

**DIGITAL FLATBED PLOTTER****Models:****632,  
732A  
2232A****632A**

Second Edition (January 1984)

This manual is a reprint that incorporates three Service Bulletins 729-0461, 729-0462, and 729-0463 for ease of handling and stocking. Updates and/or changes to this document will be published as Product Update Bulletins (PUBs) or subsequent editions.

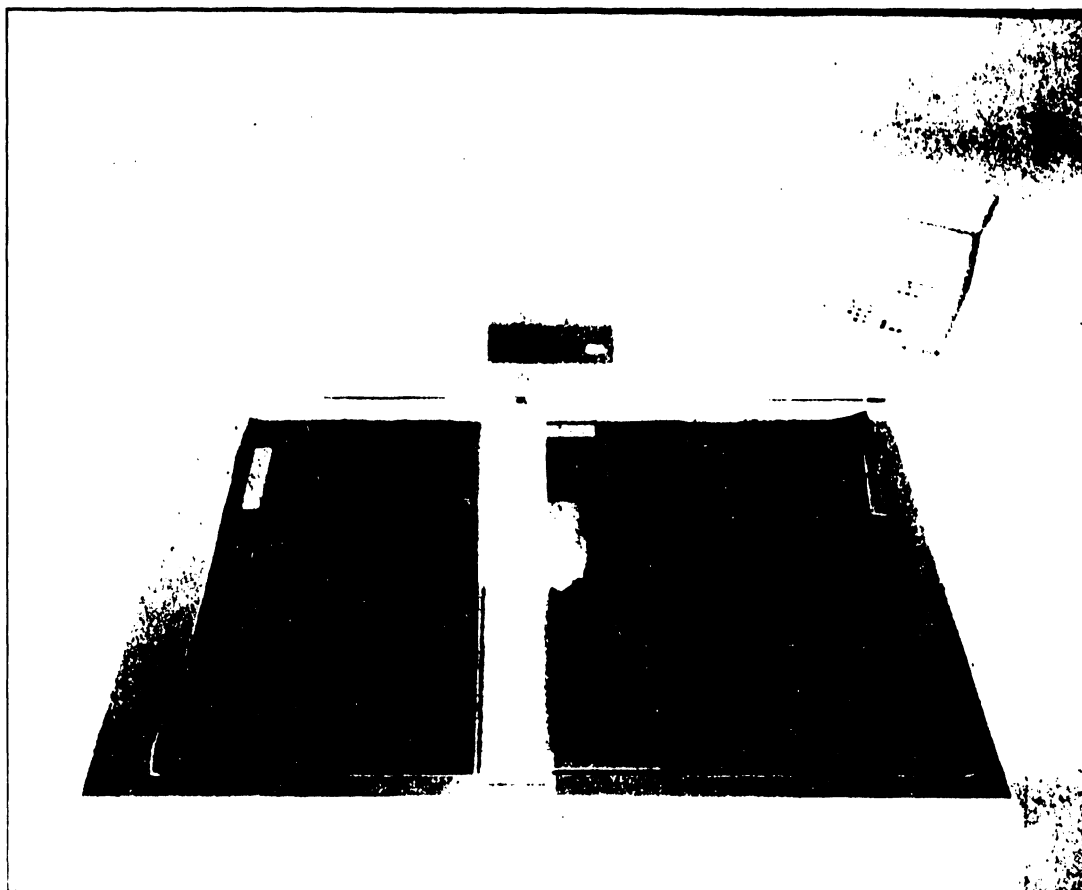
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**SERVICE  
BULLETIN  
NO. 44**

EDITED BY PRODUCT SERVICE DEPT.

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## MODEL 32 DIGITAL FLATBED PLOTTER



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## TABLE OF CONTENTS

1.	GENERAL . . . . .	3
	1.1 Description . . . . .	3
	1.2 Plotting Table and Surface . . . . .	3
	1.3 Software . . . . .	3
	1.4 Format . . . . .	3
	1.5 Specifications . . . . .	3
2.	COMPONENTS . . . . .	4
	2.1 Electronics Portion . . . . .	4
	2.2 Mechanical Portion . . . . .	5
3.	OPERATING CONFIGURATION . . . . .	5
	3.1 Calculator Connection . . . . .	5
	3.2 System Configuration . . . . .	5
	3.3 To Connect a Model 32 System . . . . .	5
4.	OPERATION . . . . .	7
	4.1 Plotting Location . . . . .	7
	4.2 Programming . . . . .	8
	4.3 Plot Pen Down - Examples . . . . .	8
	4.4 Plot Pen Up Procedure . . . . .	13
	4.5 Home Position . . . . .	13
5.	MECHANICAL ADJUSTMENTS . . . . .	16
	5.1 Adjustment Tools . . . . .	16
	5.2 Adjustment Tape . . . . .	16
	5.3 Pen Solenoid Adjustment . . . . .	16
	5.4 Plunger Overtravel . . . . .	16
	5.5 Preload Spring Tension . . . . .	19
	5.6 Dash Pot . . . . .	21
	5.7 Carrier Brake Adjustment . . . . .	21
	5.8 Leveling Y Arm . . . . .	22
	5.9 Squaring X Shaft . . . . .	24
	5.10 Making Y Arm Perpendicular to the X Shaft . . . . .	24
	5.11 X Rack Adjustment - Early Models . . . . .	24
	5.12 Pinion Loading Adjustment . . . . .	27
	5.13 Y Increment Adjustment . . . . .	27
	5.14 Cable Tension Adjustment . . . . .	32
	5.15 Photocell Adjustment . . . . .	34
	5.16 Home Position Alignments . . . . .	35
	5.17 Carriage Loading Adjustment . . . . .	39
	5.18 Y Arm Removal and Replacement . . . . .	39
6.	ELECTRICAL ADJUSTMENTS - L565 PC . . . . .	42
	6.1 +5VR Adjustment . . . . .	42
	6.2 +23VR Adjustment . . . . .	42
	6.3 Stepping Motor Frequency Adjustment . . . . .	42
7.	ACCESSORIES OF THE MODEL 32 AND THEIR USE . . . . .	44
	7.1 List of Accessories . . . . .	44
	7.2 Description of Accessories . . . . .	44
8.	DIAGNOSTICS VERIFY 8560 . . . . .	47
	8.1 Concentric Circles or Ellipses . . . . .	47
	8.2 Incrementing Radii . . . . .	48
	8.3 Rectangle Drawn at an Angle . . . . .	49
	8.4 Rectangles . . . . .	50
	8.5 90° Angle for Aligning X Shaft and Y Arm . . . . .	51
	8.6 Dash Pot Diagnostic . . . . .	51
	8.7 Subroutine - For Greater Than 999 Increments . . . . .	51
9.	PREVENTIVE MAINTENANCE PROCEDURES . . . . .	52
	9.1 Lubrication . . . . .	52
	9.2 Cleaning . . . . .	52
	9.3 Visual Inspection . . . . .	52

## ATTENTION

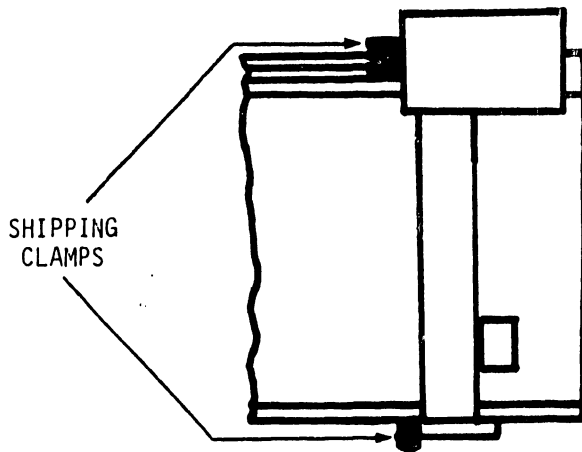
### UNPACKING & PACKING INSTRUCTIONS

When installing or replacing a Model 32 plotter, do not destroy the packing material. Do not discard the packing material until a full check-out procedure has been performed.

To install a plotter, lie the carton containing the table and arm flat on the floor with the arrows pointing up. Remove the packing tapes and cover. Remove the top layer of Instapak foam; this will reveal the plotting table. *With the aid of another person* lift the table vertically from the carton. If the plotting table is to be mounted on a Mayline or similar table and the customer wishes to install the table clamps refer to section 7.2 #5 and follow that procedure. If no clamps are to be installed simply lie the plotting table on the customer's table with the gearfence extending over one edge approximately three inches.

There are two shipping clamps on the Model 32. One is in the X rail of the table which keeps the arm forced against the right margin of the table. The wooden clamp is held by a bolt through its center. Loosen this bolt and then slide the clamp to left until it leaves the X rail. The other wooden clamp is at the opposite end of the arm. It also forces the arm against the right margin of the table. It is to the left of the arm clamped around the X gearfence. To remove it, loosen the bolt in the center of the block and pull the block away from the gearfence. See illustration below for clamp location. For packing a Model 32, reverse the above procedure.

To connect the system together, see section 3.3.



## 1. GENERAL

### 1.1 DESCRIPTION

The Model 32 Digital Flatbed Plotter provides continuous line or print plotting of curves and data. It also provides full alphanumeric labeling of plots. Circle charts, bar graphs, subdivisional plans and highway plans may be plotted. The Model 32 uses any kind of paper, including linen, vellum, and mylar, and has the option of using fiber tip, ball point, or drafting pens.

### 1.2 PLOTTING TABLE AND SURFACE

The plotting table measures 37 1/2" x 54"; the actual plotting surface is 31" x 42". Smaller plots may be positioned anywhere within the plotting surface boundaries.

### 1.3 SOFTWARE

Alphanumeric character generation is not built into the Model 32, but is provided by software. This requires a 4000 byte memory (minimum). For this reason the Model 32 is usually used in a system which contains an external memory drive.

### 1.4 FORMAT

Format and content of the alphanumeric labeling of plots is calculated and controlled by a Wang calculator.

### 1.5 SPECIFICATIONS

1) Paper Capacity:	53 1/2" x 36" (135.89 cm x 91.44 cm)
2) Plotting Area:	31" x 42" (78.74 cm x 106.68 cm)
3) Plotting Speed:	60"/Min. Avg.
4) Accuracy:	.01" (.025 cm) + .1%
5) Repeatability:	.010" (.0254 cm)
6) Plotting Increment:	.0025" (.0064 cm)
7) Operating Environment:	50°F to 90°F (10°C to 32.2°C)
8) Relative Humidity:	40% to 60%
9) Voltage:	115VAC ± 10%
10) Frequency:	60 HZ ± 1/2 HZ

## 2. COMPONENTS

### 2.1 ELECTRONICS PORTION

The electronic package (See Figure 1) contains the logic to drive the stepping motors of the plotting arm. PC boards contained in this package are as follows:

- 1) L565 - Contains the power supply regulator and stepping motor drive circuitry.
- 2) 6289 - Contains the stepping motor drive decoder circuit and the reset circuit.
- 3) 6336 - Insures that whatever differential distance is to be traveled by X and Y, the stepping motors will be incremented at the proper moment to create the proper angles.
- 4) 6337 - Contains direction decoding circuit, the pen up/down solenoid driver circuit, and interfaces with calculator I/O circuits.

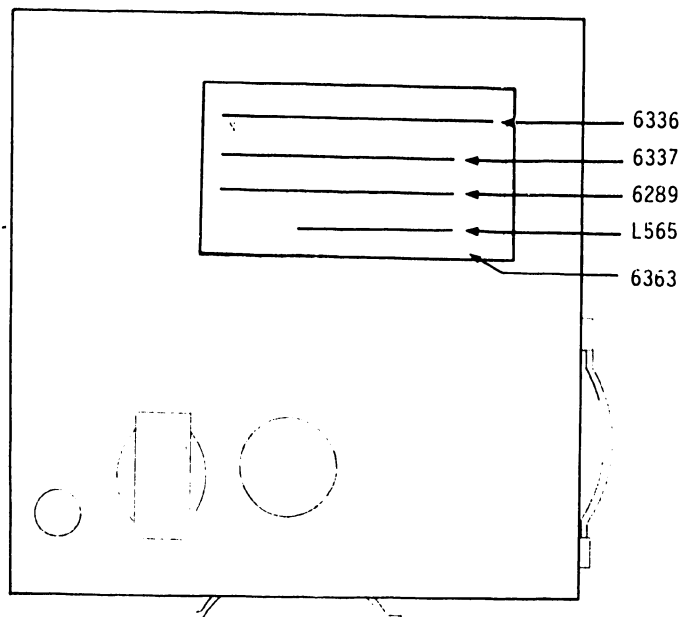


FIGURE 1  
MODEL 32 ELECTRONIC PACKAGE



## 2.2 MECHANICAL PORTION

The mechanical portion of the Model 32 consists of a plotting table and an Y arm. The Y arm moves horizontally on the plotting table while a carrier moves vertically on the Y arm. The carrier holds a pen and may be controlled to either contact the paper or to ride above it.

## 3. OPERATING CONFIGURATION

### 3.1 CALCULATOR CONNECTION

The top half of Figure 2 illustrates how the Model 32 is connected to the calculator. The Model 32 utilizes the typewriter jack on the calculator, as do other Wang plotting devices.

### 3.2 SYSTEM CONFIGURATION

The lower half of Figure 2 illustrates how the Model 32 is connected into a system. Other peripherals may be T'd with the Model 32; some of these devices utilize the same or similar codes and will perform unnecessary functions during the operation of the Model 32.

The 01 typewriter is one device that can be connected to the Model 32 via a T connector. In this case, when the plotter is issued a pen up or pen down command, the Model 01 will respond with a shift up or a shift down function. The Model 01 typewriter and other devices should be kept on while the Model 32 is in use, since they hold calculator output lines at +0V when shut off.

### 3.3 TO CONNECT A MODEL 32 SYSTEM

- 1) Connect the Model 32 typewriter cable to the typewriter jack of the calculator.
- 2) Connect the remaining cable coming from the Model 32 package to the arm of the plotting table. This cable is connected to a jack located on the bottom of the plotter, directly beneath the X-Y stepping motors. See Figure 3.

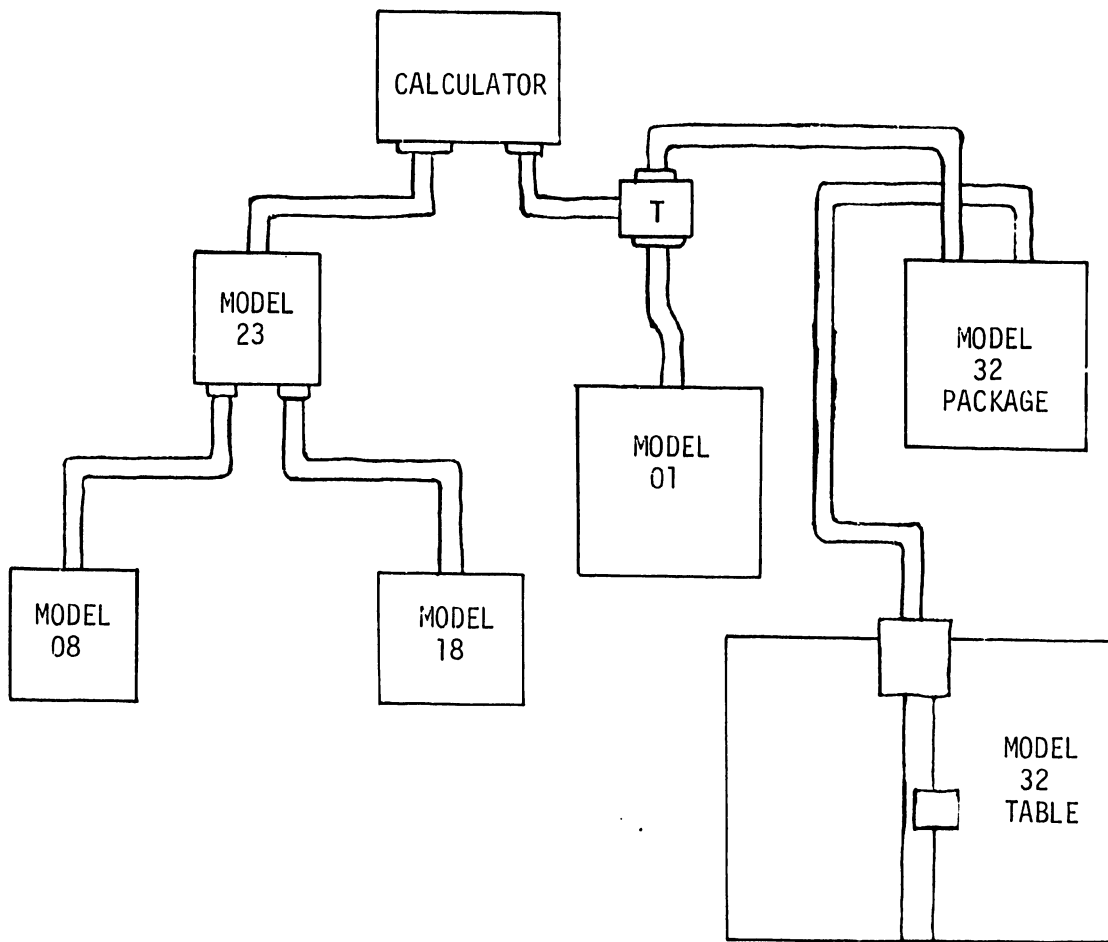
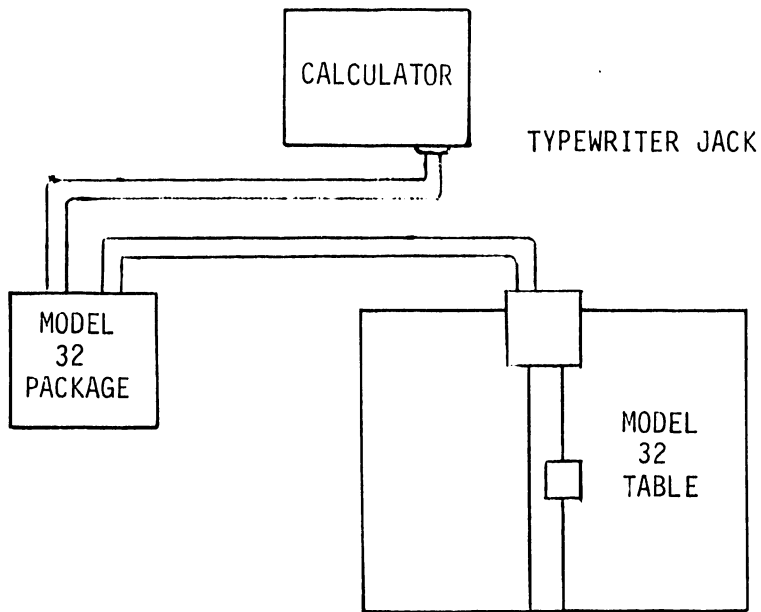


FIGURE 2  
SYSTEM CONFIGURATIONS

CABLE ATTACHES  
TO CONNECTOR  
ON THE BOTTOM  
OF THE MOTOR  
CASTING

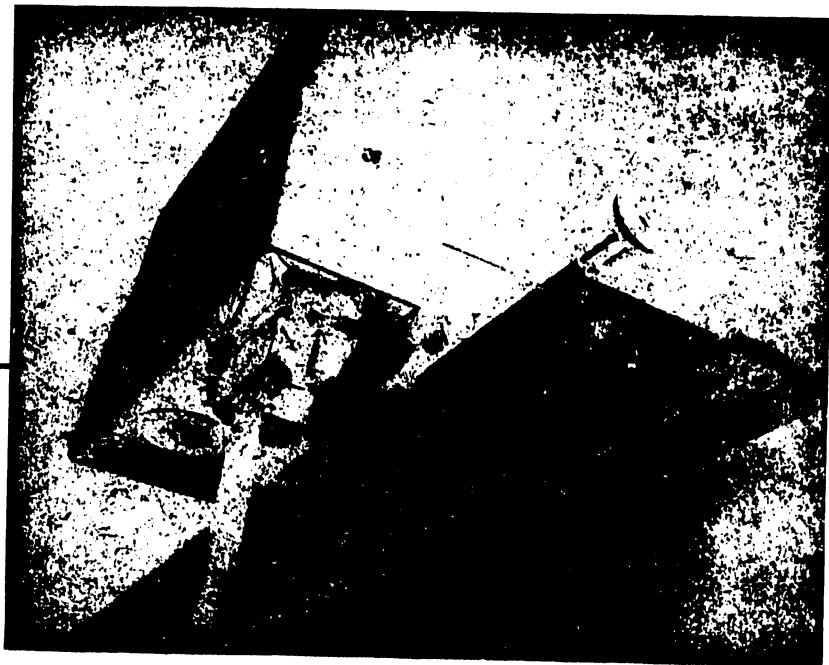


FIGURE 3  
CONNECTING PACKAGE CABLE TO PLOTTING TABLE

#### 4. OPERATION

NOTE:

The following operations apply only to a Model 600 or a Model 700/720 B, C calculator in a system incorporating the Model 32.

##### 4.1 PLOTTING LOCATION

Plot location in the 632 is determined by the contents of registers 01 and 00. Plot location in the 732 is determined by the contents of the X and Y display registers.

On command, each integer (0-999) contained in these registers will cause a plotting increment of .0025 inches. The sign of each register will determine the direction of the plot. See Figure 4.

AXIS	600	700
X	Register 01	X Register
Y	Register 00	Y Register

#### 4.2 PROGRAMMING

The following commands must be preceded by *ALPHA* in the 600 or *WRITE ALPHA* in the 700 and proceeded by *O202* in the 600 or *END ALPHA* in the 700.

<u>600</u>	<u>700</u>	<u>OPERATION</u>
0502	0902	Plot - Pen DOWN: Lowers pen if not already down, and causes a movement of .0025" per integer contained in registers 01 and 00 of the 600 or the X and Y registers of the 700. The maximum number of increments that can be made at one time is 999. If a larger value is entered into one of these registers, an error will occur. Decimal values are ignored.
0503	0903	Plot - Pen UP: Raises pen if not already raised and moves the pen using the same procedure as plot - pen down (0502-0902).
0511	0911	RESET: Raises pen if not already raised and returns it to home position (bottom left corner of plotting table).

#### 4.3 PLOT PEN DOWN - EXAMPLES

NOTE:

For each of the following examples, new zero reference X, Y axes are assumed.

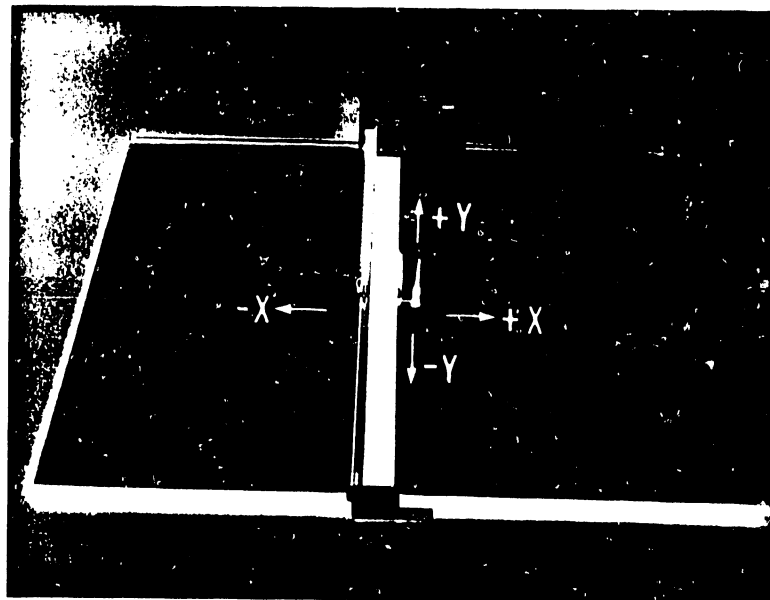
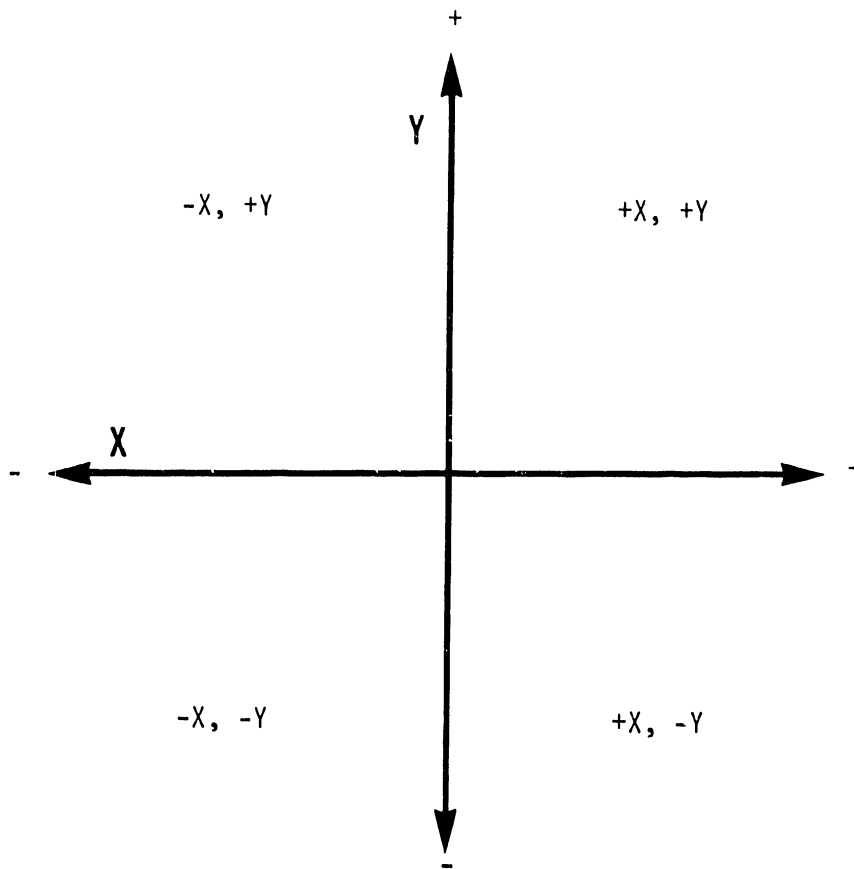


FIGURE 4  
PLOTING DIRECTION

- 1) To plot a 45° incline approximately 1/3" long, (+X, +Y), use the following procedure:

<u>600</u>		<u>700</u>
Register 01 contains +100		X register contains +100
Register 00 contains +100		Y register contains +100

Keying Instructions

<u>600</u>		<u>700</u>	
ALPHA	0902	WRITE ALPHA	0412
PLOT-PEN DOWN	0502	PLOT-PEN DOWN	0902
END ALPHA	0202	END ALPHA	0413

The pen will increment +100 in both the X and Y axes. See Figure 5.

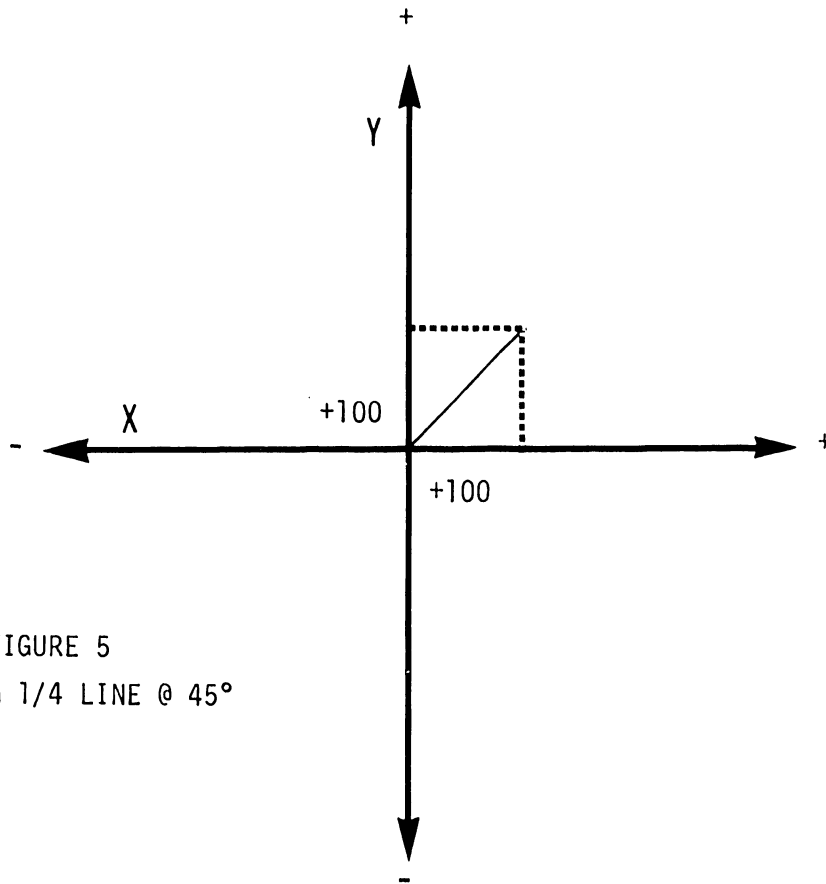


FIGURE 5  
PLOTTING 1/4 LINE @ 45°

2) Assuming new zero reference axes, if the plot-pen down command is given twice, Figure 6 will result.

Keying Instructions

	<u>600</u>		<u>700</u>	
ALPHA		0902	WRITE ALPHA	0412
PLOT-PEN DOWN		0502	PLOT-PEN DOWN	0902
PLOT-PEN DOWN		0502	PLOT-PEN DOWN	0902
END ALPHA		0202	END ALPHA	0413

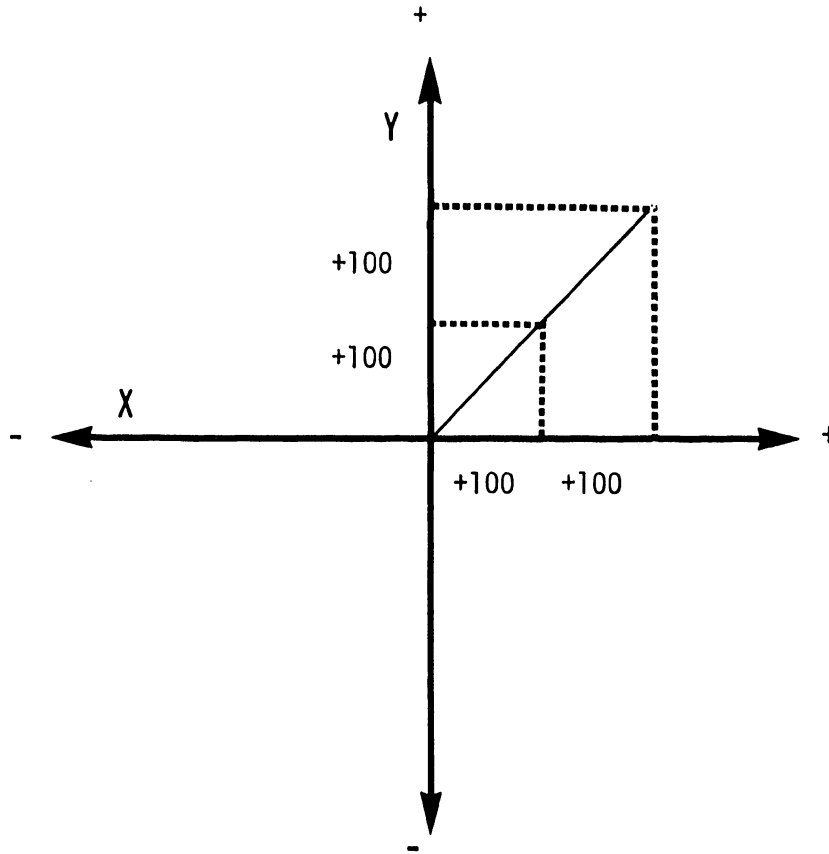


FIGURE 6  
REPETITIVE KEYING OF PLOT COMMAND

3) To plot in +X, -Y direction, use the following procedure:

<u>600</u>		<u>700</u>
Register 01 contains +300		X register contains +300
Register 00 contains -100		Y register contains -100

Keying Instructions

<u>600</u>		<u>700</u>	
ALPHA	0902	WRITE ALPHA	0412
PLOT-PEN DOWN	0502	PLOT-PEN DOWN	0902
END ALPHA	0202	END ALPHA	0413

The pen will simultaneously increment +300 in the X axis and -100 in the Y axis. See Figure 7.

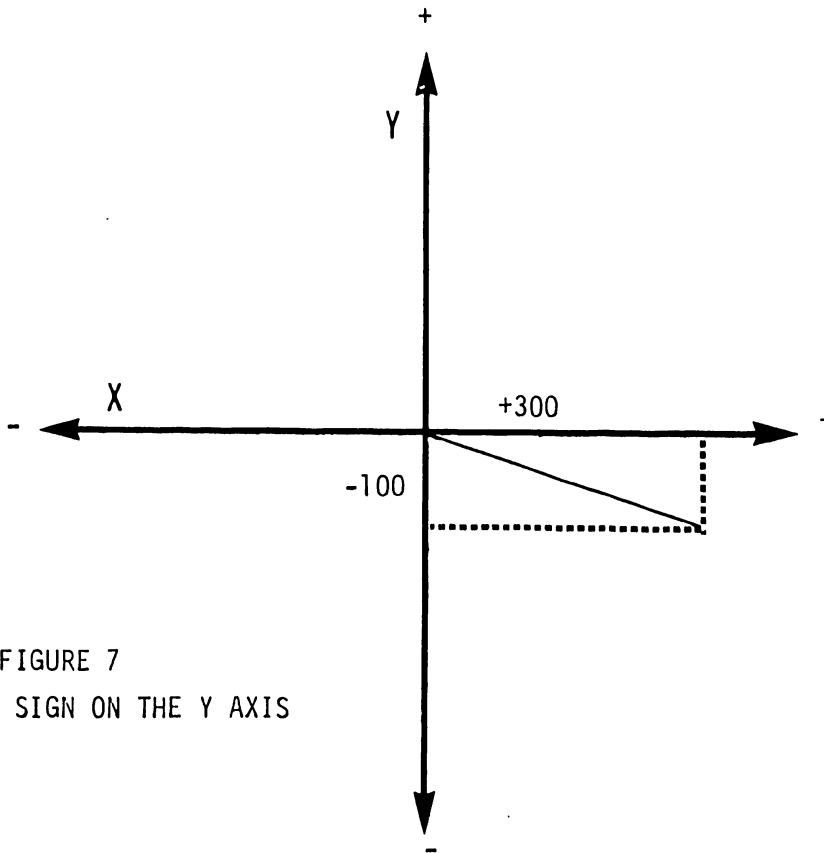


FIGURE 7  
A NEGATIVE SIGN ON THE Y AXIS



- 4) In the following example the direction of plot is changed for the second line of the plot. See Figure 8.

<u>600</u>	<u>700</u>
Register 01 contains -100	X register contains -100
Register 00 contains +200	Y register contains +200

Keying Instructions

<u>600</u>	<u>700</u>
ALPHA                    0902	WRITE ALPHA            0412
PLOT-PEN DOWN        0502	PLOT-PEN DOWN        0902
END ALPHA             0202	END ALPHA             0413

CHANGE REGISTER VALUES

CHANGE REGISTER VALUES

Register 01 contains -50	X register contains -50
Register 00 contains -100	Y register contains -100

Keying Instructions

<u>600</u>	<u>700</u>
ALPHA                    0902	WRITE ALPHA            0412
PLOT-PEN DOWN        0502	PLOT-PEN DOWN        0902
END ALPHA             0202	END ALPHA             0413

#### 4.4 PLOT-PEN UP PROCEDURE

To plot with the pen up, the same procedures as in Section 4.3 are followed except 0503 is substituted for 0502 (600) and 0903 is substituted for 0902 (700).

#### 4.5 HOME POSITION

The home position on the Model 32 is located in the bottom left corner of the plotting table. This point is usually used as a reference point so that a known starting point may be obtained at any time. See Figure 9.

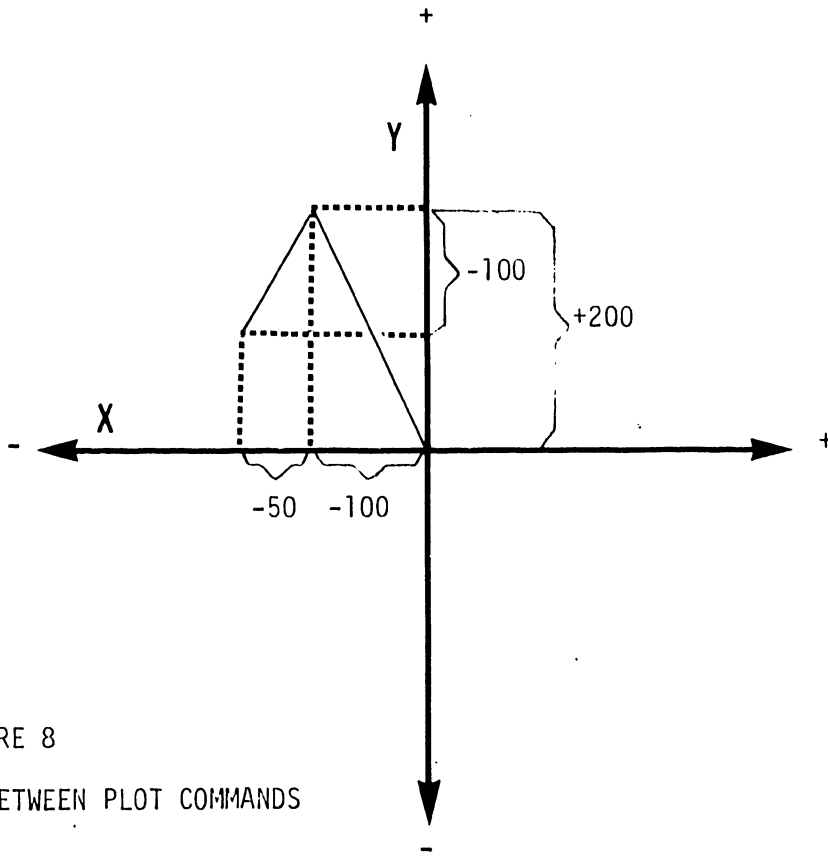


FIGURE 8  
 CHANGING DIRECTION BETWEEN PLOT COMMANDS

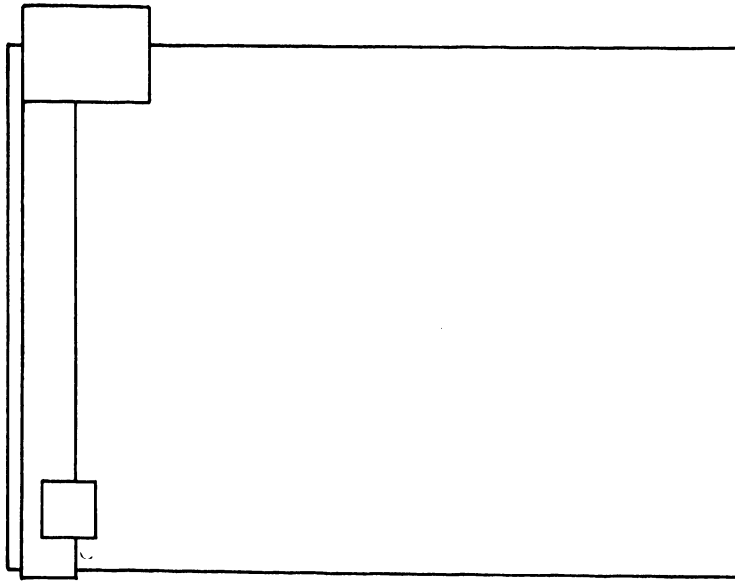


FIGURE 9  
 PLOTTER IN HOME POSITION

IN SECTIONS 5.3 - 5.5 PARTS OF THE CARRIER MECHANISM WILL BE DISCUSSED.  
FIGURE 10 HAS BEEN PROVIDED TO HELP LOCATE THESE PARTS.

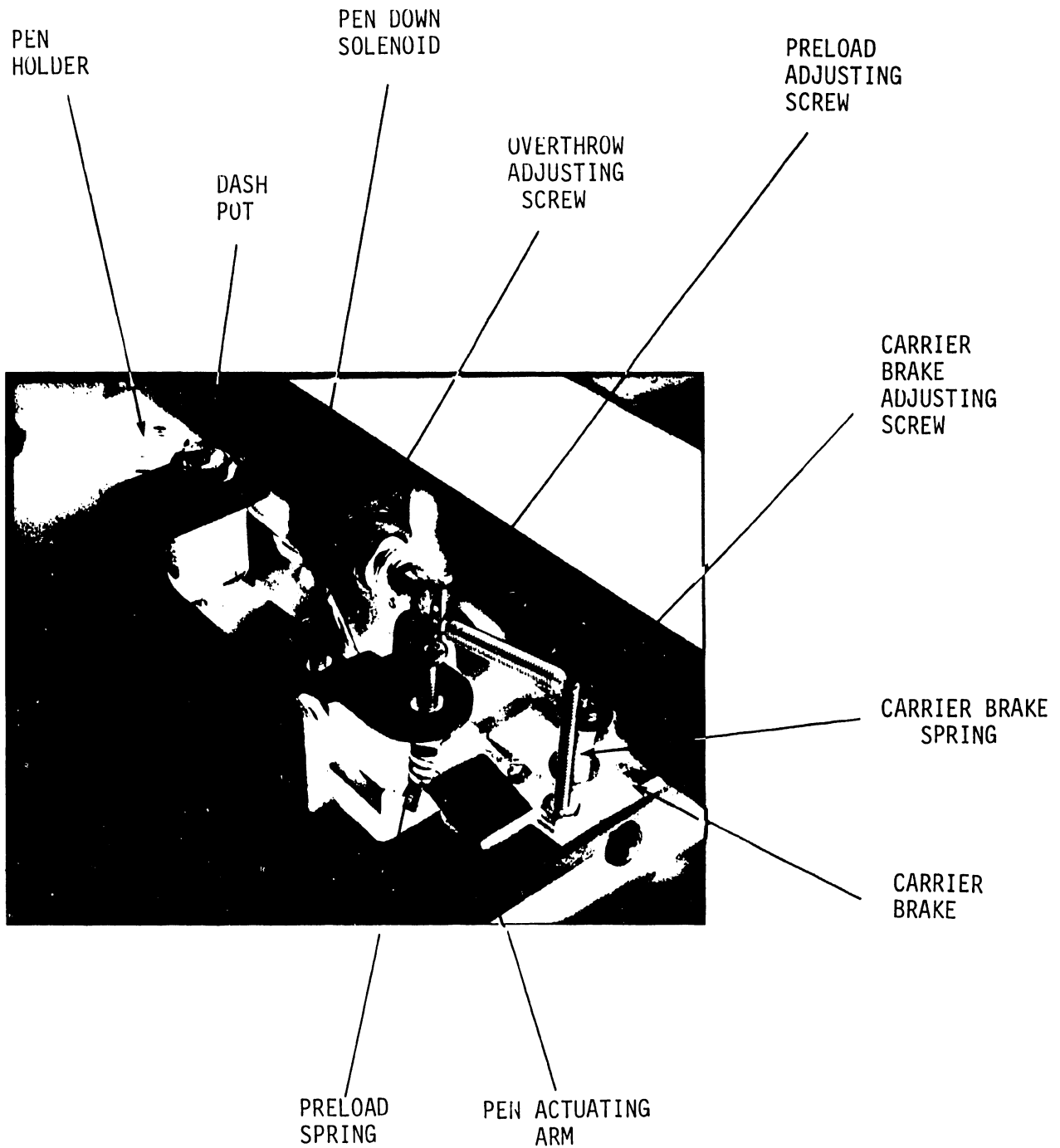


FIGURE 10  
CARRIER MECHANISM

## 5. MECHANICAL ADJUSTMENTS

NOTE:

Figure 10 is provided for a reference for Sections 5.3 through 5.5.

