



Tube Tips



A NEWSLETTER TO THE BROADCASTING INDUSTRY
RCA ELECTRON TUBE DIVISION, HARRISON, N. J.

High-Efficiency Thimble-Size Electron Tubes Made Possible by RCA 'Nuvistor' Design

RCA recently disclosed one of the most significant advances in electron tube history: a revolutionary development in electron tube design that represents a major breakthrough in tube size, performance, power drain, and reliability.

As stated by D. Y. Smith, Vice President and General Manager of the RCA Electron Tube Division, this radically new tube design concept "opens the way to mass production of high-performance, thimble-size tubes having improved ruggedness, reliability, and efficiency."

Broadcasters should take particular note that the new tubes, called "Nuvistors," will lead to important electronic developments in studio equipment and other instruments such as home television sets, communications receivers, and computers, as well as more compact and efficient electronic equipment for defense and industry.

Prototypes of the new RCA tubes are now in advanced development stages at the Division's laboratories in Harrison, N. J. Types in development include a beam power tube, a general-purpose small-signal triode, and a general-purpose small-signal tetrode. The triode and tetrode have already been demonstrated for representatives of the electronics industry, the military, and the press.

"Electron tubes," Mr. Smith said, "have by no means reached the limit of their low-cost, high-performance capabilities. Through the study of new materials, new processes, and new techniques, our engineers have not only developed the Nuvistor but foresee the practicality of even smaller tubes having power consumption reduced to one twentieth the power required for conventional tubes. They anticipate that receiving tubes of the Nuvistor design can have useful lifetimes of tens or even hundreds of thousands of hours."

The name of the new tube design is based on the words "nueva" meaning new and "vista" meaning prospect. Hence, the "new look" or "Nuvistor."

Present plans indicate that RCA expects to start limited commercial production of the Nuvistor tubes in 1960. Developmental samples of the "new look" tubes, on the other hand, will be furnished by RCA to electronic equipment manufacturers starting within the next several months.

In demonstrating the performance of its "new look" tubes, RCA showed a completely "Nuvistorized" tuner unit of a television set in operation. This tuner needs only a fraction of the plate voltage required by conventional tuners. This experimental tuner, believed to be among the smallest ever designed for TV receivers, re-



Using a magnifying glass, D. Y. Smith, Vice President and General Manager, RCA Electron Tube Division, examines the inside assembly of RCA's revolutionary thimble-size Nuvistor electron tube. In the foreground, three advanced developmental types of Nuvistor tubes—a triode, a tetrode, and a beam power tube—are shown left to right, respectively, beside their larger, present-day counterparts.

duces the overall volume of conventional tube TV tuner units by approximately one-third.

The ruggedness of the Nuvistor design was displayed in several torture and endurance tests. The tiny tube continued to function normally in an electronic circuit when placed alternately in the heating coils of a special furnace (660° F) and in liquid nitrogen (320° F). In another demonstration, the new tubes were shown operating continuously in both the special furnace and in liquid nitrogen. Operation of the Nuvistor tubes was not disturbed by a guillotine-type device which repeatedly subjected them to severe mechanical blows.

Mr. Smith further stated: "Because the tiny tubes

have improved electrical and thermal characteristics as well as improved reliability, we believe the Nuvistor will find a ready market in the television industry. The small-signal triode and small-signal tetrode, already well along in advanced development, will be of particular interest for TV tuner designs and intermediate-frequency amplifiers in view of their small size and excellent electrical characteristics. The beam power tube, now being worked on, is especially well suited for audio output and horizontal-deflection applications in television sets."

Nuvistor tubes, he said, are also expected to offer many advantages for high-speed data-processing equipment.

"The new small, high-efficiency triodes and tetrodes will find wide use in the logic and computing circuits of electronic computers. The beam power tube, capable of high peak current at low plate voltage, offers advantages for memory-core-driver applications, an important operation in which information is stored for later use. Furthermore, we envisage that the beam power tube could be utilized in series voltage regulators, low-power transmitters, servo amplifiers, and high-power sound systems for a wide variety of industrial applications."

