MARCH, 1951

Radio-Television SERVICE DEALER

The Professional Radio-TVman's Magazine

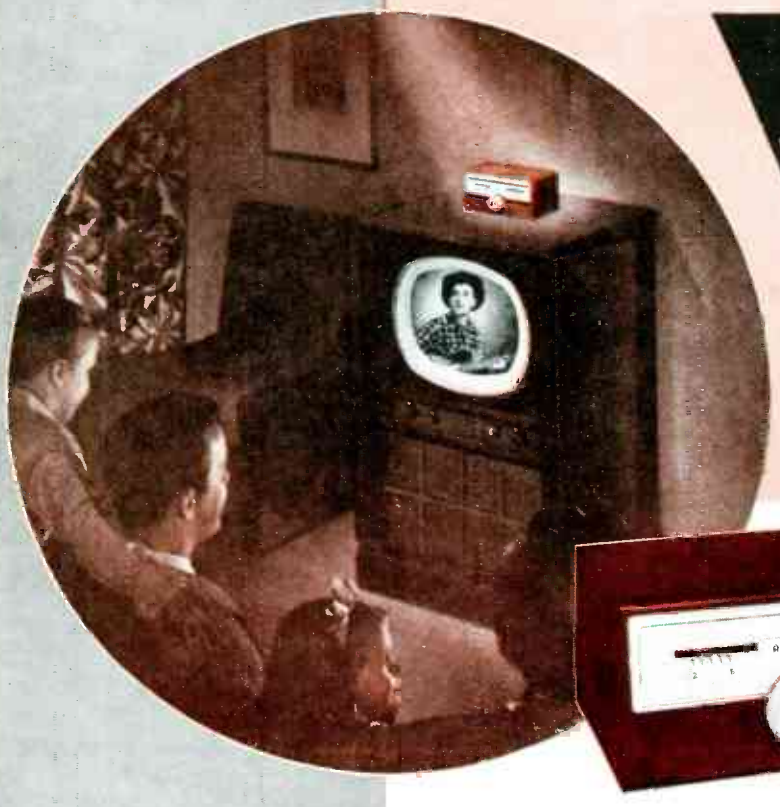
IN THIS ISSUE:

How To Use Sweep Generators, Part 1
Understanding Audio Drivers
Front Ends, Part 8
Using the Magacycle Meter For Servicing
Antenna Rotators, Part 2
Men of Radio, Part 1
Servicing Tape Recorders

AM-FM-TV-SOUND

Total Distribution Of This Issue: Over 30,000

PERFORMANCE IS WHAT COUNTS!



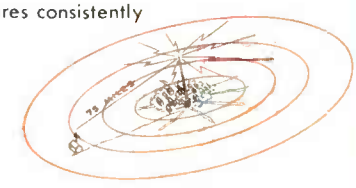
ANCHOR'S

superiority of performance

remains unchallenged!

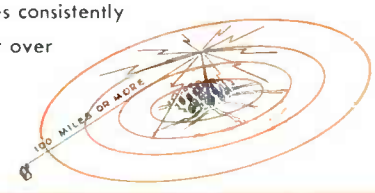
THE ANCHOR *Suburbanite*

Single-Stage Booster—for low signal areas in or near cities. Assures consistently good reception up to 75 miles.



THE ANCHOR *Granger*

Two-Stage Booster—recommended for distant rural areas. Assures consistently good reception for over 100 miles.



Despite critical material shortages, Anchor not only is offering the same high quality standards so widely hailed by the TV set industry, itself, but it is still making as many boosters as a year ago. To meet the current unprecedented demand, however, Anchor would have to expand, which is naturally not possible now! Therefore they have had to institute a very strict allocating system. No preference on deliveries to anyone has been or ever will be practiced.

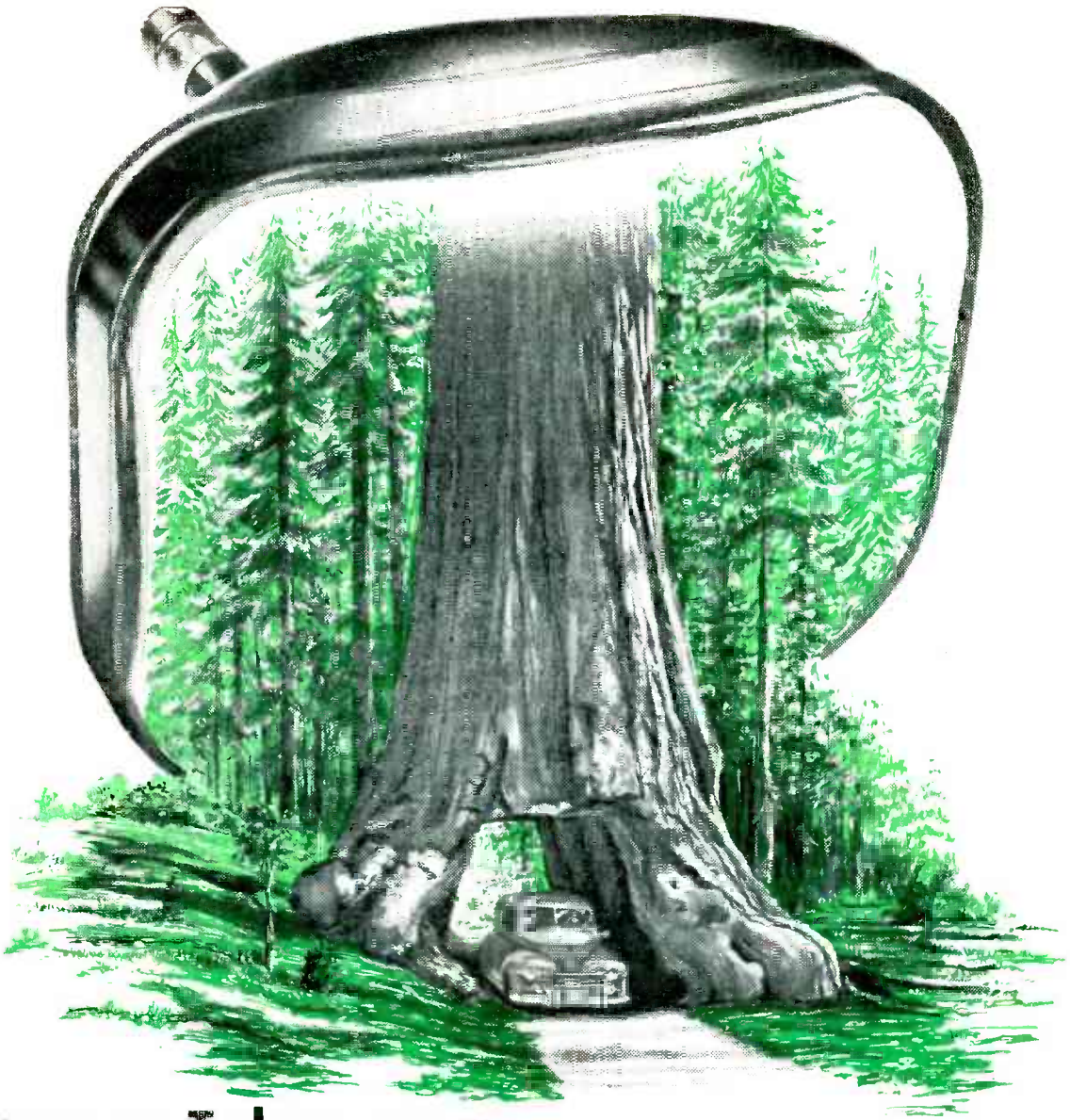
When a booster is needed to complete a perfect installation, Anchor's outstanding performance under all conditions has made it the first choice of those who buy and sell. So always buy the *best*—first!

ANCHOR RADIO CORP.

ANCHOR ENGINEERING ALWAYS A YEAR AHEAD!

ANCHOR RADIO CORP.

2215 SOUTH ST. LOUIS AVENUE • CHICAGO 23, ILLINOIS



Thomas Tubes mean

LONG LIFE

No one can say exactly how long it has taken Nature to perfect the California redwoods' secret of longer life. But we of Thomas can say that a great amount of time and effort have been spent in increasing the service life of our product.

This time and effort, as a part of our research program, have led to the use of new materials, new design improvements, new construction methods which are continuing to give the Thomas tube an ever-longer "lease on life."

You can always depend on more service, more performance from a Thomas picture tube because, "It's built that way!"

Radio Engineering Show
Grand Central Palace
New York City
BOOTH NO. S-14

THOMAS ELECTRONICS, Inc.

118 Ninth Street — Passaic, New Jersey

EDITORIAL

by S. R. COWAN

Humbly We Thank You

Twice during February we, and our staff, were honored by the radio-TV service profession. First, PRSMA, the largest association of Radio-TV servicemen in existance awarded to us Honorary Membership, the 17th such citation we have received in 11 years. Then, on February 18th, at Harrisburg, Pa., the Federation of Radio Servicemen's Association of Pennsylvania awarded us their annual placque which is given to "the one who has contributed most outstanding service to and on behalf of the service profession for the year."

This is a precedent indeed! Never before has any radio trade publication, and its staff, been singled out and granted such an honor. That we are grateful and that we will continue to strive hard in bettering the interests of the radio-TV service profession goes without saying. As it is, we enjoy a certain gratification because more independent radio servicemen, more servicemens' organizations and more dealers who operate service departments subscribe to "SERVICE DEALER" than any other trade journal published. But now, having won a more tangible token of appreciation, the 1950 Placque, we are indeed humbly proud and appreciative. Thanks fellows!

Parts Shortages & Bunkum!

For 3 consecutive years there has been a serious shortage of parts, tubes and accessories needed for the replacement radio-TV field. Manufacturers knew it. Nevertheless most of them directed the bulk of their output towards the new equipment market. We have strenuously objected to this and as a sop, just a year ago the president of RTMA publicly stated that the condition would be corrected at once. Actually some effort was made to give the service field a better break, but by so few manufacturers, and for such a short time, that in effect it was a meaningless gesture.

Conditions got worse. Then, the Korean "incident" arose and led us to fear the worst. We editorialized that as we saw it servicemen might be subjected to a tighter squeeze than ever for the benefit of TV set makers and the "war effort." Again RTMA's president countered by issuing bulletins to pacify us, stating, in effect, for public consumption, that regardless of any curtailments and cut-backs there would be no parts or tube shortages. Then, in mid-February 1951, adding insult to injury, RTMA's office issued another publicity release through "UP" stating there are plenty of parts, tubes, etc., for the service field. Nothing could be further from the truth! If newspapers really knew the true facts they wouldn't print such nonsense. And unfortunately the public believes what it reads in its newspapers and not the servicemen who simply can't obtain merchandise from jobbers.

Sanford R. Cowan
EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

COWAN PUBLISHING CORP.
67 WEST 44TH ST.
NEW YORK 18, N. Y.

MEMBER AUDIT BUREAU OF CIRCULATIONS

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26,000,000 POTENTIAL CUSTOMERS

How many will you sell!

LIFE for March 12, starts the ball rolling: 26,000,000 readers. This timely full-page ad. An ideal sales package — original Hytron *studio-matched* rectangular tubes. The choice of 9 out of 10 leading TV set makers. All backed by this *free,* sure-fire "Advertised in LIFE" display card for *your* window and *your* counter. Play safe. Call your Hytron jobber *today*. Make sure you don't miss this tie-in display card. Get your share of those 26,000,000 potential customers!

MANUFACTURERS OF RECEIVING TUBES SINCE 1921

HYTRON

RADIO AND ELECTRONICS CORP.

HYTRON RADIO TUBES

MAIN OFFICE: SALEM, MASSACHUSETTS

NEW 5th EDITION
Hytron Reference Guide for Miniature Electron Tubes

FREE from your Hytron jobber. Miniature types are still multiplying fast. You need this new Hytron Reference Guide. Originated by Hytron, it is unique . . . complete. Lists all miniatures to date, regardless of make. Six pages of pertinent data, 165 miniatures — 33 of them new. 81 basing diagrams. Lists similar larger prototypes. Get your free copy of this old friend brought up to date—today from your Hytron jobber.

TRADE FLASHES

A "press-time" digest of production, distribution, and merchandizing activities

RTMA Statistics

Television receiver production in 1950 totalled 7,463,800 sets and the output of radios amounted to 14,589,900, according to revised industry estimates released by the Radio-Television Manufacturers Association. RTMA's estimates represent production by member and non-member companies and were prepared by Frank W. Mansfield, Chairman of the RTMA Industry Statistics Committee.

The 1950 set production compares with three million TV sets and 11,400,000 radios manufactured in 1949, RTMA said.

A breakdown of the 1950 radio set production showed an estimated 8,174,600 home radios, 4,740,600 auto sets, and 1,674,700 portable receivers manufactured in the year.

Servicing Legislation

Federal legislation affecting TV servicing, as reported in PRSMA News, takes on the form of a bill which would direct the Attorney General and the Postmaster General to investigate false, fraudulent or deceitful TV service contracts.

In New York State a bill has been introduced which requires service contractors to place funds received in advance in escrow.

In New York City a bill is being considered which, aside from specifying that a license to service men may be obtained for a certain fee, places full discretion of licensing, revocations, interpretations, etc., in the hands of a commissioner.

Show Date Changes Announced

A result of the meeting in New York City on January 5, of the NEDA Industry Advisory Committee, was the re-scheduling of the association's 1951 Convention and Annual Jobber Show in Cleveland, originally planned for August 27-30.

Because the Pacific Coast Show was to be held August 29 through the 31, it was agreed that the industry could be served best by obtaining new dates

[*Continued on page 8*]

Be Sure of Your Installations—
Get the *Aptitude-Tested*
RG/U TRANSMISSION LINE CABLES

RG-5/U
APTITUDE RATING No. 8236

Frequency (Mc)	Attenuation per 100 ft
100.	2.65
200.	3.85
300.	4.80
400.	5.60

RG-8/U
APTITUDE RATING No. 8237

Frequency (Mc)	Attenuation per 100 ft
100.	2.10
200.	3.30
300.	4.10
400.	4.50

RG-11/U
APTITUDE RATING No. 8238

Frequency (Mc)	Attenuation per 100 ft
100.	1.90
200.	2.85
300.	3.60
400.	4.35

RG-54A/U
APTITUDE RATING No. 8239

Frequency (Mc)	Attenuation per 100 ft
100.	2.90
200.	4.20
300.	5.50
400.	6.70

RG-59/U
APTITUDE RATING No. 8241

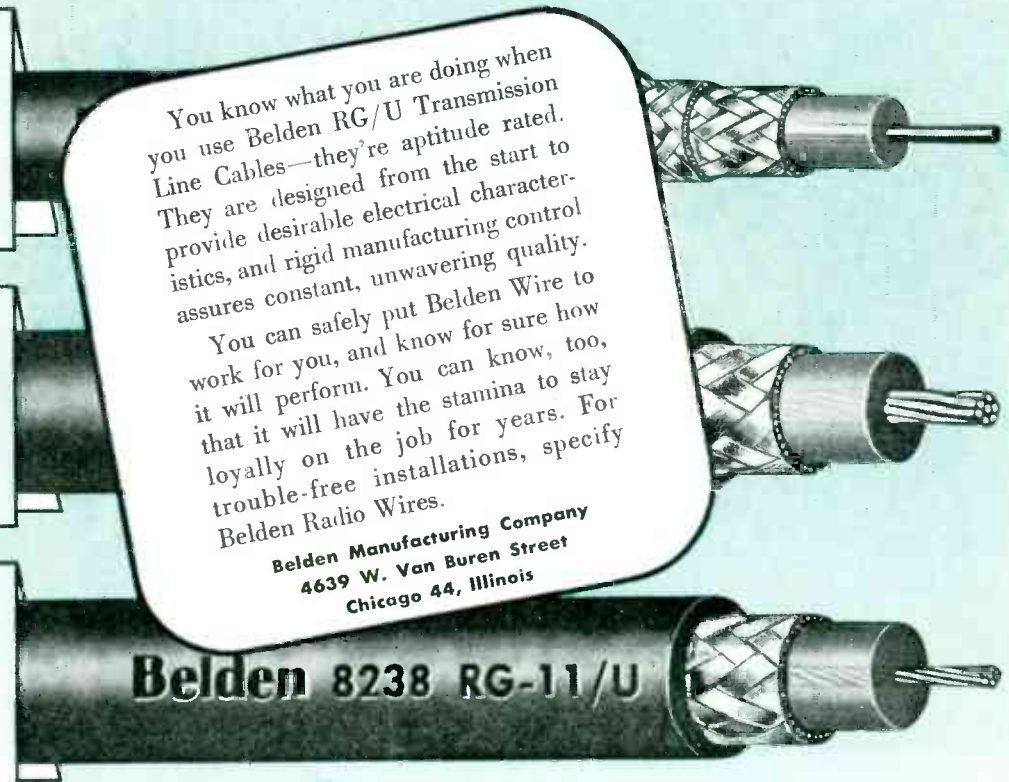
Frequency (Mc)	Attenuation per 100 ft
100.	3.75
200.	5.60
300.	7.10
400.	8.30

For use with television antenna.

You know what you are doing when you use Belden RG/U Transmission Line Cables—they're aptitude rated. They are designed from the start to provide desirable electrical characteristics, and rigid manufacturing control assures constant, unwavering quality.

You can safely put Belden Wire to work for you, and know for sure how it will perform. You can know, too, that it will have the stamina to stay loyally on the job for years. For trouble-free installations, specify Belden Radio Wires.

Belden Manufacturing Company
4639 W. Van Buren Street
Chicago 44, Illinois



RG-58/U
APTITUDE RATING No. 8240

Frequency (Mc)	Attenuation per 100 ft
100.	4.10
200.	6.20
300.	8.00
400.	9.50

For use with radio frequency transmission, video, test equipment, and pulse transmission.

Belden Radio WIRE

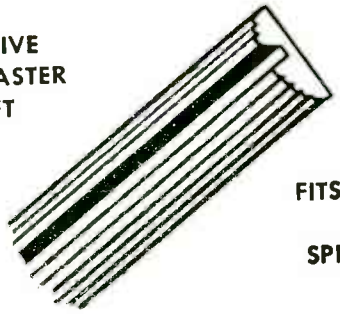
The *Aptitude-Tested* LINE

The Most Adaptable Small Control You Ever Saw...

GIVES YOU WIDEST REPLACEMENT COVERAGE WITH FAR LESS STOCK!

60 IRC Q CONTROLS WITH *ADAPTABLE* FIXED SHAFTS cover *all* important values—give you *complete* replacement coverage with minimum stock—and slash your inventory investment to the bone. No other control line so closely meets your servicing needs. No other gives you so much for your money. Here's why . . .

EXCLUSIVE KNOB MASTER SHAFT



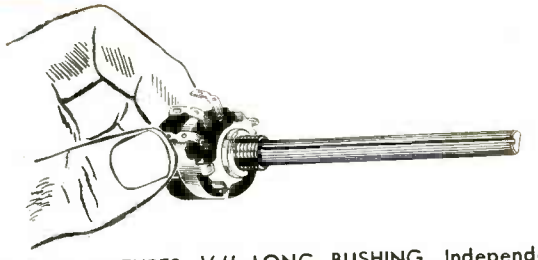
FITS KNURLED AND SPRING-TYPE KNOB

Here's the shaft you've dreamed of for years—a shaft that will fit virtually all your standard knob requirements without inserts or modification—a shaft you can just cut to length and use.

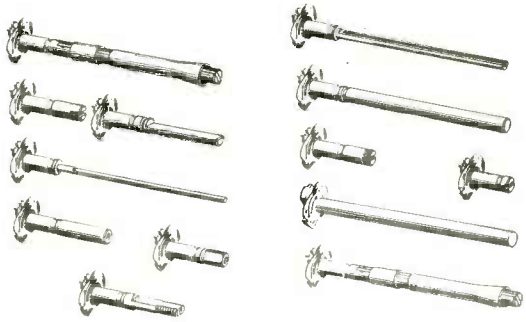
IRC's Knob Master Shaft is shown in exploded view above. Note these points of construction:

1. Substantial portion of shaft is knurled. It readily fits most knurled knobs without slotting of shaft. Either tight or loose knobs may be fitted by slotting shaft for 3/8" and adjusting ends by spreading or compressing.
2. Flat of shaft accommodates all spring-type push-on knobs requiring normal 3/32" deep flat.
3. Groove simulates narrow flat for spring-type knobs requiring 1/32" deep flat. Also provides guide for slotting where needed.

Knob Master Shaft is standard with *all* Type Q Replacement Controls. Eliminates need for stocking several different controls of the same value because of shaft differences. Far more expensive to make than ordinary replacement shafts, Knob Master is exclusive with IRC.



TYPE Q FEATURES 1/4" LONG BUSHING. Independent survey, plus IRC engineering study, prove that a 1/4" long bushing will permit more replacements than will the conventional 3/8" long bushing. Only IRC provides you with a complete standard line of controls of the small 15/16" size with the *shorter* bushing necessary for maximum replacement use.



INTERCHANGEABLE FIXED SHAFTS give you widest coverage of control replacements with a far smaller stock of controls. Resilient Retainer Ring lets you remove Knob Master Fixed Shaft and replace with any of 13 special fixed shafts. Interchange takes less than a minute, using only a pocketknife or screwdriver. You meet almost any special requirement without expanding control stocks.

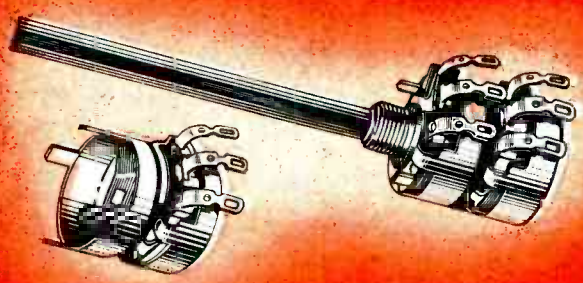
ASSEMBLE YOUR OWN STANDARD AND CONCENTRIC DUALS, TOO!

Two sensational IRC developments answer the great majority of your dual replacement problems—and eliminate long searches and waits for exact duplicates.

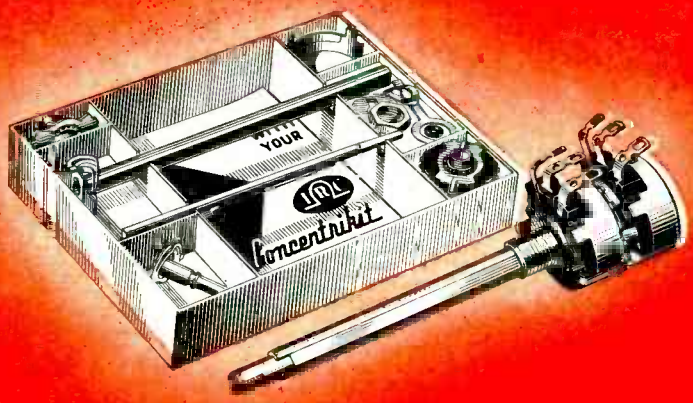
With IRC's amazing new CONCENTRIKIT of specially designed, universal parts, you can quickly assemble over 90% of all concentric dual types—in home and auto sets as well as in TV.

For standard duals, exclusive IRC MULTI-SECTIONS can be added to Q Controls just like switches—in just a few seconds – convert standard controls to duals, triples or even quadruples.

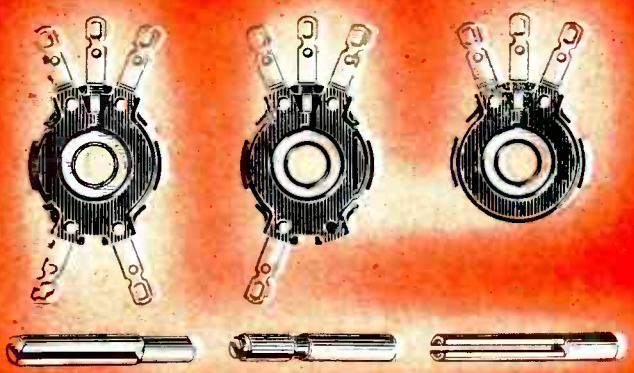
NOTHING COULD BE SIMPLER, EASIER, MORE PRACTICAL!



STANDARD GANGED CONTROLS ARE EASY TOO. For standard duals, triples, quadruples, add IRC MULTISECTIONS just as you would switches. 20 of these units provide over 11,000,000 variations—give you coverage from 500 ohms to 10 megohms. No need to stock or search for standard duals. Flexible, easy-to-use MULTISECTIONS are the answer to ganged-control problems.



NO MORE WORRYING ABOUT EXACT DUPLICATES. In a matter of minutes you can assemble your own concentric duals—with IRC's original CONCENTRIKIT. Each CONCENTRIKIT contains 11 universal parts which you combine with separate shaft ends and base elements. Step-by-step instructions, included in each kit, make CONCENTRIKIT fool-proof. It's the practical answer to television's ever-increasing need for concentric duals.



LIMITLESS OPPORTUNITIES for adapting controls to specific requirements—that's what you get with these Interchangeable Base Elements and shaft ends. Each unit contains molded base, element, terminals and collector ring—no loose parts. Designed for use with CONCENTRIKIT, these base elements are available in a wide assortment of resistance values and a variety of taps. They may also be interchanged in any standard Q Control.

New Type 76 Switches are quickly and easily attached to any IRC Q Control. In addition to Type 76-1 Single Pole, IRC now provides a double pole unit as well—Type 76-2. IRC Q Controls are 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.

IRC

INTERNATIONAL RESISTANCE COMPANY

401 N. Broad Street, Philadelphia 8, Pa.

Wherever the Circuit Says —WW—

In Canada: International Resistance Co., Ltd., Toronto, Licensee

INTERNATIONAL RESISTANCE COMPANY

415 N. BROAD ST., PHILA. 8, PA.

Please send me additional IRC Q Control information in latest issue of Catalog Bulletin DC-1.

NAME .....

COMPANY .....

ADDRESS .....

.....

J. F. ARNDT & CO., ADV. AGENCY

TRADE FLASHES

[*from page 4*]

for the NEDA event. The rather complicated task of clearing this with the Cleveland Convention Bureau, Public Auditorium and the hotels to be used was begun at once, and before the end of the meeting the change-over was an accomplished fact. The new dates for the NEDA Annual Jobber Show are September 10 through the 13.

In the same spirit of co-operation, the officers of the West Coast Electronic Manufacturers Association and Heckert Parker, WCEMA's Exhibit Manager, arranged to have their Annual Exhibit and Convention staged a week earlier, namely, August 22, 23, and 24, 1951. The twenty manufacturer-members of NEDA's Industry Advisory Committee commended NEDA for the step it had taken.

Also discussed at the meeting were the dates and timing of the five educational sessions to begin September 10, the special ladies' programs, and opening and closing periods of the exhibition itself.

Cowan Wins Industry "Oscar"

The Federation of Radio Servicemen's Associations of Pennsylvania, on Feb. 18, 1951, awarded its annual placque to S. R. Cowan, Publisher of Radio-TV Service Dealer. This

beautifully inscribed "Oscar" states that the award is made "For assistance to the Servicing Industry and for Outstanding Editorials on Behalf of the Service Technician." The illustration shows Mr. Cowan receiving the palcque from the FRSAP officers.

