Techni-talk

COMPLETE ELECTRONIC SERVICING INFORMATION

radio · tv · hi-fi

VOL. 12 No. 2 MAR.–MAY, 1960

GE WIRELESS REMOTE CONTROL SYSTEM II

The transmitter portion of the General Electric remote control system was described in the last issue. In this issue the receiver circuits will be discussed. A block diagram of the wireless remote receiver is shown in Fig. 1 and the schematic in Fig. 2.

Receiver Circuit Analysis

The remote receiver utilizes two receiver type vacuum tubes in conventional circuitry. A ferrite rod antenna, mounted with the receiver unit, incorporates a variable trimmer capacitor for means of tuning the antenna circuit.

The signal, having been picked up by the antenna assembly, is amplified by a tuned r-f stage using a 6EW6 pentode as an amplifier. The amplified r-f signal is coupled to the triode section of a 6EA8 by means of a high "Q" double tuned interstage transformer. The triode acts as a bias detector and since limiting must also be accomplished by the triode, a sensitivity control (R605) is used in the plate circuit. This control allows the plate voltage of the triode to be adjusted so that plate saturation will occur with a predetermined amplitude of input signal to the receiver.

After detection, the audio signal is amplified and further limited by a power amplifier stage, using the pentode section of the 6EA8, and is then applied across the coil of the reed relay assembly. The applied audio signal causes a magnetic field to be developed in the relay coil which is modulated at an audio rate.

Metal Reeds

Since the metal reeds are located within the magnetic field of the coil, one of the reeds whose resonant frequency corresponds to the selected audio frequency, is made to vibrate. Each of the four reeds, in the reed assembly, is resonant to a different frequency, 30cps apart, therefore each of the individual reeds corresponds to a different function of the remote system.

The reed contact points are connected to a corresponding sensitive relay coil, and when the system is idling the reed contact points are normally open. When the audio mod-

(Continued on page 11)

