

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

Second Edition (January 1984)

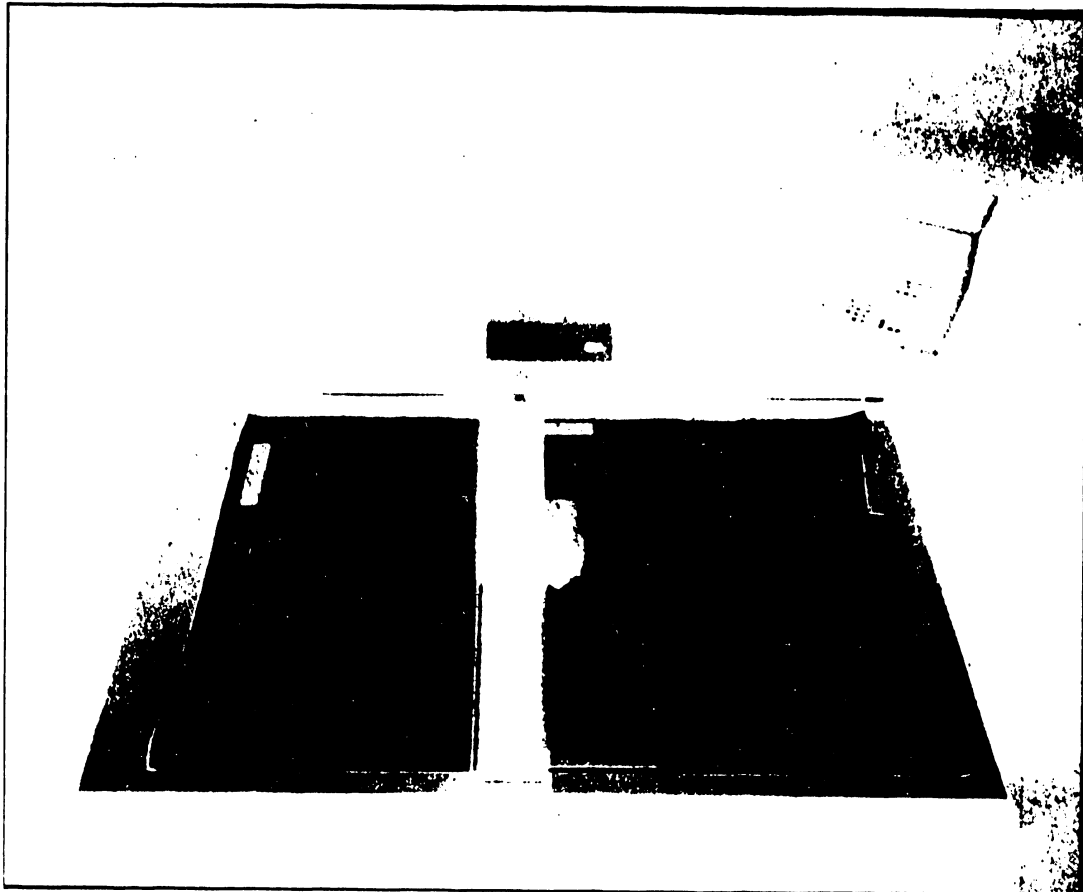
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**SERVICE
BULLETIN
NO. 44**

EDITED BY PRODUCT SERVICE DEPT.

MODEL 32
DIGITAL FLATBED PLOTTER



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ATTENTION

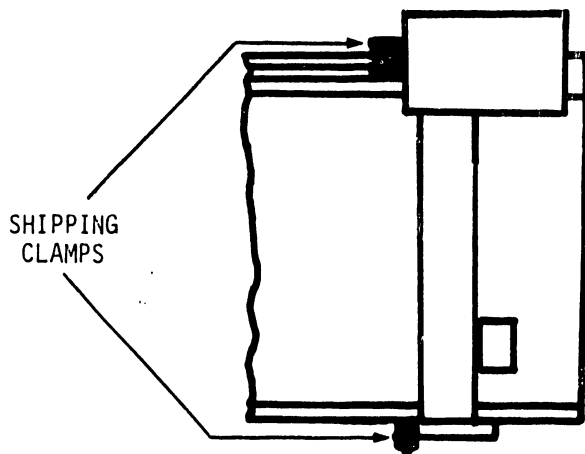
UNPACKING & PACKING INSTRUCTIONS

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 \pm 10%
10) Frequency:	60 HZ \pm 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.

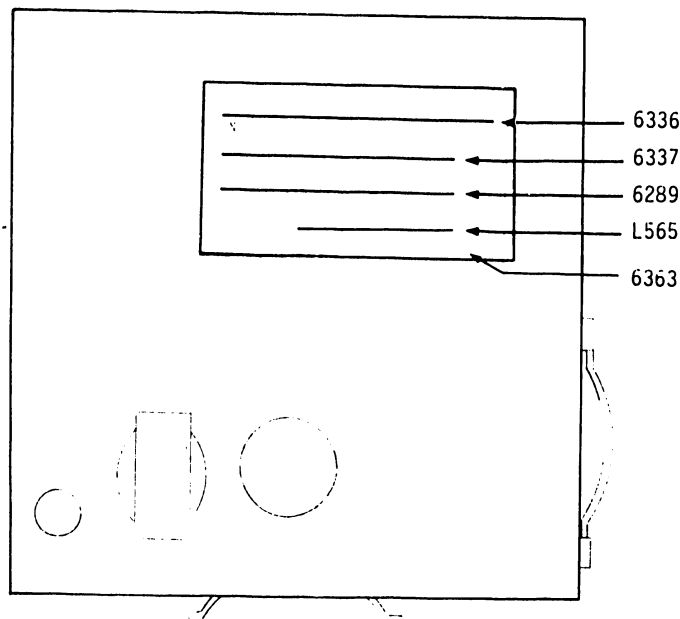


FIGURE 1
MODEL 32 ELECTRONIC PACKAGE

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.

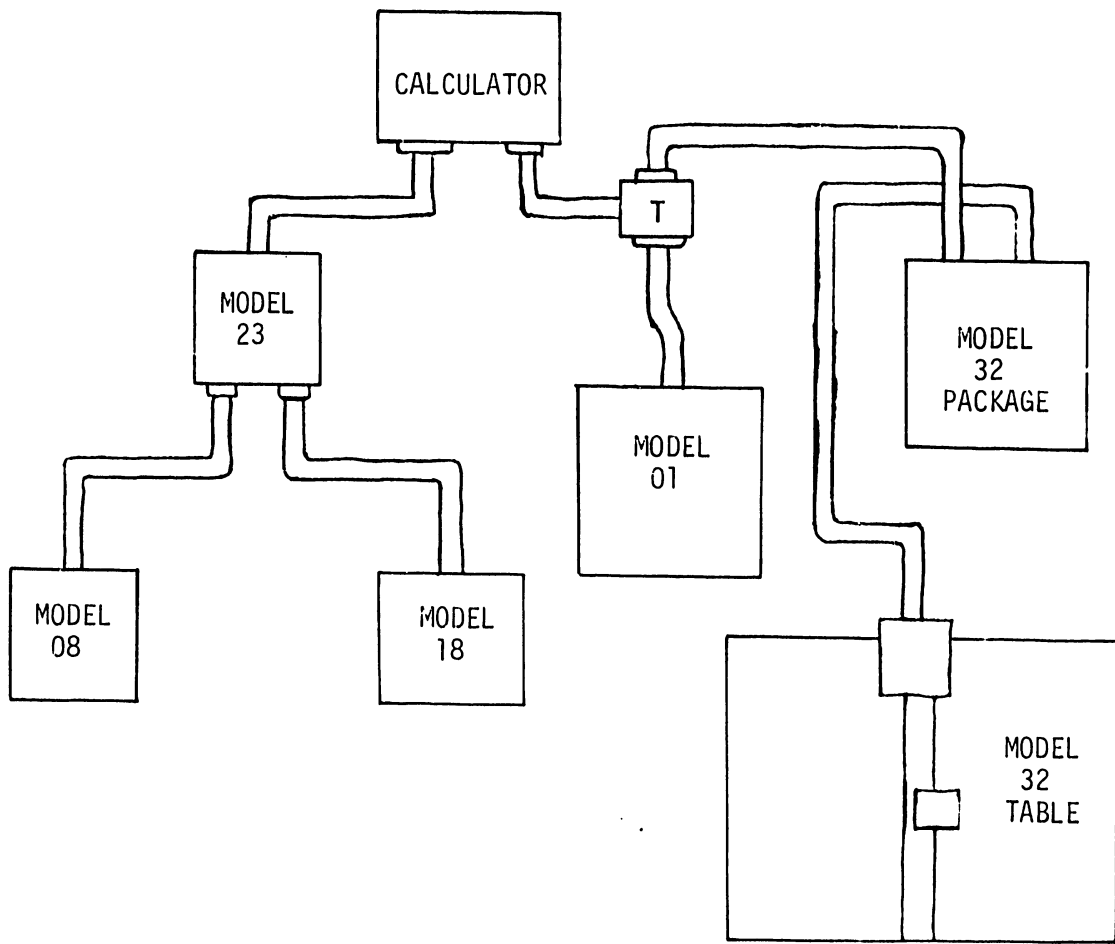
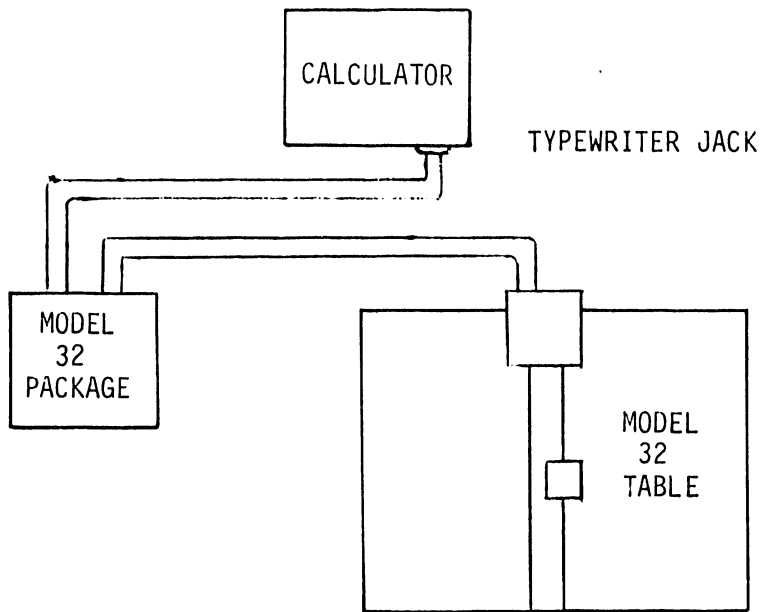


FIGURE 2
SYSTEM CONFIGURATIONS

CABLE ATTACHES
TO CONNECTOR
ON THE BOTTOM
OF THE MOTOR
CASTING

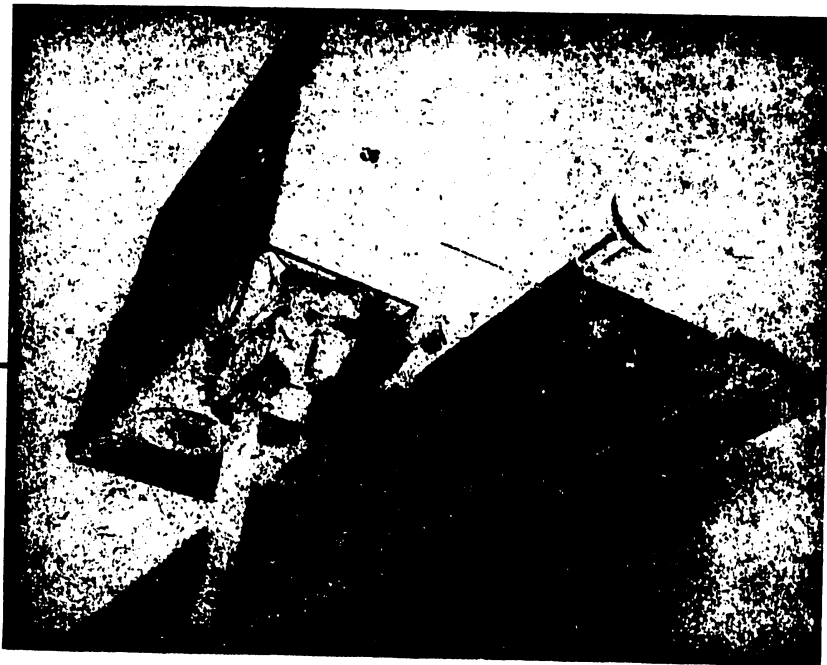


FIGURE 3
CONNECTING PACKAGE CABLE TO PLOTTING TABLE

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

<p>NOTE:</p> <p>For each of the following examples, new zero reference X, Y axes are assumed.</p>

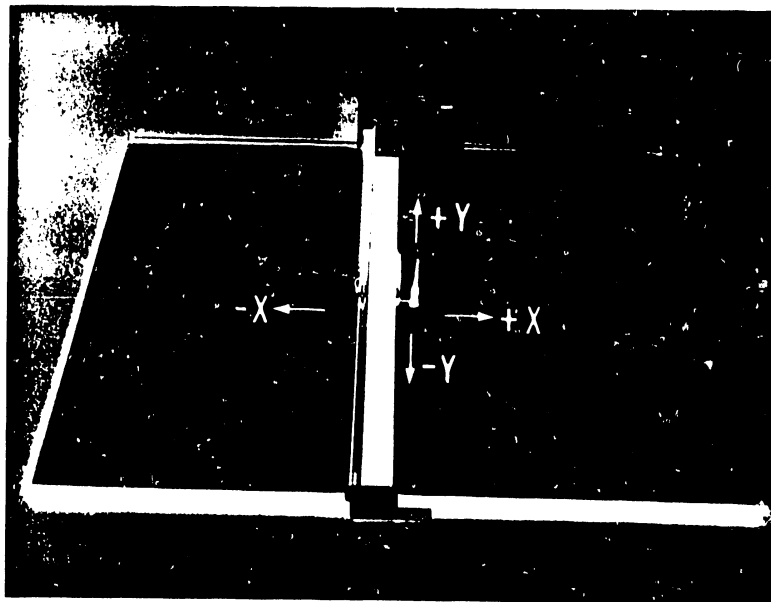
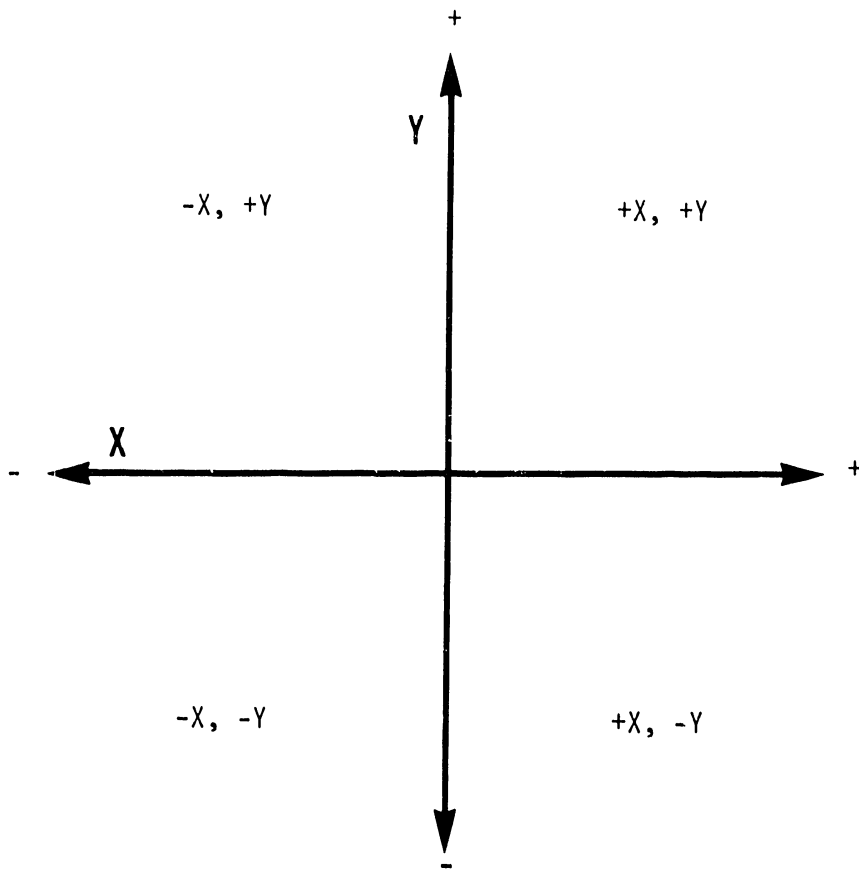


FIGURE 4
PLOTING DIRECTION

- 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.

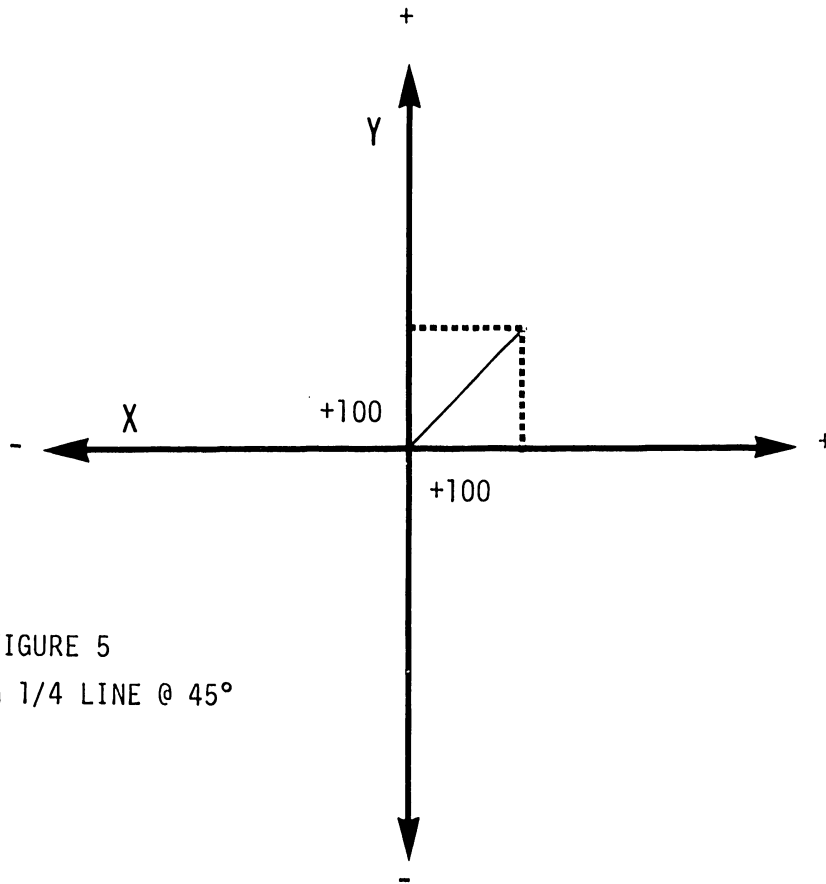


FIGURE 5
PLOTTING 1/4 LINE @ 45°

- 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

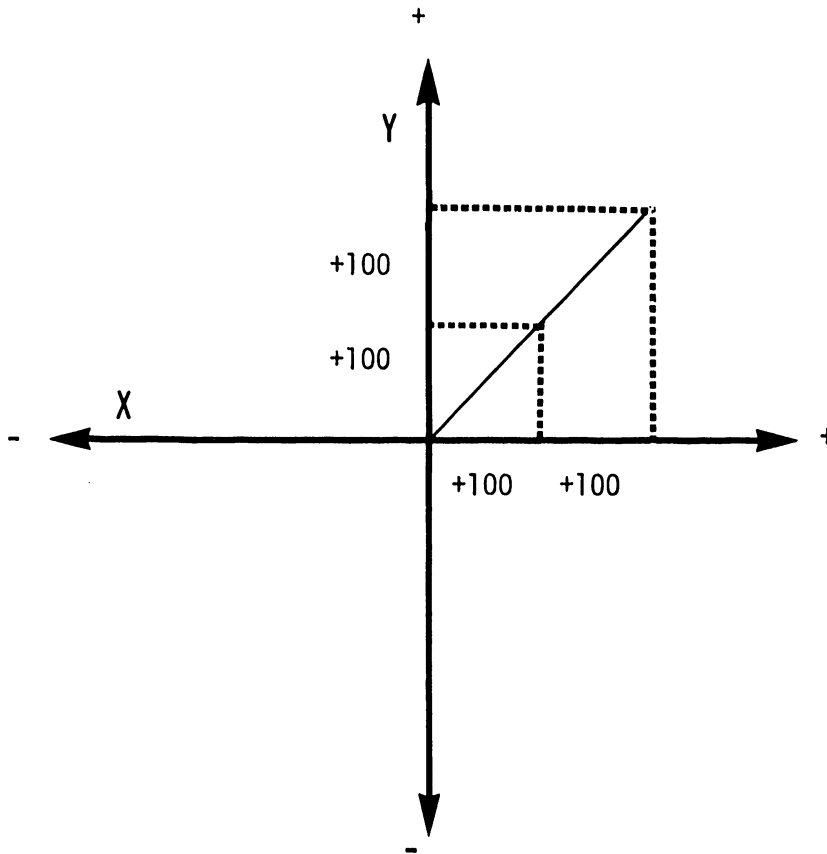


FIGURE 6
REPETITIVE KEYING OF PLOT COMMAND

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.

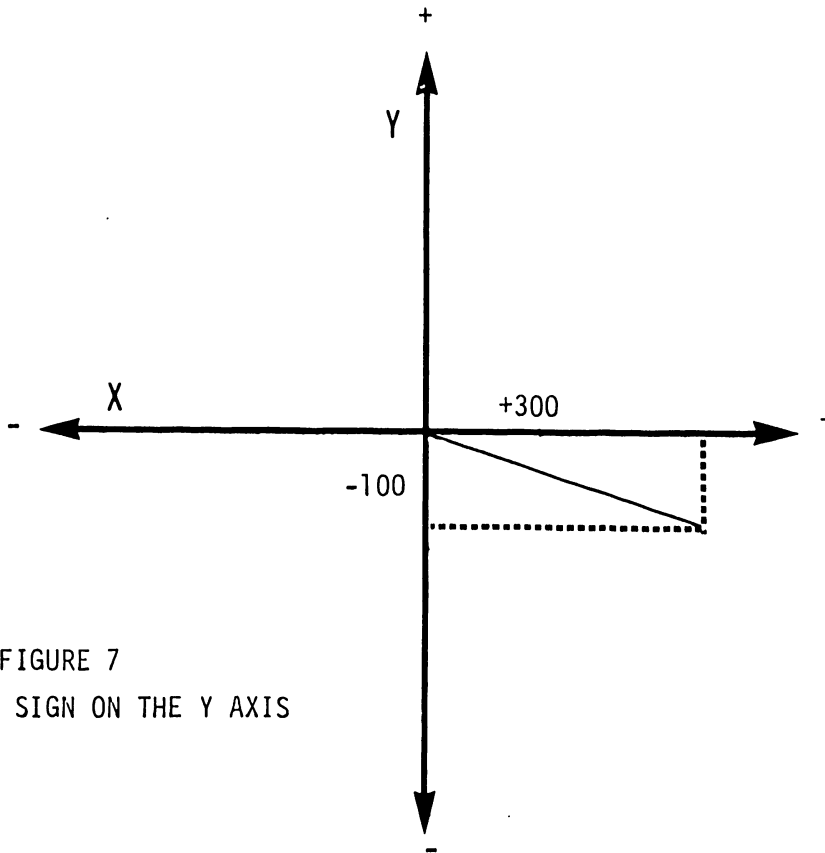


FIGURE 7
A NEGATIVE SIGN ON THE Y AXIS

- 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.

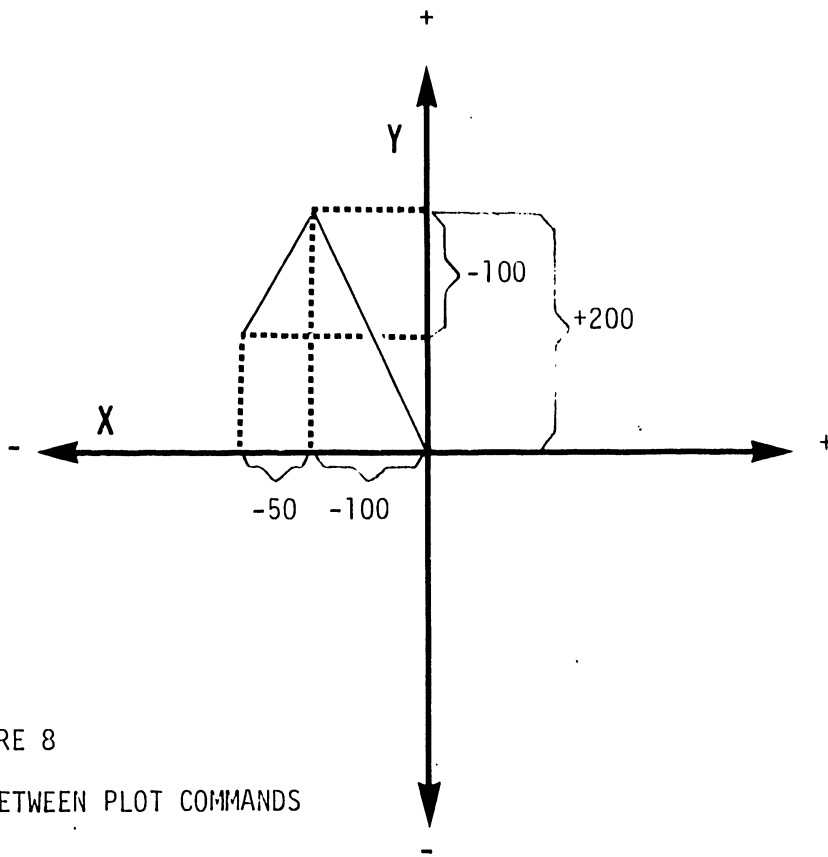


FIGURE 8
CHANGING DIRECTION BETWEEN PLOT COMMANDS

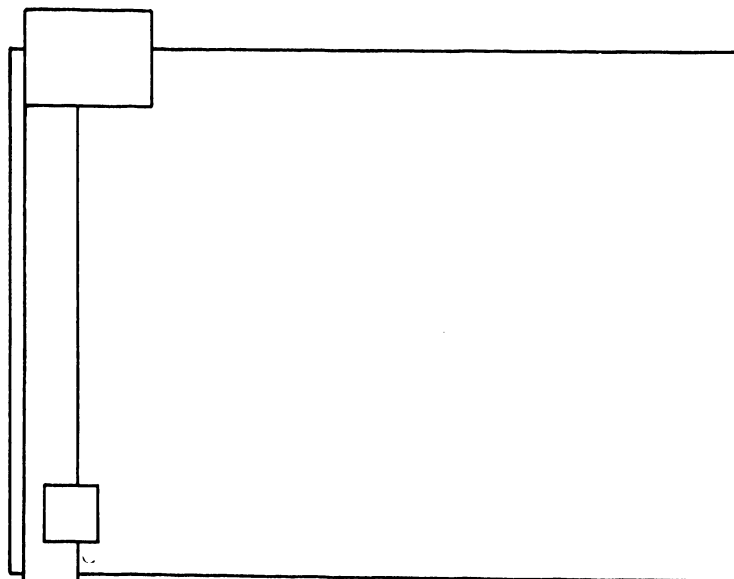


FIGURE 9
PLOTTER IN HOME POSITION

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

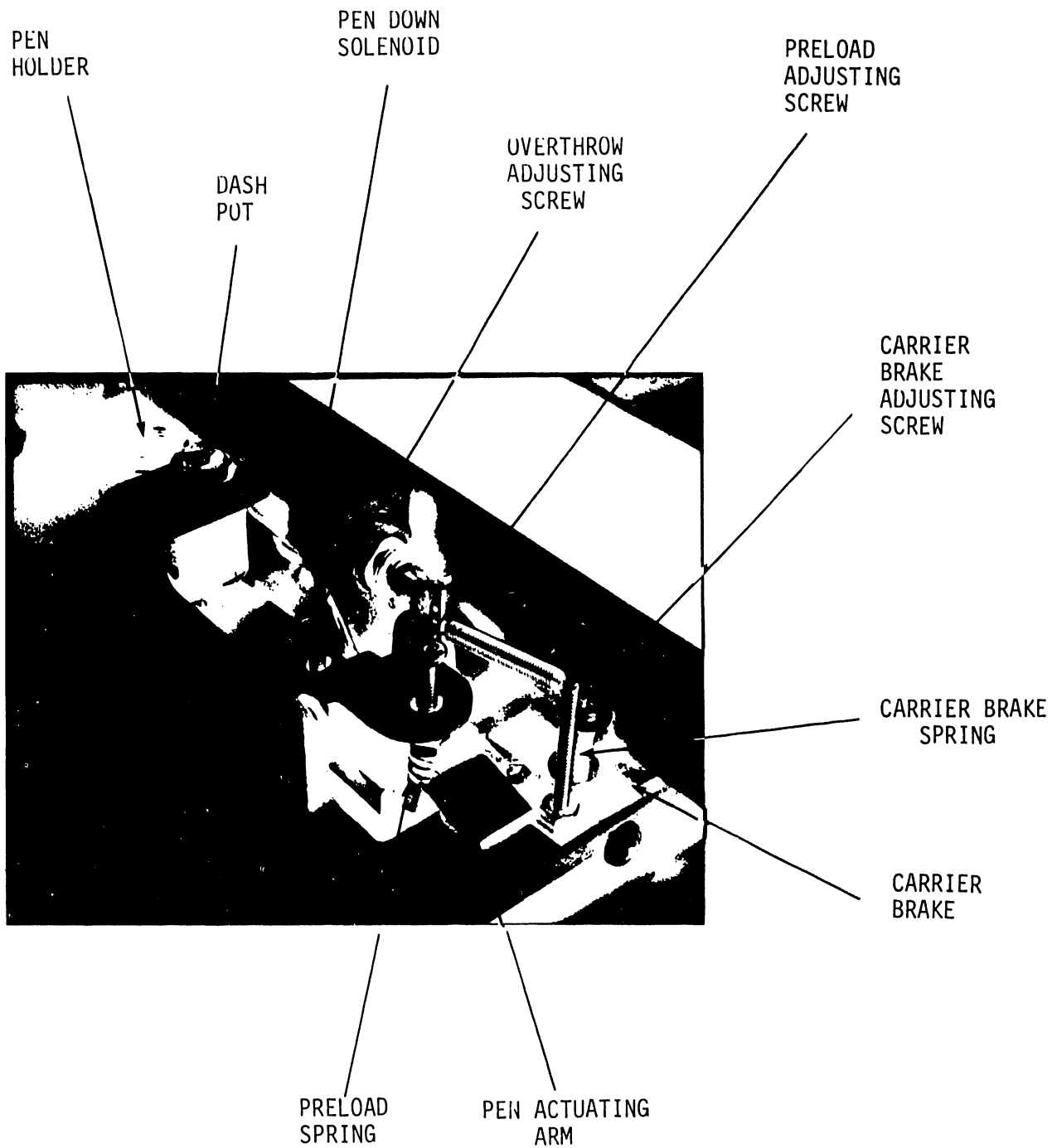


FIGURE 10
CARRIER MECHANISM

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.

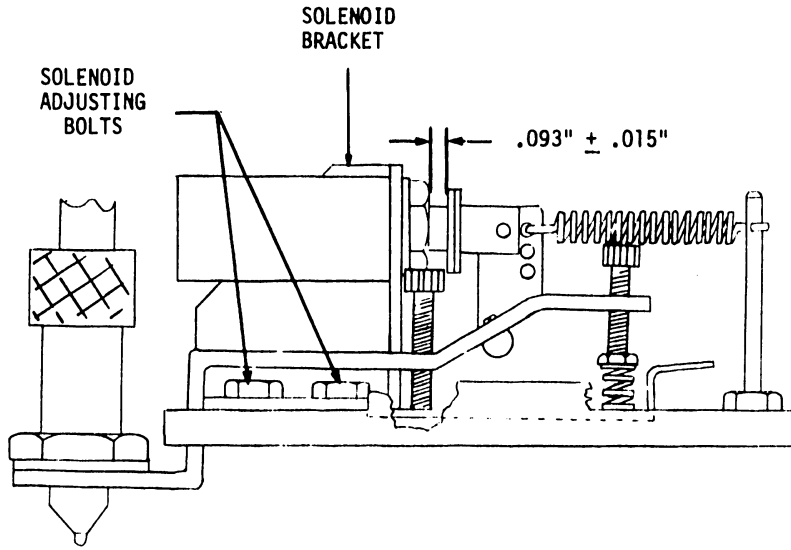


FIGURE 11
PEN SOLENOID ADJUSTMENT

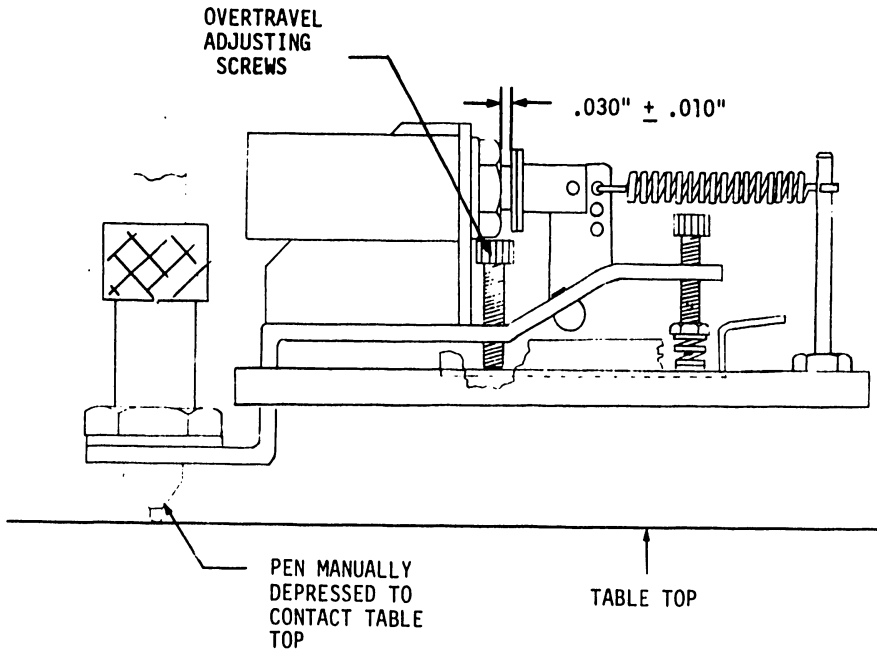


FIGURE 12
PLUNGER OVERTRAVEL ADJUSTMENT

- 3) Energize the pen solenoid (α , 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 (α , 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.

