AIRCRAFT ARMAMENTS, Inc.

STATUS REPORT

(14 October through
25 November 1961)

E41 GAS ALARM

ER-2575
REPORT NO.

November 1961
DATE

APPROVED:

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AAINC E 135A

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I. INTRODUCTION

This report describes the progress of the E41R2 Point Source Gas Alarm Program as performed by AAI per the requirements of Contract Number DA-18-108-CWL-6553 for the period from 14 October through 25 November 1961. Included herein is a description of the engineering and manufacturing actions performed under Phases II and III of the subject contract and a summary of the CONARC Test Program now in progress at Fort Benning, Georgia. As previously reported, all efforts on the Phase I program have been completed.

II. SUMMARY OF WORK PERFORMED

Alarms number 41, 42 and 43 have been completely checked out and delivered to CRDL for use by the Arctic Test Board. Manufacturing is in progress on the last group of fifteen (15) and preliminary checkout tests are being performed as each block of five (5) units is completed. At the time of this report, alarms 44, 45, 46, 47, 48 and 50 have been delivered to CRDL.

Evaluation of the Class 1 drawings is still in progress by the Army Chemical Center Engineering Command. These drawings are scheduled to be returned to AAI during the coming reporting period at which time the necessary corrective actions are to be taken by AAI. In the meantime, fabrication of details per these drawings must be continued in order to meet existing schedule requirements.

As indicated in the following section, R&D efforts were continued at AAI on photocell studies, the bridge circuit, automatic restandardization, remote warning unit, horn, inlet heater studies and other items. In addition, weekly coordination meetings were held with CRDL personnel to evaluate R&D progress on the correction of deficiencies reported during the current Fort Benning Tests.

III. DETAIL DISCUSSION OF PROGRESS

A. Phase II Program

Manufacturing is nearing completion on parts that are to be delivered to CRDL for use as spares in conjunction with the Fort Benning Test Program. A partial delivery will be made early in December with the remainder following a short time later. With the completion of this item, all action required under the Phase II portion of the subject contract will be completed.

B. Phase III Program

1. Class I Drawings

ACC ENCOM is evaluating the Class I drawings that were delivered to them on 6 October 1961. Changes found necessary as a result of this review are to be incorporated and the completed drawings delivered in January 1962.

2. Fabrication, Testing and Delivery

Fabrication of all alarms up to and including serial number 55 has been included and final predelivery checkout tests are being performed.

Procurement is complete and fabrication well along on alarms, serial numbers 56, 57 and 58. Final assembly and testing of these three alarms will be completed and delivery is scheduled for early January 1962.

Procurement of material is complete for the Master Model (Serial No. 59) and the fabrication of details and subassemblies is now in progress. Final delivery is scheduled for 15 January 1962.

3. R&D Program

During this reporting period effort has been directed towards correction of deficiencies noted during service tests and toward improving the performance and reliability of the alarm. Progress in the various areas of effort is as discussed in detail below.

a. Photometer Studies and Photocell Testing

A test rig was constructed to determine the source and cause of drift in the detection circuit. The test rig allows individual adjustment of temperatures at the lamps, photocells, and meter relays.

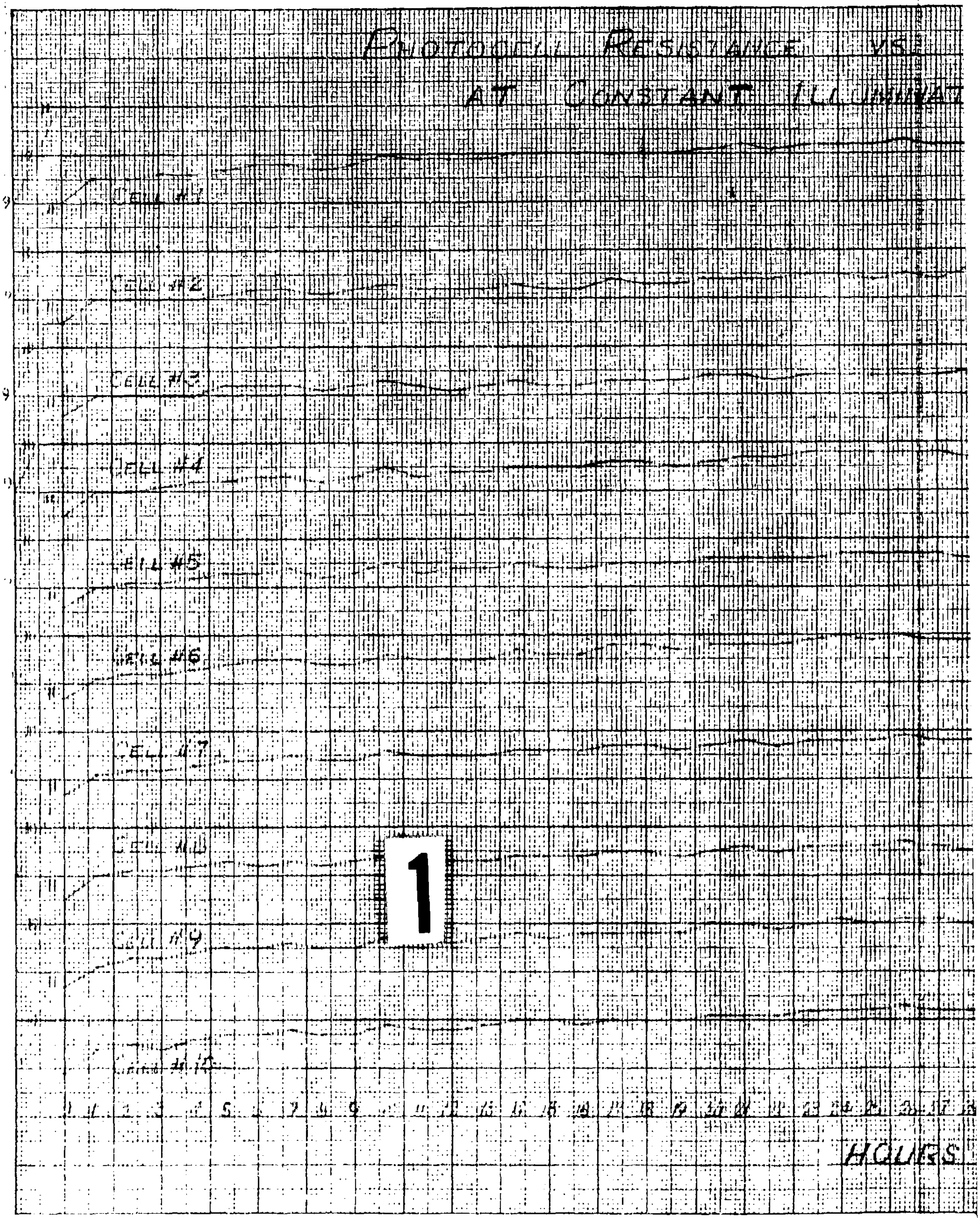
In tests conducted, temperatures in each of these areas were varied individually and altogether in an effort to locate the source of the disturbance.

Data obtained from three (3) test runs did not indicate any patterns. Drift experienced in the test set up occurred randomly in both directions and while it appeared to be induced by temperature changes at all parts of the circuit, it was impossible to predict drift phenomena from these test data. It was felt that these results were due to inadequacies in the design and construction of the test rig.