Explaining the pertinent features of the Nuvistor's unique construction, Mr. Smith said:

"For ruggedness, we start with a strong ceramic base-wafer as a platform and erect an array of tube electrode assemblies on it. Each assembly is held rigidly in place by a tripod-like structure. Nuvistor tubes are

made of ceramic materials and strong metals such as steel, molybdenum, and tungsten.

"The electrodes are strongly supported from one end in a cantilever fashion, a method employed for bridge-building in which trusses are extended from piers. This construction feature eliminates the need for mica support discs or spacers. All the electrodes are small, light cylinders. They are able to withstand a high degree of shock or vibration because of their shape and low mass."

Mr. Smith cited the following advantages of the Nuvistor construction: (1) cylindrical symmetry and cantilever construction permit the use of accurate jigs for assembly; (2) brazing of assembly in accurate jigs produces a strain-free structure; (3) micas are completely eliminated; (4) high-temperature processing results in super-clean structure; (5) indexing lugs permit safe and easy insertion into tube socket; (6) tubes can operate in high temperatures; and (7) the tubes use no glass which might shatter under mechanical or thermal shock.

"Development of the Nuvistor design concept," he stated, "leads the way to further reductions in size and power requirements and to improved reliability and performance characteristics of electron tubes. Because of the many new techniques already uncovered, we believe that a complete line of tubes including damper tubes, vertical-deflection tubes, and high- and low-voltage rectifier tubes is assured. The 'new-look' design clearly confirms that the electron tube has not yet approached its theoretical limitations."

Station Engineers Throng RCA's NAB Exhibit; Product Display Accentuates 1-Inch, Low-Power-Heater Vidicons for Transistorized Cameras, Magnetic Recording Sound Tape for Broadcast Applications

At the annual NAB Show and Convention, held during the third week of March, visiting broadcasters were especially interested in the numerous RCA Electron Tube Division products on display at Chicago's Conrad Hilton Hotel. Featured in the RCA exhibit were a wide variety of new RCA tube types of appeal to radio and television station engineers, as well as 19 new RCA magnetic recording sound tape types for broadcast applications.

Among the tubes drawing considerable attention were two new 1-inch, low-power-heater vidicons, the RCA-7262 and -7263. They facilitate the design of small, compact, transistorized television cameras—both color and black-and-white.

Both the 7262 and 7263 have a short overall length of only $5\frac{1}{8}$ inches and employ a low-power heater requiring $6/10$ watt, one-third less than that of any other commercial vidicon.

A supplementary feature is the new camera tubes' fast cathode warm-up time.

RCA's 7262 and 7263 can produce pictures of broadcast quality with as little as one footcandle of highlight illumination on their faceplates. The resolution obtainable with both vidicons is about 600 TV lines. The design of the 7262 and 7263 utilizes nonmagnetic parts in the front end, an envelope without a side tip, and an optically flat faceplate free from optical distortion.

A high degree of uniformity of characteristics from tube to tube has been realized through the use of newly developed photoconductor processes. The photoconductive surface used in both tubes has uniform thickness which allows uniform sensitivity and dark current. As a result, these vidicons feature high effective sensitivity over the entire scanned area.

The RCA-7262 is designed for camera use in moderate

environmental conditions. Because it can produce substantially uniform sensitivity over the entire scanned area, the 7262 exhibits a degree of uniformity from tube to tube that makes it possible to obtain excellent color uniformity and balance when it is used in three-vidicon color cameras.

The RCA-7263, developed under military sponsorship, is designed to provide high-quality pictures under severe environmental conditions involving shock, vibration, humidity, and altitude. The internal structure of the 7263 is reinforced against shock and vibration by multiple bulb supports and glass beading that locks the electrodes in permanent relation to each other. Like the 7262, the 7263 can provide excellent color uniformity and balance when it is used in three-vidicon color cameras.

