ELECTRONIC SERVICING

MAY
1957
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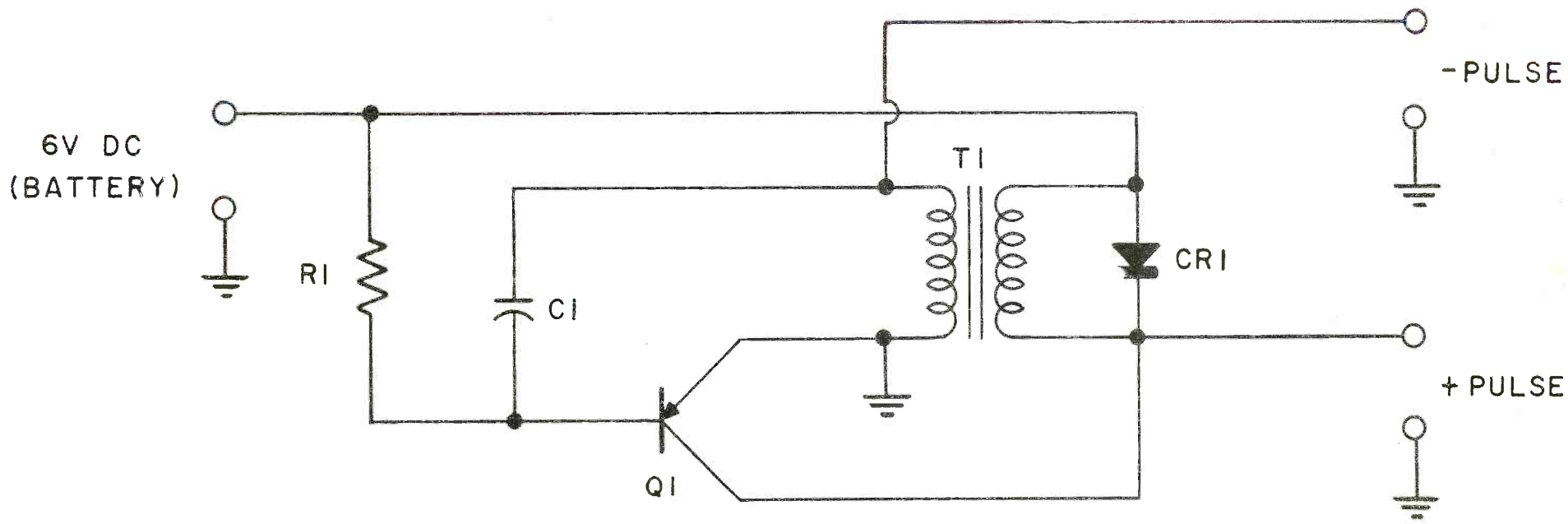


PHOTO-ELECTRIC CONTROLS

MARINE DIRECTION FINDERS

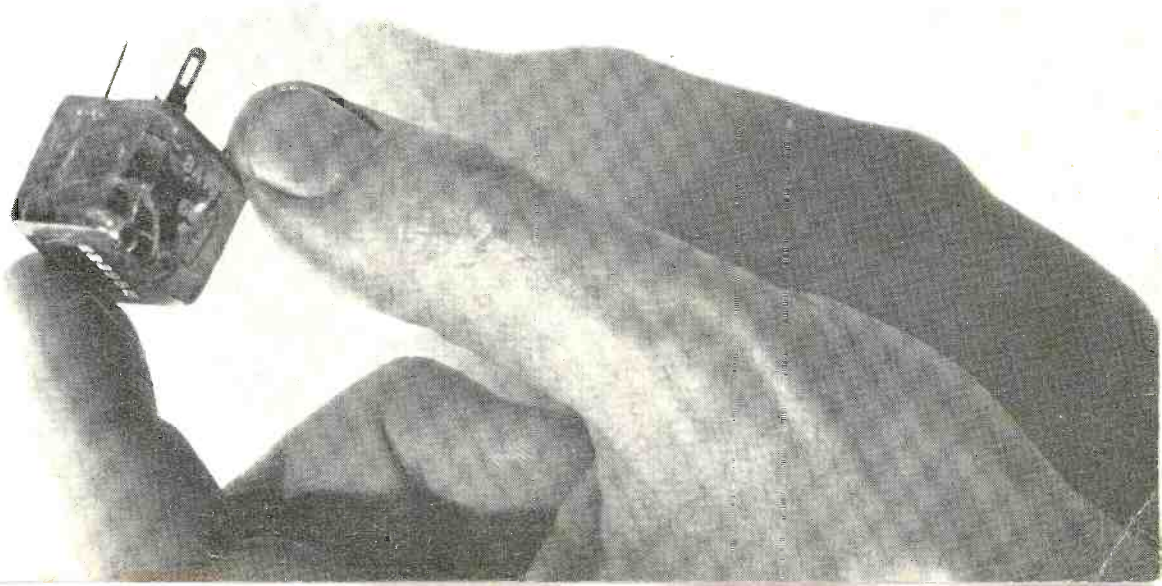
1957 WESTINGHOUSE TV

AUTO RADIO—OLDSMOBILE

HI-FI KITS

COLOR DISPLAY GENERATOR

PLUG IN SPEAKERS



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VOL. 18, NO. 5 — Member — MAY, 1957

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FEATURE ARTICLES

CIRCUIT AND SERVICE FORUM

DEPARTMENTS

THIS MONTH'S FRONT COVER

A complete blocking oscillator circuit is contained within this three-quarter inch molded cube. The circuit of the encapsulated components is shown in the schematic. Designed by DuMont, it is called the "Pulse Cube."

COWAN PUBLISHING CORP., 300 West 43rd Street, New York 36, N.Y.

by S. R. COWAN

Jobbers' Views on Servicing

Statistics, when reliable, can be informative. However, it is a known fact that the means used to present data acquired can be, and often is, intended to mislead and confuse. Let us cite examples of statistics recently released by several sources which contradict each other.

RETMA'S 1956 "Fact Book" tells us there are 41 million TV sets, 142 million radios and 30 million auto radios now in use. A contemporary serviceman's magazine tells us there are 43.9 million TV sets, 107.2 million radios and 38.1 million auto radios in use. A parts jobbers' magazine tells us that jobbers claim that there are 36.3 million TV sets, and 33.7 million auto radios in use. (It says that 43.8 million homes are radio equipped, but it does not say how many radios are in use). RETMA tells us there are 25 thousand service firms and 17 thousand retailers that also do service work (total 42 thousand) now in business while the contemporary service magazine says there are now 62 thousand major service outlets. (We spent $87 thousand in 1952-3 to obtain the name of every legitimate service firm in business, getting 53 thousand names—and this figure subsequently diminished to 47 thousand by 1956).

In 1956, according to RETMA, jobbers sold over $1.3 billion worth of replacements of all types for civilian replacement use and $892 million worth for industrial replacement use, and this did not include military sales. Now the jobber magazine says that jobbers estimate that their 1957 civilian replacement volume will be $938 million and

Ad Libs

that they estimate industrial plus government replacement sales volume will be $248 million. It's apparent that jobbers catering to industrials are trying to discount the dollar volume to discourage competition. There's entirely too much spread between all these figures. Evidently someone either "goofed" or else these statistics are presented in such manner as to confuse intentionally. Actually the figures published would not be vital to the average businessman if he were satisfied with business conditions today.

Unhappily only a few servicemen, only a few jobbers, and only a few manufacturers are satisfied. Independent service firms are facing extremely keen—and much unjustified—competition from any angles. Jobbers are catering more and more to industrials but less and less to servicemen. Manufacturers are continually pressed to lower their prices despite ever-increasing costs and diminishing profits. We have reason to believe that the erratic action of the stock and bond markets indicate that comparable conditions prevail in industries other than electronics. We also believe that our government is cognizant of this fact and intends to do something about it during the fiscal year. Lowered taxes and more realistic taxing methods, with the realization that small, independent enterprises are the backbone of American economy, are required. Our politicos know this and seem to be starting to make the moves to effect it. We hope so!

Industrial Electronics Potential

Last May, after two years of survey

[*Continued on page 6*]

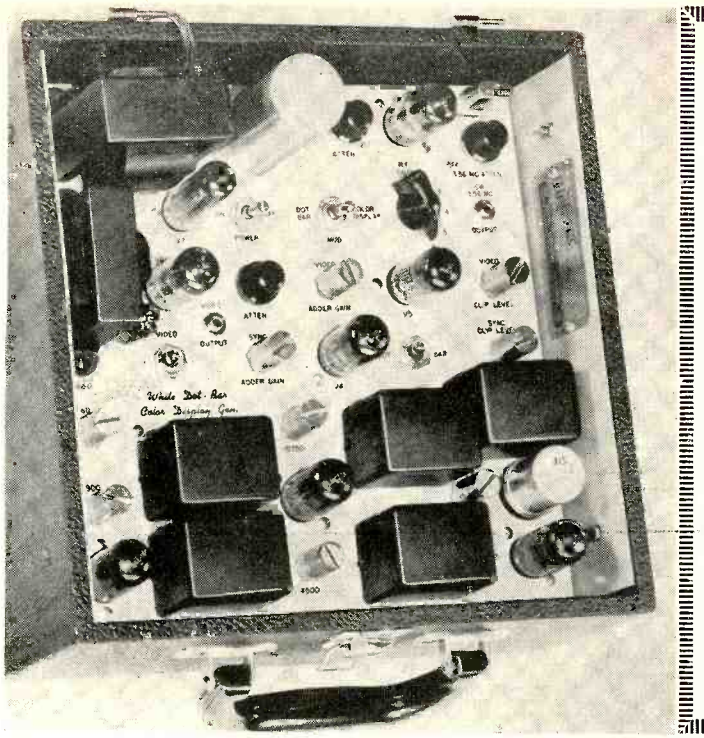

Fig. 1—Hickok color display generator also provides white dot and crosshatch output.

How To Use A COLOR DISPLAY GENERATOR

by Walter J. Cerveny

Chief Engineer Television Equipment
Hickok Electrical Instrument Co.

A discussion of the principal applications of the color bar generator as a source of set-up signal for making preliminary adjustments, and checking a color television set.

A color-display generator is lighter and more compact than an NTSC color-bar generator, and accordingly finds ready acceptance as a color-TV installation instrument. The unit illustrated in *Fig. 1* provides white-dot and crosshatch outputs in addition to the chrominance display, which makes it a complete source of set-up signals in one compact package.

Crosshatch Facilitates Preliminary Convergence Adjustments

Set-up of the three-gun color picture tube is accomplished by the following steps:

1. Adjustment of the picture-tube accelerating voltage to the value specified by the receiver manufacturer.
2. Usual adjustments for black-and-white receiver installation, such as horizontal drive, horizontal and vertical linearity, height, width, focus, and centering.
3. Field purity adjustments.
4. Static convergence.
5. Dynamic convergence.
6. Tracking of the three color guns.
7. Adjustment of the color killer, color-intensity control, and color-phasing control.

Horizontal and vertical linearity, height, and width adjustments are readily and accurately made using the crosshatch pattern as a reference. These are similar to the corresponding adjustments in black-and-white reception, and hence require no detailed explanation.

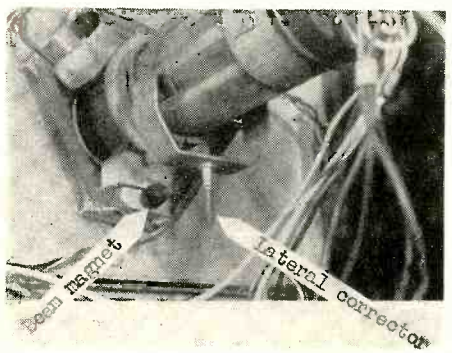

Fig. 2—Beam-magnet and lateral-corrector construction.

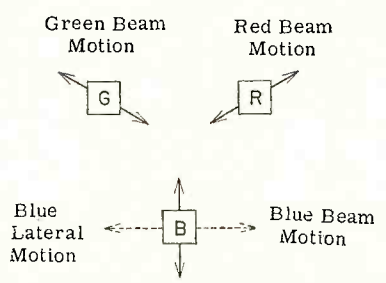

Fig. 3—Blue beam magnet produces only vertical motion of blue dot.

Static Convergence

Static convergence is concerned with the coincidence of the red, green, and blue beams in the central area of the picture-tube screen. Control of the color dot positions is accomplished by means of three beam magnets and a blue lateral corrector. Typical beam-magnet and lateral-corrector construction is illustrated in *Fig. 2*. A beam magnet is provided for each of the color guns, and the lateral corrector is an added

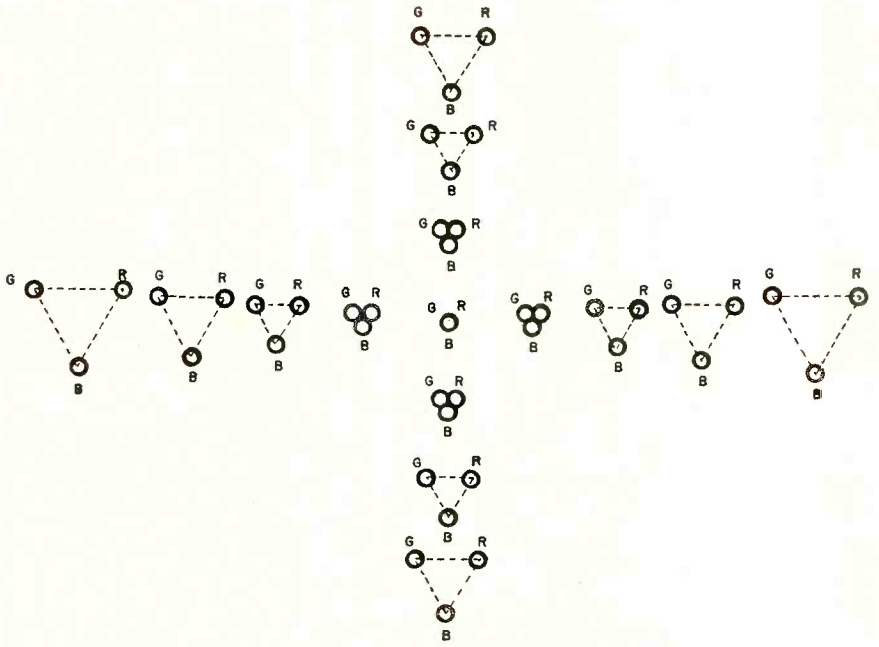

Fig. 4—The color dots at the top and bottom of the screen, and on the left and the right side will usually be out of convergence.

control for the blue gun.

The motions of the color dots resulting from adjustment of these static convergence controls is shown in *Fig. 3.* Note that the red and green dots are moved along opposite diagonals, so that there is always a crossover point of the red and green dots, where these two colors converge to yellow dots. Since the blue beam magnet produces only a vertical motion of the blue dot, as shown in *Fig. 3,* the blue lateral corrector is provided to produce horizontal motion of the blue dots which is necessary for coincidence of all three color dots; when the blue dots are moved into coincidence with the yellow dots, white dots result and convergence is obtained. In general, these adjustments suffice to obtain convergence in the central area of the screen, only.

Vertical Dynamic Convergence

The color dots at the top and bottom of the screen, and at the left- and right-hand sides will usually be out of convergence, as depicted in *Fig. 4.* The next step is to adjust the vertical dynamic-convergence controls to make the columns of red and green dots parallel to the column of blue dots, as illustrated in *Fig. 5.*

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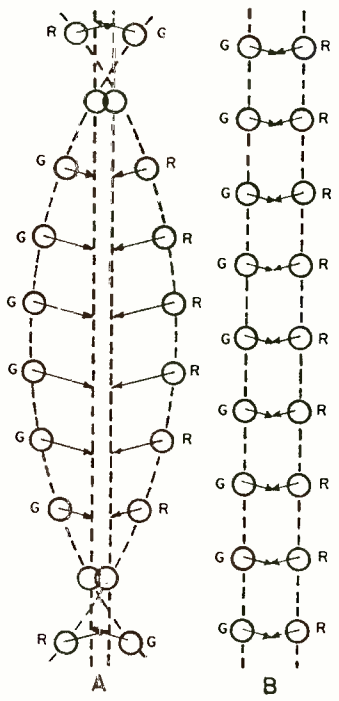


Fig. 5—Columns of red and green dots must be parallel to the blue dots.

AD LIBS

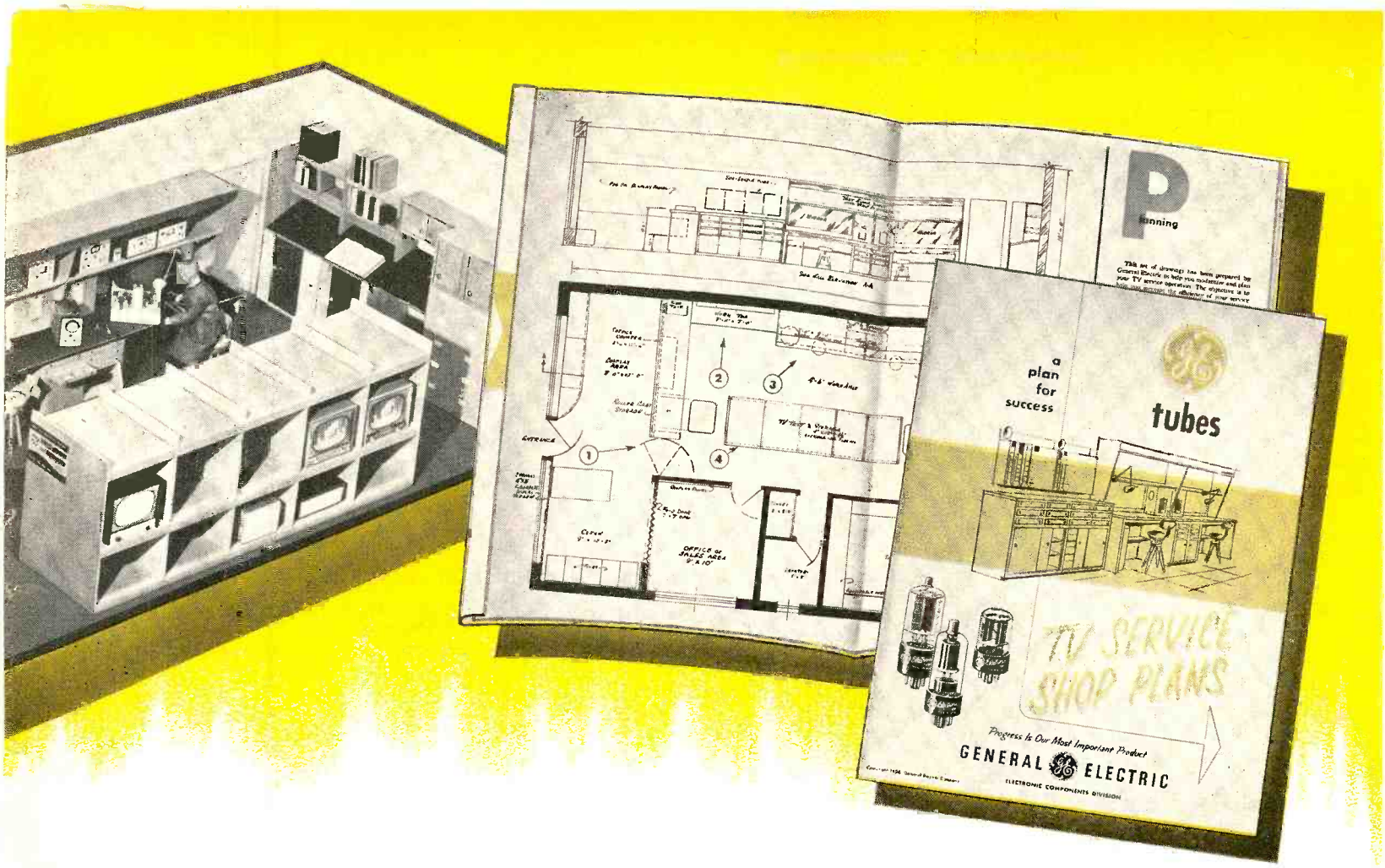
[*from page* 3]

and research, we broadened our editorial scope so we could cover all phases of industrial electronic and commercial communications equipment servicing techniques along with radio and TV servicing. The transition is taking place slowly, methodically and in a pattern that will be most beneficial to all our readers, old and new alike.

Radio-TV servicing has been, is, and will continue for sometime to be the prime source of revenue to our subscribers. That industrial electronics and commercial communications servicing is providing an ever-increasing additional source of income for those service firms which have sought that type of business is extremely gratifying. Remember well this prediction: In due time the average service firm will make more money per annum from its industrial customers than it will from its regular home-set customers.

On what basis and what known facts justify the making of such a seemingly brash prediction? The answer is simple: Today, with 77% of our homes having a TV set (41 million in use); with 140 million home radios and 30 million auto radios in use; with upwards of 20 million radio phonographs and $200 million worth of Hi-Fi and PA equipment in use, the nation's annual maintenance fees to servicemen approximate $2 billion of which $1.3 billion represents the amount spent by servicemen for the purchase of replacement tubes, parts, etc.

In contrast, the nation's use of industrial electronics and commercial communications devices has hardly begun and despite that fact Industry paid service fees and maintenance wages amounting to $400 mil-



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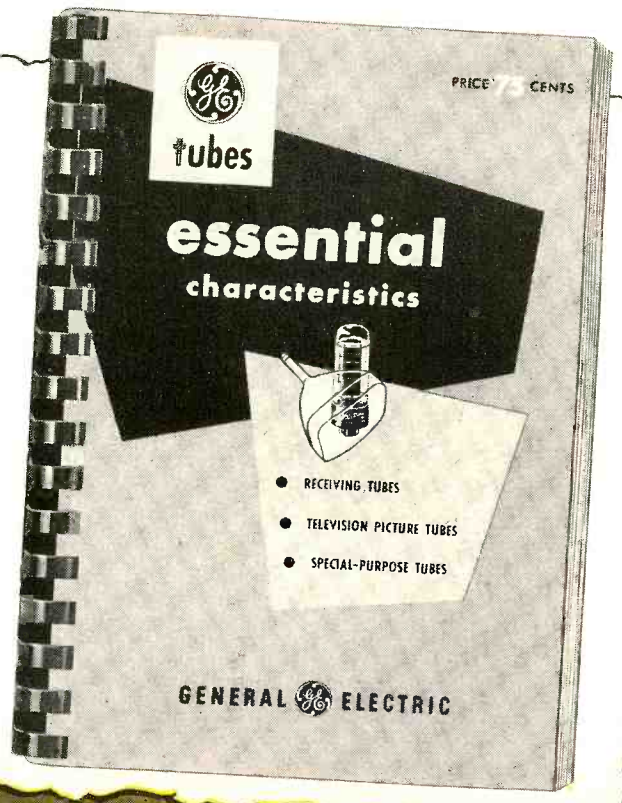

lion last year—and in addition another $892 million for replacement parts, tubes, etc. Compare those figures for a relatively new and still to be greatly expanded service market with the civilian record. The dollar volume figures for industry service and parts sales after 5 short years is almost level with civilian usage—and the latter, to say the least, is mature, having had a 25 year head start.

