P BM PBM
W HB WB

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

DATA FOLDER No. 72141

Title Emission Pulser

By

Electronic Tube Engg. Div.

Information prepared for Electronic Tube Engg.

Tests made by J. M. Cooper

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Date 10-15-42

Emission Pulser

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

October 15, 1942.

This emission pulser was designed to test the emissive qualities of the 446 vacuum tube.

The circuit used is shown in the accompanying diagram. It consists of a double multivibrator, which is used to trip the grid of a thyratron, causing the thyratron to allow a pulse of current to be sent through the tube being tested. Between the multivibrator and the thyratron is an amplifying stage using an 1852, which peaks and amplifies the output of the multivibrator and isolates the multivibrator that it may not be loaded by the grid current of the thyratron.

Discussion of Circuit

The first multivibrator gets its control voltage from the 60-cycle filament supply, and divides this frequency by two, giving an output of 30 cycles per second. This output is used to control the next multivibrator which divides the 30 cycles by 3 giving an output of 10 cycles per second. This 10 cycles is put through the 1852 stage and applied to the grid of the thyratron in such a manner as to allow only one complete half of a 60-cycle sine wave to be applied to the tube being tested for each pulse.

The current passed through the tube being tested may be observed on a cathode-ray oscilloscope and/or measured with a thermal ammeter. The thermal ammeter is used because of its ability to give a steady reading at this low frequency.

Since the thermal ammeter reads rms current, a factor must be found which, when multiplied by the ammeter readings will give peak current. For a 60-cycle sine wave the peak current is known to be the square root of two times the rms current. The tube, however, receives only one-half sine wave every sixth cycle of the 60-cycle sine wave. The peak for the 10-cycle current will be

$$(2)\ (6)\ (\sqrt{2}) = 16.97$$

times the thermal ammeter reading.

This low duty cycle allows a high voltage to be applied to the tube without damage due to the excessive plate current.

The ability to apply two or three times rated voltage to a tube brings us to the real purpose for such an elaborate test. That purpose is to eliminate the effect of variation due to space charge. The method used here is to apply such a large potential between grid and cathode (the grid being shorted to the plate) that for all practical purposes the space charge does not affect the current flow.

It is granted that a single multivibrator would be able to supply a 10-cycle voltage from a 60-cycle control voltage, in fact it was tried, but that would be a frequency division of six, which is getting toward the limit of a multivibrator's ability, and it was noted that this was slightly unstable. Since any instability whatsoever made the tester worthless, another multivibrator stage was added. The consistent results obtained from this circuit made it evident that the addition was justified.

Adjustment and Operation

To adjust the circuit first apply voltage to all filaments and plate supplies except the plate of the thyratron. Place a cathode-ray oscilloscope across one of the plate resistors of the first multivibrator, and by varying the grid resistance adjust it to give an output of 30 cycles per second. Leaving this adjustment at 30 cycles, vary the grid resistance of the next stage to give a 10-cycle output. After allowing the thyratron five minutes in which to warm up, apply a plate voltage. With the scope placed as indicated on the diagram adjust the bias of the 1852 until a single half sine wave appears on the scope.