### 5.1 ADJUSTMENT TOOLS

- 1) 1 lb x 1/4 oz Push-Pull Scale, Chatillon Mfg. #516-500
- 2) 5 lb x 1 oz Push-Pull Scale, Chatillon Mfg. #719-5
- 3) 6" Scale
- 4) 31" Scale
- 5) 45° Triangle, Pickett Mfg. # Q10-30SC-12
- 6) Extension Block 6" Gearfence
- 7) Allen Wrench Set
- 8) Feeler Gauges
- 9) Oscilloscope - carry on call

### 5.2 ADJUSTMENT TAPE - AVAILABLE FOR 720 ONLY AT THIS TIME (DECEMBER, 1973)

- 1) Diagnostic Tape, Verify #8560
- 2) Dash Pot/Increment Accuracy/90° Accuracy Test Program, Verify #8560

### 5.3 PEN SOLENOID ADJUSTMENT

With the pen solenoid de-energized (at rest), there should be a gap of .093"  $\pm$  .015" between the solenoid and plunger stopper. To adjust gap, move the solenoid bracket by loosening the two adjusting bolts. See Figure 11.

### 5.4 PLUNGER OVERTRAVEL

- 1) Place the pen carrier assembly in the home position. See Figure 9.
- 2) With the pen manually depressed to just contact the table top there should be a .030"  $\pm$  .010" gap. See Figure 12.

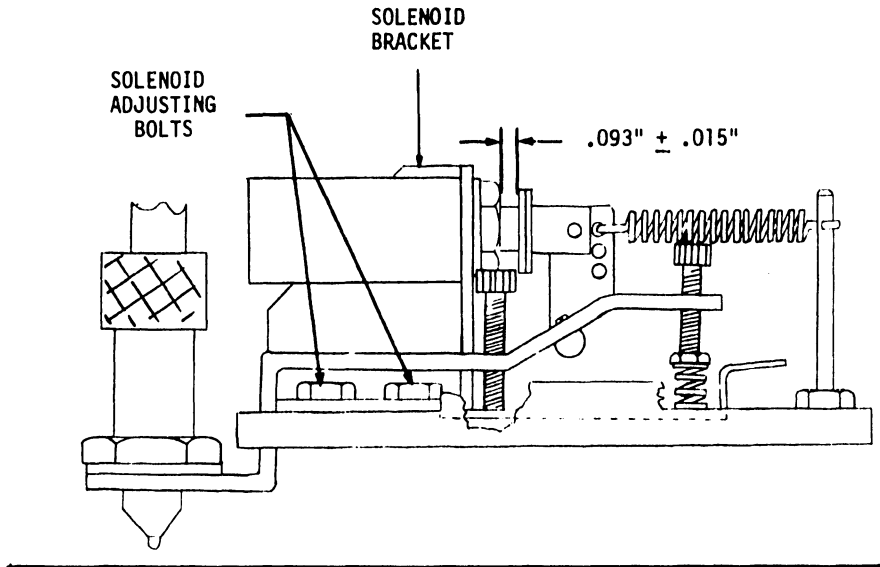


FIGURE 11  
PEN SOLENOID ADJUSTMENT

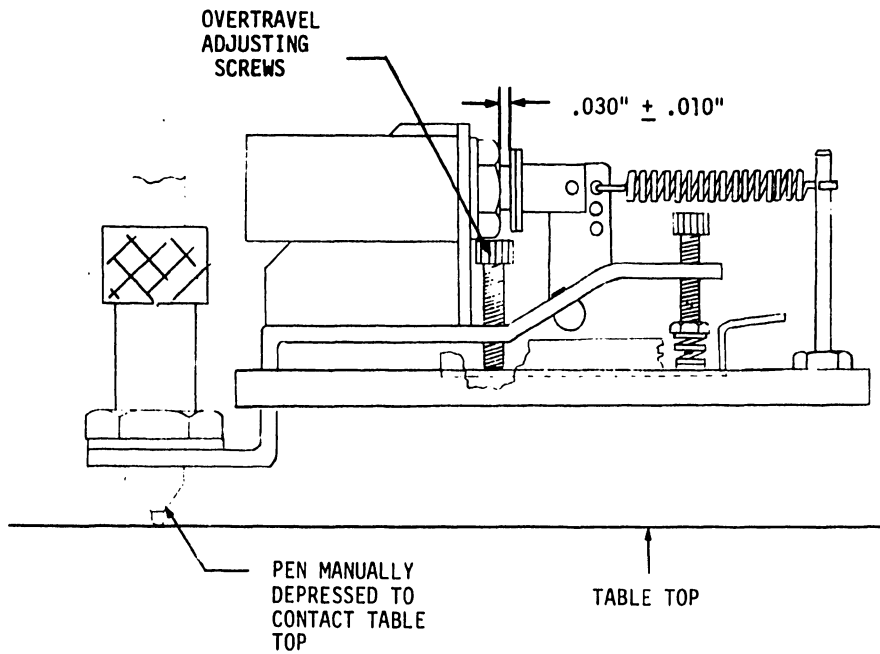


FIGURE 12  
PLUNGER OVERTRAVEL ADJUSTMENT

- 3) Energize the pen solenoid ( $\alpha$ , 0502 - 600; WRITE ALPHA, 0902 - 700) there should be a gap between the overtravel adjusting screw and the pen actuating arm. See Figure 13.

If there is no gap, return to Step 2 and readjust overtravel to .040 inches, instead of .030 inches.

- 4) Move the pen carrier to the top edge of the plotting table and energize the solenoid ( $\alpha$ , 0502 - 600; WRITE ALPHA, 0902 - 700). At this location there should also be a gap between the overtravel adjusting screw and the pen actuating arm.

If there is a gap with the pen carrier in the home position (Step 3) and there is no gap with the pen carrier moved to the top of the table (Step 4), the Y arm is not parallel with the table top. Adjust the Y arm to make it parallel; (See 5.8 and return to 5.4, #1.).

NOTE:

Maintaining proper overtravel will insure that valleys in the table top will not prevent writing. The gap between the overtravel adjusting screw and the pen actuator arm, allows the pen to float. As the pen falls into a valley, the preload spring compensates for the drop, forcing the pen down.

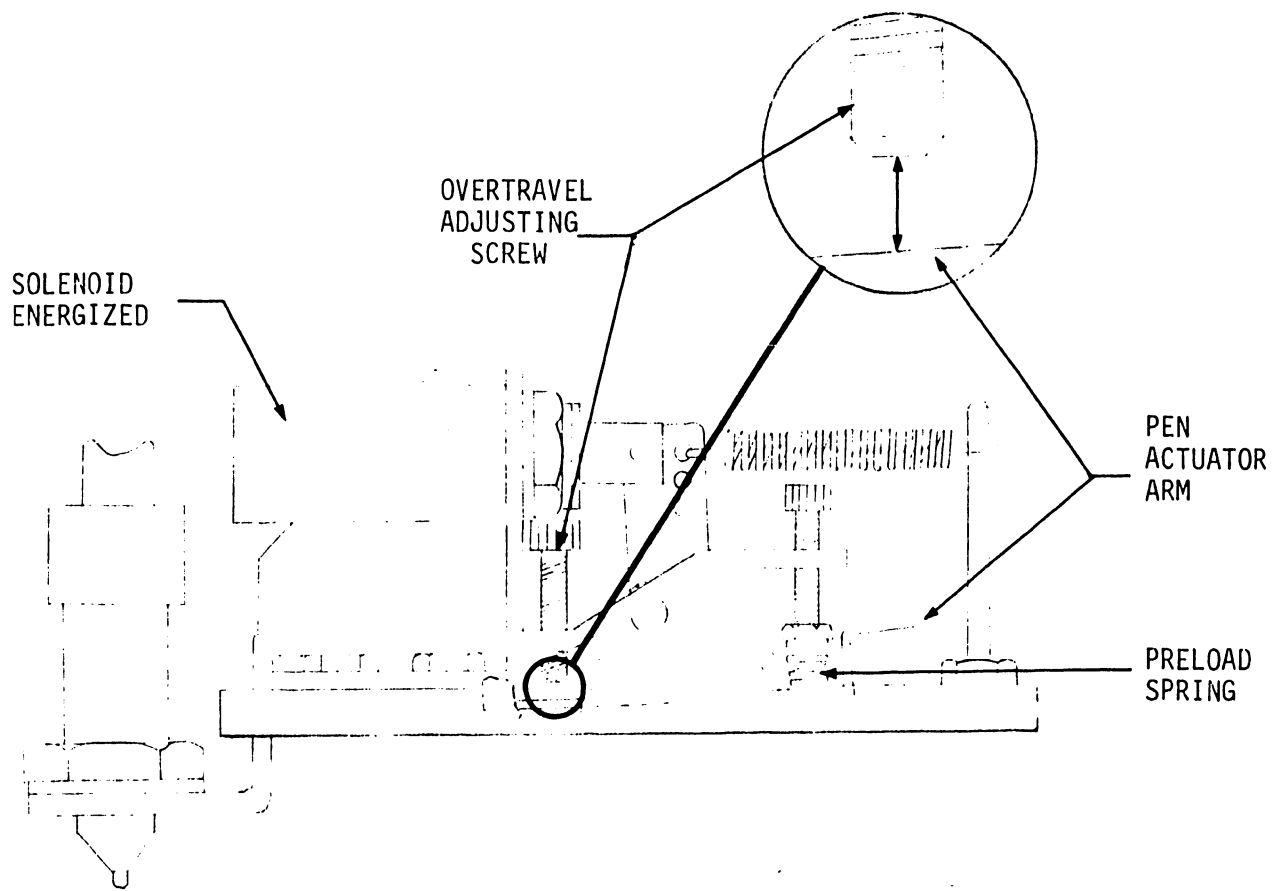


FIGURE 13  
 ENSURE GAP BETWEEN OVERTRAVEL  
 SCREW AND ACTUATOR ARM EXISTS

#### 5.5 PRELOAD SPRING TENSION

With the pen solenoid energized, attach a push-pull scale under the pen holder; raise the scale until the pen leaves the table top. At this point the scale should read 5 to 5.5 oz. If adjustment is necessary, do so with the preload adjusting screw. See Figure 14.

NOTE:  
 Maintain a reading on the low end of the tolerance if possible. This reduces the possibility of ripping paper with a drafting pen.

WHEN THE PEN LEAVES  
THE TABLE THE SCALE  
SHOULD READ 5-5 1/2 OZ.

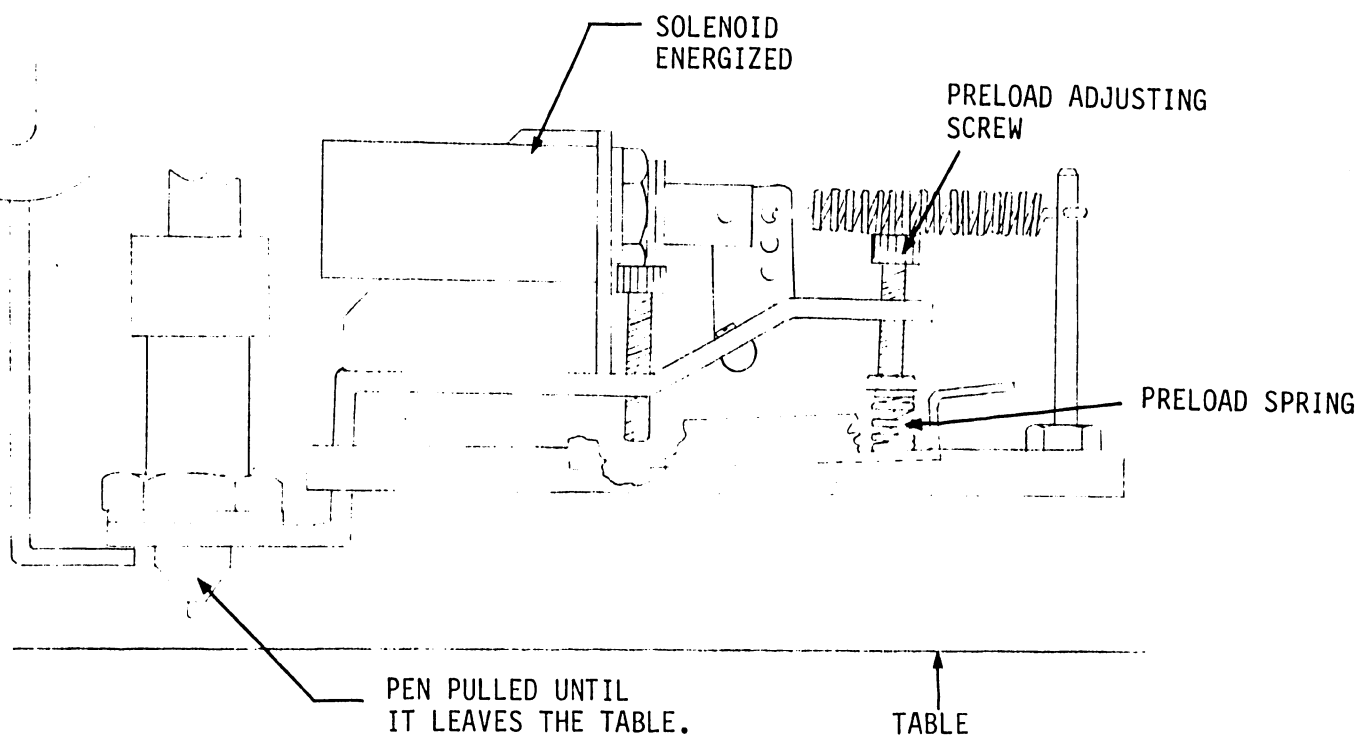


FIGURE 14  
PRELOAD SPRING ADJUSTMENT



## 5.6 DASH POT

- 1) Use a felt tip or ball point pen for this adjustment. A Mars pen will rip the paper. Load dash pot test into calculator and begin the program (see paragraph 8.6).
- 2) The dash pot screw should be turned clockwise until a broken line is generated by the program. Slowly turn the screw counterclockwise until the line becomes solid again. See Figure 15.

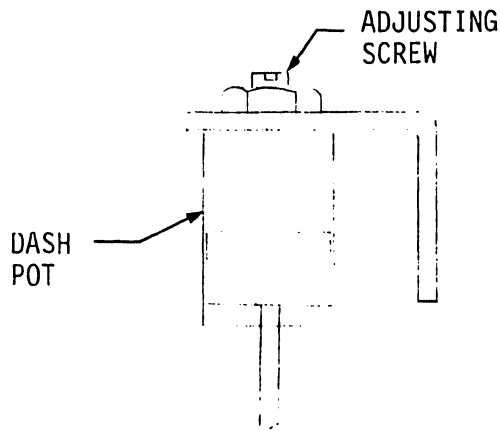


FIGURE 15  
DASH POT ADJUSTMENT

## 5.7 CARRIER BRAKE ADJUSTMENT

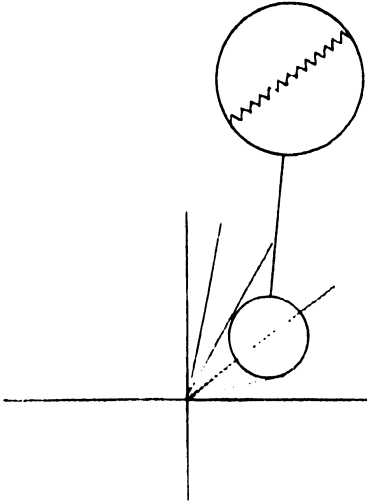
Run the radius program of the Model 32 (see paragraph 8.2); adjust the screw until there is no noticeable line oscillation or line separation. A slight line expansion is acceptable. See Figure 16.

**NOTE:**

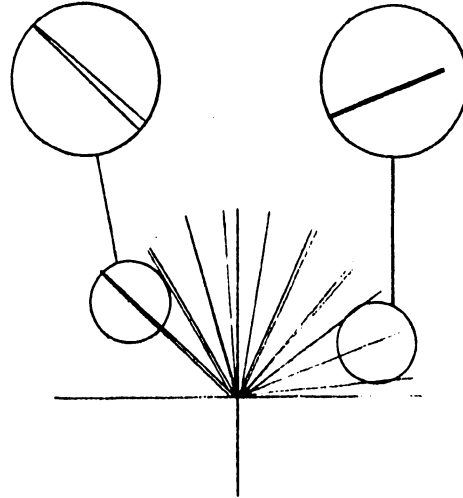
A tolerable line oscillation of several thousandths of an inch will be present on most Model 32 plotters. The oscillation is more apparent at  $7^\circ$ ,  $83^\circ$ ,  $97^\circ$ ,  $173^\circ$ ,  $187^\circ$ ,  $263^\circ$ ,  $277^\circ$ , and  $353^\circ$ .

The carrier brake is not always the cause of line separation or line oscillation. For other suggestions, see section 9, X shaft lubrication.

LINE OSCILLATION  
NOT ACCEPTABLE



LINE SEPARATION  
NOT ACCEPTABLE



LINE EXPANSION  
ACCEPTABLE

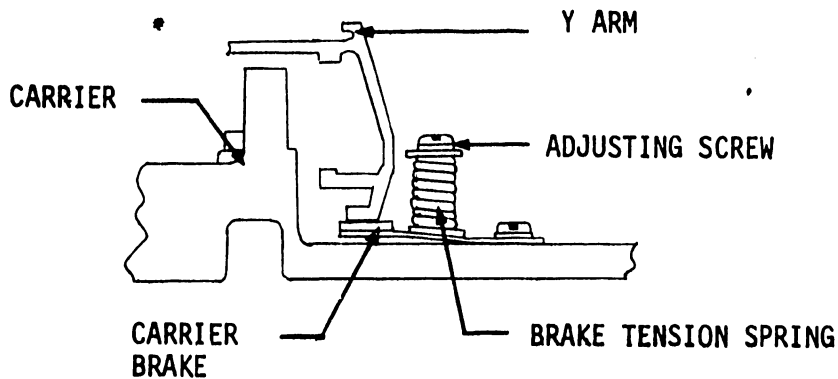
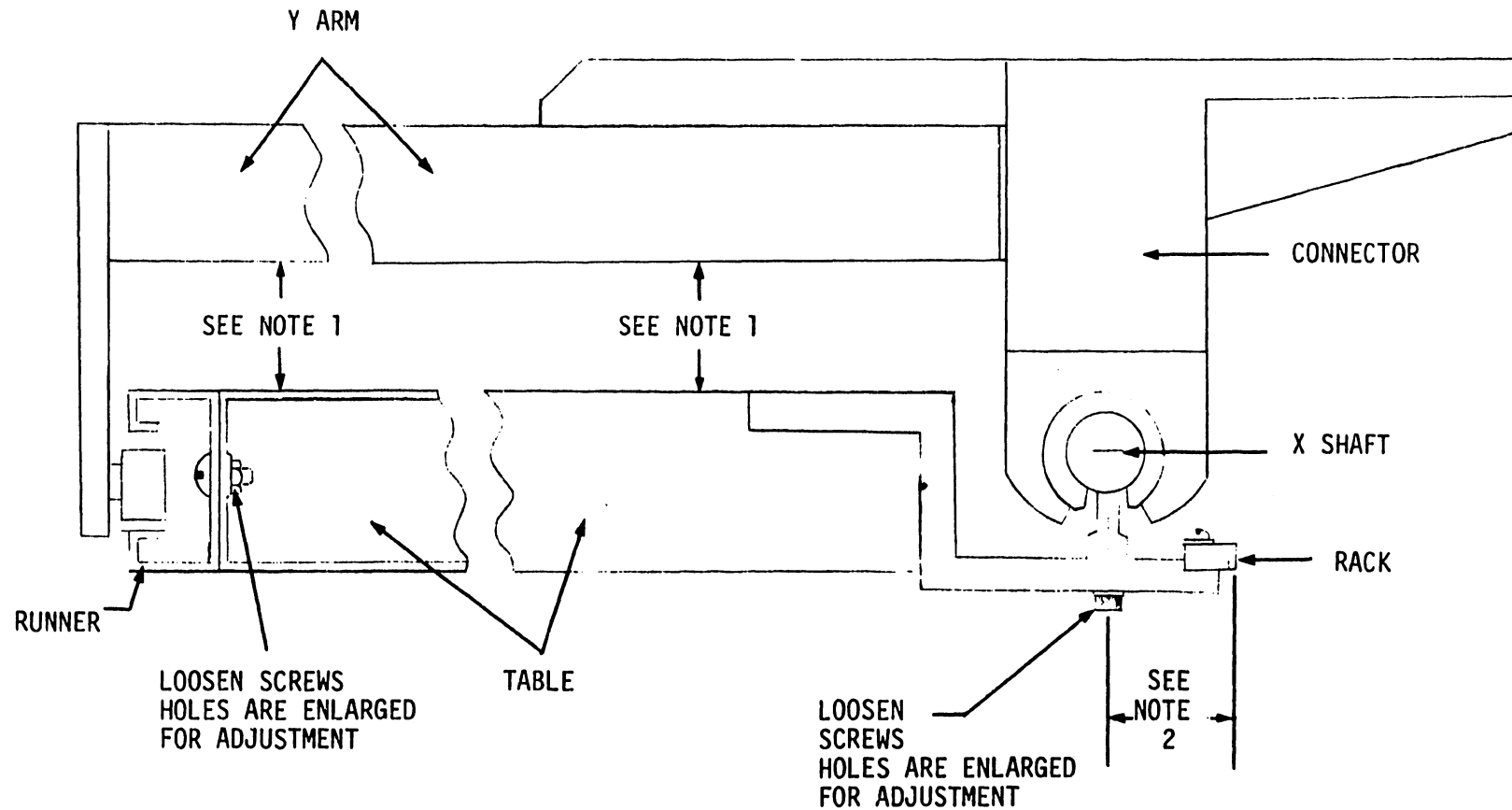


FIGURE 16  
CARRIER BRAKE ADJUSTMENT

### 5.8 LEVELING Y ARM

- 1) The distance from the bottom of the Y arm to the table surface should be uniform throughout the table, within 1/16".
- 2) Take a reading with a 6" scale at the bottom edge and at the top edge of the table. If adjustment is necessary, loosen all screws inside the runner and raise or lower the runner to correct the difference. See Figure 17.

NOTE 1

THE DISTANCE FROM THE BOTTOM OF THE Y ARM TO THE TABLE SURFACE SHOULD BE UNIFORM FROM THE BOTTOM OF THE TABLE TO THE TOP WITHIN 1/16".

NOTE 2

X SHAFT TO BE PARALLEL TO RACK WITHIN .002" OVER 10" AND .005" OVER ENTIRE RACK.

FIGURE 17  
LEVELING Y ARM - SQUARING X SHAFT

## 5.9 SQUARING X SHAFT

- 1) The rack should be parallel to the edge of the X shaft over 10" to within .002" and a maximum of .005" over the entire length of the rack.
- 2) To adjust for this, loosen the 6 screws directly beneath the X shaft and move the shaft to the specified position. See Figure 17.

## 5.10 MAKING Y ARM PERPENDICULAR TO THE X SHAFT

- 1) The Y arm must be square to the X shaft within .010" over a 30" length. This is checked with a large triangle placed on a 90° plot as shown in Figure 18. The trial plot may be generated by subroutine 0014 on tape #8560.
- 2) To adjust the Y arm, loosen the lock bolts on the motor casting where it connects to the Y arm, and shift the adjusting block by loosening one jacking screw and tightening the other. See Figure 18.

## 5.11 X RACK ADJUSTMENT - EARLY MODELS

NOTE:

Late model X Racks contain press pins eliminating any adjustment.

When the Y arm pinion gear passes a joint of two racks, there should be no visible or audible jerk.

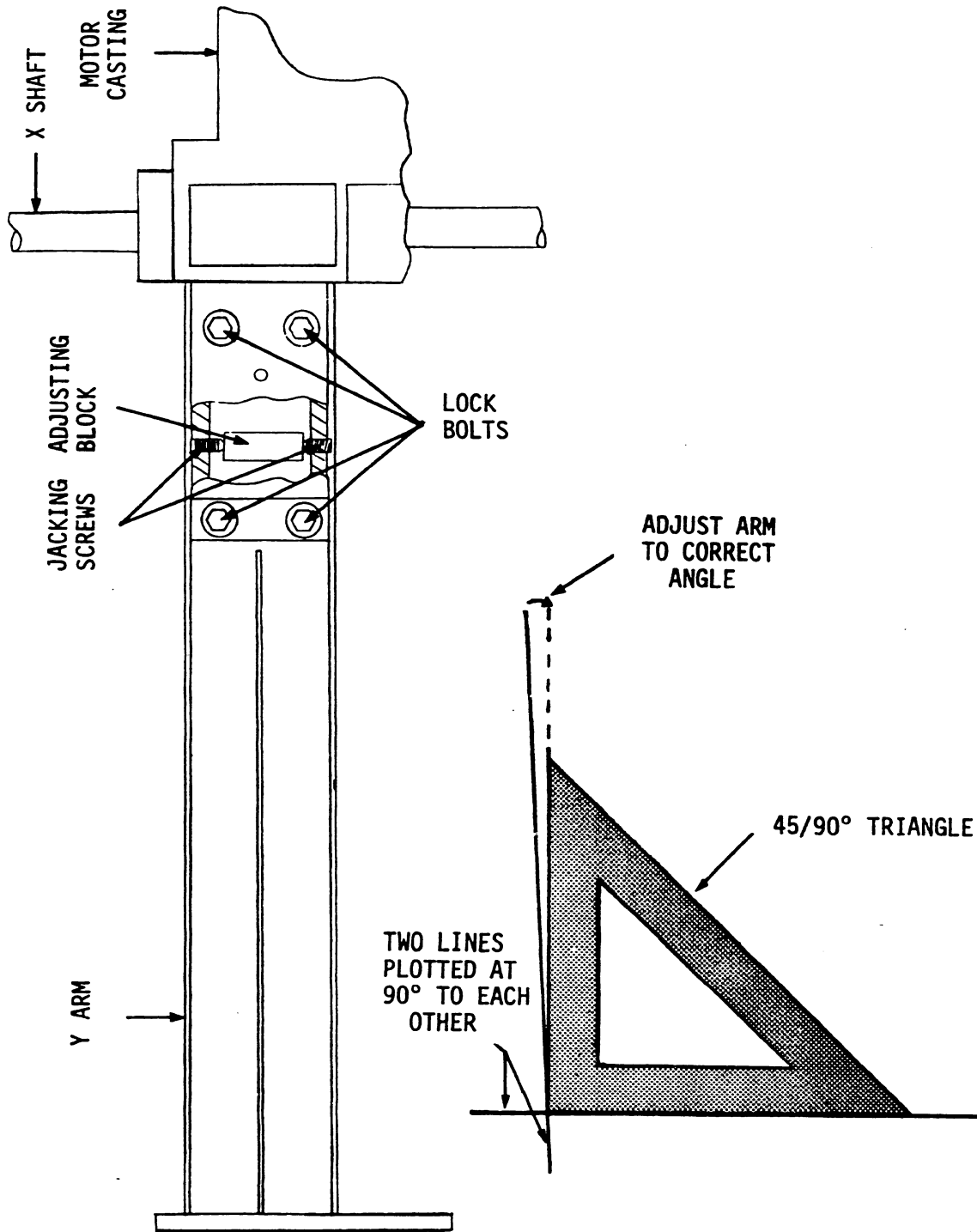


FIGURE 18  
 MAKING Y ARM AND X SHAFT PERPENDICULAR

The three X gear racks must be aligned as follows:

- 1) Loosen the holding screws of two adjoining gear racks secured to the bed.
- 2) Seat an extension block into the teeth of the two adjoining racks to be aligned. See Figure 19.
- 3) Tighten the holding screws.
- 4) Loosen the holding screws in the third gear rack and repeat steps 2 and 3.

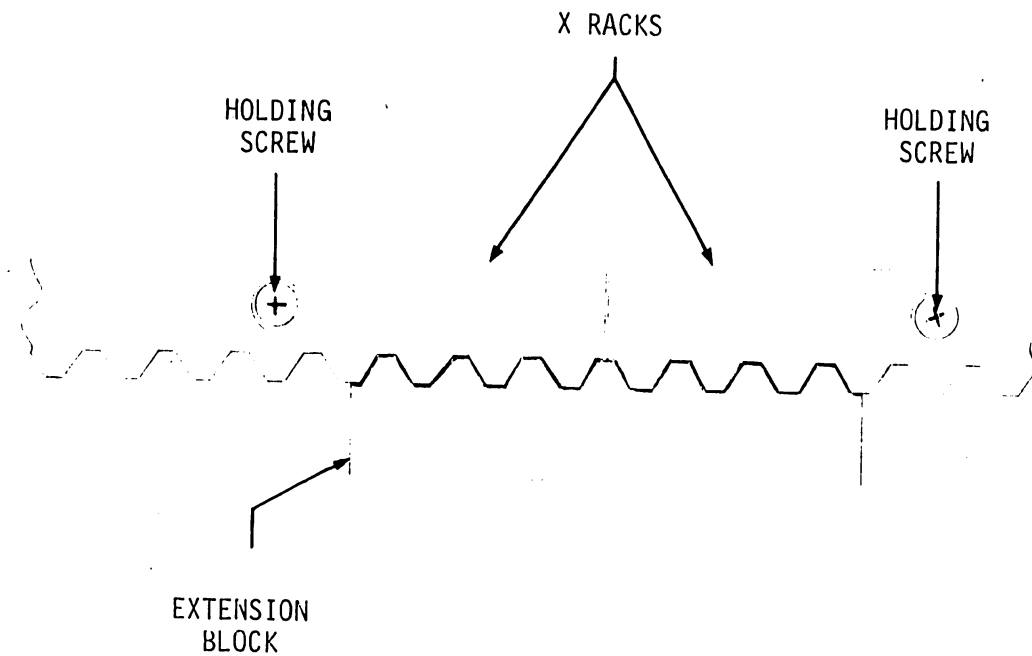


FIGURE 19  
ALIGNMENT OF X RACKS

## 5.12 PINION LOADING ADJUSTMENT

- 1) When pulling on the pinion block with a spring scale, the block should begin moving at 4.5 lbs.  $\pm$  .25 lb. See Figure 20.
- 2) To adjust the load tension, loosen the two lock screws and attach a spring scale behind the pinion block. Pull the scale away from the table. As the block begins to move, take a reading on the scale. If adjustment is necessary, turn the adjusting screw in to increase the tension or out to decrease tension. When adjustment is completed, tighten the lock screws.

**NOTE:**

Some early Model 32s do not contain an adjusting screw. With these units, adjustment must be done by trial and error. Loosen the lock screws; move the tension bracket in the desired direction to achieve correct tension. While holding the bracket in that position, tighten the lock screws.

## 5.13 Y INCREMENT ADJUSTMENT

- 1) A line in the Y direction should be accurate in length over a 31" plot within .005". Check 31" accuracy by plotting in the Y direction 12400 increments and measuring that line. Use diagnostic in section 8.8.

**NOTE:**

Some subroutines have been incorporated in the diagnostics for the Model 32. See Section 8.

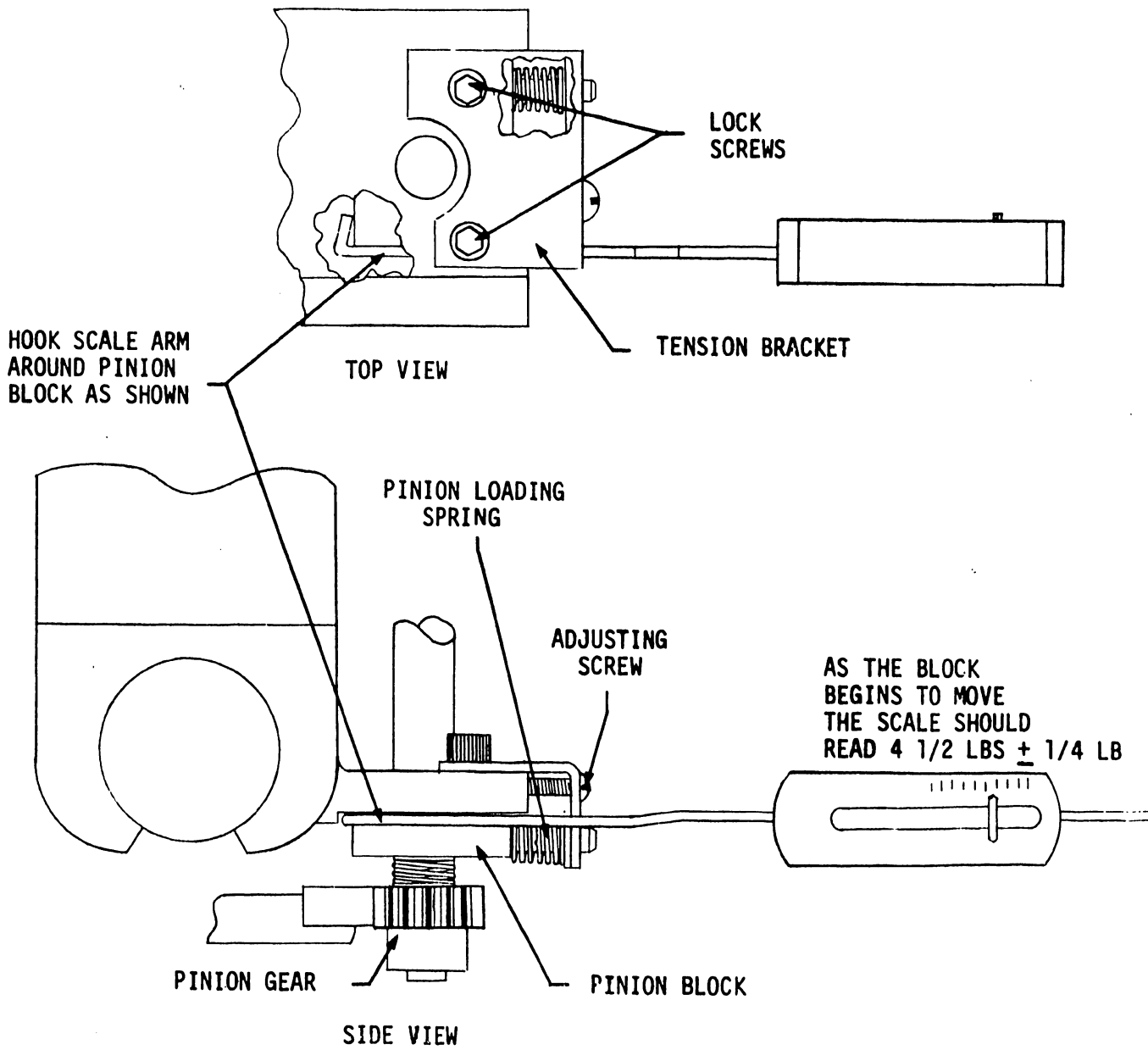


FIGURE 20  
 PINION GEAR LOAD TENSION



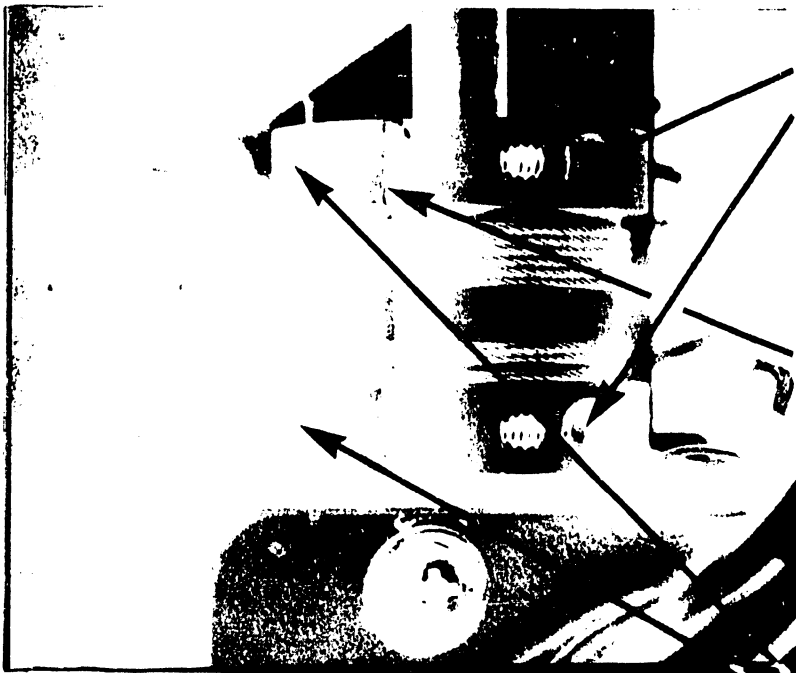
- 2) Adjustment of the Y increment is done by varying the circumference of the cable drum (See Figures 21 and 22). Increasing the diameter of the drum will cause larger increments; decreasing the diameter will cause smaller increments. The following steps explain.

NOTE:

It is only necessary to perform Step (a) below when increasing the diameter of the drum.  
To ensure uniformity when increasing or decreasing the diameter of the drum, adjust both sides equally.

- (a) In order to expand the drum, it is necessary to release the cable stress on the drum. To release this pressure, place the carrier somewhere in the middle of the Y arm (arm disconnected from table and laying upside down - SEE 5.18 FOR Y ARM REMOVAL) and loosen the cable tightening clamp underneath the carrier (See Figure 23). Loosen the coils of cable looped around the drum. Since expansion of the drum requires Y arm removal, it is suggested that when the drum is expanded, it is expanded more than necessary. The diameter can then be decreased until the correct diameter setting is reached, section 5.13 #2 (c).
- (b) To increase the diameter of the drum, remove the two lock screws shown in Figures 21 and 22, then turn the jacking screws clockwise to desired location. When jacking is completed, replace the locking screws.
- (c) To decrease the diameter of the drum, *loosen* the jacking screws slightly; *tighten* the locking screws until the desired diameter is met. Turn the jacking screws back in until they meet the opposite wall of the drum. This will prevent the drum diameter from decreasing more when the cable is retightened.
- (d) After adjustment is made, reverse the procedure in 5.13, #2 (a) to the cable, then see Section 5.14 to insure proper cable tension.