It is opined by authorities on the subject that less than 4% of this nation's manufacturing plants are now utilizing electronic devices, automation, etc., but that 40% will be within 5 years, 60% will be within 10 years, and that 90% will be in 15 years. Visualize that tremendous expansion and what it represents in terms of potential dollars to be spent on servicing and purchasing of needed replacements. Fantastic is the word!

Aside from industrial use of electronically controlled machinery—consider the expanded use of commercial communications equipment in years ahead. Today the 900,000 mobile, base and portable transmitters and receivers operated by 19,000 FCC licensees, and which provide 2-way communications for railroads, buses, etc., represent less than 14% of the present-day potential. In other words, big as it is today, commercial communications usage is still 86% unsold. Try to visualize what a tremendous annual service potential this market will be 5, 10 or 15 years hence.

The foregoing factual presentation should cause every one now engaged in radio-TV servicing to reflect upon his future opportunities. They are bright indeed! And incidentally, have you noticed that one of our competing magazines in the service field, being shrewd enough to realize that

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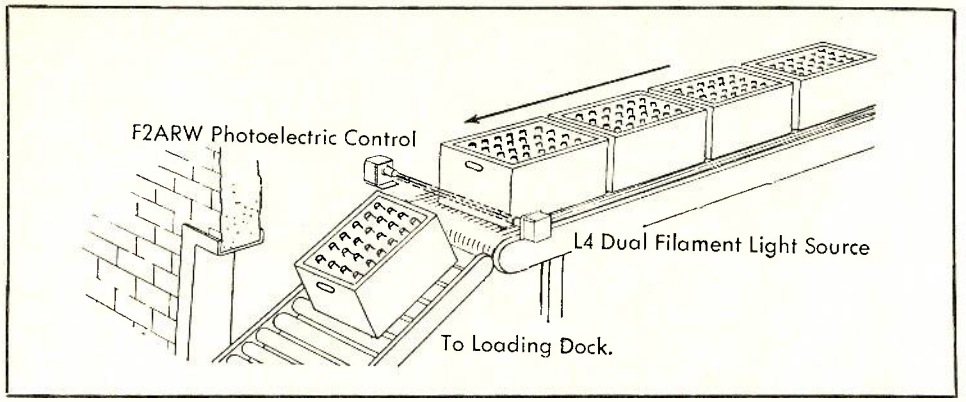

Fig. 1a—A photo-electric case counting device. The pulse output of the photo-cell circuit feeds a counting circuit which stops the conveyor at the proper count.

Photo-Electric INDUSTRIAL CONTROLS

by Allan Lytel
Supervisor - Technical Information Unit
General Electric Co.

The principles of operation of photo-electric control devices and their application to various industrial processes are treated in this article.

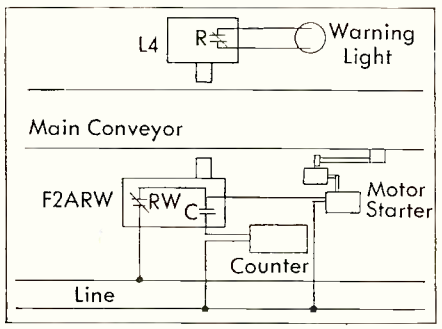

Fig. 1b—Block diagram of the counting device shown in Fig. 1a.

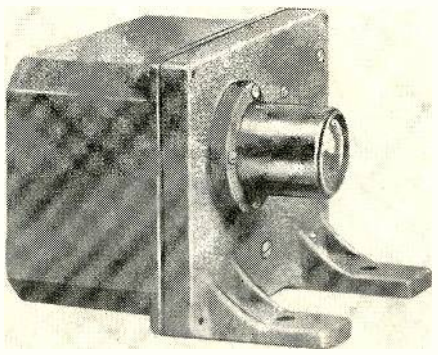

Fig. 2—Dual filament light source. (Courtesy Autotron Inc.)

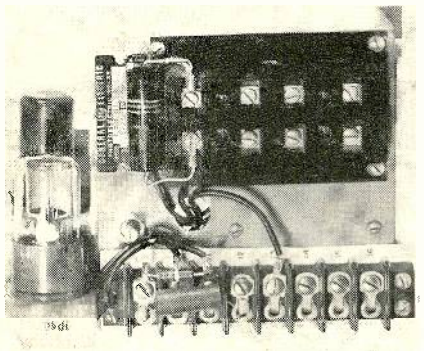

Fig. 3—Medium speed, medium sensitivity photo-electric relay. (G.E.)

MANY industrial operations use photocells for different types of control. Safety devices are no longer the only use for these cells. The electronic portion of this industrial equipment is not difficult to service and repair once the operating principles are established.

Photo-Electric Counter

The operating principles are rather straight-forward. For example, shown in *Fig. 1a* is a case-counting device. Three units plus the motor control make up this system. A light beam from the light source is received by the photocell which, in this case, provides an output signal or pulse every time a case moves along the conveyer. These pulses are counted and the counter controls the conveyer motor.

In operation, the desired number of cases for an individual delivery is set on the counter dials. The "Start" button is pushed and, when the controls are warmed up, they automatically start the conveyer. As each case passes the light beam and interrupts it, the counter advances. At full count, which has been pre-set, the counter operates a relay which stops the belt.

There are a number of protective devices built-into the equipment. Relay RW is a warm-up protection which has a time delay long enough to permit the vacuum tubes to reach the proper operating condition before the relay starts the conveyer delivering cases. In the event of a tube failure the RW relay stops the conveyer. Filament current through the tubes must also pass through the relay. An open tube filament will stop the current through the relay and the spring-loaded contacts will open and stop the conveyer. The light source has a dual filament. If one burns out or opens, the other operates and there is no shut-down, but—as a warning device, a pilot light is lit to indicate that the lamp requires replacement.

Fabric Tension Control

A second example is shown in *Fig. 4*. This is a tension control as used in fabric processing. The loop of fabric must be of the proper length to provide the necessary fabric tension. A photo-electric device is used to control the rate of feed. There are two controls, A and B. In normal operation B is interrupted but A is not.

If the loop becomes too short B is no longer interrupted and light reaches the B photocell. This speeds up the rate of fabric feed until B is again interrupted. Also—if the loop becomes too long control A is interrupted and this signal slows down the feed rate. A "fail-safe" arrangement is included to stop operation in case of a control failure.

Photo-Electric Control Building Blocks

Many commercial controls are similar to those above. There are generally four building blocks or basic components used in these controls. They are: light sources, photo-cells, time-delays, and counter plus the motor controls. Each of these is discussed below.

Light Sources — These are simple light bulbs for use on 110/220 volts. Some have the dual filament and warning light as in the above examples. The light is focused in a narrow beam which falls upon the photocell. To increase the lamp life, the voltage is often reduced. This, of course, reduces the light output but in many cases reliable operation is still obtained, especially where the light only travels a short distance. Some light sources have a safety relay built-in. This is arranged to go into action when the lamp burns out, in which case it stops a motor, closes a valve, or operates a trouble light.

Fig. 5 shows a light source. D is the input, P is the variable dropping resistance, and F is the filament. Relay R, the safety relay, is shown with the contacts A. Current through R pulls down the upper arm at A and provides a complete circuit through the contacts. Lamp failure stops the current through R and the spring opens the contacts which stops the motor in series with these contacts.

Phototubes — There are three types of photo-electric cells. The photovoltaic cell produces a voltage difference upon exposure to light, the photoconductive

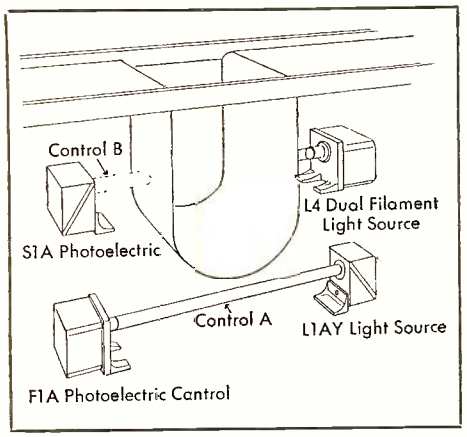

Fig. 4—Photo-electric fabric tension control. (Autotron Inc.)

changes resistance upon exposure, and the photoemissive or phototube emits electrons upon exposure to light. All three types have industrial applications but we are concerned here only with the last type.

A typical phototube is shown in *Fig. 6*. The large area negative cathode provides for the emission of electrons which are captured by the positive rod-like plate. Total current is small—usually less than 20 to 30 microamps. A phototube circuit is illustrated with a relay in series with the triode (6J5) plate. Resistor R_2 has a value of several megohms and R_1 (to limit the plate current in the triode) is 20K ohms.

This is a "light-energized" circuit. With no light on the phototube P, it is an open circuit. Bias (E_2) prevents conduction through the triode and relay R is not energized. When light falls on the phototube a large number of electrons are emitted from the cathode to the plate. This current creates a large voltage drop across R_2, large enough to overcome the initial bias and make the tube conduct. This energizes R for

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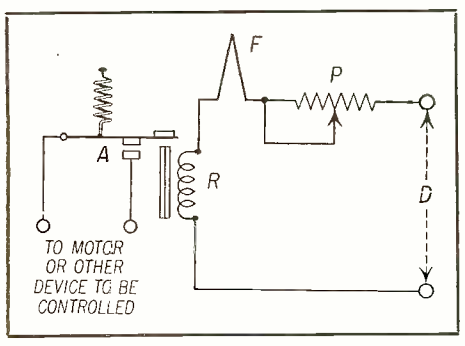

Fig. 5—Failure of the light source de-energizes relay *R*.

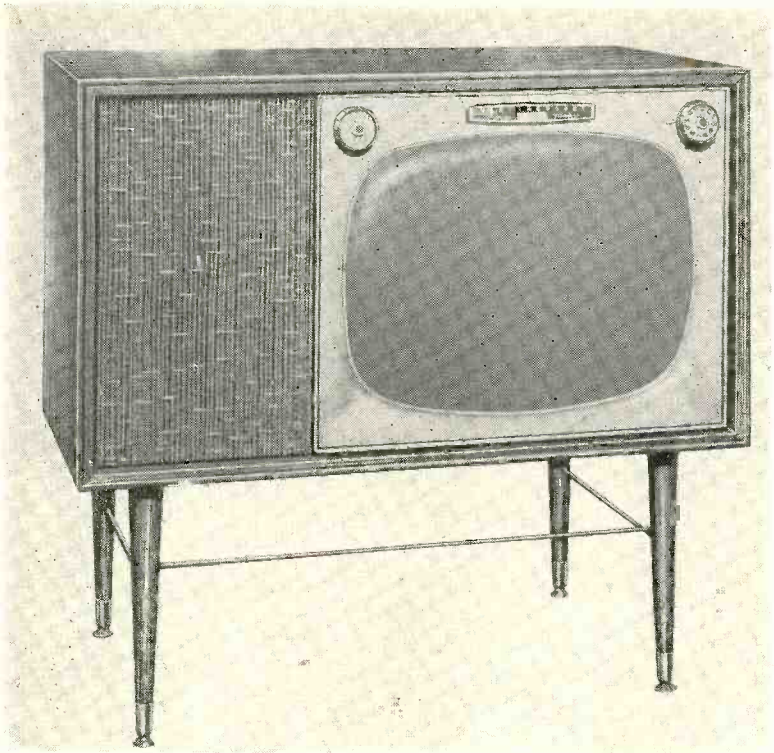

Fig. 1—The Beverly low-boy television receiver having Power Tuning channel selection and adapter for remote control.

The operation, adjustment and circuit details of Automatic Power Tuning and Remote Control Unit for the new Westinghouse receivers are discussed in this article.

1957 WESTINGHOUSE TV

Features Automatic Power Tuning

by Sol Libes

Technical Editor—Service Dept.
TV-Radio Division
Westinghouse Elec. Corp.—Metuchen, N. J.

WESTINGHOUSE receivers for 1957 feature *Power Tuning* channel selection, and push-button on-off control, plus remote control of fine tuning, channel selection, and volume control from anywhere in the room. The Beverly (Models 21KR190 and 21KR191) shown in *Fig. 1* shows the location of the Power Tuning Bar.

Servicing these automatic and remote controls does not require an automation expert. To facilitate adjustments, this article will cover the complete operation of these units, a description of the adjustment procedures, and some helpful servicing hints.

Power Tuning

The Power Tuning feature is an electro-mechanical method of automatic, push-bar, channel selection of *vhf* channels. Automatic channel selection can be achieved for each position of the tuner. The unit can be pre-set to select only those stations available in the area and to skip channels where no signal is present. In areas having only one *uhf* station the unit can also be set to select this channel. In addition, the Model H984 Chairside Remote Control unit (discussed below), is available as an optional accessory.

To operate the power tuning and select *vhf* channels the Power Tuning Bar is pressed until the desired channel number on the channel selector knob is at the arrow, and then released.

The schematic diagram for the unit is shown in *Fig. 2*. When the bar is depressed, 117 volts *ac* is applied to the motor. Solenoid action brings the eared disk (mounted on the rotor shaft) into engagement with the nylon pinion. As the gear assembly rotates, a cam causes a spring loaded arm to close lever switch 3 (see schematic diagram *Fig. 2*) which maintains the supply voltage and keeps the motor rotating for the remainder of the cycle.

At this stage of the cycle the roller on the cam engages and rotates the program disc which in turn rotates the tuner shaft. As the roller disengages, the cam lowers the spring loaded arm opening *Switch 3*, deenergizing the motor and bringing the mechanism to a stop with the program disc and tuner shaft in its correct position. If *Switch 3* is prevented from opening by a tubular clip inserted into the hole representing the unwanted channel on the programming disc, the motor will continue to rotate and cause the mechanism to continue to the next desired channel.

The receiver as shipped, is set to stop on every channel. To set for the automatic skipping of channels not used in the area, follow the procedure described below.

The motor drive unit, mounted on the rear of the tuner close to the left side of the cabinet, is shown in *Fig. 3*. The programming wheel can be seen extending from behind the motor as-

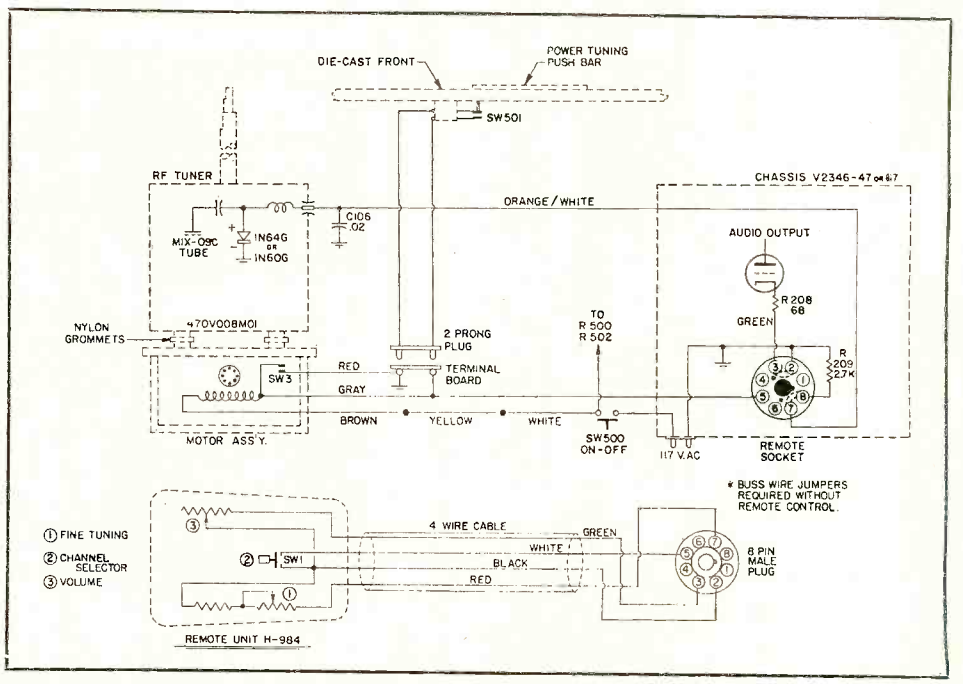

Fig. 2—Partial schematic showing the Power Tuning circuit and the interconnection between the remote control unit and the reciver.

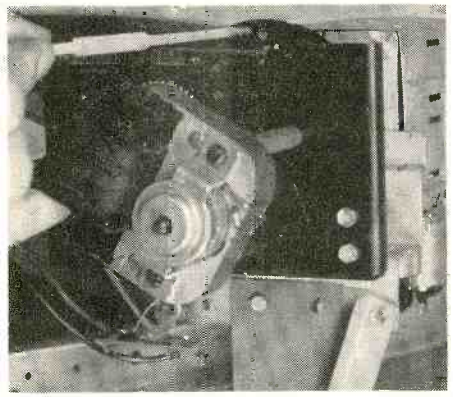

Fig. 3—Programming clip being inserted into hole of channel to be skipped.

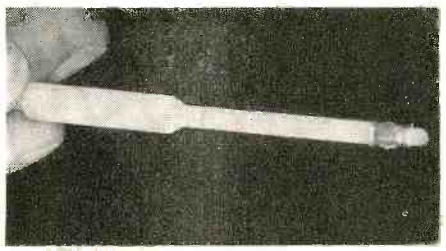

Fig. 4—A programming clip ready to be inserted into a channel hole.

sembly near the left side of the cabinet. This wheel has twelve holes (thirteen holes on chassis having *uhf* tuners) and adjacent to each hole is a stamped channel number.

Programming clips (a bag containing the programming clips is attached to the back cover of the receiver) are inserted into the holes in the programming wheel corresponding to the channels to be skipped.

To insert a programming slip into a hole, place a clip on an alignment tool, as shown in *Fig. 4*. Insert the clip into the side of the programming wheel on which the channel numbers are stamped, emerging from the non-stamped side. It is important to push the clips all the way into the holes so that the lip of each clip is flush with the wheel.

When it is necessary to remove a chassis containing power tuning it will be necessary, to first remove the two prong plug (seen in *Fig. 5*) from the terminal board on the tuner mounting bracket. This plug must be replaced when the chassis is installed in the cabinet.

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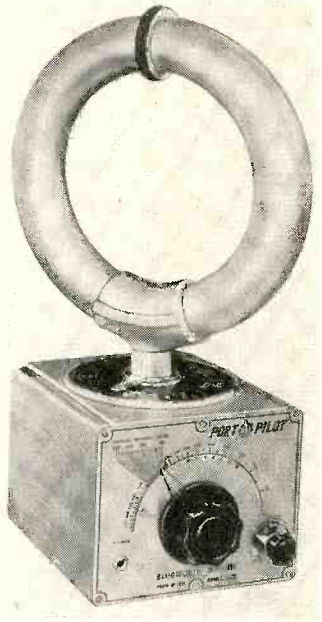

Photo of a typical direction finder using a loop antenna.

Radio Direction Finding In Marine Electronics

Part I

Directional characteristics of various antennas are discussed along with the factors which affect them. Emphasis is placed on the loop antenna.

Most of us are familiar with the operation of a radio direction finder. A loop antenna having a figure-of-eight response pattern is coupled to the front end of a receiver. Signals arriving in line with the loop are strong, while those coming in at right angles are in the "null" sector, and are very weak or not heard at all.

However, there is a little more to the matter than that, and a clear understanding of what actually takes place in marine Radio Direction Finders will help an installer newly entering the field to turn out good work.

Response Patterns

First of all, you must abandon the misconception that a loop antenna automatically has a figure-of-eight response pattern. This is not too generally understood, probably because explanations of loop-antenna operation are immersed in somewhat complicated references to current phasing and the associated mathematics. Loop operation can be clarified a little by looking at it from a different angle—that of voltage and current amplitudes, with a simple wave analogy.

Fig. 1 represents a short vertical antenna connected by a shielded lead to a receiver. The signal input to the receiver depends, of course, upon the transmitting station's field strength, but more important to our discussion, it also depends upon the radiation resistance of the antenna. Current excited in the antenna by the radiated field causes a signal voltage to appear across the radiation resistance of the antenna. Signal level is the same no matter from which direction the transmission comes.

Fig. 2 represents a pair of close-spaced short vertical antennas connected to the balanced input of a receiver. With this arrangement receiver signal input depends upon the voltage difference existing between the two antennas at any given time. With a radio-wave front arriving in the direction of signal "A" in *Fig. 2*, at the same time the signal voltage peak is excited in antenna #1, antenna #2 will be at an excitation point down the front of the slope of the oncoming wave. Thus, a difference of potential exists between the two antennas and the receiver responds to the signal. When the two antennas are one-half wave apart at the moment when the maximum positive voltage is induced in antenna #1, the maximum negative voltage would be induced in antenna #2. Thus, the greatest signal input is given to the receiver. With less spacing, the difference in potential possible between the antennas is, of course, reduced. In practical marine direction finders, the spacing between the equivaients of these two antennas must be very little; so it must be assumed to begin with, that signal voltages applied to the receiver will be very modest. Loop and associated receiver circuits should have highest possible Q to reduce any loss of this already small signal. Also, the receiver must be exceptionally sensitive and quiet.

