JULY, 1950

Radio SERVICE DEALER

The Professional Radio-TVman's Magazine

IN THIS ISSUE:

AM-FM-TV-SOUND

Paid Circulation Of This Issue: Over: 23,500
Total Distribution Of This Issue: Over: 25,000

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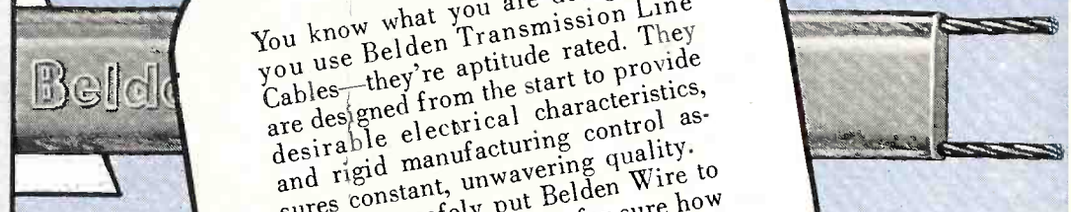
Get the *Aptitude-Tested* TRANSMISSION LINE

APTITUDE RATING No. 8225

Frequency (mc)	Attenuation per 100 ft
100.	1.1
200.	1.7
300.	2.2
400.	2.7

For use with television and FM receiving antenna. Exceptionally low losses at high frequencies.



You know what you are doing when you use Belden 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.

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300.	2.28
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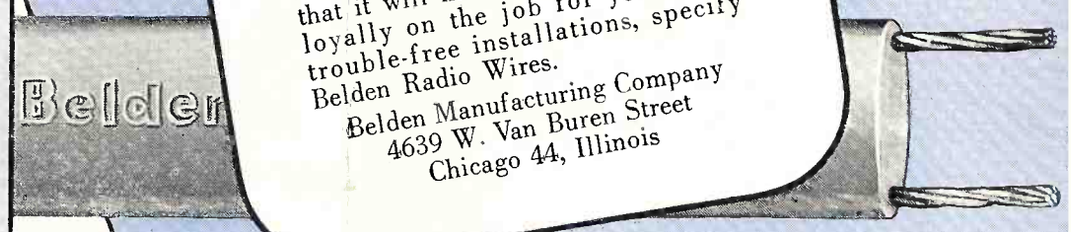

APTITUDE RATING No. 8227

Frequency (mc)	Attenuation per 100 ft
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300.	8.4
400.	10.2

