Howard W. Sams

PF PHOTOFACT

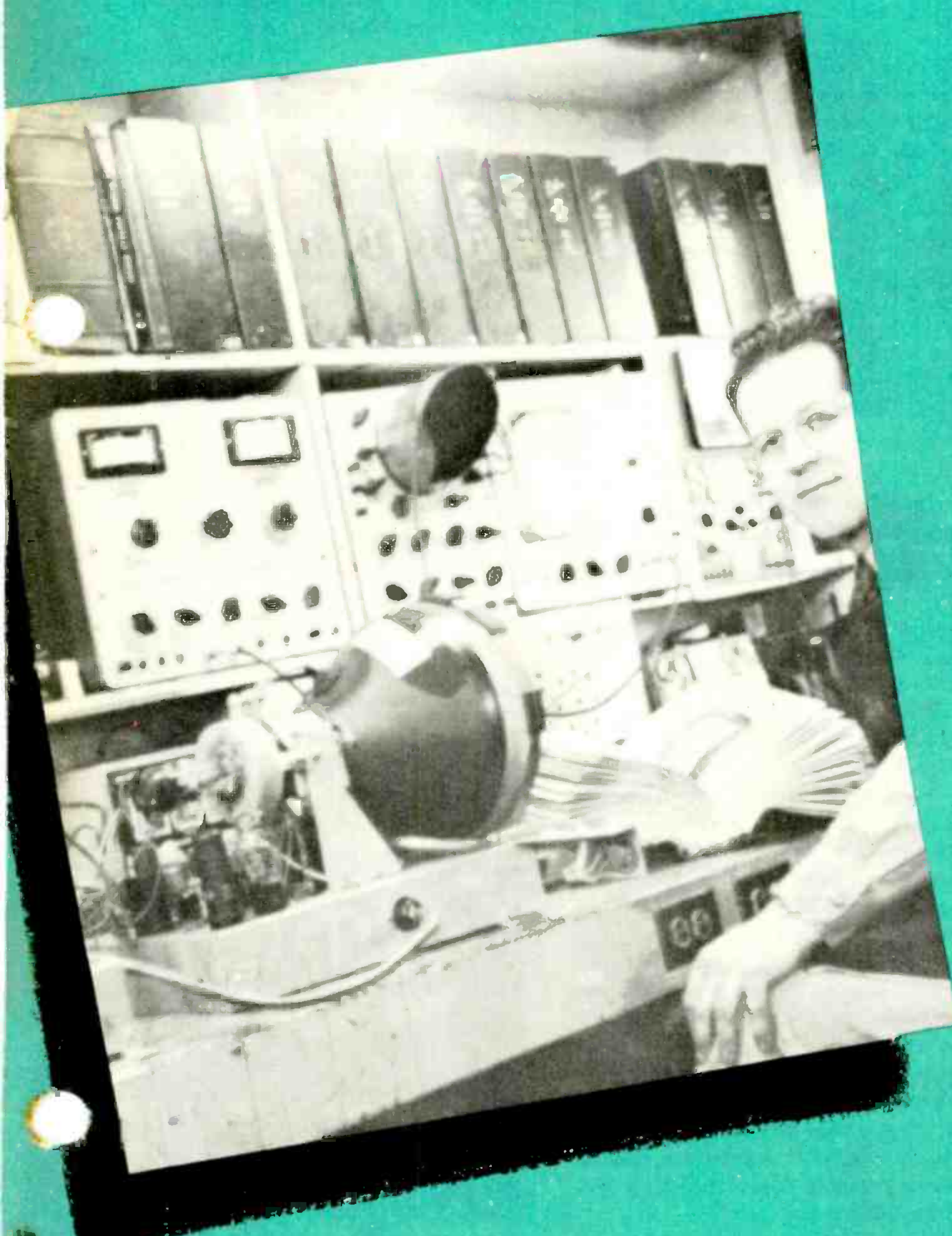
INDEX

AND TECHNICAL DIGEST

INDEX NO. 24

JANUARY • 1951

COVERING PHOTOFACT FOLDER SETS 1 THRU 120



CONTENTS

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FIRST IN A SERIES OF IRC TECHNIC-AIDS

HOW TO REPLACE THE GREAT MAJORITY OF CONTROLS IN PHOTOFACT FOLDERS WITH ONLY 59 BASIC Q CONTROLS

Small 15/16" Design—Adaptable Knob Master Fixed Shaft

Here's an end to your problem of stocking *many* small controls, or shopping and waiting for exact duplicates. With IRC's versatile Q Control line and Interchangeable Fixed Shafts, you can service virtually every type of control requirement—in a minimum of time. Ease of installation—even in crowded chassis; one-minute replacement of shafts for specials; shaft and bushing lengths to meet current radio and TV needs—all mean faster, easier servicing with fewer dollars invested.

Knob Master Fixed Shaft—Fits 90% of All TV and Radio Knobs

If all the knobs on TV, AM and FM sets were the same, there'd be no shaft problem. But since almost every one is different, the only way to simplify control replacement is to use a shaft adaptable to virtually all knobs. Because we took the trouble to find out what service technicians really need, IRC has been able to make such a shaft. The IRC Knob Master Fixed Shaft fits almost all the knobs found on TV and radio sets. This is the universal shaft supplied in every standard Q replacement control.

Adapts Quickly and Easily to Meet Conditions

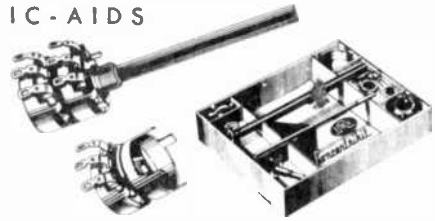
A clever combination of the old A and E shafts, the IRC Knob Master is flatted, slotted and knurled—so constructed that it fits almost any knob without alteration except cutting to length. You can use it with knurled push-on knobs, spring-type knobs or set-screw knobs. You can spread the ends to fit oversize, web-type or worn knobs. Or you can alter it quickly and easily to fit insulated TV bushings and many more special knobs.

New ¼" Long Bushing Meets Small and Large Set Requirements

You'll need no shaft inserts. The 3" length (from mounting face to control) takes care of the longer shaft lengths required in many television sets. The new ¼" long bushing lets you use Type Q Controls in smaller sets that won't take the old ⅜" long bushing. Yet, at the same time, the Q Control meets large-set requirements.

New Resilient Retainer Ring—Interchange Shafts in One Minute

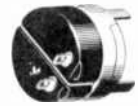
This revolutionary new feature makes it easy to remove Knob Master Shaft and replace with any of 13 Interchangeable Fixed Shafts, *in less than one minute*. This means you can meet almost any special shaft requirement at a moment's notice —*without expanding stock*. Remove cover by bending up the 4 retaining tabs, then it's the simplest kind of job to remove the resilient retainer ring with safety pin or any pointed tool and withdraw Knob Master Shaft from assembly. Insert new fixed shaft into element side of control base. Assemble bushing and groundplate on shaft in base recess. Slip new resilient retainer ring over end of shaft and push into place. Replace cover, or add switch, and interchange is completed. It's the easiest way of getting the widest coverage of replacements with only 59 controls. (Incidentally, the new resilient retainer ring assures unusually smooth rotation. Your customers will *feel* the difference at once.)



Ganged Controls Are Easy, Too . . .

New IRC Multisections provide an easy answer to your ganged-control requirements. For standard duals, simply add Multisections to Type Q Controls just as you would switches. (19 values afford 13,000,000 variations of dual, triple and quadruple controls—accommodate switches, too.)

Using IRC's original Concentrikit, you can assemble practically any concentric dual control—in just a few minutes. Service technicians who use Concentrikit, call it the most convenient solution to special TV control requirements, and auto set replacements.



New Type 76 Switches

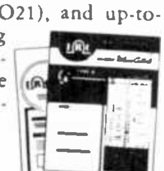
In addition to the Type 76-1 Single Pole, IRC now provides a double pole unit—Type 76-2. This gives you substantial coverage of all your switch needs. The Q Control has been so designed that switch throw takes place after contactor reaches terminal adjacent to switch toggle. This makes electrical rotation of control the same with or without switch.

Distinctive Appearance

Attractive metal-part finishes and blue bakelite base make Q Controls as attractive as they are efficient. Service technicians generally indicate that they prefer these better looking controls.

Handy Reference Material

Your request on a penny post card will bring to you the helpful new IRC Cross-Reference Guide (form SO21), and up-to-date IRC Control Catalog DC1B. Ask your IRC Distributor for these versatile Q Controls—the full-coverage line of 59.



IRC

Wherever the Circuit Says ~~~

INTERNATIONAL RESISTANCE CO.

423 N. Broad Street—Philadelphia 8, Pa.

Here is your first issue of the PF (Photofact) INDEX and Technical Digest.

We know that you will find this publication useful in your work. We know this because the PHOTOFACT Cumulative Index section alone (previously published by itself) has long been one of the most valuable and widely used reference guides in the Industry.

During the past year, for instance, over 450,000 copies of the Cumulative Index were distributed. These have been used daily by thousands of service technicians, electronic engineers, students, and others. Eventually, and quite naturally, this wide use of and constant reference to the Cumulative Index suggested its expansion into a medium of even greater value, carrying additional material of extra benefit to the Industry.

The new PF INDEX and Technical Digest is the result. It has one primary purpose: To provide the service technician with useful, informative data that will help make his work easier, quicker, more profitable.

The PF INDEX proposes to bring you helpful, informative data in these five ways:

1. We plan to include in each issue of the PF INDEX, a complete cumulative index to all PHOTOFACT Folder Sets published to date. This will make it possible to locate, instantly, the world's finest up-to-the-minute service data on all post-war Radio and TV receivers, as well as allied equipment.
2. We propose to feature in the PF INDEX, instructive articles originating from research, study and experience in our own PHOTOFACT laboratories. These articles will be not only educational, but of practical help as well.
3. We intend to reprint or review meritorious articles from other publications doing a good job for the service technician. We have received whole-hearted cooperation from several of these publications, and have their permission to reprint or review articles from their pages.
4. We have engaged a number of the foremost writers in the electronics field to prepare guest columns and feature articles for The PF INDEX.
5. We have requested our advertisers to prepare informative, useful reference material. We hope that the advertisers will take this suggestion to heart and prepare really helpful ads that will help PF INDEX readers.

These are the helpful, useful things we hope to bring you regularly in The PF INDEX. We are able to undertake this publication only because thousands of Service Technicians have become loyal and steady subscribers to PHOTOFACT Folder Sets and Volumes. It is our policy to return this loyalty in the form of additional service to our friends.

Howard W. Sams

PF INDEX

AND TECHNICAL DIGEST

VOL. 1 • NO. 1 JANUARY, 1951

HOWARD W. SAMS, *Publisher*
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CONTENTS

The PF (PHOTOFACT) INDEX is published every other month by Howard W. Sams & Co., at 2201 E. 46th Street, Indianapolis 5, Indiana, and is available from 1,015 PHOTOFACT Distributors in the United States and Canada.

INFORMATION PLEASE: *This is your publication. You can make it the way you want it by filling out and mailing the questionnaire inserted in this issue.*

This will only take a moment of your time—DO IT NOW.

ABOUT THE COVER: The photograph is of Mr. W. L. Boller, Archie's Radio & Television Service, 815 15th Street, Logansport, Indiana. Mr. Boller writes, "we appreciate Sams Photofact Service. In our work . . . we find them, without a doubt, the best and most complete of any diagrams on the market today."

Photofact subscribers are invited to submit photographs of their shop for possible use on the PF INDEX front cover. Address all communications to the PHOTOFACT INDEX.

In this, the first issue of the PF INDEX AND TECHNICAL DIGEST, we have established a format of the greatest assistance and interest to the service technician. In doing so, we have been subject to the limitation of available space, and it has been necessary to restrict editorial contributions accordingly.

We are relatively new in this particular field; to avoid overemphasis or precedent in any direction, we are making haste slowly in establishing the approach to our final objectives.

MILTON S. KIVER

President, Television Communications Institute

Shop Talk

In the beginning it is customary for the writer to state his aims - what he hopes to accomplish. In this instance, statement of the aim is quite simple. It resides in but two words - "KNOW-HOW." If a man can do a job, and know fully why he is doing it, he has all the attributes of the ideal serviceman. He has "KNOW-HOW." It is as simple and yet as difficult as that. "KNOW-HOW" requires the fusion of the mind and the hand, the book and the set, the written word and the tool. You know and I know a great many men who are either KNOW men or HOW men. The KNOW men are theory men, the HOW men are practical men. But how many of these can you honestly say fall into the "KNOW-HOW" category? Not many, I'll bet.

The objective, then, is clear. Practical service hints and procedures together with explanations of circuit operation; answers to questions submitted by you, the reader; finally, reviews of articles of interest to the service technician. The latter is somewhat new among technical publications. It has usually been customary for each publication to plod its own way - seemingly oblivious of all the rest. It was Mr. Sams' suggestion that since we are here to serve the technician, we should bring him helpful news of interest, irrespective of where it first appeared. That is the purpose of our reviews. We hope you will share our enthusiasm.

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REVIEW: The article chosen for review in this issue contains an excellent discussion of the proper handling and servicing of selenium rectifiers. It is a condensation of an article written by Irwin Wolf of the Radio Receptor Company, Inc.

SERVICING SELENIUM RECTIFIERS

SERVICE Magazine (November, 1949)
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The economic and operating advantages of selenium rectifiers have caused them to be used in considerable numbers in radio and TV sets. A selenium rectifier will perform the same function as a vacuum tube rectifier, yet, it does not require any filament power, is small in size and can be installed under the chassis, is rugged and comparatively cool in operation, and possesses a long useful life.

Of importance to the radio and television serviceman is the proper care of selenium rectifiers when they are in operation, and the proper testing procedure when these units are suspected of being faulty.

To operate a selenium rectifier correctly, it should not be subjected to so much current flow that it becomes overheated, nor should it be placed at a point within the chassis where it is likely to overheat due to the high surrounding temperature. Finally, the reverse voltage rating of the unit should not be exceeded.

TEST PROCEDURES AND CIRCUITS. When a selenium rectifier has been subjected to excessive voltage, current, or temperature conditions, it may become partially or completely damaged. Final evidence of such condition is given by an electrical test; however, there are several physical indications which may be helpful in recognizing possible trouble in the rectifier or in the external circuit:

Sparking: If a much higher than rated inverse voltage is applied across a selenium stack, a crackling, popping sound may be heard, accompanied by small blue-white sparks on the alloy surface. Ordinarily, if the surge lasts only a few seconds, the rectifier will continue normal operation thereafter.

Blowout Patches: Many of the sparks leave small, round blowout spots which appear black against the silvery alloy. These blowouts are self healing, and will not short the rectifier; however, if blowouts are observed all around the contact washer at the center of the plate, it is best to replace the rectifier.

Melted and Discolored Alloy: If excessive current is drawn through a selenium rectifier, the temperature of the rectifier may rise beyond the melting point of the alloy cathode, causing it to soften and run, with possible surface discoloration. This condition indicates that the unit is unfit for further use.

Many servicemen test selenium rectifiers by measuring their forward and reverse resistances. To them it will come as a distinct surprise that these readings are almost meaningless. The resistance reading will depend on the ohmmeter voltage and scale, since the resistance of a stack in either direction depends on the particular value of voltage across it. Ohmmeters should be used ONLY to check stack continuity and NEVER to determine the relative quality of a selenium unit.

There are several circuits and procedures concerning a selenium rectifier which will indicate its general quality for operation in receivers.

Continuity: To test a stack for an open connection, readings of resistance in both the forward and reverse directions should be taken with a high range

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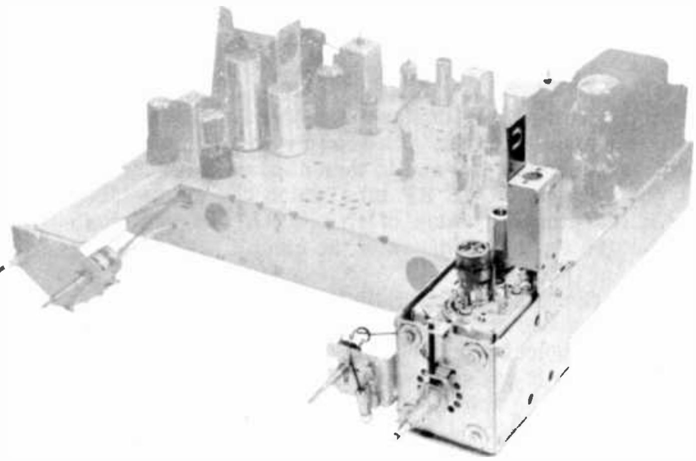
Television Tuning Units



by W. William Hensler

Research material contributed by: Wayne R. Ayers • Eugene L. Bowden • Merle E. Chaney • Garland Mowry • William D. Renner

A description of Circuits, Characteristics, Servicing Methods, and Alignment Procedures for commercially employed television tuners.

The prime function of the TV tuner is to accept the transmitted sound and picture signals and convert them to the correct intermediate frequencies. These signals are then amplified by the appropriate circuit of the TV receiver and applied to the control and reproducing mediums of the system. The tuner should have the following characteristics in order to produce pictures of good quality, with a minimum of interference.

1. Reasonable gain.
2. Good signal-to-noise ratio.
3. Good image rejection.
4. Stability.
5. Adequate band width.

Although tuners of various manufacturers differ in design and methods of tuning or channel selection, they all incorporate basic input, RF amplifier, mixer and oscillator circuits. The operation and tuning of these circuits of any specific tuner will be discussed under the section covering that tuner. However, a brief discussion at this time may serve to point out the need for, and purpose of such circuits.

INPUT CIRCUITS

The function of the television input circuit is to couple the signal from the antenna to the first stage of the tuner. This coupling should be accomplished in such a manner as to insure maximum transfer of energy from the transmission line. The input circuit should present a constant impedance equal to the characteristic impedance of the transmission line at all of the television channel frequencies. Failure to maintain matching will cause energy to be reflected back into the line, creating standing waves, and if the mismatch is severe enough, ghosts may be seen in the picture, caused by a delayed signal traveling back down the transmission line. This type of "ghost" can be detected by rotating the antenna and noting if the delayed signal is delayed by the same amount at all antenna settings.

A transformer or choke is most commonly used in the input circuit. Its connection depends upon whether the balanced or unbalanced type of transmission line is used. The most popular balanced line type is the 300 ohm twin lead, while the 72 ohm coaxial type represents the most widely used unbalanced line.

A signal is carried in the balanced line exactly as its name implies, i. e., it is of equal amplitude in each lead in the line. The distributed capacity from each line to ground or chassis should be equal. The coaxial line is unbalanced since the signal is carried by the center conductor while the other conductor makes up the shield. The unbalanced line can be used in areas where the noise level is high since the shield minimizes pickup of the noise. The cable may be placed near grounded objects such as pipes and metal framework without bad effects. The attenuation in the coaxial line, however, is greater than that of the balanced line. As a result the balanced line is usually employed in areas having low noise level and where there is a minimum of metal objects.

Figure 1-1 shows some of the basic input circuits used. (A) employs a small center tapped choke having a powdered iron core. The center tap is grounded, balancing the circuit. The signal is capacitively coupled to the grids of a push-pull amplifier. The grid loads in this circuit are usually 150 ohms and the center point is returned to ground directly or through an AGC circuit to control the gain of the RF stage. Since this circuit is balanced throughout, no special transformer is required. In (B), however, the balanced 300 ohm input is coupled to a single grid by using a transformer. Two resistors of equal value are connected in series across the primary with their junction grounded to balance the input. One side of the secondary is grounded and the other side is coupled to the grid. The grid return may be grounded or returned to an AGC circuit. (C) is a similar circuit except that the signal is coupled to the cathode of the tube which has its grid grounded. Bias for the tube is developed by the current flow through the resistor in the cathode circuit. Since this resistor is bypassed, all of the signal will be present across the choke coil (which may be tuned) in the cathode circuit. The circuit shown in (D) is a combination of (B) and (C) in that the signal is coupled to both the grid and cathode. As in circuit (C), bias is developed by the current through the resistor in the cathode circuit. The grid return resistor may be grounded or connected to an AGC circuit.

Circuit (E) is designed to operate with a 72 ohm unbalanced line. The signal is impressed across the choke coil and is then capacitively coupled to the cathode of the RF tube which has a grounded grid. Varying the value of the cathode resistor varies the input impedance of the circuit.

Circuit (F) is basically the same as that of (B) except that two primaries are used. One is used on the high channels and the other on the low channels. Switching is usually provided in the tuner to automatically connect the proper primary as the various channels are selected.

In the design of some of the input transformers an electrostatic shield is placed between the primary and secondary to prevent capacitive coupling of noise pulses. Noise pulses that might be picked up in a balanced transmission line will have the same polarity on each line and will cancel out inductively in the input coil of the tuner. There is a possibility of coupling this noise pulse capacitively to the secondary due to the close spacing of the windings. The electrostatic shield placed between the two windings lessens this possibility. Physically the shield may be placed between the primary and secondary, perpendicular to the axis of the windings, or it may be a foil interwound between the primary and secondary. The shield is of non-magnetic material so that it will not affect the magnetic coupling.

RF AMPLIFIERS

In radio applications, the main purpose of an RF amplifier is to increase the sensitivity and selectivity of the receiver. Although the signal-to-noise ratio is usually considered, it is less important than it is in the case of TV receivers. Any noise, either that picked up by the antenna or that which is generated in the circuits of the TV receiver, shows up in the picture. Since any noise generated in the RF stage will be amplified by the succeeding stages, it is desirable to select a tube that generates a minimum of noise within itself.

Both triodes and pentodes are used as RF amplifiers. Although pentodes are inherently "noisier" than triodes, the additional gain which can be obtained in the pentode offsets, to a great extent, this disadvantage, and they are used more frequently. Another advantage of the pentode is the reduced grid-to-plate capacity. This is helpful in reducing oscillator radiation caused by the oscillator signal being coupled back through the RF stage to the antenna.

Figure 1-2 shows several types of RF amplifiers used in TV tuners: (A) is a conventional circuit having a tuned input and output. These two circuits are usually stagger-tuned to give sufficient band pass. Also, resistors are shunted across the coils to further increase the band width. Note that the input circuit is series-tuned, using the input capacity of the tube as a portion of the tuned circuit. This is possible because of the high frequencies at which the circuit operates.

Several methods of injecting the signal to this stage were pointed out in the previous section on

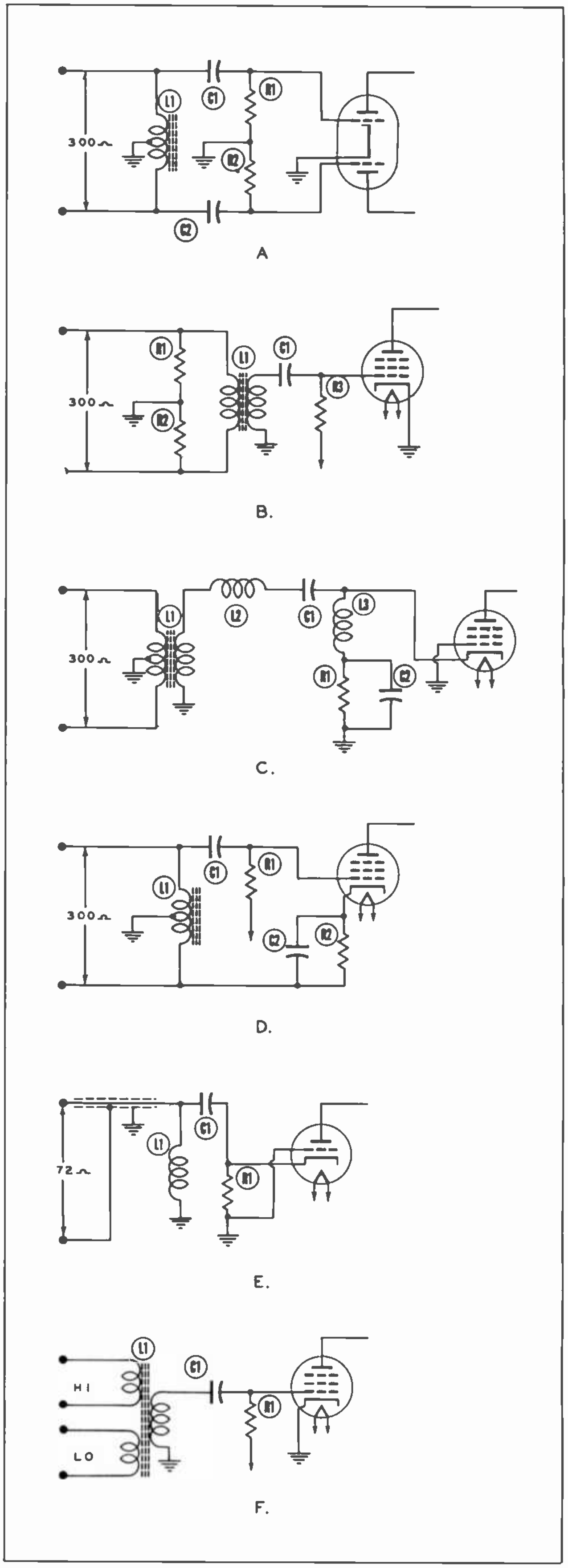


Fig. 1-1. Television Tuner Input Circuits.

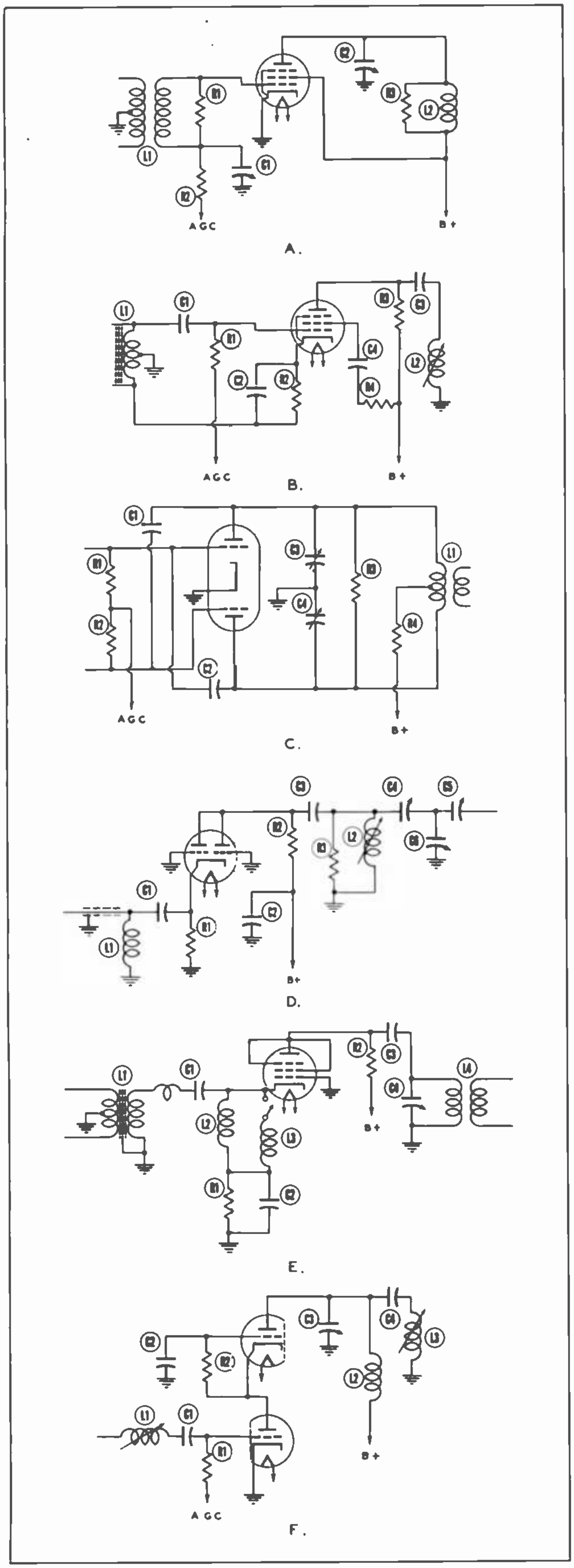


Fig. 1-2. Television Tuner RF Amplifier Circuits.

input circuits. It may be grid-driven, cathode-driven, or a combination of both, as shown in (B). The plate circuit may be series or shunt-fed. In the case of circuit (B), the tube is shunt-fed. The use of this circuit removes plate current flow from the tuned circuit, which is especially desirable when the tuned circuit has sliding contacts for channel selection.

A dual triode tube is used in (C) as a push-pull RF amplifier having both input and output circuits balanced. Neutralizing capacitors, usually 1.5 mmf., are connected from the plate of one section to the grid of the other to neutralize the circuit. The value of the 1.5 mmf. capacitors is approximately equal to the 1.6 mmf. plate-to-grid capacity of the 6J6, which is usually employed in this application. Since the amplitude of the signal on both plates is equal and of opposite polarity on all channels, an excellent source of neutralizing voltage is provided.

The resistor (R4), in series with B+ and the RF plate coil, isolates the coil from RF ground to allow for any unbalance which might exist in the circuit.

The circuit in (D) employs a dual triode tube with both sections connected in parallel. The signal is coupled to the cathode and the grids of the tube are grounded. This circuit is known as a grounded grid amplifier. The presence of the grounded grid between the plate and cathode lessens the chance for oscillator radiation back through the RF stage and to the antenna. This type circuit does not require neutralization because of the degeneration in the cathode circuit and the grounded grid acting as a shield between the plate and cathode.

The coupling circuit in the plate of the RF tube is a "common impedance" type coupling; C6 is a portion of the tuned circuits of both the RF plate and mixer grid. As a result, the signal developed across C6 by the RF tube is coupled to the mixer grid since it is common to both circuits. The setting of C6 governs the band pass of the RF mixer coupling circuit.

Circuit (E) is also a grounded grid amplifier. In this case, a pentode tube is used but the screen and suppressor grids are connected to the plate to obtain the low noise characteristics of a triode. Note the switch in the cathode circuit. The switch is open on the low-channel positions and closed on the high-channel positions. With the switch closed, the two coils are connected in parallel, which lowers the inductance. This provides better matching on the high and low channels than if a single coil only were used.

Another circuit, known as a cascade amplifier, is shown in (F). This circuit incorporates two triode sections connected in series. The first is a conventional, grid-driven stage, with the second having the grid grounded to RF by C2. With this arrangement, the low noise characteristics of the triode are utilized along with the advantages of the grounded grid amplifier. The tube employed in this circuit - a type 6BQ7 - is a specially designed miniature noval base tube to be used in this application in TV tuners. The tube is so constructed that it has extremely low grid-to-plate capacity. Although the two sections are identical, the leads are brought out the base of the tube in an order that is especially adaptable to this circuit. Since the two tubes are in series, approximately twice the B+ supply voltage is required over the usual application. This is not a particular disadvantage, however, since the required amount of voltage is usually available in the TV receiver.

For the most part, only one stage of RF amplification has been considered in this discussion. Some tuners employ two stages in cascade, and these will be treated later in the specific descriptions of individual tuner models.

Most tuners have an AGC voltage applied to the grid of the RF amplifier to prevent overloading of the stage. Improper bias may cause cross modulation, and, in cases of severe overload, may clip a portion of the signal. Since the sync pulses are at maximum amplitude, they are the first to be clipped. In the event of signal clipping in the RF stage, the receiver may be very erratic in synchronization.

Some receivers that are especially designed to operate in fringe areas may have the grid return of the RF amplifier connected to ground. When these receivers are located in a strong signal area, poor operation may result. In this case, the RF grid return should be moved to the AGC line or the variable bias line provided by the contrast circuit.

It is interesting to note that AGC voltage may be applied to a grounded grid amplifier as well as to the conventional amplifier. This is done by applying the AGC voltage to the grid and bypassing the grid to ground: thus, a means of varying the gain of the tube is provided.

Several methods of coupling the signal from the RF stage to the mixer are employed. The most popular of these are the following:

1. Inductive coupling.
2. Capacitive coupling.
3. Common impedance coupling, both inductive and capacitive.
4. Link coupling.

Either the plate circuit of the RF stage or the grid circuit of the mixer may be tuned, and in many cases, both are tuned.

MIXER CIRCUITS

Two types of tubes, triodes and pentodes, are currently employed as mixers in TV tuners. The use of the triode tube as a mixer seems to be increasing, probably because of its lower noise characteristics and the fact that a dual triode tube can serve as both mixer and oscillator.

Figure 1-3 shows a few representative types of mixer circuits. Each schematic shows both signal and oscillator inputs.

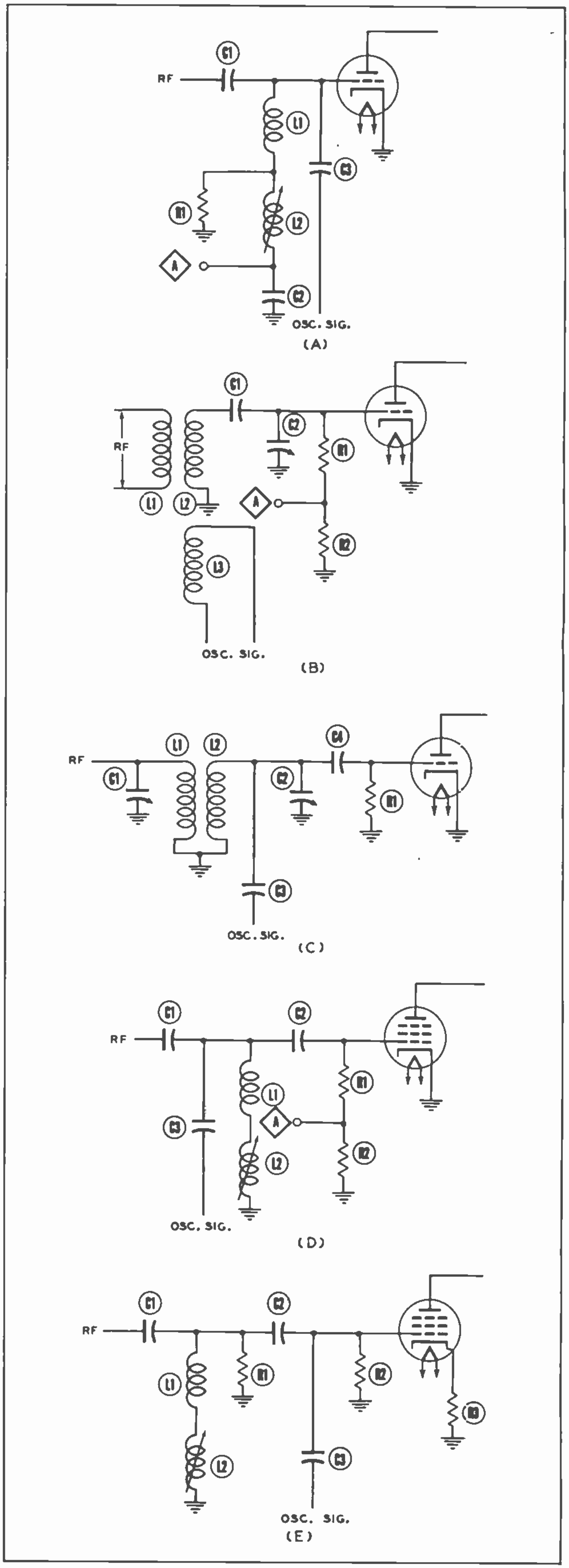


Fig. 1-3. Television Tuner Mixer Circuits.

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JOHN MARKUS

Editor-in-Chief, McGraw-Hill Radio Servicing Library

Dollars and Sense Servicing

PROLOGUE. For every dollar there must be some sense, to get the dollar and to spend it wisely. On this dual theme, then, is this page launched - to pass on to you a variety of ideas for making more money in radio and television servicing, interspersed with suggestions for spending those dollars wisely so they will beget more dollars, bring true satisfaction in their earning, and make your career in servicing happier. There'll be the latest news of your industry, an anecdote now and then, and just a bit of technicana to round out the page.