Now, when a signal comes in from the direction of signal "B" at 45-degrees, the effective distance along the line of wave travel between antenna #1 and #2 will be only .7 of that which

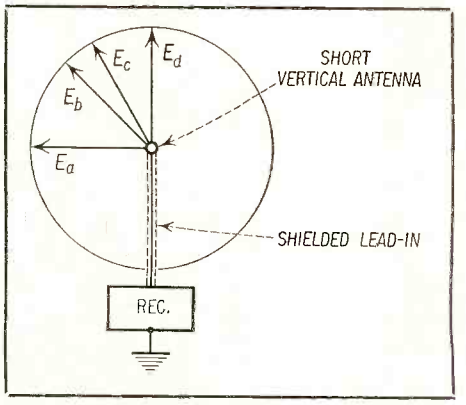

Fig. 1—A vertical antenna has a non-directional response.

by Elbert Robberson

A three band direction finder employing a ferrite loop.

it was in the case of signal "A". Therefore, the voltage difference and receiver response will be somewhat less. In a similar manner, a wave arriving from the direction shown as signal "C" will give a response of only .5 that obtained when the signal arrived in line with the two antennas. But the important feature is that a signal arriving in the direction of signal "D," at 90-degrees to the axis of the two antennas, will present both antennas with the identical level of the incoming wave at the same time. Thus, no difference of potential will exist for this direction, nor will there be any receiver signal. Thus, a signal arriving from this angle is in the "null" sector of the antenna system.

It is important to note that between the zero-angle line and the 45-degree angle line a signal reduction of only one-half power or 3-decibels occurs. However, getting around to right angles from the axis of the antennas, the rate of change is much more rapid. For example, a 3-decibel difference exists in the one degree between 88 and 89-degrees. Between 89 and 90 the change is much more pronounced—from the existence of signal to theoretically none at all.

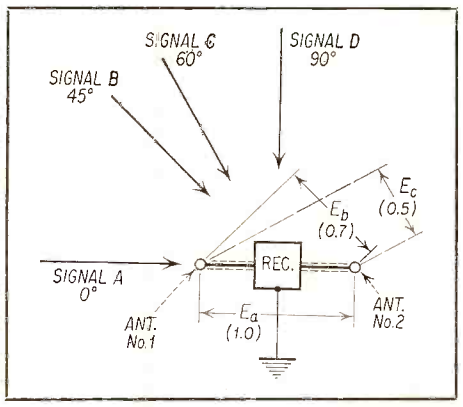

Fig. 2—Directional variations with two vertical antennas.

This is the reason for the use of the null sector in direction finding, rather than the line of maximum signal, since the null is very much sharper than the broad area of maximum response.

The form of direction-finding antenna which has been discussed so far is the "Adcock," widely employed on shore for directional radiation and reception where the most efficient antenna height and spacing can be used. On a boat, the dimensions of the DF-antenna system are seriously limited. Therefore, vertical antennas are not used for boat direction finders. However, by making the antenna in the form of a coil which has several vertical members or windings (connected across in series at the top and bottom) the practical effect of a much larger vertical antenna is obtained, giving much better signal sensitivity.

The loop antenna, while it affords greater signal strength from a given radio field, has the disadvantage of having equivalent horizontal sections at top and bottom. These horizontal-antenna components are insensitive to ground-wave radiations which cancel because they arrive at the top and bottom sections at the same time. However, additional currents are induced in the circuit from any waves arriving from

[*Continued on page 57*]

trade

Window panes and lenses made of a solid, opaque metal have been developed by Raytheon Manufacturing Company which allow invisible heat rays from sub-zero targets to reach a super-sensitive infrared detector. Other materials require targets to be 250 degrees or hotter for equal range. This advance, Raytheon scientists state, is a major breakthrough in the technology of infrared devices, opening a door to many new commercial and military applications. Use of this material, the scientists point out, may make it possible to detect enemy ships, planes and missiles from longer distances in total darkness without revealing the observer's position. It will also lead to more effective solutions of guidance, gunfire control and automatic tracking problems.

● ● ●

A testimonial dinner for Julius Finkel, president of JFD Electronics, Inc., Brooklyn, New York, celebrating his 70th birthday was held at the Commodore Hotel in New York City on March 30th. More than 200 friends, business associates and employees attended. Among the highlights of the ceremonies for Mr. Finkel, who first immigrated to this country in 1908 and became a pioneer in the electronics industry, was the presentation of a plaque and bronze scroll signed by all JFD employees, a silver plate from his seven sons who are all members of JFD, and tributes from members of the electronics industry.

● ● ●

The Heath Company, a subsidiary of Daystrom Incorporated, broke ground for its new plant, it has been announced.

Robert Erickson, president of the firm, explains that the new plant will be located on Hilltop Road in South St. Joseph, Michigan, but will keep its Benton Harbor, Michigan mailing address.

● ● ●

Proclaiming the electronics industry "one of the most forceful, potent, and dynamic forces in our way of life," Mayor Richard J. Daley of Chicago officially set May 15-23 as Electronics Week in Chicago.

During the week May 15-23 electronic industry leaders from all parts of the country will gather in Chicago for trade and industry meetings. These include the national conventions of the Radio-Electronic-Television Manufacturers Association (RETMA), and the National Electronic Distributors Association (NEDA), as well as the mammoth all-industry Electronic Parts Distributors Show, to be held at the Conrad Hilton, May 20-23. More than 12,000 are expected to attend the show alone.

An all-transistor radio for the Cadillac El Dorado Brougham has been announced by the Delco Radio Division of General Motors. Thirteen transistors are used in the radio in addition to three germanium diodes. Use of two Delco high-power transistors to drive the speakers provide ample audio power reserve and hence excellent tone quality at normal listening levels. Knife sharp selectivity is provided for adjacent channel rejection without sacrifice of broad "nose" selectivity for good tone quality.

Manual, push button and signal seeking tuning are provided in the receiver as well as a two speaker fader system and an electric antenna which automatically extends when the radio is turned on and retracts completely when the radio is turned off. This advanced design radio makes best use of the unique agc characteristics of transistors to provide reception almost completely free of fading problems.

● ● ●

A new line of Motorola medium power transistors has been announced by J. T. Hickey, Manager of the electronics company Semi-Conductor Division. The new transistors fill a gap in the power spectrum which formerly existed in the 100 milliwatt to 350 milliwatt range.

The transistors are now in use as audio amplifiers in portable radios, as driver units for power transistors, in *dc* converter units and numerous other applications.

● ● ●

A new replacement parts program for all Philco consumer products to insure prompt service throughout the United States was announced today by Ray Nugent, General Manager of the Company's Accessory Division. Known as "Factory-Distributor 90 Day Service Parts Program," it calls for a balanced inventory of service parts in each Philco distributing territory. The new program calls for maintenance of a balanced 90-day inventory of service parts in each Philco distributor territory, and provisions for an "emergency" service to Philco distributors for critically needed parts on a 24-hour basis.

● ● ●

Browning Laboratories, Inc., Winchester, Massachusetts, announces a new line of Multiplex Modulator Transmitter equipment. Gardiner Greene, President, announced that "This new equipment now enables Browning to offer a complete Multiplex system for the background music operator including transmitter, tuners, receivers, amplifiers, and accessories. We now undertake the complete responsibility in helping new stations get on the air with this new service."

flashes

Erie Resistor Corporation, Erie, Pa., announces a new company sponsored Educational Training Program for both technical and business employees. The program was initiated at the beginning of the 1956 Fall School Semester. It was originally developed to fill the needs of personnel in the Engineering and Research Departments. Response within the company has been so great that the program has been expanded to cover all employees.

• • •

Television marked another communications milestone with what is believed to be the world's first transmission of a TV picture on a light beam. This technique was used at Boston's WBZ-TV station. According to the faculty at the University of New Hampshire, this represents a major achievement in transmission of signals via a light beam. The television station's technical staff worked on setting up this experiment for a period of nearly a month, in collaboration with engineers and scientists from Baird-Atomic, Inc., Cambridge, Mass.

• • •

Television receiver production in February increased over the January output while retail sales of these items to consumers declined slightly but were reported to be above the sales level of last year, RETMA announced. February TV output amounted to 464,697 receivers compared with 430,280 sets made in January and 576,282 produced in February 1956. Cumulative production figures show 914,887 TVs made this year compared with 1,164,629 receivers produced during the corresponding months of 1956.

Retail sales to consumers of these receivers totaled 525,437 units in February compared with 623,359 sold in January and 530,554 TV sets sold in February 1956. Cumulative TV set sales totaled 1,148,796 during January and February of this year compared with 1,144,767 sold during the like 1956 period. TV sets manufactured with UHF tuning facilities totaled 68,219 in February compared with 67,079 produced in January.

• • •

Factory production and retail sales of radio receivers in February were reported by RETMA today to be above the corresponding month a year ago. Cumulative production and sales totals were reported to be substantially over the same two-month period of last year. February radio production totaled 1,264,765, including 522,859 automobile receivers, compared with 1,085,529 sets made in January, including 521,624 auto receivers. February 1956 production had been reported at 1,093,506, including 437,611 auto sets. Retail radio sales to consumers in February totaled 525,029, excluding auto receivers, compared with 563,363 sets sold in January and 454,867 radios sold in February 1956. Cumulative radio set sales this year total 1,088,392 compared with 986,073 sets sold in the two-month period of last year.

Manufacturers' sales of receiving tubes increased substantially in February over the January level while TV picture tube sales declined. Cumulative sales compared with last year show the same trend. Cumulative sales of 82,031,000 receiving tubes during the first two months of this year show a substantial increase over the 77,895,000 sold in the corresponding 1956 period. The dollar value also increased to $67,801,000 thus far this year over the $62,070,000 worth of tubes sold during the first two months of last year.

TV picture tube sales in February totaled 728,363 units valued at $13,134,778 compared with 760,855 tubes sold in January with a dollar value of $13,594,525.

• • •

Preparations and promotional ideas to aid in the observance of "National Radio Week," May 5-11, were contained in a promotion kit recently mailed to all radio set manufacturers, RETMA announced. RETMA's participation in the all-industry event is under the guidance of the Public Relations and Advertising Committee, headed by Julius Haber, of RCA. The slogan for this year's nationwide campaign again is "Give a Radio," the observance of which will be actively promoted by the nation's radio dealers, distributors, radio stations, national and regional radio networks, and community leaders, in addition to receiver manufacturers.

• • •

Executive Vice President James D. Secrest today again appeared on Capitol Hill to ask Congress to restore the necessary funds to the FCC to enable its Bureau of Safety and Special Radio Services to "do the essential job of fostering a maximum effective use of the radio spectrum." The appearance of RETMA before the Senate Appropriation Subcommittee on Independent Offices marks the second time this year the Association has appeared in support of the FCC budget for the fiscal year 1958. Messrs. Secrest and Carroll White, RETMA Mobile Radio Communications Manager, testified before the corresponding House group recently.

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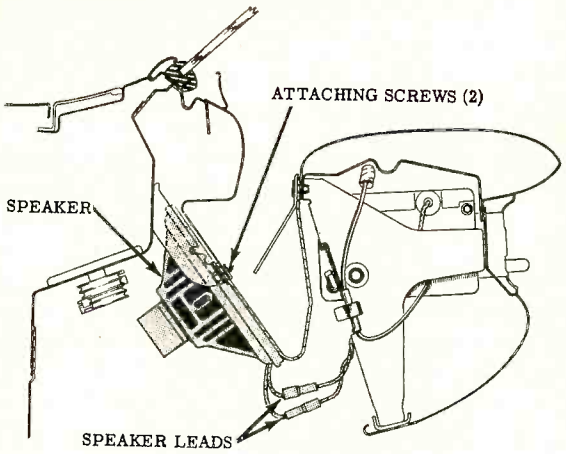

Fig. 1—Location and details of speaker mounting.

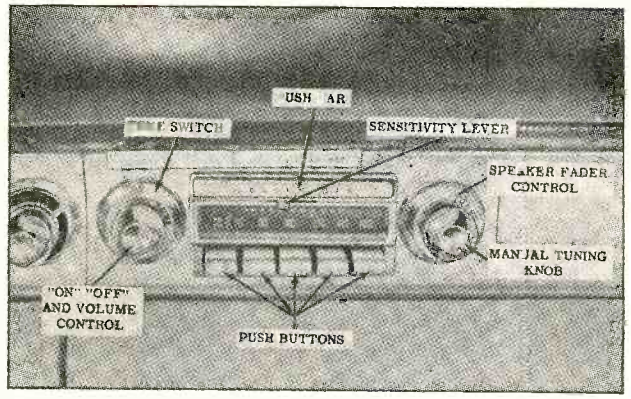

Fig. 2—Location of radio controls showing the auxiliary rear speaker control (fader control). Rear seat speakers are optional on all models.

Auto Radios for 1957 "Oldsmobile"

by Andrew Dopple

Circuit description, installation and removal hints, and servicing and adjustment procedures for the 1957 series of Oldsmobile receivers are discussed.

THE introduction of printed circuits and transistors has brought about a new concept in auto radios for 1957. These innovations allow for greater compactness and streamlining of the new sets.

Description

Two new sets using printed circuits are available for custom installation in the new 1957 Oldsmobiles, and are supplied by the Delco Radio Division of General Motors. These are the De Luxe model, part #989001 and the Super De Luxe Wonder Bar part #98002. The De Luxe is a six tube plus rectifier set while the Super De Luxe contains seven tubes plus rectifier. The additional tube in the Super job is used to trigger the automatic tuner. Both sets have five mechanical push buttons for touch tuning.

Sets mount in the center of the instrument panel with a separate 6" x 9" elliptical speaker mounted directly in front of the tuner section (see *Fig. 1*). The receiver assembly consists of two separate units, the tuner section and a power amplifier section; however both units are bolted together which simplifies installation or removal. The auxiliary rear seat speaker control has been redesigned and relocated (see *Fig. 2*). It is now known as a fader control and is located directly behind the right hand control knob, (tuner). Counter-clockwise rotation increases the front speaker volume and decreases the rear speaker volume. Clockwise rotation decreases the volume of the front speaker and increases the volume of the rear speaker. After proper balance is obtained, the volume of both speakers is

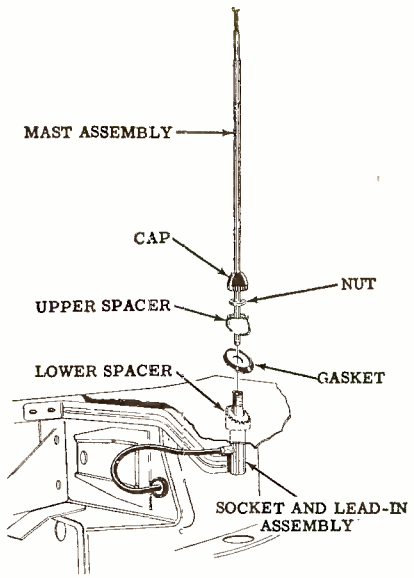

Fig. 3—Manual antenna assembly, showing lead-in wire to radio.

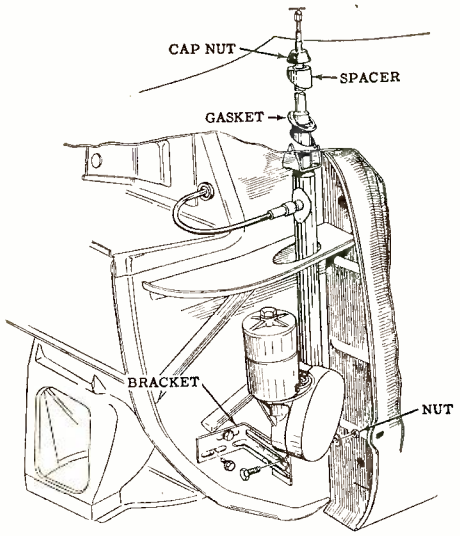

Fig. 4—Structural details of power antenna located under fender.

controlled by the volume control.

On the Super De Luxe set the selectivity control has been re-located to just below the selector push-bar (see *Fig. 2*). A three position sliding switch regulates the sensitivity of the automatic tuner, maximum sensitivity being obtained at the extreme right hand position. A foot selector switch is also included with the Super De Luxe model and is located on the left side of the front compartment floor, terminating at the rear of the receiver thru a three-prong plug. A tone control is located behind the left tuner volume control (see *Fig. 2*) on both models.

Manually adjusted antennas (see *Fig. 3*) or power antennas (see *Fig. 4*) are available, and mount on the left front fender. The control for the power antenna is installed directly above the tuner dial on the instrument panel. Auxiliary rear seat speakers are optional on all models.

Removal (All Models)

1. Remove front speaker

a. The front speaker mounts on a composition baffle directly in front of the glove compartment. The baffle is held in place by several clip fasteners and four self tapping screws (see *Fig. 1*). With a 5/16 socket wrench remove the self tapping screws and allow the speaker and baffle to hang from the clip end.

b. With a phillips-head screw driver remove the two screws holding the speaker to the baffle. Then disconnect the two speaker leads at the plastic push-in connectors and remove speaker.

2. Remove the seven phillips - head screws holding the glove box to instrument panel, push the box toward the front of car, and down and out.

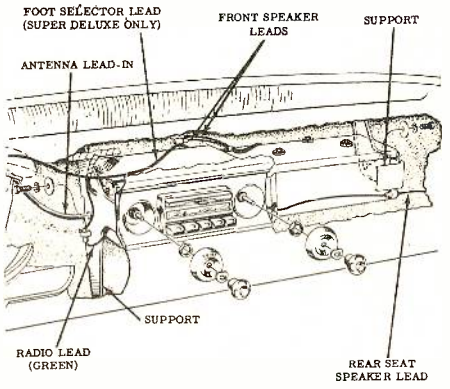

Fig. 5—Location of key points in removal procedure.

3. Disconnect the green battery "A" lead at the plastic push-in connector (see *Fig. 5*).

4. Disconnect antenna lead in.

5. On cars equipped with rear seat speakers disconnect speaker wire from push-in connector located in clip, on the lower right front corner of the power unit (see *Fig 5*).

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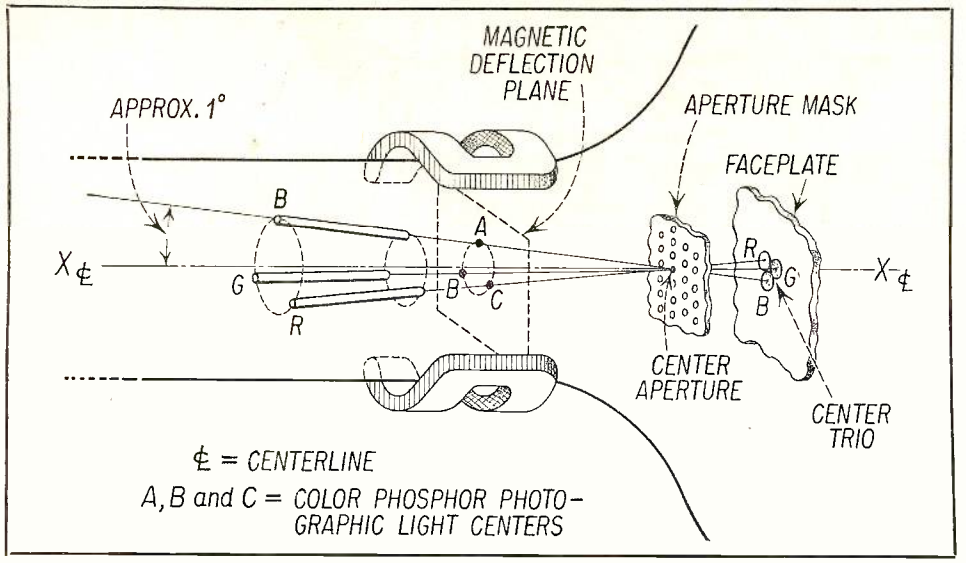

Fig. 1—Construction of the typical three-gun tube. Note the convergence of the three beams at the central portion of the aperture mask.

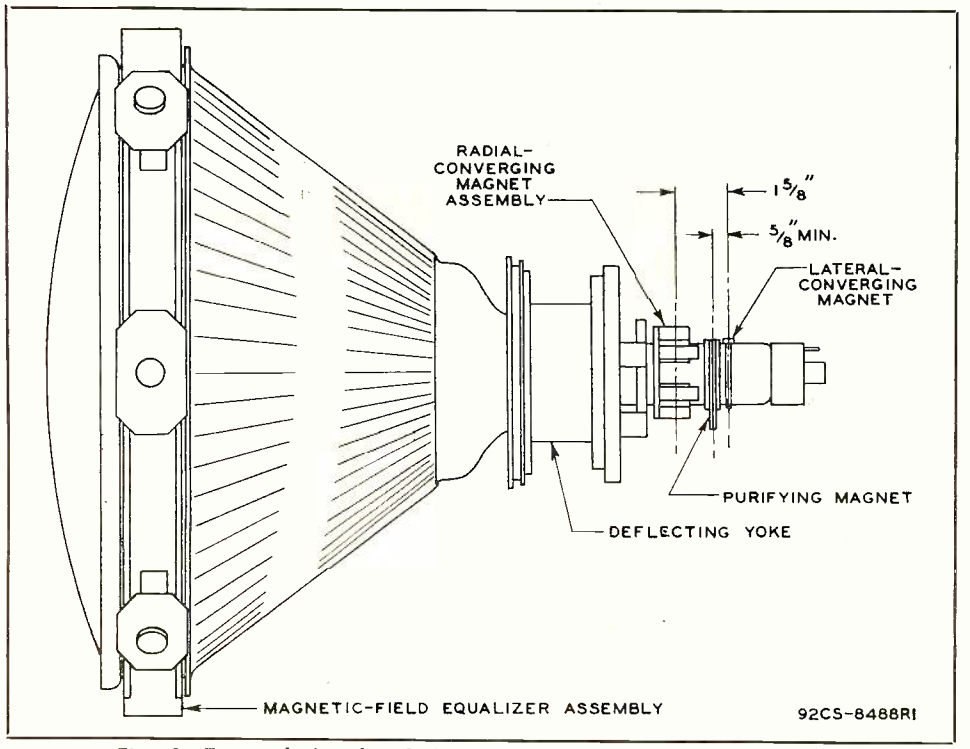

Fig. 2—External details of the 21AXP22-A including accessories.

