311.81
311.161
311.162

CWH MH

GENERAL ELECTRIC
COMPANY
SCHENECTADY, N. Y., U. S. A.

PLEASE INITIAL AND RETURN PROMPTLY TO M. Lynn FOR FILING

C O N F I D E N T I A L

DATA FOLDER No. 72147

Title: Technical Information on Sylvania Micro-thyratron

By

Electronic Tube Engg. Div.

Information prepared for

Tests made by

Information prepared by: P. W. Crapuchettes

Countersigned by

Date: 1-1-43

FN-460-E (11-43)

52147

CONFIDENTIAL

Technical Information on Sylvania Micro-thyratrons

Electronic Tube Engg. Div.
Radio, Tel. & Electronics Dept.

January 1, 1943.

Purpose

To compare the oxide-coated cathode in micro-thyratrons with the tungsten filament used in conjunction with a cold cathode.

Procedure

The Sylvania - Signal Corps specifications were reviewed before any tests were made. It was decided that ordinary tests according to the specifications would give no more information than the specifications themselves. The tests applied are more rigorous than the specifications and include the tests normally taken before shipment. Therefore, the tubes were subjected to the following tests:

1. Grid Characteristic Test

   Using a 2 megohm grid resistor and the weak* anode circuit, the critical grid voltage vs anode voltage characteristic was obtained (see Fig. 1). The voltage applied to the filament circuit (filament plus 2-ohm resistor) was 1.35 volts.

2. Grid Current and Leakage Test

   At a fixed anode voltage (120 volts) and filament voltage (1.35 volts) and using the weak* anode circuit, the tubes were fired at successively higher grid resistance. The curve of Eg vs Rg is presented in Fig. 2.

3. Time Delay and Surge Current Test

   Both firing time and peak current were measured at 1.10 volts on the filament circuit and 110 volts on the anode. Rg was 2 megohms. After five successive readings the tube was rechecked for grid leakage and grid resistance.

*R_a = 10,000 ohms; C_a = 1/4 μf.

Results

The grid characteristic is fairly flat, which is indirectly required by the specifications.

Of the seven tubes tested, 2 would not control when Rg was 5 megs, 2 more at 10 megs, the remaining 3 would control with 20 megs but would not at 40 megs. This would tend to prove that the maximum allowable grid resistance for these tubes is 2 megohms. The disk type of micro-thyratron being made by General Electric is unaffected by changes in Rg in the range of 2 to 100 megohms, illustrating the decreased leakage in this design.

The tubes were repeatedly surged on the stiff circuit. Open filaments accounted for all of the tubes. One opened after 2 firings, another after 5 firings, another after 13 firings, another after 20 firings, another after 42 firings and another after 100. The remaining tube is still operative after 25 firings. In operation, the first few firings carried 6 or 7 amperes. The remaining firings were at 5 amperes. All tubes fired within 1 millisecond.

The first 2 tubes were tested on the original circuit supplied for measuring time delay which did not incorporate a current measurement. From the shape of the tube drop wave, it was evident that the current was not 5 amperes for much more than 25 firings. These tubes did fire 100 and 42 times respectively before filament burnout.

Subsequent firings did not appreciably change the grid characteristic. The change that did take place was due to a change in emission of the filament rather than leakage, as indicated by the data.

Conclusions

From a firing time standpoint, the oxide-coated cathode is superior to the tungsten-cold cathode combination. The large number of burnouts, without warning, indicates that a cathode spot forms on the filament, sometimes becoming hot enough to melt the filament. This suggests the use of a cold cathode plus an oxide-coated filament. Preliminary tests on this combination show very promising results.

Evidently the oxide coating does not sputter to the grid in sufficient quantities to produce grid emission. The leakage resistance does not change either. The loss of control at high grid resistance is believed to be due to the method of mounting.