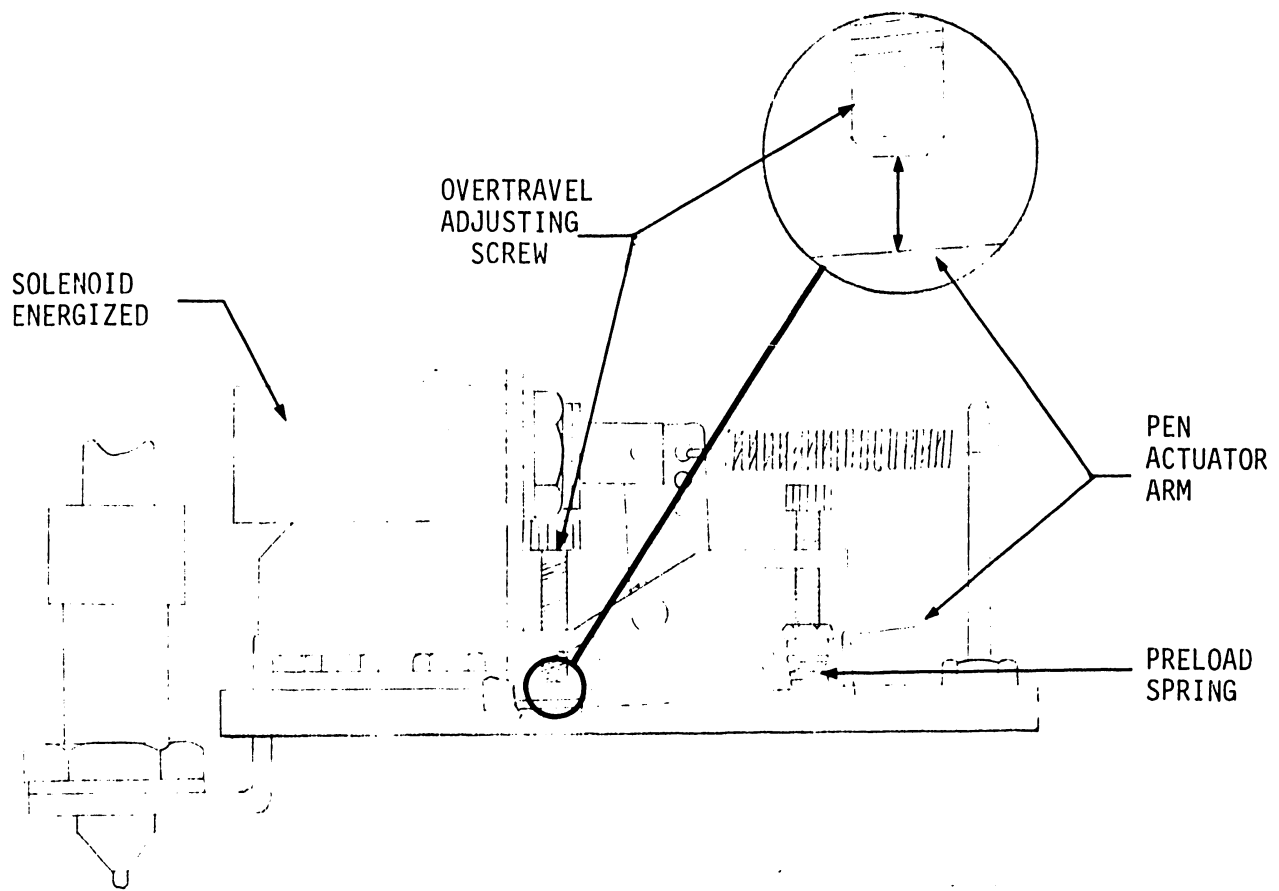


FIGURE 13
ENSURE GAP BETWEEN OVERTRAVEL
SCREW AND ACTUATOR ARM EXISTS

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.

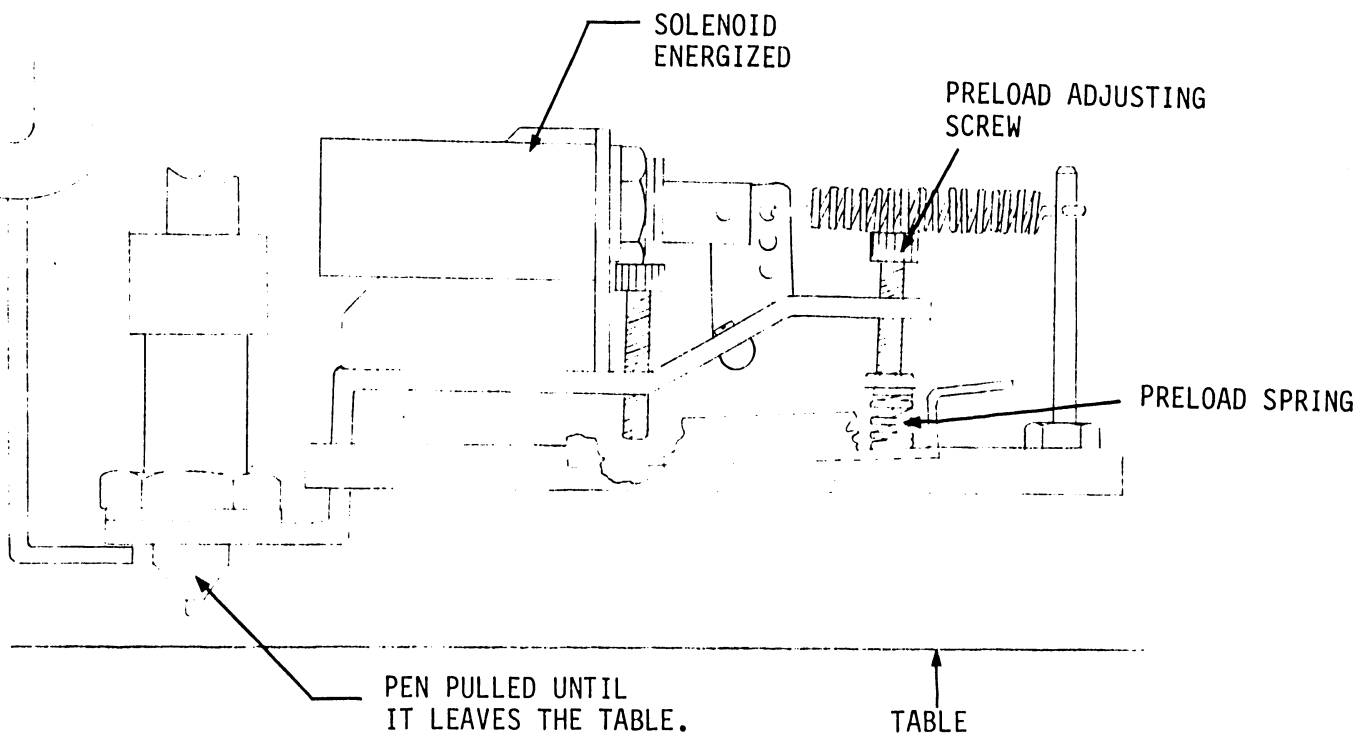


FIGURE 14
PRELOAD SPRING ADJUSTMENT

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.

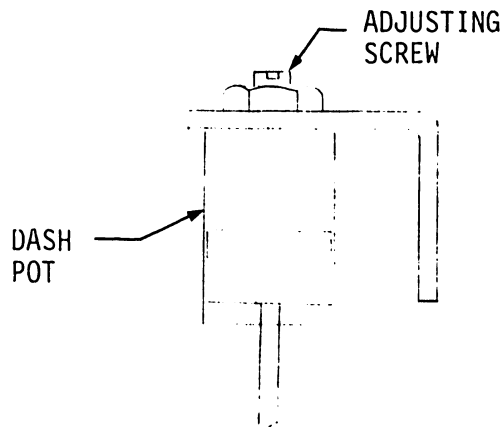


FIGURE 15
DASH POT ADJUSTMENT

5.7 CARRIER BRAKE ADJUSTMENT

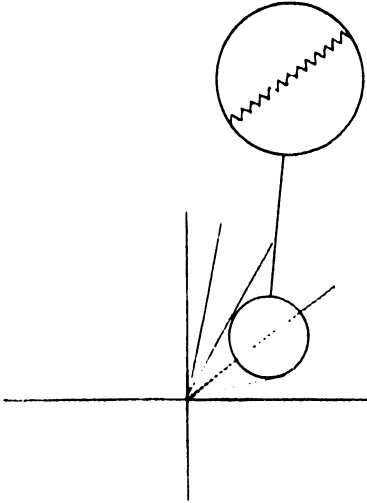
Run the radius program of the Model 32 (see paragraph 8.2); adjust the screw until there is no noticeable line oscillation or line separation. A slight line expansion is acceptable. See Figure 16.

NOTE:

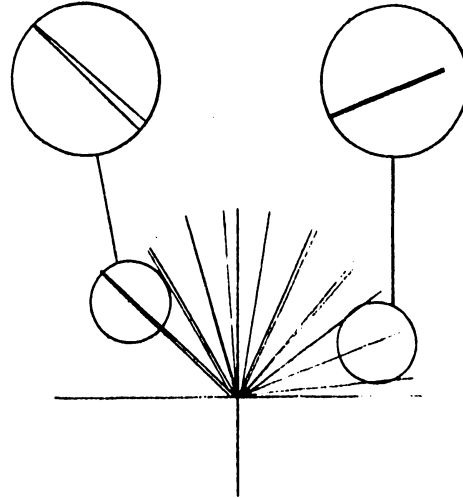
A tolerable line oscillation of several thousandths of an inch will be present on most Model 32 plotters. The oscillation is more apparent at 7°, 83°, 97°, 173°, 187°, 263°, 277°, and 353°.

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

LINE OSCILLATION
NOT ACCEPTABLE



LINE SEPARATION
NOT ACCEPTABLE



LINE EXPANSION
ACCEPTABLE

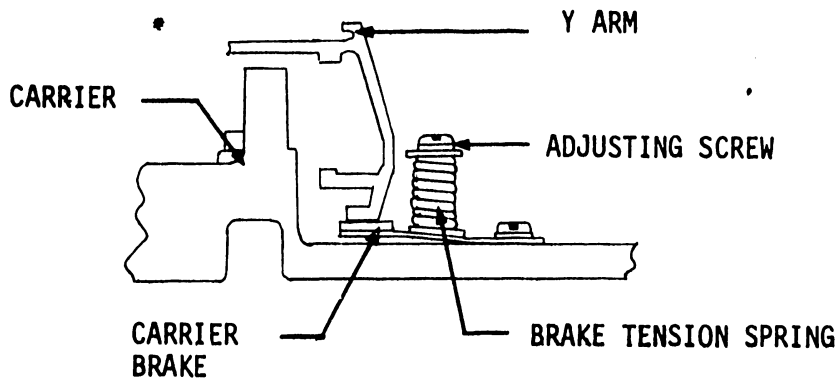
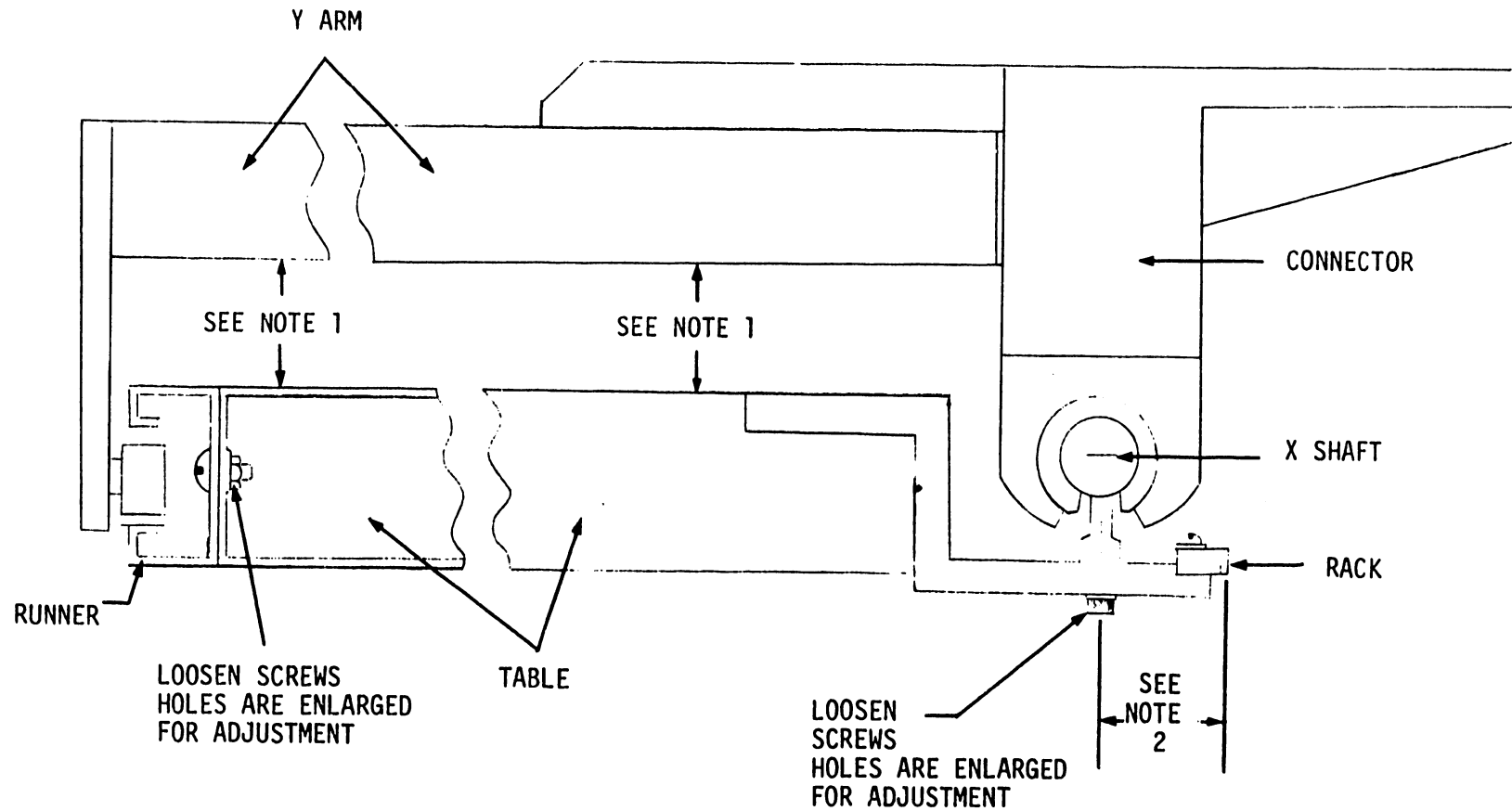


FIGURE 16
CARRIER BRAKE ADJUSTMENT

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.

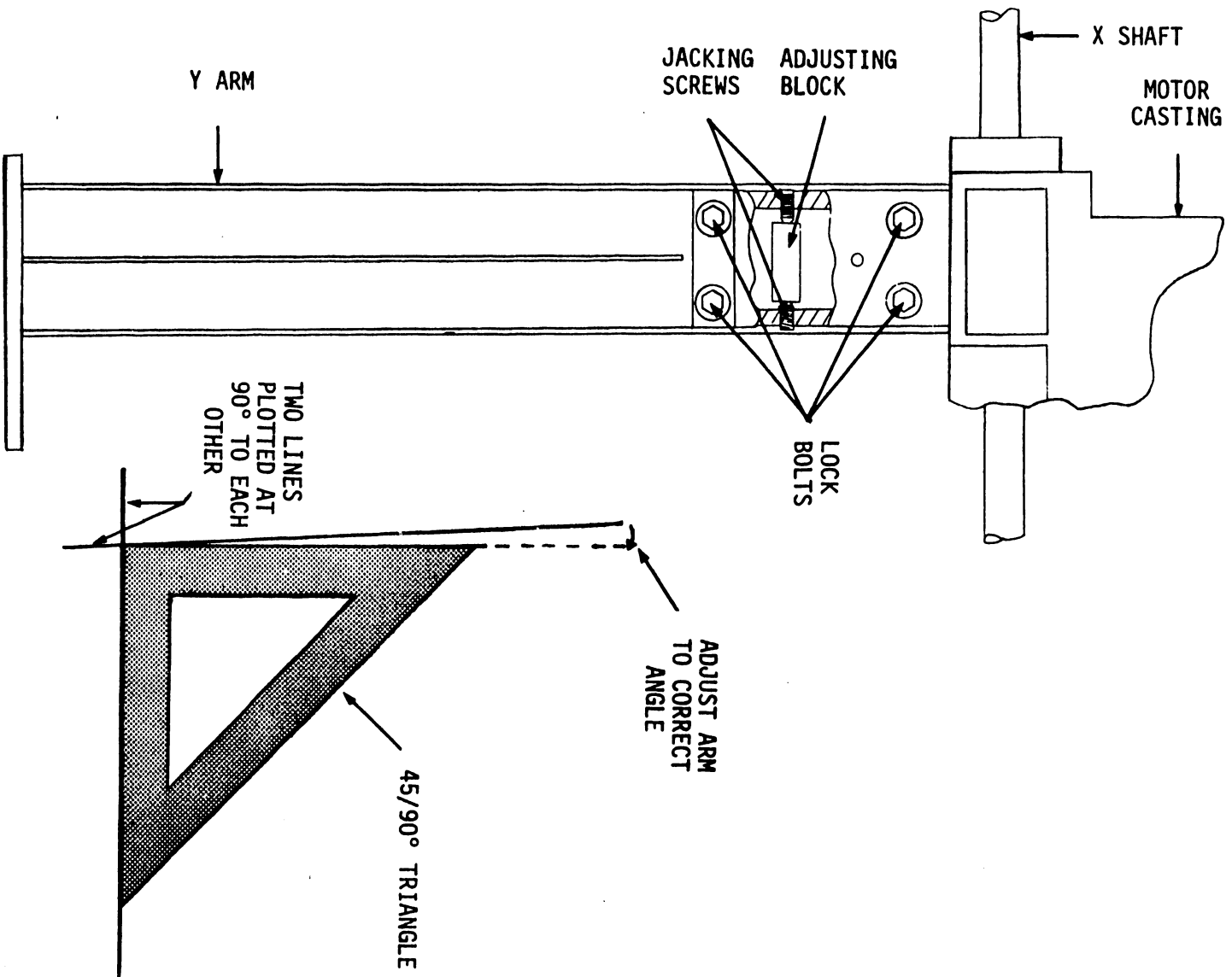


FIGURE 18
 MAKING Y ARM AND X SHAFT PERPENDICULAR

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.

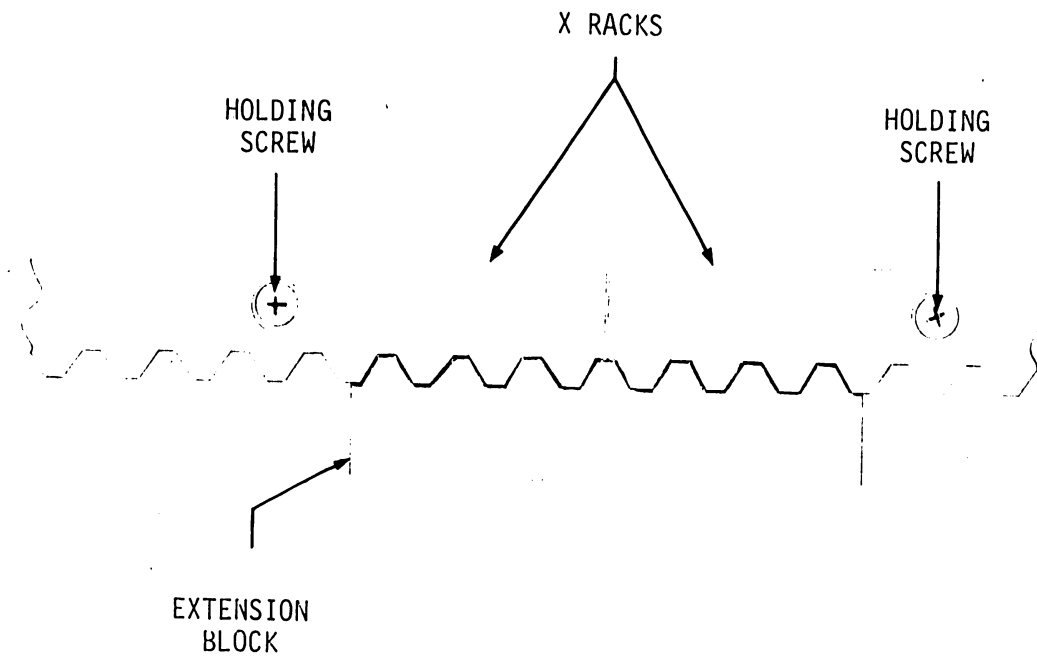


FIGURE 19
ALIGNMENT OF X RACKS

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.

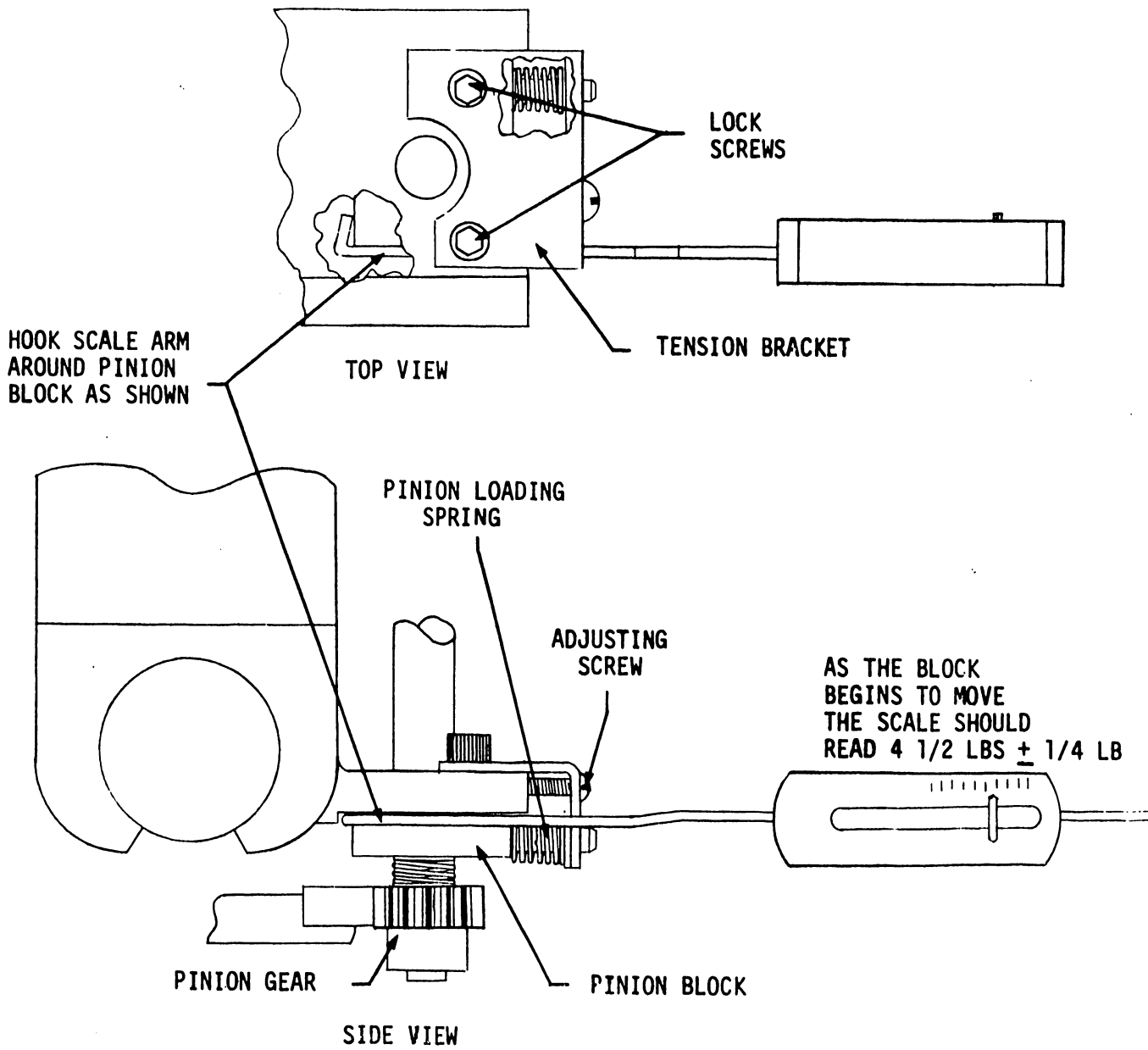


FIGURE 20
 PINION GEAR LOAD TENSION

- 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.

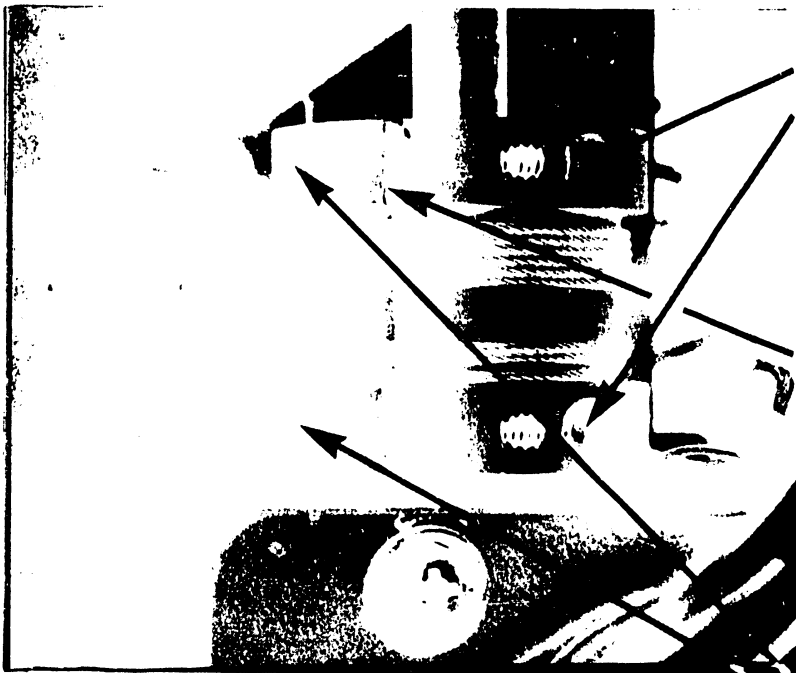
NOTE:

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

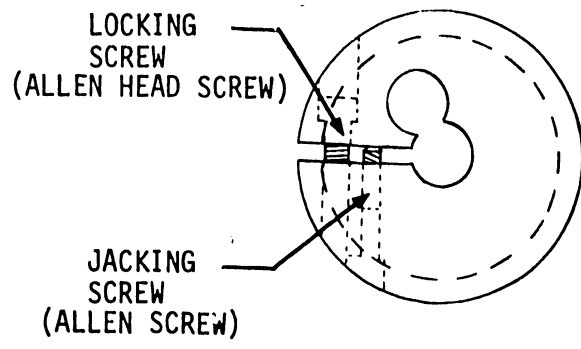


FIGURE 22
DRUM CROSS SECTION

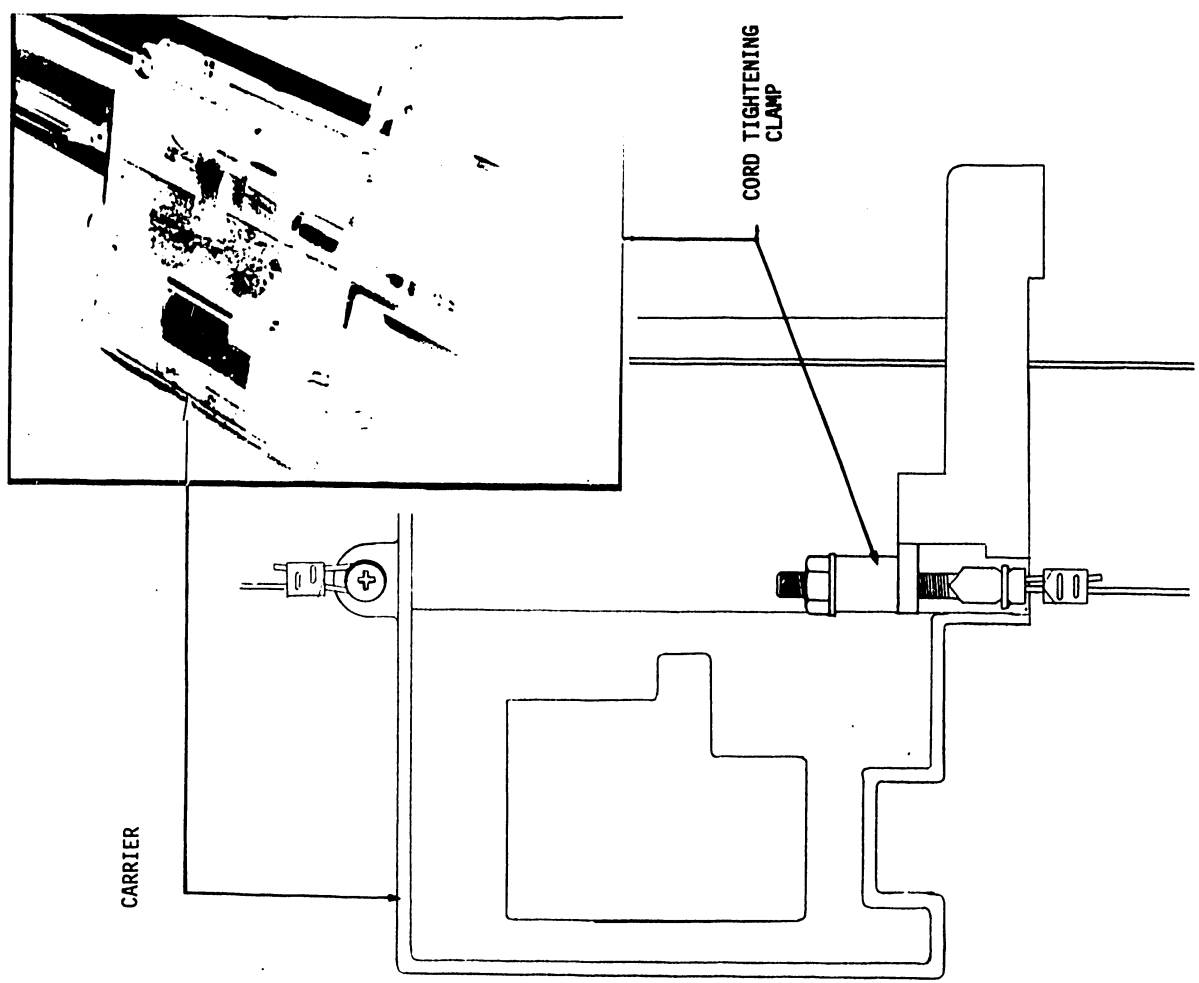


FIGURE 23
CORD TIGHTENING CLAMP LOCATION

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.

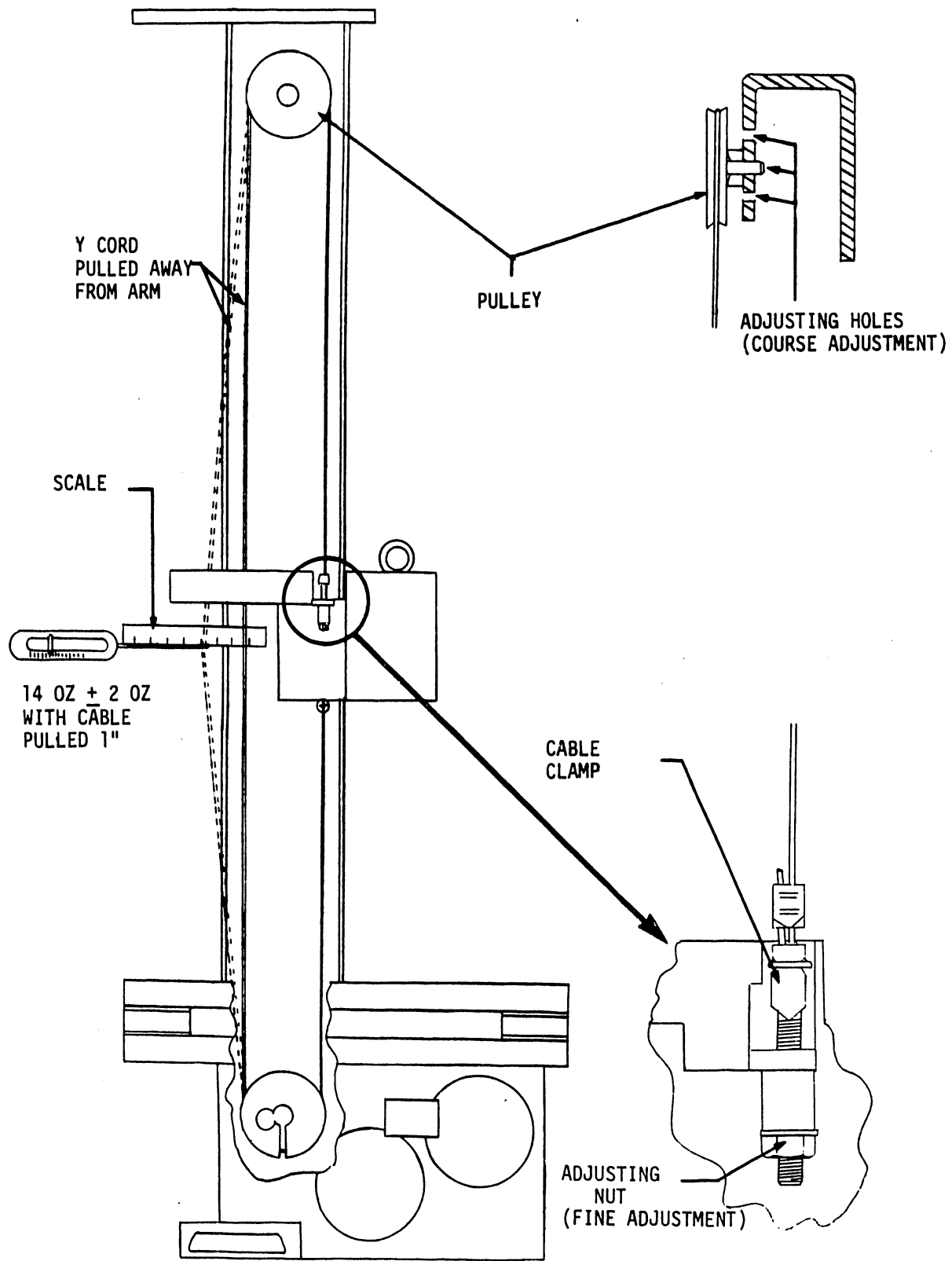


FIGURE 24
CABLE TENSION ADJUSTMENTS

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.