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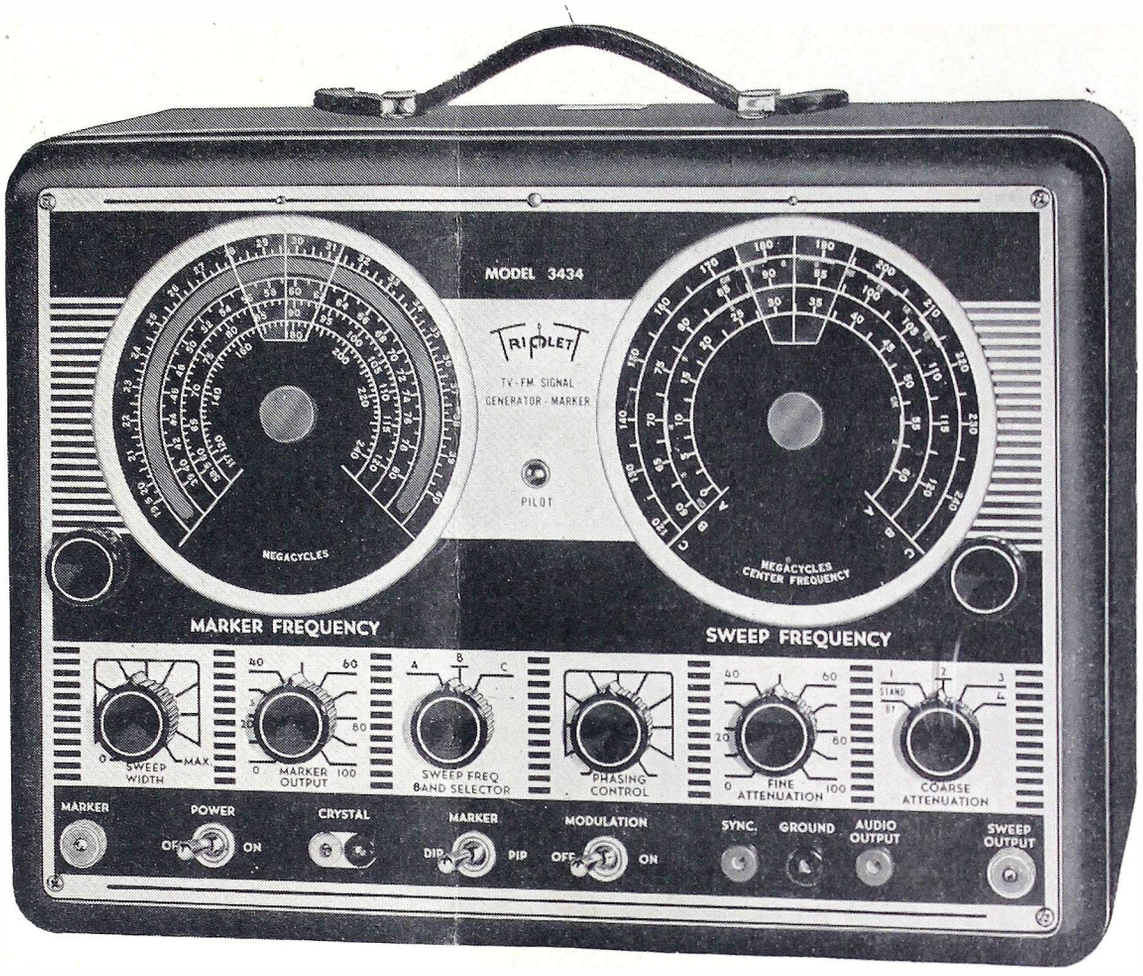
200.	6.20
300.	8.00
400.	9.50

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

Belden *Radio* **WIRE**

The *Aptitude-Tested* **LINE**



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MODEL 3434

for quick checks in all stages

Large Marker dial has a mirror scale for easier reading and reset accuracy. Straight line frequency tuning condensers provide linear scale markings. No "SKIPS" in frequency—continuously variable Sweep width control. Triplett-engineered shielding—all critical circuits enclosed. Copper plated steel construction. All these features (see Tech. Data) combined with the two built-in markers for simultaneous use set Model 3434 apart as one of the fundamental contributions to the rapid, accurate and profitable Servicing of Television.

TECH DATA

Frequency Coverage:

- **SWEEP CENTER FREQUENCY**
  Range 1— 0-60 MC
  Range 2— 60-120 MC
  Range 3—120-240 MC
- **SWEEP WIDTH:**
  0-12 MC (Continuously Variable)
- **MARKER FREQUENCY**
  19.5 to 40 MC (fundamental). 39 MC to 240 MC (harmonic)
- **CRYSTAL FREQUENCIES**
  To 20 MC on Fundamentals. Harmonics up to 216 MC. (Crystals Not Furnished)
- **MODULATION**
  400 Cycle on both Crystal and Marker Frequencies
- **AUDIO:**
  400 cycles

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EDITORIAL

by S. R. COWAN

TV a Killer - - Beware!

Not enough emphasis can be put upon the subject that TV can and does kill people. For example, during the past 30 days there were no less than 6 deaths due to TV that have come to our attention. Undoubtedly there were more about which we have no knowledge.

In Dayton, Ohio, two laymen decided to move a TV antenna. Evidently the mast, when raised, touched a high tension line. The two were electrocuted. In Kansas City a layman reached out of a window to strap down a transmission line that was loose and flapping. He reached too far, fell and died. In New York two professional TV benchmen were trouble-shooting in a TV chassis. One reached over the other's shoulder to point out where he thought the fault was. In his hand was a screw driver. A flash—and both died. The tool had hit the high voltage transformer. In San Diego a technician on his first installation job set up a ladder carelessly. It didn't slip until he reached its peak, and then he fell, breaking his neck.