PWC:ht

P. W. Crapuchettes

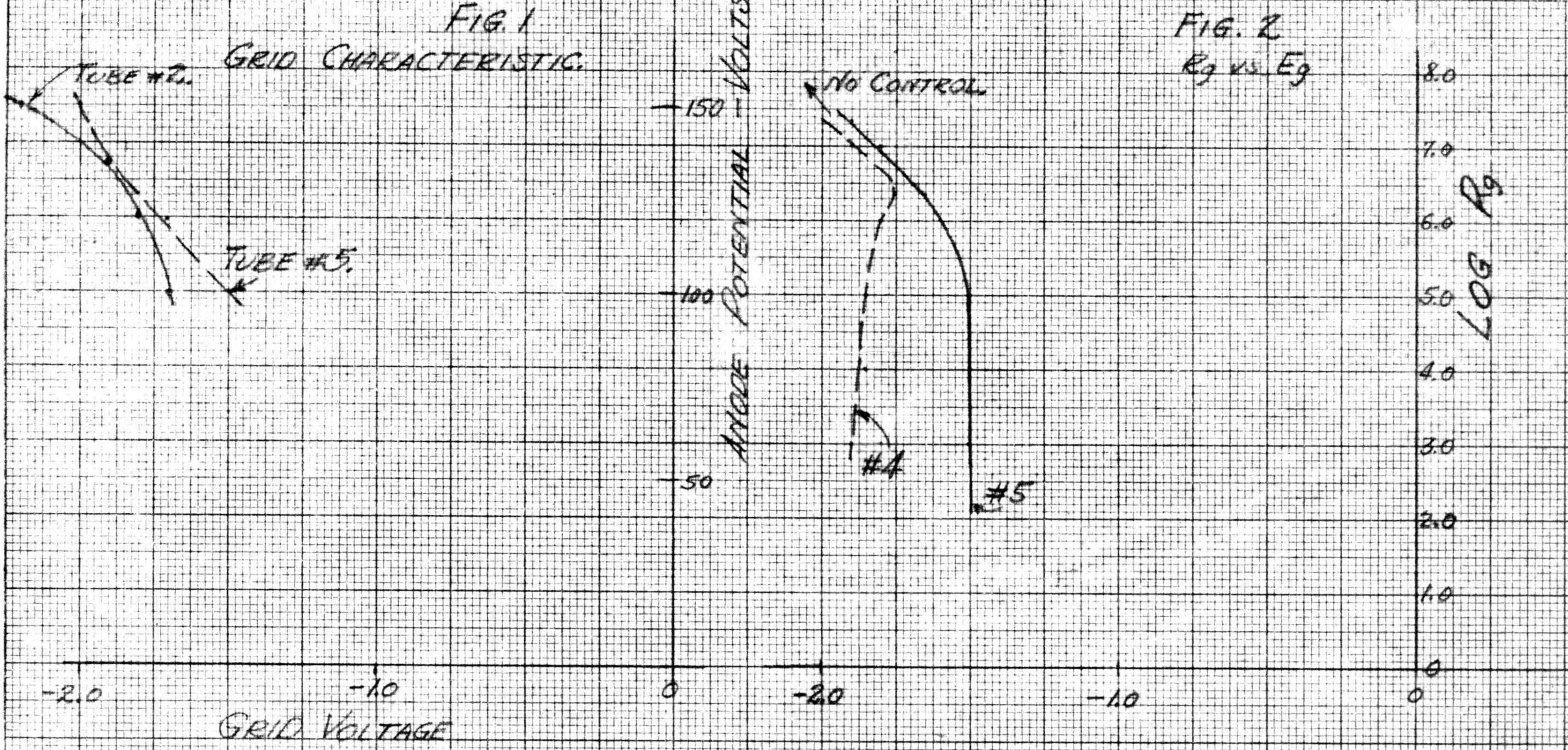
P. W. Crapuchettes
Jan. 1, 1943.

Distr.

ZG Taylor
MJ Hamner
EJ Lawton
ED Epstein
AC Gable
PW Crapuchettes
OW Pike, RW Larson
CR Knight

K-827 73
MADE BY R. [illegible]UCHETTES DEC 3
INSPECTED BY: JAN-2-4
JJ-5492

EXTREMES OF DATA FOR THE SYLVANIA MICROTHYRATRONS



R. Capuchettes
Dec. 31, 1942

Test Data

Tube #A - Destroyed in Schenectady after 100 firings

Tube #1 - Destroyed at Buffalo - fired 40 times less than one millisecond; filament burnout may have been due to arcing. E_g did not shift appreciably with consecutive firings.