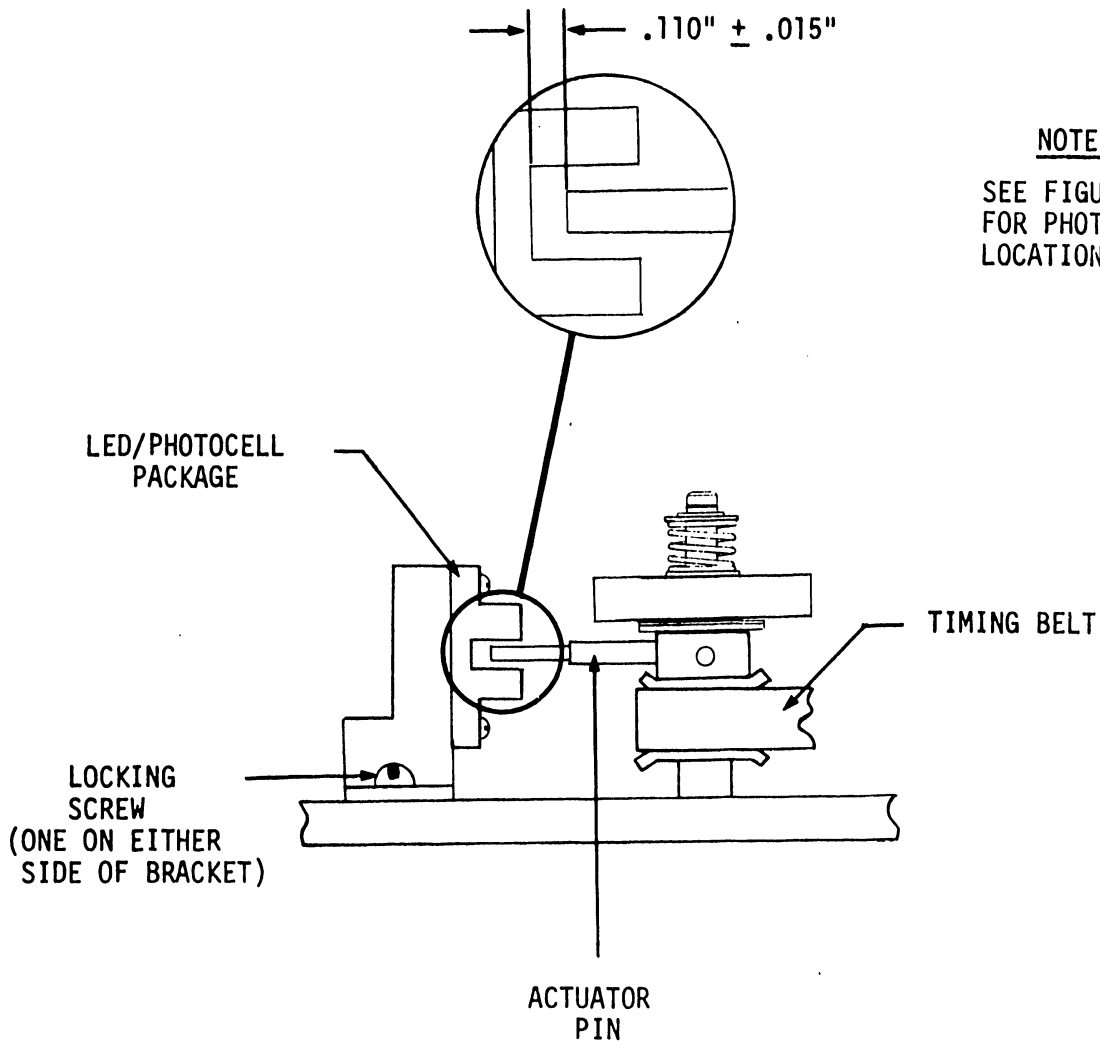


FIGURE 25
LED/PHOTOCELL ALIGNMENT

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

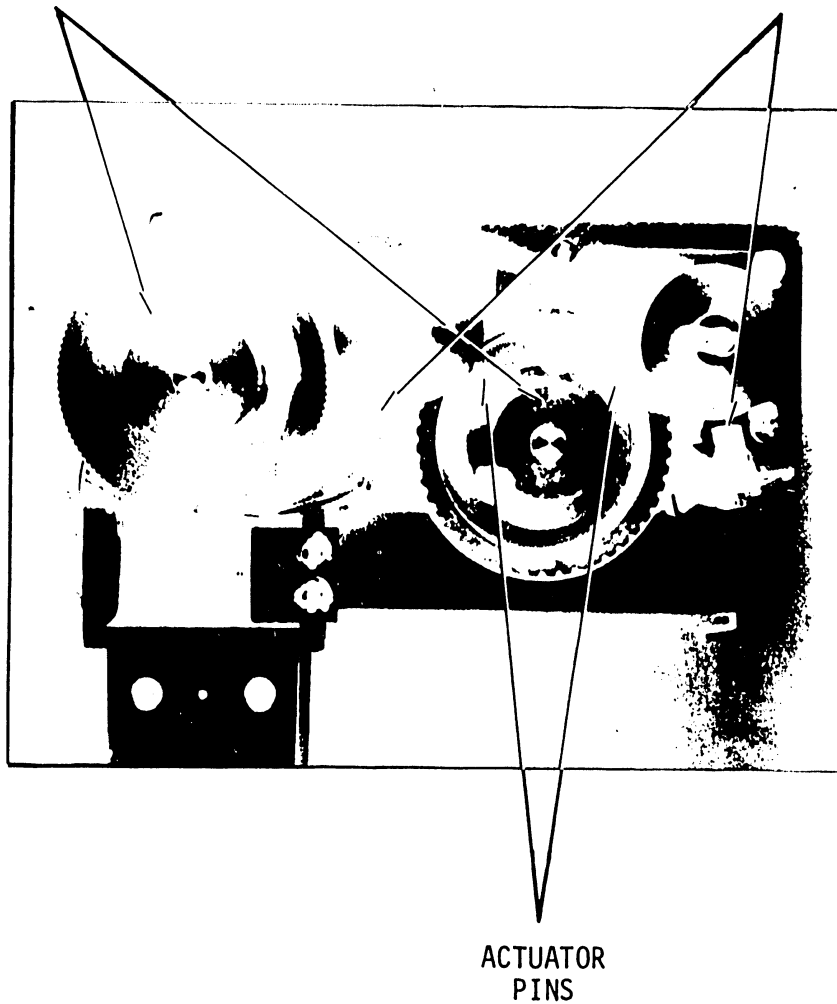


FIGURE 26
HOME POSITION COMPONENT LOCATIONS

- (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 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 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).

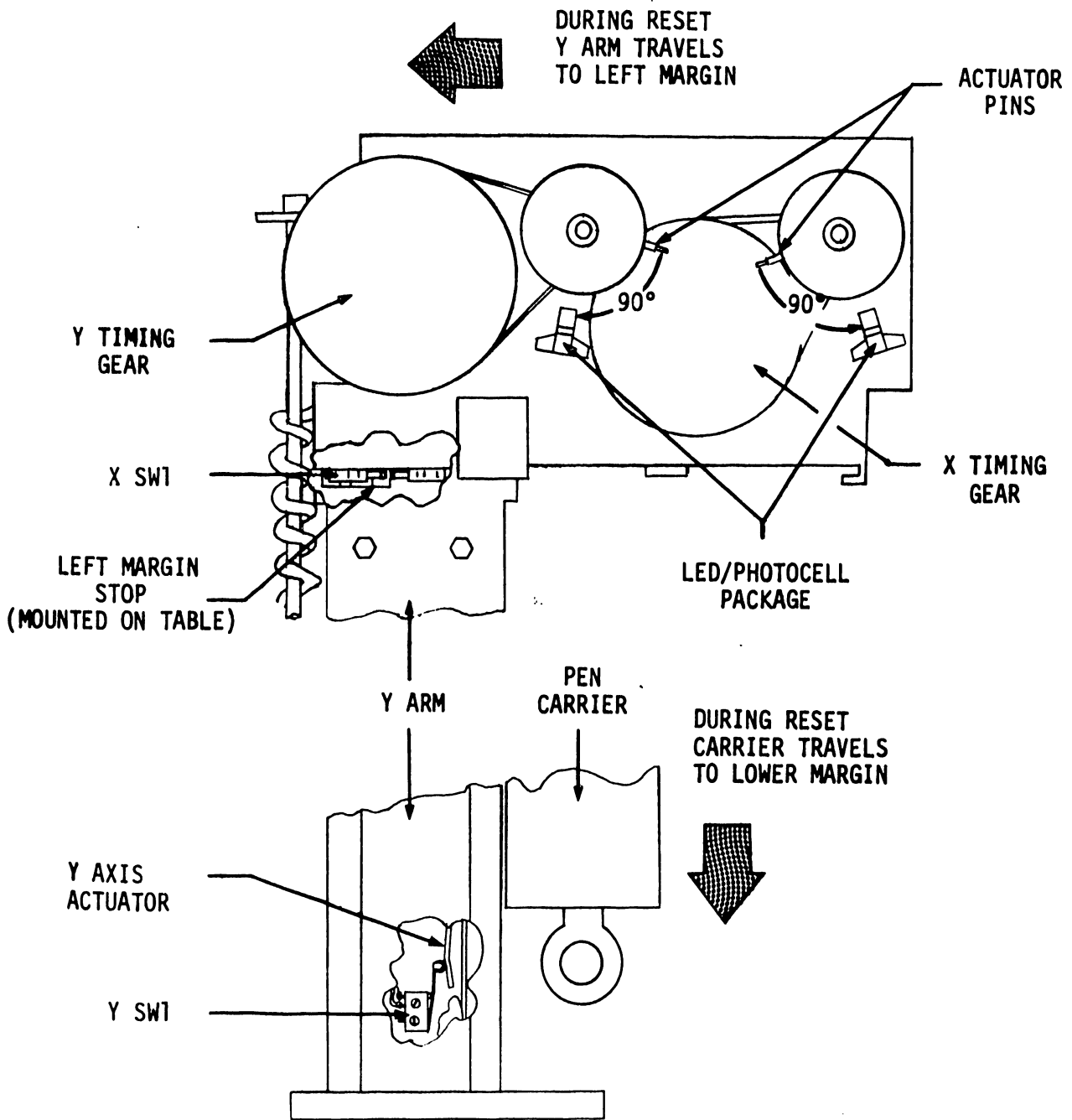


FIGURE 27
HOME POSITION ALIGNMENT

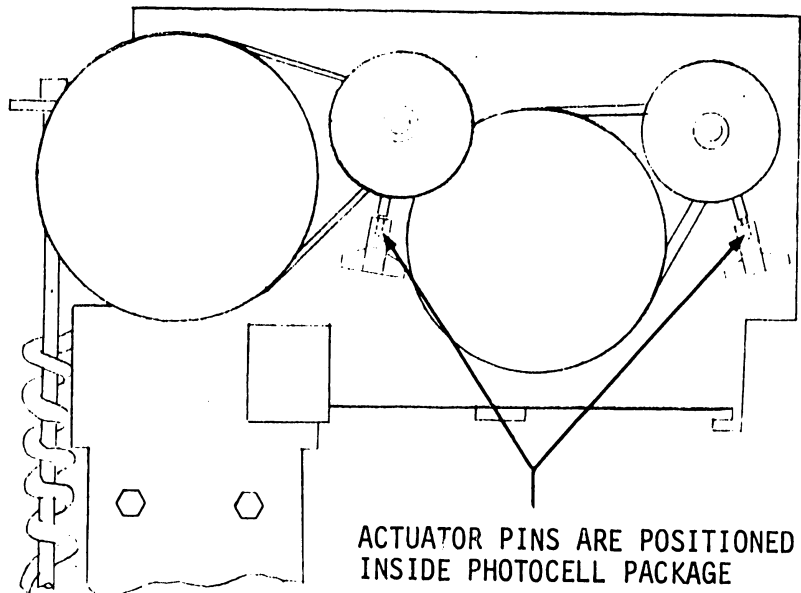


FIGURE 28
ACTUATOR PINS WHILE IN HOME POSITION

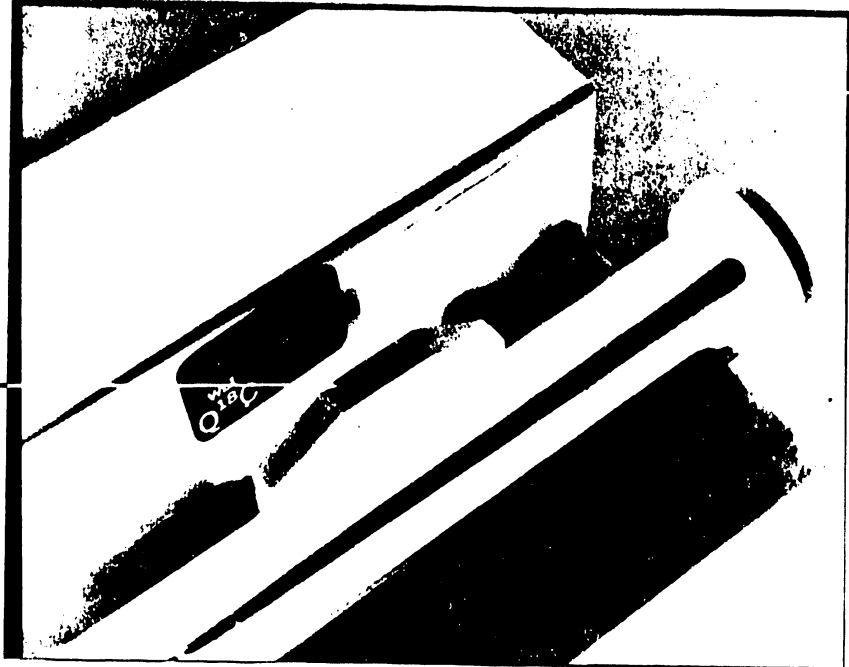


FIGURE 29
LEFT MARGIN STOP AND END CAP LOCATION

- (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.

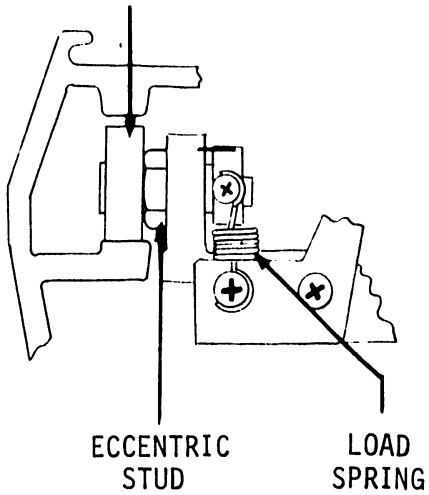
5.18 Y ARM REMOVAL AND REPLACEMENT

- 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

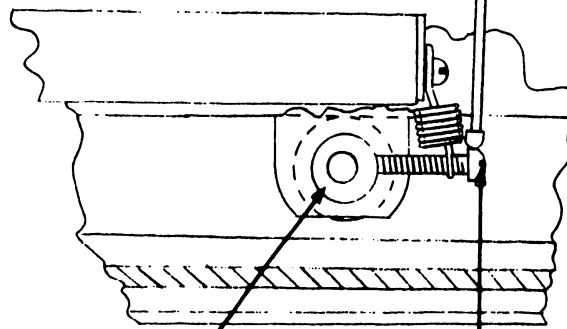
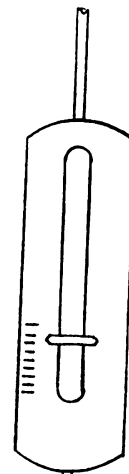
BEARING
AND
ROLLER



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.

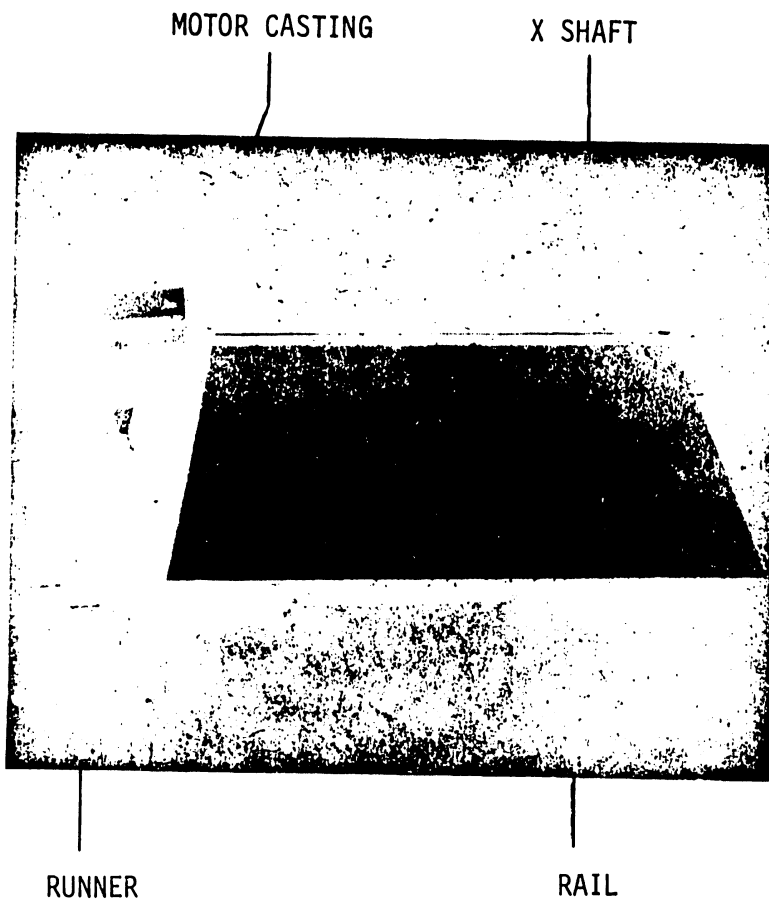


FIGURE 31
Y ARM REMOVAL

6. ELECTRICAL ADJUSTMENTS - L565 PC

6.1 +5VR ADJUSTMENT

- 1) Check +5VR from pin 14₂ (+5V) to 13₂ (+0V).
- 2) Adjust +5VR by varying R43. See Figure 32.

6.2 +23VR ADJUSTMENT

- 1) Check +23VR from pin H₂ (+23V) to 13₂ (+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 3₂ of the L565 PC.

The time from A to B, with motors at rest should be set to 180 μ s \pm 18 μ 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 μ s \pm 10 μ 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 μ s (motors in motion). The initial setting of R54 (180 μ s; motors at rest) is only preliminary. Therefore, readjust R54 until the 120 μ s \pm 10 μ s reading can be verified at the moment coinciding with the end of the 999 step traverse; (motors have reached maximum stepping speed).

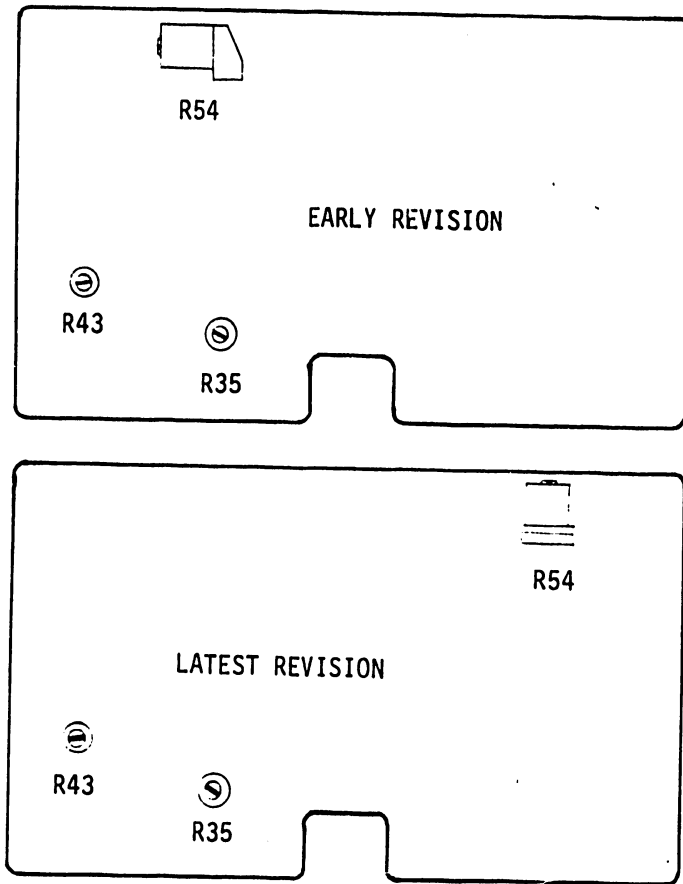


FIGURE 32
POT LOCATIONS ON L565 PC BOARD

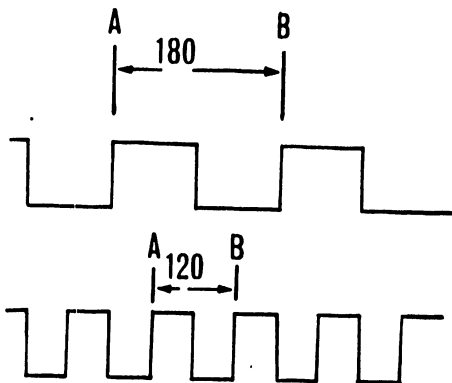


FIGURE 33

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.

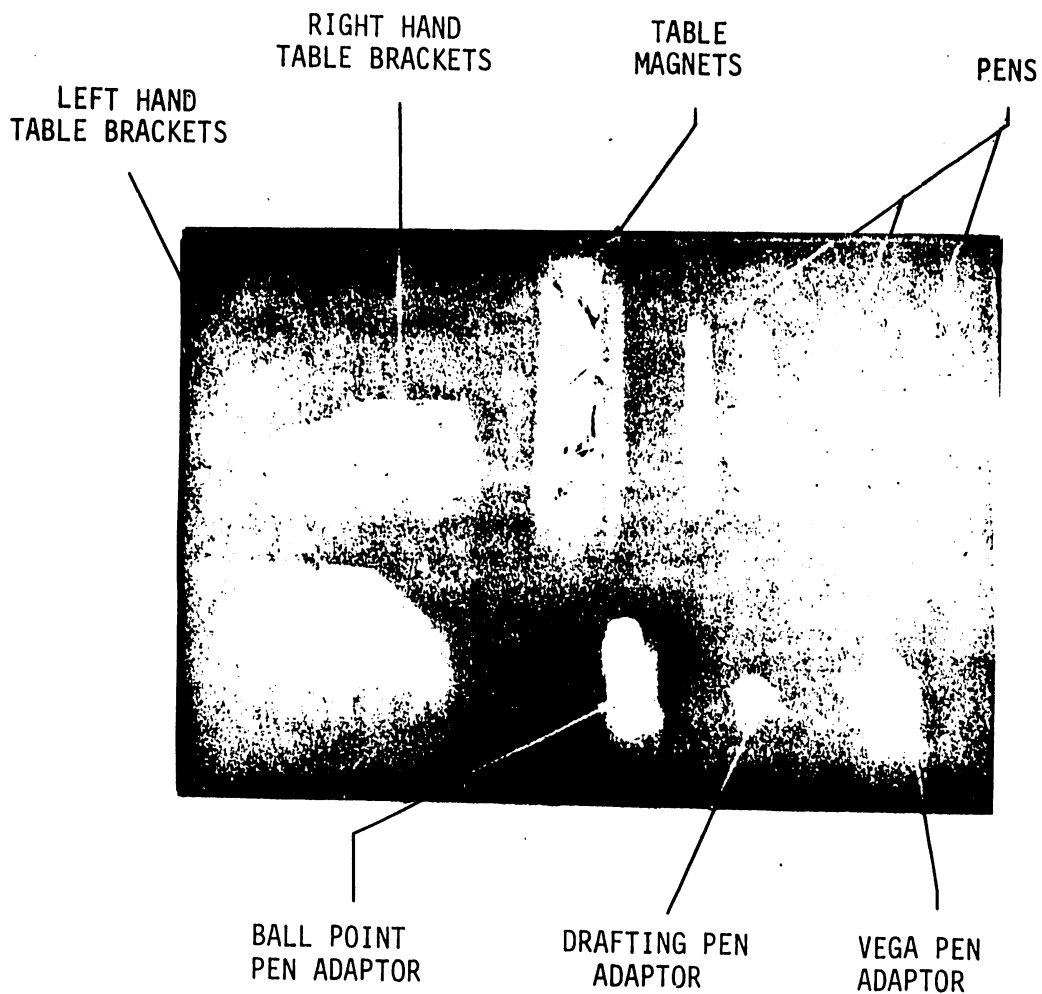


FIGURE 34
ACCESSORIES TO MODEL 32

- 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

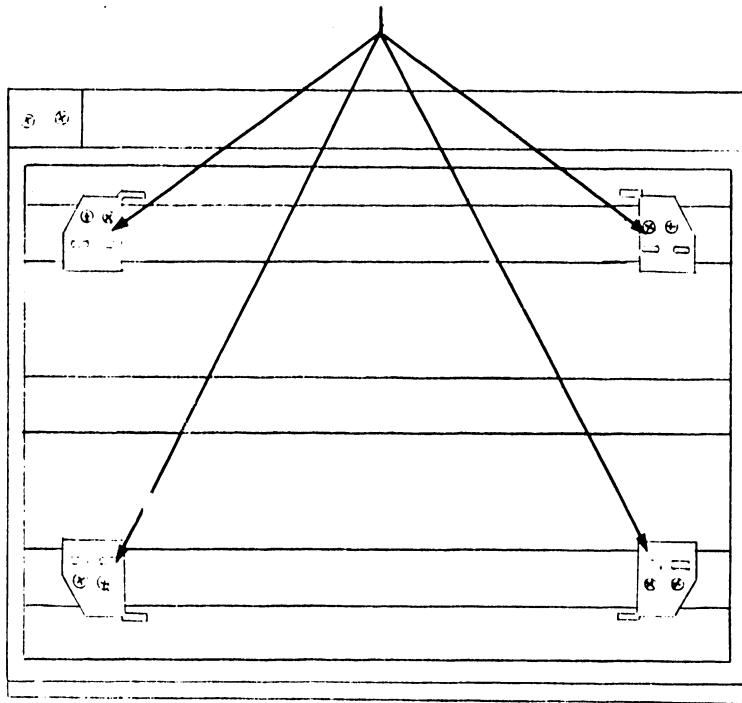


FIGURE 35
TABLE BRACKET LOCATIONS

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 00
- (b) Key a (length of major axis), GO
- (c) Key b (length of minor axis), GO
- (d) Key θ (increment of central angle), GO

2) Example (See result, Figure 36)

- (a) Key 00
- (b) Key 500, GO
- (c) Key 500, GO
- (d) Key 10, GO

$$a = 500 = 1 \frac{1}{4}''$$

$$b = 500 = 1 \frac{1}{4}''$$

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

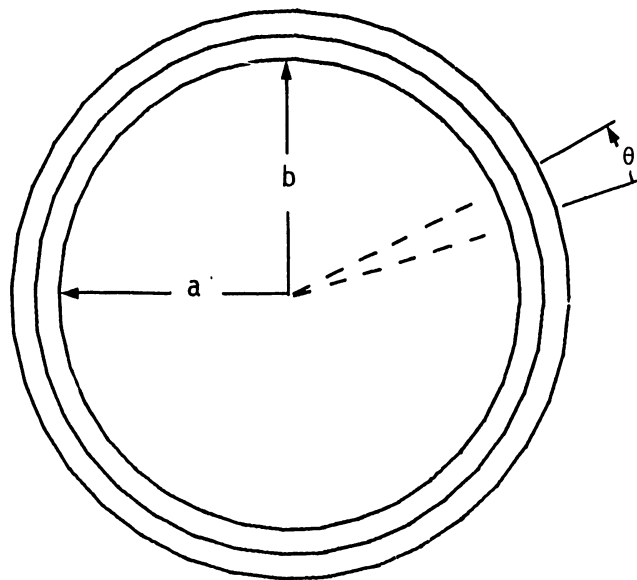


FIGURE 36
SUBROUTINE 00 OF DIAGNOSTIC

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 θ (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

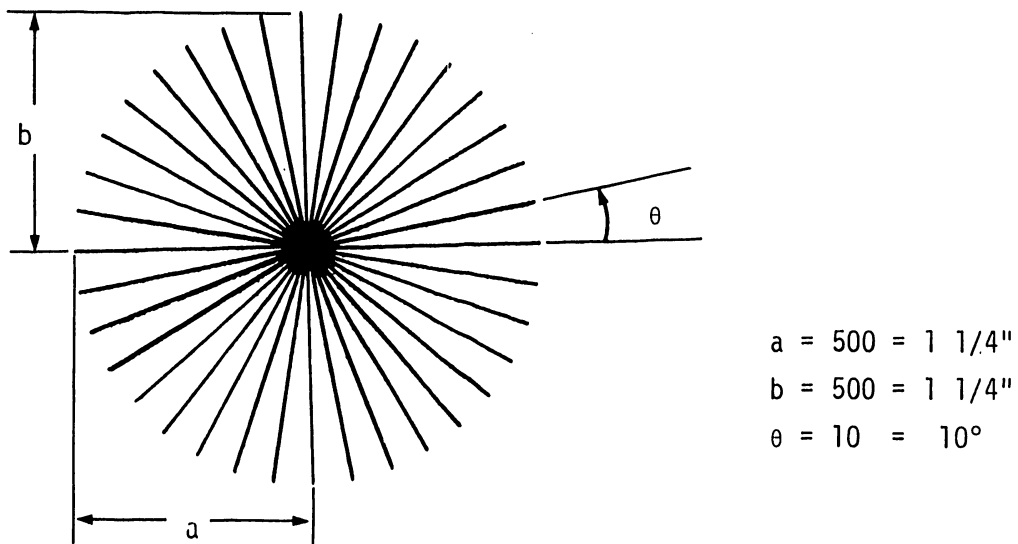


FIGURE 37
SUBROUTINE 01 OF DIAGNOSTIC

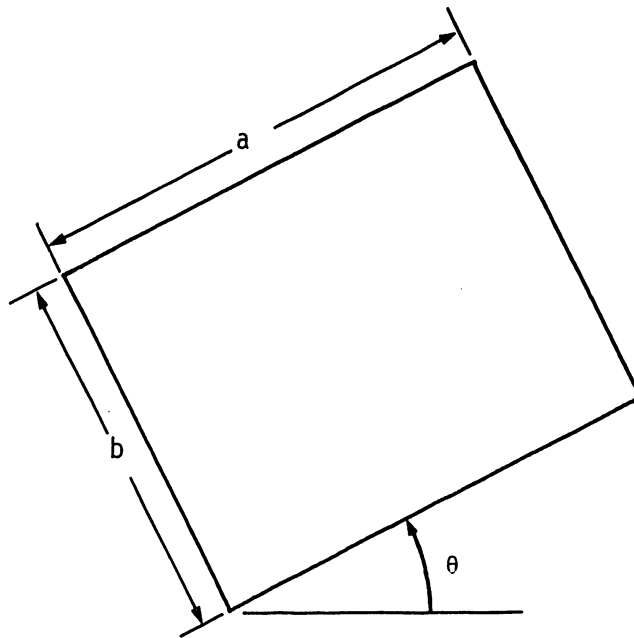
8.3 RECTANGLE DRAWN AT AN ANGLE

1) Keying order

- (a) Key 02
- (b) Key a (length of one side), GO
- (c) Key b (length of other side), GO
- (d) Key θ (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

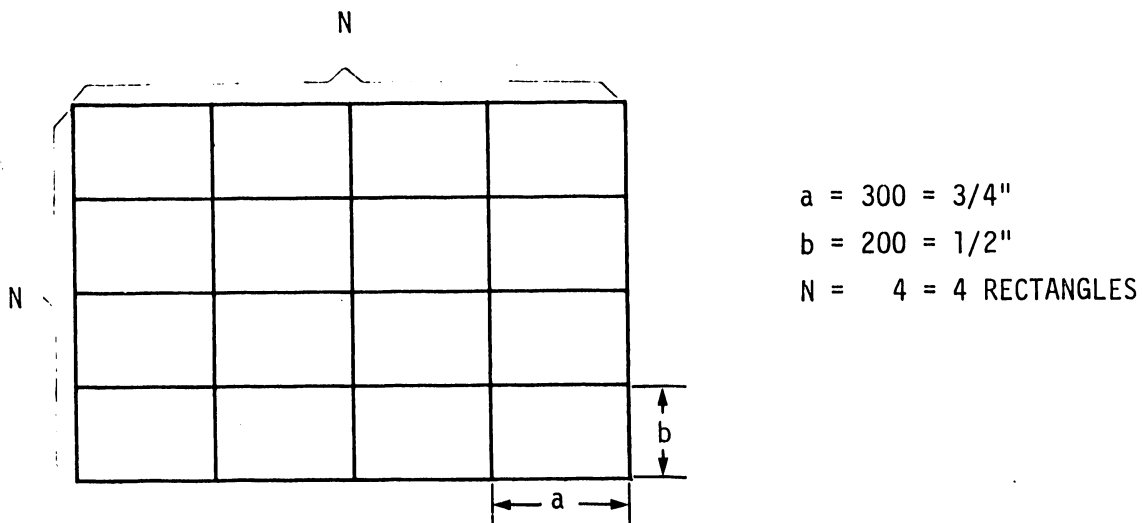


FIGURE 39
SUBROUTINE 03 OF DIAGNOSTIC

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

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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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.

