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DATA FOLDER No. 64517

Title PR-861 - 20 Mc. Oscillator
DA-482003

By
Electronic Tube Engg. Div.
RADIO TELEVISION & ELECTRONICS Dept.

Information prepared for.....

Tests made by.....

Information prepared by R. T. Penoyer

Countersigned by.....

Date 10/28/38

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PR-861 - 20 Mc Oscillator

Vacuum Tube Eng. Dept.

October 28, 1938.

Object:

A proposed change in the Navy specifications calling for oscillation test of the CG-38161 at 20 Mc made it necessary to develop a new oscillator for the factory test. The Navy specification as finally written is as follows:

Ep: 2.8 Dk V Eg₂: Opt. Pp: 480 (max)
Ip: 350 DmA Ig: 40 DmA
Rg: 5000 f: 20 Mc; t: 600 Po: 500 w (min)

Results:

An oscillator with connections as shown on the accompanying print was constructed, and tested at length. This circuit is similar to that which was developed by the RCA for the same purpose.

It is to be noted that there is only one variable condenser on the oscillator; that in the grid circuit. It was found that changes in tube characteristics required a shift in frequency in order that the conditions of Ip and Ig could be met simultaneously. Consequently, the use of an r-f meter in the load circuit to measure output was prohibited. The meter was finally left in place, merely as an indicator. The use of a vacuum thermocouple on which the light from the load lamp could be focussed was tried as a means of measuring output. This is a very accurate method, and is entirely free from drift, but it was found impossible to shield the thermocouple well enough to prevent large errors due to r-f induction. The Weston photronic cell was found to be sensitive, but subject to so much drift as to be useless. These cells are also subject to error due to r-f induction.

The method finally used was that of a vacuum photocell of high sensitivity with low plate voltage, and high series resistance. This method was found to be free from short-time drift at least, and in the final arrangement in the factory was found to be entirely free from r-f effects.

The oscillator was set up in the factory and the lamp and photocell measuring circuit calibrated on October 25. The photocell circuit was checked for r-f induction. A test was made on tube #16163 and the output found to be the same as had been obtained previously when the oscillator was set up in the engineering shop. This tube had also been

tested by the RCA under the same conditions, and the output obtained was 400 watts. The calibration readings and test data are given below. The tube #16163 will be kept for a standard to be used in checking the oscillator.

October 25, 1938

Calibration PR-861 Oscillator Lamp Load
FJ-114 Cell half blanked out

Microammeter S-018630

DP2 018925
DP2 012408

I Read	I Corr.	E Read	E Corr.	µa P.E.	Watts
5.5	5.52	52.9	53.7	13.2	296
5.9	5.92	60.5	61.3	19.1	364
6.17	6.19	65.2	66.0	23.2	408
6.4	6.4	69.9	70.7	26.8	452
6.66	6.66	74.8	75.6	30.3	501
6.52	6.52	72.2	73.0	28.5	477
6.28	6.29	67.5	68.3	24.8	429
6.02	6.04	62.7	63.5	20.6	383

Test PR-861 - #16163

Eb	Ib	Rsg	Isg	Ig	PE	Po	T
* 2800 28000	350	100,000	25	40	22.5	400	5'

The losses of the oscillator, that is, difference between total output and lamp output were determined by operating a small water-cooled tube in place of the PR-861, and measuring plate loss by means of the temperatures of the cooling water. At a lamp output of 343 watts, loss was 77 watts and at 366 watts lamp output, the loss was 82 watts. By proportion, the losses would be 92 watts at 408 watts lamp output, so that 408 watts lamp output is the minimum useful output corresponding to the minimum total output of 500 watts.

Operation:

1. The tube is placed in the oscillator, and plate lead connected to the end of the tank coil by means of the large binding post.

* Change use of 8/13/42 H. C. Bell

2. The filament is turned on, and the plate supply is turned on at a low voltage.
3. While bringing the plate voltage up to 2800 volts, the small variable condenser in the grid circuit is adjusted so that the grid current does not exceed about 40 ma. When the plate voltage is reached, the plate current should be 350 ma. If it is not, the voltage should be reduced and the following adjustment made on the set:

For I_p too high, turn the internal slider on the tank coil counter clockwise. For I_p too low, turn the slider clockwise.