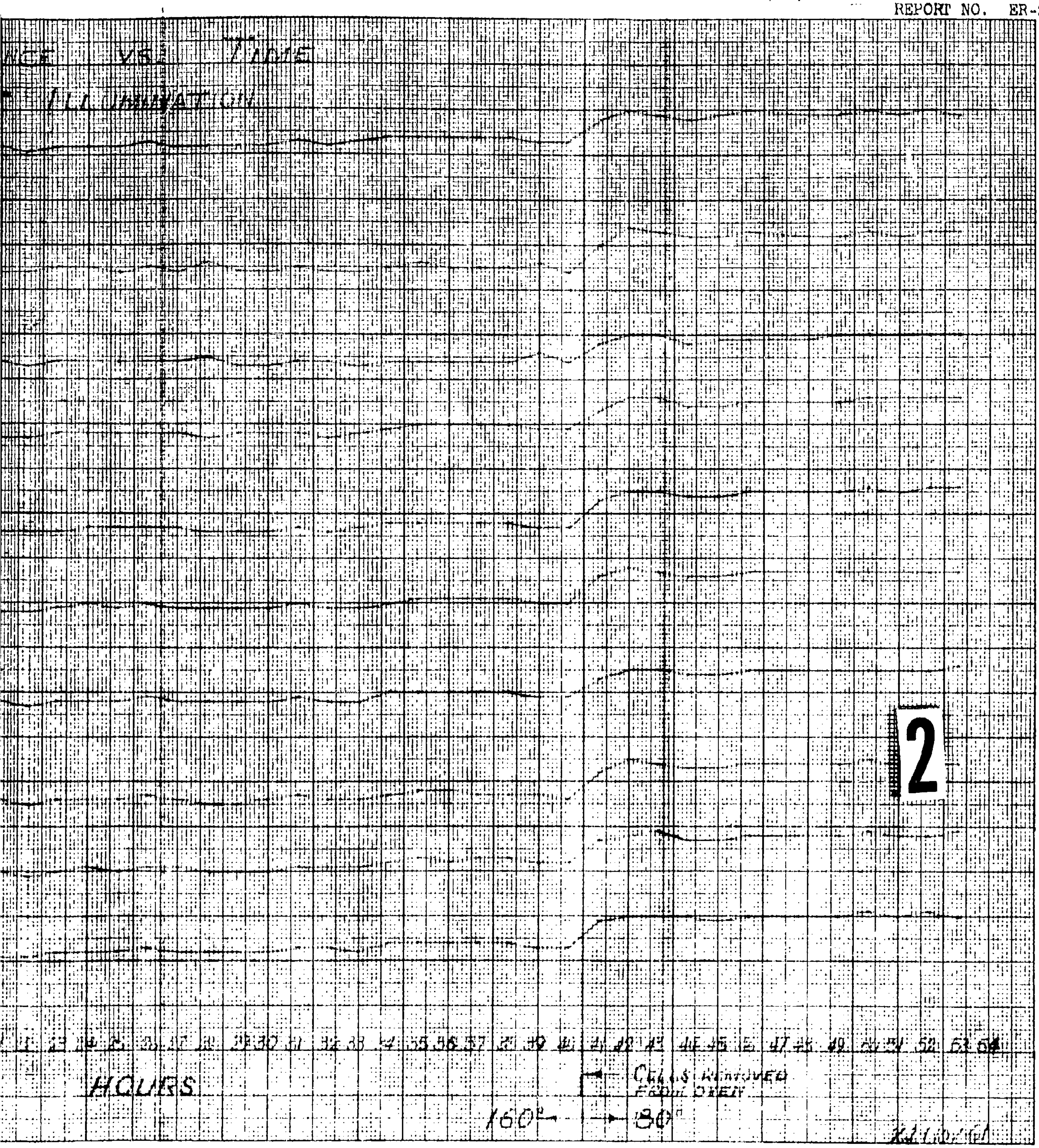
Reexamination of the problem and evaluation of previous data indicated the photocells were a prime suspect as the source of drift. Therefore, the design of the photocell test fixture was improved to eliminate experimental errors, and a photocell test program outlined for testing CL602 and CL605L photocells. A description of the apparatus and testing procedure is included with this report. See Figures 2 and 3.

The first series of tests has been conducted on type CL605L photocells. First, the photocells were dark adapted for a 12 hour period at room temperature. Then the cells were operated for 24 hours at room temperature in an ambient light approximating that which the cells experience in the photometer head. During the course of this test, the cells exhibited no appreciable change in resistance.

A similar test was repeated with this CL605L cell batch at a temperature of 160°F. At the end of the high temperature running period, the cell bank was removed from the oven and operated for an additional period of time at room temperature. The results of this test run at elevated temperature were significantly different from those obtained in the room temperature test. During the high temperature operation there was an unmistakeable drift in the upward direction of the resistance of all cells. The rate of drift varied among cells of the test batch between 5.3% and 10.4% in a 24 hour period.



PHOTOCELL RESISTANCE VS
AT CONSTANT ILLUMINAT
CELL #1
CELL #2
CELL #3
CELL #4
CELL #5
CELL #6
CELL #7
CELL #8
CELL #9
CELL #10
HOURS


NCE VS. TIME
ILLUMINATION
HOURS
CELLS REMOVED FROM OVEN
160° → 80°

The fact that no recovery was exhibited by the cells upon removal from the high ambient temperature indicates that photofatigue appears to be of more importance than temperature sensitivity. Likewise, photofatigue appears to be much more pronounced at higher temperatures. A graph illustrating individual cell behavior during this test is shown as Figure 1.

Further testing conducted at intermediate temperatures will be directed toward determining the extent of photofatigue exhibited as a function of temperature.

The test program is outlined below.

CIRCUIT:

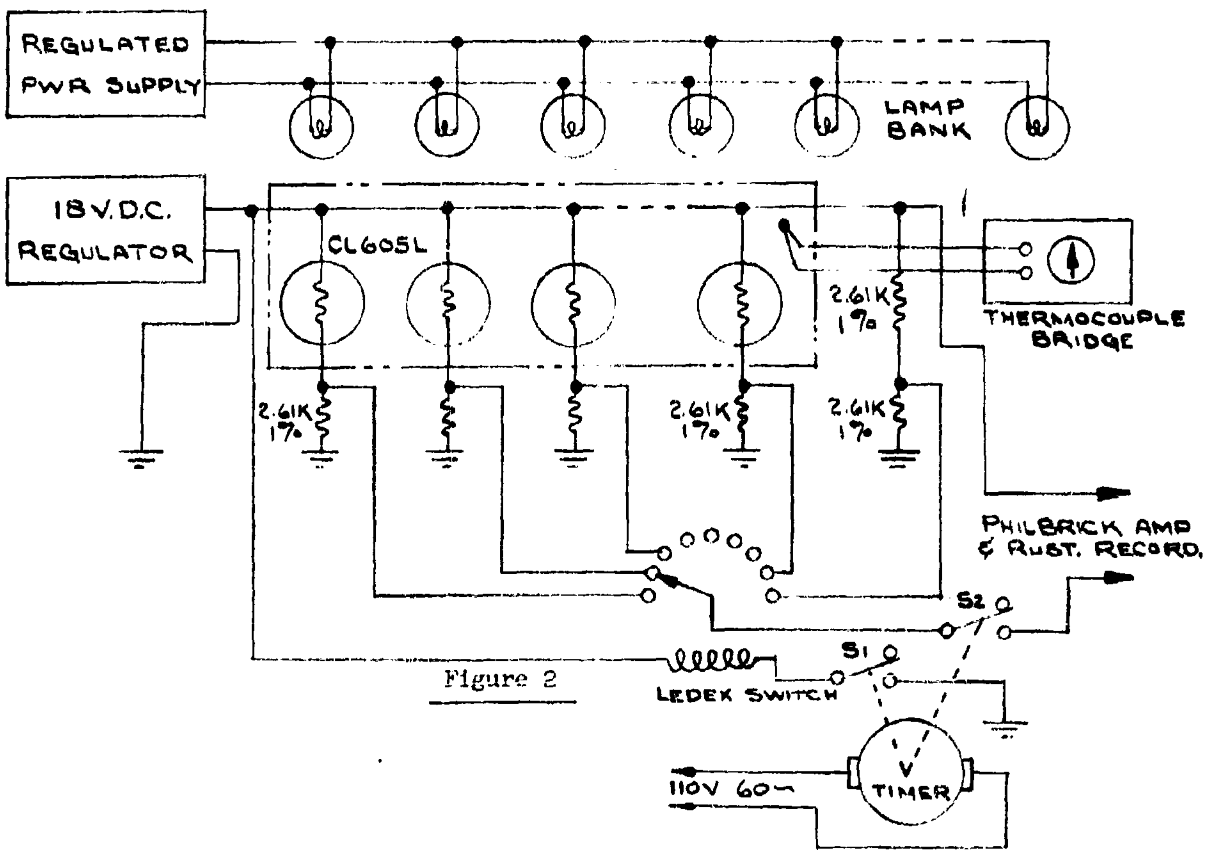


Figure 2

Lamp voltage is adjusted until photocells have resistance approximately equal to series resistors. Amplifier input is then nominally 9 volts.

S1 closes momentarily every 30 seconds to advance ledex switch. S2 opens as S1 closes and remains open for about 10 seconds. This provides an interruption to Rustrak input, thus facilitating identification of the marks on Rustrak recorder tape.

TEST FIXTURE:

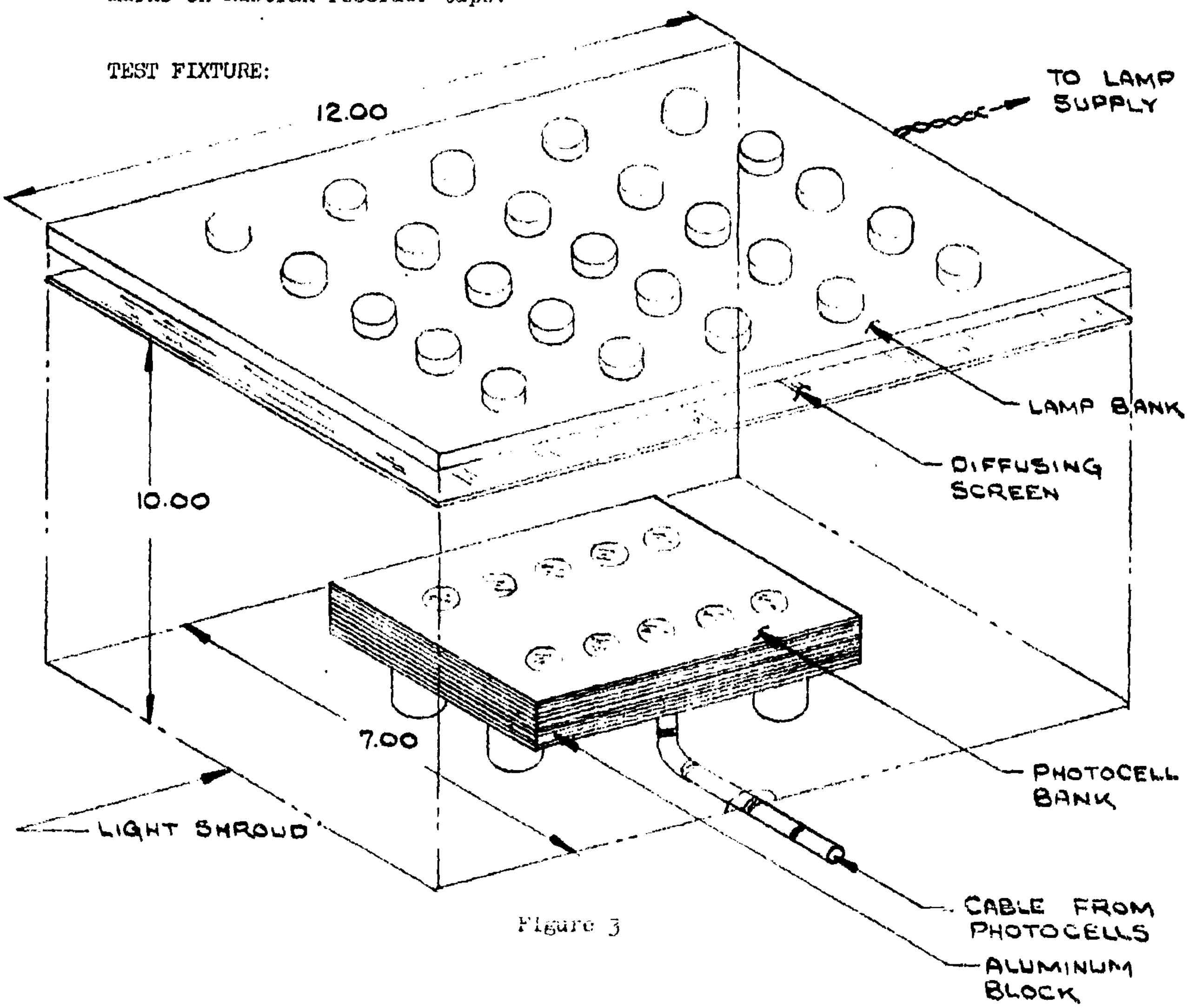


Figure 3

PHOTOCELL TEST PROCEDURE:

The purposes of the following series of tests are

1. To determine extent of photofatigue effects
2. To determine extent of photocell drift with time and temperature.

Apparatus Turn-On

When beginning a test, insure that these steps have been performed:

1. +300 and -300 V amplifier supplies are turned on
2. Amplifier filament transformer plugged in

   Steps 1 and 2 should be performed several hours prior to starting test to allow amplifier and supplies to reach thermal equilibrium.

3. Turn on lamp bank supply
4. Turn on photocell bank supply
5. Plug in timer motor
6. Plug in Rustrak recorder, insuring first an ample supply of tape

Observe the Rustrak recorder tape to assure the proper operation of the entire test set up. A repetitive series of short dashes occupying a 10-12 minute interval of tape indicates that each photocell is being sampled and recorded in sequence.

TEST I - PHOTOFATIGUE AND DRIFT
ROOM TEMPERATURE

1. Turn on apparatus as described in turn-on procedure
2. Allow test fixture to operate for one hour
3. At end of first hour turn off
   a. Lamp bank power supply
   b. Photocell bank power supply
   c. Timer motor
   d. Rustrak recorder
4. Draw line across Rustrak to indicate termination of first hour
5. Let amplifier plate and filament supplies continue running
6. Let apparatus remain undisturbed for 24 hours in order for photocells to dark adapt
7. At end of 24-hour shutdown turn on all apparatus without disturbing any previous adjustments and resume testing for an uninterrupted period of 24 hours
8. Readings will be taken at turn-on and each hour thereafter for duration of test
   a. Lamp voltage
   b. Photocell temperature (thermocouple)
   c. Rustrak tape position
9. At end of 24 hour operation the test is concluded
10. Preserve data sheet and Rustrak tape

TEST II - PHOTOFATIGUE AND DRIFT
160°F.

