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SECTION I

CONTENTS

This section contains the  
Table of Contents and a list-  
ing of all charts and drawings  
contained in the text and  
Appendix of this report.

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8.	Print Stylus
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Task Planning Chart

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## SECTION II

### PURPOSE

This section constitutes a statement of the purpose of the contract, giving a description of the phases as set forth in Signal Corps Technical Requirements No. SCL-1535, 12 March 1954. It is written in accordance with paragraph 3.2.2.5 of Technical Requirements No. SCL-2101-F.

The purpose of the contract is to conduct studies to determine the feasibility of developing a method of teletypewriter printing utilizing a minimum of moving parts and not depending upon the impact of a type face to print. The aim of the overall Signal Corps program, of which this contract is a small part, is to provide a means for high speed teletypewriter transmission. This contract represents a first step in the exploration of possibility for providing high speed teletypewriter operation utilizing non-impact printing means.

A description of the phases set forth in the technical requirements and a description of the work conducted under the first phase is presented as follows:

#### Phase I - Theoretical Investigation

The first phase of the contract was specified as a theoretical investigation to be conducted for study of possible approaches to and techniques for non-impact teletypewriter printing. The purpose of Phase I, Theoretical Investigations, was to provide results and recommendations in the form of an evaluation report to the Contracting Officer's representative, to allow intelligent selection of approaches or approach to be followed in the conduct of Phase II. Design criteria are:

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1. Reliability
2. Performance
3. Ease of Maintenance
4. Ease of Operation
5. Weight
6. Size

The program of Phase I culminated in the preparation and submission of the evaluation report "Study of Techniques for Non-Impact Teletypewriter Printing - Phase I - First Quarterly Progress Report for Period 1 July 1954 through 31 December 1954".

Phase II - Experimentation, Design, and Construction of Experimental Model

The main objective of Phase II is to develop an experimental model or models sufficiently to demonstrate the principles of operation and determine the design parameters necessary to the construction of a practical Non-impact Page Printer. By direction, preliminary work of Phase II was to commence with the investigation of available electrosensitive papers and to investigate various matrix approaches.

As set forth in the technical requirements, upon selection by the Contracting Officer's technical representative of the approach or approaches to be followed during Phase II, the Contractor initiated a program of further study and experimentation in an attempt to prove feasibility of the approach or approaches through actual design and construction of an operating experimental model. The model will be designed to demonstrate basic principles of operation and shall attempt to prove the practicality of the approach or approaches. It is expected to indicate design parameters for a practical, high speed, page printer with the following characteristics:

1. Capable of reliability under all pertinent service conditions.
2. Operable at a minimum rate of 100 characters per second.

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3. Include provision for reading copy while printing.
4. Provide copy that is at least as readable as present commercial teletypewriter page copy.
5. Provide copy or a duplicate copy that may be used to prepare up to 50 duplicates by use of one of the existing commercial processes.
6. Provide copy that will not smear under normal handling and will retain readability for at least six months.
7. Not require the use of any evacuated space for the printing area.
8. Make provision for 76 print positions per line.
9. Make use of standard "Murray Style" or pica 10-point type, with provisions for either standard or weather symbols.
10. Print six lines per vertical inch, and provide standard carriage return feature. (Allowance is made for use of a separate signal line when carriage return is required.)
11. Use of minimum number of moving parts, particularly use of individual print heads.
12. Use no exposed hazardous voltages, radiation, or hot surfaces. In addition, good practice indicates that there should be no exposed moving parts or toxic agents used.

In addition to the above characteristics, design considerations should include provision for:

1. Ease of maintenance.
2. Ease of operation.
3. Minimum weight, size, initial cost, and cost of copy.

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In accordance with contract amendment dated 20 June 1956, the Contractor will devote effort to design, preliminary development, and experimental construction of a suitable input signal translation means to allow use of standard 60-word per minute and 100-word per minute teletype signals. In this way, the non-impact teletypewriter experimental model will be equipped for use as a high speed printer or for use as a "standard communications" printer.

During Phase II, it is intended to conduct development so that the experimental model will contain as many practical features as is possible and such that there will be a minimum of additional engineering required in reducing the design to a practical page printer as embodied in a further development model.

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### SECTION III

#### ABSTRACT

The styli are now the only items which are delaying the program mechanically. Failure to properly clean parts prior to assembly has resulted in a high reject rate of the styli outer shells. Quantities of outer shells now on hand are sufficient for the experimental model. Pilot lots of relay and print styli have been ordered from two suppliers so that if difficulties are encountered one or the other may have a successful assembly technique. These pilot runs are expected to be complete by mid-October when they will be incorporated into a relay and print block for test.

Most of the electronic units have now been tested as far as practical without having print-position relays and print matrices available. Marginal performance in some units has been strengthened by engineering changes.

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SECTION IVPUBLICATIONS, LECTURES, REPORTS & CONFERENCESConference

On 9 August 1957, Messrs. J. K. Cushman and Joseph Maher of SCEL visited Anderson-Nichols & Company to view and discuss work on the subject contract. Our report of that conference was forwarded to SCEL on 13 August 1957.

The meeting was concerned with progress to date and proposed revision of scheduling in view of the delay in receiving stylus outer shells. Sample outer shells received and locally assembled into relay styli with encouraging results were shown at the meeting. A draft copy of a request to the contracting officer for extension of the period of services and indication of requirement for additional funds was discussed. ANCo indicated there would probably be sufficient funds to complete the Experimental Model assuming no excessive costs for styli.

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## SECTION V

### FACTUAL DATA

This section provides information on all work accomplished during the reporting period covered by this report in accordance with paragraph 3.2.2.8 of Technical Requirements No. SCL-2101-F.