ANTENNAS AND ACTS OF GOD. Patting themselves on the back today are the great majority of television service groups in the East and Midwest, for having thought to include an "act-of-God" clause in their contracts. Antennas came down by the thousands in the over 100 mile per hour gale, and these firms were able to charge for the costly repairs needed. Many set owners collected in turn from their insurance companies under comprehensive home storm damage clauses. But out in the cold, bankrupt, is one service organization in Newark as a result of the storm. For a two-dollar extra charge they guaranteed the antenna installation too. Over a thousand of their antennas went down, and so did they.

ARE TUBES SCARCE? "Yes," says the chap who thought he knew a bargain when he saw one. Last year and the year before, he had a lot of fun and saved a few pennies too, playing one supplier against the other. By shopping around, he got rock-bottom prices. But now his many and varied suppliers have either gone black-market or broke, and the regular tube distributors can't recognize his face even with a magnifying glass. You should hear this guy bellyache about tube shortages!

"No - just a little tight," says the steady, serious fellow in the shop around the corner. "My regular distributor is giving me all I need, even for TV sets. Sure, there's allocation of tubes, but it's based on what I bought from him last year. Found that I actually saved money by paying a bit more and getting all my supplies from this one place. I could handle an extra repair job or two in the time some spend shopping around for bargains or ordering questionable surplus parts by mail." Incidentally, have you your copy of the new Sylvania Tube Substitution Manual?

KILLING THOSE MORNING BLUES. There's a tonic effect in starting out each morning smooth-shaven, wearing a clean shirt and tie, pressed trousers and brightly shined shoes. It gives you a lift, somehow, and does something for your personality. Better yet, good grooming establishes your professional position in the minds of your customers, thus making them more receptive to paying promptly and cheerfully for "Professional Services Rendered."

THE CHANGING TIMES. A couple of years ago, life was easy for those who write about television. Most of the sets used what was called a conventional sound system, with only a few makes going to the new-fangled intercarrier sound. But look what we have today - nearly three-fourths of the models use intercarrier sound. The conventional sound system of yesterday has become unconventional. What'll we call it now?

WHERE, OH WHERE? Finding a place for a television set in the living room can be one of the most challenging problems of furniture arrangement a housewife ever ran into. Here are some factors you can bring up when asked to make suggestions. Keep the set away from windows, because bright outside light coming right past the set is annoying. Try to find a location where grownups can watch comfortably without having to move furniture each time, while still providing conversational groupings of chairs and sofa for guests. Avoid having a main-traveled route go across the front of the set, because sure as sin the kiddies are gonna squat there to watch Hopalong and Howdy Doody. Keep your technical problems of transmission line runs to yourself, and make the best of the lady's final decision if you wanna maintain good public relations.

MISMATCHES. To a technical man who keeps his antenna and transmission line impedance data right alongside the Photofact Folders on the front shelf, it's simply fantastic to think of sticking a 300-ohm conical on the sky end of a 72-ohm coax line. Yet he's gotta do it, cause there aren't any good broad-band 72-ohm arrays. So he does it. So it works. Then, after long sessions with highbrow books on antenna theory, he learns that sky-end mismatch just gives mebbe a DB or two of attenuation at the most - hardly enough to be noticed except in the fringiest of fringe areas. Also, mismatch up there doesn't make any line-reflection ghosts. - - - Incidentally, though most of the guys have been using 300-ohm twinlead with a matching transformer at the set to get down to 72 ohms for DuMont sets, we'll be seeing more coax going in even at 8 cents a foot and maybe more, because good twinlead is plenty, plenty scarce. Don't get stuck with a lot of high-priced line, though, cause the shortage can clear up overnight now that TV set production is slackening.

THE DOCTOR SAYS HM-M-M. Have you ever noticed a good doctor's professional attitude? His conversation consists mostly of short questions, concise directions, and an occasional "Hm-m-m." You never hear him thinking out loud as he tries to figure what's wrong with you. You don't hear him gossiping about his other patients or criticizing other doctors. You don't hear him complaining, "I get all the tough ones to fix, after the other doctors have butchered them up." You respect him all the more for this, and never stop to think that $3 for fifteen minutes of Hm-m-m's is a pretty good hourly rate.

PHONOGRAPH CARTRIDGES

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"QT" & "QC" Series

"MI-2" Series

"L" Series

"M" Series

"401-A" Series

"B" Series

REPLACEMENT NEEDLES

TYPE	LIST PRICE Sapphire (J)	LIST PRICE Osmium (M)	Tip Radius	USED IN ASTATIC CARTRIDGE TYPES
A-1	$1.50	$1.00	.001″	AC, ACD Series
A-3	1.50	1.00	.003″	AC-78;ACD Series
A-AG	1.50	1.00	AG	AC-AG Series
C-1	1.50	1.00	.001″	MD-1
C-3	1.50	1.00	.003″	MD-3
D	None	1.00	.003″	LT-3D; LT-4D; LT-4D1; MD
D-33	None	1.00	.001″	LT-3D; LT-4; LT-4D; LT-4D1
D-AG	None	1.00	AG	LT-4-AG
T	None	1.00	.003″	LT Series
T-33	None	1.00	.001″	LT-33
G	1.50	1.00	.001″	GC Series
G-78	1.50	1.00	.003″	GC-78 Series
G-AG	1.50	1.00	AG	GC-AG Series
Q	1.50	1.00	.003″	QT; LQD and CAC-78 Series
Q-33	1.50	1.00	.001″	QT-33; CQ; CAC & LQD Series
Q-AG	1.50	1.00	AG	CQ-AG Series
U	1.50	1.00	.001″	U-J; U-M
U-78	1.50	1.00	.003″	U-78-J; U-78-M
Nylon	1.50	1.00	.003″	Nylon 1J; Nylon 1M

CARTRIDGES FOR STANDARD RECORDS

Model No.	Element Type	List Price	Minimum Needle Pressure	Output Voltage 1000 c. p. s. .5 Meg. Load	Frequency Range c. p. s.	Needle Type
MI-2J	Magnetic	$7.50	¾ oz.	0.1	50 to 12,000	Fixed (J)
L-26A	Crystal	4.45	2¾ oz.	1.4	50 to 4,500	Optional
L-40A	Crystal	4.45	1¼ oz.	0.6	50 to 4,500	Optional
L-70A	Crystal	5.55	1¼ oz.	1.0	50 to 4,000	Optional
L-71A	Crystal	6.65	1 oz.	1.0	50 to 8,000	Optional
L-72A	Crystal	6.65	1¼ oz.	3.5	50 to 4,000	Optional
L-82A	Crystal	5.55	2¾ oz.	3.5	50 to 5,000	Optional
L-92A	Crystal	6.00	1 oz.	2.25	50 to 7,000	Optional
L-74A	PN Crystal	10.00	1½ oz.	1.4	50 to 4,000	Optional
L-78	PN Crystal	11.15	(Special P. N. Crystal Cartridge for Seeburg Record Changers)			
LT1-M	Crystal	7.00	¾ oz.	1.0	50 to 10,000	"T" (M)
LT2-M	Crystal	7.00	¾ oz.	1.0	50 to 10,000	"T" (M)
LT3-M	Crystal	7.00	¾ oz.	1.0	50 to 10,000	"T" (M)
Nylon 1-J	Crystal	7.75	1¼ oz.	1.0	50 to 10,000	Nylon (J)
QT2-J	Crystal	8.90	1 oz.	0.85	50 to 10,000	"Q" (J)
QT2-M	Crystal	8.40	1 oz.	0.85	50 to 10,000	"Q" (M)
QT3-J	Crystal	8.90	1 oz.	0.85	50 to 10,000	"Q" (J)
QT3-M	Crystal	8.40	1 oz.	0.85	50 to 10,000	"Q" (M)
CAC-78-J	Crystal	7.50	20 gr.	1.35	30 to 11,000	"Q" (J)
QC-J	Ceramic	8.90	1 oz.	0.5	50 to 10,000	Fixed (J)
GC-78-J	Ceramic	7.40	12 gr.	0.7	50 to 10,000	G-78 (J)
AC-78-J	Crystal	8.90	6 gr.	1.6	50 to 10,000	A-3 (J)
U-78-J	Crystal	8.90	5 gr.	0.5	30 to 10,000	U-78 (J)
M-22	Crystal	5.55	2¾ oz.	2.9	50 to 6,500	Optional
B-2	Crystal	5.55	2¾ oz.	2.5	50 to 4,000	Optional
B-4	Crystal	5.55	2¾ oz.	2.5	50 to 4,000	Optional
401-A	Crystal	4.45	2¾ oz.	1.4	50 to 4,500	Optional
PT	Crystal	5.00	1 oz.	1.4	50 to 10,000	Not included
MD	Crystal	9.90	(Special for early Markel Record Changers)			"D" (M)
MD-3J	Crystal	10.90	(Special for Markel Record Changer)			C-3 (J)

NOTE: Cartridge types B, QT and LT also available with PN Crystal upon request.

CARTRIDGES FOR LONG-PLAYING, SLOW-SPEED RECORDS

Model No.	Element Type	List Price	Minimum Needle Pressure	Output Voltage 1000 c. p. s. .5 Meg. Load	Frequency Range c. p. s.	Needle Type
U-J	Crystal	8.90	5 gr.	0.5	30 to 10,000	U (J)
GC-J	Ceramic	7.40	6 gr.	0.65	50 to 10,000	G (J)
CAC-J	Crystal	7.50	5 gr.	1.0	30 to 11,000	Q-33 (J)
AC-J	Crystal	8.90	5 gr.	1.0	50 to 10,000	A-1 (J)
MI-2-J-33	Crystal	7.50	6 gr.	.028	50 to 12,000	Fixed (J)
MD-1J	Crystal	10.90	(Special for Markel Record Changer)			C-1 (J)
LT-4M	Crystal	7.00	6 gr.	1.9	50 to 7,000	D-33 (M)
L-92-33	Crystal	6.00	10 gr.	3.6	50 to 10,000	Not included

With Double Needle for Standard and Slow-Speed Records

Model No.	Element Type	List Price	Minimum Needle Pressure	Output Voltage 1000 c. p. s. .5 Meg. Load	Frequency Range c. p. s.	Needle Type
ACD-J	Crystal	9.50	6 gr.	1.0	50 to 6,000	A-1 (J); A-3 (J)
ACD-1J	Crystal	9.50	(Replacement Cartridge Only for ACD-2 Assembly)			A-1 (J); A-3 (J)
ACD-2J	Crystal	10.00	(Assembly of ACD Cartridge, Turnover Mechanism & Knob)			A-1 (J); A-3 (J)
LT-4D	Crystal	8.50	8 gr.	2.0	50 to 7,000	"D"(M); D-33(M)
LQD-J	Crystal	9.50	8 gr.	1.0	50 to 7,000	"Q"(J); Q-33(J)
LQD-1J	Crystal	9.50	8 gr.	1.0	50 to 7,000	"Q"(J); Q-33(J)

With Single "All Groove"** Needle for Standard and Slow-Speed Records

Model No.	Element Type	List Price	Minimum Needle Pressure	Output Voltage 1000 c. p. s. .5 Meg. Load	Frequency Range c. p. s.	Needle Type
AC-AG-J	Crystal	8.90	6 gr.	1.0	50 to 10,000	A-AG (J)
CQ-AG-J	Crystal	7.50	8 gr.	1.0	50 to 10,000	Q-AG (J)
GC-AG-J	Ceramic	7.40	8 gr.	0.7	50 to 10,000	G-AG (J)
LT-4-AG	Crystal	7.00	8 gr.	2.0	50 to 5,000	D-AG (M)

**ALL-GROOVE NEEDLES have special tip to play 33 1/3, 45 and 78 RPM records.

Current Replacements for Discontinued Types

Discontinued Types	Equivalents	Discontinued Types	Equivalents
L-22A	L-26A	LP-23	QT-3J
L-24A	L-82A	M-23	M-22
L-25A	L-70A	B-1	B-2
L-27A	L-26A	B-3	B-2
L-32A	L-26A	Nylon 1-M	Nylon 1-J
L-36A	L-82A	MLP-1	QT3-M
L-41A	L-40A	MLP-1J	QT3-J
L-46A	L-72A	MLP-2	QT3-M
L-50A	L-72A	MLP-3	QT3-J-PN
L-73A	L-74A	QT-M	QT3-M
L-75A	L-70A	QT-J	QT3-J
L-76	L-70	MI-2M	MI-2J
L-80	L-78	LP-33	U-J
L-82V	L-82A	LP-78	U-78-J
LP-6	LT1-M	QT-33	CQ-J
LP-21	QT-3J	LT-3D	LQD-J

♦ ♦ Continued from page 8 ♦ ♦

Circuit (A) shows a mixer circuit employing a triode, with both the RF and oscillator signals coupled capacitively to the grid. Capacitors C1 and C2 are usually very small in value - - sometimes less than 1 mmf. This circuit is conventional in design and uses a minimum of components. R1 is the grid-return and C2 is the grid-leak capacitor. C3 couples the oscillator signal to the mixer grid.

Circuit (B) has both the RF and oscillator signals inductively coupled to the mixer. L1 is in the plate circuit of the RF tube, and the signal developed across the coil is coupled to L2. L3 is the oscillator coil which is placed near L2 to provide inductive coupling. This type circuit is used most frequently in turret tuners, since L1, L2, and L3 can be mounted on the coil strip to obtain the correct amount of coupling. C1, R1, and R2 make up the grid-leak network. The trimmer C2 tunes the mixer grid circuit. Point ♦A is usually brought out to some form of terminal on top of the tuner to facilitate scope connection during alignment. R2 is actually the correct value for the grid return, while R1 is placed in the circuit to isolate the scope from the mixer grid. R1 will vary in value from a few thousand ohms to perhaps 100K ohms. Normally, R1 is 1/10, or less, of the value of R2.

A combination of these two circuits is shown in circuit (C). The RF signal is inductively coupled, while the oscillator signal is capacitively coupled.

In each of the previously described mixers, a triode tube has been used. Actually, a pentode could also have been used without any change in the grid circuit. Such a circuit is shown in (D). The pentode mixer provides more gain than the triode and offers less loading on the signal due to its higher input resistance.

The pentode mixer of the circuit (E) has an unbypassed resistor in the cathode, usually having a value around 50 ohms. The resulting small amount of degeneration in the cathode circuit increases the input resistance of the stage and is helpful in holding up the gain on the high channels.

Germanium or similar crystals may also be used as mixers and are especially suited to the high-frequency applications. It is a possibility that crystals may be used as mixers in TV tuners for UHF receivers. Although no gain is provided by a crystal mixer, additional IF amplification may be used to overcome this deficiency.

LOCAL OSCILLATOR CIRCUITS

The local oscillator in a TV receiver has the same purpose as in the superheterodyne radio receiver. It must produce an RF signal of the proper frequency, which, when beat against the desired signal, will produce the correct intermediate frequency. In the design of the TV oscillator, several additional problems are encountered over those in radio oscillator design. The frequencies at which the TV oscillator must operate are much higher - so high that inter-electrode capacities of the oscillator tube must be taken into account, as well as the distributed wiring capacity in the circuit. Even characteristics of resistors in tuned circuits, operating at TV channel frequencies, must be considered. The problem of frequency drift also must be overcome for satisfactory operation.

Each type of oscillator has frequency limits over which it can be efficiently operated. If these limits are exceeded, one or more of the requirements for satisfactory operation may not be fulfilled. The oscillator may drift, have low power output, or may completely stop oscillating. Obviously, a type of oscillator must be selected that will not have these deficiencies.

Basically, all RF oscillators are the same. To sustain oscillation, signals of the proper phase and amplitude are fed back to an electron tube which furnishes the power to compensate for losses in the tank circuit. Figure 1-4 shows circuits of a few basic oscillators. All these types are not necessarily used in TV receivers, but a discussion of their operation is in order to show their similarity.

The tube is connected in the circuit so that the grid and plate are at opposite ends of the tank circuit, with the cathode at some point between. The point at which the cathode is connected determines the amount of signal being fed back to the tube. Circuit (A) is a tickler-type oscillator, one of the first oscillators to be used in radio application. L1 and C1 make up the tank circuit and the values of these components determine the frequency of oscillation. L2 is the tickler, or feedback, coil, which is placed near L1 to obtain coupling between the coils.

To review the operation of this oscillator, let us assume that the filament of the tube is hot and B+ has just been applied. At this instant, the bias on the tube is zero so the tube will conduct heavily, the current being limited largely by the impedance of L2. As current starts flowing in L2, a signal of the proper polarity is induced into L1, which drives the grid in a positive direction and further increases current flow in the tube. Also, the grid will draw current charging C2, negative on the grid side. This action continues until the tube reaches saturation. When there is no longer a change in current flow in L2, the field collapses and induces a voltage in L1, which drives the grid in a negative direction, cutting off plate current. The tank circuit then continues through a cycle of oscillation and at some point will bring the grid above the cutoff point and the cycle will be repeated. The time constant of C2 and R1 is such that only a small amount of the charge can leak off in one cycle at the lowest operating frequency. The charge on C2 starts to leak off producing a negative voltage across R1, which aids in keeping the tube cut off. When enough of the charge on C2 has leaked off, along with the oscillation action in the tank circuit taking the grid in a positive direction, the grid will rise above the cut-off point of the tube and the cycle will be repeated. It should be noted that the purpose of the tube is to replace the losses in the circuit, either from loss within the tank circuit itself or because of the power taken from the circuit. If the tank circuit, L1 and C1, were shock excited, it would continue to oscillate for several cycles in a damped train of oscillations. It is the

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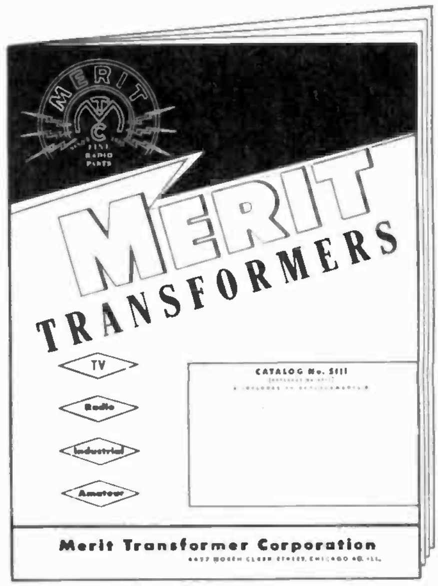

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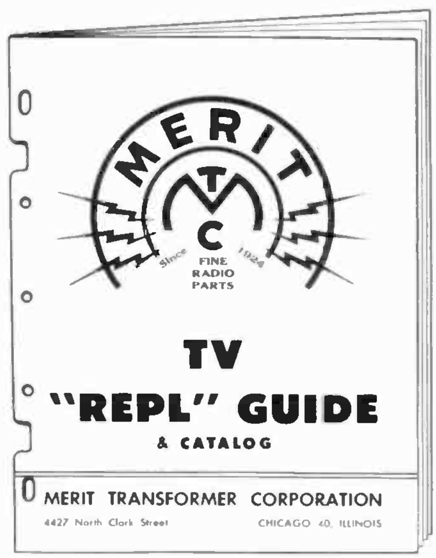
DEALER PRICE SHEET-FORM No. 2, dated JULY 31, 1950 shows the part No., Net price and List price of over 280 parts.

AUTO VIBRATOR TRANSFORMER SHEET-FORM No. 3, dated JULY 31, 1950, shows model No., Net, List prices and Specs. of VIBRATOR TRANSFORMERS for FORD-GM-MOTOROLA and MOPAR car radios. Also simple easy-to-read replacement guide covering 30 manufacturers.



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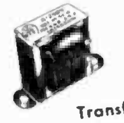

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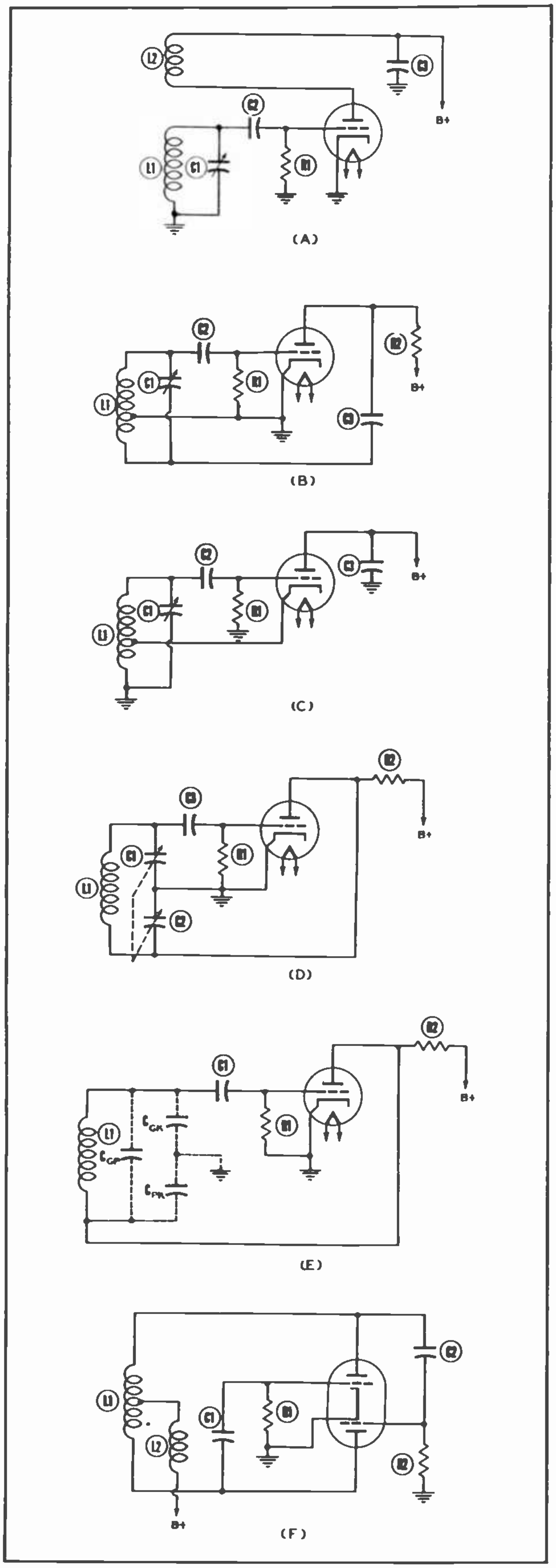


Fig. 1-4. Oscillator Circuits.

purpose of the tube to furnish the power to replace the losses and sustain oscillations. The tickler-type oscillator is usually employed in the medium frequency range.

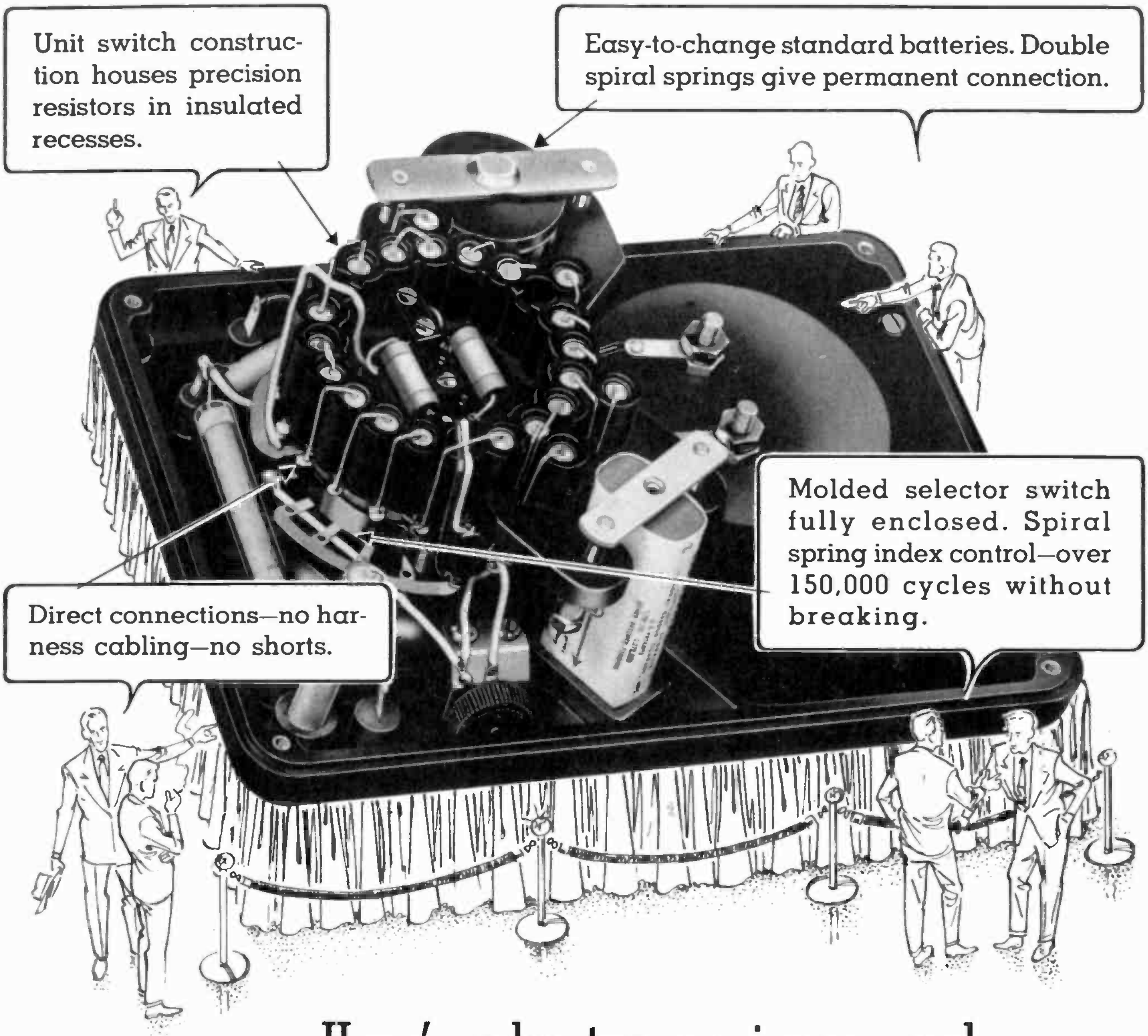
Circuit (B) shows a Hartley oscillator. The operation of this circuit is similar to that of (A). In this circuit, however, a tapped coil is used in the tank circuit. The grid and plate are coupled to opposite ends of the tank circuit, with the cathode connected to the tap. The value of C3 must be high enough to provide sufficient feedback to sustain oscillations. One disadvantage to this circuit is the fact that both terminals of the tuning capacitor C1 are above ground. This disadvantage has been overcome, however, in circuit (C), which is a modified Hartley oscillator. In this circuit, the cathode has been lifted from ground and the plate is bypassed to ground by C3. The lower end of the tank circuit is also grounded. This circuit is known as the "floating-cathode," or "grounded-plate," Hartley oscillator. It is the same circuit as the basic Hartley, except that a different point in the circuit is grounded. The "floating-cathode" type Hartley is very widely used in broadcast receivers.

Circuit (D) is a basic Colpitts oscillator. It is similar in operation to the Hartley circuit of (B); however, instead of having a tapped coil to provide feedback, two capacitors are placed in series across L1, and the junction of the two capacitors is connected to ground. The values of C1 and C2 determine the amount of feedback voltage. This oscillator operates satisfactorily in TV applications, but it is seldom used - - probably due to the fact that a split stator tuning capacitor is required.

The circuits shown in (E) and (F) are the most frequently used in TV receivers. Circuit (E) is an ultraudion oscillator. Its operation is similar to that of the Colpitts; however, interelectrode capacities of the tube are used instead of actual components. C_{pk}, the plate-to-cathode capacity, forms the voltage divider network. The grid-to-plate capacity, C_{gp}, is across the tank circuit. In some cases, an additional capacitor, usually 10 mmf. or less, will be connected between grid and plate to minimize the effect of capacity change during warmup. Also, capacitors may be connected from grid to cathode, or from plate to cathode, to obtain the proper amount of feedback. In the event of replacement of these components, they should be exact replacements to insure operation on all channels.

To better understand the operation of this oscillator, assume that the phantom ground point on L1 is grounded and a DC blocking capacitor is placed between the plate and L1. The circuit is now identical to the Hartley circuit shown at (B). The ultraudion oscillator is ideal for TV applications since it incorporates only one coil, thus requiring a minimum of contacts for channel transfer. It also permits simplified tuning in switch type or sliding contact tuners.

The push-pull oscillator of circuit (F) is frequently employed as a TV oscillator. The tank circuit consists of L1 and the inter-electrode capacity



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of the tube. L2 is in series with B+ and the center-tap of L1. This isolates the center-tap of L1 from ground to compensate for any unbalance in the circuit. R1 and R2 are the grid resistors. C1 and C2 form the feedback network, and also act as the grid leak capacitors. This circuit is identical to the push-pull RF amplifier except for the value of C1 and C2. In the RF amplifier, C1 and C2 were of a value that would neutralize the stage, while in the case of the oscillator, the capacitors are larger in value, usually 4.7 mmf., to provide sufficient feedback to sustain oscillations.

The push-pull oscillator generates considerable power and, because it is balanced, there is a minimum of external radiation. The inductance of L1 in the push-pull oscillator is varied by switching in small amounts of inductance in each half of the circuit, or L1 may be shunted by another coil to lower the total inductance. When capacitive tuning is employed, a split stator capacitor is placed across L1. In this case, two coils are used - one for the high channels and one for the low channels.

The design of most TV tuners is such that the oscillator circuits are quite stable. Only in case of replacement of the oscillator tube should it be necessary to align the oscillator circuit, and in many cases, even this is not required.

MIXER PLATE CIRCUITS

The plate load of the mixer tube is the first tuned circuit of the IF system. Its purpose is to accept the difference frequency from the output of the mixer tube and to reject all other frequencies.

Several types of tuning are employed in mixer plate circuits. The three basic types are series-tuned, shunt-tuned, and the double-tuned transformer. The shunt and transformer-tuned circuits are conventional parallel resonant circuits. The series-tuned circuit differs, however, in that the input and output capacitances of the tubes are a major part of the tuned circuit. At first glance it appears that the coil impedance would actually isolate the signal instead of coupling it.

Figure 1-5, the series-tuned circuit, is broken down to show how tuning is accomplished. Circuit "A" is the circuit as it would appear on the schematic. The tuned circuit only is shown in "B." C_{out} represents the output capacity of the mixer tube and C_{in} represents the input capacity of the first IF tube. C_2 has been eliminated from the circuit as its reactance is low enough that its presence does not affect the tuned circuit. C_1 is usually around 10 mmf. and is added in parallel to C_{out} to produce the correct capacity for tuning. During the following discussion, the combination of C_1 and C_{out} will be referred to as C_{out}. Circuit "C" is exactly the same circuit as "B" except that it is positioned differently. When drawn in this manner, it can easily be seen that L_1 is tuned by the series network of C_{in} and C_{out}. Somewhere along the coil winding of L_1 is a "phantom ground." The location of this point is dependent upon the values of C_{in} and C_{out}. If these two capacities are equal, the ground point would be at the center of L1. If C_{out} were twice the

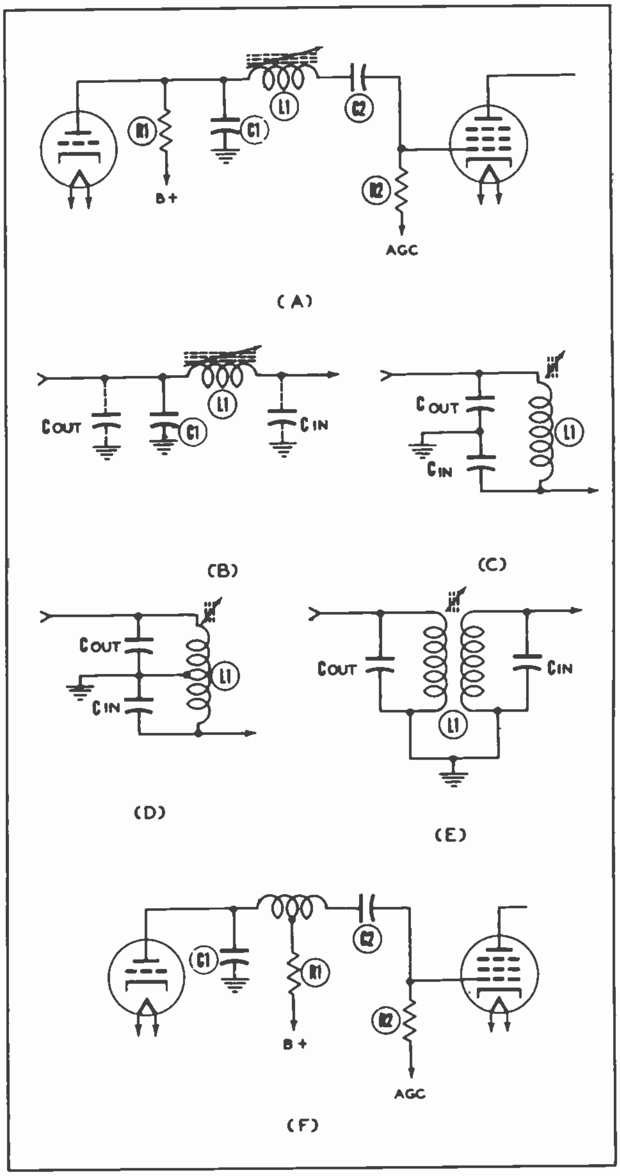

Fig. 1-5. Series Tuned Coupling Circuits.

value of C_{in}, the ground point would be one-third the way down the coil; etc. By connecting this "phantom ground" point to actual ground, the circuit would appear as in "D." Again, redrawing the circuit as in "E," it appears as a conventional double-tuned transformer.

In cases where the loading must be kept at a minimum, the plate voltage can be applied to the tube at a tap on the series coil, as shown in circuit "F." If the tap point on the coil is properly selected, there will be no signal present at this point at a certain frequency. At this frequency, there is no IF signal across R_1, and, therefore, no loading on the circuit. Since a wide band of frequencies is passed by this circuit, the "phantom ground" point will shift with frequency change causing a portion of the signal to be developed across the resistor. The loading, however, is much less than it would be if a conventional, shunt-fed circuit were used.

Jensen Replacement Needle Chart...