If professional TV men do their work carelessly with fatal results, undoubtedly this will stimulate political moves for licensing, which in our opinion is another type of death, by strangulation of free-enterprise. However, the general public should "lay off" TV installation work, for it kills professionals and novices without discrimination.

Servicemen's Clinics

RMA's "Town Meetings" Committee is preparing to hold 60 more technical clinics in as many TV areas during the next year. Meanwhile the PRSMA's 2nd Annual Radio-TV Service Convention is scheduled for the Philadelphia, Pa., Broadwood Hotel, Sept. 25, 26 and 27. Opening at 7 p.m. Monday the 25th, the first evening will be devoted to introductory addresses by key personalities. The two technical sessions, however, on the 26th and 27th will run from 10 A.M. until 10 P.M. The tentative program outline is given on page..... of this issue. Yours truly, who incidently was honored by being appointed Moderator for the technical sessions, is convinced that the most practical and worthwhile series program outline is given on page 4 of of lectures ever before offered.

Radio Reviving

TV's fast growth has somewhat relegated ordinary AM radio servicing to a secondary position during the past year. Now there are signs of a turnabout. Business indices show that AM service business has been increasing everywhere, even in TV areas, on a steady basis, and the prospects for a new high in dollar volume of servicing, and the use of replacements, tubes and accessories such as 3-speed record players, should make 1950 the banner year since radio's inception. A word of caution is in order: when you do a job do a *fine* job, and make sure you charge enough so that a profit is realized on *every* job.

MEMBER AUDIT BUREAU OF CIRCULATIONS

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EDITOR & PUBLISHER

Samuel L. Marshall
MANAGING EDITOR

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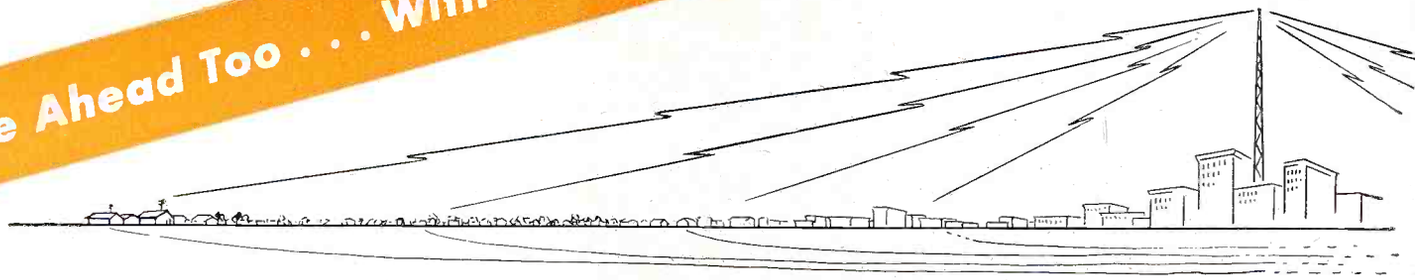
ANCHOR

Ahead Again

New 2-Stage Pre-Amplifier Increases Original TV Signal Strength 5 TIMES

LIST PRICE $44.95

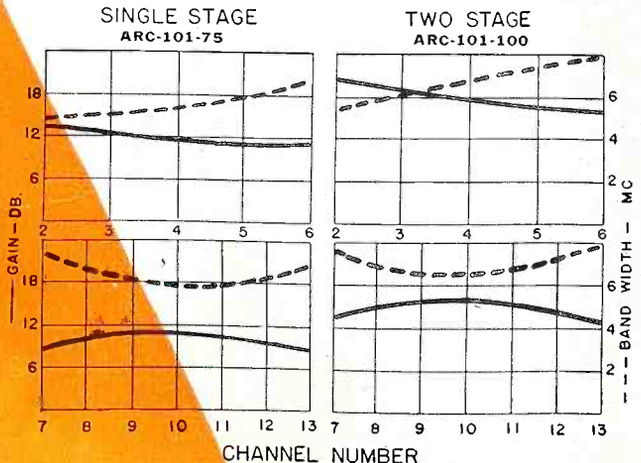
You'll be Ahead Too . . . With Greater Profits Than Ever!