#### ELECTRONIC PORTIONS

##### General

Work on the electronic portions of the Experimental Model during this quarter has consisted of nearly full time engineering effort in testing the electronics and part time technician effort in wiring.

The cable connecting the electronic portions of the printer has been completed and installed.

Non-functional testing has been completed on the character selector, styli selector, upper and lower case matrices, and the print thyratron unit. The sequential trigger unit has been partially checked functionally. Final tests of all these units must wait until the print matrix and print-position relays become available.

The Synchronizing Unit, 5-baud Storage Unit, and Baud Converter Unit have been tested by introducing an external signal and monitoring the circuit functions on an oscilloscope. This work is 95% complete. Marginal performance of some circuits has been improved by a few engineering changes.

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The block diagram and theory of operation contained in the Seventh Quarterly report (pages 7-9) are applicable and will not be described in this report.

### MECHANICAL PORTIONS

#### General

Fabrication of mechanical components has been completed with the exception of styli outer shells. Of these, there is a sufficient amount on hand to meet the minimum requirements for one machine with additional shipments being received daily.

#### Stylus

The production of outer shells was slower than anticipated. The slow production was caused by a high rejection rate resulting from failure to thoroughly clean the parts of oil and chips prior to swaging. Had the supplier departed from the common practice of using cutting oil while cutting the tubing on automatic lathes, this problem would never have occurred.

With the receipt of the first sizeable lots of both outer shells, small orders for assembly of each of the types of styli were placed with two suppliers. Since the assembly problems will be similar for both types, one supplier will make print styli Fig. 8 while the other assembles relay styli, Fig. 3. This will serve to put a relay and print matrix under test in the shortest possible time while establishing a reliable source for subsequent manufacture.

The relay stylus, Fig. 3, is assembled as follows. A stylus tip subassembly, Fig. 4, is fabricated by crimping a collar on a piece of straightened wire. The subassembly is slipped into the relay stylus outer

shell, Fig. 5, until the collar is almost out of sight. At this point the spring, Fig. 6, is threaded over the stylus tip end and the group pushed in until a small portion of the spring remains visible. The stylus contact assembly, Fig. 7, is threaded into the spring and pushed into the shell until the spring is loaded to 3 grams. Now the end of the shell is crimped to lock the pieces within. (It is easily seen that bent wires can cause excess friction and result in a faulty preload value.) The assembly is placed in a fixture and the stylus tip cut to the correct length. After finishing the end of the wire another fixture is used to locate the external collar which positions the stylus in the relay.

The print stylus, Fig. 8, is assembled in the same manner using the print stylus outer shell, Fig. 9.

The fabricator of the relay stylus has completed his tooling and tried assembling a few pieces. These were not satisfactory. A minor adjustment in the tooling, to reduce the deformation of collars, and better straightening of the stylus wire should result in the delivery of acceptable styli by the second week in October.

The manufacturer of the print styli is on the point of completing his tooling and has not tried assembling styli as yet.

#### Assembly, Matrix

New wire cores have been made; however no molding has been done during this report period.

#### 40-Contact Relay (Print-Position Relay)

Awaiting styli before being assembled.

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SUMMARY OF STATUS

Continued delays in the manufacture of styli outer shells coupled with tooling time for assembling complete styli have placed the program four weeks behind the schedule as revised 6-21-57. It is too early to predict whether any of this delay can be reduced.

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## SECTION VI

### CONCLUSIONS

Over optimism on the part of the suppliers has continually resulted in running behind schedule. The fabrication of many items requires a departure from the normal every day method of doing things. Failure to recognize this is reflected in the four to six month over-run on the spring manufacture, the six week delay in completing the outer shells because of oil and dirt, and now the slight delay in assembling styli, because of excess swaging pressures resulting in distortion of parts. Manufacture is proceeding but with more effort and time than has been anticipated.

Although engineering changes have been incorporated into some units to improve on the marginal performance, there is no substantial change to the circuitry and the operation is unchanged from that described in previous reports.

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SECTION VII

PROGRAM FOR NEXT INTERVAL

Pilot lots of relay and print styli are expected to be on hand by mid-October. While these pieces are being incorporated into the relay and print matrix for test, the balance of the styli will be put into manufacture with completion expected by the end of October. Relay and print block tests will be in progress toward the end of October. Assuming no additional difficulties in manufacture, full scale tests should be in progress by the middle of the next report period.

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SECTION IX

APPENDIX

This section contains a print of the Task Planning Chart and Figures #1 - Block Diagram, Non-Impact Printer, #2 - Block Diagram, Baud Converter, 5 Baud Storage, and Synchronizing Units, #3 - Relay Stylus, #4 - Stylus Tip Subassembly, #5 - Outer Shell (Relay Stylus), #6 - Spring, #7 - Stylus Contact Subassembly, #8 - Print Stylus, #9 - Outer Shell (Print Stylus).