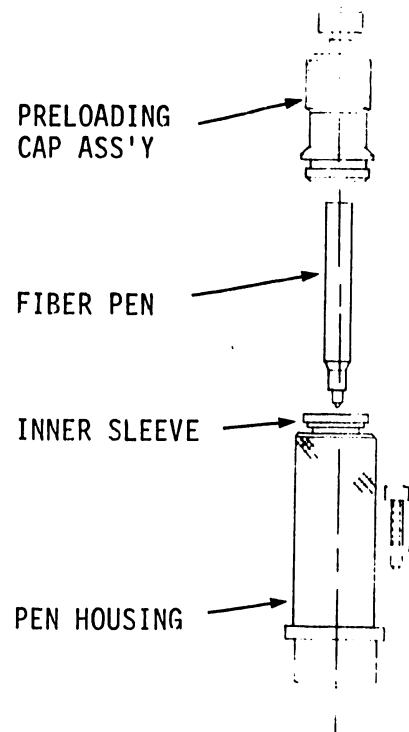


FIGURE 1

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.

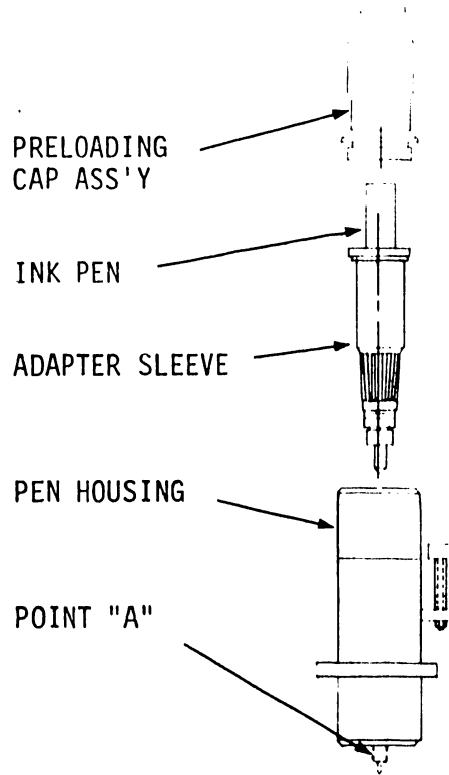


FIGURE 2

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.

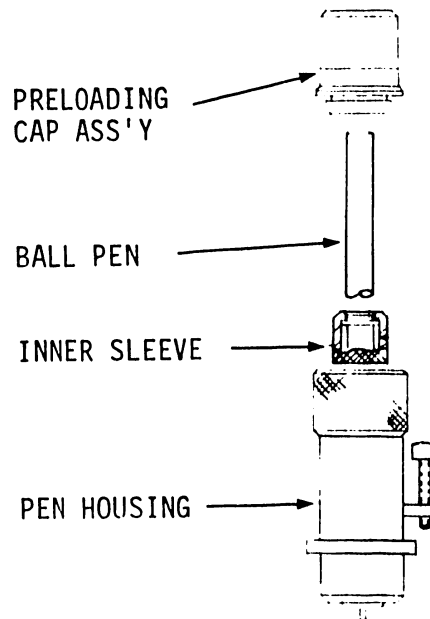


FIGURE 3

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.

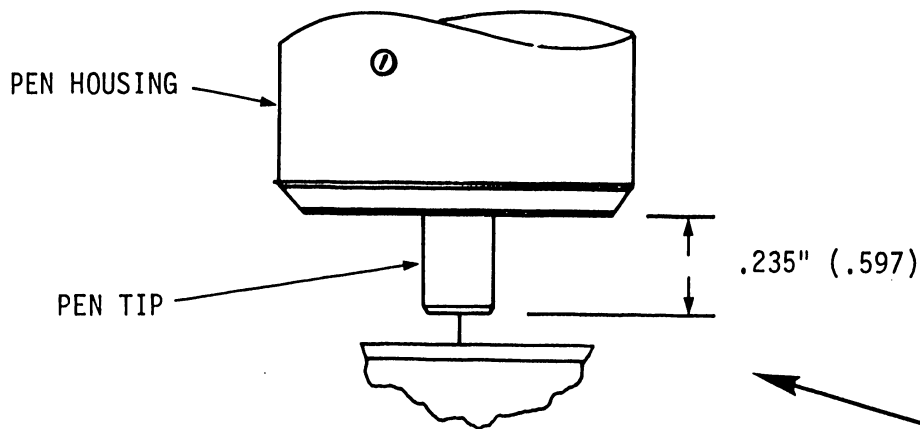


FIGURE 4

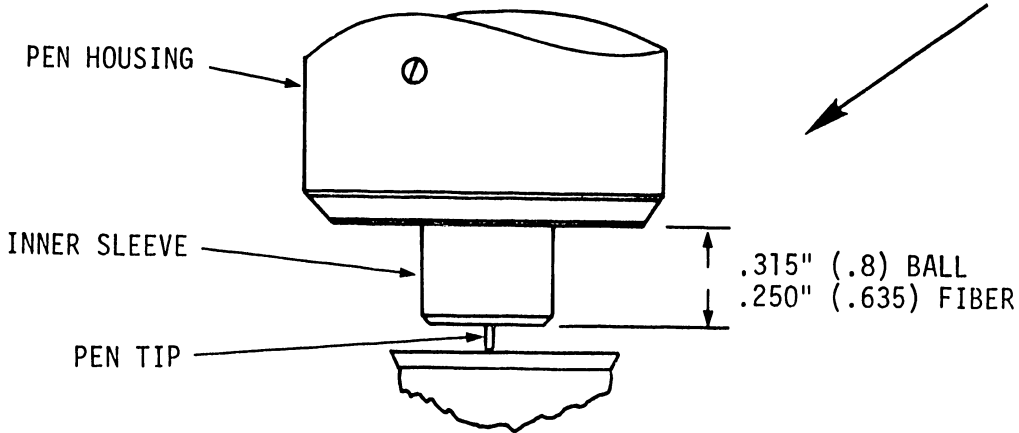
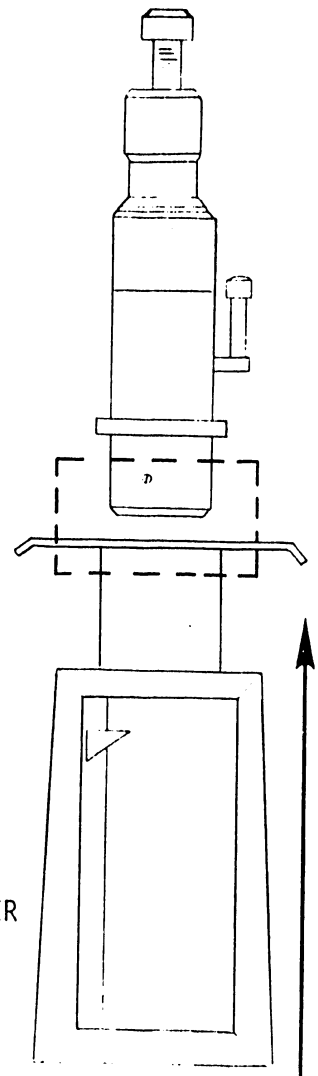


FIGURE 5



GRAM SCALE-PUSH UP

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.

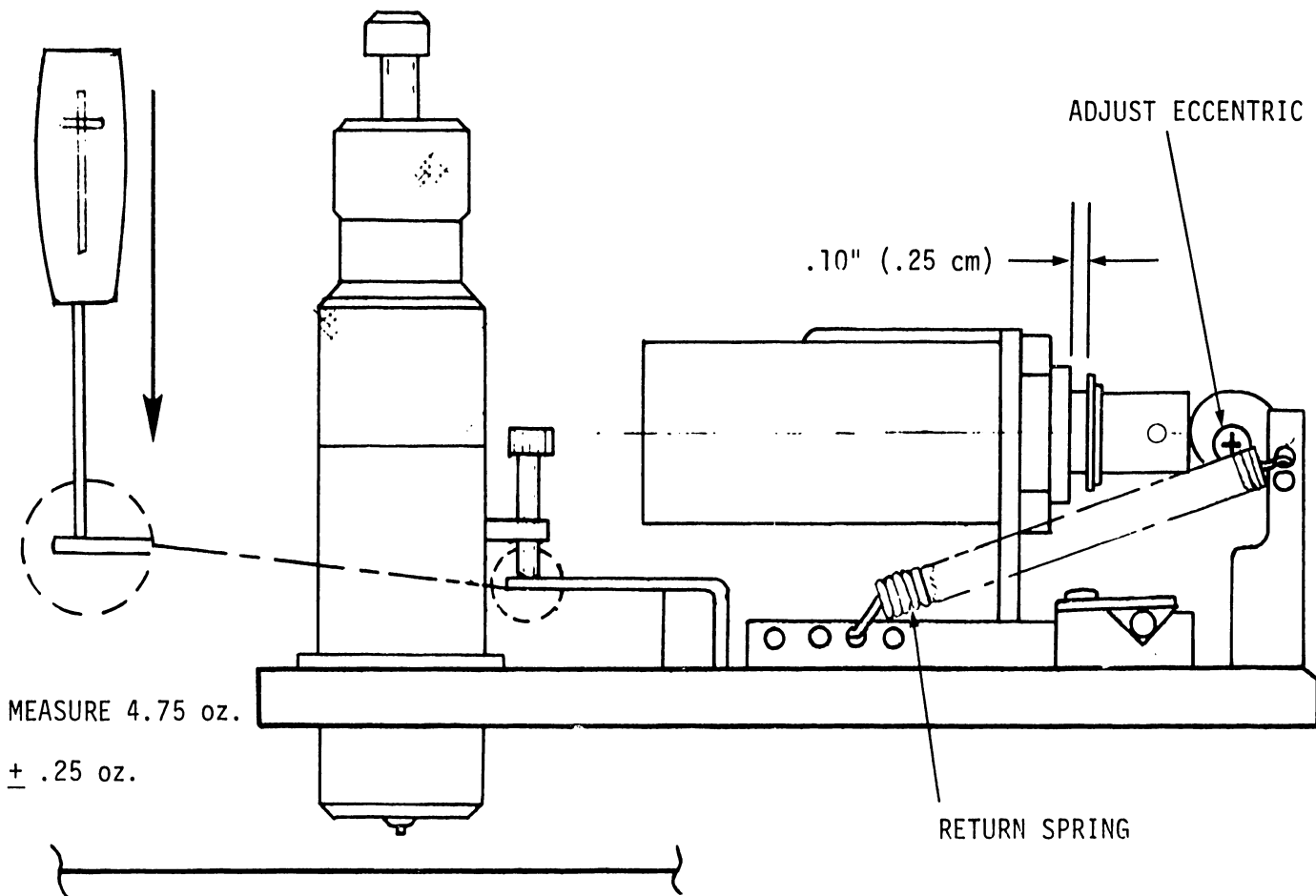


FIGURE 6
PEN AND SOLENIOD ADJUSTMENT

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.

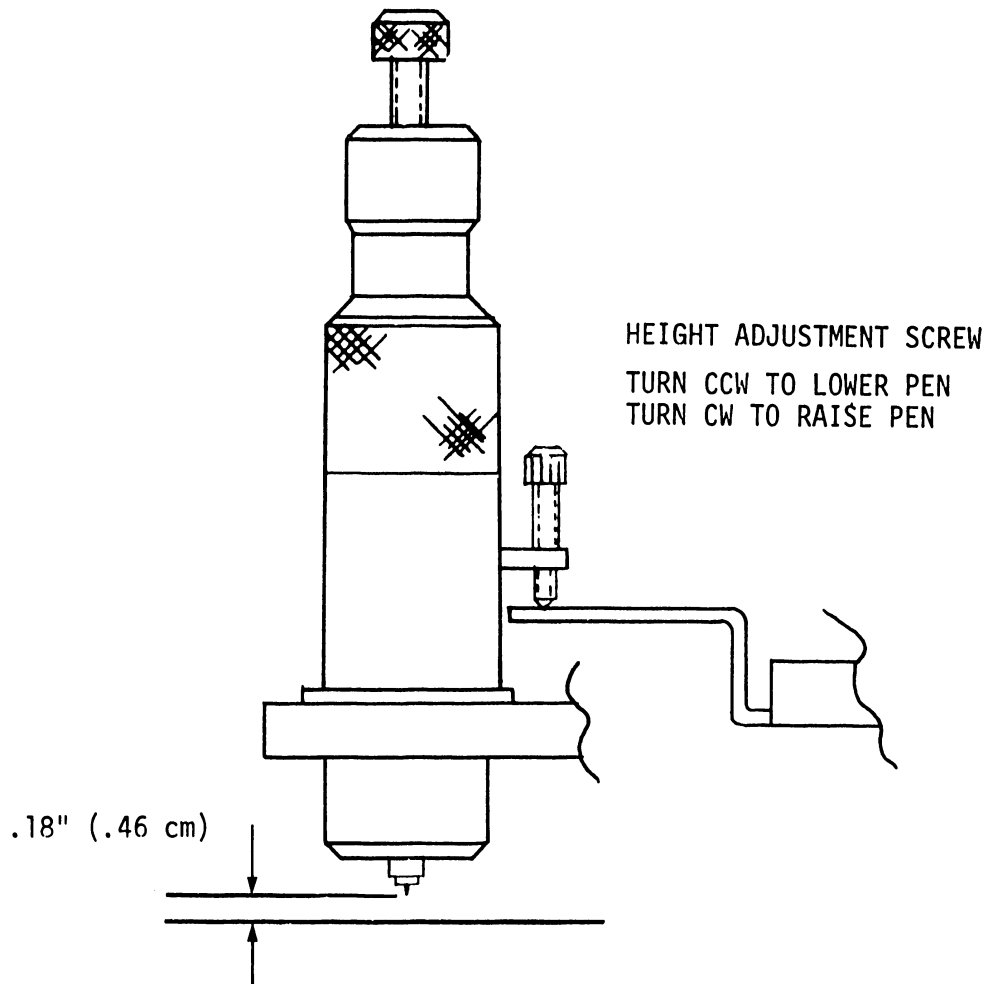


FIGURE 7

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.

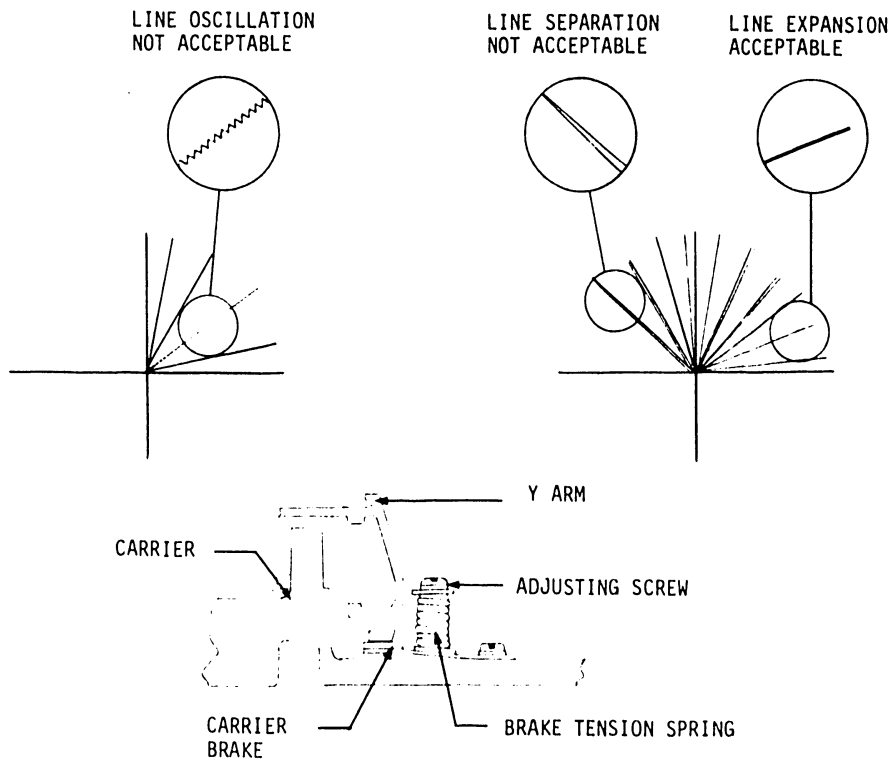


FIGURE 8
CARRIER BRAKE ADJUSTMENT

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.

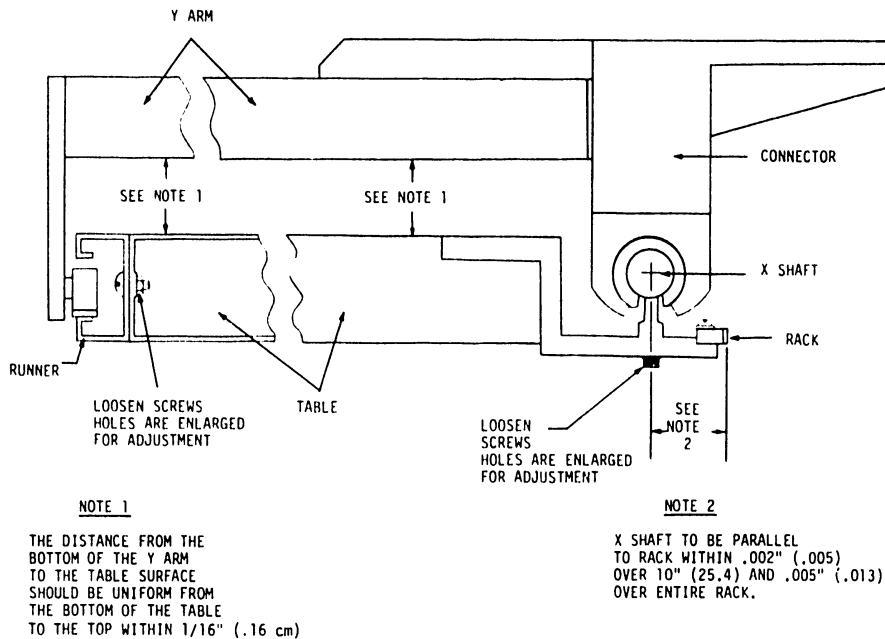


FIGURE 9

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.

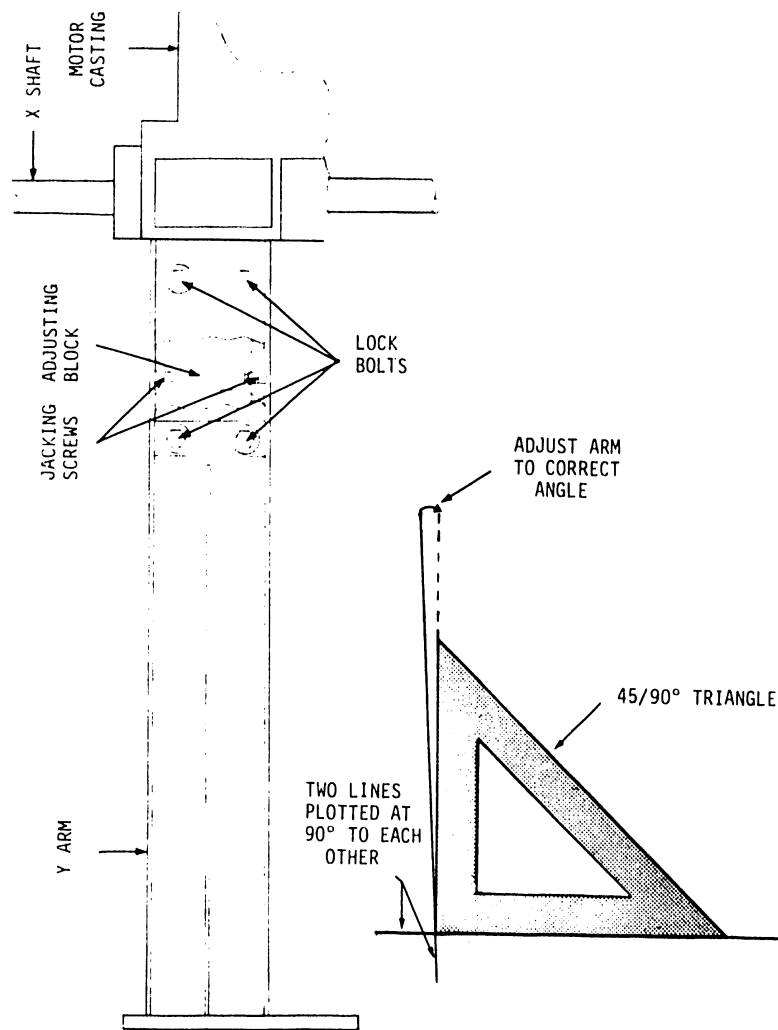


FIGURE 10

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.

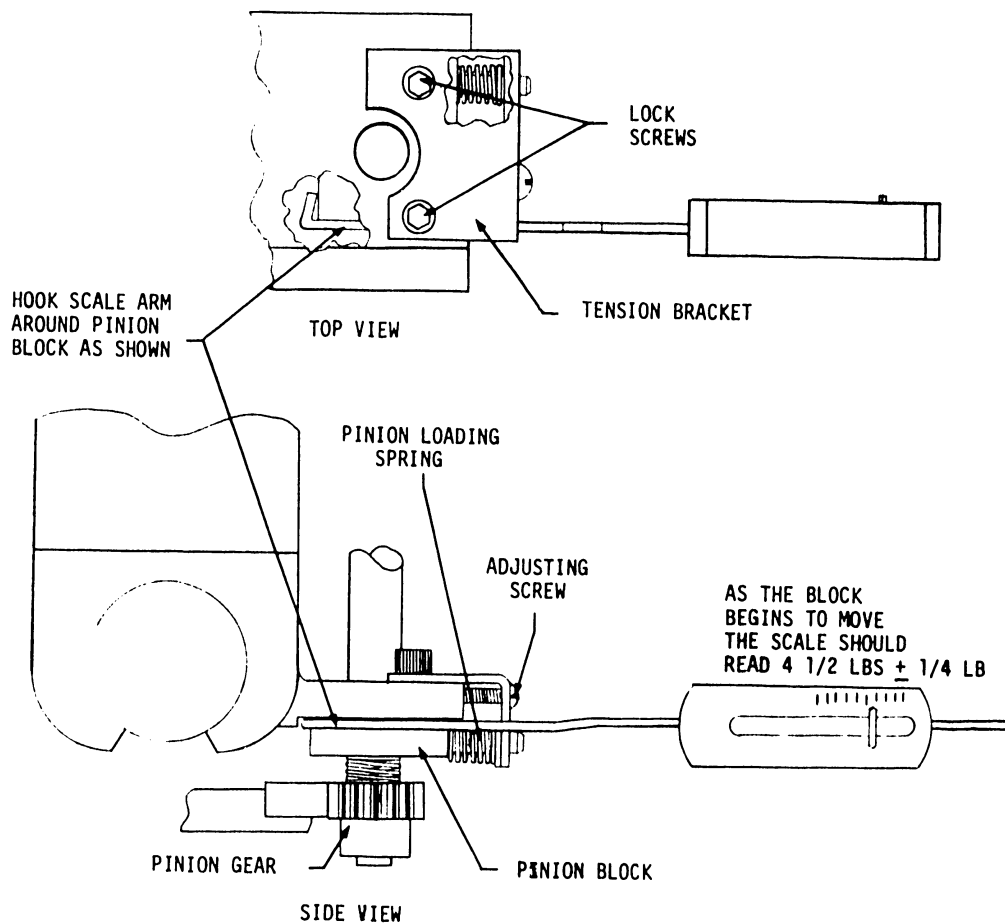


FIGURE 11
PINION GEAR LOAD TENSION

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.

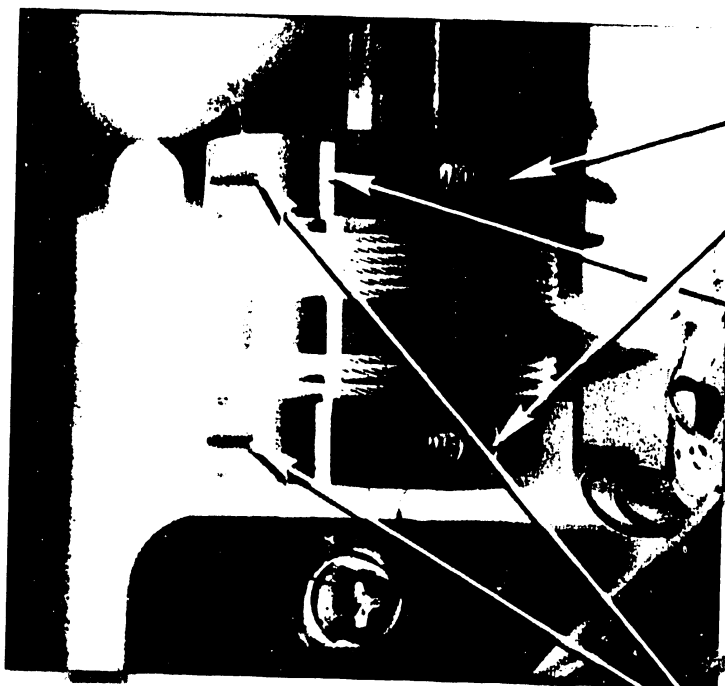
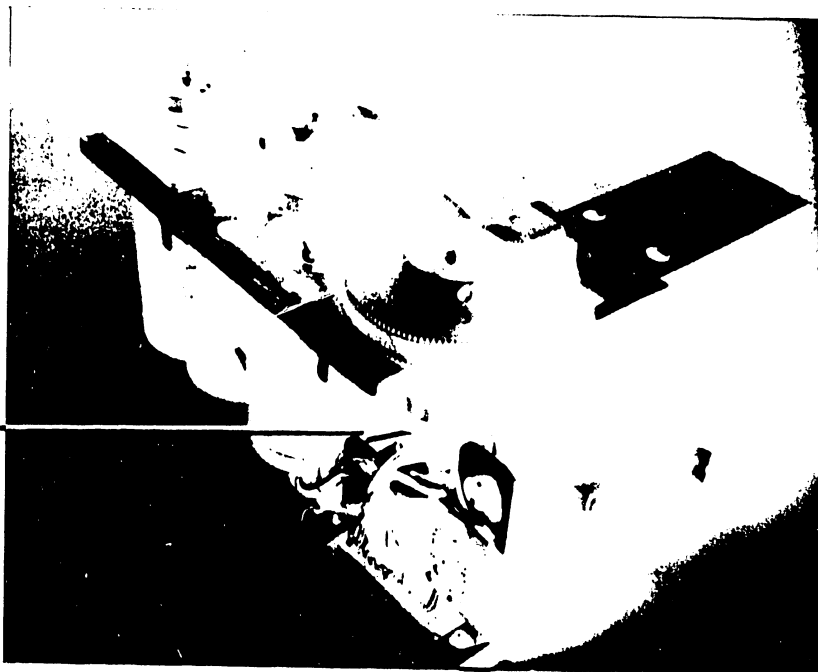
- 2) Adjustment of the Y increment is done by varying the circumference of the cable drum (See Figures 12 and 13). Increasing the diameter of the drum will cause larger increments; decreasing the diameter will cause smaller increments. The following steps explain.

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

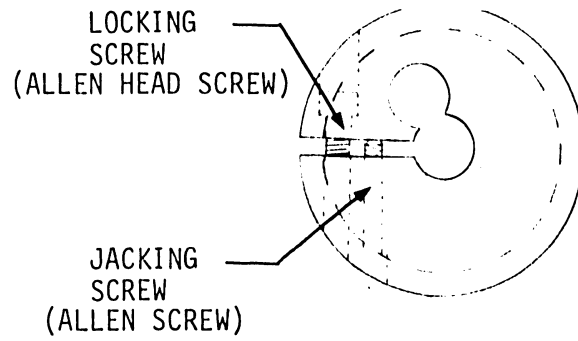


FIGURE 13

DRUM CROSS SECTION

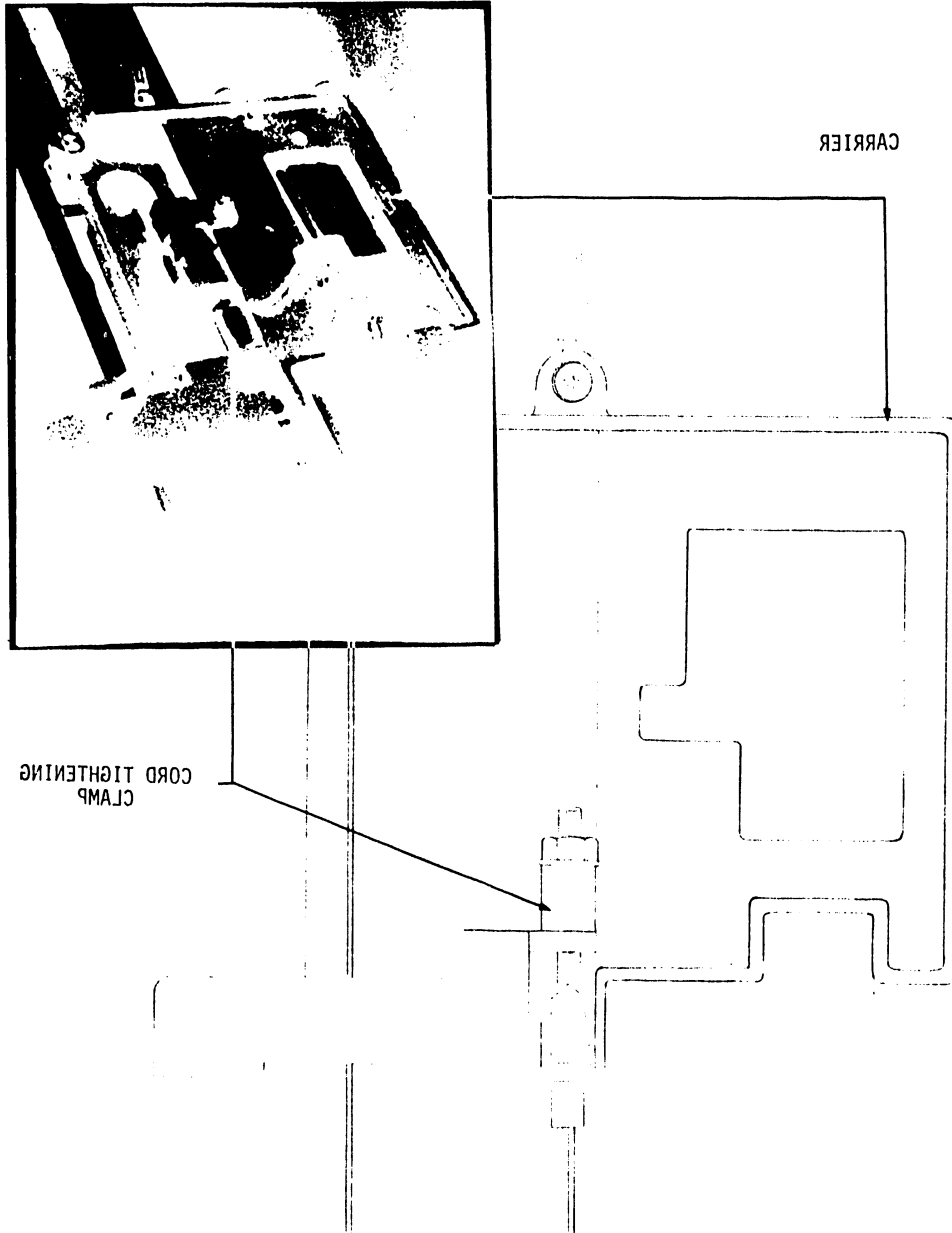


FIGURE 14

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.

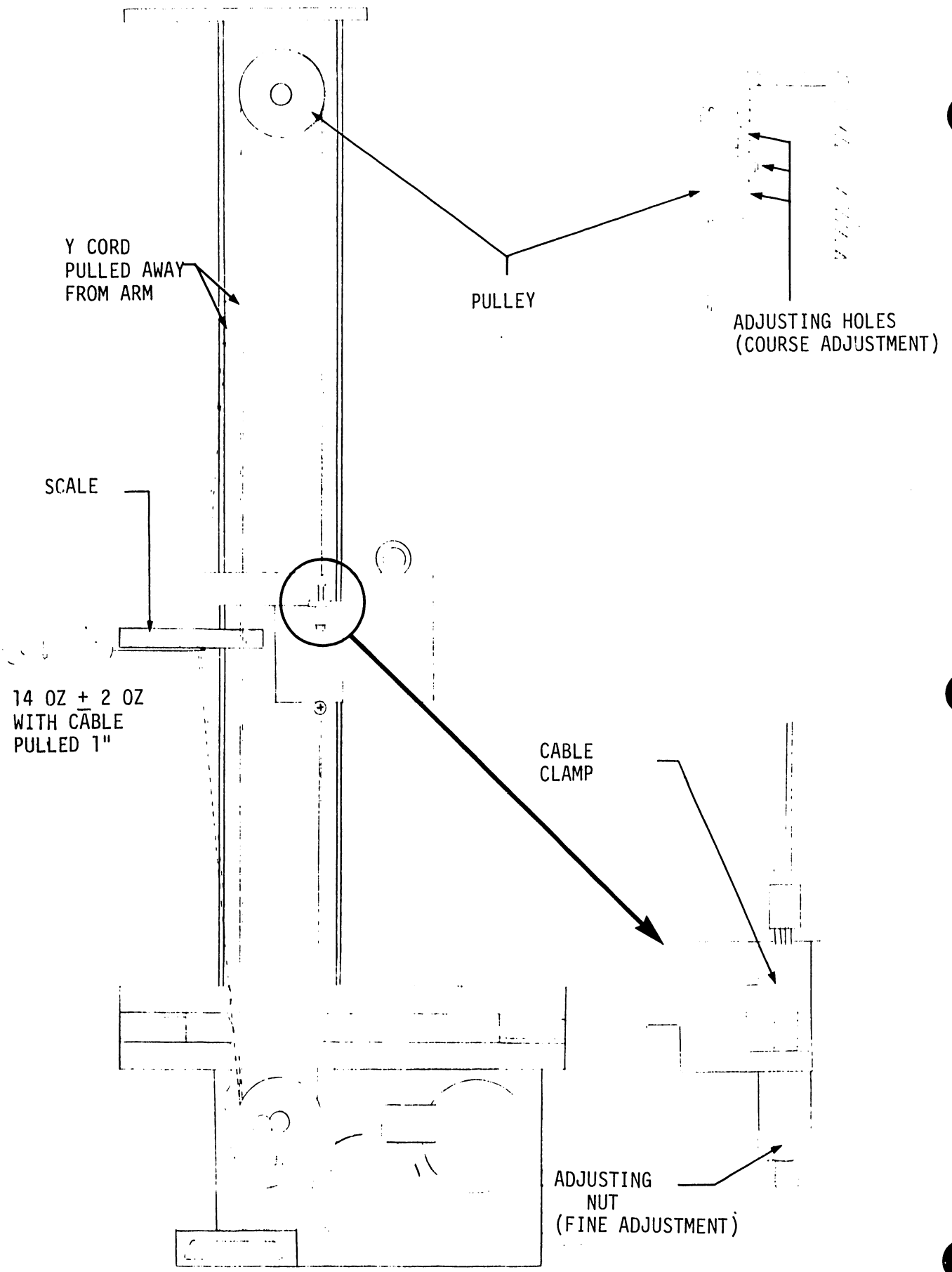


FIGURE 15

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.