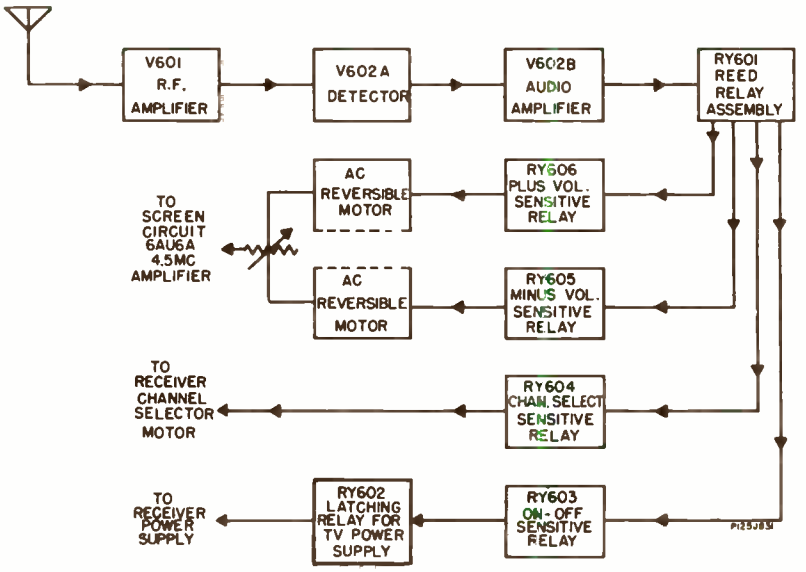


Fig. 1 Block Diagram of Remote Receiver

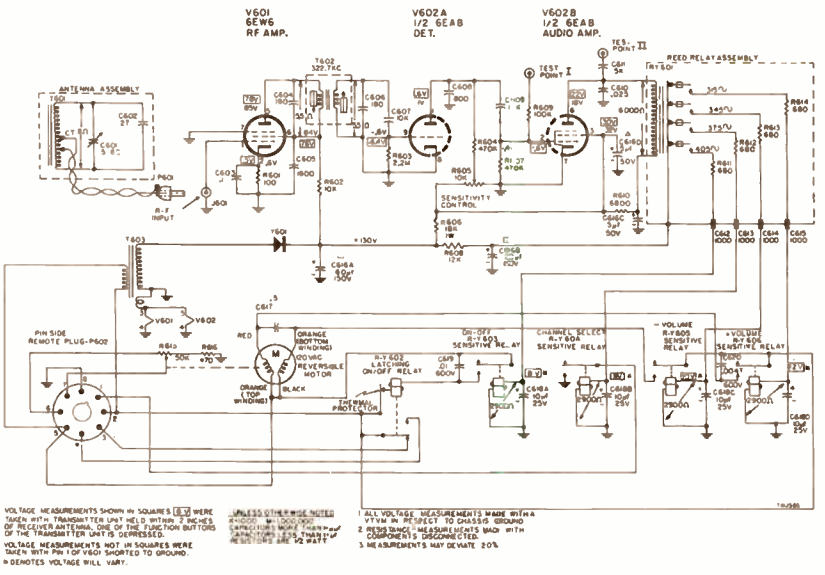


Fig. 2 Schematic Diagram of Remote Receiver

SUCCESSFUL SERVICE MANAGEMENT

PLANNING FOR SUCCESS IN THE SOARING SIXTIES

By Andrew E. Kimball
Manager, Marketing Research, Receiving Tube Department
General Electric Company, Owensboro, Kentucky

The new decade has often been called "The Soaring Sixties". This is an appropriate description. The period should see spectacular developments leading to the most exciting and rewarding period in our history.

The long range future in the U.S. will be one of substantial economic growth and prosperity, with a few bumps but no major let-downs. This growth is soundly based on America's effective utilization of brains, manpower, materials and money plus a philosophy of investment for growth.

Perhaps the most spectacular growth industry of our time is electronics. The history of past growth will extend into the Sixties. We'll see continued growth and innovation in the consumer electronics field as well as the rapid development of new technologies in electronics for military, industrial, and space markets.

Today, electronics is the fifth largest industry in the U. S. In 1959, manufacturers produced $9 billion worth of electronic goods. Distributing, serving and broadcasting revenues amounted to another $5 billion, adding up to the impressive total of $14 billion. This was over three times the total ten years ago. In the next ten years the industry should more than double again — to about $30 billion.

Electronic Product Market

In the consumer electronics area, television will continue to be tremendously important. Inventions are expected to make color TV more economical and thus more widely used. Radical design changes may be expected as new types of screens become available. Radios will continue to be very important, with wristwatch radios and transmitters a possibility.

Hi-fidelity phonographs will be even more widely used. New type recording devices to preserve both sound and picture of TV programs are possible consumer items. Electronic ovens, door openers, and electronic organs will become more popular consumer products. Electronic ignition systems for autos, plus electronic safety devices and traffic controls may well be in the sights of the Sixties. Even phonevision may become practical before many years go by — the combination of sight as well as voice in personal communication devices.

The following table illustrates the trend in the market of greatest interest to service dealers.

U.S. Service Market

1955	1960	1965
TV Sets in use (millions)		
32	52	65
Radio Sets in use (millions)		
116	137	160
Service & Parts Revenue (billions)		
$2.1	$2.5	$3.0

The significant market growth facing service dealers presents both opportunities and challenges. Even in times of market growth, many businesses fail. This is a characteristic of our economy and is one of the conditions of our competitive free enterprise system which augments growth. The strongest and smartest competitors survive and the weakest firms with the least to offer die.

The servicing industry faces the challenge of increasing competitiveness within its own ranks. More than ever before, dealers will face this challenge. There will be plenty of opportunity in an enlarging market, but the greatest rewards will accrue to those who meet the challenge best.

Market Opportunities

A key to success in modern business is the ability and willingness to look ahead at the market opportunities, recognize the changing conditions and then set plans to be sure to earn a fair share of the market growth.

The successful service dealer will want to plan for improvement in technical skills. New products and new designs dictate a need for continuing self-development. Help is provided by manufacturers, distributors, trade publications, technical books, and service associations.

The successful service dealer will want to plan for improvement in sales skills. He will want to learn how to develop his market — promote his business, attract new customers and keep them satisfied. These goals involve improvement in personal selling, in advertising and sales promotion, and customer relations abilities.

Improvement Areas

The successful service dealer will want to plan for improvement in business management skills, for example, better accounting systems, inventory control, expense control, hiring and training technicians, and generally running a more efficient and tighter shop. Recognition of service dealers desire to improve their own skills in business management and selling has prompted General Electric to provide our "Profitable Service Management" program.

The successful service dealer will want to plan for improvement in business practices. Pricing for profit is a key factor. The following three principles are important to remember in pricing for profit.

—Price fairly for both the customer and the dealer
—Price competitively
—Price so as to cover all costs (overhead, depreciation, materials, salaries) and provide an adequate return on money invested in the business.