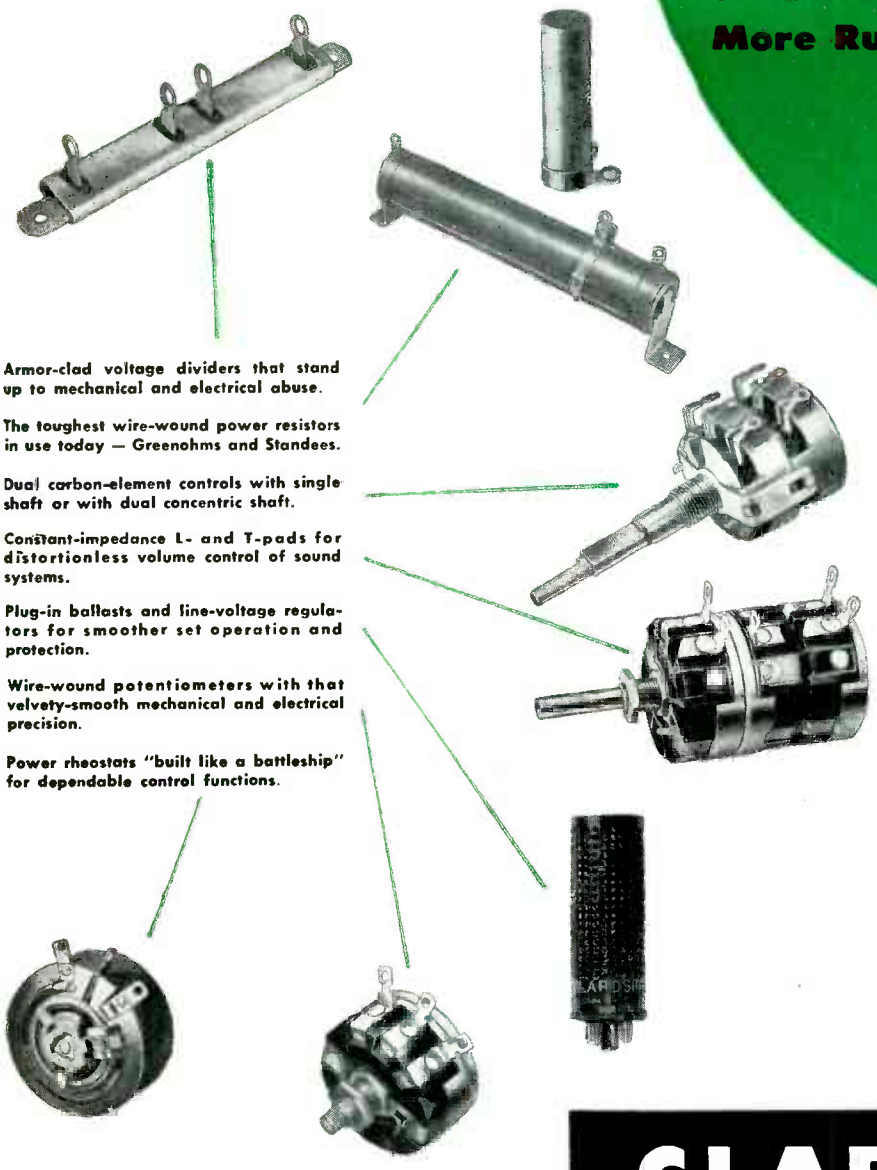
Servicemen Organize National Association

The National Electronic & Service Dealers Associations, a new national organization of associations representing servicing technicians and service dealers, was launched Sunday, January 28th, at a meeting of 22 technician and servicing dealer association dele-

[*Continued on page 12*]

DESIGNED FOR SERVICE

More Rugged Electrically
More Rugged Mechanically
More Rugged in Safety Factor
More Rugged for Longer Life



Armor-clad voltage dividers that stand up to mechanical and electrical abuse.

The toughest wire-wound power resistors in use today — Greenohms and Standees.

Dual carbon-element controls with single shaft or with dual concentric shaft.

Constant-impedance L- and T-pads for distortionless volume control of sound systems.

Plug-in ballasts and line-voltage regulators for smoother set operation and protection.

Wire-wound potentiometers with that velvety-smooth mechanical and electrical precision.

Power rheostats "built like a battleship" for dependable control functions.

★ The fact that you'll find Clarostat controls and resistors in the majority of today's TV, radio and electronic assemblies, speaks for itself. It's generally conceded that Clarostat parts are *tougher, more dependable,* and *last longer.*

And Clarostat not only supplies such initial equipment but also the replacement parts used in the servicing of such assemblies. Clarostat's up-to-the-minute servicing data insures the *correct control or resistor,* every time.

Ask your Clarostat jobber for the latest Clarostat Catalog. Also for those TV Replacement Data Sheets. Or write us.

CLAROSTAT

CLAROSTAT MFG. CO., INC. DOVER, NEW HAMPSHIRE

You get all five

...with RCA Batteries

1. Top Brand Acceptance ...makes selling easy

The *selling power* of the RCA Trademark makes it *easy* for you to move RCA Batteries . . . and gain a satisfied customer every time.

Remember, too, that RCA Batteries are *radio-engineered* for *extra* listening hours . . . provide a type for practically every renewal requirement.

So—starting now—push RCA Batteries. Build a profitable repeat business with virtually no competition from non-radio outlets.

See your RCA Battery Distributor for fast, reliable service.

2. Radio Trade Distribution

3. Completely Rounded Line

4. Radio-Engineered Quality

5. Super Selling Aids

The Batteries for the Radio Trade!

RADIO CORPORATION of AMERICA

RADIO BATTERIES — **HARRISON, N. J.**

TRADE FLASHES

[*from page 8*]

gates, held at the Hotel Hamilton in Washington, D.C.

The aims of this organization are: 1) The furtherance and improvement of the electronic servicing industry. 2) To promote the welfare of servicing dealers and technicians. 3) To promote a better understanding between electronic service industry and the electronic industry. 4) To promote and secure better relations with the public. 5) To provide educational facilities for its members. 6) To raise the standards of the electronic servicing profession. 7) To cooperate with federal, state, and municipal agencies.

Temporary elected officers are: President - Max Liebowitz (N.Y.C.). Vice-President — Norman R. Selinger (Wash. D.C.), Corresponding Secretary—Richard R. Devaney (Phila. Pa.). Recording Secretary—Roger K. Haines (Haddonfield, N.J.). Treasurer—Vance E. Beachley (Harrisburg, Pa.). Samuel L. Marshall (N. Y. C.) was appointed chairman of the Interrelations and Publicity Committees: James L. Burns (Wash. D. C.) chairman of the Membership Committee: and Frederick J. Schmidt (Steelton, Pa.) chairman of the Steering Committee.

The address of this new association is Dorchester House, 1625 Kalorama Road, N. W., Washington, D.C.

TV Station For Kansas City

Station KMBC of Kansas City, Missouri, has recently purchased a Du Mont Oak Series, 5 KW, air-cooled transmitter and necessary antenna. The announcement is made by Herbert Bloomberg, district sales manager of the Television Transmitter Division, Allen B. Du Mont Laboratories, Inc., Clifton, N. J.

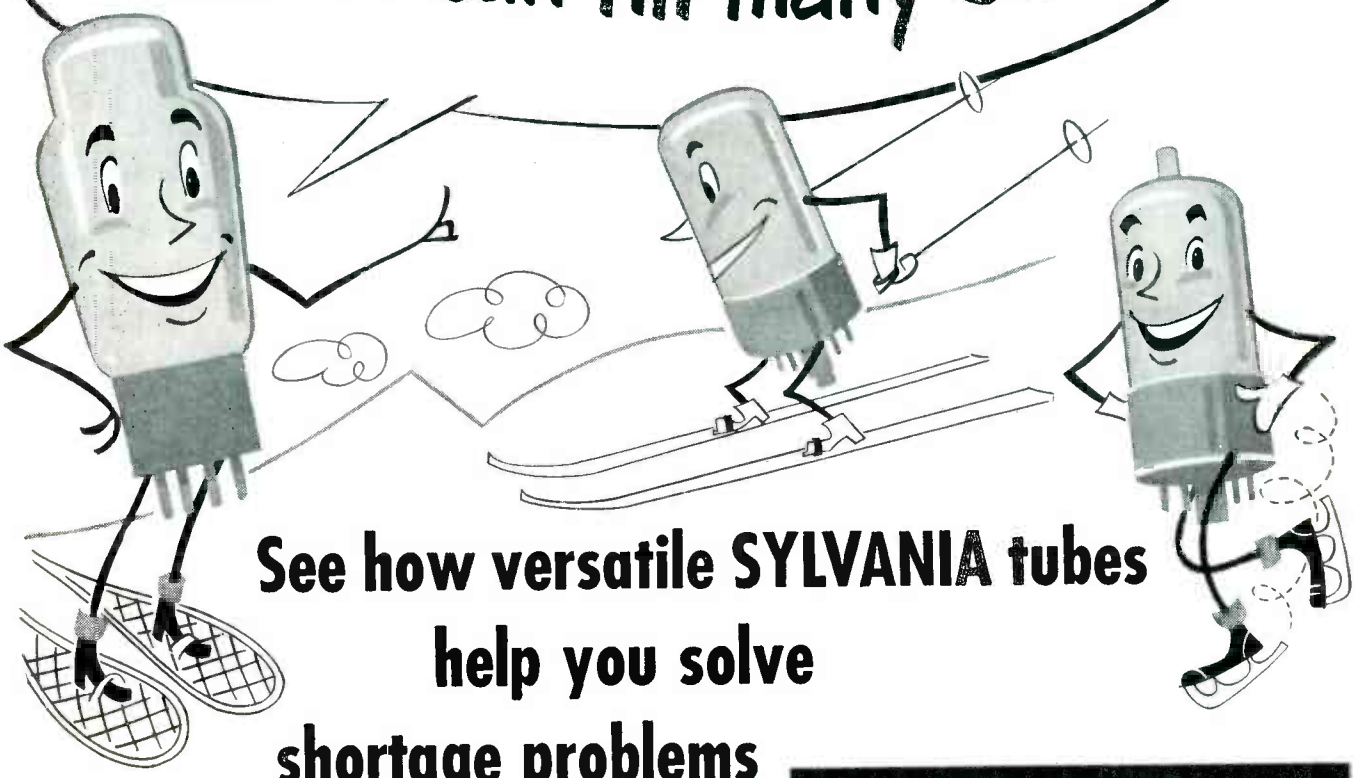
Arthur B. Church, president of KMBC, placed the order for this transmitter as part of the plans for station expansion in anticipation of the end of the present "freeze" on new television stations. The transmitter will be installed in the new building which KMBG is building under its present expansion program.

Thomas Electronic Expands Advertising

Thomas Electronics, Inc., television tube manufacturer of Passaic, N.J., marked its entry into large-circulation, direct consumer advertising with a full-page in color in the February

[*Continued on page 53*]

"Sure we can fill many Shoes"



See how versatile SYLVANIA tubes help you solve shortage problems

Yes, radio tubes are still in short supply. But, Sylvania is doing its utmost to serve all its loyal customers.

Production facilities are being increased, and all Sylvania Distributors are being taken care of on the fairest possible allocation basis.

But, there's *no shortage* in ingenuity at Sylvania! Now this company offers you service dealers a great new tube substitution manual.

Here's a complete classified listing to assist service technicians and engineers in making substitutions for tube types not immediately available. This booklet includes circuit modifications and substitution directions for battery types, 150 ma. and 300 ma. types, as well as for Transformer and Auto Tube types . . . Television Tubes and Picture Tubes, too.

40 pages of valuable, up-to-the-minute information . . . FREE from Sylvania. Get your copy from your Sylvania Distributor NOW, or mail the coupon below.

This book is being given away FREE by Sylvania as a service to its good friends, the country's radio-television service dealers.

SYLVANIA ELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC. 1901-1951 50th ANNIVERSARY FIVE DECADES OF PROGRESS

Sylvania Electric Products Inc.
Dept. R-2303, Emporium, Pa.

Please send me new booklet "Sylvania Tube Substitution Manual."

*Name*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING; WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

Here's the BOOSTER that says "YES" to all your demands...

the New AUTOBOOSTER by ITI

THE *FULLY AUTOMATIC* TV-FM BOOSTER

Here at last is a TV Booster that gives you gain up to nine times, full band width for undistorted video and audio on all channels, plus — the newest development in booster design — completely automatic operation.

The ITI AUTOBOOSTER turns itself on and off and is automatically tuned by the normal operation of the TV receiver. No confusing array of knobs — no unsightly mess of wires — You can install the ITI AUTOBOOSTER in the back of the receiver, out of sight. You get all the improved performance, all the fine picture quality that this precision-engineered booster can give you with none of the trouble of tuning, none of the exposed wiring usually involved in booster operation.

Customer acceptance is assured, too, because no customer instruction is needed. After it's installed, all you can see is the improved picture.

- ✓ AUTOMATIC ON-OFF
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How To Use

SWEEP GENERATORS

PART I

by **MATTHEW MANDL**

As TV servicing becomes of age the servicing technician realizes that the sweep generator is a necessary and integral piece of test equipment for complete TV servicing. In this first installment basic principles and waveforms are discussed. The reader will find the "approach" and illustrative material easily understood.

THE modern sweep generator, when properly used, is an instrument which greatly facilitates television and FM aligning and tracking procedures. It enables us to get a visual indication of the exact band-pass characteristics of wide-band r-f and i-f stages and thus takes the guesswork out of these servicing techniques. Besides tracking and aligning, the sweep generator is also useful as a signal source for localizing defective stages by using signal tracing methods. Commercial sweep generators are also available which incorporate sweep frequencies in the video modulation range (30 cps to 4 mc) so that the video amplifier response can be checked.

Inasmuch as the FM band lies between 88 mc to 108 mc and the present-day television channels extend to 216 mc, the very high frequencies which are involved means that special precautions must be observed in order to get satisfactory results. The long connecting leads and unshielded cables so often used in radio aligning can no longer be employed in TV or FM aligning. Besides this, the general functional aspects of the sweep generator (and marker) must be understood by the technician before he can fully utilize the time-saving benefits of sweep aligning.

While it is not necessary to understand the exact theory underlying all the circuits in a sweep generator, it is useful to know how a sweep generator enables us to get a picture of the i-f band-pass on a 'scope, and for best results we should be able to compensate for the different kinds of sweep which are encountered in both generator and 'scope. Such knowledge enables us to better interpret variations in patterns and tells us exactly which controls on the sweep generator or scope must be adjusted for best results.

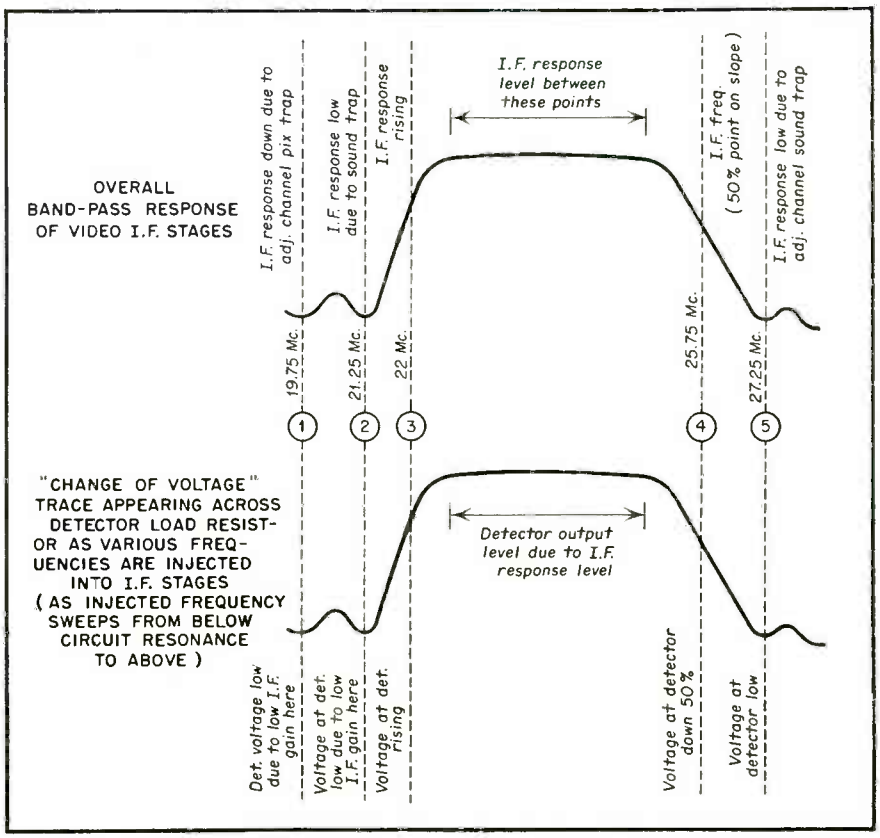


Fig. 1. Typical i-f response curve is shown at top of figure. Detected waveshape is shown at bottom.

Because of the foregoing, the essential factors of sweep generator function will be discussed in this article, as well as the nominal requirements for a good sweep generator. The second article will discuss the marker

generator and its use in conjunction with the sweep during typical aligning procedures.

How the Sweep Generator Functions

The sweep generator is nothing more than an r-f signal generator in which the frequency indicated by the dial setting is increased and decreased at a certain rate. The manner by which such a device can produce a response curve on a 'scope may be understood by referring to *Fig. 1*. At the top of this drawing is shown a typical television i-f response curve. Such a curve shows the relative gain of the i-f stages for various frequencies. The points indicated between 3 and 4 show high gain (band-pass characteristics) because between these two points is the required 4 mc wide frequency range necessary for fine picture detail.

Points *1, 2,* and *5* indicate frequencies which find little response through the i-f stages because such frequencies are trapped out to reduce adjacent channel interference. This means, then, that if we put in a frequency of 19.75 mc (point *1*) the i-f stages will provide very little gain.

If we were now to measure the d-c voltage which is developing across the video detector, we would find it to be very low as shown in the bottom drawing of *Fig. 1*. The same thing would occur if we injected a frequency of 21.25 mc into the i-f stages, for again the i-f response is poor and the voltage across the detector load resistor is low. When, however, we inject a frequency of 22 mc into the i-f amplifiers, their response is good for this frequency and the voltage across the detector resistor would rise proportionally. It can thus be seen that for various frequency which we inject into the i-f amplifiers we would get different voltages across the detector output which leave an amplitude corresponding to the gain of the i-f stages for the particular frequencies involved.

If an oscilloscope were now placed across the detector load resistor, the electron beam would move up or down to indicate a rise or drop in voltage as various frequencies are injected into the i-f stages. Thus, even though we put the same level of signals *into* the i-f stages, the fact that the frequencies differ means that the i-f response will not be the same for each and neither will be the output voltage.

Suppose now that we inject 19.75 mc. again (point *1*) and rapidly increase this frequency to 27.25 (point *5*). This would mean that the 'scope beam would move up and down rapidly

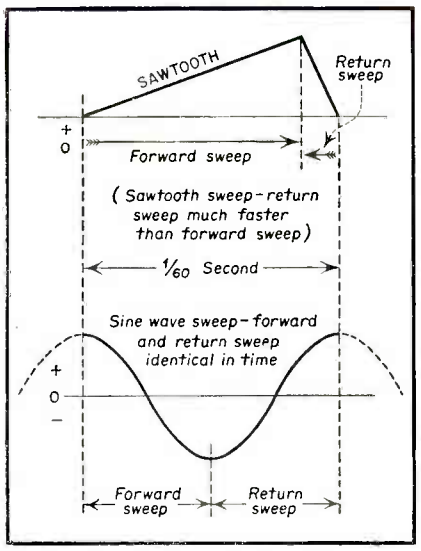


Fig. 3. Sawtooth and sine wave waveforms may be generated.

to correspond to the different levels of output across the detector. If, however, we sweep the 'scope beam across the face of the screen *at the same rate* as the signal generator, the variations in voltage would be traced out on the screen and we would get an exact reproducton of the band-pass of the i-f stages involved! By adding a device to the signal generator for changing the frequency up and down (sweeping) we convert the device into what is known as a "sweep generator".

Since the 'scope already has a horizontal sweep oscillator incorporated into its circuit, we can utilize it by synchronizing its rate with that of the sweep frequency within the generator.

The type of pattern secured, however, will depend on the *type* of sweep also, for a sawtooth or a sine wave can be used for sweep purposes. Standard sweep for an oscilloscope is a sawtooth—that is, a gradual rise in voltage and an abrupt drop to zero. This may also be found in sweep generators, but sine-wave sweep is also employed and a general knowledge of the difference this makes on the scope pattern aids materially in proper adjustments of equipment involved.

Typical Sweep Methods

Two basic methods for sweeping an oscillator frequency are shown in *Fig. 2*. At "A" is shown the general set-up when the mechanical type of sweep is employed. A low 60 cps voltage is applied to the voice coil of a modified PM speaker in which the paper cone has been replaced by a flat metal diaphram. This diaphram is brought near the tuned resonant circuit of the oscillator so that its position intercepts the magnetic field of the coil to a degree depending on its nearness. The 60 cycle current causes the diaphram to fluctuate, which in turn alters the characteristics of the resonant circuit in such a way that its resonant frequency increases and decreases. This in turn changes oscillator frequency accordingly and this "sweeps" the oscillator frequency above and below its normal value depending on the amount of movement of the diaphram. More voltage going into the voice coil makes the metal plate move a greater distance to and from the coil, and causes the oscillator

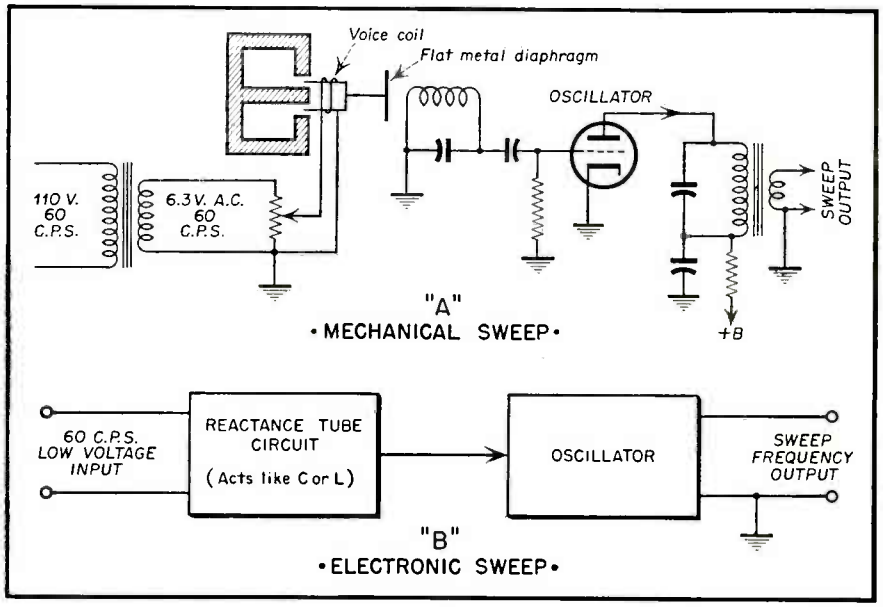


Fig. 2. Two methods of obtaining sweep in a generator. Mechanical sweep is illustrated on top; electronic-below.

to change frequency much higher or lower than at normal frequency.

Inasmuch as the resistor shown controls the amount of voltage applied to the voice coil, it has a direct influence on the magnitude of the sweep, and this control is called "sweep width" for these reasons. Thus, if we set the generator to 23 megacycles, we can set the control to sweep this frequency up to 26 mc and down to 20 mc, or by increasing sweep amplitude, from 23 mc up to 28 mc and down to 18 mc. This would make the difference between a wide looking pattern on the screen or a narrow one.

The second method of sweep shown in "B" of *Fig. 2*, consists of an electronic sweep rather than a mechanical one. Here a "reactance" type is employed, and this circuit simulates the effect of either a capacitor or inductance. When such a circuit is placed across an oscillator tuned circuit, it will have a decided effect on the frequency of the oscillator. By injecting 60 cps into the reactance tube circuit, its simulated reactance (either capacitive or inductive) changes, and this in turn causes the frequency of the oscillator to sweep above and below its present value.

The outputs of either the mechnical sweep oscillators or the electronic consist of sine-waves, though either can be converted to a saw-tooth by an additional circuit, depending on the manufacturer's choice. Thus, when using a sweep generator, the type of sweep should be ascertained for it has a definite bearing on its use.

Sine-wave vs Saw-tooth

The difference between saw-tooth and sine-wave sweeps may be understood by referring to *Fig. 3*. The saw-tooth wave shape will sweep across at a given rate, but when the voltage drops to zero the return sweep is at a much faster rate than the forward sweep. If the horizontal oscillator of the scope is also utilizing a sawtooth (common practice) the two types of sweep will coincide and the pattern will be as indicated in "C" of *Fig. 4*.

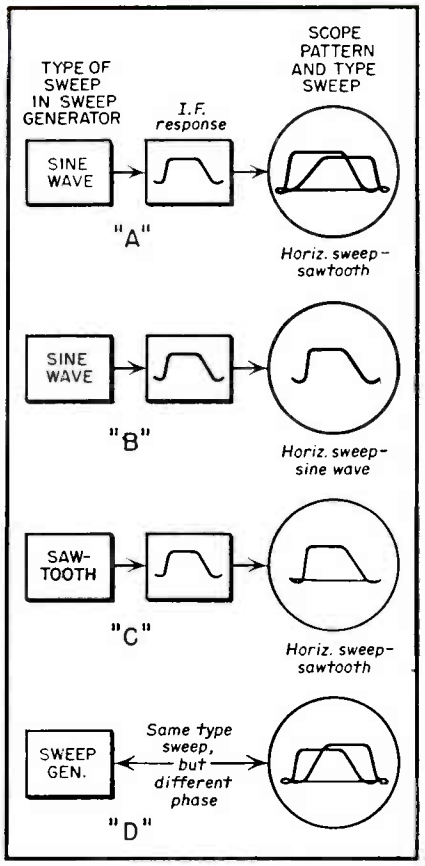


Fig. 4. The importance of using identical sweeps (sine wave or sawtooth) in both sweep generator and 'scope is illustrated in the waveshapes observed on the 'scope for various sweeps used. Improper phasing is also shown.

When a sine-wave sweep is used in the sweep generator as shown in *Fig. 3*, the forward and return sweep are occuring at identical rates, and if this type sweep is used in the generator, but a sawtooth sweep is utilized in the 'scope, the resultant pattern will be as shown in "A" of *Fig. 4*. The reason for this double pattern is because during the forward trace both the generator and scope sweeps are going in the same direction. At the right hand portion of the sweep, however, the abrupt drop in the sawtooth voltage of scope returns the beam to the left and starts to trace out the pattern again. In the meantime, however, the sine-wave sweep of the generator is sweeping the frequency from right to left, just opposite to the forward trace of the scope beam.

Sweep generators come equipped with an output terminal whereby a sample of the internal sweep can be applied to the horizontal sweep of the oscilloscope. When this is done, the internal sweep of the scope is shut off, and the result will be that both scope and generator have the same sweep, as shown in "B" of *Fig. 4*. Thus, if forward and backward sweep is linear and the phase between the two are identical, a single scope pattern will result. If there is a phase difference between the sweep voltage applied to the scope and that actuating the reactance tube of the generator, the result will be two images, slightly displaced from each other as shown in *Fig. 4* at "D". Inasmuch as this is a likely occurance when the generator sweep is applied to the horizontal deflection amplifiers a "phase" control is provided on the panel of the sweep generator in order to make correcting adjustments and get a single line trace. *Figure 5* shows the common controls to be found on the panel of a typical sweep generator.

When the sweep of the generator is not linear—that is, the beam is pulled forward at different speeds—portions of the trace may again show double lines, even though sine wave sweeps are used in both the generator and scope. With a non-linear sweep a single line trace can be obtained by blanking out the return trace, and most scopes have provisions for applying a synchronized blanking voltage to the grid of the cathode ray tube.

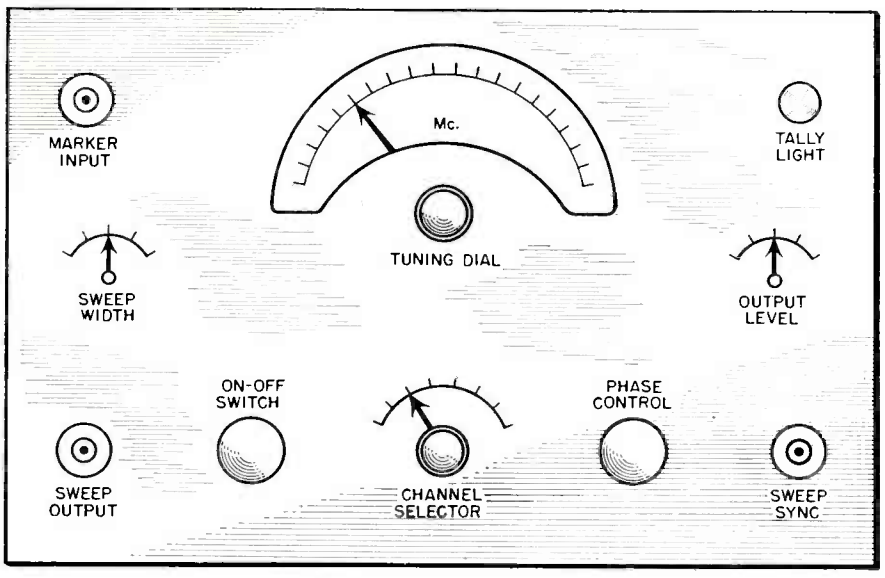


Fig. 5. Typical controls usually found on the front panel of a sweep generator.

[*Continued on page 63*]

Understanding

AUDIO DRIVERS

by **WALTER J. SWONTEK**

(Instructor, National Radio School)

This article discusses the elementary principles and requirements of a driver stage for class A, AB1, AB2, and B operation. A typical and simple problem is discussed for an application that might be found in practice.

WHEN servicing public address systems, or perhaps, building a modulator, a knowledge of what will operate properly is needed. The amateur or serviceman is usually uninterested in design engineering principles, but merely wants to know what parts to use and how to hook them up to *work*. Usually, a knowledge of what will work is obtained from memory of past experience, but, as we all know, experience is the best teacher.

Experimentation is time consuming, and the purchase of parts that will not be used, but will lay on the shelf until, maybe someday— maybe never, a use for them is found is expensive. The lost time is particularly important to the serviceman, whose time is money. The money invested in these parts is unpleasantly invested from the point of view of both the serviceman and the amateur.