4. When $I_p = 350$ ma and $I_g =$ approximately 40 ma at $E_p = 2800$ volts, the tube is allowed to oscillate for 10 minutes at the end of which time a reading of output is taken. Care should be used to see that E_p and I_p are exactly correct when output is read. Emission check is taken by reducing the photocell reading (or output) so that output decreases 10%, and reading filament voltage. A curve showing the proper amount of decrease in photocell current for each reading is included.
5. When any unusual value of output is obtained, as a general thing, the output measuring circuit should be recalibrated before condemning the tubes, because photocells are subject to drift.

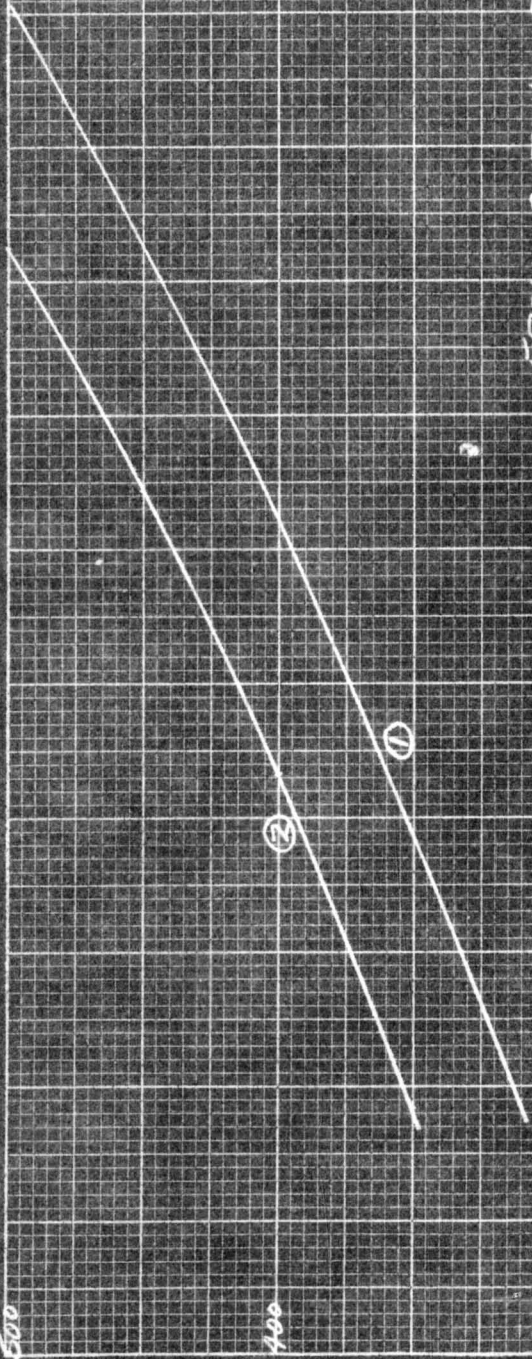
R. T. Pennoyer Oct. 31 1938
R. T. Pennoyer,

RTP:HT

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KC DeWalt }
RT Pennoyer- 1 copy
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Vacuum Tube Engg. Dept.
October 26, 1938



FROM OUTPUT READING ON
 CURVE ①, FOLLOW HORIZONTAL
 LINE TO CURVE ②. THE PHOTOCELL
 CURRENT CORRESPONDING TO THIS
 POINT IS THE VALUE TO WHICH
 THE READING IS REDUCED FOR
 10% DECREASE IN OUTPUT.