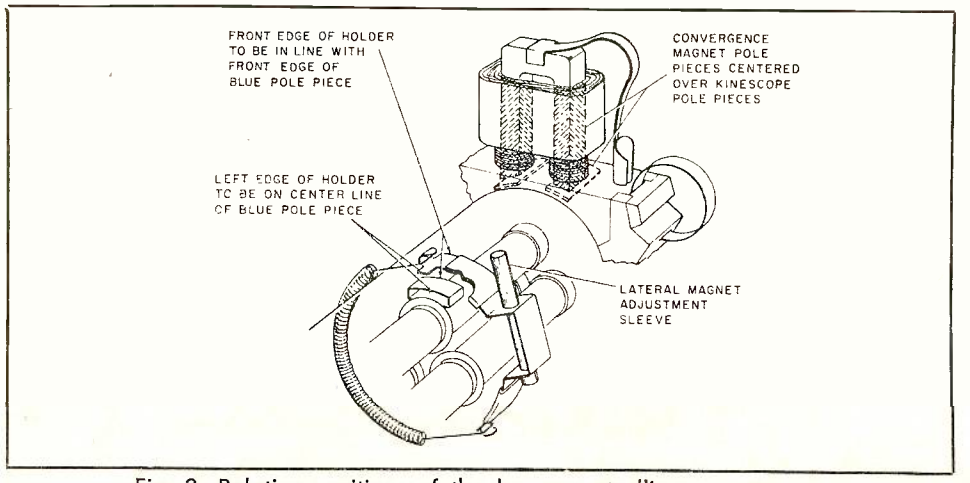

Fig. 3—Relative positions of the beam controlling components.

COLOR PICTURE TUBES

Part 2

by SAMUEL L. MARSHALL

A discussion of the construction, operating principles, and external components required for the three-gun color picture tube.

In the previous installment, color picture tubes were classified as being either 1-gun sequential or 3-gun instantaneous display devices. At the present writing the only tube used in commercially marketed color TV receivers is the 3-gun tube. The most modern version of this tube shown in *Fig. 2* is the 21AXP22-A.

Coating Faceplate With Phosphor Dots

A clear understanding of the operation of this tube and the manner in which the various external adjustments affect the movement of the various beams goes a long way in helping a serviceman set up the receiver quickly and efficiently. This understanding may be greatly facilitated by a knowledge of how the phosphor dot trios are deposited on the inner surface of the faceplate.

To this end let us examine *Fig. 1* which shows the manner in which the three color beams converge on the aperture mask and fall on the phosphor dots which cover the faceplate.

Without going too much into detail, the procedure by which the red, green, and blue phosphor dots are coated on the inner faceplate of the color tube makes use of an optical device called a "Lighthouse."* This device provides a light source of high intensity at three distinct optical centers within the neck of the tube. These centers are shown in *Fig. 1* as A, B, and C.

Every serviceman knows that the electron beam travels down the center line of the gun in a black and white tube until it enters the yoke. Here it travels a curved path, the point of emergence being dependent on the interplay of the horizontal and vertical magnetic effects. As these two magnetic fields go through their cyclical variations the beam emerging from the yoke traces out a solid angle much like the solid angle developed from the apex of a pyramid. Although the path in the yoke is curved, as stated previously, if we would visualize the point of this apex then we have defined the theoretical center of deflection.

With reference to the 3-gun picture tube containing an aperture mask, we have the situation where a pinpoint source of light placed at this very same point will produce a light output array identical with the pyramidal electronic beam array just referred to.

*Recent Improvements in the 21AXP22 Color Kinescope, by R. B. James, L. B. Headrick, and J. Evans; RCA Rev. June, 1956. Developments of a 21-Inch Metal-Envelope Color Kinescope, by H. R. Seelen, H. C. Moody, D. D. Van Ormer, and A. M. Morell; RCA Review, March, 1955.

The light, on going through the apertures in the mask, falls on a chemical preparation, and excites a colored phosphor deposit on the faceplate. Originally, a coating of a certain colored phosphor mixed with a photoresist material is applied to the faceplate. Following this, light from one of the optical centers is made to fall on the faceplate through the aperture mask. This "fixes" phosphor dots of a particular color at the points where the light strikes the faceplate. Successively applying phosphor preparations of the other two colors on the faceplate, and rotating the light sources in the Lighthouse around to each optical center in arcs of 120°, 357,-000 phosphor trios are formed on the faceplate for a total of 1,071,000 phosphor dots.

External Assemblies Required for Beam Control

In view of the foregoing, it is entirely logical to assume that if, in a perfectly constructed tube, the electron beams from the three guns are made to pass through the photographic optical centers on their way to the mask-faceplate assembly, these beams will fall on the exact centers of their assigned phosphor dots.

Unfortunately, tubes manufactured in production are never perfect. In addition, distortion of the beam from its desired path occurs during deflection of the beam for a number of reasons. Some of these will shortly be discussed. As a result, it becomes necessary to resort to various external devices to make corrections for these deviations.

The appearance of the 21AXP22-A showing the relative placement of the various external control components is shown in *Fig. 2*. Here we observe that in addition to the familiar deflection yoke, four more assemblies are used. These assemblies are labelled:

- Lateral Converging
- Purifying
- Radial Converging
- Field Equalizer

No ion trap is needed in this tube because it is aluminized.

The location of the various assemblies relative to the lateral converging magnet (as we proceed from the base of the tube to the faceplate) is fairly well de-

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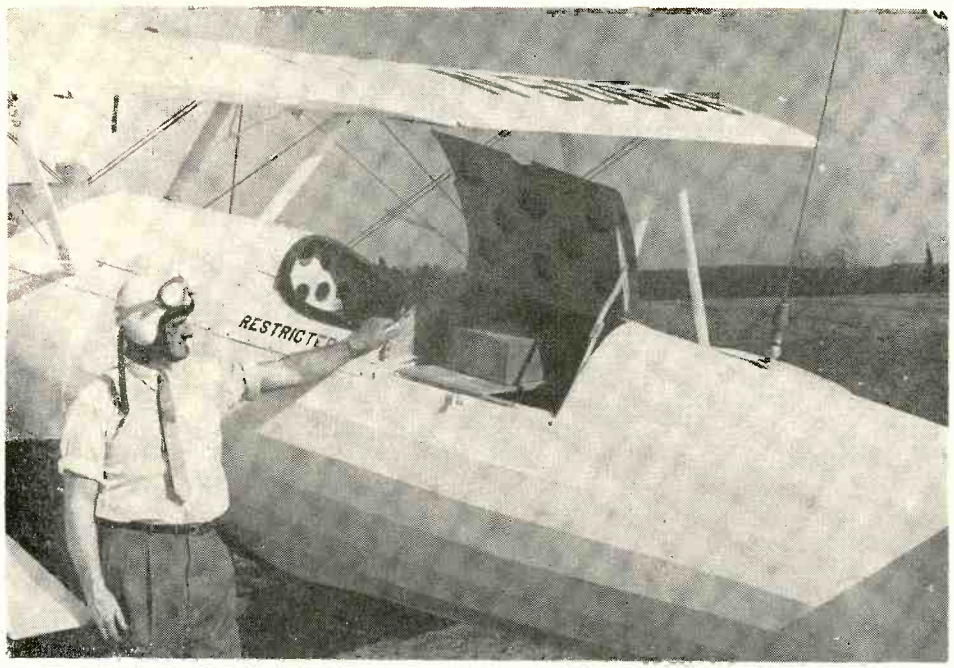


Al LiCalzi standing next to one of his mobile communication installations in a crop dusting plane.

HOW ONE MAN GOT STARTED IN MOBILE COMMUNICATIONS

by Oscar Fisch

A SHORT time ago, I received what I thought would be a routine and uneventful assignment. In line with our established policy of pointing out opportunities for expanding the field of operation of the serviceman beyond the limits set by home radio and TV servicing, our editor lined up a visit to a Mr. Al LiCalzi in Bridgeton, New Jersey. Mr. LiCalzi, according to information supplied to us by the Communications Company (Comco) of Coral Gables, Florida, was just the man we were looking for. His story, we were told, would be helpful in paving the way for others to get into this field. So off I went to Bridgeton.

After a few detours I found the address and now came the first surprise. I had expected to find a service shop in the heart of the town's business section. Here, however, was a beautiful ranch home on the outskirts of the town. Could this be the right place? I rang the doorbell and the very gracious Mrs. LiCalzi answered. In answer to my inquiry, she said that if I followed the road right behind the house down to the airport, I'd probably find Al down there.

"Ah! That sounds better," I thought. "He must have a service shop at this airport, and probably specializes in aircraft radio." Down the road I went, but not very far. The airport was just about 300 yards away. This didn't look like a commercial airport. It was a little too small. About five or six planes in all. I saw only one man on the field. "Must be the guy I'm looking for," I guessed. Sure enough, it was. A quick introduction and in no time at all we were talking turkey and using first names.

"Look Al," I said, "I hope I'm in the right place. I came down here for a story on how you got into the Mobile Communication business and pass it on to our readers. What's the set up?" His answers to this and succeeding questions unfolded what was to me an absorbing account of his entry into this field. It was a story also, which should serve to point the way to servicemen who have intentions along these lines.

Al is a flyer. He holds a commercial pilot's license and in addition is a licensed aviation mechanic. One of his activities is that of a "crop-duster." This airport I spoke of was his own and the planes were those he used in crop dusting (except for his own "pleasure" plane). In connection with this work, Al soon found that ground to air communication would be extremely helpful. For one thing, a ground observer in a jeep could direct him to areas he might have missed. For another, he found that he could stay one jump ahead of tricky weather by getting reports from a strategically placed coworker.

So Al made contact with Communications Company, Inc. and got himself some equipment. Up to this point, though he had a background in radio, his experience with communications equipment was rather limited. By carefully following the directions outlined in Comco's instruction manuals, he successfully installed the transmitter-receiver equipment in his "dusting" planes, and in a jeep. He followed this up with another installation in his home so that the little woman could contact him. (I couldn't help wondering if this wasn't a mistake). Another installation was made in the family car just to make sure she could keep tabs on him under any and all conditions. Finally, with the aid of a local F.C.C. licensed technician, the equipment was checked out and legalized.

Now crop dusting, as you can well imagine, is a seasonal occupation, so Al found time on his hands during the off-season periods. He was fascinated by this "mobile" business, and began to study it seriously. Along with this study, he gained experience by working and experimenting with his own equipment. ■■

In talking to Al, you realize that he's a very realistic, and practical person. "Look" he said to me, "The way I see it, one of these days I'll go down for my annual physical check up and they may find that my blood pressure is a little too high, or some other such thing. When that happens, I'll have to stop flying. I might just as well be ready for that day. As long as I get a bang out of this communications stuff, why not go into it?"

As his first step he made arrangements with some local radio and TV servicemen, one of whom was the aforementioned F.C.C. licensee, to work with him. Next he contacted Comco, and after discussing the situation with them, was granted an agency for his area. Since that time, about a year and a half ago, working during the fall and winter months, Al has sold and installed about $30,000 worth of equipment. He has personally handled a large majority of all the service calls on the equipment. His average installation employs one fixed station and four or five mobile units.

It is of prime importance in an operation such as this to know who your

Fig. 1—Salem County Road Dept. installation. Note the antenna.

potential customers are and how to make your initial contact with them, so I asked Al how he handled this problem. As far as recognizing potential customers was concerned, the answer was emphatically given when Al went through a list of some of his accounts.

One of these for example, was the Salem County Road Department. A photograph showing the antenna of this installation may be seen in *Fig. 1.* In this case the equipment is used for the direct dispatching of crews and equipment to points where emergency road repairs are required, where snowbound conditions exist, etc. Another case in point was the installation of equipment for the operator of one of the largest peach and apple orchards in the country. The system easily earns its keep by its use in co-ordinating the picking of the fruit with its delivery to the warehouses. Still another installation involved a road contractor, who used the equipment to insure the delivery of various road mixes at the proper time and at the proper temperature. The list could go on and on. (Our issue of December 1956, lists many other potential users.)

On the matter establishing contact with these potential customers, Al's experience proves what most servicemen know, namely, that a satisfied customer is your best advertisement. He is convinced that word of mouth advertising ranks with the best. In addition he uses newspaper and radio advertising, but feels that the newspaper ads are more effective. Finally, direct calls are made where it is felt that a particular company can use the equipment to advantage.

The average serviceman going into mobile communications must reorient himself along financial lines. When he deals with the sale and installation of communications equipment, he will be dealing with much larger sums than those ordinarily involved in radio and TV sales and servicing. A $3,000 installation is commonplace. A $5,000 installation is not at all uncommon. An important implication of these figures is that you don't have to sell a system every day in the week to make a living. If you sold only *one a month,* your earnings would show a very healthy in-

[*Continued on page* 57]

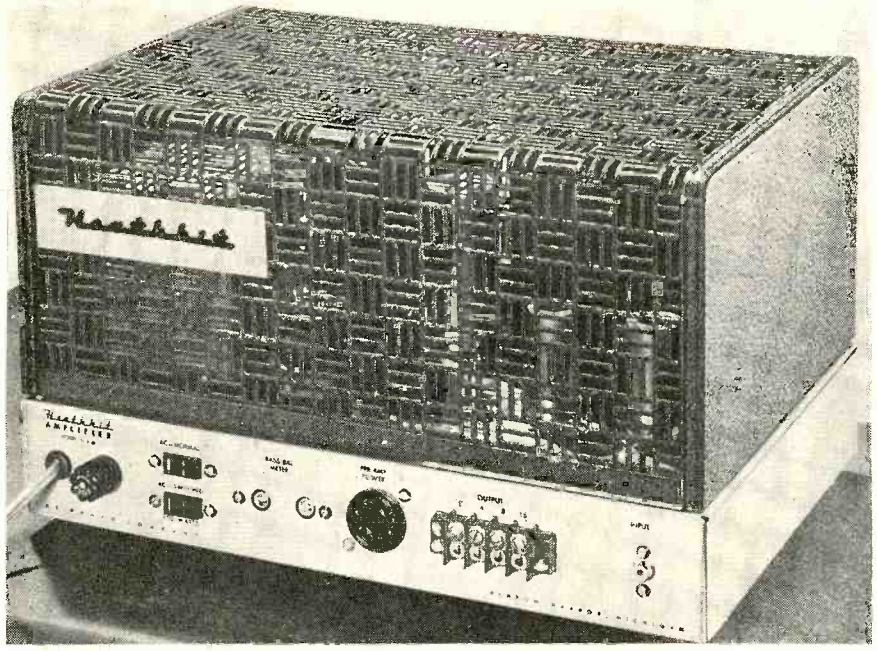


Fig. 1—Photograph of the Heathkit 25 watt, model W-5M.

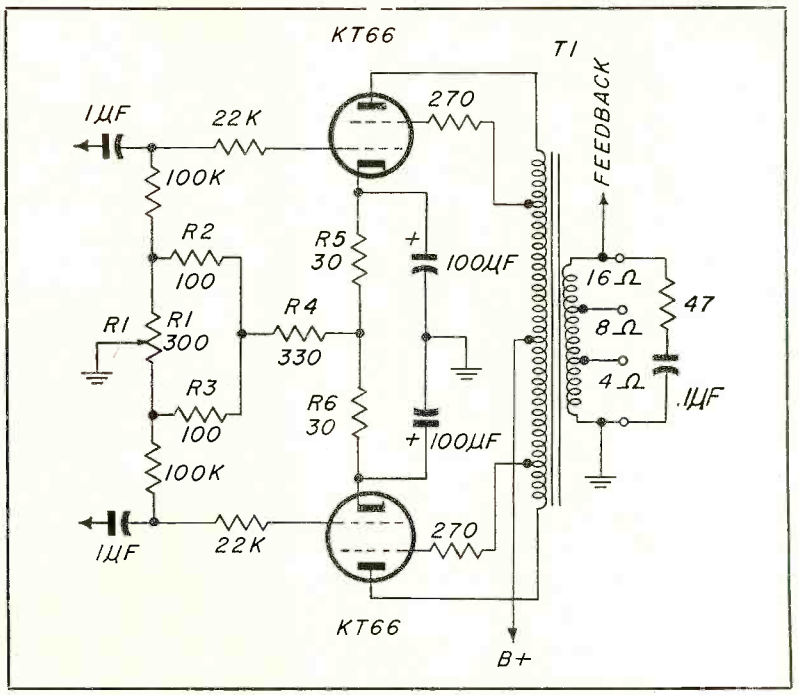


Fig. 2—Partial schematic of the output circuit of the W-5M.

HI-FI IN KIT FORM

by Peter Ruggiero

A discussion of how the average service dealer can compete with expensive Hi-Fi showrooms by utilizing kits for the assembly of the various component units.

With the ever widening popularity of high fidelity sound systems in the home, the service dealer throughout the country finds himself in a unique, if somewhat baffling situation. He wants to sell high fidelity products, but a quick trip to any sound showroom in the area indicates that the set-up, furnishings, variety of stock carried (not to mention the elaborate electronic switching set-ups, number of speaker enclosures on display, etc.) make the prohibitive dollar signs loom before his eyes. He generally has neither the finances nor the space for such a display.

Selling Wired Kits

After much thought on this subject, we decided to launch a rather ambitious project. The Heath Company of Benton Harbor, Michigan, is probably known to you. Did you know that Heathkits of great variety are available in the hi fi field? We found that with just five easily assembled and wired kits, a complete high-fidelity system can be made up and that the resulting system will stand on its own merits both in appearance, performance, and economy. It occurred to us, therefore, that here lies a practical approach to the service dealer's hi fi problems. A system such as the one described was completely wired and installed in barely more than 27 hours for all five components. It is felt that such a system installed in your shop, besides affording you with wonderful sound the whole day through, is bound to engender curiosity in (and subsequent sales from) your customers. The nice thing about this type of service is the "custom built" approach, which is almost synonymous with hi fi. In such a service, you would not only be assembling components into an integrated system, you could actually sell the fact that each unit was individually built by you for your customer.

Details on The Kits

The first unit we built was the Heathkit W-5M, a 25 watt basic power amplifier. It took approximately 7 hours of labor. A photograph of the finished unit is shown in *Fig. 1.* It's a good idea in building any of these kits to check the parts list printed at the end of the instruction manual. Occasionally an error may take place. Then, too the packaging material is often elaborately inserted to protect the parts and a small part may be inadvertently thrown out with this waste material if you don't check first.

Always follow the assembly instructions in the order in which they are given. As a technical person you may find that the steps are overly detailed but don't rush ahead. These kit manuals are the result of many hours of engineering and trial and error. To put it another way if you follow the schematic or pictorial diagram in a random manner you *may* successfully complete the kit but if you follow the manual you just can't miss!

A partial schematic of the output cir-

cuit shown in *Fig. 2* highlights some of the outstanding design features of this amplifier. Resistors *R-1, R-2, R-3* and *R-4* comprise the bias balancing system for the push-pull KT-66 output stage. In order for a push-pull circuit to be fully effective in reducing distortion and providing full power output it is important that each tube of the pair be matched to its mate. While the KT-66 is a carefully engineered tube its transconductance may still vary within small limits. Such a condition might result in unequal currents in the output tubes which would in turn mean a small amount of unbalanced *dc* current flowing through the primary of *T-1,* the output transformer. This would effectively reduce the primary inductance and increase the distortion at low frequencies where large amounts of clean power are especially needed. By varying resistor *R-1,* the bias of one tube may be altered slightly with respect to the other, so that both draw equal current. This fact is easily established by connecting a volt-meter from the cathode end of *R-5* to the cathode end of *R-6*. Adjust *R-1* until a zero reading is obtained. *R-5* and *R-6* must then have equal voltage drops across them (or equal current flowing through them since they are equal in value).

The completed unit should be placed where there is adequate ventilation, but need not necessarily be accessible to the customer because all necessary control functions are built into its companion piece, the Model WA-P2 Preamplifier.

Building The Preamp

The Model WA-P2 can be wired in about the same time as the amplifier. Here are incorporated all control features such as tone controls, phonograph equalization, volume, signal source selection, (from as many as five sources), as well as pleasing style. You will find, therefore, that the "parts density" may be a little greater than in the amplifier but again, if instructions are followed to the letter, you should encounter no great difficulty.

In our experience with this unit, we found it particularly important to place the parts exactly as shown in the pictorial diagrams and also to use sleeving

[*Continued on page 41*]

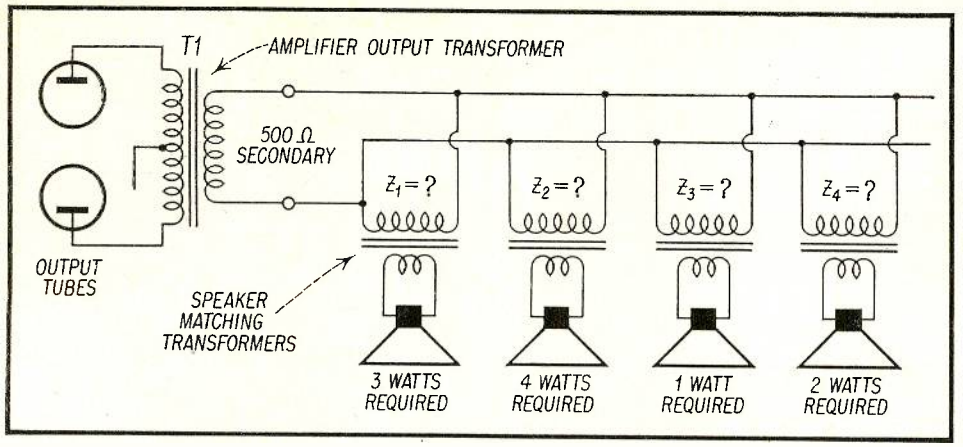


Fig. 1—In this conventional arrangement for multiple speakers, complicated matching problems are encountered.

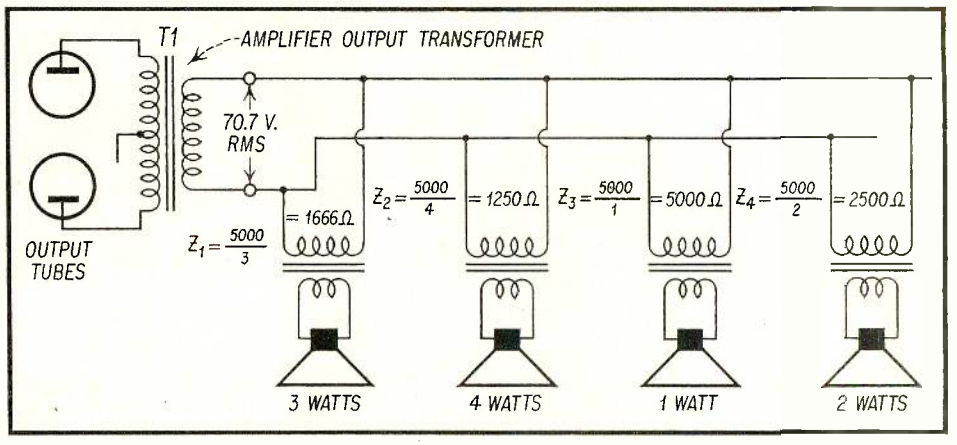


Fig. 2—The use of a 70.7 volt output tap permits this simple approach to determine transformer impedances.