CORD DRUM  
LOCATED UNDER  
Y PULLEY



JACKING SCREWS

CUT OUT IN DRUM  
ALLOWS EXPANSION  
AND CONTRACTION  
OF CORD DRUM

LOCKING SCREWS

FIGURE 21  
CORD DRUM AND CORD DRUM LOCATION

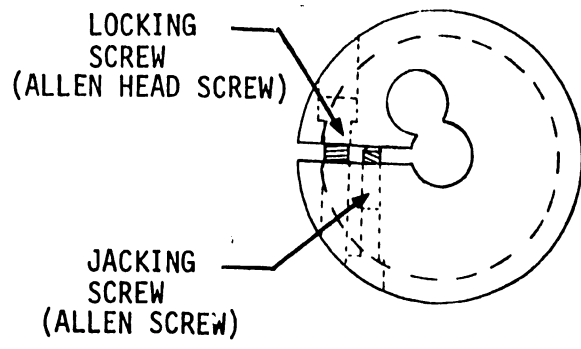


FIGURE 22  
DRUM CROSS SECTION

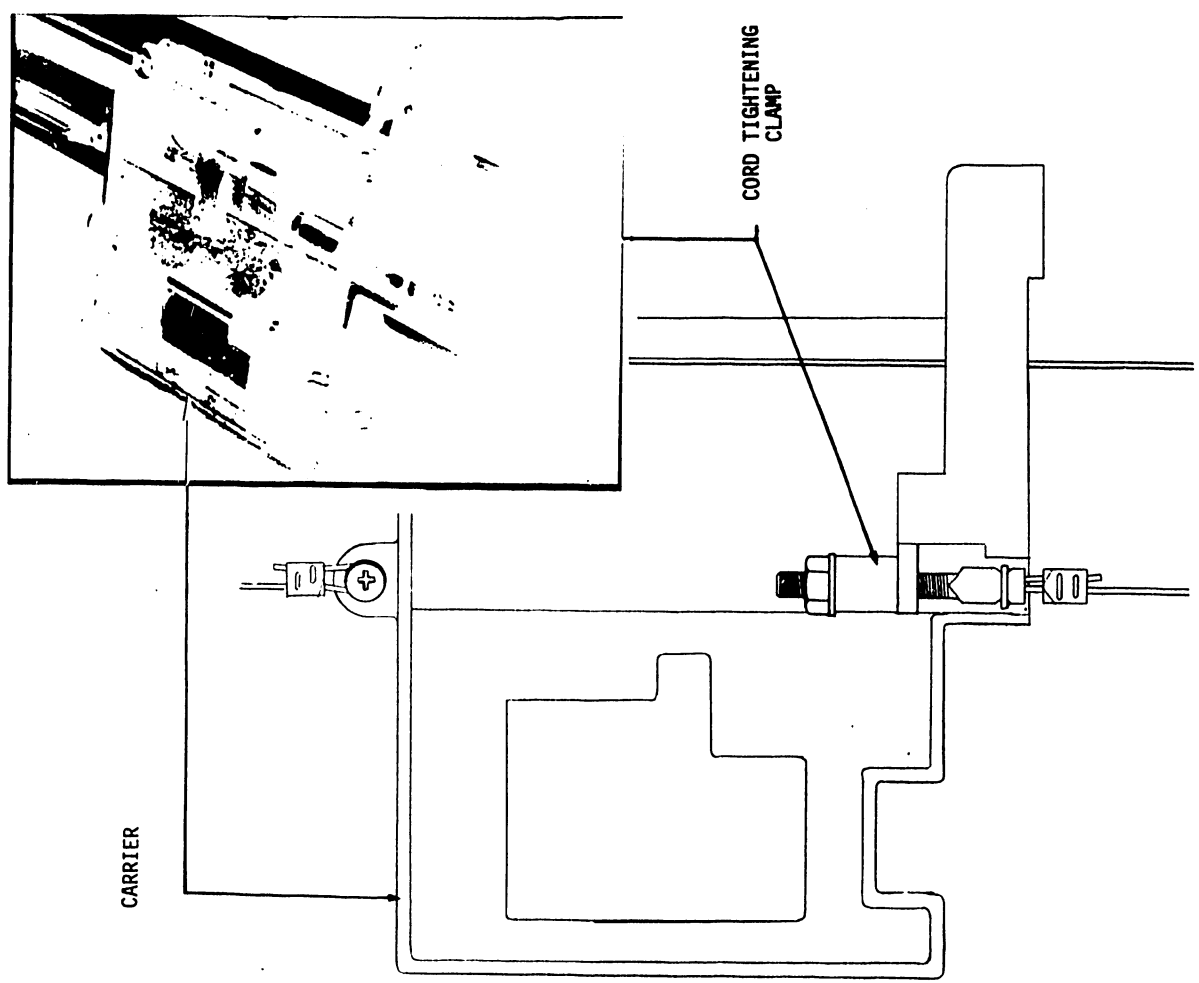


FIGURE 23  
CORD TIGHTENING CLAMP LOCATION

#### 5.14 CABLE TENSION ADJUSTMENT

- 1) With the carrier assembly in the center of the Y arm, using a spring scale, pull the cable away from the arm. When the cable is pulled a distance of 1" there should be a reading of 14 oz  $\pm$  2 oz (See Figure 24).
  
- 2) The adjusting nut of the cable clamp may be turned in or out to fine adjust the tension. If the cable needs only fine adjust, use the cable clamp adjusting nut. If the cable is loose, the pulley should be moved to take up slack. Remove the C clip holding the pulley, remove the pulley, screw out the pulley shaft, and move pulley and shaft to a different hole for better tension.

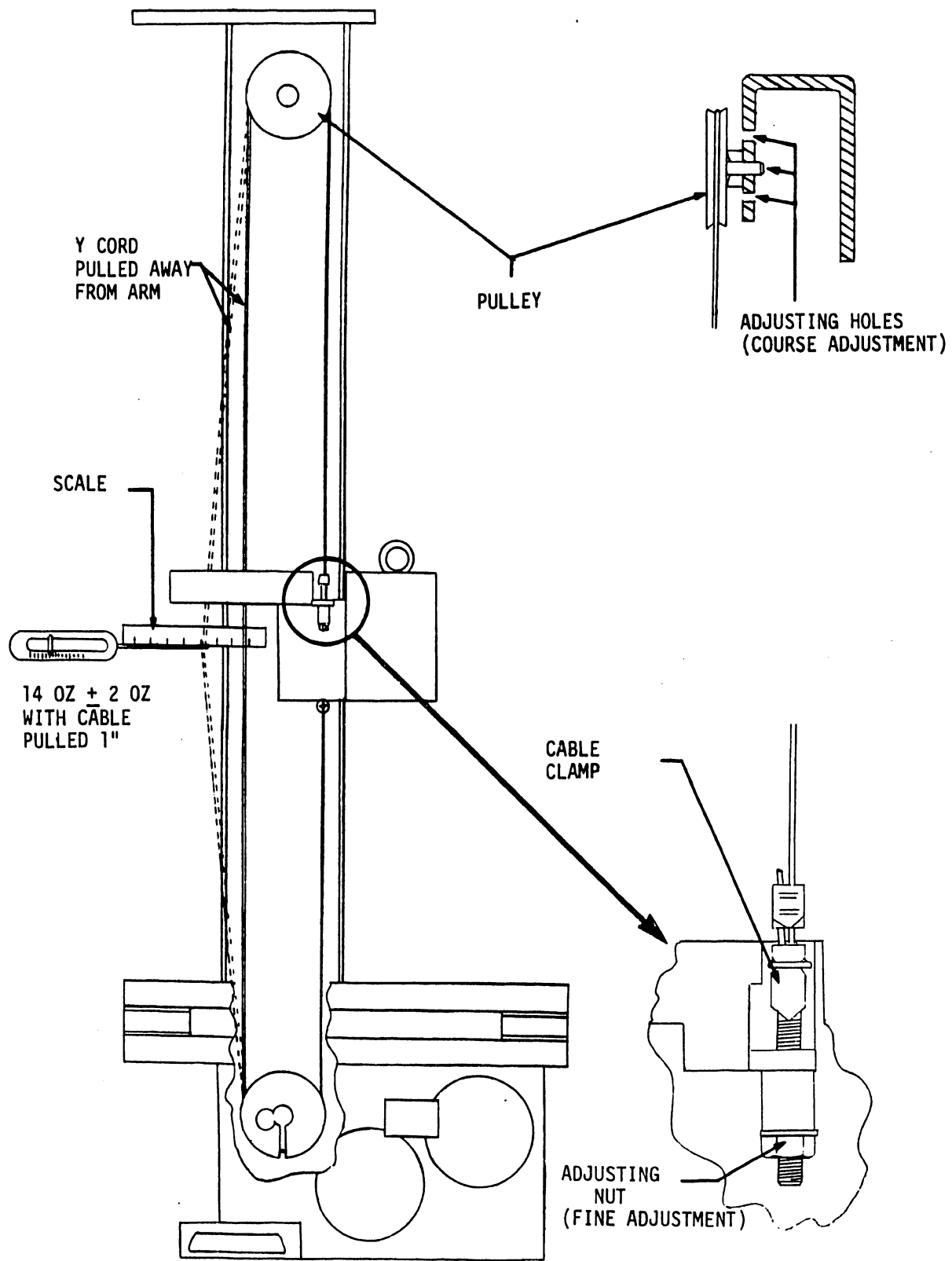


FIGURE 24  
CABLE TENSION ADJUSTMENTS

## 5.15 PHOTOCELL ALIGNMENT

- 1) With the photo actuator pin engaged within the LED/photocell package there should be a clearance of  $.110" \pm .015"$  from the tip of the actuator pin to the inside edge of the photocell package (See Figure 25).
- 2) If adjustment is required, position the actuator pin so that it is inside the photocell package. Loosen the two locking screws holding the photocell package bracket and move the bracket to the desired location.

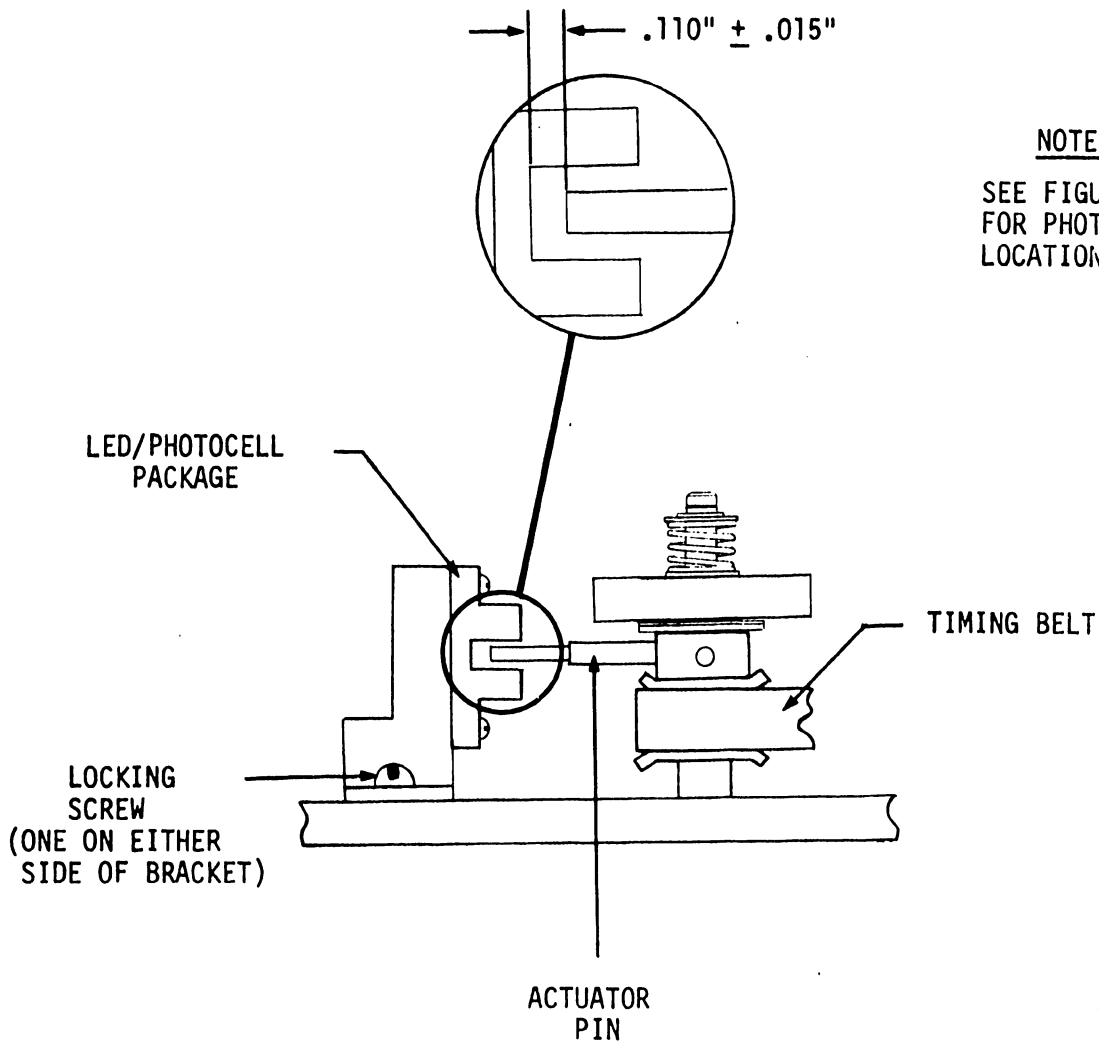


FIGURE 25  
LED/PHOTOCELL ALIGNMENT

5.16 HOME POSITION ALIGNMENTS

1) The following is a procedure for aligning Y axis home position. Refer to Figures 26, 27 and 28.

(a) Turn power off.

X & Y TIMING  
GEARS

LED PHOTOCCELL  
PACKAGES

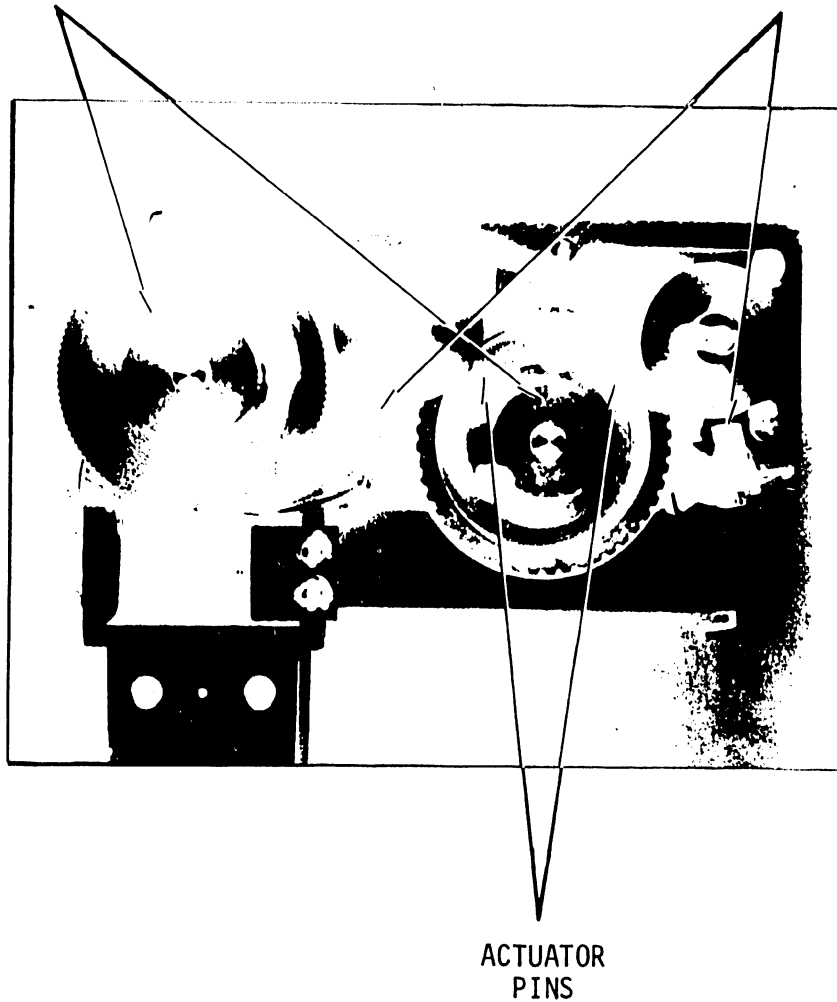


FIGURE 26  
HOME POSITION COMPONENT LOCATIONS

- (b) Move pen carrier away from bottom margin.
- (c) Remove timing belt from Y timing gear.
- (d) Move the pen carrier back toward the bottom margin until the Y axis actuator actuates the Y encoder switch (Y SW1).
- (e) Rotate the Y axis actuator pin until it is 90° from engaging the LED/photo cell package.
- (f) Replace the timing belt onto the Y timing gear.
- (g) Turn the power on. At this time the Model 32 should go to the home position. See step (h) below to check alignment.

NOTE:

Due to bright lighting in some offices, the photocells may not work properly. In such cases, replace the motor cover before turning power back on. This allows normal reset.

- (h) With the carrier and the Y arm in the home position, the actuator pins should be inside the LED/photocell packages. See Figure 28.
- 2) The following is a procedure for aligning the X axis home position. Use Figures 26, 27 and 28 for reference.
- (a) Turn power off.
  - (b) Move Y arm away from left margin.
  - (c) Remove black timing belt from X timing gear.
  - (d) Move Y arm towards left margin until left margin stop (See Figure 29) actuates left X encoder switch (X SW1).



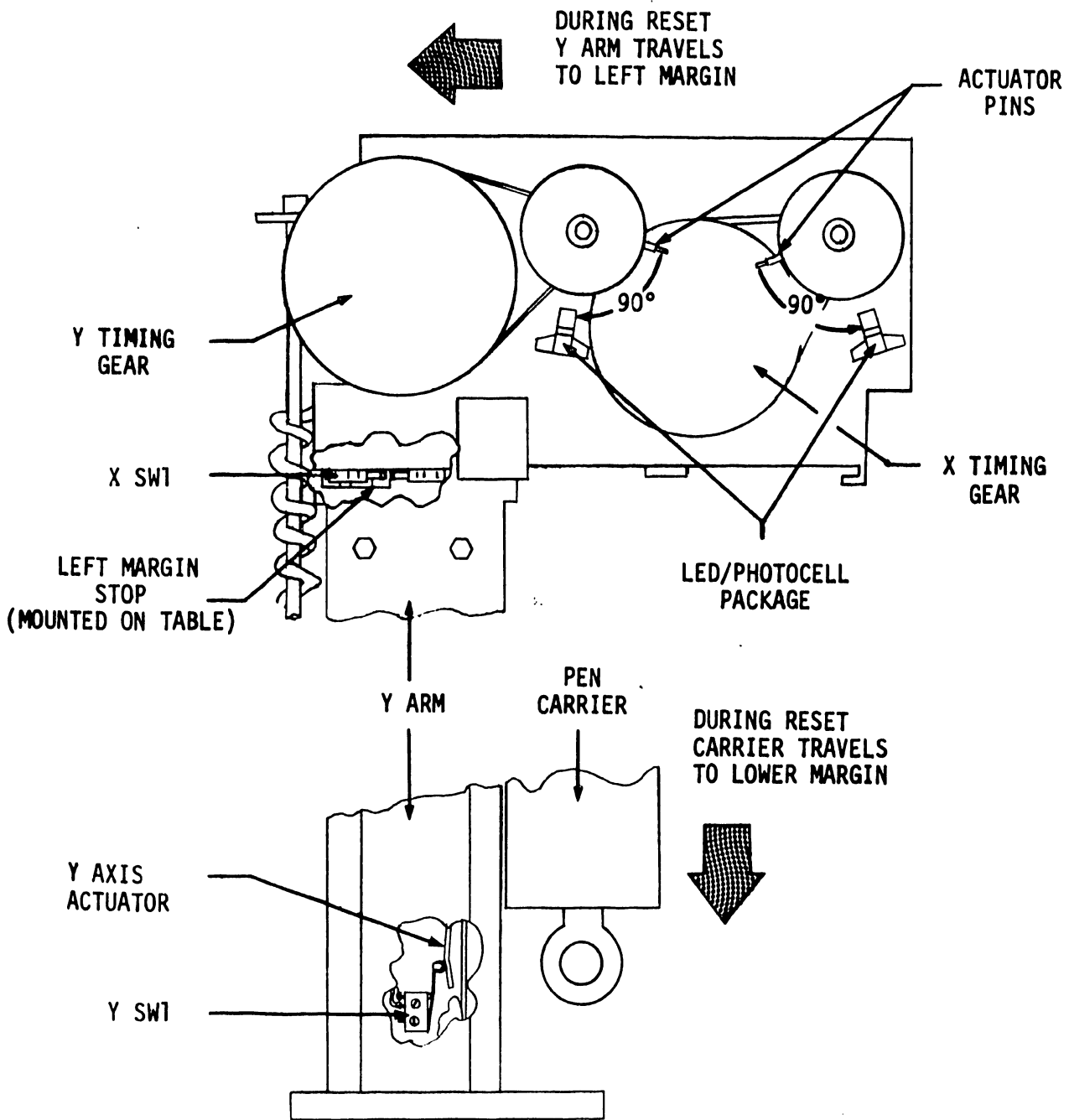
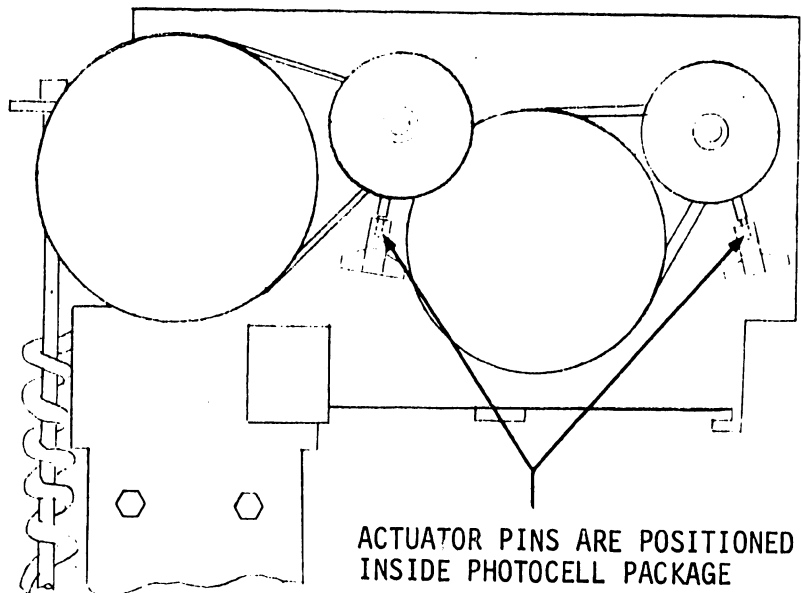
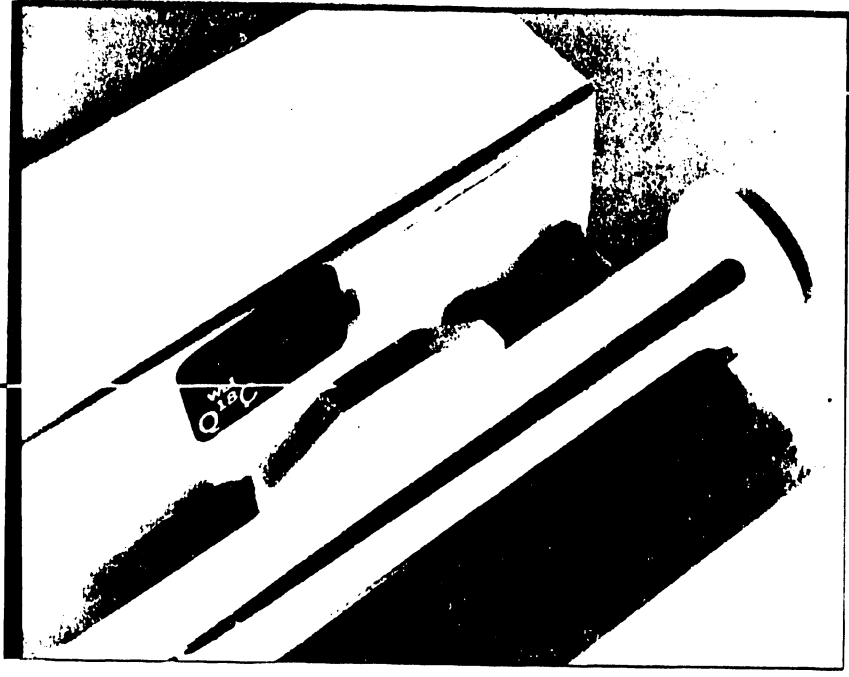


FIGURE 27  
HOME POSITION ALIGNMENT



ACTUATOR PINS ARE POSITIONED  
INSIDE PHOTOCCELL PACKAGE

FIGURE 28  
ACTUATOR PINS WHILE IN HOME POSITION



LEFT MARGIN  
STOP  
(ACTUATES LEFT  
LIMIT SWITCH)

END CAP

FIGURE 29  
LEFT MARGIN STOP AND END CAP LOCATION

- (e) Rotate the X axis actuator pin until it is 90° from engaging the LED/photocell package.
- (f) Replace the timing belt onto the X timing gear.
- (g) Turn the power on. At this point the Model 32 should go to home position. See 5.16, Step 1 (h) to check alignment.

#### 5.17 CARRIAGE LOADING ADJUSTMENT

- 1) When pushing with a spring scale on the head of the adjusting screw in a rotational direction, it should begin movement at 2 lbs  $\pm$  1/4 lb. See Figure 30.
- 2) Adjustment is made by loosening the adjustment screw, moving the collar to the desired location, and retightening the screw.

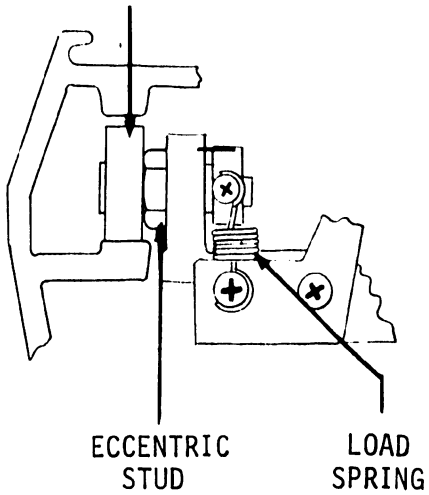
#### 5.18 Y ARM REMOVAL AND REPLACEMENT

- 1) To remove the Y arm:
  - (a) Turn the power off on the package, and disconnect the Y arm cable.
  - (b) Remove the screw in the center of the end cap located on the left end of the X shaft. Remove the end cap. See Figure 29.
  - (c) Slowly move the arm to the left end (home position) and ease it off the X shaft and rail. See Figure 31.
- 2) Replacement of the Y arm:
  - (a) Holding the arm parallel to the table top, ease the motor casting onto the X shaft simultaneously guiding the runner at the bottom of the arm into the rail.



ADJUSTING  
SCREW

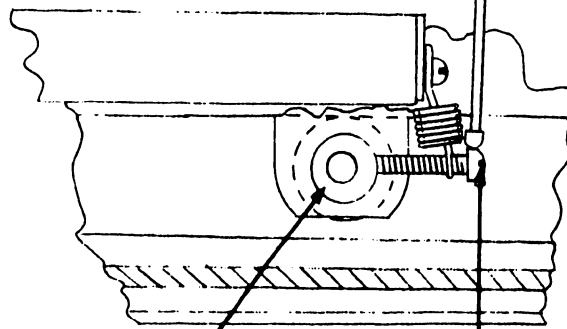
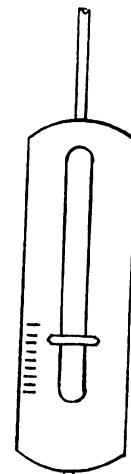
BEARING  
AND  
ROLLER



ECCENTRIC  
STUD

LOAD  
SPRING

SCREW SHOULD  
JUST MOVE AT  
2 LBS  $\pm$  4 OZS



COLLAR

ADJUSTING  
SCREW

FIGURE 30

- (b) When both the motor casting and runner are started, slowly push the arm towards the opposite side of the table. Some resistance will be felt when the pinion gear meets the X rack and when the bearing in the motor casting meets the outside of the X shaft. This resistance may be overcome by jogging the arm up and down.
- (c) Replace the stop cap on the end of the X shaft.
- (d) Reinstall screw described in 5.18, #1 (b).
- (e) See Section 5.16, #2 to realign the X home position. This is necessary because the pinion gear will be moved with respect to the left margin limit switch.

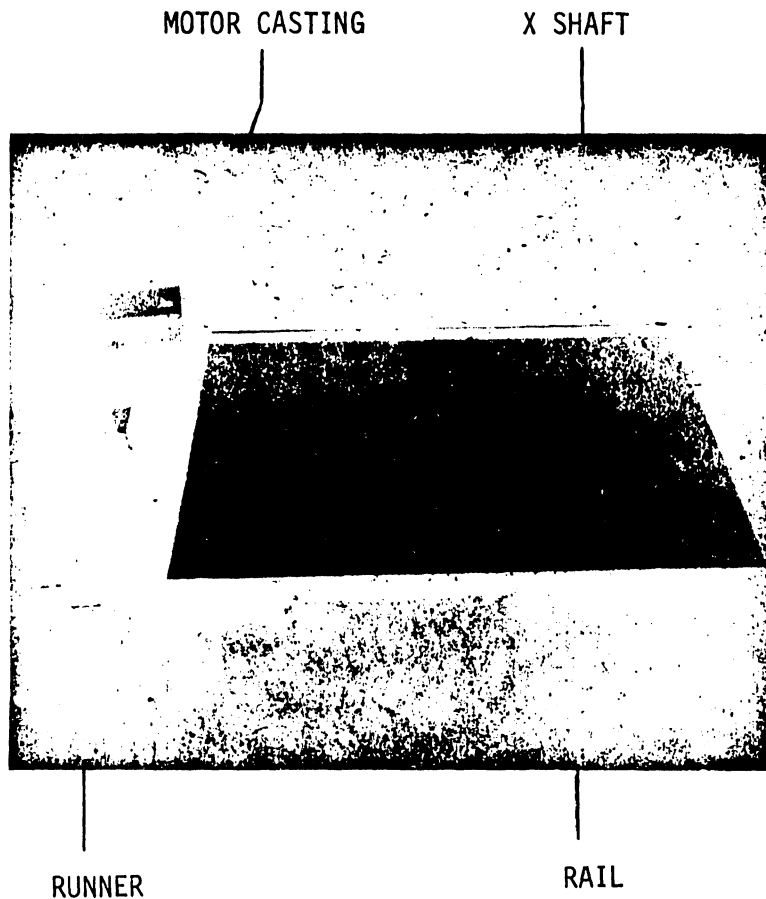


FIGURE 31  
Y ARM REMOVAL

## 6. ELECTRICAL ADJUSTMENTS - L565 PC

### 6.1 +5VR ADJUSTMENT

- 1) Check +5VR from pin 14<sub>2</sub> (+5V) to 13<sub>2</sub> (+0V).
- 2) Adjust +5VR by varying R43. See Figure 32.

### 6.2 +23VR ADJUSTMENT

- 1) Check +23VR from pin H<sub>2</sub> (+23V) to 13<sub>2</sub> (+0V).
- 2) Adjust +23VR by varying R35.

### 6.3 STEPPING MOTOR FREQUENCY ADJUSTMENT

Check the period (leading edge to leading edge) of one full cycle at pin 3<sub>2</sub> of the L565 PC.

The time from A to B, with motors at rest should be set to 180  $\mu$ s  $\pm$  18  $\mu$ s, by adjusting R54. With this adjustment accomplished, plot a line of +999(X) +999(Y), while observing the period of A to B. Observe the *change* in the period of A to B occurring at the *end* of the 999 step traverse. The period of A to B at that moment should be 120  $\mu$ s  $\pm$  10  $\mu$ s. If the above cannot be accomplished, follow standard troubleshooting procedures. See Figure 33.

The critical factor in the adjustment of R54 is the 120  $\mu$ s (motors in motion). The initial setting of R54 (180  $\mu$ s; motors at rest) is only preliminary. Therefore, readjust R54 until the 120  $\mu$ s  $\pm$  10  $\mu$ s reading can be verified at the moment coinciding with the end of the 999 step traverse; (motors have reached maximum stepping speed).

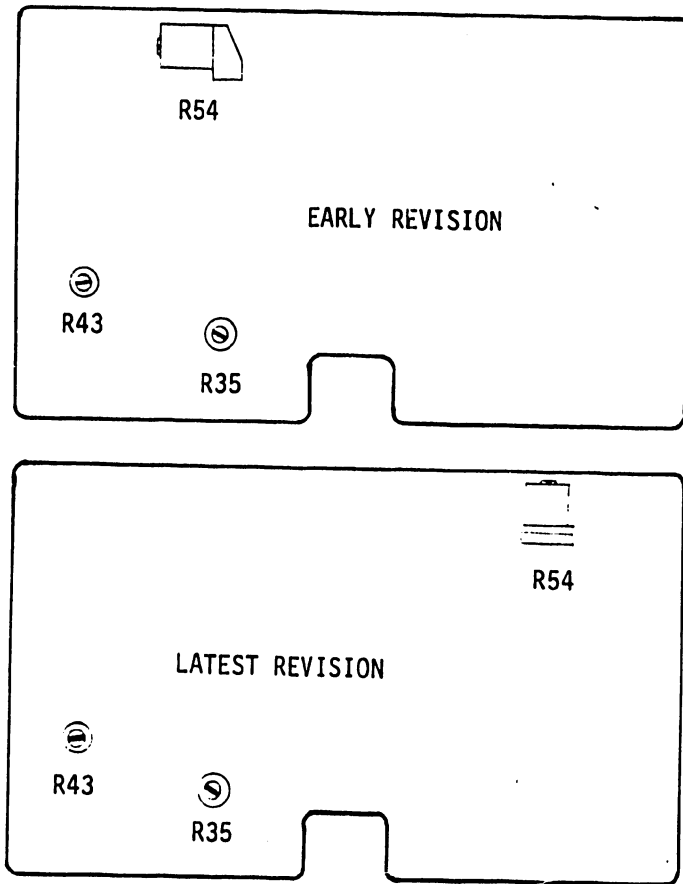


FIGURE 32  
POT LOCATIONS ON L565 PC BOARD

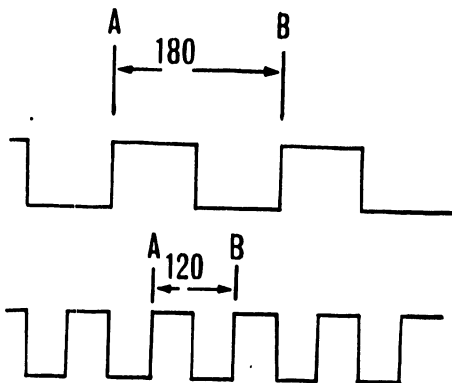


FIGURE 33

## 7. ACCESSORIES OF THE MODEL 32 AND THEIR USE

7.1 The following is a list of the accessories with WLI numbers which come with the Model 32:

1)	Vega Pens	1 Black	725-0462
		1 Red	725-0463
2)	Ball Point Lindy Pens	1 Black	900-0487B
		1 Red	900-0488B
3)	Vega Pen Adapter	1 Locknut	478-0212
		1 Adapter	458-0207
4)	Lindy Pen Adapter	1 Locknut	478-0211
		1 Adapter	458-0206
5)	Adapter for Drafting Pen	1 Adapter	458-0204
6)	Magnets	6 Plates	660-0508
		6 Magnets	458-0198
7)	Wrench	1	458-0221
8)	*Table Brackets	2 Right Hand	451-4219
		2 Left Hand	451-4220
9)	Screws, Pan Hd. 10-24 x 1/2 Lg.	8	650-5161
10)	Washer #10 Flat	8	653-6000
11)	Washer #10 Lock	8	653-6001

### 7.2 DESCRIPTION OF ACCESSORIES - See Figure 34

- 1) The Vega Pen is a fiber tip pen used when a wide or dark line is desired. The Lindy pens are fine point ball point pens used for more accurate plots.

\*Late models will not have these table brackets.



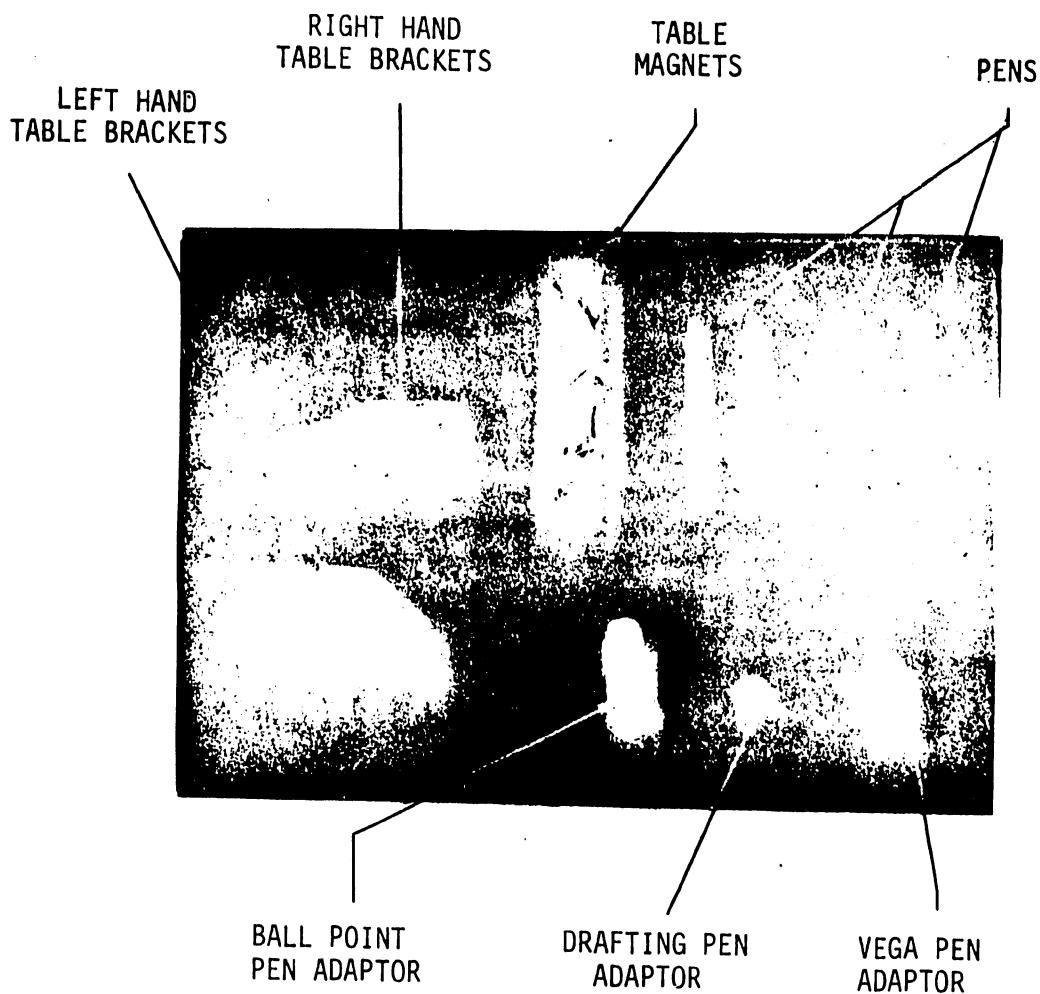


FIGURE 34  
ACCESSORIES TO MODEL 32

- 2) The Vega pen adapter holds the Vega pen. The pen is held securely in place by tightening the locknut on the adapter. The adapter is screwed into the pen arm of the carrier.

The Lindy pen adapter is used in the same manner, but for Lindy pens only.

The drafting pen adapter is threaded on its interior to adapt to a Mars drafting pen.

- 3) A wrench supplied is for tightening and loosening the pen adaptors.
- 4) The six magnets supplied are for holding the plotting paper.
- 5) Table brackets, screws, and washers have been supplied to secure the plotter to table top. The table which is recommended is a MayLine Model #7744. There are threaded holes on the bottom of MayLine tables for mounting the table brackets.

The brackets are mounted on the plotter with the screws not tightened as shown in Figure 35; the plotter is then placed on the table, the brackets are forced flush against each corner, and the bracket screws are tightened. Late models will not have these table brackets.

TABLE BRACKETS

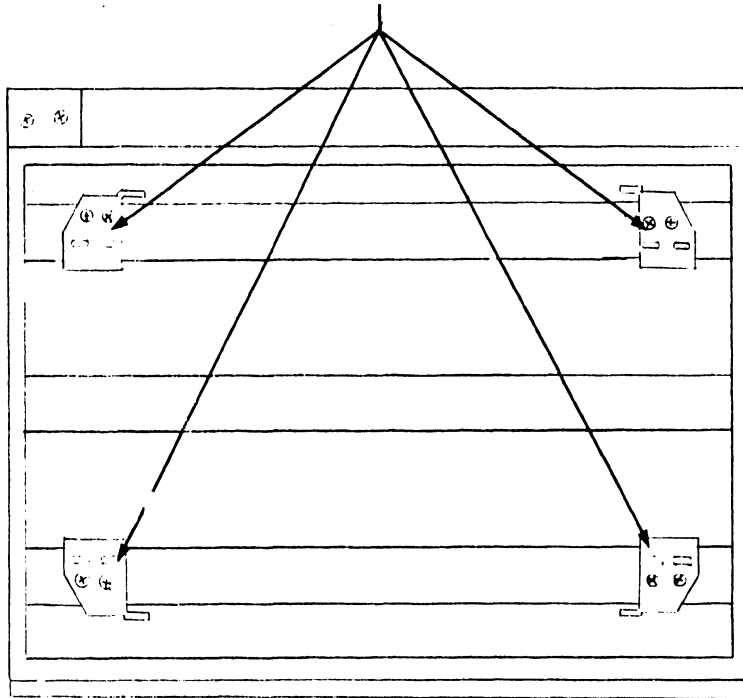


FIGURE 35  
TABLE BRACKET LOCATIONS

## 8. DIAGNOSTICS VERIFY 8560

The diagnostic tape was written for a 720, however all subroutines may be used with a 700 without a problem, except for subroutine 02 (rectangle drawn at angle). When this subroutine is used, part of the program, (VERIFY = 8560), is destroyed and must be reloaded into the calculator.