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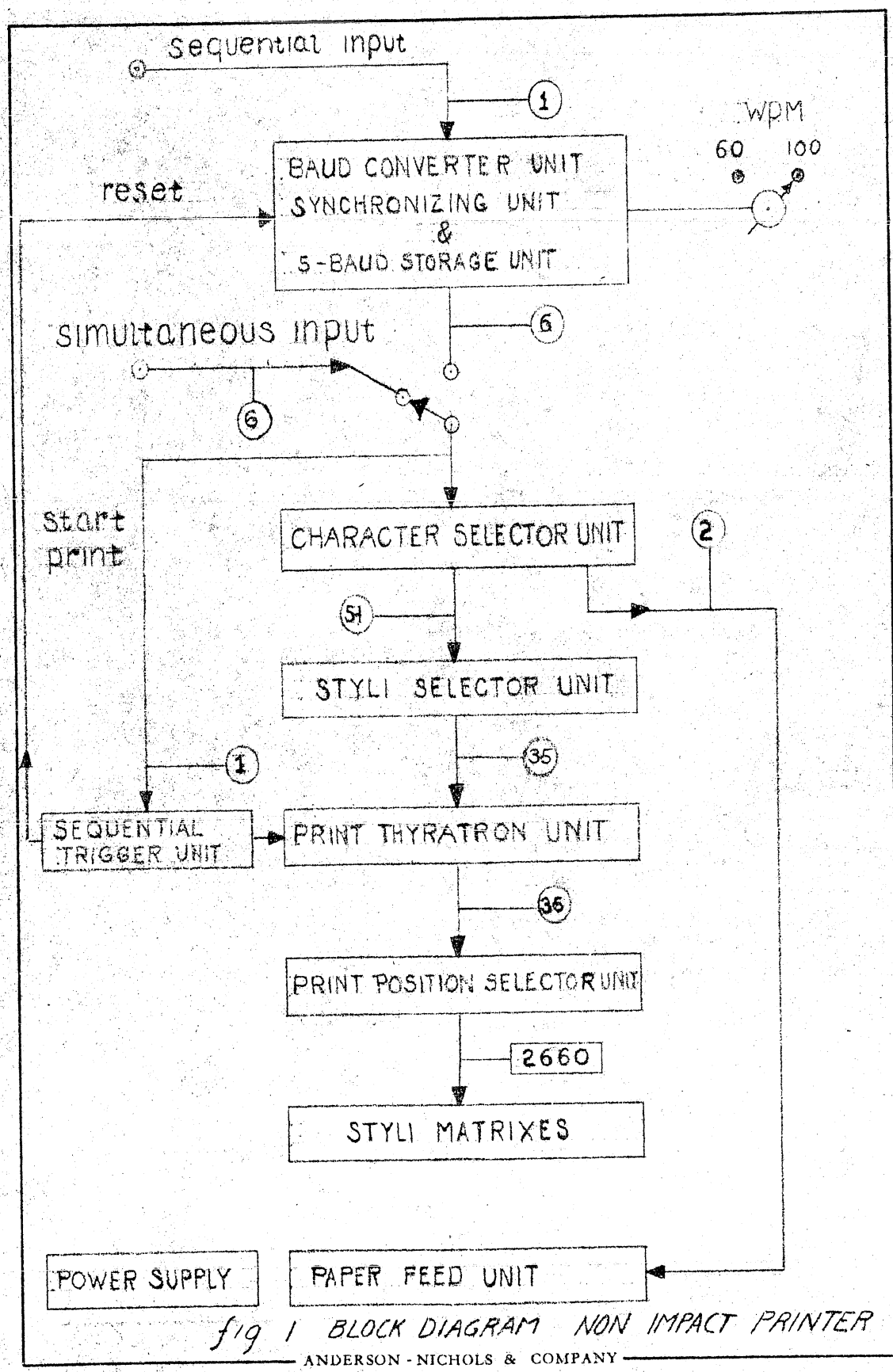
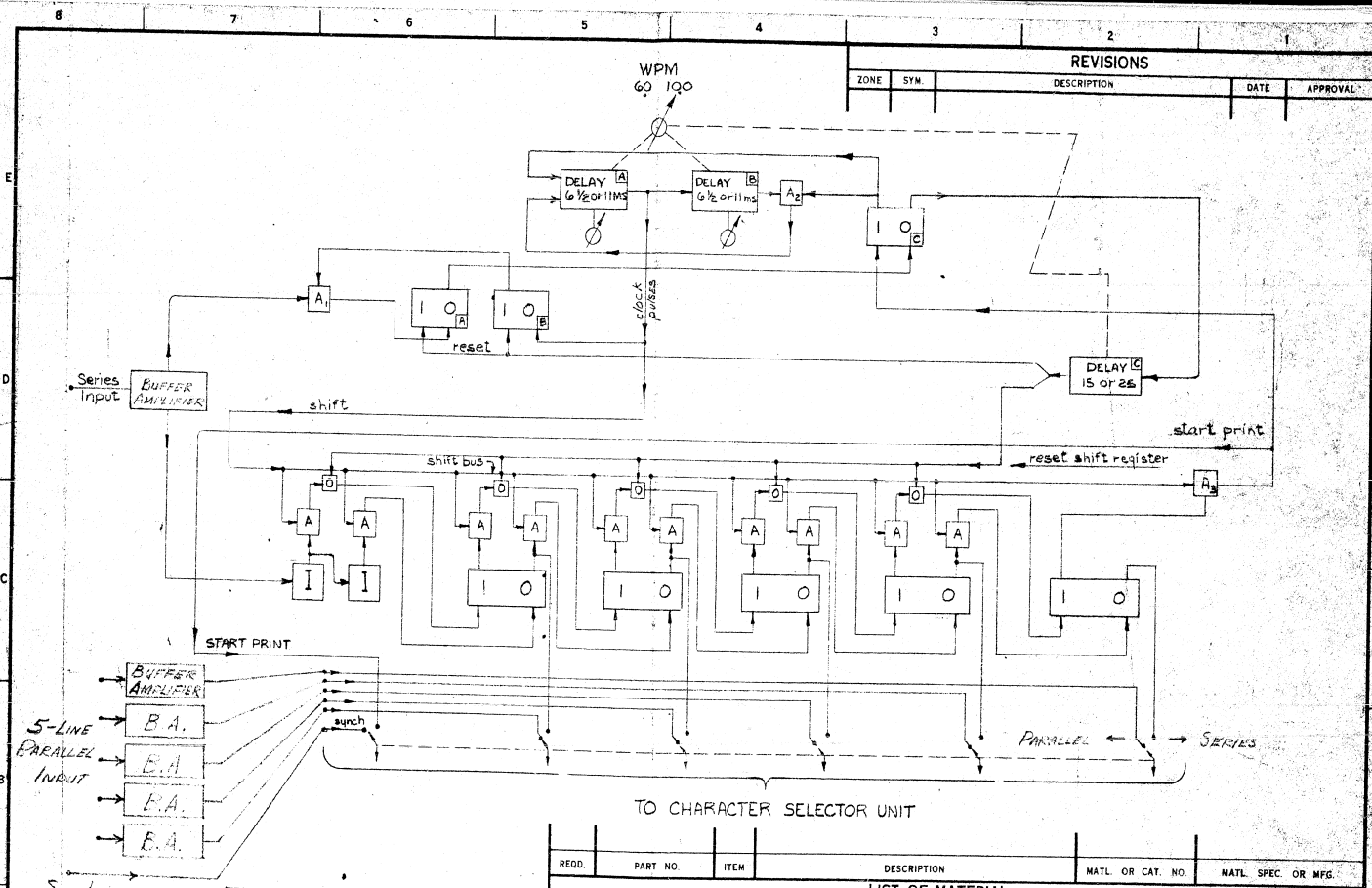