CARTRIDGE MFG.	CART. MFG. NEEDLE NO.	JENSEN NEEDLE NO.	ILLUSTRATION (Actual Size)	CARTRIDGE NUMBERS	POINT MATERIAL	POINT SIZE
Astatic Astatic Astatic	Q(M) Q-33(M) Q-AG(M)	A-80 A-80-LP A-802		QT-M; QT2-M; QT3-M; LQD; LQD-1 QT-33-M; CQ-M; LQD; LQD-1 CQ-AG-M; CQ-AG-J	Osmium Osmium Osmium	Standard Micro-Groove All Groove
Astatic Astatic	Q(J) Q-33(J)	A-81 A-81-LP		QT-J; QT2-J; QT3-J; LQD; LQD-1 QT-33-J; CQ-J; LQD; LQD-1	Sapphire Sapphire	Standard Micro-Groove
Astatic Astatic Astatic	D(M) D-33(M) D-AG(M)	A-83 A-83-LP A-832		LT-3D; LT-4D; LT-4D1; MD LTD-3D; LT-4; LT-4D; LT-4D1 LT-4-AG	Osmium Osmium Osmium	Standard Micro-Groove All Groove
Astatic Astatic Astatic	G-78(M) G(M) G-AG(M)	A-84 A-84-LP A-842		GC-78-M; MG-78-M GC-M; GC-1M; MG-1M GC-AG-M; MG-AG-M	Osmium Osmium Osmium	Standard Micro-Groove All Groove
Astatic Astatic	T(M) T-33(M)	A-86 A-86-LP		LT-1M; LT-2M; LT-3M LT-33	Osmium Osmium	Standard Micro-Groove
Astatic Astatic	C-3(M) C-1(M)	A-87 A-87-LP		MD-3 MD-1	Osmium Osmium	Standard Micro-Groove
Astatic Astatic	U-78(M) U(M)	A-88 A-88-LP		U-78 M UM	Osmium Osmium	Standard Micro-Groove
Astatic Astatic	C-3(J) C-1(J)	A-89 A-89-LP		MD-3 MD-1	Sapphire Sapphire	Standard Micro-Groove
Astatic Astatic Astatic	A-3(M) A-1(M) A-AG(M)	A-85 A-85-LP A-852		AC-78; ACD Series AC; ACD Series AC-AG-M; AC-AG-J	Osmium Osmium Osmium	Standard Micro-Groove All Groove
Astatic	Nylon 1-M	A-82		Nylon 1J; Nylon 1M	Osmium	Standard
Shure	A62A	JP-30		P-30; P-57; P-70; P-72; P-74AD; P-76; P-77; P-79; P-85; P-88; P-89; P-94; PN-30; W-22AB; W-238; W-608; W-60HS; W-60PN; W-618; W-658 Admiral 409A11	Osmium	Standard
Shure	A-63MG	JP-30-LP		Admiral 409A11; P-73; P-74AD; P-72V; P-76V	Osmium	Micro-Groove
Shure	A-66U	JP-312		Admiral 409A13-1; P-71; P-81; P-37	Osmium	Unipoint
Shure	A-61A	JPS-30		P-30; P-57; P-70; P-72; P-74AD; P-76; P-77; P-79; P-85; P-88; P-89; P-94; PN-30; W-22A; W-23A; W-60A	Sapphire	Standard
Shure	A-65MG	JPS-30-LP		P-73; P-74AD; P-72V; P-76V; W-21A; W-21AR; W-22A; W-22AB	Sapphire	Micro-Groove
Shure	A67U	JPS-312		P-71; P-81; P-37	Sapphire	Unipoint
RCA RCA	72345 74068	M-70 M-70-LP		70338; 70339 74067	Sapphire Sapphire	Standard Micro-Groove
RCA RCA	75046 75045	M-71 M-71-LP		70338; 70339 74067	Osmium Osmium	Standard Micro-Groove
RCA	39863	M-72		72551; 9890; 39919; 39550; 38598; 70332; 39851	Sapphire	Standard
RCA	38449	M-73		72551; 9890; 39919; 39550; 38598; 70332; 39851	Osmium	Standard
RCA RCA	75497 75496	M-74 M-74 LP		75475 75475	Sapphire Sapphire	Standard Micro-Groove
RCA RCA	75497 75496	M-75 M-75 LP		75475 75475	Osmium Osmium	Standard Micro-Groove
Electro-Voice Electro-Voice	S-3 S-1	E-90 E-90-LP		M12-S; H12-S; L12-S 14-S; 22-S; 34S	Sapphire Sapphire	Standard Micro-Groove
Electro-Voice	S-13	E-91		16TT; 22TT	Sapphire	Twin Point
Electro-Voice	O-13	E-93		16TT; 22TT	Osmium	Twin Point
Electro-Voice Electro-Voice Electro-Voice	O-3 O-1 O-2	E-95 E-95-LP E-962		M12; H12; L12 14; 14; 33; 335	Osmium Osmium Osmium	Standard Micro Groove All Purpose
Columbia	101	M-60-LP		45-1609	Sapphire	Micro-Groove
Columbia	102 & 103	A-81-LP		CQ	Sapphire	Micro-Groove
Webster-Electric	M	W-02		M-1	Osmium	Standard
Webster-Electric	F-14	W-05		F14; F14-1; F14-2; F14-3; F14-4	Osmium	Dual
Webster-Electric Webster-Electric	A35 A15	W-14 W-15		A1; A8 A1; A2; A3; A4; A5; A6; A8	Sapphire Sapphire	Standard Micro-Groove
Webster-Electric Webster-Electric	A30 A10	W-16 W-17		A1M; A1M-1; A5M; A6M A1M; A1M-1; A2M; A5M; A6M	Osmium Osmium	Standard Micro-Groove
Webster-Electric	Q1	W-30		Q1	Osmium	Standard
Webster-Electric Webster-Electric Webster-Electric	G3 G1 G2	W-36 W-36-LP W-362		G3M G1M G2M	Osmium Osmium Osmium	Standard Micro-Groove All Purpose
Webster-Electric Webster-Electric	WS AJ	W-37 W-37-LP		WS AJ4	Osmium Osmium	Standard Micro-Groove
Webster-Electric	A9	W-38		A9M	Osmium	All Purpose
Webster-Electric	A2	W-412		Q3; A9; F-13	Osmium	All Purpose
Webster-Electric	C9	W-422		C9	Osmium	All Purpose
Webster-Electric	Q2	W-49		Q2	Osmium	Standard
Webster-Electric Webster-Electric	F16-3 F16-1	W-72 W-73		F16; F16-1; F16-2 F16; F16-1; F16-2	Osmium Osmium	Standard Micro-Groove
Webster-Electric Webster-Electric	F15-3 F15-1	W-81 W-82		F15; F15-1 F15; F15-1	Osmium Osmium	Standard Micro-Groove
Webster-Electric	F7	15-LP		F7; F7-1; F7-2; Q2; F13	Osmium	Micro-Groove
Webster-Electric Webster-Electric	F10 F10-1	JP-30 JP-30-LP		F10; F11; F11-1 F11; F11-1	Osmium Osmium	Standard Micro-Groove
General Electric General Electric	RPJ-001 RPJ-005	GE-10 GE-10-LP		RPX-040; RPX-041; RPX-046 RPX-040; RPX-041; RPX-046	Sapphire Sapphire	Standard Micro-Groove
General Electric	RPJ-010	GE-11		RPX-050	Sapphire	Dual
Philco	45-1596	PH-10		Dynamic Reproducer 76-1622	Sapphire	Standard
Philco	45-1613	PH-11		45-1609	Osmium	Micro-Groove
Philco	35-2693	PH-12		76-4649	Osmium	Dual
Philco	45-1613	M-60-LP		45-1609	Sapphire	Micro-Groove
Philco	45-1597	PH-14		35-2671	Osmium	Standard
Philco	45-1651	PH-15		35-2671	Sapphire	Standard
Webster-Chicago	NE-215	NE-215		21P247; 21P402; 21P403	Osmium	Dual
Webster-Chicago	NE-316	NE-368		21P404	Osmium	Dual
American Microphone	S-1	AM-20		S-1; S-1A; S-2; S-2A	Osmium	Standard
American Microphone	CO-3	AM-21		C-3	Osmium	Standard
American Microphone	CO-1	AM-21-LP		C-1	Osmium	Micro-Groove
American Microphone	CO-2	AM-212		C-2	Osmium	All Purpose
Crosley	145720	C-99		145749	Sapphire	Standard
Magnavox	560102	M-02		560101	Osmium	Standard
Magnavox	560138	M-46		560133	Osmium	Twin Point

1 These needles are handled by all Radio Parts distributors.

2 A set of installation instructions is packaged with each needle.

3 Ask for them by the Jensen number indicated.

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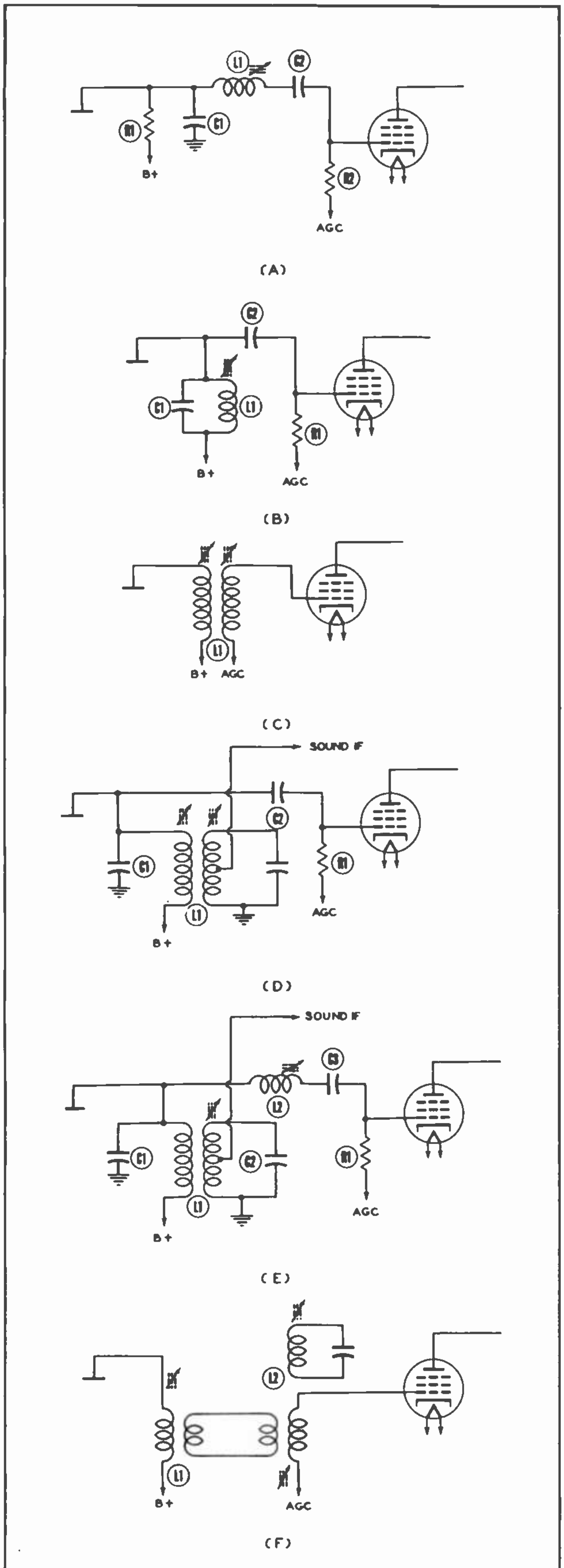


Fig. 1-6. Mixer Plate Circuits.

The circuits shown in Figure 1-6 are representative of the basic types of mixer plate circuits. Circuit "A" is a shunt-fed, series-tuned circuit. R_1 is the plate load of the mixer. C_2 couples the signal to the first IF grid, and R_2 is the first IF grid load. L1 is adjustable and is trimmed by the output capacity of the mixer, C1, and the input capacity of the first IF stage. The circuit is well suited for intercarrier applications, since no traps are needed. It is used quite frequently, especially in conjunction with a triode mixer.

A shunt, or parallel-tuned, circuit is shown in "B." L_1 is adjustable and is trimmed by C_1, along with the input and output capacity of the tubes. The signal is capacitively coupled to the IF tube. This circuit is often used with pentode type mixers. Since there is no appreciable drop in plate supply voltage across L_1, the plate and screen can operate at the same potential.

In receivers employing a separate sound IF, a trap may be added as shown in "D." The trap is inductively coupled to the mixer plate coil and "sucks out" the frequency at which the trap is tuned. The trap coil has a high "Q," which makes possible the "trapping" of a narrow band of frequencies. The lower end of the trap coil is grounded. The sound IF signal is fed to the sound IF channel from a tap on the coil. By tapping down on the coil, the loading presented by the first IF tube is minimized. With this arrangement, the trap coil performs two functions. It "sucks out" the sound IF frequency, preventing it from being fed to the video IF channel. It also supplies the sound IF signal to the sound IF channel. Since only a narrow band of frequencies will be fed to the sound IF channel, none of the video signal should be present in the sound channel.

A transformer is incorporated in circuit "C." Both primary and secondary are tuned. By changing the spacing between the windings, the pass band of the circuit can be varied to satisfy the receiver requirements.

In cases where a series-tuned circuit is desired in a receiver having a separate sound IF system, a circuit arrangement, as shown in "E," can be employed. Instead of using a resistor as the plate load of the mixer, a coil is used. The sound trap winding is placed near this coil and will absorb the signal at the frequency to which the trap is tuned.

Another method of coupling the signal from the mixer to the first IF grid is shown in "F." An additional coil is added to the mixer plate and first IF grid coils. These coils are then connected by a link which is usually a length of coaxial cable. This method is known as link coupling and is especially desirable where the first IF tube is at a distance from the tuner. Both the mixer plate and IF grid coils are tuned. An absorption trap is shown as a part of L_2. This trap may be for rejection of adjacent sound or video, or may be a sound trap, depending upon receiver requirements.

Although there are many variations of the above circuits, the understanding of the function and operation of these basic types should be helpful in servicing all mixer plate circuits.

for Greatest TV Picture Quality

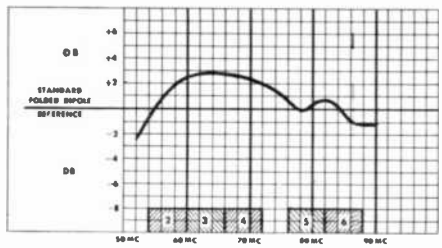
AMPHENOL INLINE*

*Reissue Patent No. 23,273

TV ANTENNAS

OUTSTANDING MECHANICAL SPECIFICATIONS

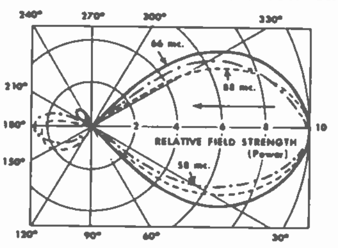
Part	Material	Yield Strength	Size	
		psi	o.d.	Wall
Mast (galv.)	¾" Thinwall Steel Conduit	32,000	0.922"	.049"
Large Folded Dipole	3S ½ H Al.	19,000	.500"	.049"
Small Folded Dipole	3S ½ H Al.	19,000	.375"	.049"
Reflector	3S ½ H Al.	19,000	.500"	.049"
Crossarm	3S H Al.	26,000	.875"	.065"
Center Support & T Casting	Al. Alloy 45,000 psi tensile strength			



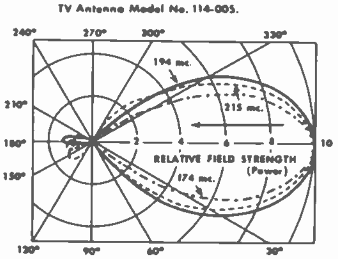
Gain of Amphenol Model No. 114-005 Antenna over a reference folded dipole. 54 to 88 mc.

EXCELLENT RADIATION PATTERNS

These are the radiation patterns of the AMPHENOL Inline antenna at 58 mc., 66 mc., and 88 mc., in the low band, and 174 mc., 194 mc., and 215 mc. in the high band. Notice the uniformity of these lobes at all frequencies. The lack of lobes off the sides and negligible ones off the back maintains high front-to-back and front-to-side ratios necessary for the rejection of various interferences. The presence of a single forward lobe is usually a very desirable feature, especially when it is wide enough to provide adequate interception area for some differences in transmitter location, changes in the wave front's direction of travel, or physical movement of the antenna in high winds. Furthermore, it is not too critical of orientation. It is necessary only to aim it and forget it.



Horizontal radiation pattern of Amphenol TV Antenna Model No. 114-005.



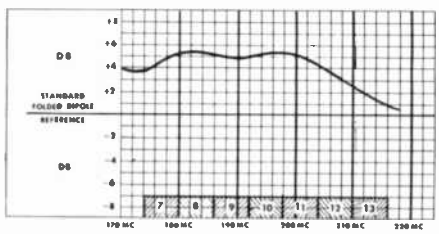
Horizontal radiation pattern of Amphenol TV Antenna Model No 114-005

HIGHER GAIN

These gain curves of the AMPHENOL Inline antenna represent the intercepted voltage of the AMPHENOL Inline Antenna as plotted against the intercepted voltage of a reference folded dipole cut to the frequency being compared. There is no channel in either the low band or high band where there is more than a three decible change within the channel that can cause picture modulation or "fuzziness." Gain of the AMPHENOL Inline antenna is quite flat over all channels.

You will find more gain designed into the high band because of greater need for it, due to higher losses at these frequencies. Also, notice the drop-off on channel six. This is at the edge of the FM band and is subject to FM interference, so the Inline's gain is purposely held down at that frequency.

The excellent broadband characteristics, impedance match, single forward lobe radiation patterns on all channels, maximum gain, lightning protection, and superior mechanical features of the AMPHENOL Inline Antenna make it the antenna for greatest TV picture quality!



Gain of Amphenol Model No 114-005 Antenna over a reference folded dipole. 174 to 216 mc

YOURS FOR THE ASKING

Send for "The Antenna Story" — a sincere discussion of TV antennas based on actual field tests.

AMPHENOL AMERICAN PHENOLIC CORPORATION

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To lessen adjacent channel video interference, a series-tuned trap is occasionally used in the mixer plate circuit. It is a series-resonant circuit connected between the plate circuit and ground, and is fixed-tuned to a frequency 6 mc. lower than the center of the video IF band of the receiver. In a receiver having 25.75 mc. video IF, the trap would be tuned between 17 and 17.5 mc. Since the video IF is the same for all channels, the trap is fixed-tuned and no adjustment is required.

SERVICING THE TV TUNER

An important rule to follow before servicing any TV tuner is to be sure that trouble actually exists in the tuner before any replacements or adjustments are made. As is often true in the case of tubes, the real test is to try a tuner of known merit in the receiver. If the difficulty is overcome, trouble must exist in the original tuner. On the other hand, if the trouble is not corrected by the tuner substitution, it is safe to assume that the original tuner is good. Obviously, it is not practical to keep a stock of all types of tuners on hand for this purpose, so in most cases a practical trouble shooting procedure must be followed. In every instance where tuner trouble is suspected, substitute known good tubes in the tuner, one at a time, and note any change. If, after replacing all tubes, trouble is still present, the signal generator may be used to locate the faulty stage by signal tracing methods.

First, let us discuss troubles that could be encountered in any type tuner. Poor sensitivity is usually caused by a defect in the input circuit or RF amplifier. To check these circuits, connect a VTVM across the video detector load and inject an unmodulated signal from the signal generator into the mixer grid. Adjust the signal generator to the center frequency of the channel to which the receiver is tuned. Attenuate the signal generator to give approximately a 2-volt reading on the VTVM. Move the signal generator lead to the plate of the RF tube. The reading on the VTVM should remain the same or decrease slightly. If there is an appreciable decrease in the reading, trouble must exist in the circuit between the RF and the mixer. If the plate connection of the tube is not accessible from the bottom of the tuner, it can be reached from the top by lifting the tube slightly and touching a wire to the proper pin. Always use a coupling capacitor in series with signal generator lead to block the direct current.

If the RF to mixer coupling circuit is satisfactory, inject the signal at the RF grid. There will be an increase in the VTVM reading if the RF stage is normal; a decrease in the reading indicates a defective stage. When making this check, the bias applied to the tuner should be around 3 volts. The bias may be applied by connecting a 3-volt battery across the AGC line.

The next step is to check the input circuit. Nearly the same meter reading should be obtained when the signal is injected at the antenna terminal or RF grid. If the readings are not of approximately the same value, check all coils in the input circuit.

When the receiver is completely dead, the trouble probably lies in the oscillator circuit. If, after substituting a good tube the set is still inoperative, couple the signal generator to the mixer grid through a small capacitor (10 mmf. or less), or through an ungrounded tube shield over the mixer tube. Set the signal generator to the frequency at which the oscillator operates on the channel under test. Choose the channel on which the strongest TV signal is present. With the generator set for maximum output, the signal should be received. It may be weak and distorted, but the test is only intended to show if the local oscillator is operating.

The construction of some tuners is such that many of the component parts are not accessible and could not be readily replaced even if the defective part can be identified. In many cases, the manufacturer of the receiver has a trade-in or service plan for such tuners. Manufacturers who have such a policy, must be contacted for approval to return a defective tuner. On those tuners where the defective part is accessible and replacement is to be made, make sure the new part duplicates the original and that it is positioned exactly the same as the old part. Take care that no other parts are moved while making the replacement. When the new part is in a tuned circuit, the alignment of the tuner should be checked.

Figure 1-7 shows a test equipment setup for tuner alignment. The signal generator is coupled to the antenna terminals through an appropriate matching network. The vertical amplifier of the scope is connected to point ◆A in the mixer grid circuit, and the horizontal amplifier of the scope is connected to the synchronized sweep output of the signal generator. This setup is basically the same for all tuners, but the alignment instructions should be read carefully for any possible variations. When a separate marker generator is used, it is loosely coupled to the sweep generator leads. This can be accomplished by clipping the marker generator lead to an insulated part of the sweep generator lead, or by coupling with a small capacitor (2 or 3 mmf.).

The signal generator should be capable of producing a frequency modulated signal, free from

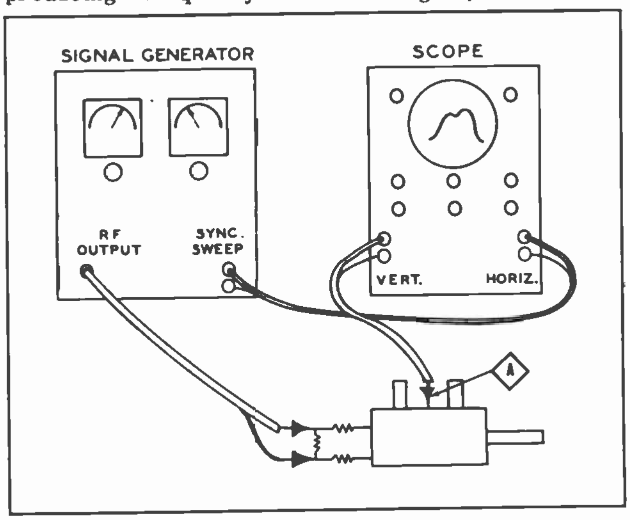

Fig. 1-7. Test Equipment Setup for Television Tuner alignment.

◆ ◆ Please turn to page 23 ◆ ◆

Floyd Makstein, field engineering manager at Emerson *recommends*

Simpson MODEL 480 GENESCOPE

FOR TV-FM SERVICING

This is what Floyd Makstein of EMERSON says about the Simpson Model 480 Genescope: . . . "The Simpson Model 480 Genescope far surpasses the standards required in the servicing and aligning of all TV-FM receivers. The wide frequency response and the 25 millivolt sensitivity of the oscilloscope, combined with the required fundamental signal sources which are provided in the AM & FM oscillator sections, simplifies the accurate aligning of all TV receivers, including those with intercarrier systems. In addition, the large, easy-to-read dials, having a 20-1 vernier control and 1000 division logging scale, cuts down on servicing time."

Mr. Makstein concludes . . . "The compactness of the complete unit will be a big factor in many of the service shops where space is at a premium. We are sure that the whole TV industry appreciated your efforts in raising the engineering standard in servicing." Emerson Service personnel *know* that modern FM and TV development and servicing demand test equipment made to the most exacting standards. They prefer the Simpson Model 480 Genescope because it is the most accurate, flexible and convenient instrument available. The Genescope will render many years of uninterrupted service and always produce accurate results.

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Step attenuator for control of output

AMPLITUDE MODULATED OSCILLATOR
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Band B: 15-75 megacycles
Band C: 75-250 megacycles
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Linear sweep frequency: 2 cycles to 60 kilocycles
60 cycle sine sweep
Frequency essentially flat to 200 KC. usable to over 3 megacycles

CONSERVE CRITICAL MATERIALS

Simpson Model 480 Genescope: size 22" x 14" x 7½"
Weight 45 lbs. Shipping Weight 54 lbs.
DEALER'S NET PRICE complete with Test Leads and Operator's Manual, $395.00.

WALTER R. JONES

Associate Professor of Electrical Engineering, Cornell University

As I See It

The questions of color television, material shortages, and other irritants, tend to keep the service technician's worry time pretty well occupied. It shouldn't be so well occupied that he can't give some attention to opportunities and responsibilities that exist now, have existed for a long time, and will continue as a major activity in the future. This refers specifically to the large numbers of receivers - both AM and FM - which are due for service ranging from checkups to major overhauls.

While the newer things may be more in the public eye and ear, the tremendous service market, represented by the less spectacular but more numerous conventional sets of preceding years, should never be neglected by the alert serviceman.

As materials become scarce we will be reminded of the days during World War II, when it was very difficult to obtain parts, especially tubes. The ingenuity displayed to keep customers' sets in operation at that time was remarkable. One of the things that was not always done was to indicate changes which had been made so that the next serviceman who works on the set will be able to check things without spending a great amount of time checking over the set.

If you live in an area where television does not exist as yet, have you kept up to date on new techniques and equipment which has become available? Much new TV test equipment will work very well on AM and FM sets and you will then have become familiar with its operation when television does arrive in your locality.

The other day I read an article to the effect that only a relatively small percentage of receivers in autos which are on the road today are in first class operating condition. That seemed to be a misstatement, so I started checking the cars of my friends and now I feel sure that the article erred on the side of being too conservative. When I questioned them as to why they did not have the receiver fixed, it was the same story - "Who fixes these things?" How many of your customers, or rather prospective customers, do not realize that you are equipped to take care of their service needs. Advertising pays!

Are there any industrial concerns in your locality which employ electronic devices for some part of their production work? Do they employ a full time electronics man or do they send their equipment away to be repaired or perhaps import a man from outside to put it in order? Have you ever investigated this matter to see the possibilities it might have for you?

It has been a long time since I have had the opportunity of presenting my thoughts to many of my friends. Numerous changes have taken place within the industry, and, naturally, the thoughts and expressions herein may similarly range the breadth of these developments. If my remarks seem to ramble, bear with me until I catch up the high spots.

"SHOP TALK" (Continued from page 4)

ohmmeter. Two readings, one with the meter leads reversed, will normally read greatly different values in each direction for a stack having continuity, while an open rectifier is indicated by the same extremely high reading in forward and reverse directions.

Reverse Leakage: The blocking quality of a selenium receiver stack may be measured in several ways. Probably the simplest and most convenient test circuit is that illustrated in Figure 1.

Polarity of rectifier connection in this circuit is immaterial. It is important that the 20 mfd. capacitor be of the paper or oil-filled type, and not electrolytic.

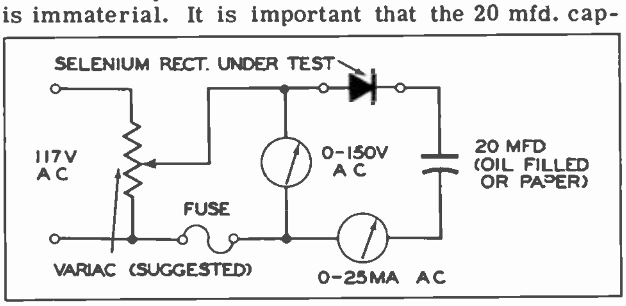

Fig. 1. Rectifier Reverse Leakage Test Circuit.

The input voltage should be increased from zero by means of a suitable potentiometer or variable autotransformer. If the stack begins to sputter and spark as the applied voltage is increased, the value of applied voltage should be allowed to remain for a few minutes at the highest value which will not cause sparking on the alloy, then slowly increased again, the procedure being repeated until the input voltage is up to 117 volts AC or until the AC milliammeter reads full scale. Only damaged or badly deformed rectifiers will exhibit this sputtering effect; for the most part, full rated voltage may be applied without causing sparking. The input voltage should be allowed to remain at 117 volts for about five minutes before a reading of AC milliamperes is taken.

If the AC milliammeter reading is 10% of the rectifier rated DC load current or less, with the 117 volts AC impressed, the stack reverse blocking quality is good. If the current reading is slightly higher than proper for the particular size stack tested the unit is poor in reverse grade, but may reform upon longer voltage application. High current readings indicate a damaged stack. For instance, if a selen-

♦ ♦ Please turn to page 53 ♦ ♦

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♦ ♦ Continued from page 19 ♦ ♦

amplitude variation, with a sweep of at least 10 or preferably 15 mc. An output of .1 volt is sufficient providing a high gain scope is available. A scope having a vertical deflection sensitivity of 20 millivolts, or less, per inch, will produce a usable waveform with .1 volt signal input. If the scope is less sensitive, a stronger signal at the input will be required.

In cases where the marker is swamped, it may be helpful to connect a capacitor of approximately 1000 mmf. across the vertical amplifier terminals of the scope. This bypasses the higher frequencies on either side of the marker, resulting in a sharper indication. During alignment, use only enough marker signal to be seen. Excessive marker injection will distort the waveform.

Some troubles that develop are peculiar to certain types of tuners. Broken or bent switch contacts may cause the switch-type tuner to fail. Dirt on the coils of a continuously variable inductance tuner may cause noisy operation. Inoperation on only one channel may show up in the turret tuner. Poor sensitivity may result if a slug is broken in the permeability tuner. Bent capacitor plates may cause poor tracking in the capacitor-tuned unit, etc. Whichever type tuner is being serviced, the faulty stage should be located and repair measures taken applicable to that type tuner.

In general, the TV tuner is a reasonably stable unit, and normally, will cause a minimum of trouble. The B+ supply voltage is low, which lessens the chance of failure of components due to overload. Alignment should be required only after replacement of tubes or components, or in case of damage to the unit.

Except for tube failures, most tuner troubles are of a mechanical nature. Where mechanical breakdown has occurred, it should be determined if repairs can be made or if the replacement of the unit is required.

GENERAL INSTRUMENT MODELS 45A and 45B TV TUNERS

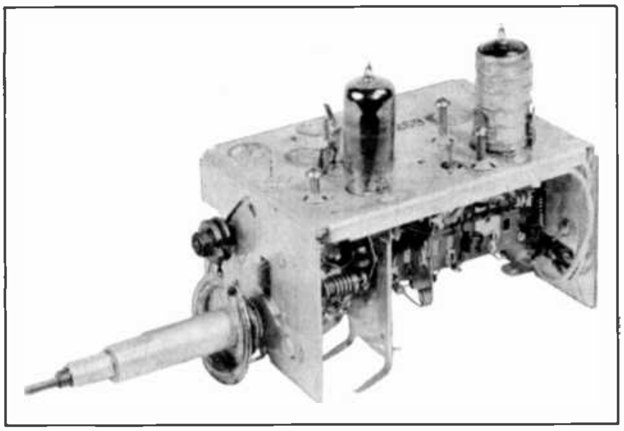

Fig. 1-8A. General Instrument Model 45 TV Tuner.

The General Instrument Model 45 tuner is a capacitively tuned unit providing continuous tuning in two ranges. One range covers the low channels and the other the high channels. A slide switch is incorporated to transfer from one range to the other. The switch is actuated by a cam arrangement which is on a shaft concentric with the fine-tuning control. A spring and detent are provided to give a positive stop at the correct point. The slide switch extends the length of the tuner, with the contacts so positioned that lead lengths are kept to a minimum. The tuning capacitor is a four-section unit with the oscillator section having a split stator. A 5-to-1 reduction of the tuning capacitor from the tuning shaft is provided through a dial cord drive arrangement. A second concentric shaft is provided for mounting of a pointer to provide calibration. This shaft is driven with a dial cord which is cemented to both the drive and driven pulley to prevent creeping. An anti-backlash spring, with pulley, keeps constant pressure on the cord to prevent slack from developing.

Figure 1-8A illustrates the General Instrument model 45B tuner.

A shield is placed between the RF input and output circuits to prevent feedback. An external shield, which covers the bottom and two sides, is held in place on the tuner by two screws. Two copper bonding clips are so positioned on this shield that they hit the RF shield mentioned above, giving a more positive bond. A terminal strip, with solder lugs, is provided at the back end of the tuner to facilitate connection to the receiver.

Two tubes are employed. The model 45A incorporates a 6AK5 as an RF amplifier and a 6J6 as a mixer and oscillator. The model 45B has a 6CB6 as an RF amplifier, and also uses a 6J6 as a mixer and oscillator. Tubes must not be interchanged in the units. Due to the change in loading and the interelectrode capacities, poor performance may result. A shield is provided for the 6J6 tube.

The primary of the input coil L1 (see Figure 1-8J) is designed to match a 300-ohm balanced transmission line. The coil is center-tapped with the tap returned to ground. The secondary is tuned in both ranges by a section of the tuning gang. In the hign range, only a portion of the secondary is used. The switch picks off a tap on the coil and also shunts L2 across the coil. R1 is shorted out and the padder capacitor C1 is in series with the tuning gang. This padder is a ± 5% ceramic unit having an N150 temperature coefficient. A3 is a ceramic trimmer and is used to adjust the high end of the high range.

In the low range, the entire secondary of L1 is tuned. R1, 1500-ohm resistor in series with L2, is shunted across L1 to broaden the response. The padder C1 is shorted out placing the full capacity of the tuning gang across L1. R2 is the grid return for the pentode RF amplifier. With this resistor returned to the AGC line of the receiver, the gain of the stage can be controlled.

The tuned circuits between the RF amplifier and mixer employ double-tuned transformers - L4, L5, L6, and L7 - having low side mutual inductive coupling to obtain proper bandwidth. The RF stage is shunt fed through L3, and the signal is coupled to the tuned circuit by C8.

In the high range, L4 and the common impedance coil are tuned with a section of the tuning capacitor which has a padder capacitor, C9, in series. The circuit is trimmed by the ceramic trimmer A4. The mixer grid circuit consists of L5 and the common impedance coil tuned by another section of the tuning capacitor with a padder capacitor, C10, in series. This circuit is trimmed by A5 . The common impedance coil for the high range consists of 3/8 inch leads, which are the ends of coils L4 and L5. The leads are brought past a window cut in the shield which is placed between L4 and L5. Note that this coil is shown on the schematic as a solid line with the inductance shown dotted. Adjustment of this coil is made by bending the leads nearer or farther away from the window. Capacitor C6 (.68 mmf.) is a high side coupling capacitor which counteracts the low side inductive coupling, thus maintaining a more uniform bandwidth throughout the tuning range.

In the low range, the circuit is essentially the same as that used in the high range, except the padders C9 and C10 are shorted out. This places the tuning capacitor directly across the tuned circuits. In this position, coils L6, L7, and the common impedance coil, L8, are used. R9 is placed in series with L7, which lowers the "Q" of the circuit, to increase the bandwidth on the low channels.

R3 serves as the dropping resistor and C5 as the bypass capacitor for the screen of the RF amplifier. In the model 45B tuner, the leads on C5 are left about 3/8" long to place a small amount of inductance in series with the capacitor. This allows partial neutralization on the high channels, which reduces loading on the antenna transformer secondary.

The tuner model 45A uses a 6AK5 tube, which has a higher input resistance, making the neutralization unnecessary.

C11 and C14 couple the RF and oscillator signals to the triode mixer grid. R4 and R5 make up the mixer grid return. The junction of these resistors is terminated on top of the tuner for scope connection during alignment. R4 isolates the scope from the mixer grid.

The oscillator uses the second section of the 6J6 connected in a Colpitts circuit. R8 and C16 form the grid leak network. R7 serves as the plate load.

The tank circuit of the oscillator, in the high range position, is comprised of L10 and the split stator section of the tuning gang. One stator has a padder, C15, in series, while the other stator has A1 paralleling it. In addition to tuning the tank circuit, this capacitor network governs the amount of feedback voltage to the oscillator tube.

In the high range, L10 and the padder, C15, are shorted out. The tank circuit now consists of L11 and the split stator tuning capacitor. One stator is paralleled by A1 , and the other is paralleled by A2 . The two parallel networks tune the tank circuit and also govern the amount of feedback to the tube. The values of the tank circuit components have been selected to give satisfactory operation over a wide range of operating voltages. Normal B+ supply to the tuner is 125 volts, but satisfactory operation may be obtained with the supply voltage between 90 and 160 volts.

The padder, C15, is a 12.5 mmf. ± 5% ceramic capacitor having a temperature co-efficient of N470. In the event replacement of any of the padder or trimmer capacitors in the tuner is required, care must be taken that an exact replacement be made. Failure to do so may result in poor tracking or unstable operation.

The schematic shows a series-tuned, mixer plate circuit. Actually, a series or parallel-tuned circuit could be used, depending upon the receiver in which the tuner is employed.

The heaters are usually connected for parallel operation, but the tuner may also be supplied for series operation, if application warrants. It is

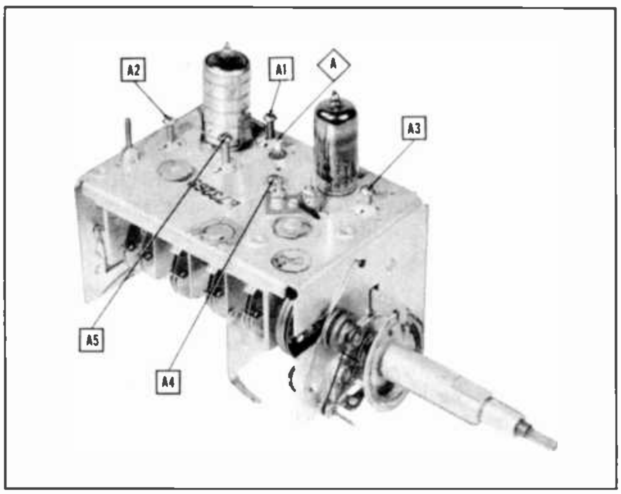

Fig. 1-8B. General Instrument Model 45 Tuner Alignment Points.

