NATIONAL UNION
TYPE 2005
VIDEOTRON

FIVE INCH ELECTROSTATIC DEFLECTION TYPE TELEVISION PICTURE TUBE

National Union Videotron Type 2005 is a cathode ray tube designed primarily for the resolution of television pictures and is used in circuits designed to resolve television signals. The 2005 finds a use in all fields where an experimental television picture signal is available. This field includes experimental laboratories, schools, colleges, radio clubs, radio experimenters, radio amateurs and all others such as radio set manufacturers, radio broadcasting stations and trade schools. Because of its exceedingly fine trace it is also an excellent oscillograph tube.

The Type 2005 is basically a five inch cathode ray tube of the electrostatic type in which the fluorescent screen material is a phosphor suitable for television. Electrodes in the 2005 provide a focused beam of electrons which impinge upon the fluorescent screen, producing an easily modulated pattern.

The picture detail provided by the 2005 is adequate for resolving a modern 441 line interlaced television picture.

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TENTATIVE CHARACTERISTICS AND RATINGS

Heater Voltage—AC or DC	2.5 Volts
Heater Current	2.1 Amperes
Overall Length	16¾"±¼"
Maximum Diameter	5 5/16"
Bulb Dimensions (See Figure 2)	
Base	Large Octal
Direct Interelectrode Capacities	
Grid to all other electrodes	12 Micro-microfarads Max.
High Voltage Anode No. 2	2000 Volts Max.
Focusing Electrode Anode No. 1	(Adjust for sharpest focus) Max 1000v.
Grid No. 2	+200
Grid Voltage for Cut-Off	—35 Volts
Screen Input	10 Milliwatts per sq. cm. Max.
Deflection Sensitivity	
D_1 and D_2	.5 Millimeters/volt at 1200 on A_2
D_3 and D_4	.56 Millimeters/volt at 1200 on A_2
Picture Detail	441 Lines

TYPICAL OPERATION

Heater Voltage	2.5 Volts
Anode No. 2 Voltage	1500—2000 Volts
Anode No. 1 Voltage	700 Volts Approx.
2nd Grid Voltage	200 Volts
1st Grid Voltage—adjust to give desired brilliance	(never positive)

The handling of the National Union 2005 in transportation and storage requires considerable care because a tube may be broken or damaged if subjected to sudden jars or excessive strain. When the 2005 is transported, the tube should be protected from moisture and in no case should the tube be placed on or slid across a hard surface. Such practice may result in scratches at the screen end of the bulb which might lead ultimately to cracks and subsequent destruction of the tube. The bulb should never be subjected to extreme or rapid temperature changes. When a 2005 is removed from its associated apparatus, it is recommended that the bulb be stored in its original carton. The base pins of the 2005 fit the standard large octal socket which can be installed for the operation of the tube in any position. The socket should be made of good insulating material, preferably one of the better ceramics. The heater is designed to operate at 2½ volts. The transformer winding supplying the heater voltage should be designed to operate the heater at the rated voltage under average line voltage conditions. This transformer should be insulated to stand the full high voltage or a total of 2000 volts. Although the filter requirements are simple, a one microfarad paper condenser either side of a 1000 henry choke is desirable in order to avoid ripple appearing in the picture output.

It is important to note that the input power to the fluorescent screen should not exceed 10 milliwatts per square centimeter. A power input in excess of this rating may cause serious loss of light output from the screen or partial destruction of the screen itself. The spot should always be kept in motion over a large area of the fluorescent screen by adequate voltage to the deflecting plates.

In Fig. 1, a typical circuit is given employing the 2005 to resolve a standard television picture. Multivibrators are used as sweep oscillators and a superheterodyne type of television receiver is employed to pick up the signals. Electrode potentials, deflecting plate bias and grid bias are obtained from bleeders and potentiometers across proper portions of two DC power supplies. The range of such a receiver is a function of its sensitivity which has been made adequate to resolve pictures within a 30 mile area of the transmitter.

It is advisable before building a receiver of this type to make certain—first—that the receiver will be used within approximately 30 miles of the transmitter and that adequate signals in this 30 mile range can be heard on an ultra high frequency receiver, designed to receive signals at or near 45 mc. With the exception of unusually good locations, it is usually futile to attempt to resolve a television signal of an intensity of less than 1 millivolt, as the noise level of the surrounding interference is usually so high that the picture will be marred by static in the form of light and dark blotches on the fluorescent screen, masking a good deal of the picture detail.