A. $E_{f\&r} = 1.35$

R_g-2 Meg E_A	Tube #2 I_f = .086 E_g	Tube #3 .083 E_g	Tube #4 .084 E_g	Tube #5 .083 E_g	Tube #6 .088 E_g
150	2.2	2.0	2.2	2.0	2.1
135	1.9	1.9	2.0	1.9	2.0
120	1.8	1.7	1.8	1.7	1.9
100	1.7	1.6	1.5	1.5	1.7

B. $E_{f\&r} = 1.35$)
$E_A = 120$ v) on weak circuit

R_g	E_g	E_g	E_g	E_g	E_g
1,000	1.8	1.9	1.9	1.5	2.2
10,000	1.9	1.85	1.85	1.5	2.1
100,000	1.8	1.8	1.85	1.5	2.0
1 meg	1.8	1.75	1.80	1.6	1.9
2 meg	1.8	1.7	1.75	1.65	1.9
10 meg	1.9	N.C.*	1.9	1.8	1.9
20 meg	2.1	N.C.*	2.0	1.9	N.C.*
40 meg	N.C.*	"	N.C.*	N.C.*	"
100 meg	"	"	"	"	"

* No control.

C. Time Delay and Surge Current Test

(Two measurements - time and peak current - are required.)

Conditions $E_A = 110$ $R_g = 2$ meg
$E_f = 1.10$

Sylvania Thyratrons

$E_A = 112.5$, $E_{f\&r} = 1.10$

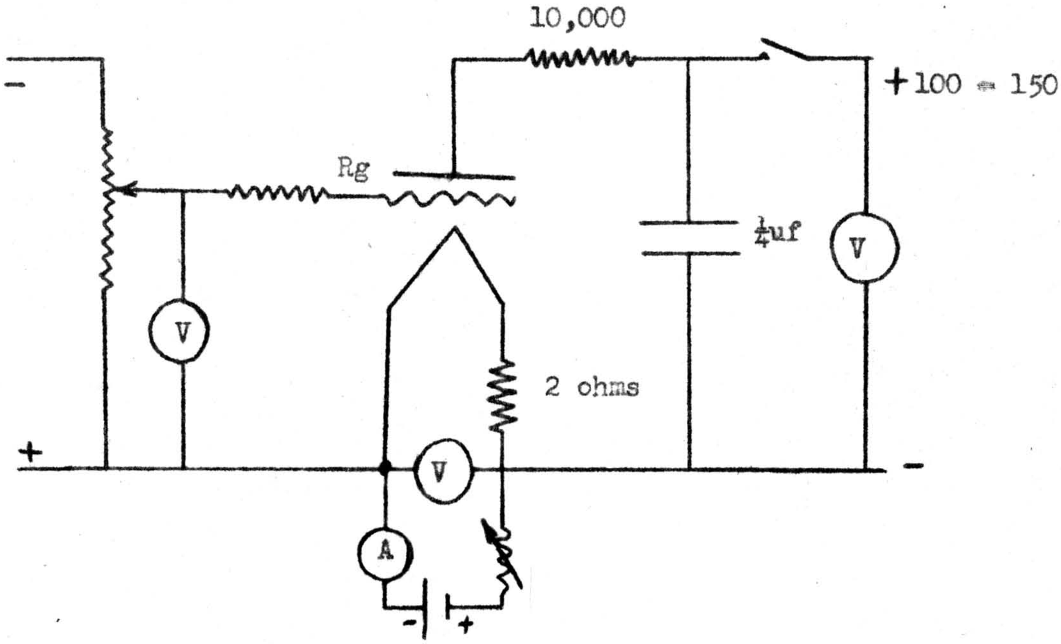
Condition	Test	Tube #2 Time Millisec	Tube #2 I_A	Tube #3 Time Millisec	Tube #3 I_A	Tube #4 Time Millisec	Tube #4 I_A	Tube #5 Time Millisec	Tube #5 I_A	Tube #6 Time Millisec	Tube #6 I_A
	1.	1–	6	1	5+	1	7	1	7	1	6
	2.	1	6	1	5+	1	7	1	7	1	6
	3.	1	6	1	5+	1	6	1	5+	Open Filament	
	4.	1	6	1	5+	1	6	1	5+		
	5.	1	6	1	5	1	6	1	5+		
$E_f = 1.35$ ($R_g = 1000$ ohms		$E_g = 1.7$		$E_g = 1.7$		$E_g = 1.7$		$E_g = 1.7$			
$E_A = 120$ ($R_g = 2$ meg		$E_g = 1.8$		$E_g = 1.7$		$E_g = 1.7$		$E_g = 1.7$			
	6.	1	6	Open Filament		1	5	1	5		
	7.	1	6			1	5	1	5		
	8.	1	6			1	5	1	5		
	9.	1	6			1	5	1	5		
	10.	1	6			1	5	1	5		
$E_F = 1.35$ ($R_g = 1000$ ohms		$E_g = 1.7$				$E_g = 1.7$		$E_g = 1.7$			
$E_A = 120$ ($R_g = 2$ meg		$E_g = 1.7$				$E_g = 1.7$		$E_g = 1.7$			
	11.	1	6			1	5	1	5		
	12.	1	5			1	5	1	5		
	13.	1	5			1	5	1	5		
	14.	1	5			1	5	No longer fires			
	15.	1	5			1	5				
$E_f = 1.35$ ($R_g = 1000$ ohms		$E_g = 1.7$				$E_g = 1.7$		Open Filament			
$E_A = 120$ ($R_g = 2$ meg		$E_g = 1.7$				$E_g = 1.7$					
	16.	1	5+			1	5				
	17.	1	5			1	5				
	18.	1	5			1	5				
	19.	1	5			1	5				
	20.	1	5			1	5				