1. Place photocell bank and lamp bank with light-tight cover into oven
2. With apparatus running adjust oven temperature to 160°. Allow apparatus to operate for an hour after thermocouple temperature has stabilized at about 160°F.
3. Follow the same test procedure outlined in Test I
   a. 24 hour shutdown maintaining 160° ambient
   b. 24 hour continuous operation with hourly readings (160°F.)

TEST III - TEMPERATURE COEFFICIENT

1. Immediately after Test II reduce oven temperature to room temperature as rapidly as possible and continue taking readings for 12 hours
2. Test series concluded. Preserve data and Rustrak tape.

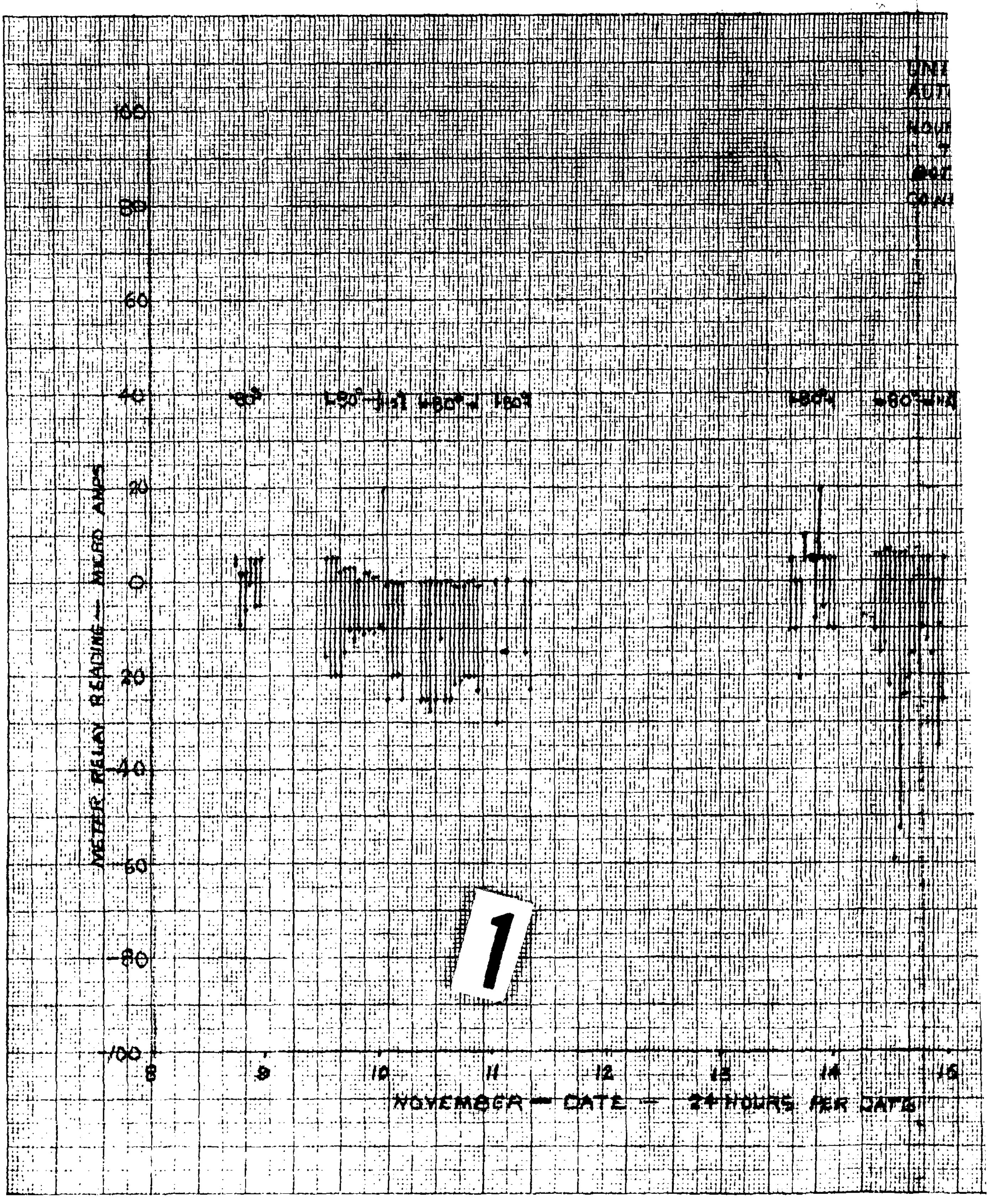
After conclusion of CL605L testing, test rig will be modified to accommodate CL602 cells. A similar test series is planned for the high impedence cells.

b. Automatic Restandardization

An automatic nulling circuit was designed that would renull the meter relay reading to zero micro amps after every cycle. The basic idea is to amplify the meter current by the use of a differential amplifier and the use of current drivers for relay switching of the feedback motor. The feedback motor adjusts the resistor in series with the photocell until the voltages on both sides of the meter relay coil are equal. The circuit is able to renull to plus or minus 10 micro amps. The renulling circuit is connected to the meter relay for six seconds after transport and it is then removed. This switching action is accomplished by use of a microswitch actuated by the timer motor. See Figure 4.

This system was built for two units and was installed in units numbers 9 and 33. Unit number 33 was sent to CRDL for testing while unit number 9 is being tested in the AAI laboratory. As of 22 November unit number 9 had 134 hours of operation without a failure in the renull circuit. The hourly meter reading at the beginning and ending of a cycle was recorded and graphed. The resulting graph is shown as Figure 5. The graph shows that the renull circuit functioned properly by renulling to within plus or minus 10 micro amps of zero each cycle.

Improvements in this circuit should be investigated before any adaptation is done. Some of the areas for improvement are elimination of two transistors, elimination of the meter relay, elimination of one zener diode, and additional design effort to optimize performance characteristics. These areas will be investigated during the next reporting period.


100
80
60
40
20
0
20
40
60
80
100
METER RELAY READING — MICRO AMPS
8
9
10
11
12
13
14
15
NOVEMBER — DATE — 24 HOURS PER DATE
1