### 8.1 CONCENTRIC CIRCLES OR ELIPSES

#### 1) Keying order

- (a) Key  $\boxed{00}$
- (b) Key a (length of major axis), GO
- (c) Key b (length of minor axis), GO
- (d) Key  $\theta$  (increment of central angle), GO

#### 2) Example (See result, Figure 36)

- (a) Key  $\boxed{00}$
- (b) Key 500, GO
- (c) Key 500, GO
- (d) Key 10, GO

$$\begin{aligned} a &= 500 = 1 \frac{1}{4}'' \\ b &= 500 = 1 \frac{1}{4}'' \\ \theta &= 10 = 10^\circ \end{aligned}$$

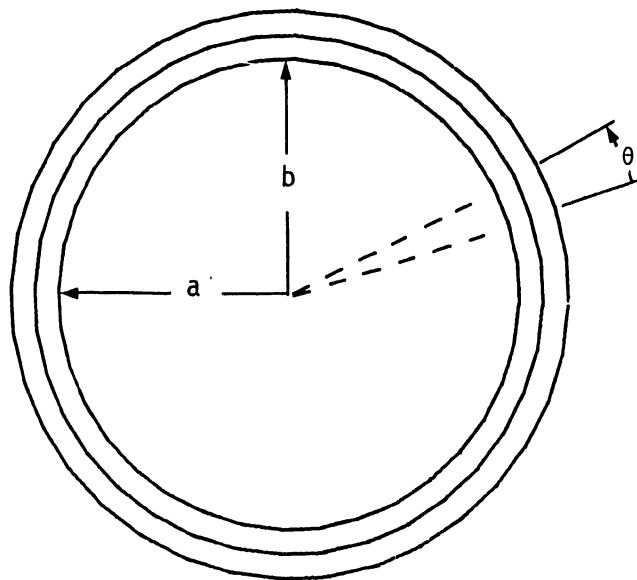


FIGURE 36  
SUBROUTINE  $\boxed{00}$  OF DIAGNOSTIC

## 8.2 INCREMENTING RADII

### 1) Keying order

- (a) Key 01
- (b) Key a (length of major axis), GO
- (c) Key b (length of minor axis), GO
- (d) Key  $\theta$  (increment of central angle), GO

### 2) Example (See result, Figure 37)

- (a) Key 01
- (b) Key 500, GO
- (c) Key 500, GO
- (d) Key 10, GO

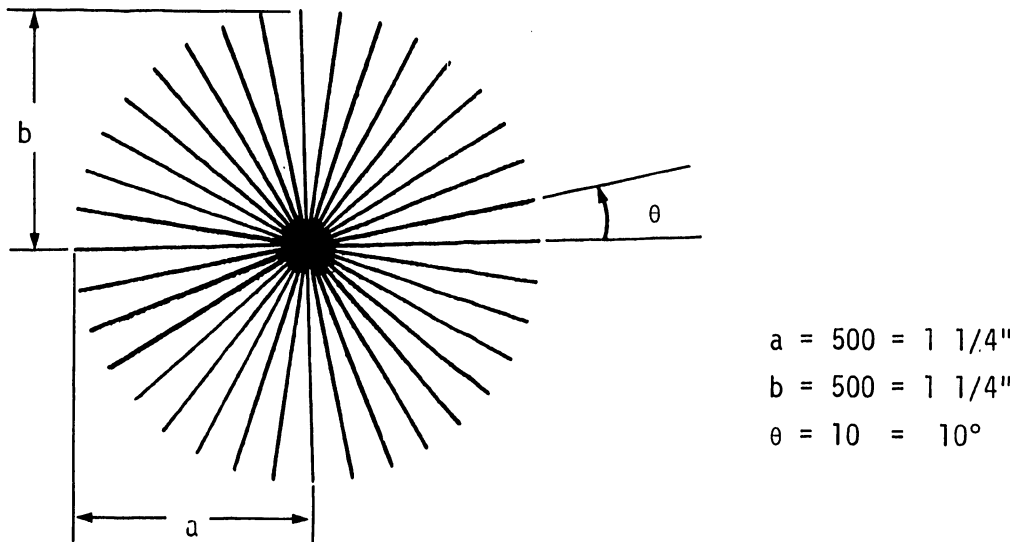


FIGURE 37  
SUBROUTINE 01 OF DIAGNOSTIC

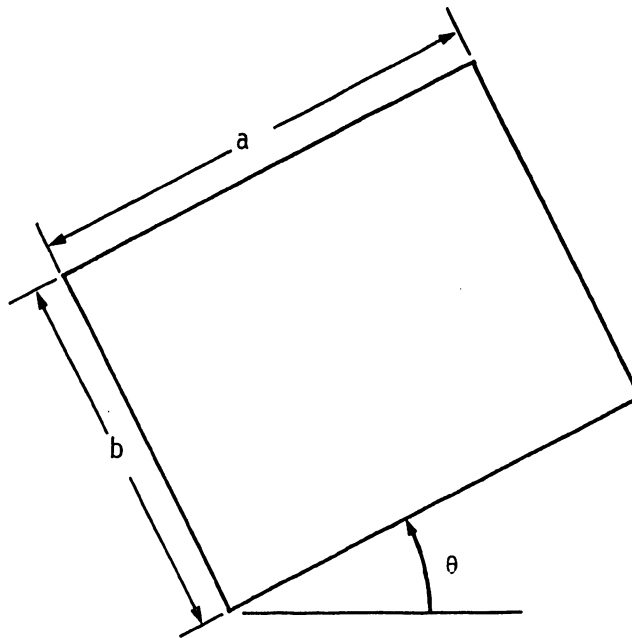
### 8.3 RECTANGLE DRAWN AT AN ANGLE

#### 1) Keying order

- (a) Key 02
- (b) Key a (length of one side), GO
- (c) Key b (length of other side), GO
- (d) Key  $\theta$  (angle), GO

#### 2) Example (See result, Figure 38)

- (a) Key 02
- (b) Key 1000, GO
- (c) Key 800, GO
- (d) Key 30, GO



$$\begin{aligned} a &= 1000 = 2 \frac{1}{2}'' \\ b &= 800 = 2'' \\ \theta &= 30 = 30^\circ \end{aligned}$$

FIGURE 38  
SUBROUTINE 02 OF DIAGNOSTIC

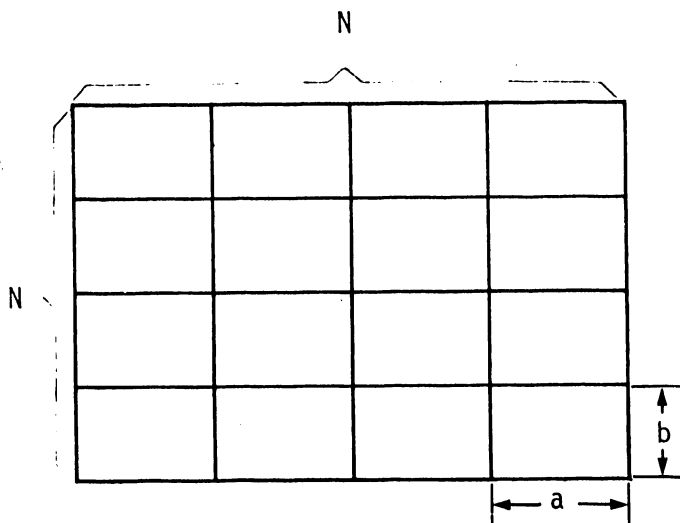
## 8.4 RECTANGLES

### 1) Keying order

- (a) Key 03
- (b) Key a (width of squares), GO
- (c) Key b (height of squares), GO
- (d) Key N (Number of squares on any side), GO

### 2) Example (See result, Figure 39)

- (a) Key 03
- (b) Key 300, GO
- (c) Key 200, GO
- (d) Key 4, GO



$$\begin{aligned} a &= 300 = 3/4'' \\ b &= 200 = 1/2'' \\ N &= 4 = 4 \text{ RECTANGLES} \end{aligned}$$

FIGURE 39  
SUBROUTINE 03 OF DIAGNOSTIC

## 8.5 90° ANGLE FOR ALIGNING X SHAFT AND Y ARM

Keying **14** will plot a large 90° angle for checking the perpendicularity of the X shaft and the Y arm, as in Section 5.10.

## 8.6 DASH-POT DIAGNOSTIC

Keying **13** will start a program to check the adjustment of the dash-pot as explained in Section 5.6.

8.7 To move pen in any direction less than or exceeding 999 increments and with the pen up.

1) Keying order

(a) Key increment and direction desired

(b) Key **15**

2) Example

(a) Key in number 1200, † (put in Y Register)

(b) Key number 1000 (X Register)

(c) Key **15**

To perform the above with the pen down, key **0315** instead of **15**.

## 9. PREVENTIVE MAINTENANCE PROCEDURES

The Model 32 should have visual and performance checks, and lubrication at least three (3) times annually.

### 9.1 LUBRICATION

The X shaft should be lubricated after being cleaned with a light coat of silicon grease.

### 9.2 CLEANING

- 1) Clean the X shaft by wiping it with a cloth or paper towel. Do not moisten the towel.
- 2) Remove any dust or foreign material from the X rail.
- 3) Clean the X Rack and pinion gear by spraying it with freon.

### 9.3 VISUAL INSPECTION

- 1) Check for any loose components, screws or bolts.
- 2) Check perpendicularity of X shaft to Y arm (Section 5.9).
- 3) Check for wear of X and Y belts.
- 4) Check cable tension of Y cable (Section 5.14).
- 5) Run Diagnostic Tests, Tape 8560.



**SERVICE  
BULLETIN  
NO. 44.1**

EDITED BY CUSTOMER ENGINEERING DIVISION

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## MODEL 632A/732A/2232A DIGITAL FLATBED PLOTTER

Production of the Model 32 Digital Flatbed Plotter has been discontinued; the Model 32A is being manufactured to improve the table, pen pressure and accuracy. All changes are mechanical: the table construction is changed to prevent warping and the pen adapter of the Model 32 is changed to three separate pen adapters (one for each type of pen) to improve accuracy and reliability of plots.

*Service Bulletin 44* is still valid for the Model 32. This bulletin, 44.1, contains a description of the Model 32A (Section 1), the mechanical adjustments (Section 5), accessories of the Model 32A and their use (Section 7), the conversion from a Model 32 to a 32A (Section 10), and assembly drawings for both Models 32 and 32A (Section 11). The sections in *Service Bulletin 44* that are valid for this bulletin are:

- Section 2 - COMPONENTS
- Section 3 - OPERATING CONFIGURATION
- Section 4 - OPERATION
- Section 6 - ELECTRICAL ADJUSTMENTS
- Section 8 - DIAGNOSTICS - VERIFY 8560
- Section 9 - PREVENTIVE MAINTENANCE PROCEDURES

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## TABLE OF CONTENTS

1. GENERAL	3
1.1 Description	3
1.2 Improvements	3
1.3 Specifications	3
2. COMPONENTS - See <i>Service Bulletin No. 44</i>	
3. OPERATING CONFIGURATION - See <i>S.B. #44</i>	
4. OPERATION - See <i>S.B. #44</i>	
5. MECHANICAL ADJUSTMENTS	4
5.1 Adjustment Tools	5
5.2 Loading Procedure for Fiber Pen	5
5.3 Loading Procedure for Ink Pen	6
5.4 Loading Procedure for Ball Pen	6
5.5 Pen Pressure Adjustment	7
5.6 Pen and Solenoid Adjustment	8
5.7 Pen Height Adjustment	9
5.8 Carrier Brake Adjustment	10
5.9 Leveling Y Arm	11
5.10 Squaring X Shaft	11
5.11 Making Y Arm Perpendicular to the X Shaft	12
5.12 Pinion Loading Adjustment	13
5.13 Y Increment Adjustment	14
5.14 Cable Tension Adjustment	17
5.15 Photocell Alignment	19
5.16 Home Position Alignment	20
5.17 Y Arm Removal and Replacement	24
5.18 Y Arm and Table Compatibility	25
5.19 Y Arm Eccentric	25
6. ELECTRICAL ADJUSTMENTS - See <i>S.B. #44</i>	
7. ACCESSORIES OF THE MODEL 32A	26
8. DIAGNOSTICS - See <i>S.B. #44</i>	
9. PREVENTIVE MAINTENANCE PROCEDURES - See <i>S.B. #44</i>	
10. CONVERSION FROM MODEL 32 TO 32A	27
11. MODEL 32 AND 32A ASSEMBLY DRAWINGS	30

## 1. GENERAL

### 1.1 DESCRIPTION

The Model 32A Digital Flatbed Plotter provides continuous line or print plotting of curves and data. Circle charts, bar graphs, subdivisional plans, and highway plans may be plotted with full alphanumeric labeling initiated by software.

### 1.2 IMPROVEMENTS

The Model 32A has a modified plotting table and pen carrier assembly. The new table is of honeycomb construction similar to that of aircraft wings. The new design eliminates warping of the table when supported incorrectly. The warping caused plots to be inaccurate, or in severe cases, missing.

The carrier assembly is designed so that the pen rises and falls vertically rather than on an arc like the Model 32. The vertical movement of the pen allows a more accurate plot while plotting on a surface that is uneven.

### 1.3 SPECIFICATIONS

- |                        |                               |
|------------------------|-------------------------------|
| 1) Table:              | Width 60.25" (153.04 cm)      |
|                        | Depth 46" (116.84 cm)         |
|                        | Weight 105 lbs (47.25 kg)     |
| 2) Electronic Package: | Height 19" (48.3 cm)          |
|                        | Width 18" (45.7 cm)           |
|                        | Depth 10" (25.4 cm)           |
|                        | Weight 30 lbs (13.5 kg)       |
| 3) Paper Capacity:     | 59.5" x 36" (151.1 x 91.4 cm) |
| 4) Plotting Area:      | 48" x 31" (121.9 x 78.7 cm)   |

- 5) Accuracy:  $\pm .01'' + .001$  inch/inch  
( $\pm .0254$  cm + .0025 cm/cm)
- 6) Stepping Increment: .0025'' (.00635 cm)
- 7) Stepping Rate: 300 to 500 steps/second
- 8) Plotting Time: 60''/minute (152 cm/minute) average
- 9) Voltage: 115 or 230 VAC  $\pm 10\%$
- 10) Frequency: 50 or 60 Hz  $\pm 1/2$  Hz

2. COMPONENTS - See *Service Bulletin 44*

3. OPERATING CONFIGURATION - See *Service Bulletin 44*

4. OPERATION - See *Service Bulletin 44*

#### 5. MECHANICAL ADJUSTMENTS

All mechanical adjustments for the Model 32A are contained in this section; no reference to *Service Bulletin 44* is required. The adjustments are arranged as follows:

- \* 1) Loading procedure for fiber pen.
- \* 2) Loading procedure for ink pen.
- \* 3) Loading procedure for ball pen.
- \* 4) Pen pressure adjustment.
- \* 5) Pen height adjustment.
- \* 6) Pen and solenoid adjustment.
- 7) Carrier brake adjustment.
- 8) Leveling Y arm.
- 9) Squaring X shaft.
- 10) Making Y arm perpendicular to the X shaft.

- 11) Pinion loading adjustment.
- 12) Y increment adjustment.
- 13) Cable tension adjustment.
- 14) Photocell alignment.
- 15) Home position alignments.
- \*16) Y arm removal and replacement.
- \*17) Y arm and table compatibility.
- \*18) Y arm eccentric.

\*New adjustments for the Model 32A.

#### 5.1 ADJUSTMENT TOOLS

- 1) 1 lb x 1/4 oz Push-pull Scale, Chatillon Mfg. #516-500
- 2) 5 lb x 1 oz Push-pull Scale, Chatillon Mfg. #719-5
- 3) 6" Scale
- 4) 31" Scale
- 5) 45° Triangle, Pickett Mfg. #Q10-30SC-12
- 6) Extension Block 6" Gearfence
- 7) Allen Wrench Set
- 8) Feeler Gauges
- 9) Oscilloscope - carry on call

#### 5.2 LOADING PROCEDURE FOR FIBER PEN - FIGURE 1

- 1) Push fiber pen into inner sleeve of pen housing until it bottoms.
- 2) Screw preloading cap assembly to pen housing.

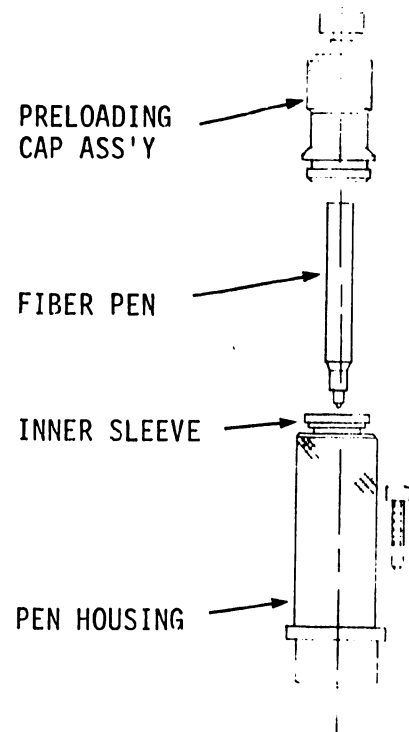


FIGURE 1

5.3 LOADING PROCEDURE FOR INK PEN - FIGURE 2

- 1) Lift adapter sleeve from pen housing. Screw plotter point into point holder. Screw point holder assembly into adapter sleeve.
- 2) Load pen slide assembly in pen housing so that pen point protrudes through hole at point "A".
- 3) Screw preloading cap assembly to pen housing.

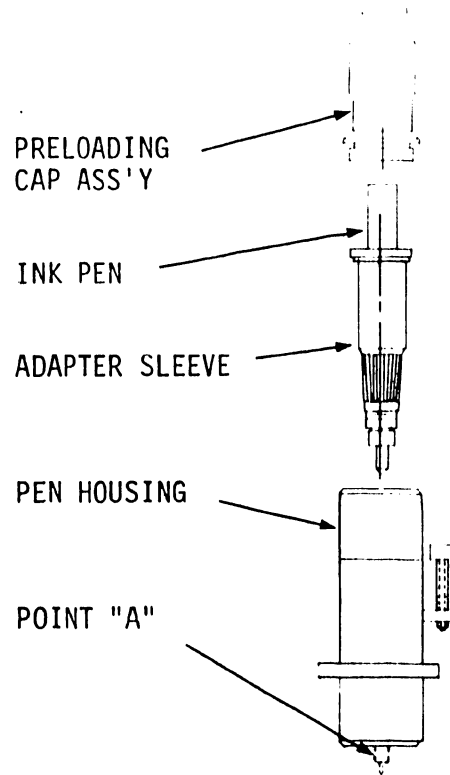


FIGURE 2

5.4 LOADING PROCEDURE FOR BALL PEN - FIGURE 3

- 1) Turn locking cap to position where grooved hole in locking cap lines up with hole in inner sleeve.
- 2) Insert ball pen so as it bottoms on inner sleeve.
- 3) Turn locking cap in either direction till grooved hole in cap locks ball pen in position.
- 4) Screw preloading cap assembly to pen housing.

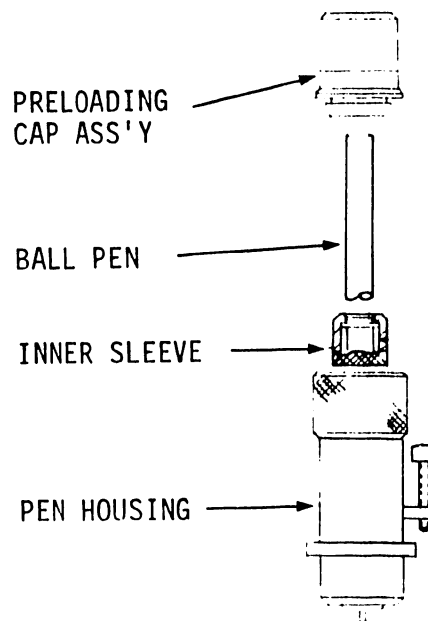
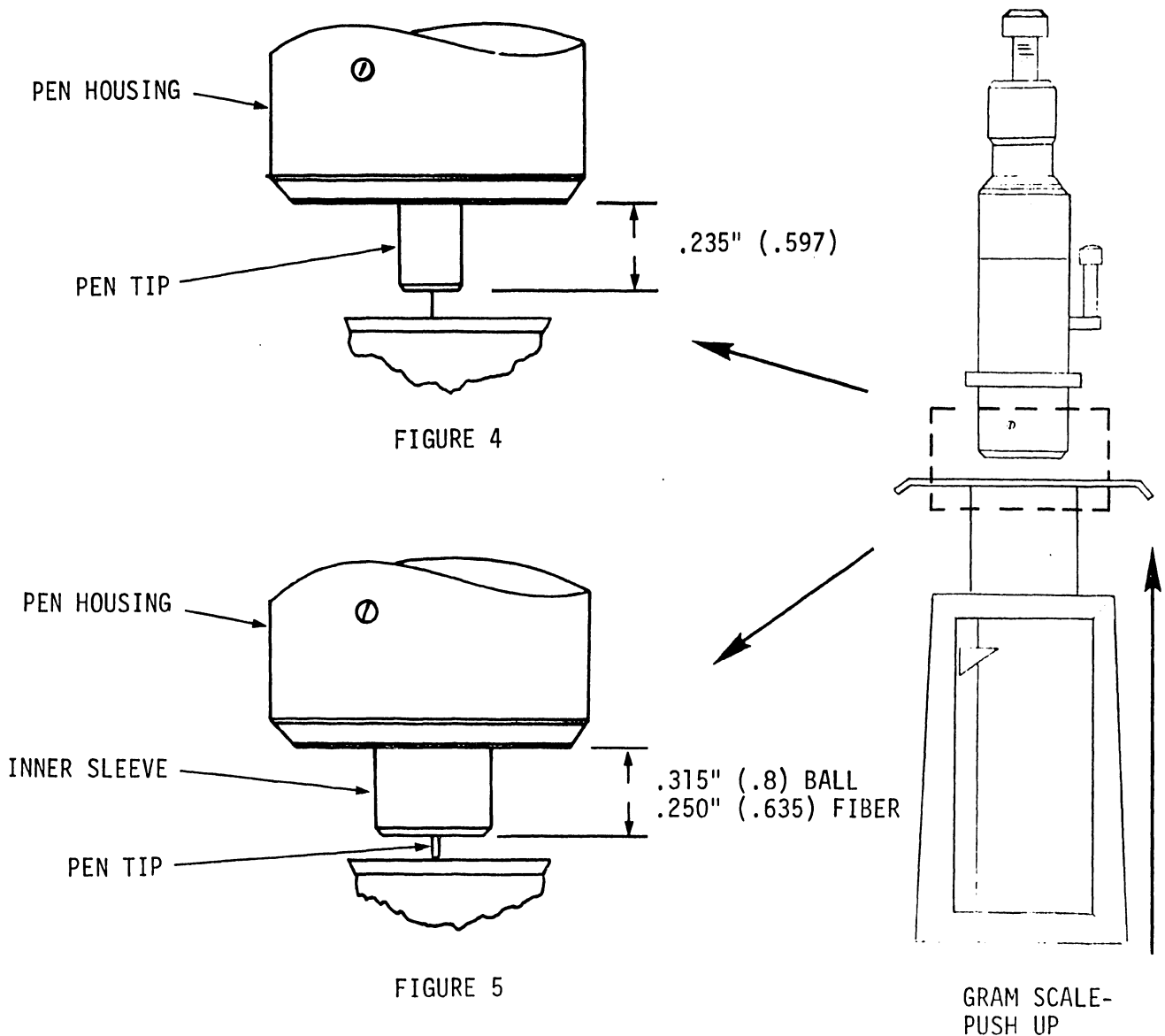


FIGURE 3

## 5.5 PEN PRESSURE ADJUSTMENT

PEN	GAP	GRAM READING
Mars Technical Pen - Fig. 4	.235" (.597 cm)	10 ± 2 grams
Ball Point Pen - Fig. 5	.315" (.8 cm)	71 ± 3 grams
Fiber Pen - Fig. 5	.250" (.635 cm)	4 ± 1 grams

Each pen holder is similar in adjusting the pressure and gap; the point of measurement differs. At the correct gap, the gram reading should be as above. To increase the pressure, turn the adjusting screw clockwise; to decrease pressure, turn the screw counterclockwise.





5.6 PEN AND SOLENOID ADJUSTMENT (See Figure 6)

- 1) With a pen housing loaded into the pen holder mount, adjust eccentric stop until .10" (.25 cm) gap is obtained at the solenoid plunger with solenoid deenergized (pen up).
- 2) Measure 4.75 oz  $\pm$  .25 downward force on the pen actuator arm at adjustment screw point. Move the return spring into the correct hole to obtain proper adjustment.

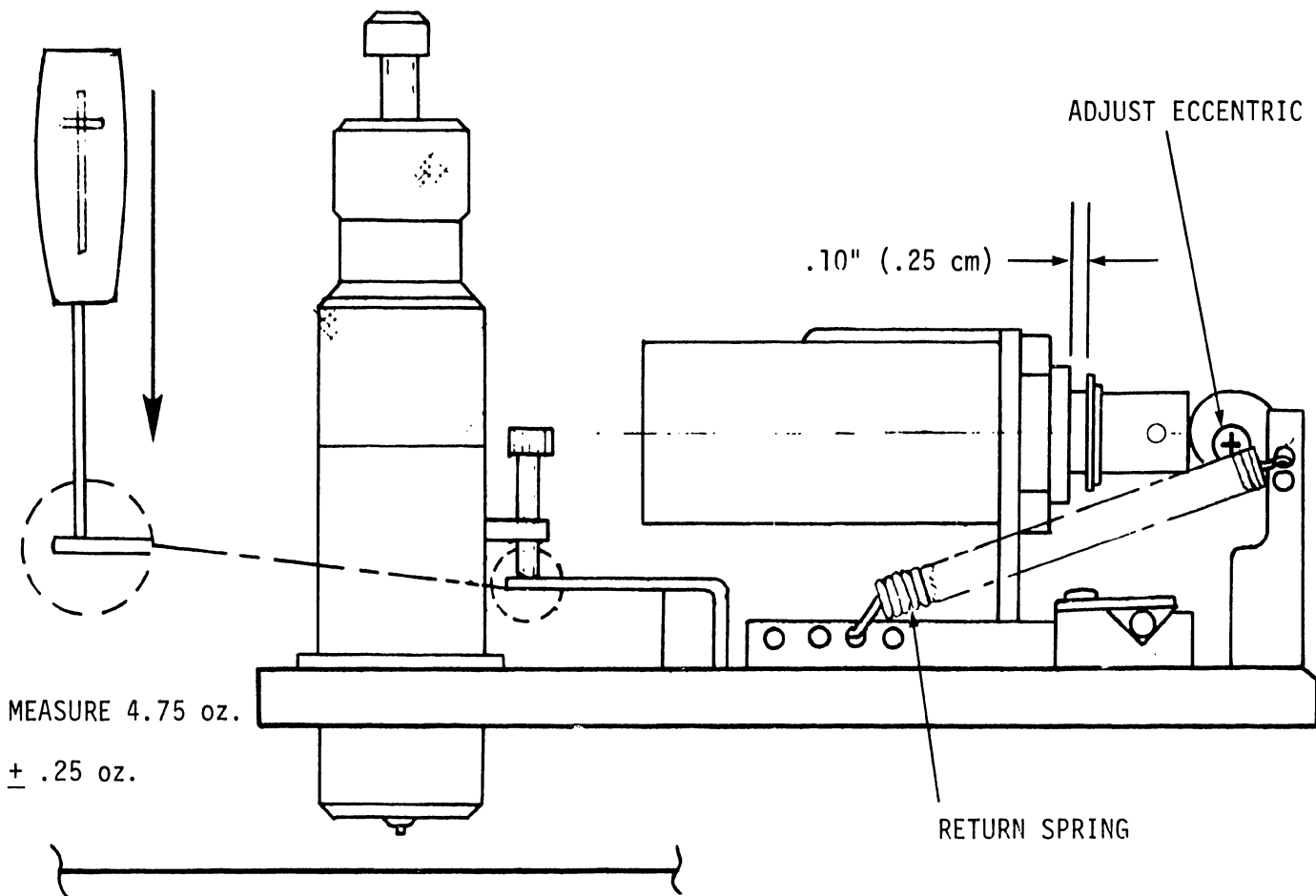


FIGURE 6  
PEN AND SOLENIOD ADJUSTMENT

## 5.7 PEN HEIGHT ADJUSTMENT (Refer to Figure 7)

- 1) With pen holder loaded into the pen holder mount, turn pen height adjustment screw counterclockwise to raise pen and clockwise to lower pen. This adjustment must be done for each pen holder.
- 2) Pen should be adjusted *just* high enough to avoid hitting a paper hold-down magnet, .18" (.46 cm) nominal, and still be able to plot over entire area, using the four corners as a quick check. If this is not possible, the Y arm may not be parallel with the table top. See Section 5.9.

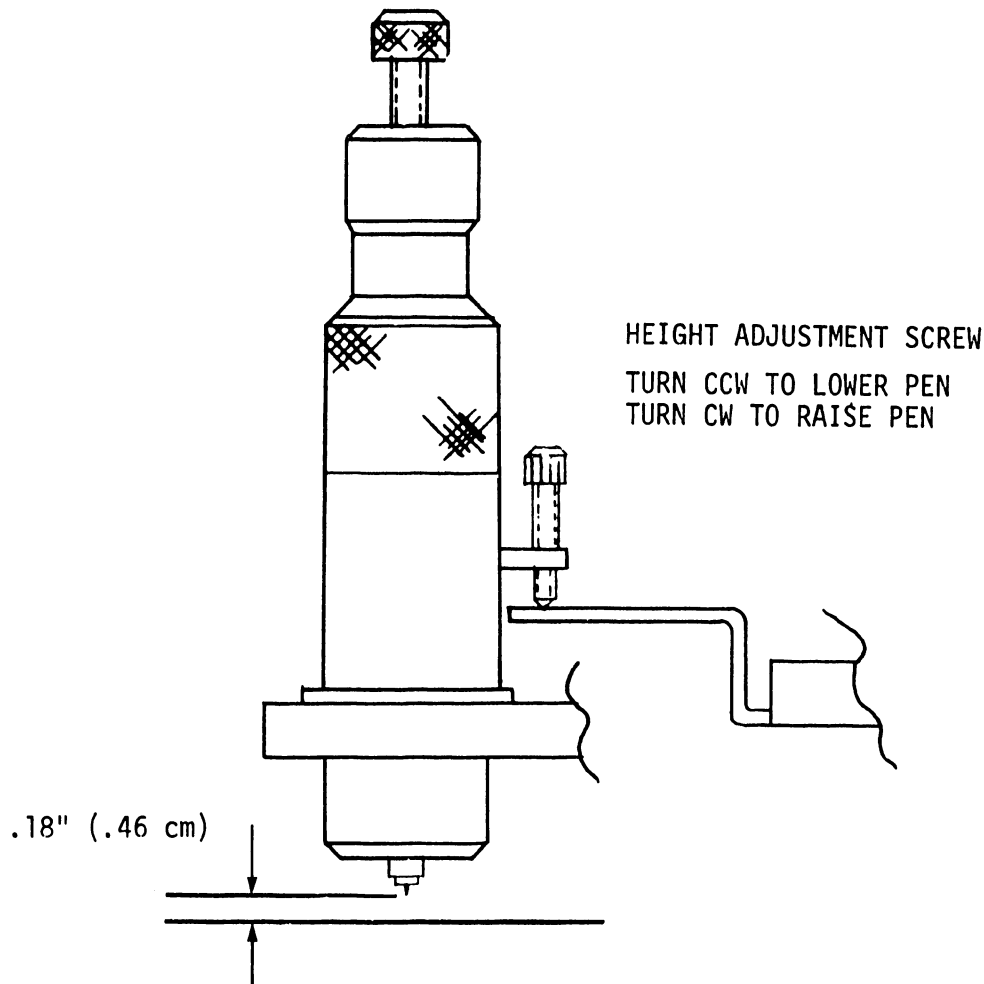


FIGURE 7

PEN HEIGHT ADJUSTMENT

## 5.8 CARRIER BRAKE ADJUSTMENT (See Figure 8)

Run the radius program of the Model 32 (see paragraph 8.2); adjust the screw until there is no noticeable line oscillation or line separation. A slight line expansion is acceptable.

### NOTE:

A tolerable line oscillation of several thousandths of an inch will be present on most Model 32A plotters. The oscillation is more apparent at 7°, 83°, 97°, 173°, 187°, 263°, 277°, and 353°.

The carrier brake is not always the cause of line separation or line oscillation. For other suggestions, see section 9, X shaft lubrication.

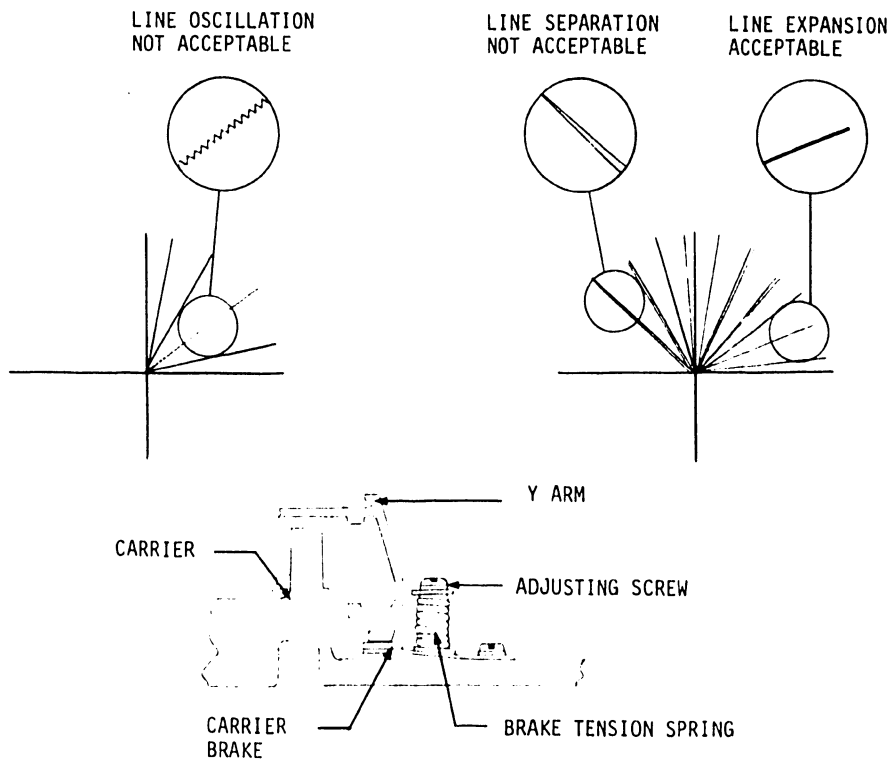


FIGURE 8  
CARRIER BRAKE ADJUSTMENT

## 5.9 LEVELING Y ARM

- 1) The distance from the bottom of the Y arm to the table surface should be uniform throughout the table, within  $1/16''$  (.16 cm).
- 2) Take a reading with a 6" scale at the bottom edge and at the top edge of the table. If adjustment is necessary, loosen all screws inside the runner and raise or lower the runner to correct the difference. See Figure 9.

## 5.10 SQUARING X SHAFT

- 1) The rack should be parallel to the edge of the X shaft over 10" (25.4) to within .002" (.005) and a maximum of .005" (.013) over the entire length of the rack.
- 2) To adjust for this, loosen the 6 screws directly beneath the X shaft and move the shaft to the specified position. See Figure 9.

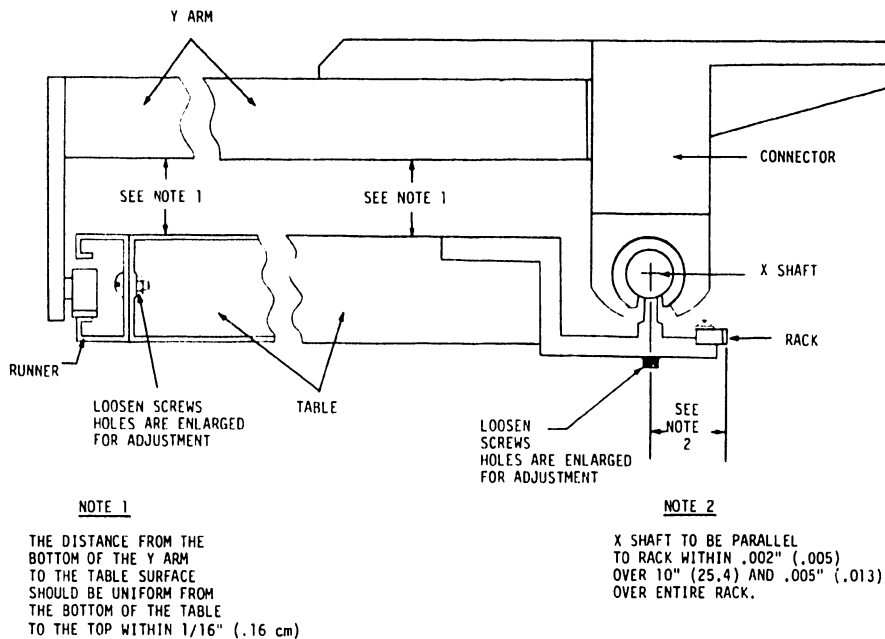


FIGURE 9

LEVELING Y ARM - SQUARING X SHAFT

## 5.11 MAKING Y ARM PERPENDICULAR TO THE X SHAFT

- 1) The Y arm must be square to the X shaft within .010" (.025) over a 30" (76.2) length. This is checked with a large triangle placed on a 90° plot as shown in Figure 10. The trial plot may be generated by subroutine 0014 on tape #8560.
- 2) To adjust the Y arm, loosen the lock bolts on the motor casting where it connects to the Y arm, and shift the adjusting block by loosening one jacking screw and tightening the other. See Figure 10.

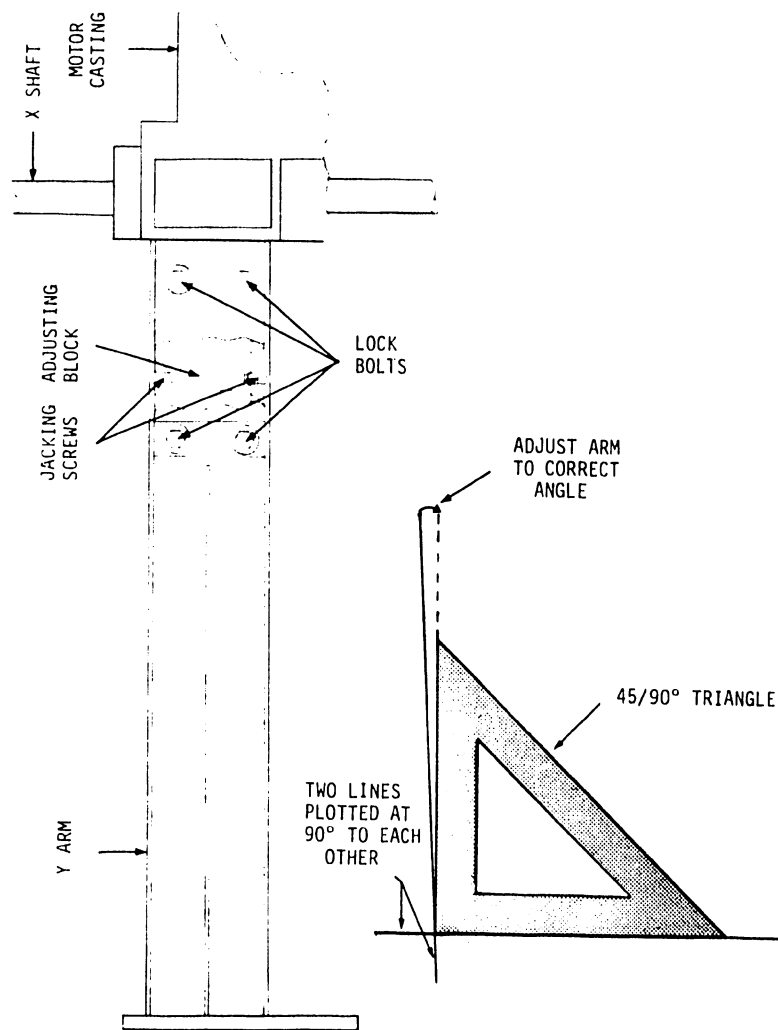


FIGURE 10  
MAKING Y ARM AND X SHAFT PERPENDICULAR

## 5.12 PINION LOADING ADJUSTMENT

- 1) When pulling on the pinion block with a spring scale, the block should begin moving at 4.5 lbs.  $\pm$  .25 lb. See Figure 11.
- 2) To adjust the load tension, loosen the two lock screws and attach a spring scale behind the pinion block. Pull the scale away from the table. As the block begins to move, take a reading on the scale. If adjustment is necessary, turn the adjusting screw in to increase the tension or out to decrease tension. When adjustment is completed, tighten the lock screws.

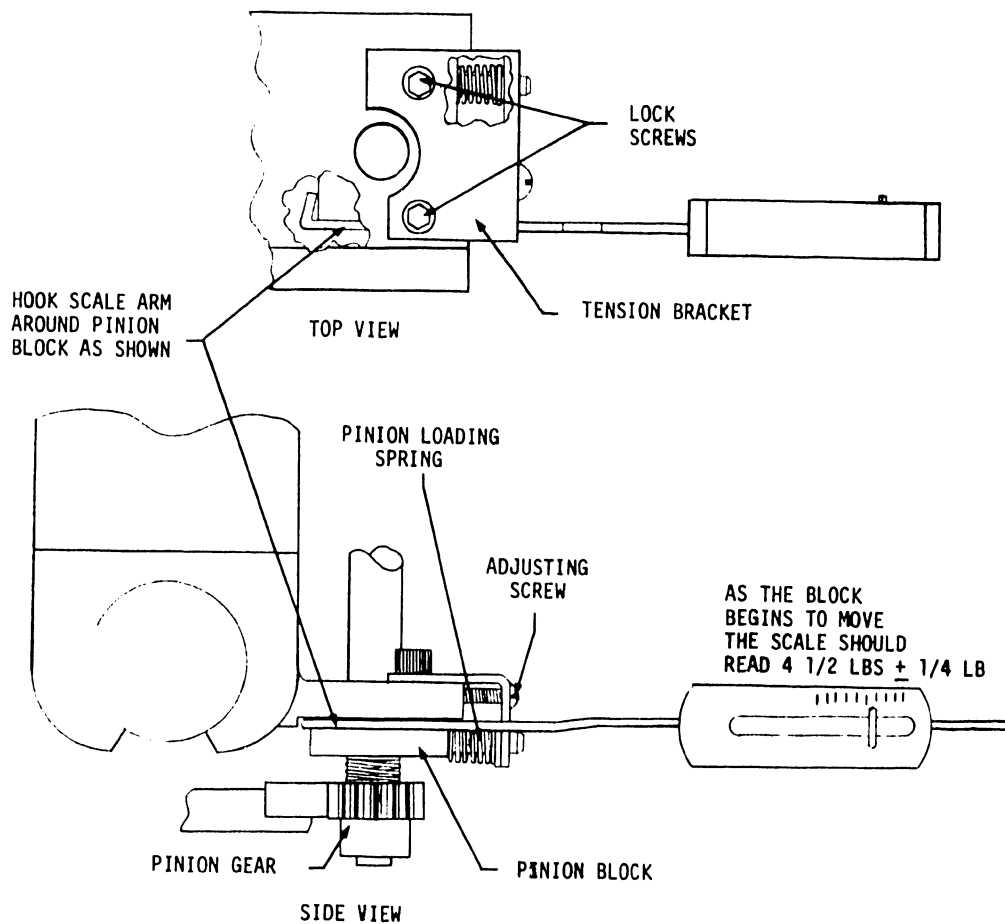


FIGURE 11  
PINION GEAR LOAD TENSION

### 5.13 Y INCREMENT ADJUSTMENT

- 1) A line in the Y direction should be accurate in length over a 31" (78.74) plot within .005" (.013). Check 31" (78.74) accuracy by plotting in the Y direction 12400 increments and measuring that line. Use diagnostic in section 8.8.

