

12

UNIVERSITY OF WASHINGTON
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
SEATTLE, WASHINGTON 98195

AD A 041506

Principal Investigators

GORDON L. MITCHELL
and
WILLIAM D. SCOTT



DD FORM
1
JUL 70

ORIGINAL CONTAINS COLOR PLATES: ALL DDC
REPRODUCTIONS WILL BE IN BLACK AND WHITE.

Prepared for
Naval Electronic Laboratory Center (Code 2509)
San Diego, California, 92152

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

AD NO.
DDC FILE COPY.

ACCESSION NO.	
DTIC	Form Section ☒
DDC	Doc Section ☐
CHARACTERISTICS	☐
JUSTIFICATION	
BY	
DISTRIBUTION/AVAILABILITY CODES	
DISC.	AVAIL. 1/2 SPECIAL
A	

12

UNIVERSITY OF WASHINGTON
College of Engineering
Department of Electrical Engineering
Seattle, Washington 98195

Contract N00123-76-C-1451

Annual Report for the Period Ending May 31, 1977

OPTICAL FIBER CUTTING MACHINE
FOR RECTANGULAR AND CIRCULAR FIBERS

Gordon L. Mitchell

June 30, 1977

Principal Investigators

Gordon L. Mitchell

and

William D. Scott

ORIGINAL CONTAINS COLOR PLATES AND
REPRODUCTIONS WILL BE IN BLACK AND WHITE

Prepared for
Naval Electronic Laboratory Center (Code 2500)
San Diego, California 92152

DISTRIBUTION STATEMENT

Approved for
Distribution

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) OPTICAL FIBER CURRING MACHINE FOR RECTANGULAR AND CIRCULAR FIBERS		5. TYPE OF REPORT & PERIOD COVERED 1 June 1976 - 30 May 1977
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Gordon L. Mitchell		8. CONTRACT OR GRANT NUMBER(s) N00123-76-C-1451 UNCL
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Washington (FT-10) Department of Electrical Engineering Seattle, WA 98195		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Ocean Systems Center San Diego, CA 92152		12. REPORT DATE June 30, 1977
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Principal Investigators: Gordon L. Mitchell, William D. Scott		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Fiber Controlled Fracture Fracture Splicing Optical		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An optical fiber cutting machine for use with rectangular or round cross section fibers has been developed. It combines a sliding-weight tension apparatus with a diamond knife crack initiation mechanism. 		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102 LF 014 6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Abstract

An optical fiber cutting machine for use with rectangular or round cross section fibers has been developed. It combines a sliding-weight tension apparatus with a diamond knife crack initiation mechanism.

Efficient butt joints in optical fiber systems require that fiber ends be well finished. Since Gloge¹ published a controlled fracture fiber finishing machine a number of variations have evolved. The fiber cutting machine described in this report was designed with the following objectives:

- Capability to cut round or rectangular cross section fibers
- Convenient and reproducible adjustment of fiber tension and bending radius
- Maximum use of purchased (rather than locally fabricated) material to minimize cost.
- Simple operating procedures

The resulting fiber cutting machine is shown in Figure 1. After setting fiber tension weights with a dynamometer the fiber is clamped in the movable block and then in the fixed block. When the support slide is pulled from under the moveable block a preset tension is applied to the fiber. Fiber breakage occurs when the diamond knife is lowered to contact the fiber.

Adjustment of fiber radius and tension for clean fiber fractures is accomplished by trial and error. With the machine shown in Figure 1, a 125 μ m diameter glass fiber required 300 grams tension and a 1.5" radius block for best breaks. The fiber tension can be reset within 5 grams of a desired value by positioning the sliding weights as shown in Figure 2. A tension vs. weight position calibration should be plotted for each fiber cutter constructed

REFERENCE

D. Gloge, P. W. Smith, D. L. Bisbee, E. L. Chinnock, Bell Syst. Tech. J. 52, pp. 1579-1588, (Nov. 1973).

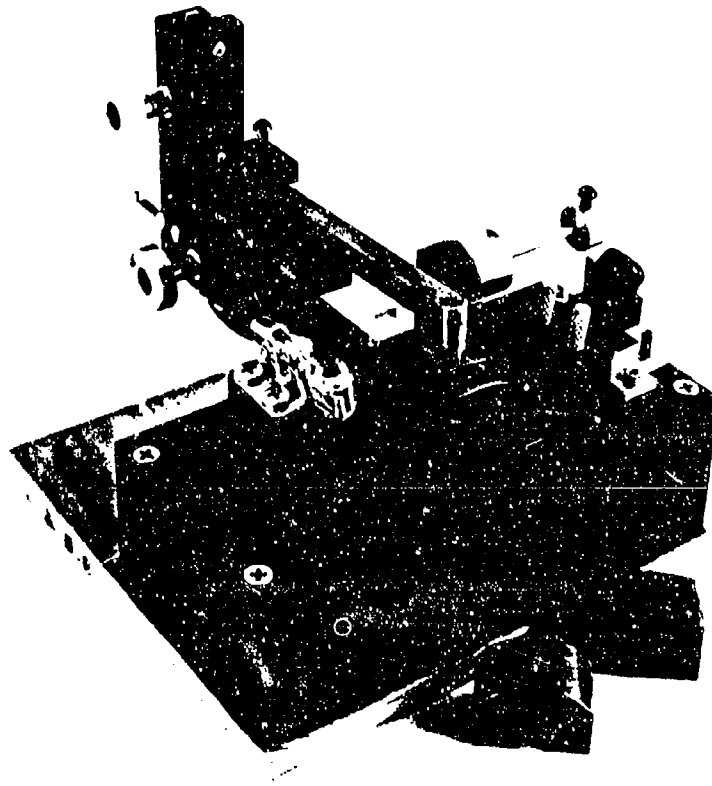


Figure 1 Fiber cutting machine. The fiber is held under tension over the radius block. When it is touched by the diamond knife a crack propagates across the fiber. If tension and radius are correct this will produce an optical quality end finish.

