



DEPARTMENT OF COMMUNICATIONS AND MISSILE TRAINING

AN/TGC-14(V) TELETYPEWRITER I & O MAINTENANCE

3AZR36350-1-I-1 thru 5, 7 & 8

18 July 1972



SHEPPARD AIR FORCE BASE, TEXAS

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INTRODUCTION TO THE COURSE AND THE AN/TGC-14(V)  
TELETYPEWRITER SET

OBJECTIVE

To analyze the purpose and principles of operation, identify and give the purpose of the basic components, and identify the operating features and mode of equipment operation.

INTRODUCTION

Welcome to the AN/TGC-14(V) Teletypewriter I & O Maintenance Course. We, the instructors and supervisors, are here to help you in your study of the AN/TGC-14(V) teletypewriter maintenance. Keep in mind, however, that the benefits which you receive from this course are in direct proportion to the effort you put forth while attending these classes. In plain words, you get out of the course exactly what you put into it. Furthermore, the degree of proficiency which you develop here will be reflected in your work when you get back on the job.

INFORMATION

The Teletypewriter Set AN/TGC-14(V) shown in figures 1-1 and 1-2, is a rugged lightweight, miniature, alphanumeric printing teletypewriter for general use under a wide range of operating conditions. The teletypewriter set is fully compatible with other commercial and military teletypewriter equipment employing the standard start-stop, five-unit code. It can also be integrated into existing landline and radio link communications systems.

The AN/TGC-14(V), often referred to as the "MITE" or "MIGHTY MITE" consists of a basic group of components supplemented by other components which are selected to fit the requirement of a given installation. Hence the designation (V) effectively covers not one but rather a series of teletypewriter sets. The letter (V) then represents the versatility of the teletypewriter set. This equipment is used in aircraft, ships, submarines, and motor vehicles.

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This supersedes SG 3AZR36350-1-I-1, 1 April 1971.

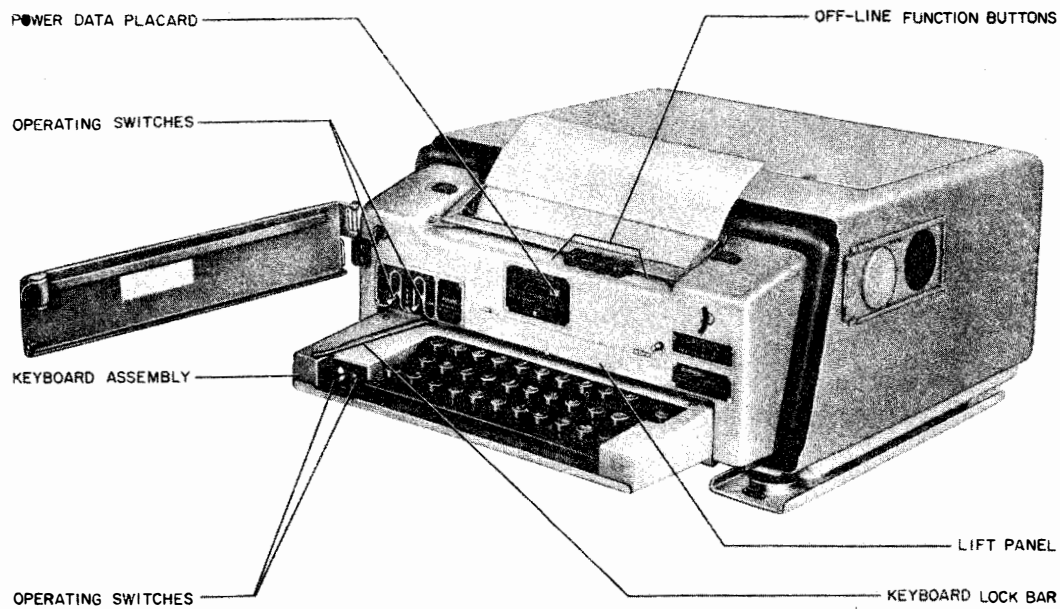


Figure 1-1. AN/TGC-14(V) Teletypewriter Set, Ready for Operation

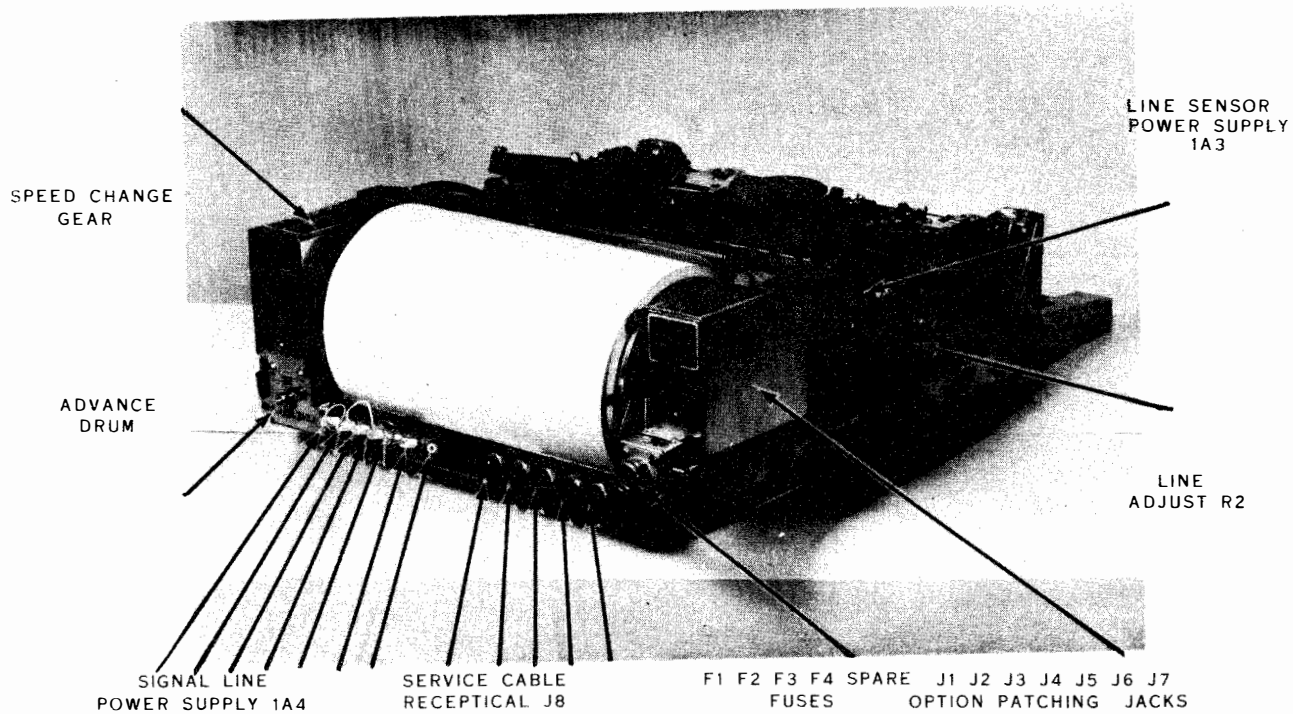


Figure 1-2. AN/TGC-14(V) Electrical Chassis, Rear View

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## BASIC COMPONENTS

The basic components of the AN/TGC-14(V) consists of an electrical chassis, a keyboard, and a printer (figure 1-3). To these components is added either an AC or a DC power supply kit which contains a signal line power supply and a line sensor (figure 1-3). The power supply kit also contains a service cable (figure 1-4) a heating element (figure 1-5) and fuses. The motor must be selected separately. A hysteresis synchronous motor is available for either 115-volt, 60 cycle per second operation or 115-volt, 400-cycle per second single-phase operation.

The versatility of the AN/TGC-14(V) is further extended by the patching option, allowing for half-duplex (simplex), full-duplex, or off-line local operation. The patching jacks are located on the left rear panel of the chassis (figure 1-2).

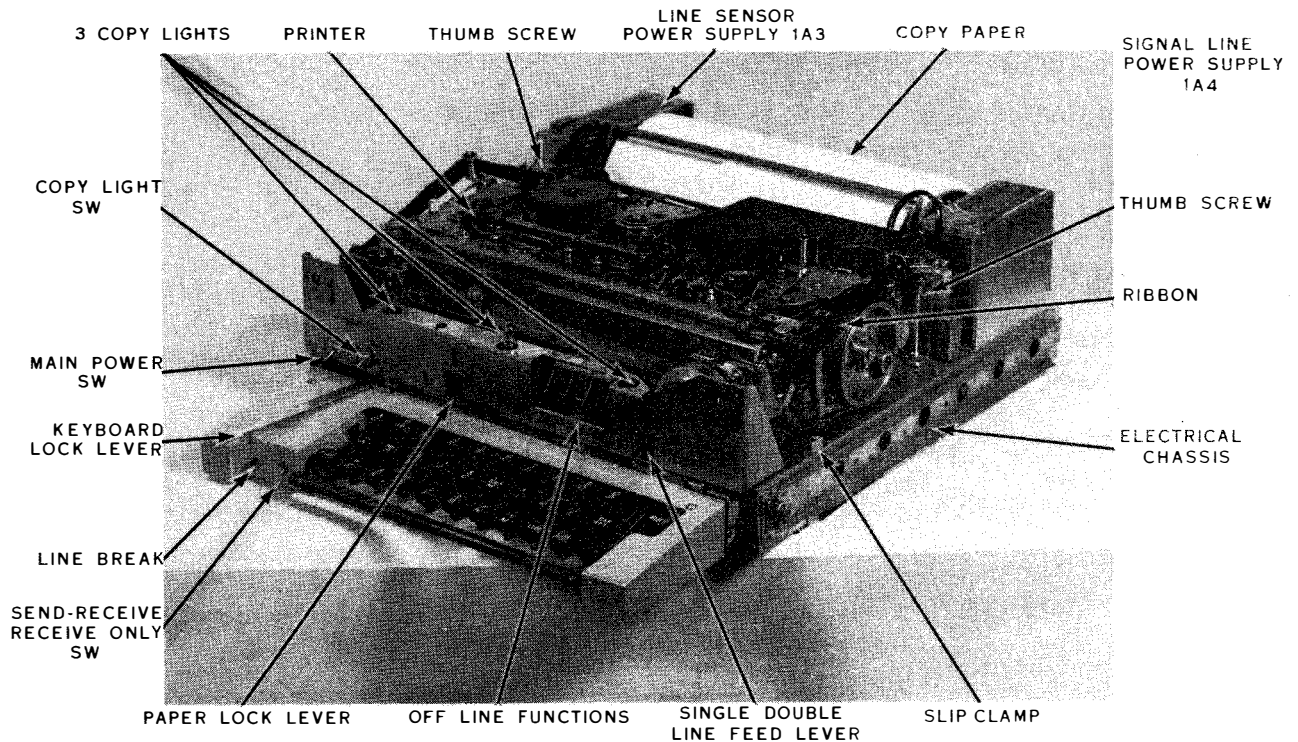


Figure 1-3. AN/TGC-14(V), Front View, Out of Case

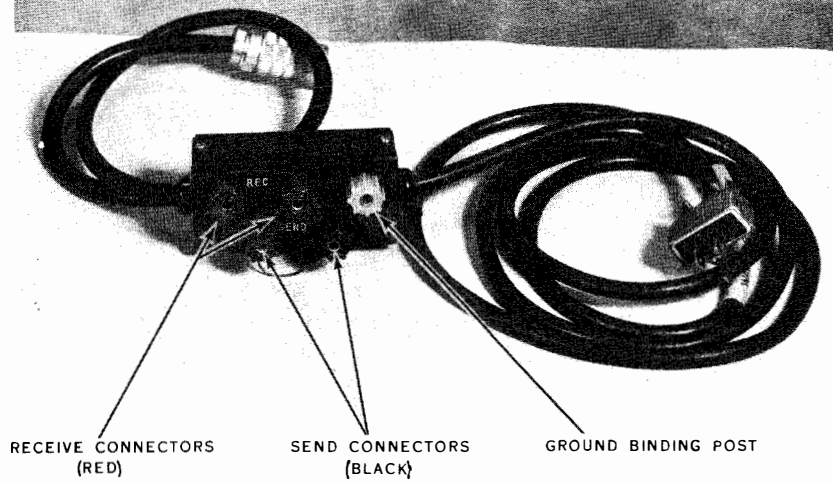


Figure 1-4. Line Service Cable and Junction Box

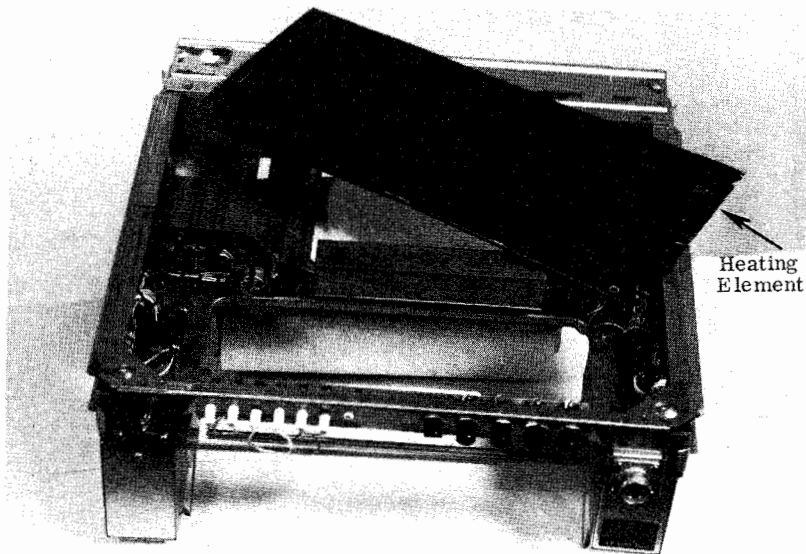


Figure 1-5. Electrical Chassis, Bottom View

### Electrical Chassis

The electrical chassis (figures 1-2 and 1-3) accommodates the printer and a standard roll of copy paper. The signal line power supply and the line sensor power supply are box-like, plug-in assemblies mounted on the rear corners of the chassis. The rear panel of the chassis houses 5 fuse holders, including one spare, and seven optional patching jacks (figure 1-2). An AC service cable receptacle is also located on the rear panel through which all power, signal line, and ground connections are made. On the far left, is the line adjust control, R2.

The front panel of the chassis has two switches, the main power switch and the copy light switch. There are three copy lights located on top of the electrical chassis and three cutout slots in the front panel for levers from the printer to protrude. These levers include, from left to right, the paper lock lever, the off-line function levers, and the single double-line feed lever.

Now, if you will turn the chassis up and look at the bottom, you will see the heating element (figure 1-5). This heating element is used when operating in an ambient temperature below 0° Centigrade (32° Fahrenheit). Two other controls located on the bottom include the thermostat, which automatically controls the heating element, and the motor stop relay.

#### Keyboard

The keyboard is a standard teletypewriter keyboard in respect to the keys and their arrangement. On the left front of the keyboard there are two switches, the signal line break key and the send-receive, receive-only switch. On top of the keyboard is a keyboard lock lever (figure 1-3) which has two positions. One position, as shown in the illustration, is the "operate" position. When the keyboard lock lever is pushed to the right, you can either remove the keyboard from the electrical chassis or push it into the chassis and under the printer, in the stored position.

The basic components of a standard keyboard have been rearranged on this equipment for compactness and simpler operation. Note how the cam assembly runs parallel with the keyboard rather than at right angles as in other teletypewriter equipment you have worked with.

#### Printer

The printer is mounted on the electrical chassis and held in place by two thumb-screws at the back and two slip clamps at the front. The AN/TGC-14(V) has a much different method of performing the same functions found on any standard teletypewriter. These functions are discussed in more detail later. The printer may be disassembled into three major sections: the front half, rear half, and the mainshaft. The printer operates on a 6.7 unit basis.

### PRINCIPLES OF EQUIPMENT OPERATION

With proper patching, this teletypewriter set supplies signal line current up to 100 milliamperes at 28-volts DC. Operational speed can be varied by speed-change gears supplied with the AN/TGC-14(V) for 60, 75, and 100 words per minute. The AN/TGC-14A(V) is supplied with speed-change gears for 45.45, 50, and 75 baud, compatible with 60, 75, and 100 words per minute respectively.

The signal code developed by a keyboard is the standard five-level, 7.42 unit for the AN/TGC-14(V) and 7.0 unit for the AN/TGC-14A(V), Baudot teletypewriter code (figure 1-6).

#### SUMMARY

This study guide has presented a general introduction to the operation and use of the AN/TGC-14(V) equipment. You have located and identified major components and purpose of each. Your next study guide covers the functional operation of the major components.





## IDENTIFICATION AND OPERATIONAL ANALYSIS OF THE MAJOR COMPONENTS

### OBJECTIVE

This study guide is designed to enable you to identify and analyze the functional operation of the major AN/TGC-14(V) components.

### INTRODUCTION

From the previous lesson, you learned the location and purpose of the main components of the AN/TGC-14(V). This study guide analyzes the functional operation of the Ribbon Feed Mechanism, Front and Rear Half of the Printer, Mainshaft, Line Sensor, Keyboard, and Power Supply.

### INFORMATION

#### FUNCTIONAL OPERATION OF MAJOR COMPONENTS

##### Ribbon Feed Mechanism

The ribbon feed mechanism (figure 2-1) is located under the paper guide plate. It automatically advances and reverses the direction of the ribbon. The motive power for the ribbon feed mechanism is supplied by the printer gear on the selector portion of the mainshaft. From this point the ribbon feed sequence of operation is as follows:

RIBBON IDLER GEAR

RIBBON FEED SLIP CLUTCH GEAR

RIBBON FEED DRIVE SHAFT

RIBBON FEED WORM

RIBBON FEED CLUTCH SHAFT GEAR ASSEMBLY

LEFT AND RIGHT INTERMEDIATE DRIVE GEARS

LEFT AND RIGHT RIBBON SPOOL GEARS, BACKSTOPS, AND SPRINGS

This supersedes SG 3AZR36350-1-I-2, 1 April 1971.

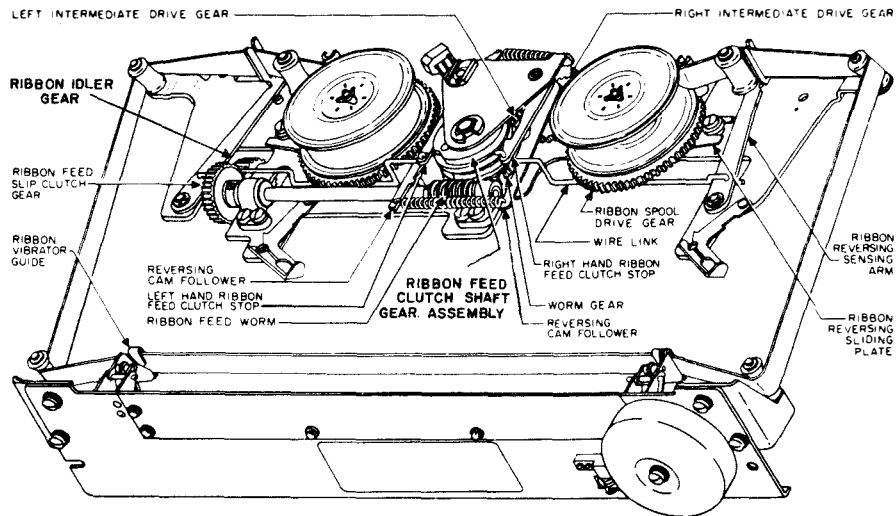


Figure 2-1. Ribbon Feed Mechanism

The ribbon is fed through the ribbon vibrator links. One side of the link is attached to brackets on the front plate assembly forming a fixed pivot point. The other side is attached to the ribbon vibrator arms forming a movable pivot point. The ribbon vibrator arms are clamped to the hammer shaft so that when the hammer is rotated toward the type cylinder, the ribbon is moved up into its path. When the hammer is rotated away from the type cylinder, the ribbon is moved down so the line of type is visible.

#### Ribbon Reverse Operation

The ribbon reverse operation is started by the action of the ribbon eyelet. The sequence of operation is as follows (figure 2-1):

RIBBON EYELET engages the

SENSING ARM and moves it outward. The sensing arm pulls the

CONNECTING LINK attached to the

RIBBON REVERSE CLUTCH RELEASE ARM. The

RIBBON REVERSE CLUTCH engages and rotates with the

RIBBON REVERSE CAM 180°. The

RIBBON REVERSE CAM FOLLOWER rides to the high part of the cam causing the movable

SLIDE PLATE to shift from one side to the other. The

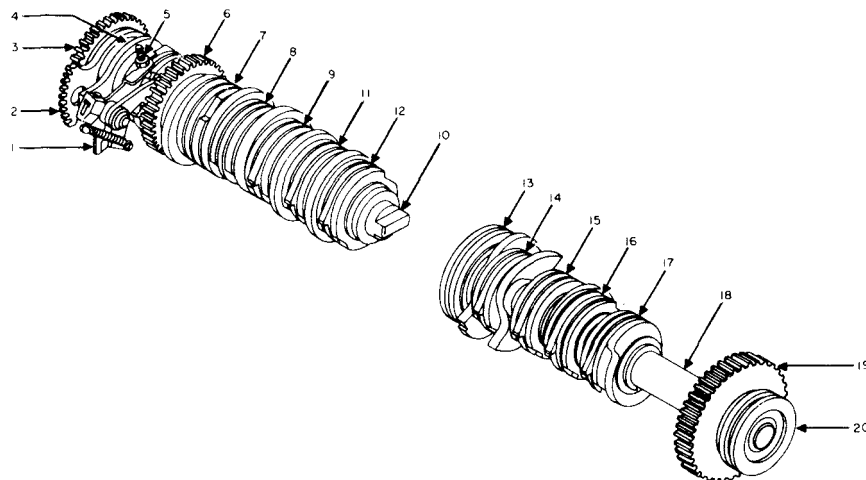
RIBBON SPOOL GEAR is mounted on the slide plate and disengages from its matching

**DRIVE GEAR.** The gears on the opposite side engage and feed the ribbon from that side.

## Printer

Earlier it was mentioned that the printer is mounted on the electrical chassis and held in place by two thumbscrews at the back and by two slip clamps at the front. The printer can be disassembled into three major sections: the front half, rear half, and the mainshaft.

**MAINSHAFT ASSEMBLY.** The printer mainshaft assembly (figure 2-2) consists of two assemblies or sections, the Selector portion and the Function portion of the mainshaft. These two sections and their component parts are identified by numbers. The number 10 identifies the Selector section, referred to as the selector mainshaft. Number 18 represents the Function section, referred to as the function mainshaft. There is a total of 10 clutches and 11 cams on the complete mainshaft assembly which are interlocked to form a rigid connection. These clutches and cams are discussed in more detail in study guide 3AZR36350-1-I-4 entitled "Theory of Operation of the Printer."