Sylvania Thyratrons (Cont'd.)

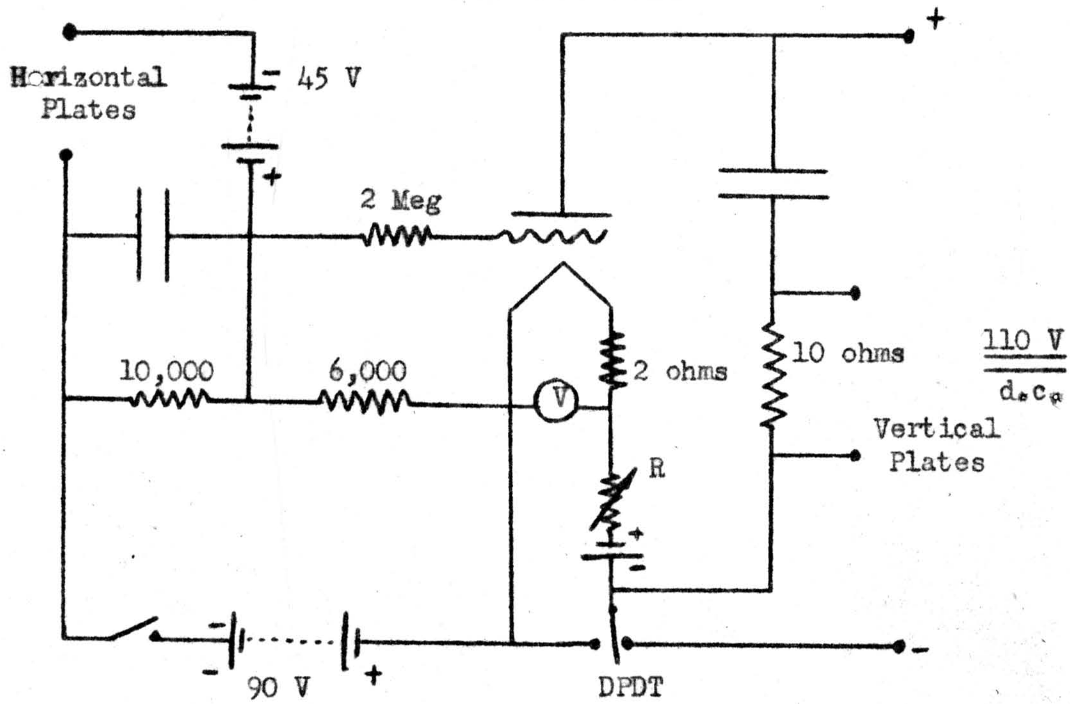
$E_A = 112.5$, $Ef\&r = 1.10$

		Tube #2		Tube #3		Tube #4		Tube #5		Tube #6	
		Time Millisec	I_A	Time Millisec	I_A	Time Millisec	I_A	Time Millisec	I_A	Time Millisec	I_A
$Ef = 1.35$ ($R_g = 1000$ ohms		$E_g = 1.9$				$E_g = 2.0$					
$E_A = 120$ ($R_g = 2$ meg		$E_g = 1.9$				$E_g = 2.0$					
	21.	1	5			Open Filament					
	22.	1	5								
	23.	1	5								
	24.	1	5								
	25.	1	5								

Grid Characteristic Circuit



Time Test Circuit



P. W. Crapuchettes
Jan. 1, 1943.