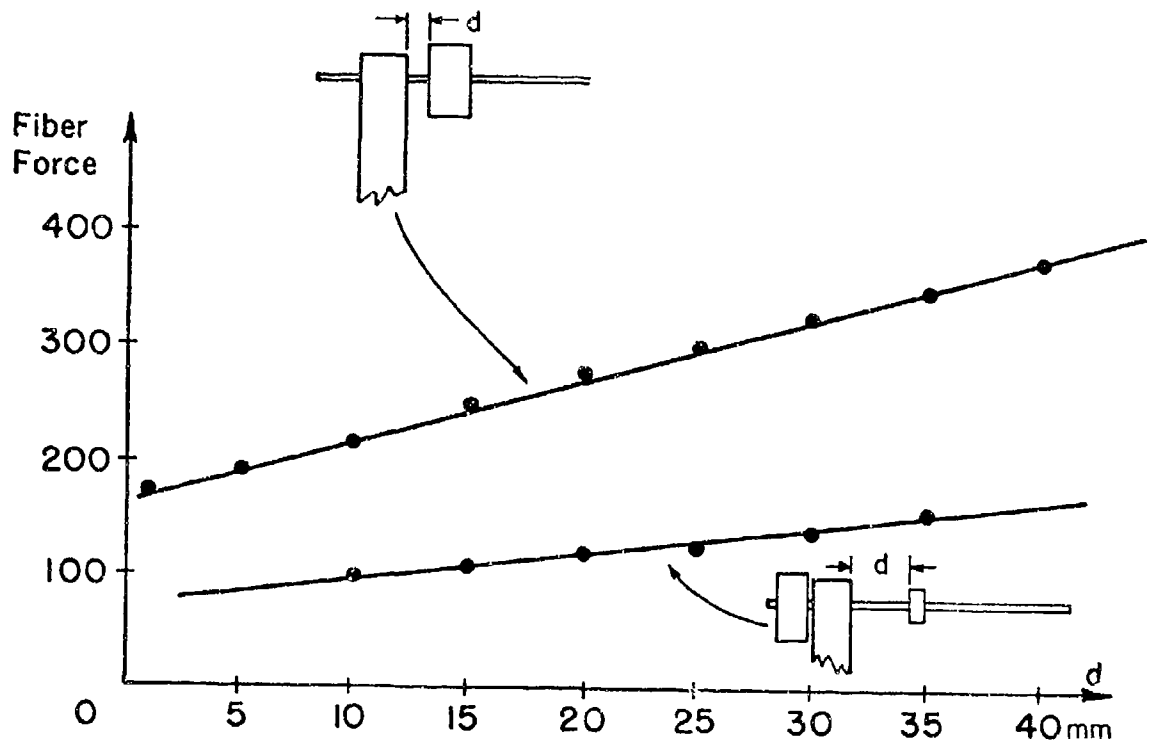


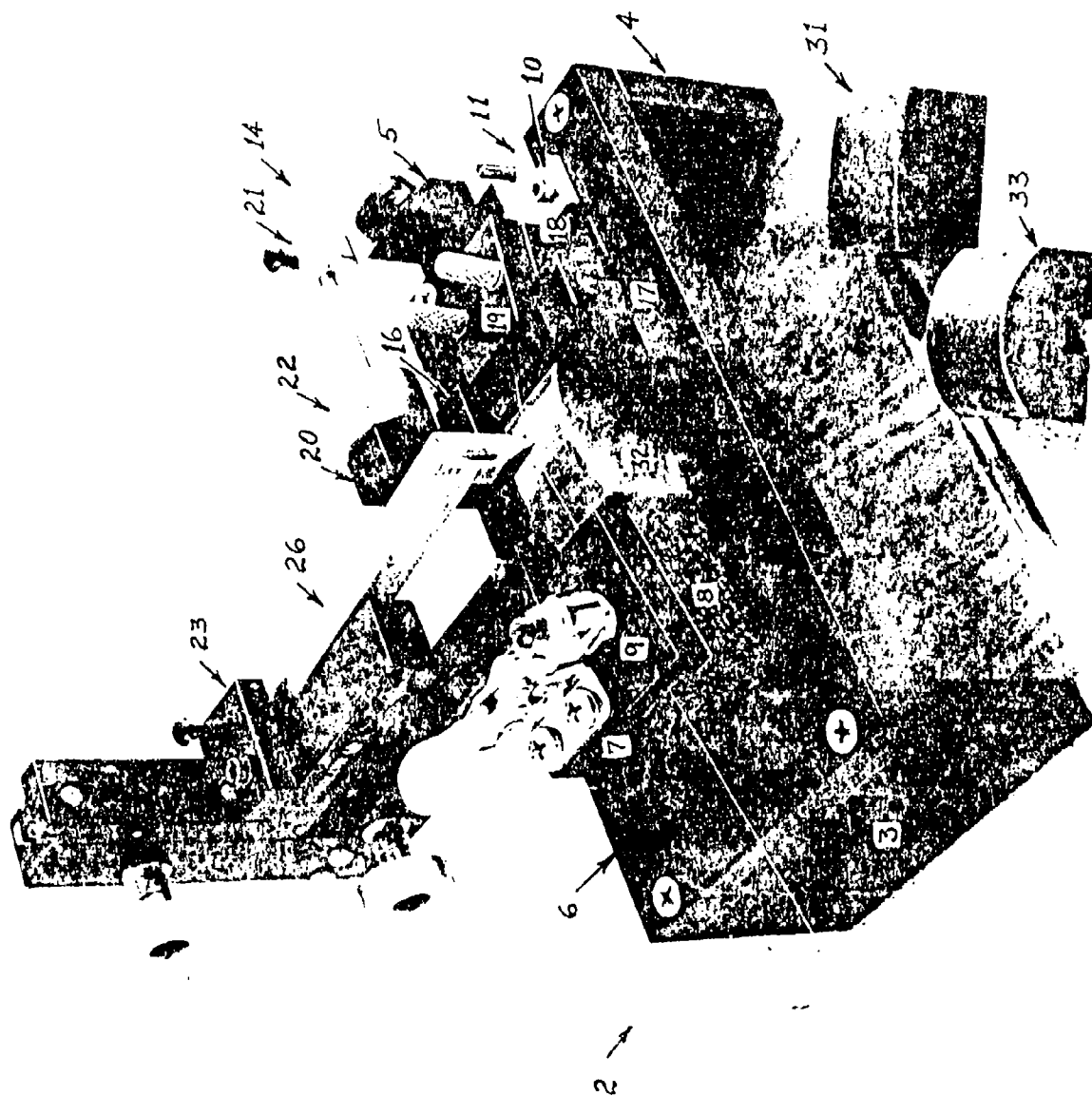
Figure 2. Fiber tension as a function of weight position for a prototype machine shown in Figure 1.

ACKNOWLEDGEMENT

The fiber cutter described in this report uses some design concepts from similar machines constructed at Bell Telephone Laboratories and the Naval Ocean Systems Center. Marcell Sollenberger fabricated the first prototypes and David Porter of the Boeing Commercial Airplane Company was responsible for design documentation.