NOTE:

Some subroutines have been incorporated in the diagnostics for the Model 32A. See Section 8.

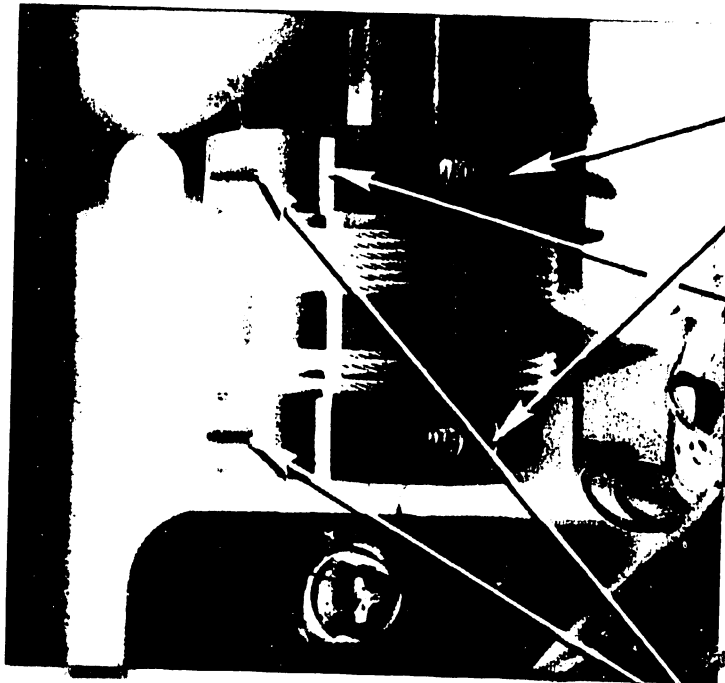
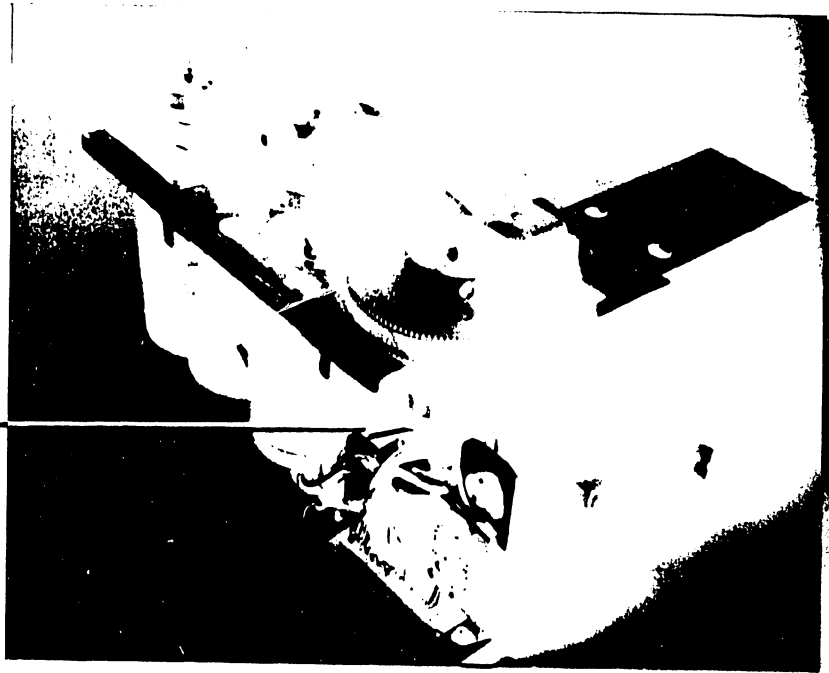
- 2) Adjustment of the Y increment is done by varying the circumference of the cable drum (See Figures 12 and 13). Increasing the diameter of the drum will cause larger increments; decreasing the diameter will cause smaller increments. The following steps explain.

NOTE:

It is only necessary to perform Step (a) below when increasing the diameter of the drum.  
To ensure uniformity when increasing or decreasing the diameter of the drum, adjust both sides equally.

- (a) In order to expand the drum, it is necessary to release the cable stress on the drum. To release this pressure, place the carrier somewhere in the middle of the Y arm (arm disconnected from table and laying upside down - SEE 5.17 FOR Y ARM REMOVAL) and loosen the cable tightening clamp underneath the carrier (See Figure 14). Loosen the coils of cable looped around the drum. Since expansion of the drum requires Y arm removal, it is suggested that when the drum is expanded, it is expanded more than necessary. The diameter can then be decreased until the correct diameter setting is reached, section 5.13 #2 (c).

CORD DRUM  
LOCATED UNDER  
Y PULLEY



JACKING SCREWS

CUT OUT IN DRUM  
ALLOWS EXPANSION  
AND CONTRACTION  
OF CORD DRUM

LOCKING SCREWS

FIGURE 12  
CORD DRUM AND CORD DRUM LOCATION



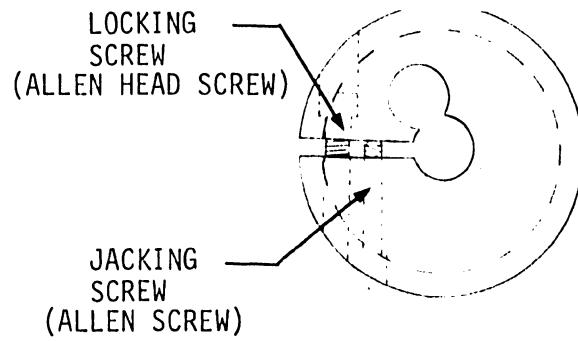


FIGURE 13

DRUM CROSS SECTION

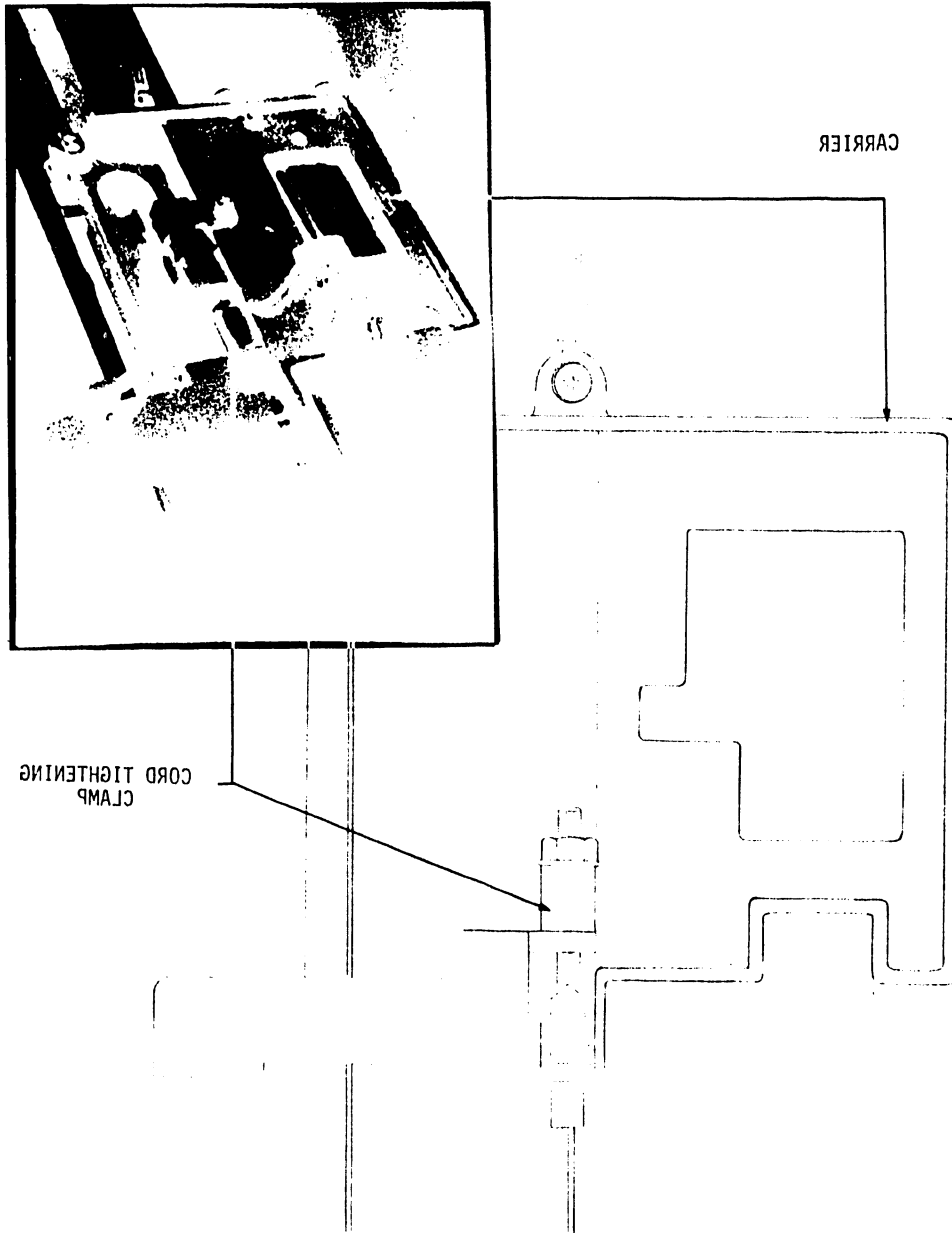


FIGURE 14

CORD TIGHTENING CLAMP LOCATION

- (b) To increase the diameter of the drum, remove the two lock screws shown in Figures 12 and 13, then turn the jacking screws clockwise to desired location. When jacking is completed, replace the locking screws.
- (c) To decrease the diameter of the drum, loosen the jacking screws slightly; tighten the locking screws until the desired diameter is met. Turn the jacking screws back in until they meet the opposite wall of the drum. This will prevent the drum diameter from decreasing more when the cable is retightened.
- (d) After adjustment is made, reverse the procedure in 5.13, #2 (a) to the cable, then see Section 5.14 to insure proper cable tension.

#### 5.14 CABLE TENSION ADJUSTMENT

- 1) With the carrier assembly in the center of the Y arm, using a spring scale, pull the cable away from the arm. When the cable is pulled a distance of 1" (2.54) there should be a reading of 14 oz  $\pm$  2 oz (See Figure 15).
- 2) The adjusting nut of the cable clamp may be turned in or out to fine adjust the tension. If the cable needs only fine adjust, use the cable clamp adjusting nut. If the cable is loose, the pulley should be moved to take up slack. Remove the C clip holding the pulley, remove the pulley, screw out the pulley shaft, and move pulley and shaft to a different hole for better tension.

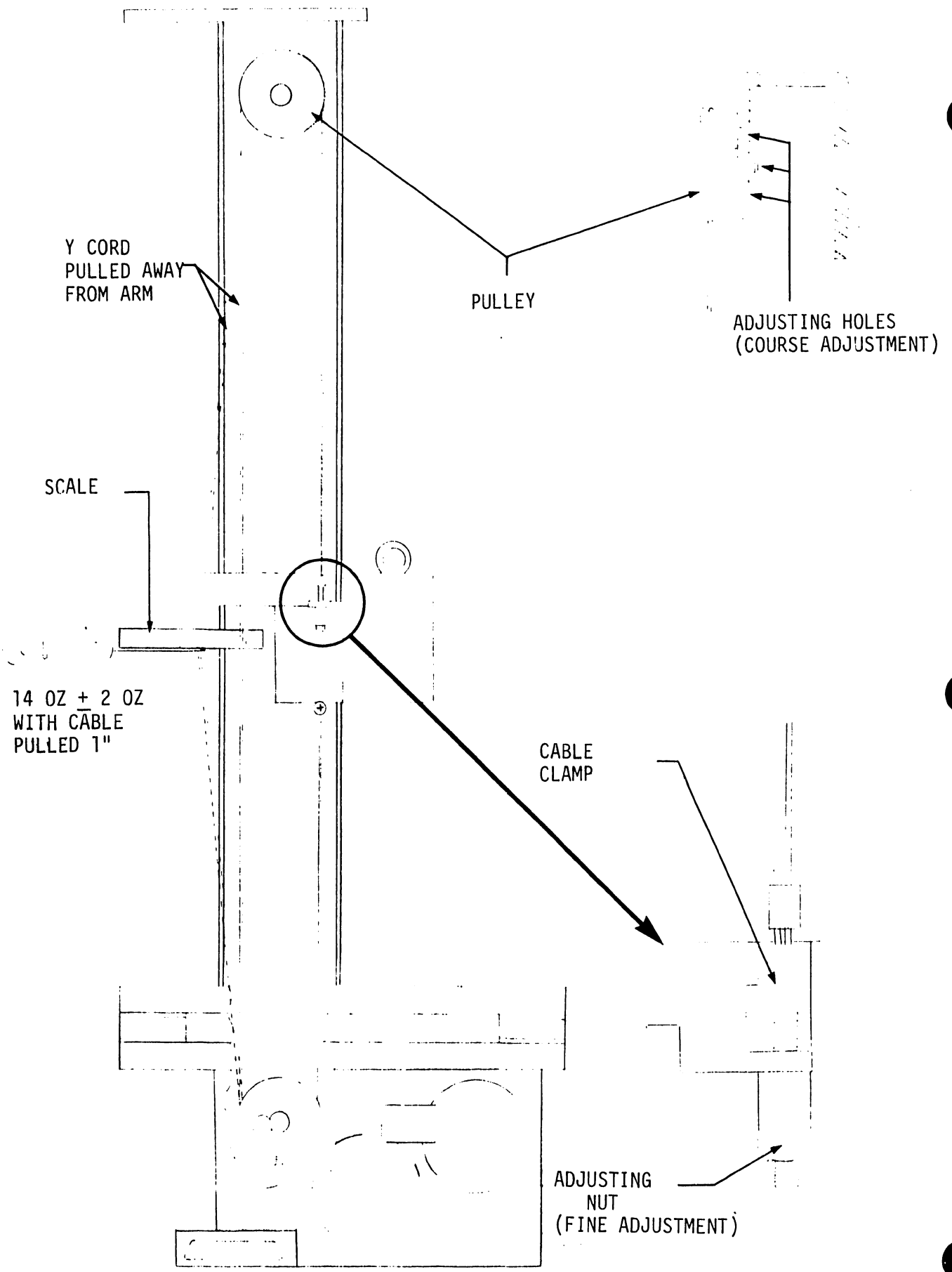


FIGURE 15

CABLE TENSION ADJUSTMENTS

## 5.15 PHOTOCELL ALIGNMENT

- 1) With the photo actuator pin engaged within the LED/photo cell package there should be a clearance of  $.110'' (.279) \pm .015'' (.038)$  from the tip of the actuator pin to the inside edge of the photocell package (See Figure 16).
- 2) If adjustment is required, position the actuator pin so that it is inside the photocell package. Loosen the two locking screws holding the photocell package bracket and move the bracket to the desired location.

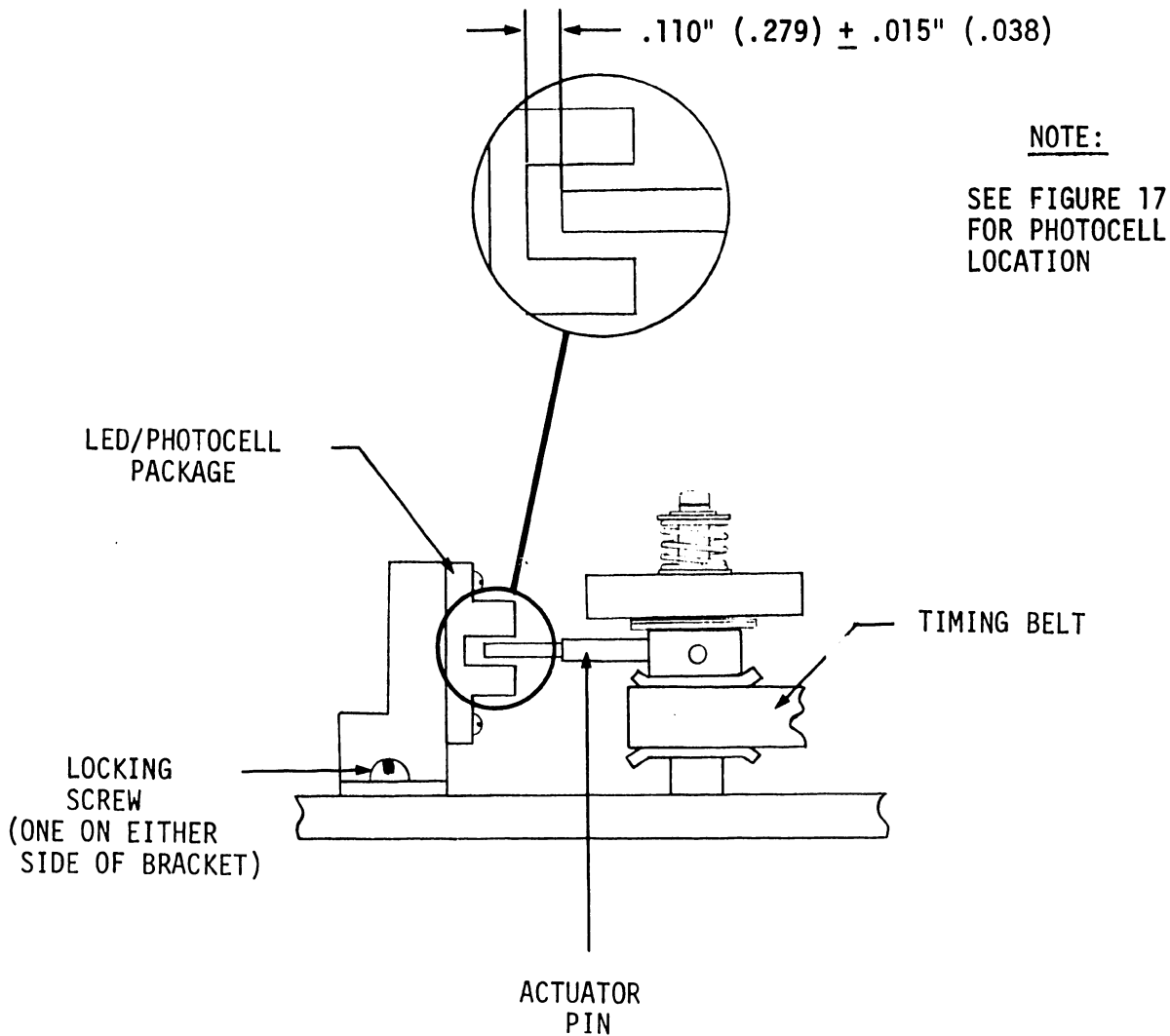


FIGURE 16

LED/PHOTOCELL ALIGNMENT

## 5.16 HOME POSITION ALIGNMENTS

1) The following is a procedure for aligning Y axis home position. Refer to Figures 17, 18 and 19.

(a) Turn power off.

X & Y TIMING  
GEARS

LED PHOTOCELL  
PACKAGES

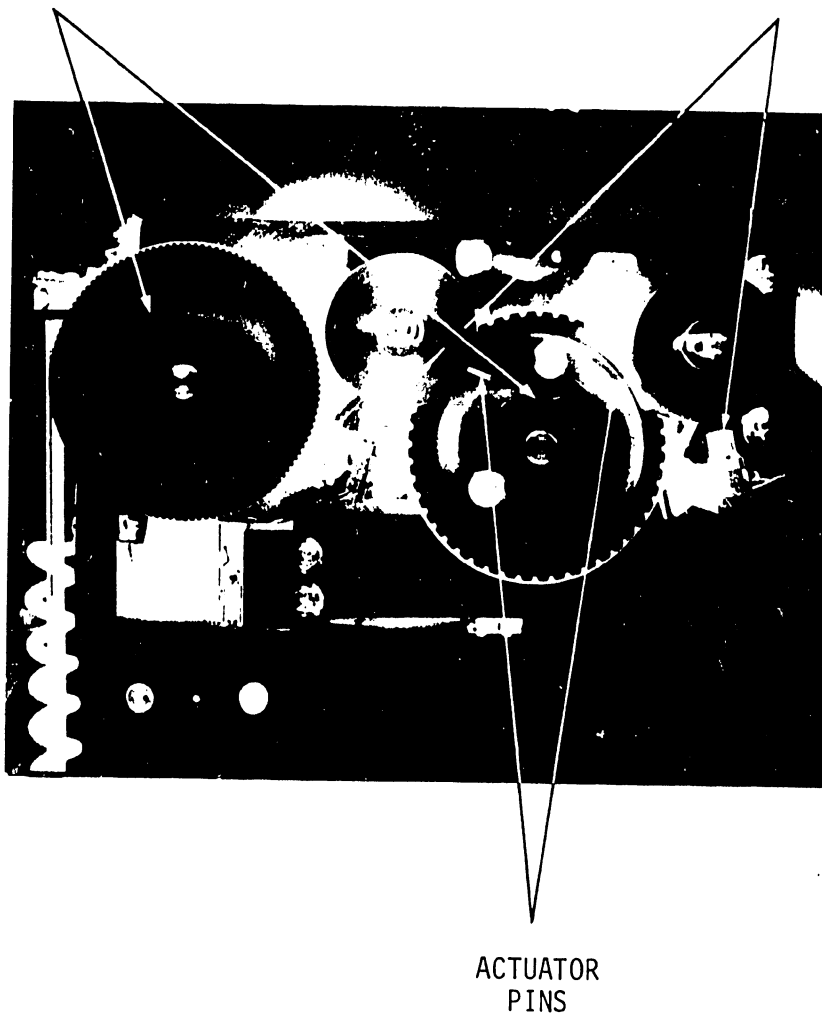


FIGURE 17  
HOME POSITION COMPONENT LOCATIONS

- (b) Move pen carrier away from bottom margin.
- (c) Remove timing belt from Y timing gear.
- (d) Move the pen carrier back toward the bottom margin until the Y axis actuator actuates the Y encoder switch (Y SW1).
- (e) Rotate the Y axis actuator pin until it is 90° from engaging the LED/photo cell package.
- (f) Replace the timing belt onto the Y timing gear.
- (g) Turn the power on. At this time the Model 32A should go to the home position. See step (h) below to check alignment.

NOTE:

Due to bright lighting in some offices, the photo-cells may not work properly. In such cases, replace the motor cover before turning power back on. This allows normal reset.

- (h) With the carrier and the Y arm in the home position, the actuator pins should be inside the LED/photocell packages. See Figure 19.
- 2) The following is a procedure for aligning the X axis home position. Use Figures 17, 18 and 19 for reference.
- (a) Turn power off.
  - (b) Move Y arm away from left margin.
  - (c) Remove black timing belt from X timing gear.
  - (d) Move Y arm towards left margin until left margin stop (See Figure 20) actuates left X encoder switch (X SW1).

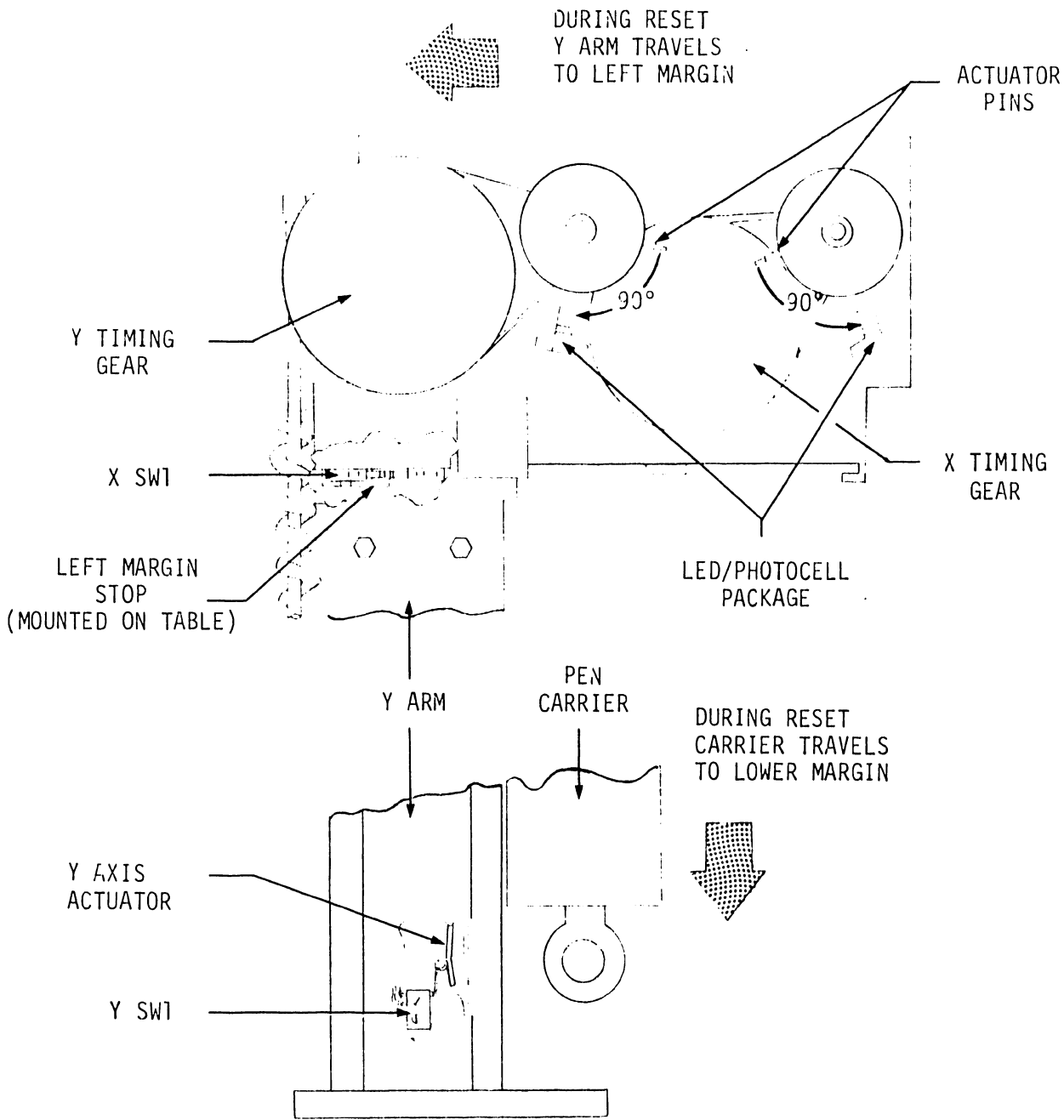


FIGURE 18  
HOME POSITION ALIGNMENT

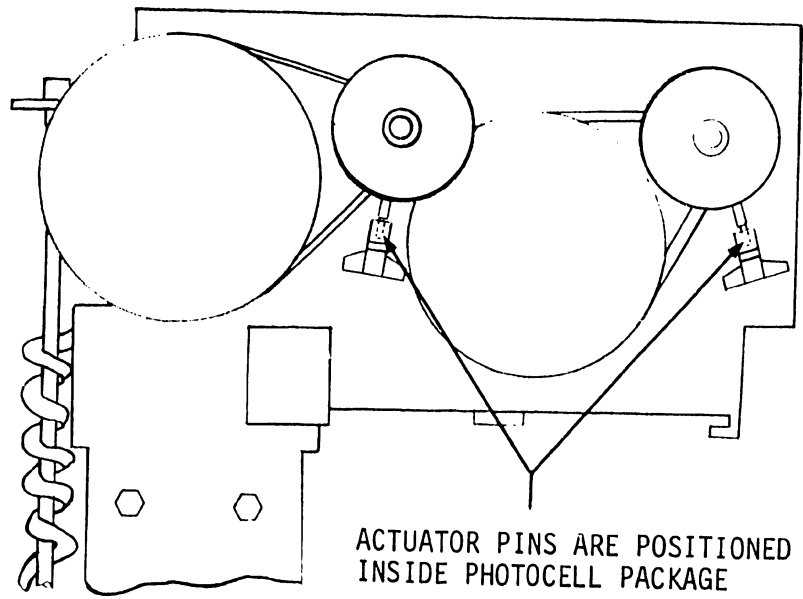


FIGURE 19

ACTUATOR PINS WHILE IN HOME POSITION

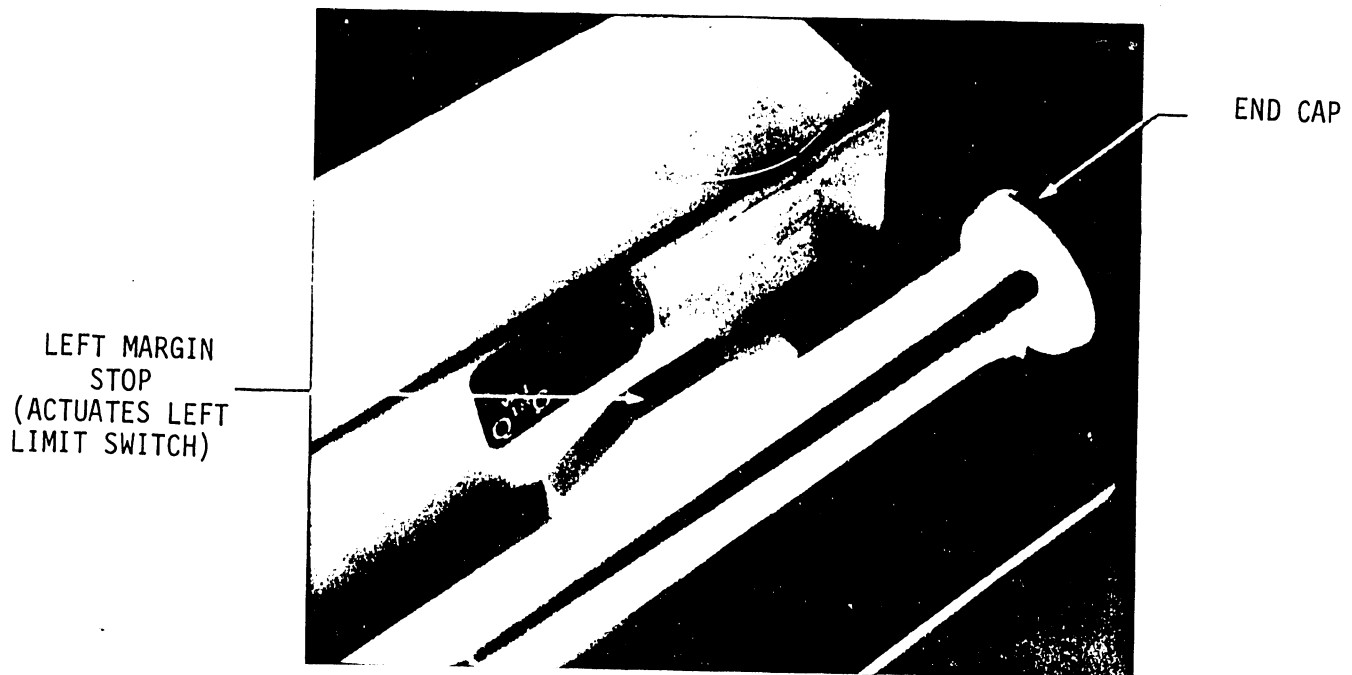


FIGURE 20

LEFT MARGIN STOP AND END CAP LOCATION



## 5.17 Y ARM REMOVAL AND REPLACEMENT

- 1) To remove the Y arm from the new table:
  - (a) Turn power off on the package and disconnect the Y arm cable.
  - (b) Remove end cap on X shaft.
  - (c) Remove stop bracket located at end of X axis runner (See Fig 21).
  - (d) Slowly slide arm and casting down to end of table (home position).
- 2) To remove the Y arm from the old table, follow all steps in 5.17 1) except for step (c). Change to: remove reinforcing bracket that runs the length of the Y axis at the end of table (home position) by removing the three thumb screws on inside edge of reinforcing bracket.
- 3) To replace the Y arm, reverse the procedures in 5.17 1) or 2). When completed, see Section 5.16 to realign the X home position. This is necessary since the pinion gear is moved with respect to the left margin.

STOP BRACKET



FIGURE 21

## 5.18 Y ARM AND TABLE COMPATIBILITY

When replacing a Y arm on a table, insure that the Y arm mount casting is the correct size for the table.

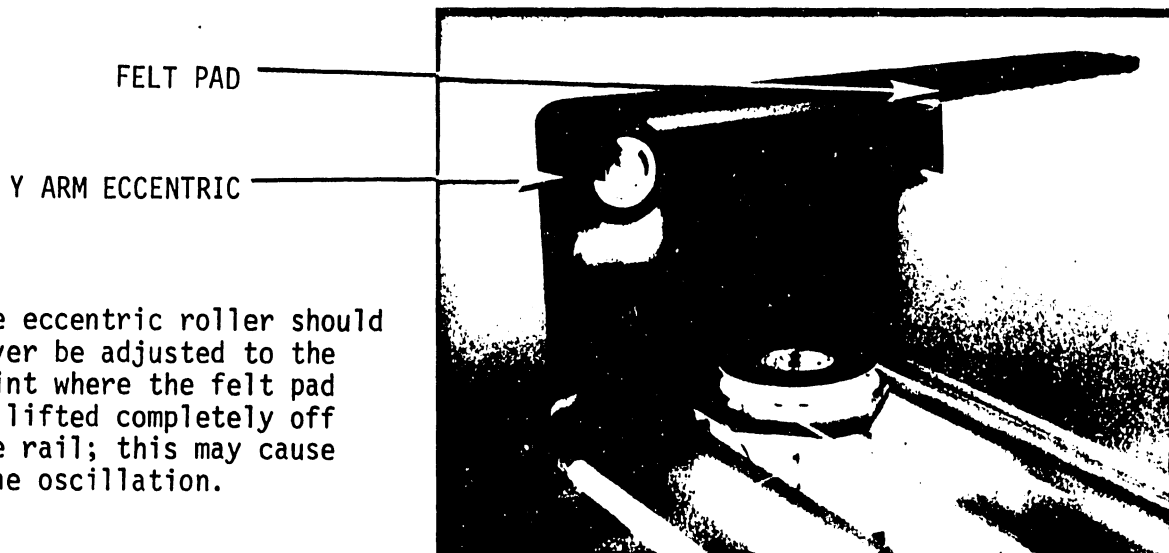
### CONDITIONS

- 1) If the table is of honeycomb construction, a Y arm with a large casting must be used.
- 2) If the table is not of honeycomb construction, a Y arm with a small casting must be used.

The Y arm casting is increased in thickness for the larger honeycomb table. The honeycomb table can be identified by its light green plotting surface and thin construction.

## 5.19 Y ARM ECCENTRIC (See Figure 22)

Located on the reverse side of the Y arm casting are a guide pad and nylon roller mounted on an eccentric. The roller should be adjusted so that minimum line separation and oscillation are present. The roller controls the weight distribution of the Y arm.



NOTE : The eccentric roller should never be adjusted to the point where the felt pad is lifted completely off the rail; this may cause line oscillation.

FIGURE 22

6. ELECTRICAL ADJUSTMENTS - See *Service Bulletin 44*.

7. ACCESSORIES OF THE MODEL 32A

The following accessories are enclosed with each plotter:

- 1) Pen stand
- 2) Ball point pen housing
- 3) Ink pen housing
- 4) Fiber tip pen housing
- 5) Black ball point pen
- \*6) Plotting point pen MARS 757-PL3-C3
- 7) Package of 5 black fiber tip pens
- 8) 8 oz. bottle blank ink MARS 747-25T
- 9) 8 oz. bottle pen cleaner MARS 746-25
- 10) 6 magnets and plates

#### Paper Recommendations

- 1) Tracing paper - 100% rag vellum
- 2) Mylar - Formulated for ink
- 3) Acetate - Treated for ink

\*The MARS pen is the only pen that will fit the ink pen housing.

#### Ink Recommendations

- 1) For paper - Waterproof ink #745-9  
Source - J.E. Staedler, Montville, NJ
- 2) For mylar and acetate - Waterproof ink #747-T  
Source - Same as above.

8. DIAGNOSTICS - See *Service Bulletin 44*.
9. PREVENTIVE MAINTENANCE PROCEDURES - See *Service Bulletin 44*.
10. CONVERSION FROM MODEL 32 TO 32A

The following is the procedure when replacing an old carrier assembly with the new style.

- 1) Remove Y arm from table as per Section 5.17.
- 2) Remove locking nuts and tension screw from front of carrier assembly (screw is connected to cable).
- 3) Remove end screw located at rear of carrier assembly (screw is connected to cable).
- 4) Position the ends of the cable so that the cable will not unwind from the drum (keep equal tension on both ends).
- 5) Remove guide rod located next to and parallel to the Y arm.
- 6) Remove Y arm mount casting.
- 7) Remove bakelite cover of Y arm.
- 8) Remove end pulley and bracket together.
- 9) Remove carrier assembly.

- 10) Two holes must be drilled in the Y arm for access to the eccentrics used to mount the new carrier assembly. Refer to Figure 23 for dimensions. The holes must be  $5/16"$  (.79 cm) or larger. The first center is located 3.5" (8.89 cm) from the end of the Y arm. The next center is 3.81" (9.68 cm) from the first. Both centers are .56" (1.42 cm) from the center line of the Y arm.
- 11) Install new carrier assembly.
- 12) Tighten the two eccentric controlled roller bearings against the guide bar.
- 13) Adjust preload bearing tension to 2 lbs  $\pm$  1/4 lb. Refer to Figure 24.
- 14) Reverse procedure from step 8.
- 15) To replace Y arm on table, see Section 5.17.

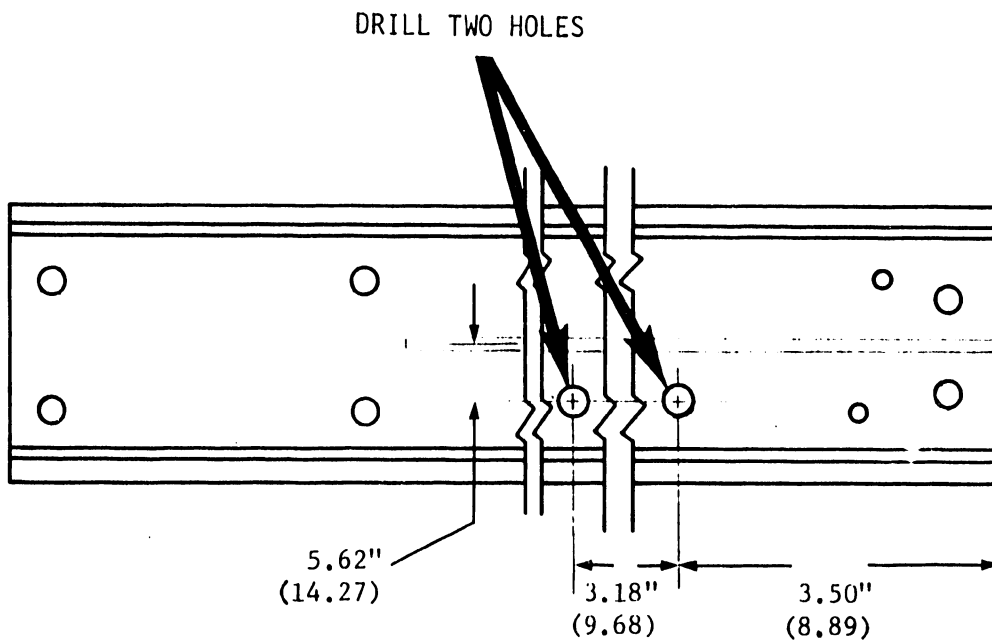
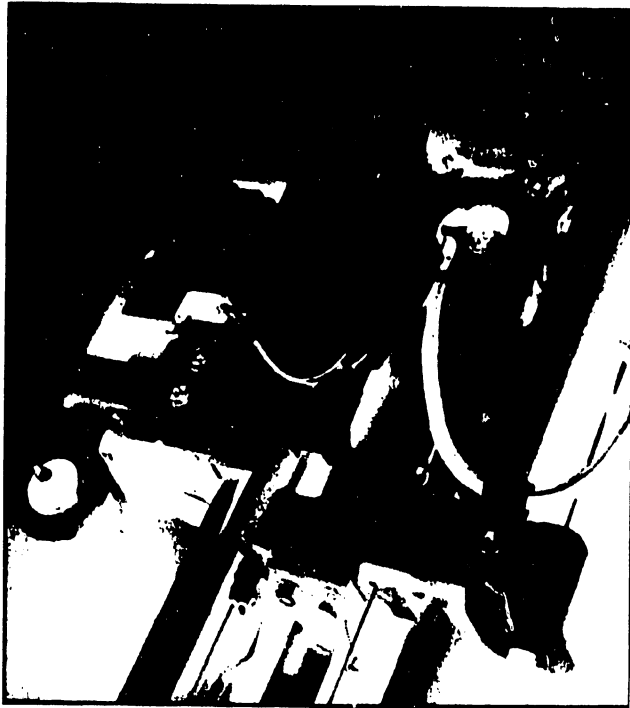


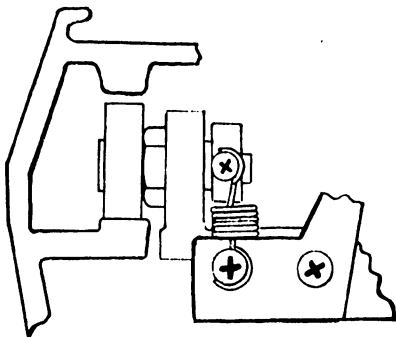
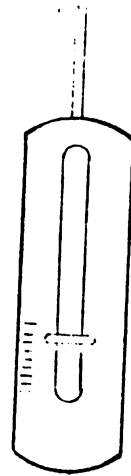
FIGURE 23



ADJUSTING  
SCREW

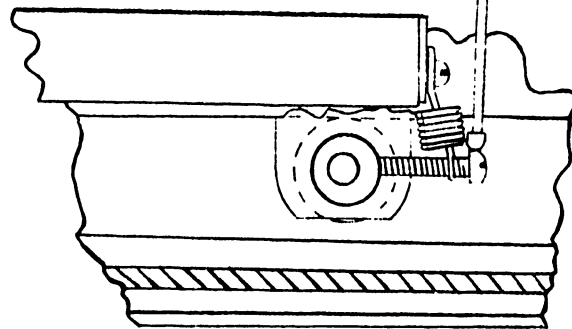
BEARING  
AND  
ROLLER

SCREW SHOULD  
JUST MOVE AT  
2 LBS  $\pm$  4 OZS



ECCENTRIC  
STUD

LOAD  
SPRING



COLLAR

ADJUSTING  
SCREW

FIGURE 24

## MODELS 2232A AND 2232B - DIFFERENCES

The stepping logic in the Model 2232A Digital Flatbed Plotter has been redesigned to improve plotting resolution. The improved version of this plotter is designated 2232B. It is important to note that the 2232B is not a simple engineering change, but a complete electronic redesign of the 2232A. Also note that the 2232B has a slower reset speed than the 2232A, yet the plotting speed is unchanged.