fig 1 BLOCK DIAGRAM NON IMPACT PRINTER  
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POOR SIGNAL



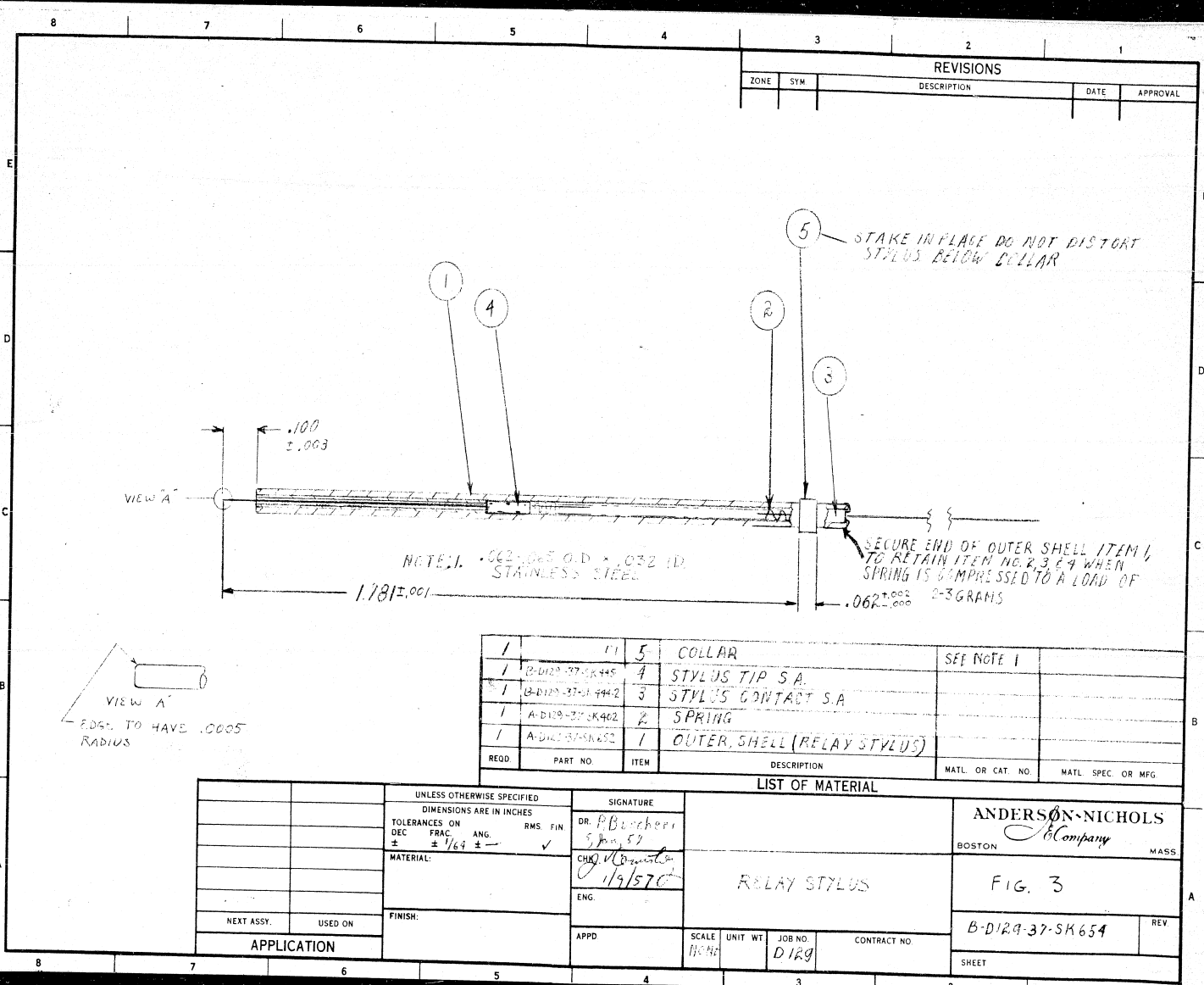
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ZONE	SYM	DESCRIPTION	DATE	APPROVAL

REQD.	PART NO.	ITEM	DESCRIPTION	MATL. OR CAT. NO.	MATL. SPEC. OR MFG.