If, however, an *understanding* of the operation of a circuit is obtained, the purchase of the correct parts is greatly simplified. and with the right parts, it is much easier to get the circuit to function properly, thus saving a great deal of time.

The writer of this article has noticed that a large part of the difficulty that servicemen and amateurs meet with in handling higher powered audio equipment has been due to a lack of understanding of the operation of the driver stage.

The purpose of this article is to try to give the reader an explanation of the operation of a driver stage which he can understand without the use of engineering, particularly avoiding engineering mathematics.

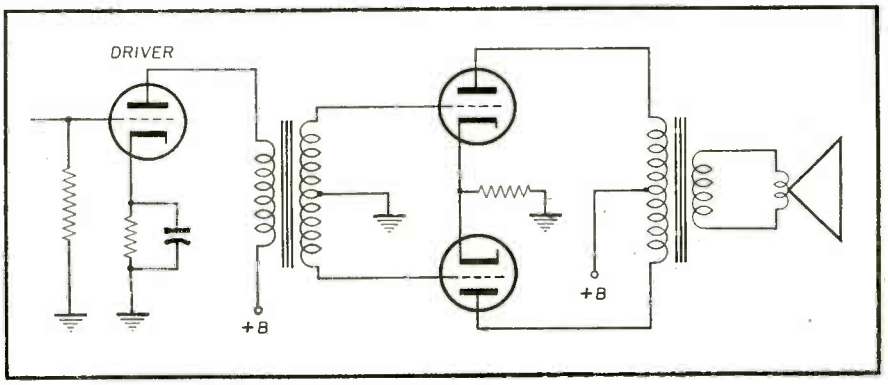


Fig. 1. Simple push-pull stage operated by triode voltage operated driver.

Whenever high power audio equipment is built, the output stage is practically always in push-pull due to the higher power output with better fidelity that is obtained. The push-pull stage requires a driver, and the operation of the push-pull stage decides what type of driver is required. Of the four classes of operation the push-pull stage may be in, two will normally draw grid current, classes AB_2 and B. Required grid signal current multiplied by required grid signal voltage results in *required grid driving power*, and the driver must be a driver. That is, the driver must be capable of delivering power output, i.e. watts.

The other two classes of push-pull operation, classes A *and* AB_1, are not normally allowed to draw grid current. Required grid signal voltage multiplied by zero signal current results in no grid driving power required, and the driver is a voltage amplifier, delivering no power output.

Since the voltage driver is the least troublesome, we shall consider it first. *Fig. 1* shows a driver stage and a push-pull stage. The circuit is simplicity itself. The driver tube is any one of the common voltage amplifier triodes such as 6J5, 6F5, 6SN7, etc. Pentodes are not used due to the difficulty of winding a transformer with a high enough primary impedance to take advantage of their high gain.

The driver transformer is really an ordinary audio transformer, with a center-tapped secondary. No current is drawn from the secondary, so very fine wire is used, and the secondary will usually be from one hundred to sistance, usually on the order of a thousand ohms or more. The primary resistance is unimportant also, and will usually be from one hundred to one thousand ohms.

The turns ratio on this driver transformer is not very critical. It will generally be one-to-one, or, in some cases, voltage gain is realized by using

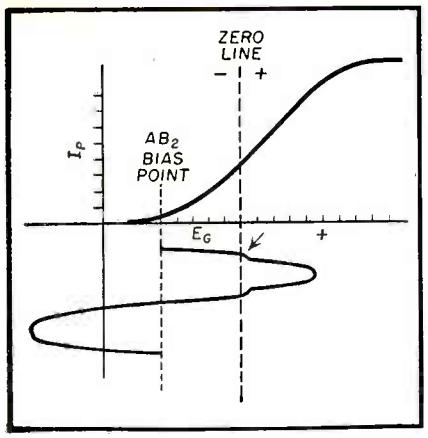


Fig. 2. Distortion produced by positive grid bias operation.

one-to-two or one-to-three step-up. If the amplifier had just barely enough gain to begin with, the turns ratio should be considered, as substituting with a transformer of too small a step-up ratio may make the overall gain insufficient.

No impedance matching problem exists, since for maximum voltage transfer from a voltage amplifier the load impedance is merely made as high as possible. The primary impedance will depend on the quality of the transformer, that is, the amount of wire and quality of core the manufacturer could afford to put into it.

The most important consideration when purchasing a driver transformer for a voltage driver is the frequency response. The transformer should be of about the same quality as the rest of the components, so that it will be flat over the same frequency range as that the amplifier is expected to cover.

The schematic of a power driver stage is almost identical with that of a voltage driver. In *Fig. 1,* if the cathode bias were removed from the push-pull stage and some other means of bias substituted, the schematic would be perfectly good for either a power driver or a voltage driver. This, of course, is due to the fact that cathode bias is very seldom used in class AB_2, and never used in class *B*. The easiest way to identify a power driver is to notice the tube type used in the driver. If this type is a power amplifier type of tube, it naturally would be a power driver.

Although schematically the two types of drivers are practically identical, their methods of operation differ in the extreme. The power driver is by far the hardest to handle. This is due to the fact that the grid impedance of a tube drawing grid current changes very rapidly from a very high value to a very low value as the grid is reversed in polarity from negative to positive, and vice versa.

The rapidly changing grid impedance of the push-pull tubes applies a rapidly changing load to the driver. If the driver has any appreciable internal impedance, this impedance will cause a sudden voltage drop in the drivers output signal wave at the point at which the grid begins to draw current. This voltage drop changes the shape of the wave, and represents harmonic distortion.

Figure 2 represents the action of one of the push-pull tubes on the

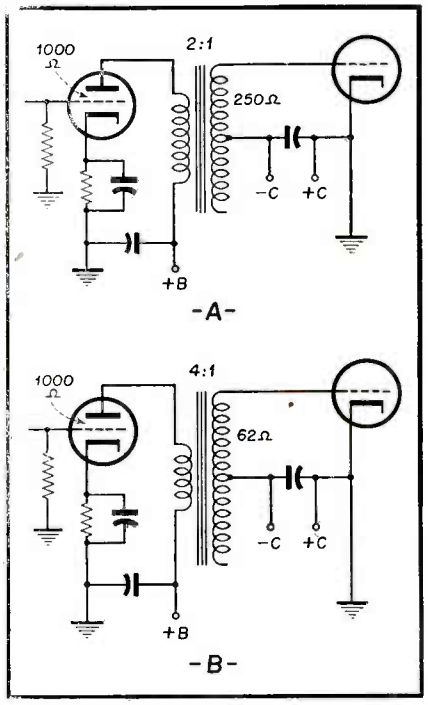


Fig. 3. Effect of turns ratio on driver impedance.

signal. As the signal starts from the bias point, the grid is negative, has a very high impedance, and draws no current. No current being drawn from the driver, there is no voltage drop in its internal impendance. The signal makes the grid go less and less negative until at the point marked by the arrow the signal has overcome the bias completely, and the grid becomes suddenly positive, immediately drawing current. This current causes a voltage drop in the internal impedance of the driver, distorting the wave.

As the signal passes the peak the grid becomes less positive until it again passes the zero line, becoming negative and removing the load from the driver. The drivers output voltage rises, again distorting the wave. The other push-pull tube will do the same thing to the other half cycle. As in power supplies, the larger the internal impedance of the driver, the poorer its regulation will be and the more the voltage will change with a change in load. Here, the voltage change is distortion.

Practically all the features of the power driver are the direct result of the engineers attemps at keeping the internal impedance of the driver as low as possible, thereby minimizing distortion. For instance, the tube in a power driver is always a triode power amplifier because triodes inherently have lower plate resistance than tetrodes or pentodes. If a pentode tube must be used, it will be triode connected for the same reason. Since two tubes in parallel have half the plate resistance of one, they are often used as power drivers.

The driver transformer has to deliver current and therefore power. It will have a wattage rating equal to or larger than the output of the driver tube. The d-c resistance of both windings is kept as low as practical to keep its internal resistance low. The secondary is usually on the order of a few ohms, the lower the better. The primary may run as high as one or two hundred ohms, again the lower the better.

Figure 3 illustrates the effect of the transformers turns ratio on the drivers internal impedance as seen by the

[*Continued on page 60*]

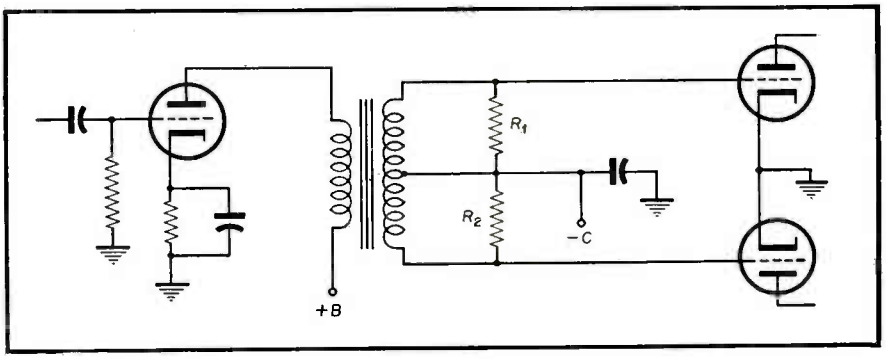


Fig. 4. The addition of resistors, R_1 and R_2 across the secondary reduces distortion.

FRONT ENDS

by Samuel L. Marshall

(From a forthcoming book, "Television Service Techniques")

Part 8

A close runner-up to cleaning and lubrication, as far as Front End repairs are concerned, is detent repair and replacement. In this article various types of detents are discussed together with the subject of indexing, which is closely related to proper detent operation in turret mechanisms.

Detent Repairs and Replacement

The mechanical device which snaps the tuning mechanism into position when tuning is a channel is called the *detent*. Detents may be used in conjunction with continuous as well as switch and drum type tuners.

Typical shaft-mounted detent mechanism used in wafer-switch type tuners are shown in *Fig. 3-59*. One of the components used in this type of detent is the shaft which is rotated on one end by the operator and which controls the switch wiper contact arms (not shown) on the other end. A flat pressure spring which is firmly secured to the shaft as shown in *Fig. 3-59B* carries with it a ball bearing which fits snugly in notched grooves of a back plate as shown in *A* and *C*. If properly adjusted, when the wipers on the band switch make best contact with the switch spring contacts the ball bearing should fit perfectly in the notched groove.

Trouble arising in detents of this type are warped shafts, flattened ball bearings, and weak pressure springs, any of which can prevent the switch wafer points from making proper contact with the coil connections. This results in noisy, intermittent and unstable tuner operation.

A commercial operation sheet relating to the procedures to be followed when replacing a typical detent is shown is *Fig. 3-60* and *Fig. 3-61*.

Certain precautions must be observed when replacing detents in wafer-type tuners. Care must be taken when removing the shaft that the wafers are not disturbed from their original positions. If any single wafer is turned while the shaft is removed, the wrong coil will be switched into the circuit when the shaft is reinserted.

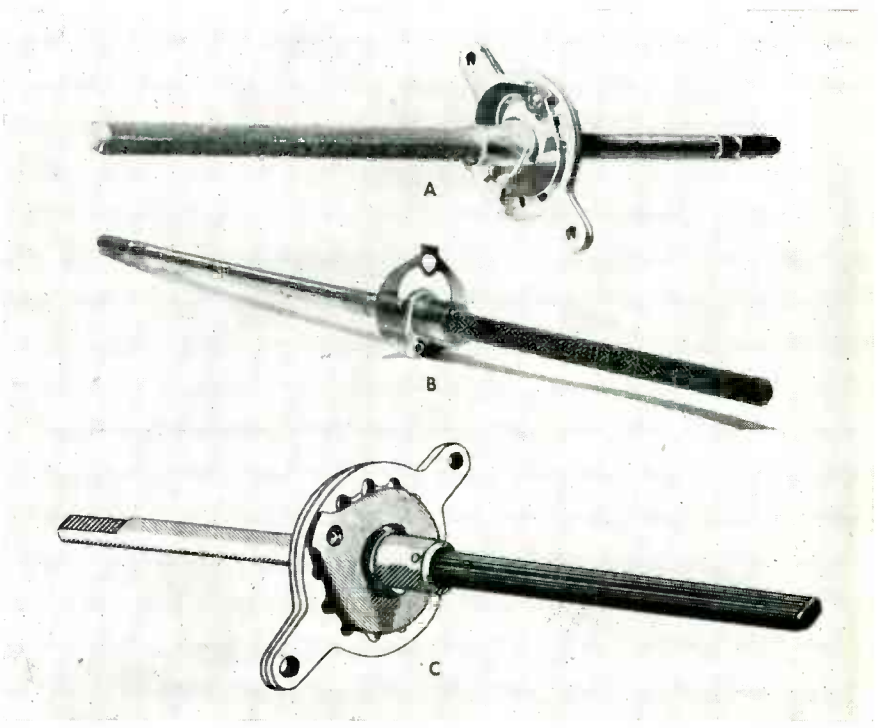


Fig. 3-59: Detent mechanism and shaft details.
(A) Complete replacement unit by JFD.
(B) Shaft and pressure spring-same as (A) above.
(C) Complete replacement unit by Tele-Matic Industries.

In the RCA tuners an "X" mark appears on the locating plate which guides the repairman when replacing the unit and insures correct positioning of the wafers.

It might also be pointed out that detent shaft lengths vary for different receivers. Therefore, when ordering a new detent it would be wise to ascertain the exact model number of the receiver for the replacement being made.

In turret-type tuners of the Standard Tuner variety the detent mechanism consists of a roller (see *Fig. 3-62*) which rotates in a grooved plate mounted around the approximate center of the drum. Pressure of this roller against the grooves is applied by means of a spring (see items 8 and 5 in *Fig. 3-58*) mounted on the tuner chassis. Spring tension is controlled by moving this spring along its holding screw and nut until the roller provides maximum tension with the drum.

In the Philco 8-position turret tuner the detent mechanism consists

*Tele Matic Industries Inc., Brooklyn, N. Y.

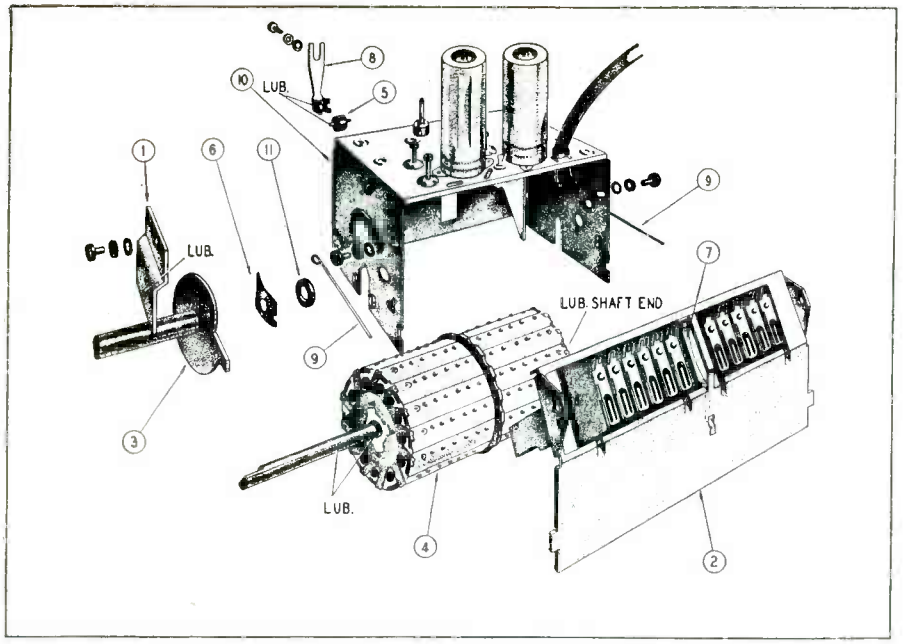


Fig. 3-58: Exploded view of Philco 12-position turret tuner. Item 8 in this figure is the detent roller pressure spring. The roller itself is shown as Item 5.

of an 8-toothed gear which engages in a roller. Pressure against the roller is applied by means of coil springs. Detent troubles in this tuner arise generally from flattening of the roller and weak springs, the latter resulting in inadequate pressure of the roller against the gear grooves. Spring replacements should be of the exact length and tension.

Indexing

In turret tuners indexing refers to the mechanical alignment of the coil contacts on the drum with the spring contacts mounted on the housing. Unless perfect alignment is obtained, and unless the mutual pressure between these contacts is correct, noise, microphonics, and erratic tuning operation results.

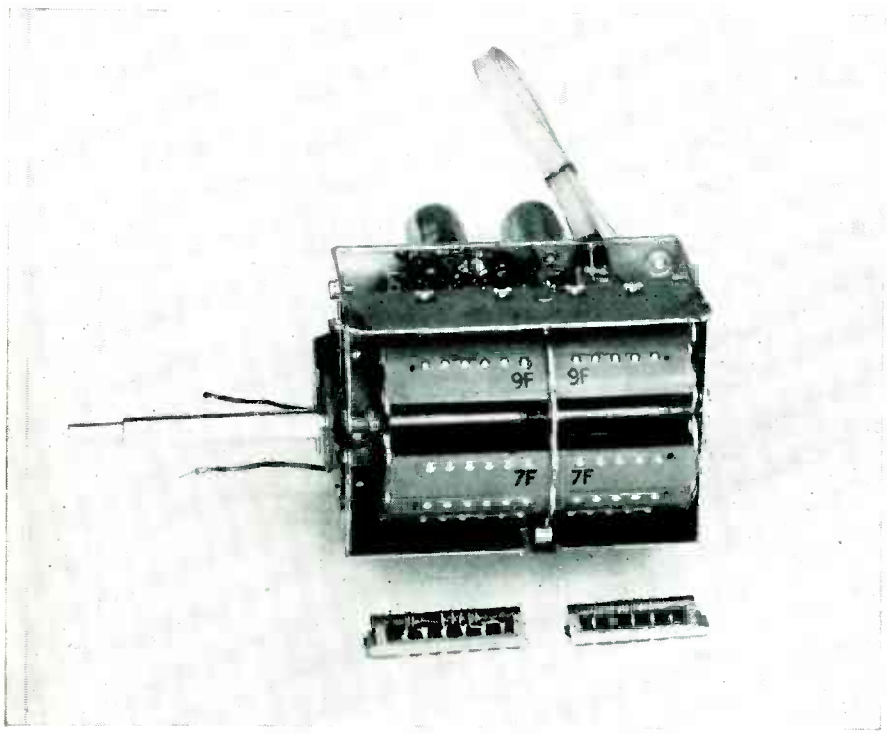
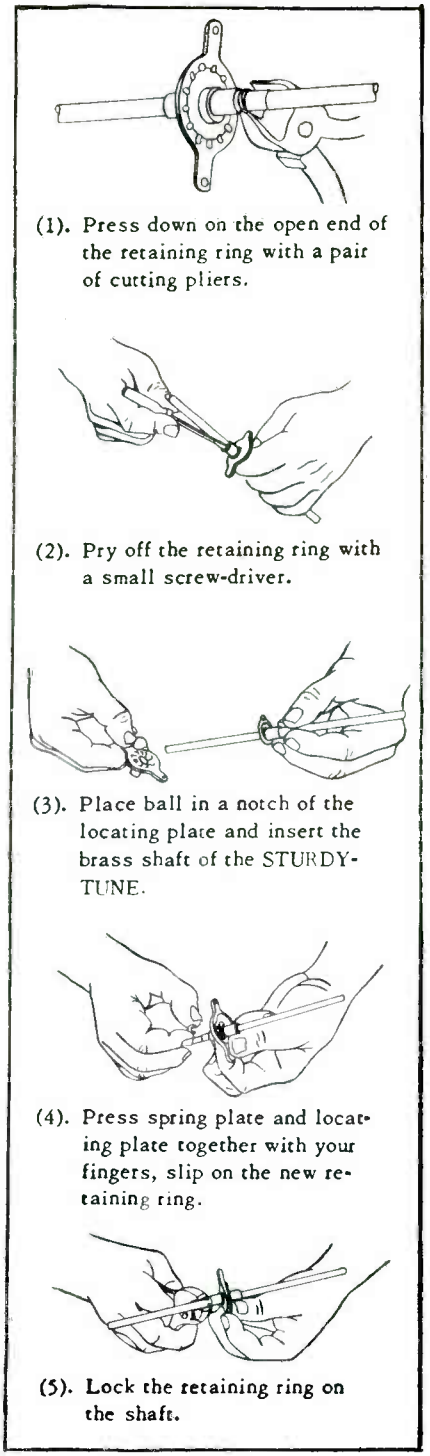


Fig. 3-62: Detent mechanism of Standard Tuner consists of roller and grooved plate mounted around center of drum. Grooved plate can be seen between numbers on coils. Roller can be seen below this plate.



(1). Press down on the open end of the retaining ring with a pair of cutting pliers.

(2). Pry off the retaining ring with a small screw-driver.

(3). Place ball in a notch of the locating plate and insert the brass shaft of the STURDY-TUNE.

(4). Press spring plate and locating plate together with your fingers, slip on the new retaining ring.

(5). Lock the retaining ring on the shaft.

Fig. 3-60: Operation sheet supplied with Tele-Matic replacement detent. The entire operation is one requiring only practice if speed is the ultimate objective. Similar operations are performed when taking apart a volume control.

The primary causes of poor indexing are worn bearing surfaces, weak springs, flattened ball bearings and worn rollers. It is relatively simple to check for faulty indexing. One merely observes the manner in which the contacts fall into position with each other. Poor alignment and pres-

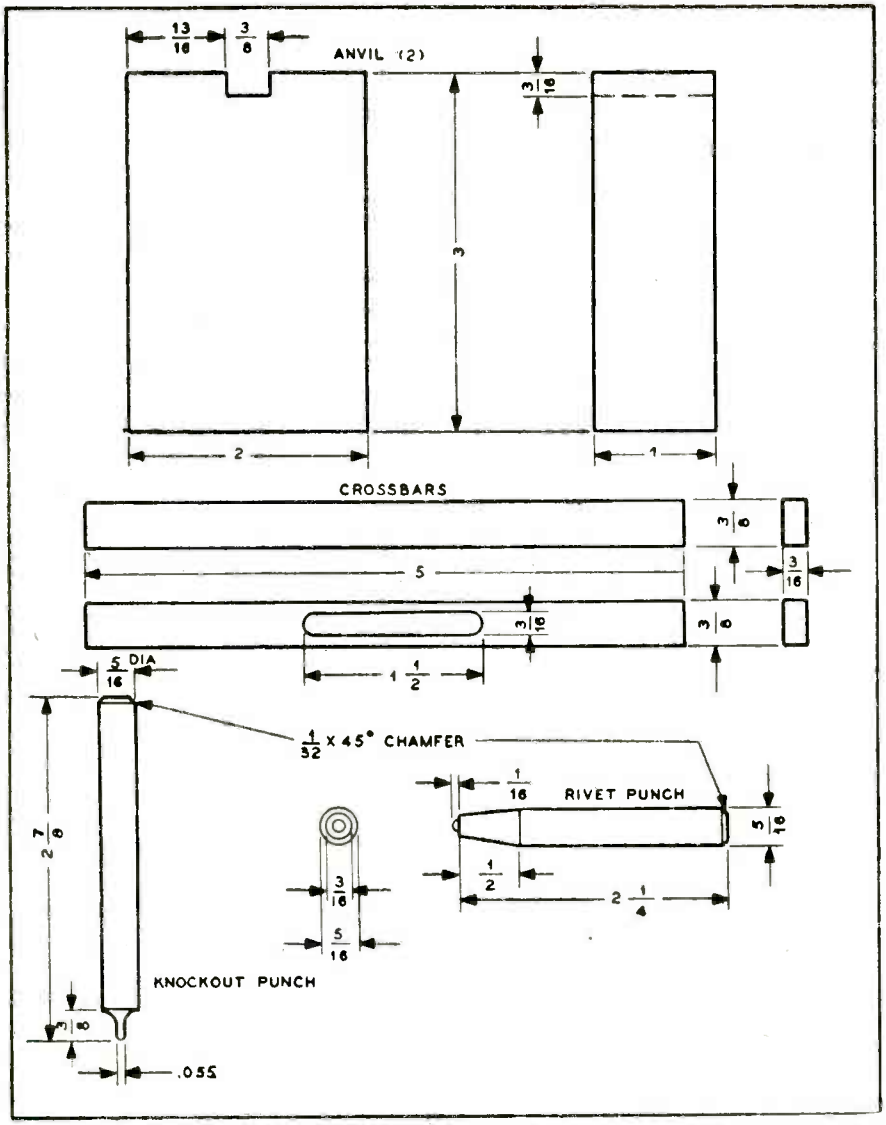


Fig. 3-63: Jig details for replacing conact spring assemblies in Philco 8-position turret tuners.

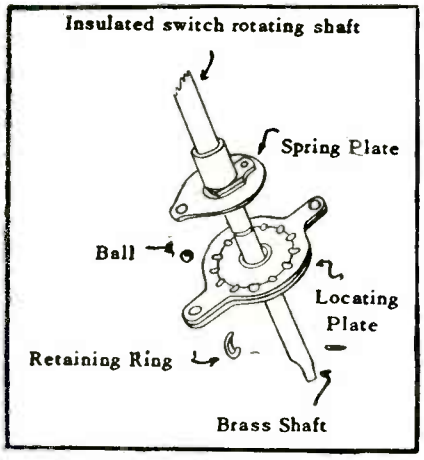


Fig. 3-61: Exploded view of the complete detent.

sure become immediately obvious. Most tuners have indexing adjustments to take up slight wear in the various parts. However, if a part becomes worn to the extent that proper indexing becomes difficult, it should be replaced.

It has been found by at least one manufacturer that the retainer spring of the Standard Tuner (see item 6, *Fig. 3-58*) which supports the turret in the tuner housing, often does not exert sufficient pressure against the turret, resulting in poor indexing. To correct this condition a .057" spring is recommended to replace the original spring which has a thickness of .049".

In the Philco 8-position turret tuner indexing is accomplished by adjusting the set screws mounted on the front and rear frame of the tuner. These screws control the alignment and pressure of the rotating contacts with respect to the stationary contacts. Sometimes proper indexing in this tuner becomes impossible because of the contact springs are beyond repair. In this case the contact panel or panels should be replaced. The procedure is as follows:*

If either or both of the contact panels are found to be defective due to broken springs or for other reasons, the contact panels only should be replaced rather than replacing the tuner assembly.

NOTE: It is necessary to replace both contact panels using this procedure.

The following tools may be made up to make the replacement of contact panels much easier and quicker. See *Fig. 3-63.*

1. Two anvels used to support the crossbars.

2. Two crossbars made of material that can be case-hardened—one slotted, used to remove the rivets and one solid, used in riveting.

3. Two punches made of drill rod and case-hardened—one a knockout punch and the other a rivet punch.

Parts Needed:

1. Oscillator & mixer panels with rivets, part #45-9520.

2. Aerial and rf panels with rivets, part #45-4919.

Procedure:

1. Remove all oscillator and rf coils from turret assembly.

2. Remove complete turret assembly from chassis by unsoldering the associated wiring, ground straps, and removing the self-tapping mounting.

3. Carefuly clip the various components from the old contact panels as close to the contacts as possible. This procedure will prevent damage to various components which might result if the leads are unsoldered, and will not greatly disturb the lead dress.

4. Remove the four self-tapping screws which hold the tube platform to the shaft and drum assembly.

5. The contact panels may be removed by punching out the rivets using the knockout punch. (The contact panel must be backed up with the anvels and the slotted crossbar, allowing the rivets to fall out.)

6. The new contact panels may be installed by riveting, using the rivet punch. (The new contact panels must be backed up in the same manner as in step #5 but using the solid crossbar.)

7. Remove the excess solder from the ends of the clipped components in the rf assembly and carefully resolder them to the correct terminals on the new contact panels. Replace the four self-tapping screws that hold the tube platform to the drum and shaft assembly. Replace turret assembly in chassis and reconnect wiring.

*From Philco Television Service Manager's Manual, June 16, 1948.

Using the MEGACYCLE METER for Servicing

by **LOUIS SANDBERG**

(Instructor, Delehanty Institute)

The Megacycle Meter is a valuable asset to the radio-tv servicing technician as an added piece of test equipment for locating troubles. In this article some of the applications of this instrument as an aid to servicing will be discussed.

THE Megacycle Meter described in the following paragraphs is a precision built variable oscillator with a set of plug-in coils capable of generating a signal with a range of frequencies from 2.2 to 400 mc. A sensitive microammeter connected in the grid circuit makes this device a grid dip oscillator the function of which will be discussed in a later paragraph.