- | <u>LEGEND</u>                               |   |
|---|---|
| 1. START CLUTCH RELEASE                     | 11. NO. 2 ROTARY CLUTCH AND E CAM         |
| 2. RANGE ADJUSTMENT GEAR SEGMENT*           | 12. NO. 1 ROTARY CLUTCH AND F CAM         |
| 3. PRINTER HELICAL GEAR                     | 13. CENTER BEARING AND RETAINER           |
| 4. LEFT-HAND BEARING AND RETAINER*          | 14. PRINT FUNCTION CLUTCH AND G AND H CAM |
| 5. START CLUTCH RELEASE ADJUSTMENT SETSCREW | 15. LINE FEED CLUTCH AND I CAM            |
| 6. START CLUTCH GEAR                        | 16. LETTERS FIGURES CLUTCH AND J CAM      |
| 7. NO. 3 LATERAL CLUTCH AND B CAM           | 17. CARRIAGE RETURN CLUTCH AND K CAM      |
| 8. NO. 4 LATERAL CLUTCH AND C CAM           | 18. FUNCTION MAIN SHAFT                   |
| 9. NO. 5 LATERAL CLUTCH AND D CAM           | 19. THIRD REDUCTION GEAR                  |
| 10. SELECTOR MAIN SHAFT                     | 20. RIGHT-HAND BEARING AND RETAINER       |

Figure 2-2. Printer Mainshaft Assembly

**LINE SENSOR.** The line sensor (figure 2-3) consists of a semiconductor diode bridge to orient the polarity of the signal to a transistor functioning as a switch. The sensor also includes a space and a mark coil amplifier transistor to energize the space and mark solenoid coils, respectively, on the selector mechanism. The line sensor also acts as a holding circuit for the figure H or the time delay motor stop function. The actual circuitry for the line sensor operation is analyzed in study guide 3AZR36350-1-I-7 and may be traced on the schematic diagram of foldout 1.

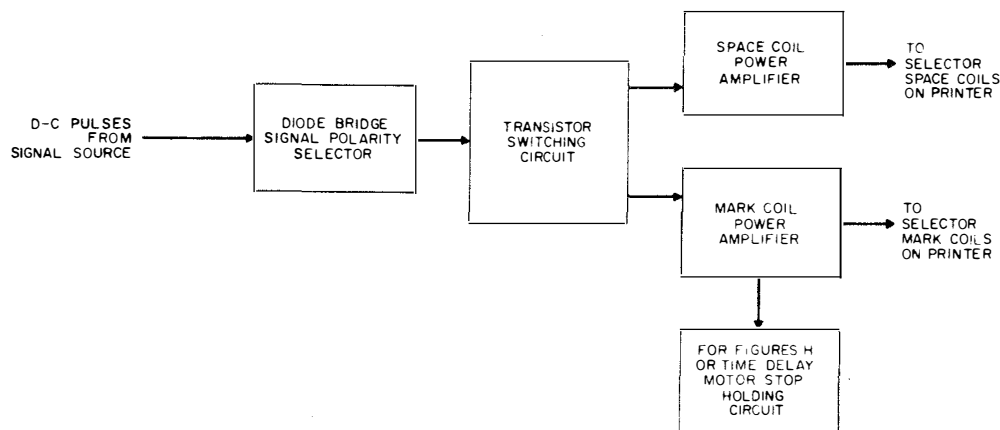


Figure 2-3. Line Sensor 1A3, Functional Block Diagram

**KEYBOARD.** The keyboard (figures 1-1 and 1-3) consists of a keyboard drive gear, a drive shaft, a clutch mechanism coupled to a set of five pulsing cams, code pulsing contacts, and a set of five code bars. The code bars set up the mechanical train of operation which causes a coded series of pulses to be generated and transmitted over a signal line. At the other end of the line, the train of pulses is received and decoded by the line sensor in the remote teletypewriter set. The remote printer translates the decoded pulses into the required mechanical action. This results in either the printing of a character or the performance of a mechanical function. The sequence steps of action of the keyboard is discussed in more detail in the next study guide.

**POWER SUPPLY.** The signal line power supply is on the right rear part of the electrical chassis (figure 1-2). It consists of a step-down transformer capable of operating on either 60 or 400 cycles per second. The power supply also has a conventional full-wave bridge rectifier and a resistance-capacitance filter network. Except for the transformer, the components are mounted on a printed circuit board. The transformer applies 33-volts AC across the rectifier formed by four diodes.

The power supply is a source of DC signal line current for the local teletypewriter equipment or for other equipment requiring currents not exceeding 100 milliamperes at 26-volts DC and a floating ground.

## SUMMARY

Thus far we have determined only the functional operation of component parts of the keyboard, printer, and electrical chassis. The next study guide analyzes the sequence steps of operation of the keyboard. It also explains the procedures used to perform the keyboard adjustments.

## REFERENCE

TO 31W4-2TGC14-1, Technical Manual for Teletypewriter Sets AN/TGC-14(V) and AN/TGC-14A(V).



## OPERATION AND ADJUSTMENT OF THE KEYBOARD

### OBJECTIVE

This study guide is written so you will be able to analyze the keyboard sequence steps of operation and to perform related mechanical adjustments.

### INTRODUCTION

The keyboard is one of the basic components of the AN/TGC-14(V). Its mechanical-electrical arrangement permits transmission of standard code impulses over signal lines to receiving units. To properly troubleshoot and perform required adjustments, one must understand the complete operation of the keyboard.

### INFORMATION

The operation of the keyboard may be subdivided into four separate operations. They include the clutch mechanism, positioning the code bars, transmission of signals to the signal line, and repeat operation.

#### CLUTCH MECHANISM

The clutch used on the keyboard drive shaft is a friction-roller type clutch (figure 3-1). It consists of two housings, a cage, four rollers, and two bias compression springs. The housings, with the cage between them, are riveted together to hold them rigid. The cage, riveted through elongated holes, is free to rotate approximately  $20^{\circ}$  in relation to the housings. The four rollers are aligned in four slots cut into the housings and cage. The slots in the cage fit snugly around the rollers and permit the rollers to travel the length of the slots. The ends of the slots in the housings have close fitting sloped surfaces. When the clutch is engaged, the slots restrict the motion of the rollers so as to force the rollers against the drive shaft. Your next thought should be, how is the clutch engaged?

When a keytop is depressed, the keylever moves the common clutch release bail down which pivots the bail arm. This pulls the clutch release link and the clutch stop and release arm toward the front of the keyboard (figure 3-2). As the clutch stop and release arm is moved forward, it is moved away from the clutch stop tab on the cage (figure 3-1). The cage is then moved forward by the compression springs. This action cams the rollers down on the drive shaft and the clutch rotates with the drive shaft. The clutch rotates  $180^{\circ}$  until the clutch stop and release arm engages one of the cage stop tabs. This action stops the clutch, allowing the roller to move back into their original position in the slots of the housings and cage. The bias compression springs tries to push the housings backwards, thus reestablishing the camming effect. However, the backstop (figure 3-2) is pulled into a notch in the housing holding the bias compression springs compressed and the clutch completely disengaged.

This supersedes SG 3AZR36350-1-I-3, 1 April 1972.

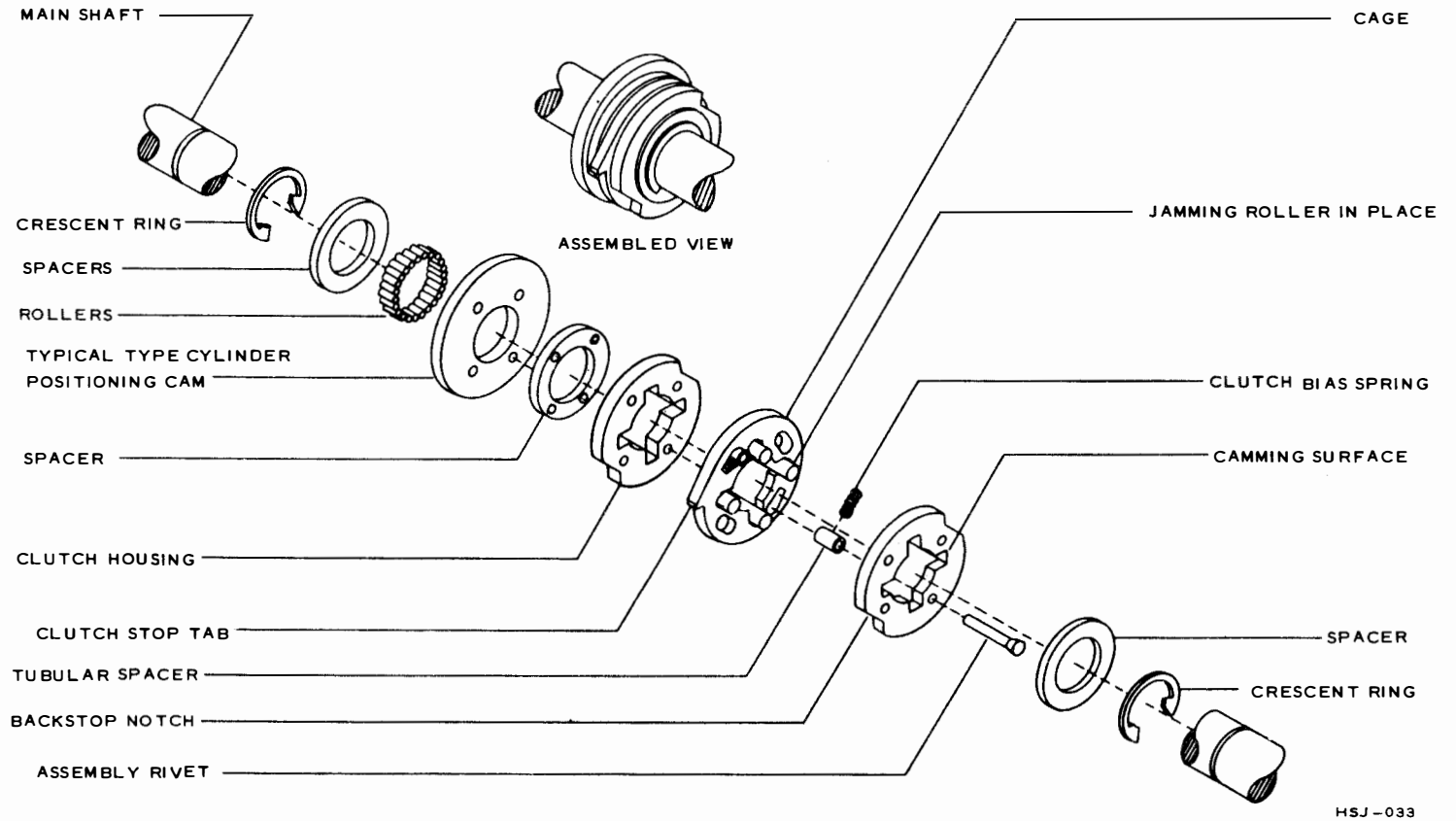


Figure 3-1. Friction-Roller Type Clutch, Exploded View



## POSITIONING THE CODE BARS

The keylever positions the five code bars as well as moving the common clutch release bail. When depressed, the front of the keylever moves down against the tension of the keylever leaf spring. The keylever also strikes the slanted sides of notches cut into the code bars, and moves them to the right or to the left. The code bars are moved to the right and out from under its related code pulsing cam follower (figure 3-2) for a mark. The code bars are moved to the left and under their respective code pulsing cam follower for a space. The code bar lock lever under tension of its spring is pulled to the low part of its cam. The front of the lock lever moves down into slots cut into the code bars locking them in their selected position, to the right or left.

The five code bars are numbered from front to rear #1, 2, 3, 4, and 5. There are nine cams on the keyboard drive shaft. From left to right they are identified as follows (figure 3-2):

MASTER PULSING CAM

START-STOP CAM

#1 CODE PULSING CAM

#2 CODE PULSING CAM

#3 CODE PULSING CAM

#4 CODE PULSING CAM

#5 CODE PULSING CAM

CODE BAR LOCK LEVER CAM

CLUTCH RELEASE LINK CAM

## TRANSMISSION OF SIGNALS TO THE SIGNAL LINE

When the code bar lock lever is pulled to the low part of its cam, the front of the code bar lock lever moves down into the notches of the code bars. This action locks the code bars in their selected position, to the left for a space and to the right for a mark during the character cycle. As the cam assembly rotates, the start-stop cam follower rides to the high part of its cam. This moves the front part of the cam follower up, opening the start-stop pulsing contacts (figure 3-2). The open contacts places a space or start impulse on the signal line.

The code pulsing cam followers 1 through 5 are pulled to the low part of their cams by their springs. The front moves down and allows the normally opened code pulsing contacts to close, placing a mark impulse on the signal line. The code pulsing cam followers then ride to the high part of their cams opening their respective code pulsing contacts. If the code bars are to the left (space), they block and prevent movement of the code pulsing cam followers. The code contacts, as a result, remain open.

3-4

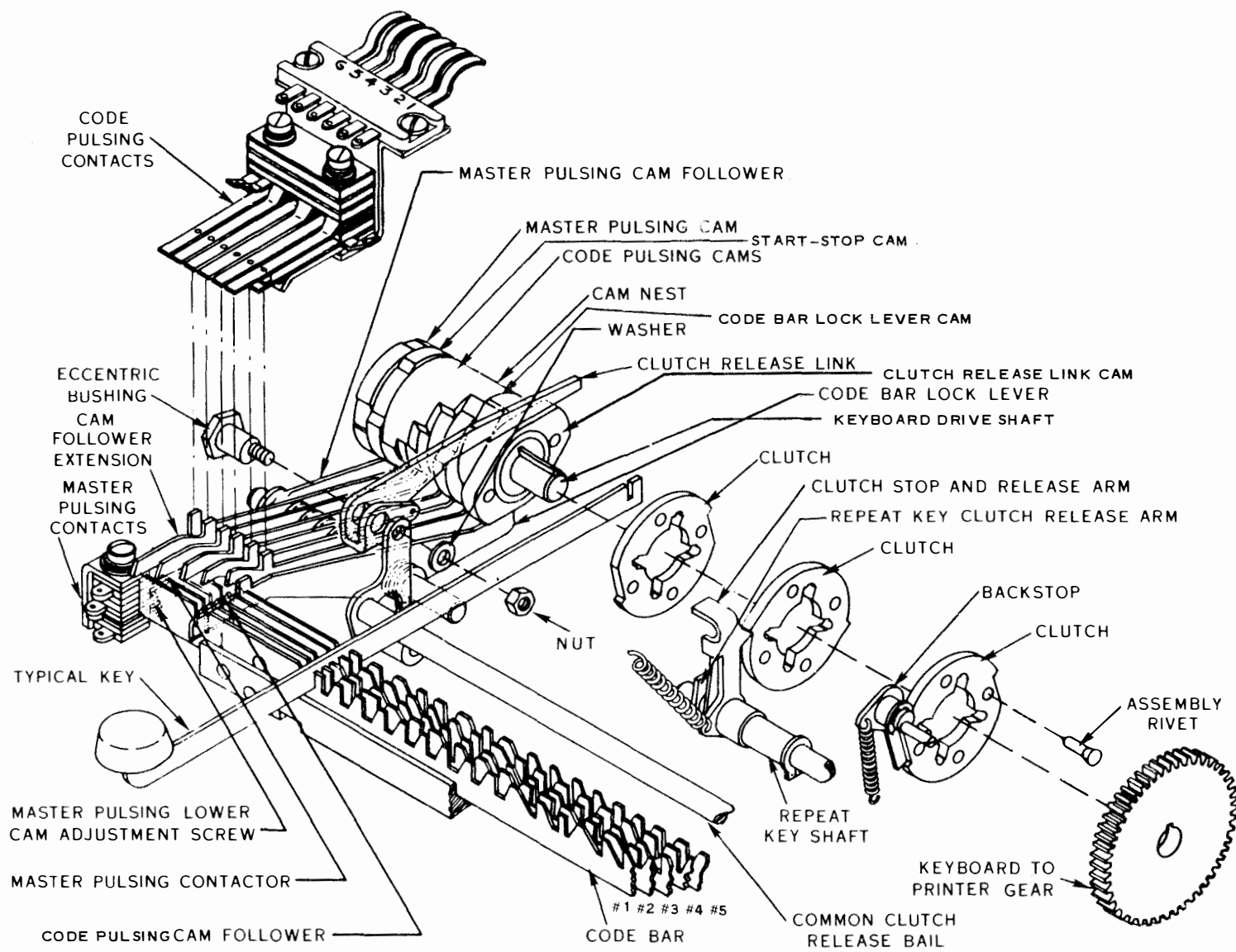


Figure 3-2. Positioning the Code Bars

The master pulsing cam follower rides on the master pulsing cam (figure 3-2) which has four high surfaces and three low surfaces for each character cycle. When riding on the high parts of the cam, the upper contacts close and control the start, #2, #4, and the stop impulses. When the cam follower is pulled to the low parts of the cam, the lower contacts close and control the #1, #3, and #5 impulses. The master pulsing contacts shape the teletypewriter signal and keep switching current off the code pulsing contacts. When the start-stop cam follower rides to the low part of its cam, the start-stop pulsing contacts close. This places a mark (stop) impulse on the signal line.

#### REPEAT OPERATION

When the repeat key is depressed, the front of the repeat keylever is moved down against the tension of the repeat keylever spring. The rear end of the repeat keylever, attached to the repeat keylever shaft by a clamp, rotates the shaft counterclockwise. Attached to the left end of the repeat keylever shaft is the repeat key clutch release arm (figure 3-2). As it is rotated counterclockwise, the top of the repeat key clutch release arm engages the clutch stop and release arm. This action operates the normal keyboard clutch release mechanism, discussed earlier. The last character selected in the code bars is repeated until the repeat key is released. The repeat keylever spring furnishes power to return the repeat key, repeat keylever, repeat keylever shaft, and repeat key clutch release arm to their normal stop position.

#### LINE BREAK

The signal line can be opened for signalling purpose or to start the motor after the automatic motor stop has turned it off, by depressing the break button. The break button, on the front of the keyboard, opens the break switch in series with the signal line, placing a space on the line.

#### ELECTRICALLY SHORTING OUT THE KEYBOARD

The SEND-REC-REC switch located on the front of the keyboard is connected across the master pulsing contacts, code pulsing contacts, and the break switch. When the switch is in the SEND-REC position, the switch is open and the operator may send and receive. When the switch is in the REC position, the switch is closed, and the keyboard is electrically shorted. This prevents the signal line from being keyed or interrupted by the keyboard.

#### KEYBOARD ADJUSTMENTS

Before attempting to perform any keyboard adjustments, it is most important that you understand the sequence steps of action that occur during the operation of the keyboard. Adjustment of the keyboard requires many interacting operations that must be performed in exact sequence.

Your student workbook contains detailed instructional procedures to follow when performing the adjustments. Read each adjustment requirement and/or procedure carefully before attempting to perform the adjustment. Make sure you understand what you have read and exactly what you are to do. Then, using proper tools and safety practices, perform the adjustment. Observe caution when making adjustments to insure other adjustments have not been altered.

## SUMMARY

The keyboard is an important component of the AN/TGC-14(V). If this equipment is to serve its function efficiently, it is necessary for you to know the complete sequence of steps for its operation and how to perform related adjustments. This knowledge is of great advantage when confronted with a piece of equipment which is not functioning properly and you have to repair or troubleshoot it.

## REFERENCE:

TO 31W4-2TGC14-1, Technical Manual for Teletypewriter Sets AN/TGC-14(V) and AN/TGC-14A(V).

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## THEORY OF OPERATION OF THE PRINTER

### OBJECTIVE

This study guide is written so you will be able to analyze and identify the sequence steps of action for the printer operation.

### INTRODUCTION

The previous study guide discussed how teletypewriter signals are transmitted from the AN/TGC-14(V) keyboard. This study guide explains how these signals are received by the printer and changed into the various mechanical operations of the printer.

### INFORMATION

The function of the AN/TGC-14(V) printer is to receive impulses from a local keyboard or from a signal line. Through the use of a magnetic selector, the signal impulses are changed to printed characters or symbols or mechanical action functions performed by the printer. The operations of the printer to be discussed in this study guide include the following:

MAGNETIC SELECTOR

PRINTER MAINSHAFT

TYPE CYLINDER

FUNCTION CAM AND EFFECTS

FUNCTION SENSING FINGERS

CHARACTER ADVANCE

CHARACTER ADVANCE PREVENT

PRINT PREVENTION

The AN/TGC-14(V) has the same functions of any standard teletypewriter. However, it differs somewhat in the method in which these functions are accomplished. For example, the AN/TGC-14(V) uses such items as chains, cables, and belts to accomplish the positioning of the type cylinder. Other teletypewriter units use selector magnets to change electrical impulses into mechanical action. The AN/TGC-14(V) uses a magnetic selector unit with two magnets operating in a much different manner.

This supersedes SG 3AZR36350-1-I-4, 1 April 1971.

