from RMA registration #135,
April 15, 1938

OA4-G

GAS-TRIODE

Cold-Cathode Starter-Anode Type

The OA4-G is a cold-cathode, glow-discharge tube. The discharge can be initiated with a very small amount of electrical energy supplied to the starter-anode circuit. This feature makes it practicable to obtain remote control of line-operated electrical devices by means of an electrical impulse generated at radio frequencies and transmitted over the same power line. The OA4-G may also be used as a voltage regulator or as a relaxation oscillator.

TENTATIVE DATA

MAXIMUM OVERALL LENGTH	4-1/8"
MAXIMUM DIAMETER	1-9/16"
BULB	ST-12
BASE	Small Shell Octal 6-Pin

CHARACTERISTICS

PEAK ANODE BREAKDOWN VOLTAGE (Starter-anode tied to cathode)	225 *min.*	Volts
PEAK POSITIVE STARTER-ANODE BREAKDOWN VOLTAGE	70 *min.*	Volts
	90 *max.*	Volts
STARTER-ANODE CURRENT (For transition of discharge to anode at 140 volts peak)	100 *max.*	Microamperes
STARTER-ANODE DROP	60 *approx.*	Volts
ANODE DROP	70 *approx.*	Volts

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

Relay Service

PEAK CATHODE CURRENT	100 *max.*	Milliamperes
D-C CATHODE CURRENT	25 *max.*	Milliamperes
TYPICAL OPERATION WITH A-C SUPPLY:		
Anode-Supply Voltage (RMS)	105-130	Volts
A-C Starter-Anode Voltage (Peak)	70 *max.*	Volts
R-F Starter-Anode Voltage (Peak)	55 *min.*	Volts
Sum of A-C and R-F Starter-Anode Voltages (Peak)	110 *min.*	Volts

INSTALLATION and APPLICATION

The *base* pins of the OA4-G fit the standard octal socket which may be installed to hold the tube in any position. Socket connections are shown on page 4.

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As a *relay tube*, the OA4-G should be operated according to the conditions given under MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS.

A schematic circuit showing the use of this type is given on page 4. In this circuit, full line voltage is applied between anode and cathode. The starter-anode is maintained at a potential just below that required for breakdown by means of the bleeder consisting of R_1 and R_2. The inductance L and the condenser C constitute a tuned circuit in series with the line. When a carrier having the frequency of the tuned circuit is impressed on the power line, a resonant voltage appears across L and C. The effect of the voltage across the condenser C is to increase the negative potential peaks on the cathode and thus to increase the potentials between cathode and starter-anode. These peaks start a discharge between cathode and starter-anode. This discharge produces free ions which enable the discharge to transfer to the anode if circuit values are such that sufficient starter-anode current flows. After the discharge occurs between cathode and anode, current flows through the relay S to close the contact of a local circuit. Because a.c. is supplied to the anode, the OA4-G ceases to discharge when the carrier is removed.

If the OA4-G is to be operated from a d-c power line, it will be necessary to provide means for reducing the anode voltage to a value under 60 volts (extinction voltage). This can be conveniently done by opening the anode circuit.

It will be noted that most of the voltage on the starter-anode required to cause breakdown is supplied by the bleeder circuit. As a result, the tuned circuit is required to supply only the difference between breakdown voltage and applied a-c voltage. Precautions should be taken in the design of equipment so that at the highest line voltage, the a-c voltage applied to the starter-anode will not be sufficient to cause the OA4-G to break down; and so that at the lowest line voltage, the carrier voltage will be high enough to make up for low line voltage. It is recommended, therefore, that provision be made to supply an r-f starter-anode voltage having a minimum peak value of 55 volts.

Typical breakdown characteristics of the OA4-G are shown in Fig.1, for conditions where the starter-anode and anode are either positive or negative, respectively. The tube is designed to be operated so that the discharge takes place when the starter-anode and anode are both positive (first quadrant). For purposes of illustration, values are also shown in the other quadrants for other polarity combinations. Operation in these quadrants is unstable.

In the first quadrant, it will be noted that the OA4-G breaks down between cathode and starter-anode when the starter-anode voltage reaches 85 volts approximately. This discharge initiates a discharge between cathode and anode, provided the anode potential is adequate. The required anode potential is a function of the current