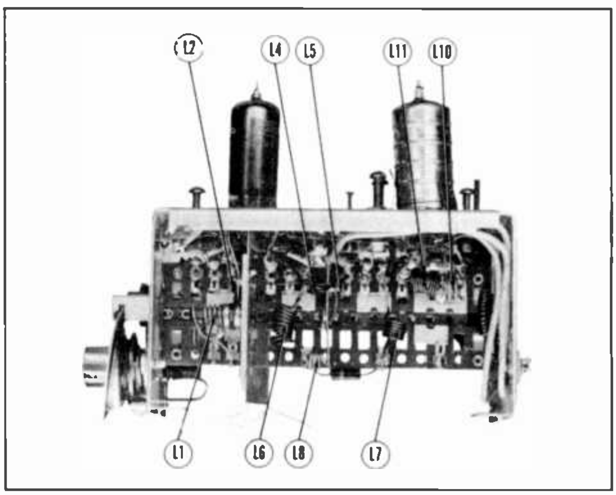

Fig. 1-8C. General Instrument Model 45 Tuned Circuit Coils.

recommended that rewiring of the filament string, from one type to another, not be attempted, as the connections are not readily accessible and damage to the tuner may result.

Most of the component parts of the tuner are accessible, but extreme care must be exercised in making any replacement. First, be sure the new part is an exact replacement for the original. Second, take care not to alter the position of any components, and make sure the tuning capacitor plates are not bent. If the plates are bent, poor tracking will result. If any parts are replaced in a frequency determining circuit, a complete alignment check should be made as outlined in the alignment instructions for this tuner.

When replacing tubes, use the same tube type as the original. Do not attempt to substitute similar pentode-type tubes for the RF amplifier, as previously explained. To do so will change the loading on the tuned circuits and poor tracking may result. Normally, the tuner will not require realignment when tubes are replaced; however, an extreme limit tube may necessitate slight trimmer adjustment. The best method is to select a tube which will not require trimmer adjustment.

If the 6J6 tube is replaced, the injection voltage at point ♦A should be checked, using a VTVM. Normally, the injection voltage will be about 2 volts. An "air check" should be made after the 6J6 replacement to see if proper tuning range is maintained. If it is not, slight adjustment of the oscillator trimmer A1 may be made to compensate for variation in inter-electrode capacities.

Immediately following are Figures 1-8B through 1-8J, giving illustrations and instructions for alignment, dial drive stringing information, and the schematic diagram of the General Instrument model 45 tuner.

We wish to acknowledge the cooperation of the General Instrument Corporation in supplying us with technical data and samples which were used in this presentation.

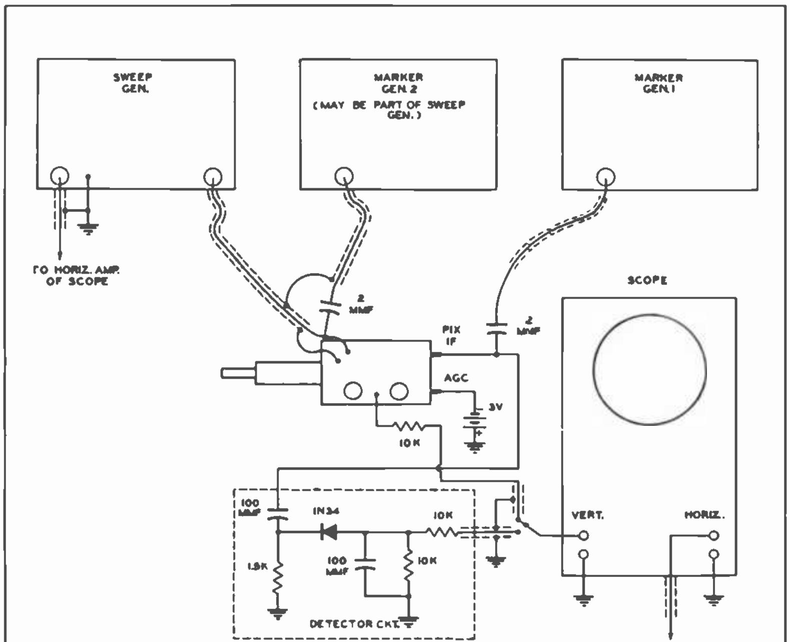

FIG. 1-8D

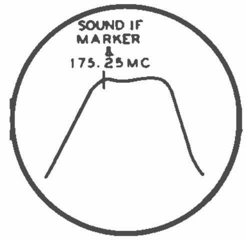

FIG. 1-8E

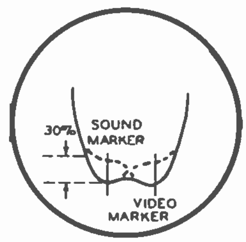

FIG. 1-8F

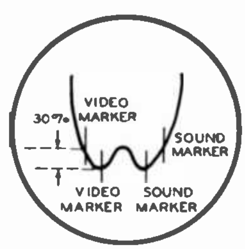

FIG. 1-8G

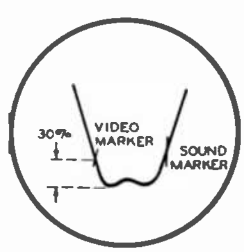

FIG. 1-8H

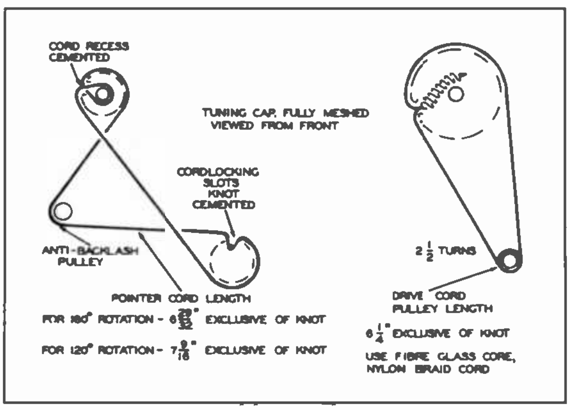

Fig. 1-8I. Dial Drive Stringing.

ALIGNMENT INSTRUCTIONS

GENERAL INSTRUMENT MODEL 45 TV TUNER

READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Two marker generators are required to align the circuits of this tuner. Marker No. 1 is coupled through a 2 or 3 MMFD capacitor to the grid of the first video IF amplifier. The frequency to which marker No. 1 is tuned will be indicated in the table by an asterisk (*). Marker generator No. 2 is connected across the sweep generator at the antenna terminals. If the sweep generator has a built in marker, it may be used for marker No. 2. The frequency to which marker No. 2 is tuned will be indicated in the table by a dagger (†).

During alignment it is necessary to switch the scope between alignment point A and the detector circuit connected to the tuner output. It is recommended that a single pole, double throw switch be used for switching the oscilloscope input, connected as shown in figure 1-8D. All connecting leads should be shielded and kept as short as possible.

The sound and video IF frequencies are used as reference points to align the oscillator, and for tracking adjustments, therefore it is necessary to determine these frequencies used in the receiver employing this tuner.

Connect the negative lead of a 3 volt battery to the AGC terminal on the tuner, connect the positive lead to chassis or common negative in transformerless receivers.

Remove the second video IF amplifier tube from its socket to prevent feedback from the video IF amplifiers.

The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

HIGH BAND OSCILLATOR ALIGNMENT

Turn the band switch to "high band" (slide switch forward).
Remove the bottom cover from the tuner.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	High side to either antenna terminal. Low side to chassis.	177MC (10MC SWP)	* Sound IF frequency †175.25MC	Tuning gang fully closed	Vert. Amp. thru detector to 1st video IF grid. Low side to chassis.	L10	Use a non-metallic tool to adjust L10 turn spacing until markers coincide as shown in figure 1-8E. Replace the bottom cover. If markers separate, make slight compensating adjustment of L10 so markers coincide with bottom cover in place.
2.	Direct	"	213MC (10MC SWP)	* Video IF frequency †215.75MC	"	"	A1	With bottom cover in place adjust A1 until markers coincide. Repeat steps 1 and 2 until the high band oscillator covers the proper range.

LOW BAND OSCILLATOR ALIGNMENT

Turn the band switch to "low band" (slide switch back).
Remove the bottom cover of the tuner.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
3.	Direct	High side to either antenna terminal. Low side to chassis.	57MC (10MC SWP)	* Sound IF frequency †56.75MC	Tuning gang fully closed	Vert. Amp. thru detector to 1st video IF grid. Low side to chassis.	L11	Use a non-metallic tool to adjust L11 turn spacing until markers coincide. Replace the bottom cover. If markers separate, make slight compensation adjustment of L11 so markers coincide with bottom cover in place.
4.	Direct	"	85MC (10MC SWP)	* Video IF frequency †84.35MC	Tuning gang fully open	"	A2	With bottom cover in place adjust A2 until markers coincide. Repeat steps 3 and 4 until the low band oscillator covers the proper range. Recheck steps 1 through 4.

HIGH BAND RF ALIGNMENT

Before attempting the RF alignment the oscillator should first be aligned as outlined in steps 1 through 4.

Turn the band switch to "high band" (slide switch forward). Feed the channel 7 video carrier frequency into the antenna terminals, and the video IF frequency into the first video IF amp grid. With the oscilloscope connected through the detector circuit to the video IF amp grid, adjust the tuning gang until the markers coincide (see figure 1-8D for equipment set up).

Leave at this setting throughout step 5.

For step 6 adjust the tuning gang in a similar manner, except that frequencies used are the channel 13 sound carrier and the sound IF frequency. Leave at this setting throughout step 6.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5.	Direct	High side to either antenna terminal. Low side to chassis.	177MC (10MC SWP)	†175.25MC †179.75MC	7	Vert. Amp. thru 10KΩ to Point • A Low side to chassis.	L4, L5, L2	If the response curve is not within the limits shown in figures 1-8F, G, or H, adjust L4 and L5 by pushing the coils on to or off of the brass studs, for proper band width and then adjust A2 in the same manner for symmetry. Proper adjustment of L4 and L5 is attained when a slight variation of either winding causes the response to shift frequency without noticeable change in band width. L2 is properly adjusted when a slight change causes the response curve to rock evenly. The band width of the channel 7 response is adjusted by altering the position of L4 and L5 ground leads past the cut out in the shield plate. For maximum gain the bandwidth should be adjusted as narrow as possible with the markers still at the top of the peaks. Replace cover and observe pass band.
6.	Direct	"	213MC (10MC SWP)	†211.25MC †215.75MC	13	"	A3, A4, A5	Adjust for maximum amplitude with sufficient band width per figures 1-8F, G or H. Recheck step 5.

LOW BAND RF ALIGNMENT

Turn the band switch to "low band" (slide switch back).
Set the tuning gang to channel 2 in the manner outlined under high band RF alignment, using the channel 2 sound carrier frequency and the sound IF frequency.
Leave at this setting for step 7.
For step 8 set the tuning control to channel 6 using the channel 6 video carrier frequency and the video IF frequency. Leave at this setting for step 8.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7.	Direct	High side to either antenna terminal. Low side to chassis.	57MC (10MC SWP)	†55.25MC †59.75MC	2	Vert. Amp. thru 10KΩ to Point ♦A Low side to chassis.	L6, L7, L1, L8	Adjust L6 & L7 by expanding or compressing coil turns for maximum amplitude with proper band width. Expand or compress turns of L1 secondary for maximum amplitude and symmetry of response. Adjustment of L6 and L7 is correct when varying either winding causes no noticable change in band width. L1 secondary is properly adjusted when slight variations cause an even rocking of the peaks. Band width is adjusted by varying the turn spacing of the coupling coil L8.
8.	Direct	"	85MC (10MC SWP)	83.25MC 87.75MC	6	"		With bottom cover in place, check channel 6 response to see if it is within the limits shown in figures 1-8F, G or H. If not, remove bottom cover and make compromise adjustments of L5 and L1. Recheck channel 2.

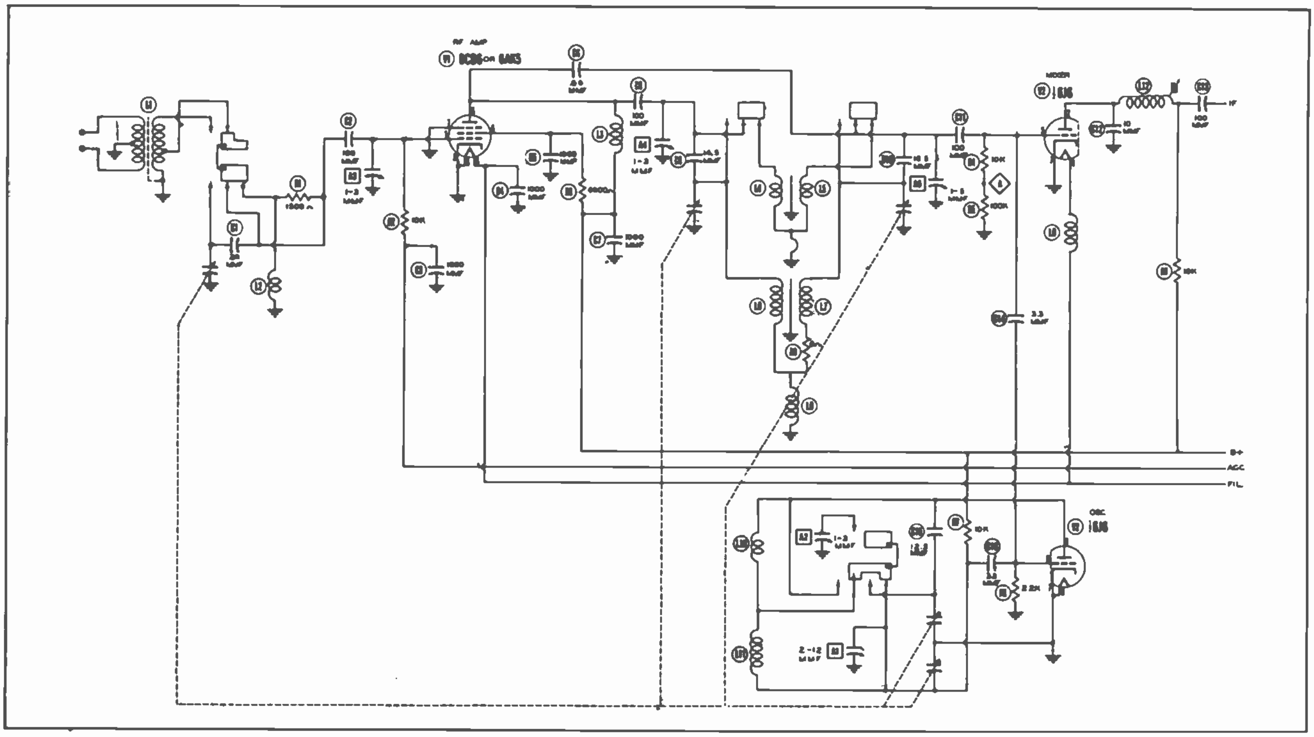

Fig. 1-8J. Schematic of General Instrument Model 45A and 45B TV Tuner.

SARKES TARZIAN TV TUNER MODEL TT-3

The Sarkes Tarzian Model TT-3 is a switch-type TV tuner in which channel selection is achieved by adding the proper amount of incremental inductances to each tuned circuit. The incremental inductors are wired directly to the switch wafer terminals. Five switch sections are employed, one each for the RF grid, RF plate, mixer grid and oscillator circuits, plus a section for switching the input circuit. Fine tuning is accomplished through the use of a small five-plate variable capacitor, which is rotated with a friction drive disc mounted on a shaft concentric to the channel switch shaft. Notches are crimped on the disc to provide limits of rotation of the tuning capacitor. A shield is placed between the RF grid and RF plate coil switch wafer sections to prevent feedback. Two five-lug terminal

♦ ♦ Please turn to page 45 ♦ ♦

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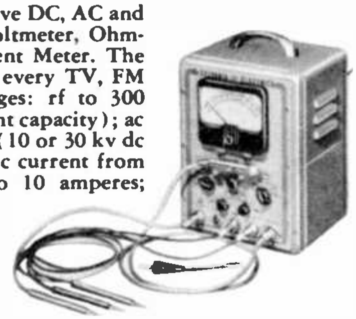
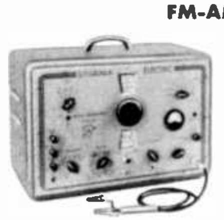


Type 221 Z



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Audio Oscillator An Accurate Sine-Wave Generator for Better Equipped Shops and Sound Specialists. Maximum output: 22.5 volts, 20-20,000 cps, flat within 2 db. Price: $129.50.

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INDEX TO PHOTOFACT

RADIO AND TELEVISION SERVICE DATA FOLDERS

No. 24

Covering Folder Sets Nos. 1 thru 120

HOW TO USE THIS INDEX: To find the PHOTOFACT Folder you need, look for the name of the receiver in the alphabetical listing below. Then find the required model number under the receiver name. Opposite the model you will find the number of the Set in which it appears and the Folder number. For example, under *ADMIRAL*, Chassis 3A1, the reference is **2**—24. The bold **2** identifies the PHOTOFACT Set number in which the Folder appears. The light face number, 24, identifies the individual Folder. It's easy to find the set you need.

IMPORTANT: The suffix letter "A" following the Set or Folder Number in the index listing below indicates a "Preliminary Data Folder." These Folders are designed to provide the service technician *immediately* with preliminary basic data on Television Receivers—pending their complete coverage in the standard, uniform PHOTOFACT Folder Set presentation.

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Production Change Bulletins contain data which is supplementary to previously issued Photofact Folders, and are listed in this Index immediately following the listing of the initial coverage of the same models or chassis.

ADMIRAL—ANSLEY

ADMIRAL—Cont.

Models 29X15, 29X16, 29X17 Tel. Rec. (See Ch. 24D1) 103
Models 29X25, 29X26, 29X27 Tel. Rec. (See Ch. 24D1) 103
Model 29X25A Tel. Rec. (See Ch. 21B1) 118
Models 30A12, 30A13 (S or SN) Tel. Rec. (See Ch. 30A1) 57
Models 30A14, 30A15, 30A16, Television Receivers (See Ch. 30A1). 57
Models 30B15, 30B16, 30B17 (S or SN) Tel. Rec. (See Ch. 30B1) 71
Models 30C15, 30C16, 30C17 (S or SN) Tel. Rec. (See Ch. 30B1) 71
Models 30F15, A, 30F16, A, 30F17, A Tel. Rec. (See Ch. 20A1) 77
Models 32X15, 32X16 Tel. Rec. (See Ch. 20X1 and 4S1) 100
Models 32X26, 32X27 Tel. Rec. (See Ch. 20X1 and 5B2) 100
Models 32X35, 32X36 Tel. Rec. (See Ch. 20X1 and 5B2) 100
Models 34R15, A, 34R16, A Tel. Rec. (See Ch. 20T1) 117
Model 36R37 Tel. Rec. (See Ch. 21B1) 118
Models 36R45, 36R46 Tel. Rec. (See Ch. 21B1) 118
Models 36X55, A, 36X36, A, 36X37, A Tel. Rec. [See Ch. 24D1 (Set 103) and Radio Ch. 5B2 (Set 100)]
Models 39X16, 39X16A, B, 39X17A, B Tel. Rec. [See Ch. 24D1 (Set 103) and Radio Ch. 5B2 (Set 100)]
Model 39X17C Tel. Rec. (See Ch. 21B1) 118
Models 39X25A, 39X26A Tel. Rec. (See Ch. 21B1) 118
Models 39X35, 39X36, 39X37 Tel. Rec. (See Ch. 21B1) 118

AERMOTIVE

181-AD .... 12—1

AIRADIO

SU-41D .... 11—1
SU-52A, B, C (Receiver) .... 13—2
TRA-1A, B, C (Transmitter) .... 13—1
3100 .... 37—1

AIRCASTLE

DM-700 .... 85—1
EV-760 (See Model DM-700) 85
G-516, G-518 .... 48—3
G-521 .... 54—3
G-724 .... 52—25
G-725 .... 50—1
K1 .... 93—1
P-20 .... 71—3
P-22 .... 87—1
PAM-4 .... 101—1
PC-8, PC-358 .... 99—1
PM-78 .... 100—2
PM-358 .... 98—1
PX .... 13—35
SC-448 .... 62—2
TD-6 .... 103—3
WEU-262 .... 91—1
WRA1-A .... 47—1
WRA-4M .... 60—1
XB702, XB703 Tel. Rec. 93A-1
XL750, XP775 Tel. Rec. 93A-1
7B .... 52—1
9 .... 50—2
10T Tel. Rec. .... *
12C, 12T Tel. Rec. .... *
15 .... 67—2
16C, 16T Tel. Rec. .... *
101 .... 86—1
102B .... 98—2
106B .... 13—3
171, 172 .... 96—1
198 .... 83—1
201 .... 81—1
211 .... 65—1
212 .... 68—3
213 .... 63—1
227I, 227W .... 84—1
312 Tel. Rec. .... *
316 Tel. Rec. .... *
412 Tel. Rec. .... *
416 Tel. Rec. .... *
568 .... 14—1
572 .... 55—1
602-182144 .... 114—2
604 .... 53—2
606-400WB .... 119—2
621 (Ch. FJ-91) .... 14—2
626 .... 18—3
641 .... 17—1

AIRCASTLE—Cont.

651 .... 15—1
5000, 5001 .... 16—2
5002 .... 19—1
5003, 5004, 5005, 5006 .... 20—1
5008, 5009 .... 46—1
5010, 5011, 5012 (Ch. 110) .... 13—4
5015.1 .... 118—3
5020 .... 16—3
5024 .... 45—1
5025 .... 24—2
5027 .... 49—3
5028 .... 44—1
5029 .... 51—1
5035 .... 46—2
5036 .... 72—2
5050 .... 48—4
5052 .... 45—2
5056-A .... 120—2
6042 .... 61—1
6050 .... 74—1
6053 .... 97—1
6514 .... 18—4
6541 .... 17—2
6544, 6547 (See Model 6541) 17
6611, 6612, 6613, 6630, 6631, 6632, 6634, 6635 .... 15—2
7000, 7001 .... 14—3
7004 .... 19—2
7014, 7015 .... 57—3
7015 Early .... 47—2
7553 .... 45—3
9008I, 9008W .... 99—2
9009I, 9009W .... 97—2
9012I, 9012W .... 94—1
10002 .... 56—1
10003-1 .... 56—2
10005 .... 62—3
10021-1, 10022-1 .... 59—3
10023 .... 58—1
10024-1 .... 58—2
108014, 108504 .... 57—4
121104 .... 73—1
121124 .... 61—2
127084 .... 55—2
131504 .... 60—2
132564 .... 69—1
138104 .... 54—3
138124 .... 64—1
139144 .... 59—4
147114 .... 56—3
149654, 150084 .... 71—4
159144 (See Model 139144) 59

AIR CHIEF (See Firestone)

AIR KING

A-400 (Ch. 470) .... 23—1
A-403 .... 20—2
A-410 .... 34—1
A-410 (Revised) .... 40—1
A-426 .... 43—1
A-450 .... *
A-501, A-502 (Ch. 465-4) .... 31—3
A-510 .... 24—3
A-511, A-512 .... 30—2
A-520 .... 49—4
A-600 .... 26—3
A-604 .... 81—2
A-625 .... 50—3
A-650 .... 45—4
800 .... 66—1
A-1000, A-1001 Tel. Receiver .... 58—3
A1001A Tel. Rec. .... 75—2
A1016 Tel. Rec. .... 91—2
A2000, A2001, A2002 Tel. Rec. (See Model A1001A) 75
A2010 Tel. Rec. (See Model A1001A) 75
A-2012 Tel. Rec. (See Model A1001A) 75
2017R Tel. Rec. .... 111—2
4601 (See Model 4609) 11
4603 .... 3—36
4604 .... 4—25
4604D (See Model 4604) 4
4607, 4608 .... 3—1
4609, 4610 Early (See Model 4607) 3
4609, 4610 .... 11—2
4625 .... 13—8
4700 .... 39—1
4704 .... 12—2
4705, 4706 .... 9—1
4708 (See Model 4704) 12

AIR KNIGHT (SKY KNIGHT)

CA-500 .... 17—4
CB-500P .... 17—31
N5-RD291 .... 17—3

AIRLINE

05BR-3021B Tel. Rec. .... *
05BR-3024B Tel. Rec. .... *
05BR-3027A Tel. Rec. .... *
05GCB-3019A Tel. Rec. .... 116—2
05GSE-3020A Tel. Rec. .... 117—3
05GSE-3037A Tel. Rec. .... *
05WG-1811B (See Model 94WG-1811A) 99
05WG-2748C, D, E (See Model 94WG-2748A) 90
05WG-2752 .... 100—3

AIRLINE—Cont.

05WG-3016A, B Tel. Rec. (See Model 94WG-3006A Set 72 and Set 110 Folder 2)
05WG-3030A Tel. Rec. .... 119—3
05WG-3031A Tel. Rec. .... 109—1
05WG-3031B Tel. Rec. .... *
05WG-3036A, B Tel. Rec. .... *
05WG-3039A, B Tel. Rec. .... *
05WG-3040 Tel. Rec. .... *
05WG-3042A Tel. Rec. .... *
54BR-1501A, 54BR-1502A .... 2—26
54BR-1503A, B, C; 54BR-1504A, B, C .... 3—4
54BR-1505A, B; 54BR-1506A, B .... 2—34
54KP-1209A, B .... 8—1
54WG-1801A, 54WG-1801B .... 4—33
54WG-2500A, 54WG-2700A .... 4—15
64BR-916A .... 3—34
64BR-916B (See Model 74BR-916B) 17
64BR-917A .... 10—1
64BR917B (See Model 64BR917A) 10
64BR-1051A .... 2—32
64BR1051B (See Model 64BR1051A) 2
64BR-1205A, 64BR-1206A .... 10—3
64BR-1208A .... 16—4
64BR-1503B, 64BR-1504B (See Models 54BR-1503A, B, C; 54BR-1504A, B, C) 3
64BR-1513A, B; 64BR-1514A, B .... 24—4
64BR-1808A .... 16—5
64BR-2200A (See Model 64BR-1208A) 16
64BR-7000A .... 51—2
64BR-7100A, 64BR-7110A, 64BR-7120A .... 57—5
64BR-7300A, 64BR-7310A, 64BR-7320A .... 54—4
64BR-7810A, 64BR-7820A .... 53—3
64WG-1050A .... 10—2
64WG-1050B, 64WG-1050C, 64WG-1050D (See Model 64WG-1050A) 10
64WG-1052A .... 9—2
64WG-1052B (See Model 64WG-1052A) 9
64WG-1207B .... 18—5
64WG-1511A, 64WG-1511B, 64WG-1512A, 64WG-1512B .... 5—5
64WG-1801C (See Models 54WG-1801A, B) 4
64WG-1804A, B .... 4—27
64WG-1804C (See Model 64WG-1804A) 4
64WG-1807A, 64WG-1807B .... 5—4
64WG-1809A, 64WG-1809B (See Models 64WG-1511A, B; 64WG-1512A, B) 5
64WG-2007A, 64WG-2007B .... 5—6
64WG-2009A, 64WG-2009B .... 6—2
64WG-2010B .... 18—6
64WG-2500A (See Model 54WG-2500A) 4
64WG-2700A, 64WG-2700B (See Models 54WG-2500A; 54WG-2700A) 4
74BR-916B .... 17—5
74BR-1053A .... *
74BR-1055A .... *
74BR-1501B, 74BR-1502B .... *
74BR-1507, 74BR-1508A .... *
74BR-1513B, 74BR-1514B (See Models 64BR-1513A, B; 64BR-1514A, B) 24
74BR-1812A (See Model 74BR-1812B) 22
74BR-1812B .... 22—2
74BR-2001A (See Model 74BR-2001B) 23
74BR-2001B .... 23—2
74BR-2003A .... *
74BR-2701A .... 24—5
74BR-2702A (See Model 74BR-2702B) 25
74BR-2702B .... 25—3
74BR-2707A .... *
74BR-2708A .... *
74BR-2715A .... *
74BR-2717A .... *
74GSG-8400A, 74GSG-8700A .... 60—3
74GSG-8810A, 74GSG-8820A .... 52—2
74HA-8200A .... 58—4
74KR-1210A .... 41—1
74KR-2706B .... 35—1
74KR-2713A .... 43—2
74WG-925A .... 24—6
74WG-1050C, D (See Model 64WG-1050A) 10
74WG-1052B (See Models 64WG-1052A, B) 9

AIRLINE—Cont.

74WG-1054A .... 22—1
74WG-1054B (See Model 74WG-1054A) 22
74WG-1056A .... 29—1
74WG-1057A .... 32—2
74WG-1207B (See Model 64WG-1207B) 18
74WG-1509A, 74WG-1510A .... 27—1
74WG-1511B, 74WG-1512B (See Models 64WG-1511A, B; 64WG-1512A, B) 5
74WG-1802A .... 25—4
74WG-1803A (See Model 74WG-1802A) 25
74WG-1804C (See Models 64WG-1804A, B) 4
74WG-1807A, 74WG-1807B (See Models 64WG-1807A, B) 5
74WG-2002A .... 26—4
74WG-2004A .... 27—2
74WG-2007B, 74WG-2007C (See Models 64WG-2007A, B) 5
74WG-2009B (See Models 64WG-2009A, B) 6
74WG-2010A (See Model 64WG-2010B) 18
74WG-2010B .... 18—6
74WG-2500A (See Model 54WG-2500A) 4
74WG-2504A .... 28—1
74WG-2504B, 74WG-2504C (See Model 74WG-2504A) 28
74WG-2505A .... 18—7
74WG-2700A, 74WG-2700B (See Model 54WG-2700A) 4
74WG-2704A, 74WG-2704B, 74WG-2704C (See Model 74WG-2504A) 28
74WG-2705A, 74WG-2705B (See Model 74WG-2505A) 18
74WG-2709A .... 26—5
74WG-2711A (See Model 74WG-2505A) 18
84BR-1065A .... *
84BR-1503D, 84BR-1504D .... *
84BR-1515A, 84BR-1516A .... *
84BR-1517A, 84BR-1518A .... *
84BR-1815B, 84BR-1816B .... 55—3
84BR-2005A .... *
84BR-2715B .... *
84BR-2719A .... *
84BR-2726B .... *
84BR-3004 Tel. Rec. .... *
84GAA3967A .... 91—3
84GCB-1062A .... 52—26
84GDC-963B .... 51—3
84GDC-987A .... 53—4
84GHM-926B .... 55—4
84GSE-2730A, 84GSE-2731A .... 70—1
84GSE-3011A Tel. Rec. .... 82—1
84HA-1527A, 84HA-1528A (See Model 94HA-1527C) 67
84HA1529A, 84HA1530A .... 85—2
84HA-1810A, 84HA-1810C .... 69—2
84HA-2727A .... *
84HA-3002A, 84HA-3002B Tel. Rec. .... 99—3
84HA3007A, B, C Tel. Rec. .... *
84HA-3010A, B, C Tel. Rec. .... 94—2
84HA-3010A, B, C Tel. Rec. Prod. Chge. Bul. 11 .... 118—1
84KR-1209A .... *
84KR-1520A .... 56—4
84KR-2511A .... 68—4
84WG-1060A .... 42—1
84WG-1060C (See Model 84WG-1060A) 42
84WG-2015A .... 38—1
84WG-2506 (See Model 84WG-2721A) 46
84WG-2506B .... 58—5
84WG-2712A .... 43—3
84WG-2712B (See Model 84WG-2712A) 43
84WG-2714A .... 36—2
84WG-2714F, G, H, I .... 56—5
84WG-2718A, 84WG-2718B, 84WG-2720A .... 45—5
84WG-2721A, B .... 46—3
84WG-2724A (See Model 84WG-2718A) 45
84WG-2728A (See Models 84WG-2718A, B; 84WG-2720A) 45
84WG-2732A, B (See Model 84WG-2712A, B) 43
84WG-2734A (See Models 84WG-2718A, B; 84WG-2720A) 45
84WG-3006, 84WG-3008, 84WG-3009, (See Model 94WG 3006A) Tel. Rec. 72
94BR-1525A, 94BR-1526A .... *
94BR-1533A .... 88—1

AIRLINE—Cont.

94BR-2740A, 94BR-2741A, B .... 89—1
94BR3004, C, 94BR3005, C Tel. Rec. 91A-3
94BR-3017A Tel. Rec. .... 89—2
94BR-3017B Tel. Rec. Prod. Chge. Bul. 7 .... 110—1
94BR-3021, 94BR-3024A Tel. Rec. .... *
94GAA3654A .... 95—1
94GCB-1064A .... 96—2
94GCB-3023A, B, C Tel. Rec. (See Model 05GCB-3019A) 116
94GDC-989A .... *
94GSE-2735A, 94GSE-2736A .... 72—3
94GSE-3011, B (See Model 84GSE-3011A) 82
94GSE-3015A Tel. Rec. .... 107—2
94GSE-3018A Tel. Rec. 93A-2
94GSE-3025A Tel. Rec. .... *
94GSE-3033A Tel. Rec. .... *
94HA-1527C, 94HA-1528C .... 67—3
94HA1529A, 94HA1530A (See Model 84HA1529A) 85
94WG-1059A .... 75—3
94WG-1804D .... 86—2
94WG-1811A .... 99—4
94WG-2742A, C, D .... 71—5
94WG-2745A .... 76—4
94WG-2746A, B; 94WG-2747A (See Model 94WG-2742A) 71
94WG-2748A, 94WG-2749A .... 90—1
94WG-2748C (See Model 94WG-2748A) 90
94WG-3006A Tel. Rec. .... 72—4
94WG-3006B Tel. Rec. .... 85—3
94WG-3008A, 94WG-3009A Tel. Rec. (See Model 94WG-3006A) 72
94WG-3009B Tel. Rec. (See Model 94WG-3006B) 85
94WG-3016A, B, C Tel. Rec. (See Model 94WG-3006A Set 72 and Model 05WG-3016A Set 110 Folder 2)
94WG-3022A Tel. Rec. (See Model 94WG-3006B) 85
94WG-3026A Tel. Rec. (See Model 94WG-3006B) 85
94WG-3028A Tel. Rec. (See Model 94WG-3006) 72
94WG-3029A Tel. Rec. (See Model 94WG-3006B) 85

ALGENE

AR5U .... 22—3
AR6U .... 22—4

ALTEC LANSING

ALC-101 .... 84—2
ALC-205, ALC-206 Tel. Rec. .... 105—3
A323B .... 66—2
A-323C (See Model ALC-101) 84

AMC

125P .... 3—27
126 .... 16—1

AMERICAN COMMUNICATIONS (See Liberty)

AMPLIFIER CORP. OF AMERICA

ACA-100DC, ACA-100GE .... 63—2
810DV .... *

AMPLIPHONE

10 .... 21—1
20 .... 21—12

ANDREA

BT-VK12 Tel. Rec. .... 76—5
CO-U15 .... 27—3
CO-VK15, COVK16 (Ch. VK1516) Tel. Rec. .... 103—4
CO-VK16 Tel. Rec. Prod. Chge. Bul. 8 .... 112—1
COVK-125 Tel. Rec. (See Model BT-VK12) 76
C-VK19 Tel. Rec. (Supp. to CO-VK16) Prod. Chge. Bul. 8 .... 112—1
CVK-126 Tel. Rec. (See Model BT-VK12) 76
P-163 (Ch. 163) .... 18—8
T16 .... 21—2
T-U15 .... 24—7
T-U16 .... 21—3
T-VK12 Tel. Rec. (See Model BT-VK12) 76
TVK-127B, M Tel. Rec. (See Model BT-VK12) 76
VJ-12, VJ-12-2 Tel. Rec. .... *
VJ-15 Tel. Rec. .... *
Ch. VK1516 (See Model CO-VK15) 103

ANSLEY

32 .... 5—27
41 (Paneltone) .... 4—38
53 .... 24—8
701 Tel. Rec. .... 71—6

RADIO APPARATUS CORP.