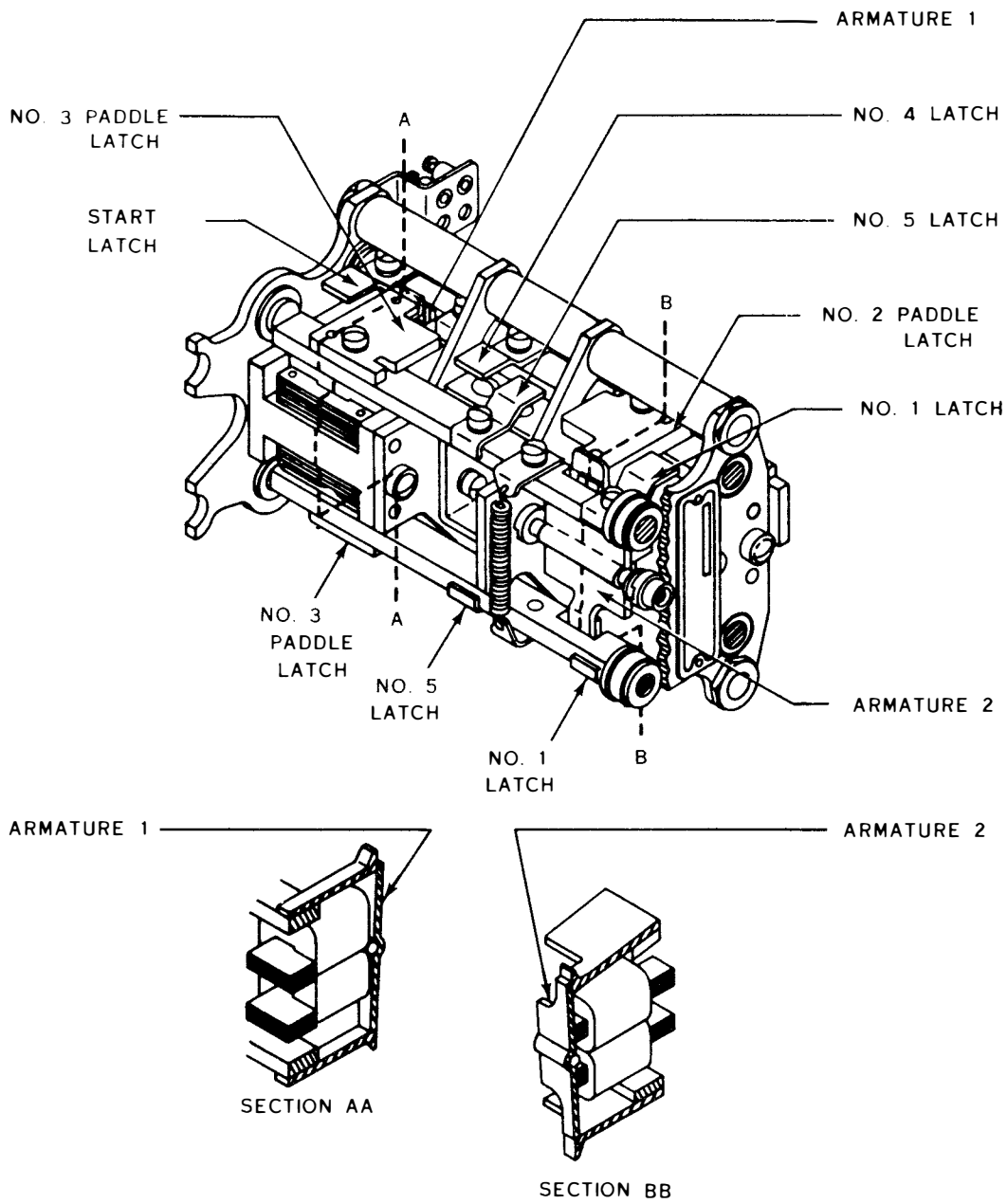


Figure 4-1. Magnetic Selector Mechanism

## MAGNETIC SELECTOR

The magnetic selector mechanism (figure 4-1) is mounted on the back of the printer. Its purpose is to receive electrical impulses from the line sensor and convert them into mechanical action. The magnetic selector consists of 2 ARMATURE SETS; 2 SOLENOID COIL SETS facing in opposite directions, each solenoid contains 4 SOLENOID COILS (2 mark and 2 space); 4 PADDLE SHAFTS; 4 PADDLE LATCHES; and 8 LATCHES. A paddle latch is a combination of a paddle and a latch. Only 7 of the 8 latches are used - the bottom start latch is not used. The pulse information from the line sensor is in the form of space or mark current.

Armature I (shown to the left in figure 4-1) controls intelligence clutches 1, 3, and 5. Armature II (right) controls the start clutch and the number 2 and 4 intelligence clutches. The two armature sets are also divided horizontally. The top halves are used for mark while the bottom halves of both armatures are used for space.

As shown in figure 4-1, the number 2 mark paddle latch is mounted on a movable shaft, along with the number 4 mark latch and the start latch. The number 3 mark paddle latch of Armature I is mounted on another shaft to which mark latches 5 and 1 are attached. A similar set of space paddles and latches are located on the two shafts at the bottom of the magnetic selector unit.

When either the mark or space coils are energized, the armature is positioned to block the inward movement of the respective mark or space paddle latch (figure 4-2). The unblocked paddle latches and latches on the paddle shaft are free to move, allowing the clutch release fingers to release their respective clutches.

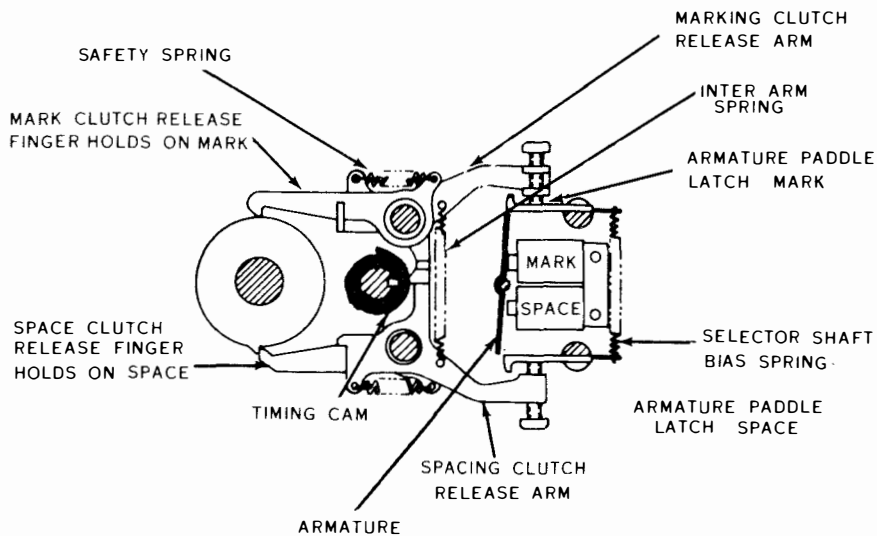


Figure 4-2. Selector, Clutch Release Mechanism

#### CLUTCH RELEASE FINGERS AND TIMING CAM

##### Start-Stop Release Finger

During a steady mark signal or stop impulse, the start latch (figure 4-1) locks the start clutch release arm in the stop position. In turn, the release arm holds the clutch release latch (figure 4-3) against the clutch stop tab. At the same time, the backstop lever rests in the cutout in the start clutch restoring cam.

To start the start clutch assembly rotating, a start impulse is received energizing the bottom (space) coils in the magnetic selector. The bottom armature is then pivoted thus blocking the movement of the bottom two paddle latches. However, the top paddle latches and latches are free to move down. This allows the rear of the start clutch release arm to be pulled down by the start clutch release arm spring (figure 4-3). Engaged in the elongated slot of the start clutch release arm is the start clutch release latch. This latch is moved out of engagement with the start clutch stop tab, causing the start clutch assembly to engage and rotate 180°.



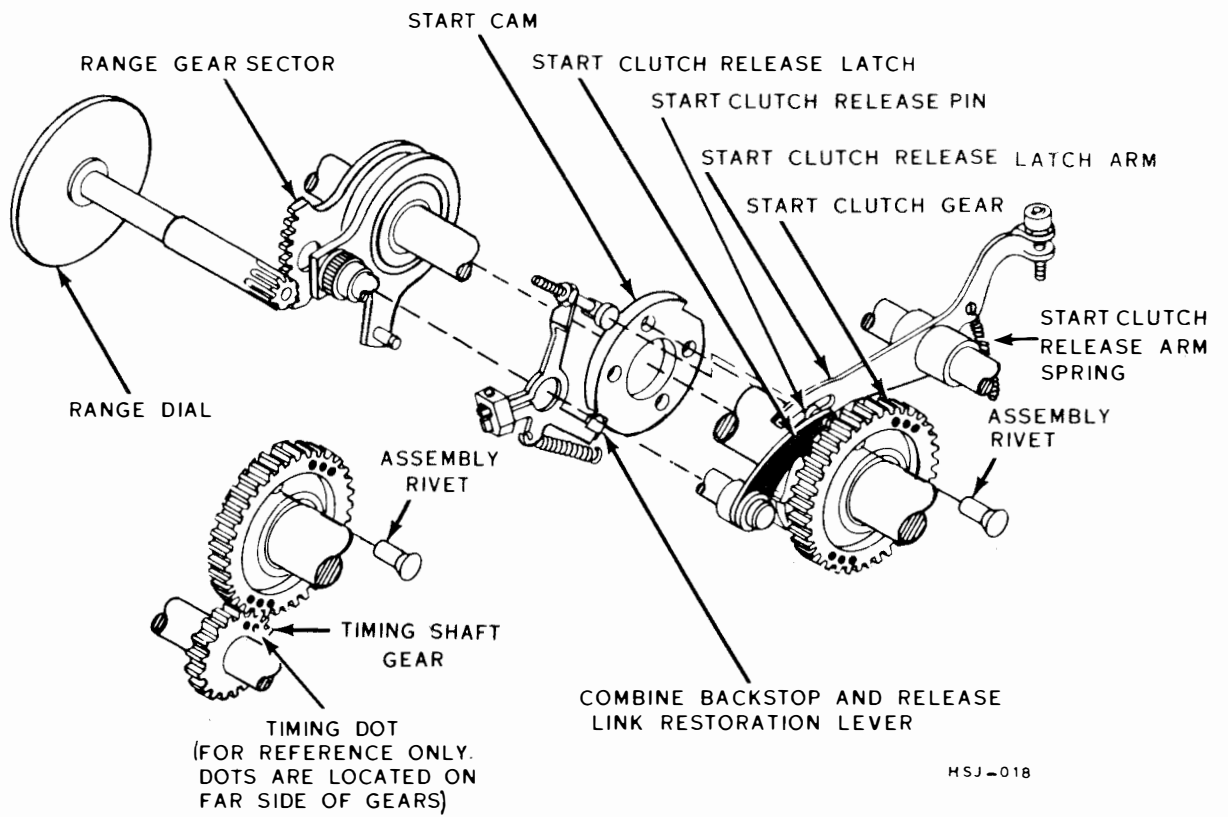
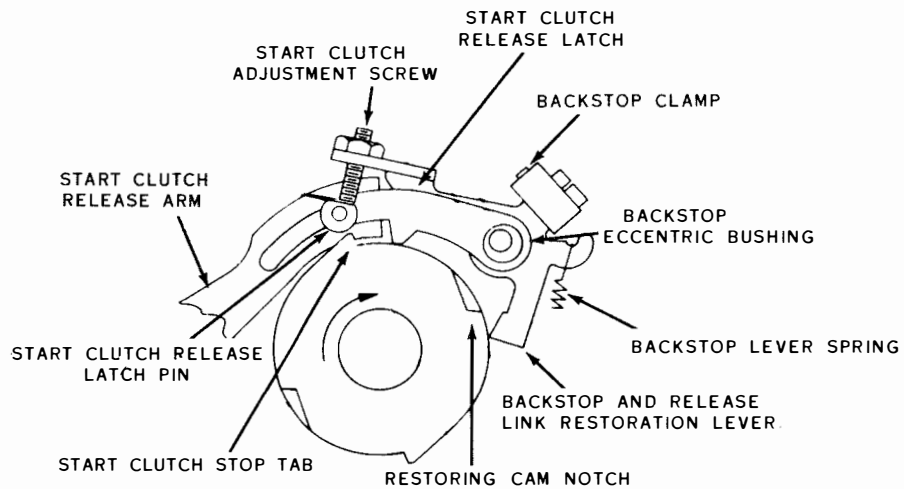


Figure 4-3. Start Clutch Release Mechanism

Attached to the start clutch assembly is a start clutch gear (figure 4-3) which drives the timing shaft gear. The timing shaft gear rotates the timing camshaft one full revolution for every one-half revolution of the start clutch. The timing camshaft has six cams designated from left to right as the #3, #4, #5, #2, #1 and the print-function timing cams. These cams cause the intelligence clutch release arms to operate in the following order: #1, #2, #3, #4, and #5. The print-function clutch release arm operates at the same time as the #5 intelligence clutch release arm.

**ORIENTATION OF THE RANGE SECTOR.** When the range knob, range dial, and range shaft (figure 4-3) are rotated, teeth on the shaft mesh with and rotate the range gear sector. Connected to the range gear sector and moving with it are the combined backstop and release link restoration lever. This permits adjustment of the timing cycle or the relationship between the timing camshaft and the intelligence impulses. Adjusting the range dial causes the intelligence clutches to be released at the most favorable position in relation to the incoming signal.

**STOPPING THE START CLUTCH ASSEMBLY.** As the start clutch assembly rotates, the start ("A") cam also rotates. The backstop and release link restoration lever riding to the high part of the "A" cam pivots counterclockwise. The adjusting screw of the backstop lever moving down moves the start clutch release latch back into the path of the start clutch stop tab (figure 4-4). The impact stops the clutch after its 180° rotation. The start clutch release arm is positioned by the start clutch release latch. The front part moves down and the rear part moves up against the tension of the start clutch release arm spring. This movement frees the start latch and paddle shaft to move to their unoperated position. The backstop and release link restoration lever is pulled into an indentation on the "A" cam holding the clutch completely disengaged. With a stop impulse (mark coil current) present, the armatures are pulled to a mark condition. This blocks the latch assemblies on the top paddle shaft so they cannot move. The start latch prevents the downward movement of the start clutch release arm. Therefore, it cannot release the start clutch until another start impulse is received.



HSJ-037

Figure 4-4. Start Clutch Release

### PRINTER MAINSHAFT

The printer mainshaft (figure 4-5), as mentioned previously, consists of two assemblies, the selector mainshaft and the function mainshaft. The selector mainshaft (figure 4-6) is on the left half of the printer, facing the front, and the function mainshaft (figure 4-7) is on the right. The mainshaft receives its power from the printer motor through a third reduction gear on the function mainshaft. The keyboard and ribbon feed mechanism receive power through the printer helical gear on the selector mainshaft. The timing cam shaft receives motive power from the start clutch gear attached to the start clutch, also on the selector mainshaft.

#### Selector Mainshaft

The selector mainshaft contains, from left to right (figure 4-6) the following:

PRINTER HELICAL GEAR (KEYBOARD AND RIBBON DRIVE GEAR)

BEARING RETAINER AND RANGE ADJUSTMENT GEAR

START CLUTCH RELEASE

START CLUTCH "A" CAM AND GEAR

No. 3 LATERAL CLUTCH AND "B" CAM

No. 4 LATERAL CLUTCH AND "C" CAM

No. 5 LATERAL CLUTCH AND "D" CAM

No. 2 ROTARY CLUTCH AND "E" CAM

No. 1 ROTARY CLUTCH AND "F" CAM

The clutch and cam assemblies are identified by a stamped capital letter. The operation of the individual components of the selector mainshaft are discussed later in their appropriate functional description.

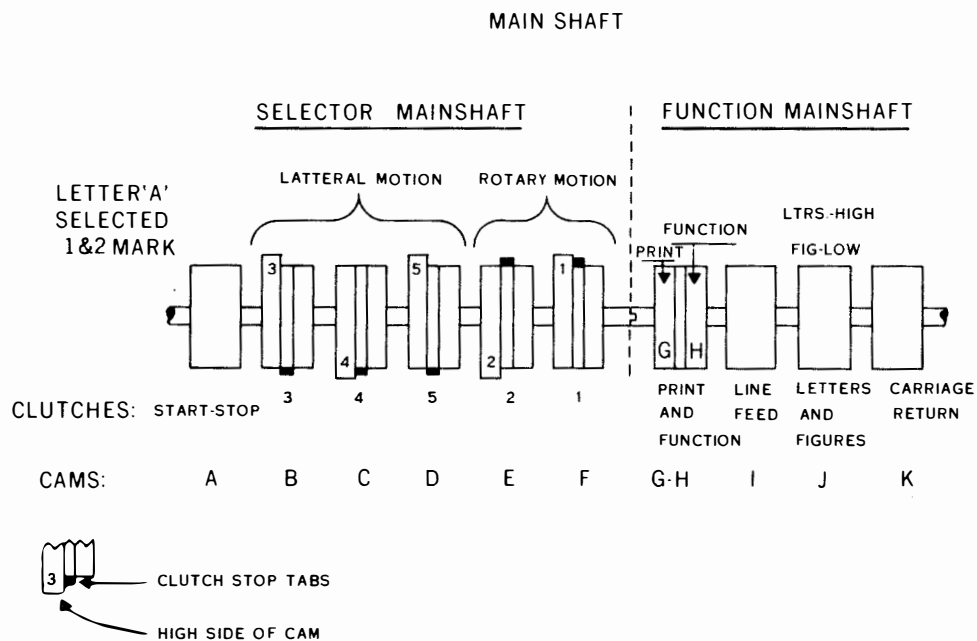


Figure 4-5. Main Shaft



## Function Mainshaft

The function mainshaft (figure 4-7), from left to right, consists of the following:

PRINT FUNCTION CLUTCH AND "G" AND "H" CAMS

LINE FEED CLUTCH AND "I" CAM

LETTERS-FIGURES CLUTCH AND "J" CAM

CARRIAGE RETURN CLUTCH AND "K" CAM

THIRD REDUCTION GEAR

Each of the cams of the above cam assembly and function clutches also has the respective capital letter stamped on it for identification. The clutches on the function mainshaft are released when a particular function is selected by the function selector. The print function clutch and cam assembly consists of a clutch and two cams which rotate 180° for each character printed or function selected. The clutch is released by a print function clutch release timing cam mounted on the timing cam shaft. The function cam starts the mechanical function selection cycle and the print cam operates the print hammer. The line feed clutch and cam assembly operates the line feed mechanism when line feed is selected. The letters-figures clutch and cam assembly moves a cam follower and pulley carriage to position the print cylinder in one of two 180° positions, representing either letters or figures. The carriage return clutch and cam assembly is used to return the print cylinder and print hammer to the left margin.

Look at the functional block diagram shown as figure 4-8. You know that there are 10 clutches and 11 cams on the printer mainshaft. Using figure 4-8, you can locate each of these clutches and cams and determine the purpose of each. As the various mechanical functions are discussed, you may want to refer back to this functional diagram from time to time.

4-11

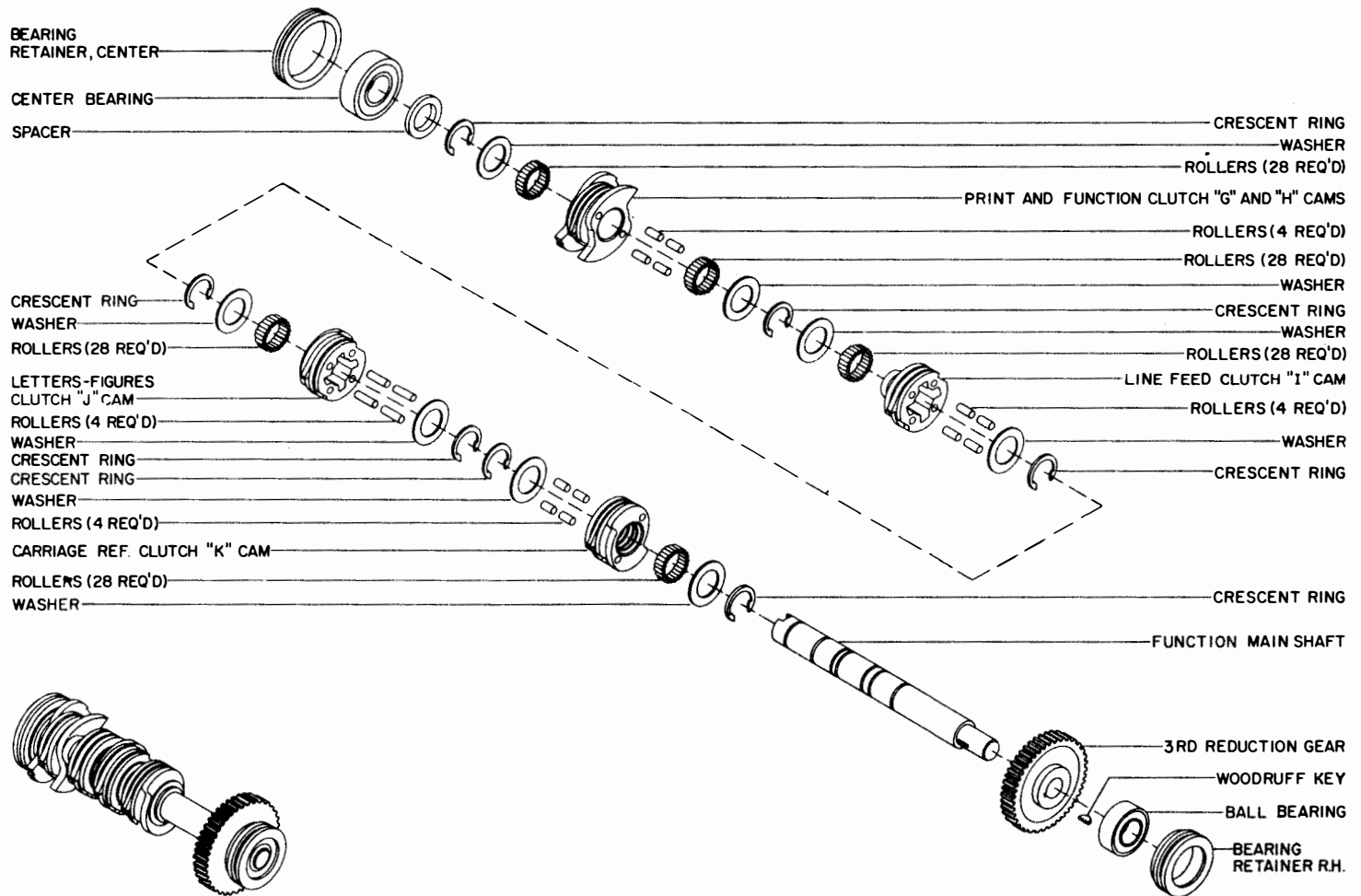


Figure 4-7. Function Mainshaft, Exploded View

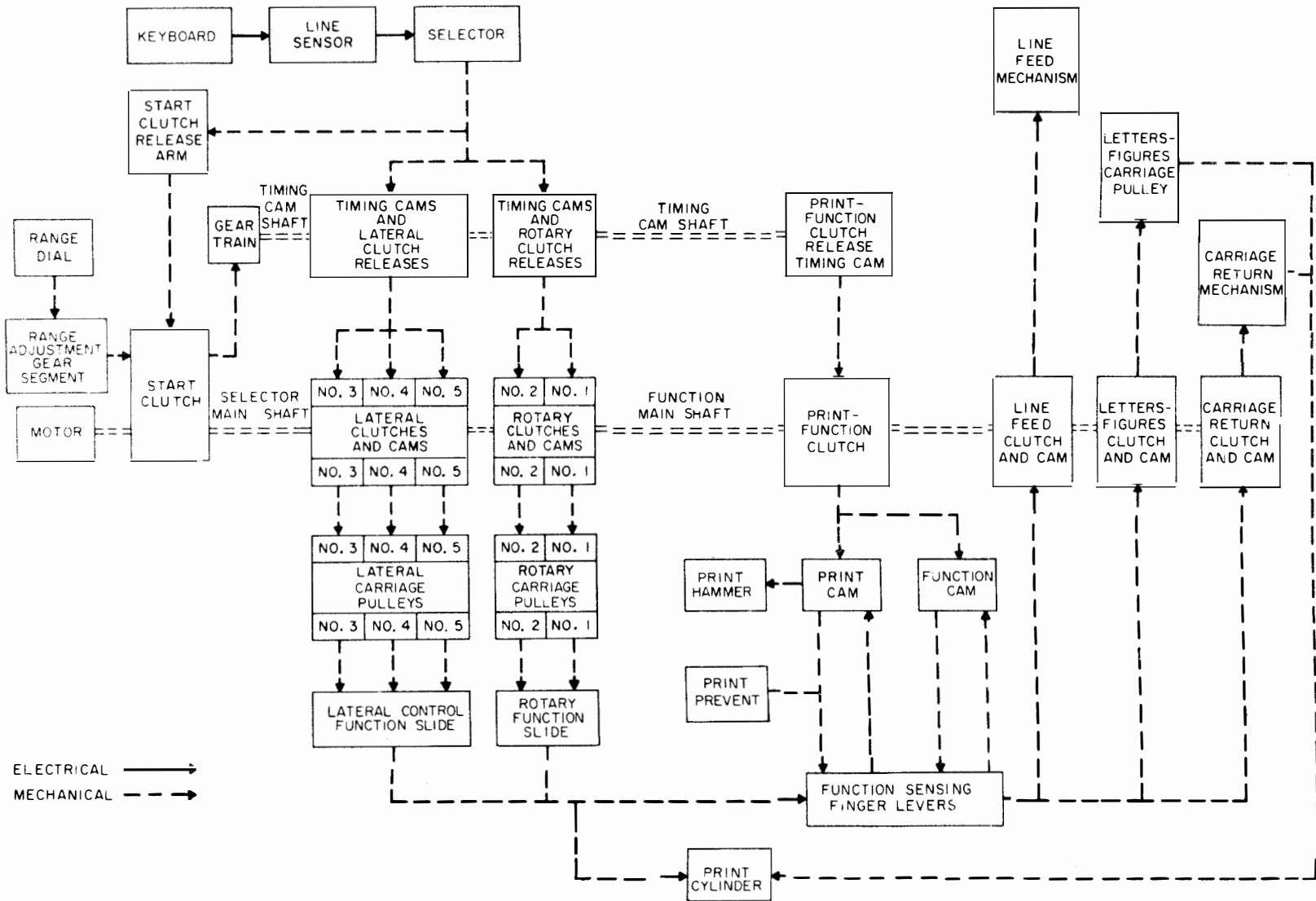


Figure 4-8. Printer Functional Block Diagram





## TYPE CYLINDER

The magnetic selector interprets the sequence in which the five intelligence pulses are received. This series of electrical pulses or signals are then converted into mechanical motion. This is accomplished by controlling the release of the print (type) cylinder positioning cam clutches. Figure 4-10 shows the clutch release fingers, clutches, and cams that are controlled by the magnetic selector. Note that the system consists of the mainshaft, five print cylinder positioning clutches and cams, and the start clutch. A pair of release fingers straddle each clutch to control whether the clutch is in a mark or space condition.