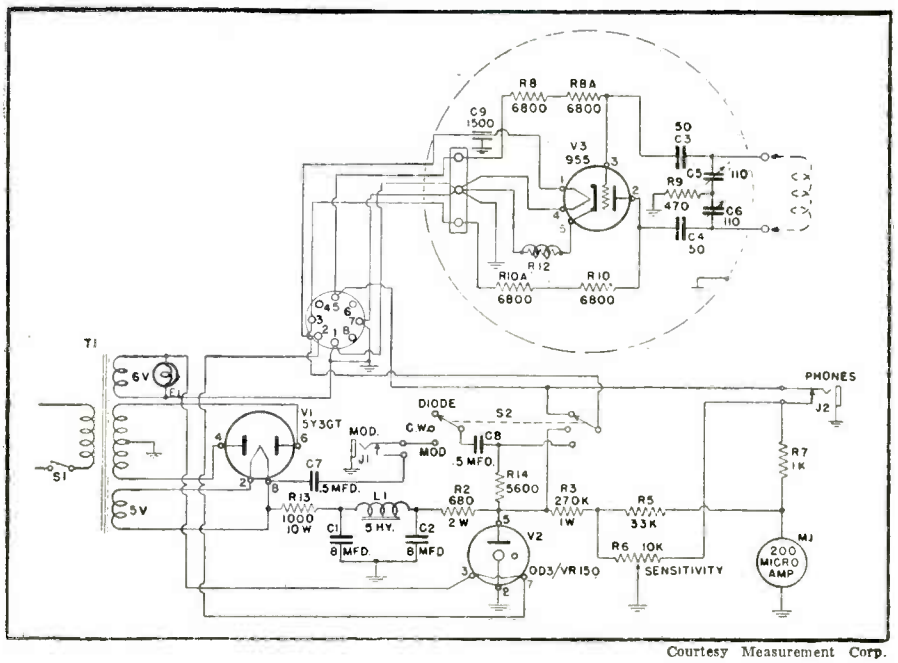
This instrument is generally used by manufacturers, development laboratories, etc. However, it is readily applicable to test procedures as performed by servicemen.

Description

Reference to the circuit diagram of the unit in *Fig. 1* will reveal that the tube complement consists of a 955 triode oscillator, a 5Y3 rectifier, and an OD3/VR150 voltage regulator. Modulation of the oscillator is obtained from the 120 cycle component contained in the full-wave power supply. External modulation may be obtained through the jack provided for this purpose.

The tuning unit of this instrument is connected to the circuit by means of a cable, which makes it very handy to use; one can place it near any part of the circuit being tested. A hand calibrated dial with a high degree of accuracy is one of the features of this instrument.

The 955 tube may be used as a diode detector with the microammeter as the indicator of the rectified current. This arrangement permits the device to be used as a highly accurate wavemeter. Provision is also made for the connection of headphones for use of the instrument as a frequency meter.



Courtesy Measurement Corp.

Fig. 1. Circuit diagram of Model 59 Megacycle Meter

The Megacycle Meter may be used as a signal generator to completely align the Front End of a TV receiver with no connections to the set whatsoever. While not possessing the accuracy of a crystal oscillator, the instrument has an accuracy well within that required of a marker generator for this purpose. Alignment of TV sound and video i-f stages may be accomplished in the same manner. Particularly useful is its function as a marker generator when used in conjunction with a sweep generator.

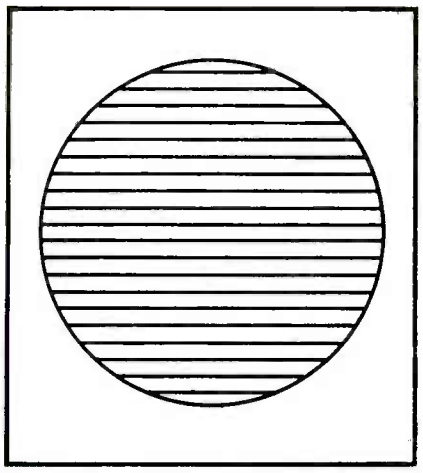


Fig. 2. Modulation of r-f or i-f carrier produces horizontal pattern for linearity measurements.

Aligning Receivers

When used for television alignment in conjunction with an oscilloscope or output meter connected to the video amplifier plate, the Megacycle Meter (using modulation) is placed near the antenna lead, and the oscillator, mixer, and r-f stages are aligned for maximum indication of the scope or output meter.

For video i-f alignment the instrument is placed near the mixer coil, whereupon the video i-f stages are aligned for maximum indication at the frequencies designated by the manufacturer.

For television sound i-f alignment the pickup coil of the instrument is placed near the mixer i-f coil and the sound i-f stages are aligned for maximum audio output. Following this, the discriminator secondary is adjusted for minimum audio output.

For sound trap alignment the Megacycle Meter is placed near the trap and the latter is tuned for minimum grid current indication on the megacycle meter at the trap frequency.

The above mentioned alignment procedure is not meant to minimize the superiority of a good sweep alignment, however, it affords a means of performing a rapid and acceptable alignment.

As a marker generator for sweep aligning it is generally excellent because it can be injected anywhere along the i-f strip without materially changing the slope of the i-f response curve.

Resonance Indication

When used as an absorbtion wavemeter it can readily measure the frequency of any oscillator falling within the frequency range from 2.2 mc to 400 mc. Due to the exposed oscillator coils of the meter any degree of coupling loose, critical, or overcoupling is possible, thereby effecting variable loading of the resonant circuit under test.

Model 59 Megacycle Meter showing probe and removable coil.

Inductance & Capacitance Determinations

Determining the inductance or capacitance of unknown components or finding the resonant frequency of an r-f/i-f or oscillator coil is easily accomplished.

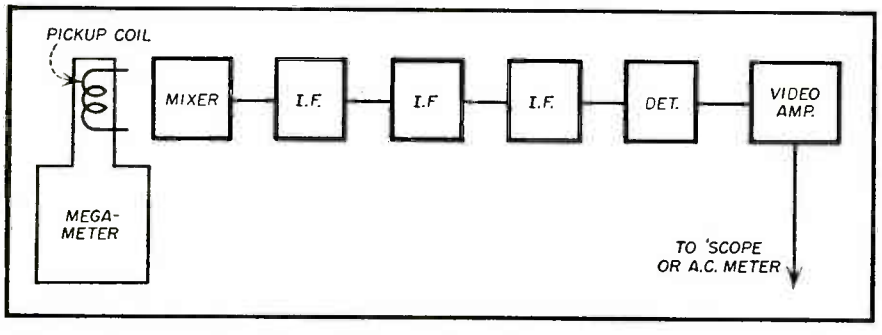


Fig. 4. Setup required for plotting video i-f response curve of TV receiver.

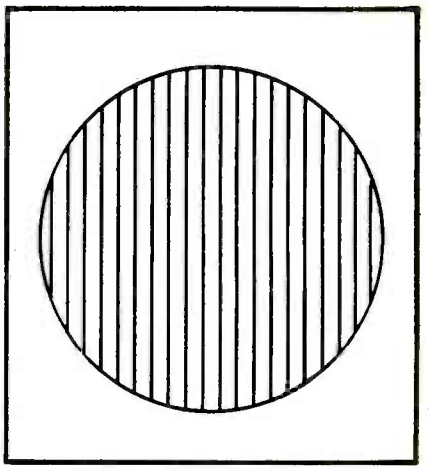


Fig. 3. Modulation frequency of 300 kc is required for vertical pattern.

When an unknown capacity is to be determined, the capacitor is connected across a known inductance (the instrument coils may be used for this purpose. And the resonant frequency is then found by minimum grid current indication. Since the inductance is known, and the resonant frequency is now known it becomes a simple matter to determine the unknown capacity. At resonance the inductive reactance (X_L) is equal to the capacitive reactance (X_C), therefore at resonance $2\pi FL$ is equal to $\frac{1}{2\pi FC}$. Since C is unknown, by transposing the equation we find $C = \frac{1}{4\pi^2F^2L}$; thus, by finding the resonant frequency we can determine the capacity of an unknown condenser. A chart is supplied with the instrument to aid in the determination of unknown capacitor values.

When an unknown inductance is to be checked, a known capacity is placed across the inductance and once again the resonant frequency is found with the megacycle meter. Again the above mentioned procedure is applied, this time with (L) as the unknown factor. Therefore, upon transposing the equation once again we find that $L = \frac{1}{4\pi^2F^2C}$, and the inductance is then readily found. By using this method of checking coils, all kinds of r.f., i.f. and oscillator coils can be wound and tested as described.

Linearity Measurements

The Megacycle Meter may be used for horizontal or vertical linearity adjustments. The meter is supplied with a jack marked Mod. through which an audio signal is used to modulate either the i-f or r-f carrier. The frequency of the modulator should be

[*Continued on page 61*]

ANTENNA ROTATORS

PART 2

by J. F. SEYBOLD
(Rotator Engineer, Radiart Corp.)

Fig. 7. Radiart Tele-Rotor control box which houses the motor capacitor and step-down transformer.

In this concluding installment the author discusses further rotator service techniques. Also treated are the applications of rotators in various types of installations, and engineering data on rotator installations subjected to winds of high velocities.

The control box of the Tele-Rotor (*Fig. 7*) houses the motor capacitor, a step-down transformer to reduce the 115 volt a-c line to 24 volt a.c. for the motor and 6.3 volt a.c. for the indicating lamps, and the "fingertip" control switch, which is a two-pole three position type, extending thru the front of the control box cover. A serrated lever knob allows simple finger-tip pressure control in either direction of rotation, and returns to the center "OFF" position when no pressure is applied to either side.

Four screws holding the rubber feet also retain the base plate to cover. The removal of these, the control knob and the indicator dial will allow convenient inspection of the parts. To remove the indicator dial, simply lift under the dial edge, using a blade or fingernail, until the assembly snaps up out of the hole in the cover. By gently pulling outward on the two snap springs, the plastic dial may be removed.

Here too, when troubleshooting, simple ohmmeter checks will determine the possible causes of inoperation. The primary of the transformer should have a value of about 25 ohms; the secondary (24 V) winding will show a resistance of approximately one ohm. A check across the capacitor should cause the ohmmeter needle to drop to a low value then return gradually to a higher reading (capacitor charging). The common lead of the ohmmeter may be connected to either capacitor terminal since the capacitor is not polarized. It is important that the capacitor, if requiring replacement, be replaced only with a non-polarized or motor starting type condenser, *NOT* an electrolytic type used in d-c filter circuits.

Who Needs a Tele-Motor?

Perhaps the most inaccurate impression observed in television today is, "A rotator is required in a fringe or outer fringe area". Rotators are a necessity in the fringe areas to obtain, in many cases, a maximum signal that provides only the minimum requirements of a satisfactory viewing picture.

In metropolitan areas, a rotator is required to:

1. Reduce excessively strong signals on channel being received by allowing rotation of the antenna.
2. Reduce or eliminate co-channel interference or "venetian-blinding" effect.
3. Reduce or eliminate adjacent channel interference or "over-riding", evideced by floating flame bars.
4. Reduce or eliminate "ghosts" or allow the direct reception of "ghost" signal where such reflected signals are stronger than the "straight-line" signal.
5. Allow for any varying conditions that may affect the reception of a satisfactory signal from a given direction.

The serviceman, in many cases supplying contract dealer service, should consider both his and the customers' best interests. By providing set dealers and customers with information about rotators and the advantages of installing a rotator with the initial outside antenna installation, the dealer will not have to 'sell' the necessity of a rotator to his customers.

Errata

We wish to correct certain typographical errors which appeared in the Feb. installment. Under title-"Radiant" should be "Radiart". In Fig. 2. "Top Left" should be "Top Right", and vice versa. "Columbus, Ohio" should be "Columbus, Indiana". Photo by James R. Gillen should be noted "Courtesy of Crescent Radio Supply, Glasgow, Ky." On page 15, 2nd par. 1st line "rotating" should follow the word "antenna". On page 16 "Fig. 3" (only) and "Fig. 4" (only) should be interchanged.

WIND VELOCITY M.P.H.	HEIGHT OF MAST – FEET			
	12	14	16	18
10	14.4	18.8	23.4	28.2
20	57.4	62.1	93.6	112.6
30	129.1	169.2	210.5	252.3
40	229.6	300.7	374.3	450.2
50	358.7	469.8	584.8	703.5
60	516.5	676.6	842.1	1013.0
70	703.0	921.0	1146.3	1378.8
80	919.0	1203.0	1497.2	1801.0
90	1162.8	1523.1	1895.6	2280.3
100	1437.6	1883.0	2343.6	2819.1

Fig. 8B. Bending moments on LZX-4.

WIND VELOCITY M.P.H.	HEIGHT OF MAST – FEET				
	5	6	8	10	12
10	2.9	3.8	5.8	7.9	10.2
20	11.5	15.4	23.3	31.7	40.6
30	26.0	34.5	52.4	71.4	91.3
40	46.2	61.4	93.2	126.8	162.2
50	72.1	95.9	145.6	198.2	253.5
60	103.9	138.1	209.7	285.2	365.0
70	141.4	188.0	285.4	388.4	496.8
80	184.6	245.6	372.8	507.3	649.0
90	233.7	310.9	472.0	642.2	821.5
100	288.5	383.7	583.6	792.7	1014.0

Fig. 8A. Bending moments on LZX-2.

By doing the above, the service dealer will eliminate the costly "no-charge" call backs to re-orient antennas, and will at the same time preserve his dealers' and customers' goodwill as well as his integrity as a service dealer.

In addition, the recommendations of the service dealer will be depended upon by both the dealer and the customer. It, therefore, is important that the serviceman base his recommendations on equipment he knows to be dependable and economical.

Engineering Data

Since an antenna and rotator installation may be subjected to winds of high velocities, it is necessary to provide means of handling the large side thrusts that may be developed at the rotator. This is accomplished in the Tele-Rotor by using two rows of ball bearings equally spaced on 6-1/2 inch diameter ball races *(Figs. 3* and *4)*. As shown in the Comparison Chart *(Fig. 8)*, 525 ft.-lbs. of sidethrust forces is required to stall the Tele-Rotor.

The turning force is shown as "Torque, Ft.-Lbs." and is 36 ft.-lbs. for the Tele-Rotor. This amount of torque will easily handle the most elaborate antenna array, even with cable lengths up to 750 feet long and line voltages down to 95 volts.

Tests have shown that the Tele-Rotor can operate efficiently in the temperature range of 220°F. to -59°F., even under high humidity and salt spray conditions to which the unit may be subjected in the field.

The heavily ribbed supports are designed to safely handle sidethrust forces, due to gusts and winds of high velocity, up to 1300 ft.-lbs. The charts *(Figs. 8A, B)* show the total forces exerted against combined antenna and mast arrays of various heights for the popular "Lazy-X"

[*Continued on page 57*]

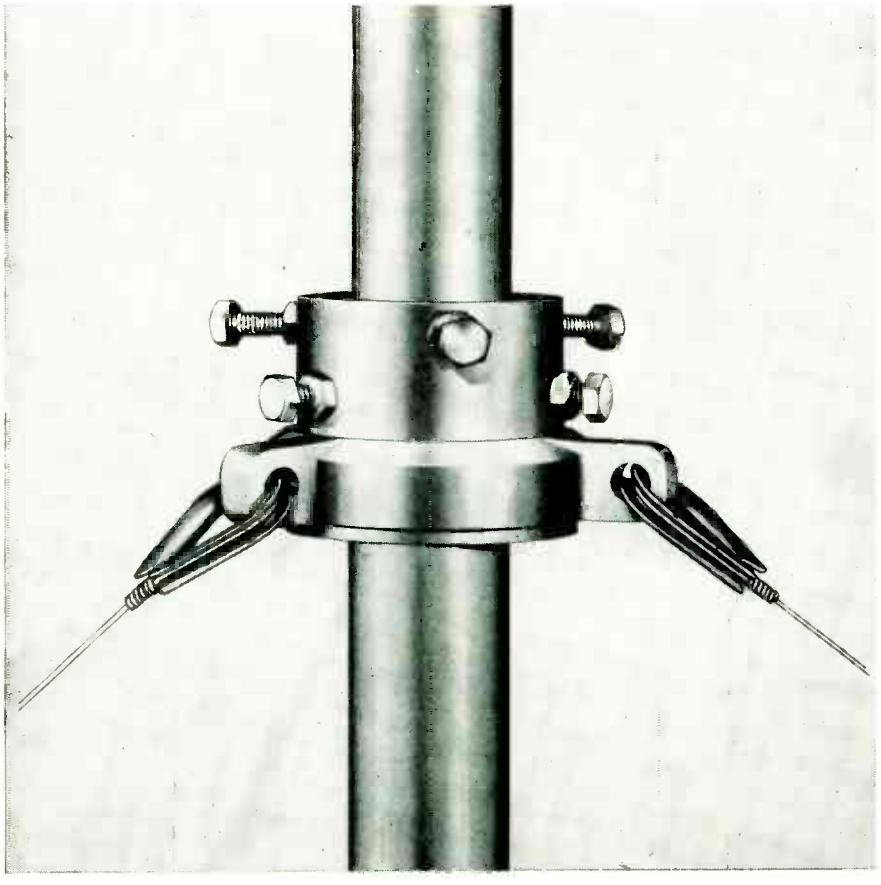


Fig. 10. Guy wires ataached to rotating guy ring.

Fig. 9. Tele-Rotor mounted inside tower or superstructure.

MEN OF RADIO

PART 1

by WILLIAM R. WELLMAN

The history of our profession is certainly of interest to most of us who are actively engaged in it. However, we are usually too pressed for time to engage in research on this score. In presenting this series, we wish our readers many happy hours of relaxation.

IN another year or so, radio will celebrate the completion of a phenomenal half-century of commercial application, growth and development. Perhaps no other scientific achievement, including the progress of the automotive industry, has made comparable strides in so short a space of time.

Most active members of the radio profession are far too busy to indulge in the intensive reading required to gain a fair knowledge of the history of the art, for the story is scattered over the pages of such diverse publications as encyclopedias, biographies, technical reports and newspapers. Yet the story of radio's development and the men who made it possible is truly fascinating and merits the attention of everyone having direct or indirect contact with the work.

Early Experiments in Wireless

The assumption is generally made that radio is about fifty years old, and if we accept the beginning of commercial operations as the starting point, this assumption is correct but the idea of an electrical communication system that needed no connecting wires between stations is far older. In fact, the thought goes back more than 150 years, for in 1795 one Salve, a Spanish physicist, proposed sending signals over the 120-mile water gap between Alicante, Spain and the Mediterranean island of Majorca, without the use of connecting wires between the two points. He suggested charging one shore positively and making the opposite one negative; the resulting flow of electricity through the sea was to make signalling possible. Although he never had a chance to test his idea, we know now that it is not wholly fantastic; in fact, it is one of three possible methods of effecting communication between separated points without employing metallic conductors. These three methods are: (a) conduction, using water or the earth as the conductor; (b) induction, whereby parallel coils or wires at the sending and receiving stations are linked electromagnetically; and (c) radiation. Neither the conduction nor the induction methods comprise radio as the term is understood today; the use of that word implies the radiation of energy through space. Nevertheless, both systems might be classed as "wireless" inasmuch as no metallic conductors are necessary.

Samuel F. B. Morse
(1791-1872)

Salva's theories were shown to be workable by Sommering, a Bavarian, about 1810, but no practicable application was made of the discovery one reason for this was that Sommering, although able to clearly demonstrate the flow of current through a body of water, lacked suitable apparatus for receiving signals - the telegraph had not yet been invented. Later on, about four years before the opening of the historic Baltimore-Washington telegraph line, Steinheil, a German experimenter, applied much the same principle to a land telegraph system, using the earth as a conductor. Steinheil was one of the men who had plunged into telegraph research after Morse had shown the idea to be valuable. Although Morse, and not Steinheil, won the race and produced the first commercially usable system, Steinheil's work was perpetuated in the familiar one-wire, grounded return system in which an elevated wire is used as the outgoing circuit and the earth acts as the return. Like many such discoveries, Steinheil's work was the result of an accident. History does not tell us whether he profited from his efforts, but it is quite likely that he did not.

Contributions by Morse

Morse, who managed to keep ahead of the field in telegraph development and who was awarded the laurels of inventor of the telegraph, conducted more than one experiment in "wireless" communication. The inventor, by the way, was a noted artist and early photographer; he was also the founder of an organization that later became the National Academy of Design. Again, in this case, a line of research began as the result of an accident. His conception of the telegraph came in 1832 and by 1835 he had an experimental system in operation. Seven years later a line probably the first to be laid under water had been completed between Governor's Island, in New York harbor, and Castle Garden, at the southern tip of Manhattan Island. During the initial test, only the first few words of a message had been sent, when the line went completely dead. Morse, who happened to be looking out across the channel,

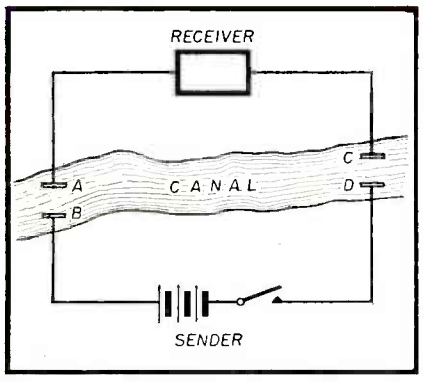


Fig. 1. Morse's experiment in sending signals across water.

witnessed the ruin of a beautiful experiment; the underwater line had become entangled in the anchor of a vessel. As he watched, the anchor was raised with the wire stretched across it. A sailor stepped forward, cut the line and dropped the severed ends overboard.

It would be very interesting to report that Morse's line continued to function even though cut, but the truth is that communications were permanently disrupted. His telegraph experiments were continued and, as we know, were brought to a conclusion that was considered spectacular in that day. But in the meantime, his curiosity had been aroused. He was speculating upon tthe possibility of dispensing with wire conductors altogether when sending telegraph signals across a body of water. Would a system continue to function when both wires were eliminated and a body of water substituted? He determined to find out, and in a letter written to Congress (then considering an appropriation of $30,000 to finance the Balitmore-Washington line) he said: "I immediately devised a plan for avoiding such accidents in the future by so arranging the wires along the banks of the river as to cause the water itself to conduct the electricity across. The experiment was deferred until I arrived in Washington; and on Dec. 16, 1842 I tested my arrangement across the canal and with success."

A general idea of the arrangement used by Morse will be gained from the sketch, *Fig. 1.* From one terminal of the sending equipment a wire was run a considerable distance along the bank of the canal, upstream, where it was led into the water. A second wire, connected to the remaining terminal of the sender, was led downstream for a distance, then also placed in contact with the water. On the opposite bank of the canal a similar arrangement prevailed, with wires attached to the apparatus terminals running for a way up and downstream before making contact with the water. The reason for the separation of the two wires on a given side of the canal was, of course, to avoid the possibility of a short circuit which would have happened if the wires were led into the water too close together. In this experiment, Morse connected his wires to copper plates, shown as *A, B, C* and *D* in the drawing. He later learned that the flow of electricity through the water was proportional to the size of the plates and the distance between the plates on one side of the river. The further discovery was made that the spacing between the two plates on one side of the stream should be about three times as great as the distance across the stream.

Despite Morse's successful experiments and notwithstanding the fact that he had gone a step beyond the single-wire telegraph line and had dispensed with both conductors, the idea never attained commercial status. Not too long after the opening of his first commercial line, the growth of the industry demanded that service be extended across rivers, lakes and oceans; when that time came, the submarine cable provided a more expedient solution to the problem. There is little reason to doubt that although it cannot be classed as a form of radio telegraphy, the arrangement did have considerable effect on the scientific thought of the period and perhaps led others to attempt further research in communication without wires.

Loomis' Contributions

About 1872 Mahlon Loomis, an American dentist, developed and patented a scheme of communiciation which employed atmospheric electricity and which, he claimed, needed no wires between the sending and receiving apparatus. His claims for his invention were broad and sweeping; in his application for a patent he stated that he would not only be able to "communicate from one continent of the globe to another" but that the method could also be used to "generate Light, Heat and Motive Power." (The capitals are Loomis'.) The specifications went on to say that because atmospheric electricity is more abundant . . . (when) greater altitude is attained" he proposed building "suitable towers and apparatus to attract the electricity" on the tops of high mountains.

Sounds fantastic, doesn't it? Well, it must be admitted that some of Loomis' claims were highly exaggerated and he never succeeded in communicating from one continent of the globe to another, but the cold facts are that he did prove conclusively that signalling could be carried out with his equipment over a distance of at least fourteen miles. And some of his contemporaries thought so well of the idea that Congress was persuaded to consider an appropriation of $50,000 to finance it. The appropriation was never made and Loomis' invention passed into the discard.

Dolbear's Contribution

Amos E. Dolbear, noted professor of physics and astronomy at Tufts College, developed a method of electric signalling that is of more than passing interest to radio men. About 1864 he became interested in electrical communication and in the years following he contributed much to the progress of the industry; his inventions include a writing telegraph and a form of magnetic telephone. During his experiments with the telephone, one of the wires connecting the two stations became disconnected (another fortunate accident) and he noted, to

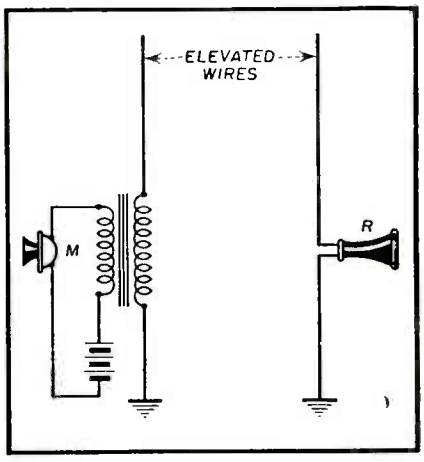


Fig. 2. Loomis' contribution to wireless signalling.

his amazement, that the apparatus continued to operate. He reasoned that some kind of energy transfer was taking place between the cut ends of the wire. He determined to find out just how far the cut ends could be separated and still permit the equipment to work. The result was a system which he patented in 1886. The patent application included a set of specifications and a drawing somewhat like that of *Fig. 2.* In his claims for the invention he was far more modest than his predecessor, Loomis, but then Dolbear was a conservative, cautious professor of physical science. He said "Electrical communication may thus be established between points certainly more that half a mile apart; but how much farther I cannot now say."

Even the most casual consideration of Dolbears description and the ac-

companying sketch will bring out two points: First, his invention was differents from most earlier attempts at "wireless' signaling in that it did not depend upon conduction through either water or the earth. Second, the fact that the apparatus developed a pulsating current, controlled by the microphone, *M*, in the drawing, indicates that his method was the closest approach to true electric wave telegraphy that had been made up to that time. It is plain that some form of radiation was responsible for the energy transfer between the sending and receiving stations, although this radiation took place at a new frequency.

Contributions of Edison

It would be difficult to find a branch of electrical science which has not been profoundly affected by the work of Thomas A. Edison, most prolific of American inventors. All radio men are aware that it was one of his observations that led to the eventual development of the vacuum tube. One of his best known inventions, the phonograph, is incorporated in a modern form in a very large percentage of the receivers sold today, and there would be no radio transmitters without the generator, which he helped to develop. Less well known is the fact that he was at one time directly interested in the field of wireless transmission and reception and developed and patented a system that was fairly successful for a time.

In 1875, during the course of an experiment, he noted that sparks could be drawn from a gas pipe in his laboratory - "sparks of an oscillatory nature" as he described them. He set up equipment to demonstrate the phenomenon to visitors to the laboratory; there is little doubt that at that particular time he was close to an important discovery, for the experiment was singularly like some of those performed later by Heinrich Hertz. But apparently he was engrossed in other research, for he soon

Thomas Alva Edison
(1847-1931)

gave up the idea. A few years later, however, he again delved into the field of wireless, and in 1885 he filled application for a patent on a system based upon the inductive effect existing between two coils or wires placed close to and parallel to each other. The principle of this system is illustrated in *Fig. 3*. He evidently felt that his system was valuable for communication at sea, because reference to such an application appears several times in his patent specification. The invention was never used for that purpose, but it was used commercially for a while in communicating over short distances. Apparatus was installed on trains and at fixed points along the railroad right of way, so that travelers might communicate en route. There is nothing in the record to indicate that Edison's system did not work well, but after a time patronage fell off and the system was discarded. Perhaps the public was not yet ready for wireless.

Marconi

That the public state of mind can affect the reception accorded an invention is not entirely a matter of speculation. It can be shown that only a few years later the average man was clamoring for wireless while Marconi was still preparing for his historic test. It is interesting to note that in 1903, during the meteoric rise of the Marconi Company, that firm bought the Edison patent "for a song", as Edison phrased it. The statement is probably true, for Marconi appeared to have no intention of using it, but purchased it merely to prevent its development and exploitation by other firms. Another point that might have had some bearing on the matter is that Edison had implicit faith in, and a very high regard for Marconi. When the news of the Italian inventor's success was received and there was still some doubt as to whether the feat had actually been accomplished, Edison was asked for his opinion. He said, in effect, "If Mr. Marconi says that he has received wireless signals from across the Atlantic, then you may be assured that he has done it." Curiously enough, the basic idea behind Edison's wireless system came to the fore again about twelve years ago when a somewhat similar arrangement was used to adjust the

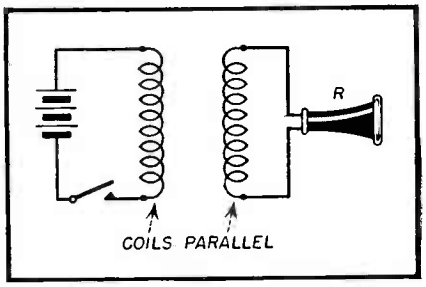


Fig. 3. Edison's wireless circuit.

tuning and volume level of a home radio receiver from a small control box located a few yards away from the set.