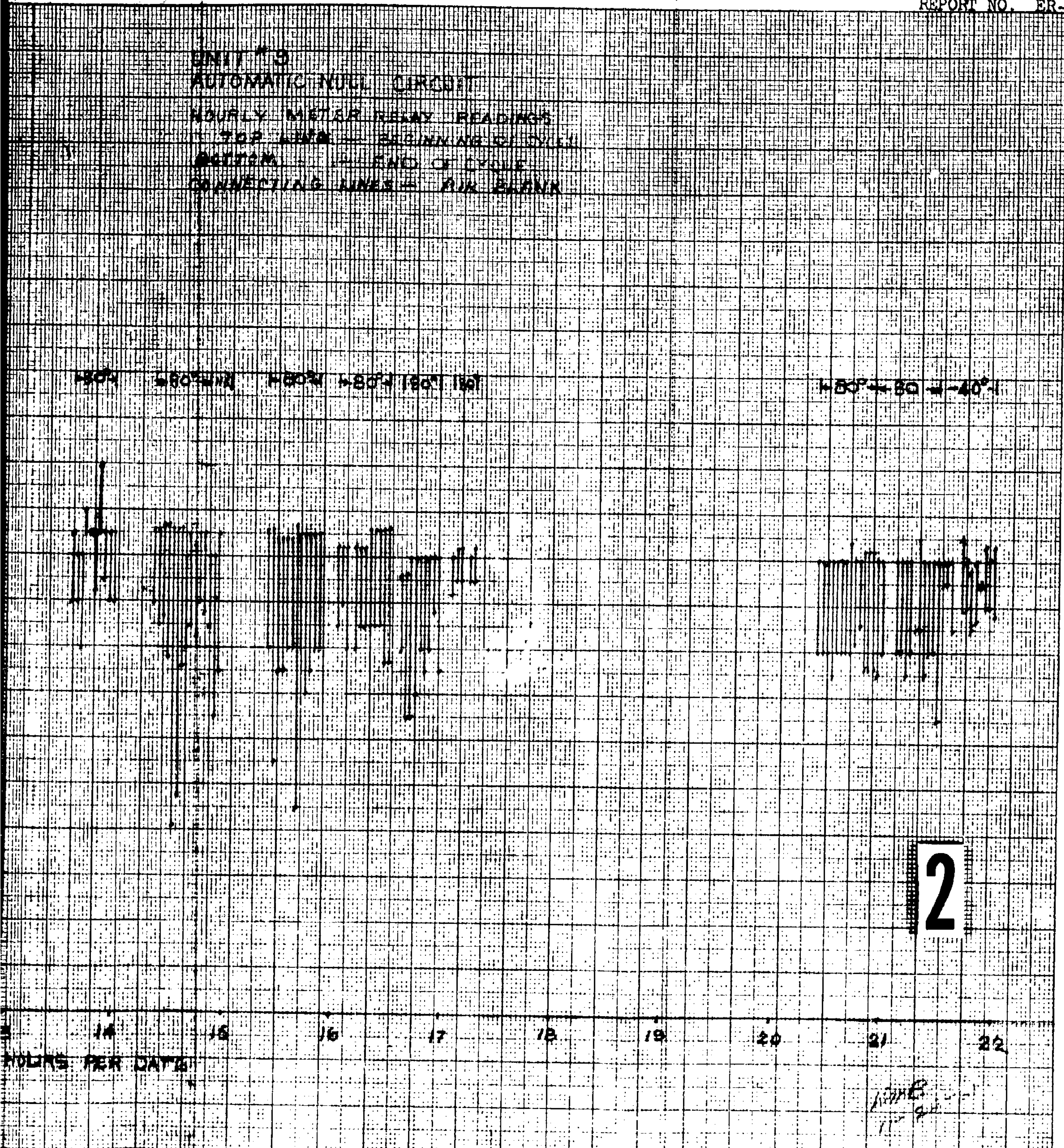
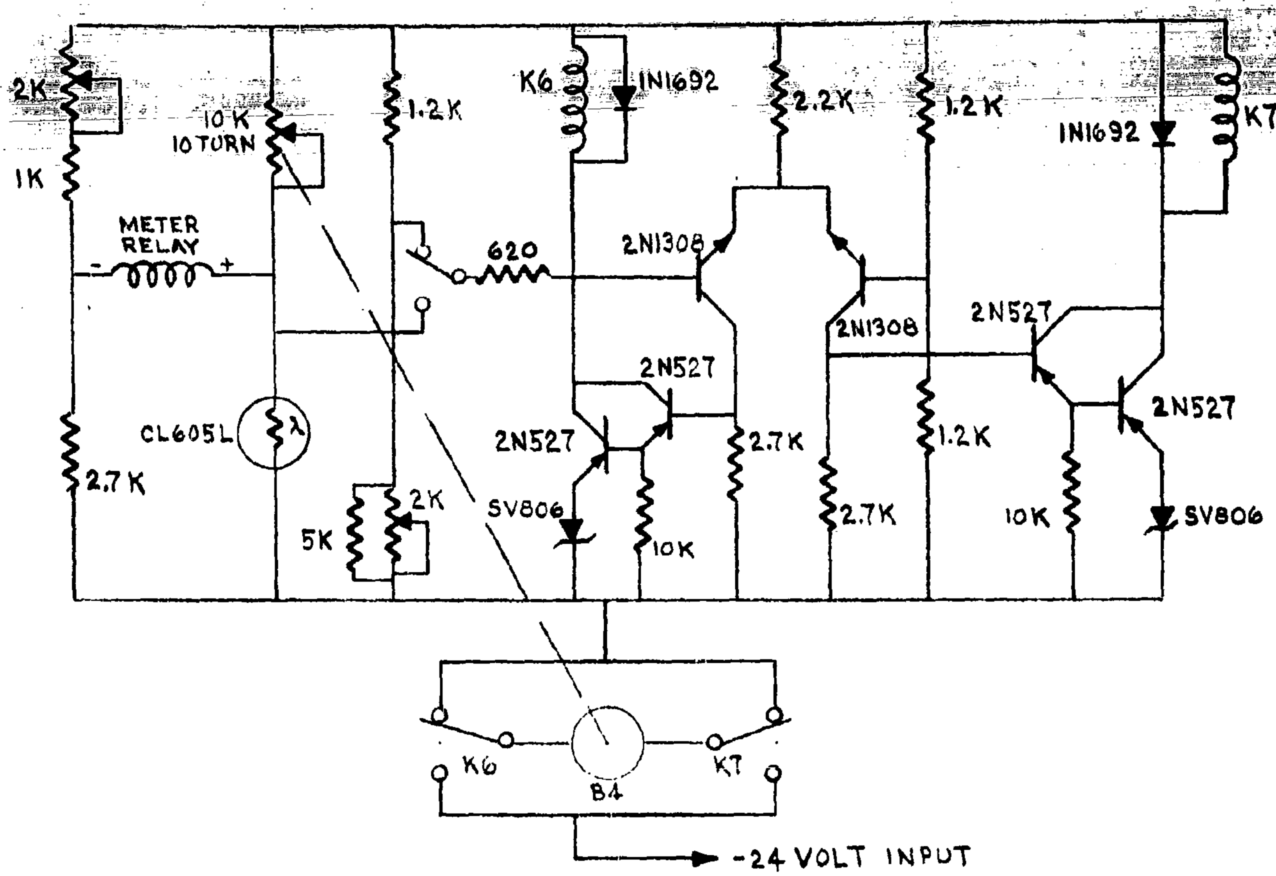

AUTOMATIC NULL CIRCUIT
HOURLY METER RELAY READINGS
14
15
16
17
18
19
20
21
22

FIG 5



AUTOMATIC NULL CIRCUIT

FIG. 4

c. Bridge Circuit and Two-Spot Detection Head

One two-spot detection head has been assembled and in test in unit number 11 for several weeks. Two photocells are employed; one over the sampling spot, the second looking at a reference spot on the tape ahead of the sampling area. No air is drawn through the reference spot.

During the first three 12-hour tests of the unit in normal operation, far greater fluctuations in meter current were displayed than can be tolerated. Since the bridge circuit is more sensitive than the standard alarm detection circuit, the meter was shunted with resistance to make the circuit only as sensitive as the standard alarm. By doing this a reduced meter fluctuation was achieved, although still not to an acceptable amount.

The suspected major cause of meter fluctuation was variation in tape saturation since the fluid nozzle deposited the solution on the tape quite near the reference cell. As a remedy, the fluid nozzle was extended so as to wet the tape at a greater distance before the head. Better results were immediately noted in that the rapid fluctuation of meter current was eliminated. However, wide variation in meter current still occurred from cycle to cycle.

In an attempt to determine whether instability existed within the electronics of the bridge circuit or resulted from external mechanical influences, the external variations were eliminated. The meter was nulled on dry tape with no fluid or air flow or tape advance. Over periods of 12 hours the bridge current was very steady, even when the alarm was exposed to high and low temperature extremes.

It has been concluded that the bridge circuit is electrically stable and sound; however, very sensitive to external influences such as variation in tape, fluid or air flow, and drum seating from cycle to cycle. Hence, while the bridge configuration is amply sensitive and desirable from the standpoint of simplicity, it is unsuitable for use as long as the above mentioned mechanical variations exist to so great an extent.