As the receiver designated in the schematic of Fig. 1 was designed to perform as simply as possible, it was not considered necessary to employ circuits which might add unnecessary complications, therefore, automatic volume control is not used nor is an automatic means of setting the background brightness employed. Both of these features are manual, the picture detail however, will be adequate for complete enjoyment of such programs as are being experimentally transmitted.

The receiver and sweep circuit controls can be assembled on a 10" x 24" chassis and the power supply transformers, chokes and condensers mounted on a second chassis. This is both necessary and desirable as the magnetic fields of the power transformers may be strong enough to distort the pattern should the transformers be placed too close to the cathode ray tube. Standard volume control type potentiometers are used throughout and with the exception of the decoupling resistor in the 6V6G final video stage, all resistors can be of the 1 watt variety. In general by-pass condensers can be electrolytic or of paper, although some of the smaller capacities, particularly in the high frequency portion of the receiver can economically be of the mica type. Wherever high frequencies are being employed all electrolytic condensers should be by passed with paper condensers. Care should be taken in the video amplifier, to avoid control grid or anode capacity to ground, such as would result from fastening grid to plate or plate to grid coupling condensers to the chassis by metal bands or employing metal case condensers.

The sweep circuits are of the miltivibrator type and are easily synchronized. Care should be employed to insulate the cathode of the cathode ray tube and the wiring leading thereto well from the ground. This voltage is DANGEROUS and should be treated with the utmost respect. Good regulation in the low voltage power supply for the receiver is absolutely essential. Only large heavy duty transformers should be employed to generate this DC. A supply which will give well filtered DC at a potential of 300 volts with sufficient reserve to allow a drain of 200 mils will be found satisfactory. Proper adjustment of the sweep circuits and the synchronizing separation and selector circuits can best be accomplished when receiving a television signal. At this time adjustment of the IF transformers, staggering them somewhat, will result in a considerable improvement in picture detail with but a slight loss in gain as the response of the intermediate frequency amplifier is widened. In the circuits employed, little or no phase shift will result from this practice.

The overall gain of the receiver was measured and found to be better than 50,000. It will respond to and reproduce a picture with a 1/10th millivolt signal, although a stronger signal is much more desirable. The over-all gain of the receiver is controlled in the cathode circuit of the first IF stage. Means are provided for positioning the pattern, for setting the sweep frequencies in both directions, for focus, average brightness, videotron grid bias and synchronizing impulse selection and separation. Each of the RF circuits in the high frequency portion of the receiver is independently tuned.

A receiver of the above design was assembled and tested on a standard television picture. The results were gratifying and the operation of the receiver was not found to be critical.

It is advisable that amateurs or experimenters, who have not had experience in the operation and design of receivers which operate in the ultra high frequency band, review the literature before attempting to build a receiver.

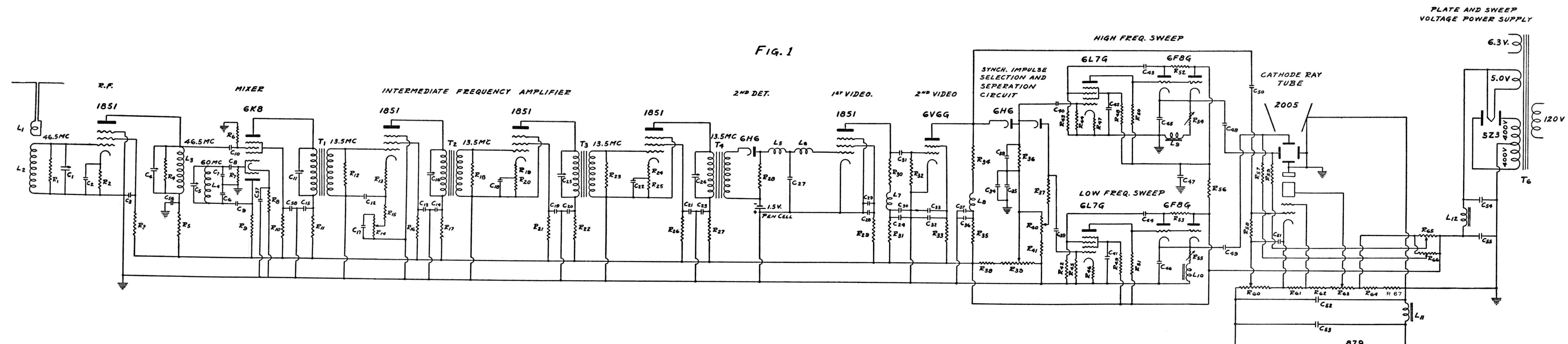
REFERENCES:

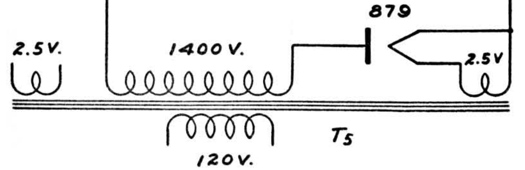
QST—December, January, February, March, April, May 1937—1938—*M. P. Wilder*

Electronics — 1937 *and* 1938

Television Vol. I and II *RCA Technical Press*

FIG. 1





HIGH VOLTAGE POWER SUPPLY

RESISTORS

R1 1,500 ohms
R2 — 150 ohms
R3 60,000 ohms
R4 1,500 ohms
R5 5,000 ohms
R6 —250,000 ohms
R7 25,000 ohms
R8 300 ohms
R9 — 50,000 ohms
R10— 60,000 ohms
R11— 5,000 ohms
R12— 1,500 ohms
R13— 10 ohms
R14— 2,000 ohms pot.
R15— 150 ohms
R16— 60,000 ohms
R17— 5,000 ohms
R18— 1,500 ohms
R19— 10 ohms
R20— 150 ohms

R21— 60,000 ohms
R22— 5,000 ohms
R23— 1,500 ohms
R24— 10 ohms
R25— 150 ohms
R26— 60,000 ohms
R27— 5,000 ohms
R28— 2,500 ohms
R29— 60,000 ohms
R30— 2,000 ohms
R31— 5,000 ohms
R32— 2 Megs.
R33— 60,000 ohms
R34— 1,200 ohms
R35— 5,000 ohms
R36— 25,000 ohms
R37— 5,000 ohms
R38—120,000 ohms
R39—100,000 ohms pot.
R40—250,000 ohms pot.

R41—250,000 ohms
R42— 5 Megs.
R43— 5 Megs.
R44— ½ Meg.
R45— ½ Meg.
R46— 1,000 ohms
R47— 1,000 ohms
R48— 60,000 ohms
R49— 60,000 ohms
R50—100,000 ohms
R51—100,000 ohms
R52— 2,000 ohms
R53— 2,000 ohms
R54— 50,000 ohms pot.
R55—100,000 ohms pot.
R56— 3,000 ohms
R57— 1 Meg.
R58— 2½ Meg.
R59— 1 Meg.
R60— 50,000 ohms

R61—200,000 ohms
R62—300,000 ohms
R63—300,000 ohms pot.
R64— ½ Meg.
R65— 1 Meg. pot.
R66— 1 Meg. pot.
R67— 2 Megs.

CONDENSERS

C1 — 50 µµf
C2 — .05 µf N.U. T-405
C3 — .05 µf N.U. T-405
C4 — 50 µµf
C5 — 75 µµf
C6 — 50 µµf
C7 — 50 µµf
C8 —100 µµf
C9 —100 µµf

C10—100 µµf
C11—TRIMMER
C12— .05 µf N.U. T-405
C13— .05 µf N.U. T-405
C14— .05 µf N.U. T-405
C15— .05 µf N.U. T-405
C17— ¼ µf N.U. T-425
C16—TRIMMER
C18— .05 µf N.U. T-405
C19— .05 µf N.U. T-405
C20— .05 µf N.U. T-405
C21— .05 µf N.U. T-405
C22— .05 µf N.U. T-405
C23— .05 µf N.U. T-405
C24— .05 µf N.U. T-405
C25—TRIMMER
C26—TRIMMER
C27— 30 µµf
C28— .05 µf N.U. T-405
C29— 8 µf ELECTRO N.U. T-Can

CONDENSERS (Continued)

C30— 8 µf ELECTRO N.U. T-Can
C31— .1 µf N.U. T-410
C32— .05 µf N.U. T-405
C33— 8 µf N.U. T-Can
C34— 8 µf N.U. T-Can
C35— .05 µf N.U. T-405
C36— 8 µf N.U. T-Can
C37— .05 µf N.U. T-405
C38— .0025 µf
C39— .005 µf
C40— 2 µµf
C41— 8 µf N.U. T-Can
C42— 8 µf N.U. T-Can
C43— .002 µf
C44— .002 µf
C45— .001 µf
C46— .25 µf N.U. T-425
C47— 16 µf N.U. T-Can
C48— .1 µf N.U. T-410
C49— .25 µf N.U. T-425