ANCHOR'S NEW 2-STAGE BOOSTER NOW Enlarges Your TV Market for Sales to Thousands of New Suburban and Fringe Area Residents

In 1949 the ANCHOR Single Stage BOOSTER improved television reception for 1 out of every 4 TV Set Owners. Thousands of apartment dwellers, suburban and fringe area residents the nation over demonstrated their preference by making ANCHOR the Number One BOOSTER in sets sold. ANCHOR developed this recognition only through its own top-notch performance by being able to deliver sharp snow-free pictures in most difficult conditions. Now ANCHOR has added the new Two Stage BOOSTER to their line to bring television, and the finest television reception, to everyone. The New ANCHOR Pre-Amplifier Will Out-perform Any Two Stage BOOSTER on the market.

ANCHOR'S performance curves have never been challenged. Undisputed laboratory tests prove that the ANCHOR Two Stage BOOSTER increases the original TV signal strength 5 TIMES.



- *Single Knob Construction allows switching and tuning with a flick of the wrist.*
- *Radically new switching of tube and circuit components.*
- *Modernly styled with streamlined plastic escutcheon. Soft mahogany leatherette finish.*
- *Most stable non-regenerative unit available. The unit that is not returned.*

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Phila. Svcmen's Exhibit

The second annual Radio, Television and Electronics Exhibit sponsored by the Philadelphia Radio Service Men's Association will be held at Philadelphia's Broadwood Hotel from September 25 to 27, it was announced by David Krantz, Show Committee Chairman.

Purpose of the show is to acquaint servicemen, dealers and others in the servicing industry with the newest developments in electronics. For this purpose many important educational seminars and lectures will be held during the daily sessions, which will begin at 7:00 P.M. September 25 and run from 10:00 A.M. to 10:00 P.M. on September 26 and 27.

Activities of the first evening will be concentrated on an introductory program with addresses by key industrial figures and civic officials, plus opening of the many trade displays which will hold prominent positions in the main ballroom of the Broadwood Hotel.

It is expected that more than 8,000 people in the industry will be in attendance. Special sessions for dealers, service technicians, Hams and students will be carried out during the PRSMA SHOW, stated Mr. Krantz. Educational exhibitions and films will be prepared by leading organizations in the industry.

The program was arranged by a panel of trade officials which included John Rider, nationally known editor and writer; Lewis Winners, editor; Sanford R. Cowan, publisher; David Krantz; Fred Shunaman, editor; Stanley W. Myers, John J. Zagury and Harry Bortnick, will be varied, touching upon different facets of the electronics field. Included in the subjects to be covered will be: "Future Of The Television Industry", "Problems of Ultra-High Wave Frequency", "Radio vs TV", "Conversion of TV Receivers to Large Tubes", "Record Changer Clinic." Other subjects will be directed at students for whom special periods have been arranged, with subject material relating to the problem, "Where Do You Go From School?" The program will be divided into subject periods of interest to servicemen, dealers and students. Each evening's program will be devoted to a subject of wide, general trade interest, such as "Color Television", "Phonovision" and demonstrations. Prominent speakers from the industry will highlight each program.

Educational displays will be exhibited by the Signal Corps, the Armed Forces and the Telephone Co. Color television will be demonstrated by several prominent manufacturers. Other manufacturers will demonstrate their newest products and techniques.

Among exhibitors who have reserved booth space at the PRSMA Show are the following: Channel Master Corporation, Hickok Electrical Inst. Co., JFD Manufacturing Co., Inc., Kay Electric Co., Vee-D-X—The La Pointe Plascomold Corp., Philco Corporation, Philco Distributors, Inc., Radio Service Dealer Mag. (Cowan Publishing), Raymond Rosen & Co., Inc., Service Magazine, Sheldon Electric Co., Sylvania Electric Product Inc. Many local representatives will present products of their manufacturers.