Attention is being directed toward the reduction of these variations and to a design of photometer head which is less affected by such variations.

d. Remote Warning System

A demonstration model of the transistorized remote warning system was delivered to CRDL for testing. After correction of some wiring errors, the unit has operated satisfactorily. CRDL testing has been very limited thus far.

Further AAI evaluation of the same circuit revealed several features that needed improvement:

(1) At higher temperatures, the danger of thermal runaway existed

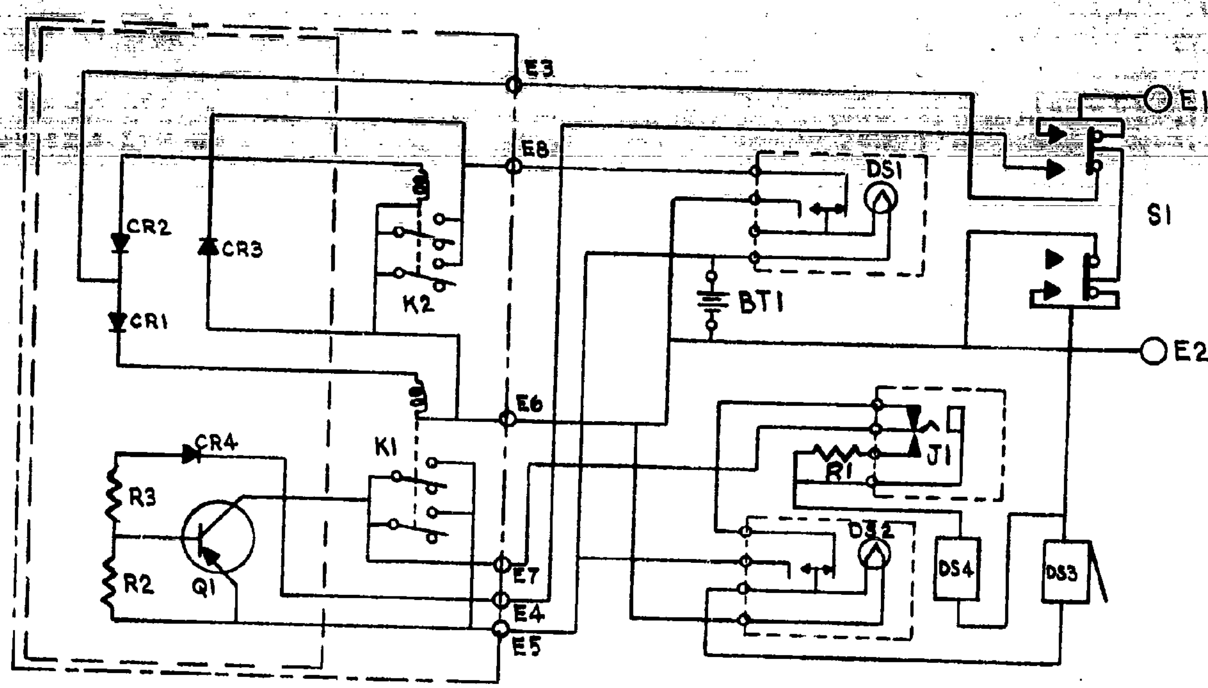
(2) The constant current drain on the batteries could require frequent replacement of the batteries

(3) When giving an alarm indication, there was a one volt drop across the transistor, thus limiting the lower voltage to which batteries may be operated

For these reasons, the circuitry has been redesigned, as shown in Figure 6. Two sensitive relays detect the signals from the E41 alarm, while a transistor circuit is used for the continuity and polarity check. The revised circuit will exceed the performance of the all-transistor circuit.

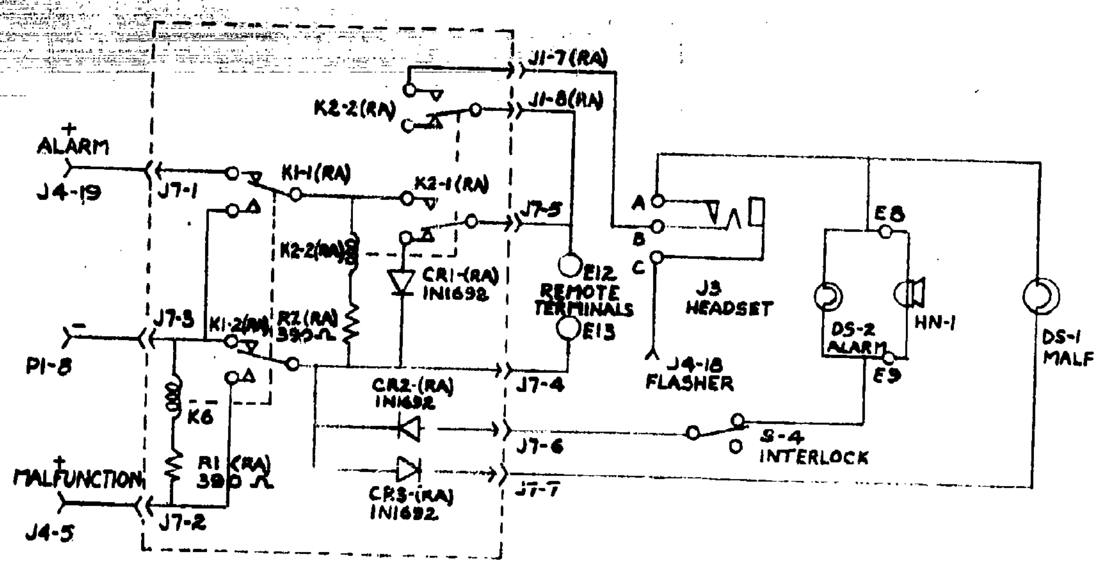
Mechanical design of a prototype unit is underway.

Some rework of the present E41 alarm circuit is necessary to operate the E54R1 unit. This is shown in Figure 7. In addition, a new mounting plate is required for the input, headset and remote jacks.



R1 - 20Ω	1/2w	5%	DS-1	- Malfunction Light	E1,2	Signal Inputs from E41 Alarm
R2-1K	1/2w	5%	DS-2	- Alarm Light		
R3-510Ω	2w	5%	DS-3	- Alarm Buzzer	E3-8	Circuit Board Terminals
CR1,2	1N198		DS-4	- Alarm Flasher		
CR3,4	1N1692		J-1	- Alarm Headset Jack		
Q1	2N527		S-1	- DPDT Push Switch	BT1	Four BA-30 cells-6v or Four BB-412 cells-4.8v
			K-1	- Alarm Relay		
			K-2	- Malfunction Relay		

Figure 6



REVISED E41R2 WIRING TO ACCEPT E54R1 REMOTE CONTROL UNIT

FIG 7

e. Inlet Heater System Studies

Problem #1

During alarm testing, particularly at high temperatures, it has been observed that the intake air heater was turning on full at ambient temperatures where no heat was required. This of course resulted in excessive air blank and/or dry tape. An analysis of the heater system was made and showed that this condition could be caused by thermal runaway of the transistors in the heater control circuit. A design analysis of this circuit was made. The analysis showed that Q5, the output transistor, was insufficiently biased to prevent turn on and the associated possibility of thermal runaway at high ambient temperatures. To correct this condition R15 was changed from 1.2k to 390 Ω. This change eliminated the possibility of thermal runaway of Q5 and did not affect circuit performance. No alarms tested to date with this change have shown signs of thermal runaway or heater turn-on.