C50— .05 µf 2000v. VC-S5 C-D
C51— 1 µf paper tube N.U. U-41
C52— 1 µf 2000v. N.U. OX-2001
C53— 1 µf 2000v. N.U. OX-2001
C54— 16 µf 425v. N.U. T-Can
C55— 16 µf 425v. N.U. T-Can
C56— .05 µf N.U. T-405
C57— .05 µf N.U. T-405
C58— .05 µf N.U. T-405

COILS

L1 —5 turns ¼" OD spaced 1 turn
L2 —7 turns ½" Mand. spaced ½ thickness (No. 12)
L3 —8 turns ½" Mand. spaced ½ thickness (No. 12)
L4 —7 turns ½" Mand. spaced ½ thickness (No. 12)
L5 —120 µh—175 turns on a ½ Mandrel of No. 34 enameled wire
L6 —120 µh—175 turns on a ½ Mandrel of No. 34 enameled wire
L7 55 µh— 85 turns on a ½ Mandrel of No. 34 enameled wire
L8 — 50 µh— 75 turns on a ½ Mandrel of No. 34 enameled wire

COILS (Continued)

L9 — 300 henries
L10—2000 henries
L11—1000 henries
L12— 30 henries Kenyon T-151

TRANSFORMERS

T1—T 100 13.5 Mc (Aladdin)
T2—T 100 13.5 Mc (Aladdin)
T3—T 100 13.5 Mc (Aladdin)
T4—T 100 13.5 Mc (Aladdin)
T5—Kenyon T-203
T6—Kenyon T-244

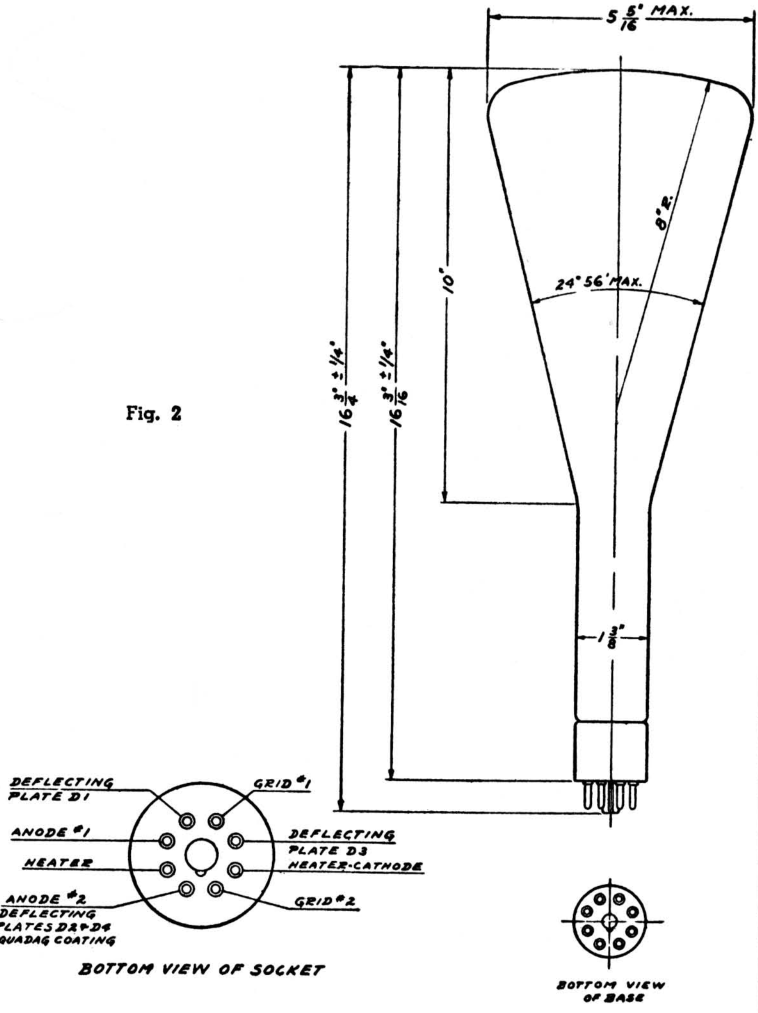


Fig. 2

NATIONAL UNION RADIO CORPORATION

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