An invitation to attend the Show has been extended to all organizations and servicemen. Tickets of admission will be distributed by all Parts and Radio Distributors.

Mass Meeting Protests Licensing

On the evening of June 14th, the auditorium of Central Commercial High School, in New York City, was jammed with 1100 servicemen who came to protest the proposed Municipal bill to license television servicemen.

The bill, proposed by Councilman Keegan, aimed to establish a fee of $500.00 for a license to install or service television receivers. In addition, the bill sought to limit licenses to shops having a minimum of 500 square feet working space, and 30 square feet of bench area. Under this proposed bill each licensed shop would be required to employ a minimum of

[*Continued on page 8*]

FEATURE FOR FEATURE COMPARE FOR YOURSELF!

and You'll See There Is NO COMPARISON

THE RADIART TELE-ROTOR is Head and Shoulders Above All Others!

The ONLY Rotator with ALL the Important Features

FEATURES	TELEROTOR		Rotator A		Rotator C	Rotator K	Rotator M	Rotator N	Rotator U
	TR-1	TR-2	Type 1	Type 2					
TORQUE FT. LBS.	36	36	5½		4.5	6.75	2.25	4.5	6.00
TORQUE PER POUND OF ROTATOR	3.13	3.13	0.91		0.55	1.08	0.35	0.58	0.96
SIDE THRUST OVERLOAD (FT. LBS.) TO STOP ROTATION	525	525	94		50	83	88	110	160
WEATHER PROOFING	One piece "Water Shed" Dome Housing		Rubber Gasket		Metal Ring	Felt Washers	Rubber Gasket	Rubber Gasket	Rubber Gasket
ELECTRICAL TO MECHANICAL EFFICIENCY TORQUE PER WATTS CONSUMED	72%	58%	16.4%	16.3%	13%	11%	4%	11%	11%
TYPE OF LOAD BEARING	Two 6½ in. dia. Ball Races		Double Sleeve		Sleeve & Ball 2 in. dia. Ball Race	Sleeve	Sleeve	Double Ball Race 1 in. dia. Ball Race	Double Sleeve
MAST CAPACITY	2"	2"	1⅜"		1¾"	2"	1¾"	2"	1½"
ALIGNMENT OF ROTATOR SUPPORT MAST AND ANTENNA MAST	In Line	In Line	Off Set		Off Set	Off Set	In Line	Off Set	In Line
MOUNTING VERSATILITY	Mast or Platform		Mast Only		Mast Only	Mast Only	Mast Only	Mast Only	Mast or Side Plate
TYPE OF DIRECTIONAL INDICATION	End of Rotation Light	Dial lights 8 Positions and end	End of Rotation Light	Meter	Meter	Meter	End of Rotation Light	Meter	Meter

You Can't Beat a RADIART ANTENNA on a TELE-ROTOR.... It's TOPS!

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You can put your confidence in—

GENERAL ELECTRIC

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ONE SOURCE for all your tube requirements—metal and glass tubes; miniatures; TV picture tubes in a wide range of sizes and types; also germanium diodes and selenium rectifiers. General Electric's line is complete! G. E.'s list of types includes *newest* tube designs for new radio-TV receivers! . . . Stock G-E 100-percent, to simplify ordering — to benefit from unit deliveries — to profit from General Electric tube quality and product popularity!

Mallory Plascap*

...Made with Amazing Mallocene*!

World's First Completely Engineered Plastic Tubular Capacitor

Here's the plastic tubular that's years ahead of its time . . . made possible *now* by Mallocene, amazing Mallory plastic development that gives you *four exclusive* performance firsts, leaves ordinary plastic tubulars far behind!

Gone is the old bugaboo of "call-backs" due to construction weaknesses beyond your control. For the Mallory Plascap is dependable. No oil leakage, no unsoldered leads, no off-center or deformed cartridges, no messy outside wax coating, no insulation problems. The Mallory Plascap makes your service job easier! See your Mallory Distributor.

The Secret of Mallocene . . .