Problem #2

During alarm testing at low temperatures it was observed that the intake air temperatures at the prefilter and tape varied considerably and values of temperature below 70°F. were sometimes obtained. CRDL has specified that 70°F. is the minimum air temperature allowable.

To investigate this problem, a detailed analysis was made of the control circuitry, including performance measurements. Except for the set up procedure, no problems were found to exist in the control circuitry with respect to drift or performance.

Measurements were made on the heater and its effect on the air temperature. These tests showed that to insure sufficient heater capacity under worst case conditions, a heater resistance of 155 ± 10Ω was required. Alarm schematics showed these values; however, the heater fabrication drawings called for a resistance of approximately 180Ω. Heaters with the correct resistance of 155 ± 10Ω are being installed in all alarms at present.

On the basis of the heater power requirement curves and circuit performance curves, a set up procedure was devised to insure that the air temperature at the prefilter did not go below 70°F. under any conditions. The set up procedure was based on the assumption that the thermistor temperature was equal to the prefilter air temperature. Two alarms were set up under worst case conditions to test this new procedure.

The results of this test showed that the air temperature at the prefilter varied between 69°F. and 80°F. Since this result was not expected, several additional tests were made during which the significant parameters were continuously recorded. These tests showed that the case temperature has a significant affect on the thermistor temperature. This means that the air temperature cannot be closely controlled since the thermistor does not accurately measure the air temperature. The tests also showed large temperature transients due to the case heaters.

To try to improve this condition, the reference temperature for the heater system was raised 5°F. by a change in set up procedure. Tests of this change showed that the case heaters were still overpowering the air temperature at the thermistor for control of the prefilter air temperature.

On the basis of this test data, it was felt that a change in the mechanical configuration of the thermistor is required to reduce the effect of case temperature on thermistor resistance. Several small bead type thermistors have been ordered and will be installed and tested as soon as received.

f. Waterproofing

In the previous progress report, it was concluded that Hysol Number 12-007 A1B waterproofing met the required standards set up for waterproofing of the printed circuit board in the gas alarm. Since then this type of waterproofing has been installed on all alarms made since alarm number 35. This includes alarm number 44 as well as the three Arctic Test Board alarms.

A new type of waterproofing called DC-F-145 was tested and it was determined to be desirable for use on the head connector and the adjoining heads. This was installed on alarm number 44 and the three Arctic alarms. This new compound is flexible and therefore useable on wires and connectors.

g. Lamp Socket Corrosion

In the E41 Gas Alarm, DS1 and DS2 have been corroding. This corroding prevents proper contact between the GE 313 light bulb and the receptacle center post. A special MIL specification receptacle was acquired from the Dialco Company called 711 MS.

Comparison test of the alarm receptacle which was being used in the E41 Alarm was made with the 711 MS. The testing was done in the following three areas:

(1) Warm humid air that passes through 8 MG reagent solution

(2) Cycle test with receptacle half covered with reagent

(3) Cycle test while half covered with water

The visual results of the test are as follows:

(1) The humid air test had little if any effect on either type receptacle

(2) The 711 MS after being cycle tested for 46 hours was covered with solid reagent, but showed no signs of rusting, whereas the standard receptacle was rusted

(3) During the water soak test the 711 MS showed some discoloration, whereas the standard receptacle had rusted on the inside.

After visual inspection of the entire test results, it was decided that the 711 MS receptacle would give superior service if placed in the E41 alarms. Therefore, this type of lamp socket was installed in unit number 44 as well as the three (3) Arctic alarms.

h. Audible Warning Device

(1) Standard Edwards Horn

The two horns that failed under CRDL environmental testing were returned to The Edwards Company for examination and rework. According to the CRDL test data delivered to Edwards, these units were subjected to 200°F. temperatures during the tests. Edwards feels that the failures were due to this abuse, rather than to a design or construction fault. They rebuilt them and expect to complete testing during the week of 27 November. When the units are received at AAI they will be subjected to the test program outlined below.

Each test shall run for twelve hours with the horn operating for five minutes at half hour intervals. Voltage, current, ambient temperature, top surface temperature and bottom surface temperature shall be recorded.

Test 1. Room Temperature - Four hours at 20 V, four hours at 24 V, four hours at 28 V.

Test 2. -40°F. - Start at 28 volts and decrease one volt per hour to 20 volts. Add approximately 1/8" water on the top surface and allow to freeze. Continue testing at 20 volts until the end of the twelve hour period.

Test 3. +125°F. - Start at 20 volts and increase one volt per hour to 28 V. Continue testing at 28 V until the end of the twelve hour period.

Test 4. Raise the temperature from +60°F. to +125°F. in six hours. Return to 60°F. in similar steps. Start at 20 V; change to 24 V at the first half hour, to 28 V at the first hour. Continue changing voltage at each half hour.

Test 5. 125°F. air temperature with sufficient radiation to give a top surface temperature measurement of 165°F. This temperature is to be measured using a thermocouple covered by O.D. adhesive tape. Input at 24 volts.

Test 6. 125°F., 100% relative humidity, 24 volts Input

Test 7. (Two hours only) - Immerse the horn under two feet of water. Extend the venting to above surface level. The terminals must be waterproofed to permit operation of the horn under water.

(2) Motor Driven Horn

Several sounding devices were taken to the sound measuring facilities in Room 4, Building 2300, CRDL where the following sound levels were measured at three feet.

	Item	db
1.	Motor driven unit using Globe 3A998 motor with 1/8" aluminum sounding plate	80
2.	Motor driven unit using Globe 3A998 motor with 1/16" steel sounding plate	82

	Item	db
3.	Motor driven unit using Globe 3A998 motor with .010" steel diaphragm	80
4.	Motor driven unit using Globe 3A998 with .003" Be-Cu diaphragm	80
5.	Motor driven unit using Globe SS-5 motor with .010" steel diaphragm	69.5
6.	CRDL Motor driven "bell" gear using Globe's air motor and .003 Be-Cu diaphragm	80
7.	Electronic Siren operating CRDL's driver at approximately 2500 cps. This is the only item not enclosed in a gas alarm case.	80.5
8.	Edwards Horn installed in Alarm #45	80

i. Adjust Knob Guard

A guard to prevent accidental movement of the meter adjust knob during alarm handling has been designed, fabricated and tested with satisfactory results. Tests consisted of installation on an alarm and checking to determine ease of operation. The device was also coated with approximately 1/8" of ice and was operated satisfactorily. An additional unit was then fabricated and installed on an alarm and subjected to additional tests by CRDL personnel. Results were satisfactory so this component will be included as a part of the modifications on alarm number 44 which will incorporate corrections to those problems revealed during the current Fort Benning Test Program.

j. Vehicular Installation Kit

OTAC, Detroit, is to send a completed kit to USAIB Fort Benning, Georgia by 1 December 1961.

k. Batteries and Charger

On 31 October a meeting was held at USASRDL Ft. Monmouth, New Jersey at which time Lt Colonel M. L. Mott, USAIB, stated the need for a new battery to be used on the E41 Gas Alarm, a charger for company level operation and a standard connector for power inputs. Two committees were formed to work on these areas. Details of the meeting are contained in the minutes prepared by CRDL. The meeting of these committees originally scheduled for 22 November has been postponed until 29 November to permit rework on the battery case design. A mock-up battery case is to be presented at that time.

l. Tape Runout Mechanism

Two types of tape runout sensors were designed, manufactured and tested. It was agreed that the design which had been developed by CRDL would be incorporated into the alarm configuration. This concept utilizes a pair of tape guide posts which are electrically associated with a relay type actuating circuit. In operation, when the end of the tape is reached, a metallic strip which has been applied to both sides of the last three or four inches of tape passes between the two posts, completing an electrical circuit. This completed circuit closes the relay and introduces a malfunction condition to the alarm.