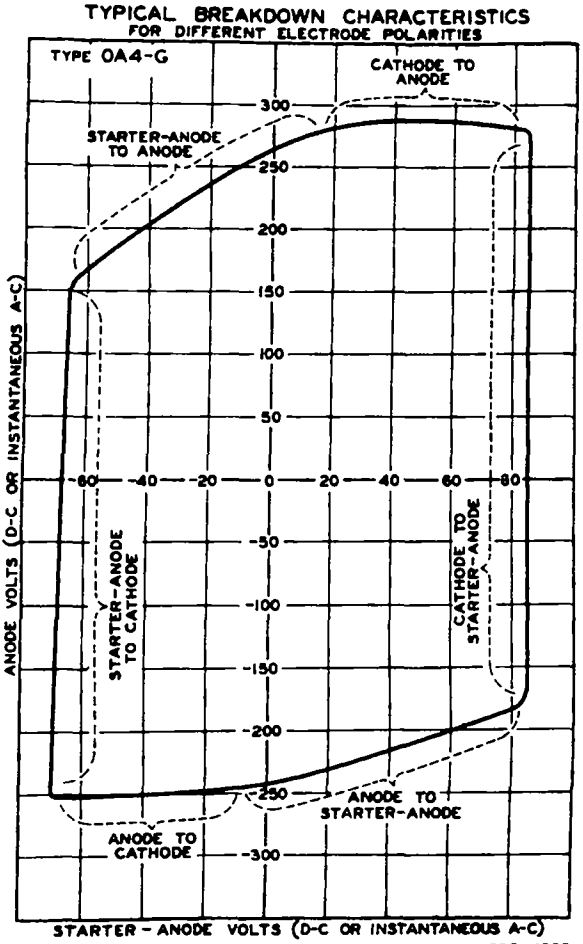


FIG. 1 92C-4899

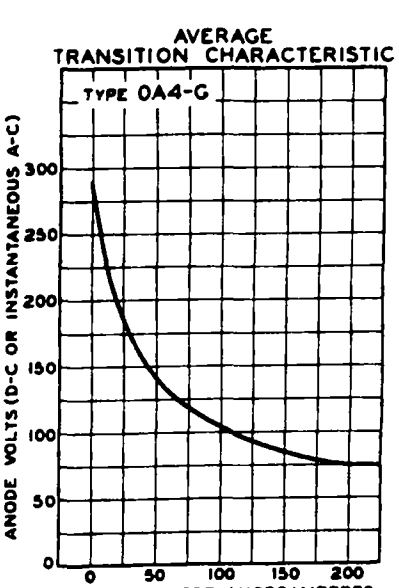


FIG. 2 92C-4897

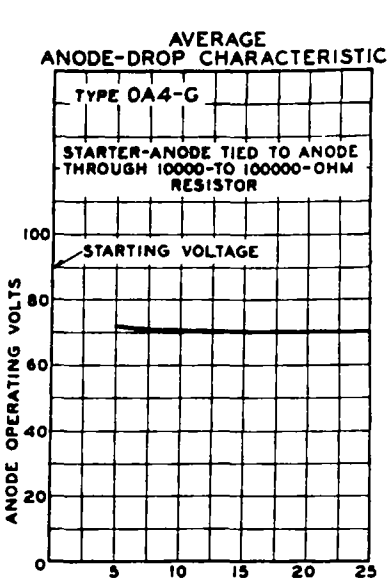


FIG. 3 92C-4898

flowing in the starter-anode circuit. The relationship between anode voltage and starter-anode current is shown in Fig.2. In practice, it is desirable to have a current of at least 200 microamperes flowing to the starter-anode.

READING LIST

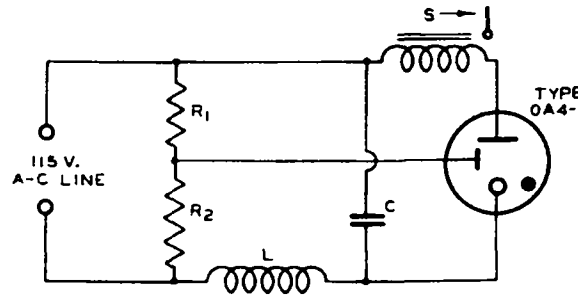
Darrow, K.K. *Electrical Phenomena in Gases.* Williams and Wilkins, Baltimore, Md.

Dow, Wm. G. *Fundamentals of Engineering Electronics.* John Wiley and Sons, Inc., New York, N.Y.

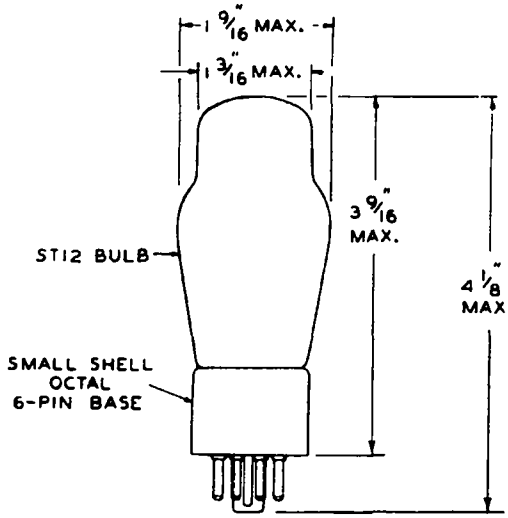
Thomson, J.J. *Conduction of Electricity through Gases.* Cambridge University Press, Oxford, England.

Townsend, J.S. *Electricity in Gases.* Claredon Press, Oxford, England.

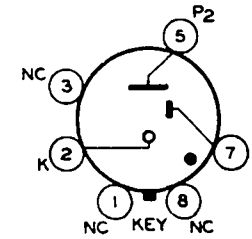
SCHEMATIC RELAY CIRCUIT USING TYPE OA4-G
A-C OPERATION



C, L = HIGH-Q TUNED CIRCUIT FOR R-F SIGNAL
R_1 = 15000 OHMS (½ WATT)
R_2 = 10000 OHMS (½ WATT)
S = RELAY—CHOSEN FOR DESIGN REQUIREMENTS
● = GAS TUBE TYPE



BOTTOM VIEW
OF SOCKET CONNECTIONS



G-4V
P_1 = STARTER-ANODE
P_2 = ANODE
K = CATHODE
NC = NO CONNECTION