Each clutch is held in its mark or space position by one of the two release fingers. When a continuous mark or space pulse is received, the corresponding clutch remains stationary. If a continuous RY combination is received, each clutch turns 180° with each new character cycle because the mark and space combinations are exactly the opposite for R and Y. In an RQ continuous combination, the number 2 clutch remains motionless because, for both R and Q, the number 2 is a marking pulse. All the other clutches alternate between the mark and space position.

Clutches 1 and 2 (figure 4-10) are used for the rotary positioning operation of the print cylinder. Clutches 3, 4, and 5 are used in the lateral positioning of the print cylinder. Operation of all five clutches is basically the same. However, when clutches 1 and 2 are held to a mark condition, the cam followers are riding on the high side of their cams. When the number 3, 4, and 5 clutches are held to a mark, the cam followers are riding on the low side of their cams. For example, if the letter A (1 and 2 mark) is selected, all five cam followers ride on the high side of their cams. For the letter M (3, 4, and 5 mark), all cam followers ride on the low side of their cams. On the end of each cam follower is a carriage pulley (figure 4-10) which provides mechanical power for the rotary and lateral positioning of the print cylinder. This power is gained by the use of chains which pass through the carriage pulleys (figure 4-11). In operation, pulleys 1 and 2 control the motion of the rotary chain and pulleys 3, 4, and 5 control the motion of the lateral chain. Also, the cam followers move to different preset distances. This allows for four possible combinations in the rotary system and eight combinations in the lateral system.

### Rotary Positioning

The rotary chain through pulley carriages 1 and 2, is lengthened or shortened by motion of the two cam followers and the rotary spring on the left end of the print cylinder shaft. If the movement of the pulley carriages shortens the rotary chain, the chain moves to the left, pulling the rotary function slide with it (figure 4-11). This causes the rotary cable passing through the rotary transfer pulley (rotary cable pulley) to rotate the index wheel, print cylinder shaft, and print cylinder to the selected character. This, in effect, lessens the spring tension that has been preset on the rotary spring. When the pulley carriages lengthen the rotary chain, the chain moves to the right and increases the tension on the rotary spring. These actions cause the print cylinder shaft, print cylinder, and index wheel to rotate in opposite directions. The index wheel moves continuously in one direction or the other, depending on the selection made by clutches 1 and 2.

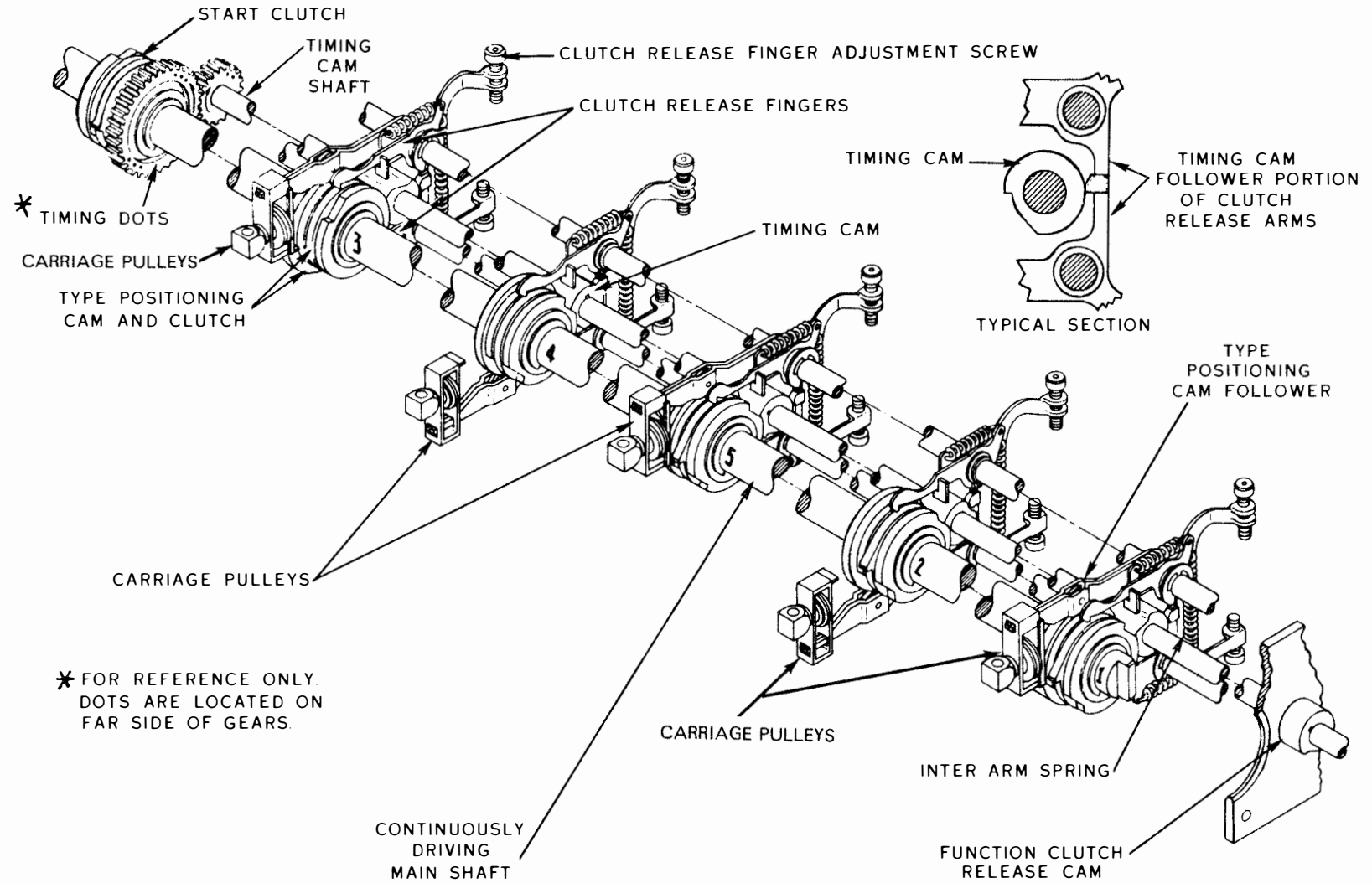


Figure 4-10. Clutch Release Mechanism

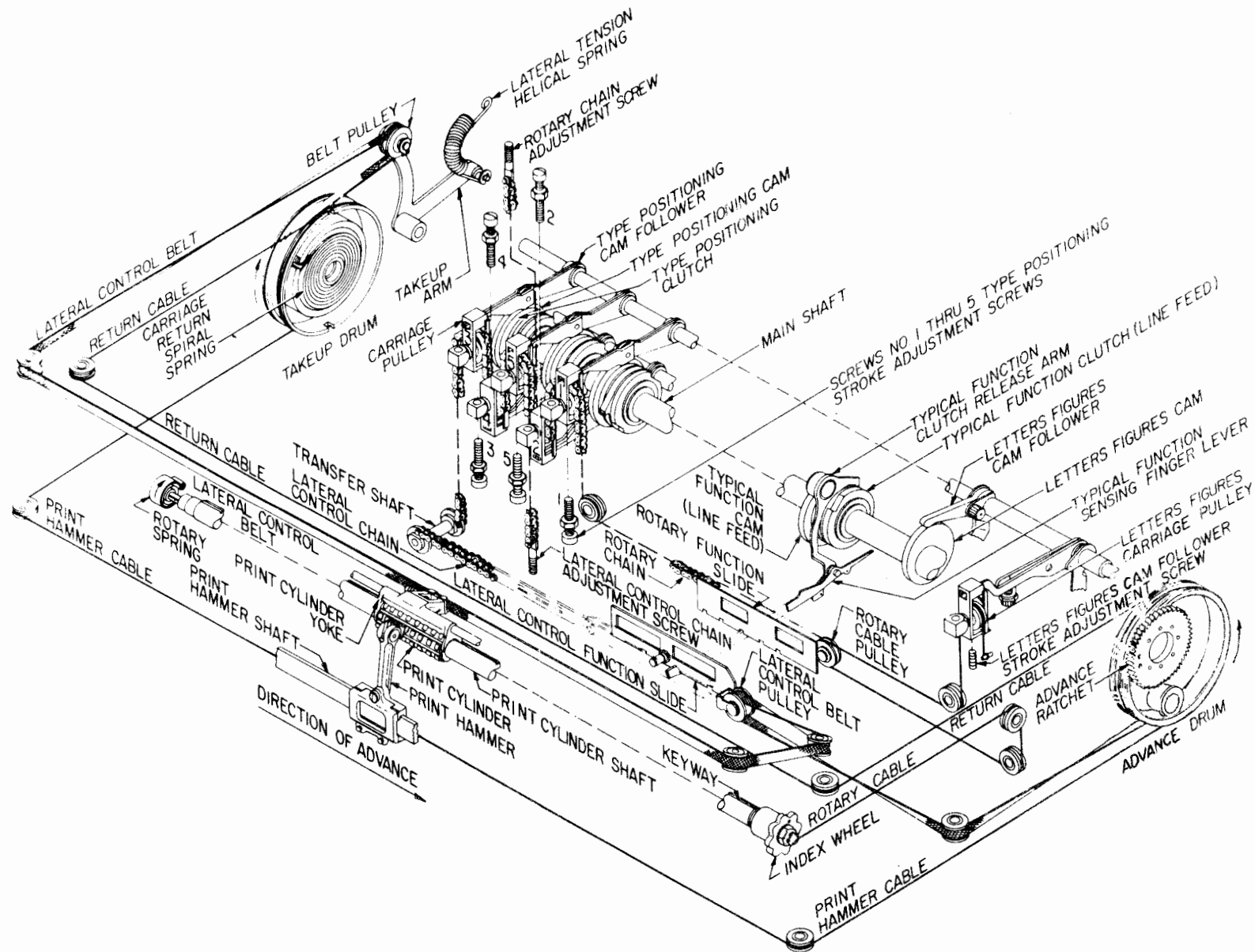


Figure 4-11. Print Cylinder and Print Hammer Positioning System

Figure 4-12 illustrates the surface of the print cylinder with 8 vertical (rotary) print cylinder positions. Four of the eight rotary positions correspond to letters and the other four correspond to figures. The letters-figures cam follower and pulley system determines within which group of four rows the rotary positioning takes place. The pulley is moved to high position for letters and to the low position for figures. The stroke movement of the rotary transfer pulley, through which the rotary cable passes (figure 4-11) positions the print cylinder so that the selection is within one of the two 180° segments of the cylinder.

A	W	J	Λ	U	Q	K	V	360°
E	Z	D	B	S	Y	F	X	
Ξ	L	R	G	I	P	C	V	
ϛ	T	<	O	■	H	N	M	
-	2	'	Λ	7	1	(	v	180°
3	"	\$	?	⊙	6	!	/	
Ξ	}	4	8	8	∅	:	:	
ϛ	5	<	9	■	#	,	.	

Figure 4-12. Print Cylinder

### Lateral Positioning

The lateral positioning of the print cylinder is controlled by selector clutches, cams, and cam followers 3, 4, and 5; a lateral chain; a lateral function slide; and a lateral belt (figure 4-11). The lateral belt terminates at the takeup drum on the left side of the printer and at the advance drum on the right end of the printer. Movement of pulley carriages 3, 4, and 5 cause the lateral chain to lengthen or shorten. If shortened, the lateral function slide is moved to the left. The takeup arm then moves in a counterclockwise direction applying more tension to the takeup arm spring. The main portion of the lateral belt is moved to the right. The print cylinder yoke, clamped to the lateral belt, fits over the print cylinder (figure 4-11). Therefore, movement of the lateral belt to the right when the lateral chain is shortened, moves the type cylinder to the right.

Lengthening the lateral chain, by positioning the cam followers on the low side of their cams, moves the lateral function slide to the right. Therefore, the takeup arm moves clockwise releasing the tension from the takeup arm spring, and the lateral belt, yoke, and print cylinder move to the left to a selected position. The takeup arm moves enough to allow the print cylinder to move through all eight lateral rows of type (figure 4-12) without affecting the step-by-step advances of the advance drum. The takeup arm isolates the lateral positioning from the advance of the print cylinder. Figure 4-13 illustrates the units of travel accomplished by each pulley carriage and how the various combinations can be established for a particular code combination.

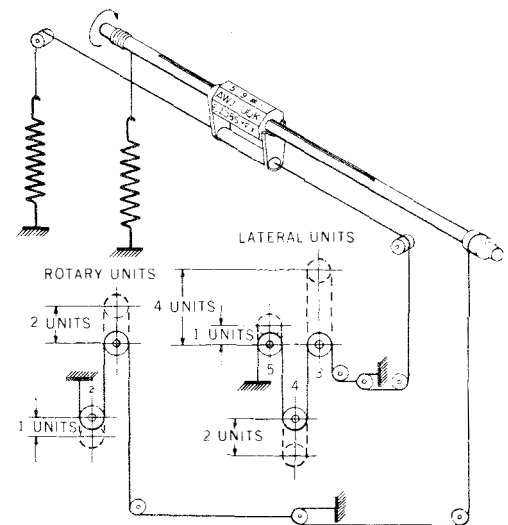


Figure 4-13  
Print Cylinder Positioning Mechanism

For example, with code pulses 1 and 2 spacing and 3, 4, and 5 marking, we have the letter M shown by the solid lines in figure 4-13. With all cam followers on the low side of their cams, the print cylinder is positioned fully to the left and rotated so that M is toward the paper. Note the position of M on the type cylinder in figure 4-12. It is located in the bottom right corner of the letters portion on the print cylinder. To select A, all five clutches must rotate 180°. Therefore, with 1 and 2 marking and 3, 4, and 5 spacing, all cam followers are on the high side of their respective cams. The dashed lines in figure 4-13 represent the position of the pulleys for the letter A. So, moving from the bottom row where M is located to the top row on the print cylinder where A is, requires one rotary unit movement of pulley 2 and two units of rotary movement for pulley 1. This is of course a total of three units of rotary movement of the print cylinder to be lined up with the print hammer. Now all we need is seven units of lateral movement to the right so the letter A is lined up with the print hammer. We get one lateral unit movement for the number 5 pulley, two units for pulley 4 and four units of lateral movement for pulley 3.

Listed below are the four possible evenly space rotary positions and the eight possible lateral positions of the print cylinder, (figure 4-12).

CAM FOLLOWER POSITION		ROTARY ROW POSITION	CAM FOLLOWER POSITION			LATERAL ROW POSITION
#1	#2		#3	#4	#5	
SPACE	SPACE.	. . . . 4	MARK	MARK	MARK.	. . . . 8
SPACE	MARK . . . .	. 3	MARK	MARK	SPACE . . . .	. 7
MARK	SPACE. . . .	. 2	MARK	SPACE	MARK. . . .	. 6
MARK	MARK . . . .	. 1	MARK	SPACE	SPACE . . . .	. 5
			SPACE	MARK	MARK. . . .	. 4
			SPACE	MARK	SPACE . . . .	. 3
			SPACE	SPACE	MARK. . . .	. 2
			SPACE	SPACE	SPACE . . . .	. 1

### Printing

Once the print cylinder has been positioned by the rotary and lateral positioning action, printing takes place immediately. Printing action is begun when the print-function clutch on the function mainshaft is released. Release of the clutch turns the print cam to rotate the print cam follower and print lever shaft clockwise. The print cam follower moves to the high part of the print cam (figure 4-14). It then drops off the high part, accelerated by the print helical spring. This action rotates the print shaft and terminal lever counterclockwise. The motion is transmitted through the print hammer actuator link to the hammer shaft and print hammer. The print hammer release is moved with the terminal lever forcing the print hammer actuator link away from the terminal lever just before the hammer impact. However, the

speed of the print hammer is fast enough to complete the printing stroke even though the driving force has been removed.

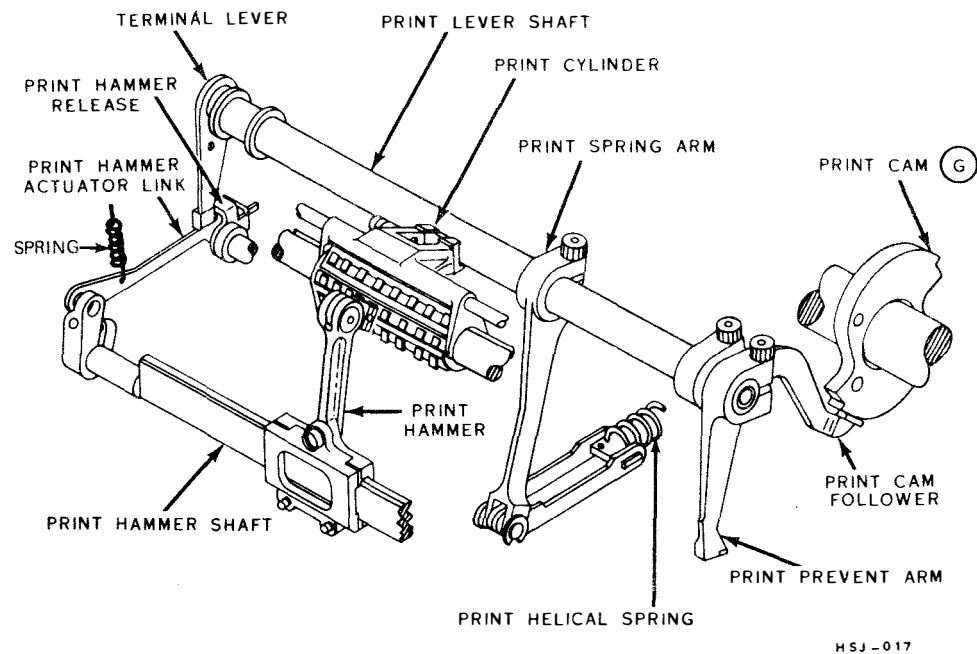


Figure 4-14. Printing Action Linkage

The hammer shaft spring, not shown in figure 4-14, furnishes power to return the print hammer release, print hammer actuator link, hammer shaft, and print hammer to their normal stop position. The print cam furnishes the power to return the remaining printing linkage to its normal stop position as the print cam follower starts to ride up on the high surface of its cam.

#### FUNCTION CAM AND EFFECTS

The rotary and lateral function slides (figure 4-11), parts of the function selector mechanism, have slots cut in their bottom edges. These slides are used to select mechanical functions as distinguished from the normal printing of a character. The slots in the slides are arranged so that a particular combination of code impulses, for a function, align a pair of these slots directly above the selected function sensing finger (figure 4-15). The function sensing finger then enters the aligned slots by spring action.