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SIGNATURE		D129		ANDERSON-NICHOLS	
TOLERANCES ON	DEC.	FRAC	ANG.	RMS	FIN	BOSTON MASS.	
±	±	±	±	✓		FIGURE 2	
MATERIAL:		DR. J. ASHTON		BAUD CONVERTER UNIT, 5-BAUD STORAGE UNIT, AND SYNCHRONIZING UNIT		REV.	
FINISH:		30 JAN '57					
NEXT ASSY. USED ON		CHK					
APPLICATION		ENG					
		APPD. <i>Med. Field 19 April</i>		SCALE UNIT WT. JOB NO. CONTRACT NO.			
						SHEET	

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REVISIONS				
ZONE	SYM	DESCRIPTION	DATE	APPROVAL

RECD	PART NO.	ITEM	DESCRIPTION	MATL. OR CAT. NO.	MATL. SPEC. OR MFG.
		1	COLLAR		SEE NOTE 1
	B-D129-37-SK445	4	STYLUS TIP S.A.		
	B-D129-37-SK442	3	STYLUS CONTACT S.A.		
	A-D139-37-SK402	2	SPRING		
	A-D129-37-SK652	1	OUTER SHELL (RELAY STYLUS)		

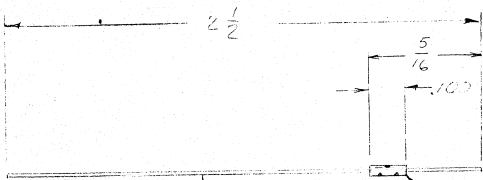
VIEW A  
EDGES TO HAVE .0005 RADIUS

UNLESS OTHERWISE SPECIFIED				SIGNATURE		ANDERSON-NICHOLS	
DIMENSIONS ARE IN INCHES				DR. P. B. ...		BOSTON MASS	
TOLERANCES ON DEC	FRACTION	ANG.	RMS FIN	CHK. ...		FIG. 3	
±	± 1/64	±	✓	ENG. ...		B-D129-37-SK654	
MATERIAL:				APPD		REVISION	
FINISH:				SCALE 11/32"		JOB NO. D129	
NEXT ASSY. USED ON				UNIT WT		CONTRACT NO.	
APPLICATION				SHEET		REV	

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								<b>REVISIONS</b>	
ZONE		SYM		DESCRIPTION			DATE	APPROVAL	



**CRIMP 3 PLACES**

**NOTES:**

1. .008 DIA. STAINLESS STEEL WIRE  
SUPREHANT CO, BOSTON, MASS.
2. STAINLESS STEEL HYPODERMIC TUBING, .018 O.D. X .009 I.D.
3. WIRE MUST BE STRAIGHT

1	RE 2 COLLAR	SEE NOTE 2			
1	A 1 WIRE	SEE NOTE 1			
REQD	PART NO.	ITEM	DESCRIPTION	MATL OR CAT. NO.	MATL SPEC OR MFG.

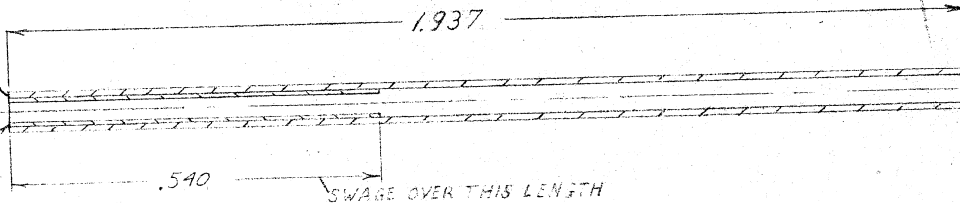
**LIST OF MATERIAL**

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES				SIGNATURE		ANDERSON-NICHOLS <i>Company</i> BOSTON MASS.	
TOLERANCES ON	DEC	FRAC	ANG	RMS	FIN	STYLUS TIP SUBASSY	
	±.005	± 1/32	±		✓		
MATERIAL:						FIG. 4.	
FINISH:							
NEXT ASSY.	USED ON	APPD		SCALE	UNIT WT	JOB NO.	CONTRACT NO.
				NONE		0129	
APPLICATION						B-D129-37-445 SK SHEET	

APPLICATION			REVISIONS		
NEXT ASSY.	USED ON	SYM.	DESCRIPTION	DATE	APPROVAL

NOTES:  
 1. E. OF FABRICATION TO BE STRAIGHT - WITHIN .002 T.T.R.  
 2. BURRS TO BE REMOVED FROM TUBING ENDS. PRIOR TO ASSEMBLY

21 GA. STD. STAINLESS STEEL  
 HYPODERMIC TUBING  
 (.032 O.D. x .020 I.D.)



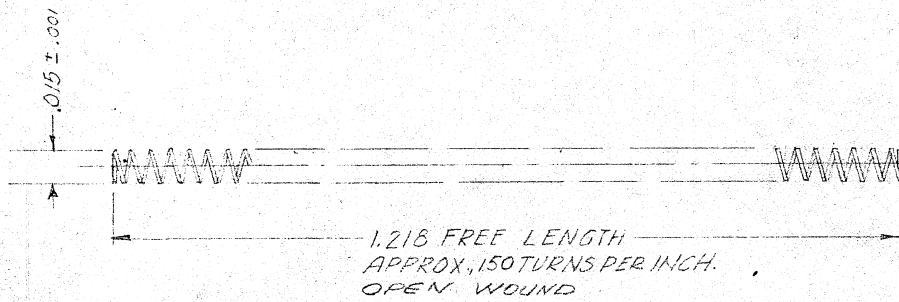
26 GA. STD. STAINLESS STEEL  
 HYPODERMIC TUBING  
 (.018 O.D. x .010 I.D.)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SIGNATURE		ANDERSON-NICHOLS <i>Company</i> BOSTON MASS.	
TOLERANCES ON DEC. ± .005 ±	FRAC. ±	ANG. ±	RMS. FIN. ✓	FIG. 5.	
MATERIAL: AS NOTED		DR. <i>P. Buccheri</i> CHKD. <i>V. [unclear]</i> 1/14/57		A-D129-37-SK652	
FINISH:		SCALE NONE	UNIT WT.	JOB NO. D 129	CONTRACT NO. REV.
APPD.		SHEET		SHEET	

