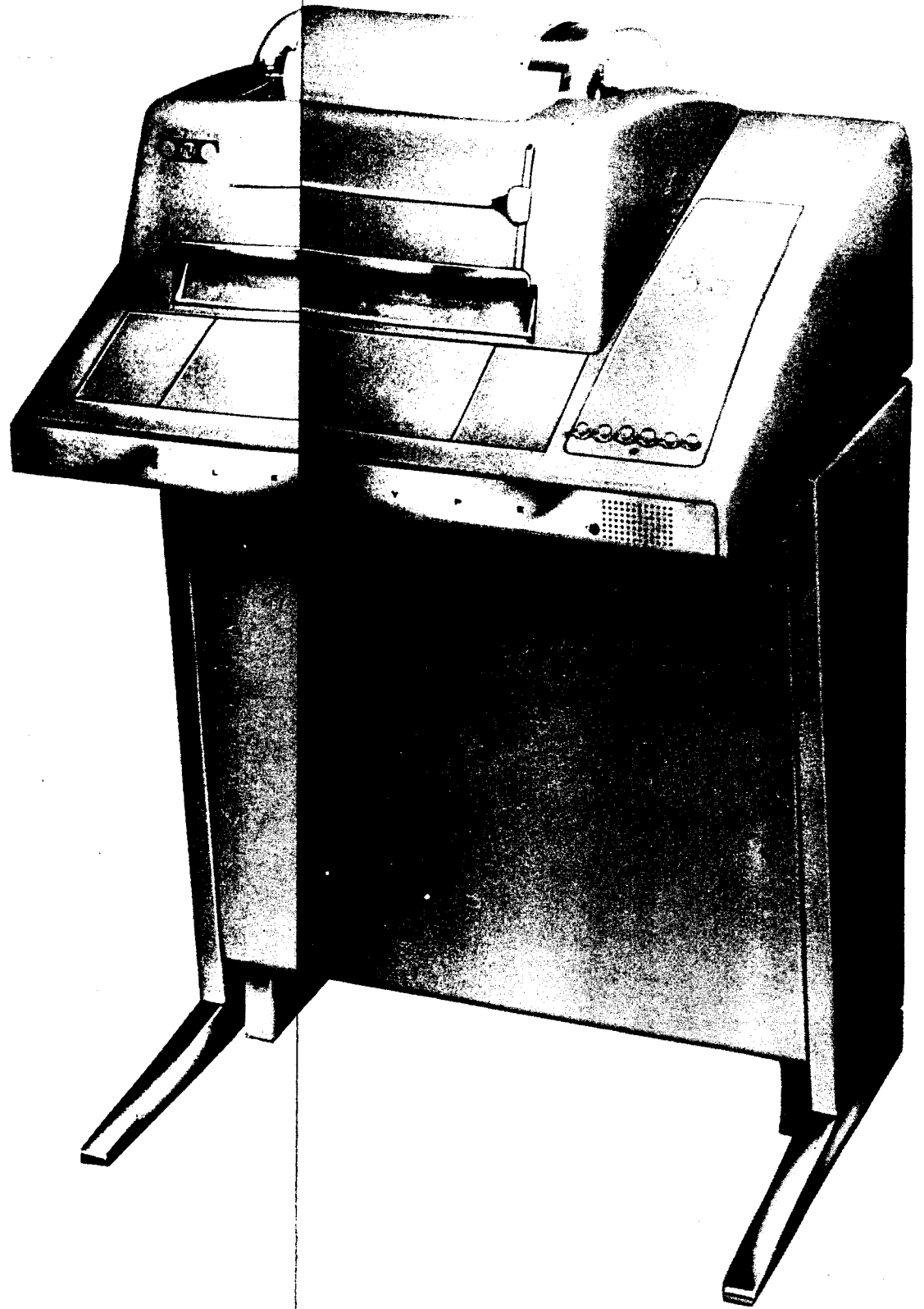
Fig. 10 - 35 ROTR Set

Fig. 11 - 33 ASR, Simplified
Block Diagram

Fig. 12 - 35 ASR, Simplified
Block Diagram