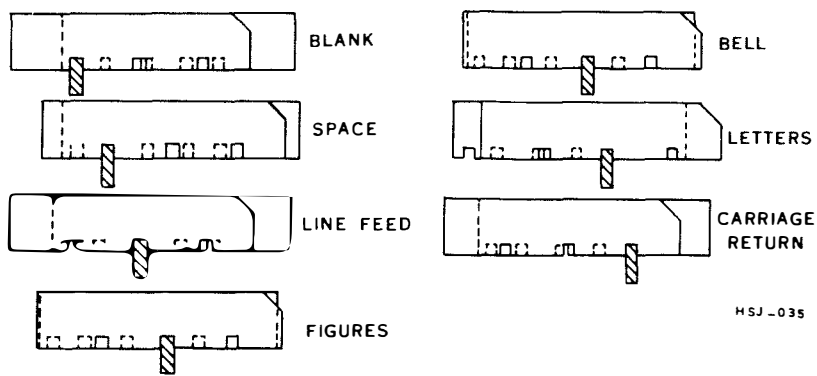


Figure 4-15. Rotary Function and Lateral Control Function Slides, Function Positions

The sensing fingers in the function selector are, from left to right:

BLANK

SPACE

AUTOMATIC LINE FEED

LINE FEED

FIGURES

BELL

LETTERS

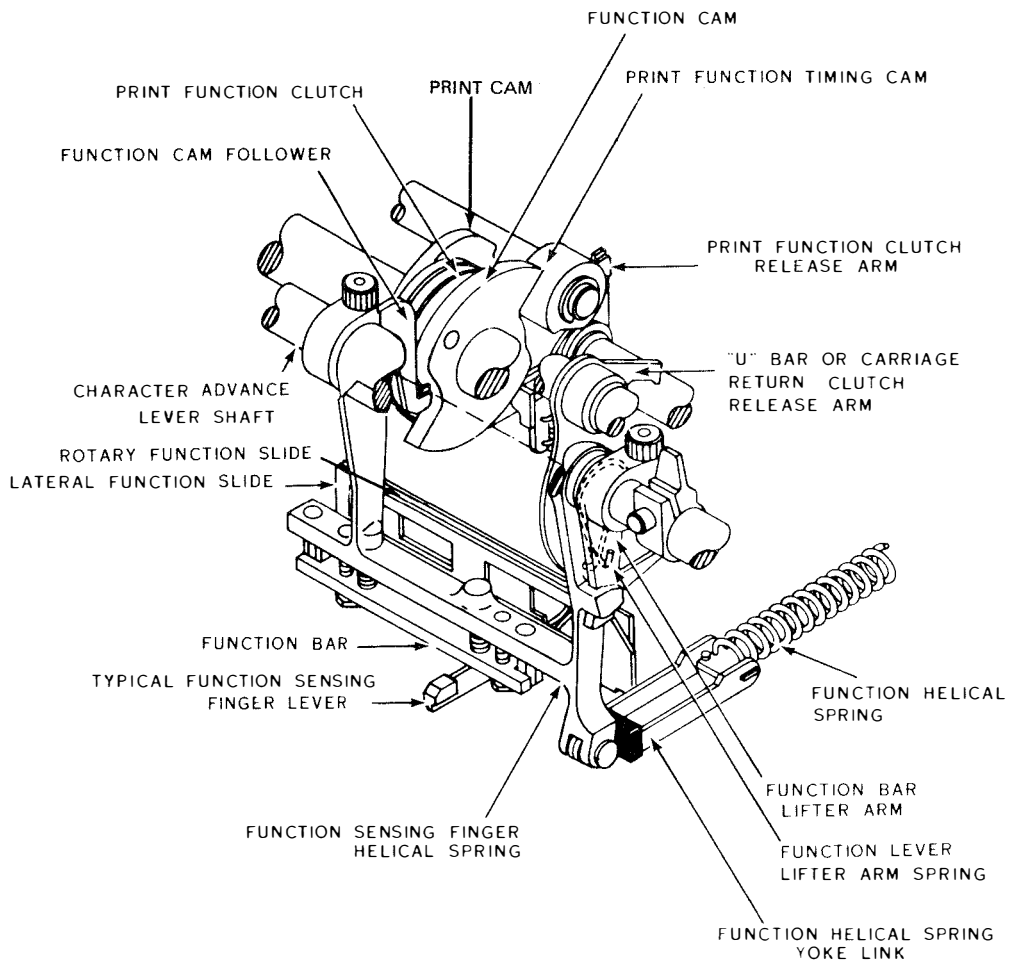
OFF-LINE LETTERS

CARRIAGE RETURN

AUTOMATIC CARRIAGE RETURN

The selected function sensing finger enters the function slide slot only momentarily to sense the required function and then is pushed out. After sensing the mechanical function, the function selector (figure 4-16) releases the appropriate clutch on the function mainshaft to perform the function. The function bar, supported by two arms, pivots on the character advance lever shaft. The character advance lever shaft, to which the function bar lifter arm is clamped, also supports the function cam follower. The function helical spring holds the function cam follower against the function cam.





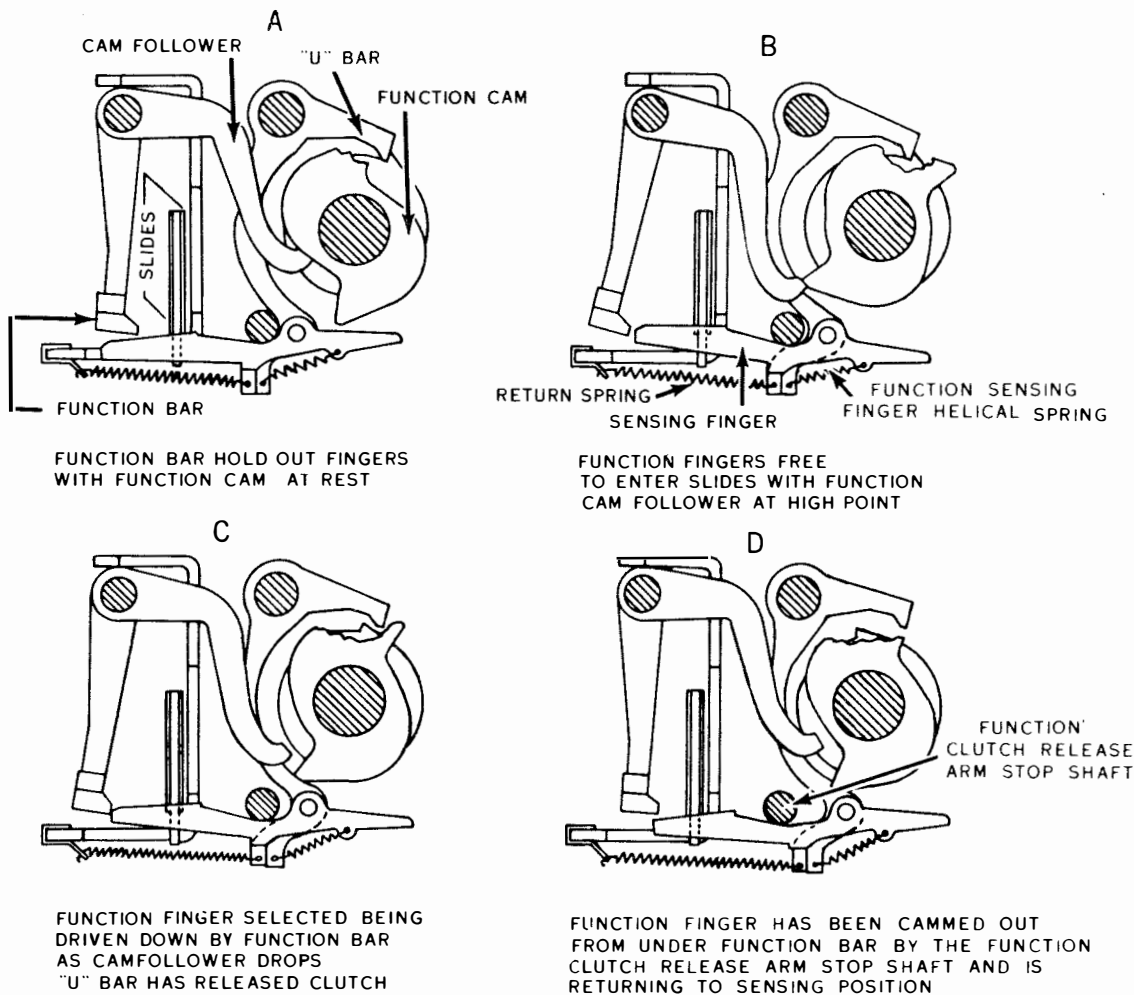
HSJ-009

Figure 4-16. Function Selector, Start of Function Cycle

The function cam, or H cam, is a part of the function-print clutch on the function mainshaft (figure 4-5, page 4-8). The function-print clutch is released by a clutch release finger simultaneously with the number 5 clutch on the selector mainshaft. The clutch release finger is operated by the function-print timing cam located on the same timing camshaft as the magnetic selector timing cam.

When the function-print clutch is in the stop position, the function cam follower is positioned one-third of its distance upward on the function cam. Upon its release, at the same time the number 5 pulse is received, the function-print clutch and cam rotate, moving the function cam follower downward. This action rotates the character advance lever shaft clockwise and raises the function bar lifter arm. This, in turn, raises the function bar toward the front of the printer and over the tops of the function sensing fingers. This allows all the function sensing fingers to rise and

the selected one to move into the slots of the rotary and lateral slides that are aligned by the received pulses. After the sensing finger is aligned in the pair of slots, the function cam follower drops off the high side of the function cam. The function helical spring and function helical spring yoke link then pulls the function bar back toward the rear of the printer. This operates the selected function sensing finger.



"FUNCTION CAM FOLLOWER FUNCTION BAR AND FUNCTION FINGER INTERACTION"

H5J-020

Figure 4-17. Function Cycle

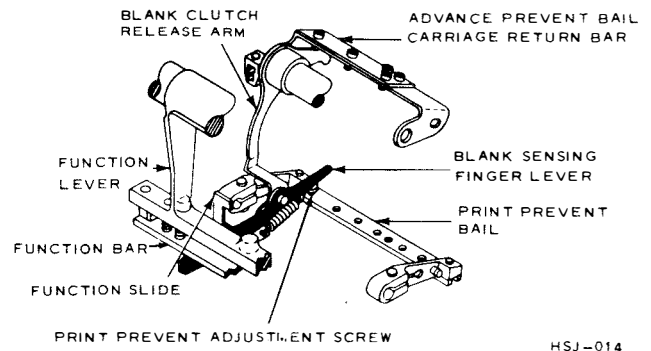
Figure 4-17 illustrates a complete function cycle. In figure 4-17A, with the function cam at rest, the function bar holds all sensing fingers clear of the rotary and lateral slide so the slide can position freely. In figure 4-17B, with the forward movement of the function bar, the fingers are free to move upward against the slides with one finger engaging the slots. Figure 4-17C shows the rearward movement of the function bar to drive the selected function sensing finger to the rear while the unselected sensing fingers are cammed downward. The motion of the selected sensing

finger moves the U-bar or carriage return clutch release arm, to which it is pivotly connected, releasing the associated clutch. In figure 4-17D, the motion of the function bar continues beyond the point at which the function is performed, pushing the upper surface of the sensing finger against the function clutch release arm stop shaft. This action cams the sensing finger downward until it is kicked out from the front of the function bar. The sensing finger is then returned by its spring to the original sensing position. The function bar, after reaching its rearward position, is moved forward again about one-third the distance by the function cam follower. At this time, the function-print clutch reaches its stop point and the function cycle is complete. When no function is selected, the function bar rides on the tops of the function sensing fingers and no function clutch is released.

## FUNCTION SENSING FINGERS

### Blank Function Sensing Finger

When the blank function is selected (figure 4-18), the blank function sensing finger is pulled into the aligned slots of the lateral and rotary slides by spring action. The rear part of the blank function sensing finger is raised up into the path of the function bar. Remember, the function bar has been positioned to the front by the function cam and cam follower. The function bar is now moved to the rear by the function helical spring and function helical spring yoke link.



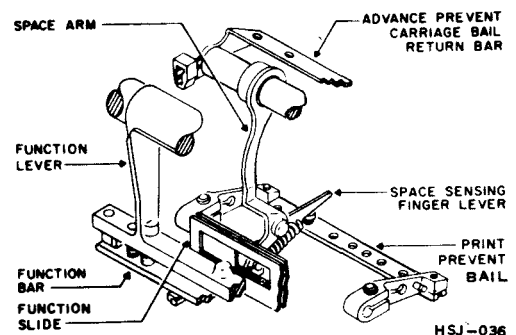
HSJ-014

Figure 4-18.  
Function Selector, Blank Linkage

Attached to, and moving with, the sensing finger is the blank clutch release arm, which pivots counterclockwise against spring tension. The upper part of the blank clutch release arm strikes the advance prevent bail carriage return bar and pushes it upward, preventing both printing and advance.

### Space Function Sensing Finger (Figure 4-19)

The space function combines the advance function and print suppression. The space function sensing finger falls into the lateral and rotary slides, moving the print prevent rod outward without moving the advance prevent bail. Printing is suppressed but advance takes place.



HSJ-036

Figure 4-19  
Function Selector, Space Linkage

## Automatic Line Feed and Carriage Return Function Sensing Fingers

Automatic line feed and carriage return are provided at the end of any line if carriage return has not been signalled to the machine. The line feed and carriage return function sensing fingers are similar to the other sensing fingers, as shown in figure 4-20. However, these fingers do not actually sense the slide alignment. The fingers are spring loaded and, therefore, tend to fall in front of the function bar regardless of the position of the rotary and lateral function slides. This action is prevented by the automatic carriage return and line feed actuator assembly affixed to the V-lever shaft. The actuator assembly and shaft are spring loaded against the automatic line feed and carriage return function fingers in such a manner that the bias springs that pull the fingers in front of the function bar are overcome. When the advance drum reaches the end of the line with no carriage return signal, the stop pin mounted on the advance drum pushes against the V-lever, or 72 character block, overcoming the shaft spring and turning the shaft. This relieves the spring tension on the two function fingers. The two fingers fall in front of the function bar on the next stroke and release the automatic line feed and carriage return clutch for line feed and carriage return.

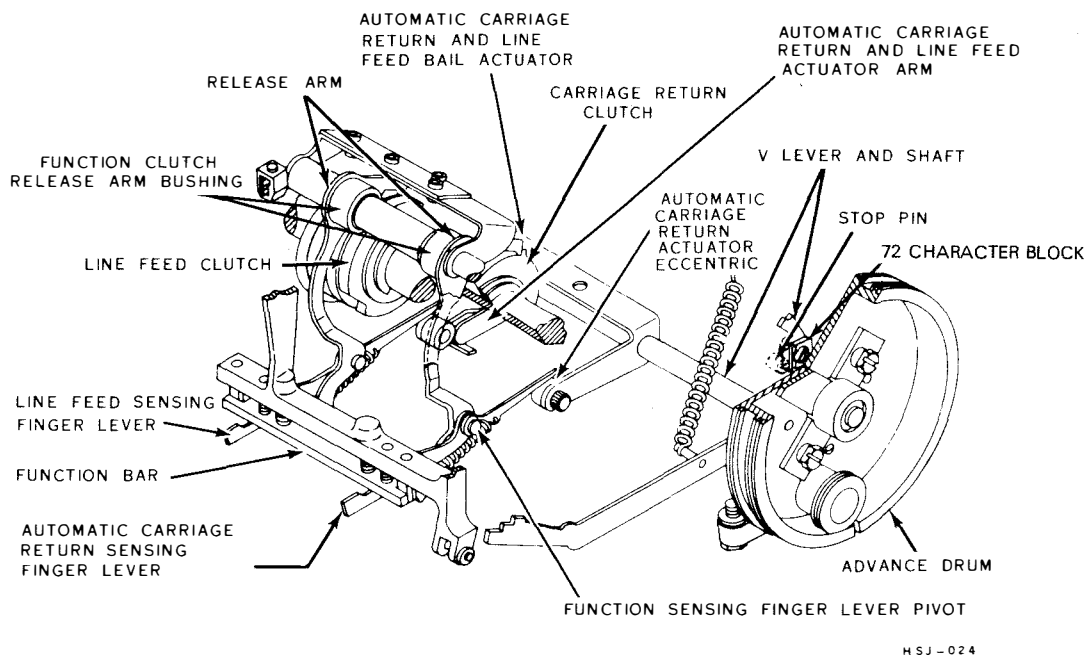


Figure 4-20. Automatic Carriage Return and Line Feed Linkage

### Line Feed Function Sensing Finger

Line feed occurs when the line feed pulse sequence is received in the printer. The mechanical operation is similar to other functions discussed. It differs in that the line feed cam follower moves to the high part of its cam, transferring its motion through a torque shaft to the line feed pawl (figure 4-20). This moves the pawl upward against a tooth on the detent ratchet. This causes the ratchet to move the platen either one or two movements, depending on the position of the single-double line feed lever. The single-double line feed lever protrudes through the front of the printer.

Off-line operations of the line feed can be accomplished by pressing down on the off-line button on the front of the printer. This causes the line feed clutch release arm to release the line feed clutch without having a pulse sequence for line feed received in the printer.

**SINGLE LINE FEED.** Single line feed is accomplished by moving the line feed shift arm to the left (figure 4-21). The line feed shift lever is then moved to the front of the machine. This moves the line feed pawl away from the line feed ratchet wheel so only the second notch on the line feed pawl engages and moves the ratchet one tooth.

**DOUBLE LINE FEED.** Double line feed is accomplished when the line feed shift arm is moved to the right. This action moves the line feed shift lever to the rear of the machine, away from the line feed pawl. The line feed pawl is then pulled up by its spring, causing the first notch on the line feed pawl to engage the line feed ratchet wheel and move the wheel two teeth.

The third notch on the line feed pawl (figure 4-21) is a reference notch used for adjustment purposes. The line feed detent wheel is held in position by its detent.

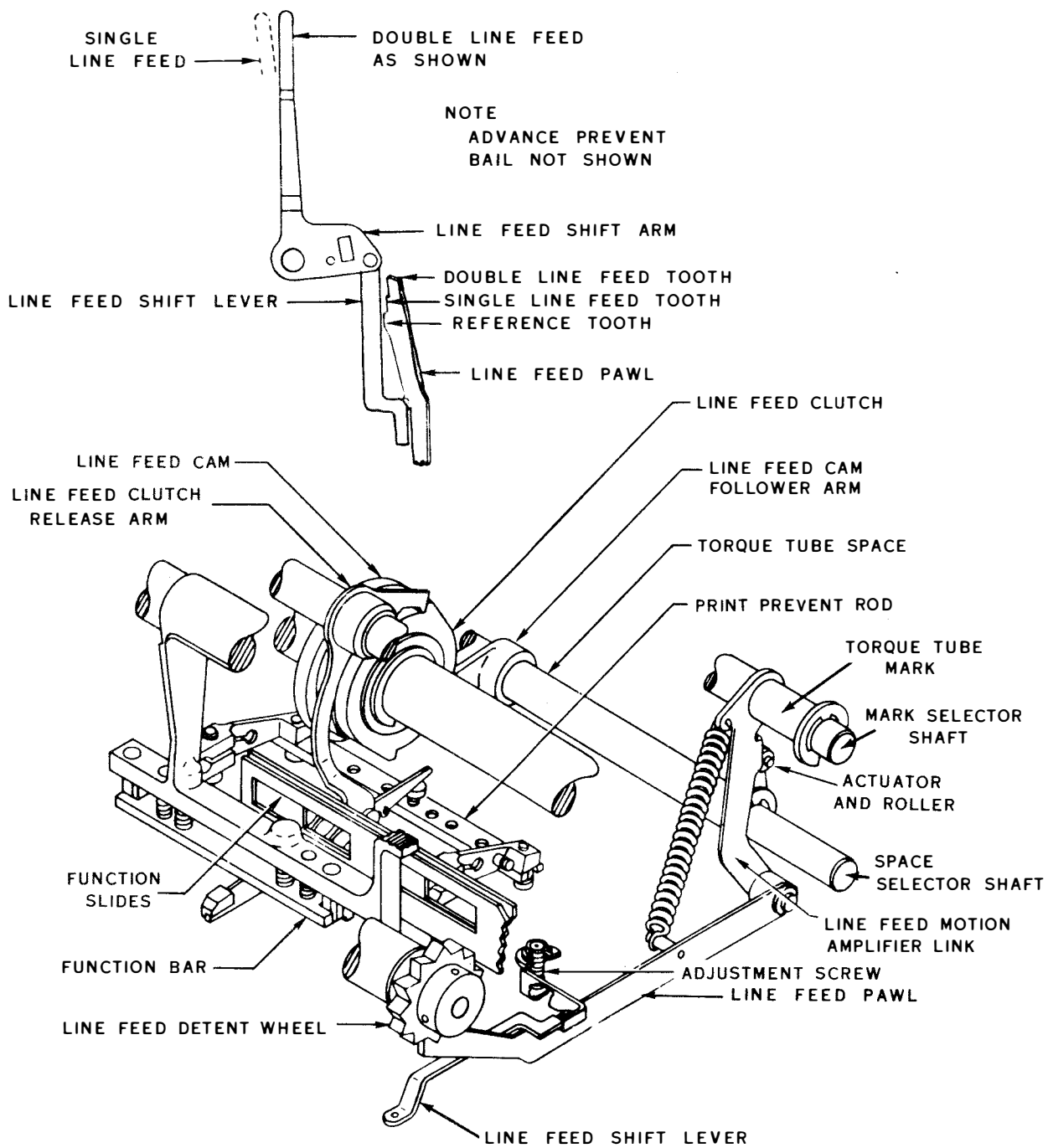


Figure 4-21. Line Feed Linkage

## Letters and Figures Function Sensing Fingers

When the letters or figures function is selected (figures 4-22), the letters or figures function sensing finger, lateral and rotary slides, print prevent bail, function bar, and the letters-figures clutch release arm operate as for the blank function. The upper part of the letters-figures clutch release arm operates the advance prevent bail and releases the clutch, allowing the letters-figure clutch to rotate 180°. The letters clutch release arm holds the clutch in figures position, as shown in figure 4-22 and the figures clutch release arm holds the clutch in letters position. The opposite is true when in letters position. Affixed to the letters-figures clutch is the letters-figures (j) cam. The letters-figures cam follower is on the high side of the J cam for letters and on the low side for figures. This transmits the motion through the torque shaft to the letters-figures arm. The letters-figures arm is fitted into a slot in the letters-figures pulley carriage which is positioned up for letters and down for figures. This causes the rotary cable to be lengthened or shortened, rotating the star wheel and the print cylinder shaft 180° in one direction or the other. The type cylinder now positions to either letters or figures.