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APPLICATION			REVISIONS		
NEXT ASSY.	USED ON	SYM.	DESCRIPTION	DATE	APPROVAL
	D129-37-446	A	PITCH INCREASED TO 150 TURNS/INCH	3/1/57	JRC

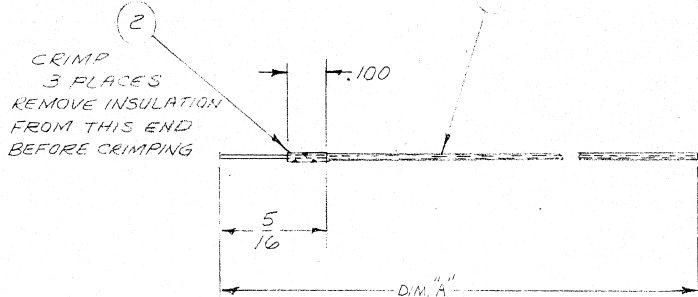


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SIGNATURE		ANDERSON-NICHOLS	
TOLERANCES ON DEC. FRAC. ANG. RMS FIN.	DR. M.L. PRATT 7 AUG 56	SPRING		BOSTON MASS.	
$\pm .010 \pm - \pm - \checkmark$	CHK. <i>[Signature]</i> 12 Sept 56			FIG. 6	
MATERIAL: .003 DIA. NO. 302 STAINLESS STEEL SPRING WIRE	ENG. <i>[Signature]</i> 12 Sept 56			A-D129-37-402 <sup>SK</sup>	
FINISH:	APPD.	SCALE No	UNIT WT.	JOB NO. D129	CONTRACT NO. REV.
				SHEET 1	



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REVISIONS				
ZONE	SYM.	DESCRIPTION	DATE	APPROVAL



- NOTES:-
- .008 DIA. STAINLESS STEEL WIRE,  
 NYLON INSULATION .002 THK.  
 SUPREMANIT CO., BOSTON, MASS.
  - STAINLESS STEEL HYPODERMIC TUBING,  
 .018 O.D. X .003 I.D. (26GA.)

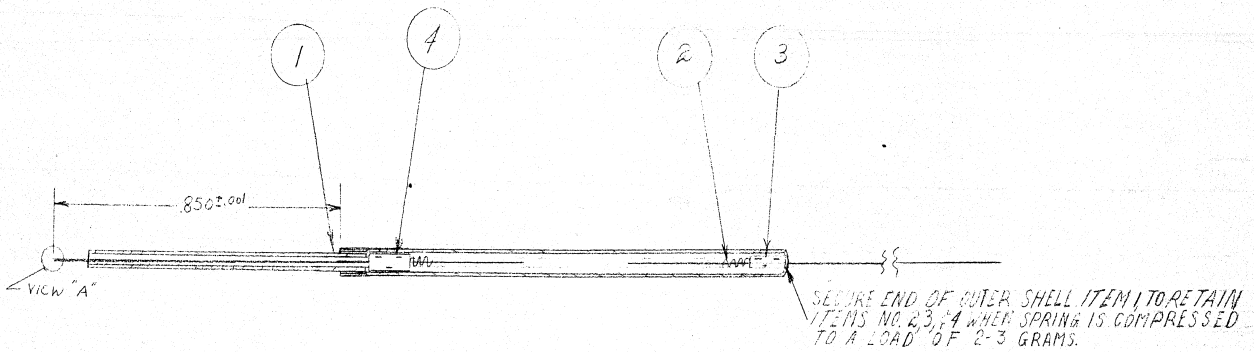
DIM "A"	PART NO.
36	B-D129-37-SK 444-1
8	B-D129-37-SK 444-2

REQD.	PART NO.	ITEM	DESCRIPTION	MATL OR CAT. NO.	MATL. SPEC. OR MFG.
1	P2	2	COLLAR	SEE NOTE 2	
1	P1	1	WIRE, INSULATED	SEE NOTE 1	

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SIGNATURE		ANDERSON-NICHOLS	
TOLERANCES ON	DEC. FRACTION ANG. RMS FIN.	DR. B.B. HODGE'S		BOSTON MASS	
±.005 ± 1/64 ± —	— ✓	31 AUG 56		FIG. 7	
MATERIAL:		CHK. <i>[Signature]</i>		REV	
FINISH:		ENG. <i>[Signature]</i>		B-D129-37-SK 444	
NEXT ASSY.	USED ON	APPD.	SCALE NONE	UNIT WT.	JOB NO. D129
APPLICATION		CONTRACT NO.		SHEET	