DETAIL DRAWINGS

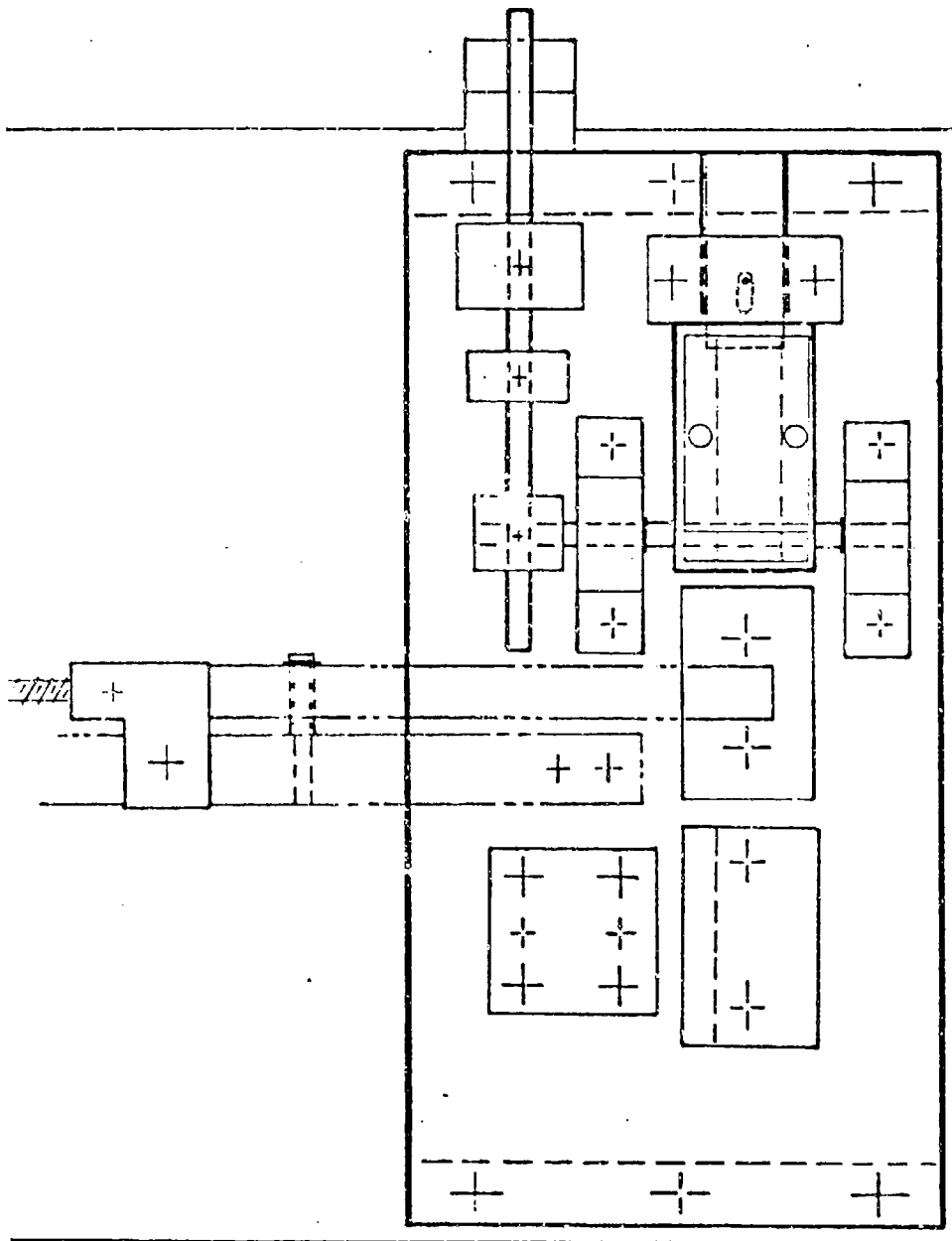
FIBER CUTTING MACHINE

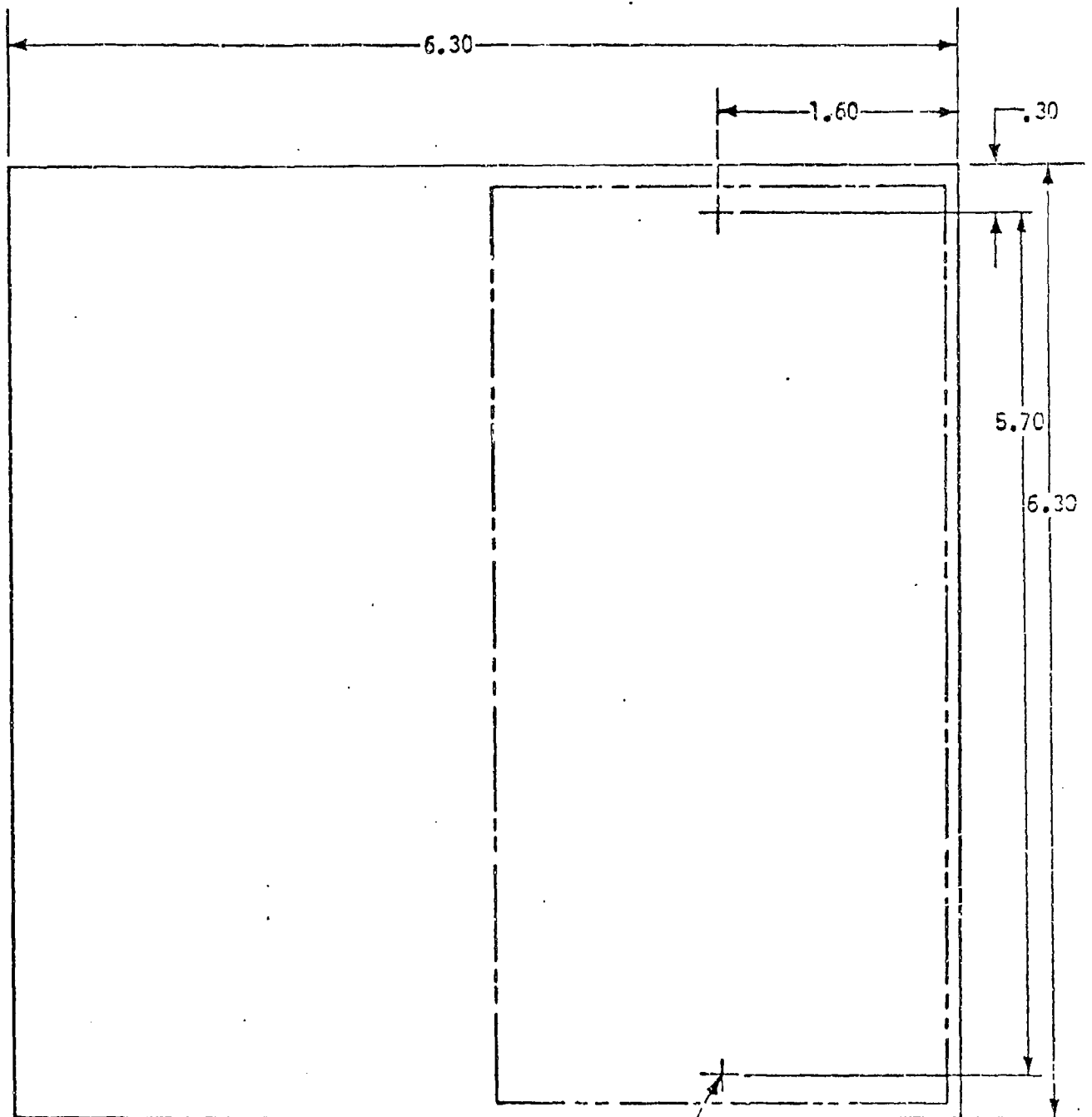


		4	MS51977-11	SET SCREW	-	
		1	MS51977-10	SET SCREW	-	
		1	MS171431	PIN	SPRING	
		1	MS171525	PIN	SPRING	
		1	NAS1189-08-4	SCREW	FLAT HEAD	
		6	NAS1189-08-12	SCREW	FLAT HEAD	
		6	NAS1190-08-4	SCREW	PAN HEAD	
Aluminum Alloy; 6061-T4 FINISH IS 250 ✓ TOLERANCE; $\pm .03$, EXCEPT AS NOTED						
		QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
PARTS LIST						
		DWN		SCALE		SHEET
		ENGR				
		APPD				

	-30	1	-26	cutter arm rework	Bell Labs Diamond Knife Victory Diamond Tool Co. P. O. Box 274 East Hanover, N.J. 07936	
	-26	1	-27	balance screw	6-32 UNCx2.50 LONG	
	-26	1	-28	cutter arm weight	.45 DIAx.48 LONG ST. STEEL	
	- 1	1	-30	mechanical stage MA88	Swift Mechanical Stage College Biological Supply 21707 Bothell Way Bothell, Washington 481-0731	
	- 1	1	-31	3" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	-32	1.5" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	-33	.75" radius block	1.20x.85x.74 Al. Alloy	
	- 1	1	2059	toggle clamp	De Sta Co Campbell Industrial Supply 3433 Airport Way So. Seattle, Washington 98134 447-7100	
	-12	2	-	CIRCLIP	1/8" DIAMETER	
	-30	1	-			
	- 5	1	-	GROMMET	.60" DIA, RUBBER	
	-21	1	4-40	SCREW	SLOT HEAD, TEFLON	
	-22	1	6-32	SCREW	SLOT HEAD, TEFLON	
	-26	1	6-32	SCREW	FLAT HEAD, 2.5 LONG	
	-12	2	Ms24585C29	SPRING		
		1	MS24677-1	SCREW	SOCKET HEAD	
		2	MS24677-7	SCREW	SOCKET HEAD	
		6	MS24677-10	SCREW	SOCKET HEAD	
		1	MS24677-14	SCREW	SOCKET HEAD	
		2	MS24677-17	SCREW	SOCKET HEAD	
		QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
PARTS LIST						
		DWN		SCALE		SHEET
		ENGR				
		APPD				

-	1	- 1	optical fiber cutter	-	
- 1	1	- 2	base board	6.5 x 6.5 x 3/8 plywood	
- 1	1	- 3	end support	3.0x1.5x.36 Al. Alloy	
- 1	1	- 4	end support with restraint	3.0x1.5x.36 Al. Alloy	
- 1	1	- 5	restraint	1.75x.75x.60 Al. Alloy	
- 1	1	- 6	mounting plate	6.06x3.0x.36 Al. Alloy	
- 1	1	- 7	clamp base	.96x.94x.78 Al. Alloy	
- 1	1	- 8	fiber restraint base	1.24x.76x.74 Al. Alloy	
- 1	1	- 9	fiber restraint	1.24x.76x.25 Al. Alloy	
- 1	1	-10	slide plate retainer	1.10x.50x.10 stainless steel	
- 1	1	-11	slide plate	1.12x.48x.10 stainless steel	
- 1	1	-12	tension clamp assembly	-	
-12	1	-14	lever bar	1/8"DIAx3.6 LONG stainless steel	
-12	1	-15	mounting bar	1/8"DIAx2.45 stainless steel	
-12	1	-16	mounting bar support	1.36x.85x.36 stainless steel	
-12	1	-17	bar end support	1.36x.85x.36 stainless steel	
-12	1	-18	tension clamp block	1.25x.75x.74 Al. Alloy	
-12	1	-19	tension clamp	1.10x.25x.74 Al. Alloy	
-12	1	-20	bar joint	1.10x.50x.42 Al. Alloy	
-12	1	-21	small weight	.56DIAx.28 LONG stainless steel	
-12	1	-22	large weight	.70DIAx.50 LONG stainless steel	
-30	1	-23	cutter arm block	1.0x.80x.25 Al. Alloy	
-26	1	-24	bushing - -	bronze 1/8 I.D. x .35 LONG	
-30	1	-25	pivot pin	1/8 DIAx1.0 LONG stainless steel Rod	
	QTY	PART NUMBER	DESCRIPTION	SPECIFICATION	REV
PARTS LIST					
	DWN		SCALE		SHEET
	ENGR				
	APPD				

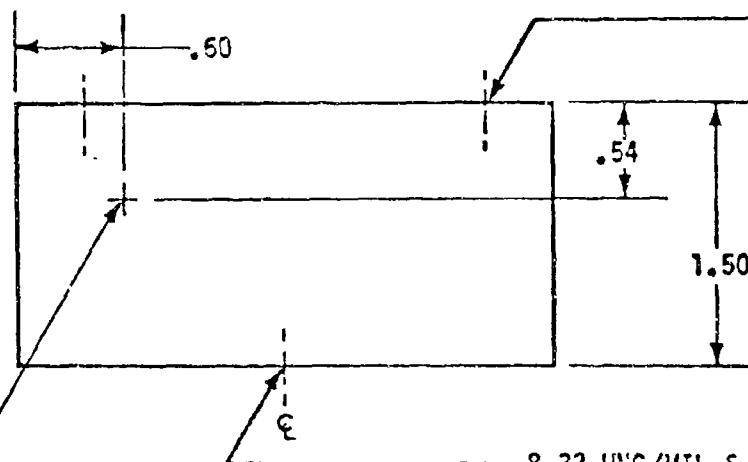
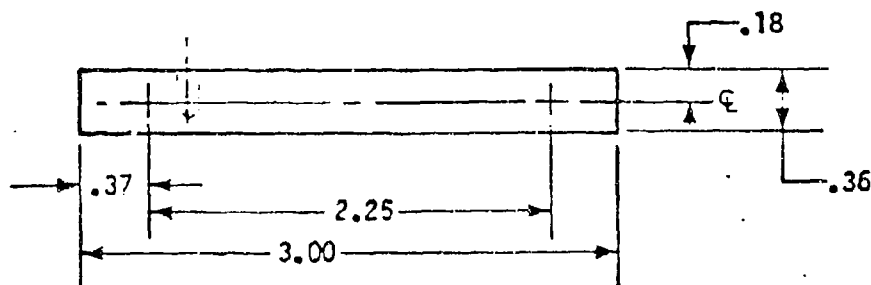




Drill .192-.203 Dia. Hole thru
CSK 100° to .335 - .345 Dia.
to Assemble with -3 and -4,
and NAS 1189-00-12 (or Equiv.)
(2 Places)

-2 BASE BOARD

3/8 Plywood (Material Optional)



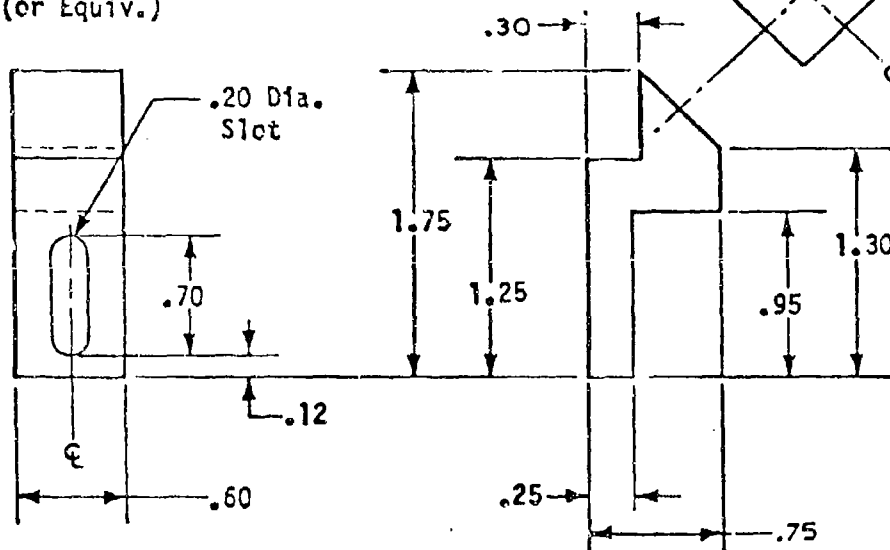
8-32 UNC/MIL-S-7742
 .40 Min. Depth Complete Thread
 Drill .45 Min. Deep
 To Assemble With -6 And
 NAS1189-08-12 (Or Equiv.)
 (2 Places)

-4 Only
 8-32 UNC/MIL-S-7742
 .25 Min Depth Complete Threads
 Drill .30 Min Deep
 (Far Side)
 To Assemble with -5
 and NAS1190-08-4
 (or Equiv.)