There is only *one* logical way to build a molded type plastic tubular capacitor . . . with a plastic that sticks to the metal leads! But with ordinary construction methods, this has been impossible, for such a plastic would stick to the metal mold!

Here's the secret of the Mallory Plascap. First, an extremely tough plastic shell is molded. The cartridge is carefully centered within this shell. Then, the cartridge is surrounded with Mallocene. When Mallocene hardens, it actually becomes part of the outer plastic shell, and *sticks to the metal leads!* Thus, Mallocene provides a solid plastic tubular capacitor with the *first* moisture-proof construction!

1ST **TRISEAL CONSTRUCTION**—Sealed *three* ways —with moisture-free Mallotrol* . . . tough outer plastic shell . . . exclusive Mallocene!

1ST **FASTITE LEADS**—Permanently fastened . . . sealed with Mallocene . . . unaffected by soldering-iron heat!

1ST **DISTORTION-FREE WINDING** — No flattened cartridges due to molding pressures . . . no failures due to "shorts"!

1ST **TRU-CENTER CARTRIDGE**—Cartridge centered every time . . . uniform insulation guaranteed at all points!

Plus these Top Features: Operates at 85°C . . . . No messy outside wax coating required . . . Great mechanical strength . . . Small in size . . . Light in weight . . . High dielectric strength . . . Lead to outside foil clearly identified . . . Handsome yellow case . . . Legible part-numbers and ratings.

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MALLORY CAPACITORS . . . CONTROLS . . . VIBRATORS . . . SWITCHES . . . RESISTORS . . . RECTIFIERS . . . VIBRAPACK* POWER SUPPLIES . . . FILTERS
*Reg. U. S. Pat. Off.
APPROVED PRECISION PRODUCTS
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Trade Mark

TRADE FLASHES

[*from page 4*]

three workers, one of whom would be an office worker.

Among the speakers at this meeting were Noel Payne, Corresponding Secretary of ARSNY, who spoke for the Association; Louis Calamaris, Executive Secretary of National Electronics Distributors Association, who flew from Chicago to be at the meeting; Col. John F. Rider, publisher, and Tim Alexander, of Motorola, Chairman of the Service Committee of Radio Manufacturers Association.

These speakers strongly condemned the proposed legislation as being discriminatory and ineffectual in eliminating the conditions at which it was aimed.

Max Leibowitz, President of ARSNY, made a plea that all present voice their disapproval of this bill by writing to their councilmen.

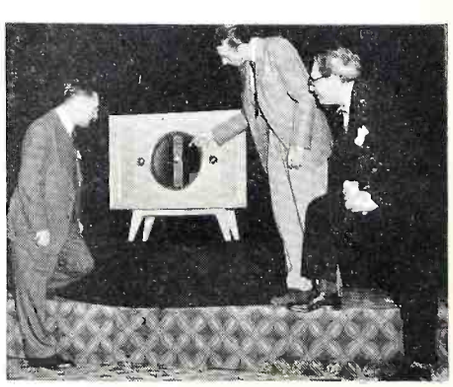
Arthur Silverberg, Vice-President of ARSNY, acting as moderator, read a petition, signed by 441 students of RCA Institute, protesting that a bill such as this would discourage those who have chosen television as their career, from continuing in this field.

Col. Rider was authorized by Paul Rutheiser, Commander American Legion of N. Y. county, to speak for him in his absence. Col. Rider stated that the Legion disapproved of the bill because it would make it impossible for many veterans, with limited funds, to enter the television field, even though they were technically qualified.

A resolution was passed requesting that the Council defeat this bill at its next session.

Jensen Introduces New Speaker

Picture shows Sanford Cowan Publisher of Radio Service Dealer and



Burton Browne of Burton Browne Advertising being shown the Jensen Triaxial speaker by Ralph Glover, Chief Engineer of Jensen.

[*Continued on page 28*]

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. . . it wins all performance tests! . . . is also lowest priced!