To recaptulate: The development of wireless signalling up to about 1880 was not rapid, and no startling gains had been made, but several experiments had shown that it was possible to dispense with both of the conductors of a telegraph system and still communicate by means of conduction, induction or even a form of radiation. None of these systems, however, were based upon true electric wave communication at high frequencies, although one brilliant scientist had already predicted the existence of waves that he claimed were closely allied to light waves. But the story of Maxwell, of Hertz who proved Maxwell's theories and went on to develop a method of generating the waves, and of Branly who developed a device to detect them will be told in the next installment of this series.

A New Protective Spray

In the Mort Farr Company's shop in Phila. the protective Krylon spray is applied (from a tinger-tip controlled aerosol container) to all high-voltage connections to prevent corona, a frequent cause of lines or snow on the TV screen. Arcing caused by moisture can be prevented by applying this spray.

Prior to installing the antenna on the roof, the installer applies a protective coat of the transparent acrylic plastic spray to the entire surface of the antenna. The plastic covering, which hardens much like plexiglass, prevents rust, corrosion and pitting—bane of good TV reception.

When it is necessary to splice lead-in wires, crews are instructed to spray Krylon on the break. This "sets" the connection in a water-tight plastic covering, thus eliminating any possible break down due to moisture or corrosion. After taping, Krylon is applied again. Note thumbed trigger for spraying.

Not only is it important to spray the antenna, but turnbuckles, mast stand-offs, mast clamps on the chimney mounts, the mast itself, and all nut, bolt and clamp connections should be coated. This eliminates rust, and hence the possibility of rusty rain water dripping off the connections onto the house.

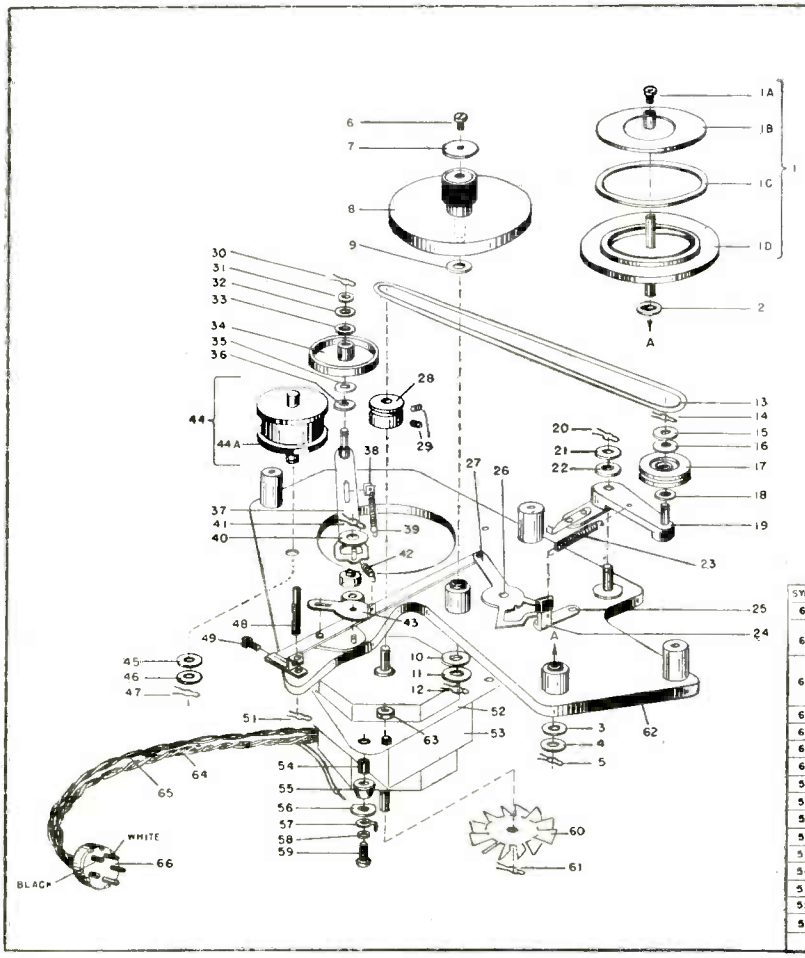
SERVICING TAPE RECORDERS

by C. A. TUTHILL

Servicing procedures and details on two popular types of tape recorders. These principles may be applied to most tape recorders on the market.

EITHER electrical or mechanical servicing of modern tape recording machines usually calls for the removal of the top plate from the cabinet. This plate often supports the mechanism. In such case removal of the plate includes removal of the mechanisms as a whole while the electronic components individually or collectively remain within the cabinet until their removal is effected. This article deals only with the servicing of mechanisms.

It is advisable to plan disassembly procedure before taking action. For example:- It is necessary to plan a means for resting the mechanism in a practical fashion after its removal. A means must be provided to guard against slippage if the mechanism is rested on edge. Protection must also be afforded any ventillation fan which may be mounted on the bottom of the unit or attached to the motor.



SYMB	DWG. NO	QTY	DESCRIPTION
66	M-51	1	PLUG W/SHELL
65		1	16" FLEX. WIRE
		1	16" FLEX. WIRE
64		1	13" FLEX. WIRE - WHITE
		1	13" FLEX. WIRE - BLACK
		1	11" FLEX. WIRE
63		4	10-32 STAN. HEX. NUT.
62	2090	1	BASE & BUSHING ASSEMBLY
61	2073	1	SPRING RETAINER
60	2095	1	FAN
59		3	10-32 RHMS - STL.
58		3	NO. 10 SPLIT LOCKWASHER
57	LUG-175	1	LUG
56	2069	3	SPECIAL WASHER
55	2001	3	GROMMET
54	2006	3	BUSHING
53	2000	1	MOTOR
52	2068	2	MOTOR MTG. PLATE
51	2073	3	SPRING RETAINER
49		1	8-32 BHMS - STL.
48	A-13804	1	CONTROL SHAFT
47	2073	1	SPRING RETAINER
46	2011	1	BAKELITE WASHER
45	2070	1	FELT WASHER
44A	2060	1	FELT WASHER
44	2082	1	REWIND DRUM ASSEMBLY.
43	2043	1	IDLER CAM
42	2039	1	IDLER CAM SPRING
41	2071	1	SPRING RETAINER
40	2031	1	RETAINING WASHER
39	2038	1	IDLER LEVER SPRING
38	2042	1	IDLER LEVER SPRING CLIP
37	2089	1	IDLER LEVER ASSEMBLY
36	2044	1	BAKELITE WASHER
35	2065	1	FISHPAPER WASHER
34	2003	1	IDLER WHEEL
33	2065	1	FISHPAPER WASHER
32	2044	1	BAKELITE WASHER
31	2030	1	FELT WASHER
30	2073	1	SPRING RETAINER
29		2	6-32 ALLEN SET SCREW
28	2033	1	MOTOR BELT PULLEY
27	2091	1	CONTROL LINK ASSEMBLY
26	2021	1	RIVET
25	2021	1	RIVET
24	2094	1	BRAKE ASSEMBLY
23	820151P4	1	BRAKE SPRING
22	2012	1	FELT WASHER
21	WAS-496	1	BAKELITE WASHER
20	2073	1	SPRING RETAINER
19	2080	1	BELT PULLEY LEVER ASSEM.
18	WAS-496	1	BAKELITE WASHER
17	2081	1	BELT PULLEY ASSEMBLY
16	2012	1	FELT WASHER
15	WAS-496	1	BAKELITE WASHER
14	2072	1	SPRING RETAINER
13	2002	2	"O" RING BELT
12	2073	1	SPRING RETAINER
11	2011	3	BAKELITE WASHER
10	2070	1	FELT WASHER
9	2011	1	BAKELITE WASHER
8	2083	1	CAPSTAN ASSEMBLY
7	A-13832	1	CAPSTAN TOP PLATE
6		1	4-40 BHMS-STL-NP
5	2073	1	SPRING RETAINER
4	2011	1	BAKELITE WASHER
3	2070	3	FELT WASHER
2	2011	3	BAKELITE WASHER
1D	2087	1	TAKE-UP DRUM ASSEMBLY
1C	2061	1	FELT WASHER
1B	2079	1	TAPE DISC ASSEMBLY
1A		2	4-40 PH. BHMS-STL-NP
1	2077	1	TAPE DISC & TAKE-UP ASSEMBLY

Fig. 1. Exploded view of Bell Model RT-65 tape recorder.

Where much of this service work is to be handled it is well to make up a staggered pedestal arrangement on a common base. Upright wooden dowels or battens (about 6" long) projecting from a common base will receive the weight of the chassis and allow clearance for most servicing. Commercial machines will be discussed with apologies to manufacturers whose products are not mentioned. Often identical mechanisms appear in several machines and such will be given space here.

Example 1. **BELL MODEL RT-65**

Removal of the mechanical assembly from the Bell Model RT-65 tape recorder is effected as follows:

1. Remove four 10/32 truss head screws along right and left edges of top plate or panel.

2. Grasp takeup reel platform with left hand and lift that side of top plate clear: Next grasp right front corner of plate with right hand and grasp left rear corner with left hand. Pull plate to the right enough for the casting to clear brackets on left side of cabinet and lift up. This frees plate excepting head wires and 5-prong plug. Always allow for short connectors.

3. Push plate to extreme rear of cabinet resting its rear edge on vent grille. Rest front of plate on wooden prop or equivalent while four leads to heads are unsoldered. Detach 5-prong plug and then the mechanical assembly is free for removal.

4. Remove plate and assembly carefully and rest on pre-arranged pedestals, as discussed earlier, to protect fan blades and other components. Otherwise remove fan and rest assembly on motor shaft and block it for safety.

When necessary to remove top plate from balance of mechanical assembly, take these three steps:

(a) Remove pointer knob from control shaft.

(b) Remove four Phillips oval head 10/32 screws recessed in panel. Top plate will then lift clear of remainder of mechanical assembly.

(c) Disconnect two wires to blade switch to allow separation of top plate from main mechanism.

Before proceeding with any service work it is wise to study the exploded view of all mechanical parts identified by tabulation in *Fig. 1* as well as the other leverage mechanism detailed in *Fig. 2.* A rapid acquaintance with the entire mechanism is at once available hence the minute details given in service manuals will not be repeated here.

Lubrication

No sliding or rotating part should stick in any position. If burred or binding, correction should be effected deftly and where dirt causes sticking it should be removed by either a rag or pipe cleaner sparingly dipped into carbon tetrachloride. With reference to *Fig. 2,* the bell crank (14), and the roller slide assembly (10) should be exercised to check their free action. Check the bell crank (14) to see that it moves freely and does not strike rubber grommet (17). The above and all wiping surfaces of mechanical linkages should be cleaned of all dirt or other foreign material then lightly lubricated with Sta-put #18 grease. Lubricant should be applied at point of friction only and wiped clear of all other surfaces. Take care that no lubricant contacts the drive belt or slippage will result. Pipe cleaners are also good for applying grease or oil.

The felt clutch washers on takeup and rewind drums should be lubricated only after tests indicate the necessity.

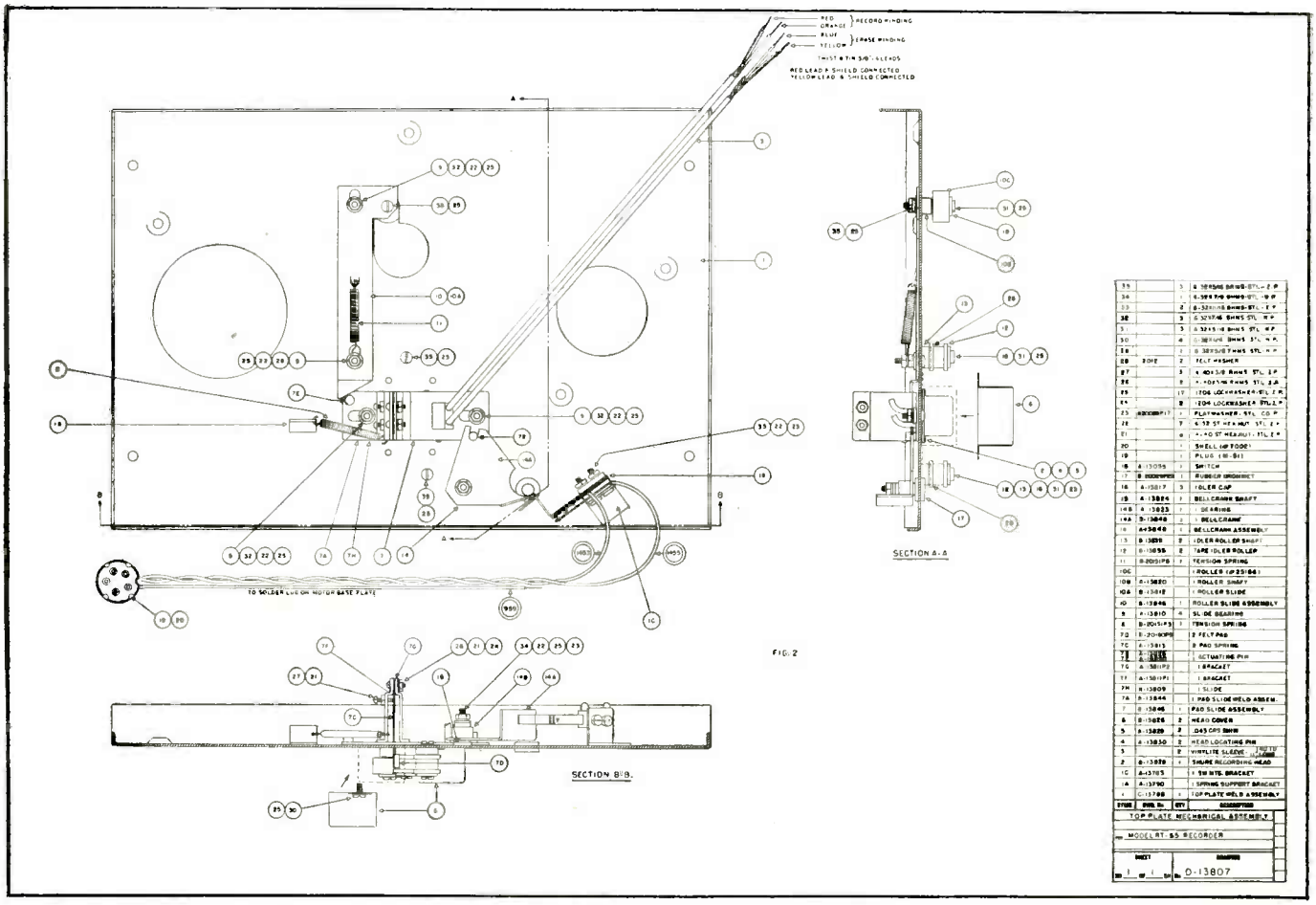


Fig. 2. Leverage mechanism details of Bell Model RT-65 tape recorder.

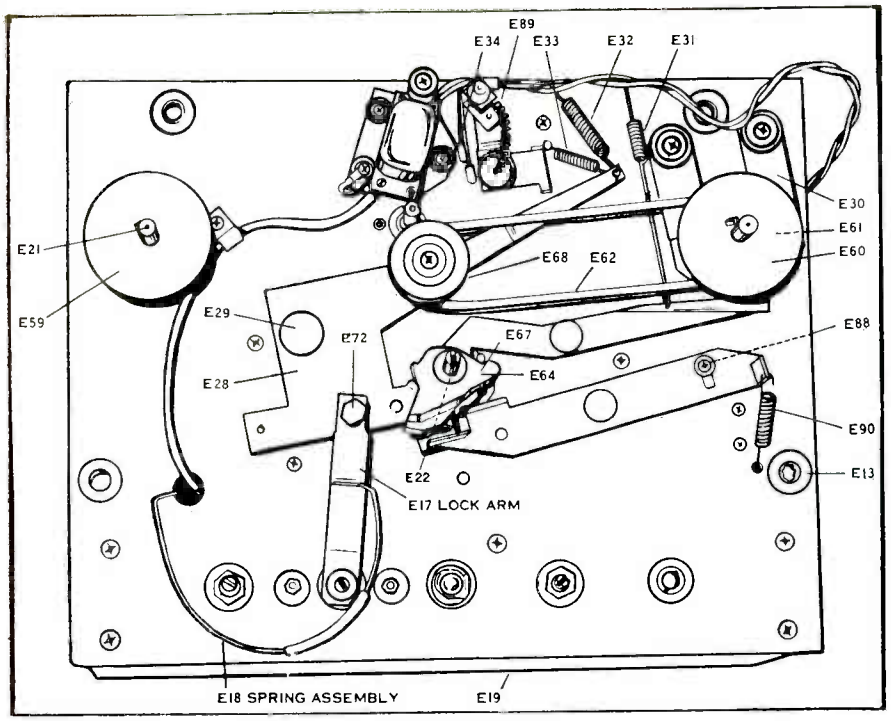


Fig. 3. Top plate of chassis with top plate removed.

Use a small amount of Sta-put oil (# 360) and make tension tests for normal operation checking the running speed at the same time. Wipe off excess oil from all surfaces including felts. When tension tests cannot be met with small amount of oil, the felts are worn and should be replaced. To run such tests, proceed as follows:

1. After motor has been running in cabinet for at least a 5 minute warm-up and clutches have been slipping normally for forward operation, place a full 5-inch reel of plastic tape on the takeup drum. Hook a gram or ounce scale to end of tape and turn control to *Forward* position. The pull should be 1½ to 2 ounces (40-55 grams). If excessive wipe oil off clutch. If inadequate add a few drops. (Addition of oil increases tension and pull of either clutch).

2. Place a full 5" reel of plastic tape on rewind drum and hook scale to tape end as before. Motor control should be in *OFF* position. Measure pull necessary to unwind tape from reel. This should be ½ to ¾ ounce (15 to 20 grams). Vary lubrication as above for correction.

For bearings and shafts, clean first, then apply but two or three drops of a light spingle oil such as kensington # 9.

All driving surfaces, such as capstan and pressure roller, and all surfaces which touch the recording tape must be free of oil or grease. These should be periodically wiped clean with a clean dry cloth. When necessary to use carbon tetrachloride, use it sparingly and rub it free immediately from any accidental contact with a rubber surface or the machine will not drive normally for several hours.

Head Tests and Adjustments

For accurate check of head alignment, use pre-recorded triple-M-head alignment tape # 119, (7.500 cycles or 1 mil wavelength). Be sure the switch is in *Playback* position to avoid accidental erasure. Play the alignment tape back through recorder with *a-c* vacuum tube voltmeter plugged into monitor jack. With volume control at maximum the voltmeter should read 15 volts or more.

Provided amplifier and tubes are functioning properly, there are three factors which may cause sub-normal meter readings. These are:

1. Unclean head
2. Improper pressure of felt pads
3. Improper head alignment.

For correction proceed with same numerical order given above.

1. Remove right hand cover which serves to protect felts and springs. Clean the head of any dirt on either poles or bakelite sparlingly with carbon tetrachloride. Dirt reduces output level by holding tape away from poles.

2. Start recorder and turn volume up to maximum. Using index finger, push gently toward the head the pressure felt which is farthest from front. If this action results in a rise of one or two db (2 or 3 volts), check the pressure of the felts with a gram or announce scale gauge after stopping machine. This check is accomplished as follows:

(a) Turn Control lever to Forward; (b) Connect the gauge to the top of the felt pad and to the spring; (c) Pull gauge at right angles just enough to lift the felt pad off the head and then read the gauge. If indicated pressure is under two ounces, the springs can be bent forward by carefully applying pressure at their bottoms or the equivalent is accomplished when their set screws are tightened if loose. The latter adjustment is very critical, - use care. Too much pressure will wear the head unnecessarily cause dirt to accumulate too fast, cause tape to slow down or vary in speed resulting in *wows*.

3. For optimum results the alignment of the recording head must be in correspondence to tape travel. Tape travel must be parallel vertically and laterally with head fixation. Deviations will introduce losses, and this holds for all machines regardless of price. When the head is clean and pressure pads have proper tension yet descrepancies are still noted, check the retaining screws on each side of a head. If both screws are tight and all other conditions are checked as normal mark exactly with a scriber the position of each screw in the bracket which it holds. Loosen one retaining head screw slightly and gently twist head alignment while 7500 cycle head alignment tape is being played back. If no change is noted on scale of output meter, retighten first screw exactly upon its original mark and then slightly loosen the second retainer screw. Vary slightly the position of the head, either way from its original position, until maximum response is noted on the output meter. Secure retaining screws at this specific point.

Mechanical Instability

1. Wows

For simplicity direct reference is made to *Fig. 1.* Check idler wheel (34), capstan (8), belt (13), takeup drum (1-D) and felt pressure disc (16) for *wow* or instability. These parts should not have flat spots or be oily or greasy with the one exception of the felt disc. Make a mark with chalk or crayon on each of the above rotational components so that it may be seen while the mechanism is in normal operation. Record a constant tone of 400 or 1000 cps and play it back. Listen to and watch for synchronization between any evident *wow* in the new record and marks affixed. Replace

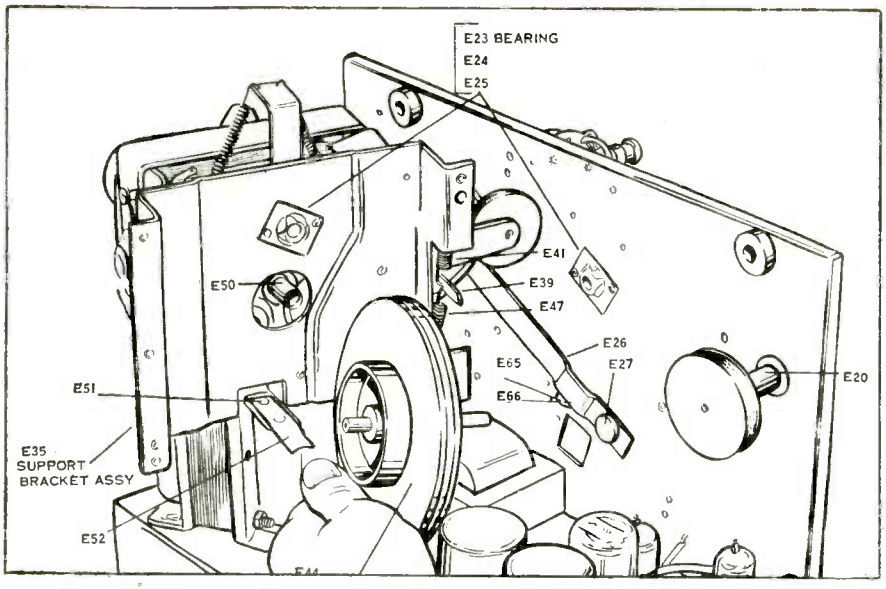


Fig. 4. Ekotape Model 109, 110, 111, 112 (Webster) details. Replacing flywheel assembly.

whichever part shows a synchronous relation between its mark and the *wow*.

2. Flutter

The cause of *flutter* which is a very rapid *wow* is very difficult to locate. In early models the roller nearest the front panel was originally bakelite. It is advantageous to use an aluminum one now available. Pressure pad pressure should be checked as previously discussed. Check motor for undue vibration or slightly bent shaft. Check motor shock mounts. These should normal vibration. Check fan blades and if necessary bend one for rotational balance.

EXAMPLE #2. EKOTAPE MODELS 109, 110, 111 & 112 (Webster)

Removal of Mechanism

All service work except cleaning of the head assembly requires removal of the mechanism from the carrying case. To remove the chassis which includes mechanism and amplifier, remove the screws in the corner of the top plate and carefully lift the combined unit out partially to a rest on blocks. Then disconnect the speaker and input plugs and lift the unit free. It is well to note at this point that when the unit is replaced, it is first necessary to connect the plugs and then take care that the power cord is looped under the speaker and fed through the slot in the case so as to clear all moving parts before lowering the unit back into normal position.

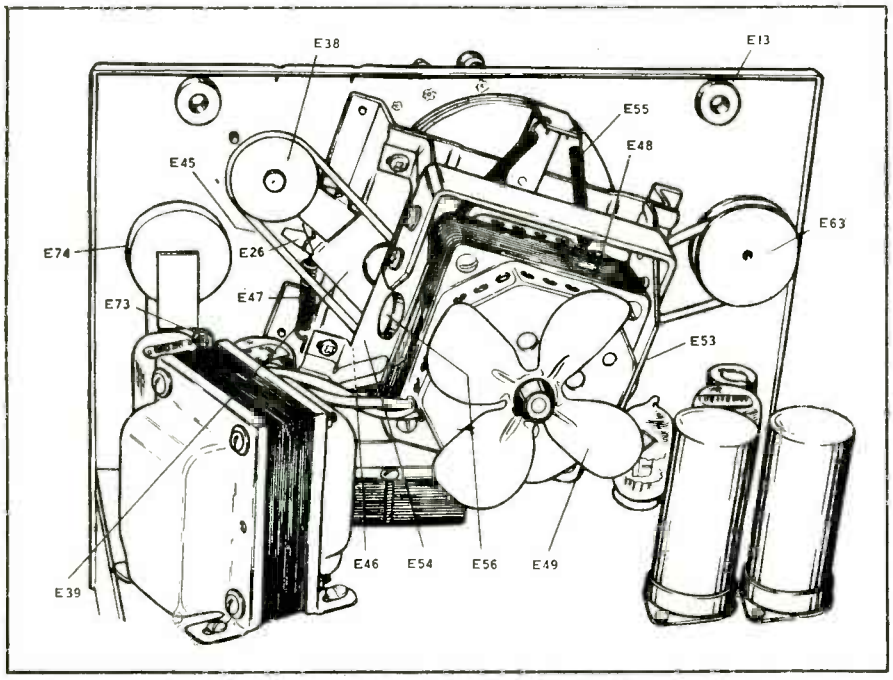


Fig. 5. Operating mechanism.

Removal of Top Plate

Removal of the top plate (E-12) is necessary for access to the mechanism shown in *Fig. 3*. The top plate is rubber mounted upon the mechanism mounting plate (E-19) and secured by four screws installed from the rear of the chassis.

Remove fuse holder cover (E-81); Remove Volume and Tone control knobs. Remove the cover over the pressure pads; remove the retaining ring and tension washer and then lift off the pressure pad assembly. Remove the top plate retaining screws, mentioned above, and carefully work the top plate free from the rubber mounts. Clean and lubricate the mechanism as detailed under Lubrication section.

Replacing Flywheel

Irregularities on the flywheel drive tire or capstan require replacement of the flywheel assembly (E-44) shown in *Fig. 4*. To remove the flywheel proceed as follows:

Unhook the motor springs (E-52 and E-55), also the Fast Forward springs (E-41 and E-43). Next remove rewind belt (E-86) from reel shaft spingle. Remove five screws retaining flywheel support bracket assembly (E-35) then pull off the bracket and flywheel as indicated in *Fig. 4*.

When installing a new flywheel, check fit in bearings carefully and be sure bearing is snug in mount. If bearing fit is sloppy or binds, replace bearings. After the flywheel and bracket are reinstalled, check for free operation rotating it by hand before turning on motor. Connect motor springs, fast forward spring and restate rewind belt. Check operation on *Rewind, Stop, Forward* and *Fast* before completing reassembly. Be sure *Fast Forward* drive is in proper position before attaching springs.

Record Lock Arm

The record lock arm (E-17) *Fig. 3* interlocks *Record* position of the selector knob in *Forward* position only. It is an indexing arm which automatically returns selector knob to *Play* position when the control knob is moved to any other position. To remove the arm (E-17), remove the spring assembly first; then loosen two socket head set screws in the hub.