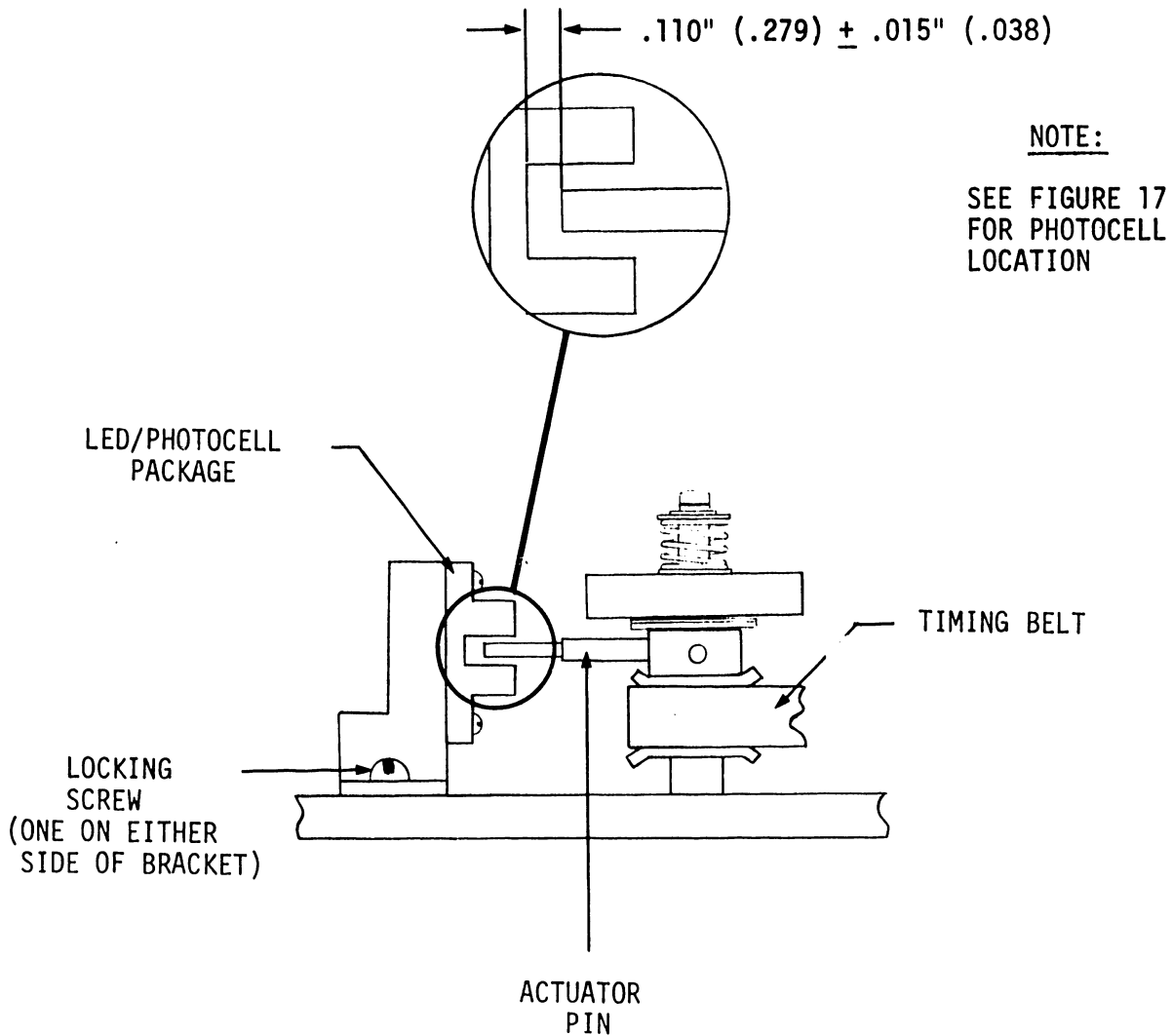


FIGURE 16

LED/PHOTOCELL ALIGNMENT

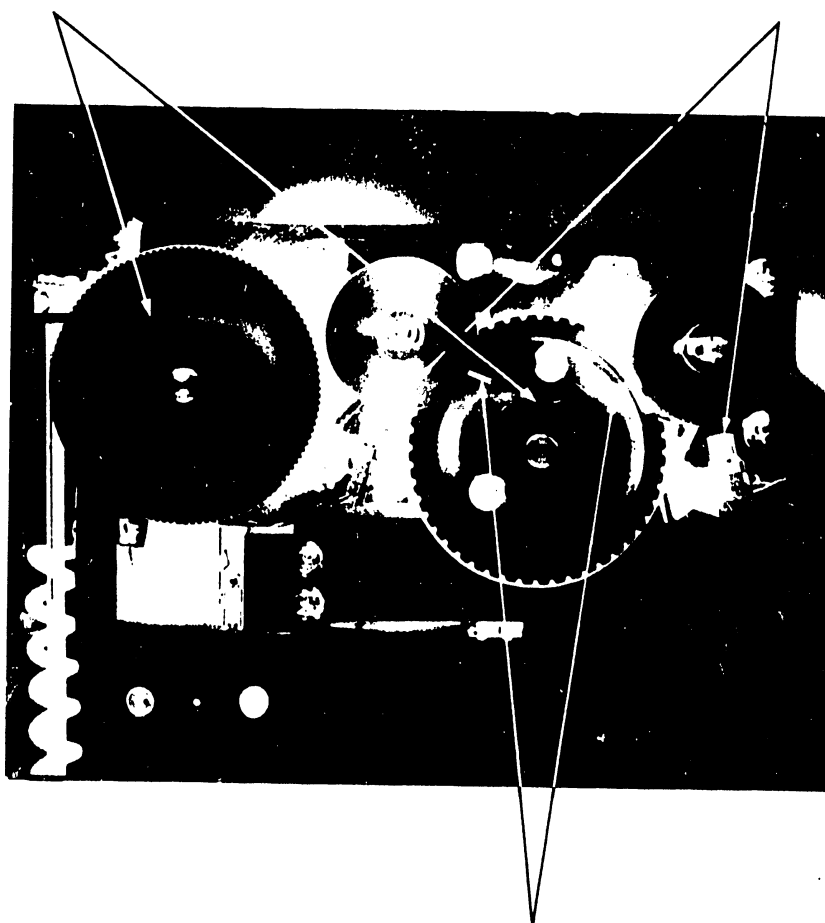
5.16 HOME POSITION ALIGNMENTS

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



ACTUATOR
PINS

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).

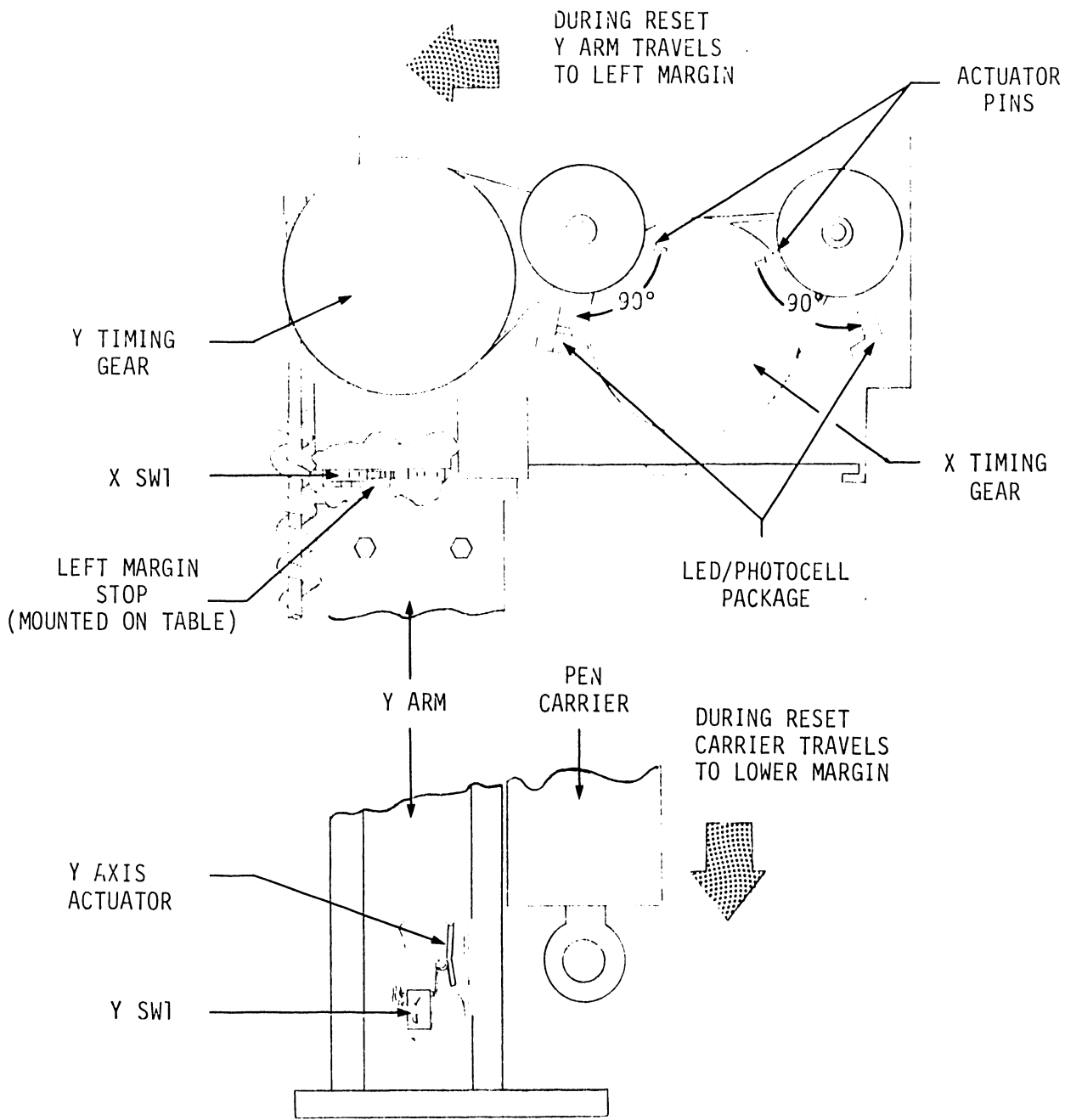


FIGURE 18

HOME POSITION ALIGNMENT

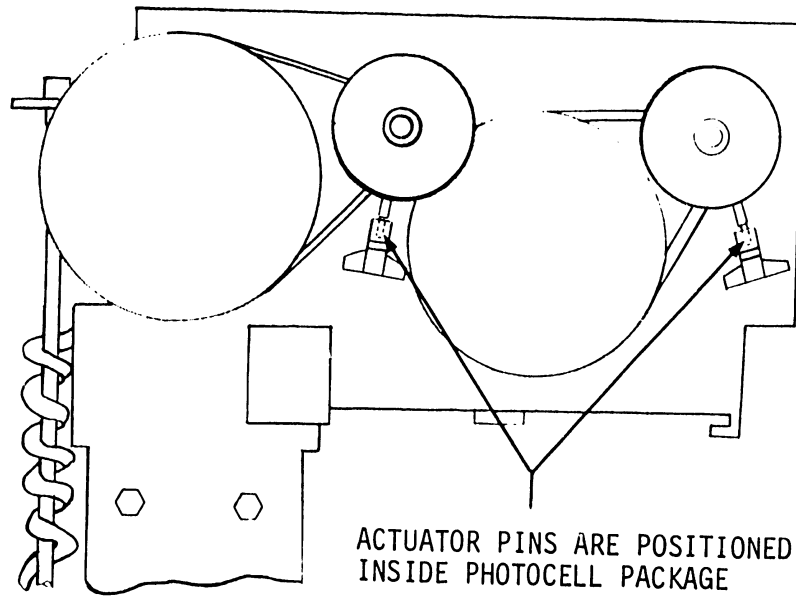


FIGURE 19
ACTUATOR PINS WHILE IN HOME POSITION

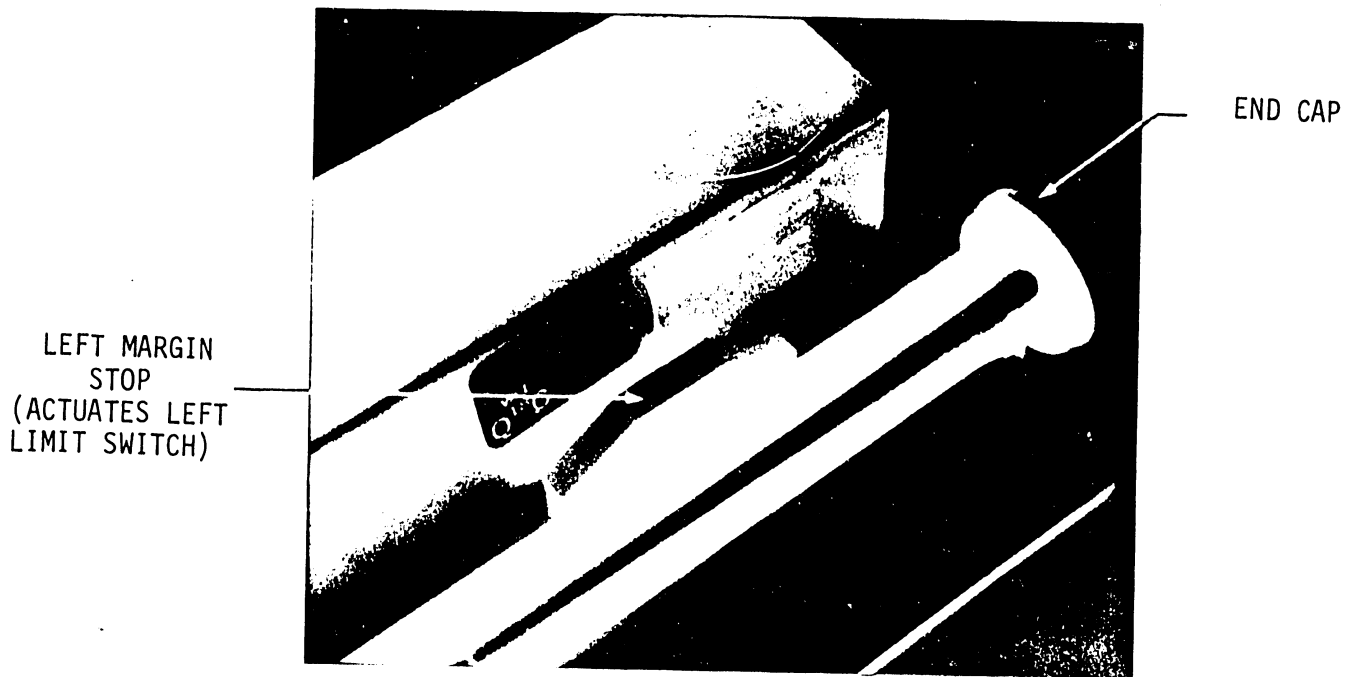


FIGURE 20
LEFT MARGIN STOP AND END CAP LOCATION

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

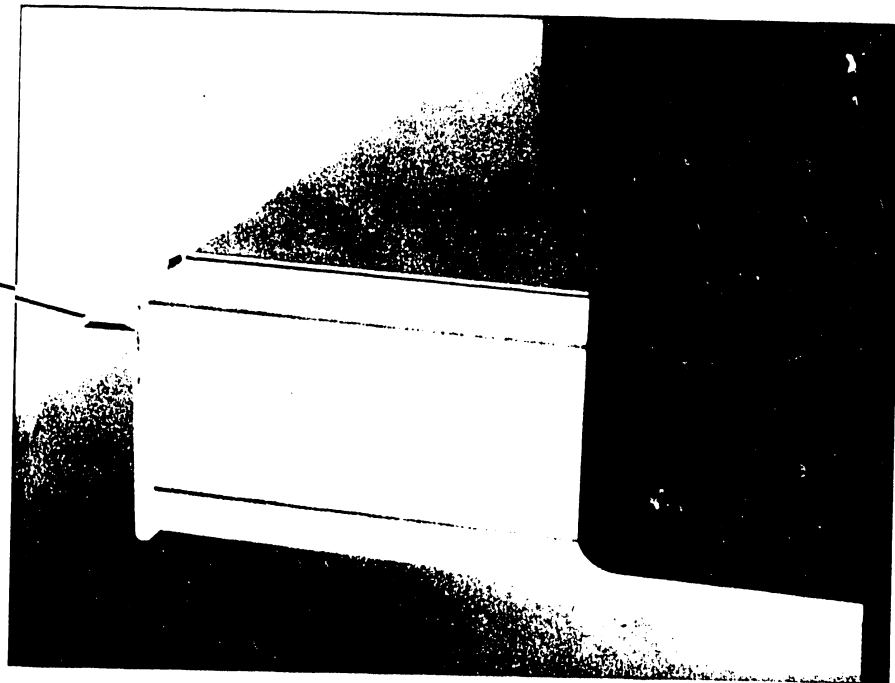


FIGURE 21

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.

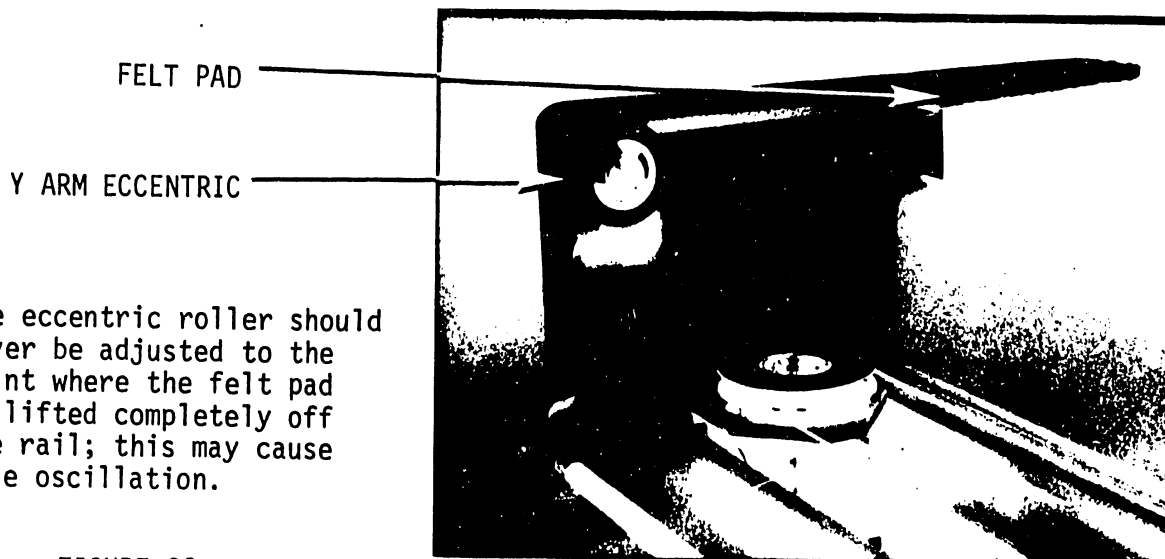
CONDITIONS

- 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.

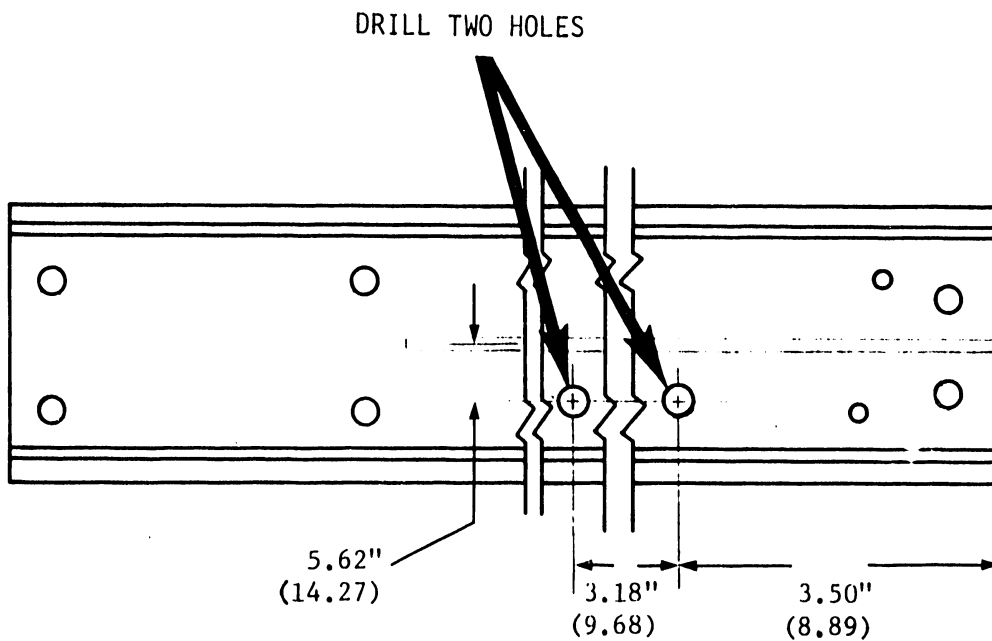
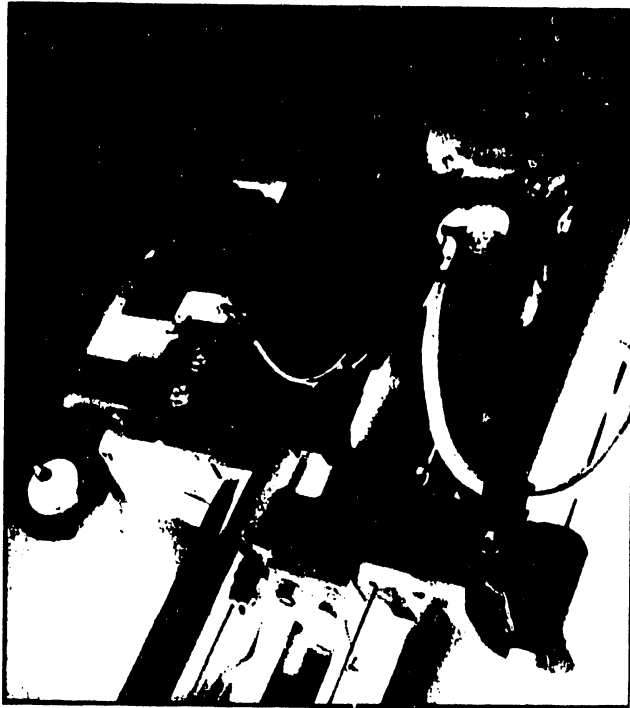


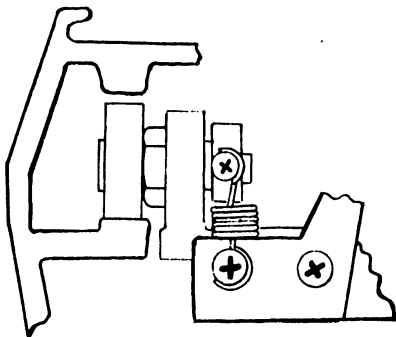
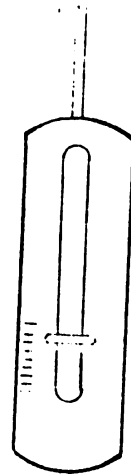
FIGURE 23



ADJUSTING
SCREW

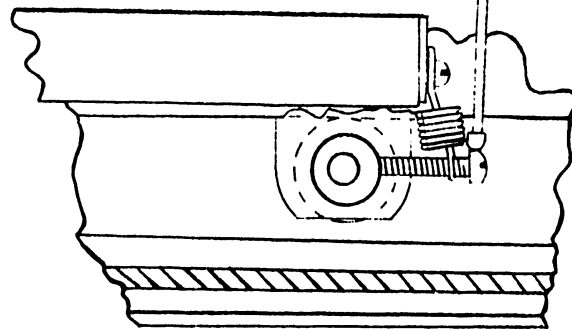
BEARING
AND
ROLLER

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

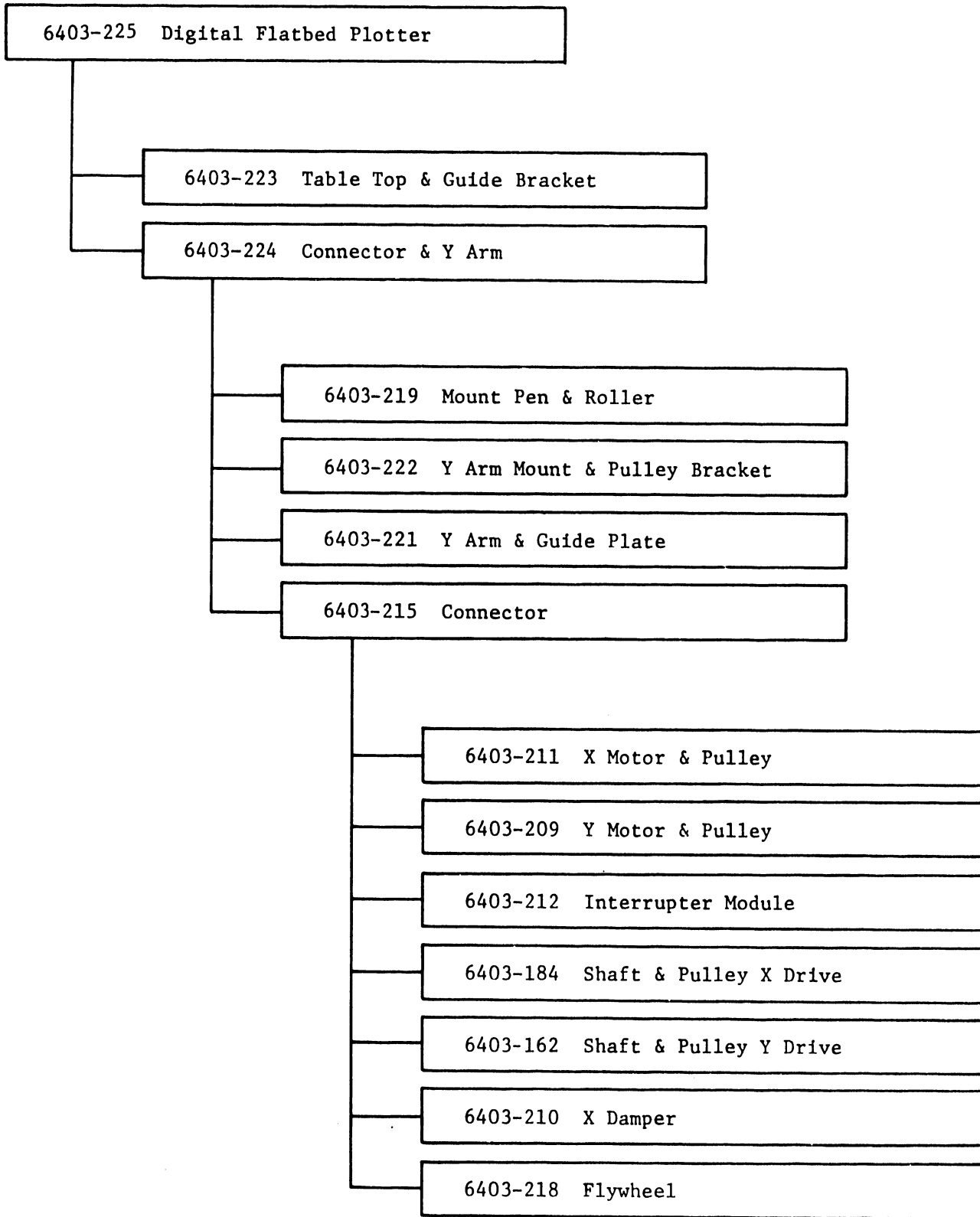


FIGURE 25

MODEL 32A ASSEMBLY DRAWINGS

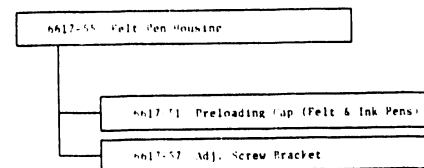
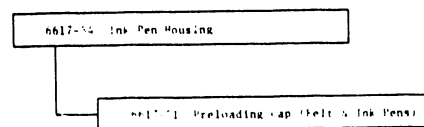
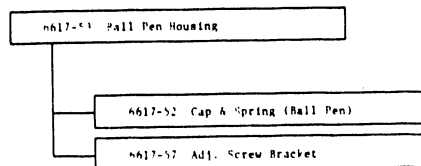
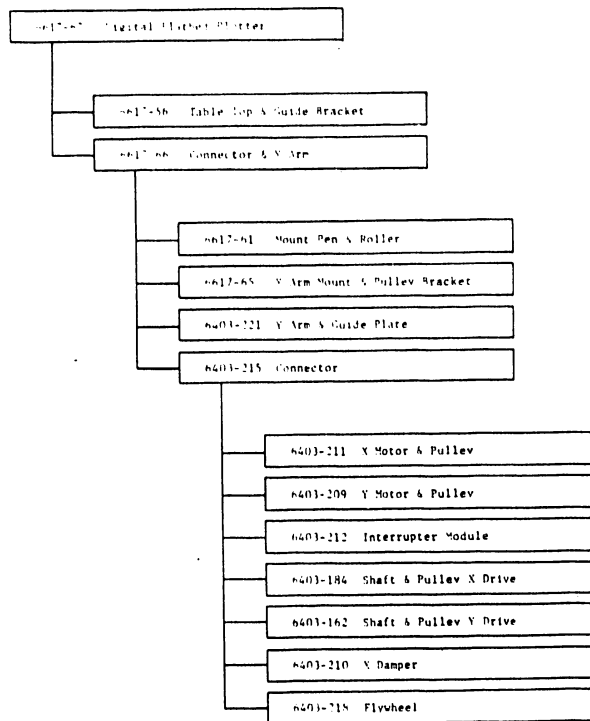
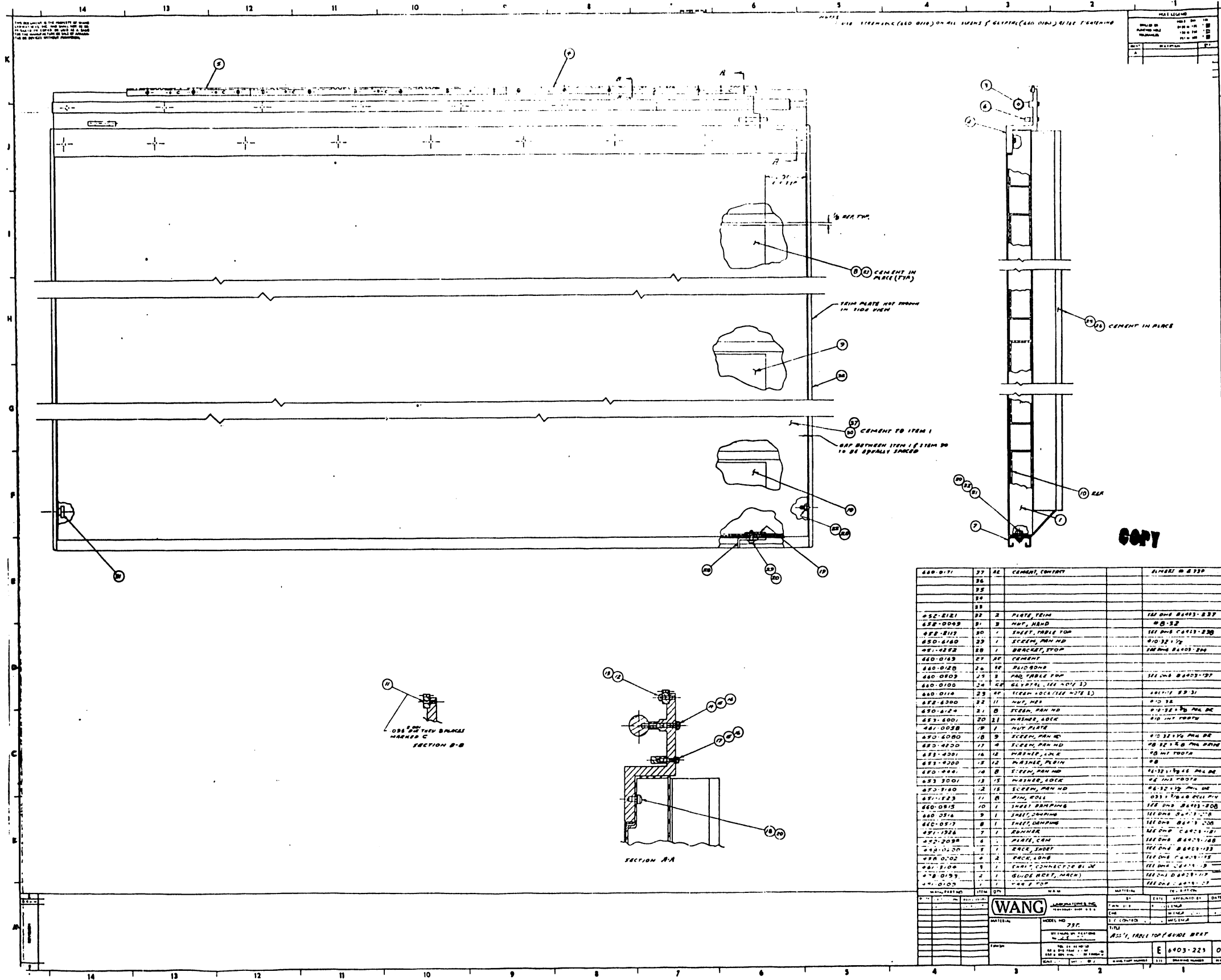
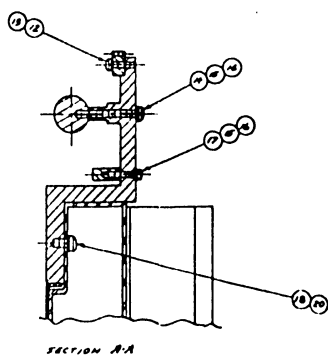
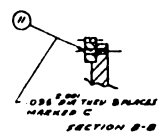