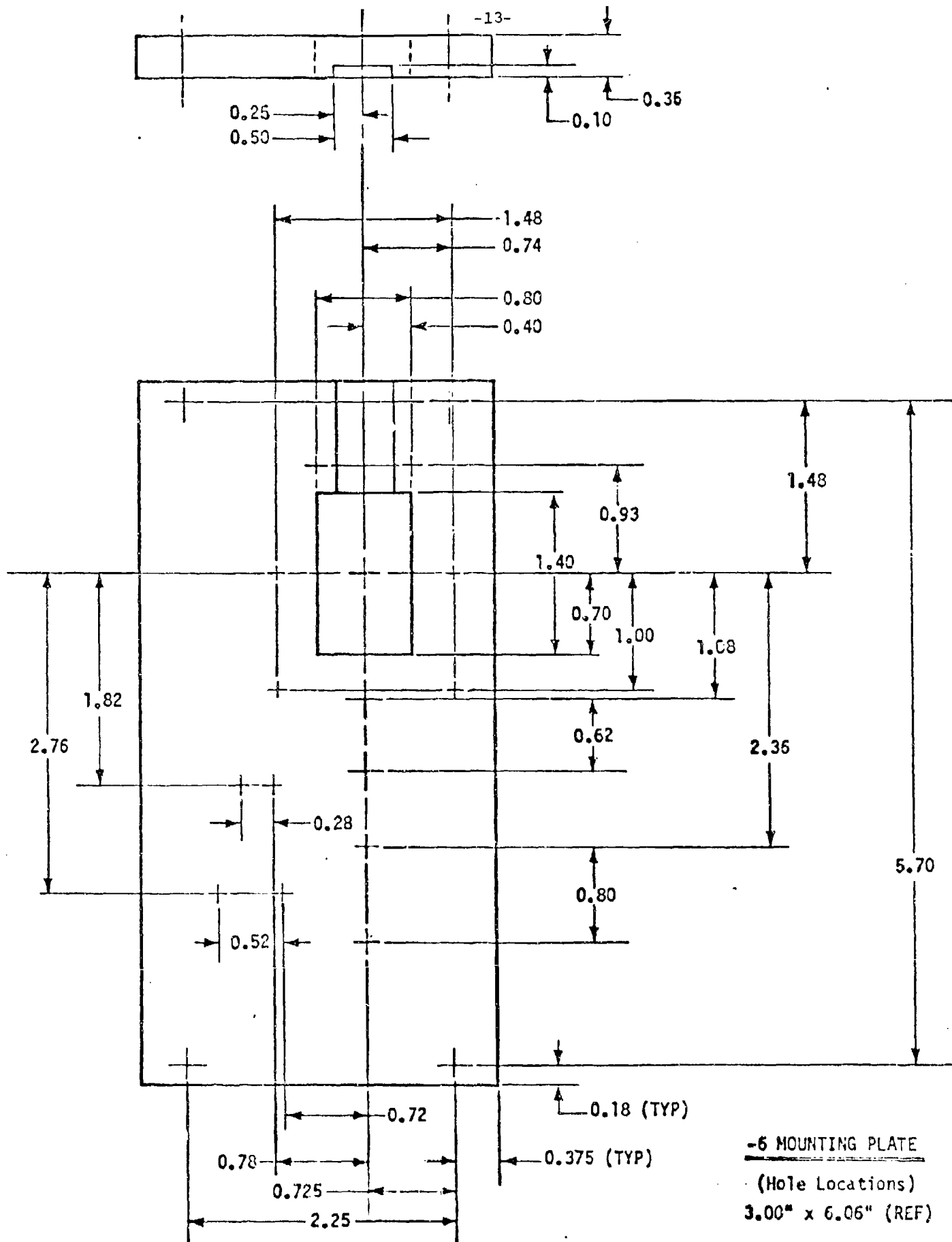
8-32 UNC/MIL-S-7742
 .38 Min. Depth Complete Threads
 Drill .42 Min. Deep
 To Assemble with -2 and
 NAS1189-08-12 (Or Equiv.)

-3 END SUPPORT
-4 END SUPPORT WITH RESTRAINT

6-32 UNC/MIL-S-7742
 .25 Min. Depth
 Complete Threads
 Drill .30 Min. Deep
 To Assemble with
 MS24677-14 and
 Rubber Grommet,
 .60 Dia. X .30 Deep
 (Or Equiv.)



-5 RESTRAINT



-14-

Drill .192-.203 Dia. Hole thru
CSK 100° to .335-.345 Dia.
to Assemble with -4 and NAS1189-08-12 (Or Equiv.)
(2 Places)

4-40 UNC/MIL-S-7742
.20 Min. Depth Complete Threads
Drill .25 Min. Deep
To assemble with -10 and MS24677-1
(Or Equiv.)
(2 Places)

Drill .161-.172 Dia. Hole thru
C' Bore .228 -.236 Dia. X
.138 Min Deep (Far Side)
To Assemble with -17 and
MS24677-10 (Or Equiv.)
(2 Places)

.161-.172 Dia. Hole thru
C' Bore .228 -.236 Dia. X
.138 Min. Deep (Far Side)
To Assemble with -16 and
MS 24677-10 (Or Equiv.)
(2 Places)

Drill .192-.203 Dia. Hole thru
C' Bore .272 -.280 Dia X
.164 Min Deep (Far Side)
To Assemble with -31, 32, or 33
and MS24677-17 (Or Equiv.)
(2 Places)

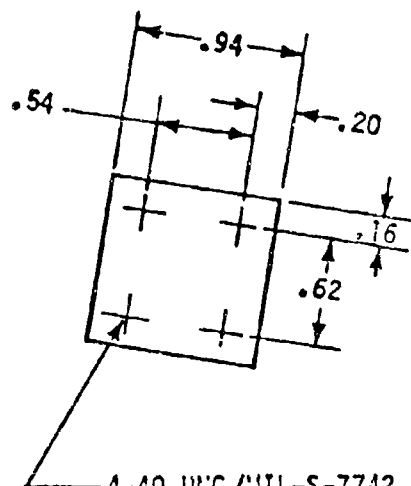
6-32 UNC/ MIL-S-7742
.25 Min. Depth Complete
Threads
Drill .30 Min. Deep

Drill .161 -.172 Dia. Hole thru
C' Bore .228 -.236 Dia X
.138 Min Deep (Far Side)
To Assemble with -8 and
MS 24677-10 (Or Equiv.)
(2 Places)

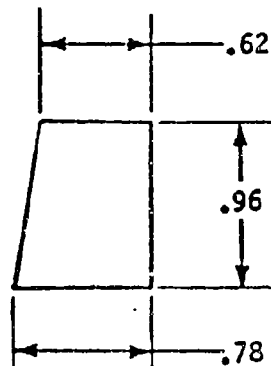
.161-.172 Dia. Hole thru
C' Bore .228 -.236 Dia X
.138 Min. Deep (Far Side)
To Assemble with -7 and
MS24677-10 (Or Equiv.)
(2 Places)

Drill .192 -.203 Dia. Hole thru
CSK 100° to .335 -.345 Dia
To Assemble with -3 and NAS1189-08-12 (Or Equiv.)
(2 Places)

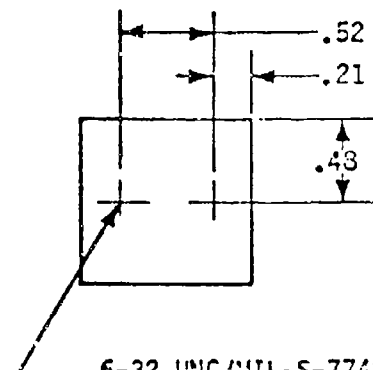
-6 MOUNTING PLATE
(FASTENERS)



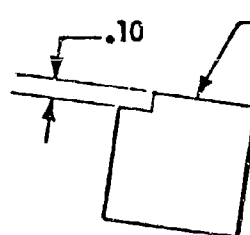
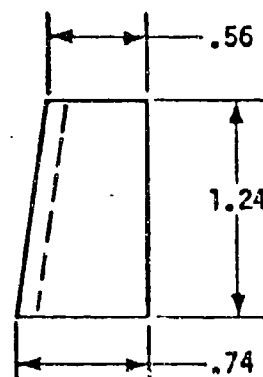
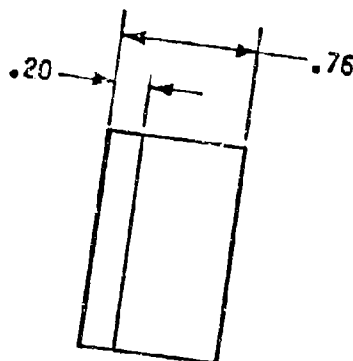
4-40 UNC/MIL-S-7742
 .25 Depth Complete Threads
 Drill .30 Min Deep
 To Assemble with Toggle Clamp
 and NAS1190-08-4 (Or Equiv)
 (4 Places)