(See Policalarm)

RCA VICTOR

AAPU-1 .... *
A55 (Ch. RC-1087)...... 109—10
A106 (Ch. RC-622)........ 97—12
B1-A, B1-B, B1-C (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21-1) Tel. Rec. .... *
B2-C, B2-F, B2-G, B2-H (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21-1) Tel. Rec. .... *
B3-A, B3-B .... *
B4-A, B4-B, B4-C......... *
B5-A, B5-B .... *
BX6 (Ch. RC-1082)...... 103—13
BX55 (Ch. RC-1088), BX57 (Ch. RC-1088A) .... 102—11
MI-12224, MI-12224A ... 81—12
MI-12236, -A, -B, -C, MI-12237, -A, MI-12238, -A, MI-12239, -A .... 78—13
MI-12287, MI-12288 .... 89—12
MI-12289, MI-12290 .... 80—12
MI-12291, MI-12292, MI-12293, MI-12294 .. 86—8
MI-12295 (See Model MI-12287). 89
MI-12296, MI-12298 (See Model MI-12289). 80
MI-12299 (See Model MI-12287). 89
MI-13159 .... 10—26
MI-13167 .... 35—19
PPAU-1 .... *
RV151 (Ch. RK121C, RS-123D) .... 61—17
S1000 (Ch. KCS31-1, RC617B) Tel. Rec...... 91A-11
T100 (Ch. KCS-38) Tel. Rec. .... 93—9
T120, T121 (Ch. KCS 34C) Tel. Rec. (See Model T100) 93
T164 (Ch. KCS40) Tel. Rec. ....109—11
TA-128 (Ch. KCS42A), TA-129 (Ch. KCS41-1) Tel. Rec. ....110—11
TA169 (Ch. KCS43 & Radio Ch. RK135D) Tel. Rec. ....108—10
TC124, TC125, TC127 (Ch. KCS34, B) Tel. Rec. (See Model T100)...... 93
TC165, TC166, TC167, TC168 (Ch. KCS40A) Tel. Rec. (See Model T164)..........109
2T51 (Ch. KCS45) Tel. Rec. ....111—11
2T51 (Ch. KCS-45) Tel. Rec. Prod. Chge. Bul. 11........118—1
2T60 (Ch. KCS-45A) Tel. Rec. Prod. Chge. Bul. 11........118—1
2T60 (Ch. KCS45A) Tel. Rec. (See Model 2T51). 111
2T81 (Ch. KCS48, Radio Ch. RC-1090) Tel. Rec.. *
6T53 (Ch. KCS47AT, T) Tel. Rec. (See Model 6T54).....113
6T53 (Ch. KCS47AT, T) Tel. Rec. Prod. Chge. Bul. 12........120—1
6T54 (Ch. KCS47, A) Tel. Rec....113—7
6T54 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12........120—1
6T64, 6T65 (Ch. KCS47, A) Tel. Rec. (See Model 6T54).....113
6T64, 6T65 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12....120—1
6T71 Ch. KCS47, A) Tel. Rec. (See Model 6T54). 113
6T71 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12........120—1
6T72 (Ch. KCS 40B) Tel. Rec. (See Model T164)..........109
6T74, 6T75, 6T76 (Ch. KCS47, A) Tel. Rec. (See Model 6T54).....113
6T74, 6T75, 6T76 (Ch. KCS47, A, AT, T) Tel. Rec. Prod. Chge. Bul. 12 ....120—1
6T84 (Ch. KCS48, Radio Ch. RC-1090 or RC-1092) Tel. Rec..... *
6T86, 6T87 (Ch. KCS48, Radio Ch. RC1090 or RC1092) Tel. Rec...... *
8B41 (Ch. RC-1069), 8B42 (Ch. RC-1069A), 8B43 (Ch. RC-1069B).. 76—16
8B46 (Ch. RC-1069C) (See Model 8B41)...... 76
8BX5 (Ch. RC-1059)..... 46—20
8BX6 (Ch. RC-1040C) .... 44—18

RCA VICTOR—Cont.

8BX54, 8BX55 (See Model 8BX5) 46
8BX65 (See Model 8BX6). 44
8F43 (Ch. RC-1037B)..... 97—13
8PCS41, 8PCS41B, 8PCS41C (Ch. KCS24B-1, KRK1A-1, KRK4, KRS20A-1, KRS20B-1, KRS21A-1, RS-123C) Tel. Rec. .... 90—9
8R71 (Ch. RC-1060), 8R72 (Ch. RC-1060A).. 53—20
8R74, 8R75, 8R76 (Ch. RC-1060, A) (See Model 8R71)..... 53
8T241, 8T243, 8T244 (Ch. KCS28) Tel. Rec... 74—8
8T270 (Ch. KCS29, KCS29A) Tel. Rec....... 85—13
8TC270, 8TC271 (Ch. KCS29, KCS29A) Tel. Rec. (See Model 8T270) 85
8TK29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec..... 88—9
8TK320 (Ch. KCS33A-1) (Radio Ch. RK-135A-1) Tel. Rec. (See Model 8T270) 85
8TR29 (Ch. KCS32, KCS32A, KCS32B, KCS32C, RK135, RK135A) Tel. Rec. (See Model 8TK29).... 88
8TS30 Tel. Rec. (See Model 630TS) 54
8TV41 (Ch. KCS25D-1, KCS25E-2, RK117A, RS-123A) Tel. Rec...... *
8TV321, 8TV321B, 8TV323, 8TV323B (Ch. KCS30-1) (Radio Ch. RC616B, C, J, K) Tel. Rec. (See Model 8T241) 74
8V7 (Ch. RC-615) (See Model 77V1) 38
8V90 (Ch. RC-618, RC-618A), 8V91 (Ch. RC-616A, RC-616H) ... 56—20
8V111, 8V112 (Ch. RC-616) 58—18
8V151 (See Model RV151) 61
8X53 (Ch. RC-1064) ..... 39—17
8X71, 8X72 (RC-1070)..... 63—15
8X521 (RC-1066), 8X522 (RC-1066A) .... 52—17
8X541, 8X542 (Ch. RC-1065, RC-1065A) 59—16
8X544, 8X545, 8X546, 8X547 (See Model 8X541) 59
8X681, 8X682 (Ch. RC-1061) .... 65—10
9BX5 (Ch. RC-1059B, C) (See Model 8BX5)..... 46
9BX56 (Ch. RC-1068)..... 79—13
9EY31, 9EY32 .... 98—10
9PC41A, B, C (Ch. KCS24C-1, D, KRK-4, KRS20B-1, KRS21A-1, RS-123C) Tel. Rec. (See Model 8PCS41)... 90
9T57 (Ch. KCS49, A) Tel. Rec. 111-1A
9T77, 9T79 (Ch. KCS49, A) Tel. Rec. (See Model 9T57).....111
9T89 (Ch. KCS60 and Radio Ch. RC1092) Tel. Rec..111-1A
9T240 (Ch. KCS28, A) Tel. Rec. (See Model 8T241) 74
9T246 (Ch. KCS28C) Tel. Rec. (See Model 8T241) 74
9T246 (Ch. KCS38) Tel. Rec. (See Model T100).. 93
9T256 (Ch. KCS38C) Tel. Rec. (See Model T100).. 93
9T270 (Ch. KCS29, KCS29C) Tel. Rec. (See Model 8T270)..... 85
9TC240 (Ch. KCS28B) Tel. Rec. (See Model 8T241) 74
9TC245 (Ch. KCS34B) Tel. Rec. (See Model T100).. 93
9TC247 (Ch. KCS34, B) Tel. Rec. (See Model T100).. 93
9TC249 (Ch. KCS34, B) Tel. Rec. (See Model T100).. 93
9TC272, 9TC275 (Ch. KCS29, KCS29C) Tel. Rec. (See Model 8T270) 85
9TW309 (Ch. KCS41-1, RK135C) Tel. Rec....... 95A-11
9TW333 (Ch. KCS30-1, Radio Ch. RC616N) Tel. Rec. (See Model 8T241). 74
9TW390 (Ch. KCS31-1, RC617A) Tel. Rec. (See Model S1000).... 91A
9W101, 9W102, 9W103 (Ch. RC-618B), 9W105 (Ch. RC-618C)....... 73—10
9W106 (Ch. RC-622) (See Model A106)..... 97
9X561 (Ch. RC-1079B), 9X562 (Ch. RC-1079C). 101—9

RCA VICTOR—Cont.

9X571 (Ch. RC-1079), 9X572 (Ch. RC-1079A) 107—7
9X641 (Ch. RC-1080), 9X642 (Ch. RC-1080A). 87—9
9X651 (Ch. RC-1085), 9X652 (Ch. RC-1085A). 104—9
9Y7 (Ch. RC-1057B)..... 75—13
9Y51 (Ch. RC-1077)...... 98—11
54B1, 54B1-N, 54B2, 54B3 (Ch. RC589) ..... 7—22
54B5 (Ch. RC1047) ..... 17—25
55AU (Ch. RC1017)...... 2—16
55U (See Model 55AU).... 2
55F (Ch. RC-1004E)...... 4—6
55FA (See Model 55F).... 4
56X, 56X2, 56X3 (Ch. RC-1011) .... 1—16
56X5 (See Model 56X10).. 1
56X10 (Ch. RC-1023B)..... 1—12
58AV, 58V (Ch. RC-604) . 1—32
59AV1, 59V1 (Ch. RC-605) 6—25
63E (Ch. RS-127) .... 28—28
64F1, 64F2 (Ch. RC1037), 64F3 (Ch. RC1037A) ... 4—16
65BR9 (Ch. RC-1045) .... 23—16
65F (See Model 55F) 4
65AU (Ch. No. RC-1017A) 14—23
65U, 65U-1 (See Model 65AU) 14
65X1, 65X2 (Ch. RC-1034) 4—30
65X1, 65X2 (Ch. RC-1064) 31—26
65X8, 65X9 (See Model 65X1) 4
66BX (Ch. RC-1040, RC-1040A) .... 14—24
66E (Ch. RS-126) .... 17—26
66X1, 66X2, 66X3, 66X4.. 7—23
66X7, 66X8, 66X9 (See Model 66X1)..... 7
66X11 (Ch. RC-1046A), 66X12 (Ch. RC-1046), 66X13, 66X14, 66X15 (Ch. RC-1046B) .... 27—20
67V1, 67AV1 (Ch. RC-606) .... 9—27
68R1, 68R2, 68R3, 68R4 (Ch. RC-608) .... 23—17
75X11, 75X12 (Ch. RC-1050) .... 33—21
75X14, 75X15 (Ch. RC-1050) (See Model 75X11) 33
75X16, 75X17, 75X18, 75X19 (Ch. RC-1050B) (See Model 75X11)..... 33
77U (Ch. RC-1057A) ..... 38—17
77V1 (Ch. RC-615) ...... 38—18
77V2 (Ch. RC-606-C) .... 39—18
610V1 (Ch. RC610C) 610V2 (Ch. RC610) .... 31—27
612V1, 612V2, 612V3 (Ch. RK-121, RS-123).. 17—27
612V4 (See Model 612V1) 17
621TS (Ch. KCS21-1) Tel. Rec. (Servicer).... 78
630TCS Tel. Rec. (See Model 630TS).... 54
630TS Tel. Rec.......... 54—18
641TV (Ch. KCS25A1-1, KCS25C-2, RK117A, RS-123A) Tel. Rec..... 91A-11
648PTK (Ch. KCS24-1, KRK1-1, KRS20-1, KRS21A-1, RK-121A, RS-123A) Tel. Rec. (See Model 8PCS41)... 90
648PV (Ch. KCS24A-1, KRK-1A, KRS20-1, KRS21A-1, RK-121A, RS-123B) Tel. Rec. (See Model 8PCS41)... 90
710V2 (Ch. RC-613A) .... 40—15
711V1 (See Model 711V2) 22
711V2, 711V3 (Ch. RK-117 & RS-123) ..... 22—24
721TCS (Ch. KCS26-1, 2) Tel. Rec. (See Model 730TV1) 70
730TV1 (Ch. KCS27, RC610A) Tel. Rec....... 70—7
730TV2 (Ch. KCS27, RC610B) Tel. Rec. (See Model 730TV1)... 70
741PCS (Ch. KCS24B-1, KRK1A-1, KRS20A-1, KRS21A-1, RS-123C) Tel. Rec. (See Model 8PCS41) 90
Ch. KCS-20A-1 (See Model 630TS)...... 54
Ch. KCS-20B-1 (See Model 630TCS.... 54
Ch. KCS-20J-1 (See Model 8TS30)..... 54
Ch. KCS21-1 (See Model 621TS)..... *
Ch. KCS24-1 (See Model 8PCS41)... 90
Ch. KCS24A-1 (See Model 8PCS41)... 90
Ch. KCS24B-1 (See Model 8PCS41)... 90
Ch. KCS24C-1 (See Model 8PCS41)... 90
Ch. KCS24D (See Model 8PCS41)... 90
Ch. KCS25A1-1 (See Model 641TV).... *

RCA VICTOR—Cont.

Ch. KCS25C-2 (See Model 641TV).... *
Ch. KCS25D-1 (See Model 8TV41).... *
Ch. KCS25E-2 (See Model 8TV41).... *
Ch. KCS26-1, KCS26-2 (See Model 721TCS).... *
Ch. KCS27 (See Model 730TV1)... 70
Ch. KCS28 (See Model 8T241).... 74
Ch. KCS28, A, B C (See Model 8T241).... 74
Ch. KCS29, KCS29A (See Model 8T270)..... 85
Ch. KCS29C (See Model 8T270) 85
Ch. KCS30-1 (See Model 8T241).... 74
Ch. KCS31-1 (See Model S1000) 91A
Ch. KCS32, KCS32A, KCS32B, KCS32C (See Model 8TK29) 88
Ch. KCS33A-1 (See Model 8T270)..... 85
Ch. KCS34, B, C (See Model T100)...... 93
Ch. KCS-38, C (See Model T100)...... 93
Ch. KCS40, A, B (See Model T164)..........109
Ch. KCS41-1 (See Model TA-128)........110
Ch. KCS42A (See Model TA-128)........110
Ch. KCS43 (See Model TA169) 108
Ch. KCS45, A (See Model 2T51).....111
Ch. KCS47, A, AT, T (See Model 6T54).....113
Ch. KCS48 (See Model 2T81) .... *
Ch. KCS49, A (See Model 9T57).....111
Ch. KCS60 (See Model 9T89).....111
Ch. KRK-1A (See Model 8PCS41)... 90
Ch. KRK1-1 (See Model 8PCS41)... 90
Ch. KRK1A-1 (See Model 8PCS41)... 90
Ch. KRK4 (See Model 8PCS41)... 90
Ch. KRS20-1 (See Model 8PCS41)... 90
Ch. KRS20A-1 (See Model 8PCS41)... 90
Ch. KRS20B-1 (See Model 8PCS41)... 90
Ch. KRS21A-1 (See Model 8PCS41)... 90
Ch. RC-589 (See Model 54B1)...... 7
Ch. RC-604 (See Model 58AV)..... 1
Ch. RC-605 (See Model 59AV1).... 6
Ch. RC-606 (See Model 67V1)..... 9
Ch. RC-606C (See Model 77V2)..... 39
Ch. RC-608 (See Model 68R1)...... 23
Ch. RC-610 (See Model 610V1).... 31
Ch. RC610A, RC610B (See Model 730TV1)... 70
Ch. RC610C (See Model 610V1).... 31
Ch. RC-613A (See Model 710V2).... 40
Ch. RC-615 (See Model 77V1)..... 38
Ch. RC-616 (See Model 8V111).... 58
Ch. RC-616A, RC-616H (See Model 8V91)..... 56
Ch. RC-616B, RC-616C (See Model 8T241).... 74
Ch. RC-616J, RC-616K (See Model 8T241).... 74
Ch. RC-616N (See Model 8T241).... 74
Ch. RC617A (See Model 9TW390) 91A
Ch. RC617B (See Model S1000).... 91A
Ch. RC-618, RC-618A (See Model 8V90)..... 56
Chassis RC-618 B, C (See Model 9W101)... 73
Ch. RC-622 (Sep Model A106)..... 97
Ch. RC-1004E (See Model 55F)...... 4
Ch. RC-1011 (See Model 56X)...... 1
Ch. RC-1017 (See Model 55AU)..... 2
Ch. RC-1017A (See Model 65AU)..... 14
Ch. RC-1023B (See Model 56X10).... 1

RCA VICTOR—Cont.

Ch. RC-1034 (See Model 65X1)..... 4
Ch. RC-1037, RC-1037A (See Model 64F1)...... 4
Ch. RC-1037B (See Model 8F43)...... 97
Ch. RC-1038, RC-1038A (See Model 66X1)..... 7
Ch. RC-1040, RC-1040A (See Model 66BX)..... 14
Ch. RC-1040C (See Model 8BX6)..... 44
Ch. RC-1045 (See Model 65BR9)..... 23
Ch. RC-1046, A, B (See Model 66X11).... 27
Ch. RC-1047 (See Model 54B5)..... 17
Ch. RC-1050, RC-1050B (See Model 75X11).... 33
Ch. RC-1057A (See Model 77U)...... 38
Chassis RC-1057B (See Model 9Y7) 75
Ch. RC-1059 (See Model 8BX5)..... 46
Ch. RC-1059B, RC-1059C (See Model 9BX5)..... 46
Ch. RC-1060 (See Model 8R71)..... 53
Ch. RC-1060A (See Model 8R72)..... 53
Ch. RC-1061 (See Model 8X61)..... 65
Ch. RC-1064 (See Model 8X53)..... 39
Ch. RC-1064 (See Model 65X1)..... 31
Ch. RC-1065, RC-1065A (See Model 8X541).... 59
Ch. RC-1066 (See Model 8X521).... 52
Ch. RC-1066A (See Model 8X522).... 52
Ch. RC-1068 (See Model 9BX56).... 79
Ch. RC-1069A, B (See Model 8B41)..... 76
Ch. RC-1070 (See Model 8X71)..... 63
Ch. RC-1077 (See Model 9Y51)..... 98
Ch. RC-1079, A (See Model 9X571) 107
Ch. RC-1079B, RC-1079C (See Model 9X561)....101
Ch. RC-1082 (See Model BX6) 103
Ch. RC-1085, RC-1085A (See Model 9X651)....104
Ch. RC-1087 (See Model A55)......109
Ch. RC-1088, RC-1088A (See Model BX55).....102
Ch. RC-1090 (See Model 2T81).......... *
Ch. RC-1092 (See Model 2T81).......... *
Ch. RK-117 (See Model 711V2).... 22
Ch. RK-117A (See Model 8TV41).... *
Ch. RK-121 (See Model 612V1).... 17
Ch. RK-121A (See Model 8PCS41)... 90
Ch. RK-121C (See Model RV151).... 61
Ch. RK-135, RK-135A (See Model 8TK29).... 88
Ch. RK-135A-1 (See Model 8T270)..... 85
Ch. RK135C (See Model 9TW309).. 95A
Ch. RK135D (See Model TA169)........108
Ch. RS-123 (See Model 612V1).... 17
Ch. RS-123 (See Model 711V2).... 22
Ch. RS-123A (See Model 8PCS41)... 90
Ch. RS-123B (See Model 8PCS41)... 90
Ch. RS-123C (See Model 8PCS41)... 90
Ch. RS-123D (See Model RV151).... 61
Ch. RS-126 (See Model 66E)...... 17
Ch. RS-127 (See Model 63E)...... 28

RME

DB-22A .... 50—14
HF10-20 .... 49—17
VHF 2-11 .... 79—14
VHF-152A .... 51—18
45 .... 13—25
84 .... 14—13

RADIOLA

61-1, 61-2, 61-3 (Ch. RC-1011) .... 14—25
61-5 (Ch. RC-1023) 61-10 (Ch. RC-1023B) .. 12—25
61-8, 61-9 (Ch. RC-1034) 27—21

RADIOLA—Cont.
62-2 (See RCA Model 65U-1) 14
75ZU (Ch. RC-1063A) 36—19
76ZX11, 76ZX12 (Ch. RC-1058, RC-1058A) 36—20
Ch. RC-1011 (See Model 61-1) 14
Ch. RC-1023, RC-1023B (See Model 61-5) 12
Ch. RC-1034 (See Model 61-8) 27
Ch. RC-1058, RC-1058A (See Model 76ZX11) 36
Ch. RC-1063A (See Model 75ZU) 36

RADIO CRAFTSMAN
RC-1 (Tuner), RC-2 (Audio Amp.) 39—19
"Kitchenoire" 6—14
RC-8 66—13
RC-10 110—12
RC100 Tel. Rec. 96—9
RC-100A Tel. Rec. 117—11

RADIO DEVELOPMENT & RESEARCH CO.
(See Magic-Tone)

RADIOETTE
PR-2 50—15

RADIONIC (See Chancellor)
Y62W, Y728 26—22

RANGER
118 28—27

RADIO MFG. ENGINEERS
(See RME)

RADIO WIRE TELEVISION
(See Lafayette)

RAULAND
BA21 87—10
W-819-A 43—16
1814 99—13
1820 100—10
1821, 1822 59—17
1825 97—14
1835 60—17
1841 58—19
2100-S (Sub-station) (See Model 2101-A) 39
2101-A (Master Station) 39—20
2105 (Master Station) 36—21
2206, 2206H, 2212, 2212H, 2218, 2218H, 2224, 2224H 80—13
2306, 2312, 2324 (See Model BA21) 87
2400 Series 33—22

RAY ENERGY
AD 7—24
AD4 7—25
SRB-1X 13—26

RAYTHEON (Also See Belmont)
A-7DX22P Tel. Rec. (See Model 7DX21) 81
Models A-10DX24, B-10DX22 Tel. Rec. 75—14
A-10DX24, B-10DX22 Tel. Rec. Prod. Chge. Bul. 1 103—19
C1102 (Ch. 12AX22) Tel. Rec. 94—8
C1102, C1104 (Ch. 12AX22) Tel. Rec. Prod. Chge. Bul. 3 105—1
C1104 (Ch. 12AX22) Tel. Rec. (See Model C1102) 94
C-1104B (Ch. 12AX27) Tel. Rec. 93A-13
C-1401 (Ch. 14AX21) Tel. Rec. *
C1602 (Ch. 16AX23, 25, 26) Tel. Rec. 99—14
M701 (Ch. 10AX22) Tel. Rec. (See Model C1102) 94
M701 (Ch. 10AX22) Tel. Rec. Prod. Chge. Bul 3 105—1
M1101 (Ch. 12AX22) Tel. Rec. (See Model C1102) 94
M1101, M1103, M1105 (Ch. 12AX22) Tel. Rec. Prod. Chge. Bul. 3 105—1
M1103 (Ch. 12AX22) Tel. Rec. (See Model C1102) 94
M1105 (Ch. 12AX22) Tel. Rec. (See Model C1102) 94
M-1105B, M-1106, M-1107 (Ch. 12AX27) Tel. Rec. (See Model C-1104B) 93A
M-1402, M-1403, M-1404 (Ch. 14AX21) Tel. Rec. *
M-1601 (Ch. 16AX23, 25, 26) Tel. Rec. (See Model C1602) 99
P-301 (See Model 7DX21) Tel. Rec. 81
RC-1405 (Ch. 14AX21) Tel. Rec. *
7DX21, 7DX22P Tel. Rec. 81—13
10AXF43 Tel. Rec. (See Model A-10DX24) 75

RAYTHEON—Cont.
10AXF43, 10DX22 Tel. Rec. Prod. Chge. Bul. 1 103—19
10AXF44 Tel. Rec. (See Model C-1102 (Set 94) and Model A-10DX24 (Set 75))
10DX21, 10DX22 Tel. Rec. (See Model A-10DX24) 75
10DX24 Tel. Rec. (See Model A-10DX24) 75
18DX21A Tel. Rec. (See 7DX21) 81
Ch. 10AX22 (See Model M701) 94
Ch. 12AX22 (See Model C1102) 94
Ch. 14AX21 Tel. Rec. *
Ch. 16AX23, 25, 26 (See Model C1602) 99
Ch. 16AY210 Tel. Rec. *

RECORDIO (Wilcox-Gay)
6A10, 6A20 (Ch. 6A) 10—27
6B10, 6B20, 6B30, 6B32 8—27
7D42, 7D44 (Ch. 7D1) 52—18
7E40, 7E44 47—20
8J10, 8J50 62—17
9G10 91—10
9G40M, 9G42 86—9
9H40B 89—13
Ch. 6A (See Model 6A10) 10
Ch. 7D1 (See Model 7D42) 52

REGAL (TOK-FONE)
Tok-Fone (20-watt Amp.) 13—27
A-16T31 Tel. Rec. *
AP40, ARP400, ARP450 15—26
BP48 49—18
CD31 Tel. Rec. (See Model 16T31) 80
CD36 Tel. Rec. *
CR761 50—16
FM78 68—14
L-76 5—18
W700 (See Model W800) 14
W800, W801 14—26
W900, W901 13—28
16T31 Tel. Rec. 80—14
16T36 Tel. Rec. *
19C36 Tel. Rec. *
205 26—23
208 (See Model W800) 14
747 27—22
777 53—21
1007 Tel. Rec. 83—9
1030, 1031 Tel. Rec. (See Model 16T31) 80
1049 17—28
1107 41—19
1207, 1208 Tel. Rec. (See Model 1007) 83
1230 Tel. Rec. (See Model 16T31) 80
1500 38—19
1607 Tel. Rec. (See Model 1007) 83
1749 28—29
7152 70—8
7162 69—12
7163 66—14
7251 46—16

REMBRANDT
80 Tel. Rec. *
130 Tel. Rec. *
721, 1606, 1606-15, 1950 Tel. Rec. 65—11

REMLER
MP5-5-3 8—28
5300B, 5300B1, 53001 23—18
5310 40—17
5400, 5410 44—19
5500 "Scottie Pup" 27—23
5505, 5510, 5515 "Scottie Pup" (See Model 5500) 27
5520, 5530 "Scottie Junior" (See Model 5500) 27
6000 77—9

RENARD
L-1A, PT-1A, 185T-1 9—28

SCOTT (E. H.)
Musicale 44—20
Music Control, Dynamic Noise Suppressor 46—21
6T11, 6T11A Television Receiver 52—19
6T11, 6T11A Tel. Rec. Prod. Chge. Bul. 4 105—2
13A Tel. Rec. *
16A 40—18
300 Tel. Rec. *
400 Tel. Rec. (See Model 6T11) 52
400 Tel. Rec. Prod. Chge. Bul. 4 105—2
510 103—14
800-B 14—27
800BT Tel. Rec. (See Model 6T11 (Set 52) and Model 800B Set 14)
800BT Tel. Rec. Prod. Chge. Bul. 4 105—2

SCOTT (H. H.)
210-A 79—15
211-A 81—14

SEARS-ROEBUCK
(See Silvertone)

SENTINEL
IU-284GA (See Model 284GA) 22
IU-2841, IU-284NA, IU-284NI, IU-284W (See Model 2841) 1
IU-285P (See Model 285P) 6
IU-293CT (See Model 293CT) 29
IU-293I, IU-293T, IU-293W (See Model 293 Series) 1
IU-294I, IU-294N, IU-294T (See Model 294 Series) 1
IU312PG, IU312PW 103—15
IU-313I, IU-313W (See Model 313I) 39
IU-314E, IU-314I, IU-314W (See Model 314E) 38
IU-316PM, IU-316PT (See Model 316PM) 48
IU-335PG, PI, PM, PW 105—9
IU339-K 111—12
IU416 Tel. Rec. 117—12
IU419, IU420 Tel. Rec. 115—9
IU420B Tel. Rec. *
IU423, IU424 Tel. Rec. *
L-2841, L-284NA, L-284NI, L-284NR, L-284W 23—19
284GA 22—25
2841 1—2
284NA, 284NI (See Model 2841) 1
285P 6—27
286P, 286PR 23—20
289T 6—28
292K 16—30
293 Series 1—14
293-CT 29—22
293I, 293T, 293W (See Model 293 Series) 1
294 Series 1—11
294I, 294N, 294T (See Model 294 Series) 1
295-T 22—26
296B, 296M 46—22
302-I, 302-T, 302-W 33—23
305-I, 305-I-3, 305-W, 305-W3 33—24
309-I, 309N, 309-R, 309-W 28—30
312PG, 312 PW (See Model IU312PG) 103
313-I, 313-W 39—21
314-E, 314-I, 314-W 38—21
315-I, 315-W 40—19
316PM, 316PT 48—22
332 (See Model 313-I) 39
333 (See Model 315-I) 40
335PG, PI, PM, PW (See Model IU-335PG) 105
339-K (See Model IU339-K) 111
400TV Tel. Rec. 73—11
401, 402 Series Tel. Rec. 70—9
405TVM Tel. Rec. (See Model 400TV) 73
406 Series Tel. Rec. (See Model 401 Series) 70
407 Series Tel. Rec. *
409 Series Tel. Rec. *
411 Series Tel. Rec. (See Model 401 Series) 70
412, 413, 414, 415 (Series YA, YB, YC, YD, YE, YF) Tel. Rec. 100—11
412, 413, 414, 415 Tel. Rec. Prod. Chge. Bul. 4 105—2
416 Tel. Rec. (See Model IU416) 117
419, 420 Tel. Rec. (See Model IU419) 115
420B Tel. Rec. *
423, 424 Tel. Rec. *

SETCHELL-CARLSON
416 2—14
427 21—29
437 39—22
447 40—20
458-RD 106—13
469 99—15
570 97—15

SHERIDAN ELECTRONICS
(See Vogue)

SIGNAL
AF252 37—19
141 44—21
241 33—25
341-A 39—23
341-T 25—25

SILVERTONE
1, 2 (Ch. 132.878) 101—10
33 (Ch. 548.363) 111—13
41, 41A (Ch. 135.245) 101—11
51, 53 (Ch. 132.887) 112—8
54, 56 (Ch. 132.888) 115—10
64, 65 (Ch. 101.859-2) 113—8
101 (Ch. 549.100), 101A (Ch. 549.100-1) Tel. Rec. 102—12
105 (Ch. 132.882) Tel. Rec. *

SILVERTONE—Cont.
106 (Ch. 132.889) Tel. Rec. *
108 (Ch. 549.100) Tel. Rec. (See Model 101) 102
112 (Ch. 478.289) Tel. Rec. 118—9
120 (Ch. 478.311) Tel. Rec. 115—11
122 (Ch. 478.289) Tel. Rec. *
125 (Ch. 478.257) Tel. Rec. 104—10
133 (Ch. 100.043) Tel. Rec. *
138 (Ch. 549.100-3) Tel. Rec. 99A-10
159 (Ch. 478.309) Tel. Rec. (See Model 120) 115
160-12 (Ch. 549.100-4) Tel. Rec. 97A-12
161-16 (Ch. 100.112) Tel. Rec. 99A-10
179-16 (Ch. 132.890) Tel. Rec. *
180-16 (Ch. 132.890) Tel. Rec. *
194-16 (Ch. 132.890) Tel. Rec. *
195-16 (Ch. 132.890) Tel. Rec. *
210 (Ch. 132.880) 109—12
215 (Ch. 528.174) 117—13
220 (Ch. 528.173) 110—13
225 (Ch. 528.171-1) 107—8
239 (Ch. 548.360-1) 115—12
245 (Ch. 548.358-1) 107—9
246 (Ch. 137.906) 111—14
249 (Ch. 548.360-1) (See Model 239) 115
1300 (Ch. 319.200), 1300-1 (Ch. 319.200-1) 90—10
1301 (Ch. 319.190) 91—11
1304 (Ch. 185.706) *
6002 (Ch. 132.818) 5—35
6011 (Ch. 132.816), 6012 (Ch. 132.816A) 15—27
6016 (Ch. 132.820) 27—24
6050 (Ch. 132.825-4) 15—28
6051 (Ch. 110.451), 6052 (Ch. 110.452) 13—29
6071 (Ch. 132.826-1) 15—29
6072 (Ch. 110.454) 13—30
6092 (Ch. 101.672-1B), 6093 (Ch. 101.672-1A) 10—28
6100 (Ch. 101.660 1A) 6—29
6104 (Ch. 101.662-2D) (See Model 6105) 7
6105 (Ch. 101.622 2B) 7—26
6106A (Ch. 101.662-4E) 29—23
6111 (Ch. 101.662-3C) (See Model 6105) 7
6111A (Ch. 101.662-5F) (See Model 6106A) 29
6200A (Ch. 101.800-3) 65—12
6200A (Ch. 101.800-1) 9—29
6203 (Ch. 101.800A) (See Model 6200A) 9
6220, 6220A (Ch. Nos. 101.801, 101.801-1A) 9—30
6230 (Ch. 101.802), 6230 (Ch. 101.802-1) 11—21
6285A (Ch. 101.666-1B) 20—28
6290 (Ch. 101.677-B) 20—29
6293 (Ch. 528.6293-2) 99—16
6295 (Ch. 528.6295) 98—12
6685 (Ch. 139.150, Ch. 139.150-1), Power Shifter 15—30
7010 *
7011 *
7012 *
7013 *
7016 *
7017 *
7020 (See Model 7021) 16
7021 (Ch. 101.807, 101.807A) 16—31
7025 (Ch. 132.807-2) 29—24
7054 (Ch. 101.808) 15—31
7070 (Ch. 101.817) 30—26
7080 (Ch. 101.809) 16—32
7080, 7080A (Ch. 101.809-2) 58—20
7085 (Ch. 101.814) 30—27
7086 (Ch. 110.466) 27—25
7090 (Ch. 101.810) 15—32
7095 (Ch. 101.826) (See Model 7115) 16
7100 (Ch. 101.811) 17—29
7102 (Ch. 101.814 1A) (See Model 7085) 30
7103 (Ch. 110.466-1) (See Model 7086) 27
7105, 7106 *
7111 (Ch. 434.140) 30—28
7115 (Ch. 101.825), 7116 (Ch. 101.825-1A), 7117 (Ch. 101.825-1B) 16—33
7119 (Ch. 101.825-2C) 62—18
7145 (Ch. 436.200) 23—21
7148 (Ch. 431.188), 7148A (Ch. 431.188-1) 23—22
7152 (Ch. 109.626) 25—26
7153 (Ch. 109.627) 26—30
7165 (Ch. 101.823-A, 1A), 7166 (Ch. 101.823, 101.823-1) 10—29
7210 (Ch. 101.820) 32—20

SILVERTONE—Cont.
7220 (Ch. 161.801-2C) (See 6220) 9
7226 (Ch. 101.819A) 31—28
7230 (Ch. 101.802-2A) (See 6230) 11
7300 (Ch. 435.240) 45—22
7350 (Ch. 435.410) 38—22
7351 *
7352 *
7353 (See Model 7350) 38
8000 (Ch. 132.838) 31—29
8003 (Ch. 132.818-1) 53—22
8004 (See Model 8003) 53
8005 (Ch. 132.839) 33—26
8010 (Ch. 132.840) 40—21
8011 (See Model 8010) 40
8020 (Ch. 132.841) 43—17
8021 (Ch. 132.868) 70—10
8022 *
8024, 8025 (Ch. 478.206-1) 80—15
8050 (Ch. 101.813) 33—27
8051 (Ch. 101.839) 49—19
8052 (Ch. 101.808-1C) 68—15
8053 (Ch. 101.808-1D) (See Model 8052) 68
8070 (Ch. 101.817-1A) (See Model 7070) 30—26
8071 *
8072 (Ch. 101.834) 34—19
8073 (Ch. 135.243) 84—9
8080 (Ch. 101.852) 52—20
8083, 8083A (Ch. 101.809-1A) (See Model 7080) 58
8084, 8084A (Ch. 101.809-1B) (See Model 7080) 58
8086 (Ch. 101.814-5C) 61—18
8086A, 8086B (Ch. 101.814-6C) (See Model 8086) 61
8090 (Ch. 101.821) 49—20
8092 *
8097A (Ch. 101.825-4) (See Model 7119) 62
8100 (Ch. 101.829) 51—19
8101, 8101A, 8101B, 8101C (Ch. 101.809-3C) (See Model 7080) 58
8102 (Ch. 101.814-2B) (See Model 8086) 61
8102A (Ch. 101.814-3B) (See Model 8086) 61
8102B (Ch. 101.814-2B) (See Model 8086) 61
8103 (Ch. 110.473) 56—21
8104 (See Model 8086) 61
8105, 8105A (Ch. 101.833) 35—20
8106, 8106A (Ch. 101.833-1A) (See Model 8105) 35
8107A, 8108, 8108A (Ch. 101.851), 8109 (Ch. 101.851-1) 64—10
8112, 8113 (See Model 8115) 62
8115 (Ch. 101.825-3D), 8115A, B, C (Ch. 101.825-4), 8117 (Ch. 101.825-3E), 8118 (Ch. 101.825-3F), 8118A, B, C (Ch. 101.825-4) (See Model 7119) 62
8124, 8125, 8126 (Ch. 101.831A, Ch. 101.831-1) (See Model 8127) 41
8127, A, B, C (Ch. 101.831A), 8128, A, B, C (Ch. 101.831), Wire Recorder Amp. (Ch. 101.773) 41—20
8130 Television Receiver 49—21
8132 (Ch. 101.854) Tel. Rec. 66—15
8133 (Ch. 101.829-1, Ch. 101.846) Tel. Rec. (See Model 8132) 66
8144 (Ch. 431.199) 32—21
8145 (Ch. 109.631) 45—23
8148 (Ch. 109.632) 44—22
8149 (Ch. 109.633) 48—23
8150 (Ch. 109.634) 32—22
8152 (Ch. 109.635) (See Model 8153) 42
8153 (Ch. 109.635), 8153A (Ch. 109.635-1) 42—22
8155 (Ch. 463.155) 57—17
8160 (Ch. 109.636), 8160A (Ch. 109.636A) 50—17
8168 (Ch. 109.638) 46—23
8169 (Ch. 109.638) (See Model 8168) 46
8200 (Ch. 101.800-2B) (See Model 6200A (Ch. 101.800-3)) 65
8201 (See Model 6200A) 65
8210 (Ch. 101.820-1A) 71—13
8220, 8221 (Ch. 101.801-3D), 8222 (See 6220) 9
8230 (Ch. 101.835) 59—18
8231 (See Model 8230) 59
8260 (Ch. 101.823-2B) (See Models 7165, 7166) 10—29

SILVERTONE—Cont.