The A and B versions of the Model 2232 differ only electronically. The 6289 and 6337 PCBs of the A version were replaced by 7089 and 7088, respectively, in the B version. These pc board pairs must not be mixed.

### NOTE:

A customer having a Model A plotter should continue to use the Model A electronics unless a conversion is made through the sales division.

## 11. MODEL 32 AND 32A ASSEMBLY DRAWINGS

All assembly drawings for both plotters are contained in this section. Refer to Figures 25 and 26 for the breakdown of the drawings. The base number for Model 32 drawings is 6403-XX and the 32A number is 6617-XX. The drawings are reproduced to help identify mechanical parts for ordering purposes.

The following is the order in which the assembly drawings are arranged in this section:

DRAWING #	MODEL	PAGE
E6403-225	32	33
E6403-223	32	34
E6403-224 sheet 1 of 2	32	35
D6403-224 sheet 2 of 2	32	36
D6403-219	32	37
C6403-222	32	38
C6403-221	32/32A	39
E6403-215	32/32A	40
B6403-211	32/32A	41
B6403-209	32/32A	42
B6403-212	32/32A	43
C6403-184	32/32A	44
B6403-162	32/32A	45
B6403-210	32/32A	46
B6403-218	32/32A	47
E6617-67	32A	48
E6617-56	32A	49
E6617-66 sheet 1 of 2	32A	50
D6617-66 sheet 2 of 2	32A	51
D6617-61	32A	52
C6617-65	32A	53
D6617-53	32A	54
C6617-52	32A	55
B6617-57	32A	56
D6617-54	32A	57
C6617-51	32A	58
D6617-55	32A	59



MODEL 32 ASSEMBLY DRAWINGS

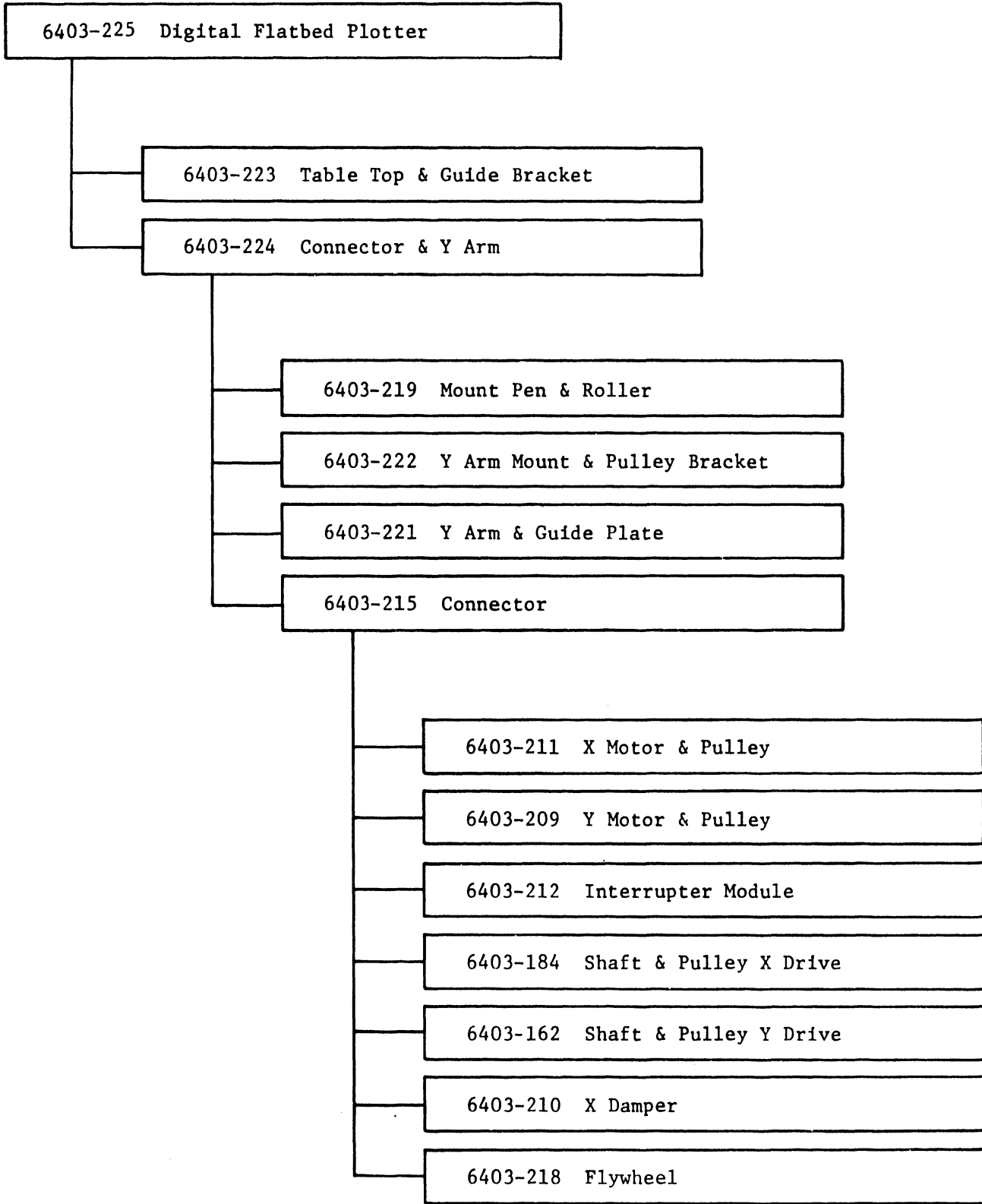


FIGURE 25

# MODEL 32A ASSEMBLY DRAWINGS

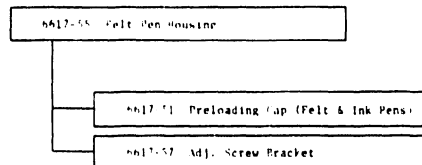
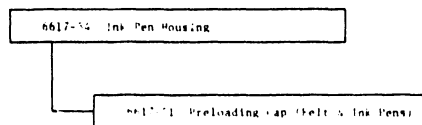
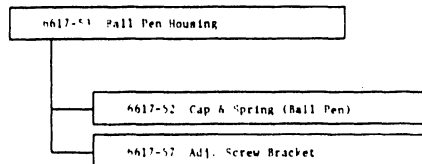
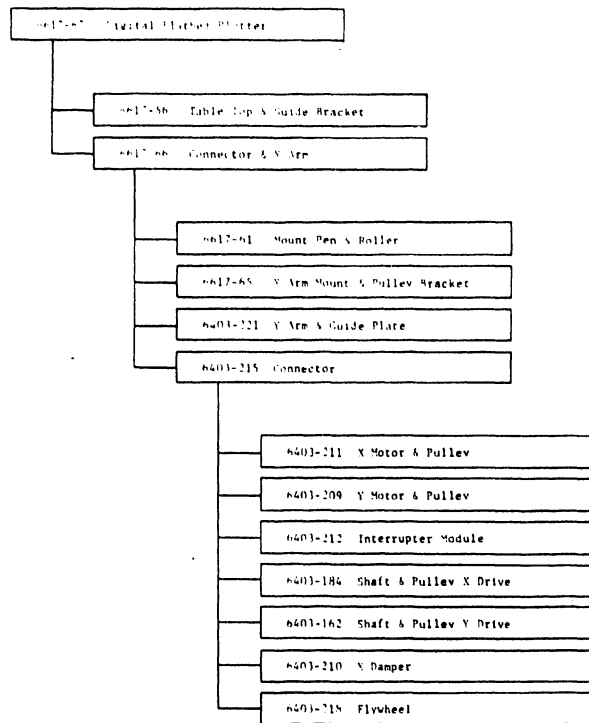
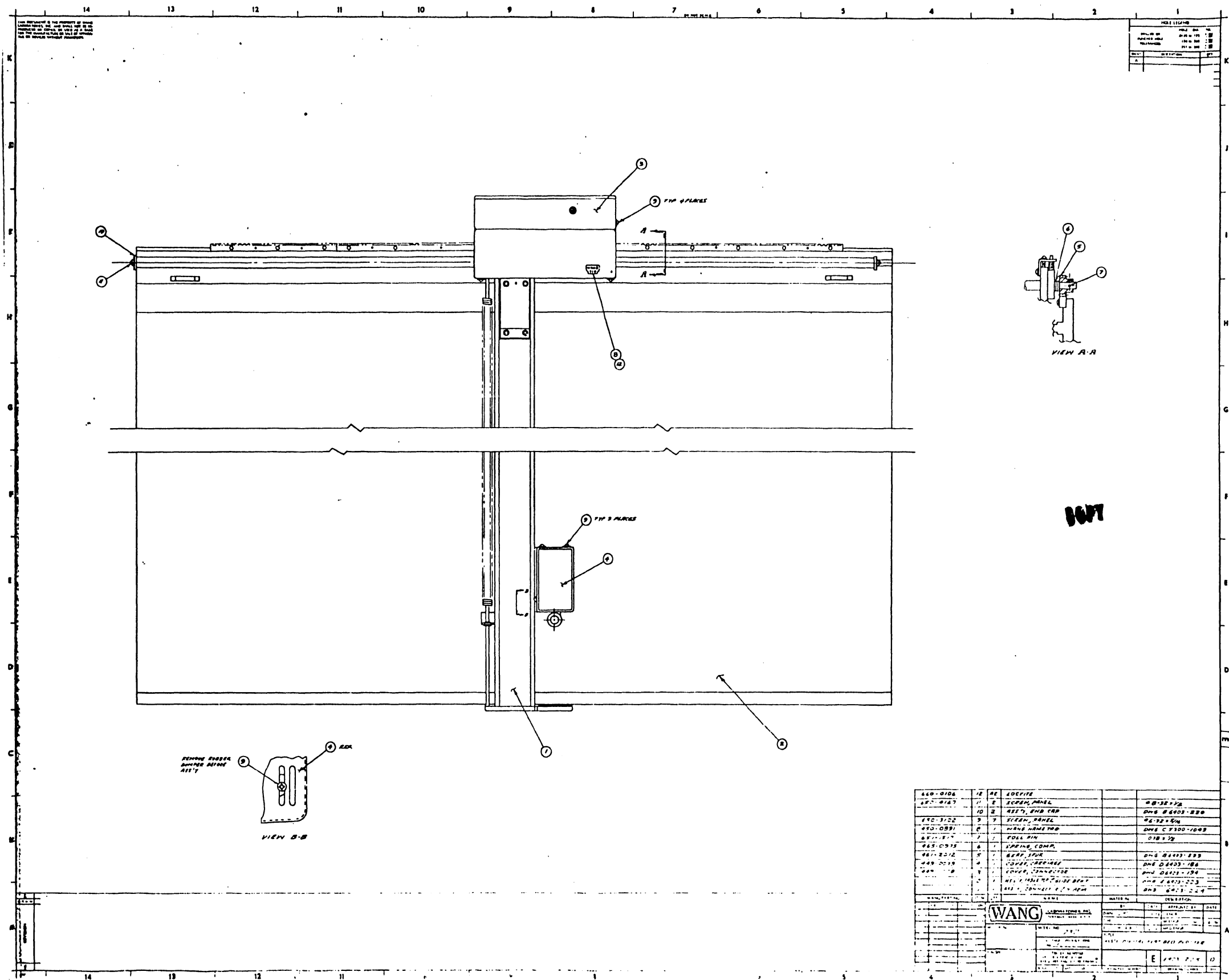
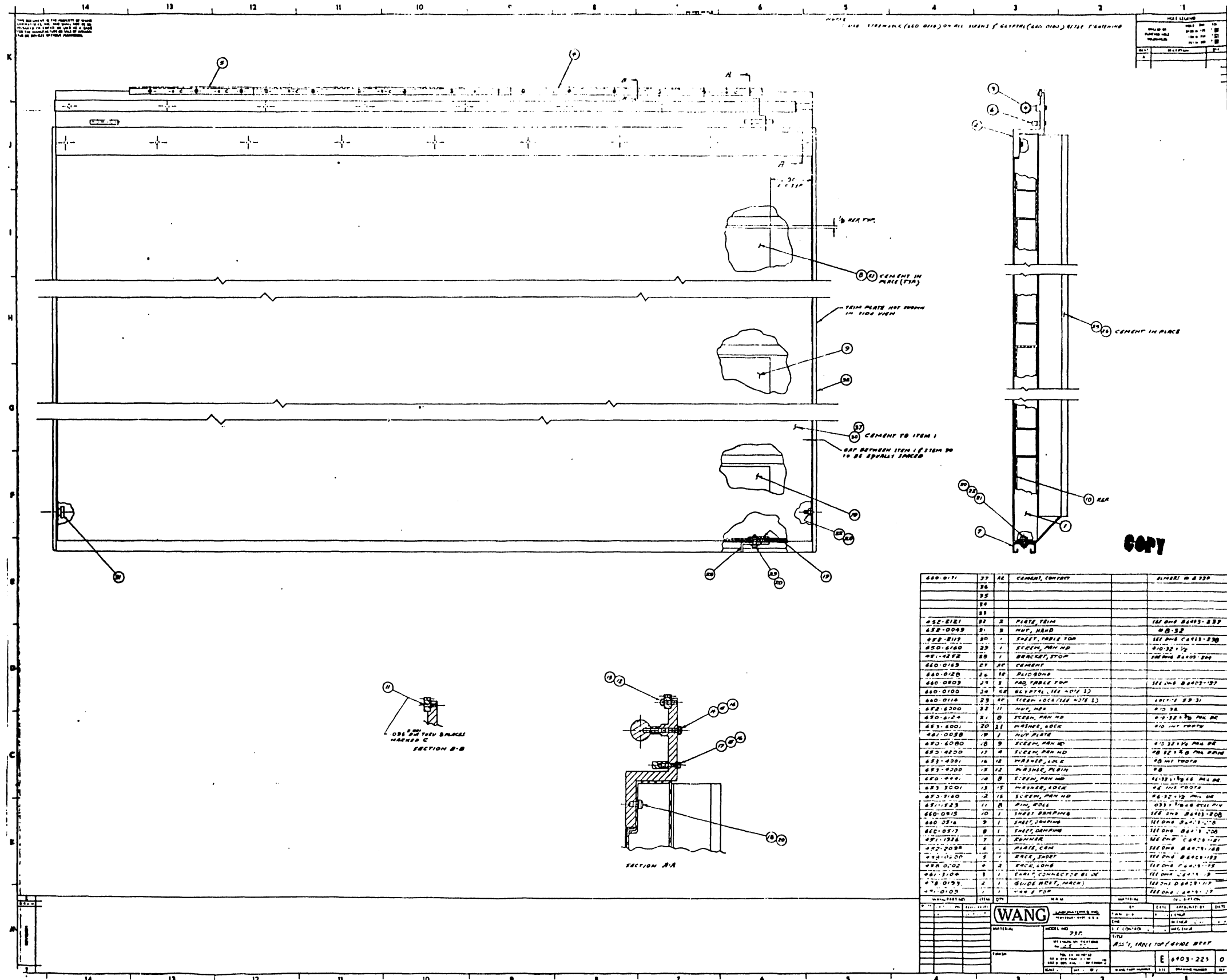


FIGURE 26



REV.	DESCRIPTION	DATE
1		
2		

QTY	DESCRIPTION	DATE
12	LOCITE	
11	SCREEN, PANEL	#B-32-72
10	ASST, END CAP	DWG B 6403-220
9	SCREEN, PANEL	#C-32-54
8	WAVE WINDING	DWG C 7300-1003
7	ROLL PIN	O18 x 1/2
6	SPRING, COMP.	
5	WAVE, SPAC.	DWG B 6403-223
4	COIL, SPRING	DWG D 6403-188
3	WAVE, CONNECTOR	DWG D 6403-184
2	WAVE, CONNECTOR	DWG D 6403-184
1	WAVE, CONNECTOR	DWG D 6403-184

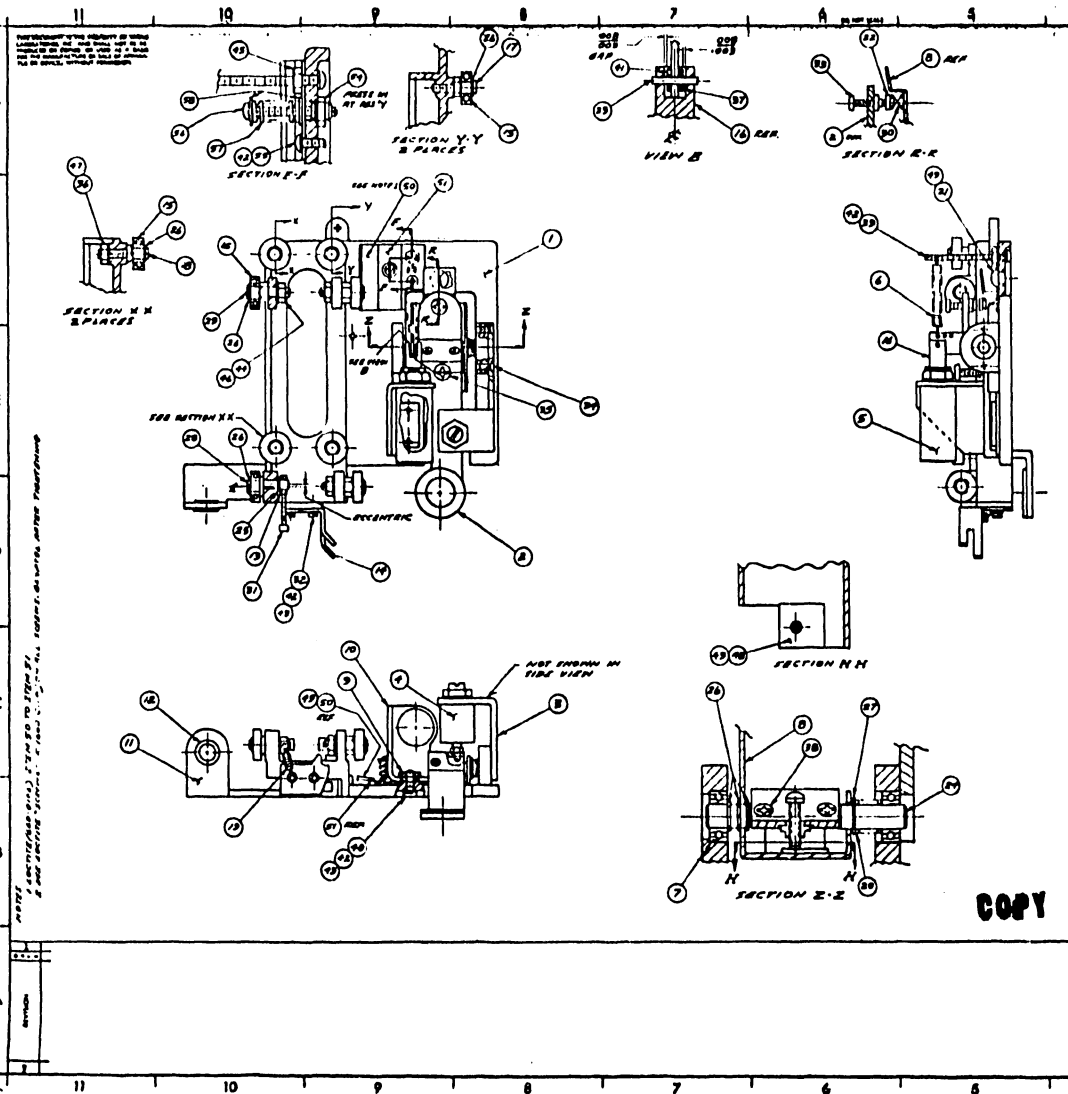


COPY

ITEM NO.	QTY	DESCRIPTION	UNIT	REMARKS
440-0171	27	CEMENT, PORTLAND	ALBERT W 2 250	
440-0172	26			
440-0173	25			
440-0174	24			
440-0175	23			
440-0176	22	PIECE, TRIM	SEE DWG 0403-230	
440-0177	21	NUT, HARD	# 8-32	
440-0178	20	WASHER, FLAT	SEE DWG 0403-230	
440-0179	19	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0180	18	SCREEN, STOP	20 1/2 X 1 1/2	
440-0181	17	CEMENT		
440-0182	16	ALUMINUM		
440-0183	15	PAV. TABLE TOP	SEE DWG 0403-230	
440-0184	14	ALUMINUM, SEE NOTE 1		
440-0185	13	SCREEN, LOCK (SEE NOTE 1)	20 1/2 X 1 1/2	
440-0186	12	NUT, HARD	# 10-32	
440-0187	11	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0188	10	WASHER, LOCK	# 10-32	
440-0189	9	NUT PLATE		
440-0190	8	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0191	7	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0192	6	WASHER, LOCK	# 10-32	
440-0193	5	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0194	4	WASHER, LOCK	# 10-32	
440-0195	3	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0196	2	WASHER, LOCK	# 10-32	
440-0197	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0198	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0199	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0200	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0201	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0202	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0203	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0204	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0205	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0206	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0207	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0208	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0209	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0210	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0211	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0212	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0213	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0214	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0215	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0216	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0217	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0218	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0219	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0220	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0221	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0222	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0223	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0224	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0225	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0226	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0227	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0228	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0229	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0230	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0231	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0232	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0233	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0234	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0235	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0236	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0237	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0238	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0239	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0240	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0241	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0242	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0243	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0244	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0245	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0246	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0247	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0248	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0249	1	SCREEN, PAN NO	20 1/2 X 1 1/2	
440-0250	1	SCREEN, PAN NO	20 1/2 X 1 1/2	







425-0000	50	2	WASHER, FLAT		#0
445-0084	57	1	SPRING, COMP		
440-0240	58	1	SCREEN, PAN HD		B 373 3/4 X 4
440-0390	59	1	SCREEN, PAN HD		44-3210 40
445-0044	54	1	NUT, HEX		44-032 5
440-0700	51	RE	SCREW, T		
440-0704	52	RE	SCREW, T		
445-0385	51	1	SPRING, BEAVE		DWG B 4403-216
440-0521	50	1	THRO. BEAKE		DWG B 4403-217
440-0704	49	RE	SCREW, T		
440-0514	48	1	WAS. ADJUSTMENT SCRN		SEE DWG B 4403-207
445-0009	47	2	WASHER, LOCK		44-32 1/2 X 4
445-4001	46	3	WASHER, LOCK		#10 INT FOOTN
445-0000	45	1	NUT, HEX		#6-32
445-4000	44	3	NUT, HEX		#10-32
445-0000	43	4	WASHER, FLAT		#6
445-0001	42	6	WASHER, LOCK		#6
445-0001	41	1	WASHER, FLAT		#3
440-0760	40	3	SCREEN, PAN HD		#4-32 1 1/2 X 40
440-0322	39	1	SCREEN, PAN HD		#4-32 1 1/2 X 4
440-0322	38	2	SCREEN, PAN HD		44-32 1 1/2 X 4
445-0107	37	RE	WASHER, SHIM		1/2 X 1/4 X .002
445-0042	36	2	NUT, MET USM		1/2 X 28 1/2 THK.
440-4200	35	1	SCREEN, PAN HD		#4-32 1 1/2 X 4
440-0761	34	3	SCREEN, PAN HD		#4-32 1 1/2 X 4
440-4240	33	1	SCREEN, PAN HD		#4-32 1 1/2 X 4
440-0764	32	2	SCREEN, SOC HD CAP		#4-32 1 1/2 X 4
445-0242	31	1	SCREEN, SOC HD CAP		#4-40 1 1/2 X 4
445-0382	30	1	SPRING, PEN ARM FEELNG		SEE DWG B 4403-202
445-0204	29	3	STUD, BR		SEE DWG B 4403-171
445-0104	28	1	STUD, BR. TRACE UP		SEE DWG B 4403-122
445-1713	27	1	RING, SHAP		5133-25
445-1713	26	1	RING, SHAP		5133-25
445-1712	25	1	RING, SHAP		5133-18
445-0107	24	1	SHAP, PAN ARM		SEE DWG B 4403-180
445-1723	23	1	ROLL PIN		1/2 X 1/4 X 40
445-0022	22	1	NUT, HEX		#2 X 32
445-0211	21	1	BUMPER, RUBBER		
445-0380	20	1	SPRING, COMP		
445-0318	19	1	SPRING, EXTENSION		
445-0201	18	2	STUD, BR (SHAP AND BEE)		SEE DWG B 4403-125
445-0202	17	2	STUD, BR (SHAP AND BEE)		SEE DWG B 4403-124
445-1702	16	1	PLUNGER, SOLENOID		SEE DWG B 4403-5
445-0009	15	8	BEARING, BALL		SC 444
445-4212	14	1	BRKT ACTUATOR		SEE DWG C 4403-102
445-0409	13	1	COLLAR		
445-0708	12	1	BUSHING, NYLONIC		TYPE Y 5/4 X 22
445-4212	11	1	BRKT, PULSER		SEE DWG C 4403-180
445-4213	10	1	SOLENOID BRACKET		SEE DWG B 4403-140
445-0054	9	1	NUT, PLATE		SEE DWG B 4403-220
445-0008	8	1	ARM, PEN ACTUATOR		SEE DWG C 4403-170
445-0070	7	2	BEARING, BALL		SC 180 H H
445-0321	6	1	SPRING, EXTENSION		
445-0004	5	1	SOLENOID		
445-0222	4	1	DRAINOFF		
445-4214	3	1	BRKT, DRAINOFF MTD		SEE DWG B 4403-170
445-0008	2	1	ARM, PEN ARM		SEE DWG B 4403-221
445-0001	1	1	MOBNT CHAS. (COLLECTOR)		SEE DWG C 4403-102

COPY

NO.	REV.	DATE	BY	CHKD.	APP'D.	DATE	REV.	DATE	BY	CHKD.	APP'D.
1	1	12/15/52	WANG								

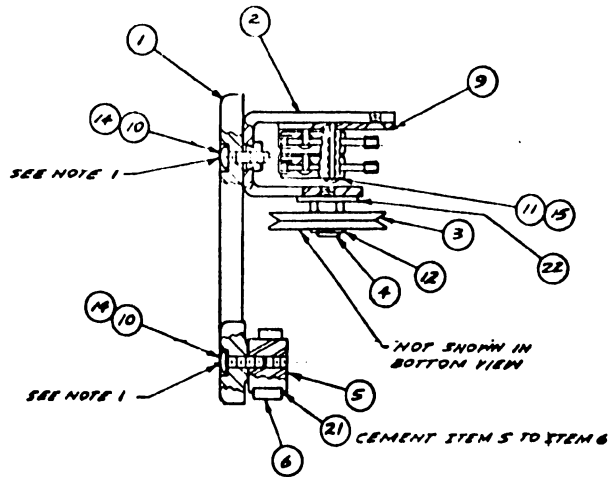
**WANG** CORPORATION  
 MODEL NO. 732  
 TITLE: PEN MOUNT PIN ROLLER  
 PART NO. D 6403-215  
 DATE: 12/15/52

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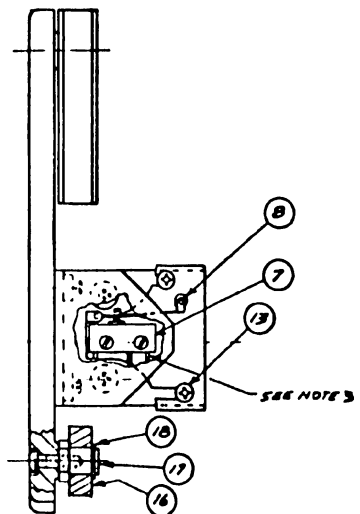
60 NOT KAN

- NOTE  
 1. RUBBER BUMPER REMOVED FROM PANEL SCREENS  
 2. USE LOCTITE "SCREENLOCK" ON ALL SCREENS GLYPOL AFTER TIGHTENING  
 3. MICRO SWITCH TERMINALS TO BE POSITIONED AS SHOWN

HOLE LEGEND		
DRIILLED OR PUNCHED HOLE	HOLE DIA.	TOL.
	Ø.125 ± .003	± .002
	Ø.136 ± .004	± .002
	Ø.151 ± .005	± .002



**COPY**



653-6018	22	1	WASHER	3/16 ID X 3/4 OD X 1/8 THK
660-0106	21	NR	LOCTITE	
660-0100	20	NR	GLYPOL	
660-0114	19	NR	LOCTITE "SCREENLOCK"	
651-1732	18	1	RING, RESTRAINING	TEURAC 5133-31
461-3127	17	1	STUD, ROLLER	SEE DNG B 6403-213
461-3128	16	1	ROLLER, MOUNT YARM	SEE DNG B 6403-214
653-0990	15	2	WASHER, LOCK	#2 INT TOOTH
653-9001	14	4	WASHER, LOCK	#8 INT TOOTH
650-2082	13	2	SCREW, FLAT HD	#4-40 X 1/4 LG
651-1727	12	1	RING, CRESCENT	5103-25
650-0200	11	2	SCREW, PAN HD.	#2-56 X 5/8 LG
650-4167	10	4	SCREW, PANEL	#8-32 X 1/2 LG
452-2087	9	1	PLATE, SWITCH MTE	SEE DNG B 6403-143
325-9044	8	2	ACTUATOR	JS-246
325-2907	7	2	SWITCH	BURGESS V4T-7
660-0512	6	1	PAD, GLIDE	SEE DNG. B 6403-200
461-1525	5	1	GLIDE, YARM	SEE DNG B 6403-143
478-0198	4	1	STUD, PULLEY	SEE DNG B 6403-153
		3	ASS'Y, PULLEY & BRG.	SEE DNG B 6403-172
451-4218	2	1	BRKT, PULLEY MTE	SEE DNG C 6403-183
450-0092	1	1	INDENT, YARM MACHINING	SEE DNG C 6403-120

REV	DESCRIPTION

QTY	FIRST USED ON	ASSY USED ON	WANG LABORATORIES, INC. <small>LABORATORY MADE U.S.A.</small>		BY	DATE	APPROVED BY	DATE
1	6403-222	6403-222	<b>WANG</b> LABORATORIES, INC. <small>LABORATORY MADE U.S.A.</small>		DWN HT	6-18-57	E ENGR	
					CHR		M ENGR	
			MATERIAL	MODEL NO	E C CONTROL			
				732	MEG ENGR			
			FINISH	TOL EX AS NOTED <small>HR ± .010 FRAC ± 1/64          HR ± .005 ANG ± 1'30" FINISH</small>	TITLE			
					ASS'Y, YARM MOUNT & PULLEY BRKT			
			SCALE 1/1	SHT 1 OF 1	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
						C	6403-222	0

38

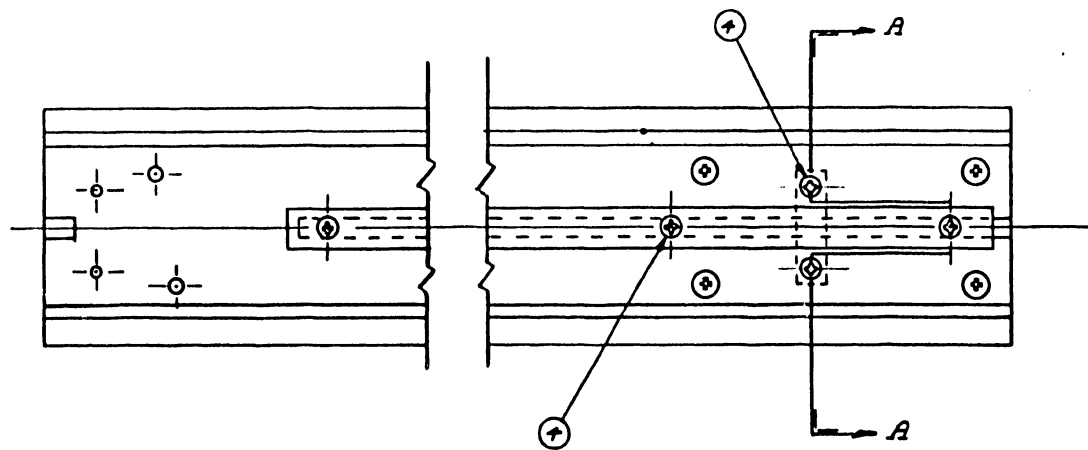
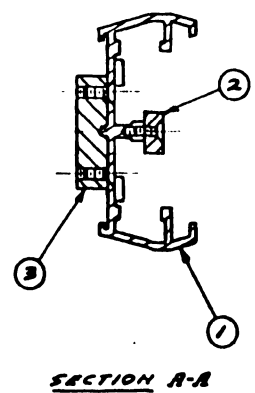


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NOTE  
1 USE LOCTITE "SCREW LOCK" ON ALL SCREWS  
GLYPTOL AFTER TIGHTENING

HOLE LEGEND		
DRILLED OR PUNCHED HOLE TOLERANCES	HOLE DIA. Ø125 to 125 136 to 230 251 to 300	TOL. ±.001 ±.002 ±.003
IDENT	DESCRIPTION	QTY
A		

E  
D  
C  
B  
A



**COPY**

660-0100	6	AR	GLYPTOL		
660-0114	5	AR	LOCTITE, "SCREW LOCK"		
650-3121	4	13	SCREW, FLAT HD		#6-32 x 3/8 LG.
452-2036	3	1	PLATE, ADJUSTMENT		SEE DWG B 6403-146
461-0089	2	1	GUIDE PLATE		SEE DWG B 6403-140
478-0132	1	1	ARM, Y MACHINING		SEE DWG D-6403-118
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
DATE	FIRST USED ON	ASSY USED ON	<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin-right: 5px;"><b>WANG</b></div> <div style="font-size: small;">LABORATORIES, INC. TELEPHONE: 688-5100</div> </div>		
1	21433-224	36433-224			
			MATERIAL	MODEL NO	732
			ME INGRS SPECIFICATIONS No. 55-1001		
			FINISH	TOL ER AS NOTED RR ± .018 FRAC ± 1/64 RFR ± .005 ANG ± 1'30" FINISH V	
			SCALE 1/1	WGT 1	QTY 1
			WANG PART NUMBER	SIZE	DESCRIPTION NUMBER
				C	6403-221 0

REV	DESCRIPTION
1	

7 6 5 4 3 2 1

39



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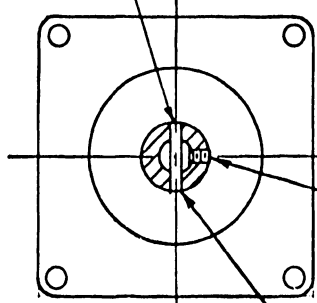
NOTES:

1. RELATIONSHIP OF FLAT ON ITEM 3 (PIN) TO ITEM 2 (PULLEY) MUST BE AS SHOWN.

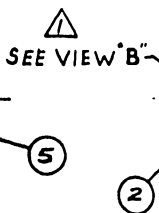
HOLE LEGEND

DRILLED OR PUNCHED HOLE TOLERANCES.	HOLE DIA.	TOL.
	0.133 to .125	± .001
	.126 to .250	± .001
	.251 to .500	± .001

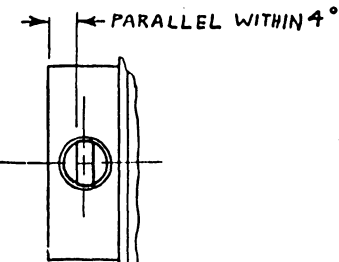
#46 (.081) DRILL THRU AT ASS'Y



SECTION X-X



SEE VIEW B



VIEW B ENLARGED N.T.S. SEE NOTE 1

WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
660-0114	5	AK	LOCTITE, SCREEN LOCK		
651-1517	4	I	PIN, ROLL		.078 x 1/2 LG.
461-3109	3	I	PIN, PHOTO CELL		SEE DWG B6403-159
478-0207	2	I	PULLEY, BLANK, X MOTOR		SEE DWG B6403-123
700-0005 M	1	I	MOTOR, STEP		

BY	DATE
2/1/68	2-3-74

REVISION	DATE	BY
1	4-17-74	W.F.M.

QTY.	FIRST USED ON	ASSY USED ON	BY	DATE	APPROVED BY	DATE
1	E4403-215	E4403-225	DWN	NY	E ENGR	6/7/73
			CHK		M ENGR	2-6-74



LABORATORIES, INC.  
TEWELSBURY, MASS. U.S.A.

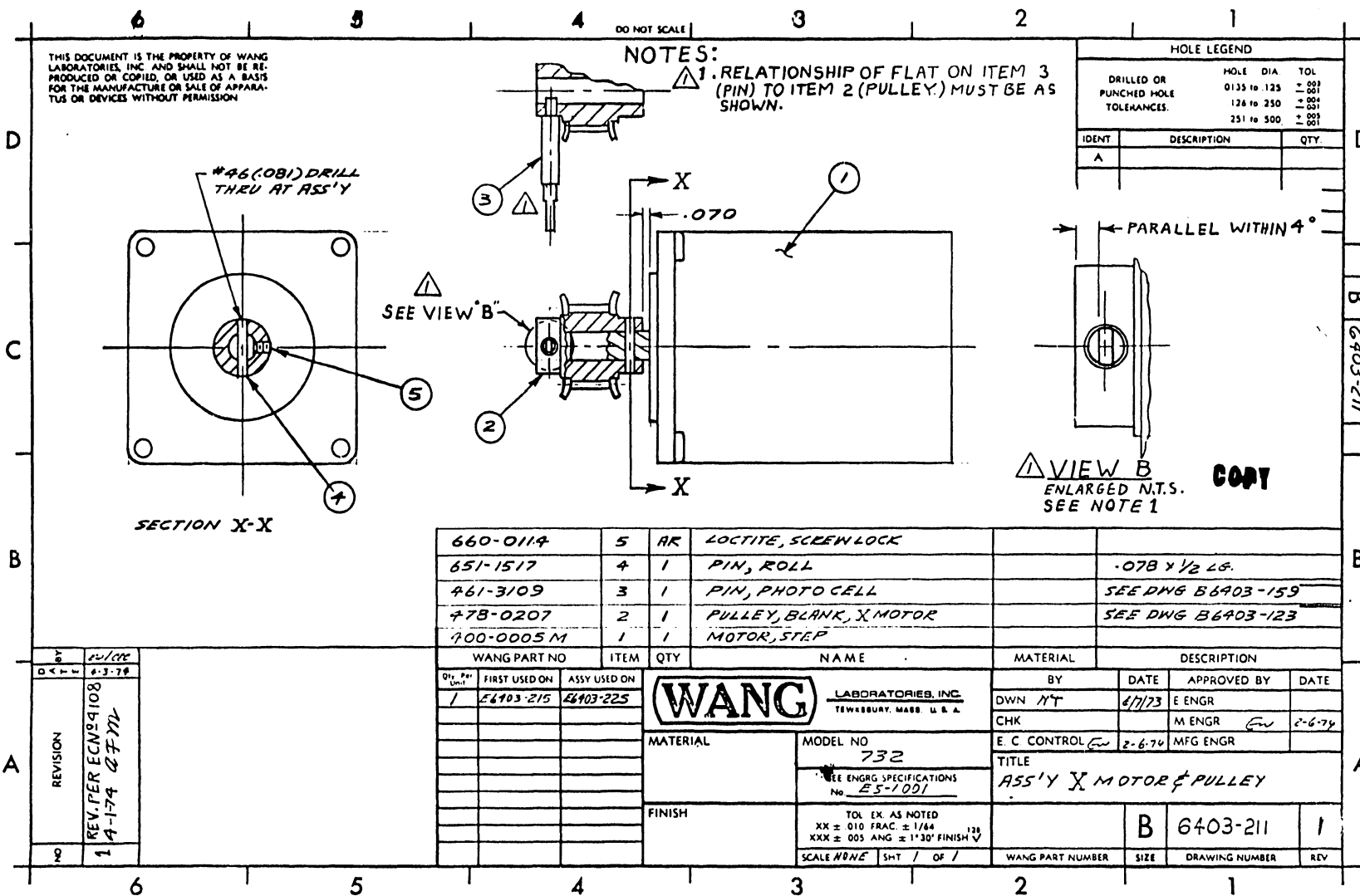
MATERIAL	MODEL NO
	732
	SEE ENGRG SPECIFICATIONS No. E5-1001
FINISH	TOL. EX. AS NOTED XX ± .010 FRAC ± 1/64 XXX ± .005 ANG ± 1'30" FINISH

TITLE	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
ASS'Y X MOTOR & PULLEY	B	6403-211		1

B 6403-211

A

41



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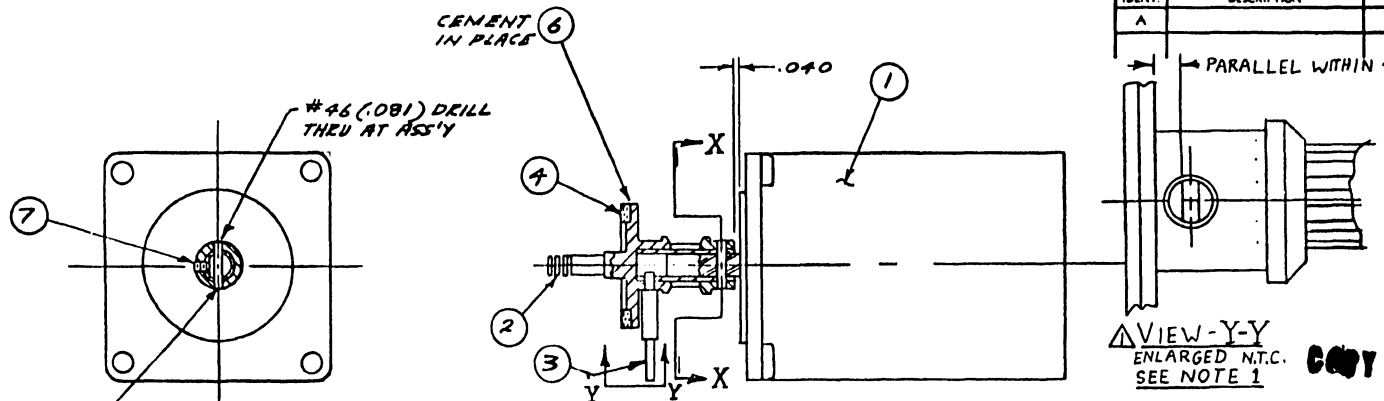
NOTES:

1. RELATIONSHIP OF FLAT ON ITEM 3 (PIN) TO ITEM 2 (PULLEY) MUST BE AS SHOWN

HOLE LEGEND

DRILLED OR PUNCHED HOLE	HOLE DIA.	TOL.
	0.135 to .125	+ .001
	.126 to .250	+ .001
	.251 to .500	+ .001

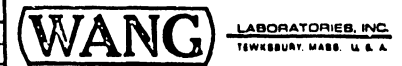
IDENT.	DESCRIPTION	QTY.
A		



WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
660-0114	7	AR	LOCTITE "SCREW LOCK"		
660-0106	6	AR	LOCTITE		
651-1517	5	1	PIN, ROLL		.078 DIA X 1/2 LG.
656-0006	4	1	CORK, ANNULUS		SEE DWG B 6403-187
461-3109	3	1	PIN, PHOTOCELL		SEE DWG B 6403-159
279-0051	2	1	ASS'Y, Y DRIVE PULLEY		SEE DWG. C 6403-126
400-0005M	1	1	MOTOR, STEP		

REV	DATE	BY
1	4-1-72	CPM
2	1-3-74	ECM

QTY	FIRST USED ON	ASSY USED ON
1	E 6403-215	E 6403-225



MATERIAL	MODEL NO
	732
FINISH	SEE ENGR SPECIFICATIONS No. ES 1001
	TOL EX AS NOTED XX ± 0.10 FRAC. ± 1/64 XXX ± 0.05 ANG. ± 1°30' FINISH ✓
SCALE 1/1	SHT 1 OF 1

BY	DATE	APPROVED BY	DATE
DWN M	6/6/73	E ENGR	
CHK		M ENGR	2-6-74
E. C. CONTROL	2-6-70	MFG ENGR	
TITLE ASS'Y, Y MOTOR & PULLEY			
	B	6403-209	1
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV.