-7 CLAMP BASE

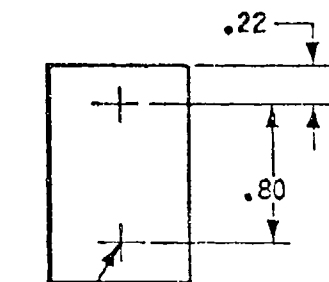


6-32 UNC/MIL-S-7742
 .40 Min. Depth
 Complete Threads
 Drill .45 Min. Deep
 To Assemble with -6
 and MS24677-10
 (Or Equiv.)
 (2 Places)

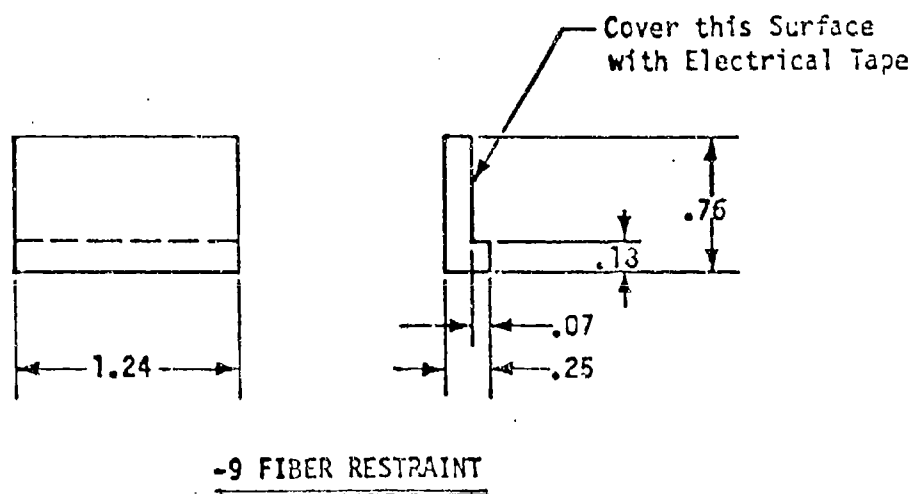
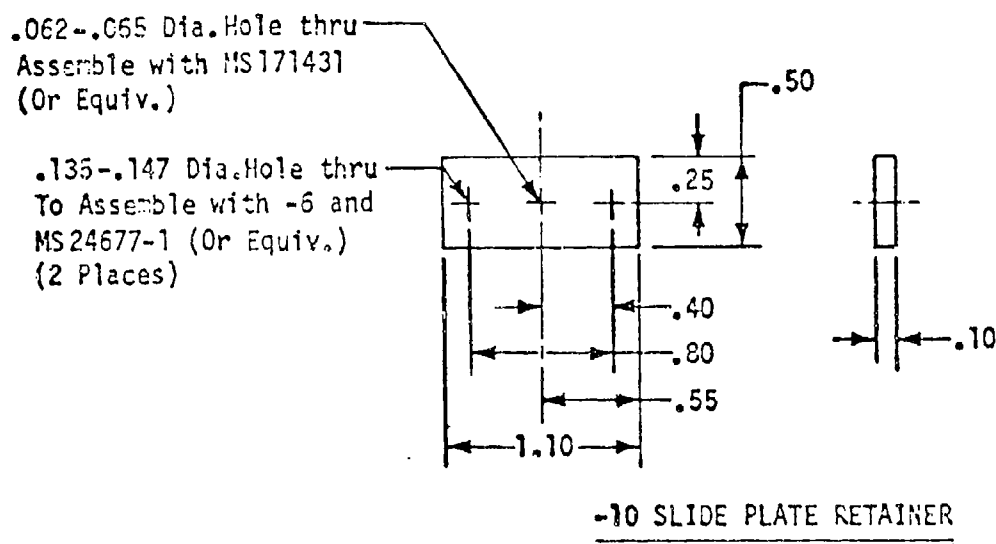
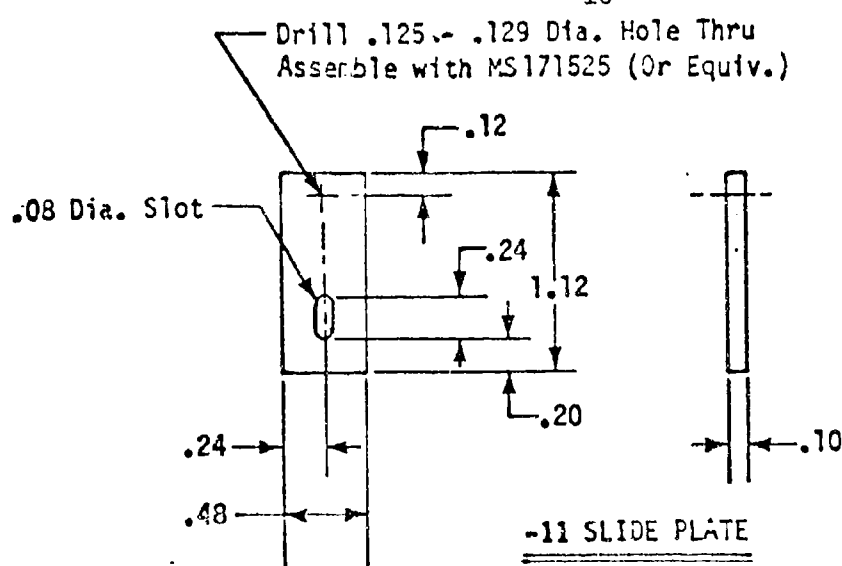


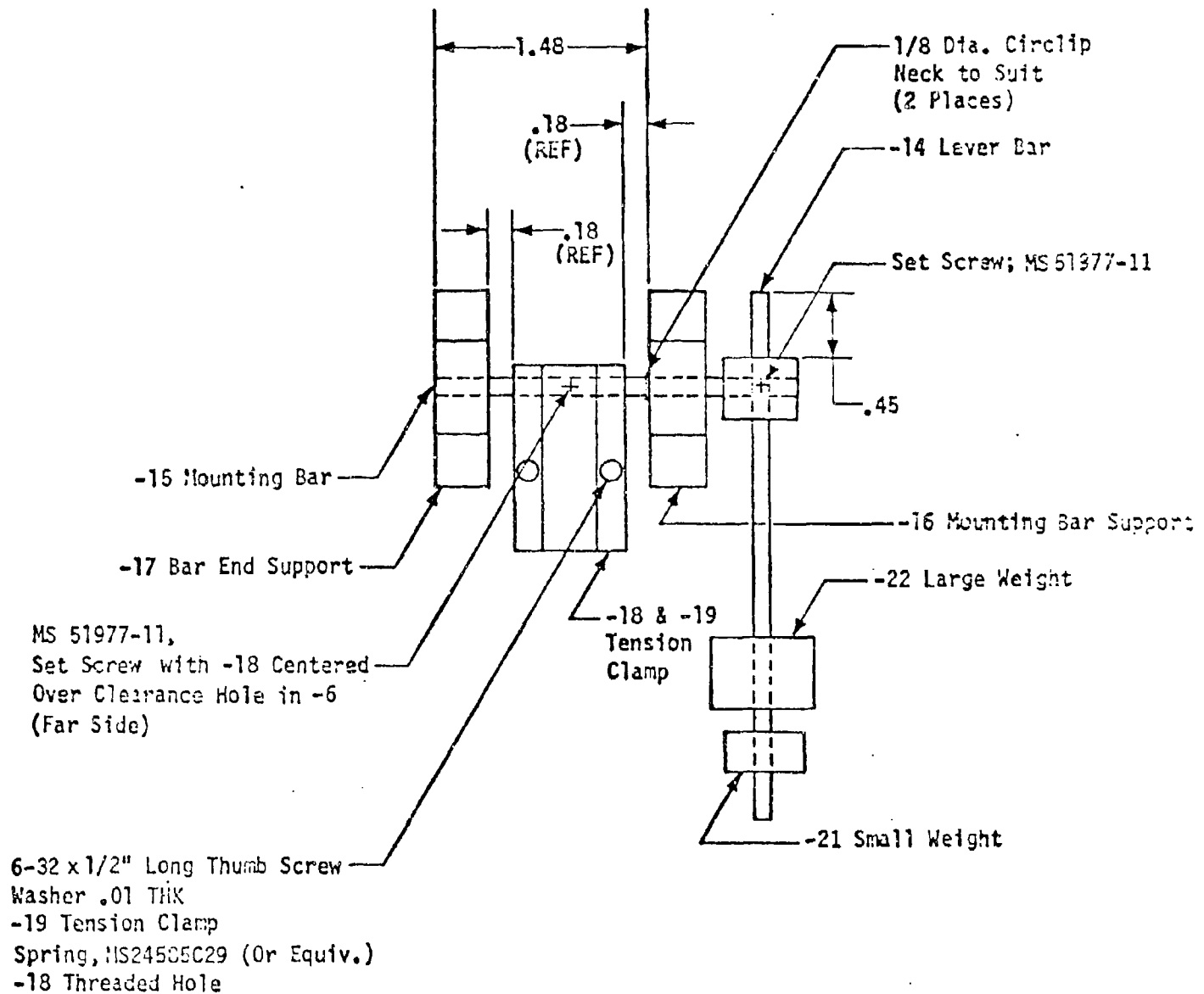
Cover This Surface with
 Electrical Tape