To install the arm (E-17), set the control knob to *Forward* and turn the selector shaft to its extreme counterclockwise position. Install the arm with indexing ball in the index hole in the pinch roller lever and shaft assembly (E-28). Next move arm 1/16"

TROUBLE SHOOTING CHART

TABLE 1
WEBSTER ELECTRIC EKOTAPE TAPE RECORDER

Trouble	Cause	Remedy
No drive, noisy or irregular drive on FAST forward.	*Drive belt broken,* *Broken fast forward spring.* *Trip brake spring not clearing rewind belt.* *Motor out of alignment.*	*Replace drive belt.* *Replace spring.* *Adjust trip brake spring.* *Align motor.*
Supply reel over-runs on fast forward.	*Broken brake spring or unhooked trip spring.* *Trip brake tension too light.*	*Replace brake spring or* *Adjust trip brake.*
Take-up reel does not take up tape on PLAY position.	*Broken or defective take-up drive belt.* *Dirt under take-up disc or dirt in reel spindle.* *Lift lever out of adjustment. Broken or defective lift lever spring.*	*Replace belt.* *Clean and lubricate reel spindle.* *Adjust lift lever.* *Replace spring.*
Tape over-runs from rewind to stop.	*Brake lever spring E31, broken.* *Take-up pulley and shaft E60, out of adjustment.* *Pads on brake yoke, E30, missing.*	*Replace spring.* *Adjust take-up disc and shaft assembly.* *Replace brake yoke, E30*
Uneven sound, wows caused by tape slipping	*Foreign substance ccked on pinch roller or capstan.* *Worn or damaged pinch roller.* *Broken or defective pinch roller spring.* *Uneven pull on supply reel due to gummy or dirty bearing.* *Excessive pressure pad tension on heads.*	*Clean roller and capstan.* *Replace pinch roller assembly.* *Replace spring.* *Clean supply reel spindle.* *Relieve pressure pad tension.*
No drive, noisy or irregular drive on REWIND.	*Rewind belt broken, dirty or defective.* *Control knob loose.* *Motor mount misaligned.* *Drive pulley loose.* *Bent or damaged motor bracket or engagement bracket lever.* *Lift lever out of adjustment.*	*Replace rewind belt.* *Tighten control knob setscrew.* *Realign motor mount.* *Tighten pulley setscrew.* *Adjust or replace bracket lever to normal operating position.* *Adjust lift lever.*
Tape rewinds slowly (creeps) at stop position.	*Motor mount misaligned.* *Bent or damaged motor engagement bracket lever.*	*Realign motor mount.* *Replace or adjust bracket lever.*

farther counterclockwise, tighten set screws in place and replace spring assembly (E-18). The *Play-Record* switch shaft has been previously drilled and the cone point set screw should go into this indentation in the switch shaft.

Motor Replacenent

When a drive motor (E-48) is replaced (see *Fig. 5*) it is necessary to adjust the drive clearance carefully so that the mechanism will function properly in all control knob positions. When a motor is installed and all springs are attached check the following:

(a) *Fast Forward* Position - The fast forward drive belt (E-45) should engage the motor drive pulley and fast forward drive pulley (E-38) with kick-out lever (E-26) clear of fast forward plate and pulley assembly (E-39). The trip pin on the fast forward drive mechanism should engage the brake trip of the trip assembly, (E-30/E-31) when passing beyond the *dog* of the brake trip not exceeding 1/16 inch. This prevents any over-run or looping of the tape in going from *Fast Forward* to *Forward*. For correction of any misalignment, loosen the four motor mounting screws and, with all springs attached and with the mechanism set for *Fast Forward* position, make adjustments by shifting motor bracket (E-51) in slotted retainer holes. When adjustment meets requirements, secure motor bracket into permanent position by tightening the four mounting screws.

CAUTION—Check fast forward brake spring (E-43) to see that a clearance of approximately 3/64 inch exists between spring and rewind belt (E-86) in both *Fast Forward* and *Forward* positions.

(b) *Rewind* and *Stop* position—motor drive pulley (E-50) should be clear of everything, touch nothing, when control is set at *Stop* position. At *Rewind,* motor drive should engage the rewind belt (E-86). Corrections are made by slightly bending the rocker arm bracket on the motor mounting bracket (E-51).

(c) *Forward* position–Motor should engage flywheel tire *only*. Adjustment is made by nudging motor bracket in slotted retainer holes. No adjustment should be of great variance; each should be slight until optimum results are obtained.

Lubrication

Normally this machine requires no lubrication. Motor, flywheel shaft and spingles operate in oilite bearings. If cam and/or lever actions become sluggish it may be due to gum or dirt in pivots or under levers. Clean off all old lubricant, accumulated dirt and gum with a cleaning cloth and cleaning solvent. Apply lubricant sparingly on working surfaces. Do *not* overlubricate. Use light machine or spindle oil for oilite bearings. Use Wadhams BRB # 1 or Lubriplate for moving parts.

Trouble Shooting

No matter how well equipment is designed and manufactured, faults will normally occur during extended periods of operation. This section is intended to expedite location and correction of faults. Never disassemble a unit until first an attempt is made to localize trouble to a particular section or component by means of simple preliminary tests and checks. Troubles which are not listed in *Table 1,* or which cannot be corrected by average procedure, should be referred to the factory or an authorized distributor. In such cases submit the model and serial number of the unit because gainful modifications are being rapidly included in present day manufacture.

General

Burred or bent spindles can be replaced when drive pulleys at their lower ends are released through loosening of set screws. The brake yoke

[*Continued on page 57*]

The serviceman asks, "Shall I buy it or build it?" One answer to this question is given in the following articles.

BUILD YOUR OWN INSTRUMENT?

by HARRY R. ASHLEY

(Pres. Electronic Inst. Co. Inc.)

NO one knows a radio serviceman's problems better than the serviceman himself. Having been a serviceman for many years, I know! For example, when I started in business, one of my first big problems was simply this: How could I get the kind of good test equipment that I wanted at prices I could afford? Remember, I started with a relatively small amount of capital and a whole lot of good intentions.

Years ago, when I decided to open my own shop I figured that first of all I'd need a good VTVM, and the one I had my heart set on was priced at $75. In those days 75 bucks was much moola, but the job I wanted rated as being real high class. (Now-a-days $75 is peanuts compared to then, but, let's not discuss politics).

So, I bought the VTVM I wanted, and shortly thereafter I learned a lesson, a sad lesson, that I'm going to recount for your benefit and guidance. As I said before, I bought the instrument and put it to work on some jobs that were in the shop. Then, in a few days, during a lull, and finding some spare time on my hands, I decided to "look inside" my new pride and joy to see what made such an outward "marvel of complexity" work. I looked inside at the maze of wires, the components and evaluated the engineering skill involved in the construction—and what happened? I nearly fainted! All I found was two tubes, a few resistors and condensers and a meter all wired together. That plus the cabinet with its fancy embossed panel represented the 75 hard-to-accumulate bucks I had paid. That's why I felt so low

I then hopped over to the Jobber from whom I'd bought the VTVM and said, "Look, you've already made this sale, so take your hair down and tell me honestly, why was this job priced at $75?"

"It's sensitive, you know", he said.

"Sure it's sensitive", I sputtered, "but it doesn't measure the voltage of a flea's sneeze, and I don't need it to. What's the low-down?"

And then he said, "All right—it's the assembly labor, accuracy & calibration that runs the costs way up. Remember, close to 50% of the total cost was paid toward assembly labor, high quality parts and calibration.

That's when I heard a bong inside my output tube! And I *said to myself,* "assembly labor—calibration reading the wiring diagram, positioning the parts, dressing the leads, making good mechanical connections, soldering good electrical connections, checking for cold-soldered joints—why that's the very work I do for a living—and I went out and bought it from somebody else!" It struck me that I was just like an auto mechanic who went out and had someone else repair his broken down car. It just isn't done! And again, I said to myself, "Some day I'm going to do something about it. Goodness, I could assemble a VTVM myself, and all I need is the wiring diagram and the parts. Time I have, and the know-how. And, gosh, what I could save would buy me something else that I really need."

Many years passed before I kept that promise, and strangely enough, in order to do it I had to get into the instrument manufacturing business—that is, I got into one "angle" of the business—more properly stated the assembly end, (lining up the basic schematics, the components, and effecting the merchandising plans, but not doing any actual production assembly work)—and that's how I started in my present enterprise, which might be called the "sell a kit" and not labor costs" business.

But, there's more to it than just the mere plan to by-pass and eliminate labor costs alone. You see, as a kit supplier, I also had in mind the premise that many technicians, particularly students, beginners in business with limited capital, hams and even some factories, are desirious of knowing what's in their instruments, why those things are in it, and what those things have in the way of maximum applications and ranges and uses. In substance, I feel that almost as many people would just as soon build their own instruments as buy them, and as I said before, most newcomers to the servicing ranks would be better servicemen if they built or assembled some of their own test instruments and by doing so obtain an invaluable amount of "know-how".

Test equipment is to a serviceman what a stethescope or thermometer is to a doctor. Each does its job, starting right from the point of basic diagnoses before any treatment can be prescribed, and each must also be dependable and accurate. But when it comes to test equipment, the design and components of a kit must be of the ultra finest, and because when one builds a kit he handles every part and sees for himself just what high standards are maintained.

[*Continued on page 60*]

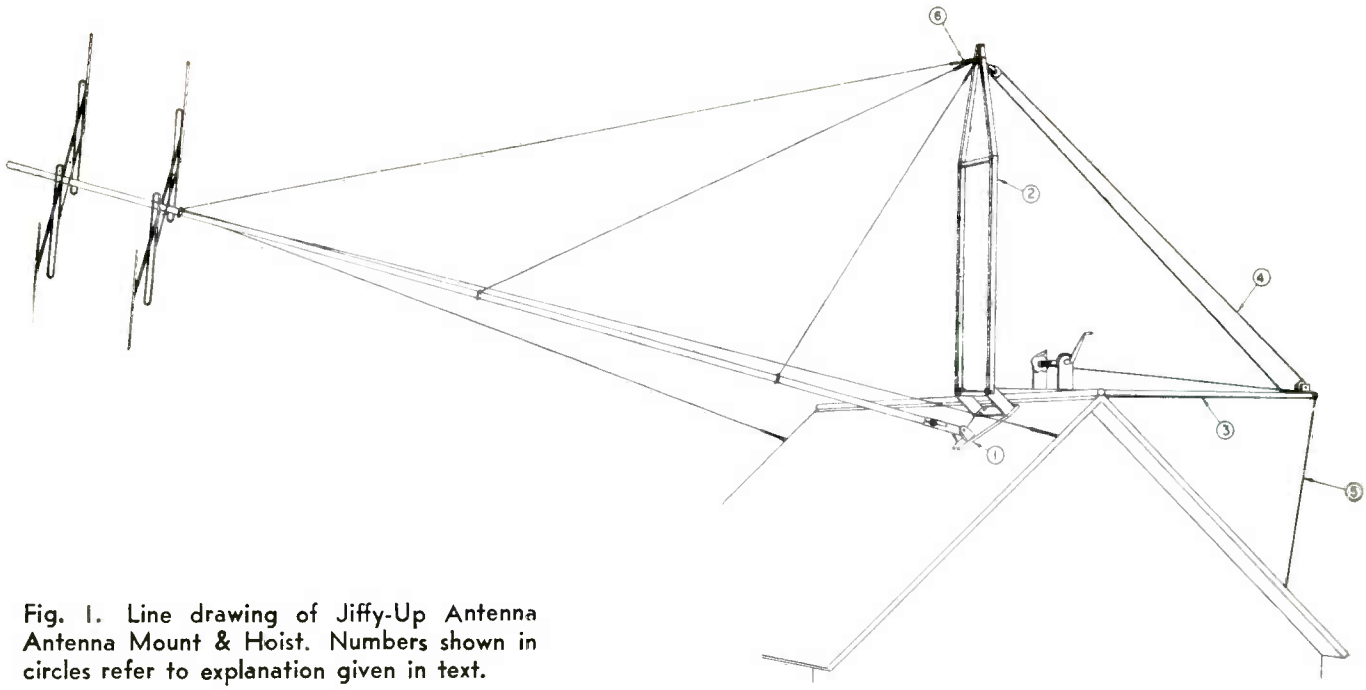
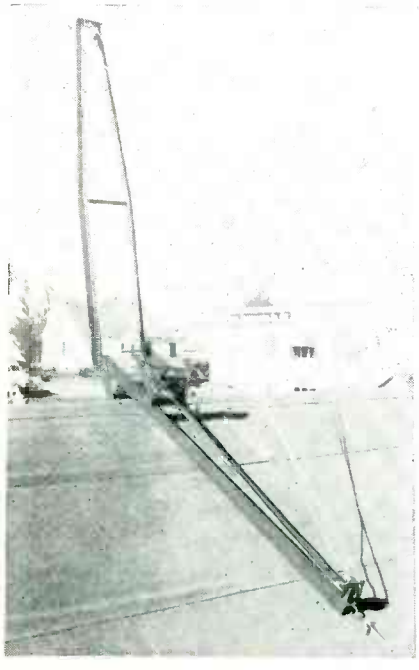


Fig. 1. Line drawing of Jiffy-Up Antenna Antenna Mount & Hoist. Numbers shown in circles refer to explanation given in text.

The Jiffy-up ANTENNA HOIST and ROOF MOUNT

WITH the ever increasing number of high mast and tower installations going on all over the country the problem of raising heavy towers on flat and gabled roof tops becomes of greater concern. A unique hoist and roof mount was recently developed for this purpose and is described in the following paragraphs for the edification of the TV installer.

This hoist is attached to the roof mount in a matter of minutes for either erecting or lowering the mast.



Courtesy The Haugen Company

Fig. 3. Antenna hoist shown mounted on roof top. On completion of installation hoist is removed.

It can be self guyed and takes only one man to crank it up. It will raise or lower a mast of 50 feet and can of course be made in a larger and more rugged hoist for higher antennas.

Figure 1 shows a line drawing with the details numbered to aid the reader in following the mounting and hoisting operations. First (1) the roof mount (*Fig. 2*) is mounted to the roof using lag screws. This unit is mounted as close to the ridge of the gable as possible.

The next operation is to attach the hoist (2) and (3) to the roof mount. *Figure 3* illustrates this operation completed. The cable provided with the hoist is then strung as shown in the diagram.

It is important that the cable be securely tied down (5) because it must withstand the entire weight of the mast and antenna during erection. For heavy masts it is suggested that one eighth inch cable or heavy gauge wire be used securing it at eave of roof or after using a #0 screw eye or equivalent.

Fig. 2. Roof Mount

The hoisting cables (6) are then attached to the gin pole(2). These cables are to be used for guying the mast after erection. For masts over 25 feet

[*Continued on page 57*]

SHOP NOTES

Write up any "tricks-of-the-trade" in radio servicing that you have discovered. We pay from $1 to $5 for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor".

Demagnetizing TV Tubes

A Weller soldering gun or any similar type soldering unit can often be used to demagnetize small sections of the metal-side picture tubes of the 16AP4 variety. After the magnetized section has been localized by use of a small pocket compass, the a-c magnetic field generated around the tip of the soldering gun can be utilized to neutralize the magnetized area. This is best accomplished by bringing the tip of the soldering gun as close to the magnetized area as possible and moving the flat portion of tip around the area in question. Do not apply the tip section directly to the metal side of the tube, or a portion of the soldering tip will be shorted, and overheat the iron. Remove the iron from the area before turning off the a-c power to the gun, so the latter will not introduce any residual magnetism set up by the collapsing field when the gun is shut off.

An extremely thin piece of mica can be used. for it allows the flat side of the tip to be pressed closely against the offending area with the mica acting as insulation between the metal side and the gun tip. If the gun tip, as shown at *A* in Fig. *1* is bent in the form of a circle as at *B*, better results are obtained.

This will eliminate the bending effect the magnetized area has on a portion of the picture.

Submitted by
Matthew Mandl
Trenton N. J.

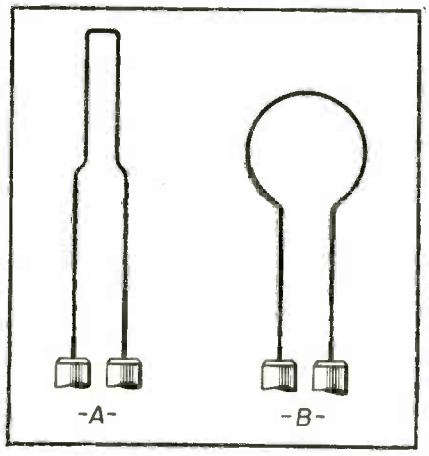


Fig. 1. Demagnetizing tips.

Audio Oscillation in Philco Model 49-1603

An unstable but sustained audio oscillation in these models is caused by feedback in the a-f amplifier stages (see *Fig. 2*) due to the length of lead between filter *C102c* and pin #4, the 35L6 screen and tie point for condensers *C207* and *C202*. A glance at the simplified circuit shows how the feedback occurs thru condensers *C207*, *C202* and *C203*. The phase shift across these condensers is sufficient to cause oscillation if the filter *C102c* does not by-pass all of the audio frequencies in adequate amounts. It would seem that a new filter would remedy the fault, but this is NOT the case. Let us say here, a new filter will NOT cure the trouble if it is connected at the same terminals as the old unit but may, however, if connected at another point.

Shunting *C202*, a 0.25 μf condenser, with a new unit also seems to cure the trouble; also by merely taking hold of the present condenser the oscillations cease. This instability of the oscillation makes it hard to trace, even the cable of a 'scope will cause the oscillations to cease. There are two or three ways to remedy the trouble. The least expensive way is to remove the blue lead of the filter bank from its terminal and tie it to pin #4 of the 35L6 socket. This could conceivably cause some sets to oscillate in the i-f section but is unlikely because of the adequacy of the plate decoupling networks.

The best remedy, consistent with good engineering, is to remove the direct feedback path. This can be done by removing the 0.25 μf condenser *C202*, a 200 volt unit, and replace with a 400 or 600 volt unit connecting it from the junction of resistors *R202* and *R203* to common instead of pin #4 of the 35L6. Another equally good cure is to remove the plate by-pass condenser *C207* from pin #4 and tie to pin #8 of the 35L6. This also effectively removes the feedback path. A higher voltage unit in this location is recommended.

Submitted by:
Wayne Lemons,
Buffalo, Missouri

Stromberg-Carlson Model TV125 And TC19 Receivers —Imported Signal to Noise Ratio at the Sound Detector for Better Audio Reproduction.

To improve the signal to noise level at the ratio-detector stage for clearer audio reproduction. the C133 (TC19) and C56 (TC125) capacitors have been increased from 1-mf to 5-mf, 50-volt value (Part No. 111030). The audio reproduction on early TC19 receivers, as well as TC10 and TC125 models, can be improved by changing this capacitor.

Stromberg-Carlson
Service Department

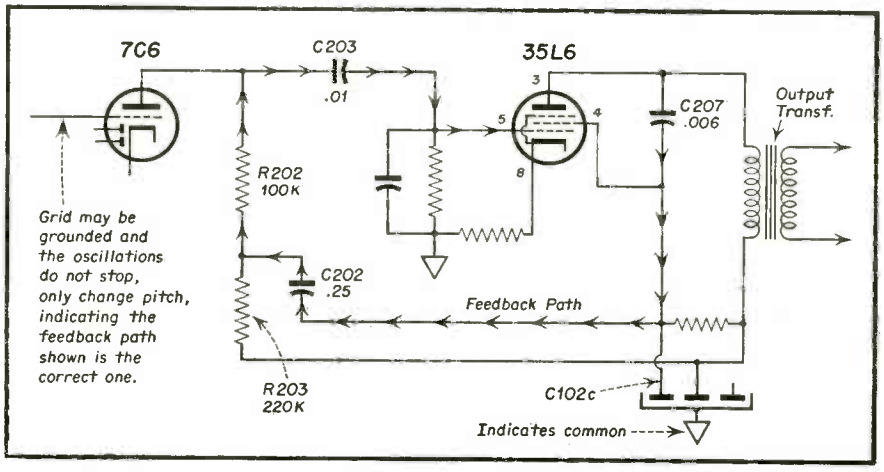


Fig. 2. Partial schematic of audio stage in Philco Model 40-1603 where audio oscillation might occur.

TUBE TOPICS

by **JAMES COREY**

A new regular department devoted to presenting up-to-the-minute information to the Radio-TV Service Dealer on tube replacements and substitutions of all types, including picture tubes.

PERHAPS the newest thing in tubes is the just-announced series of picture tubes in which electrostatic focus has been substituted for (electro) magnetic focusing. These new tubes available in the three popular rectangular sizes are the 14GP4, 17FP4, and 20FP4, the characteristics which are given in detail elsewhere in this issue. Significant feature of this development is that a focus coil or focusing magnet assembly is not required, thus saving the critical materials in these components, which savings should mean very many more TV sets can be produced in 1951 even though there is a drastic curtailment in the amount of copper and cobalt for civilian use.

Focusing by electrostatic means is achieved through the addition of a focusing electrode in the form of a cylinder operating at a comparatively high potential. While the 14GP4 is similar to the 14CP4/14BP4, the 17FP4 to the 17BP4A, and the 20FP4 to the 20CP4, these electrostatically-focused designs are not directly interchangeable with their magnetically focused counterparts, since they require a focusing potential on the order of 2000 to 3500 volts. In new sets, however, the changeover should not be very difficult to accomplish. The focusing voltage can be obtained from a separate fly-back power supply operating from the primary side of the horizontal sweep transformer to isolate it from the effect of beam current variations of the picture tube as brightness is varied. A typical high-voltage supply is illustrated in *Fig. 1*. The voltage for the focusing electrode ranges from 19% to 30% of the second anode potential at essentially zero current. A leakage current ranging from -15 to + 25 microamperes may occur.

While the manufacturer takes extreme care in assembling the electrodes of the gun to keep the beam centered as it emerges from the electron gun, some means must be provided for compensating for decentering due to external causes. At the moment the practical means is electrical centering in the yoke winding the same as used in the early TV sets. Perhaps magnetic centering assemblies using a very weak field will be developed in the near future.

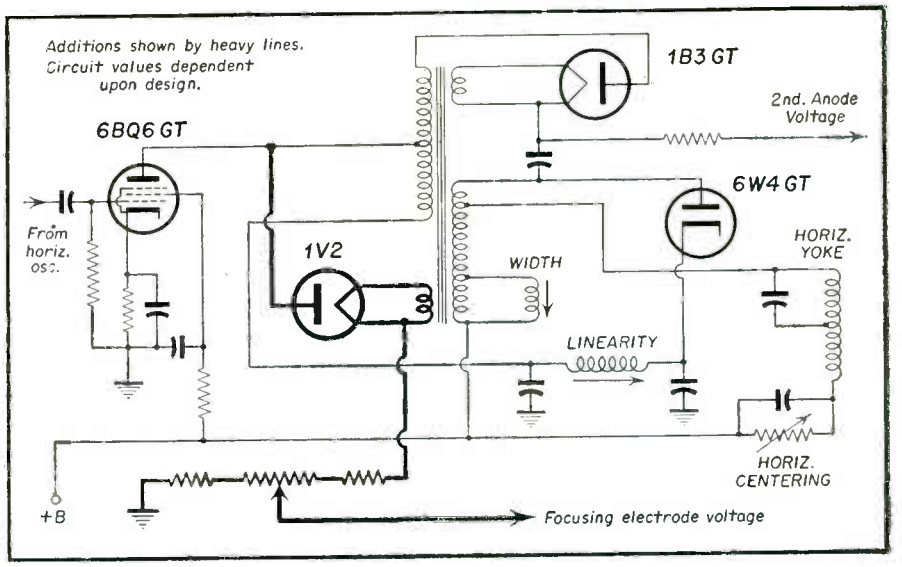


Fig. 1. Circuit showing how voltage for focusing electrode on electrostatically focused tubes may be obtained.

SUBSTITUTIONS vs. REDESIGNS

While many servicemen and dealers are wondering about substitutes for many of the scarcer TV types, in general there are none. This is because at the higher frequencies not only must the so-called static characteristics be the same but also interelectrode capacitances and series lead inductances. These latter requirements also mean that changes involving rewiring or changing of sockets are not practical in tuners. Even substitutions in the i-f. stages may cause major complications.

To be termed a substitute, the writer feels that a tube should be interchangeable without any major changes in the circuit and provide essentially the same performance. Where more than a socket and possibly a resistor change are needed, it is felt that such should be classed as a reengineering of the circuit. Such redesigns should be avoided as much as possible for generally there isn't sufficient profit to allow for engineering and possible complications. After all, even set manufacturers' engineers are averse to making such changes in the middle of a production run.

6AG5, 6BC5, and 6AG5S

One interchange in TV tuners or i-f. amplifiers between types that generally creates no complications is the use of a 6BC5 for a 6AG5 or vice-versa. While both types are tight in supply, it's possible one or the other may be available at the moment. These are essentially the same tube, except

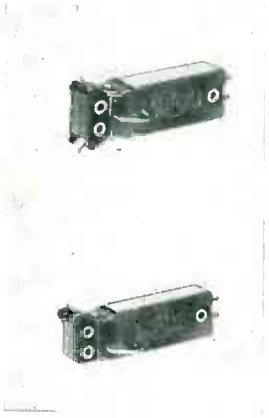
[*Continued on page 58*]

NEW PRODUCTS

PHONO CARTRIDGE-CRYSTAL OR CERAMIC

The currently most popular crystal cartridge produced by The Astatic Corporation, Conneaut, Ohio—the miniature, lightweight "AC" Series with both double-needle turnover and single-needle models—now is available with ceramic elements as well as crystal in all styles, according to a recent company announcement.

External physical characteristics are the same for all models, as are the minimum needle pressures of approximately five grams. Output of the crystal models, at approximately 1.000 c.p.s., is 1.0 volt, using the Audiotone 78-1 and RCA 12-5-31V test records, while that of the ceramic versions is 0.4 volts. Frequency range of the single-needle crystal units, with either 3-mil needle for 78 RPM or All-Groove needle for all record types, is 50 to 10,000 c.p.s., double-needle 50 to 6,000



c.p.s. The single needle ceramics have a frequency range of 50 to 6,000 c.p.s., double-needle 50 to 5,000 c.p.s.

Principal purpose of developing the "AC" ceramic element cartridges, the Astatic announcement states, is to make the improved performance characteristics of the crystal series available for applications where high temperature or humidity threaten damage or impaired performance to crystal or other type cartridges.

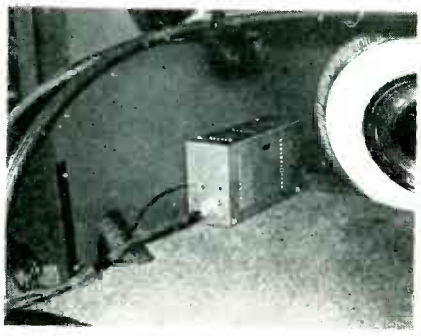
NEW PLUG-IN AND TWIST ELECTROLYTIC CONDENSERS

Illinois Condenser Company announces a a completely new and improved line of Plug-in and Twist-prong electrolytic Condensers to meet the most exacting commercial and JAN specifications. Built for the most rugged service to which an electrolytic can be subjected to, they feature a completely new phenolic molded cap structure that hermetically seals the container. Hermetic seal, employing molded-in terminals, is so perfect that these units can be used for the most difficult conditions encountered—from adverse marine operations to stratosphere use. These capacitors are also immune to sudden temperature and barometric changes, and built to withstand wider temperature ranges than ordinarily associated wtih

electrolytics. They meet all Navy and Army Air Corps requirements, are available for high or low voltage requirements, or both. Economy in mass producing these new capacitors allows complete distribution, without additional cost, for civilian TV and usual electronic applications as well as new and replacement service in aircraft, fire, police, and related emergency services. For further information write Illinois Condenser Company, 1616 North Throop Street, Chicago 22, Illinois.

TWO-WAY MOBILE CARFONE

This new RCA Carfone equipment, intended for highly-selective two-way mobile radio communcation in 152-174-megacycle band, features transmitter-receiver unit (left) in popular "Sandwich Case," newly designed speaker, control unit with palm-type microphone, and whip antenna. The equipment develops greater



power output, while retaining the 31-circuit selectiviiy and revolutionary transducer modulation control which makes possible adjacent-channel operaton designed to exceed all RMA and FCC requirements.

NEW ELECTROSTATICALLY-FOCUSED RECTANGULAR PIX TUBES

National Union Radio Corp. of Orange, N.J. announces four new rectangular Videotron picture tubes having gray-filter face plates, three of which employ electrostatic-focusing in place of the conventional magnetic focusing. This new series of tubes is available in the now-popular 14, 17, and 20-inch sizes. The fourth type, having magnetic focusing is a 20-inch tube. Focusing of the electrostatic type is achieved through the use of a new gun design having a zero-current focusing electrode operating at approximately 22% of the second-anode potential. In new set designs the electrostatically-focused tubes will replace the equivalent magnetically-focused tubes providing a savings of about 2 pounds of copper where electromagnetic focus coils are employed.

Type NU-20CP4 is a 20-inch tube for use in electromagnetically-deflected sets. It employs conventional magnetic focusing. Type NU-20CP4 having a 70° (diagonal) deflection provides a rectangular picture of 17 x 12-3/4 inches. In application it is similar to the now-popular type NU-14CP4/14BP5, NU-16KP4/16RP4 and NU-17BP4A except that it has a larger screen size. The second-anode potential rating is 18,000 volts maximum—in use a value of 14,000 volts is typical.

Type NU-14GP4, having electrostatic focus is a 14-inch tube, otherwise similar to the NU-14CP4/14BP4. It is magnetically deflected (70° diagonal angle) providing an 11-1/2 x 8-5/8 inch rectangular picture. The second-anode potential rating is 14,000 volts maximum—in use a value of 12,000 volts is typical. The focusing electrode requires approximately 2500 volts d-c.