4.2

B 6403-209

B

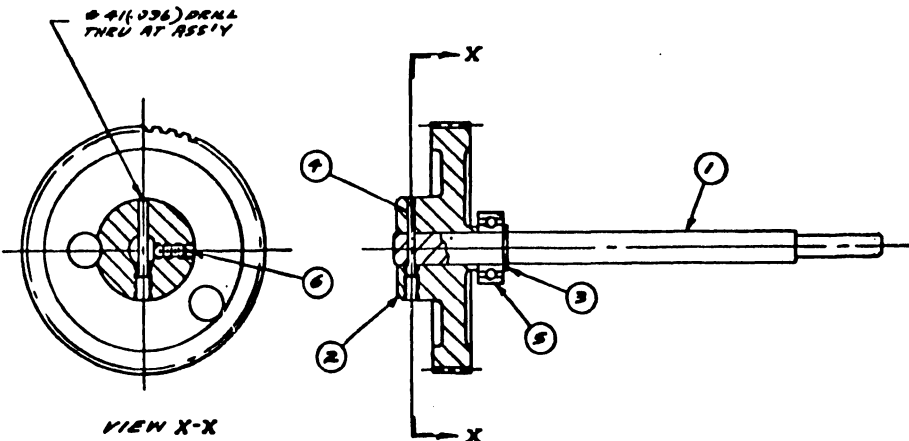
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NOTES  
 1. PRELOAD BALL BUSHING AGAINST SHARP RING BY USING ITEM 2, PULLEY X DRIVE. THEN DRILL PIN AS SHOWN

HOLE LEGEND		
DRILLED OR	HOLE DIA.	TOL.
FANCHED HOLE	Ø175 H 125	±.002
TOLERANCES	125 H 250	±.002
	251 H 500	±.002
IDENT	DESCRIPTION	QTY
A		

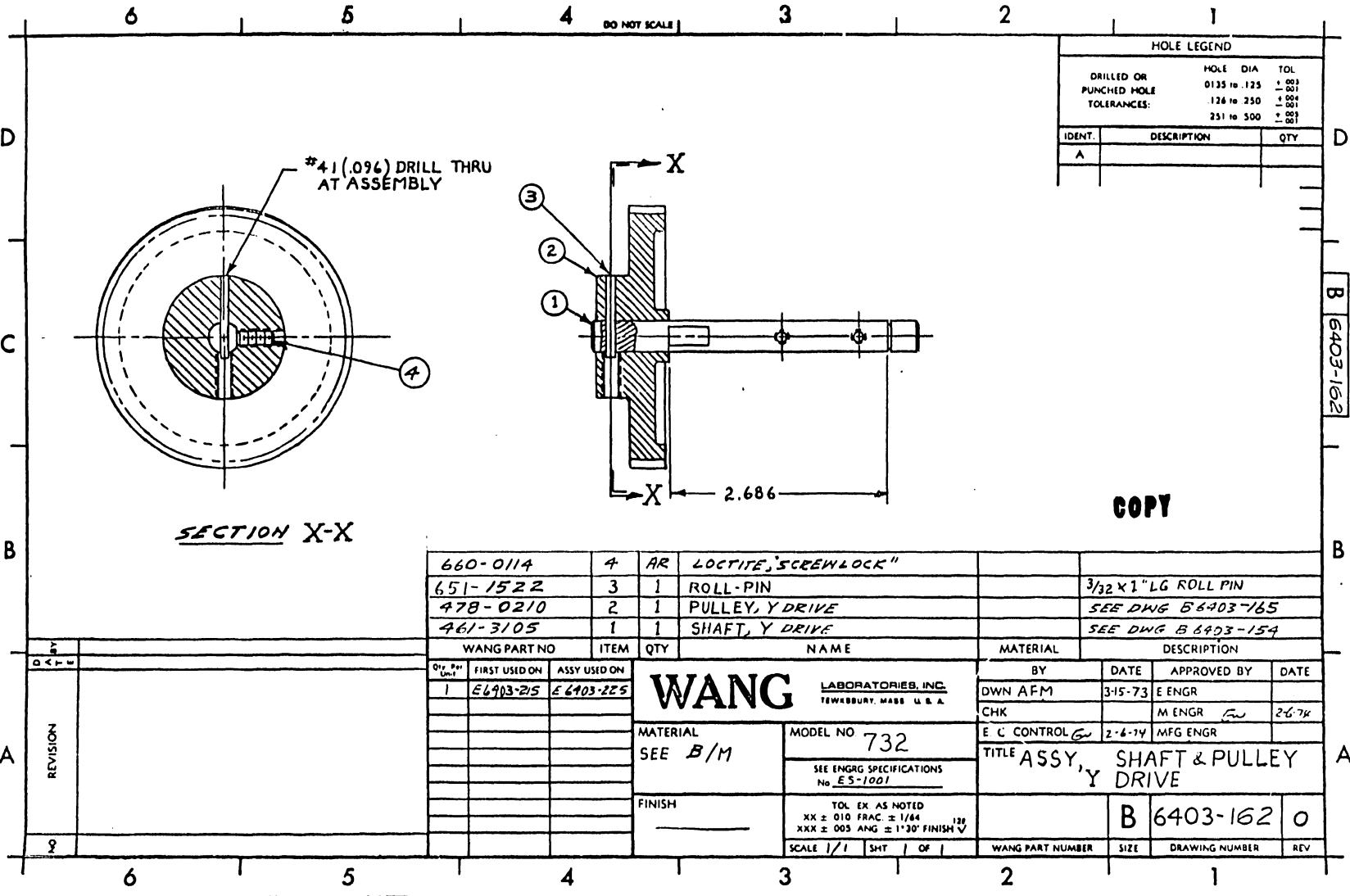


77

**COPY**

680-0114	6	12	LOCTITE, SCRELOCK®		
465-0008	5	1	BEARING, BALL		3/8 ID Y 20 OD
651-1522	4	1	PIN, ROLL		.093 X 1.00 LONG
651-1729	3	1	RING, SHAP		5103-37 (TRUARC)
478-0208	2	1	PULLEY, X DRIVE		SEE DWG C 6403-12B
461-3108	1	1	SHAFT, X DRIVE		SEE DWG B 6455-170
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
BY	DATE	APPROVED BY	DATE		
DWN WY	4/4/75	E ENGR			
CHK		M ENGR			
E C CONTROL		MFG ENGR			
<b>WANG</b> LABORATORIES, INC. TEMPERLEY MASS U.S.A.			MODEL NO	TITLE	
			732	ASS'Y, SHAFT, PULLEY X DRIVE	
			SEE ENG. SPECIFICATIONS NO. 25-7061		
FINISH			TOL. EX. AS NOTED	C 6403-184 0	
			Ø & Ø10 FRAC ± 1/64		
			Ø & Ø15 ANG ± 1' 30" FINISH		
SCALE 1/1			SHT 1 OF 1	WANG PART NUMBER	SIZE DRAWING NUMBER REV

REV	DATE	DESCRIPTION
1	10-21-75	11-23-75



45

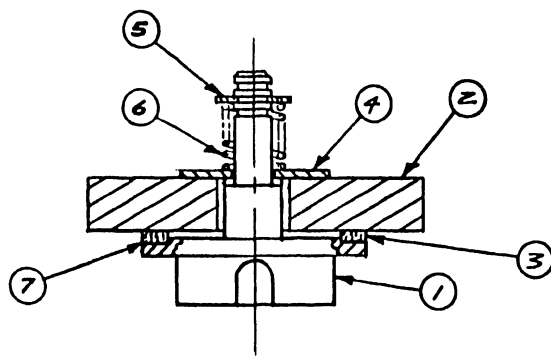
B 6403-162

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HOLE LEGEND		
DRILLED OR	HOLE DIA.	TOL.
PUNCHED HOLE	0135 to .125	± .001
	126 to .250	± .001
TOLERANCES:	251 to 500	± .001

IDENT	DESCRIPTION	QTY
A		



5097

660-0106	7	AR	LOCTITE		
465-0992	6	1	SPRING, COMP.		
651-1712	5	1	RING, RETAINING		5133-18
653-6004	4	1	WASHER, NYLON		#10
656-0006	3	1	CORK, ANNULUS		SEE DWG B6403-187
	2	1	ASS'Y, FLYWHEEL		SEE DWG B6403-218
465-1030	1	1	HUB, DAMPER X DRIVE		SEE DWG C6403-199

QTY	WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
1	6403-215	6403-225		<b>(WANG)</b> LABORATORIES, INC. TENNESSEEBURY, MADE U.S.A.		
				MATERIAL	MODEL NO	TITLE
					732	ASS'Y, X DAMPER
				FINISH	TOL. EX. AS NOTED XX ± 010 FRAC ± 1/64 XXX ± 005 ANG ± 1°30' FINISH V	
					SCALE 2/1 SHT 1 OF 1	

BY	DATE	APPROVED BY	DATE
DWN NY	6/11/73	E ENGR	
CHK		M ENGR	2-7-74
E C CONTROL SV	2-7-74	MFG ENGR	

B	6403-210	0
WANG PART NUMBER	SIZE	DRAWING NUMBER

REVISION	DATE
1	

97

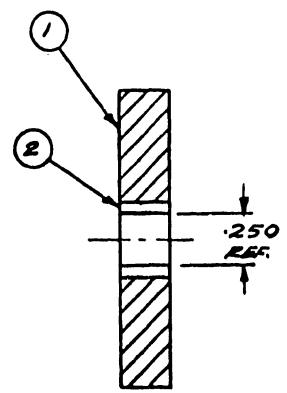


6 5 4 DO NOT SCALE 3 2 1

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HOLE LEGEND		
DRILLED OR PUNCHED HOLE TOLERANCES	HOLE DIA	TO
	0.135 to 125	± .01
	126 to 250	± .01
	251 to 500	± .01

IDENT	DESCRIPTION	QTY
A		



**COPY**

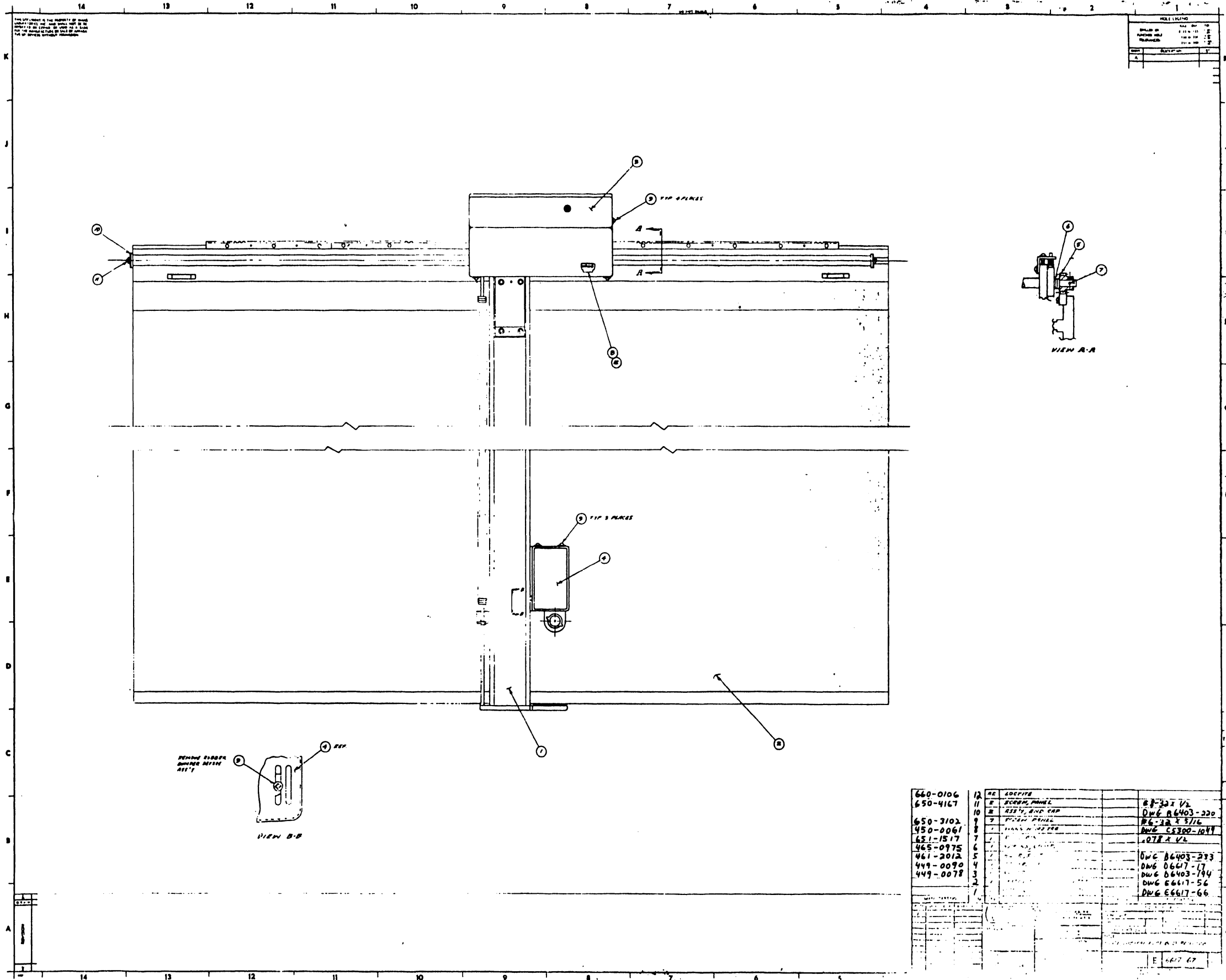
465-0216	2	1	BEARING, RULON	DRS 0406-2
465-1110	1	1	FLYWHEEL	SEE DWG B 6403-19B

QTY	WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
2	E6403-210	E6403-225		<b>WANG</b> LABORATORIES, INC. NEW URY, MASS U.S.A.	BY	DATE
	E6403-215	E6403-225			DWN NY	6-6-73
					CHK	M ENGR EW 2-6-74
				MATERIAL	E C CONTROL EW	MFG ENGR
				MODEL NO	TITLE	
				SEE B/M	732	ASS'Y, FLYWHEEL
				FINISH	SEE ENGRG SPECIFICATIONS No. E3-1001	
					TOL EX AS NOTED XX ± 010 FRAC ± 1/64 XXX ± 005 ANG ± 1'30" FINISH	
				SCALE 2/1	SHT 1 OF 1	WANG PART NUMBER
						B 6403-218
						0
						SIZE
						DRAWING NUMBER
						REV

6 5 4 3 2 1

47

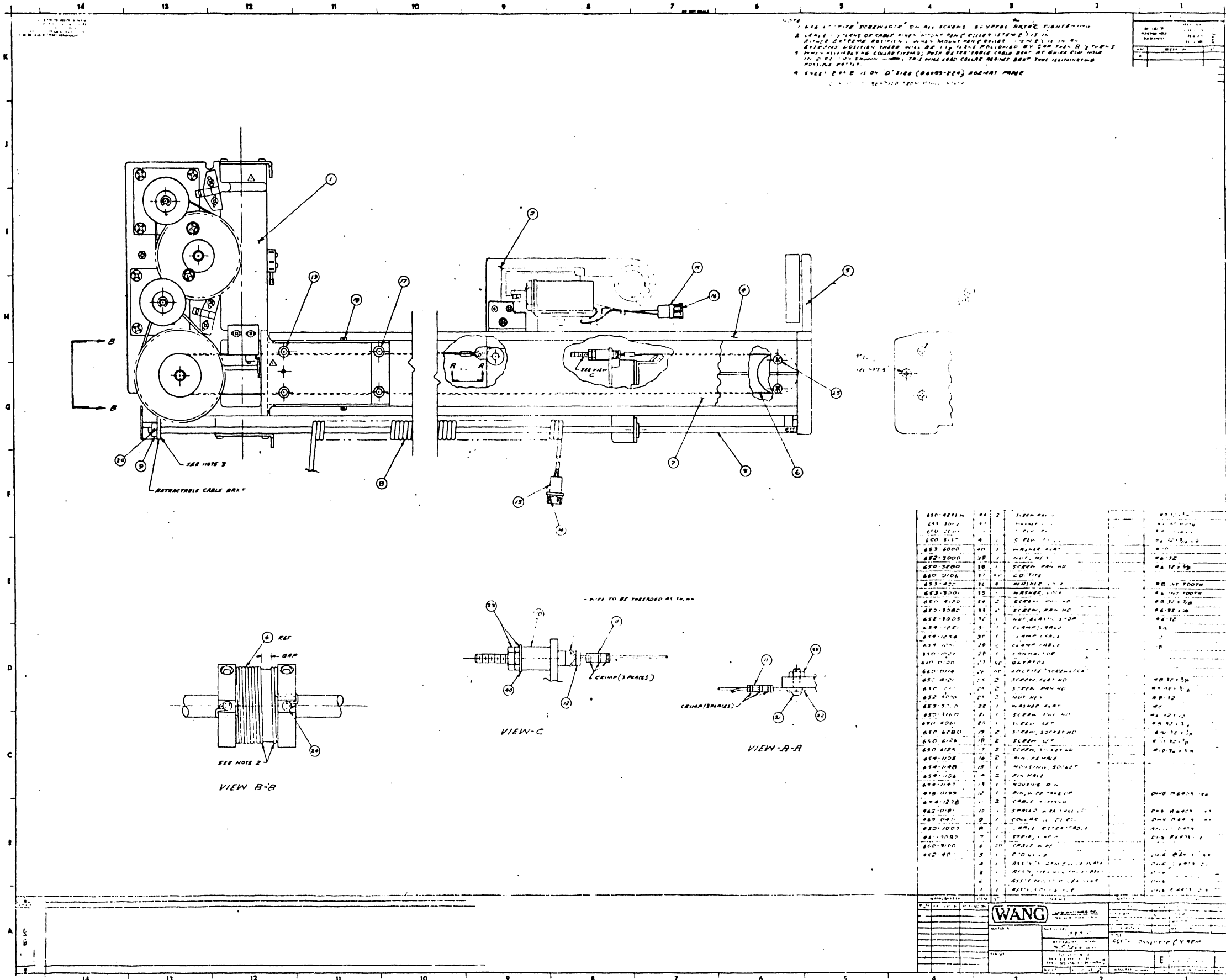
D  
C  
B  
A



REV. NO.		DATE	BY
1			
2			
3			
4			

660-0106	12	NO. 100718	
650-4167	11	NO. 100718	
650-3102	10	NO. 100718	
450-0061	9	NO. 100718	
651-1517	8	NO. 100718	
465-0975	7	NO. 100718	
461-2012	6	NO. 100718	
449-0090	5	NO. 100718	
447-0078	4	NO. 100718	
	3	NO. 100718	
	2	NO. 100718	
	1	NO. 100718	





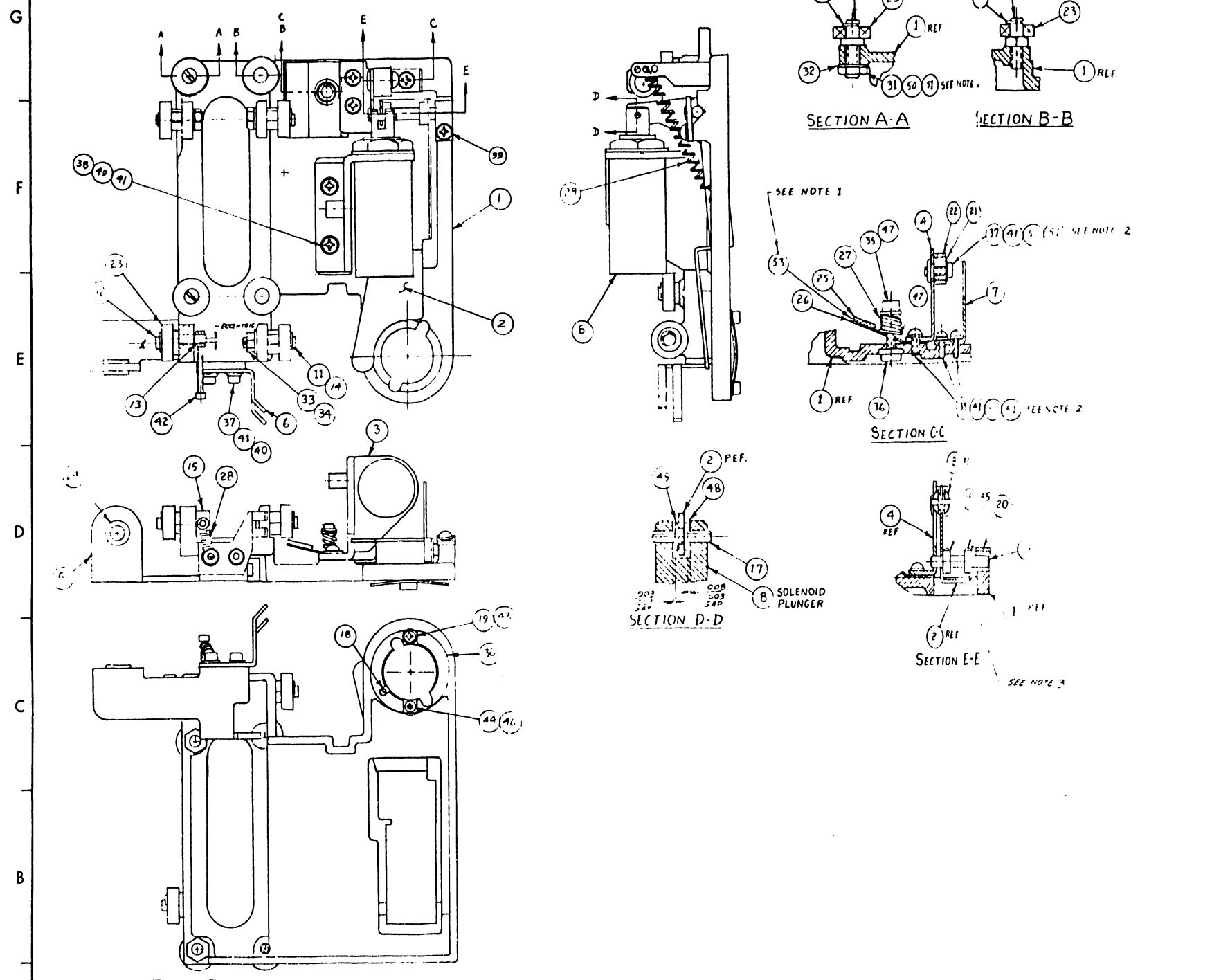
ITEM NO.	QTY	DESCRIPTION	UNIT	REMARKS
650-4214	4	SCREEN PINS		
650-4215	4	SCREEN PINS		
650-4216	4	SCREEN PINS		
650-4217	4	SCREEN PINS		
650-4218	4	SCREEN PINS		
650-4219	4	SCREEN PINS		
650-4220	4	SCREEN PINS		
650-4221	4	SCREEN PINS		
650-4222	4	SCREEN PINS		
650-4223	4	SCREEN PINS		
650-4224	4	SCREEN PINS		
650-4225	4	SCREEN PINS		
650-4226	4	SCREEN PINS		
650-4227	4	SCREEN PINS		
650-4228	4	SCREEN PINS		
650-4229	4	SCREEN PINS		
650-4230	4	SCREEN PINS		
650-4231	4	SCREEN PINS		
650-4232	4	SCREEN PINS		
650-4233	4	SCREEN PINS		
650-4234	4	SCREEN PINS		
650-4235	4	SCREEN PINS		
650-4236	4	SCREEN PINS		
650-4237	4	SCREEN PINS		
650-4238	4	SCREEN PINS		
650-4239	4	SCREEN PINS		
650-4240	4	SCREEN PINS		
650-4241	4	SCREEN PINS		
650-4242	4	SCREEN PINS		
650-4243	4	SCREEN PINS		
650-4244	4	SCREEN PINS		
650-4245	4	SCREEN PINS		
650-4246	4	SCREEN PINS		
650-4247	4	SCREEN PINS		
650-4248	4	SCREEN PINS		
650-4249	4	SCREEN PINS		
650-4250	4	SCREEN PINS		
650-4251	4	SCREEN PINS		
650-4252	4	SCREEN PINS		
650-4253	4	SCREEN PINS		
650-4254	4	SCREEN PINS		
650-4255	4	SCREEN PINS		
650-4256	4	SCREEN PINS		
650-4257	4	SCREEN PINS		
650-4258	4	SCREEN PINS		
650-4259	4	SCREEN PINS		
650-4260	4	SCREEN PINS		
650-4261	4	SCREEN PINS		
650-4262	4	SCREEN PINS		
650-4263	4	SCREEN PINS		
650-4264	4	SCREEN PINS		
650-4265	4	SCREEN PINS		
650-4266	4	SCREEN PINS		
650-4267	4	SCREEN PINS		
650-4268	4	SCREEN PINS		
650-4269	4	SCREEN PINS		
650-4270	4	SCREEN PINS		
650-4271	4	SCREEN PINS		
650-4272	4	SCREEN PINS		
650-4273	4	SCREEN PINS		
650-4274	4	SCREEN PINS		
650-4275	4	SCREEN PINS		
650-4276	4	SCREEN PINS		
650-4277	4	SCREEN PINS		
650-4278	4	SCREEN PINS		
650-4279	4	SCREEN PINS		
650-4280	4	SCREEN PINS		
650-4281	4	SCREEN PINS		
650-4282	4	SCREEN PINS		
650-4283	4	SCREEN PINS		
650-4284	4	SCREEN PINS		
650-4285	4	SCREEN PINS		
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650-4287	4	SCREEN PINS		
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650-4293	4	SCREEN PINS		
650-4294	4	SCREEN PINS		
650-4295	4	SCREEN PINS		
650-4296	4	SCREEN PINS		
650-4297	4	SCREEN PINS		
650-4298	4	SCREEN PINS		
650-4299	4	SCREEN PINS		
650-4300	4	SCREEN PINS		



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- NOTES:  
 1. USE LOCTITE ITEM 53 TO BOND ITEM 25 TO ITEM 24.  
 2. USE LOCTITE "SCREWLOCK" (ITEM 50) ON ALL SCREWS & GLYPHAL (ITEM 51) AFTER TIGHTENING UNLESS OTHERWISE SPECIFIED.  
 3. LOCOTITE COLLARS (ITEM 15) SO THAT PER ARM ACTUATOR (ITEM 2) HAS CLEARANCE AS SHOWN IN SECTION D-D AND IS FREE TO MOVE ON DOWN PIN (ITEM 16).

DR. FILE NO.	DATE
REVISED BY	DATE
APPROVED BY	DATE
DATE	DATE



ITEM NO.	QTY	DESCRIPTION	REF.	LOCTITE
660-0106	53	A/R		LOCTITE
660-0100	52			
660-0114	51	WASHER		
653-0107	49	WASHER		
653-1001	48	WASHER, FLAT		
653-4000	47	WASHER, FLAT		
653-2027	46	LOCK WASHER		
650-2040	45	SCREW, SEC. SET		
650-2061	44	SCREW, PAN. HD.		
650-2101	43	SCREW, FL. HD.		
650-2242	42	SCREW, LOCKING CAP		
653-3001	41	LOCK WASHER		
653-3000	40	WASHER, FLAT		
650-3100	39	SCREW, PAN. HD.		
650-3120	38	SCREW, PAN. HD.		
650-3166	37	SCREW, PAN. HD.		
650-0044	36	NUT, HEX.		
650-4742	35	SCREW, SET. HD.		
653-6001	34	LOCK WASHER		
652-6000	33	NUT, HEX.		
653-0007	32	LOCK WASHER		
652-0053	31	NUT, JAM		
465-0997	30	PLATE, LEAF SPRING		
465-1600	29	SPRING, EXTENSION		
465-0578	28	SPRING, EXTENSION		
465-0584	27	SPRING, COMP.		
465-0585	26	SPRING, PLATE		
660-0521	25	SPRING, PLATE		
465-0708	24	BUSHING, COLLAR		
465-0009	23	PLATING, BALL		
465-1024	22	PLATE, ADJUSTABLE STOP		
465-1025	21	HUB, ADJUSTABLE STOP		
452-0021	20	PLATE, HOOD DOWN		
458-0281	19	STOP, PEN HOUSING		
651-1520	18	ROLL PIN		
651-1509	17	ROLL PIN		
651-1637	16	DOWN PIN		
465-0409	15	COLLAR, SET SCREW		
651-1727	14	SNAP RING		
651-1712	13	SNAP RING		
478-0196	12	DOWN PIN		
478-0204	11	DOWN PIN		
478-0202	10	DOWN PIN		
478-0101	9	DOWN PIN		
320-1011	8	SOLENOID PLUNGER		
465-0285	7	WASHER, FLAT		
465-4216	6	PART, ACTUATOR		
465-4215	5	PART, ACTUATOR		
465-4275	4	PART, HOOD FRONT		
465-4278	3	PART, HOOD FRONT		
465-0279	2	ARM, PEN ACTUATOR		
450-0094	1	DOWN PIN		

REV.	DATE	DESCRIPTION
1	11-1-57	ISSUED FOR PRODUCTION

**WANG** LABORATORIES, INC.  
 MADE IN U.S.A.

MATERIAL	DATE
FINISH	DATE

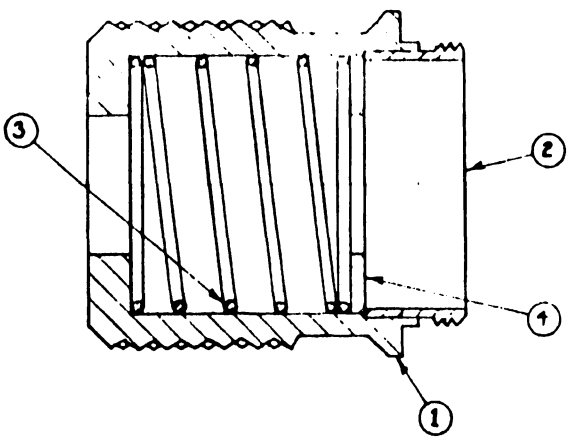






7 6 5 4 3

DATE	DESCRIPTION	QTY



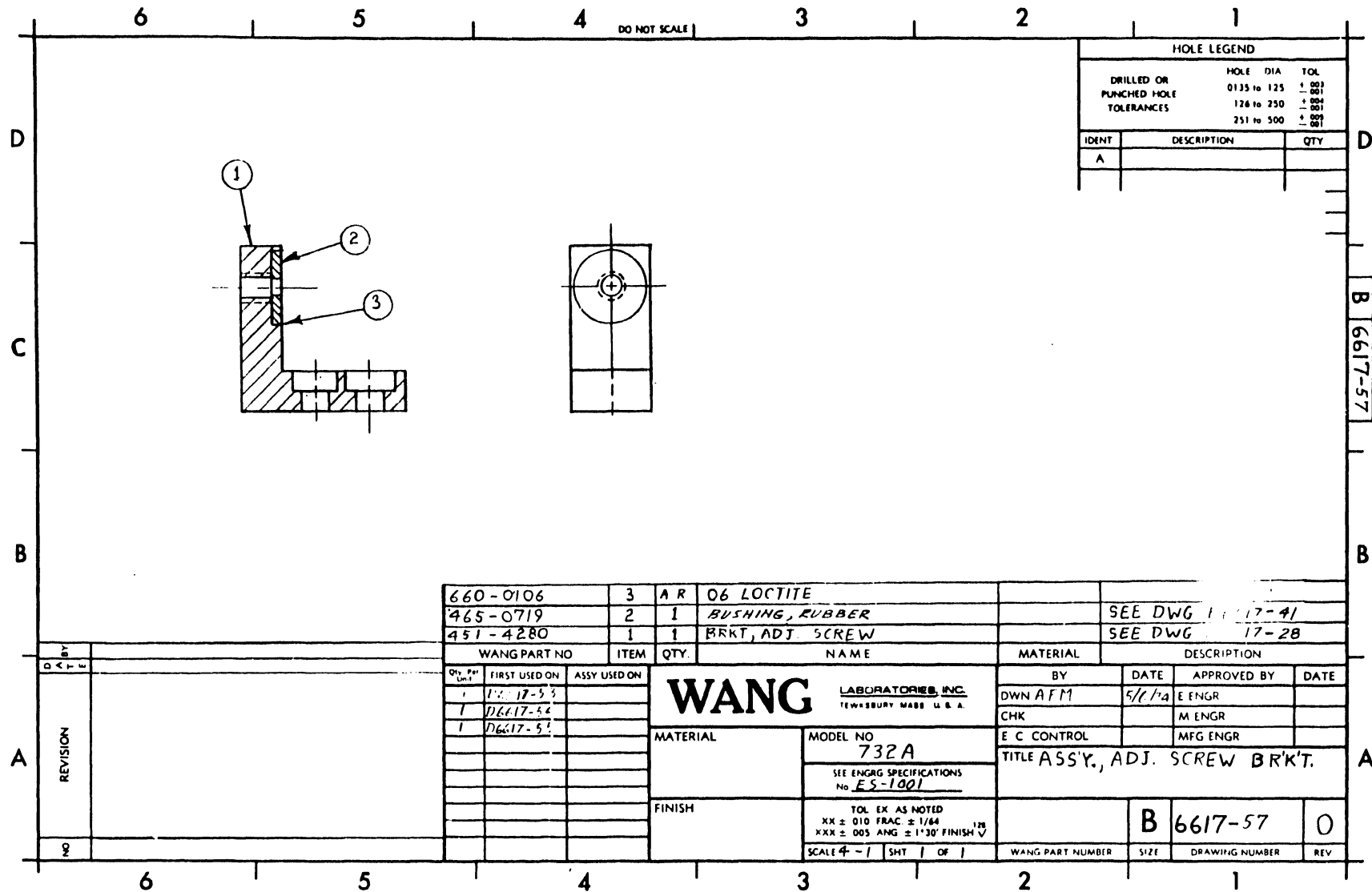
**COPY**

NO. OF PIE	4	1	SPRING	SEE DWG 136617-39	
NO. OF PIE	3	1	COMPLETE BALL PEN	SEE DWG 136617-49	
NO. OF PIE	2	1	INSERT	SEE DWG 136617-7A	
NO. OF PIE	1	1	CAP, COMPLETE BALL PEN	SEE DWG 136617-21	
WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
DATE	FIRST DRAFTING	ASSY. DRAFTING	BY DATE APPROVED BY DATE		
1					
MATERIAL			MODEL NO.	TITLE ASSY. CAP & SPRING (BALL PEN)	
			732A		
FINISH				C	6617-52 0

55

E  
D  
C  
B  
A

5 4 3 2 1



HOLE LEGEND		
DRILLED OR PUNCHED HOLE	HOLE DIA	TOL
	0135 to 125	+ .003 - .001
	126 to 250	+ .004 - .001
	251 to 500	+ .005 - .001

IDENT	DESCRIPTION	QTY
A		

WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
660-0106	3	A R	06 LOCTITE		
465-0719	2	1	BUSHING, RUBBER		SEE DWG 11-17-41
451-4280	1	1	BRKT, ADJ SCREW		SEE DWG 11-17-28

DATE	BY	DATE	APPROVED BY	DATE
	DWN AFM	5/6/44	E ENGR	
	CHK		M ENGR	
	E C CONTROL		MFG ENGR	

QTY	FIRST USED ON	ASSY USED ON
1	11-17-53	
1	11-6617-54	
1	11-6617-55	

<b>WANG</b> LABORATORIES, INC. NEWBURY MASS U.S.A.		BY		DATE	APPROVED BY	DATE
MATERIAL		MODEL NO		TITLE ASSY., ADJ. SCREW BRKT.		
FINISH		732A		E C CONTROL		
		SEE ENGRG SPECIFICATIONS No. ES-1001		MFG ENGR		
		TOL EX AS NOTED XX ± 010 FRAC ± 1/64 XXX ± 005 ANG ± 1'30" FINISH ✓		B 6617-57 0		
		SCALE 4-1 SHT 1 OF 1		WANG PART NUMBER SIZE DRAWING NUMBER REV		







**SERVICE  
BULLETIN  
NO. 44.2**

EDITED BY CUSTOMER ENGINEERING DIVISION

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## MODEL 632 AND 632 ALPHA USER ROM DIAGNOSTICS

### 1. MODEL 632 DIAGNOSTIC

The 632 diagnostic requires at least a 600-6 and contains 8 sub-routines that can be used to test and adjust the plotter. The program has a verify of 5669.

#### 1.1 PEN UP

By keying f(x)  , the pen can be moved to any legal plotting position without plotting.

#### Keying Order:

- (a) Key X increments
- (b) STORE LEFT
- (c) Key Y increments
- (d) STORE RIGHT
- (e) Key f(x)  . Pen moves to the position entered.

#### 1.2 PEN DOWN

By keying f(x)  , the plotter plots to the position keyed in the left and right registers.

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LABORATORIES, INC.

838 NORTH STREET, TEWKSBURY, MASSACHUSETTS 01876, TEL. (617) 851-4111, TWX 710 343-6780, TELEX 94-7421

Printed in U.S.A.  
13-210A

Keying Order:

- (a) Key X increments
- (b) STORE LEFT
- (c) Key Y increments
- (d) STORE RIGHT
- (e) Key f(x) 01. Pen is lowered and plots to the position entered.

### 1.3 CIRCLE

By keying f(x) 02, the plotter draws a circle with the given radius and incrementing angle. The pen must be moved to the desired plotting area before plotting the circle.

Keying Order:

- (a) Key f(x) 02. Display is blanked.
- (b) Enter the length of the radius. GO. Display blanks.
- (c) Enter the incrementing angle in degrees. GO.

EXAMPLE: (See Figure 1.)

- (a) Key f(x) 02.
- (b) Key 500, GO.
- (c) Key 10, GO.

$$a = 500 = 1.25'' \text{ (3.18 cm)}$$

$$\theta = 10 = 10^\circ$$

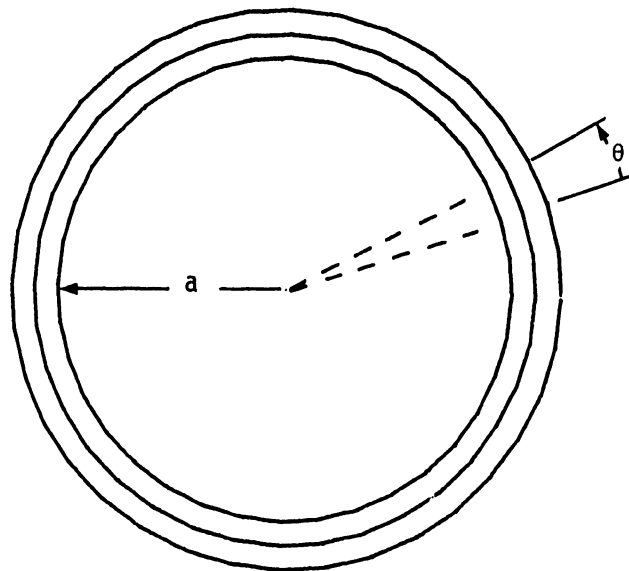


FIGURE 1



#### 1.4 INCREMENTING RADII

By keying  $f(x)$   $\boxed{03}$ , the plotter draws lines from a center point with an incrementing angle. The pen must be moved to the desired plotting area.

Keying Order:

- (a) Key  $f(x)$   $\boxed{03}$ . Display is blanked.
- (b) Enter the length of the radius. GO. Display blanks.
- (c) Enter the incrementing angle in degrees. GO.

EXAMPLE: (See Figure 2.)