-8 FIBER RESTRAINT BASE

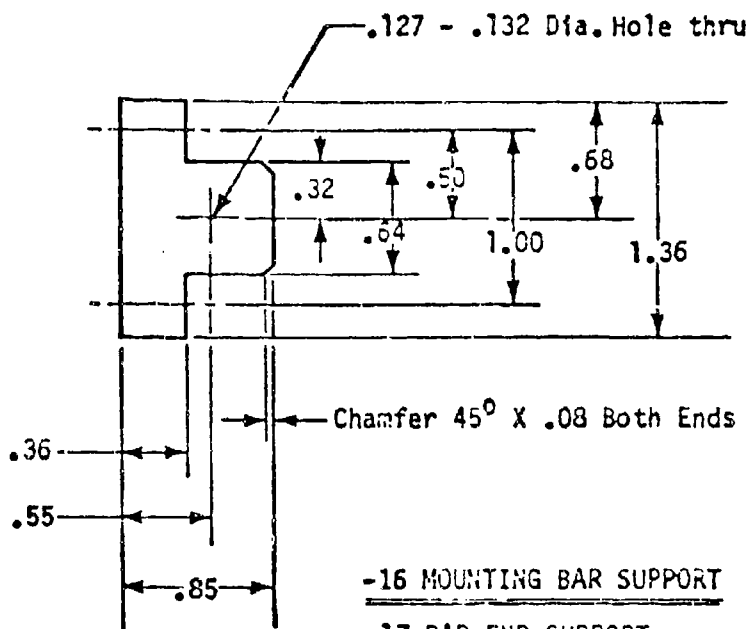


6-32 UNC/MIL-S-7742
 .40 Min. Depth
 Complete Threads
 Drill .45 Min. Deep
 To Assemble with -6
 and MS24677-10
 (Or Equiv.)
 (2 Places)



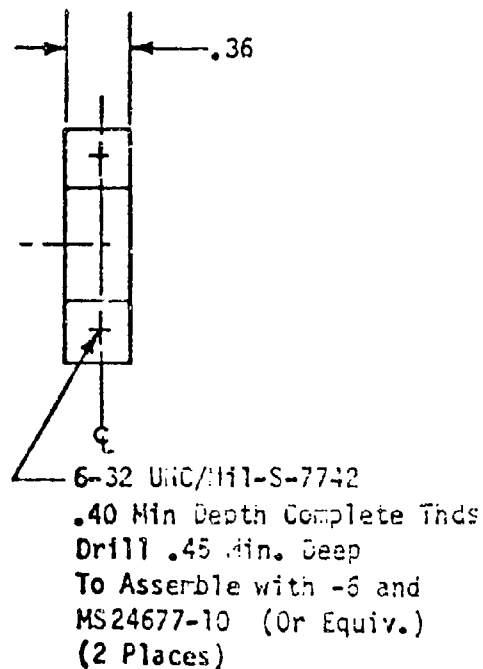


-12 TENSION CLAMP ASSEMBLY

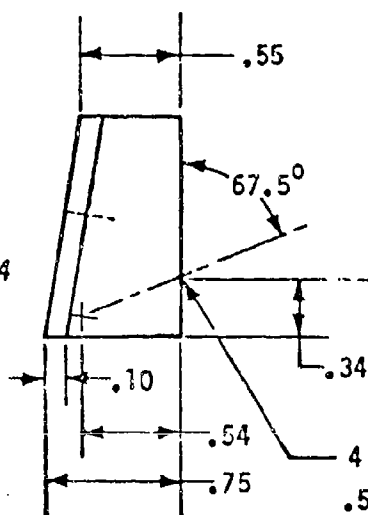
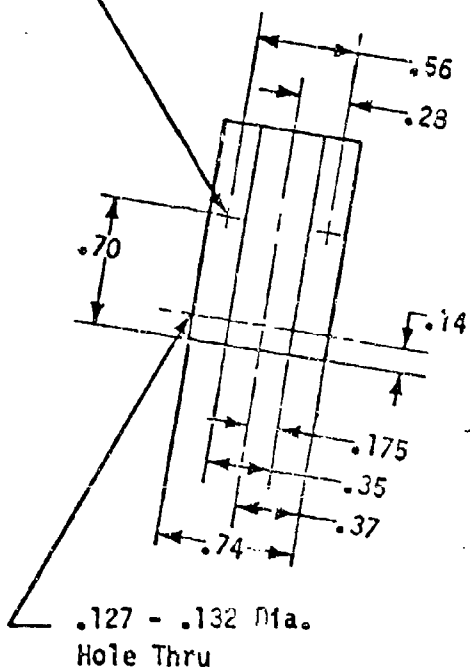


-16 MOUNTING BAR SUPPORT

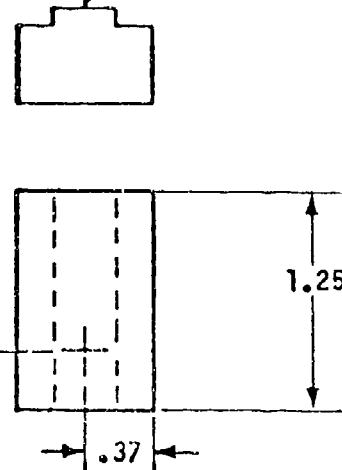
-17 BAR END SUPPORT



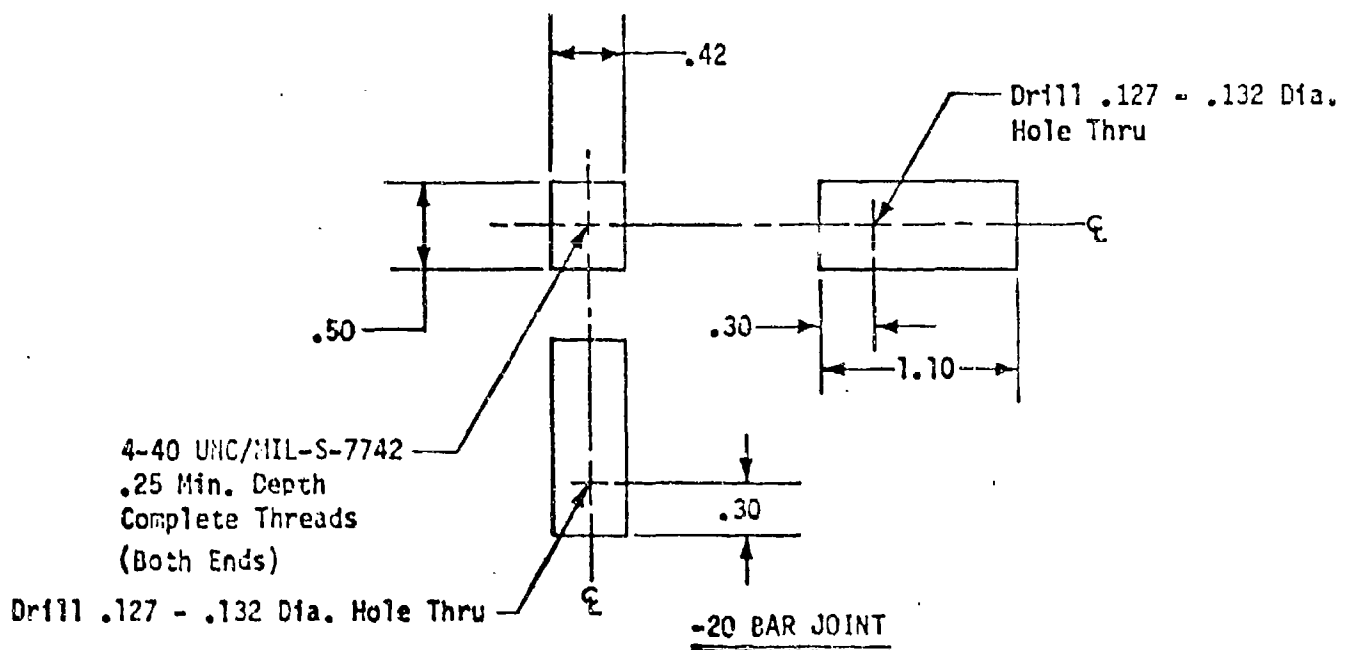
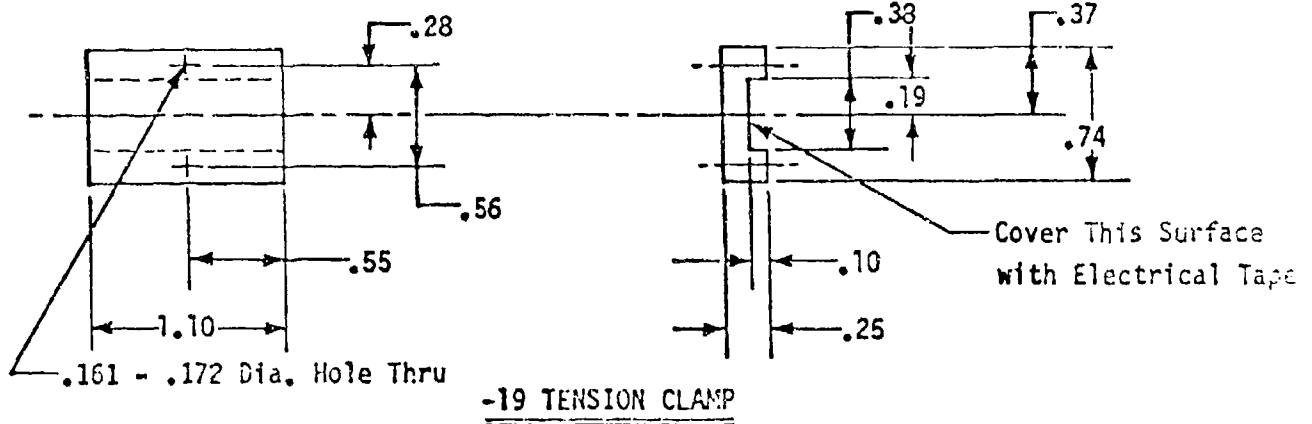
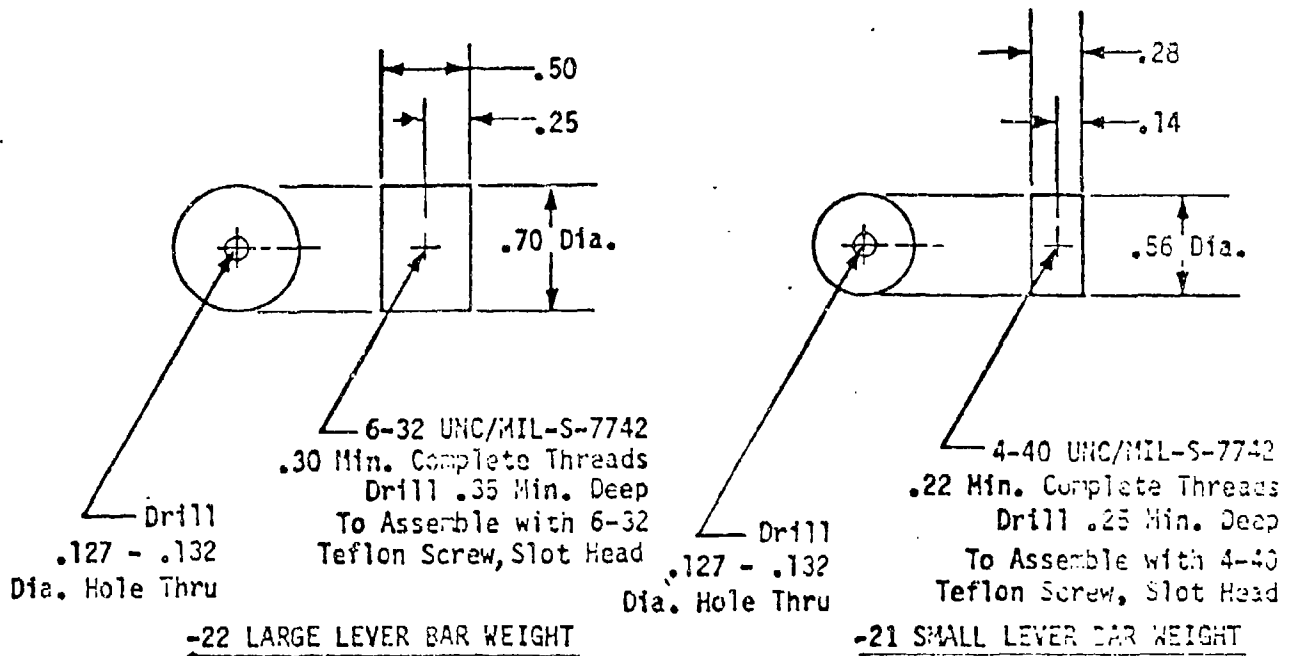
6-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads, Drill .45 Min. Deep
C'Bore .192 - .203 X .20 Deep
To Assemble With -19