The future should be exciting and rewarding — but the reward will be greatest for those who recognize the opportunities, accept the challenges, and convert them into *profitable* realities.

FULL LINE OF G-E AUDIO TUBES

A full line of General Electric audio tubes to deliver top performance in high-fidelity equipment is now available.

This audio tube line is termed a "break-through in performance," and includes eleven receiving tubes specifically designed to handle with top efficiency every tube function of high-fidelity equipment.

All tubes feature 3-ply (rectifiers) and 5-ply (power output) plate material.

The eleven tubes in General Electric's audio line are: 5AR4, 6BQ5, 6CA4, 6DZ7, 6L6GC, 7025, 7189A, 7247, 7355, 7408 and 7581.

G-E audio tubes deliver top performance in high-fidelity equipment.

Technni-talk

COMPLETE INDEX

Vol. 1, No. 1 through Vol. 12, No. 2

HOW G-E PICTURE TUBE PHOSPHORS ARE MADE

"Research, technical design, and manufacturing control are three keys to product quality. To these add liberal amounts of tested raw materials and mix well for utmost customer satisfaction."

In maintaining its reputation for product quality the General Electric Company relies heavily on the services of thousands of external suppliers of raw material, some large, some small. In the case of many critical items to insure maximum quality control and continued improvements the General Electric Company manufacturers its own raw materials and parts. In the electronic tube field this includes such important items as certain of its glass requirements, bases, filaments, lead wires, critical chemicals and many others. In this article the General Electric manufactur of phosphor, an important picture tube ingredient, is described.

The story of television is not complete without a chapter on phosphor and its function in a television picture tube. Briefly a phosphor is a material which is capable of absorbing certain kinds of energy (ultraviolet, x-rays and cathode rays are examples), then releasing this energy in the form of visible light. When the exciting energy is absorbed, a slight change occurs in the structure of certain atoms in the phosphor. The light is emitted as the atom returns to its original structure. This sequence of events is called the process of luminescence.

The screen is made up of a uniform thin layer of fine phosphor particles. A fourteen-inch screen contains over three billion of these fine particles. A screen is formed by allowing the phosphor powder to settle out of suspension onto the faceplate of the glass bulb, then carefully decanting the liquid and drying.

A phosphor in general is composed of two essential parts: one is the base material or "matrix" while the other is the "activator" which is a specially chosen impurity incorporated into the base material in very small amounts at very high temperature. Often, and this is true of those phosphors used in picture tubes, a second special activator or "co-activator" must be used to enable the activator to locate properly in the matrix.

The quality of a picture tube phosphor is determined by the processes used by the phosphor manufacturer and the controls he exercises over these processes, just as the quality of the television picture tube is determined by the tube manufacturer's choice of materials (including, of course, phosphor) and processes and the effectiveness of his controls.

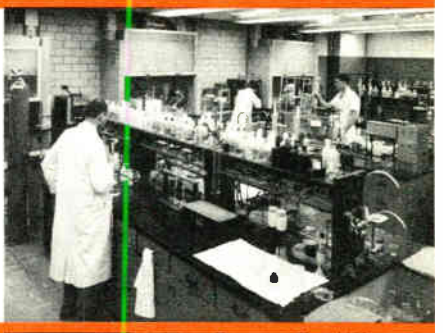
General Electric television picture tube phosphors are engineered and produced at Cleveland, Ohio, in facilities especially designed for phosphor operations. Here, critical control, as shown in the pictures, of the entire manufacturing process assures the quality of General Electric picture tubes.

Particle Size

Particle size distribution has a significant effect on screen appearance. Here, a technician is shown measuring the particle size of a General Electric picture tube phosphor using the recording sedimentation pan balance, a device developed by G-E engineers.

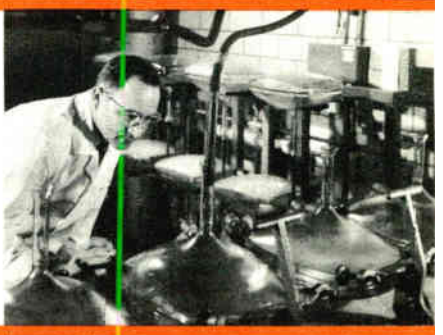
Pure Materials

Because extremely pure raw materials are required to assure bright picture tube screens, ultra-sensitive methods of chemical analysis have been developed in this laboratory.