8270 (Ch. 101.822), 8270A (Ch. 101.822A) .. 57—18
9000 (Ch. 132.857) ..... 65—13
9005, 9006 (Ch. 132.858) 72—11
9022 (Ch. 132.871) ..... 76—17
9054 (Ch. 101.849) ..... 63—16
9073, 9073A (Ch. 135.244), 9073B (Ch. 135.244-1) ...... 83—10
9073C (Ch. 135.243-1) (See Model 9073) 83
9082 (Ch. 135.245) (See Model 41) 101
9101 (Ch. 101.809-3C) (See Model 7080) 58
9102 (See Model 7080) .. 58
9105 (Ch. 132.875) ..... 89—14
9107A (Ch. 101.851-1) (See Model 8107A) 64
9115 (Ch. 478.224), 9116 (Ch. 478.221) Tel. Rec.. 97—16
9119, 9120 (Ch. 101.865) Tel. Rec. ..... *
9120A (Ch. 101.865-1) Tel. Rec. .... *
9121 (Ch. 101.867) Tel. Rec. .... *
9122 (Ch. 101.864) (See Model 8132) 66
9122A (Ch. 101.868) Tel. Rec. .... *
9123 (Ch. 110.499), 9124 (Ch. 110.499-1), 9126 (Ch. 110.499-2) Tel. Rec. .... 79—16
9125 (Ch. 478.252) Tel. Rec. .... *
9125A (Ch. 478.253) Tel. Rec. (See Model 125) .. 104
9128A (Ch. 101.868) Tel. Rec. .... *
9131 (Ch. 478.210) Tel. Rec. .... 84—10
9133, 9134 (Ch. 101.866, Radio Ch. 101.859) Tel. Rec. .... 95—5
9153 (Ch. 435.417) ..... 67—16
9161 (Ch. 548.358) ..... 88—10
9260 (Ch. 101.850) ..... 51—20
9270 (Ch. 547.245) ..... 82—11
9280 (Ch. 528.168) ..... 94—9
Ch. 100.043 (See Model 133) ...... *
Ch. 100.112 (See Model 161-16) 99A-10
Ch. 101.660-1A (See Model 6100) 6
Ch. 101.662-2B, 101.662-2D, 101.662-3C (See Model 6105) 7
Ch. 101.662-4E, 101.662-5F (See Model 6106A) .. 29
Ch. 101.666-1B (See Model 6285A) 20
Ch. 101.672-1A, 101.672-1B (See Model 6092) ... 10
Ch. 101.677B (See Model 6290) 20
Ch. 101.773 (See Model 8127) 41
Ch. 101.800-1, 101.800-1A (See Model 6200A). 9
Ch. 101.800-3 (See Model 6200A) 65
Ch. 101.801, 101.801-1A (See Model 6220) 9
Ch. 101.802, 101.802-1 (See Model 6230) 11
Ch. 101.807, 101.807A (See Model 7021) 16
Ch. 101.808 (See Model 7054) 15
Ch. 101.808-1C, 101.808-1D (See Model 8052) .. 68
Ch. 101.809 (See Model 7080) 16
Ch. 101.809-1A, B, 101.809-2, 101.809-3C (See Model 7080) 58
Ch. 101.810 (See Model 7090) 15
Ch. 101.811 (See Model 7100) 17
Ch. 101.813 (See Model 8050) 13
Ch. 101.814, 101.814-1A (See Model 7085) 30
Ch. 101.814-2B, 101.814-3B, 101.814-5C, 101.814-6C (See Model 8086) 61
Ch. 101.817 (See Model 7070) 30
Ch. 101.819A (See Model 7226) 31
Ch. 101.820 (See Model 7210) 32
Ch. 101.821 (See Model 8090) 49
Ch. 101.822, 101.822A (See Model 8270) 57
Ch. 101.823, 101.823A, 101.823-1, 101.823-1A (See Model 7166) 10
Ch. 101.825, 101.825-1A, 101.825-1B (See Model 7115) 16

SILVERTONE—Cont.

Ch. 101.825-2C, 101.825-3D, 101.825-3E, 101.825-3F, 101.825-4 (See Model 7119) 62
Ch. 101.829 (See Model 8100) 51
Ch. 101.829-1 (See Model 8132) 66
Ch. 101.831, 101.831A, 101.831-1 (See Model 8127) 41
Ch. 101.833 (See Model 8105) 35
Ch. 101.834 (See Model 8072) 34
Ch. 101.835 (See Model 8230) 59
Ch. 101.839 (See Model 8051) 49
Ch. 101.846 (See Model 8132) 66
Ch. 101.849 (See Model 9054) 63
Ch. 101.850 (See Model 9260) 51
Ch. 101.851, 101.851-1 (See Model 8107A) 64
Ch. 101.852 (See Model 8080) 52
Ch. 101.854 (See Model 8132) 66
Ch. 101.859 (See Model 9133) 95
Ch. 101.859-2 See Model 64) 113
Ch. 101.864 (See Model 9122) 66
Ch. 101.865 (See Model 9119) ..... *
Ch. 101.865-1 (See Model 9120A) .... *
Ch. 101.866 (See Model 9133) 95
Ch. 101.867 (See Model 9121) ..... *
Ch. 101.868 (See Model 9122A) .... *
Ch. 109.626 (See Model 7152) 25
Ch. 109.627 (See Model 7153) 26
Ch. 109.631 (See Model 8145) 45
Ch. 109.632 (See Model 8148) 44
Ch. 109.633 (See Model 8149) 48
Ch. 109.634 (See Model 8150) 32
Ch. 109.635, 109.635-1 (See Model 8153) 42
Ch. 109.636, 109.636A (See Model 8160) 50
Ch. 109.638 (See Model 8168) 46
Ch. 110.451, 110.452 (See Model 6051) 13
Ch. 110.454 (See Model 6072) 13
Ch. 110.466, 110.466-1 (See Model 7086) 27
Ch. 110.473 (See Model 8103) 56
Ch. 110.499 (See Model 9123) 79
Ch. 110.499-1 (See Model 9124) 79
Ch. 110.499-2 (See Model 9126) 79
Ch. 132.807-2 (See Model 7025) 29
Ch. 132.816, 132.816A (See Model 6011) 15
Ch. 132.818 (See Model 6002) 5
Ch. 132.818-1 (See Model 8003) 53
Ch. 132.820 (See Model 6016) 27
Ch. 132.825-4 (See Model 6050) 15
Ch. 132.826-1 (See Model 6071) 15
Ch. 132.838 (See Model 8000) 31
Ch. 132.839 (See Model 8005) 33
Ch. 132.840 (See Model 8010) 40
Ch. 132.841 (See Model 8020) 43
Ch. 132.858 (See Model 9005) 72
Ch. 132.868 (See Model 8021) 70
Ch. 132.871 (See Model 9022) 76
Ch. 132.875 (See Model 9105) 89
Ch. 132.878 (See Model 1) 101
Ch. 132.880 (See Model 210) 109
Ch. 132.882 (See Model 105) ...... *
Ch. 132.887 (See Model 51) 112

SILVERTONE—Cont.

Ch. 132.888 (See Model 54) 115
Ch. 132.889 (See Model 106) .... *
Ch. 132.890 (See Model 179-16) ... *
Ch. 135.243 (See Model 8073) 84
Ch. 135.243-1 (See Model 9073) 83
Ch. 135.244, 135.244-1 (See Model 9073) 83
Ch. 135.245 (See Model 41) 101
Ch. 137.906 (See Model 246) 111
Ch. 139.150, 139.150-1 (See Model 6685) 15
Ch. 185.706 (See Model 1304) ...... *
Ch. 319.190 (See Model 1301) 91
Ch. 319.200, 319.200-1 (See Model 1300) 90
Ch. 431.188, 431.188-1 (See Model 7148) 23
Ch. 431.199 (See Model 8144) 32
Ch. 431.202 (See Model 8130) 49
Ch. 434.140 (See Model 7111) 30
Ch. 435.240 (See Model 7300) 45
Ch. 435.410 (See Model 7350) 38
Ch. 435.417 (See Model 9153) 67
Ch. 436.200 (See Model 7145) 23
Ch. 463.155 (See Model 8155) 57
Ch. 478.206-1 (See Model 8024) 80
Ch. 478.210 (See Model 9131) 84
Ch. 478.221 (See Model 9115) 97
Ch. 478.224 (See Model 9115) 97
Ch. 478.252 (See Model 9125) ..... *
Ch. 478.253 (See Model 125) 104
Ch. 478.257 (See Model 125) 104
Ch. 478.289 (See Model 112) 118
Ch. 478.309 (See Model 120) 115
Ch. 478.311 (See Model 120) 115
Ch. 528.168 (See Model 9280) 94
Ch. 528.171-1 (See Model 225) 107
Ch. 528.173 (See Model 220) 110
Ch. 528.174 (See Model 215) 117
Ch. 528.6293-2 (See Model 6293) 99
Ch. 528.6295 (See Model 6295) 98
Ch. 547.245 (See Model 9270) 82
Ch. 548.358 (See Model 9161) 88
Ch. 548.358-1 (See Model 245) 107
Ch. 548.360-1 (See Model 239) 115
Ch. 548.363 (See Model 33) 111
Ch. 549.100, 549.100-1 (See Model 101) 102
Ch. 549.100-3 (See Model 138) 99A
Ch. 549.100-4 (See Model 160-12) 97A

SIMPLON

CA-5 .... 22—27
WVV2 .... 17—30

SKY KNIGHT (See Air Knight)

SKYRIDER (See Hallicrafters)

SKYROVER

N5-RD-250 (9022-N), N5-RD-251 (9022-H) ... 6—31
N5-RD295 (Ch. 5A7) .... 21—30

SKY WEIGHT

81B .... 20—30
82 .... 13—13

SONORA

RBU-176 .... 5—31
RB-207 (See Model RB-176) 5
RCU-208 .... 5—30
RDU-209 .... 3—29
RET-210 .... 24—24
RGMF-212, RGMF-230 ... 27—26
RKRU-215 (Ch. RKRU) .... 9—31
RMR-219 .... 19—28

SONORA—Cont.

RMR-220, RMR-245 (See Model RMR-219) .. 19
RQU-222 .... 8—23
RWFU-238 .... 23—24
RX-223 .... 19—29
WAU-243 .... 27—27
WBRU-239 .... 32—23
WCU-246 .... 36—22
WDU-233 .... 25—27
WDU-249 .... 37—20
WEU-262 .... 33—28
WGFU-241, WGFU-242 .. 24—25
WJU-252 .... 36—23
WKRU-254A .... 34—20
WLRU-219A .... 37—21
WLRU-220A (See Model WLRU-219A) 37
WLRU-245A See Model WLRU-219A) 37
WXTU-700, WXTUA-700A Tel. Rec. .... *
YB-299 .... 112—9
100 .... 41—21
101 .... 48—24
102 .... 53—23
171 .... 109—13
172 (See Model 171) 109
302, 303 Tel. Rec. 97A-13
306 .... 108—11
401 .... 47—21
402A (See Model RMR-219) 19
402F (See Model WLRU-219A) 37

SOUND, INC.

"Intersound," .... 7—27
MB6P3, MB6P6, MB6P30, MB6R4 .... 35—21
MB7E3 .... 28—31
MB7E8 .... 26—24
5R2 .... 28—32

SPARKS-WITHINGTON (See Sparton)

SPARTON

4AW17 (Ch. 417) .... 50—18
4AW17-A (Ch. 417A) .... 49—22
5AH06, 5AI06 (See Model 5AW06) 4
5AI16 (Ch. 5-16) .... 30—29
5AM26-PS (Ch. 5-26-PS) . 5—17
5AW06 (Ch. 5-06) ...... 4—17
5AW16 (Ch. 5-16) See Model 5AI16 (Ch. 5-16) 30
6AM06 (Ch. 6-06) .... 34—21
6AM26 (See Model 6AW26PA) 15
6AW26PA (Ch. PC5-6-26) 15—33
6-66A (Ch. 666A) .... 51—21
7AM46 (Ch. 7-46) .... 1—31
7AM46PA, 7BM46PA, 7BW46PA, 8AM46 (See Model 7AM46) 1
10AB76-PA, 10AM76-PA, 10BM76-PA (See Model 10BW76-PA) ... 15
10BW76-PA (Ch. 10-76PA) 15—34
100, 101 (Ch. 5A7) ..... 38—23
102, 103, 104 (See Model 100) 38
121 (Ch. 8L9) .... 57—19
122 (See Model 121) 57
130, 132, 135, 139 (Ch. 5A10) .... 94—10
141 (See Model 121) 57
141A (Ch. 8L10) .... 92—6
142 (See Model 121) 57
150, 151, 152, 155 (Ch. 4E10) .... 91—12
201 .... *
1000, 1001, 1003 (Ch. 12L7) .... 60—18
1005, 1006, 1007, 1008 (Ch. 8-57) .... 29—25
1010 (Ch. 7L7) .... 35—22
1015 (See Model 10BW76PA) 15
1020, 1021, 1023 (See Model 1000) 60
1030, 1030A (Ch. 6L8) ... 37—22
1031, 1031A (See Model 1030) 37
1035, 1035A, 1036, 1036A, 1037, 1037A, 1039, 1040, 1041 (Ch. 9L8) .... 62—19
1051, 1052 (Ch. 6B9) .... 58—21
1058, 1059, 1060, 1061, 1064, 1071, 1072 (See Model 121) 57
4900TV (Ch. 24TV9C, 3TV9C, 9L8A) Tel. Rec. 64—11
4916, 4917, 4918 (Ch. 24TL10, 3TL10, 6S10) Tel. Rec. .... *
4920, 4921, 4922 (Ch. 24TM10, 3TM10, 6S10) Tel. Rec. .... *
4935 (Ch. 23TC10) Tel. Rec. .... *
4939TV, 4940TV, 4941TV (Ch. 24TV9, 3TV9) Tel. Rec. (See Model 4900TV) 64
4942 (Ch. 23TC10) Tel. Rec. .... *

SPARTON—Cont.

4944, 4945 (Ch. 3TB10, 24TB10) Tel. Rec. ...... 86—10
4951, 4952 (See Model 4900TV 64
4954 (Ch. 23TC10) Tel. Rec. .... *
4960 (Ch. 23TC10) Tel. Rec. .... *
4964, 4965 (Ch. 23TB10, 3TB10) Tel. Rec. 93A-14
4970, 4971 (Ch. 8S10) (See Model 141A) 92
5002, 5003 (Ch. 23TD10) Tel. Rec. .... 102—13
5006, 5007 (Ch. 23TD10) Tel. Rec. (See Model 5002) 102
5010, 5011 (Ch. 19TS10, A) Tel. Rec. .... 104—11
5014, 5015 (Ch. 19TS10, A) Tel. Rec. (See Model 5010) 104
5025, 5026 Tel. Rec. ..... *
5029, 5030 Tel. Rec. ..... *
5035, 5036, 5037 Tel. Rec. .... *
5052 (Ch. 24TR10, 3TR10) Tel. Rec. 97A-13
5056, 5057 (Ch. 19TS10, A) Tel. Rec. (See Model 5010) 104
5064, 5065 (Ch. 23TB10 and 3TB10) Tel. Rec. (See Model 4964) 93A
5068, 5069 (Ch. 24TV9C) Tel. Rec. (See Model 4900TV) 64
5071, 5072 (Ch. 19TS10, A) Tel. Rec. (See Model 5010) 104
5076, 5076BB, 5077, 5077BB Tel. Rec. .... *
5079, 5080 Tel. Rec. ..... *
5082, 5083 Tel. Rec. ..... *
5088, 5089 Tel. Rec. ..... *
Ch. PC-5-6-26 (See Model 6AW26PA). 37
Ch. 3TB10 (See Model 4944) 86
Ch. 3TR10 (See Model 5052) 97A
Ch. 3TV9, 3TV9C (See Model 4900TV) ... 64
Ch. 4E10 (See Model 150) 91
Ch. 5A7 (See Model 100). 38
Ch. 5-06 (See Model 5AW06) 4
Ch. 5A10 (See Model 130) 94
Ch. 5-16 (See Model 5A116) 30
Ch. 5-26PS (See Model 5AM26PS). 5
Ch. 6B9 (See Model 1051) 58
Ch. 6L8 (See Model 1030) 37
Ch. 6-06 (See Model 6AM06) 34
Ch. 7L7 (See Model 1010) 35
Ch. 7-46 (See Model 7AM46) 1
Ch. 8L9 (See Model 121). 57
Ch. 8L10 (See Model 141A) 92
Ch. 8S10 (See Model 141A) 92
Ch. 8-46 (See Model 8AM46) 1
Ch. 8-57 (See Model 1005) 29
Ch. 9L8 (See Model 1035) 62
Ch. 9L8A (See Model 4900TV) 64
Ch. 10-76PA (See Model 10BW76PA) 15
Ch. 12L7 (See Model 1000) 60
Ch. 19TS10, 19TS10A (See Model 5010) 104
Ch. 23TB10 (See Model 4964) 93A
Ch. 23TC10 (See Models 4935, 4942, 4954, 4960) .... *
Ch. 23TD10 (See Model 5002) 102
Ch. 24TB10 (See Model 4944) 86
Ch. 24TR10 (See Model 5052) 97A
Ch. 24TV9, 24TV9C (See Model 4900TV) ... 64
Ch. 417 (See Model 48W17) 50
Ch. 417A (See Model 48W17A) .. 49
Ch. 666A (See Model 6-66A) 51

SPIEGEL (See Aircastle)

STARK

410 .... 40—22
1010 .... 88—2
1020 .... 89—5

STARRETT

Gotham Tel. Rec. .... 101—12
Henry Hudson, Henry Parks Tel. Rec. .... 92—7
John Hancock Tel. Rec. .... 96—10
Nathan Hale Tel. Rec. .... 87—12
Robert E. Lee Tel. Rec. (See Model Henry Hudson 92

TRUETONE—Cont.

D2027A .... 97—18
D2050A Tel. Rec........ *
D2603 (Factory No. 461) . 13—33
D2604 .... 13—34
D2605 (Factory Model 2AW2) .... 9—34
D2606 .... 65—15
D2612 (Code SW-9022-G) 3—9
D2613 .... 13—37
D2615 (Factory Model 6D110) .... 2—18
D2616 (Factory Model 6D117) .... 10—32
D2616-B .... 31—32
D2619 (Factory No. 2701) 27—29
D2620 .... 1—28
D2621 .... 4—32
D2622 .... 14—30
D2623 .... 11—29
D2624 (Factory 27D14-600) 2—6
D2626 (Fact. No. 457-2).. 52—22
D2630 (Factory 27D14-602 Issue A) ... 1—10
D2634 .... 12—31
D2640 (Factory No. 459) . 43—21
D2642 .... 12—32
D2644 (Factory No. 101C) 11—30
D2645 .... 4—39
D2661 (Factory 4B19) .... 2—23
D2663 (Ch. 4C1) .... 11—31
D2665 (Factory 4B114 Series A) .... 22—31
D2692 .... 39—28
D2709 (Factory No. 470) . 27—30
D2710 (Factory No. 24D22-630BR) .... 23—31
D2718 (Factory No. 227D14-638IU) .... 23—32
D2743 .... 25—29
D2745 (See Model D1645) 6
D2748 (Ch. 7156) ...... 26—27
D2806, D2807 (Factory Model 181) .... 44—26
D2810 (Factory No. 24D24-730BB) .... 36—27
D2815 .... 48—25
D2819 (Factory No. 26A82-738) .... 35—24
D2851 .... 38—28
D2906 (Factory No. 189).. 69—14
D2910 .... 65—16
D2919 (Fact. No. 6DF21). 59—22
D2963 .... 73—13
D2982 Tel. Rec.......... *
D2983 Tel. Rec.......... 68—18
D2985 Tel. Rec.......... 70—11
D2987 (See Model 1990) Tel. Rec. 69
D2988, D2989 Tel. Rec.... *
D2990 Tel. Rec.......... *
D3615 (Factory 25B02-606) 18—32
D3619 (Factory 5P110) ... 10—33
D3630, D3630N .... 19—33
D3720 .... 24—29
D3721 (Factory 1108X) .. 32—28
D3722 (Fact. No. 472).. 51—24
D3809 (Factory No. 178) . 43—22
D3810 .... 39—27
D3811 (Fact. No. 114BXH) .... 47—24
D3840 .... 49—26
D3910 (Fact. Model 140611) .... 74—10
D4620 (Factory No. 5C12) 26—28
D4630 (Factory 26C19-61) 7—28
D4818 (Fact. No. 134DX) 45—26
D4832 (Fact. No. 25C22-82) .... 47—25
D4842 (Fact. No. 26C21-81) .... 50—21
2D1088A Tel. Rec. .....105—11
2D1088B Tel. Rec......... *
2D1089A Tel. Rec........113—10
2D1089B Tel. Rec......... *
2D1093A, 2D1094A Tel. Rec. ....119—12
2D1094A Tel. Rec........ *
2D2053 Tel. Rec........120—11

ULTRADYNE

L-46 .... 4—21

UNITED MOTORS SERVICE (See Delco or Buick, Chevrolet, Oldsmobile and Pontiac)

U. S. TELEVISION

C-12923P Tel. Rec....... *
C16030 Tel. Rec......... 99A-12
C19031 Tel. Rec. (See Model C16030).... 99A
CFM-12823P Tel. Rec...... *
CFM-15925 Tel. Rec....... *
CFM-16926 Tel. Rec....... *
K-25936 Tel. Rec......... *
K-30936 Tel. Rec......... *
KFM-25-PIC Tel. Rec...... *
KFM-25836 Tel. Rec....... *
KFM-30836 Tel. Rec....... *
KRF-15933 Tel. Rec....... *
KRV-12831P Tel. Rec...... *
KRV-15831P Tel. Rec...... *
T-3X4836 Tel. Rec........ *
T502M, T502P Tel. Rec.... *
T-507, T-507M Tel. Rec... *
T-525L Tel. Rec.......... *
T621M, T621P Tel. Rec.... *
T-10823 Tel. Rec....... 89—15

U. S. TELEVISION—Cont.

T-10925 Tel. Rec......... *
T-12823 Tel. Rec......... *
T-12923P Tel. Rec........ *
T-15823 Tel. Rec......... *
T-15925 Tel. Rec......... *
T16030 Tel. Rec. (See Model C16030)... 99A
T19031 Tel. Rec. (See Model C16030)... 99A
5A16, 5B16, 5C16 (See Model 5C66 Early). 17
5A66, 5B66, 5C66, 5D66MPA .... 24—30
5C66 Early .... 17—9
8-16M (Dumbarton) ..... 26—29

UNITONE

88 .... 5—26

V-M

1001-A .... 10—34

VAN-CAMP

576-1-6A .... 7—29

VIDEO CORP. OF AMERICA (See Videola)

VIDEODYNE

10FM, 10TV, 12FM, 12TV Tel. Rec. .... 69—15

VIDEOLA

VS-160, VS-161 Tel. Rec.. 92—9
VS-165, VS-166, VS-167, VS-168 Tel. Rec. (See Model VS-160).... 92

VIEWTONE

RC-201A, RRC-201 ...... 11—32

VIZ

RS-1 .... 14—31

VOGUE

532 A-P .... 11—33
Ch. Models 553R, 554R .. 8—32

WARWICK (See Clarion)

WATTERSON

ARC-4591A .... 16—36
PA-4585, APA-4587 ..... 3—2
RC-4581 .... 16—35
4581 .... 3—32
4582 .... 6—34
4782 .... 24—31
4790 .... 16—34
4800 .... 43—23

WEBSTER-CHICAGO

66-1A .... 34—26
100-621 ....113—11
130 ....119—13
161-1 .... 55—23
288 ....117—14
362 ....105—12
760 ....112—12
762 (See Model 362)....105

WEBSTER (Telohome)

W606M .... 56—24
604M .... 57—23

WESTERN AUTO (See Truetone)

WESTINGHOUSE

H-104, H-105 .... 4—11
H-104A, H-105A, H-107A, H-108A .... 21—36
H-107, H-108, H-110, H-111 .... 4—19
H-113, H-114, H-116 (See Model H-117)..... 11
H-117, H-119 .... 11—34
H-122 .... 6—35
H-122A, H-122B (See Model H-122)..... 6
H-125, H-126 .... 3—19
H-130 (See Model H-122) . 6
H-133 .... 14—34
H-137 (See Model H-138). 6
H-138 .... 6—36
H-147 .... 31—33
H-148 .... 15—37
H-148A (See Model H-148) 15
H-153, H-153A (Ch. V-2103) .... 35—25
H-154 (See Model H-104A) 21
H-155 (See Model H-153). 35
H-156 (See Model H-153) 35
H-157 (Ch. V-2122) ..... 33—31
H-161 (Ch. V-2118) ..... 34—27
H-162 (See Model H-117). 11
H-164 (Ch. V-2119-1) ... 36—28
H-165 .... 32—29
H-166, H-167 (See Model H-164)..... 36
H-168, H-168A, H-168B (Ch. V-2118) (See Model H-161) 34
H-169 (Ch. V-2124-1) ... 37—24
H-171, H-171A, H-171C (Ch. V-2103) (See Model H-153) 35
H-178 (Ch. V-2123) ..... 35—26
H-181 Tel. Rec.......... *
H-182 (Ch. V-2128), (Ch. V-2128-1) .... 53—25

WESTINGHOUSE—Cont.

H-183, H-183A .... 48—26
H-184 (See Model H-153) 35
H-185 (Ch. V-2131, V-2131-1) .... 54—20
H-186M, H-187 (Ch. V-2132) .... 60—21
H-188 (Ch. V-2133)...... 51—25
H-190, H-191, H-191A (Ch. V-2134) .... 59—23
H-195 (See Model H-184). 54
H-196 Tel. Rec.......... 65—17
H-196A (CHV-2130-1) Tel. Rec. (See Model H-196) 65
H196A (DX) (Ch. V-2130-11DX or V-2130-12DX) Tel. Rec. 84—13
H-198 (Ch. V-2137-2)..... 73—15
H-199 (Ch. V-2137-1)..... 69—16
H-202 (Ch. V-2128-2)..... 50—22
H-203 (Ch. V-2137)...... 62—21
H-204 (See Model H-202). 50
H-207A (Ch. V-2130-1, V-2137) Tel. Rec. (See Model H-196)......... 65
H207A (DX) (Ch. V-2130-11DX or V-2130-12DX and Radio Ch. V-2137) Tel. Rec. (See Model H196A [DX] 84
H207B (DX) (Ch. V-2130-21DX or V-2130-22DX and Radio Ch. V-2137) Tel. Rec. (See Model H196A [DX] 84
H-210, H-211 (Ch. V-2144, V-2144-1) ... 61—20
H-212 (Ch. V-2137) (See Model H-203) 62
H-214, H-214A (Ch. V-2103-3) .... 75—16
H-216, H-216A (Ch. V-2146-05, V-2146-45, V-2149-1) Tel. Rec..... 97A-14
H-217, H-217A (Ch. V-2146-1, V-2137, V-2149) Tel. Rec...... *
H-217, H-217A (Ch. 2146-11DX, V-2137, V-2149) Tel. Rec. (Supp. to H-217B, Set 91)..... 99A-14
H-217B (Ch. V-2146-35DX, V-2137, V-2149) Tel. Rec. .... 91—14
H-220 (See Model H-190) 59
H-223 (Ch. V-2150-01, V-2150-02) Tel. Rec.... 78—14
H-225 (DX) (Ch. V-2130-31DX or V-2130-32DX) Tel. Rec. (See Model H196A [DX] 84
H-226 (Ch. 2146-21DX, 2146-25DX, 2149) Tel. Rec. (See Model H-217B) 91
H-231 (Ch. 2150-51 and V-2137-3 or V-2137-3S, V-2149-2) Tel. Rec. 99A-14
H-242 (Ch. 2150-31) Tel. Rec. 97A-14
H-251 (Ch. V-2150-81, -82, -84) Tel. Rec...... 99A-14
H300T5, H301T5 (Ch. V-2148) .... 88—14
H-302P5 (Ch. V-2151-1).. 91—15
H303P4, H304P4 (Ch. V2153) .... 89—16
H-307T7, H-308T7 (Ch. V-2136) ....100—13
H-309P5, H-309P5U (Ch. V-2156) ....101—16
H-310T5, H-310T5U, H-311T5, H-311T5U (Ch. V-2161, V-2161U). 99—18
H-312P4, H-312P4U, H-313P4, H-313P4U, H-314P4, H-314P4U, H-315P4, H-315P4U (Ch. V-2153-1) .... 98—13
H-316C7 (Ch. V-2136-1). 112—13
H-317C7 (Ch. V-2136-1) (See Model H316C7)...112
H-318T5, U (Ch. V-2157, U)........117—15
H-320T5, U (Ch. V-2157, U) (See Model H-318T5) 117
H-321T5, U, H-322T5, U (Ch. V-2157-1, U) (See Model H-318T5)..117
H-323T5, U (Ch. V-2157-2, U) (See Model H-318T5) 117
H-324T7, H-325T7, U (Ch. V-2136-2) ....113—13
H-600T16 (Ch. V-2150-61, A, B) Tel. Rec......... 98—14
H-601K12, H-602K12 (Ch. V-2150-41) Tel. Rec. (See Model H-600T16).. 98
H-603C12 (Ch. V-2152-01 & V-2149-3) Tel. Rec...100—14
H-604T10, H-604T10A (Ch. V-2150-91A, -94, -94A) Tel. Rec. (Supp. to H-609T10, Set 95)..... 99A-14

WESTINGHOUSE—Cont.

H-605T12 (Ch. V-2150-101) Tel. Rec... 97—19
H-606K12 (Ch. V-2150-111, A) Tel. Rec......120—12
H-607K12 (Ch. V-2150-111, A) Tel. Rec. (See Model 606K12)...120
H-608C12 (Ch. V-2152-01, V-2149-3) Tel. Rec. (See Model H-603C12)..100
H-609T10 (Ch. V-2150-94C) Tel. Rec... 95—7
H-610T12 (Ch. V-2150-136] Tel. Rec.........105—13
H-611C12 (Ch. V-2152-16) Tel. Rec. ....112—14
H-613K16 (Ch. V-2150-146] Tel. Rec.........107—12
H-614T12 (Ch. V-2150-136] Tel. Rec. (See Model H610T12)..105
H-615C12 (Ch. V-2152-16) Tel. Rec. (See Model H-611C12) 112
H-617T12 (Ch. V-2150-176) Tel. Rec. ....103—17
H-617T12 (Ch. V-2150-176, U, V-2150-177U) Tel. Rec. Prod. Chge. Bul. 10 ....116—1
H-618T16 (Ch. V-2150-186) Tel. Rec. (See Model H-617T12)..103
H-618T16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10...116
H-619T12,U (Ch. V-2150-176,U) Tel. Rec. (See Model H-617T12).103
H-619T12 (Ch. V-2150-176, U, V-2150-177U) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10...116
H-620K16 (Ch. V-2150-186) Tel. Rec. (See Model H-617T12)..103
H-620K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10...116
H-622K16 (Ch. V-2150-186,A,C,CA) Tel. Rec. (See Model H-617T12)..103
H-622K16 (Ch. V-2150-186, A, C, CA) Tel. Rec. (See Model H-617T12) Prod. Chge. Bul. 10...116
H-625T12 (Ch. V-2150-197) Tel. Rec...114—11
H-626T16 (Ch. V-2172) Tel. Rec. ....116—13
H-627K17 (Ch. V-2171) Tel. Rec. (See Model 626T16)...116
H-628K16, H-629K-16 (Ch. V-2171) Tel. Rec. (See Model H-626T16).116
H-630T14 (Ch. V-2176) Tel. Rec. (See Model H-626T16).116
H-633C17, H-634C17 (Ch. V-2173) Tel. Rec...... *
H-636T17 (Ch. V-2175) Tel. Rec. (See Model H-626T16).116
H-637T14 (Ch. V-2177) Tel. Rec. (See Model H-626T16).116
H-638K20 (Ch. V-2178) Tel. Rec. .... *
H-1251 (See Models H-125, H-126) 3
Ch. V-2102 (See Model H-104).... 4
Ch. V-2102-1 (See Model H-138).... 6
Ch. V-2103 (See Model H-153).... 35
Chassis V-2103-3 (See Model H-214).... 75
Ch. V-2107 (See Model H-133).... 14
Ch. V-2118 (See Model H-161).... 33
Ch. V-2119-1 (See Model H-164).... 36
Ch. V-2120 (See Model H-165).... 32
Ch. V-2122 (See Model H-157).... 33
Ch. V-2123 (See Model H-178).... 35
Ch. V-2124-1 (See Model H-169).... 37
Ch. V-2128, V-2128-1 (See Model H-182).... 53
Ch. V-2128-2 (See Model H-202).... 50
Chassis V-2130-1 (See Model H-196).... 65
Ch. V-2130-11DX, V-2130-12DX (See Model H196A [DX])... 84

WESTINGHOUSE—Cont.