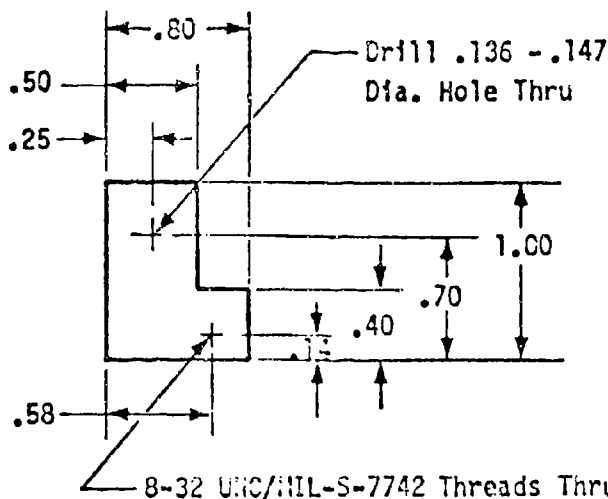


Coat This Surface
with Electrical Tape



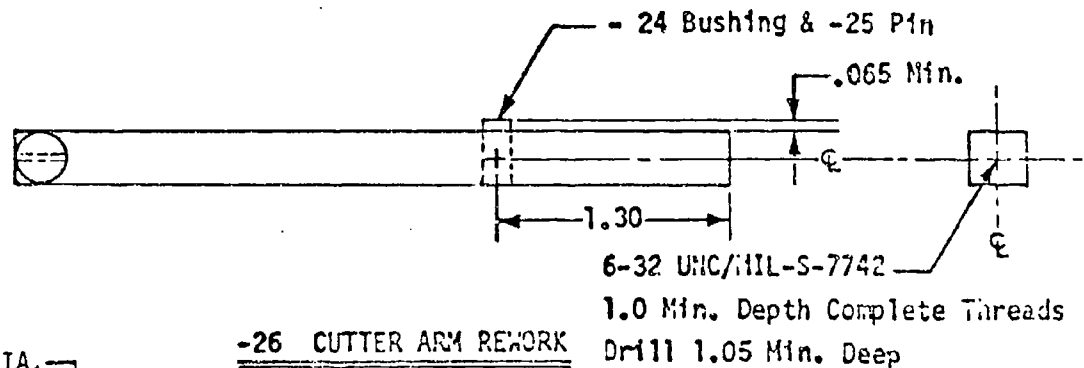
-18 TENSION CLAMP



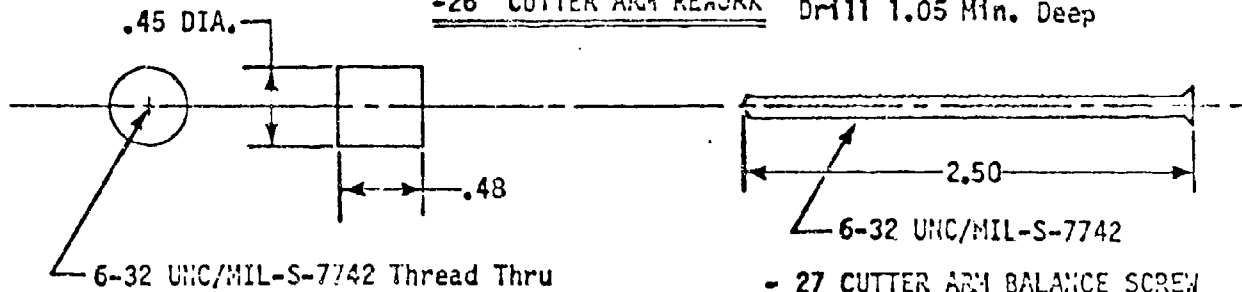


To Assemble With -30 and NAS1190-08-4 (Or Equiv.)