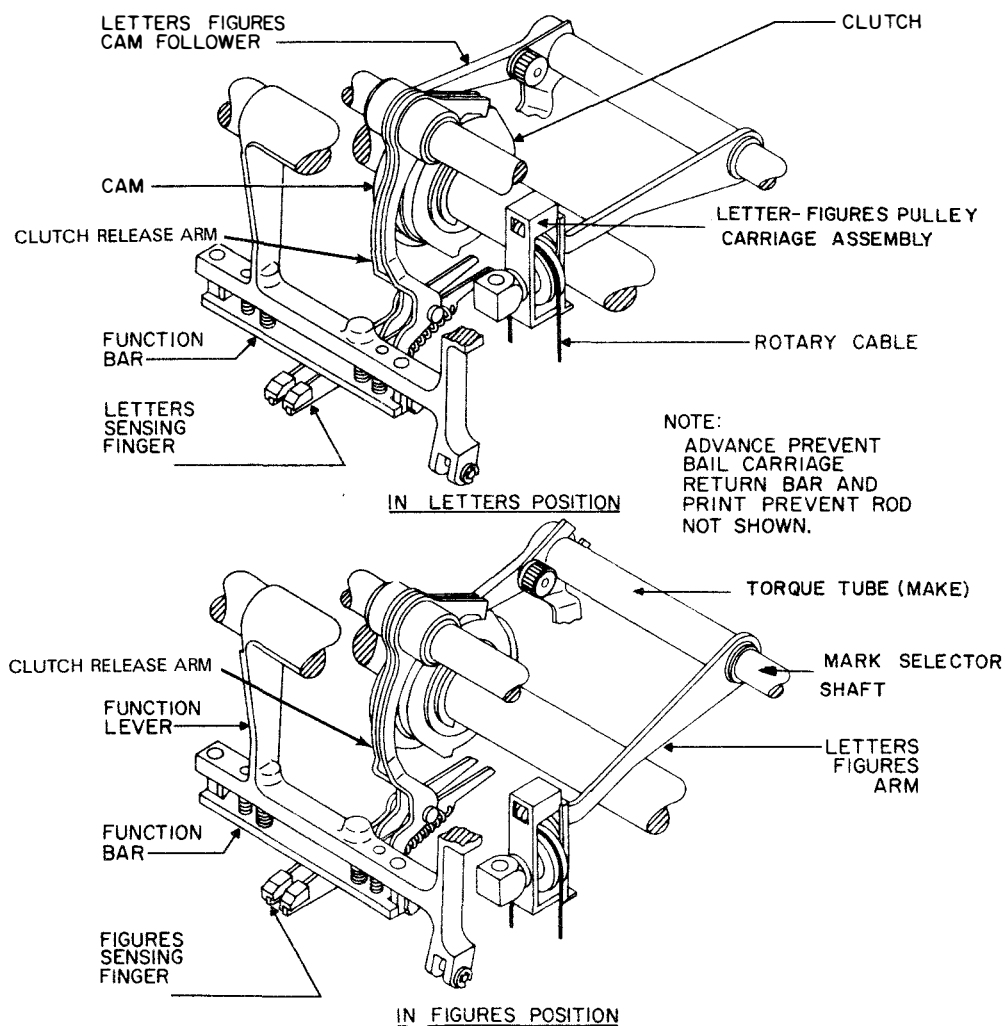
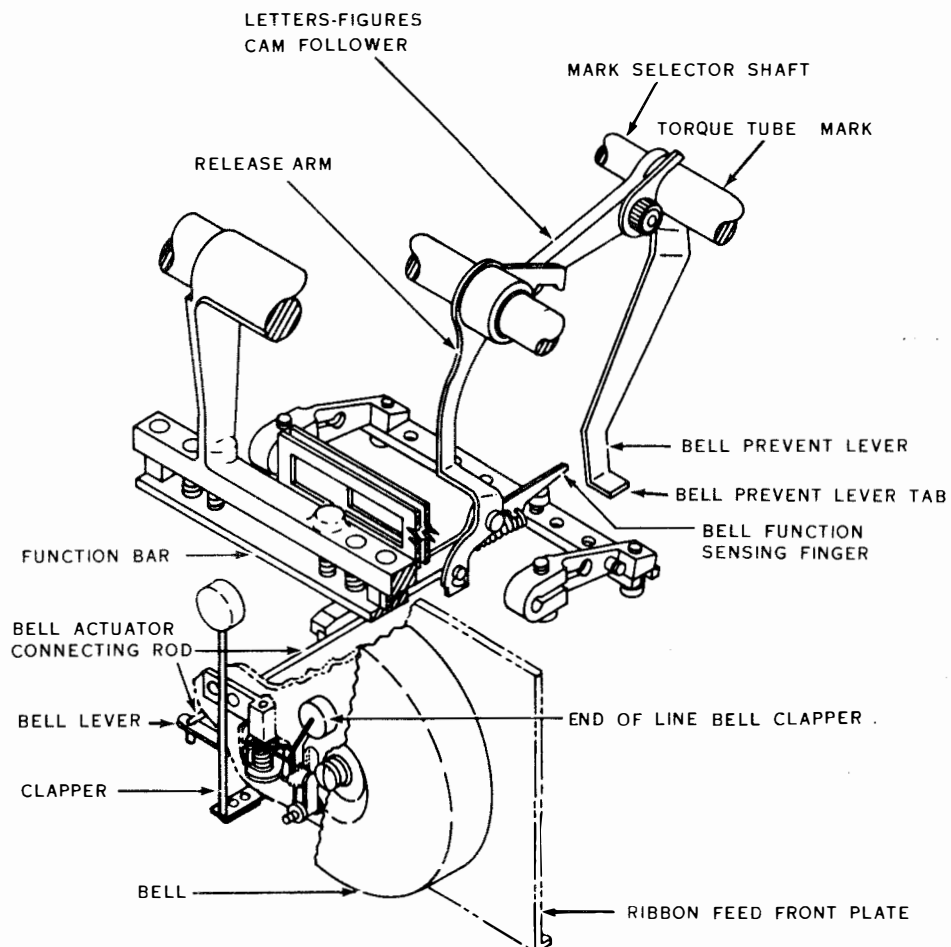


Figure 4-22. Letters-Figures Linkage

## Signal Bell Function Sensing Finger

Unlike other nonprinting functions, the signal bell function can be selected only when the machine is in figures position. This is accomplished by the bell prevent lever tab (figure 4-23). The bell prevent lever is attached to the letters-figures cam follower so that when "letters" is selected, the bell prevent lever tab moves under the bell function sensing finger. This prevents the sensing finger from being pulled up into the aligned slots of rotary function slides. Only in the figures position can the bell function sensing finger engage the slots on the function slides. Operation of the bell function sensing finger prevents printing and advance in the same manner as the other functions. The bell function clutch release arm does not release a clutch, but pulls the bell actuator connecting rod. This causes the clapper to move away from the bell. When the bell function sensing finger is cammed out, the bell function clutch release arm returns to its original position. The clapper then moves rapidly toward the bell and hits it as a result of overtravel.



HSJ-013

Figure 4-23. Bell Function Linkage



## End-Of-Line Bell

When the print hammer has advanced to a predetermined character, it comes into contact with and rotates the end-of-line bell lever clockwise. This, in turn, moves the end-of-line connecting rod and end-of-line clapper to the left. When the print hammer has cleared the end-of-line bell lever, it is released and its spring returns the end-of-line bell lever and end-of-line connecting rod to their normal stop position. The end-of-line bell clapper spring returns the clapper to the right to strike and ring the end-of-line bell.

## Figure H, Motor Stop Function

This function can be selected only when the equipment is in the figures position, and the H key has been depressed. Unlike the bell function which results in print and advance suppression, this function does not prevent printing and advancing. When figures H is received, the character '#' is printed and the printer operates in a steady mark condition. Actual stopping of the motor is accomplished both mechanically and electrically. The mechanical components are mounted on top of the printer, as illustrated in figure 4-24. The code bars and code bar extensions are operated by

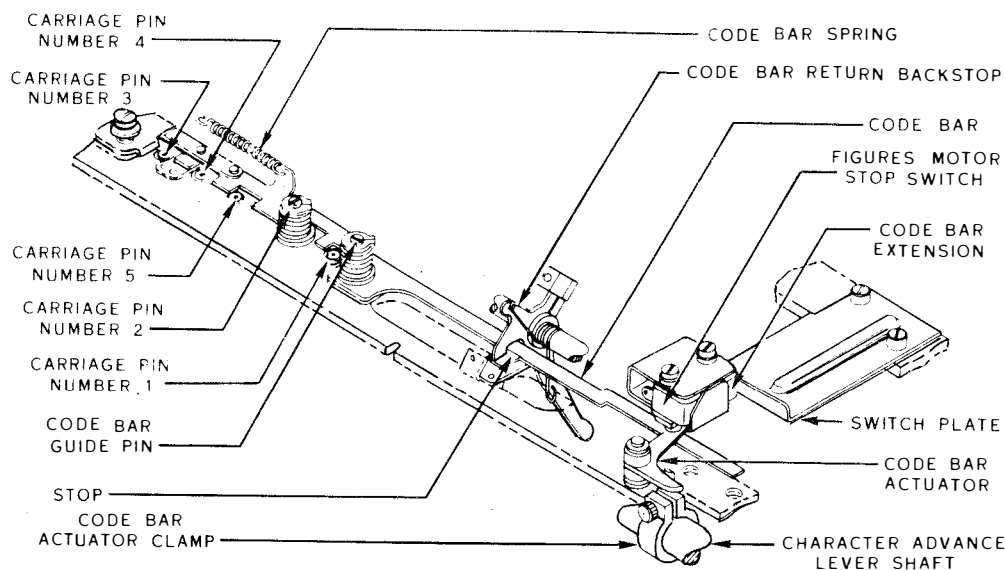


Figure 4-24. Motor Stop

action of carriage pins 1, 3, 4, and 5, the code bar return backstop and the function shaft actuator. During printing functions, the spring-loaded code bar and its extension are released by the function shaft actuator and simultaneously blocked by the code bar return backstop and one or more of the carriage pins. Upon receiving the next print function, the function shaft actuator moves the code bar and extension to the right and away from the carriage pins and code bar return backstop. The carriage pins and code bar return backstop are then repositioned in preparation for the next character to be typed and the code bar is again released by the function shaft actuator.

When the figures key is depressed, the high portion of the letters-figures cam is positioned under the code bar return backstop cam follower. The code bar return stop is moved away from the code bar. The code bar is still blocked until the "H" key is depressed. When the "H" key is depressed, carriage pins 1, 3, 4, and 5 drop down. Carriage pin 2 moves up, allowing the code bar to move to the left. Halfway across, carriage pins 1, 3, 4, and 5 actuate the stop switch. When the stop switch is actuated, a relay holding circuit is set up in the line sensor to prevent motor operation until the next start pulse is received.

### Off-Line Functions

Four off-line functions may be operated on the local printer without electrically affecting the signal line or the selector mechanism. Off-line function keys, or buttons, for Line Feed, Letters, Figures, and Carriage Return are located on the print front cover. Except for letters, the off-line function key operates its off-line function lever (figure 4-25). The lower part of the function lever is moved to the rear, pushing the off-line function slide to the rear. In turn, the function slide rotates the function clutch release arm, which releases the appropriate function clutch. Since the function sensing levers do not engage the rotary and lateral function slides in off-line function selection, there is no print prevention motion. Printing takes place since the printer is receiving intelligence. However, the function clutch release arm does prevent character advance.

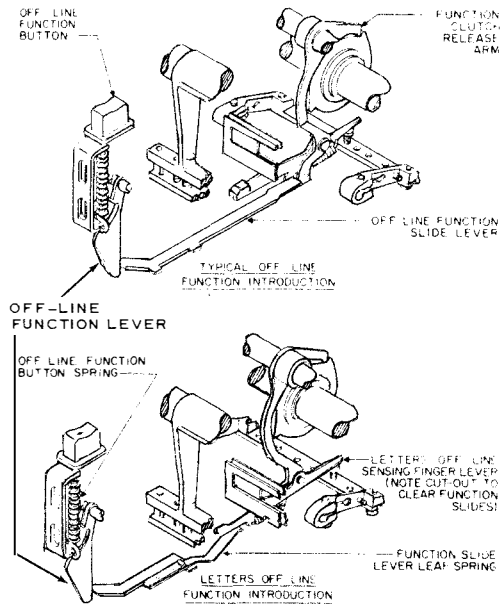


Figure 4-25  
Off-Line Function Control Linkage

The operation of the off-line letters function is timed to the normal stroke of the function bar, thus preventing theoretically jamming the printer. Therefore, the manual introduction of the letters function is accomplished differently than are the other off-line functions (figures 4-25). The letters off-line function key causes the lower part of the off-line letters function lever to move the off-line letters function slide to the rear. The function slide cams a function slide lever leaf spring against the letters off-line sensing finger. The sensing finger is moved against the function bar. When the function bar is at its high point, the letters off-line sensing finger falls under the function bar without interfering with the function slide. The finger is driven downward by the function bar and pivots the function clutch release arm, which releases the letters function clutch.

### Carriage Return Function Sensing Finger

When the carriage return function is selected, pulses 1, 2, 3, and 5 are spacing and pulse 4 is marking. The lateral and rotary control function slides align and the

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carriage return function sensing finger is pulled up into the aligned slots by spring tension. The function bar hits the sensing finger and drives it to the rear (figure 4-26). This causes the clutch to be released by the carriage return function clutch release arm. As the clutch rotates, the carriage return cam follower moves to the high side of its cam and moves the advance prevent bail and the carriage return shaft in a counterclockwise direction. At the same time, the carriage return lock lever falls under the cam follower, locking it away from the clutch cam to insure full carriage return.

During rotation of the carriage return shaft and lever, the check pawl link and advance prevent lever move downward disengaging from the advance ratchet (figure 4-26) until carriage return is completed. As the carriage return cycle is completed, the stop pin on the inner face of the advance ratchet strikes the V-lever, rotating it counterclockwise. This, in turn, rotates the lock lever disconnect arm, disengaging the lock lever from the carriage return cam follower. The cam follower then returns to its unoperated position, ready for another carriage return sequence.

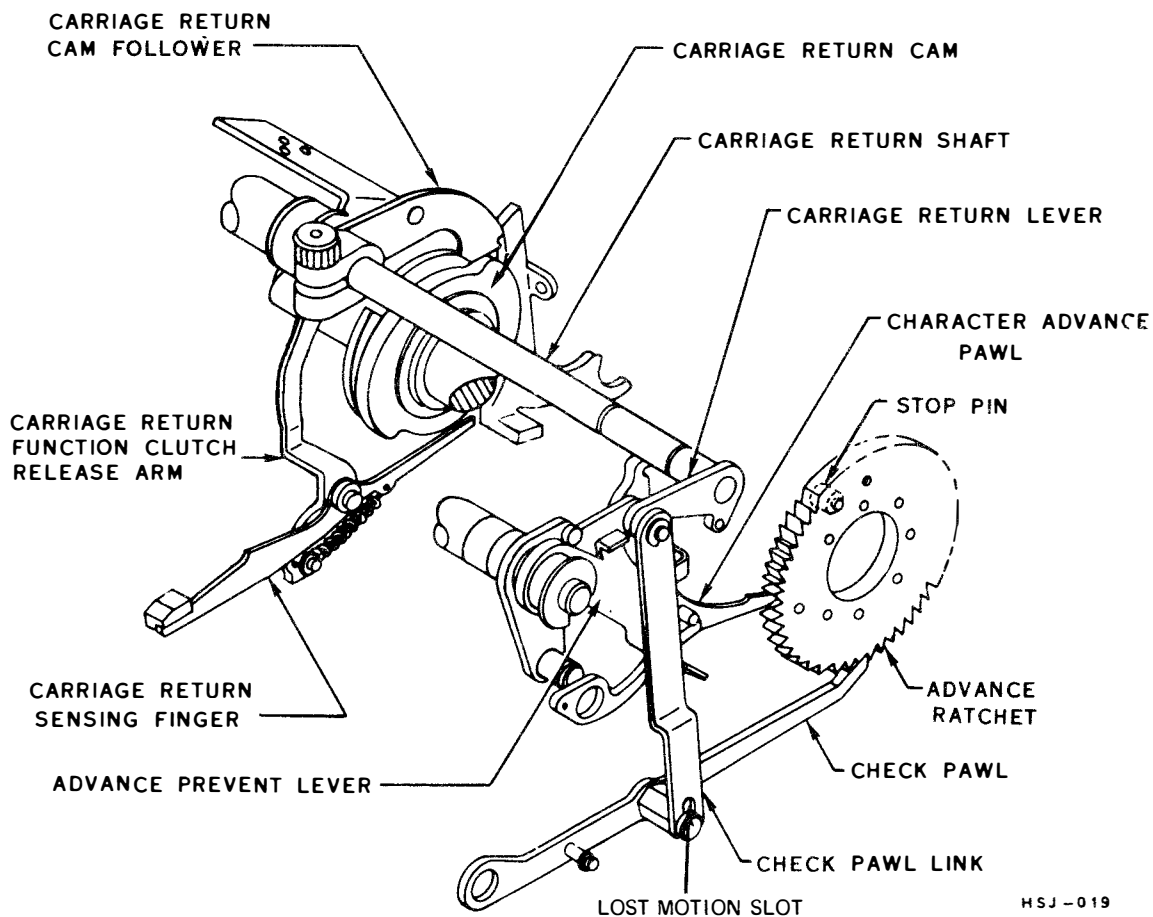
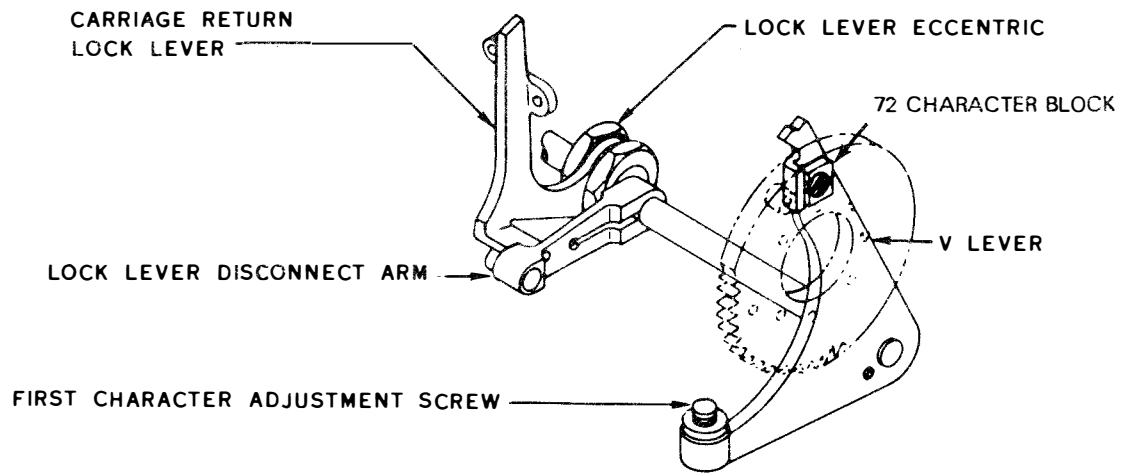


Figure 4-26. Carriage Return Linkage

REF-72-207

## Character Advance

Character advance is accomplished by moving the print cylinder and print hammer space-by-space across the page. When the end of the line is reached, the print cylinder and hammer are returned to the left side of the page. Character advance is achieved when the function cam is released (figure 4-26) and the function cam follower rises to the high part of the cam. The function cam follower rotates the character advance lever shaft assembly and the character advance pawl clockwise (figure 4-27). The character advance pawl, connected to the rear extension of the character advance lever shaft terminal lever, moves down and engages a tooth on the advance drum ratchet. The advance drum is rotated one space counterclockwise, pulling the print hammer and type cylinder one space to the right. Remember, the print hammer and type cylinder are moved through the medium of the print hammer cable and the lateral control belt, shown in figure 4-11. As the function cam follower reaches the high part of the function cam, the check pawl engages a tooth on the advance ratchet. This action prevents backward movement of the advance drum until the character advance pawl is positioned for the next character advance cycle.

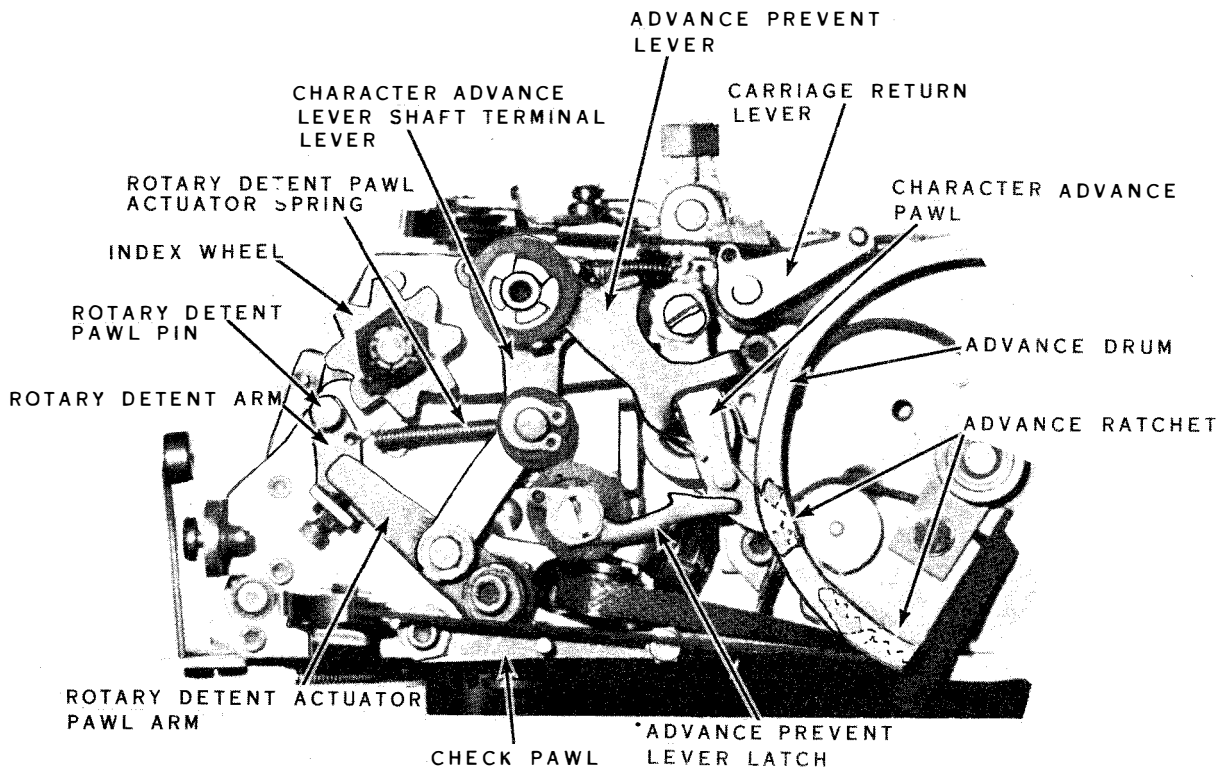


Figure 4-27. Character Advance Mechanism

As the function cam continues to rotate, the function helical spring pulls the function cam follower to the low part of the cam. This rotates the character advance lever shaft and the character advance lever shaft terminal lever counterclockwise. In turn, the character advance pawl moves away from the tooth on the advance ratchet

and engages the next tooth on the advance ratchet. The function cam continues to rotate to its stop position, leaving the function cam follower approximately one-third the way up on the high side of the function cam, and the print cylinder advanced approximately one-half space. The advance ratchet is held in place by the check pawl.

#### Character Advance Prevent

Advance prevention (figure 4-28) occurs for all functions except space. The function clutch release arms move the advance prevent bail up, about half the distance the carriage return cam (attached to the advance prevent bail) moves when it goes to the high side of its cam. The motion from the function clutch release arms moving the advance prevent bail is transmitted through the carriage return shaft to the carriage return lever. This is sufficient motion to withdraw the advance feed pawl and engage it on the advance prevention latch, but not sufficient to release the advance check pawl. Therefore, advancing is prevented without permitting carriage return. If desired, character advance on function may be allowed by adjustment of the screws located on top of the advance prevent bail.