Ch. V-2130-21DX, V-2130-22DX (See Model H196A [DX])... 84
Ch. V-2130-31DX, V-2130-32DX (See Model H196A [DX])... 84
Ch. V-2131, V-2131-1 (See Model H-185).... 54
Ch. V-2132 (See Model H-186M)... 60
Ch. V-2133 (See Model H-188).... 51
Ch. V-2134 (See Model H-190).... 59
Ch. V-2136 (See Model H-307T7) 100
Ch. V-2136-1 (See Model H-316C7)..112
Ch. V-2136-2 (See Model H-324T7)..213
Ch. V-2137 (See Model H-203).... 62
Ch. V-2137-1 (See Model H-199).... 69
Chassis V-2137-2 (See Model H-198).... 73
Ch. V-2137-3, V-2137-3S (See Model H-231) 97A
Ch. V-2144, V-2144-1 (See Model H-210).... 61
Ch. V-2146-05 (See Model H-216) 97A
Ch. V-2146-11DX (See Model H-217) 99A
Ch. V-2146-21DX, V-2146-25DX (See Model H-217B).... 91
Ch. V-2146-35DX (See Model H-217B).... 91
Ch. V-2146-45 (See Model H-216)..... 97A
Ch. V-2148 (See Model H300T5)... 88
Ch. V-2149 (See Model H-217B).... 91
Ch. V-2149-1 (See Model H-216)..... 97A
Ch. V-2149-3 (See Model H-603C12).100
Ch. V-2150-01, V-2150-02 (See Model H-223).... 78
Ch. V-2150-11 (See Model H-606K12). *
Ch. V-2150-31 (See Model H-242).... 97A
Ch. V-2150-41 (See Model H-600T16).. 98
Ch. V-2150-51 (See Model H-231) 99A
Ch. V-2150-61, A, B (See Model H-600T16). 98
Ch. V-2150-81, -82, -84 (See Model H251)..... 99A
Ch. V-2150-91A (See Model H-604T10).. 99A
Ch. V-2150-94 (See Model H-604T10, A)... 99A
Ch. V-2150-94C (See Model H-609T10) ..... *
Ch. V-2150-101 (See Model H-605T12) 97
Ch. V-2150-111, A (See Model H-606K12).120
Ch. V-2150-136 (See Model H-610T12)..105
Ch. V-2150-146 (See Model H-613K16)......107
Ch. V-2150-176,U (See Model H-617T12)..103
Ch. V-2150-177U (See Model H-617T12, Set 103 and Prod. Chge. Bul. 10, Set 116)
Ch. V-2150-186, A, C, CA (See Model H-617T12).103
Ch. V-2150-197 (See Model H-625T12)..114
Ch. V-2151-1 (See Model H-302P5)... 91
Ch. V-2152-01 (See Model H603C12) 100
Ch. V-2152-16 (See Model H-611C12).112
Ch. V-2153 (See Model H303P4)... 89
Ch. V-2153-1 (See Model H-312P4) 98
Ch. V-2156 (See Model H-309P5)..101
Ch. V-2157, U, -1, -1U, -2, -2U (See Model H-318T5) 117
Ch. V-2158-1A (See Model H-626T16)...... *
Ch. V-2161, V-2161U (See Model H-310T5)... 99
Ch. V-2162-3, -6 (See Model H-626T16)...... *
Ch. V-2171 (See Model H-626T16)..116
Ch. V-2173 (See Model H-633C17). *
Ch. V-2175, V-2176, V-2177 (See Model H-626T16) 116
Ch. V-2178 (See Model H-638K20). *

WILCOX-GAY
(Also See Recordio)
G403, G404 Tel. Rec. (See Majestic Model 12T2)..108
OD-446M (OD Series) Tel. Rec. ....101—17
OF439-1-C (Ch. OF Series) Tel. Rec. ....98—15
OD Series (See Model OD-446M)..101
OL Series Tel. Rec........ *
9D Series Tel. Rec....... *
9W Series Tel. Rec....... *

WILLYS-OVERLAND
8030 .... 50—23

WILMAK
W-446 "DENchum" ..... 21—11

WOOLAROC
3-1A (Ch. 6-9022-J), 3-2A (Ch. 6-9022-K) .. 6—37
3-3A (Code 7-9003-D) ... 6—38
3-5A .... 22—32
3-6A/5 .... 24—32
3-9A, 3-10A .... 7—30
3-11A (Ch. 56A76) ...... 8—33
3-12A/3 .... 23—33
3-13A, 3-14A, 3-15A, 3-16A .... 34—28
3-17A, 3-18A .... 34—29
3-20A .... 24—33
3-29A .... 7—31
3-61A (See Model 3-71A) 36
3-70A .... 31—34
3-71A .... 36—29

ZENITH
G500 (Ch. 5G40)........ 83—16
G503 (Ch. 5G41)........ 99—19
G510, G510Y (Ch. 5G02). 84—14
G511, G511W, G511Y (Ch. 5G01) .... 85—14
G516 (Ch. 5G03).......109—15
G615, G615W, G615Y (Ch. 6G05) .... 86—14
G660, G663, G665 (Ch. 6G01) .... 96—12
G723 (Ch. 7G04).......104—13
G724 (Ch. 7G02).......103—18
G725 (Ch. 7G01).......101—18
G881, G882, G883, G884, G885 (Ch. 8G20)...... 98—16
G-2322 (Ch. 23G22) Tel. Rec. .... 98—17
G2322Z (Ch. 23G24) Tel. Rec. 91A-13
G-2322Z1 (Ch. 23G24Z1) Tel. Rec. .... *
G2327Z (Ch. 23G24) Tel. Rec. (See Model G2322Z)... 91A
G-2340, R (Ch. 23G22) Tel. Rec. (See Model G2322) 98
G2340RZ, Z (Ch. 23G24) Tel. Rec. (See Model G2322Z)... 91A
G2340Z1, RZ1 (Ch. 23G24Z1) Tel. Rec..... *
G2346R (Ch. 23G22) Tel. Rec. (See Model G2322) 98
G2346RZ (Ch. 23G24) Tel. Rec. .... *
G2350RZ, Z (Ch. 23G24) Tel. Rec. (See Model G2322Z)... 91A
G2353E (Ch. 23G22) Tel. Rec. (See Model G2322) 98
G2353EZ (Ch. 23G24) Tel. Rec. (See Model G2322Z)... 91A
G2353EZ1 (Ch. 23G24Z1) Tel. Rec. .... *
G2356EZ (Ch. 23G24) Tel. Rec. (See Model G2322Z)... 91A
G2420E (Ch. 24G20) Tel. Rec. .... 93—11
G2420-EOX (Ch. 24G20-OX) Tel. Rec. (See Model G2420E)... 93
G2420R (Ch. 24G20) Tel. Rec. (See Model G2420E)... 93

ZENITH—Cont.
G2420-ROX (Ch. 24G20-OX) Tel. Rec. (See Model G2420E)... 93
G2437RZ, G2438RZ, Z, G2439RZ (Ch. 24G26).. 91A-12
G2441 (Ch. 24G24) Tel. Rec. (See Model G2322) 98
G2441R (Ch. 24G22/23) Tel. Rec. (See Model G2322).... 98
G2441RZ, Z (Ch. 24G26) Tel. Rec. (See Model G2437RZ).. 91A
G2441Z1, RZ1 (Ch. 24G26Z1) Tel. Rec.... *
G2442E, R (Ch. 24G22/23) Tel. Rec. (See Model G2322) 98
G2442RZ (Ch. 24G26) Tel. Rec. (See Model G2437RZ).. 91A
G2442EZ1, RZ1 (Ch. 24G26Z1) Tel. Rec.... *
G2448R (Ch. 24G22/23) Tel. Rec. (See Model G2322) 98
G2448RZ (Ch. 24G26) Tel. Rec. (See Model G2437RZ).. 91A
G2448RZ1 (Ch. 24G26Z1) Tel. Rec. .... *
G2454R (Ch. 24G21) Tel. Rec. (See Model G2420E)... 93
G-2454-ROX (Ch. 24G21-OX) Tel. Rec. (See Model G2420E)... 93
G2951, G2951R, G2952R, G2952-ROX (Ch. 29G20) Tel. Rec. .... 95—8
G2957R (Ch. 23G23 & Radio Ch. 666201) Tel. Rec. (See Model G2322) 98
G2958R (Ch. 23G23 & Radio Ch. 66201) Tel. Rec. (See Model G2322) 98
G3059R (Ch. 24G24/25 & Radio Ch. 6G20) Tel. Rec. (See Model G2322) 98
G3062 (Ch. 24G24/25 & Radio Ch. 6G20) Tel. Rec. (See Model G2322) 98
G3062Z (Ch. 24G26) Tel. Rec. .... *
G3157RZ, Z (Ch. 23G24, 8G20/22) Tel. Rec..... 91A-13
G3157Z1, RZ1 (Ch. 23G24Z1) Tel. Rec. *
G3158RZ (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ).. 91A
G3158RZ1 (Ch. 23G24Z1) Tel. Rec. .... *
G3173RZ, Z (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ).. 91A
G3174RZ (Ch. 23G24, 8G20/22) Tel. Rec. (See Model G3157RZ).. 91A
G3259RZ (Ch. 24G26, 8G20/22) Tel. Rec....91A-12, 13
G3259RZ1 (Ch. 24G26Z1) Tel. Rec. .... *
G3262Z (Ch. 24G26, 8G20/22) Tel. Rec. (See Model G3259RZ).. 91A
G3262Z1 (Ch. 24G26Z1) Tel. Rec. .... *
G3275RZ (Ch. 24G26, 8G20/22) Tel. Rec. (See Model G3259RZ).. 91A
G3276Z (Ch. 24G26, 8G20/22) Tel. Rec. (See Model G3259RZ).. 91A
H615 (Ch. 6G05) (See Model G615)..... 86
H880RZ (Ch. 8H20)......114—12
H-1083E (Ch. 10H20) (See Model H2437E)...120
H1086R, H1087R (Ch. 10H20) (See Model H2437E) 120
H2226R, H2227E, H2227R (Ch. 22H20) Tel. Rec....114—13
H2250R, H2255E (Ch. 22H20) Tel. Rec. (See Model H2226R)...114

ZENITH—Cont.
H2328EZ, RZ (Ch. 23H22Z) Tel. Rec. ....118—11
H2352RZ, H2353EZ (Ch. 23H22Z) Tel. Rec. (See Model H2328EZ) 118
H2437E, R, H2438R, H2439R (Ch. 24H20) Tel. Rec. ....120—13
H2445R (Ch. 24H21) Tel. Rec. (See Model H2437E) 120
H2447R (Ch. 24H21) Tel. Rec. (See Model H2437E) 120
H2449E (Ch. 24H20) Tel. Rec. (See Model 112437E) 120
H3267R (Ch. 24H20 and Radio Ch. 8H20) Tel. Rec. [See Model H2437E (Set 120) and Model H880RZ (Set 114)]
H3467R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120
H3475R (Ch. 24H20 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120
H3477R (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120
H3478E (Ch. 24H21 and Radio Ch. 10H20) Tel. Rec. (See Model H2437E) 120
4G800 (Ch. 4E41) .... 35—27
4G800WZ, 4G800YZ, 4G800Z (Ch. 4E41Z)..... 52—23
4G903, 4G903Y (Ch. 4F40) .... 76—20
4K016 (Ch. 4C52) .... 6—39
4K035 (Ch. 4C53) .... 6—40
5D011, 5D027 (Ch. 5C01, 5C01Z) .... 3—17
5D810 (Ch. 5E02) .... 54—21
5G003 (Ch. 5C40) .... 17—35
5G003Z (Ch. 5C40Z), 5G003ZZ (Ch. 5C40ZZ) 30—31
5G036 (Ch. 5C51) .... 30—32
5R080-5R086 (Ch. 5C02, 5C04) ...... 4—4
6D014, 6D014W, 6D029, 6D029G (Ch. 6C01) ... 9—35
6D015, 6D015Y, 6D030 (Ch. 6C05, 6C05Z) .... 3—24
6D815, 6D815W, 6D815Y (Ch. 6E05) .... 55—24
6G001, 6G001Y (Ch. 6C40) .... 3—14
6G001YZ1 (See Model 6G001) 3
6G004Y (Ch. 6C41) ..... 20—35
6G038 (Ch. 6C50) ...... 32—30
6G801 (Ch. 6E40)....... 53—26
6R060 .... *
6R084 (Ch. 6C21) ...... 20—36
6R087 (Ch. 6C22) ...... 7—32
6R886 (Ch. 6E02) ...... 34—30
7H820, 7H820W (Ch. 7E01) .... 43—24
7H822 (Ch. 7E02), 7H822WZ, 7H822Z (Ch. 7E02Z) .... 55—25
7H918 (Chassis 7F03).... 75—18
7H920, 7H920W (Ch. 7F01) .... 77—13
7H921 (Chassis 7F04).... 73—16
7H922 (Ch. 7F02)....... 87—15
7R070 (Ch. 6C06) ...... 37—25
7R887 (Ch. 7E22)....... 54—22
8G005Y (Ch. 8C40) ..... 7—33
8G005YT (Z1) (Ch. 8C40T) (Z1), 8G005YT) (Z2) (Ch. 8C40T) (Z2)...... 53—27
8H023 (Ch. 8C01)...... 4—40
8H032, 8H033 (Ch. 8C20) .... 1—33
8H034 (See Model 8H023) 4
8H050, 8H051, 8H052, 8H061 (See Model 8H032) 1
8H832, 8H861 (Ch. 8E20) 52—24
9H079, 9H079E, 9H079R, 9H081, 9H082R, 9H085R, 9H088R (Ch. 8C21).... 7—34

ZENITH—Cont.
9H881, 9H882R, 9H885, 9H888R (Ch. 9E21) ... 43—25
9H984, 9H984LP (Ch. 9F22) .... 64—14
9H995 (Chassis 9E21Z)... 74—12
12H090, 12H091, 12H092, 12H093, 12H094 (CH. 11C21) .... 2—20
14H789 (Ch. 13D22) .... 41—24
27T965R (Ch. 27F20) Tel. Rec. (See Model G2951) 95
28T925 (Chassis 28F22) Tel. Rec. .... 64—15
28T926E, 28T926R (Chassis 28F25) Tel. Rec. (See Model 28T925) 64
28T960, 28T961, 28T962, 28T963 (Ch. 28F20, 28F20Z, 28F21) Tel. Rec. (See Model 28T925)........ 64
28T964R (Chassis 28F23) Tel. Rec. .... 74—13
29T926R, E (Ch. 28F25) Tel. Rec. (See Model 28T925) 64
37T996 RLP (Ch. 28F23, 9E21Z) Tel. Rec. (See Models 42T999RLP and 9H995). 74
37T998 RLPU (Chassis 28F20, 9E21Z) Tel. Rec. [See Model 28T925 (Set 64) and Model 9H995 (Set 74)]
42T999RLP (Chassis 28F23, Radio Ch. 13D22) Tel. Rec. See Model 28T964R) 74
Ch. 4C52 (See Model 4K016).... 6
Ch. 4C53 (See Model 4K035).... 6
Ch. 4E41 (See Model 4G800).... 35
Ch. 4E41Z (See Model 4G800Z).... 52
Ch. 4F40 (See Model 4G903) 76
Ch. 5C01, 5C01Z (See Model 5D011).... 3
Ch. 5C02, 5C02Z (See Model 5R080).... 4
Ch. 5C04 (See Model 5R080).... 4
Ch. 5C40 (See Model 5G003).... 17
Ch. 5C40Z, 5C40ZZ (See Model 5G003Z).... 30
Ch. 5C51 (See Model 5G036).... 30
Ch. 5E02 (See Model 5D810).... 54
Ch. 5G01 (See Model G511) 85
Ch. 5G02 (See Model G510) 84
Ch. 5G03 (See Model G516).........109
Ch. 5G40 (See Model G500) 83
Ch. 5G41 (See Model G503).... 99
Ch. 6C01 (See Model 6D014).... 9
Ch. 6C05, 6C05Z (See Model 6D105).... 3
Ch. 6C06 (See Model 7R070).... 37
Ch. 6C21 (See Model 6R084).... 20
Ch. 6C22 (See Model 6R087).... 7
Ch. 6C40 (See Model 6G001).... 3
Ch. 6C41 (See Model 6G004Y).... 20
Ch. 6C50 (See Model 6G038).... 32
Ch. 6E02 (See Model 6R886).... 34
Ch. 6E05 (See Model 6D815).... 55
Ch. 6E40 (See Model 6G801).... 53
Ch. 6G01 (See Model G660).... 96

ZENITH—Cont.
Ch. 6G05 (See Model G615).... 86
Ch. 6G20 (See Model G2957).... 98
Ch. 7E01 (See Model 7H820).... 43
Ch. 7E02, 7E02Z (See Model 7H822).... 55
Ch. 7E22 (See Model 7R887).... 54
Ch. 7F01 (See Model 7H920) 77
Ch. 7F02 (See Model 7H922).... 87
Chassis 7F03 (See Model 7H918).... 75
Chassis 7F04 (See Model 7H921).... 73
Ch. 7G01 (See Model G725).....101
Ch. 7G02 (See Model G724).....103
Ch. 7G04 (See Model G723).....104
Ch. 8C01 (See Model 8H023).... 4
Ch. 8C20 (See Model 8H032).... 1
Ch. 8C21 (See Model 9H079).... 7
Ch. 8C40 (See Model 8G005Y).... 7
Ch. 8C40T(Z1), 8C40T(Z2) (See Model 8G005YT(Z1) 53
Ch. 8E20 (See Model 8H832).... 52
Ch. 8G20 (See Model G881)..... 98
Ch. 8G20/22 (See Model G3157RZ) 91A
Ch. 8H20 (See Model H880RZ) 114
Ch. 9E21 (See Model 9H881).... 43
Chassis 9E21Z (See Model 9H995).... 74
Ch. 9F22 (See Model 9H984).... 64
Ch. 10H20 (See Model H2437E)....120
Ch. 11C21 (See Model 12H090).... 2
Ch. 13D22 (See Model 14H789).... 41
Ch. 22H20 (See Model H2226R) 114
Ch. 23G22 (See Model G2322) Tel. Rec....... 98
Ch. 23G23 (See Model G2957) 98
Ch. 23G24 (See Model G2322Z) 91A
Ch. 23G24Z1 (See Model G2322Z1). *
Ch. 23H22Z (See Model H2328EZ)..118
Ch. 24G20 (See Model G2420E) 93
Ch. 24G20-OX (See Model G2420E) 93
Ch. 24G21 (See Model G2454R) 93
Ch. 24G21-OX (See Model G2454-ROX) 93
Ch. 24G22/23 (See Model G2441R).... 98
Ch. 24G24 (See Model G2441).... 98
Ch. 24G24/25 (See Model 3059R)..... 98
Ch. 24G26 (See Model G2437RZ).. 91A
Ch. 24G26Z1 (See Model G2441Z1). *
Ch. 24H20, 24H21 (See Model H2437E)....120
Ch. 27F20 (See Model 27T965R).... 95
Ch. 28F20, 28F20Z, 28F21, 28F22 (See Model 28T925) 64
Ch. 28F23 (See Model 28T964R).. 74
Ch. 28F25 (See Model 28T925).... 64
Ch. 29G20 (See Model G2951).... 95

ADDITIONAL BENEFITS FROM PHOTOFACTS

From time to time, PHOTOFACT Folder Sets include valuable "bonus" materials, as well as useful data of a special nature. The following useful materials are extra benefits available in the Sets indicated at no additional cost.

	Set No.
1—RMA Production Source Code (July 1, 1946)	5
2—RMA Production Source Code (Jan. 1, 1949)	70
3—RMA Production Source Code (Revisions as of July 1, 1949)	92
4—TRADE DIRECTORY—Parts Manufacturers	12
5—National Electrical Code on Antennas	88
6—Record Changer Cross Reference by Manufacturer and Model	118
7—Mica Capacitor Color Codes	48
8—Ion Trap Alignment	62
9—"Let's Look at the Sync Pulses"	64
10—Replacement of Disc & Plate Type Ceramic Capacitors	68
11—Certificate entitling subscriber to PHOTOFACT Volume Labels for Vols. 1-10	62
12—Certificate entitling subscriber to PHOTOFACT Volume Labels for Vols. 11-20	102
13—Certificate entitling subscriber to 100 Door Knob Hangers	80
14—Photofact Television Course appearing serially in	38-51, 54
15—CR Tube Dimension Chart	112
16—CR (Electromagnetic) Tube Characteristics Chart	112
17—CR Tube Interchangeability Chart	112

See next page for Photofact Folder Sets covering Record Changers and Recorders.

RECORD CHANGERS

(CM-1) indicates service data *also* available in Howard W. Sams 1947 Record Changer Manual. (CM-2) indicates service data available in Howard W. Sams 1948 Record Changer Manual. (CM-3) indicates service data available in Howard W. Sams 1949, 1950 Record Changer Manual.

ADMIRAL
RC-150 ....(CM-1) 26—31
RC-160, RC-160A, RC-161, RC-161A (Supplement to RC-200) ....(CM-1) 21—37
RC-170, RC-170A..(CM-1) 31—2
RC-180, RC-181 ..(CM-2) 76—1
RC-182 Supplement (CM-2) 76—2
RC-200 ....(CM-1) 9
RC210, RC211, RC212 (CM-3) 72—1
RC-221, RC-222 ...(CM-3) 79—1
RC220, RC221, RC222 Changes ......(CM-3) 108—2
RC320, RC321, RC322 (See Model RC220 Changes) .....(CM-3) 108
RC400 ....104—1

AERO
46A ....(CM-1) 19—34
47A ....(CM-2) 77—2

AVIOLA
100 ....(CM-1) 33—32

BELMONT
C-9 ....(CM-2) 34—31

CRESCENT
C-200 ....(CM-1) 20—37
6 Series ....(CM-3) 89—4
250 Series ....(CM-2) 78—5
350 Series ....(CM-2) 80—3

FARNSWORTH
P-51, P56 ....(CM-1) 13—36
P-72, P73 ....(CM-2) 75—8

GARRAD
RC-60 ....(CM-2) 81—7

GENERAL ELECTRIC
P6 ....(CM-2) 79—8

GENERAL INDUSTRIES
RC130L ....(CM-1) 22—33

GENERAL INSTRUMENT
204 ....(CM-1) 23—34
205 ....(CM-1) 10

LEAR
PC-206A ....(CM-1) 18—33

MAGUIRE
ARC-1 ....(CM-1) 7

MARKEL
70, 71 ....(CM-2) 84—8
74, 75 ....(CM-3) 91—7

MILWAUKEE ERWOOD
10700 ....(CM-1) 16—37
11200 ....(CM-2) 86—6
11600 ....(CM-3) 72—7

MOTOROLA
B24RC, B25RC, B27RC, B28RC ..(CM-1) 12—35
RC30 ....(CM-2) 80—9

OAK
6666 ....(CM-1) 19—35
9201 ....(CM-3) 111—10

PHILCO
D10, D10A ......(CM-1) 14—21
M-4 ....(CM-1) 25—30
M-7 ....(CM-1) 28—35
M-8 ....(CM-2) 83—7
M-9C ....(CM-2) 74—7
M-12C ....(CM-3) 109—9
M-20 ....(CM-3) 103—11

RCA
RP168 ....(CM-3) 72—10
RP-176 ....(CM-1) 25—31
RP-177 ....(CM-2) 44—27
RP-178 ....(CM-2) 79—12

SEEBURG
K ....(CM-1) 11—36
L ....(CM-1) 24—34
M ....(CM-1) 32—19
S, SQ ....(CM-2) 78—12

SILVERTONE
101.761-2, 101.762-2 .....(CM-2) 77—10
101.761-3, 101.762-3 .....(CM-2) 83—11
101.762, 101.763 ......(CM-2) 88—11

SPARTON
C48 ....(CM-2) 87—11

THORENS
CD-40 ....(CM-1) 39—29

TRAV-LER
A ....(CM-3) 72—13

UNIVERSAL CAMERA
100 ....(CM-1) 36—30

UTAH
550 ....(CM-1) 8
650 ....(CM-1) 22—34
7000 ....(CM-1) 27—31
7001 ....(CM-2 83—15

V-M
200-B ....(CM-1) 15—36
400 ....(CM-1) 26—33
400 (Late) ....(CM-2) 90—13
402, 400C ....(CM-2) 82—12
402D, 400D .....(CM-2) 87—14
404 (See Model 405) (CM-3) 73
405 ....(CM-3) 73—14
406, 407 ....(CM-3) 102—16
800 ....(CM-1) 21—38
800-D ....(CM-2) 84—12
802 ....(CM-3) 77—12
910 ....(CM-3) 115—14
950 ....(CM-3) 107—13

WEBSTER
50 ....(CM-1) 24—35
56 ....(CM-1) 17—36
70 ....(CM-1) 29—28
133 ....(CM-2) 82—13
148 ....(CM-2) 86—12

WEBSTER—Cont.
246 ....(CM-2) 74—11
256 ....(CM-2) 88—13
346 ....(CM-3) 100—12
356, 357 ....(CM-3) 106—16

WESTINGHOUSE
V4914 ....(CM-2) 47—26
V4944 ....(CM-2) 86—13

ZENITH
S11468 ....(CM-1) 23—35
S11680 ....(CM-1) 27—32
S14001 ....(CM-2) 75—17
S13675, S14002, S14006, S14008 (CM-2) 85—15
S14004, S14007 ..(CM-2) 79—18
S14012, S14014 (CM-3) 110—14
S14022 ....(CM-3) 112—15
S14023 ....(CM-3) 105—14
S14024, S14025 (See Model S14022) (CM-3) 112
S14026 (See Model S14023) ......(CM-3) 105
S14027 (See Model S14022) ......(CM-3) 112

MISCELLANEOUS
Series 700F ......(CM-2) 89—9
Series 700F 33/45 (CM-3) 75—11
Series 700FLP ...(CM-2) 101—6
Series 700FS ....(CM-2) 104—8
Series 700R .....(CM-2) 91—8

RECORDERS

BRUSH SOUND MIRROR
BK-401 Tape Recorder (CM-1) 42—25
BK-403 ....(CM-2) 78—3
BK-416 ....(CM-2) 81—4

BRUSH MAIL-A-VOICE
BK-501, BK-502, BK-503 ....(CM-1)

CRESCENT
H-2A1 Series ....(CM-3) 119—4

CRESCENT—Cont.
M-2000, M-3000 Series...120—4
1000 Series ......(CM-2)
1000 Series Revised (CM-3) 77—4

CRESTWOOD
CP-201 ....(CM-3) 118—4

EICOR
1000 ....(CM-3) 90—4

GENERAL INDUSTRIES
R70, R90 ....(CM-1) 35—28

INTERNATIONAL ELECTRONICS
PT3 ....(CM-2) 88—4

LEAR DYNAPORT
WC-311-D ....(CM-2) 80—8

MAGNECORD AUDIAD
AD-1R ....(CM-2) 84—7

MASCO
375 ....(CM-3) 117—7

RCA
MI-12875 ....(CM-2) 85—12

SILVERTONE
771 ....(CM-1) 26—32
101.774-2, 101.774-4 (CM-3) 114—10

ST. GEORGE
1100 Series Wire Recorder ..(CM-1) 40—24

WEBSTER-CHICAGO
79-80 Wire Recorder (CM-1) 37—26
178 ....(CM-3) 113—12

WEBSTER ELECTRIC
Ekotape ....(CM-3) 116—12

WIRE RECORDING CORP.
WP ....(CM-2) 76—19

♦ ♦ Continued from page 27 ♦ ♦

strips are provided at the rear of the tuner for making the necessary connections to the receiver. The oscillator tube is shielded and a snap-on shield is provided which, when in place, completes the external shielding of the tuner.

Two tubes are employed. A 6AG5, 6CB6, or 6AK5 serves as the RF amplifier, and a 6J6 performs the oscillator and mixer functions.

Referring to the schematic of Figure 1-9B, it can be seen that the signal is connected to the input coil L_1, which has a split primary. The other ends of these coils are grounded in the high channel positions by the rear switch section. On the low channels this ground is broken and the signal is connected across the primary of L4, which has a grounded center tap. In this manner, a balanced input is maintained with a minimum of switching.

In the high channel positions, the signal is coupled to the secondary of L_1, which is the channel 13 antenna coil. The primary of L_1 is wound on a wax-impregnated cardboard tube and the secondary is inside the tube. Adjustment is made by compressing or expanding the windings of the secondary. C_1 couples the signal to the RF grid and R_1 serves as the grid load, which is returned to the AGC line to control the gain of the stage. As the channel switch is rotated counterclockwise, the bar shown on the schematic moves down, adding a small inductance at each channel position, lowering the resonant frequency of the circuit. When the channel 6 position is reached, the incoming signal is connected across the primary of L4 and is inductively coupled to the secondary of L4.

The primary of L4 is wound on a wax-impregnated cardboard tube similar to L_1, and the secondary is wound inside the tube. Adjustment is made by expanding or compressing the windings of the secondary. R2 shunts the low-channel coils providing greater bandpass characteristics on the low channels. As the channel switch is rotated from channel 6 to channel 2, small incremental inductances are added, which lowers the resonant frequency. The low-

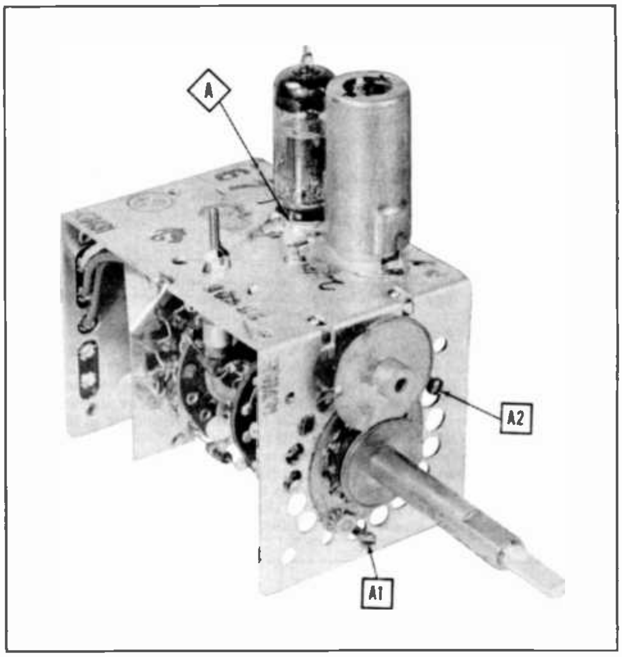


Fig. 1-9A. Alignment Points.

ALIGNMENT INSTRUCTIONS

SARKES TARZIAN MODEL TT-3 TV TUNER

READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The incremental loops on the high band channels and the incremental coils on the low band channels should not normally need adjusting. However in the event of damage to the coils, or if part replacement changes the original L/C ratio of the coils, it will be necessary to adjust the coils. Adjustment is accomplished by spreading or squeezing the turns, using as an indicator the same equipment used for adjusting A1 and A2. If the coils are adjusted it is essential that the adjusting be started with channel 12 and progress towards channel 2 (except for channel 6 which is adjusted with A2).

OSCILLATOR ALIGNMENT

In the receivers which employ a separate sound channel, the oscillator can most conveniently be aligned by feeding the channel sound carrier frequency into the antenna terminals and adjusting the oscillator for zero voltage reading on a VTVM connected across the sound detector output.

The signal generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

Set the fine tuning control to the mid-position of its range.

SEPARATE SOUND IF RECEIVER OSCILLATOR ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
1.	Two 120Ω carbon res.	Across antenna terminals with 120Ω in each lead.	215.75MC (Unmod.)	13	Across sound detector output.	A1	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
2.	"	"	209.75MC	12	"		Check all high band channels to see that zero voltage indication can be obtained within 30% rotation of the fine tuning control. If not, compromise adjustment of A1 may be required.
			203.75MC	11			
			197.75MC	10			
			191.75MC	9			
			185.75MC	8			
			179.75MC	7			
3.	"	"	87.75MC	6	"	A2	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
4.	"	"	81.75MC	5	"		Check all low band channels to see that zero voltage indication can be obtained within 30% rotation of the fine tuning control. If not, compromise adjustment of A2 may be required.
			71.75MC	4			
			65.75MC	3			
			59.75MC	2			

INTERCARRIER RECEIVER OSCILLATOR ALIGNMENT

The most convenient method of oscillator alignment to use with this type of receiver is the beat frequency method. To employ this method it becomes necessary to determine,exactly,one of the IF frequencies used in the receiver. The video IF frequency is usually given in the alignment instructions and is therefore used in the following example, although the sound IF frequency could be used in a similar manner. After the video IF frequency is determined it is necessary to add this frequency to the channel video carrier frequency to determine at what frequency the oscillator operates on each channel.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Two 120Ω carbon res.	Across antenna terminals with 120Ω in each lead.	211.25MC plus video IF freq. (see paragraph above)	13	Vert. Amp. to tuner output (1st video IF amp. grid)	A1	Adjust for zero beat indication on scope. This will be indicated by a narrow trace between two wide ones.
2.	"	"	(see paragraph above)	12 thru 7	"		Check all high band channels to see that zero beat indication can be obtained within 30% rotation of fine tuning control. If not,compromise adjustment of A1 may be required.
3.	"	"	83.25MC plus video IF freq.	6	"	A2	Adjust for zero beat indication on scope.
4.	"	"	See paragraph above	5 thru 2	"		Check all low band channels to see that zero beat indication can be obtained within 30% rotation of the fine tuning control. If not,compromise adjustment of A2 may be required.

RF, MIXER AND ANTENNA ALIGNMENT

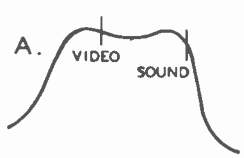
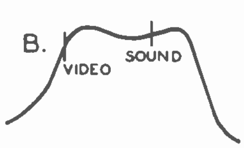
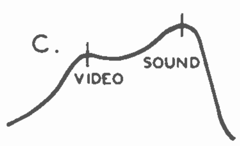
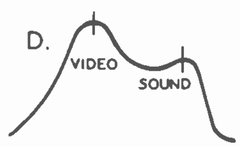
If the AGC terminal is not grounded, connect the negative lead of a 1 1/2 volt battery to the AGC terminal, positive to chassis or to the common negative line in transformerless receivers.

Connect the vertical amplifier of the scope to point A through a 10K ohm decoupling resistor.

The signal generator is coupled to the antenna terminals through the same matching network as used in oscillator alignment above.

The bandpass of this tuner is achieved through overcoupling instead of stagger tuning. The adjustment of the coils is accomplished by compressing or expanding the coils. The object of the alignment is to adjust the coils in the plate of the RF amp and the mixer grid to the same frequency at the center of the band. The overcoupling is accomplished by the close spacing of the RF plate and mixer grid coils and by the capacitors C4, C5 and C8. The RF grid circuit is also adjusted to the center frequency which fills in the valley at the center of the response curve. Each coil should be checked by using a tuning wand to see if adjustment is required before the coil is disturbed.

The oscillator alignment should have been checked before the following alignment is attempted as the mixer loading varies with the oscillator injection voltage. Channel 13 must be aligned first. Set sweep generator to center frequency of channel 13 and check the position of the sound and video markers. If L1, L2 and L3 are properly aligned the response curve will be similar to figure 1-9C. If it is not place the tuning wand near the coils to determine which coil or coils require adjustment. If the powdered iron end of wand improves response, the coil must be compressed. If the brass end improves response, the coil must be expanded. The following table may be used as a guide to determine in most cases which coil requires adjustment.

RESPONSE CURVE	DEFICIENCY	ADJUSTMENT
	Insufficient bandwidth at high end.	Decrease inductance of RF plate coil.
	Insufficient bandwidth at low end.	Increase inductance of RF plate coil.
	Gain too high at high end.	Decrease inductance of mixer grid coil. (On low channels it may be necessary to decrease RF grid coil inductance).
	Gain too high at low end.	Increase inductance of mixer grid coil. (On low channels it may be necessary to increase RF grid coil inductance).

The last two cases show two adjustments. Only one is correct. In every case, use the tuning wand to determine what adjustment is required.

The antenna coil is adjusted to the center of the band which tends to fill in the "valley" of the overcoupled response curve resulting in a flat top response curve.

In order to check the overall response, check the adjustment of the proper coils. In the case of channel 13, it would be L3, L2 and L1. The proximity of either end of the tuning wand to L2 or L3 makes the response wider, not narrower, when the coils are properly adjusted. The proximity of the powdered iron end of the wand to L1 will cause the gain at the high end to decrease and the low end to increase if the coil is properly adjusted. The brass end will cause the gain at the high end to increase and the low end to decrease. If such is not the case the antenna coil is not adjusted at the center frequency.

Follow the same procedure for channels 12 through 7 adjusting the proper incremental coils on the switch sections. The inductance of the small loops is decreased by pushing them in. Normally these incremental inductances need not be adjusted.

Channel 6 is aligned following the same procedure as given for channel 13 except L9, L8 and L4 are adjusted. Check channels 5 through 2.

In the event full bandwidth cannot be reached on any channel, place the picture carrier on top of the response curve letting the sound carrier go down on the side slightly.

channel incremental coils are shorted out when the tuner is operating on a high channel since there is a possibility that these coils may have a natural resonant frequency that might fall within one of the high channels. By shorting them out, the possibility of interference being caused by parasitic oscillations in these coils is eliminated.