FIGURE 26



COPY



ITEM NO.	QTY	DESCRIPTION	UNIT	REMARKS
440-0171	37	CEMENT, CONCRETE		ALUMINUM 4 250
440-0172	26			
440-0173	20			
440-0174	20			
440-0175	20			
440-0176	20			
440-0177	20			
440-0178	20			
440-0179	20			
440-0180	20			
440-0181	20			
440-0182	20			
440-0183	20			
440-0184	20			
440-0185	20			
440-0186	20			
440-0187	20			
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440-0237	20			
440-0238	20			
440-0239	20			
440-0240	20			
440-0241	20			
440-0242	20			
440-0243	20			
440-0244	20			
440-0245	20			
440-0246	20			
440-0247	20			
440-0248	20			
440-0249	20			
440-0250	20			

WANG

MODEL NO. 250

DATE: 10/10/50

BY: [Signature]

REVISIONS:

1. [Description]

2. [Description]

3. [Description]

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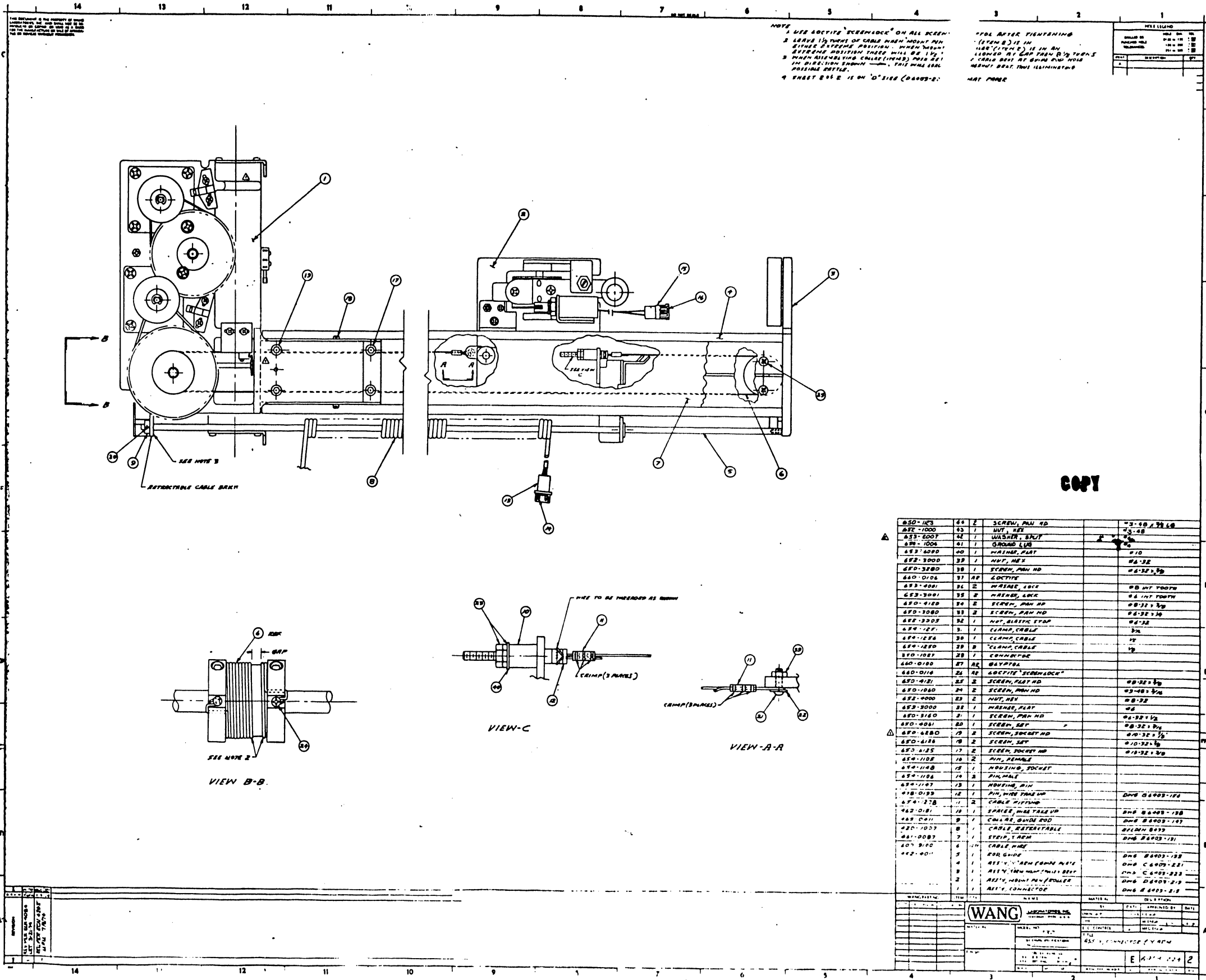
96. [Description]

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98. [Description]

99. [Description]

100. [Description]



COPY

QTY	DESCRIPTION	UNIT	REF. NO.
40	SCREW, PAN HD		"3-48 x 3/16"
13	WHT. WAX		"3-48"
42	WASHER, SPRT		"3-48"
41	GROUND LUG		"3-48"
40	WASHER, FLAT		"#10"
39	NUT, HEX		"#6-32"
38	SCREW, PAN HD		"#6-32 x 3/8"
37	SCREW, PAN HD		"#6-32 x 3/8"
36	WASHER, LOCK		"#6 INT TIGHT"
35	WASHER, LOCK		"#6 INT TIGHT"
34	SCREW, PAN HD		"#6-32 x 3/8"
33	SCREW, PAN HD		"#6-32 x 3/8"
32	NUT, PLASTIC STAP		"#6-32"
31	CLAMP, CABLE		"3/8"
30	CLAMP, CABLE		"1/2"
29	CLAMP, CABLE		"1/2"
28	CONNECTOR		"1/2"
27	WASHER		"#6-32 x 3/8"
26	SCREW, PAN HD		"#6-32 x 3/8"
25	SCREW, PAN HD		"#6-32 x 3/8"
24	SCREW, PAN HD		"#6-32"
23	WASHER, FLAT		"#6-32"
22	SCREW, PAN HD		"#6-32 x 1/2"
21	SCREW, SET		"#6-32 x 1/2"
20	SCREW, SOCKET HD		"#6-32 x 1/2"
19	SCREW, SET		"#10-32 x 1/2"
18	SCREW, SOCKET HD		"#10-32 x 3/8"
17	MIN. REMALE		
16	WASHER, SOCKET		
15	WASHER, SOCKET		
14	WASHER, SOCKET		
13	HOUSING, PIN		DWG B-4003-124
12	HOUSING, PIN		DWG B-4003-124
11	CABLE FITTING		DWG B-4003-124
10	SPACER, HAS TUBE UP		DWG B-4003-124
9	CABLE BAND END		DWG B-4003-124
8	CABLE, RETRACTABLE		DWG B-4003-124
7	STAP, TARM		DWG B-4003-124
6	CABLE WIRE		DWG B-4003-124
5	ROD GUIDE		DWG B-4003-124
4	ASSEMBLY PART		DWG B-4003-124
3	ASSEMBLY PART		DWG B-4003-124
2	ASSEMBLY PART		DWG B-4003-124
1	ASSEMBLY PART		DWG B-4003-124

WANG ENGINEERING CO.

DATE: 10/1/54

BY: [Signature]

SCALE: 1/2" = 1"

PROJECT: [Project Name]

FIG. NO. [Figure Number]

REV. NO. [Revision Number]

DATE: 10/1/54

BY: [Signature]

SCALE: 1/2" = 1"

PROJECT: [Project Name]

FIG. NO. [Figure Number]

REV. NO. [Revision Number]

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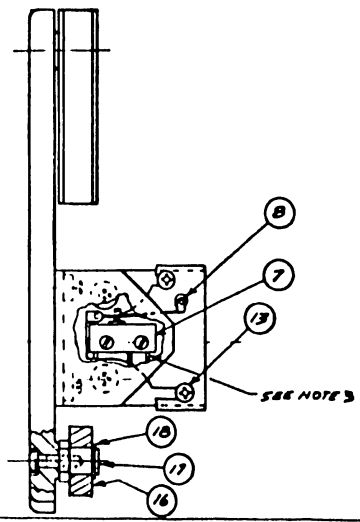
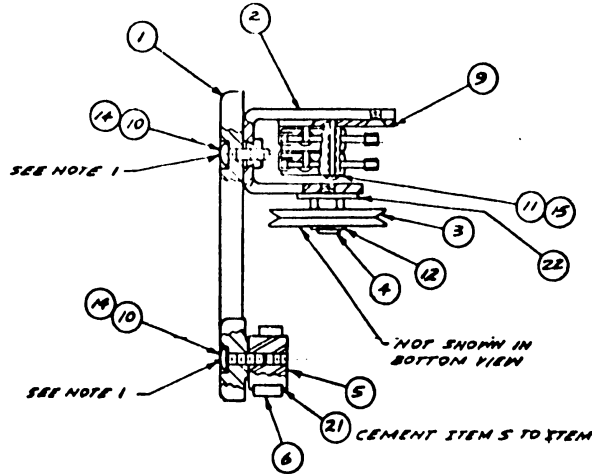
50 NOT KAN

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

TABLE LEGEND

DRAWN OR PUNCHED HOLE TOLERANCES	HOLE DIA	TOL
	0.125 to 1.125	± .005
	1.25 to 2.50	± .006
	2.51 to 5.00	± .008

IDENT	DESCRIPTION	QTY
A		



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	GLYPDOL	
660-0114	19	NR	LOCTITE "SCREENLOCK"	
651-1732	18	1	RING, RESTRAINING	TEUROC 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
452-2097	9	1	PLATE, SWITCH MTG	SEE DNG B 6403-143
325-9044	8	2	ACTUATOR	JS-246
325-2307	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	1	ASS'Y, PULLEY BRG.	SEE DNG B 6403-172
451-4218	2	1	BRKT, PULLEY MTG	SEE DNG C 6403-183
450-0032	1	1	MOUNT, YARM MACHINING	SEE DNG C 6403-120

REV	DATE	DESCRIPTION

QTY	FIRST USED ON	ASSY USED ON	WANG	LABORATORIES, INC.	BY	DATE	APPROVED BY	DATE
1	5/23/54	5/23/55			DWN HT	6/18/54	E ENGR	
					CHR		M ENGR	
					E C CONTROL ENR		M ENGR	

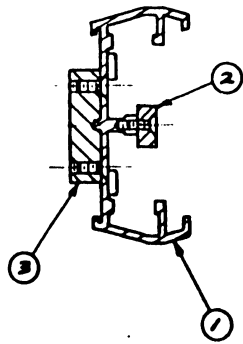
MATERIAL	MODEL NO	TITLE	WANG PART NUMBER	SIZE	DRAWING NUMBER	REV
	732	ASS'Y, YARM MOUNT & PULLEY BRKT	C 6403-222	0		

38

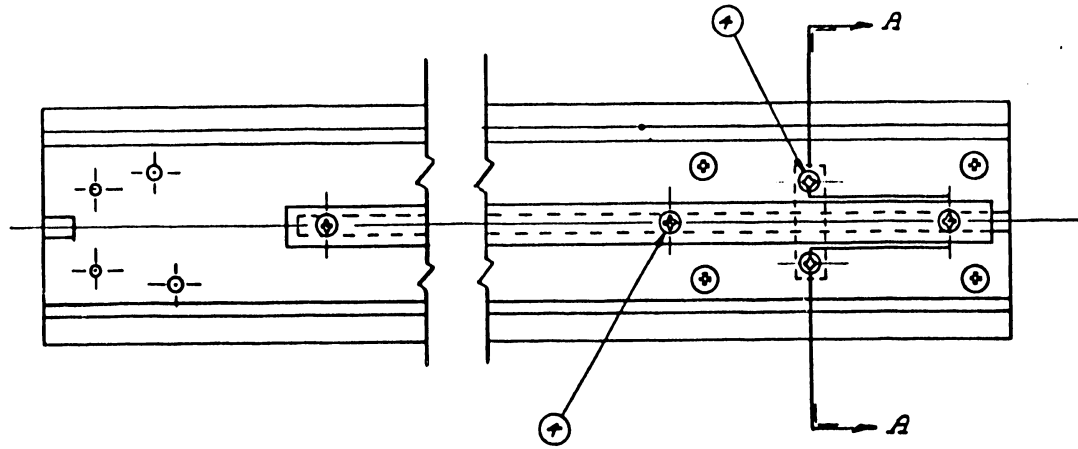
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NOTE
1 USE LOCTITE 'SCREW LOCK' ON ALL SCREWS
GLYPTOL AFTER TIGHTENING

HOLE LEGEND			
DRAILED OR	HOLE DIA.	TOL.	
PUNCHED HOLES	0.125 to 1.75	± .005	
TOLERANCES	1.75 to 2.50	± .005	
	2.51 to 5.00	± .01	
IDENT	DESCRIPTION	QTY	
A			



SECTION A-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.
452-2034	3	1	PLATE, ADJUSTMENT		SEE DWG B 6403-146
461-0083	2	1	GUIDE PLATE		SEE DWG B 6403-140
478-0132	1	1	ARM, Y MACHINING		SEE DWG D-6403-110
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
DL. #	FIRST UND ON	ASSY UND ON	WANG LABORATORIES, INC. TEMPERLEY WISE U.S.A.		
1	214:3 224	6403-221			
			MATERIAL	MODEL NO	732
			MECHANICAL SPECIFICATIONS No. 55 1001		
			FINISH	TOL. EX. AS NOTED EX ± 0.01 FRAC ± 1/64 SER ± 0.05 ANG ± 1'30" FINISH V	
			SCALE 1/1	SMT 1	0/1
			WANG PART NUMBER	SIZE	DL. WING NUMBER
				C	6403-221 0

REV	DESCRIPTION
1	042-1
2	

39

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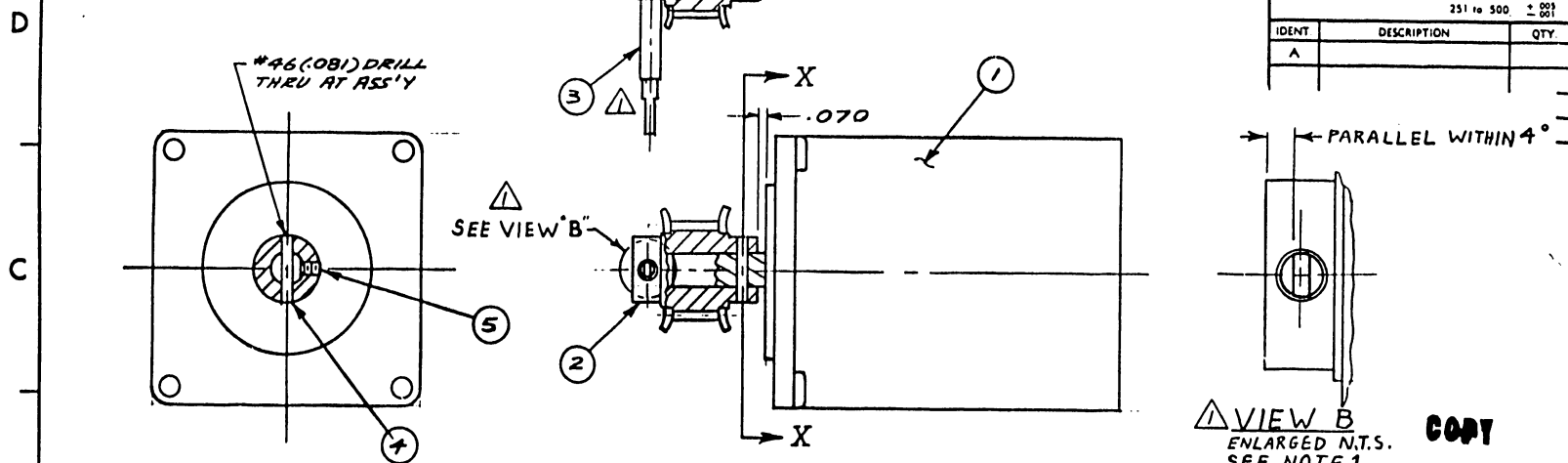
DO NOT SCALE

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
	0.135 to 1.25	± .002
	1.26 to 2.50	± .004
	2.51 to 5.00	± .007

IDENT	DESCRIPTION	QTY.
A		



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 B 6403-159
778-0207	2	I	PULLEY, BLANK, X MOTOR		SEE DWG B 6403-123
700-0005 M	1	I	MOTOR, STEP		

BY	DATE
ECN	4-3-78

REVISION	REV. PER	DATE
1	REV. PER ECN 94108	4-3-78
	14-174	QF 77

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 B 6403-159
778-0207	2	I	PULLEY, BLANK, X MOTOR		SEE DWG B 6403-123
700-0005 M	1	I	MOTOR, STEP		

QTY. PER UNIT	FIRST USED ON	ASSY USED ON
1	E4103-215	E4103-225

WANG LABORATORIES, INC. TEWASBURY, MASS. U. S. A.		BY	DATE	APPROVED BY	DATE
		DWN	NYT	6/7/73	E ENGR
MATERIAL		CHK		M ENGR	2-6-74
		E. C. CONTROL		2-6-74	MFG ENGR
MODEL NO 732		TITLE ASS'Y X MOTOR & PULLEY			
		SEE ENGR SPECIFICATIONS No. ES-1001			
FINISH		TOL EX. AS NOTED		B 6403-211	
		XX ± 010 FRAC ± 1/64 XXX ± 003 ANG ± 1'30" FINISH		1	
SCALE	NO	SHT	OF	WANG PART NUMBER	REV

41

B 6403-211

A

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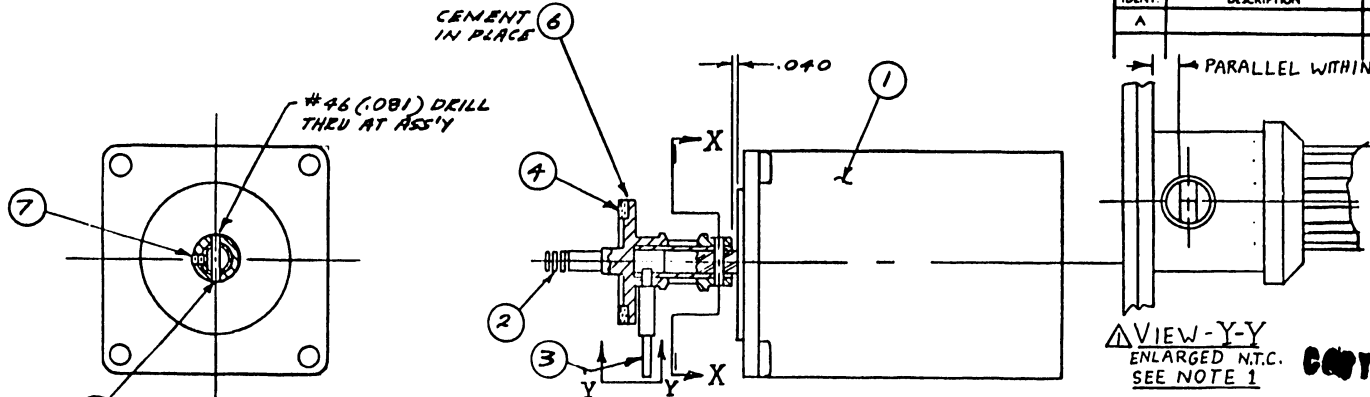
NOTE 5:

△ 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.
	0135 to .125	± .001
	.126 to .250	± .002
	.251 to .500	± .003

IDENT.	DESCRIPTION	QTY.
A		



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 B6403-187
461-3109	3	1	PIN, PHOTOCELL	SEE DWG B6403-159
279-0051	2	1	ASS'Y, Y DRIVE PULLEY	SEE DWG. C6403-126
400-0005M	1	1	MOTOR, STEP	

BY	DATE
W/CCT	4-3-74

NO	REVISION
1	REVISED ECN# 4108 4-1-72 RFM

QTY.	WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
1	E6403-215	E6403-225				



MATERIAL	MODEL NO	732
FINISH	SEE ENGRG SPECIFICATIONS	NO. ES 1001
	TOL EX AS NOTED	XX ± 010 FRAC ± 1/64
		XXX ± 005 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	2-6-74	MFG ENGR	

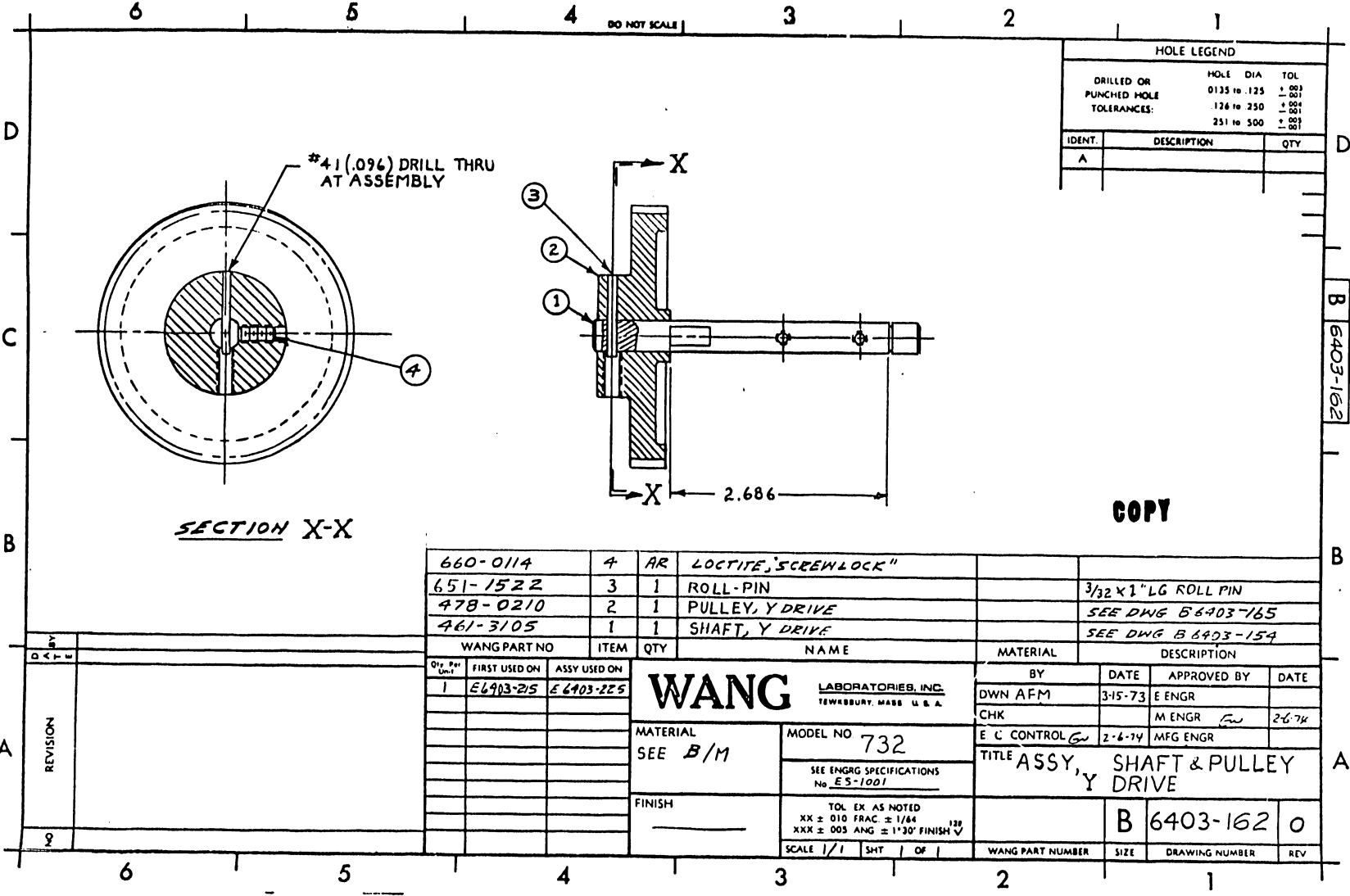
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV.
B	6403-209	1	

42

B 6403-209

B

A



HOLE LEGEND		
DRILLED OR PUNCHED HOLE	HOLE DIA	TOL
	0135 to .125	± .003
	.126 to .250	± .004
	.251 to .500	± .005
		± .001
IDENT.	DESCRIPTION	QTY
A		

COPY

660-0114	4	AR	LOCTITE, "SCREWLOCK"		
651-1522	3	1	ROLL-PIN		3/32 x 1" LG ROLL PIN
478-0210	2	1	PULLEY, Y DRIVE		SEE DWG B 6403-165
461-3105	1	1	SHAFT, Y DRIVE		SEE DWG B 6403-154
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION

BY	DATE	DESCRIPTION

QTY	FIRST USED ON	ASSY USED ON
1	E 6403-25	E 6403-225

WANG LABORATORIES, INC.
TEWASBURY, MASS U.S.A.

MATERIAL: SEE B/M

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 ✓

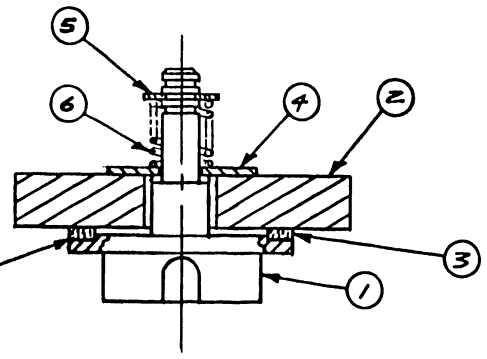
SCALE 1/1 SHT 1 OF 1

BY	DATE	APPROVED BY	DATE
DWN AFM	3-15-73	E ENGR	
CHK		M ENGR	2-6-74
E C CONTROL	2-6-74	MFG ENGR	
TITLE ASSY, SHAFT & PULLEY Y DRIVE			
	B	6403-162	0
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

45

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HOLE LEGEND		
DRILLED OR	HOLE DIA.	TOL.
	0125 to .125	+ .001
PUNCHED HOLE	126 to .250	+ .004
TOLERANCES:	251 to .500	+ .001
		- .001
IDENT	DESCRIPTION	QTY
A		



CEMENT ITEM 3 TO ITEM 1

COPY

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
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION

BY	DATE

REVISION

QTY.	FIRST USED ON	ASSY USED ON
1	E6403-215	E6403-225

WANG LABORATORIES, INC.
TEWESBURY, MASS. U. S. A.

MATERIAL

MODEL NO. 732

SEE ENGRG. SPECIFICATIONS No. E51001

FINISH

TOL. EX. AS NOTED
XX ± 010 FRAC. ± 1/64
XXX ± 005 ANG. ± 1°30' FINISH ✓

SCALE 2/1 SHT 1 OF 1

BY	DATE	APPROVED BY	DATE
DWN MY	6/11/73	E ENGR	
CHK		M ENGR	2-7-76
E C CONTROL	2-7-74	MFG ENGR	
TITLE			
ASS'Y, X DAMPER			
	B	6403-210	O
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

94

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DO NOT SCALE

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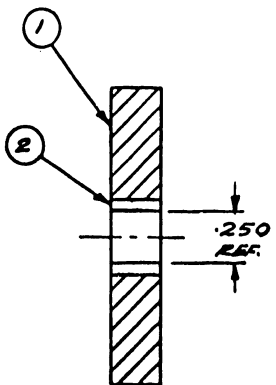
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HOLE LEGEND

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

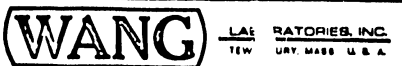
IDENT	DESCRIPTION	QTY
A		



COPY

465-0216	2	1	BEARING, RULON		DRS 0406-2
465-1110	1	1	FLYWHEEL		SEE DWG B 6403-19B
WANG PART NO	ITEM	QTY	NAME	MATERIAL	DESCRIPTION

QTY. PER UNIT	FIRST USED ON	ASSY USED ON
2	E6403-210	E6403-225
	E6403-215	E6403-225



MATERIAL	MODEL NO
SEE B/M	732
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

BY	DATE	APPROVED BY	DATE
DWN NY	6-6-73	E ENGR	
CHK		M ENGR	Ew 2-6-74
E C CONTROL	Ew 2-6-74	MFG ENGR	
TITLE			
ASSY, FLYWHEEL			
	B	6403-218	0
WANG PART NUMBER	SIZE	DRAWING NUMBER	REV

REVISION
2

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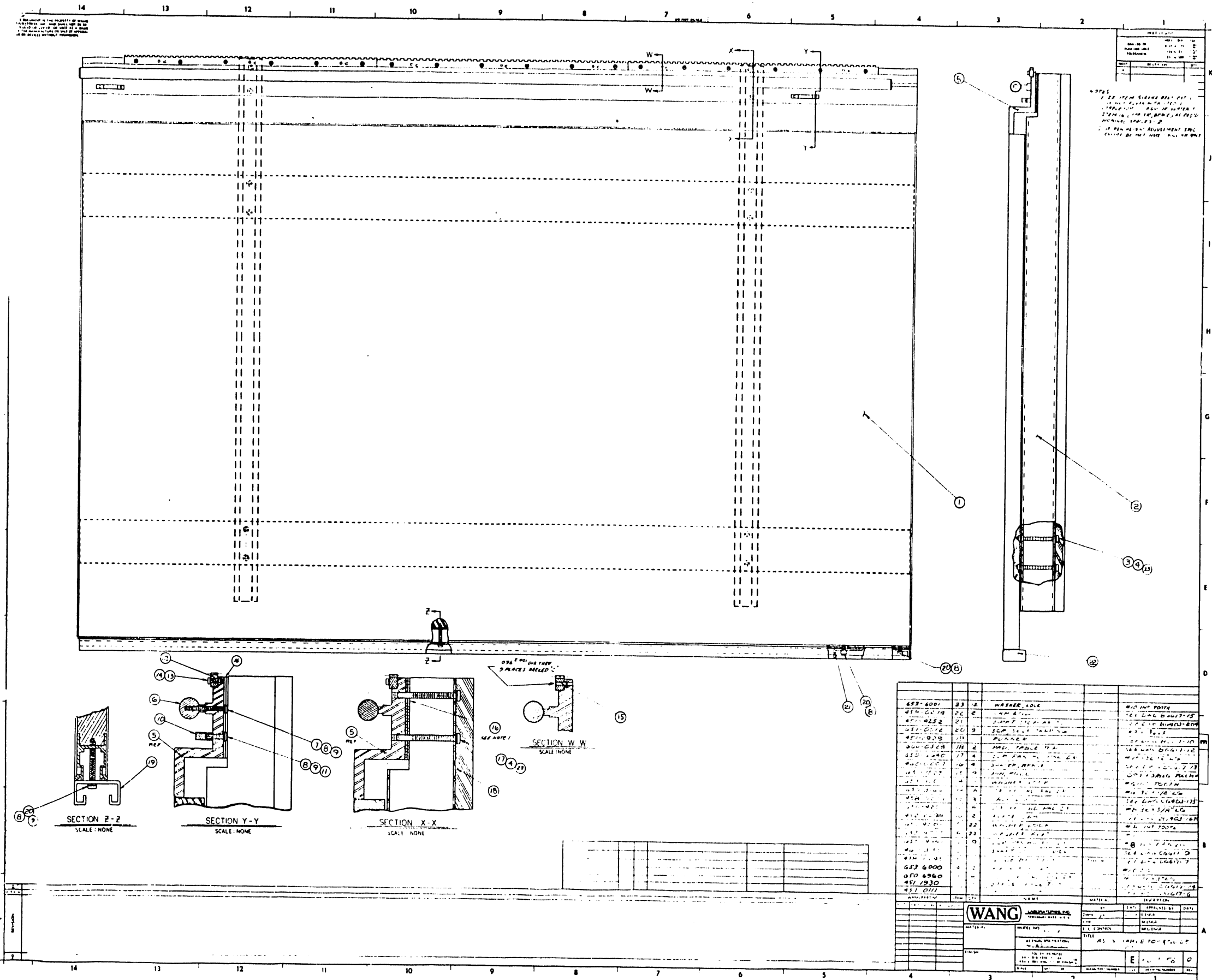
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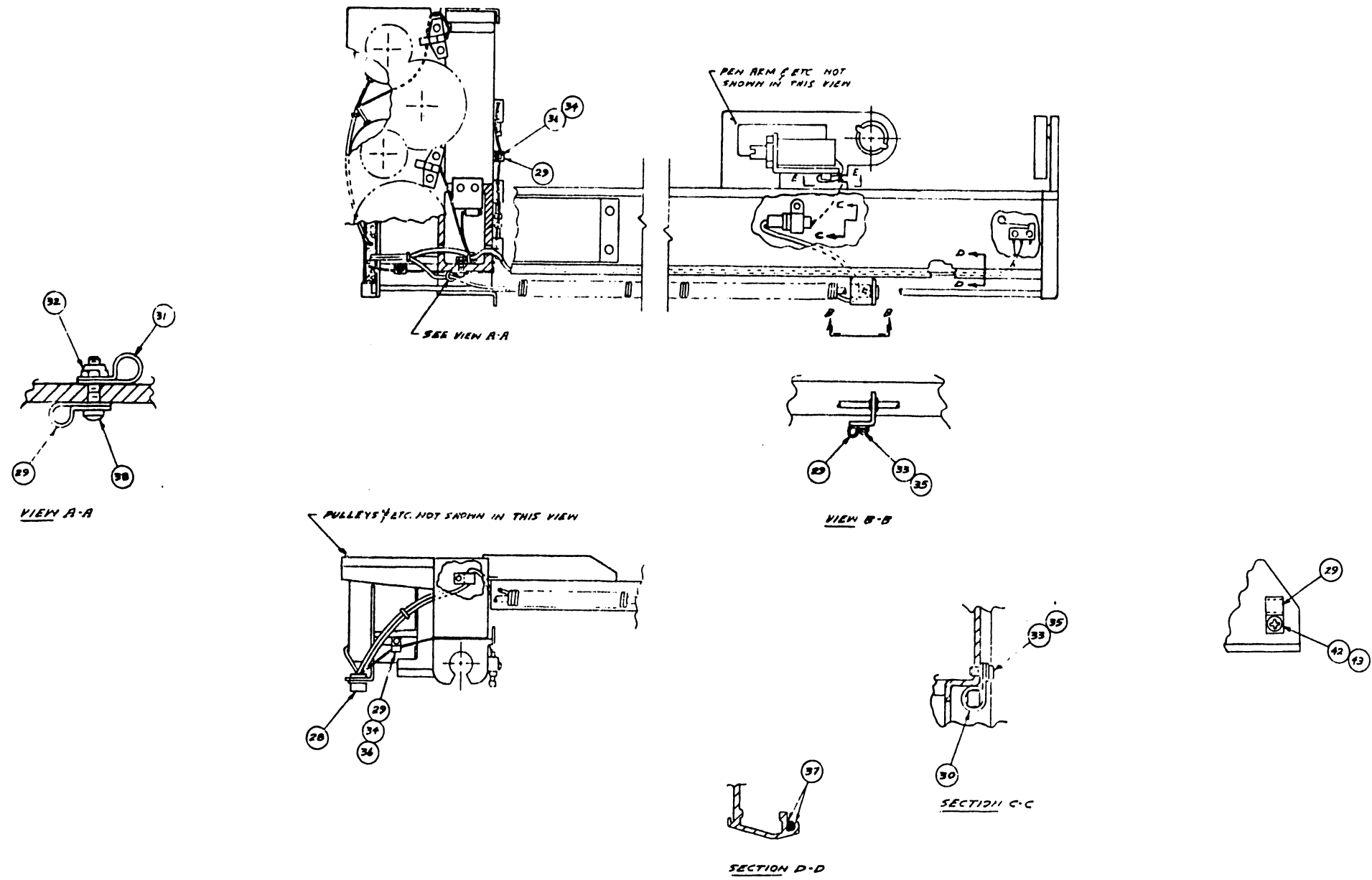
47