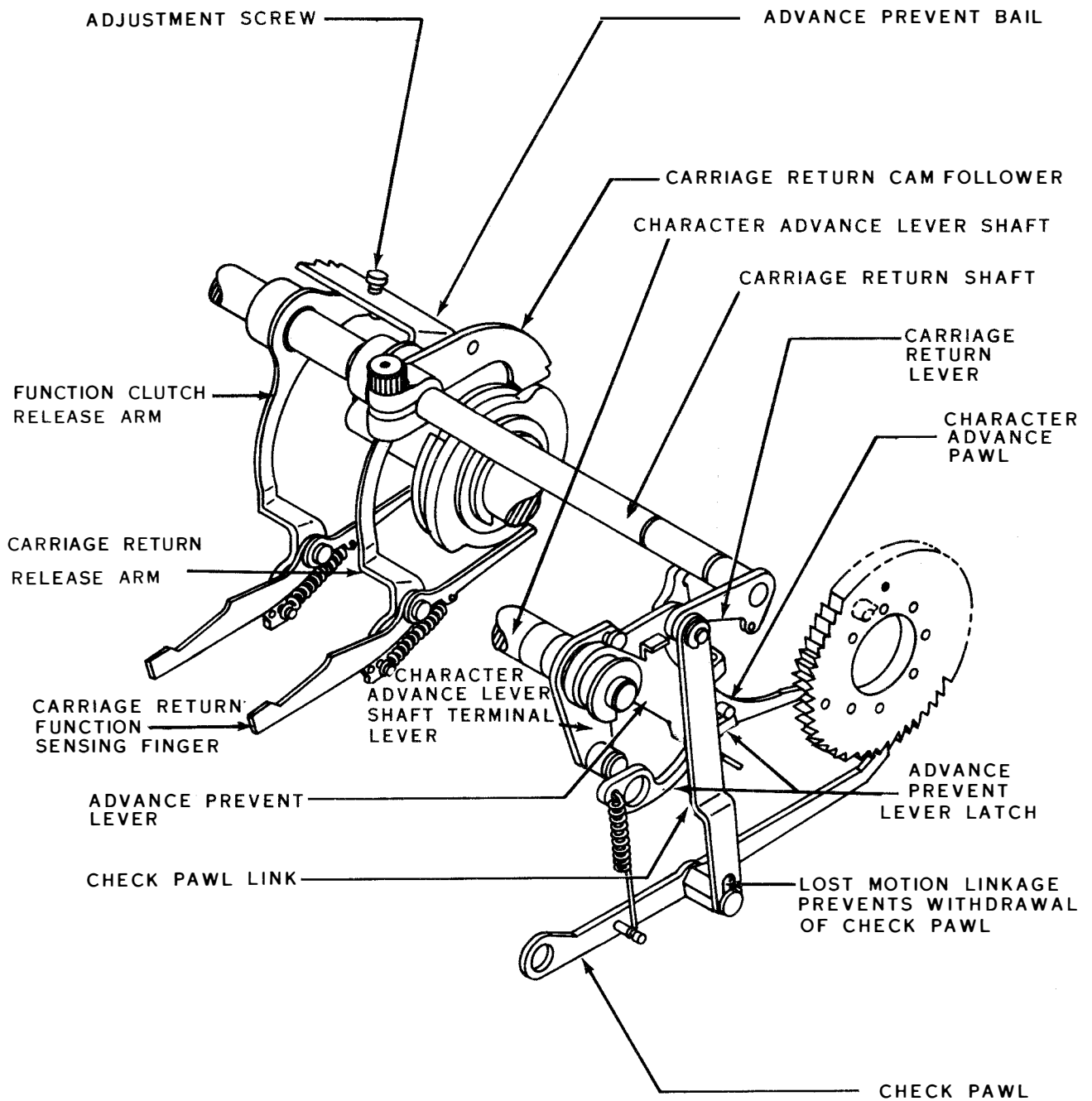


Figure 4-28. Character Advance Prevention Linkage

## SUMMARY

The AN/TGC-14(V) printer receives coded impulses from the local keyboard transmitter or from the signal line. For the printer to change these impulses into printed characters, symbols, or performed functions, involves many different operations. This study guide has presented the sequence steps of action for each of these operations:

1. MAGNETIC SELECTOR
2. CLUTCH RELEASE FINGERS AND TIMING CAM
3. PRINTER MAINSHAFT
4. TYPE CYLINDER
5. FUNCTION CAM AND EFFECTS
6. FUNCTION SENSING FINGERS
7. CHARACTER ADVANCE AND CHARACTER ADVANCE PREVENT
8. PRINT PREVENTION

The next two projects involve the disassembly, reassembly, and adjustment of the printer. Therefore, it is important that you understand and can analyze the operations of the printer. If you are unsure of any of these printer operations, turn back and review the material in this study guide.

## REFERENCE

TO 31W4-2TGC14-1, Technical Manual for Teletypewriter Sets AN/TGC-14(V) and AN/TGC-14A(V)



## DISASSEMBLY, REASSEMBLY, AND ADJUSTMENT OF THE PRINTER

### OBJECTIVE

This study guide is designed to enable you to follow given procedures and safety practices, use proper tools to disassemble and reassemble the printer and printer mainshaft, and to perform related printer adjustments.

### INTRODUCTION

The previous study guide explained the operations of the printer. Now you must learn how to disassemble and reassemble the printer and printer mainshaft, and how to perform related adjustments.

### INFORMATION

The Simplified Preventive Maintenance Procedures manual (TM-1002) contains the standard procedures for properly maintaining the AN/TGC-14(V). These procedures include how to follow a preventive maintenance schedule, disassemble and reassemble the printer and printer mainshaft, and perform related adjustments. These procedures are given a sequential order determined by experienced technicians, and should be followed in the order given. However, before following any of these disassembly, reassembly, or adjustment procedures, read each of them carefully. Make sure you understand what you have read and exactly what you are to do. Then, using proper tools and safety practices, follow the procedures in the sequential order given. Observe caution when making adjustments to assure that other related adjustments are not, or have not been, altered. Be sure to check equipment operation after each adjustment to make sure the adjustment has been done correctly.

### SUMMARY

The AN/TGC-14(V) is a very efficient operating piece of equipment when properly maintained. To maintain this equipment requires a thorough, analytical understanding of its operation and how to perform related adjustments according to given procedures.

### REFERENCE

TO 31W4-2TGC14-1, Technical Manual for Teletypewriter Sets AN/TGC-14(V) and AN/TGC-15A(V).

NAVSHIPS 0967-066-1020 (TM-1002), Simplified Preventive Maintenance Procedures for Teleprinter TT-298B/UG and Teletypewriters TT-299A/UG and TT-299B/UG, 15 October 1965.

This supersedes SG 3AZR36350-1-I-I-5 & 6, 1 April 1971.



## ELECTRICAL OPERATION OF THE AN/TGC-14(V)

### OBJECTIVE

This study guide provides experience enabling you to trace and analyze the ac and dc circuits of the AN/TGC-14(V) teletypewriter set.

### INTRODUCTION

Training on any electromechanical device is not complete without a thorough understanding of the electrical circuits involved. Thus far you have been working with the mechanical operations of the "Mighty Mite" and a very brief review of the characteristics and operation of solid state devices. To fully understand the overall operation of the equipment, it is necessary to trace and analyze the ac and dc circuits of the AN/TGC-14(V). These circuits include:

#### AC Circuits:

- AC Input to T1
- Motor
- Copy Lamps
- Heating Element

#### DC Circuits:

- DC Test Circuit
- Motor Stop
- Motor Stop Hold
- Energizing the Mark Coil
- Energizing the Space Coil
- Biasing Transistors

### INFORMATION

The circuits of the "Mite" are simple series, parallel, and series-parallel arrangements, much like the circuits in other equipment you have worked with. Figure 2-1 is a simplified block diagram showing the functional arrangement of the major assemblies of the teletypewriter set. Each unit is coded as follows:

- 1A1 - Electrical Chassis
- 1A2 - Printer
- 1A3 - AC Line Sensor (1A6 - DC Line Sensor)
- 1A4 - AC Signal Line Power Supply (1A7 - DC Signal Line Power Supply)
- 1A5 - AC Service Cable (1A8 - DC Service Cable)
- 1A9 - Keyboard

This supersedes SG 3AZR36350-1-II-2, 1 April 1971.

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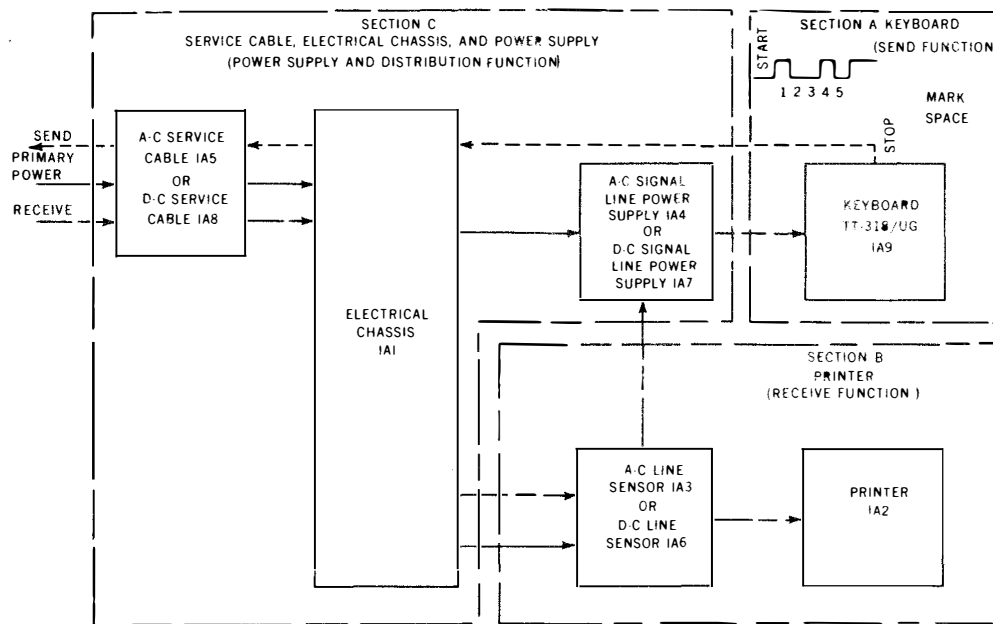


Figure 7-1. Simplified Electrical Block Diagram

Note that for dc operation, these components are replaced with dc operating assemblies.

#### ELECTRICAL FUNCTION OF MAJOR ASSEMBLIES

The electrical chassis 1A1 serves to route the incoming and outgoing signals and to distribute primary power to the appropriate assemblies. Three types are available: A motor and other components needed to operate on 400-cycle ac input (airborne equipment), 60-cycle ac input (technical field station), and 27-volt dc input (mobile tactical equipment). For operation on either type of ac input power, the purpose of the ac power supply is to furnish motor power as well as a dc signal line current source with a floating ground.

For the transmission of intelligence, the keyboard TT-318/UG (1A9) functions as the switching device for the output power supply. This output may be of either positive or negative polarity, since the teletypewriter can operate on either type pulse. However, only neutral signals can be used. Depressing a key or space bar establishes the mechanical code which is converted into a coded motion of pulsing contacts. The output of these contacts is the coded pulse train which is routed through the electrical chassis to either the line sensor or the signal line.

When the line sensor (1A3 in figure 7-1) receives the coded pulse train signal, the sensor operates as an electrical switch. It switches the start pulse, the five intelligence pulses, and the stop pulse in sequence to the magnet selector in the printer (1A2 in figure 7-1). The magnetic selector converts the intelligence pulses into mechanical functions to operate the clutches on the printer mainshaft. When the pulse train signals cease, a steady mark pulse remains and the signal loop is closed.



MODE 2. In mode 2 operation, signal line power is supplied by an external source, either by another teletypewriter set or by an external power supply. Mode 2 is obtained by patching J1 to J2, J3 to J4, and J6 to J7 (figure 7-3).

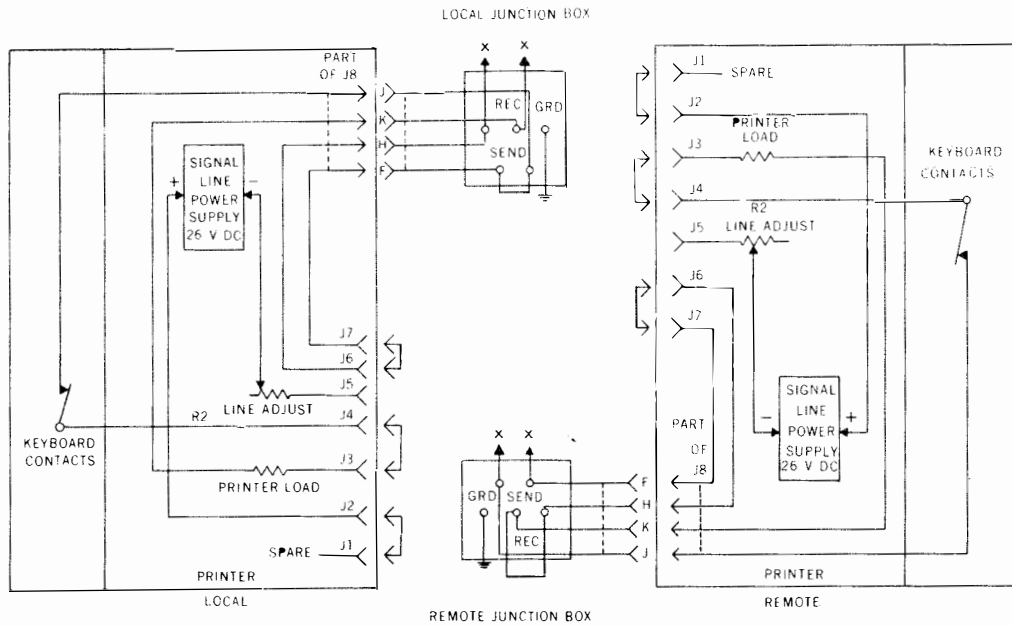


Figure 7-3. Mode 2 Operation Patching

MODE 3. Mode 3 is full-duplex operation, or communications between two points in both directions at the same time. Normally, this mode of operation does not allow the home station to keep a copy of the message sent. Your equipment and the one at the distant station are supplying power to the receive circuit during mode 3 operation. For mode 3 operation, patch J2 to J3, J5 to J6, and J4 to J7 (figure 7-4).

MODE 4. During mode 4 operation, all signal line power is supplied from either an external power supply or a remote teletypewriter set. Figure 7-5 shows mode 4 operation with J1 patched to J2, J3 to J6, and J4 to J7.

Let us trace out mode 4 operation on figure 7-5; starting at the negative side of the left external power supply. Continue up through the send side of the local junction box to J of J8 then through the local keyboard contacts to J4 patching jack. Go on through J4, which is patched to J7, to Y and then back on the send side of the local junction box. It continues through H of J8 to J6 strapped to J3, through the printer to K of J8, then back to the receive side of the remote junction box. The circuit is completed at the positive side of the left external power supply. Notice that the local keyboard is in series with the remote printer. The circuit for the other half of the external power supply (right), traced out in the same way, gives us a full-duplex operation.

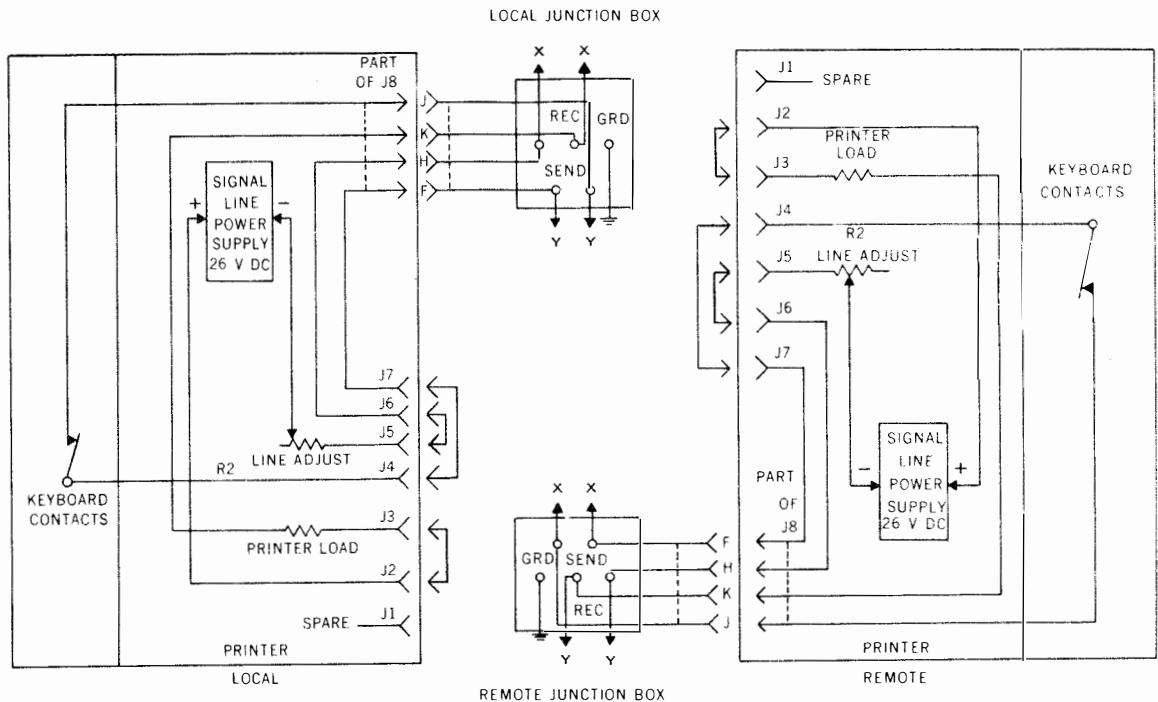


Figure 7-4. Mode 3 Operation Patching

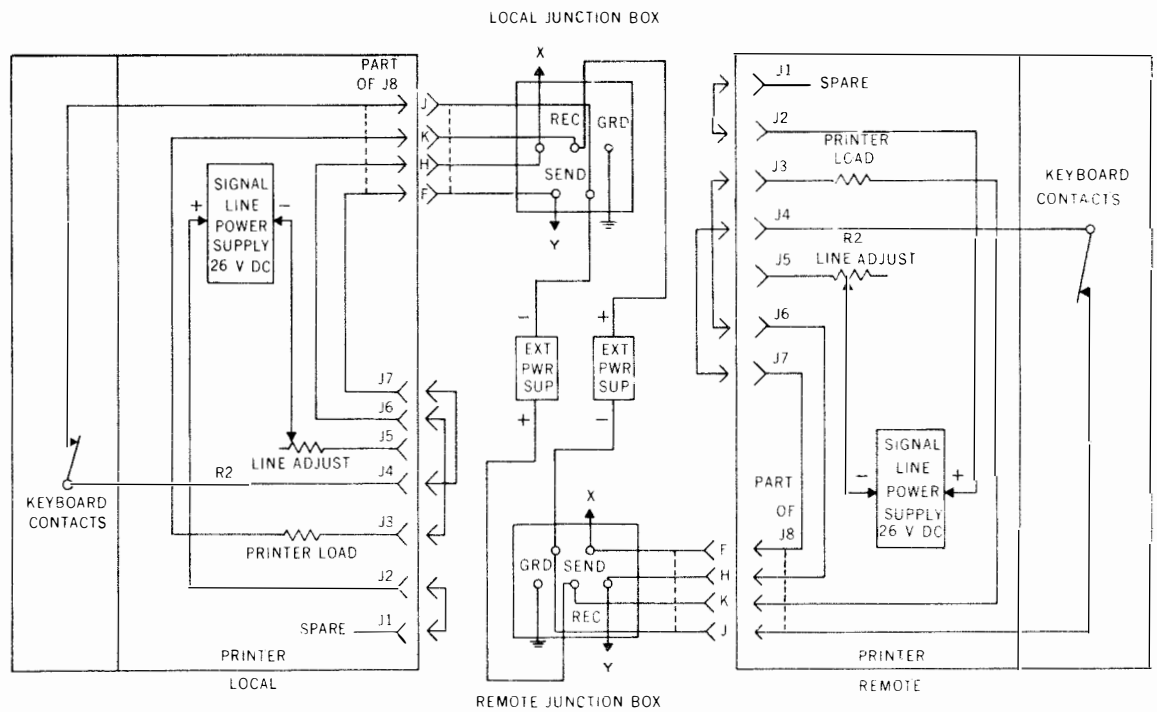


Figure 7-5. Mode 4 Operation Patching

MODE 5. In mode 5, the local teletypewriter set supplies power to the local keyboard and the remote printer; the remote teletypewriter supplies power to the remote keyboard and the local printer. Figure 7-6 shows that for mode 5 operation J2 is strapped to J4, J3 to J6, and J5 to J7. Now let us analyze the ac and dc circuits.

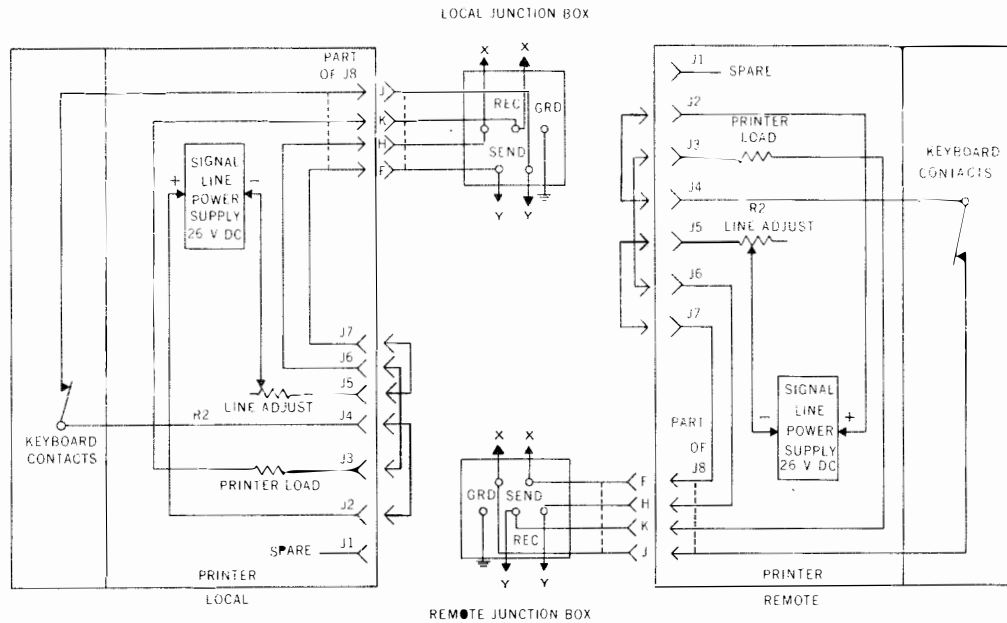


Figure 7-6. Mode 5 Operation Patching

### AC CIRCUITS

As previously mentioned, the input to the signal line power supply is 115-volt ac, 60- or 400-Hertz (cycles) per second, single phase. The maximum output of the power supply should not exceed 100 MA at 26 volt dc. AC power enters the equipment at P2 on the line service cable 1A5, and goes to terminals A, B, and C of P1 and J8. Therefore, terminals A and C are the ac input terminals while terminal B is fixed ground. All ac circuits start at A and C.