It may be noted that individuals at AAI who have been associated with the operation of the circuitry involved in this design have expressed feelings of uncertainty in the system's operation. A circuit analysis at AAI indicates the configuration's reliability will be marginal. These marginal conditions occur due to the basic circuit design and the accumulation of tolerances of the electrical components used. The most extreme tolerance range presents itself in the relay used in the concept. If these component tolerances accumulate to one extreme, the malfunction circuit will not be actuated by the shorting tape. On the other hand, if the accumulation occurs to the other extreme, the circuit will be actuated by the tape itself when it is wetted with potassium chloride. It should be noted that the circuit could be improved by merely selecting more precise components. Those components used in tests to date have functions in accordance with the design objectives without difficulty; however, the possibility exists for future troubles to be experienced in this area. It is for this reason that AAI is continuing R&D efforts in this area.

m. Removable Drum

A removable drum configuration has been designed, fabricated, and is currently being tested in alarm unit number 44. This configuration was conceived with the intent of providing a more convenient method of cleaning the photometer head components; namely, the light pipe and photocell, without removing the head from the alarm.

The initial design of the unit was completed by AAI and submitted to CRDL for design evaluation. CRDL proceeded to manufacture a prototype unit which deviated slightly from the AAI design. These deviations included a reduction in size of the drum support spindle and replacement of a retaining leaf spring with a captivated thumb nut mechanism. A most important factor which must be considered as a result of this change is that excessive loading may be introduced to the tape transport motor by manipulation of the thumb screw during drum removal or replacement. This motor is capable of resisting a maximum loading of 100 in. oz. at its output shaft. In normal removal and replacement of the drum it is anticipated that this loading factor may be exceeded and thereby cause a motor failure. The Manuals will be revised calling the operator's attention to this fact.

The removable drum is constructed in the following manner:

(1) A support spindle is secured to the moving plate of the tape transport mechanism.

(2) A thrust bearing and motor drive fitting is installed within the spindle.

(3) A rulon bearing is first pressed into a drum support sleeve and the sleeve assembly is fitted on the support spindle. This support sleeve incorporates a cam ring to actuate the tape transport sensing switch and a keying guide to maintain a relationship between the removable and stationary portions of the assembly.

(4) The motor drive fitting, within the support spindle is then threaded into the drum support sleeve.

(5) The drum will now be slipped over the support sleeve. This drum is identical to the existing transport drum with the exception of the bore and the fact that it lacks a switch actuating cam ring.

(6) A drive plate which acts as a retainer for the drum's phonograph needles is secured to the outboard face of the drum. This plate is keyed to match the keying guide on the drum support sleeve.

(7) A thumb nut and thumb nut retaining mechanism is then secured to the drive plate.

In operation the drum is removed by simply loosening the thumb nut and sliding the drum off of its support sleeve. It will be noted that since the actuating cams are a part of the drum support sleeve, which remains in the unit, the relationship between the switch setting and the cam is not disturbed. This condition also affords maximum protection to the switch during drum removal or replacement.

To reinstall the drum portion, the operator need only slide the drum back onto its support sleeve, align the keying plate with the keying guide and secure the thumb nut. Again, during these removal and replacement operations, care must be taken in limiting the loading to the tape transport motor to below 100 in. ozs.

4. Service Test Liaison

During most of this report period units 35, 36 and 37 were operated eight (8) hours per week-day. There were no false alarms due to meter drift. When operated for twelve (12) hours, 6 amp hour batteries were used, therefore no unplanned low voltage malfunction occurred.

On 15 October units 21 and 26 were removed from testing for return to CRDL. Throughout this report period unit 14 was not subjected to rough handling and was, for all practical purposes, removed from testing.

Unit 35 had one (1) false alarm, caused by exposure to 25 mph winds and an estimated 12"/hour rainfall for 8 minutes. The pre-filters were wet, and a dark spot was on the tape, seemingly from the conversion filter. There were no malfunctions.

Additional testing included a 31-mile dust run on an APC M-113, which resulted in insensitivity to GF agent; three (3) air drops with the unit packed in the original packing crate, and RFI testing by Ft. Bragg Airborne Electronics Board. The results of the latter two tests were satisfactory.

Unit 36 had two malfunctions. One was caused by broken insulation on the harness. The other occurred when using a 12.5 amp/hr BB422 radar battery, after 59-1/2 hours of operating time. Two false alarms occurred: one with the standard air intake, 25 mph winds and 12"/hr simulated rainfall; the other with the sampling tube, no wind and 12"/hr simulated rainfall. Both alarms were caused by darkening of the tape. Additional testing was identical to unit 35 except that a GP bag was used in the air drop. The results were identical.

Unit 37 had no malfunctions and two false alarms during this period. The first alarm was caused by the 25 mph, 12"/hour simulated rain test. The second occurred some time after an air drop and appeared to be caused by a faulty alarm delay circuit. The printed circuit board was replaced.

The unit was air dropped three (3) times in a GP bag, and except for the false alarm indicated above, operation was satisfactory throughout.

No interference to communications equipment was observed by the Airborne Electronics Board during its testing.

C. General

During this reporting period, weekly coordination meetings have been held at ACC between representatives of CRDL and AAI. The purpose of these meetings was to insure that proper R&D actions were being taken and that proper progress was being achieved to correct known alarm problems.

Following this approach maximum insurance was maintained that the program is not lagging in critical areas and that proper decision can be made on a timely basis which would affect future engineering and manufacturing actions. It has been determined during these meetings that certain corrections will be made to alarm number 44 which will be returned to Fort Benning for further user evaluation. The decision was also made during these meetings that alarms 41, 42 and 43 would be modified to the E41R3 configuration for the Arctic Test Board testing.

Those items which are being subjected to the weekly review and the priority status of each item is given in the following tabulation.

E41 ALARM PROGRAM

Program Priority	Task	Sub-Task
2	I. Drift	a. Field Procedures
7		b. Waterproofing
8		c. Photohead Studies
9		d. Automatic Restandardization
24		e. Bridge Circuit
30		f. Finned Covers
3	II. Photohead Maintenance and Tape Problems	a. Tape Guide Supply Reel Lock
4		b. Tape Run-Out - Electrical
15		c. - Microswitch
31		d. - Optical
5		e. Improved Cleaning Procedures
10		f. Tape Drum Removal
25		g. Photohead Component Improvement
27		h. Design Removable Head
28		i. Modified Drum Movement
1	III. Prefilter	a. Improved Storage Stability
6		b. Improved Seating & Sealing
16		c. Dust & Rain Prefilter
29		d. Throwaway Prefilter
11	IV. Mech - Elec	a. Inlet Air Heater System
13		b. Improved Edwards Horn
14		c. Motor Driven Horn
18		d. Improved Remote Warning
19		e. Corroding of Lamp Sockets
20		f. Freezing at Exit Air Heater
21		g. Guard for Null Knob
22		h. Vehicular Installation
23		i. Batteries - Charger
26		j. Loud-Speaker Horn
11a		k. Deposition on Valves
		l. Radio Interf. Suppressor
12	V. Sensitivity Studies	a. Sens. Studies
		b. Storage Stability - Chem Kit
17	VI. Manuals	a. Rev. Op. and Maint. Instruc.

IV. FUTURE PROGRAM

The future program at AAI will be for the continuation of the R&D effort as indicated in the tabulation in the preceeding paragraph and for the completion of the remaining alarms, spares and the Master Model alarm.