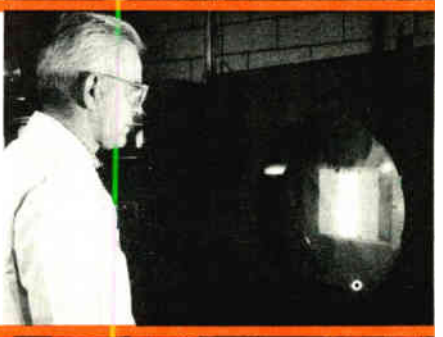
Screen Settling

An engineer in the phosphor plant is shown checking the screen settling properties of a new phosphor designed to improve the brightness and appearance of picture tubes. Before acceptance a lot will be sent to the tube factory and subsequent tests on production equipment will determine acceptibility.



Phosphor Color Mix

A technician employs a demountable tube (an evacuated mechanical device simulating an operating tube) to evaluate phosphor color mix against a color standard plaque. This permits blending to desired standards and permits "lot to lot" uniformity.



Color Control

The engineer is operating a General Electric recording spectroradiometer used for color control of electronic phosphors. It can measure color many times more accurately than the human eye.

Turn Time into Dollars with

Your time is the most important thing you have to sell. Make every minute count, by organizing your working day for profits! General Electric's new Service Call Board makes this easy for you. At a glance, you are told what calls you must make, where and when . . . pick-ups and deliveries that are scheduled . . . customers to be seen or phoned. Everything is down in black and white.

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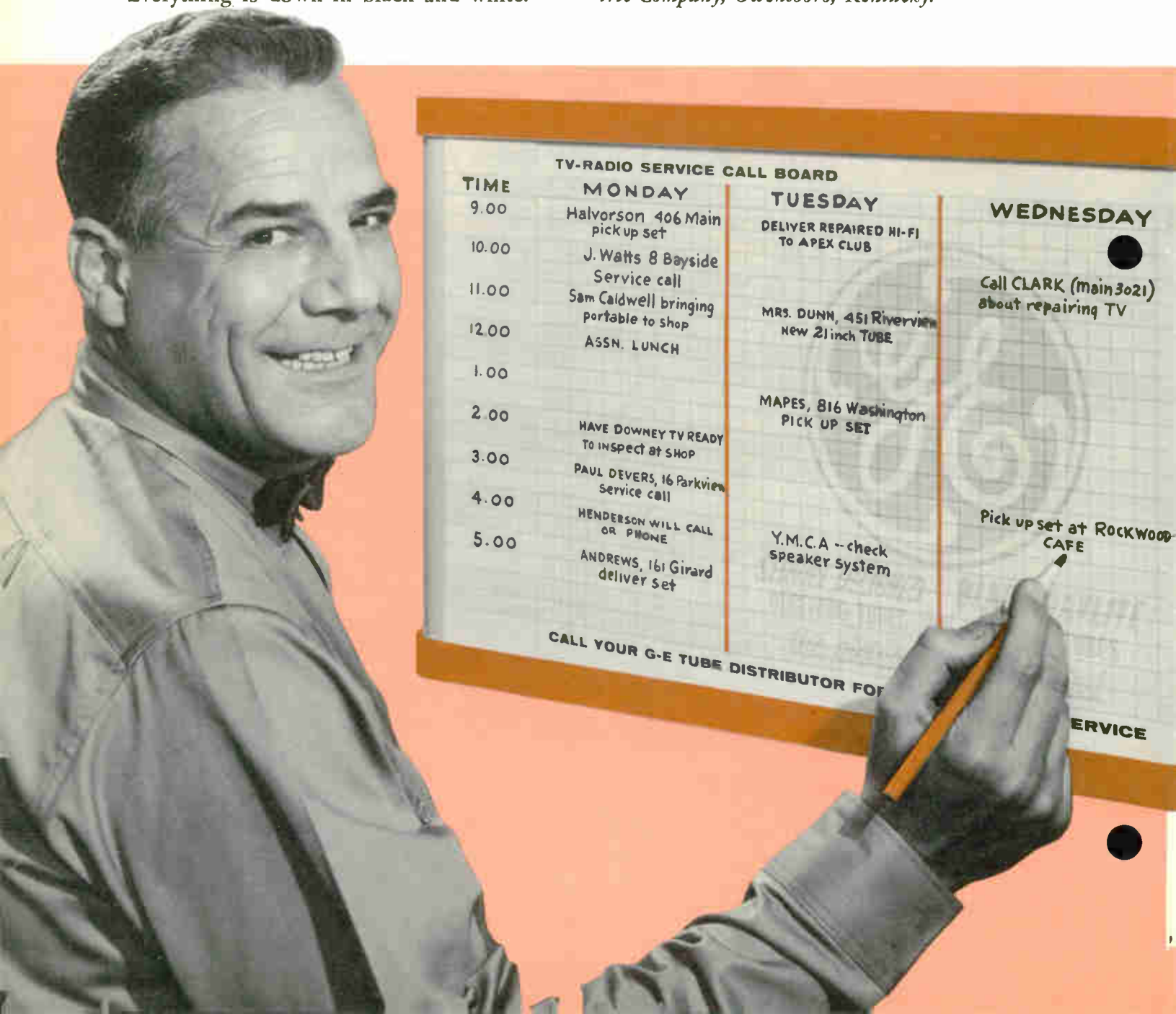