THE DB 400
$29.95 LIST

REGENCY FEATURES:

- Single-knob tuning control.
- Off-on switch controls the TV set.
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- The use of Contra-Wound Bifilar Coils with push-pull triode design gives a balanced circuit.
- Electrical symmetry makes possible balanced-bridge neutralization which insures stability and eliminates self-oscillations.
- No external impedance matching devices required.

REGENCY FEATURES:

- A handsome plastic cabinet design in mahogany or blonde; created to please the most discriminating interior decorator.
- Wide bandwidth assures equal enjoyment of both video and audio on all 12 channels.
- Underwriters' (UL) Approved.

Regency
Division, I.D.E.A., INC.
55 N. New Jersey St., Indianapolis 4, Indiana

Horizontal

A. F. C. CIRCUITS

by WALTER H. BUCHSBAUM

Part 1

This is the first of a series of articles on horizontal a-f-c circuits used in television receivers. In addition to a discussion of the initial horizontal hold problems that gave rise to the development of these circuits, and analysis of the various types of circuits used, methods of servicing are also discussed.

THE horizontal scanning frequency under the present television standards is 15,750 cycles per second and the sawtooth generator contained in each receiver must operate at exactly this frequency. The synchronizing pulses sent out by the transmitter must control the operation of the sweep circuits at the receiver, otherwise the picture will not be reproduced in one piece. The horizontal sweep section in every television receiver has a number of different adjustments, all necessary to keep the receiver in synchronism with the transmitter. When the horizontal sawtooth frequency is higher than that of the synchronizing pulses an effect like the one illustrated in *Fig. 1,* is obtained.

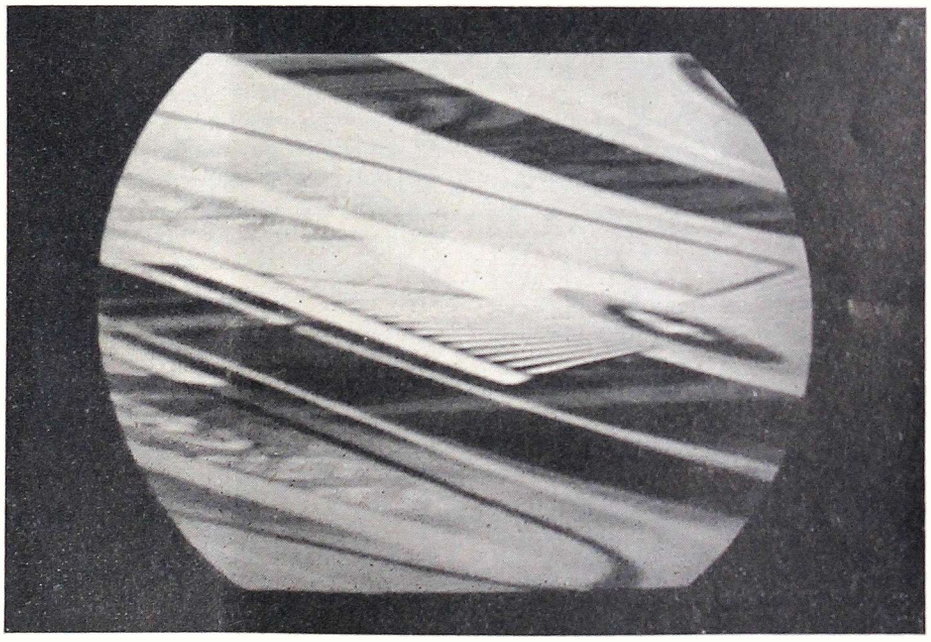


Fig. 1. Loss of horizontal synchronization.

Horizontal Hold Problems

In earlier television receivers the synchronizing pulse controlled the sawtooth oscillator directly and on weak signals the horizontal hold control had to be constantly re-adjusted. Noise pulses riding through with the synchronizing pulses would trigger the oscillator causing the appearance of a picture torn to pieces. When a station was tuned in the picture would waver and tear until the proper synch pulse level was reached. Interference of most types caused the picture to disintegrate entirely. To minimize the effects of these changes in the synchronizing pulses it was necessary to separate, clip, limit and amplify the synchronizing pulses very carefully.