JMC:ht

J. M. Cooper

J M Cooper
Oct. 15, 1942

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THIRD ANGLE PROJECTION

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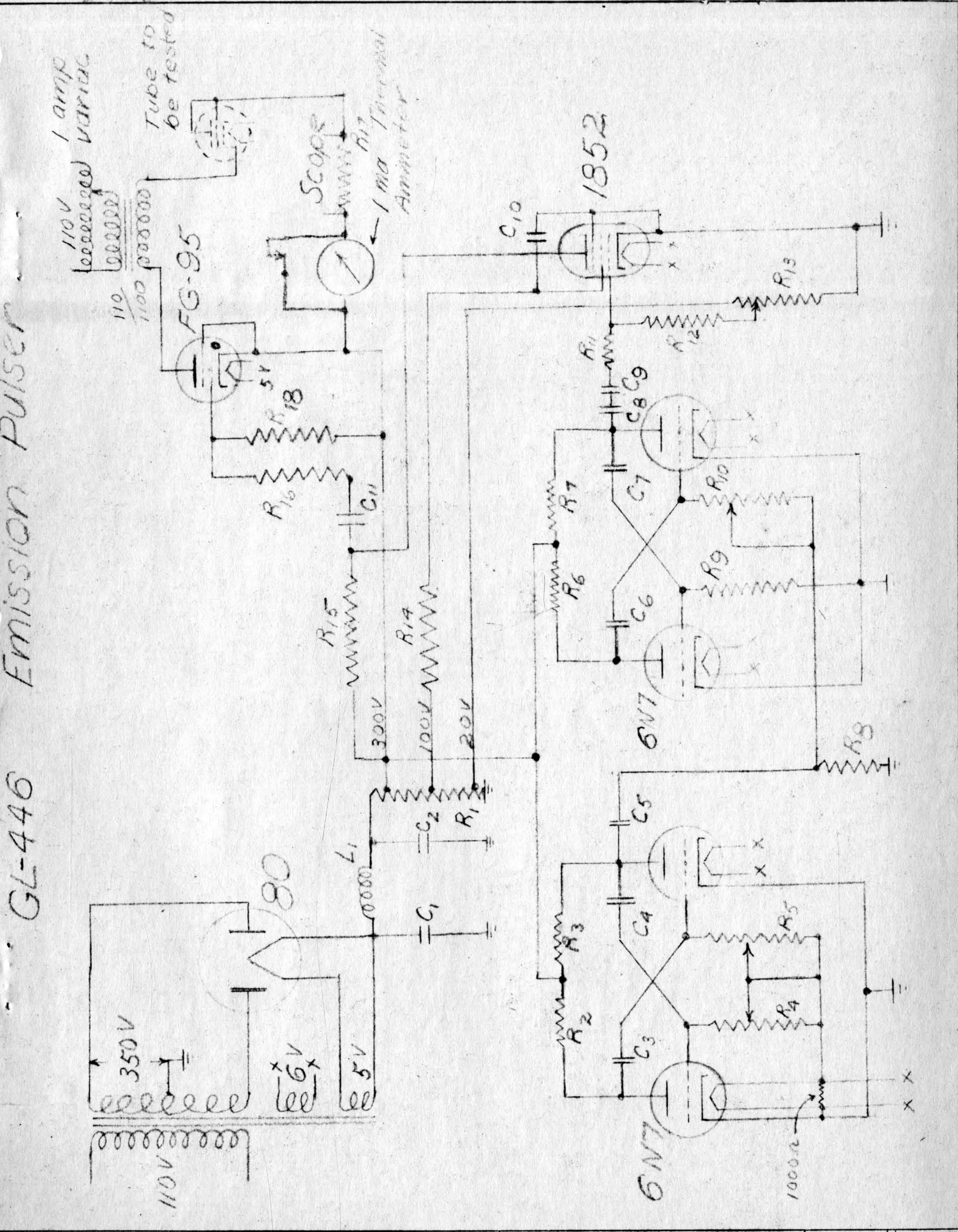

REVISIONS	MADE BY J M Cooper	INSPECTED BY BSA 10/16/42	
	GENERAL ELECTRIC WORKS	K- SHEET NO. 1 CONT. ON SHEET	PRINTS TO

FF-449-A (1-41)

PRINTED IN U.S.A.

NOMENCLATURE FOR GL-446 EMISSION PULSER

R1 - 20,000 ohms - 100 watts divideohm
R2 - R3 - .25 meg.
R4 - R5 - .25 meg. ganged pot.
R6 - R7 - .5 meg.
R8 - .2 meg.
R9 - .2 meg.
R10 - 75 M
R11 - .5 meg.
R12 - .5 meg
R13 - 10 M pot.
R14 - 20,000 ohms
R15 - 600 M
R16 - .5 meg
R17 - 2,500 ohm - 10 watt
R18 - .3 meg

C1 - C2 - 8 mfd.
C3 - C4 - .05 mfd.
C5 - .1 mfd.
C6 - C7 - .5 mfd
C8 - .025 mfd.
C9 - .5 mfd.
C10 - 2 mfd.
C11 - 1 mfd.

L1 - 20 henries