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- Write, erase—write, erase—again and again on transparent plastic roll-around cover!
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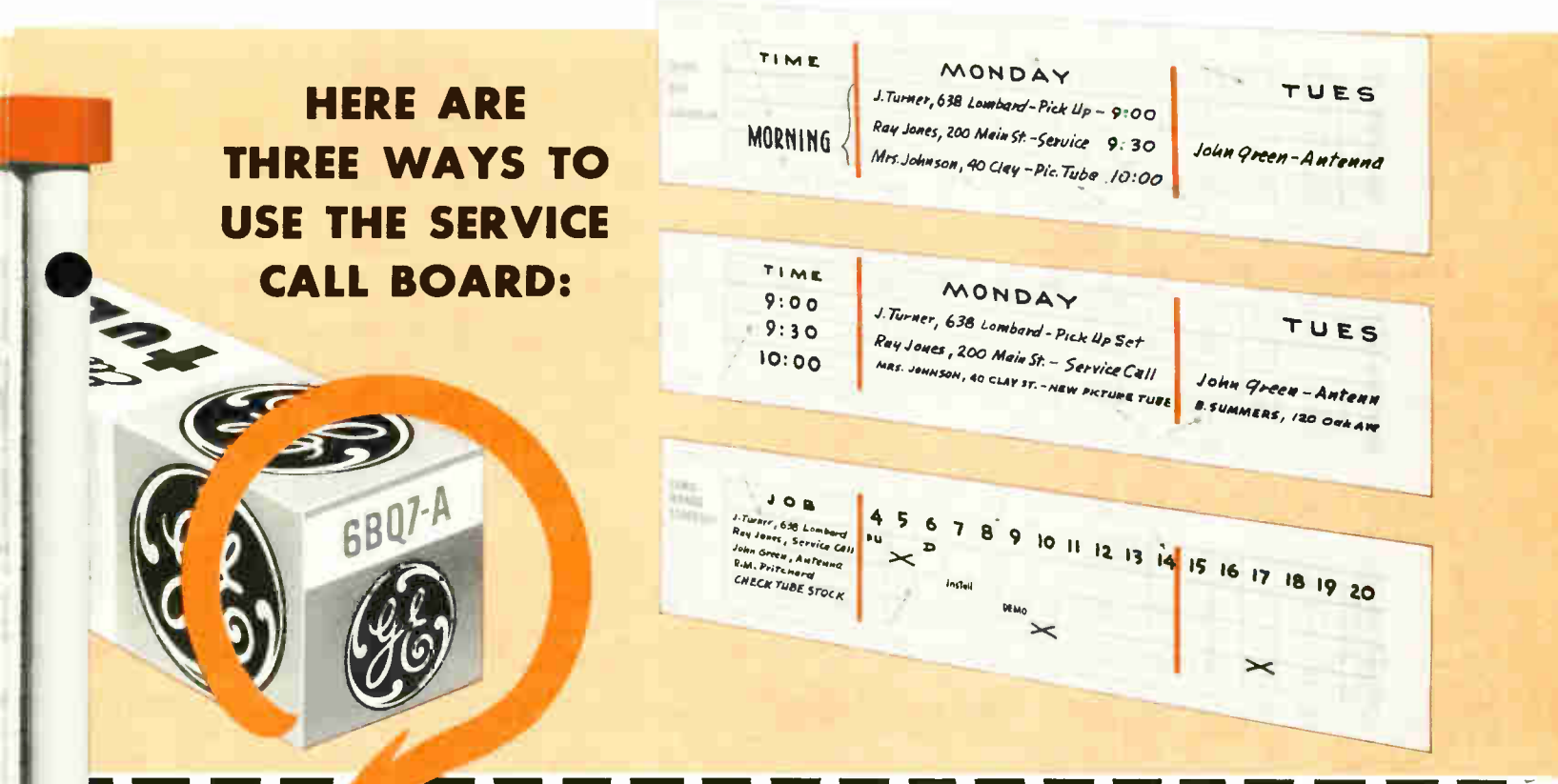