#### AC input to T1

The ac input circuit to T1 starts at terminal A and goes through the 5-amp main ac fuse F1, switch S1, and the 0.5-amp fuse F3. It then parallels to the two primary windings of T1. The primary winding in the line sensor (1A3) acts as a step-down transformer supplying 6-volt ac to the copy lamps and 33-volt ac to the rectifier. The primary and secondary windings in the signal line power supply (1A4), step the ac down to 33-volt ac for the signal line rectifier.

#### Motor

There are three types of motors that may be used with the AN/TGC-14(V) equipment, depending on the location of use. As previously stated, the ac hysteresis synchronous motor, PD-82/U, operates at 60-Hertz per second when equipment is used



at technical field stations. The ac synchronous motor PD-83/U operates at 400-Hertz per second, as used in airborne equipment. In some rare cases, equipment used at mobile tactical stations requires motors that operate on a 26-volt dc input.

Using foldout 1, the ac motor circuit may be traced from terminal A of J8 through the F1 fuse and switch S1 to the first junction, up through the F2 1-amp fuse and contacts 3 and 5 of the motor stop relay, and to both sides of capacitors C1A and C1B. These two start capacitors give the motor the phase shift. The motor circuit is completed through the start and running windings of the motor to terminal C of J8 and P1.

#### Heating Element

The heating element located on the underside of the electrical chassis (figure 1-5) is used when operating in temperatures below 0°C (32°F). The heating element is controlled by a thermostatically operated switch (S3, foldout 1). This element operates as soon as the equipment is plugged into ac power.

The circuit for the heating element is traced from terminal A of P1 and J8 through F1 to the junction. From this point the circuit continues up through the thermostatically operated switch S3 to the heating element, and back to terminal C on J8 and P1.

The ac heating element is identified by the brown and red colored leads and measuring 66.5 ohms  $\pm$  10 percent. If a dc element is used, the leads are brown and green, measuring 3.4  $\pm$  10 percent. Make sure the ac and the dc elements are not used one for the other.

### DC CIRCUITS

The rectifier in the ac signal line power supply (1A4) and the rectifier in the ac line sensor (1A3) are both identified as A1 on foldout 1. Each rectifier has an input of 33-volt ac and an output of 26-volts dc. The line sensor network (A2) has an attenuator or semiconductor diode bridge. This bridge receives dc positive and negative pulses from the ac signal line power supply (1A4) or from a signal line loop. The bridge orients the pulse polarity so that only negative pulses appear at the base of PNP transistor Q1. Q1 thus serves as a switch to control current flow to power amplifier PNP transistors Q2 (for mark) and Q3 (for space). In other words, when Q1 conducts Q2 also conducts, and its collector-emitter output current operates the mark coils of the magnetic selector (1A2). When Q1 cuts off, Q2 is cut off, and Q3 conducts, allowing the space coils of the magnetic selector to operate. Let us see how all this action takes place. First of all, remember that the patching connection jacks on the equipment in the classroom are arranged for local test operation, as shown in figure 2-2 for Mode 1.

#### DC Test Circuit

What happens when the equipment is first plugged in and before a keytop is depressed? A negative pulse is applied from the signal line power supply through the line sensor network to the base of Q1, causing the mark coils of the magnetic selector to be energized.

The path for this negative pulse, or dc test circuit, is traced from the negative side of the rectifier in the ac signal line power supply (foldout 1) through:

Terminal 7 of P1 and J10  
Line adjust resistor R2  
Terminal J5 strapped to J4  
Keyboard contacts (1A9)  
Terminal J of J8 and P1  
Send terminals E2 and E1 (strapped)  
Terminal F of P1 and J8  
Fuse F4 (0.250-amps)  
Terminal J7 strapped to J6  
Terminal H of J8 and P1  
Receive terminals E4 and E1 (strapped)  
Terminal K of P1 and J8  
Terminal 8 of J9 and P1  
Terminal E11 of the ac line sensor diode bridge

The test circuit is completed from terminal E12 of the bridge through terminal 7 of P1 and J9, terminal J3 strapped to J2, terminal 9 of J10 and P1, and R1 to the positive side of the ac signal line power supply rectifier. With a closed signal line loop, a negative pulse is now applied to the base of Q1 from the diode bridge through E14 and R3.

The negative pulse applied to the base (input) of Q1 causes Q1 to conduct. Remember the rule for a PNP transistor: In order for a PNP transistor to conduct, the collector must have the most negative potential, the base less potential, and the emitter the least negative. This is just the condition we have at this time, resulting in a collector to emitter output. To trace this output circuit, you start from the negative side of the line sensor power supply (1A3 A1). The circuit then continues through the junction up to E6, through E5, R4, and the collector-emitter of Q1. The circuit is completed through R6 and R9, back to the positive side of the line sensor power supply.

#### Energizing the Magnetic Selector Mark Coils

During the time Q1 reaches its maximum conduction (-26 vdc) the potential at the junction just above R6 becomes negative. This places a negative potential, or forward bias, on the base (input) of Q2. Therefore, the same rule applied to Q1 also applies to Q2 at this time; Q2 conducts. Earlier we said that when Q2 conducts, the mark coils in the magnetic selector are energized, releasing their respective clutches by means of the clutch release fingers.

The output circuit of Q2 through the mark coils begins at the negative side of the line sensor power supply (1A3 A1). The circuit goes to the junction, then left through terminal 9 of P1 and J9, E6, R3, and E7 on the electrical chassis (1A1) to terminal 12 of J9 and P1. The circuit continues up through terminal D of J1 and P1, the parallel mark coils of the magnetic selector and terminal B of P1 and J1, to terminal E9 in the A2 line sensor. It then goes down through CR8, E10, the collector-emitter of Q2, R7, and R9, back to the positive side of the ac line sensor power supply (1A3 A1).

Current through the collector-emitter of Q2 has the same effect on R7 that current through Q1 has on R6. However, this time the negative potential at the junction above R7 is applied to the emitter of Q3 instead of the base. This causes reverse bias rather than forward bias on Q3. In other words, the base of Q3 now has more positive potential than its emitter. Therefore, Q3 does not conduct on a mark pulse.

## Energizing the Magnetic Selector Space Coils

When a keytop is depressed, the first pulse transmitted is either a start or space pulse. This causes an open in the dc test circuit or signal line loop. Therefore, the mark coils deenergize and the space coils energize. Why? With an open in the signal line or dc test circuit, there is no current flow to the diode bridge in the ac line sensor (1A3 A2). If there is no current through the diode bridge, no negative potential can be applied to the base of Q1. This means that Q1 has reverse bias applied to it and, therefore, cannot conduct. The potential at the junction above R6 now becomes positive, reverse biasing Q2, cutting it off. With Q2 not conducting, the potential at the junction above R7 also becomes positive and is applied to the emitter of Q3. This allows the base of Q3 to become more negative than its emitter. Under these conditions Q3 conducts, energizing the magnetic selector space coils and the mark coils will deenergize.

The conduction path of Q3 is traced from the negative side of the A-C line sensor power supply (1A3 A1). It follows the same path to the space coils as the conduction path of Q2 to the mark coils. From the space coils, the circuit continues through terminal C of P1 and J1, and terminal E8, then left and down through the collector-emitter of Q3. The circuit is completed through R7 and R9 to the positive side of the A-C line sensor power supply. The next pulse received may be a mark pulse or a space pulse. If it is a mark pulse, Q1 conducts, Q2 conducts through the mark coils, and Q3 cuts off. If it is a space pulse, Q1 and Q2 cut off and Q3 conducts through the space coils.

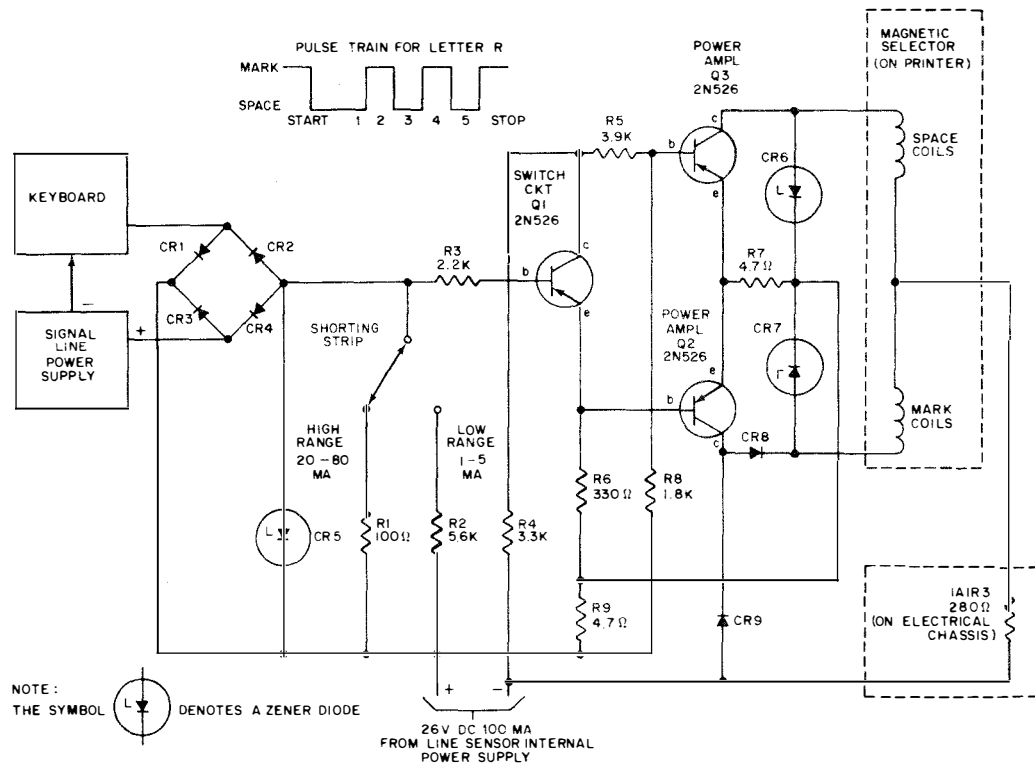


Figure 7-7. Line Sensor, Simplified Schematic Diagram

## Low Current Operation

The base input circuit of transistor Q1 includes a shorting strip which can be used in either of two positions (foldout 1 and figure 7-7). One position places a 100-ohm resistor (R1) parallel to the base input circuit for a 20- to 80-ma input range. The second position places a 5,600-ohm resistor (R2) parallel to the base input circuit for a 1- to 5-ma range. Resistors R1 and R2 shunt portions of the signal current from the base input to Q1. This reduces the input resistance of the circuit. When the shorting strip is positioned for the high range (20 to 80 ma), the line sensor has an input resistance of 125 ohms at 60 ma. When positioned for the low range (1 to 5 ma), the input resistance is 2,500 ohms at 5 ma. The shorting strip is accessible by removing the line sensor metal cover.

To avoid transistor damage from excessive signal current, Zener diode CR5 shunts any excessive signal current and voltage level above 12 volts. CR5 also protects transistor Q1 from any transients or spikes caused by radio or other interference. Zener diodes CR6 and CR7 prevent inductively produced pulses exceeding a level of -25 volts from appearing on the collectors of power amplifiers Q2 and Q3.

**CAUTION:** When using the internal signal line power supply (1A4) for low current (1 to 5 ma) operation, an external 50K-ohm resistor should be placed in series with the receiver (red) binding post on the service cable junction box.

## Motor Stop Circuit

The AN/TGC-14(V) motor is stopped when the figures and the figures H motor stop keytops are depressed. Through the operation of the magnetic selector and other mechanisms on the printer, switch S1 is closed. This completes the circuit through the motor stop relay K1, located on the electrical chassis (foldout 1, 1A1). K1 energizes and closes motor stop relay contacts 2 and 7 and opens contacts 3 and 5. When contacts 3 and 5 are open, there is no power to the printer motor.

Since the motor stop switch S1 is closed only momentarily, another circuit must be used to keep the motor stop relay energized. It is called the motor stop holding circuit.

## Motor Stop Holding Circuit

The motor stop holding circuit is possible because of the conduction of Q2. Therefore, Q2 serves two purposes: (1) it energizes the mark coils of the magnetic selector on mark impulses, and (2) it provides the voltage source to keep motor stop relay K1 energized on either a steady mark condition or stop pulse. Assuming the motor stop switch S1 has opened, the motor stop relay is held energized by the motor stop holding circuit, which begins at the negative side of the ac line sensor power supply (1A3A1). The circuit continues through terminal 9 of P1 and J9, K1, K1 contacts 7 and 2, terminal 12 or J9 and P1, terminal E10, collector-emitter of Q2, R7, and R9, back to the positive side of the ac line sensor power supply (1A3A1).

## SUMMARY

The ac and dc circuits just covered complete the discussion of the mechanical and electrical operation of the AN/TGC-14(V). You should now be able to troubleshoot this equipment with very little difficulty.

As a brief review, remember, the input to the signal line power supply and the line sensor power supply is 115-volt ac stepped down to 33-volt ac. The output from the power supplies is 26-volt dc. The diode bridge in the line sensor network receives the negative pulse applied to the input base of Q1 from the signal line power supply or signal line loop. Q1 serves as a switch, controlling current to power amplifiers Q2 and Q3. The negative pulse causes Q1 to conduct through its collector-emitter from the negative to the positive side of the line sensor power supply. A negative potential is then applied to the base input of Q2 from the junction above R6. With current from the line sensor power supply, Q2 conducts, energizing the mark coils of the magnetic selector. When Q2 conducts, the negative potential at the junction above R7 is applied to the emitter of Q3, causing Q3 not to conduct. Therefore, the magnetic selector space coils are not energized. When a space pulse (no current) is applied to the base of Q1 from the signal line power supply or signal line loop, Q1 does not conduct, causing Q2 to cut off. This allows Q3 to conduct and energize the space coils in the magnetic selector.

Remember also that the AN/TGC-14(V) can operate in either one of five modes depending on the connection arrangement of patching jacks J1 through J7.

## REFERENCE

TO 31W4-2TGC14-1 - Technical Manual for Teletypewriter sets AN/TGC-14(V) and AN/TGC-14A(V).

TROUBLESHOOTING AND PREVENTIVE MAINTENANCE  
OF THE AN/TGC-14(V)

OBJECTIVE

This study guide will help you to understand and be able to use proper procedures when locating mechanical and electrical troubles that may occur in the AN/TGC-14(V) teletypewriter set.

INTRODUCTION

Much time and effort can be spent looking for a trouble in the AN/TGC-14(V) if it is not done in a planned (systematic) manner. Therefore, it is important that you develop a trouble analysis procedure to help you locate troubles in the shortest time possible. This is especially true since it is impossible to know all the troubles that can occur in the AN/TGC-14(V) teletypewriter set.

INFORMATION

The first and most important technique in troubleshooting is knowing the overall operation of the AN/TGC-14(V) teletypewriter set. This includes the step-by-step sequence of action, electrical as well as mechanical. In other words be thoroughly familiar with the equipment and follow these procedural steps:

VISUAL CHECK

See that all switches, plugs, and controls are in their proper place or position.

Make sure all fuses are good and in their correct holders. Also check to see that the value of each fuse is correct.

Make sure the three basic components, electrical chassis, keyboard, and printer are properly fastened together.

OPERATION OF EQUIPMENT

Turn the main power switch ON and determine what the equipment is doing (indication): running open, running closed, garbling, continuously transmitting, continuously receiving, or inoperative.

Determine if the trouble is electrical or mechanical by

1. operating the line break switch S4.
2. moving a patching jack in or out.
3. observing the #2 armature. If it moves and makes a noise, the trouble is probably mechanical. If the #2 armature does not move or make a noise, the trouble is probably electrical.

This supersedes SG 3AZR36350-1-II-3, April 1971.

## ISOLATING THE TROUBLE

Determine which of the components is causing the trouble; the keyboard, the printer, or the electrical chassis.

1. Remove the keyboard or hold the send lock switch in LOCK position. This usually determines if the trouble is in the keyboard or not.

2. When the printer receives impulses to operate the magnetic selector, this indicates the printer is good up to this point. Now check the operation of each character combination and function operation.

3. Continuity check: When making a continuity check of a circuit, make sure any parallel circuit(s) is disconnected or isolated. The ac signal line power supply output can be checked by placing a meter in series with patching jacks J2 and J5.

4. Mechanical adjustment check: Set up various code combinations, turn the motor slowly and observe whether all mechanical parts are moving as they should and in the correct sequence.

## TROUBLE INDICATIONS

### Running Open

When the AN/TGC-14(V) runs open, this indicates there is no signal line battery or there is an open in the local test circuit. Under either of these conditions the #2 armature of the magnetic selector remains in the spacing position. If manually moved to the marking position, it will return to the spacing position.

### Running Closed

When the AN/TGC-14(V) runs closed, the keyboard does not transmit or the printer does not receive. That is, in general, the armature remains in the mark position and does not go to the space position.

### Garbling

Garbling is an indication the keyboard is transmitting and the printer is receiving, but the character combination or functional symbol is incorrect. This can be caused by an electrical or mechanical malfunction. Therefore, follow the steps under "Visual Check" and "Isolating the Trouble."

### Continuous Transmission or Continuous Receiving

This indicates either a loss of local dc battery (ac line sensor power supply) or a mechanical malfunction. Always start with checking the start-stop mechanism for correct sequence of operation.

### Inoperative

This indication calls for a thorough check to determine if all plugs, fuses, connectors and the basic components are affixed as prescribed, and that the ac input is correct.

## TABLES AND CHARTS

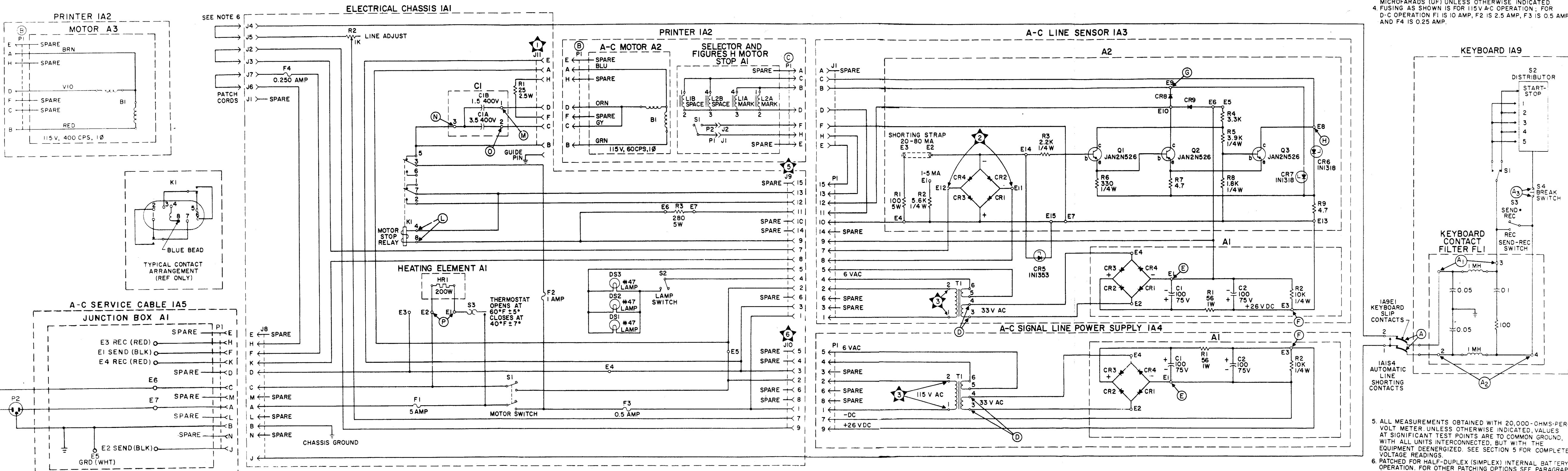
More detailed procedural steps for troubleshooting are found in tables of TO 31W4-2TGC14-1, Technical Manual for Teletypewriter Sets AN/TGC-14(V) and AN/TGC14A(V).


### REFERENCES

- TO 31W4-2TGC14-1 - Technical Manual for Teletypewriter Sets AN/TGC-14(V)  
and AN/TGC-14A(V)
- TO 31W4-2TGC14-1-2 - Addendum to Technical Manual for Teletypewriter Set  
AN/TGC-14A(V)



- NOTES:
1. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH THE UNIT NUMBER, OR ASSEMBLY DESIGNATION, OR BOTH.
  2. ALL RESISTORS ARE 1/2 WATT ±5% AND VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED.
  3. ALL CAPACITORS ARE ±10% AND VALUES ARE IN MICROFARADS (UF) UNLESS OTHERWISE INDICATED.
  4. FUSING AS SHOWN IS FOR 115V A-C OPERATION; FOR D-C OPERATION F1 IS 10 AMP, F2 IS 2.5 AMP, F3 IS 0.5 AMP, AND F4 IS 0.25 AMP.



5. ALL MEASUREMENTS OBTAINED WITH 20,000-OHMS-PER-VOLT METER, UNLESS OTHERWISE INDICATED. VALUES AT SIGNIFICANT TEST POINTS ARE TO COMMON GROUND, WITH ALL UNITS INTERCONNECTED, BUT WITH THE EQUIPMENT DEENERGIZED. SEE SECTION 5 FOR COMPLETE VOLTAGE READINGS.
6. PATCHED FOR HALF-DUPLEX (SIMPLEX) INTERNAL BATTERY OPERATION. FOR OTHER PATCHING OPTIONS SEE PARAGRAPH 2-9.
7. ALL DIODES ARE TYPE AF16G45 UNLESS OTHERWISE INDICATED.
8. THE SYMBOL  DENOTES A ZENER DIODE.

Teletypewriter Set AN/TGC-14(V),  
Schematic Diagram

FOLDOUT 1

ATC-SHEPPARD AFB TEX.