Plug in Speakers for P.A. Systems

by Leonard Feldman

A description of a system which allows changing the number of speakers and the power delivered to each speaker, without resorting to complicated series parallel matching networks.

A COMPLETELY new approach to Public Address System installation is fast becoming standard in this country. Besides the obvious advantages of having *anything* in the electronics business become more or less standardized, this particular innovation results in a much simpler job for the service dealer who is called upon to do Public Address installations as a regular part of his business.

The Old Approach

If you ever tackled a PA job in the old days, it was a pretty complicated affair. First of all, a determination as to the exact number of speakers and their location was required. Usually, in the interest of less arithmetic and more profits, the tendency was to have each speaker handle as much power as the next, because calculations involving equal impedances or resistances are fairly simple. Thus, if it was decided that four speakers would do the job and that a total of 10 watts of power was required, four speaker impedance matching transformers were selected whose combined (parallel) primary impedance would match the 500 ohm output of the power amplifier. In other words, the primary impedance of each matching transformer was selected as 2000 ohms. The trouble came when it was realized that one of the speaker baffles was to be mounted in, say, the small executive office while another one was expected to cover a large, noisy production floor. The office personnel cried for mercy and were nearly deafened whereas the shop men couldn't hear the system at all. An easy way out was to pump *more* power than necessary into each loudspeaker and then put resistive pads at each speaker and use them much as one would use a volume control on a radio. Although this system works it is both wasteful of amplifier power (and thereby initial cost) and requires the purchase of rather expensive wirewound pads for as many speakers as there are in the system. Another alternative was to get out the old slide rule and go through some arithmetic gymnastics and hope to come up with an answer. *Fig. 1* illustrates what a gigantic task this would be. It can be seen that since each speaker is required to deliver a different percentage of the total 10 watts put out by the amplifier, each of the four impedances of the matching transformers would have to be different. To make matters worse, the parallel impedance of all four would still have to be equivalent to 500 ohms. Try solving that by any means other than "trial and error." Actually, it can be done, using simultaneous equations from your old algebra textbook. But then, assuming you'd gone to all that trouble and installed the system up to the last splice, what happens if your customer, upon hearing the system, likes it so much that he says "Say, could you add another speaker in the rest room? We overlooked that!"? Pull out all the matching transformers, unsolder all the connections, sit down with pencil and paper again and so on.

Plug In Speakers

The new method of PA system installation stems from a very common household phenomenon: the power receptacles all over the house through which the utility company supplies 120 volts of *ac*. No one ever worries about plugging in lamp after appliance after electrical gadget—at least until the circuit fuse is overloaded. We know that the *voltage* available will always be around 120 volts and that each appliance will take only that amount of power in watts for which it was designed. The reason this is so is that the internal

[*Continued on page 60*]

HI FI IN KIT FORM

[*from page 23*]

in several places not called for in the instructions. This is one place where extra caution pays off in preventing shorts. We found, too, that the control lugs in some cases come very close to the bottom cover screws, and bent them away, accordingly. This unit contains no power supply but is connected, by means of a power cable, to the amplifier discussed previously, from which it derives necessary filament and B plus voltages. A "hum buck" control insures minimum hum regardless of filament unbalance from one set of tubes to the next. Two cathode follower circuits are employed, for low impedance outputs for tape recording purposes as well as the main amplifier output. Tone control circuitry is the standard "losser" type, with continuously variable bass and treble boost and attenuation. Separate high frequency "roll-off" and low frequency crossover controls for phono equalization offer a total of 16 combinations of equalization characteristics—more than enough to compensate for any recording made or yet to be made. *Fig. 3* is a photo of the completed unit. While the basic model does not include a loudness control, provision is made for its inclusion should your customer require this refinement.

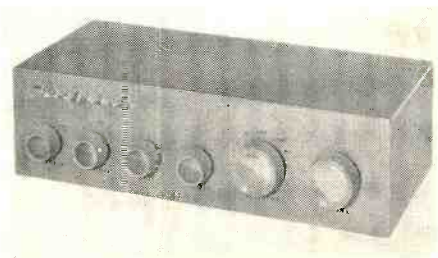


Fig. 3—Photograph of completed preamplifier built from a kit.

Tuner Kits

The *am* Tuner, Model BC-1, and the *fm* Tuner model FM-3A can be wired in approximately 7 hours per kit. Since we were dealing with *rf* and *if* frequencies in this project, point to point wiring was the rule. The manual stresses keeping leads as short as possible, but it cannot be overemphasized. The finished kits are identical in appearance. Figure 4 is a photograph of

[*Continued on page 51*]

THE ANSWERMAN

Inquiries Sent To The Answerman Will Be Acknowledged Only If Accompanied By Radio-TV Service Firm Letterheads.

by ELECTRONIC SERVICING Technical Staff

Dear Sir:

I have a customer's TV receiver that operates well except for one slight difficulty. With variations in the brightness control setting there are changes in the picture height. Is there anything I can do to prevent this condition? The receiver is a Du Mont chassis RA-343.

A. G.
Great Neck, Long Island

Regulation of the high voltage can be increased by making the following alterations which will help prevent vertical size changes with variations in brightness setting. Reduce *R253* from 33K to 15K, 1 watt, and *R248* from 68K to 18K. Increase *R249* from 33K to 120K ohms. These changes in the cathode circuit of the picture tube, as shown in *Fig. 1,* will improve the receiver in that better regulation will be obtained.

Mr. Answerman:

I have run into several TV receivers, the type with metal cabinets, which result in a shock when the cabinet is touched. I have checked and can not seem to find anything wrong in the set. An example of this condition was found in an Admiral 14YP3 receiver.

H. P.
Chicago, Ill.

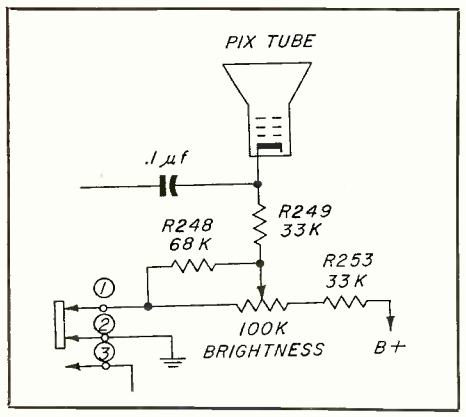


Fig. 1—Picture tube cathode circuit of DuMont RA-103.

There are a number of things that can be tried with receivers that exhibit complaints of this type. Perhaps the first is to try reversing the *ac* line plug in the wall outlet and determine if this helps. In the particular case of the Admiral receiver it is suggested that the parallel resistor-condenser combination (*Fig. 2*) of the 470K resistor (*R601*) and the .01 *uf* condenser (*C506*) be checked to determine that they are properly connected. If resistor *R601,* connected between the control panel bracket and chassis should be disconnected or broken a static charge will build up on the cabinet. This charge is great enough to cause a shock to be felt when the cabinet is touched. It is likely that these components have become loosened, possibly during servicing of the receiver. In many other types of receivers, the resistor-condenser parallel combination connects between the picture tube mounting bracket and the chassis. If these components are not properly connected static charges can easily accumulated on the metal cabinet and produce shocks.

Dear Answerman:

I have a GE "M" chassis in which there is a considerable loss of contrast or picture drive. The sound is weak, also. I have checked the tuner, *if* strip and video detector circuit and have found nothing wrong. Voltages are about normal. Is it possible that the trouble is in an *if* coil?

S. R.
Albany, N.Y.

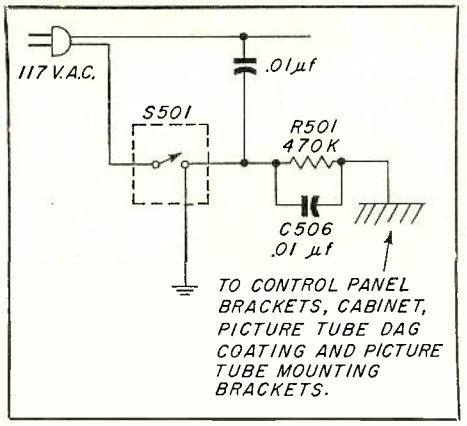


Fig. 2—Elements which may be responsible for cabinet shock.

Of course, it is possible that something is wrong in an *if* coil or stage. However, it is more likely that the trouble is occurring in the video amplifier section. It is probable that the video amplifier tube (6AU8) momentarily shorted internally, as some of them occasionally do, and caused the contrast potentiometer to burn; thus increasing its resistance. A partial schematic is shown in *Fig. 3.* The contrast control, *R163,* should be checked to make sure it hasn't increased in value. As can be noted, the sound take-off is in the plate circuit of this tube; thus, trouble here will also affect the audio output level. Of course, there is another strong possibility that should be investigated, and that is incorrect negative bias furnished by the horizontal output stage. Under certain conditions the negative voltage supplied by this stage for video amplifier bias has increased to such an extent that the gain of the video amplifier is reduced. Therefore, it is suggested that the horizontal output stage also be checked in problems related to video amplification. Measure the associated resistors and capacitors in this stage and try another horizontal output tube (12BQ6GA). ■■

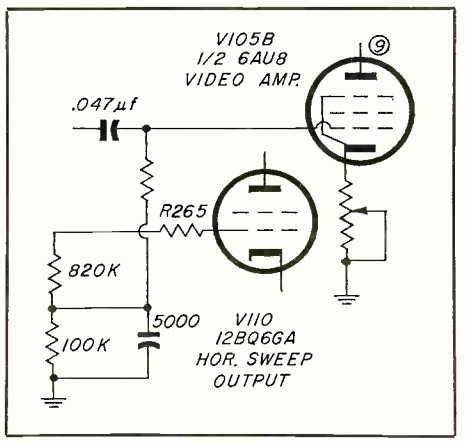


Fig. 3—Partial schematic of video amplifier stage—GE "M" series.

PHOTO-ELECTRIC CONTROLS

[*from page 9*]

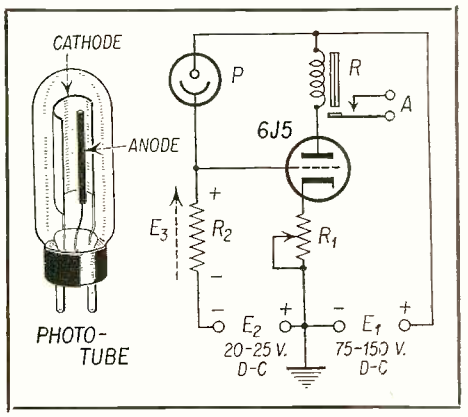


Fig. 6—Light energized relay.

counting or control purposes.

In a "dark energized" phototube circuit, as shown in *Fig. 7,* an interruption of the light beam actuates the relay. Initially, light falling on the phototube results in an effective "short" being placed across *R3.* This short results from the comparatively low resistance of the phototube when it is in a conducting state. Under these conditions the negative bias on the triode is the voltage drop across the portion of R_2 between the cathode tap and the point marked –E. This tap is adjusted so that when light falls on the phototube, shorting R_3, the grid bias developed across the tapped portion of R_2 is sufficient to cut

[*Continued on page 50*]

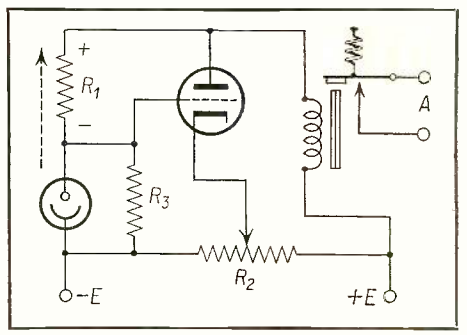


Fig. 7—Dark energized relay.

Mfr: GE **Chassis No.** ST line

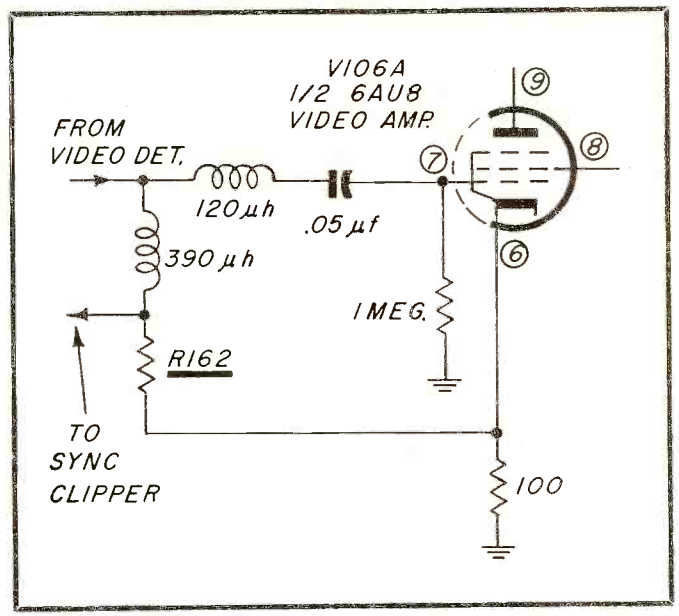
Card No: GE ST-1

Section Affected: Picture

Symptons: Wiggles in pix, trailing whites.

Cause: Resistor reduced in value.

What To Do:
Change: *R162* (3.9K).



Mfr: GE **Chassis No.** ST line

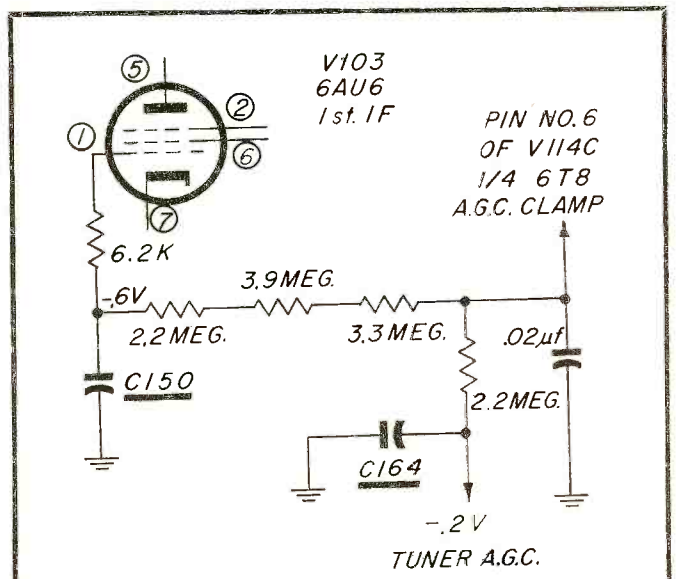
Card No: GE ST-2

Section Affected: Picture and/or Sound

Symptoms: Motorboat or flutter in pix and/or sound.

Cause: Open *agc* filter capacitors.

What To Do:
Change *C150* (.05 μf) or *C164* (.15 μf).



Mfr: GE **Chassis No.** ST line

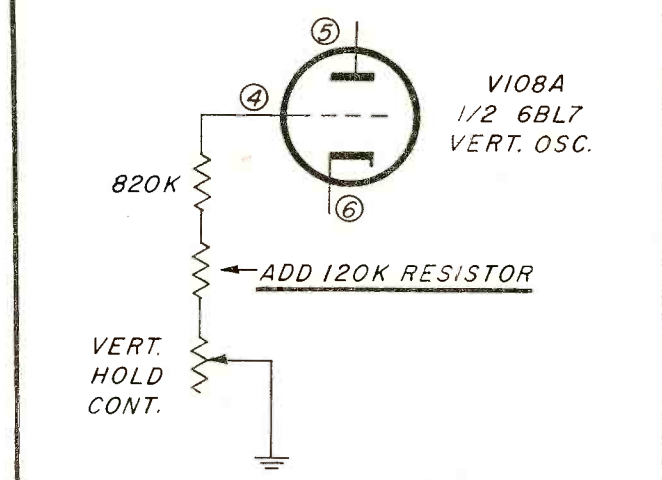
Card No: GE ST-3

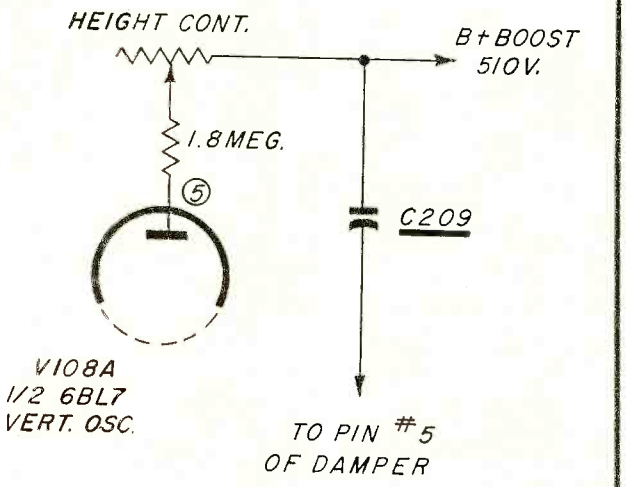
Section Affected: Sync

Symptoms: Vertical hold range does not center properly.

Reason for Change: Altered circuit constants. (See Note Below) (Production change incorporated in some chassis).

What To Do:
Add: 120K resistor in series with vertical hold control.





Mfr: GE **Chassis No.** ST line

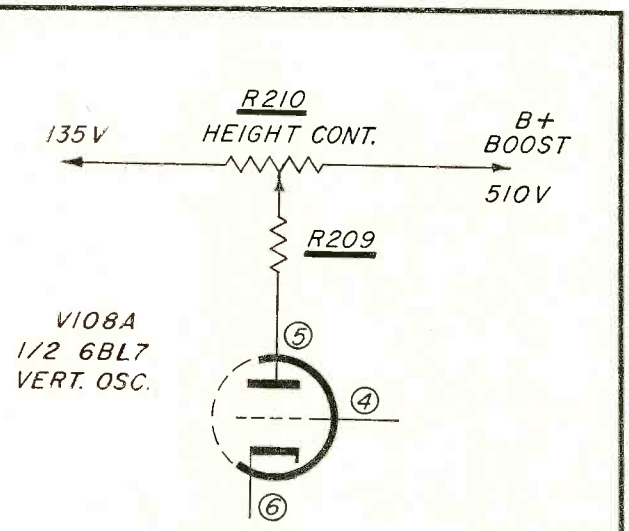
Card No: GE ST-4

Section Affected: Raster

Symptoms: Bright vertical bars in raster, poor horizontal linearity, inadequate width.

Cause: Open capacitor

What To Do:
Change *C209* (40 *mf*).



Mfr: GE **Chassis No.** ST line

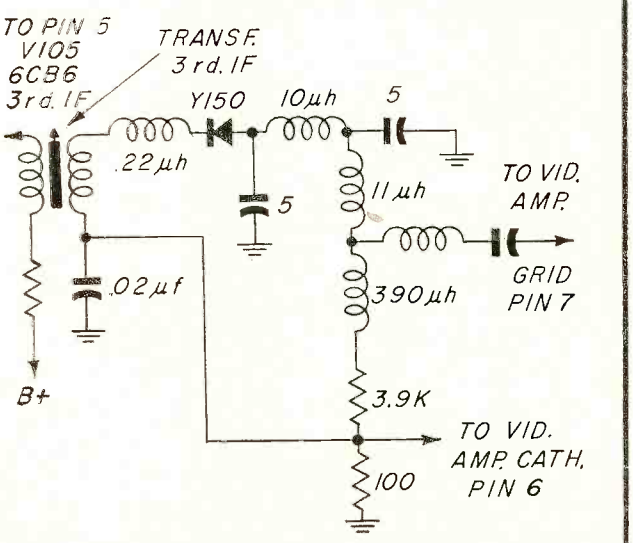
Card No: GE ST-5

Section Affected: Raster

Symptoms: Inadequate pix height.

Cause: Resistance increases in value.

What To Do:
Change: *R209* (1.8 megohm)
or *R210* (3 meg)



Mfr: GE **Chassis No.** ST line

Card No: GE ST-6

Section Affected: Sound and pix

Symptoms: No pix; weak sound.

Cause: Defective video detector crystal.

What To Do:
Replace: *Y150*, video detector crystal.

Mfr: Philco **Chassis No.** TV-396

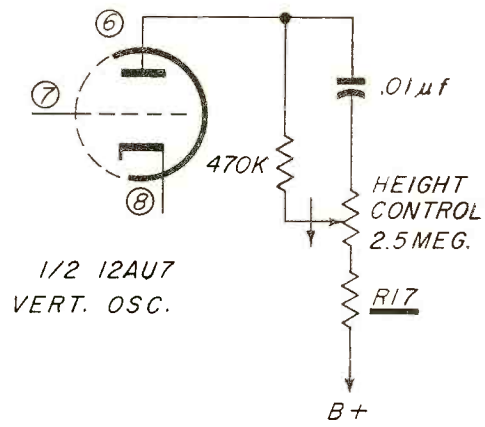
Card No: PH396-1

Section Affected: Raster

Symptoms: Pix height adjustment inadequate

Reason for Change: Circuit improvement (Prod change—Run 3)

What To Do:
Change: *R17* from 470K to 820K.



Mfr: Philco **Chassis No.** TV-396

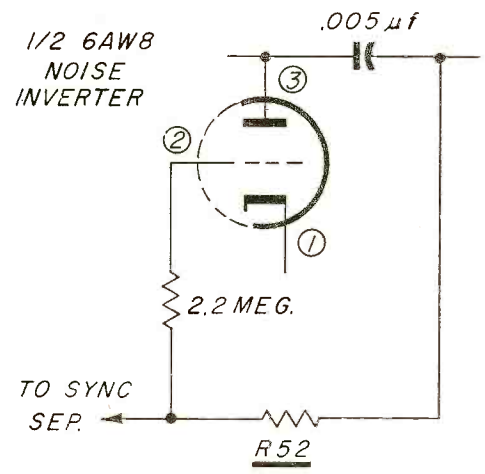
Card No: PH396-2

Section Affected: Sync

Symptoms: Vertical sync and *agc* not performing at optimum.