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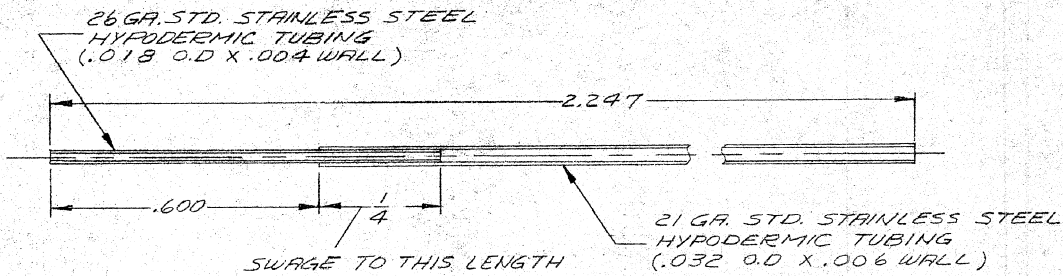
REVISIONS				
ZONE	SYM	DESCRIPTION	DATE	APPROVAL

RECD.	PART NO.	ITEM	DESCRIPTION	MATL. OR CAT. NO.	MATL. SPEC. OR MFG.
	B-DIR-37-445	4	STYLUS TIP SA		
	B-DIR-37-444	3	STYLUS CONTACT SA		
	A-DIR-37-402	2	SPRING		
	A-DIR-37-665	1	OUTER SHELL (PRINT STYLUS)		

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED		SIGNATURE		ANDERSON-NICHOLS	
DIMENSIONS ARE IN INCHES		DR. P. Buecheri		BOSTON MASS.	
TOLERANCES ON	RMS FIN	5, Jan 57		FIG. 8	
DEC. ± .005 ± 1/64 ±	✓	CHK'd J. Conity 1/9/57		B-DIR-37-SK 653	
MATERIAL:	FINISH:	ENG.		REV.	
NEXT ASSY.	USED ON	APPD.	SCALE NONE	UNIT WT. D129	CONTRACT NO.
APPLICATION		PRINT STYLUS		SHEET	

APPLICATION			REVISIONS			
NEXT ASSY.	USED ON	SYM.	DESCRIPTION	DATE	APPROVAL	



1.  $\epsilon$  OF FABRICATION TO BE STRAIGHT & CONCENTRIC WITHIN .002 T. I. R.
2. BURRS TO BE REMOVED FROM TUBING ENDS PRIOR TO ASSEMBLY.
3. .008 DIA. WIRE TO PASS FREELY THRU ASSEMBLY.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		SIGNATURE		ANDERSON-NICHOLS <i>&amp; Company</i>	
TOLERANCES ON DEC.    FRAC.    ANG.    RMS. FIN.		DR. D. BEISSON		BOSTON	MASS.
±        ±        ±        ✓		28 JUNE '57		FIG. 9	
MATERIAL:		CHK. <i>J. Jacobs</i>	OUTER SHELL (PRINT STYLUS)	A-D129-37-SK665	
NOTED		28 JUNE 57		REV.	
FINISH:		ENG. <i>J. Jacobs</i>			
		APPD.	SCALE	UNIT WT.	JOB NO.
			4:1		D129
					CONTRACT NO.
					SHEET

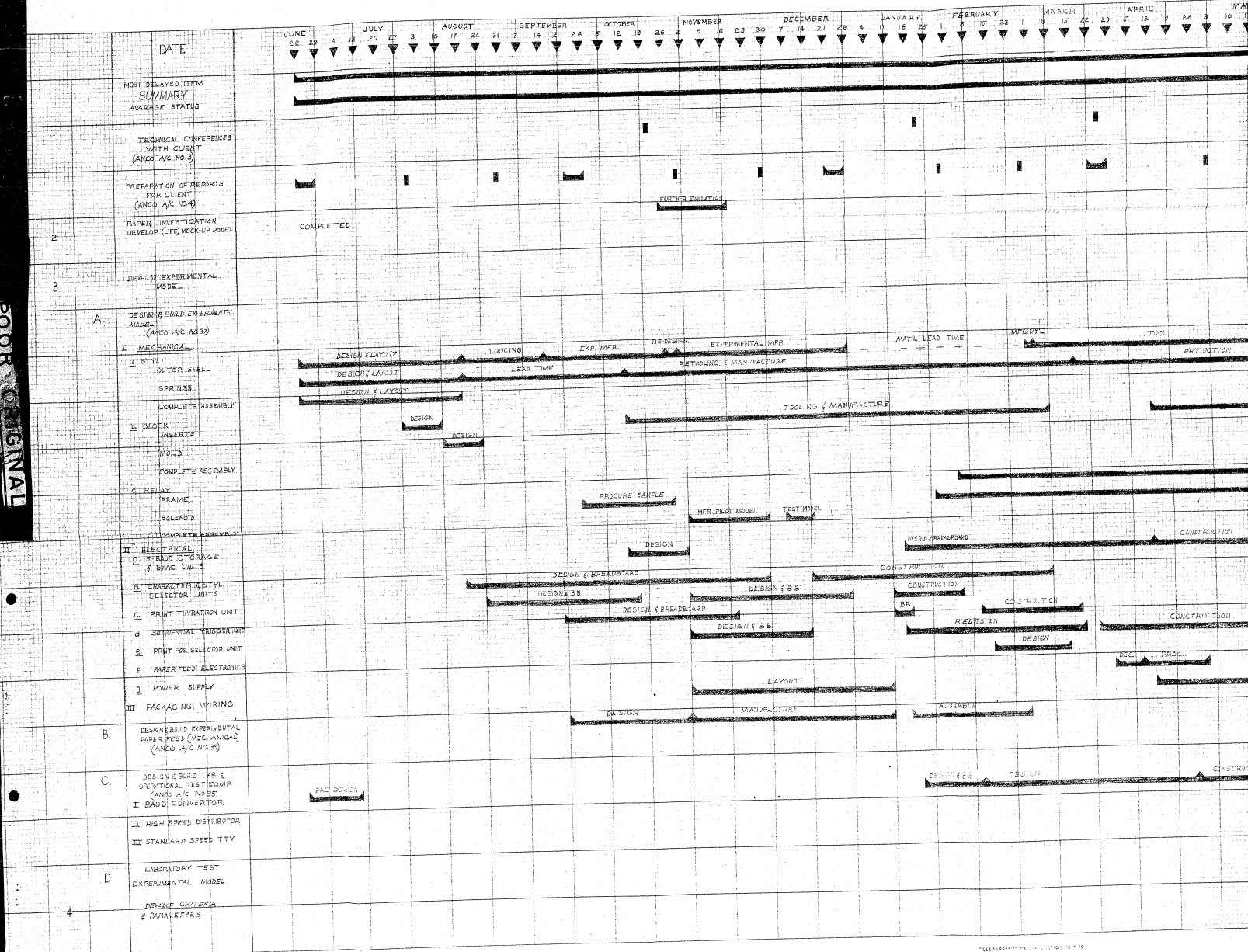
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NON IMPACT PRINTING PHASE II B  
TASK PLANNING CHART (REVISED, 6-21-57)