Distributor Resale prices (optional) are \$480.00 for the RCA-7262 and \$690.00 for the RCA-7263.

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Two new forced-air-cooled beam power tubes—the RCA-7203/4CX250B and -7204/4X250F—also invited considerable comment at RCA's NAB booth.

Both the 7203 and 7204 are very small, compact types. The ceramic-metal-seal construction employed throughout in these tubes can withstand operation at higher temperatures than a conventional glass-seal design, and thus provides improved reliability. A specially designed high-efficiency radiator which is brazed directly to the plate for better heat transfer makes possible a maximum plate-dissipation rating of 250 watts with no sacrifice in tube reliability.

The 7203 is useful as an af power amplifier and modulator, as a wide-band amplifier in video applications, as a linear rf power amplifier in single-sideband suppressed-carrier equipment, and as a class C amplifier



and oscillator. It can be operated with full ratings at frequencies up to 500 Mc.

The 7204 is identical to the 7203 except for heater rating. Whereas the heater in the 7203 is rated at 6 volts/2.6 amperes, the 7204 heater is rated at 26.5 volts/0.58 ampere.

Distributor Resale price (optional) is the same for both the 7203 and 7204: \$46.25 per tube.

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For use in airborne and fixed-station equipment, RCA exhibited another new forced-air-cooled beam power tube, the 7213, a UHF type with ceramic-metal seals. This tube is designed for use as a linear rf power amplifier and as a class C rf power amplifier. Small in size for its power capability, the 7213 has a maximum plate dissipation rating of 1500 watts and can be used with full ratings at frequencies up through the Aeronautical Radio-Navigation Band of 960 to 1215 Mc. Distributor Resale price (optional) is \$485.00.

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Eight new tubes for use in portable two-way mobile radio transceivers were also on display by RCA at the NAB Show. Identified as RCA types 7054, 7055, 7056, 7057, 7058, 7059, 7060, and 7061, these tubes are designed to operate over a heater voltage range of 12 to 15 volts.

RCA-7054 is a power pentode for use in class C rf power amplifier, oscillator, and frequency multiplier service at frequencies up to 40 Mc. It may also be used in modulator and af power amplifier applications.

RCA-7055 is a twin diode for use in low-current rectifier, detector, and speech-clipper applications.

RCA-7056 is a sharp-cutoff pentode. It is designed as an rf amplifier tube at frequencies up to 45 Mc.

RCA-7057 is a medium-mu twin triode for use as an rf amplifier tube in direct-coupled cathode-drive circuits at frequencies up to 200 Mc.

RCA-7058 is a high-mu twin triode for use in phase-inverter, resistance-coupled amplifier, and low-frequency oscillator circuits.

RCA-7059 is medium-mu triode—sharp-cutoff pentode for use as an oscillator and mixer tube at frequencies up to 40 Mc. The triode of this tube may also be used as an oscillator at frequencies throughout the VHF region, and as a high-perveance rectifier for noise-squelch circuits when connected as a diode.

RCA-7060 is a medium-mu triode—power pentode. The triode unit is particularly useful as a reactance modulator; the pentode unit as a class C rf amplifier and frequency multiplier at frequencies up to 40 Mc.

RCA-7061 is a beam power tube specifically designed for use as an af power amplifier.

Distributor Resale prices (optional) are: 7054, \$1.45; 7055, 95¢; 7056, \$1.10; 7057, \$1.85; 7058, \$1.20; 7059, \$1.60; 7060, \$1.95; and 7061, \$1.25.

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Every year, more tubes originally developed for military purposes are proving of increasing interest to broadcasters. Such a tube is the RCA-12AT7-WA,

“premium” high-mu twin triode. This 9-pin miniature type was another feature attraction in the RCA NAB exhibit of tubes for application in mobile equipment.