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OR DEVICES WITHOUT PERMISSION

NOTE
1. USE LOCKWASH SCREWLOCK ON ALL SCREWS GLYPTOL AFTER TIGHTENING
2. SHEET 1052 IS ON "B" SIZE (A 6617-66) SIZE FORMAT PAPER

HOLE LEGEND		
DRILLED OR PUNCHED HOLE	HOLE DIA.	TOL.
DRILLED OR PUNCHED HOLE	0.125 to .125	±.001
TOLERANCES	1/16 to .150	±.001
	.151 to .500	±.002



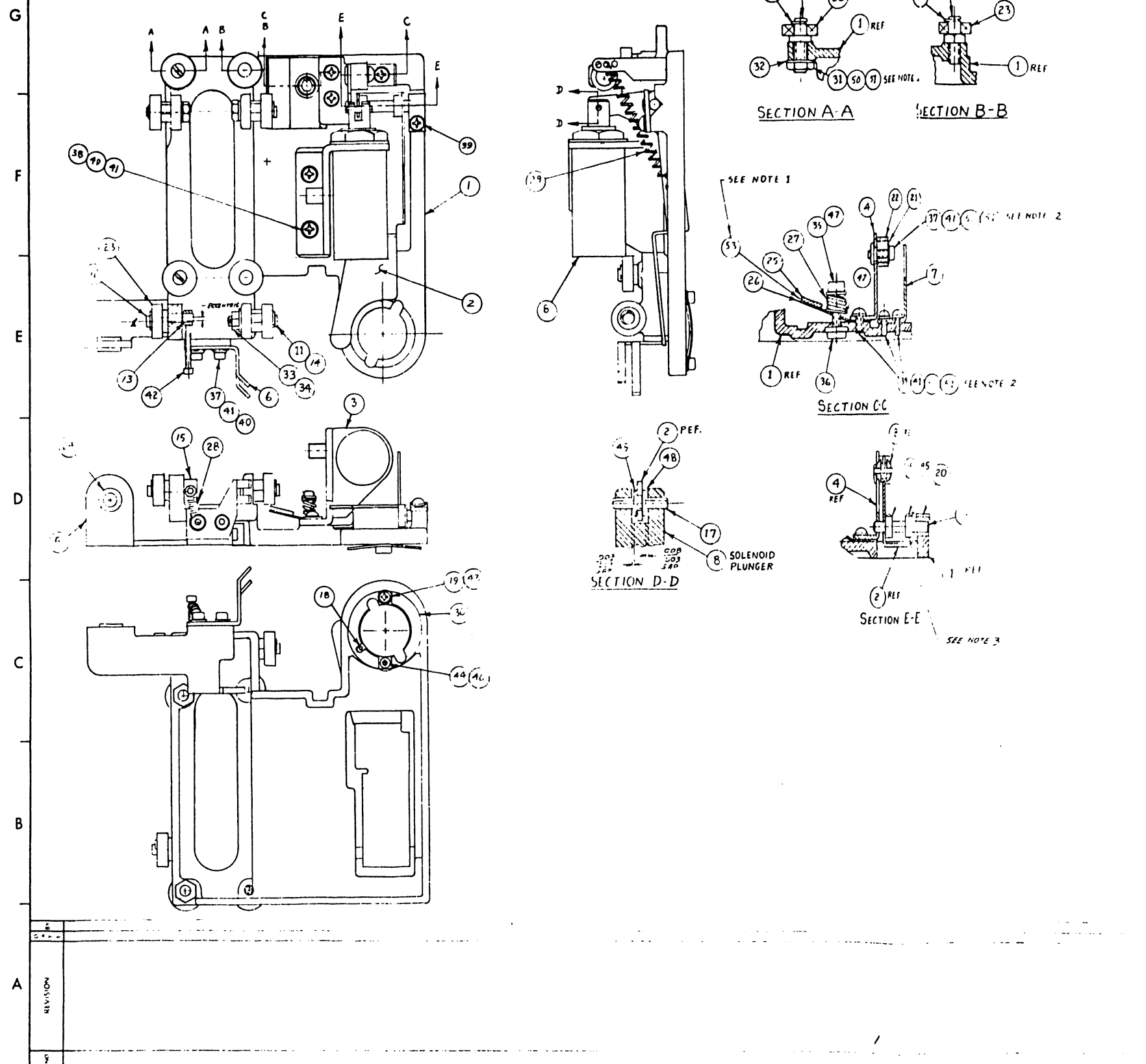
REVISION	DATE	DESCRIPTION
1		

WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
1	FIRST USED ON	ASSEMBLY ON			
			WANG LABORATORIES, INC. TEMPERLEY MASS U.S.A.	BY DWN PVT	DATE 6-6-74
			MATERIAL	MODEL NO 732 A	APPROVED BY LENGR
			FINISH	ME ENG SPECIFICATIONS No. ES 1221	DATE M ENGR
				100 GR AS NOTED RA ± 0.16 FIN ± 1/64 IN RR ± 0.05 ANG ± 1/30 FINISH	TITLE ASSEMBLY, CONNECTOR SYSTEM
			SCALE SMT 2 OF 2		DATE D 6617-66
					QTY 0

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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. LOCTITE COLLARS (ITEM 15) SO THAT PER ARM ACTUATOR (ITEM 2) HAS CLEARANCE AS SHOWN IN SECTION D-D AND IS FREE TO MOVE ON DOWEL PIN (ITEM 16).

DR. TED OR	DATE
PLANNING DEPT.	10-15-57
TELEPHONE	253-1111
TELETYPE	253-1111



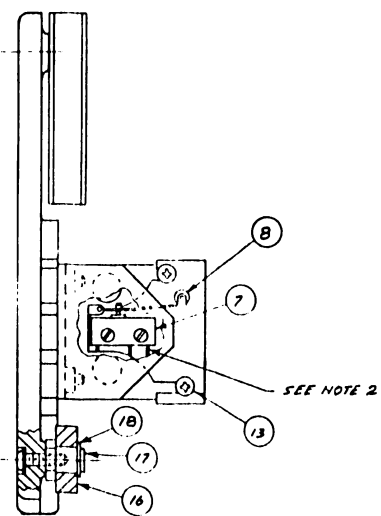
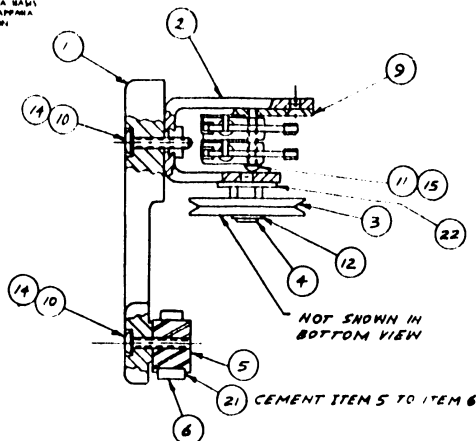
ITEM NO.	QTY	DESCRIPTION	REF.
660-0106	53	N/R	LOCTITE
660-0106	52		
660-0106	51	AR	GLYPHAL
660-0112	50	AR	SCREWLOCK
653-0107	49	AR	WASHER, FLAT
653-1001	48	1	WASHER, FLAT
653-4000	47	2	WASHER, FLAT
653-2027	46	1	LOCK WASHER
650-2040	45	2	SCREW, SEC MET
650-2061	44	1	SCREW, PAN HD
650-2101	43	1	SCREW, FL HD
650-2242	42	1	SCREW, LOCK HD CAP
653-3001	41	9	LOCK WASHER
653-3000	40	2	WASHER, FLAT
650-3100	39	5	SCREW, PAN HD
650-3120	38	2	SCREW, PAN HD
650-3166	37	3	SCREW, PAN HD
652-0044	36	1	NUT, NUT
650-4742	35	1	SCREW, SEC MET
653-6001	34	3	LOCK WASHER
652-0000	33	2	NUT, HEX
653-0000	32	2	LOCK WASHER
652-0053	31	2	NUT, JAM
465-0977	30	1	PLATE, LEAF SPRING
465-1600	29	1	SPRING, EXTENSION
465-0978	28	1	SPRING, EXTENSION
465-0984	27	1	SPRING, COMP
465-0985	26	1	SPRING, PLATE
660-0521	25	1	SPRING, PLATE
465-0708	24	1	BUSHING, COLLAR
465-0009	23	1	PLATING, BALL
465-1024	22	1	THUMB, ADJUSTABLE STOP
465-1025	21	1	HUB, ADJUSTABLE STOP
452-0021	20	1	PLATE, HOOD DOWN
458-0281	19	1	STOP, TEN HOUSING
651-1520	18	1	ROLL PIN
651-1509	17	1	ROLL PIN
651-1637	16	1	DOWEL PIN
465-0409	15	1	COLLAR, EXTENSION
651-1727	14	1	SNAP RING
651-1712	13	1	SCREW, PAN HD
478-0196	12	1	SCREW, PAN HD
478-0204	11	1	SCREW, PAN HD
478-0202	10	1	SCREW, PAN HD
478-0101	9	1	SCREW, PAN HD
370-1011	8	1	SOLENOID, ARM
465-0285	7	1	WASHER, FLAT
451-4216	6	1	PLATE, CONTACT
451-4215	5	1	PLATE, CONTACT
451-4275	4	1	PART, CONTACT
451-4278	3	1	PART, CONTACT
451-0279	2	1	ARM, PIN, ACTUATOR
450-0094	1	1	ARM, INT. CONTACT

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

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NOTE
1. USE LOCTITE "SCREWLOCK" ON ALL SCREWS - GLYPTOL AFTER TIGHTENING
2. MICRO SWITCH TERMINALS TO BE POSITIONED AS SHOWN

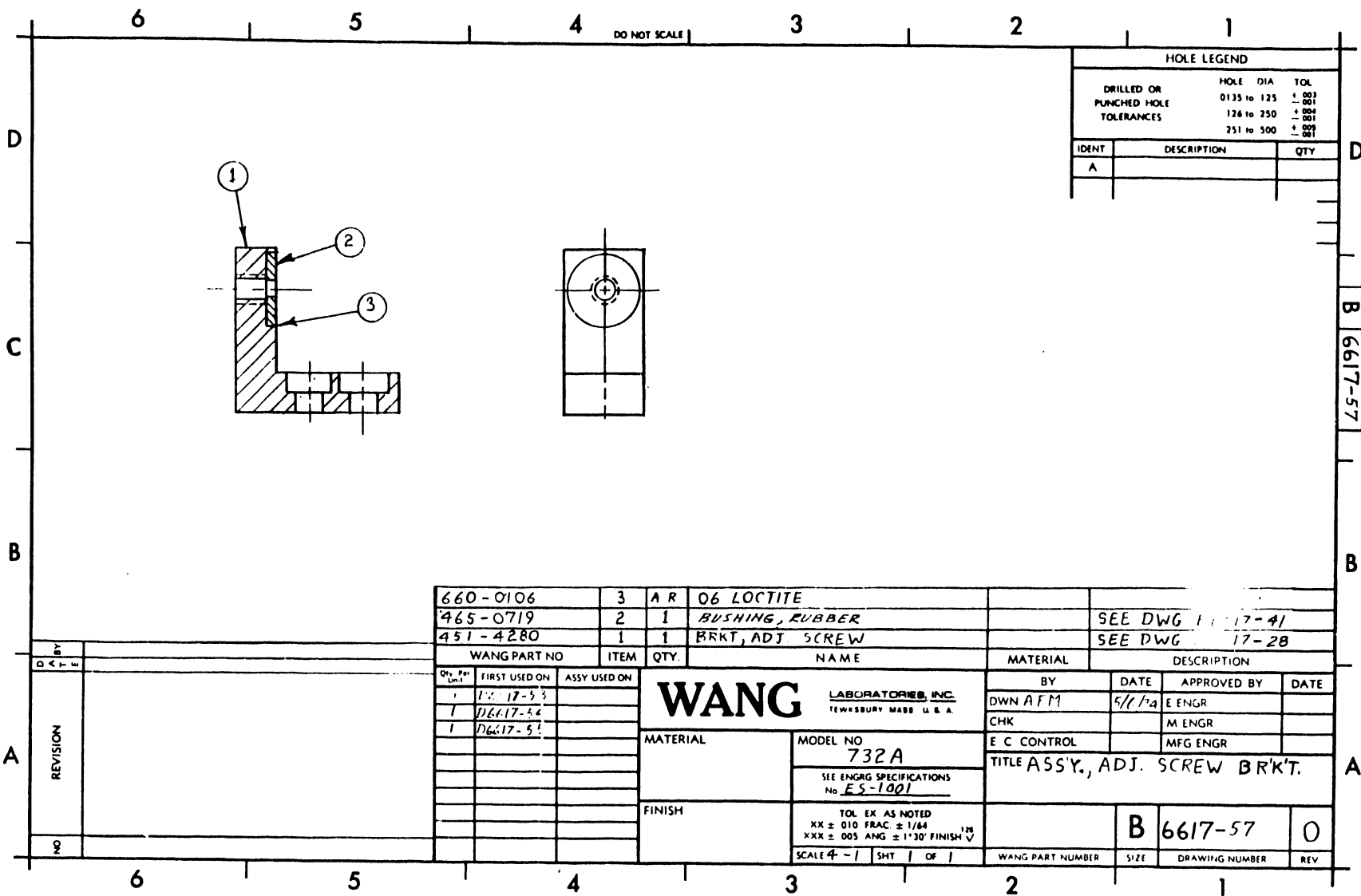
HOLE LEGEND		
DRILLED OR PUNCHED HOLE TOLERANCES	HOLE DIA	TOL
	0.125 to 1.25	± .001
	1.26 to 2.50	± .002
	2.51 to 5.00	± .003
IDENT	DESCRIPTION	QTY
A		



453-6012	22	1	WASHER		3/16 ID X 3/4
640-010A	21	AR	LOCTITE		
660-0100	25	AR	GLYPTOL		
640-01	1	AR	LOCTITE 'SCREWLOCK'		
151-1730	12	1	RING, RETAINING		TEAROUT
421-302	17	1	STUD, ROLLER		SEE DWG 6617-214
461-822	1	1	ROLLER, MOUNTING		SEE DWG 6617-214
153-1112	2	2	WASHER, LOCK		#2 11
153-422	4	4	WASHER, LOCK		#B 11
640-020	17	2	SCREW, FLAT		#4-40
671-127	12	1	RING, CRUSH		5103
670-0220	11	2	SCREW, FLAT		#2-56
650-4243W	10	4	SCREW, FLAT		#B 3/16
452-2097	9	1	PLATE, SWITCH MFG		SEE DWG 6617-214
325-9044	8	2	ACTUATOR		15 201
325-2307	7	2	SWITCH		WARRANTY 15 201
640-0512	6	1	PAD, GUIDE		SEE DWG 6617-214
461-1525	5	1	GUIDE, YARM		SEE DWG 6617-214
478-0198	4	1	STUD, PULLEY		SEE DWG 6617-214
	3	1	ASSY, PULLEY & BRG		SEE DWG 6617-214
151-4218	2	1	BRKT, PULLEY MTG		SEE DWG 66403-183
450-0693	1	1	MOUNT, YARM MACHINING		SEE DWG 6617-11

REV	DATE	BY	DATE	APPROVED BY	DATE
1	6/6/74	NT	6/6/74	E ENGR	
		CHK		M ENGR	
		E C CONTROL		MFG ENGR	
TITLE ASSY, YARM MOUNT & PULLEY BRKT					
MATERIAL					
MODEL NO 732 A					
MFG ENG SPECIFICATION No. 25.1201					
FINISH TOL EN AS NOTED RR 2 010 BRG - 1.000 RR 2 005 ANG - 1.100 FINISH V SCALE 1/1 SH 1 OF 1					
WANG PART NUMBER					
C 6617-65 0					
DRAWING NUMBER					

53



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

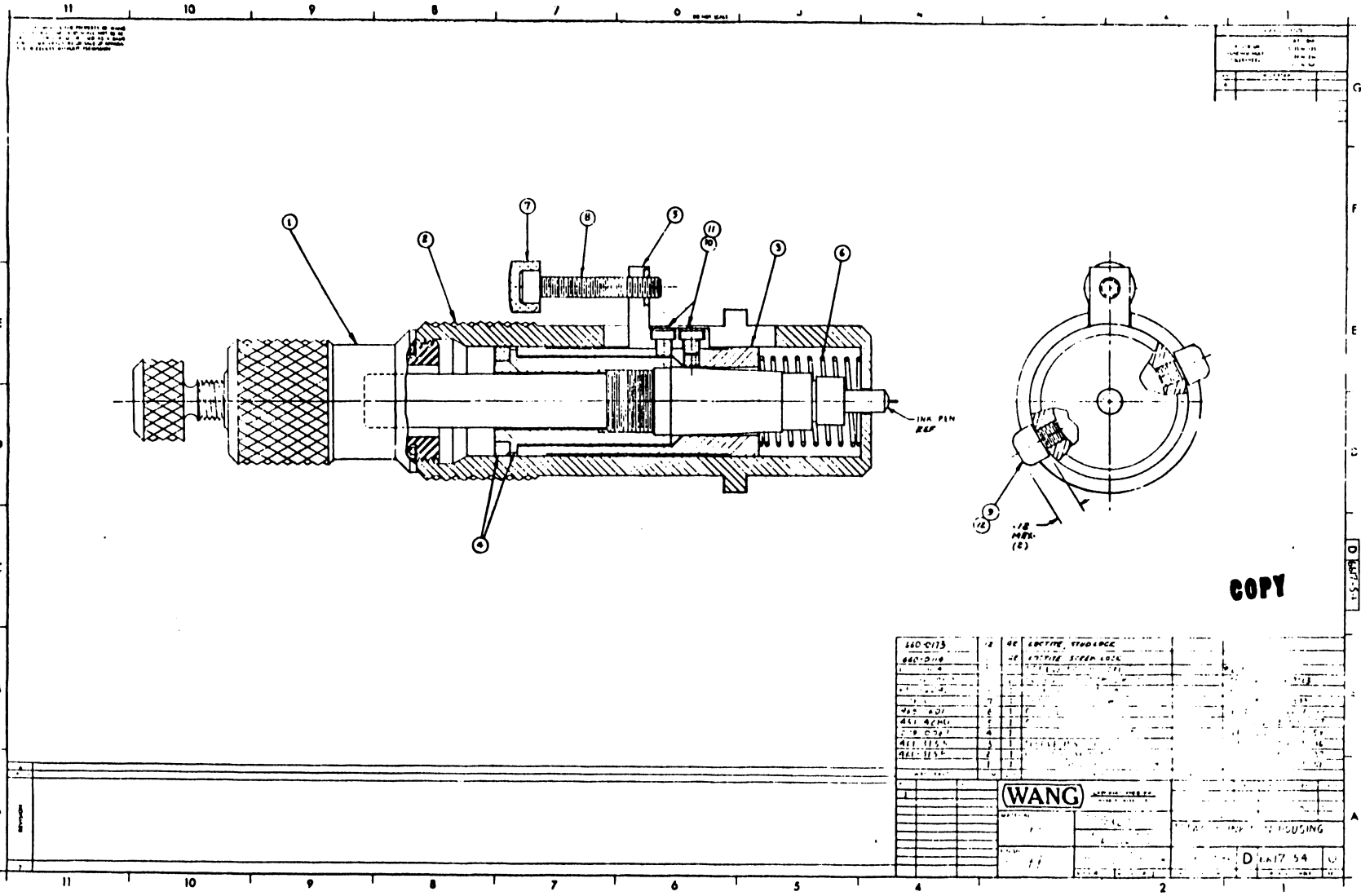
IDENT	DESCRIPTION	QTY
A		

660-0106	3	A R	06 LOCTITE		
465-0719	2	1	BUSHING, RUBBER		SEE DWG 17-41
451-4280	1	1	BRKT, ADJ. SCREW		SEE DWG 17-28
QTY	BY	DATE	APPROVED BY	DATE	
	DOWN AFM	5/6/74	E ENGR		
	CHK		M ENGR		
	E C CONTROL		MFG ENGR		
TITLE ASSY., ADJ. SCREW BR'KT.					
WANG LABORATORIES, INC. <small>TEWESBURY MASS U.S.A.</small>					
MATERIAL		MODEL NO		732A	
FINISH		SEE ENGRG SPECIFICATIONS		No. ES-1001	
		TOL EX AS NOTED		XX ± 010 FRAC. ± 1/64	
				XXX ± 005 ANG ± 1'30" FINISH √	
SCALE 4-1		SHT 1 OF 1		WANG PART NUMBER	
				B 6617-57	
				0	
				DRAWING NUMBER	
				REV	

B 6617-57

A

57

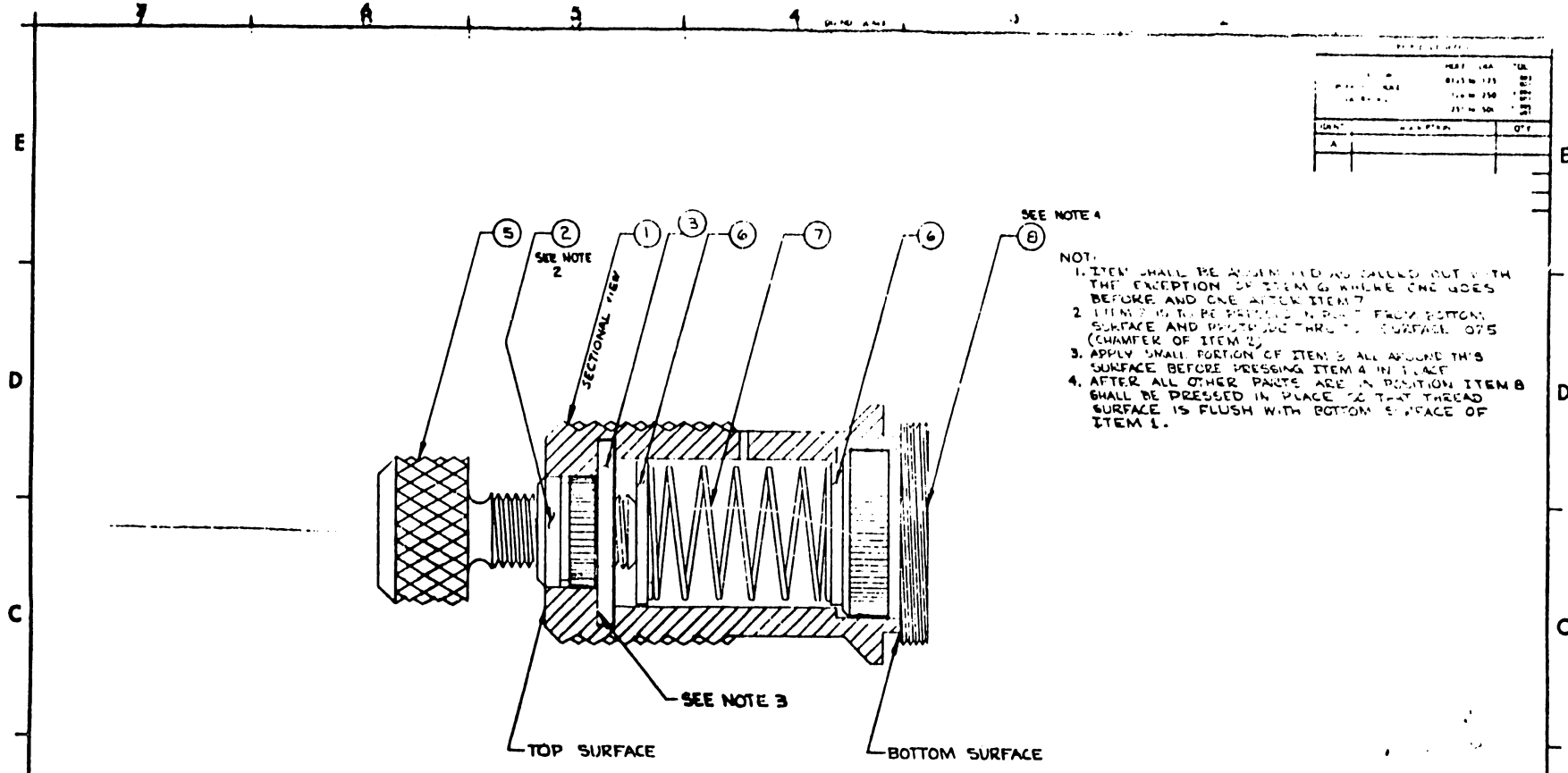


COPY

WANG

D 17 54

REV	DATE	BY
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100	12/14/63	JTB



NOTE 4

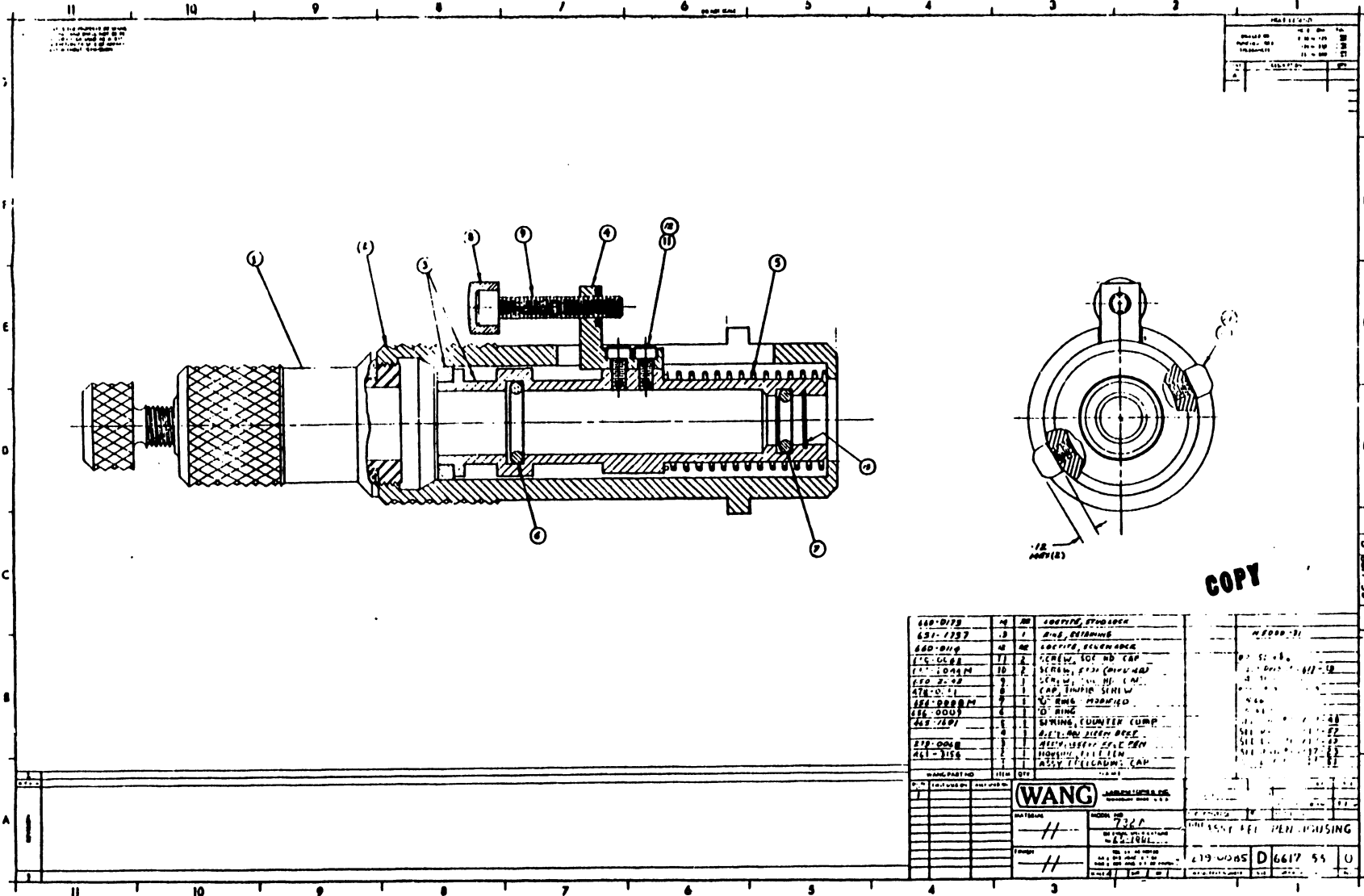
NOT:

- ITEM 1 SHALL BE ASSEMBLED AND CALLED OUT WITH THE EXCEPTION OF ITEM 6 WHICH COMES BEFORE AND ONE AFTER ITEM 7
- ITEM 2 SHALL BE PRELLOADED FROM BOTTOM SURFACE AND PROTRUDE THROUGH SURFACE OF 5 (CHAMFER OF ITEM 3)
- APPLY SMALL PORTION OF ITEM 3 ALL AROUND THIS SURFACE BEFORE PRESSING ITEM 4 IN PLACE
- AFTER ALL OTHER PARTS ARE IN POSITION ITEM 8 SHALL BE PRESSED IN PLACE SO THAT THREAD SURFACE IS FLUSH WITH BOTTOM SURFACE OF ITEM 1.

WANG PART NO.	ITEM	QTY	NAME	MATERIAL	DESCRIPTION
461-3162	B	1	INVERT (WANG) MALE		
461-1664	2	1			
461-6716	6				
461-1665	5	1			
461-1117	4				
461-3163	3				
461-3164	1	1			
461-3165	7	1			
461-3166	8	1			

DATE	BY	DATE	APPROVED BY	DATE
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59



REVISION	
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2	11-10-55
3	11-10-55
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5	11-10-55
6	11-10-55
7	11-10-55
8	11-10-55
9	11-10-55
10	11-10-55
11	11-10-55

COPY

NO.	REV.	DESCRIPTION	DATE
440-0173	40	SCREW, STUB LOCK	
451-1137	10	RING, STAINLESS	
460-0119	40	SCREW, SCREWDRIVER	
115-0144	11	SCREW, TORX HD CAP	
115-1044	10	SCREW, TORX (DRILL) HD	
150-21-02	9	SCREW, TORX (DRILL) HD	
178-01-01	9	CAP, TORX (DRILL) HD	
186-0000M	9	O-RING, MODIFIED	
186-0000	6	O-RING	
247-7101	1	SPRING, COMPRESSOR CUMPL	
279-0000	1	SPRING, COMPRESSOR CUMPL	
461-3150	1	ASSY THERMAL CAP	

WANG PART NO.	ITEM	QTY
440-0173	40	
451-1137	10	
460-0119	40	
115-0144	11	
115-1044	10	
150-21-02	9	
178-01-01	9	
186-0000M	9	
186-0000	6	
247-7101	1	
279-0000	1	
461-3150	1	

WANG		WANG LITHO CO.
DATE	NO.	REV.
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BY	CHKD	APP'D
///	///	///
11-10-55	7360	
BY	CHKD	APP'D
///	///	///
11-10-55	7360	
BY	CHKD	APP'D
///	///	///

ES-177-0

619-0045 D 6617 55 U

**SERVICE
BULLETIN
NO. 44.2**

EDITED BY CUSTOMER ENGINEERING DIVISION

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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WANG

LABORATORIES, INC.

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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.

$$a = 500 = 1.25'' \text{ (3.18 cm)}$$
$$\theta = 10 = 10^\circ$$

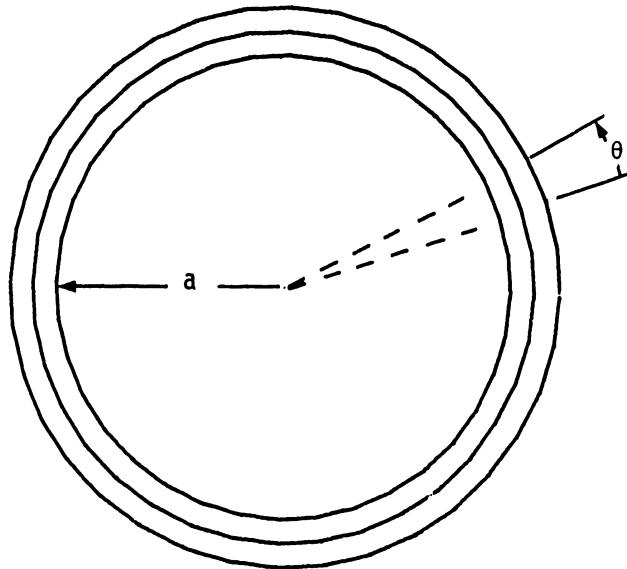


FIGURE 1

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.