CONTRACT NO.  
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FILE NO.  
412 PH-PA 21 (4434)

CLIENT  
SIGNAL CORPS

POOR COPY

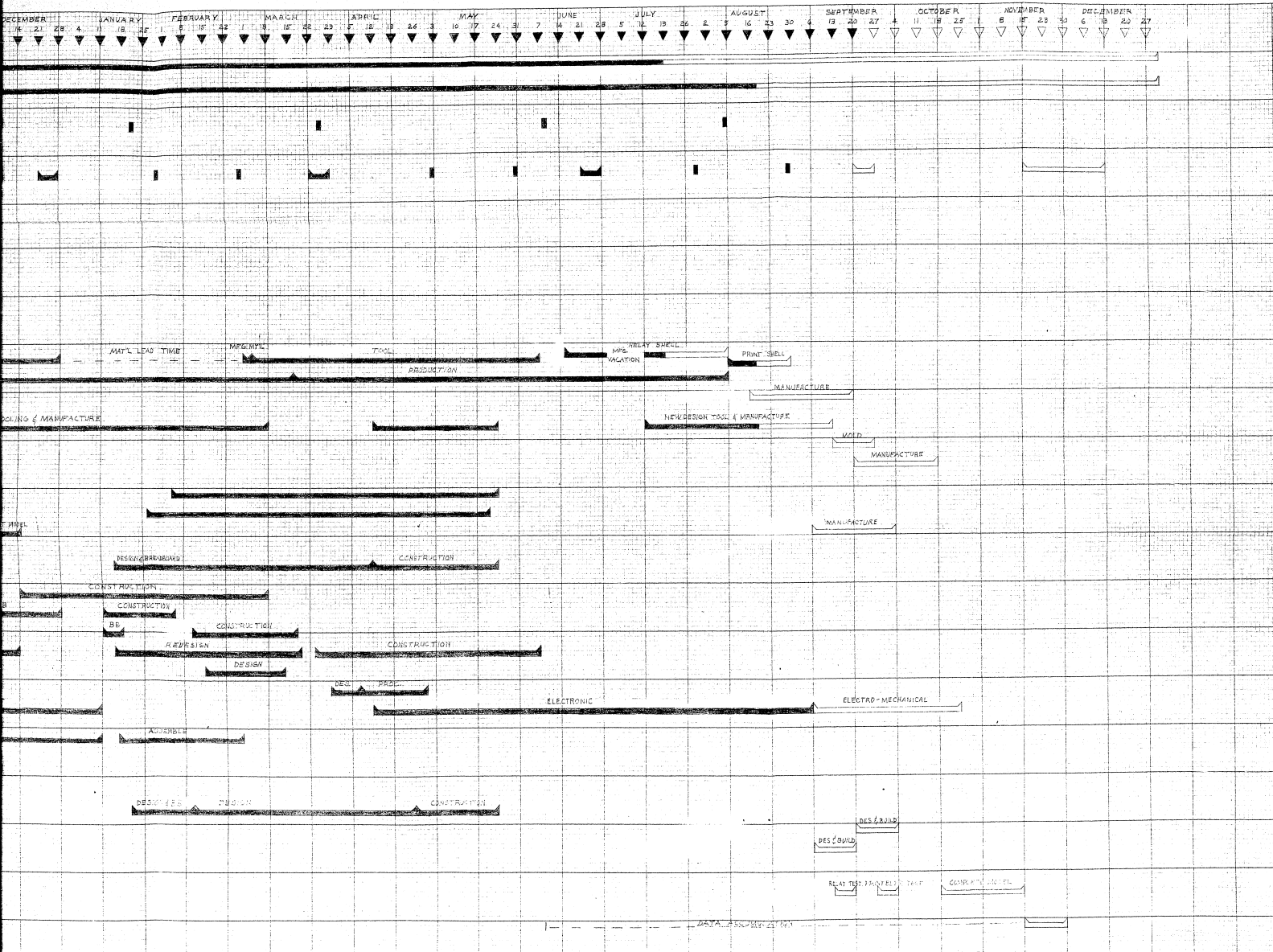


CONTRACT NO.  
DA-36-038-30-644-B  
FILE NO.  
412-PH-52-21 (4434)

CLIENT:  
SIGNAL CORPS

CONTRACTOR  
ANDERSON-NICHOLS & CO.  
150 CAUSEWAY ST.  
BURLINGTON 14, MASS.

ENGINEER IN CHARGE  
L.W. MARSH



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