The 12AT7-WA may be used in radio-frequency amplifier circuits and high-speed switching applications. It offers dependable performance under difficult conditions where shock and vibration are involved.

Distributor Resale price (optional) of the RCA-12AT7-WA is \$3.05.

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Prompted by the growing interest in “ham-type” tubes by broadcasters, the RCA NAB exhibit included the 7094 high-perveance beam power tube, recently introduced for use by the radio amateur fraternity of which many broadcasters are members. This tube is intended for use as an rf amplifier, oscillator, af power amplifier, and modulator in both mobile and fixed-station equipment.

In cw service, the 7094 can be operated with 500 watts input (ICAS) at frequencies up to 60 Mc and with reduced input to 175 Mc. It has a maximum plate dissipation of 125 watts (ICAS). Because of its high power gain, the 7094 can function with relatively low plate voltage to give large power output with small driving power.

Small and compact for its power-output capability, the 7094 includes among its design features a strong button-stem construction with short terminal leads, a plate structure with large radiating fins for effective cooling, and ceramic mount supports which provide extra strength to the electrode structure.

Distributor Resale price (optional) of the RCA-7094 is \$31.95.

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In addition to the many RCA tubes, broadcasters paid considerable attention to the array of RCA magnetic recording sound tape on exhibit at the NAB Convention. This display highlighted RCA’s 19 new industrial sound tape types, all of which possess the excellent quality required for radio and television sound applications. These industrial types are available in three thicknesses, ¾, 1, and 1½ mil, and are designed to NAB and EIA reel and hub specifications.

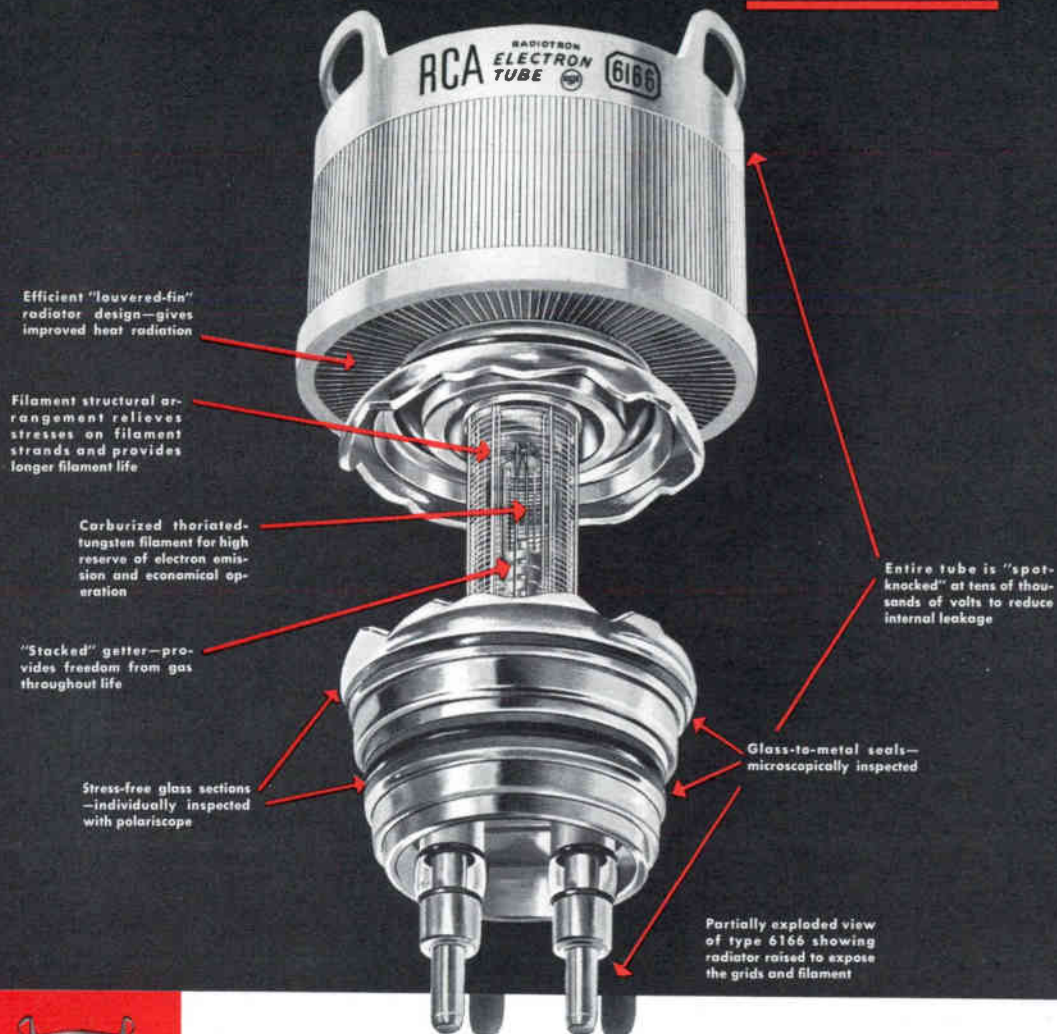
Eight of the new RCA tapes (269C1, 270C1, 271C1, 272C1, 276C1, 277C1, 278C1, 279C1) are 1.0-mil Long-Play types; three of them (273C1, 274C1, 275C1) are Extra-Long-Play types made from tensilized “Mylar,” the registered trade-marked Dupont polyester film; and eight of them (265C1, 266C1, 267C1, 268C1, 280C1, 281C1, 282C1, 283C1) are Professional Grade tapes with a thickness of 1.5 mil.