Reason for Change: Circuit improvement (Prod change—Run 2)

What To Do:
Change: *R52* from 220K to 390K.
Note: See Cards PH396-3, 4, 5.



Mfr: Philco **Chassis No.** TV-396

Card No: PH396-3

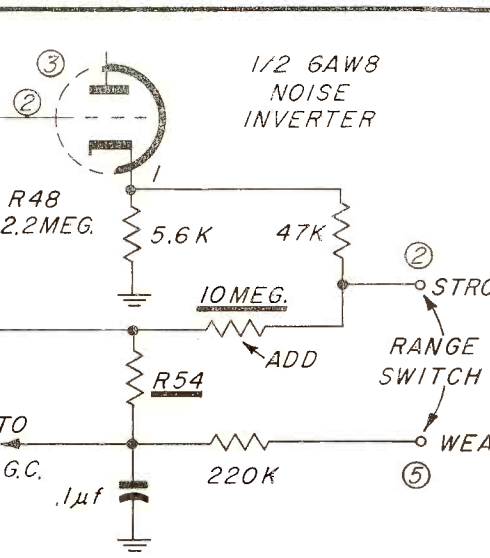
Section Affected: Sync

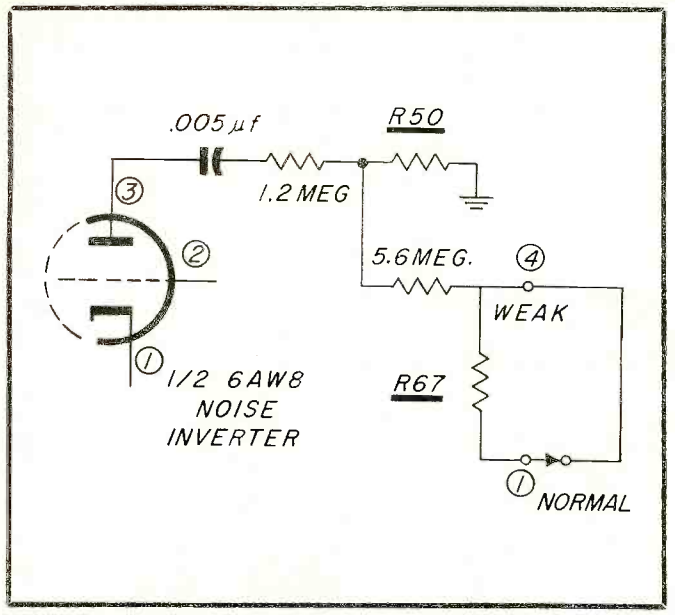
Symptoms: Vertical sync and *agc* not performing at optimum.

Reason for Change: Circuit improvement (Prod change—Run 2)

What To Do:
Add: 10 megohm resistor between position 2 of range switch and the junction of *R48* & *R54*.

Change: *R54* from 6.8 meg. to 5.6 meg.
Note: See Cards PH396-2, 4, 5.





Mfr: Philco **Chassis No.** TV-396

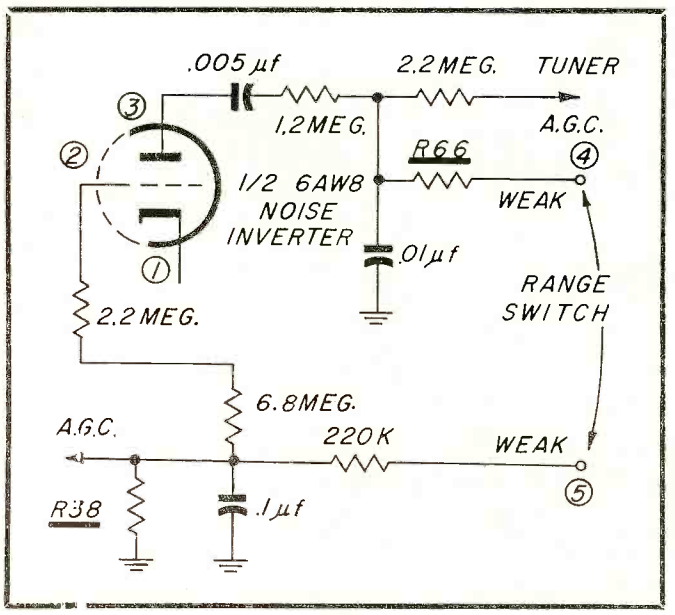
Card No: PH396-4

Section Affected: Sync

Symptoms: Vertical sync and *agc* not performing at optimum.

Reason for Change: Circuit improvement (Prod change—Run 2)

What To Do:
Change: *R50* from 1 meg to 1.5 meg.
Remove: *R67* (15 meg).
Note: See Cards PH396-2, 3, 5.



Mfr: Philco **Chassis No.** TV-396

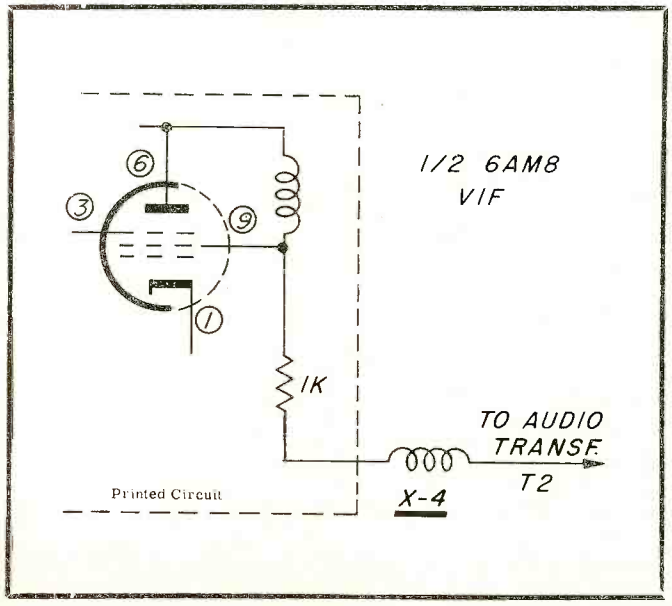
Card No: PH396-5

Section Affected: Sync

Symptoms: Vertical sync and *agc* not performing at optimum.

Reason for Change: Circuit improvement (Prod change—Run 2)

What To Do:
Change: *R66* from 5.6 meg to 6.2 meg.
Change: *R38* from 2.2 meg to 4.7 meg.
Note: See Cards PH396-2, 3, 4.



Mfr: Philco **Chassis No.** TV-396

Card No: PH396-6

Section Affected: Picture

Symptoms: Poor adjacent channel beat attenuation.

Reason for Change: Better circuit operation (Prod change—Run 3)

What To Do:
Move: Choke *X-4* from chassis onto the printed circuit board.

TRADE FLASHES

[from page 15]

TELERAMA, sponsored by the Council of Radio and Television Service Associations of Delaware Valley was held recently at the Ritz-Carlton Hotel in Atlantic City, New Jersey. Exhibits and demonstrations were shown by RCA, GE, Raytheon, and many other large firms.

● ● ●

Perma Power is building a new factory at 3100 N. Elston Avenue, Chicago, Illinois. They anticipate moving in the immediate future.

● ● ●

The Philco Service Division is seeking local non-retail service shops to handle service calls for Philco merchants who do not have their own service facilities. These shops would make standard charges for service labor and parts. They will cover an area of approximately twenty miles in radius. Those interested may contact Philco Service Headquarters at 2nd and Westmoreland Sts., Philadelphia 40, Pa.

● ● ●

Blonder-Tongue Laboratories has consolidated its engineering, manufacturing and administrative operations in a three level building in Newark, New Jersey. The move enables the company to accelerate research and development work, increase production capacity, and offer more extensive display and demonstrator areas for distributors, dealers and industrial accounts.

● ● ●

WORKMAN TV INC., announced a new line of model ‡GM Miniature Globar Resistors. These resistors will be available at all electronic parts jobbers in the U.S., and Canada. The resistors (¼" long by 1/16" diameter) are specially designed for modern circuitry where severe space limitations demand the tiniest of components. Capable of dissipating one-fifth wait of power continuously, the resistors are very stable in value even at temperatures as high as 125°C.

● ● ●

Mr. David Wald, president of Dewald Radio Mfg. Corp., manufacturers of radio, television and electronic products announces the appointment of Mr. George H. Fass as National Domestic Marketing Director. Mr. Fass was previously connected with Dean Electronics and has also been a manufacturers' representative. Mr. Seymour Wald will act as assistant sales manager to Mr. Fass.

● ● ●

Estimated Department of Defense military electronics expenditures in major categories of military functions increased substantially during the second quarter of fiscal year 1957 over the first quarter, according to a compilation issued. Total expenditures in the first half of the fiscal year 1957 are expected to exceed $1.53 billion.

Comdr. Edmund B. Redington, recently retired Coast Guard electronics expert, has joined RETMA as a staff engineer and liaison member of the RETMA Engineering Department assigned to the Military Products Division at RETMA headquarters, Executive Vice President James D. Secrest announced.

● ● ●

Favorable consideration of a proposal that RETMA change its name in recognition of industry trends and that several divisions broaden their product scopes and membership services highlighted the Association's first quarterly meetings. The Board of Directors referred to the Organization Committee a proposal that RETMA's name be changed by substituting "Electronics" for the present "Radio Electronics-Television" in the interest of simplicity and in keeping with the growing diversity of the industry's products.

● ● ●

The electronics industry established a new record during 1956, RETMA revealed in issuing its third annual "Electronics Industry Fact Book." Factory sales of radios, television, phonographs, military and industrial equipment and components were $5.9 billion, it was said. When distribution, servicing, and broadcasting revenues are added, the "Fact Book" states, the industry value totals $11.6 billion—twice the value of the billings in 1950 but only half that anticipated by 1965. Consumers enthusiastically endorsed another one of the industry's new products, the transistor radio, by purchasing 986,000 units from manufacturers. Copies of the "Fact Book" are available to non-RETMA members and the general public for 50 cents a copy from RETMA headquarters, 1721 DeSales St., N.W., Washington 6, D. C.

● ● ●

Transistor sales in January and February more than doubled the number sold in the corresponding period last year. This upward trend in sales of the semiconductor device emphasizes the steady growth in both production and application.

● ● ●

A new 25,000 square foot plant for Rek-O-Kut is scheduled to go into operation in July, it was announced by George Silber, President of the company. The company's new plant will cover an entire city block in Queens, N. Y. The new plant is an outgrowth of the greatly increased sales volume in the high fidelity components industry in recent years, according to Silber. It will be one of the most modern in the industry and will enable Rek-O-Kut to substantially increase its production over present facilities in the Long Island City plant.

PHOTO-ELECTRIC CONTROLS

[*from page* 42]

off the triode, and under these conditions no current flows through the relay.

Interruption of the light beam removes the short across R_3. Now R_3 in series with R_1 is connected across the B plus supply with the junction of R_1 and R_3 positive with respect to –E. Thus, we have two opposing voltages being applied between the triode grid and its cathode; the positive voltage drop between the grid end of R_3 and –E, and the positive voltage drop between the cathode end of the tapped portion of R_2 and –E. The net result is a reduction in bias between grid and cathode. This causes plate current to flow; thereby actuating the relay and closing the contacts across "A."

A *dc* power source is not required, *ac* serving as well. The amplifier tube acts as a rectifier to the tube conducting when the place is positive. ■■

SELF SERVICE TUBE TESTERS

DURING the last year, there has been an intense interest on the part of service dealers in the operation of self service tube testers. The questions below are a composite of the many inquiries received from service technicians and dealers by Calex Mfg. Inc., major manufacturer of these testers.

Can money be made with self service testers?

Yes. The average drug store or other such location sells about $40 worth of tubes per week at list price (some sell over $100). After the store takes its commission of 25% to 30% and after you figure the cost of the tubes, that still leaves about $12 per week profit on each machine.

What about all the sets that cannot be fixed by buying a tube?

Those customers who fail to repair their set at the self service checker, are prepared for a major shop job. But, let's face it, 80% of the TV troubles can be repaired by tube replacement. And that doesn't count the battery operated radios, car radios, etc. When a customer fixes his own set he brags about it and introduces his neighbors to the self service tester.

How can the service dealer get into this business?

Many dealers have already started. There is terrific interest on the part of many more. For example, more than 1,000 service dealers wrote in for a manual on "How To Run A Tubetesting Route" in reply to a recent ad by the Calex Manufacturing Inc. of Seaford, N. Y. The best way for a service dealer to start, is to stop mulling it over and place a tester in his own shop, and in as many local drugstores as he feels he can cover. A little experience in his own shop, with the self service trade, is worth more than all the discussion that has been made on the subject.

Can I get financial assistance if I want to expand rapidly?

The tester manufacturer can help you somewhat in extending terms, and you should see your tube jobber who is just as anxious as you are to have you expand your tube business.

How do I handle the details of this new business?

The tester manufacturer gives you all the dope, including catalogue sheets, consignment forms, window banners, inventory forms, etc.

How often are the stores visited for refilling stock?

Stores that sell over $75 per week are visited once per week. Stores that sell around $40 per week, once every two weeks, and stores below $30 per week, once every three weeks. On the average, once every two weeks.

Will it hurt my service business?

No, it will help. You will sell many times more tubes than you now do; and after all, that is the profit making part of your business. Also some service dealers have placed signs on their drugstore testers advising the customer that the service dealer backs up the tubes sold. Some offer credit on the tube toward a service call, if it does not repair the set.

Is it too late to start now?

If your area does not have a tester in the large volume drug stores and supermarkets, you are fortunate since you can get in on the ground floor. If the better spots are already covered in your area, you can still get in the picture; new shopping areas, normal turnover, some stores want better testers, and, believe it or not some drug stores have refused testers because they did not want to infringe on their local service shop's business. ■■

HI FI IN KIT FORM

[*from page 41*]

the FM tuner. What's more, the cabinet size is equal to that of the preamplifier just discussed. Thus, all the units can be stacked or mounted side by side on a book-shelf, etc. The *if* transformers and the discriminator transformer (in the case of the *FM* tuner) are prealigned at Heath, but it is usually possible, by realignment, to improve performance and calibration considerably. Since, unlike the home builder, you are in the fortunate position of having the necessary generators and meters to perform this alignment in the shop, you may reasonably expect superior results.

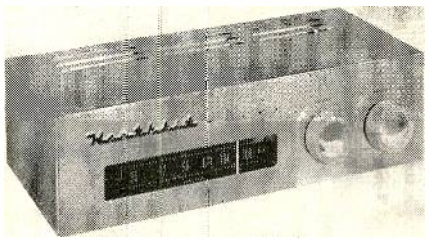


Fig. 4 — Photograph of the completed FM tuner built from a kit.

A circuit usually not encountered in table model radios is shown in *Fig. 5*. It is a part of the schematic of the *am* tuner and is known as a "whistle filter." In *AM* reception, if two adjacent channels are separated by only 10*kc*, their difference frequency will beat, through the normal heterodyning process and produce a sharp, annoying whistle. The reason this is not apparent in smaller receivers of the non-hi-fi variety is that the audio response of such receivers seldom extends to 10,000 cycles in the first place, so that this effect is not apparent. In hi fi equipment, where amplifiers are

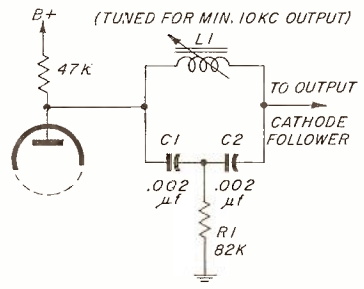


Fig. 5—Schematic showing whistle filter used in AM tuner.

flat to at least 20,000 cycles, the whistle is quite pronounced, particularly at the high end of the dial, where stations are usually crowded close to one another. The circuit, consisting of *L-1, C-1, C-2* and *R-1* is called a bridged T filter and is set to provide a sharp notch in the frequency response at 10,000 cycles. Because the filter action is so sharp, slight misadjustment of *L-1* will render it ineffective. If the circuit were tuned to 11 *kc*, the response at 10 *kc* would be practically flat, and no attenuation of the whistle would take place. It is suggested, therefore, that in tuning the whistle filter, an audio oscillator be used, carefully set at 10 *kc*. This method is described in the manual along with several other alternatives which we found to be not as effective.

The *FM* tuner, while somewhat more "open" from the wiring aspect, requires even more care than the *AM* tuner. Here we are dealing with a band of frequencies between 88 and 108 *mc* (and an *if* of 10.7 *mc*, which is quite "hot" all by itself). Skill in soldering will really make a difference, for a cold solder joint in a by-pass disc capacitor can cause oscillation and regeneration which is very difficult to track down once the set is completed. Follow the component and lead dress recommended in the instruction booklet and align the completed receiver with instruments rather than by ear. You will find that the sensitivity is at least as good as that specified by Heath and generally much better.

System Assembly

Having completed the electronic assembly of the units outlined, interconnections are made by means of shielded phono-cable equipped with standard RETMA phono plugs at each end. That is, the *am* tuner, the *fm* tuner and a record changer are hooked into the appropiate inputs of the WA-P2 preamplifier, which serves as the control center of the system. The amplifier output of the preamp is connected to the basic amplifier (W-5M) input by means of a similar cable. Connection from the amplifier to the speaker system can be made using virtually any twin lead cable—even TV 300 ohm twin-lead works fine.

Loudspeaker Systems

Speaker enclosure and system kits, available as models SS-1 and SS-1B, require neither the artistry of a cabinet maker nor the skill of a carpenter. All the parts are prefabricated and what's more, the necessary crossover capacitors and inductors are included, for a true 4-way speaker system. You may be able to work with a qualified cabinet finisher to obtain professional results.

Far be it from us to set your labor rates, but you can readily see that with a modest investment for the electronic elements of the system and 27½ hours of labor, plenty of room is left for substantial profits, while at the same time providing your customer with an excellent hi fi system at far less than he would have to pay for finished units available today. ■■

COLOR PICTURE TUBE

[*from page 19*]

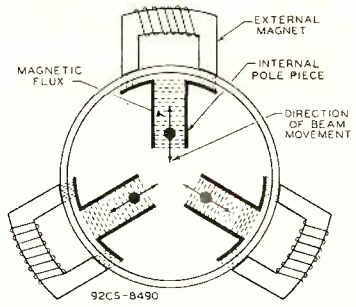


Fig. 4—Radial control of beam by radial converging magnets.

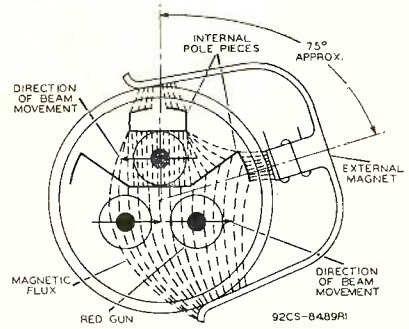


Fig. 5—Lateral magnet controls horizontal motion of the blue beam.

fined from the figure. To establish the location of the lateral converging magnet relative to the tube itself we refer to *Fig. 3* which shows the left edge of the magnet holder as being positioned directly above the center line of the blue pole pieces. In this figure a fixed magnet is used; however later designs are making use of an electromagnet so that the adjustment may be made from the front of the receiver.

Radial and Lateral Static Convergence Magnets

One of the items for which the tube must be corrected is mechanical misalignment of the three electron guns. It will be observed from *Fig. 1* that these guns are slightly tilted (approximately 1°) toward the tube's axis. This tilt aids in converging the three beams at the center aperture of the mask. If any gun is originally misaligned its corresponding beam will strike the mask or enter a different aperture, thereby lighting up a phosphor of an adjacent trio.

The geometric phosphor design is such that as the beam goes through successive apertures it strikes successive trios, and lands on phosphors of the same color only. In this case the beam may be converged again on its correct phosphor trio by adjustment of the static radial and lateral converging magnets shown in *Fig. 2.*

A more detailed view of the operation of these magnets is shown in *Figs. 4* and *5*. Here we show electromagnetic control of the static convergence functions; although *pm* components may be used as well. Radial converging magnets as shown in *Fig. 4* provide radial control of the beams in the manner shown by the arrows in the figure; radial, in this case, referring to a direction along a radius through the tube's axis. A lateral magnet provides horizontal control (see *Fig. 5*) of the blue beam with respect to the red and green beams, the latter two being made to move in a direction opposite to the blue beam, as shown by the arrows in this figure.**

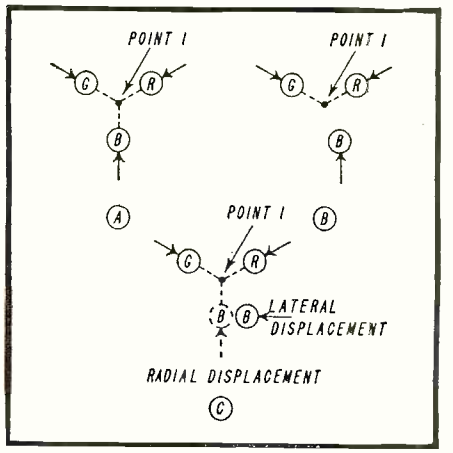


Fig. 6—Effect of static convergence adjustments on beam motion.

It is common practice, as shown in *Fig. 1,* to mount the 21AXP22-A so that the blue gun is above the red and green guns. Thus, viewed from the front, the blue beam appears below the red and green beams as in *Fig. 6.*

Static convergence adjustments are illustrated in this figure. In *6A* we show radial adjustment of the three beams to produce convergence at point 1. In *Fig. 6B* however, we find that straight radial adjustment will not

**Earlier blue lateral controls provide motion of only the blue beam relative to fixed red and green beams.

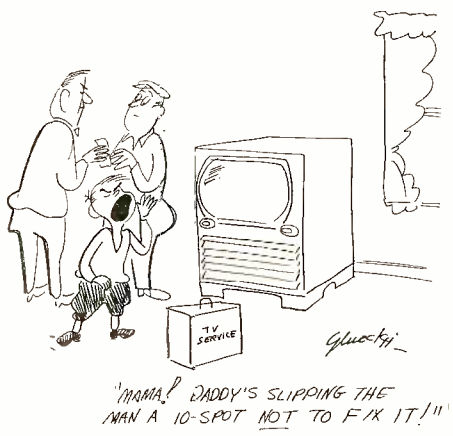
produce convergence, the blue beam being somewhat to the right of point 1. Here it becomes necessary to apply additional lateral motion of the blue beam bringing it over to the left with respect to the red and green beams. This involves simultaneous motion of the red and green beams in one direction and the blue beams in the opposite direction, and is effected by means of a lateral convergence magnet. The objective is to position the blue beam laterally between the red and green beams, as in *Fig. 6C*; following this the beams may be converged by radial adjustments.