- (a) Key  $f(x)$   $\boxed{03}$ .
- (b) Key 500, GO.
- (c) Key 10, GO.

$$a = 500 = 1.25'' (3.18 \text{ cm})$$

$$\theta = 10 = 10^\circ$$

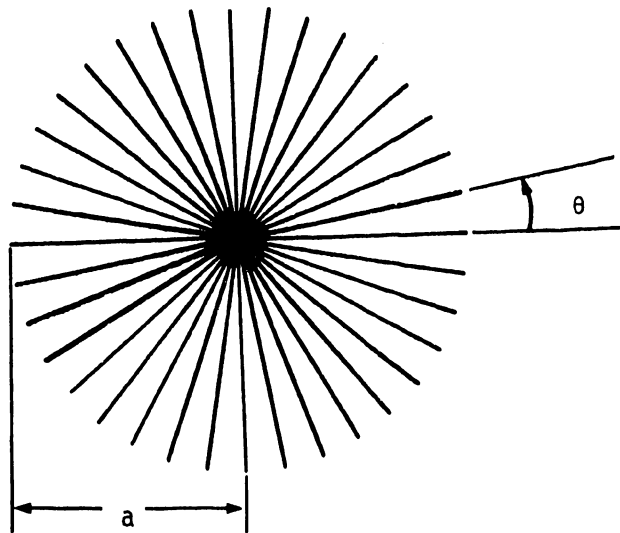


FIGURE 2

#### 1.5 90° CHECK

By keying  $f(x)$   $\boxed{04}$ , the plotter draws two perpendicular lines.

Keying Order:

- (a) Key  $f(x)$   $\boxed{04}$ .
- (b) Key GO.

## 1.6 RECTANGLES

By keying  $f(x)$  **05**, the plotter draws  $N \times N$  rectangles where the length of each side are entered. The pen must be moved to the desired plotting area.

Keying Order:

- (a) Key  $f(x)$  **05**. Display blanks.
- (b) Key length of X side. GO. Display blanks.
- (c) Key length of Y side. GO. Display blanks.
- (d) Key number of rectangles on each side. GO.

EXAMPLE: (See Figure 3.)

- (a) Key  $f(x)$  **05**.
- (b) Key 300, GO.
- (c) Key 200, GO.
- (d) Key 4, GO.

$$\begin{aligned} a &= 300 = .75'' (1.9 \text{ cm}) \\ b &= 200 = .5'' (1.3 \text{ cm}) \\ N &= 4 = 4 \text{ RECTANGLES} \end{aligned}$$

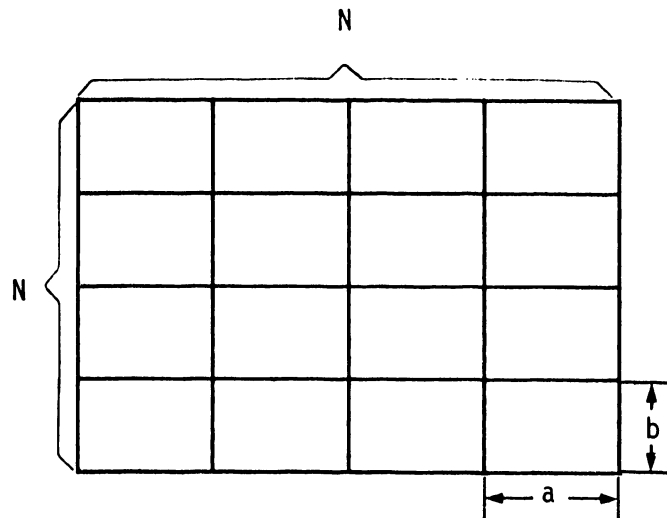


FIGURE 3

## 1.7 DASH POT

By keying  $f(x)$  **06**, the plotter starts a dash pot program that plots a 30" (76.2 cm) line in .25" (.64 cm) increments. Refer to Section 5.6 of S.B. #14 for dash pot adjustment.

## 1.8 RESET

By keying  $f(x)$  **15**, the carrier returns to the home position with the pen up.

## 2. MODEL 632 ALPHA USER ROM DIAGNOSTIC

The 632 Alpha User ROM diagnostic contains two blocks. Block one, verify 12131, performs a pass/fail test using the output of the plotter for determining a pass or fail condition. Block 2, verify 12134, is used when a fail condition occurs in block 1. Block 2 checks each of the eight (8) PROMs and all of their functions and is designed to specify what PROM is bad. All plotting output figures shown are actual size.

### EQUIPMENT NEEDED:

600-14  
632 Digital Flatbed Plotter  
632 Alpha User ROM

### 2.1 OPERATING INSTRUCTIONS - BLOCK 1 (12131)

- (a) Plug user ROM into the 600.
- (b) Turn the 600 and 632 units on.
- (c) Put paper on the plotting surface near the home position.
- (d) PRIME. LOAD PROGRAM. VERIFY 12131.

INSTRUCTION	DISPLAY RESULT	PLOT
1. PRIME, GO	10	NONE
2. Key GO	0	NONE
3. Key GO	7	NONE
4. Key GO	11	NONE
5. Key GO	41	NONE
6. Key GO	105	NONE
7. Key GO	1	NONE
8. Key GO	2	NONE
9. Key 1, GO	-467	FIGURE 4

If the plotter has an output like Figure 4, the Alpha ROM is good.

# 632 ALPHA ROM DIAGNOSTIC

EFJKQUVXYZ+-=078%/\*( ), ' " ° \$

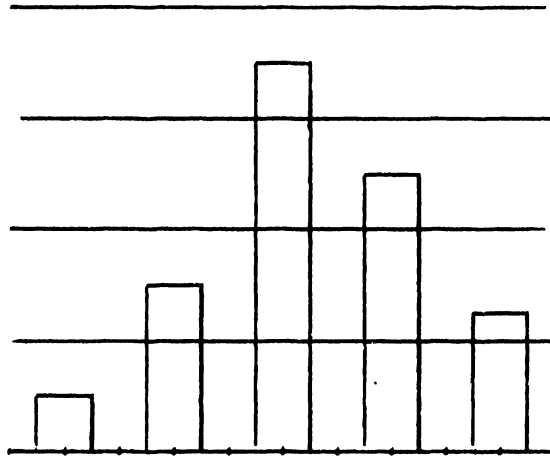
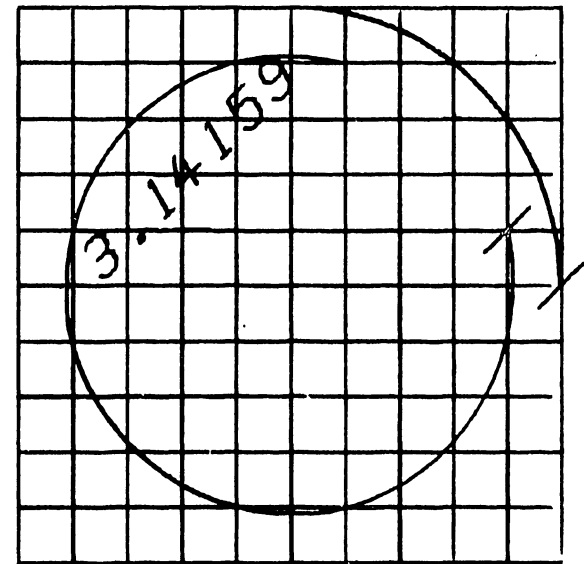
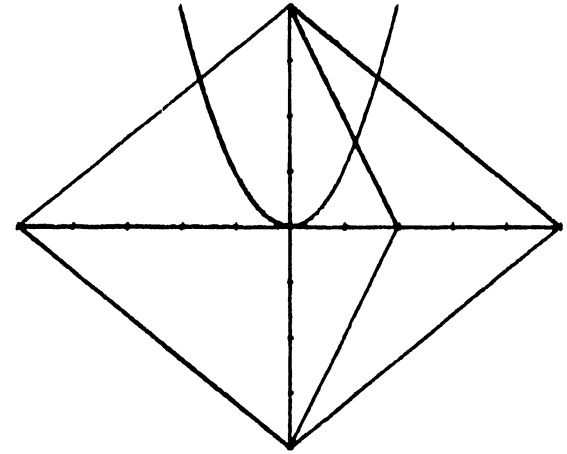
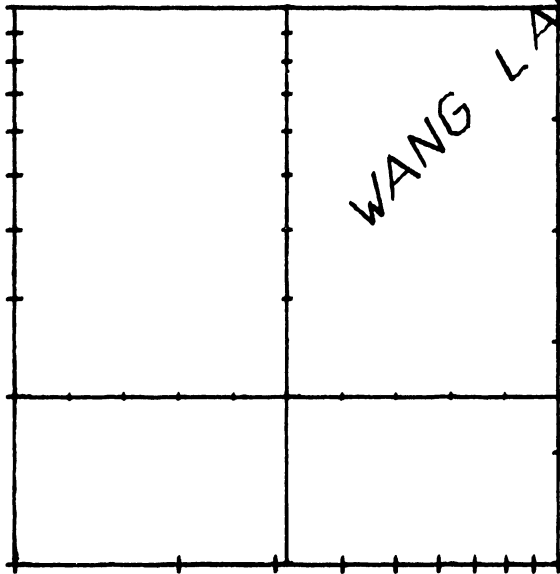


FIGURE 4

6



If the output does not agree with Figure 4, continue the test with step 10. Some of the steps between 10 and 35 of block 1 and numerous steps of block 2 contain a X.1 number in the display after keying GO.

For Example:

- 1.1 indicates PROM #1 will be tested after keying GO.
- 2.1 indicates PROM #2 will be tested after keying GO.
- 34.1 indicates PROMs 3 and 4 will be tested after keying GO.

See Figure 5 for the numbering of the PROMs for the purpose of this diagnostic, the PROM numbers and their locations.

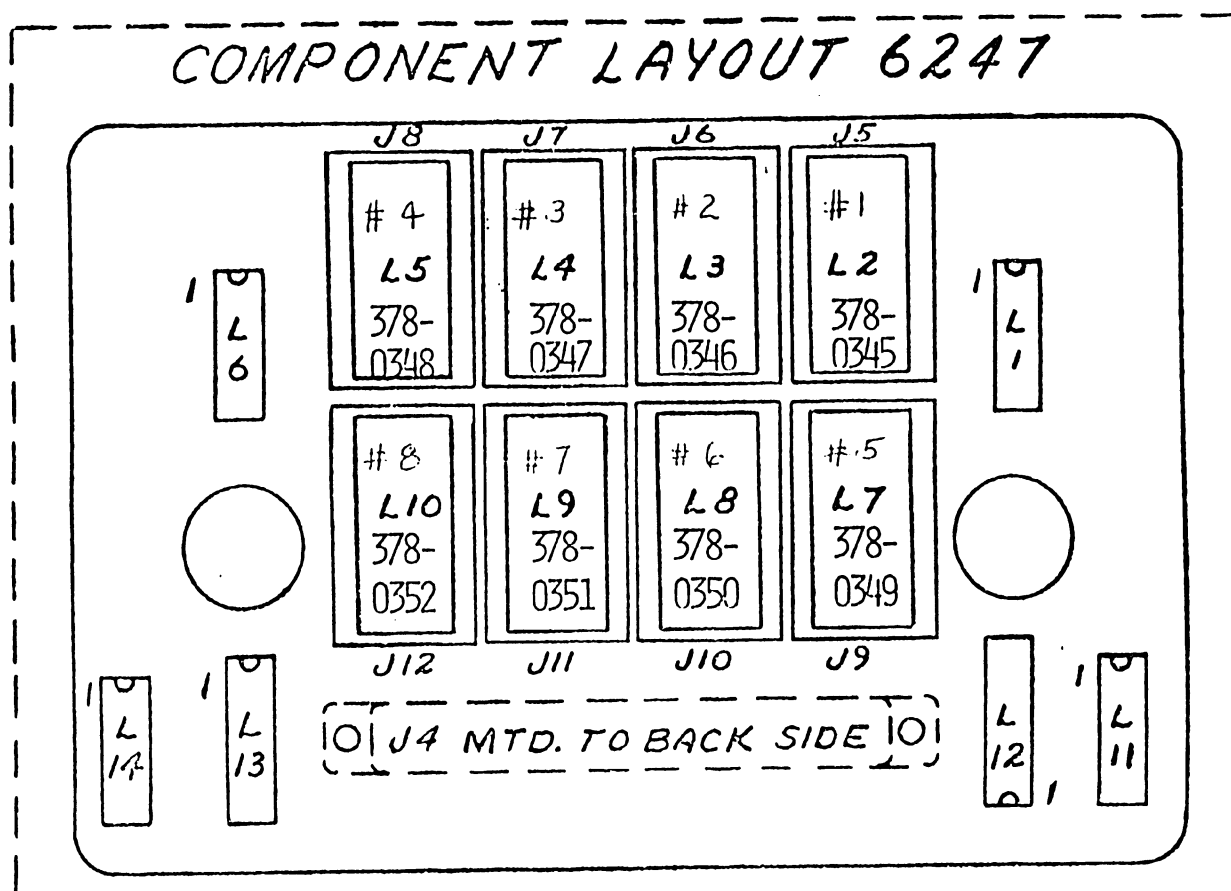


FIGURE 5

INSTRUCTION	DISPLAY RESULT	PLOT
10. Key PRIME	0	NONE
11. Set f(x) down	0	NONE
12. Key 15	1.1	*
13. Key GO	1	NONE
14. Key GO	2	NONE
15. Key GO	1	NONE
16. Key GO	3	NONE
17. Key GO	1	NONE
18. Key GO	4	NONE
19. Key GO	1	NONE
20. Key GO	5	NONE
21. Key GO	1.1	NONE
22. Key GO	100	NONE
23. Key GO	300	NONE
24. Key GO	2.1	NONE
25. Key GO	3.1	NONE
26. Key GO	3.1	NONE
27. Key GO	1	NONE
28. Key GO	2	NONE
29. Key GO	3.1	NONE
30. Key GO	34.1	NONE
31. Key GO	0	NONE
32. Key GO	5	NONE
33. Key GO	149	NONE
34. Key GO	294	NONE
35. Key GO	99999	NONE

\*The output plot is two parallel lines 9" (22.9 cm) long and 7.5" (19 cm) in the Y direction.

## 2.2 OPERATING INSTRUCTIONS - BLOCK 2 (12134)

1. Run block 1 of the diagnostic.
2. LOAD PROGRAM, VERIFY 12134. PRIME.
3. After each PROM test, replace the paper on the plotter.

INSTRUCTION	DISPLAY RESULT	PLOT
To test PROM #1:  1. Key SEARCH 1 2. Key GO 3. Key GO 4. Key GO 5. Key GO 6. Key GO	1.1 2.1 1.1 2.1 1.1 99999.0	NONE P1* P2 P3 P4 P5  Final output must = Fig. 6

\*P1 through P20 are identified in APPENDIX A.

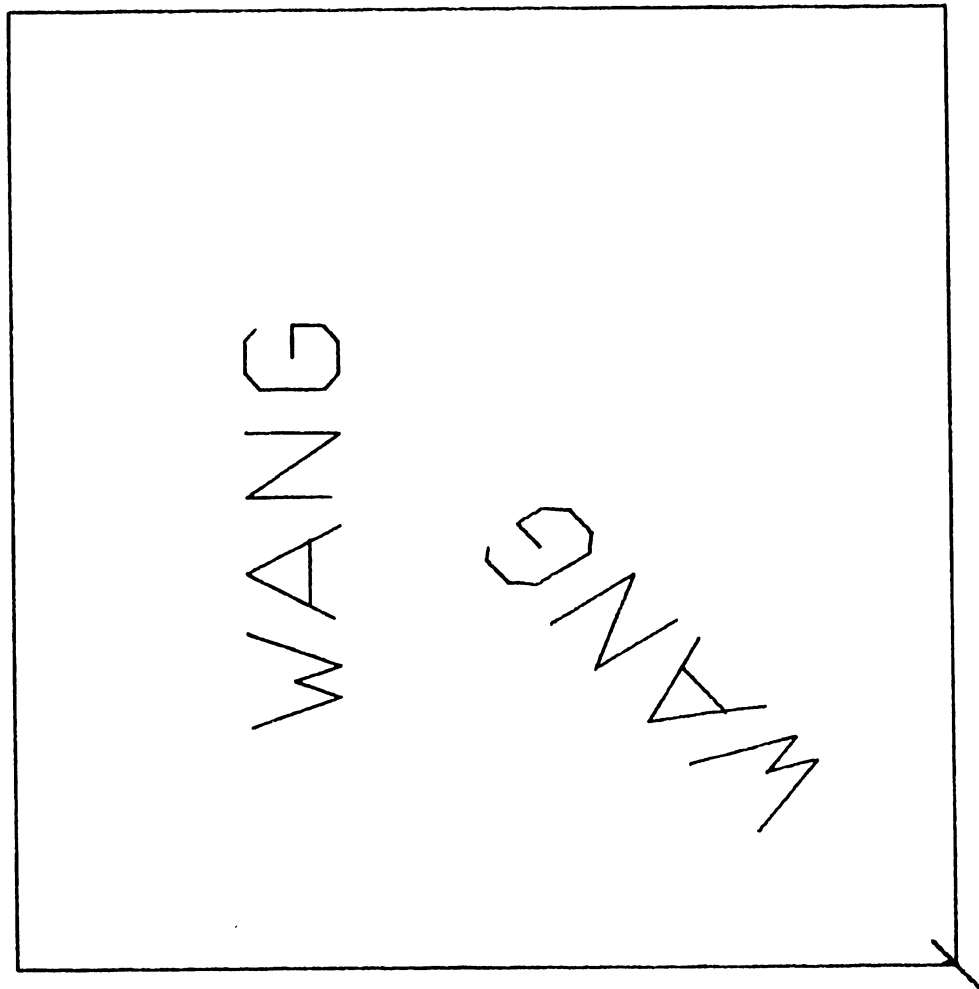


FIGURE 6

INSTRUCTION	DISPLAY RESULT	PLOT
To test PROM #2:		
1. Key SEARCH 2	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	2.1	P3
5. Key GO	1.1	P4
6. Key GO	5678.1	P5
7. Key GO	2.1	P6
8. Key GO	23.1	P7
9. Key GO	99999.0	P8
Final output must = Fig. 7		
To test PROM #3:		
1. Key SEARCH 3	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	3.1	P3
5. Key GO	2.1	P9
6. Key GO	1.1	P4
7. Key GO	5678.1	P5
8. Key GO	23.1	P6
9. Key GO	3.1	P8
10. Key GO	3.1	P10
11. Key GO	99999.0	P11
Final output must = Fig. 8		



WANG

632.1

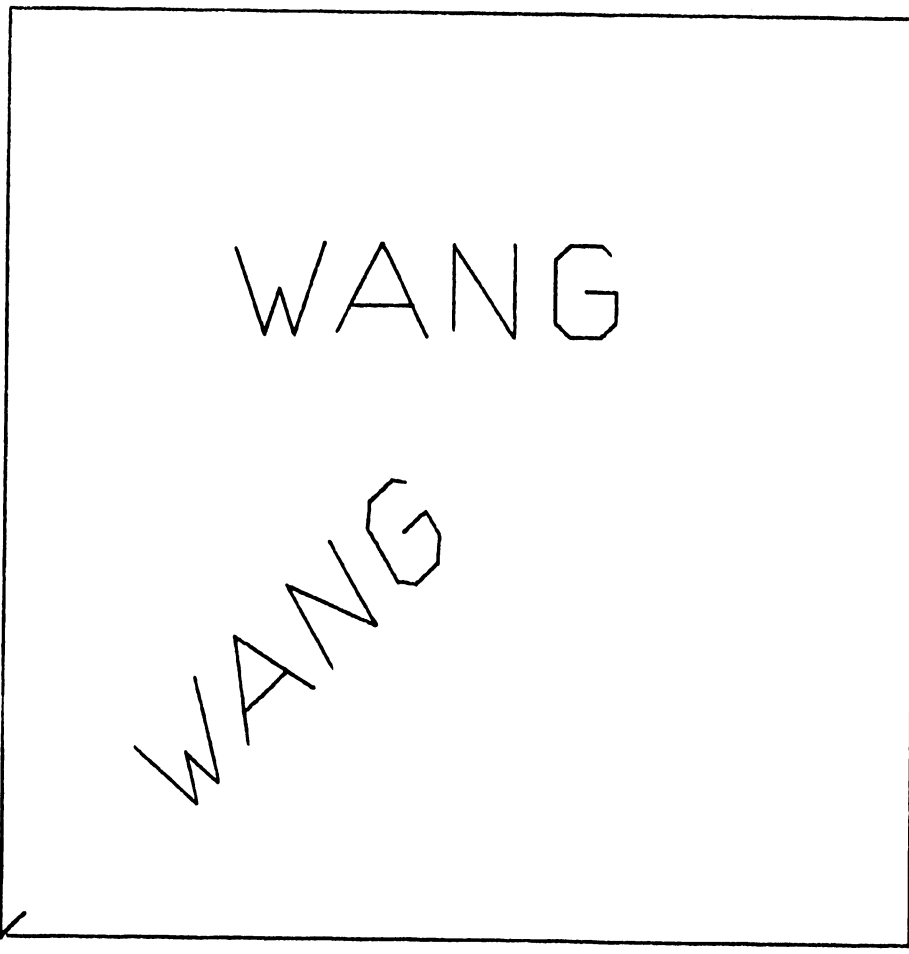


FIGURE 7

11

ABCDE

EFGHIJKLMNOPQRSTU

VWXYZ+-=012345678

89%/\*( ) . , ' " \$

632.1

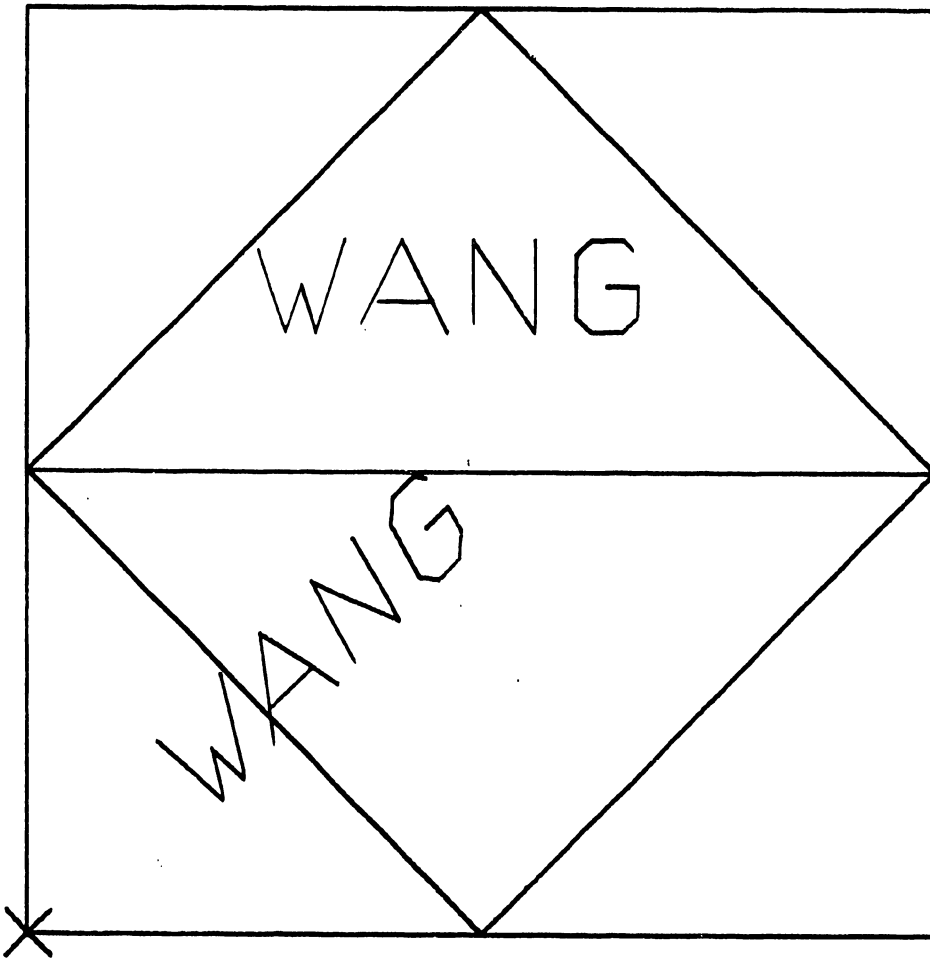


FIGURE 8

12

ABCDE

EFGHIJKLMNOPQRSTU

VWXYZ+-=012345678

89%/\*() , ' " " ° \$

INSTRUCTION	DISPLAY RESULT	PLOT
To test PROM #4:		
1. Key SEARCH 4	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	3.1	P3
5. Key GO	4.1	P9
6. Key GO	4.1	P12
7. Key GO	4.1	P13
8. Key GO	45.1	P14
9. Key GO	99999.0	P15
Final output must = Fig. 9		
To test PROM #5:		
1. Key SEARCH 5	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	2.1	P3
5. Key GO	1.1	P4
6. Key GO	5678.1	P5
7. Key GO	45.1	P17
8. Key GO	5.1	P15
9. Key GO	99999.0	P16
Final output must = Fig. 10		

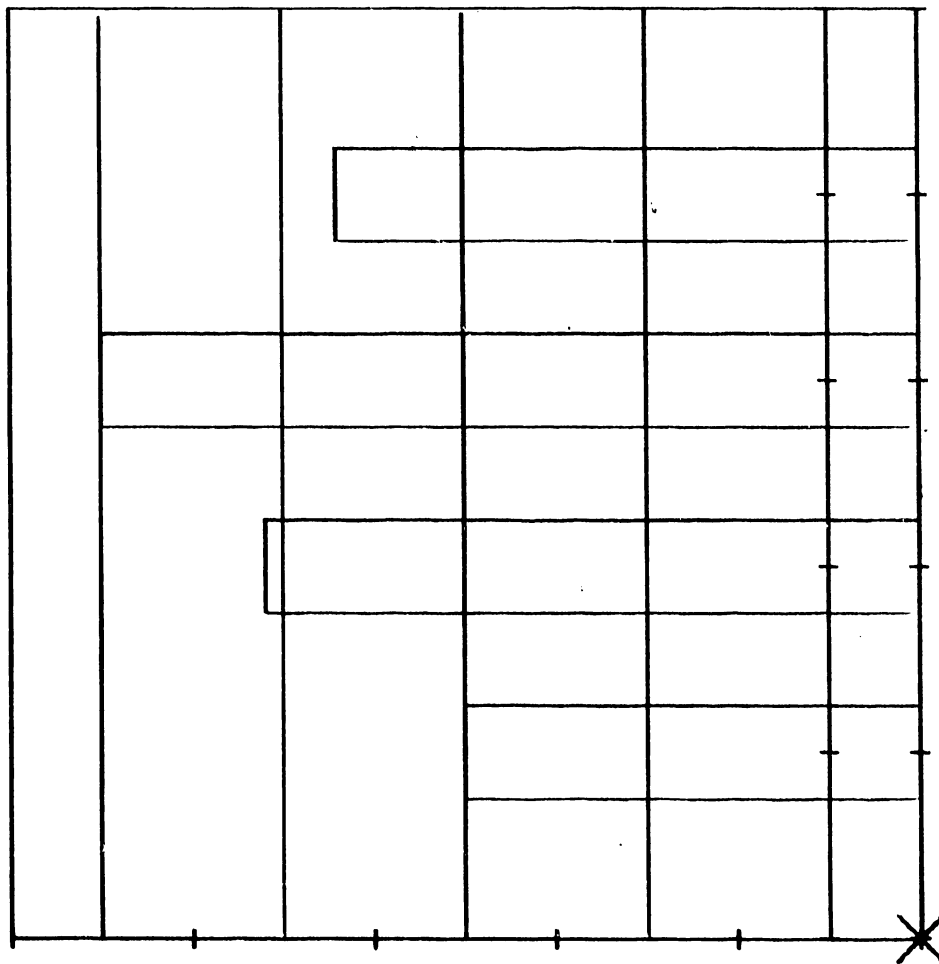
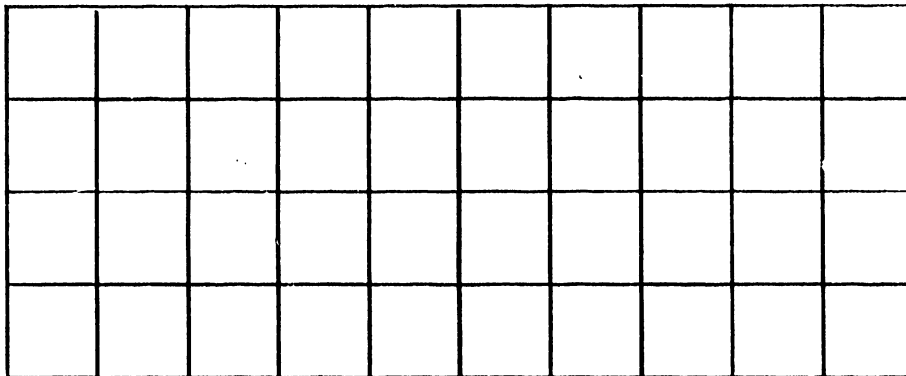


FIGURE 9

ABCDE

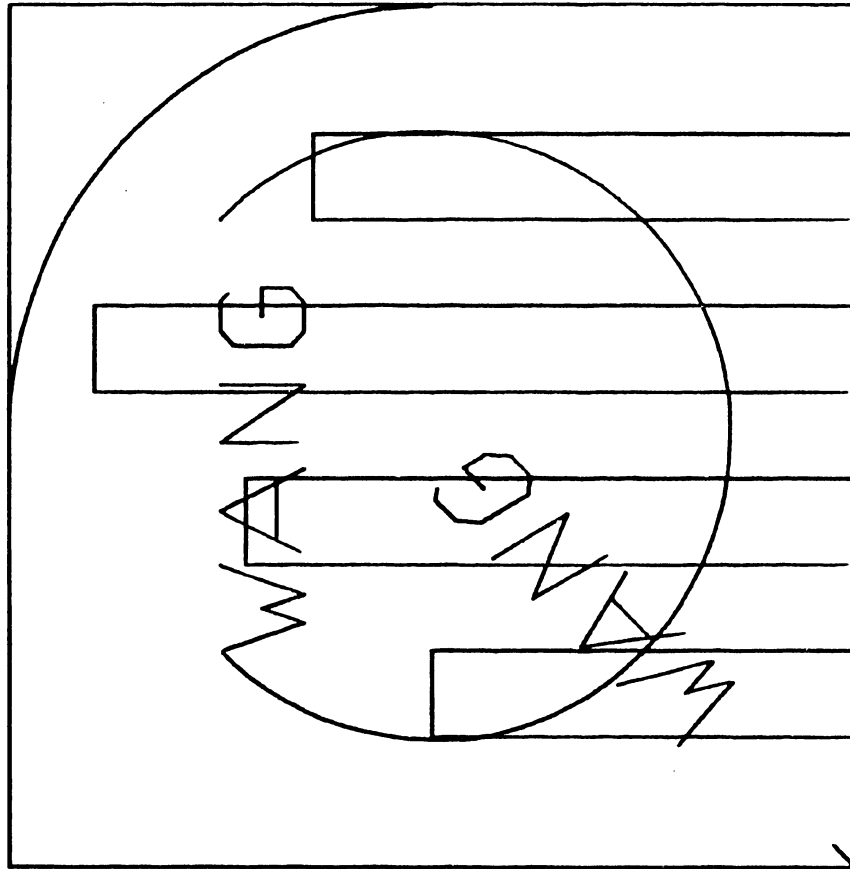
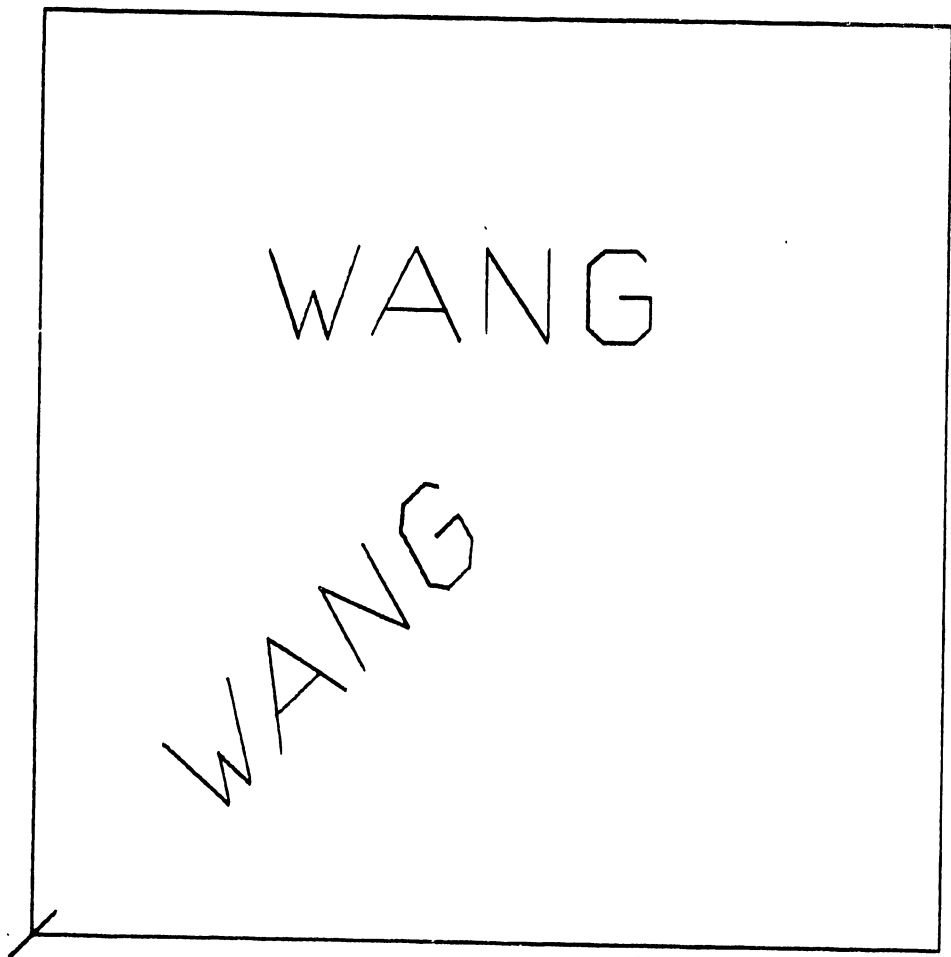


FIGURE 10

INSTRUCTION	DISPLAY RESULT	PLOT
To test PROM #6:		
1. Key SEARCH 6	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	2.1	P3
5. Key GO	1.1	P4
6. Key GO	5678.1	P5
7. Key GO	99999.0	P18

Final output must = Fig. 11

FIGURE 11



EFGHIJKLMNOPQRSTUVWXYZ

INSTRUCTION	DISPLAY RESULT	PLOT
To test PROM #7:		
1. Key SEARCH 7	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	2.1	P3
5. Key GO	1.1	P4
6. Key GO	5678.1	P5
7. Key GO	99999.0	P19
Final output must = Fig. 12		
To test PROM #8:		
1. Key SEARCH 8	1.1	NONE
2. Key GO	2.1	P1
3. Key GO	1.1	P2
4. Key GO	2.1	P3
5. Key GO	1.1	P4
6. Key GO	5678.1	P5
7. Key GO	99999.0	P20
Final output must = Fig. 13		

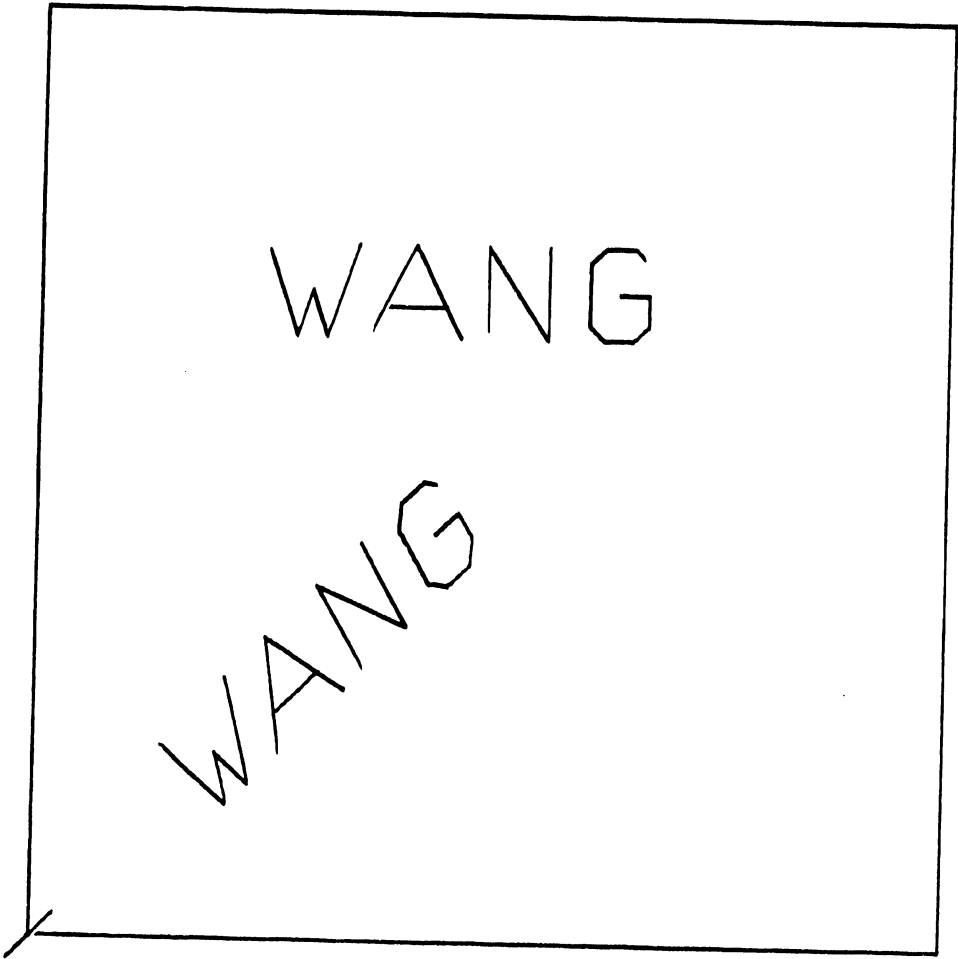


FIGURE 12

VWXYZ+-=012345678



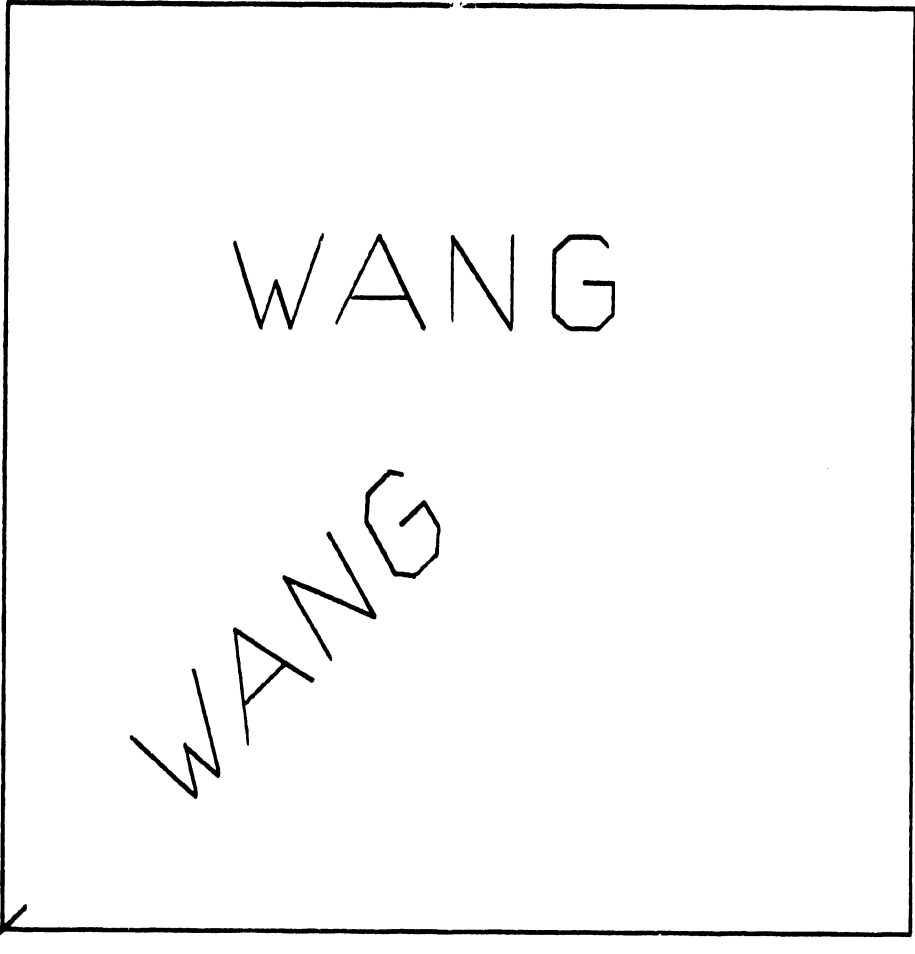


FIGURE 13

89% / \* ( ) . , ' " " " 0 \$

## APPENDIX A - DIAGNOSTIC PLOT DEFINITIONS

- P1 - Plot "/"
- P2 - Move the pen up at the position of P1
- P3 - Draw a 5" x 5" square
- P4 - Plot "WANG" at a 45° angle
- P5 - Plot "WANG" at a 0° angle
- P6 - Plot entire character string "ABC...\$ in 4 lines
- P7 - Plot "WANG" above the 5 x 5 square
- P8 - Plot "632.1" beside P7
- P9 - Plot "\" which intersects with P1 at origin
- P10 - Plot a square inside the 5 x 5 box
- P11 - Plot a straight line inside the small square
- P12 - Plot the XY axes with 5 hash marks each
- P13 - Plot horizontal lines
- P14 - Plot grid
- P15 - Plot bar chart
- P16 - Plot the arc of a circle
- P17 - Plot string of "ABCDE"
- P18 - Plot string of "EFGH...UV"
- P19 - Plot string of "VWXY...8"
- P20 - Plot string of "89%1...\$"

**END**