Videotron type NU-17FP4 is a 17-inch tube having electrostatic focusing designed to replace types NU-16KP4/16RP4 and NU17BP4A in new set designs. Through the use of a focusing electrode operating in the vicinity of 2500 volts, his tube requires no external focusing field coil. Like the NU-17BP4A the NU-17FP4 has a second-anode potential rating of 16000 volts maximum. A typical anode operating potential is 12000 volts. The NU-17FP4 has a 70° deflection angle measured on the diagonal and provides a rectangular picture 10-3/4 x 1/4 inches.

Type NU-20FP4 is a 20-inch tube similar to the NU-20CP4 except that it has electrostatic focusing. Other specifications are the same. The focusing-electrode potential is approximately 3000 volts for a second-anode potential of 14000 volts.

Focusing-electrode voltage at essentially zero current drain is readily obtained from a simple fly-back type power supply operating from the primary side of the horizontal-output transformer. Use of a separate rectifier from the primary is preferable since voltage variations due to changes in the beam current are negligible. A low-cost tube such as the 1V2 is satisfactory. Any decentering of the electron beam due to external causes is compensated for by the use of conventional electrical-centering circuits in the vertical and horizontal yoke windings.

CARRYING CASE FOR TUBES

A New Product is announced by Argos Products Company, Inc., of Genoa, Illinois, known as the "Television Tube Caddy". The company believes that this is the first product of its kind on the market. It is estimated that better than 90% of all television service calls are solved by tube replacements. Also, because of the variety of tubes needed and duplication of certain types because of frequency of failure, a working supply of about 162 tubes need be carried by the television technician at all times. The Television Tube Caddy has drawers which automatically classify tubes by sizes, each tube type number clearly visible. Inventory is seen at a glance. Removable partitions permit expansion of stock to 221 tubes, or allow additional space for tubes not in cartons or small tools. There is also a compartment especially sized to carry 22—3AG fuse boxes. Clips on the cover are installed for holding a current price list and

We're Doing Our Best to Keep Up With the Demand

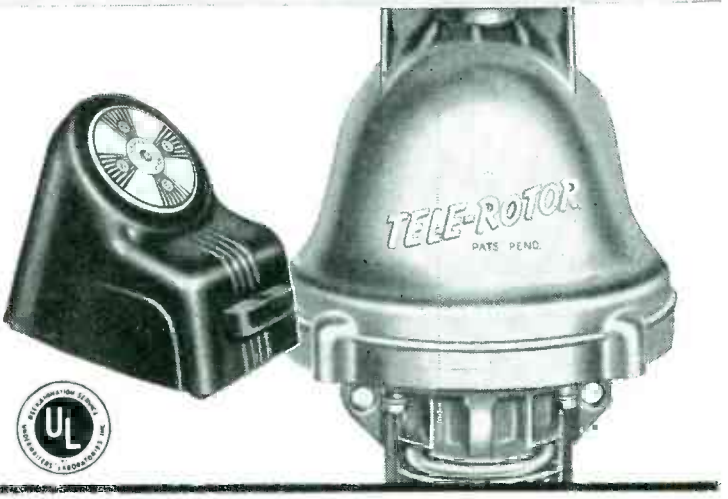
AND THE DEMAND IS PHENOMENAL — far beyond our material limitations . . . but be patient and your order will be delivered. We are distributing TELE-ROTORS uniformly throughout all TV areas . . . so wait . . . don't compromise with quality. YOU CAN'T BEAT A TELE-ROTOR!

CONSISTENTLY DEPENDABLE ROTATORS

TELE-ROTOR

This heavy-duty TELE-ROTOR has no match! It's more powerful . . . will turn any TV antenna array under any weather conditions. Easily installed . . . it is trouble-free in performance. Easiest of all to operate!

MODEL TR-2 . . . . . rotator with "compass control" cabinet having illuminated "perfect pattern" dial . . . (uses 8 wire cable) **$49.95**



CONSISTENTLY DEPENDABLE ROTATORS

TELE-ROTOR CUB

The new TELE-ROTOR "CUB" is ideal for average installations. The same husky motor as the Heavy-Duty model . . . the "CUB" is the fastest and easiest of all rotators to install. All-In-Line design . . . with true in-line thrust between antenna and mast. The ¾" STEEL shaft rotates on a case hardened steel ball . . . with inline reamed oiless bearings.

MODEL 502A . . . . . rotator with plastic control cabinet having indicating meter for "hairline" tuning. (Uses 5 wire cable) **$44.95**

MODEL 501A . . . . . rotator with control cabinet having end-of-rotation signal. Light flashes every 7.2° showing antenna is turning. (Uses 5 wire cable) **$34.95**

CORNELL-DUBILIER SOUTH PLAINFIELD, N. J.

THE RADIART CORPORATION CLEVELAND 2, OHIO

inventory sheet. The construction is sturdy plywood with a leatherette covering. Gold beading adds to its appearance. The Tube Caddy will be sold through jobbers to the Television Technician and Radio Serviceman. The resale price is $13.50.

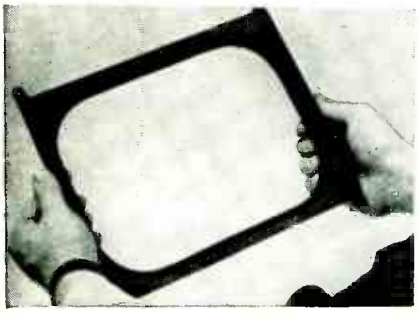
TV CABINETS

One of the 18 fine Custom-styled models of TV cabinets in full door- and half-door motifs for custom chassis installations by Service-

Dealers manufactured by Legion Cabinet Corp., 88-48 Livonia Avenue, Brooklyn 12, N. Y. Price Schedules and Photos may be secured on request.

MASK FOR 12QP4A

The Cathode-ray Tube Divisioion of Allen B. Du Mont Laboratories Inc., has announced a specially designed T-V mask for simplifying the replacement of the Types 12JP4 and 12RP4 with the Type 12QP4A.



The new mask is available through the Authorized Du Mont Teletron distributors at low cost, and will adapt the Type 12QP4A to early Du Mont Telesets and most receivers of other manufacture which employ either the 12JP4 or 12RP4.

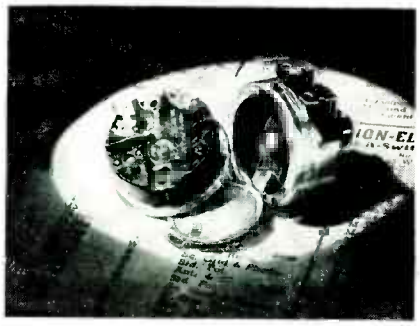
Popularity of the Type 12QP4A as a replacement for the 12JP4 and 12RP4 is based on its close similarity to those older types, plus the features of a flatter face, and a gray filter face plate.

The greater radius of face curvature of the Type 12QP4A, which is the largest consideration in replacing the older types, is compensated for by the mask, making the replacement simple and direct. When replacing the Type 12QP4 for the Type 12JP4 an ion-trap magnet must be added.

NEW AD-A-SWITCH CONTROLS

Fitting the right switch to the right control is further simplified by the latest pry-off dust cover of Ad-A-Switch controls offered by Clarostat Mfg., Co., Dover, N. H.

Instead of the former separate dust-cover lid held in place by lugs engaging with side straps on the control proper, the new construction features a single-piece metal casing



with scored center section and tab. This section readily prys open and tears off, leaving the control casing open to take the proper Ad-A-Switch. Two lugs on the Ad-A-Switch engage with side straps, and are slightly bent to hold the switch firmly in place. Switch mechanism and control rotor are, of course, duly aligned so that the assembled unit functions smoothly.

There is a choice of six (6) types to meet any switching need. The inclusion of the Pick-A-Shaft feature, providing a choice of twelve (12) different shafts, meets the mechanical requirements for the replacement unit.

HYTRON 20FPA4

The Hytron type 20FP4 is a directly-viewed picture tube having a rectangular screen with the standard 4 to 3 aspect ratio designed for use in television receivers. The tube utilizes electrostatic focus and magnetic deflection to provide 17" X 12-3/4" pictures of high quality.

An outstanding feature of this type is its focusing method. It employs a focusing electrode of zero current design and allows the set designer to eliminate the magnetic focus unit. Furthermore, since the tube is of all glass rectangular construction, a net saving in weight and space is achieved over the round glass type of picture tube. The rectangular shape also permits full viewing of the picture, easy mounting of the tube and lastly a saving in high voltage insulation.

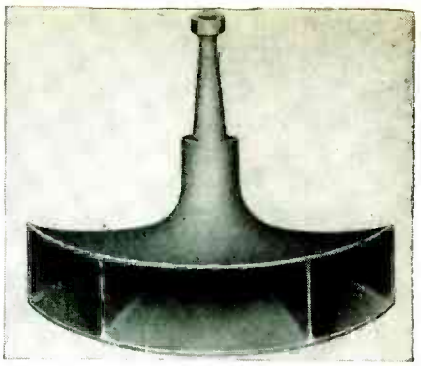
Other features of the 20FP4 are:

1: A relatively flat face incorporating a neutral density gray filter to increase the contrast ratio.

2: An electron gun designed to be used with a single-magnet external ion-trap magnet.

"COBRA"-TYPE HORN

The new Racon COB-11 "cobra"-type horn is designed for public address systems requiring high clarity reproduction with maximum concentration of sound in a horizontal plane. It provides a uniform sound field over a hori-



zontal angle of 120° and a vertical angle of 40°. It is of "straight" horn design and is exponentially flared throughout for maximum transfer of energy. The low frequency cut-off design point is 250 cycles.

The COB-11 may also be used as a middle register or high frequency horn in high quality wide range audio systems using 2 or 3 loudspeakers. The combination of high efficiency, wide angular coverage and low cut-off make it ideally suited for this purpose.

For full details on this model and the rest of the complete Racon line, write directly to Racon Electric Co., Inc., 52 East 19th Street, New York 3, N. Y.

SPACE SAVING 'SCOPE

The Simpson Electric Company of Chicago has in production a new type of oscilloscope It is the Model 476 MIRRORSCOPE, designed to save space on the testing bench. By use of the Mirroscope principal, the 5" cathode ray tube is counted in a vertical position. This Construction reduces bench requirements to an area of only 9" x 8". The cathode ray image is reflected from a high grade mirror

mounted in the adjustable cover at the top of the cabinet, thus the viewing surface is brought near the eye level when the instrument is used on benches of normal height. Mirror and wing sides at top - for deflecting light-fold into the cabinet when it is not in use. Height is 16¼ inches with a width of 9⅛ inches. Shipping weight is 30 lbs, actual weight is 24 lbs. Dealers' net price is $179.50. High Frequency Crystal Probe is $7.50. For further information write, Simpson Electric Company, 5200 W. Kinzie, Chicago, Illinois

STAPLE TACKER

Tiny as a toy, yet efficient as a large industrial staple tacker, a new pocket-size tool has been developed by the Heller Company of

Licking co-channel INTERFERENCE!

30 db

FRONT-TO-BACK RATIO

The New TACO Special TWIN-DRIVEN YAGI

THIS IS IT—the answer to co-channel interference.

Better than twice the front-to-back ratio of previous antenna designs.

Gain comparable to regular Twin-Driven Yagi.

Pinpoint directivity eliminates

other forms of interference picked up at antenna.

Comes tuned for any low-band channel, either stacked or single.

SEND FOR ENGINEERING BULLETIN NO. 65

TECHNICAL APPLIANCE CORPORATION

SHERBURNE, N. Y. IN CANADA: STROMBERG-CARLSON CO., LTD., TORONTO 4, ONT.

Cleveland, Ohio, to effect new savings of time and money in making wire installations.

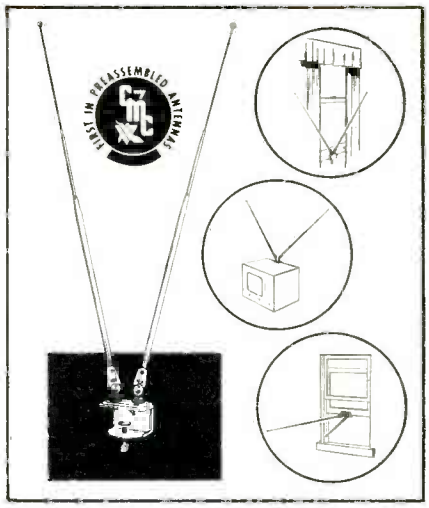
This new tacker speedily staples braided, rubber-coated, single and double strand wire and hollow tube lines. Front and rear guides circle the wire and permit rapid drawing around difficult angles or corners, along baseboards, plaster walls, window frames, ceilings, door jambs and rafters.

Uses an improved staple, made in several colors, whose driving points easily penetrate plaster, composition board, hard and soft woods (with holding power up to 64 lbs.) Drives the staple to a desired depth without marring or injuring the wire.

TV ANTENNA

Channel Master Corp.'s new "Clamp-On" TV antenna, the first antenna to clamp anywhere, solves many mounting problems, and may be installed indoors or outdoors, on furniture, fixtures, windows, etc.

Simplifying the job of the installation man, the "Clamp-On" also permits greater variety in home decoration by eliminating the need for confining the antenna to the TV cabinet or any other particular location.



The "Clamp-On" takes a firm grip anywhere. Its ball-mounted, telescoping dipoles swing out in a 360° arc. The elements can be set to form a Horizontal Vee for any channel in any direction,—actually providing higher gain than conventional indoor antennas.

BOOSTER BY STANDARD COIL

A new and improved television booster, the Model B-51, has just been announced by Standard Coil Products Co. Inc., Chicago and Los Angeles. Promising even better TV reception for fringe areas and other difficult locations, this "Standard Booster" is attractively styled in a dark brown plastic cabinet that harmonizes beautifully with all popular makes of television sets.

A product of the same firm that has just completed the manufacture of its four-millionth TV tuner (first in the young industry to reach this figure), the "Standard Booster" is a single stage pre-amplifier featuring continuous one-knob tuning with no switching from high to low bands. High gain in all channels is claimed, with a low noise factor and use of printed circuits as additional features.

Now in production, the new "B-51 Standard Booster" will shortly be available to dealers and jobbers everywhere. Additional information and prices may be obtained from distributors or by writing to Standard Coil Products Co. Inc., 2329 North Pulaski Road, Chicago 39, Illinois, or 1919 Vineburn Avenue, Los Angeles, California.

5-ELEMENTS YAGIS

The JFD Manufacturing Co., Inc., Brooklyn, New York announces the development of a new line of 5-Element Yagi Television Antennas for high gain reception in fringe and remote areas.

A high impedance driven element assures a terminal impedance which is a true match

Use Sheldon "Telegenic" Picture Tubes

FOR REPLACEMENTS, CONVERSIONS & INITIAL EQUIPMENT . . .

Miss Connie Corrado
Inspector
Sheldon Electric Co.

Because . . . *THEY STAND UP!*

"I KNOW THAT SHELDON 'TELEGENIC' PICTURE TUBES ARE GOOD. I INSPECT THEM."
They are custom-made. They have a life of more than 4,000 hours.

(This Advertisement is being repeated by POPULAR DEMAND!)

WRITE TODAY for the new Sheldon **"General Characteristics & Dimensions"** Wall Chart containing complete data on ALL Sheldon tubes.

KEEP INFORMED ON COLOR TELEVISION. Get your **FREE** copy of **Television Mis-Information #4** with its feature presentation on color television.

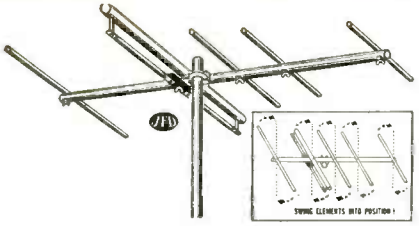
SHELDON ELECTRIC CO.

A Division of ALLIED ELECTRIC PRODUCTS INC.

68-98 Coit Street, Irvington 11, N. J.

Branch Offices & Warehouses: CHICAGO 7, ILL., 426 S. Clinton St. • LOS ANGELES 26, CAL., 1755 Glendale Blvd.

VISIT BOOTHS 390-1-2 AT THE RADIO ENGINEERING SHOW, GRAND CENTRAL PALACE, MARCH 19-22



to 300 ohm transmission lines. The five-element beam, employing triple directors, is custom-cut to suit exact channel wavelength. "Quik-Rig" elements swing into position and wing nuts tightened for instant assembly. Construction is of heavy-wall corrosion-resistant aircraft alumnum with a 1" OD collector element and crossarm.

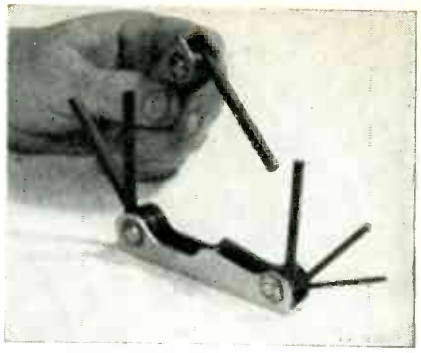
High front-to-back ratio rejects co-channel interference. A special jumper harness is available for stacking bays where conditions require. Models are available for all low band and high band channels. JFD Yagi Model No. 5Y9, for example, identifies the 5-element Beam cut for channel 9.

Litrature describing the features in greater detail is available upon request from the manufacturer and its distributors.

SOCKET HEAD SCREW & BOLT TOOL

To meet the need for a single tool that fits all the popular size socket screws and bolts, the H. D. Hunter Co., Los Angeles, has developed the handy, new "Smitty."

This cleverly-built, hand tool has five of the most popular, standard-size, socket-head wrenches that fold knife-like into a single



sturdy handle. It is small enough to fit conveniently into a pocket, yet its unique design permits greater leverage than ordinary wrenches now in use, and gives easy access to even the most difficult places. The individual wrenches are made of high quality, tempered steel to assume longer life and can be ground down when the end becomes worn. When it is no longer possible to grind the individual wrenches they can be easily and quickly replaced by removing the end bolt and inserting a new wrench of the same size—keeping the ""Smitty" complete and eliminating the need of buying a new tool.

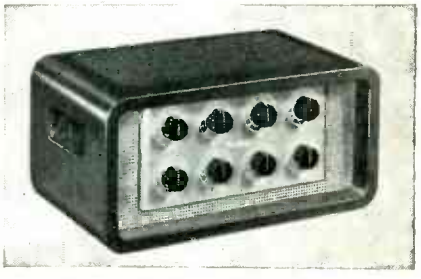
COIN OPERATED TV SET

Covideo, Inc., one of the pioneers in the manufacture of coin-operated television sets,

having released its original 10" screen table model in October, 1949, is in full production now on their new 14 inch set which had its first showing last spring.

NEW REMOTE MIXER-PREAMPLIFIER

Rauland-Borg Corporation of Chicago introduces a new completely self-contained Re-

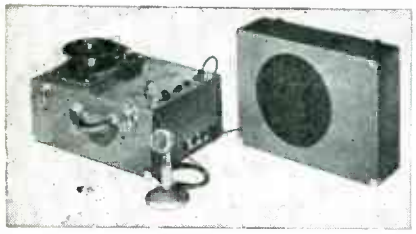


mote Mixer and Preamplifier. It is designed to mix four inputs (high or low impedance mikes and crystal pickups) and to feed the program over remote line to main amplifying

equipment located at any required distance away (up to several miles, if desired). The Model 1904 Mixer-Preamp may be instantly converted for use with from one to four low-impedance mikes by inserting Rauland R1002 plug-in transformers. Other features include: Master gain conrol, separate bass and treble controls, self-contained 24 volt AC supply and switch for remote relay control of main amplifying equipment.

CONTINUOUS RECORDED MUSIC SYSTEM

Ristaucrat, Incorporated, Appleton, Wisconsin, is now forming a distributor-dealer organization for its new, low-priced, continuous recorded music system. Ristaucrat units are designed and priced for easy sale to any size factory, store, office, or club.



Available in 3 models, all Ristaucrat units are equipped with a patented re-stacker which holds twelve 45 r.p.m. records.

The Emperor model (illustrated) is designed for dual use as a portable music or public address system. Encased in an attractive Hartmann trunk cabinet, it is sold equipped with tubes, a 15 watt Webster amplifier, a 12" Oxford PM speaker, microphone and 25 feet of extension cord. If necessary, as many as 15 additional speakers may be used with the EMPORER.

All models are available for immediate delivery. For illustrated brochure and discount schedules, write to: Ristaucrat, Incorporated, 1216 East Wisconsin Avenue, Appleton, Wisconsin.

ELECTRONIC MIXER FOR PA

The compact PENTRON AUDIO-MIX has four individual controls which permit a wide range of audio blending applications on each of its four channels simultaneously, with professional results. A combination plug and screw type coupling on the output cord assure easy connection to any audio system. Other specifications include six high impedance

inputs, four microphone, two phonograph: microphone gain, 8 db., phonograph gain, -22db.,: selenium rectifier; two tubes, (12 AX7), may also be used with 12 AY7 low noise level tubes for extremely technical applications. Frequency response 20 to 20,000 cycles; power consumption, 8 watts; AC 105/120 volts, 50/60 cycles; extremely low hum level. Size 8" x 6" x 5", weight 4¼ lbs. List price $59.50. For full information and literature on the new

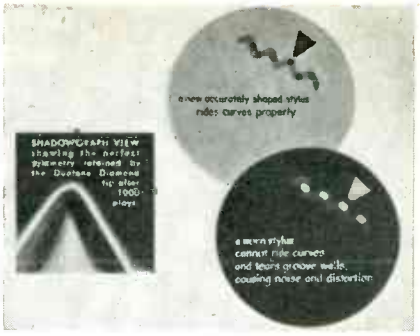
AUDIO-MIX write The Pentron Corporation, 221 East Cullerton Street, Chicago 16.

DIAMOND STYLUS

The Duotone Company of Keyport, New Jersey, announces the new Duotone Diamond Replacement Phono Needle available for most models of standard tone arms.

The new Diamond Replacement needles are available for most standard pickups and are mounted in the various shanks and holders required for each model. For special types, the Duotone Company offers needle replacement service at the factory where experts will install the diamond as requred.

The shadowgraph view shows the perfect symmetry retained by the Duotone diamond Tip after 1000 record playings.



The Duotone Diamond retails for $20.00 for popular types of pickups with prices slightly higher for other than standard models. Readers are invited to request illustrated literature

CONDUCTIVE COATING

Now a new fast-drying conductive coating designated "Tube Koat" for recoating the outsides of television picture tubes, perfected by General Cement Mfg. Co., 919 Taylor Avenue, Rockford, Ill.

There has long been a need by servicemen and distributors for a way to repair the outer coating of television picture tubes that are peeling or have become scratched during repair. Also used to coat the inner part of the T-V cabinets to prevent high voltage leaks and static discharge.

For further information about "Tube Koat" contact the General Cement Mfg. Co., Rockford, Illnois, or the area representative.

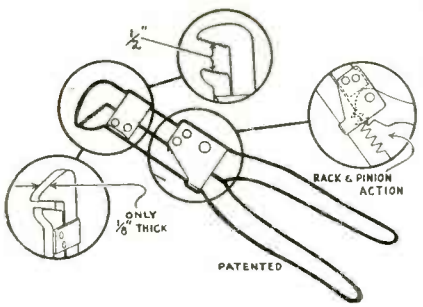
MECHANICAL ROTATOR

Coming at a time when most Americans are beginning to tighten their belts and purse-strings, Select-A-Beam, he new, low-cost, hand-operated, TV antenna rotator "for home or ham," introduced to the market in January, 1951, is proving to be doubly easy to sell, according to Neo Products Corporation, Erie, Mich., its developers and manufacturers.

A small, worm-gear, control box for attachment to the outside of the house easily turns the antenna 360° in seconds and may be operated from either the outside or inside. Positions lock automatically, but for even more speed and ease in turning to chosen stations, a simple, mechanical, metering device has been provided.

POWER-GRIP WRENCH

A new tool known as the "Power-Grip" wrench is being marketed by the Colman Tool & Machine Co., P. O. Box 364, Amarillo,

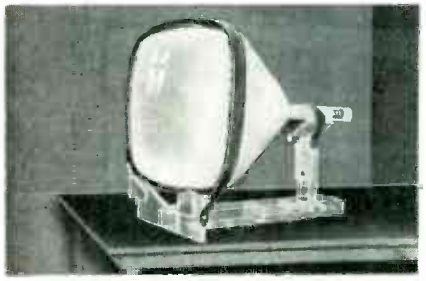


Texas. Incorporating a rack-and-pinion action with an angle head, the wrench affords extreme pressure application in ordinarily inaccessible spots. Head thickness is only 1/8", while overall length is 5¼". Jaw opening gives an infinite number of sizes from 0 to slightly over 1/2".

A handy tool for applying a strong grip on small parts in close quarters, the wrench is useful for machinists and mechanics, tool-&-die makers, radio and ignition repairmen and assemblers, instrument makers, appliance repairmen, and home hobby workers. Made of fine alloy steel, it is guaranteed unbreakable. Finish is non-glare black with polished straps. The wrench is priced at $1.50.

PIX TUBE HOLDER

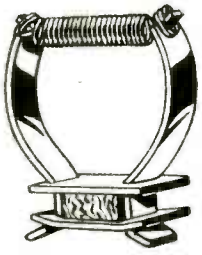
Just introduced by Precision Plastic Products, Inc., Chicago plastic fabricators, this new television tube holder is designed to fit the requirements of all television servicemen. Called the Tube Vise, this handy device safely and securely holds any size TV tube in a

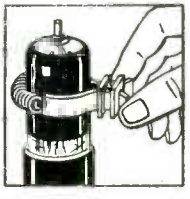


rigid, adjustable frame. It is claimed to eliminate or minimize the ever present danger of tube breakage. Made of clear, lustrous plastic with web straps that hold the tube front and rear, it makes profits by facilitating repairs. Lists at $14.95 postage paid. For full information write direct to manufacturer.

BARKHAUSEN OSCILLATION DAMPER

Perfection Electric Company, 2635 South Wabash Avenue, Chicago has just introduced a device called the B. O. Eliminator, which is proving very effective in eliminating the ver-





tical black bars which appear in TV pictures when Barkhausen Oscillation occurs in the horizontal sweep output tube (such as the 25BQ6, 6BQ6, 6EV5, 25EV5, 6AU5 or 25AU5, etc.). Barkhausen Oscillation is set up near the screen

grid of the horizontal sweep output tube, is radiated to the input of the tuner, and sets up vertical black bars that appear on the face of the picture tube. They are especially noticeable with weak signal impulses, as in fringe area. However, if a concentrated magnetic field is placed near the source of the B. O. (the screen of the horizontal output tube), then the above effect (the black vertical bars) is usually eliminated.

The Perfection Eliminator, designed to banish Barkhausen Oscillation, is easily installed by slipping it over the tube as shown here. The Eliminator is moved up or down or turned to the right or left until the dark vertical bars disappear from the picture. This item is the latest addition to the Perfection line of radio and television parts which includes Speakers, Ion Traps and Beama-Juster TV Picture Centering Controls.

NEW V-O-M

Triplett Model 666-RL is a new handy size, compact Volt-Ohm-Mil-Ammeter answering a need for portability and quick testing usage. AC-DC Voltage ranges from 0 to 5000, 1000 Ohms/Volt; Direct Current to 10 Amps.; Resistance: 0-3000-300,000 Ohms, 3 Megohms. 3" Red.Dot Lifetime Guaranteed instrument mounted flush with the panel. Black and red dial markings on white background. Only one selector switch required for all settings. Enclosed, molded switch retains contact alignment permanently. Direct connections, no cabling, eliminates chance for shorts. Precalibrated rectifier.

Model 666-RL is used in the leather case by dropping the front and top flaps (one turn of a fastener). The strap handle permits hanging the tester during work where both hands should be free. Furnished with self-

contained batteries, test leads and instructions. For further information write, The Triplett Electrical Instrument Co., Bluffton, Ohio.

20 INCH RECTANGULAR TUBE

General Electric's tube divisions will start production soon on a 20-inch rectangular picture tube, it has been announced here.

Designated as the 20CP4, the new tube is a magnetic-focus and deflection, direct-view, all-glass picture tube for television applica-

tions. It has a screen area of 217 square inches.

Features of the 20CP4 are an electron gun designed to be used with an external single-field ion-trap magnet for the prevention of ion-spot blemish, a high-quality neutral-density faceplate to increase picture contrast and detail under high ambient light conditions and a space-saving rectangular face shape.

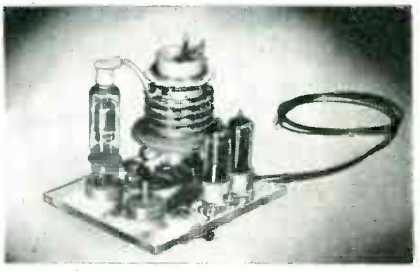
Maximum ratings of the tube include: anode voltage, 18,000 volts; grid-No. 2 voltage, 410 volts; grid No. 1 voltage, negative-bias value, 125 volts; positive-bias value, 0 volts; positive-peak value, 2 volts.