● **SEND 10 OF THESE PLUS $3 TO RECEIVE YOUR CALL BOARD!** Fill out and mail the coupon (right) enclosing $3, also 10 carton-ends with type number of the popular, fast-moving G-E 6BQ7-A. Mail direct to Chicago warehouse address given on the coupon.

General Electric Company
3800 N. Milwaukee Ave., Chicago 41, Ill.

Enclosed is $3, also 10 General Electric 6BQ7-A carton-ends. In return, ship me prepaid one new G-E Service Call Board.

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319-301

NEW "SHADOW GRID" 6FG5

NEW "SHADOW GRID" 6FG5 radio and television tube.

The football concept of a "blocking back" is used by General Electric in a new type of receiving tube containing an extra grid.

The tube is registered as the 6FG 5, and is known as a "Shadow Grid" pentode. The extra grid is placed directly in front of, and precisely aligned with, the screen grid. It is grounded to the cathode and thus tends to repel electrons flowing from cathode to anode. As a result, the electrons are diverted around the wires of the screen grid. In effect, the additional grid partially shields each wire of the screen grid from the flowing electrons, and no electrons strike the screen grid directly.

This reduces screen current and opens the door to new standards of performance. Plate-to-screen current ratios as high as 60-to-1 have been obtained with this design — thus drastically reducing screen dissipation.

The first practical advantage of this "Shadow Grid" tube to the equipment manufacturer is to permit operation of the screen at the same voltage as the anode by tying the screen grid to the plate supply, thus completely eliminating the need for a dropping resistor and by-pass capacitor.

Another advantage lies in the fact that reduction in screen current permits exceptionally low noise figures as compared with standard pentodes used in VHF television tuner service.

Further, higher transconductance is achieved with this new tube, making it feasible in some cases to reduce a three-tube IF strip to two.

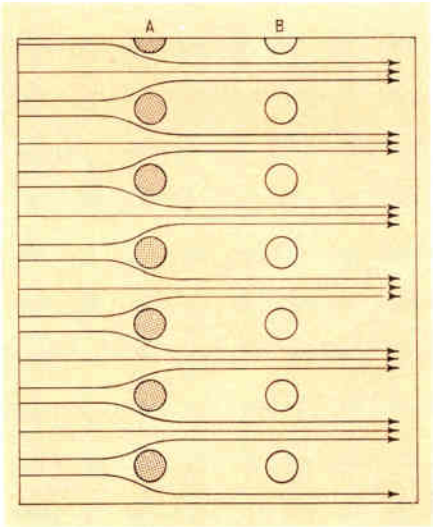
Basic development work at General Electric's Receiving Tube Department in Owensboro, Ky., centered around usage of the 6FG5 in VHF television tuner applications. Screen voltages varying from 135 to 265 volts d-c are usable, providing flexibility for equipment designers in aiming for significant cost savings.

Since with the "Shadow Grid" tube design the screen current will increase only slightly with changes in either screen or plate voltage, the transconductance of this kind of tube can be increased to allow additional reduction in noise figures as required by equipment designers.

Average characteristics of the type 6FG5 are listed at 9500 micromhos transconductance, 9 ma plate current, 0.42 ma screen current, plate and screen voltage of 250 volts d-c, with minus 0.2 volts on the control gird, and cut-off at minus 5 volts. Grid-to-plate capacity is reduced considerably, to 0.02 mmf, which helps eliminate band-pass "tilt" problems.

The new shadow grid structure also may offer improved service in AGC circuits. This would become possible if or when the new grid is brought out to a separate pin connection instead of being connected internally to the cathode—thus allowing separation of the signal and AGC bias points and minimizing cross-modulation.

The "Shadow Grid" tube is expected to be used in a wide variety of electronic equipment.