To provide better control of the beams, and to minimize interaction of the static convergence fields on each other, polepieces are mounted directly on the tube guns as shown in *Figs. 4* and *5*. These polepieces are also used to identify the different color guns and to establish the correct locations of the convergence electromagnets on the neck of the tube. Thus, in *Fig. 5*, we observe that the lateral electromagnet is mounted so that its center line is 75° displaced from the center line of the lateral pole piece. Note the opposing fields produced by the lateral electromagnets as shown by arrows for the blue gun and for the red and green guns.

[*To be continued*]

AD LIBS [*from page 7*]

we have pioneered and opened the vast industrial vistas to radio-TV servicers —now has seen fit to follow our lead? They've added the word "Electronic" to their magazine's name and they're now starting to editorialize on how big the industrial service field is. We relish the imitation. It's said that "Imitation is the Sincerest Form of Flattery." ■■



"MAMA! DADDY'S SLIPPING THE MAN A 10-SPOT NOT TO FIX IT!"

WORK

Unusual Service Problems And Their Solutions

by **PAUL GOLDBERG**
Service Manager

THIS article concerns itself with odd problems originating in the damping circuit of the horizontal amplifier. To solve problems of this nature a thorough knowledge of the receiver circuitry is extremely helpful.

RCA KCS 68C

The receiver was turned on and it was observed that the picture was hooking at the top and bending intermittently. It seemed to be an *agc* problem as the contrast could not be lowered to a point we could consider normal. The *agc* control was adjusted, but did not lower the contrast sufficiently to eliminate the hooking. The tubes receiving *agc* voltage were then replaced individually, but had no effect. (*rf* amp. 6BQ7, 1st and 2nd video *if* 6AU6 and 6CB6, the first audio 6AV6, *agc* amplifier 6CB6.) Voltage checks were then made at the screen, cathode and grid of the *agc* amplifier, V 111, 6CB6. All were found to be approximately correct. The voltage (*agc* voltage) at the plate measured approximately one volt negative instead of about 5 or 6 volts negative. The schematic of this portion of the receiver, *Fig. 1,* was next studied. This receiver uses a variation of the keyed *agc* system. A composite video signal is fed from the 6AG7 plate circuit to the grid of V 113, 6SN7, sync separator. This tube conducts only on sync pulse tips because of the high bias on its cathode. On conduction the positive sync pulses are fed from the cathode of the sync separator V 113 to the grid of the *agc* amplifier. Simultaneously a pulse is fed from the horizontal output circuit through capacitor *C177* to the plate of V 111. The *agc* tube is cut off and will only conduct on the simultaneous positive voltages arriving at its grid and plate. The plate current produces a voltage drop across *R144,* 56 k. This drop provides the *agc* voltage. The sync pulse varies in size in accordance with the video signal. The greater the signal strength the greater the sync pulse voltage, and therefore the greater the negative *agc* voltage. Knowing these facts, the *agc* circuitry was examined. Capacitors *C177* and *C176,* the *agc* pulse transfer condensers were checked for leakage but were found to have none. At this point we noticed that the width of the picture just managed to fill the screen. We tried to increase the width by adjusting the width and horizontal linearity controls, but could not increase the width at all. *L107,* the horizontal linearity coil was examined for burned turns, but was found to be perfect.

On occasion, *L107* develops shorted turns which cause an insufficient width condition. We were obviously working on the assumption that the insufficient width and insufficient *agc* voltage had a common cause. The yoke was next unplugged and a new yoke was tried. (This yoke is of the plug-in variety). Immediately the width spread out and the hooking disappeared. As there was no trapezoidal effect, the yoke was ex-

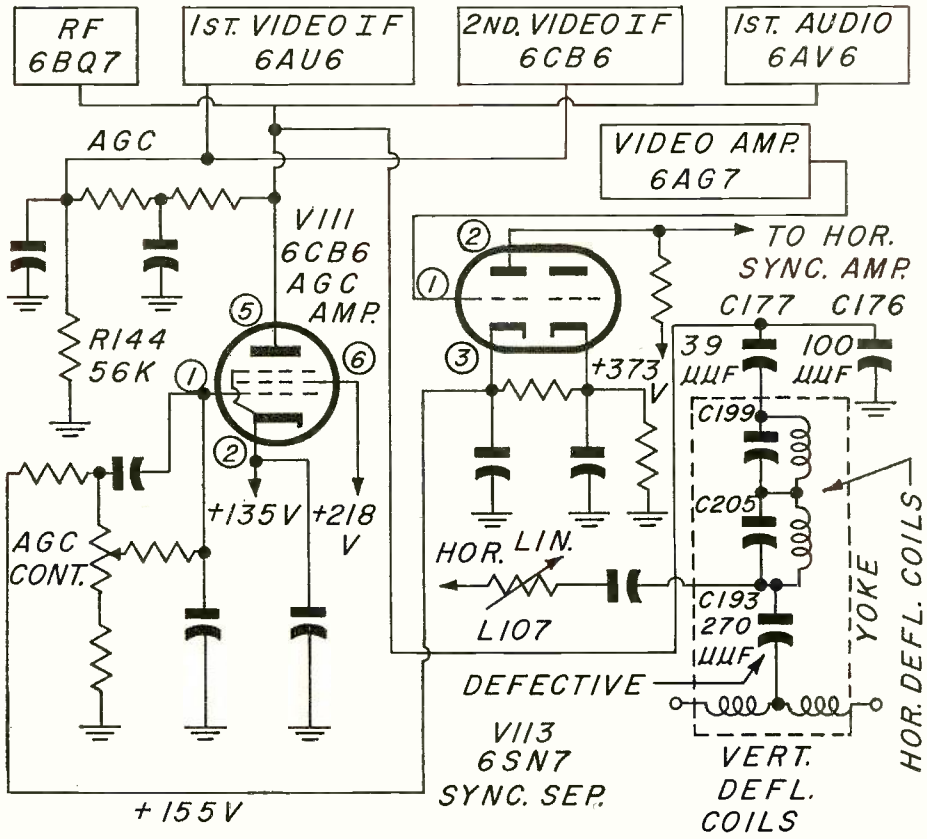


Fig. 1—Partial schematic of the RCA KCS-68C, showing the keyed agc circuit.

BENCH

This Month's Problem: Analysis of troubles arising in the damper circuit.

amined for a defective component. Capacitors *C193, C205,* and *C199* were checked. *C193,* 270 mmf, was found to be leaking. Its resistance measured one meg. Therefore, instead of replacing the entire yoke, just this condenser was replaced. The original yoke was again installed and the receiver functioned properly.

The shunt resistance created by the defective *C193* lowered the *agc* pulse voltage to such a point that a slight overload occurred. This caused insufficient width and the hooking and bending of the picture.

DUMONT RA — 130A

The receiver was turned on and it was noted that the raster's width was short about three inches on each side. There was also some blooming when the brightness was increased. The horizontal linearity of the raster was satisfactory, however. Fig. 2 illustrates the portion of the schematic involved. The two 6W4's were replaced, then the two 6BG6's, but they had no effect. The 6SN7 horizontal oscillator was also replaced, but had no effect. Adjusting the drive and width controls didn't increase the width either. The schematic revealed that the secondary winding of the flyback transformer T206 was essentially in series with the primary, thus forming an auto-transformer circuit. It was also observed that a series shunt type size control was used across the secondary of *T206*. The portion of the size control's inductance between terminals 1 and 3 was in series with the deflection yoke, whereas that portion between 2 and 3 was in parallel with the yoke. This horizontal size control presents a constant load to the secondary and permits a variation of size without affecting linearity. *R373* is the damping resistor across the series portion of the size control to prevent ringing. Resistors *R360, R361, R362, R363, R364* (each 10 k) provide damping for the yoke. The extra 6BG6 and 6W4 are needed because of the high current involved.

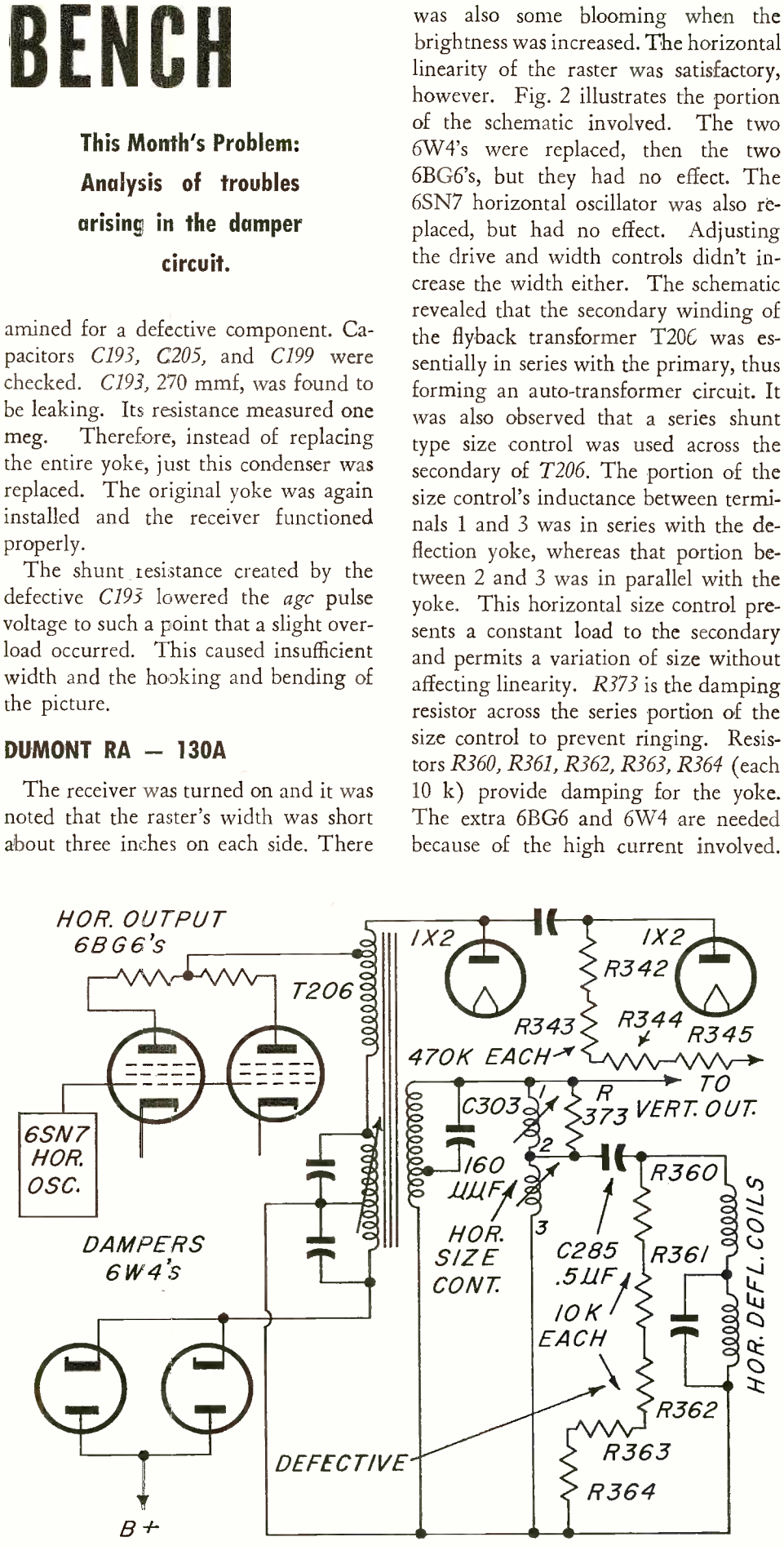


Fig. 2—Partial schematic of horizontal output and damper in DuMont chassis RA 130A

Keeping these facts in mind, and also that the horizontal linearity was satisfactory, we eliminated the possibility of defective condensers in the 6BG6 circuitry. The condensers across the horiontal linearity coil would also cause a horizontal linearity problem. *C303,* 160 mmf, was checked for leakage and found to be functioning properly. The high voltage resistors *R342, R343, R344, R345* were resistance checked and found to be O.K. Occasionally these resistors will decrease in value to such an extent that the width will be affected severely

As there were no white vertical lines nor a trapezoidal effect, the yoke was eliminated as a possible cause of our trouble. The yoke damping resistors *R360, R361, R362, R363* and *R364* were resistance checked and found to measure a total of 6.5 K instead of 50 K. Here was our trouble. Capacitor *C285,* .5mf, was next measured for possible leakage, but it checked good. Instead of installing five 10 K resistors at two watts each, which was called for; we installed two 25 K at 10 watts each. Thus, we have a 20 watt damping resistance. ■■

ASSOCIATION NEWS

by Samuel L. Marshall

National Alliance of Television and Electronic Service Associations (NATESA)

The annual Radio-TV-Electronic Service Industry Convention and Institutes will take place at the Chicago Sheraton Hotel, 505 N. Michigan Ave., August 16th, 17th, 18th, 1957. This affair has been sponsored over the last seven years by NATESA. This year, three separate local affiliates, Will County Television & Radio Service of Joliet, Milwaukee Association of Radio & Television Service (MARTS) of Milwaukee, Television Electronic - Service Association (TESA) Chicagoland will be co-hosts.

Directors and Alternates representing affiliated locals, from points as far separated as Fairbanks, Alaska; Seattle, Washington; Miami, Florida; Boston, Massachusetts; San Francisco, California; Canada; Venezuela; Panama Canal Zone, will conduct official business and plan the future of the independent service industry. Non-members are invited to participate.

Three very special Institutes, one each on business, technical and association activities will be conducted by top level experts from various phases of the over-all industry. Breakfasts, luncheons, cocktail parties, banquets, floor shows and other special activities will glamorize the three day affair.

Empire State Federation of Electronic Technicians Associations (ESFETA)

Gordon Vrooman, of Syracuse, and Syracuse TV Technicians Association, was reelected President of the Empire State Federation of Electronic Technicians Associations at the 8th annual meeting held in the Hotel Syracuse. Robert Larsen, of Valley Stream, and the Radio Television Guild of L. I., was elected Vice President. George Carlson of Jamestown, and Electronic Technicians Association of Jamestown, was elected Secretary, P. P. "Pat" Pratt, of Buffalo, and Television Electronic Service Association of Western N. Y., received a unanimous vote for reelection as Treasurer. The Sergeant at Arms position went to Thomas Salisbury of Rome, and the Mohawk Valley TV Technicians Guild.

California State Electronics Association (CSEA)

A campaign intended to familiarize state senators with the significance of the state licensing bill, and plans for the Second Annual Convention and installation highlighted CSEA's Board of Directors meeting in Fresno.

H. Lawrence Schmitt, President of CSEA, said that a report by legal counsel Anthony J. Anastasi to directors advised the bill still is in committee, normal channel en route to the Senate floor. Directors and Board of Delegates were enlisted to work with their local associations in setting up the local level among their senators.

Schmitt said Jim Wakefield, Convention Committee chairman, reported manufacturers' regional representatives were giving the convention solid support. He reported a series of discussions and panels would be offered on such topics as business operations, servicing, cost accounting, customer relations and accounts receivable.

TESA, S.W. Mo.

TESA, S.W. Mo. met at Davison's TV in Buffalo.

An interesting discussion of tube replacements in warranty with nearly everyone getting into the act provided some real down to earth assistance and information on the subject. A new application form was atuhorized to be printed after being approved in committee.

All the names of shops in attendance were placed in a hat for purpose of choosing the next meeting place. A-1 TV in Buffalo was the place designated by the drawing. All technicians and shop owners are invited to attend. We hope to have a discussion on "How to price TV Service," led by Carrol King.

Long Island Guild

Chris Stratigos, long active in Guild affairs, has been elected to the presidency of the Long Island Radio and Television Guild. At a regular scheduled meeting, the Guild, while endorsing the principle of licensing, withheld full support pending three considerations which TV repairmen consider as essential for effective licensing. These are:

1) That the television service industry be assured of full representation in the preparation of any licensing bill within the state of New York.
2) That an active member of the television service industry be a part of any permanent commission that might be established to supervise licensing.
3) That before any local licensing bill is passed an attempt be made to obtain state or at least county wide licensing.

MOBILE COMMUNICATIONS

[*from page 21*]

crease. It may take a little time to close a deal. Time may be lost in following blind leads. But the large *dollar value* of the *one* you *do* sell provides an ample margin of profit.

Closely tied to this financial reorientation, there must be a positive and dynamic approach to the selling aspect of the operation. Too many servicemen, unfortunately, sell service only (plus a few replacement parts). Mr. LiCalzi has emphasized selling and has found it to be a rewarding and satisfying experience. He enjoys the selling aspect every bit as much, and perhaps even more than the installation and servicing.

Statistics released by the F.C.C. show a fantastic rise in the use of mobile communication equipment each year. We've done our best to show how one man is taking advantage of the opportunities which exist. The important question, however, is—"What are *YOU* going to do about it?" ■■

MARINE RADIO DIRECTION FINDERS

[*from page 13*]

above. These horizontal antenna signals add to or subtract from the vertical-antenna signal voltages, depending upon their phase, or time of arrival. This results in bearing errors or, in many instances, the absolute obliteration of the null. Since signals arriving from above are usually experienced only at high frequencies, or at night at relatively great distances on the low radio-beacon frequencies, this defect inherent to the loop antenna over the Adcock or vertical antenna is accepted as a necessary evil. It is important however, that the defect be recognized and explained to the customer in order to avoid subsequent dissatisfaction on his part.

In directive antennas it is important to note that anything which might artificially or extraneously induce a higher or lower voltage in one antenna over that of the other would give the effect of shifting the null position. Hence, it is very important that such systems be accurately balanced. In loop antennas, only the inductive component of incoming waves must induce the signal voltage. Signal induced capacitively on one side of the loop or the other from the electro-static component of the incoming wave would unbalance the voltage difference, giving rise to a shifting of the null.

The practical result of this antenna effect is illustrated by *Fig. 3*. In this case, an outside antenna is connected to the receiver input. The effective time of arrival of the electro-statically induced signal current is such that it tends to add to the voltage on one side of the circuit and subtract from that on the other. This distorts the figure-of-eight response pattern of the system, and one lobe is, therefore, larger than the other. With only a small amount of this pick-up, the nulls are shifted toward one another, as shown in *Fig. 3a*. A greater amount of signal input from the antenna effect results in the even more distorted null positions of *Fig. 3b*. When signal input from the external

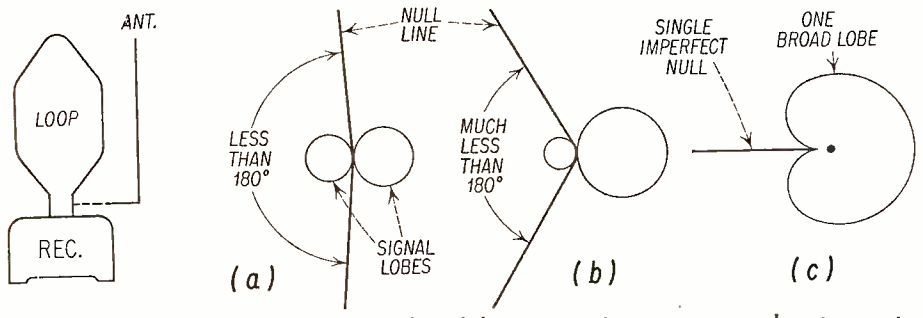


Fig. 3—Different lobe patterns produced by connecting an external antenna to the receiver, in addition to the loop: (a) slight distortion with weak additional signal; (b) greater distortion with stronger signal; (c) pattern loop and external antenna signals are equal.

antenna equals loop signal, the smaller of the two lobes is completely removed, resulting in the cardioid response pattern of *Fig. 3c*. When this antenna effect occurs accidentally from the presence of undesired conductive elements capacitively coupled to the receiver input, severe bearing inaccuracies result.

In some radio direction finders, the antenna effect is put to practical use through deliberate connection of an external antenna to obtain the uni-directional cardioid pattern. In the case of confusion as to which of the two possible reciprocal bearings is the correct one, switching in this external antenna will give the loop a broad uni-directional response pattern by which the correct direction may be "sensed." Since, in boat navigation, the pilot is seldom in a position where he does not know which of the two reciprocal bearings is correct, this sense feature has small value, and for this reason, many modern direction finders have no such provision.

A number of different input circuits are used in marine direction finders. *Fig. 4a* shows the balanced input scheme which was at one time most common, and is still found in larger equipments. This circuit is capable of the greatest accuracy and the balance control can be manipulated to compensate for unwanted antenna effect due to capacitance.

Simple one-band direction finders designed for reception of marine beacons are built with a high-impedance loop, the inductance of which is designed to tune directly across the beacon band. However, it is desirable today that a radio direction finder be capable of receiving signals not only on the low-frequency band, but also on the broadcast and the marine radiotelephone frequencies. This is too great a frequency spread for the loop to cover directly, so circuits such as that shown in *Fig. 4b* are used. For low-frequency reception, an extra capacitor is shunted across the loop to lower its resonant frequency. Inductance of the loop is such that it will resonate directly across the broadcast band. On the high-frequency, or marine radiotelephone band, an inductance added in parallel with the loop lowers the effective inductance of the circuit, permitting it to tune across the high-frequency channel. Another system that permits covering a wide band of frequencies is the use of a low-impedance loop which is small enough to tune directly across the high-frequency band. For the lower frequencies, loop circuit resonance is brought about by the addition, inside the set, of a loading inductance *(Fig. 4c*. Having only a small proportion of turns in the loop antenna, this system is least sensitive for general use.

Not all radio direction-finder loop circuits, by any means, are balanced. Many direction finders have the circuit shown in *Fig. 4d*. This circuit has the advantage of simplicity and sensitivity. However, it must be noted that for accurate bearings, circuit resonance is essential, so that inductive and capacitive reactances cancel. When the loop is off-resonance on the low-frequency side, there will be a large lagging current, and off-resonance on the high-frequency side, a leading current. Naturally, the reactive voltages, having different phasing from those developed across the desired resistive element of the circuit, add to and subtract from normal loop signal response. An off-tune unbalanced loop will thus act as if an outside antenna were connected.