Proper bandpass is obtained in the RF to mixer coupling circuit by overcoupling instead of the more frequently used method of stagger tuning. L_2, the channel 13 RF plate coil, is wound on a ceramic form, which is a part of the ceramic spacers for the switch sections. L_3, the channel 13 mixer grid coil, is self supported, being soldered to pin 5 of V2 and the switch terminal. In addition to the inductive coupling existing between these coils, capacitive coupling is provided by C4. As the channel switch is rotated counterclockwise, or down on the schematic, small inductances are added, as was done in the antenna circuit.

In order to maintain proper bandpass on all channels, additional capacity must be added in the coupling circuit as the operating frequency is decreased. Between channels 11 and 6, additional coupling is provided by C_5, while C_8 provides coupling on channels 5 through 2. Inductive coupling for the low band channels is achieved by the relative positions of L_8 and L_9. Adjustment of these coils is made by compressing or expanding the turns.

The low channel incremental coils are shorted out when the tuner is operated on any high channel

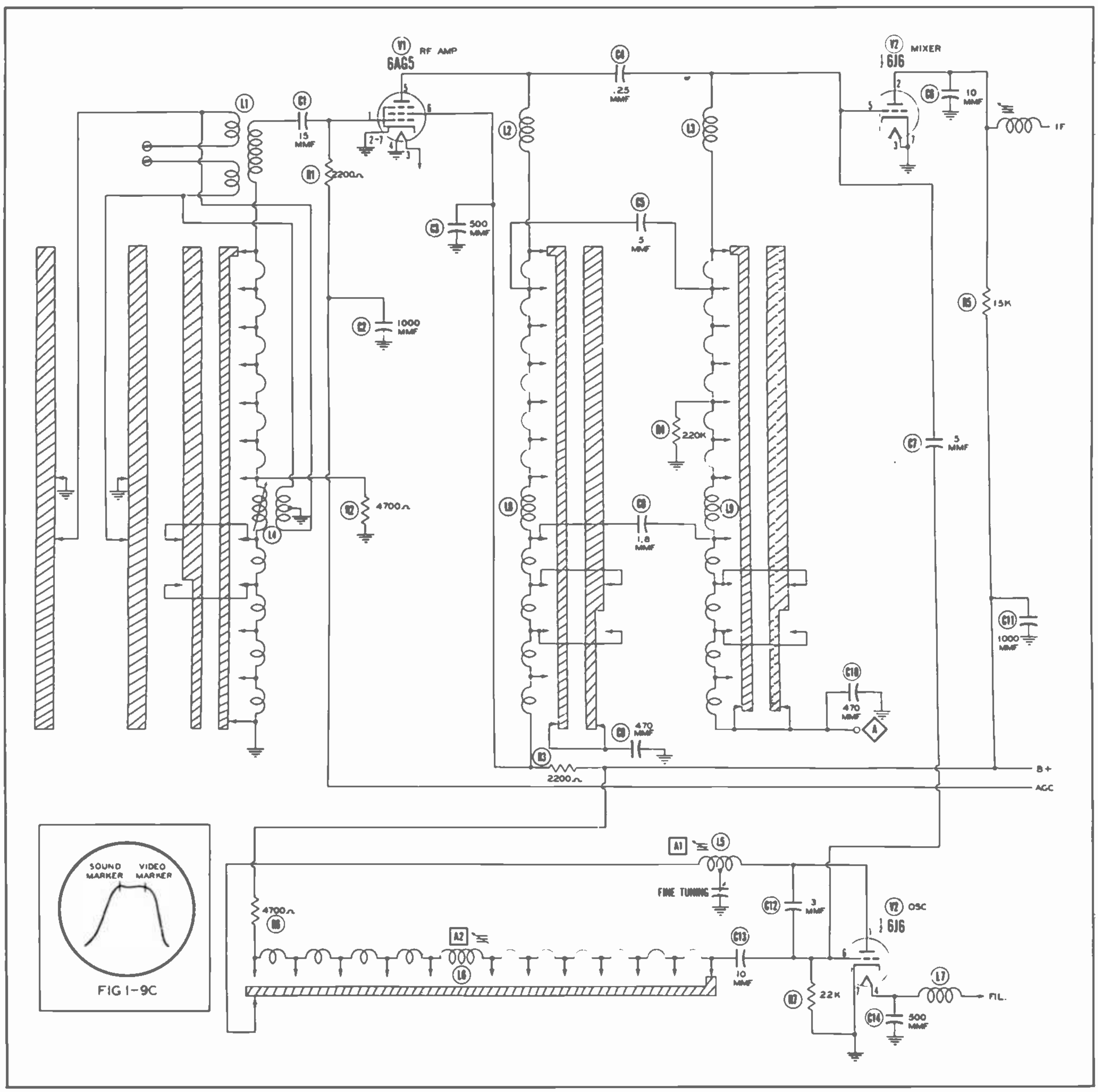


Fig. 1-9B. Schematic of Sarkes Tarzian Model TT-3 TV Tuner.

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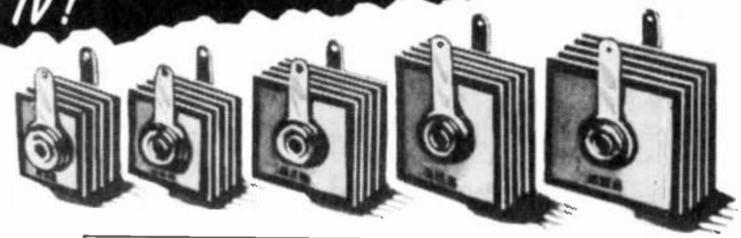

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SELENIUM RECTIFIERS

When you specify SELETRON *"Safe Center"* Selenium Rectifiers you eliminate arc-over danger, short circuits and heating at the center contact point. Assembly pressure, or pressure applied in mounting the rectifier cannot affect its performance—a SELETRON feature accomplished by deactivating the area of the plate under the contact washer.

The millions of SELETRON Selenium Rectifiers in satisfactory service as original equipment in the products of leading manufacturers are millions of reasons why *you* can specify SELETRON and be *safe!*

Consult your local jobber!

MODEL NO.	PLATE SIZE	STACK THICKNESS	MAX. INPUT VOLTAGE R.M.S.	MAX. PEAK INVERSE VOLTAGE	MAX. D.C. OUTPUT CURRENT
1M1	1" sq.	3/8"	25	75	100 MA
8Y1	1/2" sq.	3/16"	130	380	20 MA*
16Y1	1/2" sq.	11/16"	260	760	20 MA*
8J1	11/16" sq.	3/16"	130	380	65 MA
5M4	1" sq.	11/16"	130	380	75 MA
5M1	1" sq.	7/8"	130	380	100 MA
5P1	1 3/16" sq.	7/8"	130	380	150 MA
6P2	1 3/16" sq.	1 3/16"	156	456	150 MA
5R1	1 1/2" x 1 1/4"	7/8"	130	380	200 MA
5Q1	1 1/2" sq.	1 1/8"	130	380	250 MA
6Q1	1 1/2" sq.	1 1/8"	156	456	250 MA
6Q2	1 1/2" sq.	1 3/8"	156	456	250 MA
6Q4 (†)	1 1/2" sq.		130	380	300 MA
5QS1	1 1/2" x 2"	1 1/8"	130	380	350 MA
6QS2	1 1/2" x 2"	1 1/4"	156	456	350 MA
5S1	2" sq.	1 1/8"	130	380	500 MA
6S2	2" sq.	1 3/8"	156	456	500 MA

* This rectifier is rated at 25 MA when used with a 47 ohm series resistor.
(†) Stud mounted—overall: 2"

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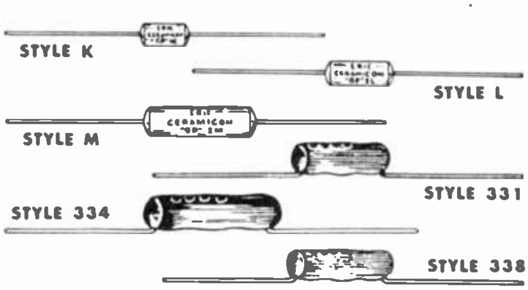
ERIE CERAMICONS



ERIE CERAMICONS are small fixed capacitors consisting essentially of a ceramic dielectric with silver electrodes which are fired on at a very high temperature. Erie Ceramicons are outstanding because of their excellent high frequency characteristics, small size, rugged construction and availability in a wide range of capacity values.

Physical dimensions of styles illustrated are:

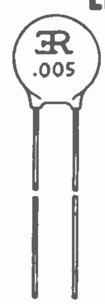
Style K length .562" diameter .250"
Style L length .812" diameter .250"
Style M length 1.328" diameter .340"
Style 331 length .460" diameter .240"
Style 334 length 1.213" diameter .415"
Style 338 length .550" diameter .312"

"GP" general purpose Ceramicons are ideally suited for such applications as coupling and by-passing, in circuits where temperature coefficient is not important—in other words for all receiver applications *except* in frequency determining circuits. Working voltage—500 volts D.C. Use Erie "GP" Ceramicons as replacements for molded mica and paper tubular capacitors.

NPO Zero Temperature Coefficient CERAMICONS

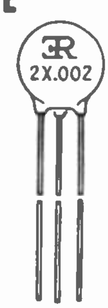
NPO zero temperature coefficient Ceramicons are highly recommended for frequency applications where no capacity change with change in temperature is desired. "Q" for NPO Ceramicons above 30 mmf is 1000 or higher. Below 30 mmf "Q" decreases slightly as capacity decreases. Working voltage—500 volts D.C. Can be used as replacements for silver mica condensers.

ERIE DISC AND PLATE CERAMICONS



STYLE 811

Erie Disc and Plate Ceramicons consist of a flat Hi-K* ceramic dielectric with silver fired onto the dielectric. Lead wires are firmly soldered to the silver electrodes, and the unit is given a protective coating of phenolic. Very efficient at high frequencies. Use ERIE Disc and Plate Ceramicons as replacements for molded mica and paper tubular capacitors.



STYLE 812

*"Ceramicon", "GP", and "Hi-K" are registered trade names and refer to ceramic dielectric condensers manufactured by Erie Resistor Corp.

Electronics Division
ERIE RESISTOR CORP., ERIE, PA.
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for the reason previously mentioned. R_3 and C_3 form a decoupling network for the RF amplifier, while C_9 and C_{10} terminate the tuned circuits in the RF plate and mixer grids, respectively. R_4 serves as the grid return for the triode mixer employing 1/2 of a 6J6.

Point ♦A is brought out to the top of the tuner in a novel way. C_{10} is a tubular ceramic and is so mounted that it acts as an insulating shield for the wire terminating point ♦A. The wire is threaded through C_{10} and extends above the tuner chassis.

When properly aligned, the RF to mixer coupling circuit has a double-humped response curve with the sound and video signals at the peaks. The antenna circuit is adjusted at the center of the band, which fills in the "valley" and flattens the response.

The other section of the 6J6 is connected in a modified Colpitts oscillator circuit. Coarse tuning is accomplished by adding or subtracting small inductances in the tank circuit as the channel switch is rotated. Both L_5 and L_6 are wound on ceramic forms, which are a part of the channel switch spacers, and have brass slugs which can be adjusted from the front panel. C_{12} is connected between the oscillator plate and grid to lessen the effect of interelectrode capacity change during tube warmup or when a tube replacement is made. The fine-tuning capacitor is connected from the plate circuit to ground, which also has plenty of range to overcome any variation of interelectrode capacity in a replacement tube. R_6 serves as a plate load for the oscillator. If, after the oscillator tube is replaced, alignment of the oscillator circuit is required, A1 and A2 may be adjusted on channels 13 and 6, respectively. All other channels should fall within range since the inductance of the incremental coils is very small compared to the inductance of L_5 and L_6. C_{13} and R_7 comprise the grid leak network, and C_{14} and L_7 decouple the filament from the rest of the receiver.

In the event that the tuner is dead on only one channel, it is probable that the switch is not making proper contact. With the channel switch set to receive the channel which is inoperative, apply a slight pressure to the contacts that are in the circuit. If the faulty contact is located, it is probable that it can be adjusted to make proper contact. Since all the coils of each circuit are in series, a poor connection between two of the coils will cause the tuner to be erratic at all channels below this point. It is unlikely that any of the coils should become "open," so trouble of this type is usually caused by a poor solder connection. Resoldering the coils to the terminal will usually restore normal operation, but care must be taken not to add solder to the high-frequency incremental coils, as their inductance will be changed. After a repair of this type, the alignment should be checked.

We wish to acknowledge the cooperation of Sarkes Tarzian, Inc., in supplying us with technical data and samples which were used in this presentation.

STANDARD COIL TV TUNER

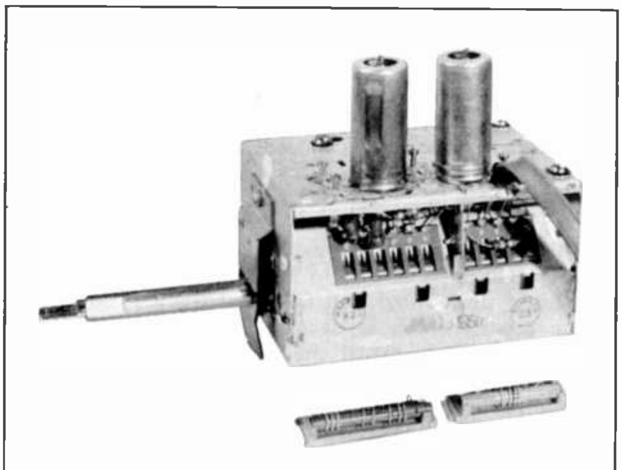


Fig. 1-10A. Standard Coil TV Tuner.

The standard coil tuner employs separate, switched inductances for channel selection. The coils are mounted on bakelite moldings which are clipped into a turret drum. Two coil strips are used for each channel. One strip (L1) contains the input coils, and the other (L3) has the RF plate, mixer grid and oscillator coils. (See Figure 1-10C.) A spring-loaded arm with a roller engages the detent plate to lock the turret into position on the desired channel. The detent plate also acts as a shield between L1 and L3. Electrical connection in each position of the turret is made to coils L1 and L3 by eleven spring contacts. These contacts are mounted on an insulated strip and positioned so that contact is made to the coil terminal contact buttons.

The fine tuning mechanism is controlled by a shaft which is concentric with the channel selector shaft.

Two tubes are employed. A 6AG5, 6BC5, or a similar RF pentode is used as an RF amplifier, while a 6J6 serves as the mixer and local oscillator. Both tubes are provided with shields. Operating voltages are supplied through color-coded leads which extend from the tuner.

The entire turret drum, with the coils in place, may be removed from the tuner frame by moving the spring clips at each end of the unit. This gives access to the components and tube sockets which are not accessible from the side of the tuner.

The tuner is normally supplied with the coils mounted for progressive tuning from channels 2 to 13 in a clockwise direction. If desired, the coils can be repositioned for any desired sequence of tuning. If this is done, care must be taken that the proper coil strips are paired in the turret.

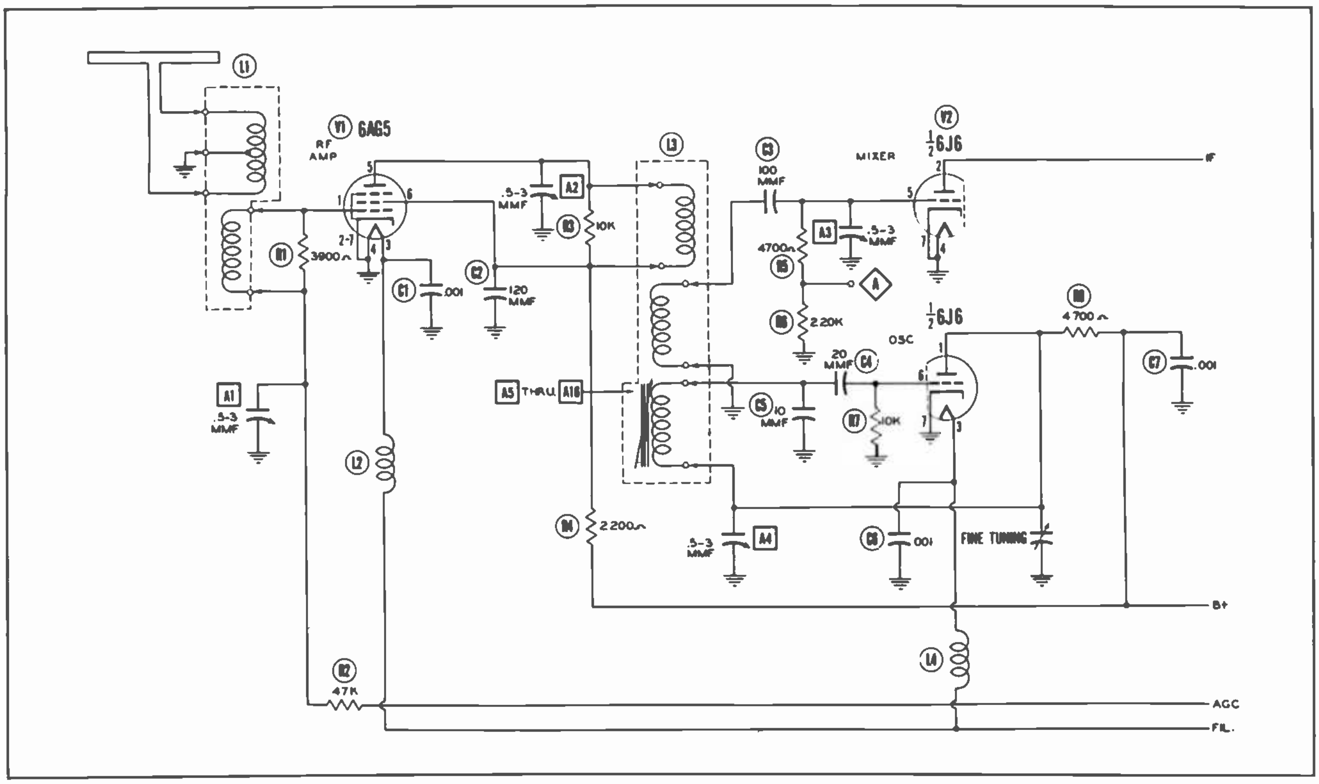


Fig. 1-10C. Schematic of Standard Coil TV Tuner.

The input circuit is designed for 300 ohm balanced line. The center tap of the input coil is grounded. The RF grid coil is positioned near the input coil to give inductive coupling of the signal to the grid-driven pentode RF stage (V1). The grid coil is series-tuned by the input capacity of the RF amplifier and A1. R2 is the DC grid return, and its connection to the AGC line enables the gain of the stage to be controlled.

The plate circuit is shunt-tuned by A2 and the capacitance of the tube. Proper bandpass characteristics are achieved by stagger-tuning the input and output circuits of the RF stage. Shunt resistors R1 and R3 on the RF grid and plate coils, respectively, further broaden the bandpass. The plate and screen voltages are supplied through the decoupling network R4 and C2. The filament is also decoupled by L2 and C1.

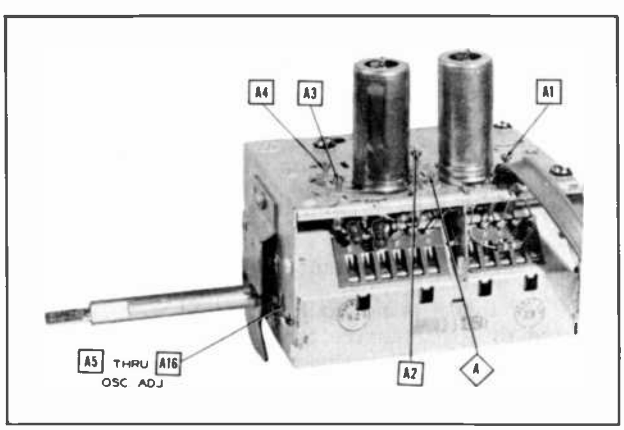


Fig. 1-10B. Alignment Points

Both the RF and oscillator signals are inductively coupled to the mixer grid coil, which is shunt-tuned by A3 and the input capacity of the triode mixer tube (V2). C3 serves as the grid leak capacitor, and the series network, R5 and R6, as the grid return. The junction of R5 and R6, Point ♦A, is terminated on top of the tuner for scope connection during alignment. R5 serves as an isolation between the scope and mixer grid.

The oscillator is a modified Colpitts type. The tank circuit consists of the oscillator coil portion of L3, the fine-tuning capacitor, trimmer A4, C5, and the interelectrode capacitances of the tube. C5 and the parallel combination of trimmer A4 and the fine-tuning capacitor, form the feedback network. C4 and R7 comprise the grid leak network. R8 is the oscillator plate load and C7 bypasses the B+ supply to the tuner, which is usually between 120 and 150 volts. The filament of the 6J6 is decoupled by L4 and C6. The filaments of both tubes are wired in parallel for 6.3-volt operation. Each oscillator coil is tuned by a brass screw accessible through a hole in the front of the tuner frame. The hole is so positioned that only the coil in use can be adjusted. The adjustments are A5 through A16 and permit adjustment or "touch up" of the oscillator on all twelve channels. These adjustments are usually made with the chassis in place in the cabinet. A4 serves as an overall oscillator adjustment, and is to be used only when the oscillator frequency of one or more channels will not fall within the range of the individual oscillator adjustment screw and fine-tuning capacitor. Normally A4 does not require adjustment unless tubes or components have been replaced.

ALIGNMENT INSTRUCTIONS
STANDARD COIL TV TUNER

READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Connect the synchronized sweep voltage from the signal generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
The complete response curve will not be seen unless the sweep in the generator exceeds 12MC, however the entire response curve is not necessary
Adjust the sweep generator frequency to center the response curve on the scope such that the curve is symmetrical.
If the AGC terminal on the tuner is not connected to ground connect the negative lead of a 1 1/2 volt battery to the AGC terminal, positive to B-.

RF AND MIXER ALIGNMENT

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Two 120Ω carbon res.	Across antenna terminals with 120Ω in each lead.	207MC (10MC SWP)	205.25MC 209.75MC	12	Vert. Amp. thru 10KΩ to Point •A Low side to chassis.	A1, A2, A3	Adjust for response curve similar to figure 1-10D with markers at 90%.
2.	"		213MC (10MC SWP)	211.25MC 215.75MC	13	"		Check all channels for response curve similar to figure 1-10D. If markers fall below 70% on any channel, make slight adjustment of A1, A2 and A3 with channel switch set for that channel. Recheck all channels to see that they have not been seriously affected.
			201MC (10MC SWP)	199.25MC 203.75MC	11			
			195MC (10MC SWP)	193.25MC 197.75MC	10			
			189MC (10MC SWP)	187.25MC 191.75MC	9			
			183MC (10MC SWP)	181.25MC 185.75MC	8			
			177MC (10MC SWP)	175.25MC 179.75MC	7			
			85MC (10MC SWP)	83.25MC 87.75MC	6			
			79MC (10MC SWP)	77.25MC 81.75MC	5			
			69MC (10MC SWP)	67.25MC 71.75MC	4			
			63MC (10MC SWP)	61.25MC 65.75MC	3			
			57MC (10MC SWP)	55.25MC 59.75MC	2			

OSCILLATOR ALIGNMENT

Complete oscillator alignment may not be necessary. If the oscillator seems to be off frequency approximately the same amount for a majority of the channels, it may be possible to correct them in one step using A4. It should be noted that this is an all channel oscillator circuit adjustment and should not be adjusted for any individual channel. If adjustment of A4 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment for each channel that is off frequency. The channel strip adjustments are reached through a hole just to the right of the channel switch shaft. The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
The signal generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

SEPARATE SOUND IF RECEIVER OSCILLATOR ALIGNMENT

On receivers which employ a separate sound IF channel the oscillator can be most conveniently aligned on each channel by feeding the channel sound carrier frequency into the antenna terminals and adjusting the oscillator for zero voltage on a VTVM connected to the sound detector output.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
Two 120Ω carbon res.	Across antenna terminals with 120Ω in each lead.	215.75MC (Unmod.)	13	Across sound detector output	A5	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
		209.75MC	12		A6	
		203.75MC	11		A7	
		197.75MC	10		A8	
		191.75MC	9		A9	
		185.75MC	8		A10	
		179.75MC	7		A11	
		87.75MC	6		A12	
		81.75MC	5		A13	
		71.75MC	4		A14	
		65.75MC	3		A15	
		59.75MC	2		A16	

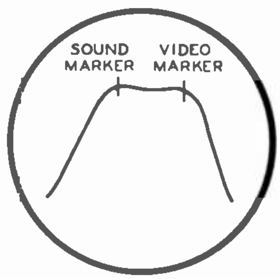


FIG 1-10D

INTERCARRIER RECEIVER OSCILLATOR ALIGNMENT

The most convenient method of oscillator alignment to use in this type of receiver is the beat frequency method. To employ this method it becomes necessary to determine exactly, one of the IF frequencies used in the receiver. The video IF frequency is usually given in the receiver alignment instructions and is therefore used in the following example, although the sound IF frequency could be used in a similar manner. After the video IF frequency is determined it is necessary to add this frequency to the channel video carrier frequency to determine at what frequency the oscillator operates on each channel.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
Two 120Ω carbon res.	Across antenna terminals with 120Ω in each lead.	211.25MC plus video IF freq. (see paragraph above)	13	Vert. Amp. to IF output terminal of tuner (1st video IF amp. grid)	A5	Adjust for zero beat indication on scope. This will be indicated by a narrow trace between two wide ones. Repeat this procedure for each channel using the video carrier frequency of that channel, plus the video IF frequency of the receiver, as the signal generator frequency.

In the event the drum is removed from the unit, care must be taken when it is replaced, so that the fine-tuning cam is properly positioned between the fine-tuning capacitor plates. If the fine-tuning shaft binds, or is rough in operation, it should be thoroughly cleaned and lubricated. The concentric tuning shaft may be pulled off the selector shaft after the drum is removed from the unit. When reassembling the unit, make sure that all springs or spacers are properly positioned on the shaft.

If the tuner is erratic in operation on any channel, the coils for that channel should be carefully inspected and the windings checked for continuity. The contact buttons should also be clean and secure. If the coil strip is in good condition, the fault may be in one or more of the contact springs. Reinsert the coil strip in the drum and turn to the erratic channels. The coil spring contact can be checked by a slight pressure applied with a probe of insulated material such as an alignment tool. If by this procedure the tuner can be made to operate properly, additional contact pressure is required. This can be achieved by removing one of the coil strips and rotating the drum so that the blank position is under the terminal board. Slight bending of the defective contact spring can now be accomplished.

The tuned circuits are very stable and normally do not require adjustment, unless a tube or component part has been replaced. In the event that alignment is required, a complete alighment is given in this section. Adjustments A1 through A4, inclusive, are accessible from the top of the tuner.

We wish to acknowledge the cooperation of the Standard Coil Products Co., Inc., in supplying us with technical data and samples which were used in this presentation.

"SHOP TALK" (Continued from page 21)

ium rectifier rated at 100 ma. DC were put on this test, and the current reading were 10 ma. AC or less at 117 volts AC input, the unit would be good. A reading of 11-12 ma. would indicate poor reverse quality, while higher readings would point out the stack as bad.

Forward Voltage Drop: Grading of the voltage drop across a selenium rectifier due to internal forward resistance at approximate load current may be accomplished with the circuit of Figure 2.

The common 6.3-volt filament transformer is most convenient for supplying this circuit with power. In all cases, the transformer of highest current rating available should be used, since it is important that the internal resistance of the secondary be as low as possible. Input voltage should be made variable by a variac.

Input test voltage for this forward grading circuit is 6 volts AC. Good forward quality in a selenium rectifier is indicated by a DC milliammeter reading of 90% rated selenium rectifier load current or greater. Current readings below the proper value for each particular size rectifier indicate that the stack has aged or that the alloy area has been seriously reduced by excessive blowout patches.

Rated selenium rectifier load currents for specific units under test should be obtained from the service literature material covering the equipment in which the rectifier circuit is employed, or from catalog ratings and characteristics published by the rectifier manufacturers.

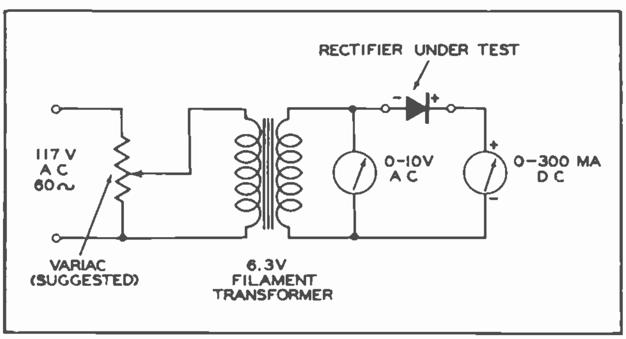


Fig. 2. A Forward Voltage-drop Test Circuit.

The foregoing tests will serve to indicate which rectifiers are not suitable for further use. When a rectifier has passed the foregoing tests, it should be tried out in the receiver circuit in which it is to be used. If you find that the rectifier does not produce the required output voltage, try a new unit. Normally, selenium rectifiers should last the life of the set; continued replacement of these units indicates a faulty component other than the rectifier.

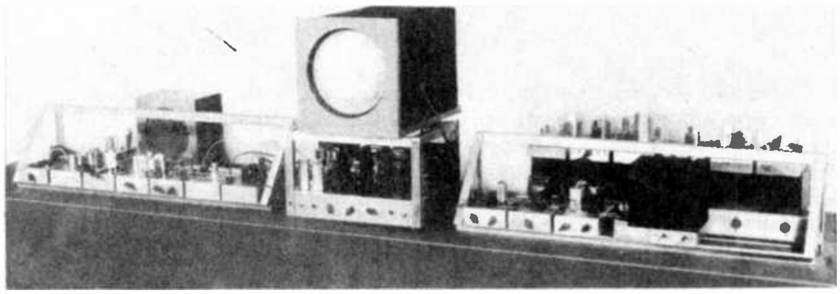
SERVICE OF SELENIUM RECTIFIERS. Servicing procedure for selenium rectifier power supplies is very similar to that for circuits using rectifier tubes. Analysis and procedure is based upon a normal AC or DC line input to the receiver, and upon normal temperature surrounding the rectifier. The general continuity, forward, and reverse tests which have been described may be used where testing is necessary in service applications.

CARE AND REPLACEMENT TECHNIQUES. Although the selenium rectifier is quite rugged, there are a number of precautions which should be considered in insuring long life and satisfactory operation of the unit in a radio or TV set:

(a) During the process of soldering the rectifier terminals to circuit wires, the heated soldering iron and solder should not be brought in contact with the plates, nor should the iron be applied to the terminals for long periods of time. Extreme heat may melt the alloy or damage the stack.

(b) In mounting the unit under a chassis, the plates should be kept in a vertical plane, and provision made for adequate ventilation.

(c) Under no condition should the selenium rectifier be painted in the field without consultation with the manufacturer, since certain paints have adverse effects on the selenium stack characteristics.



Introducing
the "Thing"

The technical personnel of the Sams' Company has many characteristics in common with electronic technicians throughout the country. They have genuine interest in the work they do, the equipment which they process, and in attaining an understanding of equipment purpose. Above all, they have an insatiable curiosity - - - to see, to know, and to demonstrate, if possible, the operation of electronic circuits.

We have always felt that this is a healthy attitude and that it is productive not only of more complete information on the subject, but more accurate and helpful instructive material as well, due to the greater understanding of construction or circuit purpose.

Some time ago, we decided to actively aid and abet these characteristics. Since we feel that many of you have the same interests, the desire to see and to know - possibly without the same opportunity for pursuing these objectives - we are presenting an account of our experience in this uncharted field. The illustration heading this writeup shows the most immediate results.

The rack layout you see, more or less affectionately termed "The Thing" by our technical staff, really consists of individual circuit or system chassis plugged into the power supply interconnection service of the rack. The input and output terminals for the individual chassis are available for connection to those of adjacent units. Plug-in and holding features of the chassis provide secure mounting. Combined with the design and strength of the racks, it makes possible operation of the rack in two positions - for maximum accessibility to parts and measurement points and for general observation.

With respect to purpose of "The Thing," let's just say at this time that we wanted to provide the most flexible system which we could devise for general experimentation and proving - - - in the fields of radio, television, and allied electronic applications.

We believe that the potential of this activity is really large. From time to time, we intend to publish findings accuring from it. In fact, we suspect that in terming it "The Thing," some of the personnel may have had the thought of comparing its creation to that of a Frankenstein-like creature and that we might find ourselves in the same relative position. We will have to take that chance.

We want to extend our sincere thanks to the following component manufacturers for their contribution in terms of information, parts, and general helpfulness in making this project possible:

Aerovox Corporation; Centralab, Div. of Globe Union Inc.; Chicago Transformer Div., Essex Wire Corporation; Clarostat Mfg. Co., Inc.; Cornell-Dubilier Electric Corp.; Erie Resistor Corporation; International Resistance Company; Jensen Manufacturing Company; Littlefuse, Inc.; Meissner Mfg. Div., Maguire Industries, Inc.; Merit Coil & Transformer Corp.; Quam-Nichols Company; Sprague Products Co.; Standard Transformer Corp.; Sylvania Electric Products Inc.

As always any suggestions or comments you may have with respect to this project will be more than welcome.

James R. Ronk
Editor

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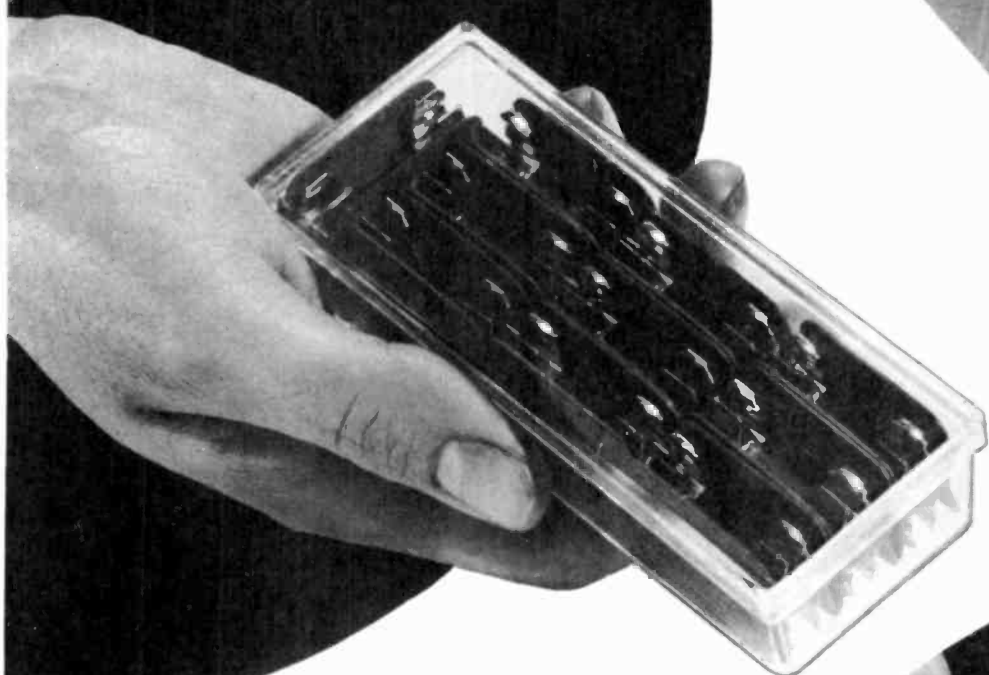

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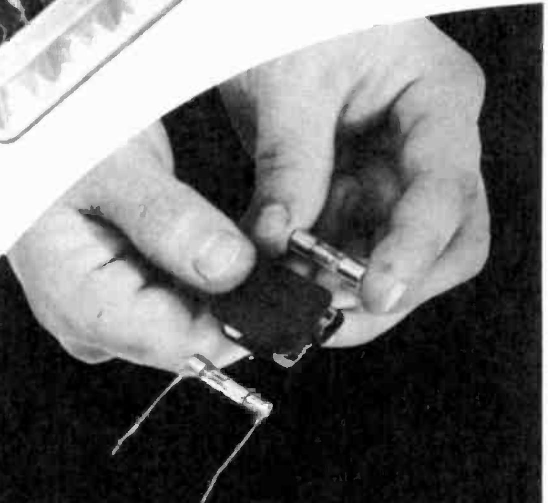

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