EXAMPLE: AT OUTPUT 468 W, READING
 28, REDUCE TO 283 FOR EMISSION CHECK

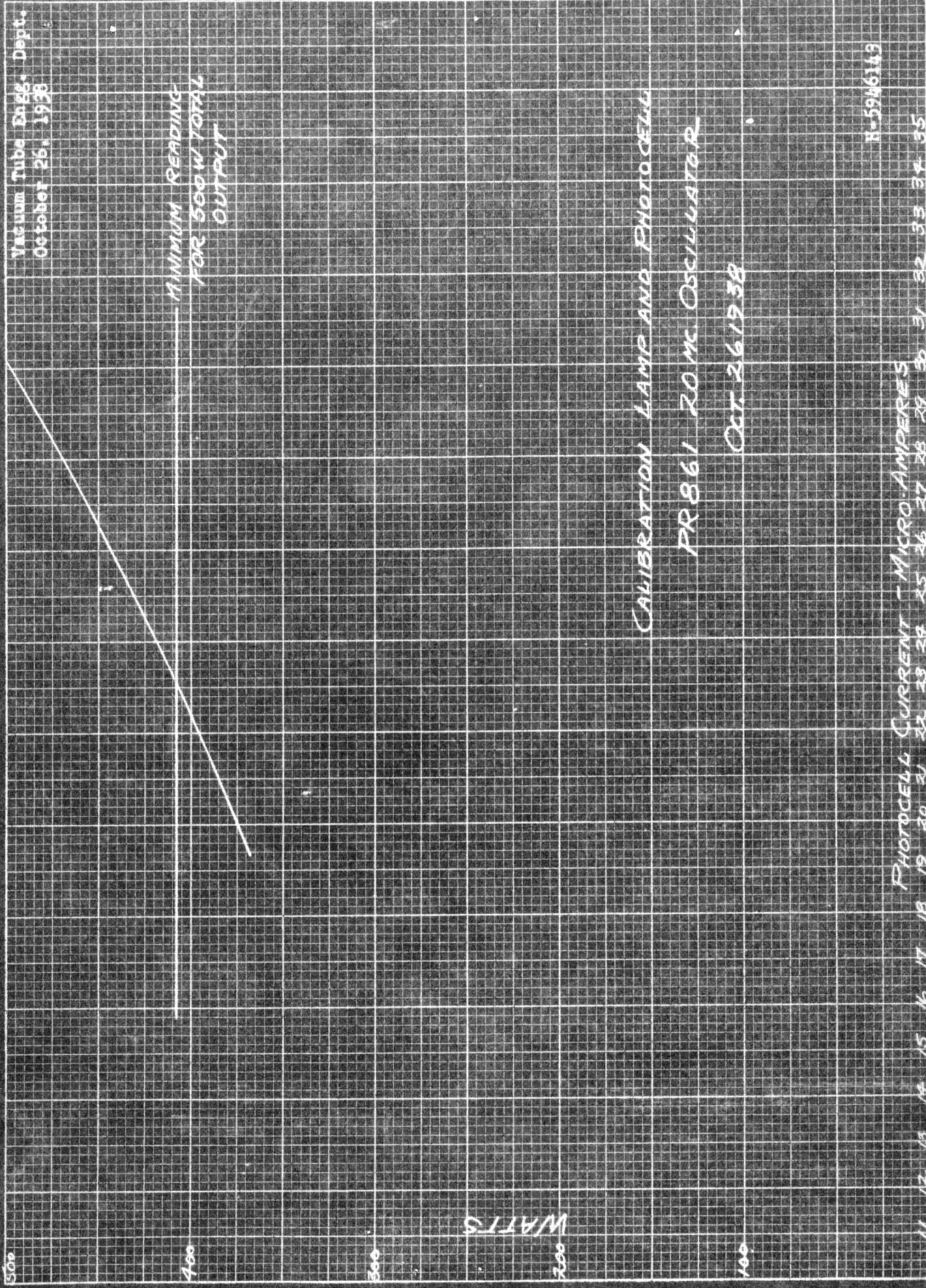
PR 861 A AMP AND PHOTOCELL

Oct. 26 1938

H-5916142

PHOTOCELL CURRENT - MICROAMPERES

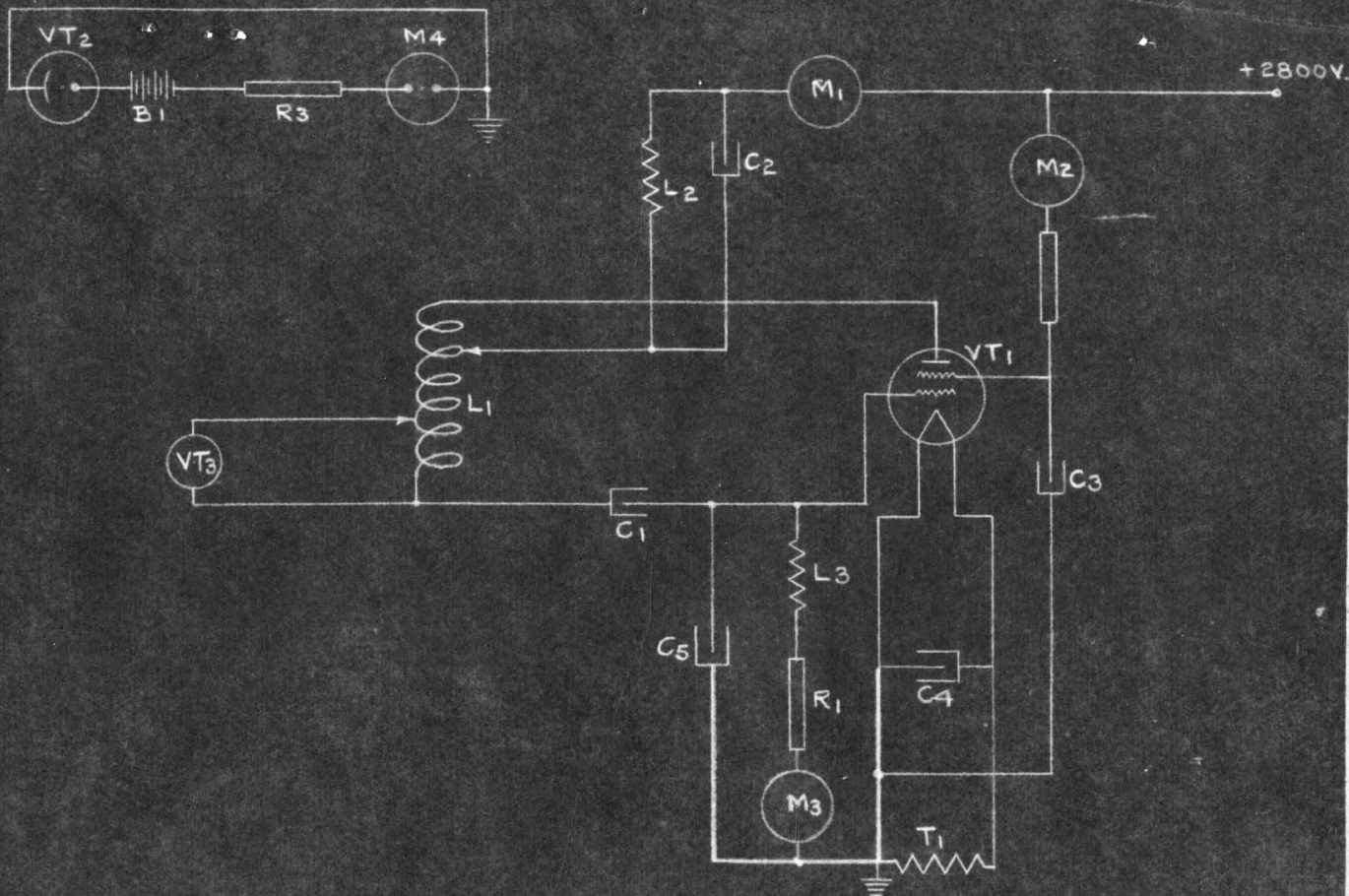
Vacuum Tube Engg. Dept.
October 26, 1938



CALIBRATION LAMP AND PHOTOCELL
PR 861 20 Mc OSCILLATOR
OCT. 26, 1938

1-5946143

PHOTOCELL CURRENT - MICRO-AMPERES
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35



NOMENCLATURE

- VT₁ - PR-861 under test
- VT₂ - FJ-114 photocell, half window blanked
- VT₃ - 1000 w, 110 v. Beacon type lamp
- L₁ - Tank coil, 8 turns 5 1/4" dia., 5" long
- L₂ - Tuned R.F. choke
- L₃ - 2.5 mh Hammarlund choke
- C₁ - .0005 μf mica condenser Dublier PL275-40
- C₂ - .005 μf by pass mica condenser
- C₃ - .005 μf by pass mica condenser
- C₄ - .01 μf by pass condenser
- C₅ - 100 μuf max. variable air condenser
- M₁ - 500 ma., DO type meter
- M₂ - 50 ma., DO type meter
- M₃ - 100 ma., DO type meter
- M₄ - 40 ma., DP2 type meter
- R₁ - 5000 ohm grid leak
- R₂ - 100,000 ohm screen grid resistor
- R₃ - 250,000 ohm resistor
- B₁ - 22.5 v "C" battery
- T₁ - 11 v. transformer

SCHEMATIC DIAG. OF CONNECTIONS
FOR PR.861, 20MC. OSCILLATOR

DRAWN BY J.J. Farkas NOV 2, 1938 INSPECTED BY Nov 4, 1938 JH 7599

REVISIONS

GENERAL ELECTRIC
SCHEMATIC WORKS

K-5104785

VT8

PRINTS TO