[*To be continued*]

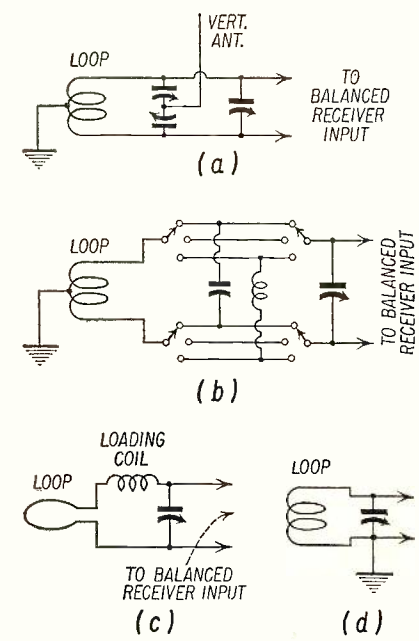


Fig. 4—Types of input circuits used with direction finders.

1957 WESTINGHOUSE TV

[*From page 11*]

Chairside Remote Control

The Model H984 Chairside Remote Control Unit, shown in *Fig. 6,* provides full control over channel selection, fine tuning and volume from any place in the room. This unit is an optional accessory and is installed merely by removing the two jumpers from the female socket on the rear apron of the receiver and inserting the male plug from the remote unit cable into the socket.

Remote channel selection is accomplished with the Remote unit as with the Power Tuning Bar, simply by pressing the button and releasing it. With the button depressed, switch 1 (*Fig. 2*) is closed and current is allowed to flow through the motor from the *ac* line, thus activating the Power Tuning. The operation from then on is as described previously.

Remote Fine Tuning is performed by a germanium crystal diode acting as a variable capacitive reactance across the local oscillator tank circuit in the *rf* tuner.

Servicing The Remote Control Unit And Power Tuning

The troubles listed here would most likely have their causes external to the system. The system, however, can be quickly and easily serviced.

1. Dirty relay contacts.
   All switch and control contacts may be cleaned with a contact cleaner. If spring contacts should become carbonized or burned, resurface the contact with crocus cloth.
2. Defective cable.
   The cable should be positioned away from areas of heavy traffic and under normal operating conditions should require no maintainance. If the cable becomes damaged check each individual wire for continuity and for any possible short between wires.
3. Defective Motor.
   To check the motor, turn the set off and check for continuity with an ohmmeter or, with power applied, check the motor leads for proper supply voltage. To restore normal operation in case of increased torque due to accumulation of household dust, heat and low line voltage, the mechanism should be cleaned and the tuner detent lubricated.
4. Improper programming.
   Check to see that all the programming clips are pressed flush against the programming wheel and that they are inserted from the rear of the receiver. Check to see if the leaf springs are making contact. If not, reform the springs. Check the phosphor bronze spring which rests on the programming clips. If the spring fails to rest properly on the programming slips it may be reformed. Care must be taken to insure that the programming clips will pass under this spring during manual tuning. ■■

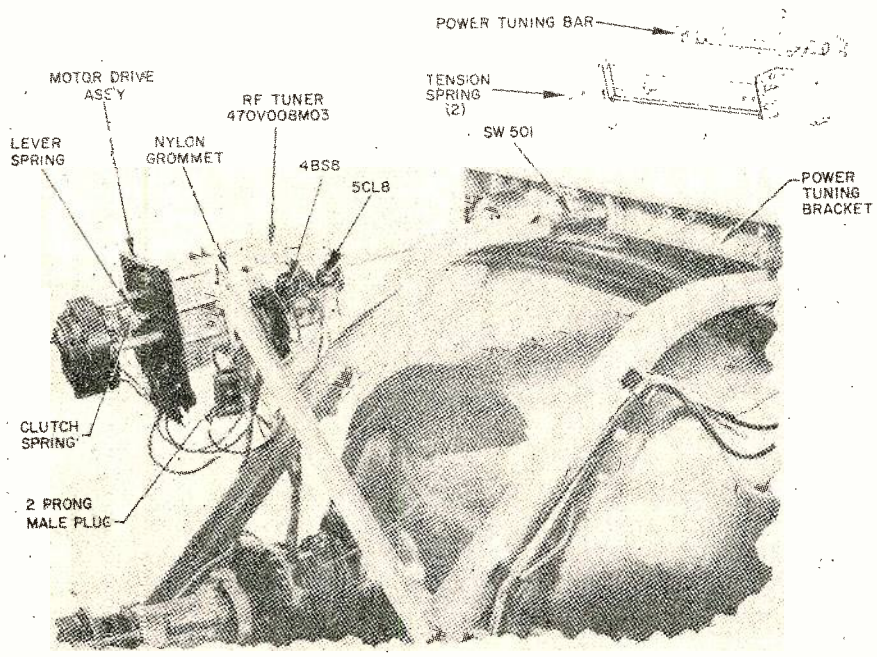


Fig. 5—View of interior of set showing the power tuning assembly.

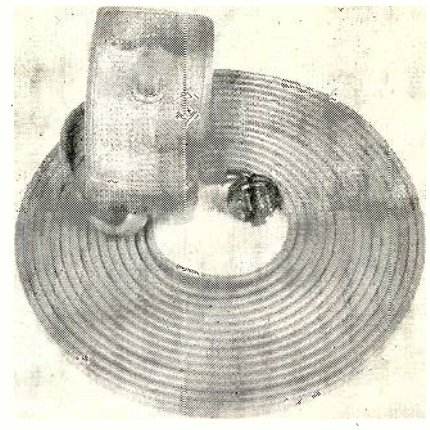


Fig. 6—Plug-in remote control unit.

PLUG IN SPEAKERS

[*from page 24*]

impedance of the supply (or, the "looking backwards into the line" resistance) is extremely low. That's the same as saying that we have a "constant voltage" source, which, in fact, is exactly the case. It's true that the total amount of power we can extract from the system is limited by fuses, wiring, etc., but so long as we stay within those limits, the voltage will remain constant regardless of the wattage drawn from the system. This idea was translated, in its entirety, to public address amplifier design. In other words, the amplifier voltage decided upon is 70.7 volts (just like the 120 volts at the baseboard receptacle). Of course, it should be remembered that since we are dealing with audio signals, this voltage appears only when full signal is applied to the amplifier input, but this is not important to the method of figuring out speaker transformers and sound distribution which follows. Now, in order for an amplifier to behave this way, regardless of wattage being "drawn" from it by the load, the amplifier must have a low internal impedance. Such impedances are obtained by means of large amounts of negative feedback. An amplifier whose nominal source impedance without feedback is 10 ohms will have an internal source impedance of only 1 ohm if 20 db of inverse feedback is applied.

Designing PA Installations

1. The first step in designing a PA installation is to decide on the total power which will be required in the system to adequately cover the volume of space acoustically. Anyone who has done PA work, even using older methods, will have an easier time here, because of previous experience. One watt of electrical power fed to an average efficiency loudspeaker will generally cover about 3000 cubic feet in which light-machinery factory work is taking place, for example. In selecting an amplifier, always allow for future addition of speakers in locations not originally planned for.

2. Decide where you are going to place each speaker to get best coverage and determine whether two speakers in a large open area will do a better job if fed with one watt each and properly spaced than a single speaker at one end of the area fed with two watts, etc.

3. Determine how much power each speaker is to handle. Base your considerations purely on acoustic requirements, not on "even numbers," etc.

4. Here's the trick of the whole problem. Simply divide the watts required from a given speaker into the number 5000 and presto! Out comes the required primary impedance of the speaker matching transformer. For example, if a given speaker should produce a maximum of two watts, use a 2500 ohm primary-to-voice-coil-secondary transformer. If another speaker, mounted to cover a larger area, is supposed to handle five watts, use a 1000-ohm - primary - to - voic - coil - secondary matching transformer, etc. No pads! No mathematics! No complete revamping of the entire system every time a new speaker is to be added to the existing installation!

How the System Works

The reason for the magic number 5000 becomes fairly obvious if you recall the formula for power, $W = \frac{E^2}{Z}$. By transposing, we get $Z = \frac{E^2}{W}$, where Z is the unknown primary impedance of the required matching transformer, *W* is the power required from a given speaker, and *E* is the output voltage. Since *E*, the voltage, is always constant regardless of load and since its value is 70.7 volts, per the new PA system standard, E^2 is always 5000 (70.7 x 70.7). It doesn't matter how many speakers you hang on to the system, nor is it important how great the difference between the power desired from one speaker to the next. The formula still works, providing you purchase a PA amplifier equipped with an output marked "70.7 volts."

Figure 2 illustrates how simply the problem of *Fig. 1* can be solved using this new approach. Did you get the answers doing it thet hard way? ■ ■

COLOR BAR GENERATOR

[*from page 5*]

Although this portion of the convergence procedure can be accomplished using either dot output, or crosshatch output from the generator, *it will be found that use of crosshatch (or vertical bars) facilitates the adjustments considerably*. The reason for this is that indication of vertical line-up is more apparent to the observer when a continuous line pattern is used, rather than a succession of dots.

It is very helpful to note that the vertical column of blue dots (or the blue vertical bar) is a reference line for vertical convergence—that is, the red and green columns *must* finally come into line with the blue column. To understand why this is so, observe the color-dot motion produced by adjustment of the three vertical-tilt controls, as shown in *Fig. 6*. While a horizontal component of motion is produced by the red and green tilt controls, *the blue tilt control produces only vertical motion of the blue dots.*

The same observation applies to the dot motion resulting from adjustment of the vertical-amplitude controls, as illustrated in *Fig. 7*. Hence, it must be concluded that since the blue dynamic controls can change only the vertical spacing of the blue dots, *final vertical convergence can be obtained only along the line defined by the vertical blue-dot column.*

This is an important guidepost to observe in vertical dynamic convergence, which will assist the beginner

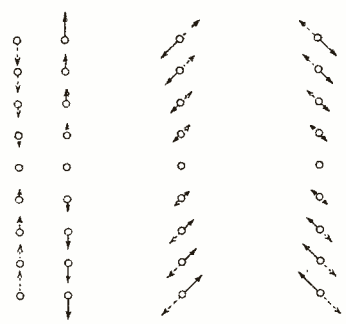


Fig. 6—Motion of dots from adjusting vertical-tilt controls.

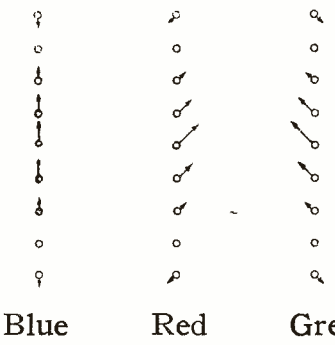


Fig. 7—Motion resulting from adjusting vertical amplitude controls.

immensely. More experienced set-up men can dispense with the guidance of the blue-dot reference line, but the apprentice is strongly advised to take advantage of this built-in reference provided by the color picture tube. The beginner will also find it useful to *always keep the center-screen area converged* by retouching the beam-magnet adjustments as required, while gradually working in the top and bottom convergence with the dynamic controls.

Remember these important general principles:

1. The static controls (beam magnets and lateral corrector) produce *uniform* motions of the color dots over the entire screen area.
2. The dynamic controls (tilt and amplitude) produce *non-uniform* motions of the color dots at various screen areas.

Horizontal Dynamic Convergence

In essential respects, horizontal dynamic convergence follows the same general principles as vertical dynamic convergence. Keep the center of the screen converged to white dots by readjustment of the static controls, as required—meanwhile, gradually work the left and right-hand edges of the screen into convergence by adjustments of the horizontal dynamic controls.

The blue dots will form a reference line for final convergence, when the

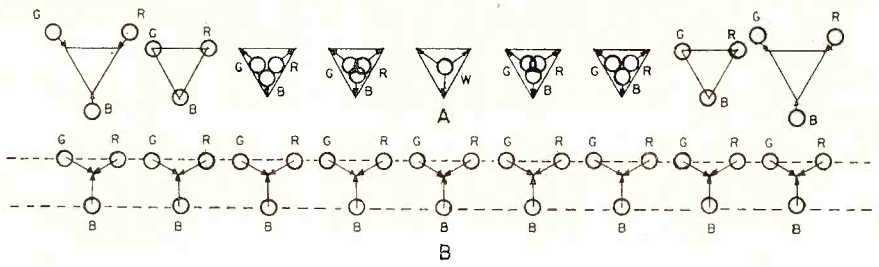


Fig. 8A—The blue dots are curved to a peak in center-screen, 8B—Rows of red and green dots are then straightened out.

following adjustments are made: First advance the blue horizontal amplitude control to maximum (so that appreciable blue-dot displacement is obtained). Then, adjust the blue horizontal phase control for "resonance"—i.e., so that the blue dots are curved to a peak in center-screen, falling off equally to either side, as shown in *Fig. 8A*. Finally, adjust the blue amplitude control to make the row of blue dots perfectly straight—it is advisable to use a yardstick or other straight-edge to insure that the row of blue dots is really straight.

The rows of red and green dots can then be straightened and brought into convergence with the blue dots (or horizontal bars, if used) by adjustment of the red and green phase and amplitude controls, as depicted in *Fig. 8B*. It will be found that the procedure is complicated somewhat by the interaction of the various convergence controls, so that touch-up of previous adjustments will be required from time to time.

Convergence is by far the most tedious and time-consuming portion of the set-up procedure, and the beginner must be prepared to undergo an extended training period before facility is acquired.

Adjustment of Color Phasing Control

The color display provided by the generator is a spectrum of hues which permits the receiver color-phasing control to be accurately adjusted at the end of the set-up procedure. The correct sequence of hues is depicted in *Fig. 9*. When the color-phasing control is properly adjusted, the spectrum appears with reddish-orange at the extreme left side of the screen followed by a gradual transition to red, blue, and green at the right side of the screen.

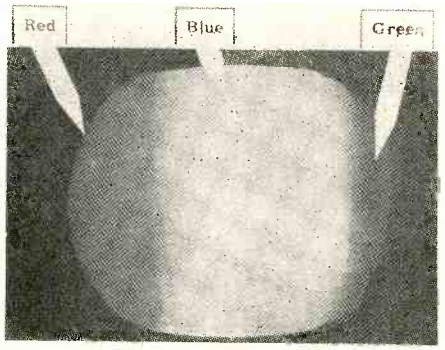


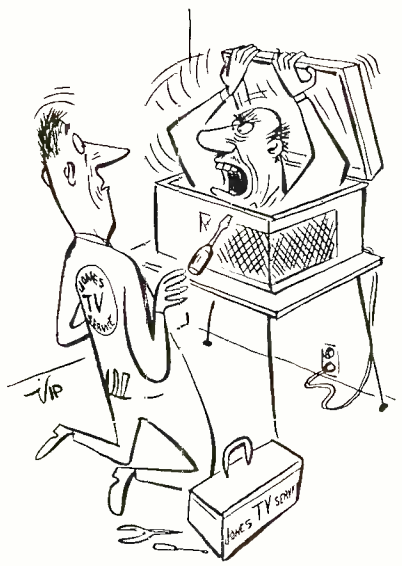
Fig. 9—Proper phasing produces correct color sequence and hues.

Other Applications

These are the principal applications of the dot, bar, crosshatch, and color-display outputs of the generator in set-up procedure. In addition, the color-display signal finds numerous useful applications in servicing the chrominance circuits of the color-TV receiver. These cannot be discussed in detail within the limits of this article, but may be listed in part as follows:

1. Alignment of the quadrature transformer.
2. Checking color-detector outputs for correct relative levels.
3. Check of burst-gate timing.
4. Check of matrix gain.
5. Adjustment of *afc* balance control.
6. Test of color-killer threshold.
7. Localization of circuit faults in the three color channels.

It is apparent that a color-display generator, in spite of its relative simplicity as compared with an NTSC color-bar generator, is a highly useful instrument in both set-up and servicing applications. In addition to its use in the shop its light weight and portability make the color-display generator particularly valuable for field use. ■■



"Before you start fiddling with this phonograph—did you bring JENSEN NEEDLES?"

SERVICING 1957 EMERSON RECEIVERS

by HAROLD BERNSTEIN

Service Manager, Emerson Radio & Phonograph Corp.

Concluding installment on important features of the 1957 Emerson TV Receivers.

Important Note—In the March installment of this article an important paragraph was erroneously omitted. This paragraph reads as follows:

"All of the models in the DeLuxe series are 21" receivers incorporating a full power transformer chassis (5U4GB rectifier tube and parallel filaments), and the new Standard Coil Neutrode type tuner for superior signal to noise ratio and trouble free operation."

The section describing the video detector and *agc* action, on page 42 of the March issue, applies *only to the DeLuxe Series*.

Automatic Noise Inverter

Figure 7 is a simplified diagram of the automatic noise inverter used in the Eldorado sets. The detected composite video signal is amplified by the sync amplifier, V-1, and fed to the sync separator, V-3. A portion of this signal, taken from the junction of R-1 and R-2, is fed to the grid of the noise inverter, V-2. The cathode and grid bias voltages of V-2 are such that the tube will not conduct for any signal equal to or less in amplitude than the sync pulses tips, since these tips are kept just below the cut off point of the noise inverter tube. Any noise pulses, however, which are of greater amplitude and of the same polarity as the sync pulses will cause the tube to conduct and amplify these noise pulses. The amplified noise pulses (which are now of greater amplitude and of opposite polarity from the original noise pulses contained in the video signal) are also fed to the input of the sync separator tube where they are effectively cancelled before they have a chance to upset the operation of the sync separator tube. Those noise pulses which were lower in amplitude than the sync pulses are not affected, but they are not of sufficient amplitude to cause poor sync. The resistor *R-7* couples the grid leak bias of the sync separator to the grid of the noise inverter. Slight

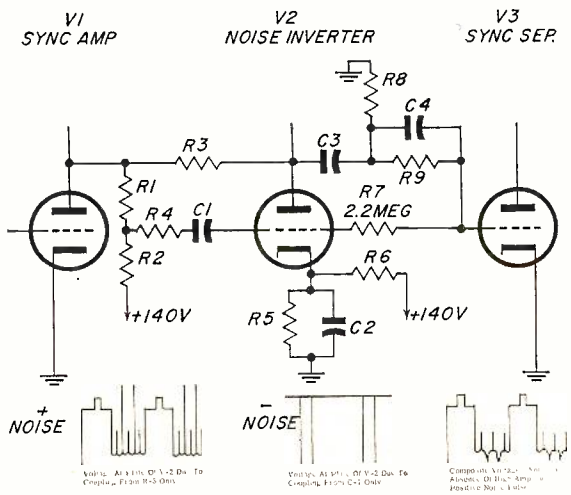


Fig. 7—Simplified diagram of the noise inverter circuit

variations in signal amplitude will affect the sync separator's grid leak bias. This will automatically change the grid bias to the noise inverter so that the tips of the sync pulses will remain clamped just under the cut off point of the noise inverter. This tube therefore can only conduct on high amplitude noise pulses which are the ones we desire cancelled.

Adjacent Channel Sound Trap

These receivers use an extremely high efficient "Bridged T Trap" for the adjacent channel sound trap. When adjusted properly, an attenuation ratio well in excess of 1000 to 1 may be obtained. The circuit using this trap is shown in *Fig. 8*. In the design of the Bridged T the impedance of *AB* is made equal to the impedance of *BD* at the desired trap frequency. The impedance of *BC* is such, that at the desired frequency a phase reversal takes place, whereby the voltage across *BD* is equal in amplitude but *opposite* in phase to the voltage across *BC*. ■■

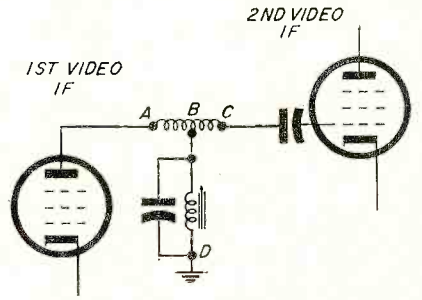


Fig. 8—Bridged T sound trap.

OLDSMOBILE FOR 1957 [*from page 17*]

6. If set is a Super De Luxe—disconnect foot selector button plug from rear of set.

7. With a small screw driver remove the front panel control knobs, and washers.

8. With a 7/8" deep socket, remove the two front panel mounting nuts from the controls.

9. With a 7/16" wrench remove the two bolts holding the receiver to the two mounting brackets (hold set while removing these bolts to prevent falling).

10. Bring set forward to clear controls from panel and remove set. To replace receiver reverse above procedure.

Push Button Adjustment

1. Pull button to left and pull out to maximum.
2. Tune to the desired station.
3. Push button all the way in; station is now locked in.
4. Proceed with remaining buttons in the same manner.

Trimmer Adjustment

1. Fully extend antenna.
2. Tune to weak station between 600-1000 kc with volume full on.
3. Adjust trimmer (located at right lower rear of tuner section) for maximum volume.

Note. Trimmer adjustment can be made thru the glove box after installation.

Service Hints

Complaints of speaker rattle have been traced to vibration of the clips etc., which hold the composition speaker baffle. Be sure all clips, bolts, etc., are tight and that the baffle does not vibrate against wires or some other object. Many speaker complaints have been eliminated by replacing the baffle clips with self tapping screws. In fact, this was done at the factory in all recent Oldsmobile cars.

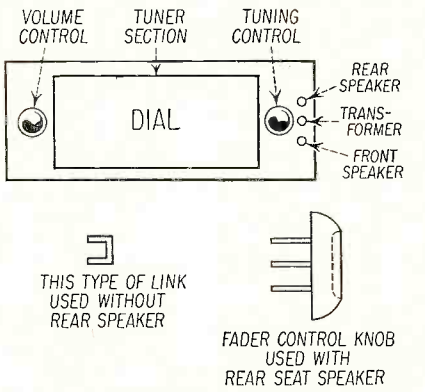


Fig. 6—Output link details.

Bench Testing

Radios removed from cars which do not have rear seat speakers, have a jumper wire which connects the transformer output to the speaker lead (see *Fig. 6*). If car is equipped with a rear seat speaker the fader completes this connection and also connects to the rear speaker lead. ■■

Advertisers' Index