-23 CUTTER ARM ATTACHING BLOCK

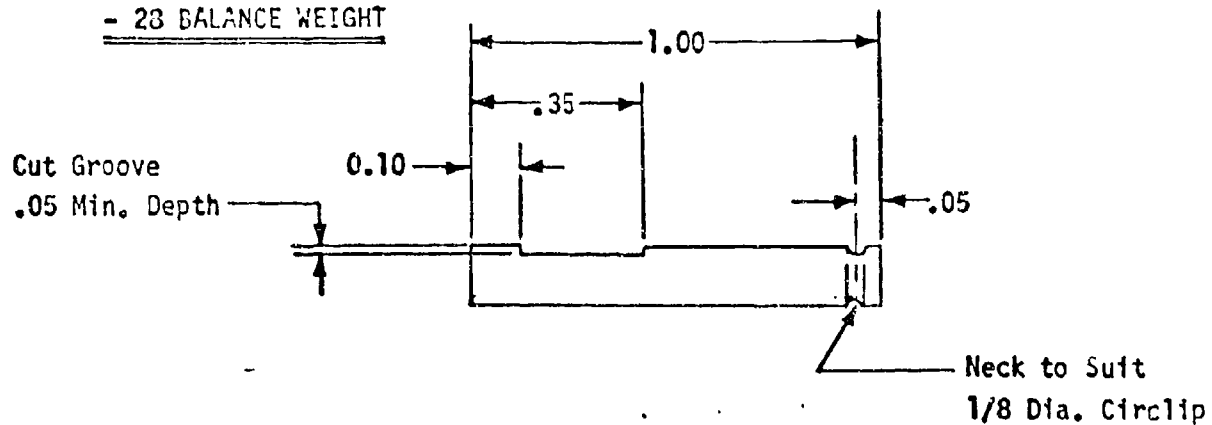


-26 CUTTER ARM REWORK



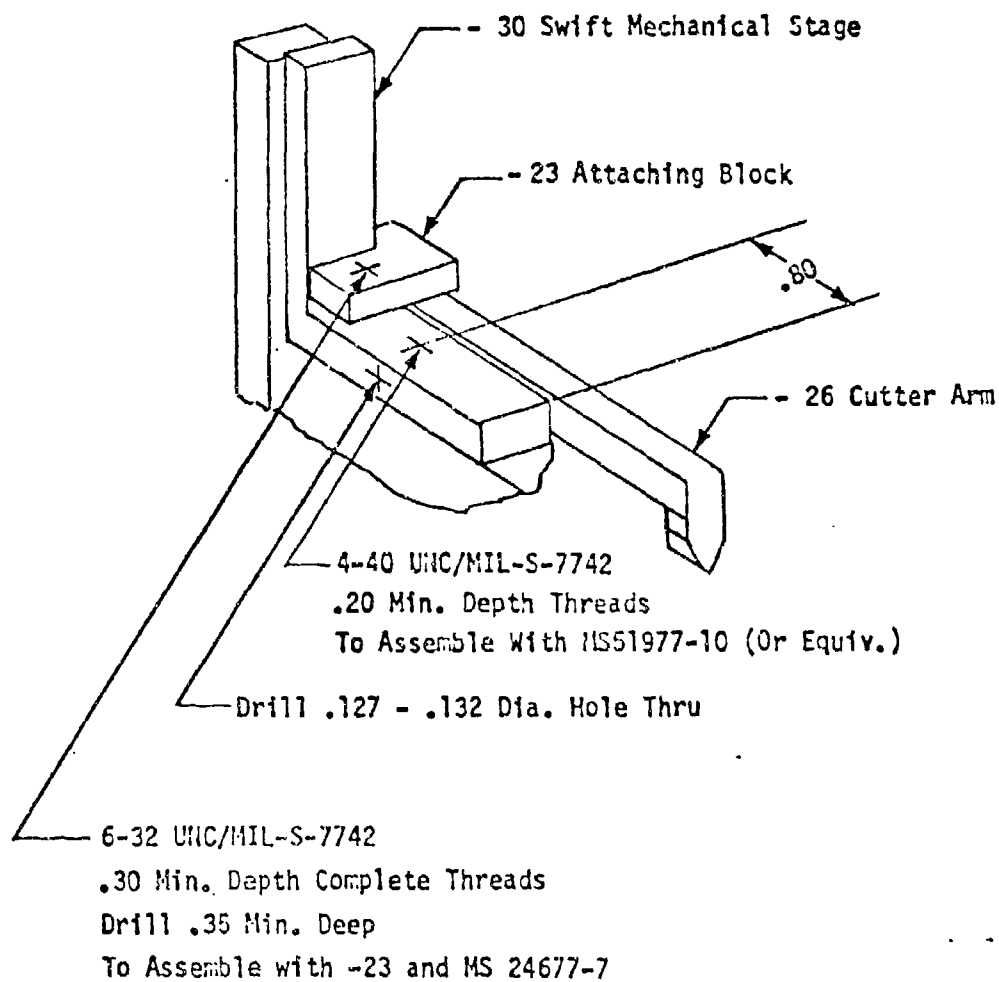
- 23 BALANCE WEIGHT

- 27 CUTTER ARM BALANCE SCREW

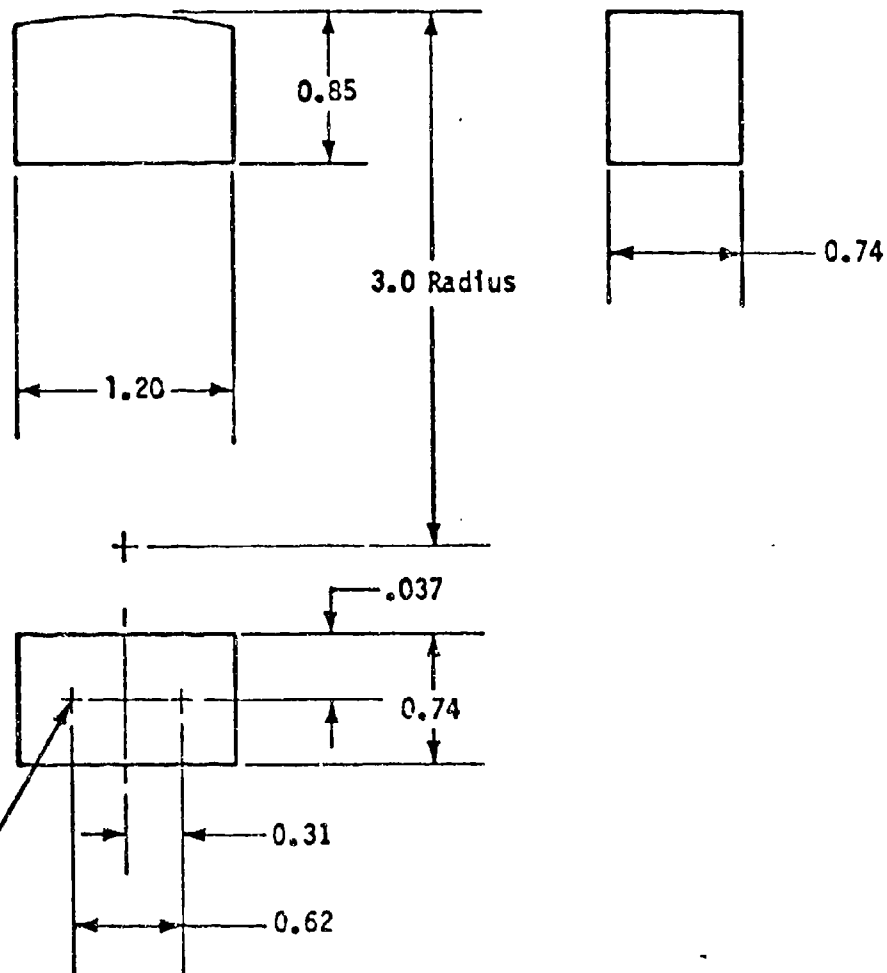


-25 PIVOT PIN

(NO SCALE)

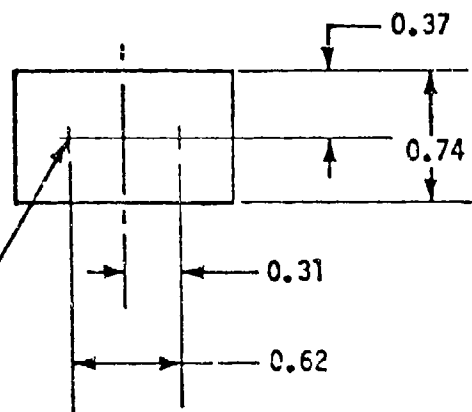
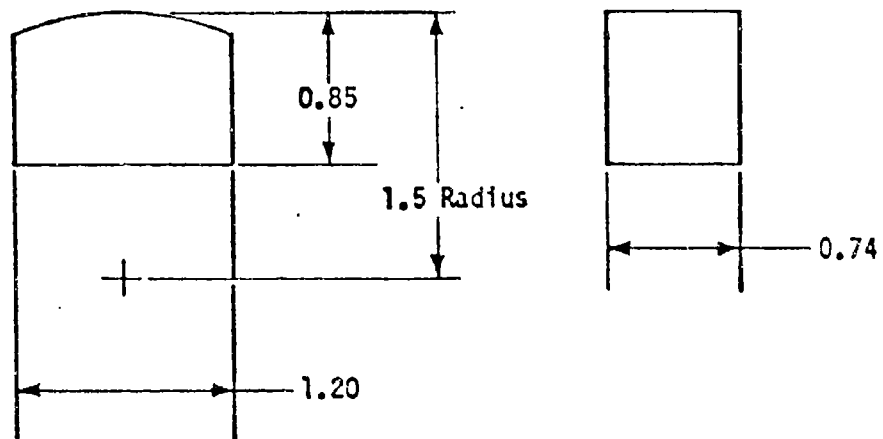


- 30 SWIFT MECHANICAL STAGE REWORK



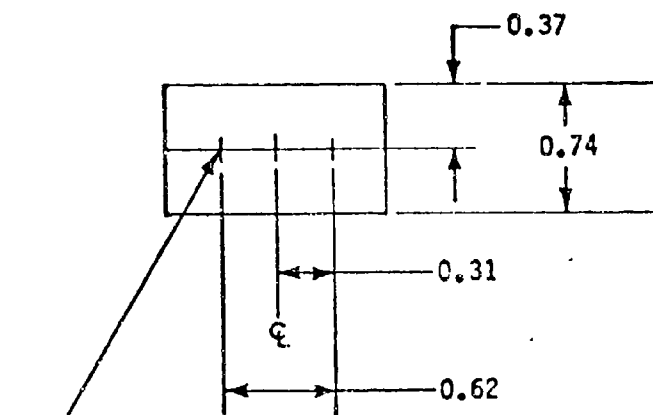
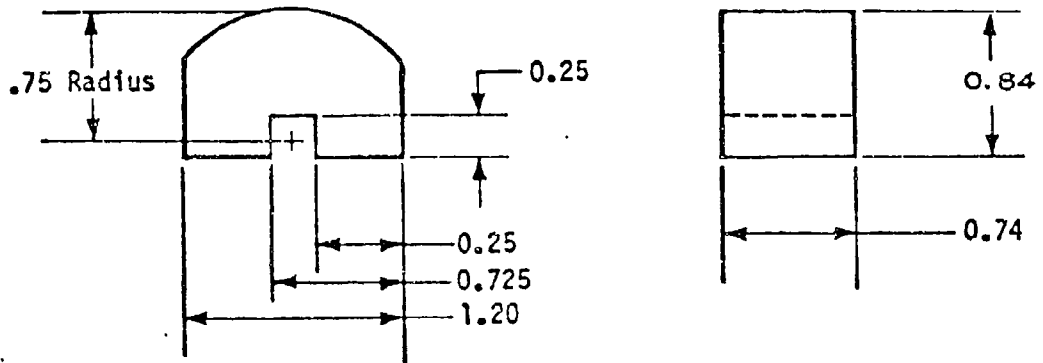
8-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads
Drill .45 Min. Deep
To Assemble with -6 and
MS24677-17 (Or Equiv.)
(2 Places)

-31 BLOCK



8-32 UNC/MIL-S-7742
.40 Min. Depth Complete Threads
Drill .45 Min. Deep
To Assemble With -6 And
MS24677-17 (Or Equiv.)
(2 Places)

- 32 BLOCK



8-32 UNC/MIL-S-7742
 .40 Min. Depth Complete Threads
 Drill .45 Min. Deep
 To Assemble With -6 and
 MS24677-17 (Or Equiv.)
 (2 Places)

-33 BLOCK