SHADOW GRID (A) diverts electron flow around screen grid (B) of General Electric's new 6FG5 — thus drastically reducing screen current and opening door to new standards of receiving tube pentode performance. With this design, the screen grid can be tied directly to the plate voltage supply, eliminating dropping resistors and by-pass capacitors. Also, the reduction of screen current permits exceptionally low-noise pentode operation.

BENCH NOTES

H V Insulator

I had a Motorola model #21T58MGA come in the shop with a high voltage leak at the bottom of the 3A3 HV Rectifier. After changing the two resistors at the bottom of the 3A3 and putting corona dope under the bottom of the HV Rectifier it still had the same arc over to the bottom of the metal cabinet. To correct this, I cut a strip of linoleum about six inches square and slid it under the 3A3. This can be done without removing any screws.

Howell's Radio & TV Service
1619 Gorman Street
San Antonio 2, Texas

Screws and Nuts Replaced Quickly

Often screws and nuts are difficult to replace due to close quarters. This is easily accomplished by scraping wax from the outside of paper condensers then placing wax in slot of screw and pushing screwdriver into it. This will hold the screw for easy replacement. For nuts, simply apply some of the wax around the outside rim then place nut in the holder and proceed to replace in set.

Glenn F. DePoe
445 N. Morris Street
Waynesburg, Pennsylvania

Slipping Tuner Turrets

In some of the early turret tuners it was common for the turret to slip on the shaft causing improper channel indication.

The factory had suggested drilling a small hole through the turret and shaft and pinning them with a nylon or fiber rod.

I have found a much easier repair which can also be used on other tuners where the shaft slips in relation to a turret or wafer.

First: Set the turret or wafer and selector knob for proper indexing.

Second: Apply one of the new epoxy resin glues to both turret or wafer and the shaft.

Epoxy resin glue hardens almost immediately and makes a permanent repair which is imposible to break even with force.

William J. Praetz
203 Covert St.
Brooklyn, New York

Instrument Protection

Pieces of foam rubber about half-inch thick cemented on the bottom of test instruments eliminate needless jarring and shocks during movement. This reduces the posibility of cracked cases and thereby prolongs the instrument's useful life.

H. Josephs
P. O. Box 22
Gardenville, Penna.

Those desiring to have letters published in this column should write the Editor Techni-Talk, Electronic Components Division, General Electric Company, Owensboro, Kentucky. For each such letter selected for publication you will receive $10.00 worth of General Electric tubes. In the event of duplicate or similar items, selection will be made by the Editor and his decision will be final. The Company shall have the unlimited right without obligation to publish or otherwise use any idea or suggestion sent to this column.

Caution: The ideas and suggestions expressed in this column are those of the individual writers. These ideas and suggestions have not been tried by the General Electric Company and therefore are not endorsed, sponsored or recommended.

Copies of all issues are still available. If you are missing any copies and cannot obtain them from your distributor, send five cents for each issue to: Editor, Techni-Talk, General Electric Company, 316 E. Ninth Street, Owensboro, Kentucky.

TELEVISION — Electrical Safety Test

In a recent letter from a distributor, it was brought to light that it is possible through some service fault to create a hazardous condition in the transformerless type chassis often used in portable sets. With a little effort, service men can check each set before handling it back to the customer, thus insuring him against any possibility of injury.

The following procedure appeared in the "Q3" Final Service Manual:

Should the receiver become damaged, or the chassis removed to effect repairs, or for any other desirable reason, the following advised safety test should be performed.

The receiver on which the safety test is to be made must be in good operating condition and completely assembled.

With no power applied to the receiver, short the two prongs of the power plug together and connect one probe of an ohm-meter to the shorted prongs of the power plug.

The power switch of the receiver should be "On" and the channel selector knob and one of the primary control knobs (contrast, vertical, brightness, or volume) removed. All built-in antennas should be connected to their proper connections on the antenna terminal board.

All readings obtained between the power plug and the following listed points should be over 125,000 ohms to be considered within the safety limits.

1. Cabinet body (to insure proper contact use a cabinet back retaining screw for test point).
2. Each individual antenna terminal.
3. VHF tuner selector shaft.
4. One of the primary control shafts.
5. Handle.
6. Rear chassis foot.
7. Interlock retaining screw.

RADIO — Motorboating in Transistor Radios

A slow rate of audio oscillation or motorboating may occur in several models of transistor radios if the filter electrolytic, connected in series with the resistor across the battery, drops below a certain value. The motorboating is eliminated when fresh batteries are installed but reoccurs if the batteries run down slightly. Therefore, if a customer complains that motorboating appears within a short time after batteries have been replaced, check the electrolytic capacitor or install an additional one in parallel.