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

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

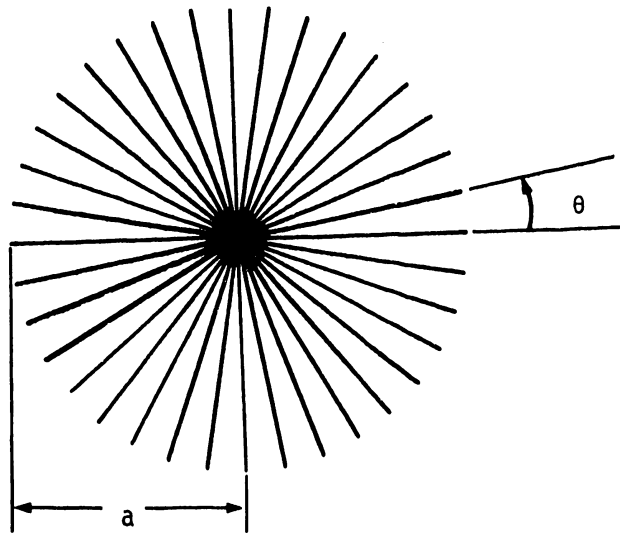


FIGURE 2

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 $f(x)$ $\boxed{05}$, 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 $f(x)$ $\boxed{05}$. 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 $f(x)$ $\boxed{05}$.
- (b) Key 300, GO.
- (c) Key 200, GO.
- (d) Key 4, GO.

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

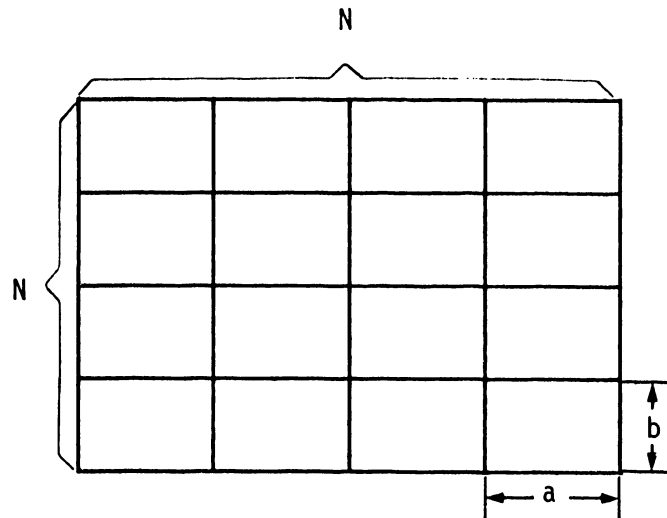


FIGURE 3

1.7 DASH POT

By keying $f(x)$ $\boxed{06}$, 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 $f(x)$ $\boxed{15}$, 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

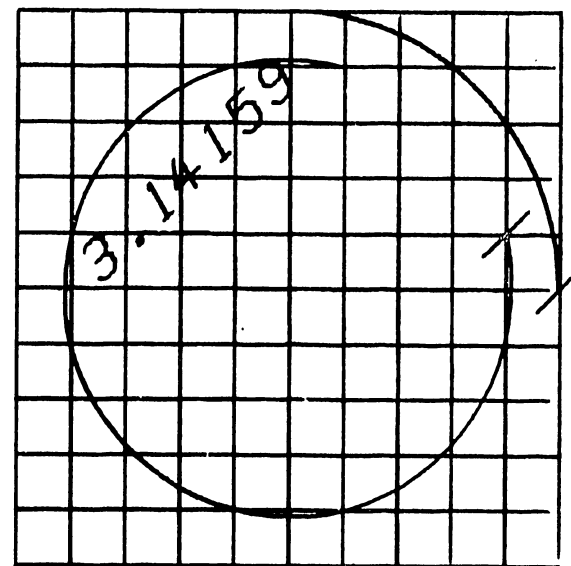
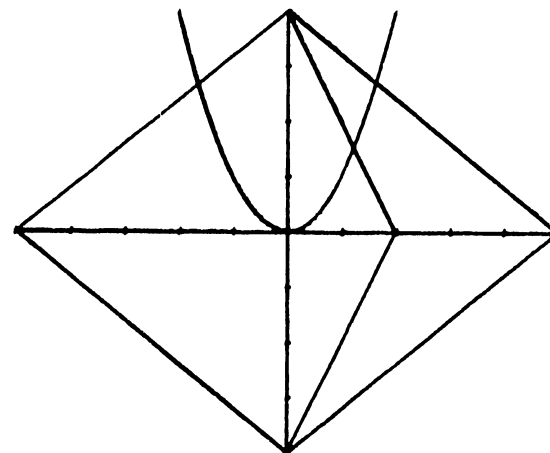
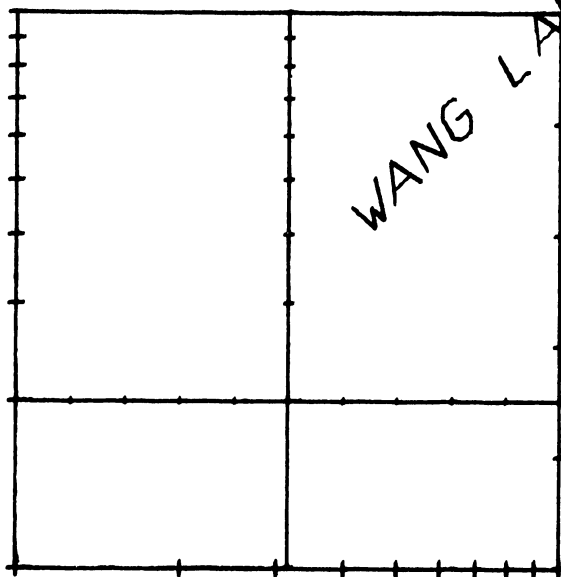
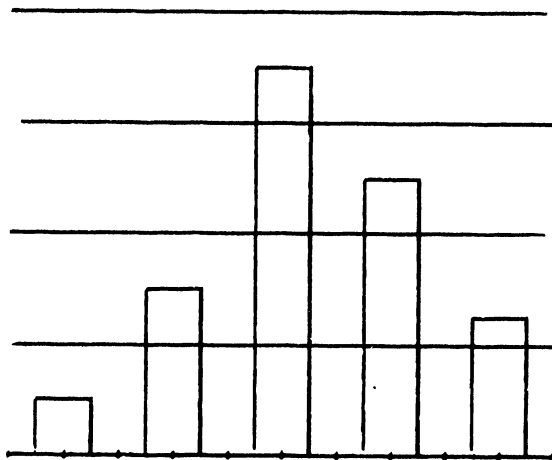
If the plotter has an output like Figure 4, the Alpha ROM is good.

632 ALPHA ROM DIAGNOSTIC

E F J K Q U V X Y Z + - = 0 7 8 % / * () , ' " " " ° \$

6

FIGURE 4



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.

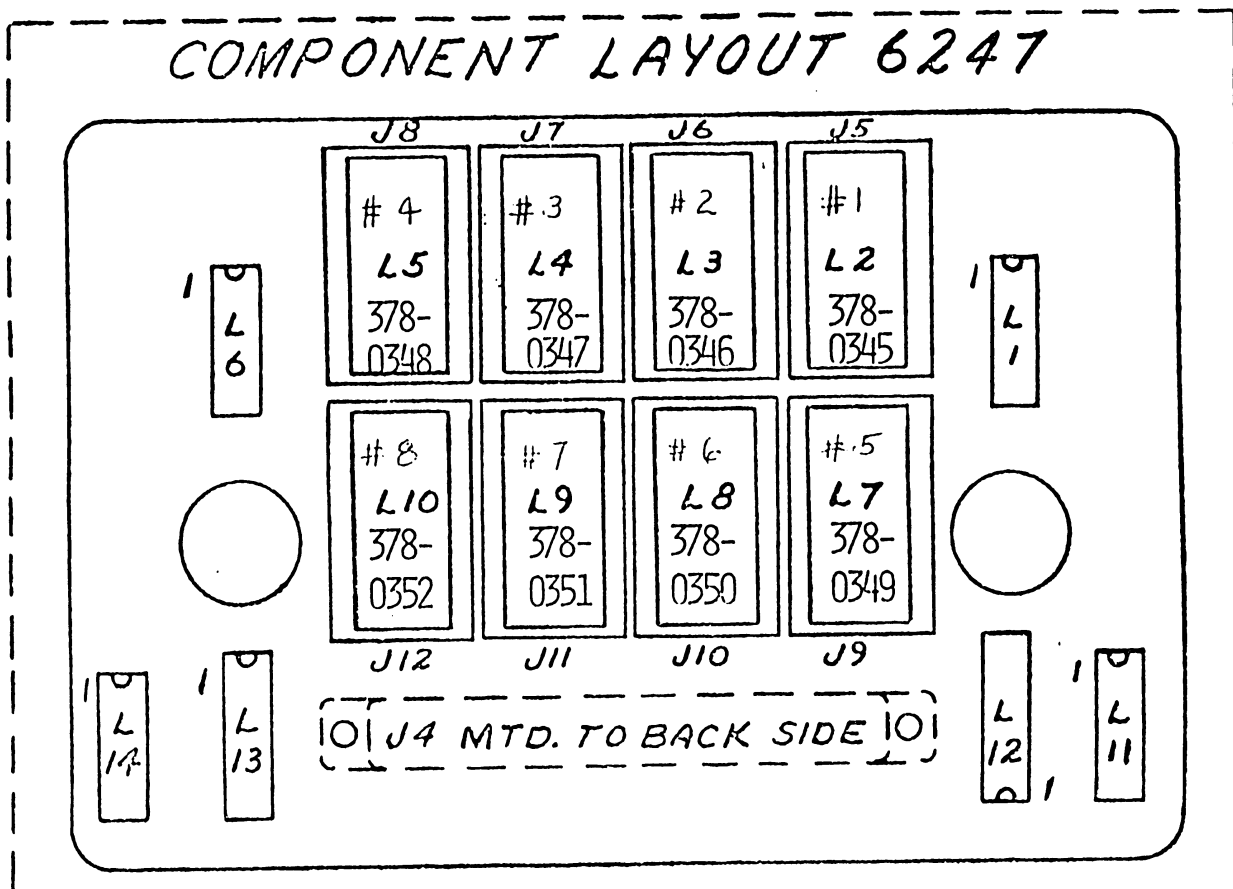


FIGURE 5

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.

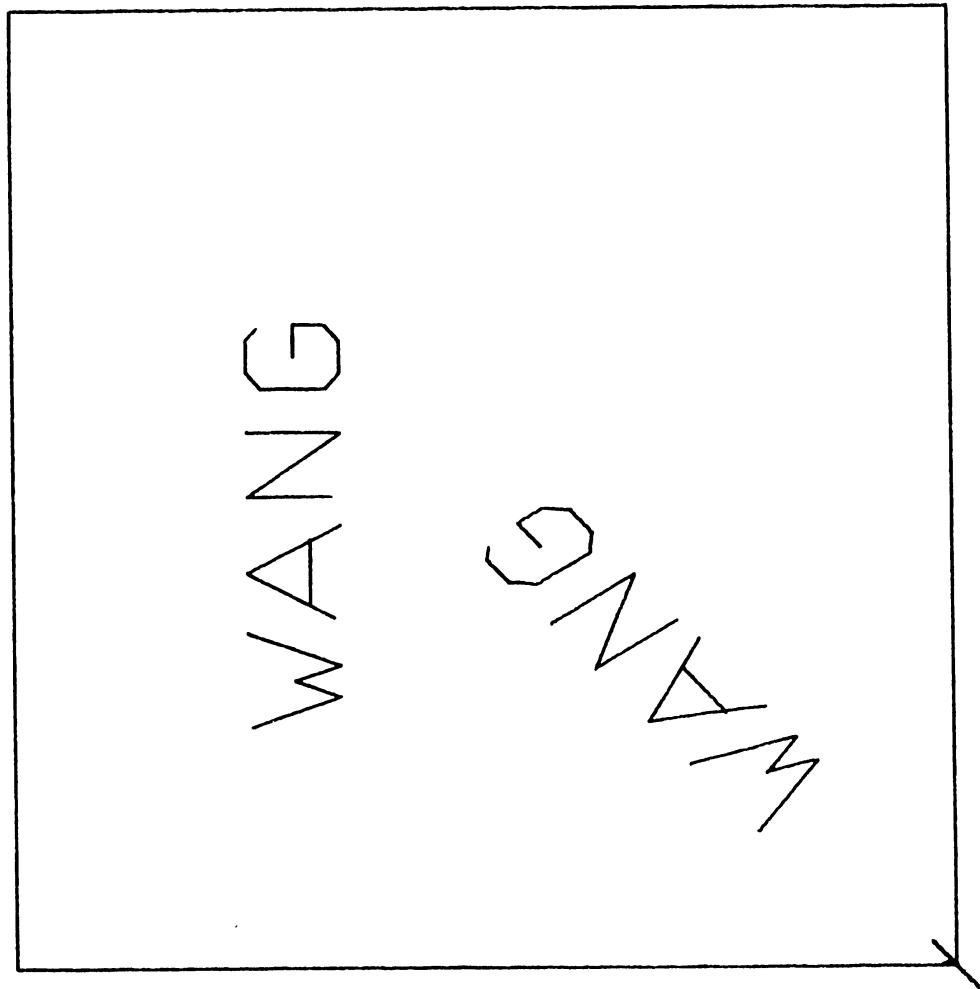


FIGURE 6

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		

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632.1

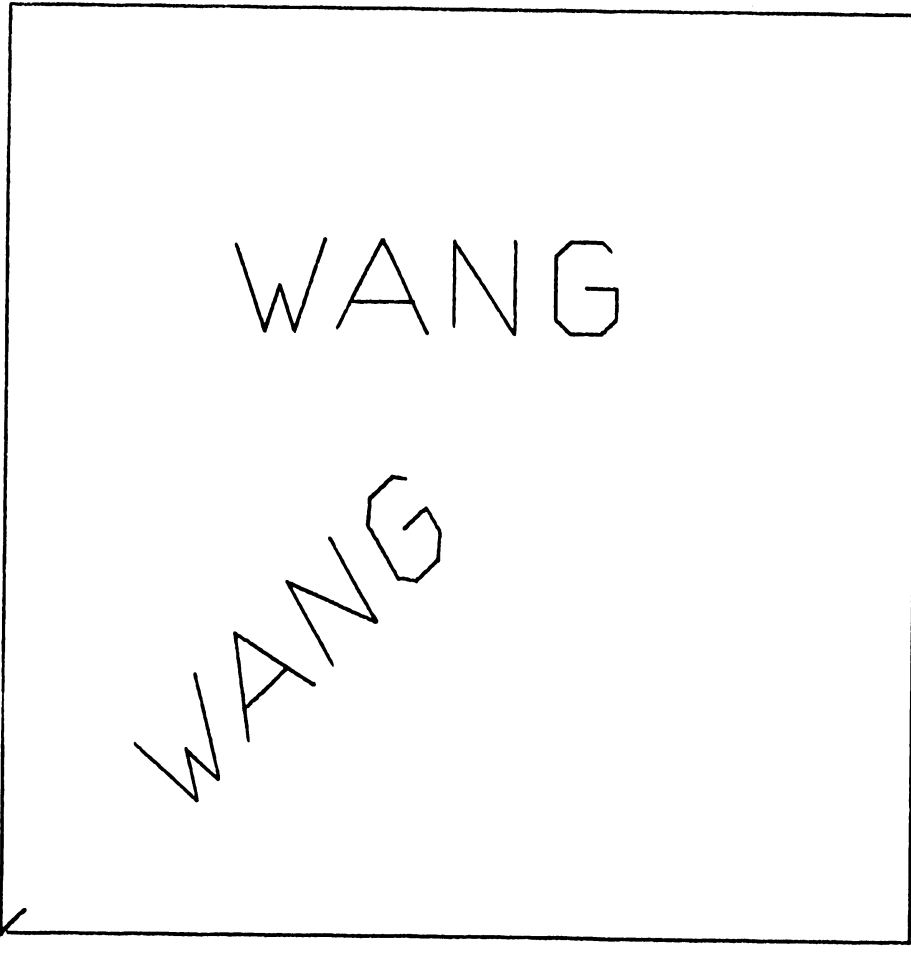


FIGURE 7

11

ABCDE

EFGHIJKLMNOPQRSTU

VWXYZ+-=012345678

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

632.1

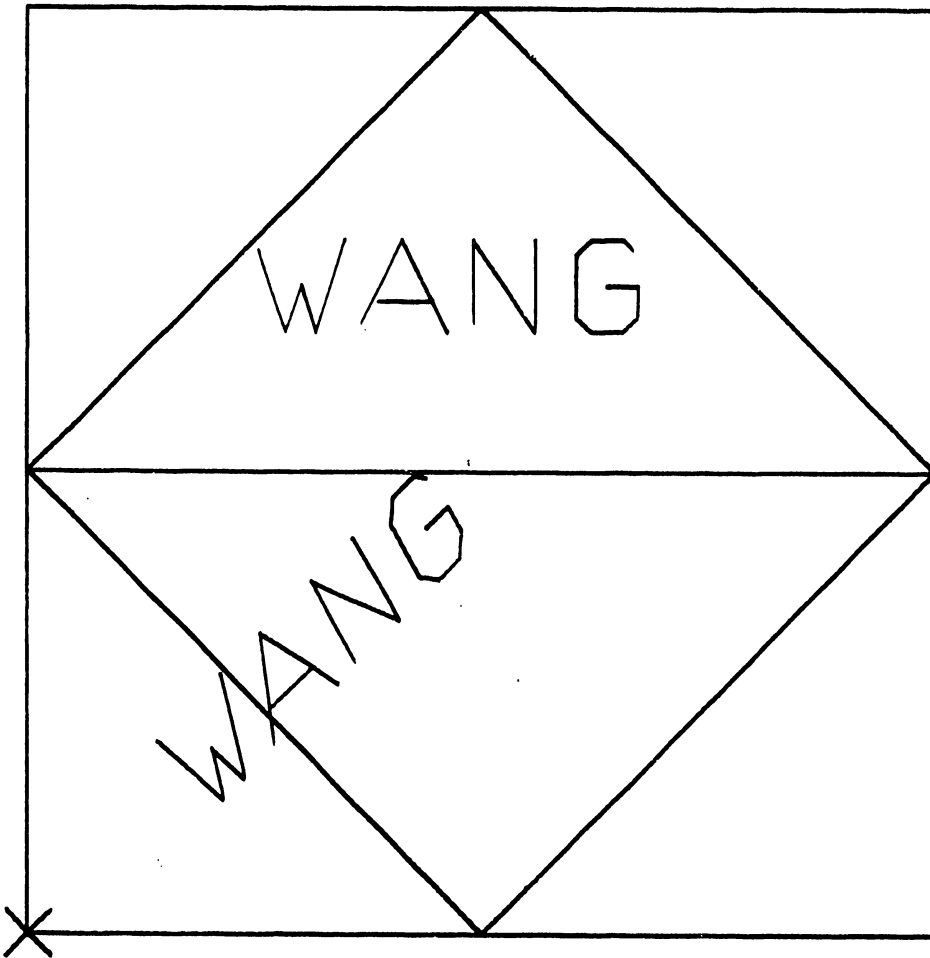


FIGURE 8

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		

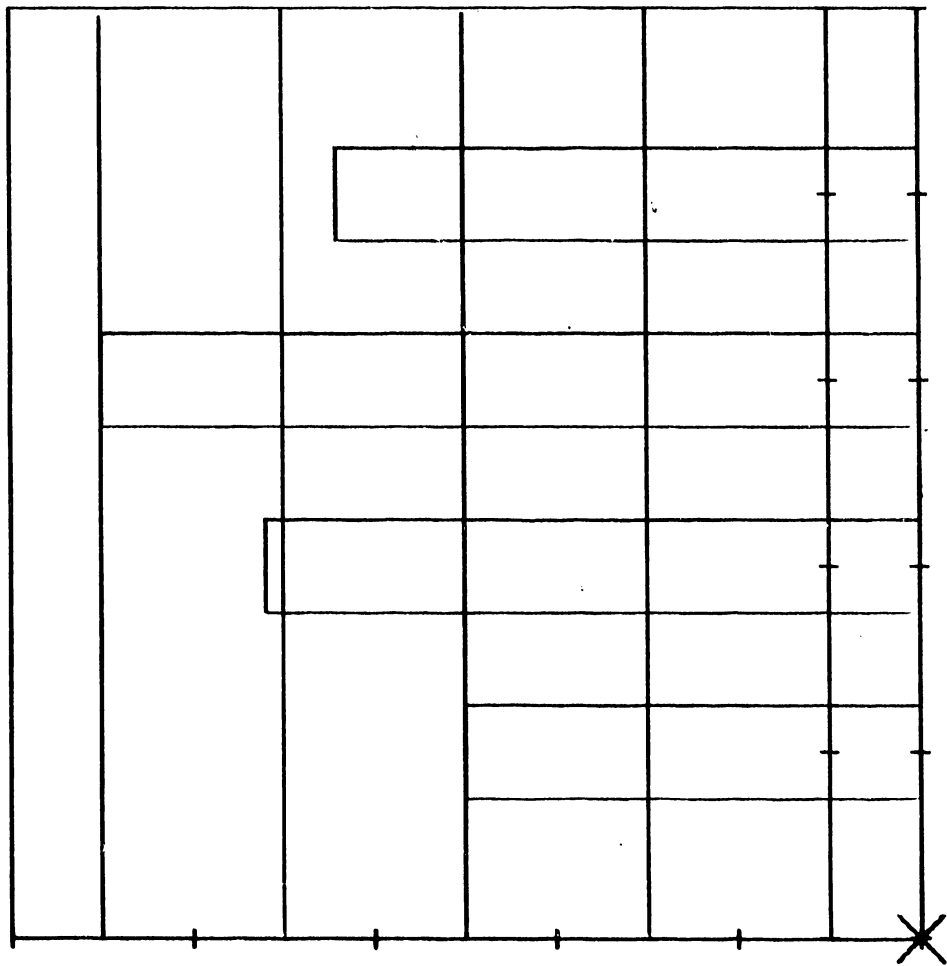
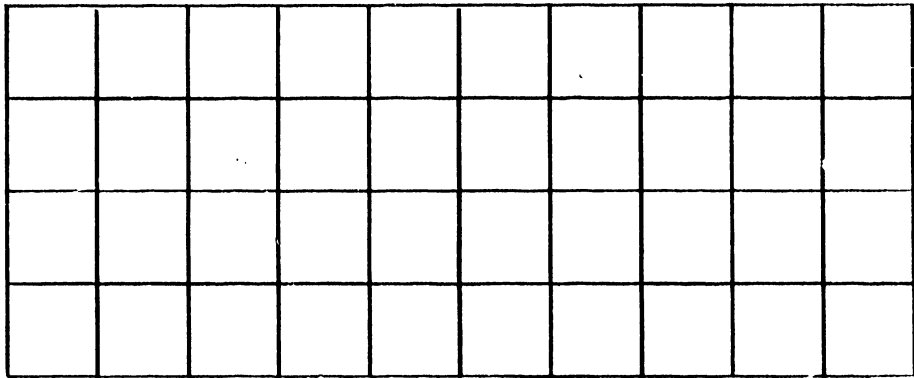


FIGURE 9

ABCDE

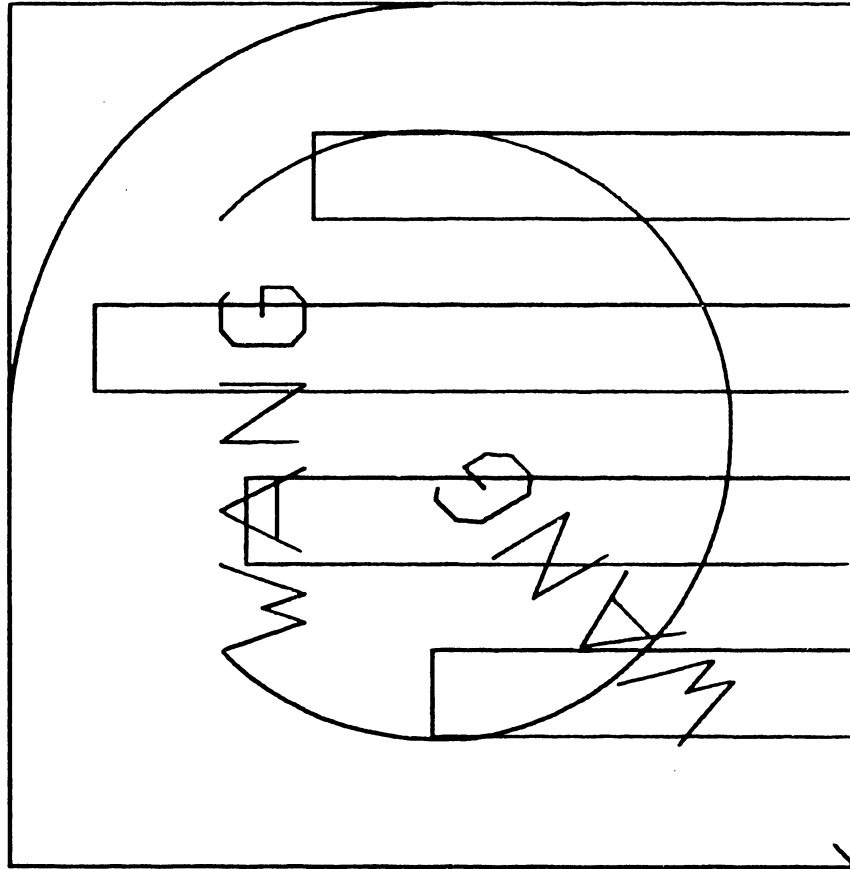
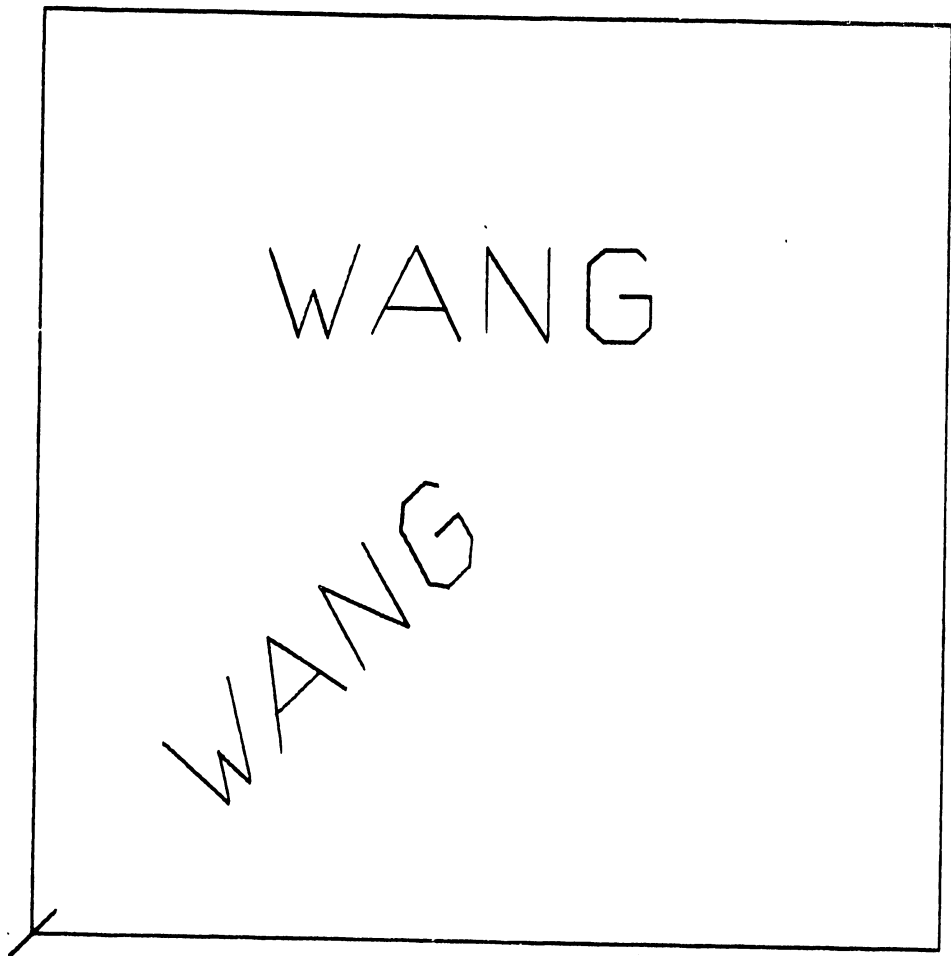


FIGURE 10

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		

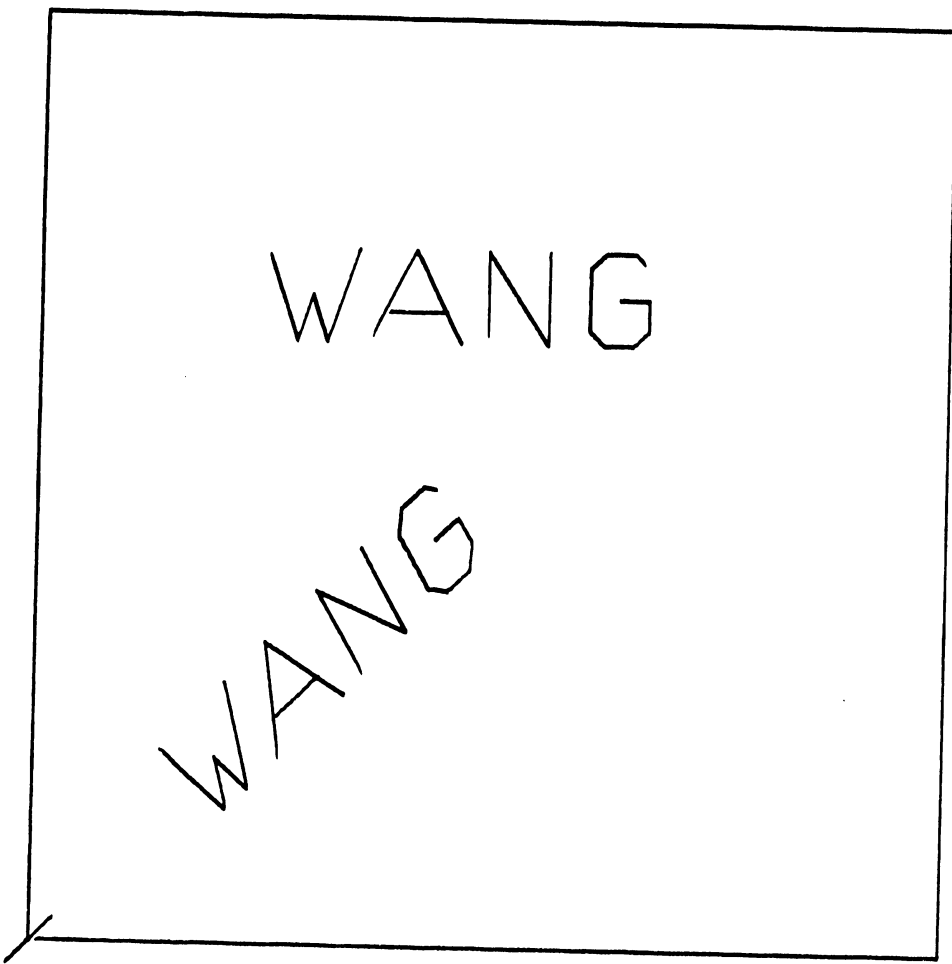


FIGURE 12

VWXYZ+-=012345678

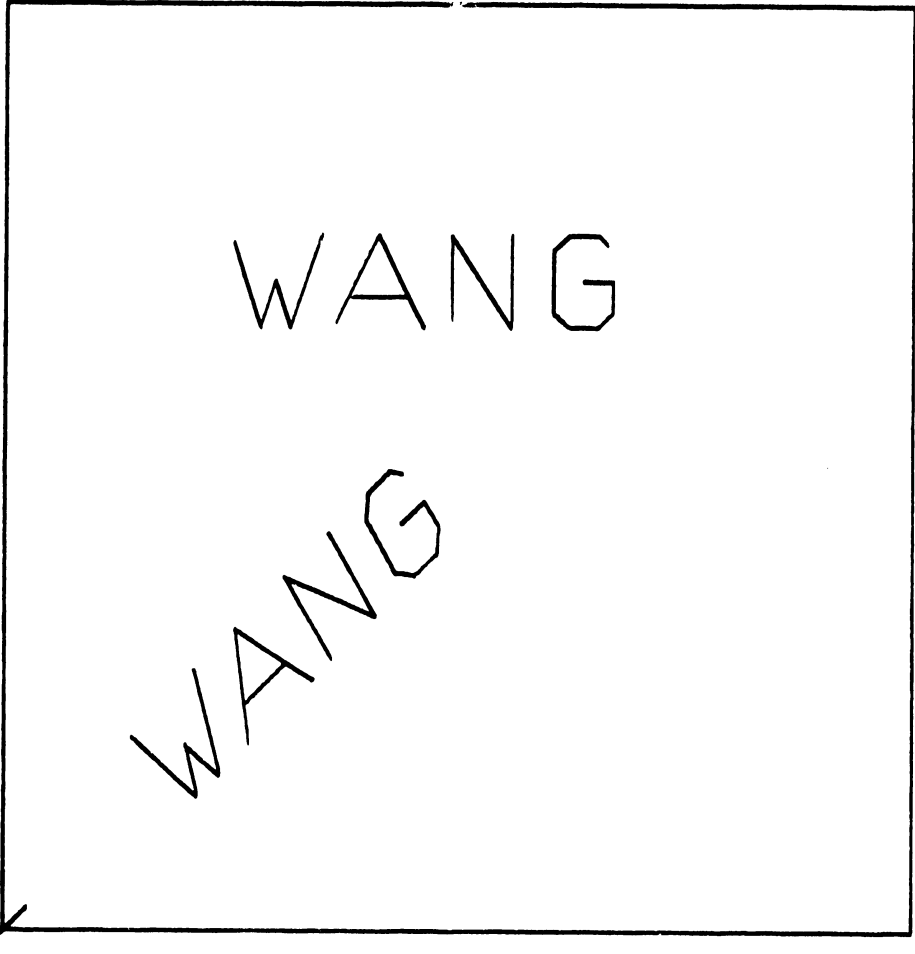


FIGURE 13

89% / * () . , ' 66 99 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