Further information on the 20CP4 may be obtained from the Tube Divisions, General Electric Company, Schenectady.

RSD 3 New Prods.

R-F POWER SUPPLY

Spellman Television Corp. of 3029 Webster Ave., New York 67, N.Y. has announced a



new compact high voltage unit designed for industrial or laboratory applications. It is well filtered 4500 volt RF DC Power Supply, completely enclosed, measuring only 5-5/8" x 4½" x 5". Voltages up to 7500 volts at 1 milliampere may be obtained. It is available with either negative or positive polarity out-

TRADE FLASHES

[*from page 12*]

10th issue of the Saturday Evening Post. The announcement was made by Tom Clinton, president of the electronics firm.

Sylvania Launches 1951 Ad Campaign

Sylvania Electric Products Inc. has launched a 1951 advertising campaign for its Radio Tube Division which will coordinate a weekly TV program, national advertising and comprehensive point of sale material, the largest ever sponsored by a radio and television manufacturer to promote radio-television servicing, according to Terry P. Cunningham, director of advertising.

New NU CR Tubes

Kenneth C. Meinken, President, National Union Radio Corp. of Orange, N.J. has just announced the development of a new design of television picture tubes which permits the savings of over two pounds of copper in each TV set by utilizing electrostatic focus in place of electromagnetic focus. This savings of copper is achieved by eliminating the focusing coil used on electromagnetically-focused tubes.

New RCA Service Book

The fifth bound volume of RCA Victor Service Data which provides, in a single hard-cover book, service and technical data on all 1949 models of RCA Victor television and radio receivers and Victrola phonographs, is now available to servicemen through RCA distributors.

G. E. Booklet

General Electric Company makes available a handbook on Recommended Tube Types for AM, FM and television receiver applications.

The book this time includes television picture tubes and germanium diodes and should serve as a very complete reference on the tubes which may most advantageously be used in your sets.

New Rider Books

The following publications are announced by John F. Rider, Publisher, Inc. 480 Canal St., N. Y. 13, N. Y.:

Rider's Television Manual Volume 6, the latest in the series of television servicing data, is now in production.

Scheduled for availability in March, the new volume takes up where TV Volume 5 leaves off. Factory-authorized servicing data from 66 manu-

facturers are included in the 12 x 15 inches manual.

Vacuum - Tube Voltmeters (Revised), is scheduled for publication in March.

Thoroughly revised and almost completely rewritten, it is right up to the minute in its coverage of all types of vacuum-tube voltmeters (diode, triode, rectifier-amplifier, tuned, amplifier-rectifier, slide-back).

Altec Lansing Opens New Plant

The Altec Lansing Corporation has opened a new plant in Beverly Hills, California to supplement the production facilities in Los Angeles and New York. The two Hollywood offices were also consolidated with the new facilities at 9356 Santa Monica Blvd.

Promotions and Personnel Changes

Dr. R. M. Bowie, formerly manager of the Physics Laboratories of Sylvania Electric Products Inc., Bayside, N. Y., has been appointed to the staff of the vice president of engineering, E. Finley Carter, as director of engineering, according to an announcement by Mr. Carter.

The appointment of John T. Burdick as Director of Midwest Sales of Sylvania Electric Products, Inc., annonuced by R. H. Bishop, Vice President in Charge of Sales.

Sylvania Electric Products Inc., Radio & Television Division, Buffalo, announces the appointment of William D. Stroben as Advertising and Promotion Manager. Also announced is the promotion of Arthur A. Currie to Field Sales Manager. Former District Sales Manager of the New England—Eastern New York State sales territory, Mr. Currie assumes his new appointment effective immediately.

L. S. Thees, General Sales Manager of the RCA Tube Department has announced the following promotions in the Sales Division.

W. L. Rothenberger has been appointed Manager of Sales Operations. M. J. Carroll continues as Manager of the Equipment Sales Section; H. F. Bersche continues as Manager of the Renewal Sales Section; L. J. Battaglia has been appointed Manager of the Renewal Sales Field Force, reporting to Mr. Bersche.

L. F. Holleran has been appointed Manager of Sales Administration. G. C. Brewster has been appointed Manager of the Sales Planning Section, and M. R. Stoecker has been appointed Manager of the Product Distribution Section.

Julius Haber, Advertising and Sales Promotion Director for all RCA Technical Products, will, in addition, be Acting Manager of Advertising and

Public Relations for the Tube Department. Lawrence LeKashman has been appointed Manager of the Advertising and Sales Promotion Section, reporting to Mr. Haber.

Howard S. Gwynne has been appointed Assistant to the General Sales Manager.

D. H. Cogan, President of Air King Products Co., Inc., New York manufacturer of television, radio and wire recorders today announced the appointment of Miss Muriel Young as cabinet design consultant to Air King. Also announced was the appointment of Edward S. White as the Assistant Chief of Advanced Development, Edwin Weise Jr. as advertising and Sales Promotion manager, and Samuel Olchak as Assistant Sales Manager.

Mr. Carl Holys has been named Factory Manager and Mr. Ed. Morey placed in charge of sales announced by the Wilcox-Gay Corporation whose plants are located in Charlotte, Michigan. Mr. Holys will be in full charge of all Wilcox-Gay production according to an announcement released by G. F. Langford, Executive Vice President of the Company. Mr. Morey's offices will be in Charlotte, Michigan.

Appointment of George Krakora to the newly created position of personnel director of Stewart-Warner Electric, the radio and television division of Stewart-Warner Corporation, has been announced by E. G. Fossum, general manager of the division.

Appointment of five new service representatives and the disclosure that a series of nation-wide service meetings will begin shortly, was announced by E. W. Merriam, manager, Teleset Service Control Department, Allen B. Du Mont Laboratories, Inc., following the department's quarterly regional service managers and field representatives meeting, held at the Du Mont East Paterson, N.J. plant last week.

The addition of the five new men, will enable the department to assure a field service representative visit to each receiver sales distributor at least once a month, Merriam said.

The new appointees include, William C. Platt, Northwestern states; Howard Lester, Southern Ohio and western Pennsylvania; Raynald Dufour, Missouri, Iowa and Nebraska; Erico Compertz, New Jersey and Anthony Boullion, Baltimore and Washington, D.C.

Merriam also revealed that the department would shortly begin publication of the monthly Du Mont Service News, for all service personnel. This publication will include latest data on installation and service problems on Du Mont receivers.

The appointment of Oakley F. Hoyt as Director of Defense Production for Hudson Wire Company is announced by its president, Robert M. Akin, Jr. Manufacturers of fine wires for over a half century, the Hudson Wire organization has production plants in Ossining, (N.Y.), Winsted and Norwalk (Conn.) and Pownal (VT.) A new Midwest Plant is now under construction at Cassopolis, Mich.

Theodore A. Smith, who for the past five years has headed the sales activities of the RCA Engineering Products Department, has been appointed Assistant General Manager of the department, it was announced today by L. W. Teegarden, RCA Vice President in charge of Technical Products of the RCA Victor Division.

Edwin Dorsey Foster, U.S. Navy (Ret.), has been appointed Director of a newly established Mobilization

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Subscribe to "RTSD"—

"The Professional Radio-Television man's Magazine"— published monthly. All articles are exclusive and timely. Practically every issue is worth what an entire 1 year subscription costs.

★ The more in a group the bigger the savings. 6 men in a group save $1.00 each; 4 men groups save $ .75 per man. Present "RTSD" subscribers may participate in or form a group with co-workers, or even competitors. Still active subscriptions are automatically extended 1 year. Start a Group today! The timely and exclusive technical data appearing in future issues of "RTSD" will make this the best investment you ever made. The special Group Rate offer may be withdrawn at any time—so hurry.

Use This Coupon For Convenience

(The coupon below can be used for from 1 to 6 subscription orders. Use it today!)

TEAR OUT — MAIL TODAY

RADIO-TELEVISION SERVICE DEALER
67 West 44th Street, New York 18, N. Y.

Please enter 1 year subscription orders for the names given below. Our remittance is enclosed.

NOTE: If you do not wish to tear this order blank out, just print or type the information on a single sheet of paper, following the style given. Each subscriber's occupation must be clearly described.

	In U.S.A. & Canada	Foreign Rates
☐ One 1-year subscription	$2.00	$3.00
☐ Two 1-year subscriptions, each	1.75	2.75
☐ Three 1-year subscriptions, "	1.50	2.50
☐ Four 1-year subscriptions, "	1.25	2.25
☐ Five 1-year subscriptions, "	1.10	2.00
☐ Six 1-year subscriptions, "	1.00	1.50

Name ....
Address ....
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Describe Title or Position and Type of Business ....
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State whether a New Subscriber ☐ or Renewal Order ☐

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Planning Department of the RCA Victor Division of Radio Corporation of America, it was announced today by Charles M. Odorizzi, Operating Vice President of the Division.

Vin Ulrich, Manager of National Union's Renewal Sales Division announces the appointment of William H. Clithero, Jr. as District Manager for the Southwest territory, comprised of the states of Texas, Oklahoma, Arkansas, and Louisiana. Bill will handle renewal sales of N.U. receiving tubes, Videotran television picture tubes, and panel lamps. His headquarters will be at: 3100 Hedgerow, Dallas, Texas.

The appointment of H. I. ("Dan") Danziger as Vice-President is announced by Henry L. Crowley & Company, Inc., West Orange, N.J. This is addition to his previous duties as General Manager.

TAPE RECORDERS

[from page 37]

assembly (E-30) should be replaced when pads are worn or ineffective. This assembly is readily replaceable when two retainer screws in rubber mounts are loosened. The pinch roller assembly (E-28) is freed by removing the center attaching screw. When a new roller is installed, take care that it fits without play yet revolves freely.

When any of the mechanism levers are bent, damaged otherwise, or excessively worn, replace the complete mounting plate assembly. Otherwise return the complete unit to the factory for repair. For further details see literature issued by the manufacturer.

ROTATORS

[from page 28]

models LZX-2 (2 bay) and LZX-4 (4 bay). In this data, determined in the C-D, Radiart laboratories, the direction of the total force was that which presented the greatest projected area of the antenna and mast to the wind.

It will be noted in the chart for LZX-4, under the double lines in the columns for various mast heights, that values are obtained which exceed the safe limit of the Tele-Rotor. It is therefore, imperative, where the velocity of the wind may exceed 70 mph., that the Tele-Rotor be mounted inside the tower, if used, or that a standard superstructure (*Fig. 9*) be used in the installation.

In installations where several feet of free mast exist between the top of the rotator and the lower antenna bay, it is recommended that guys be attached to a rotating guy ring (*Fig. 10*). When guys are required, the use of guy wire thimbles will prement chafing of the loops thru the guying holes. A turnbuckle incorporated into the lower end of each guy wire will allow proper tensioning. It is important that the guy wires not be drawn up too tightly.

Every service dealer should check and know his local rules and regulations pertaining to antenna and rotator installations. Underwriters' Laboratories requires the grounding of both the antenna and rotator downleads thru suitable lightning arrestors. The National Electrical Code also requires the direct grounding of the antenna installation.

ROOF MOUNT

[from page 39]

in height three or more cables are used to prevent the mast from buckling. Turnbuckles are inserted in the points shown at (6), and even tension is maintained in these cables. The mast is then cranked up to about 5 degrees from vertical position and the remaining guy cables are secured to the roof. Following this the mast is slowly cranked to a vertical position. See *Fig. 4*.

The mast can be self guyed while erecting by attaching a guy cable to each end of the roof as shown in *Fig. 1* exactly the same distance and height from the ridge of the gable

Fig. 4. Mast almost completely raised vertically.

that the mast is secured to roof mount. A turn buckle is used in each cable to take up or loosen tension as mast is being erected.

TUBE TOPICS

[*from page 41*]

for a minor change in the 6BC5 to provide a slightly higher plate current and correspondingly greater transconductance. The 6BC5 when originally introduced in the Philco sets was known as 6AG5S. Since the manufacturing tolerances for transconductance are about ± 20%, it follows that a 6BC5 on the low side of center may actually have lower transconductance than a 6AG5 on the high side. In general, however, 6BC5 should provide a bit higher gain than 6AG5 because of the higher average transconductance. Capacitances and series inductances are the same in both types. Significant pentode characteristics are listed below: See *Fig. 2.*

As a triode the 6BC5 has proportionately higher transconductance and about 5% lower amplification factor than the 6AG5. These differences are not at all significant.

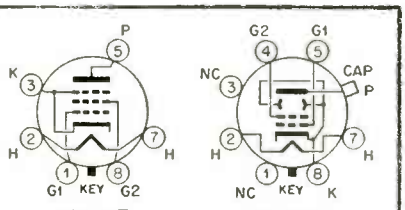
6AV5GT, 6AU5GT, and 6BQ6GT

6BQ6GT was the original low-cost horizontal sweep amplifier tube which was followed by the 6AU5GT and 6AV5GT. 6BQ6GT has a top cap while the others are single-end. Characteristicwise the 6AV5GT is the same as the 6BQ6GT- maximum rat-

	6AG5	6AG5S 6BC5	
Heater potential	6.3	6.3	volts
Heater current	0.3	0.3	amp.
Plate potential	250	250	volts
Screen potential	150	150	volts
Cathode bias resistor	180	180	ohms
Plate current	6.5	7.5	ma.
Screen current	2	2.1	ma.
Transconductance	5000	5700	micromhos
Plate resistance	0.8	0.8	megohm

Fig. 2. Characteristics of 6AG5 and 6BC5 type tubes.

ings are likewise identical. Obviously then they are interchangeable by changing the socket connections. (see *Fig. 3*). But if the single-ended 6AV5GT is used, a socket capable of handling peak potentials in excess of 5000 volts with a normal accumula-



	6AU5GT	6AV5 GT 6BQ6 GT	
Heater potential	6.3	6.3	volts
Heater current	1.25	1.2	amp.
Plate potential	100	250	volts
Screen potential	100	150	volts
Mu, grids No.1 to No.2	5.9	4.5	
Transconductance	6000	5500	micromhos

Fig. 3. Socket connections and characteristics of 6AU5 and 6BQ6 Type Tubes.

tion of dust and moisture must be employed. In many sets 6AV5GT and 6AU5GT are directly interchangeable even though there is a difference in characteristics which is not readily

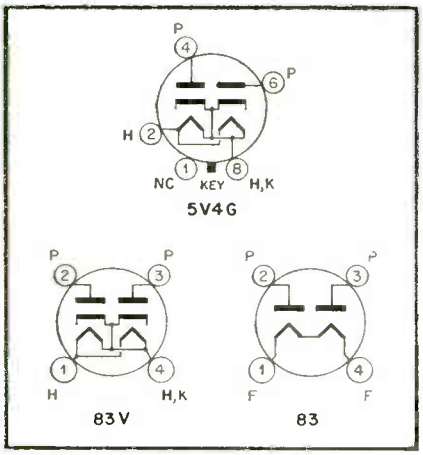


Fig. 4. Socket connections of 5V4G, 83V and 83

evaluated from the published values. What has been said of the 6-volt tubes applies also to the 25-volt versions.

In general, it will be found that 6AU5GT requires somewhat less grid drive voltage and negative bias than the 6AV5GT or 6BQ6CT. Where there is ample drive from the horizontal oscillator these differences are swamped out. When making such a substitution, the serviceman should measure the plate and screen currents and make sure that maximum ratings are not exceeded.

Incidentally, in the event of short life on those or similar sweep amplifiers, the serviceman should check the plate and screen currents to see if they are within ratings. Sometimes with insufficient drive or too high screen voltage the horizontal sweep amplifier tube draws excessive plate current resulting in excessive plate dissipation. Melting of solder on the top cap of a 6GQ6GT is a definite sign of excessive plate dissipation.

5V4G, 83V and 83

Types 5V4G and 83V are identical except for basing. In power rectifier applications there is no reason why

83V's which are available can not be substituted for 5V4G by means of a socket change (see *Fig. 4*). In TV damping circuits the substitution is okay if the maximum inverse peak rating of 1400 volts is not exceeded. While the 5V4G tubes being made today are rated for 2100 volts in horizontal damper circuits, it's quite possible that tubes of older manufacturer or type 83V won't handle this application. In passing, it might be well to point out that type 83V was originally introduced to replace type 83 in many circuits, although the 83 has a higher inverse peak rating of 1550 volts and, of course, a somewhat lower tube drop. This means an 83V will give somewhat less output voltage than an 83, which may not be important in some applications, making the 83V a satisfactory substitute.

KITS

[*from page 38*]

Radio theory is valuable knowledge. But you old-timers know that it took years of actual experience handling radios before you could translate that his first kit than would a chap with basic theory into cash-producing real understanding. The same is true of test equipment. Sure, you "know how" it works, but, you'll admit that to be thoroughly "at home" with an instrument you've really got to construct one, or something almost exactly the same. The basic idea in most leading TV training schools today is to make the students build actual TV sets so they'll know how and why they work, and so they'll know what went wrong in any circuit, if one should bloop. You only get the "real feel" of something you actually put some of yourself into. Hundreds of servicemen have told me that they got a tremendous "kick" out of assembling their own instruments. It's the emotional satisfaction, the pride and thrill of seeing your own labor converted into something that contributes to your own income. Or, as I said before, if know-how and labor is your stock in trade, don't be too hasty about buying it from someone else. And remember, reliable instrument kit manufacturers stand as squarely behind their products just as any other type of seller of assembled equipment. It's possible that a rank beginner might have to work a little harder putting together a lot of technical background, but, that's a part of this business that should be sought after rather than be avoided, for after all, once you are a serviceman, trouble-shooting is going to be your every-day routine job.

AUDIO DRIVERS

[*from page 21*]

grid. Since only one of the push-pull grids is drawing current at any instant, driver transformer turns ratios are always considered as being the ratio of the entire primary to one-half the secondary.

Figures 3A and *3B* are identical except for turns ratio. In each case the tube is assumed to have an internal plate resistance of one thousand ohms. Remembering that the impedance ratio on transformers is equal to the square of the turns ratio, it is easily seen that in *Fig. 3A* with an impedance ratio of four-to-one the driver will present an internal impedance of two hundred and fifty ohms. In Fig. 3B the impedance ratio is sixteen-to-one, and the driver will show an internal impedance of only sixty two ohms or

so. The self-evident conclusion is, of course, that *the greater the step-down ratio the better*. This is true within limits.

Another fact enters the picture here, this being that the greater step-down ratio also steps the voltage down. If we have too great a step-down, we will find ourselves without sufficient voltage for the grids. Also, if the step-down is great enough so that the impedance reflected into the secondary approaches the d-c resistance of the secondary, it doesn't pay to step-down any further, since the total impedance of the secondary as seen from the grid can never be less than its resistance.

The following procedure for finding turns ratio required will be satisfactory for most purposes, but is still simple. First, look up the power output of the driver tube and the recommended load resistance for it. Multiply this wattage by the resistance, and then take the square root of the answer. This is the voltage across the primary. Multiply this by one and four tenths to find peak voltage across the primary. Then look up the peak AF grid voltage required per grid of the push-pull tubes. If this is given grid-to-grid, divide by two. The voltage ratio is the turns ratio required. Of course, the voltage ratio will probably come out something like two hundred and sixteen volts on the primary and forty nine volts on half the secondary. Transformers aren't made with ratios like that, so use the next smaller ratio. In this case two hundred and sixteen-to-forty nine is pretty close to four-to-one, which would be used.

A bleeder resistance is used across a power supply to improve the regulation. The same thing is often done to a power driver, as shown in *Fig. 4*. Resistors *R1* and *R2* are about ten thousand ohms each. They load the driver while the grids are not drawing current, markedly improving regulation and reducing distortion.

Once the power driver is understood, a great advantage of zero bias class *B* tubes immediately stands out. With zero bias, one of the grids is always drawing current, the driver is never running without a load, and driver internal impedance becomes less critical, although still important.

MC METER

[*from page 26*]

able to create at least 20 horizontal black and white bars across the screen of picture tube. This would require

able to create at least 20 horizontal black and white bars across the screen of picture tube. This would require a modulation frequency of about 1600 cycles. See *Fig. 2.*

It will now be possible to adjust the vertical height and vertical linearity controls without a test pattern properly by watching the spacing between the black white bars. When correct adjustment is made the spacing should be even throughout the entire picture tube.

For checking and adjusting the horizontal size and horizontal linearity without a test pattern a similar procedure is used. The modulation frequency, however, must be made very much higher as only 1 black and 1 white vertical bar would appear for every 15,750 cycles of modulation. To create 20 white and black vertical bars on face of CRT, a modulation frequency of 300,000 cycles is required to modulate the carrier of the megacycle meter. See *Fig. 3.*

When adjusting the horizontal size and horizontal linearity controls we look for even spacing of the vertical black and white bars across the entire face of the CRT. This is a simple and foolproof method.

Checking Video I-F Response

Another important use to which this instrument can be put is plotting a video i-f response curve. It is accomplished in the following manner. Referring to the block diagram in *Fig. 4* a scope or a-c meter is connected to the video amplifier plate load. The unshielded pickup coil of the Megacycle Meter is placed near the mixer tube. Use Megacycle Meter with modulation switch on and rotate through the i-f range, which in most cases will run from 20 through 28 mc. Adjust the meter range switch or

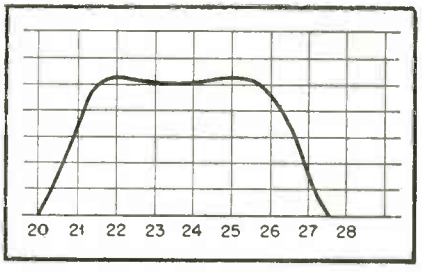


Fig. 5. I-F Response Curve.

vertical control on the 'scope to indicate not more than maximum indication on the meter or 'scope. When a 'scope is used, the 120 cycle saw tooth modulation will be observed. Adjustment should be made while running the Megacycle Meter through the entire i-f range using graph paper and starting at 20 mc. See *Fig. 5.* Observe and record the voltage or deflection amplitude of 'scope on graph paper. Repeat the same procedure at 20.5 mc

Repeat in steps of every half megacycle, being careful not to change the coupling or the gain control of tele set. When the last indication is made on the graph, all points are then joined together and a complete i-f response curve is obtained.

SWEEP GENERATOR

[*from page 19*]

When this is necessary, the instruction manual of the particular 'scope in use should be consulted.

Requirements for Good Sweep

A good sweep generator should have adequate frequency coverage for the television channels, and for this reason should extend to approximately 220 megacycles. The sweep width should be easily controlled and extend to at least 15 megacycles so that the over-all 6 megacycle TV band-pass can be seen in its entirety on the screen of the scope. Inasmuch as the inter-carrier type of TV receiver has a 4.5 mc sound i-f frequency, the sweep generator should be able to cover this range, and the lowest frequency setting should be at least 4 mc.

The sweep generator should also have a phase control, an input jack for the marker generator, an r-f attenuator for output control, a sync output terminal, and a linear sweep in either direction. Of great importance is also the fact that the sweep output level should remain constant for the entire sweep range. A change in output level during some portions of the sweep will lead to erroneous humps or dips on the pattern obtained on the scope.

Additional refinements would include provisions for blanking the return trace, thus eliminating the necessity for accomplishing this at the oscilloscope, and inclusion of a marker system.

The marker system (or a separate marker generator) is necessary in order to establish the frequency points along the response curve which shows on the scope. It is only by utilizing such a device that we can be sure that the band-pass is set on the required frequencies, for the sweep generator only gives the response curve and does not indicate exact frequency points along it.

A discussion of marker generator requirements, as well as typical procedures for utilizing the three aligning units of sweep, marker and scope, will be discussed in the next issue of RSD.

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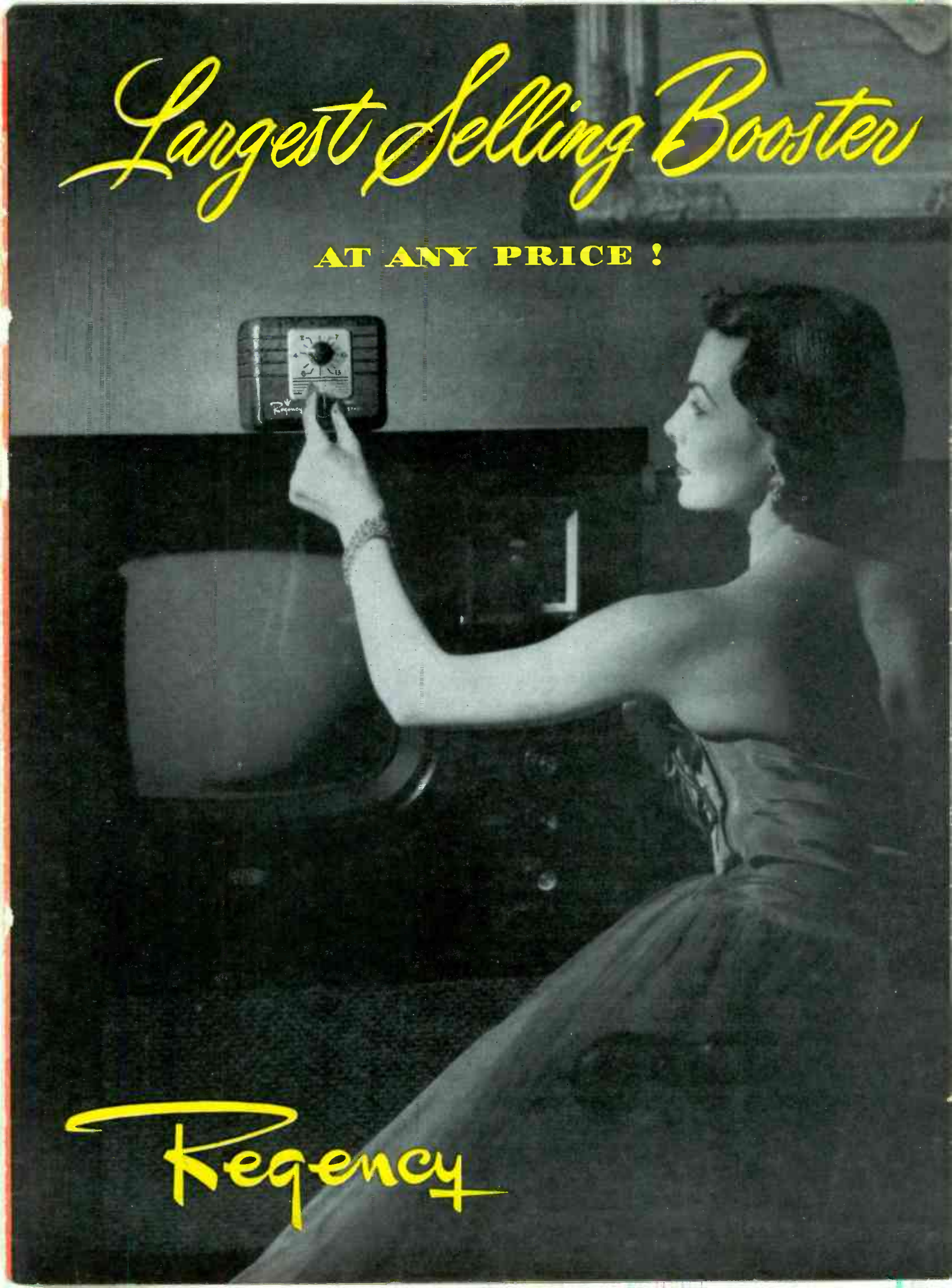

Regency

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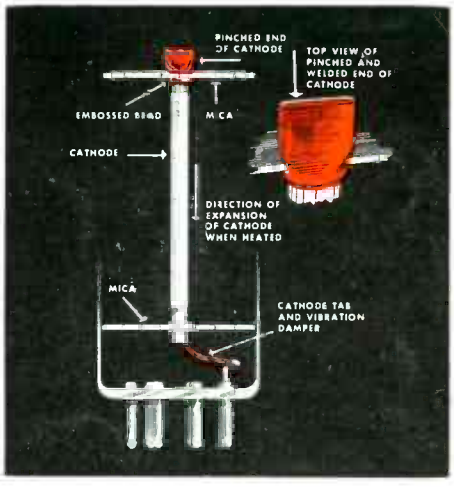
Engineering progress is part and parcel of RCA quality. For instance . . . many of the popular RCA types use *"inverted" pinched cathodes* to minimize microphonics by preventing cathode vibration or displacement.

This improved performance is achieved by clamping the top mica firmly between an embossed bead on the cathode and its pinched top end. This arrangement holds the upper end of the cathode rigidly, but permits the heated cathode to expand freely downward through the bottom mica without producing cathode strain. The lower end of the cathode is prevented from vibrating by means of the damping tab connected between the cathode and stem lead.

This example is another reason why you can count on *extra* performance and long life from RCA tubes—the quality tubes.



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