RCA’s 19 industrial sound tape types are available on 10½-inch reels and hubs and are intended for the exacting requirements of radio and television sound. They are also excellent for use in commercial sound studios. Frequency response is essentially flat throughout the entire audio spectrum, and the output is uniform from reel to reel.

The oxide coating of RCA sound tape is impregnated with dimethyl silicone. This coating provides a built-in dry lubricant which safeguards the life of the recording heads by reducing friction and wear. Oxide dispersion is uniform and the strict quality control imposed by RCA on tape manufacture insures high-level recording with low distortion.

List prices (optional) of the 19 new RCA tape types are as follows: 265C1, \$8.50; 266C1-269C1 are \$10.90 each; 270C1-272C1 are \$12.85 each; 273C1-275C1 are \$20.50 each; 276C1, \$12.00; 277C1-279C1 are \$14.40 each; 280C1, \$12.10; and 281C1-283C1 are \$14.50 each.

RCA Power Tube features keep "VHF" hour meters clicking



Efficient "louvered-fin" radiator design—gives improved heat radiation

Filament structural arrangement relieves stresses on filament strands and provides longer filament life

Carburized thoriated-tungsten filament for high reserve of electron emission and economical operation

"Stacked" getter—provides freedom from gas throughout life

Stress-free glass sections—individually inspected with polariscope

Entire tube is "spot-knocked" at tens of thousands of volts to reduce internal leakage

Glass-to-metal seals—microscopically inspected

Partially exploded view of type 6166 showing radiator raised to expose the grids and filament



Take the RCA-6166, for instance. "Tailored" specifically to supply the aural and visual power-amplifier requirements of medium- and high-power VHF transmitters, this RCA Power Tetrode type has been running up remarkable life-performance records.

What's back of long-term RCA power-tube reliability? First, RCA tube engineers work hand in hand with transmitter designers and station

engineers—to take measure of RCA tube performance "in the circuit". Second, RCA tube engineers never "let go" in their effort to evolve superior manufacturing techniques and design improvements to make good tubes even better.

For lower tube cost per hour of transmitter operation, always specify RCA. Your RCA Electron Tube Distributor provides "on the spot" delivery.

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