After this has been done, check the operation of the radio at reduced battery voltage. (A variable power supply is handy for this.) The following table lists some transistor models which may be prone to motorboating if the electrolytic value drops too low:

MODEL NUMBER	CAPACITOR SYMBOL No.	RECOMMENDED VALUE
P715, P765	C12	100 mf.
P720	C15	175 mf.
P725A	C16	175 mf.
P745	C16	50 mf.
P750	C16	175 mf.

Techni-talk SUGGESTION AND INQUIRY COUPON

If you would like to receive additional information on some specific G-E Electronic Component, just clip out this coupon, write in the material desired, and send it to the Editor. Information, if available, will be sent to you by return mail.

Please check your name and address on the reverse side. Make any necessary corrections below.

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G-E WIRELESS REMOTE SYSTEM

(Continued from page 1)

ulated magnetic field excites one of the reeds and causes it to vibrate, the reed contact is closed for each half cycle of reed vibration. This action causes a current to flow through a corresponding sensitive relay coil and the sensitive relay arm is made to pull in by the magnetic field built up in the relay coil. This closes the contact points of the relay and thus causes the proper function to be activated.

The off-on function is performed by a two position latching relay contained in the Remote Receiver. This operates in conjunction with the TV receiver off-on switch. The channel select function is performed by completing the a-c Power loop needed to supply power for the power tuning motor mounted in the TV receiver.

The increase volume or decrease volume function is performed by supplying power to an a-c reversible motor. The motor is mechanically coupled to a variable potentiometer (R615) which when varied, changes the screen voltage available to the 4.5 MC Audio I-F amplifier tube in the TV receiver.

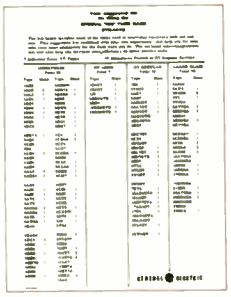
The remote receiver unit contains its own transformer power supply utilizing a germanium diode in a half wave rectifier circuit for the B+ supply. An octal plug and socket is used to interconnect the remote receiver with the TV receiver, and Pins 2 and 5 of the socket are used for the 120 Volt a-c supply to the remote unit.

The power to the remote unit can be turned on or off by a slide switch located just above the antenna input terminals on the back of the TV receiver, and Pins 2 and 5 of the socket are used for the 120 Volt a-c supply to the remote unit. The power to the remote unit can be turned on or off by a slide switch located just above the antenna input terminals on the back of the TV receiver.

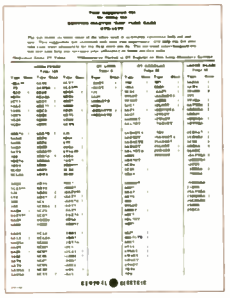
Under normal conditions the remote receiver unit should be left turned on so that it may receive the control signals sent out by the remote transmitter unit, however if it is planned not to use the unit over an extended period it can be turned off.

G-E Service Cases Now Have Suggested Tube Inventory

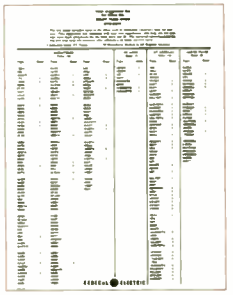
All three G-E Service Cases now contain a suggested inventory list packed in each case. The list includes most tubes used in television receivers both old and new. Tube types used exclusively in color TV receivers are indicated with an asterisk. This list combined with your own experience, will help you fill your service case most adequately for the particular type of field work you do.



ETR-2156
Tube Inventory List for Special "160" Service Case.



ETR-2155
Tube Inventory List for Service Master "240" Service Case.



ETR-2157
Tube Inventory List for Giant Service Case.

ETR-1478
Holds 85 Miniatures, 39 GT types and 38 Large Glass Tubes.

ETR-1477
Holds 126 Miniatures 54 GT types and 48 Large Glass Tubes.

ETR-2071
Holds 189 Miniatures 128 GT types and 48 Large Glass Tubes.

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In this issue:

Techni-talk on AM, FM, TV Servicing, published bi-monthly by Electronic Components Division, General Electric, Owensboro, Ky. In Canada: Canadian General Electric Co., Ltd., 189 Dufferin St., Toronto 3, Ontario. R. G. Kempton, Editor.

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