Another problem of synchronization is the tendency of the sawtooth oscillator to change its frequency, even if the synchronizing pulses are noise free and of sufficient amplitude. This oscillator drift can be due to some or all of the following effects: Heat changing the electrical value of different components, changes in line voltage, tube aging, etc. No matter how well designed an oscillator is, some tendency to drift will always be present.

When the first postwar television receivers were designed the perfection of an automatic means of controlling the sawtooth oscillator was given priority. A system which would be impervious to changes in synchronizing pulse amplitude, noise or interference and which would instantly compensate for any oscillator drift was the dream of most television engineers. The requirements, operation and limitation of such a system and description of the three basic AFC systems now in use is the topic of this article.

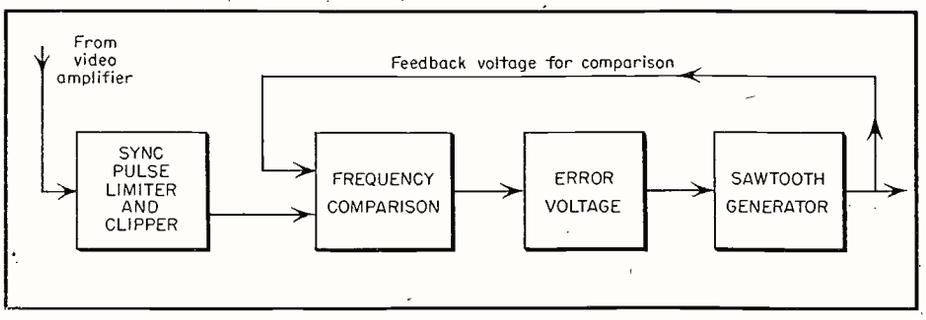


Fig. 2. Basic elements of horizontal a.f.c.

Basic Requirements of An AFC

The drawing of *Fig. 2,* shows the basic elements of a practical automatic frequency control circuit. The horizontal synchronizing pulses sent out by the transmitter must first be separated from the picture elements and the vertical pulses. To remove them from the picture signals a clipper circuit is used which permits only the top of the signal, the synchronizing pulses, to pass. The limiter stage is required to maintain the synchronizing pulse at a fixed level and remove strong noise pulses. The number of tubes and the complexity of this synchronizing pulse separating section depends on the type of AFC used. Some AFC circuits require a very clean and constant pulse, others operate equally well with a small amount of picture signal mixed in, or when the synchronizing pulse amplitude varies.

The heart of any AFC system is the section which compares the frequency of the synchronizing pulses and that of the local oscillator. In two of the basic AFC systems described here this frequency comparison is performed by a double diode arranged in a discriminator type of circuit. In FM radio the detector operates not on rectification like in AM, but converts changes in frequency into the audio signal. At the center frequency the output of the discriminator is zero, but as the frequency increases, a negative voltage might result, while a decrease in frequency would produce a positive voltage. The principle of operation of the frequency comparing network in AFC systems in very similar to that used in FM discriminators.

The error voltage developed by the frequency comparing network must have some very special characteristics. First it must be possible to adjust the circuit so that no error voltage is produced when the horizontal oscillator is locked-in. Secondly, the error voltage must vary in such a manner that it brings the oscillator back to the sync frequency. As an example, let us consider the case where an oscillator is used whose frequency increases as the control voltage is made more positive. For some reason this oscillator runs at a slightly higher frequency than that of the incoming pulses. The error voltage must go more negative to reduce the oscillator frequency to the value of the synch pulse speed. If the error voltage developed would increase in a positive direction, this would make the oscillator frequency even higher. Such a condition can occur in home-built receivers or when some parts are replaced. The remedy for it is a simple reversing of the connections to the diode or the oscillator transformer.

The error voltage must be applied gradually to prevent over-compensation. If the error voltage would act instantly or directly on the oscillator its effect might be too fast, just like a steering wheel in an autmobile must have some slack to permit smoother steering. Occasionally an AFC system is used which permits the serviceman to adjust the application of the error voltage on the oscillator. Maladjustment of this control is indicated when the picture appears to lock-in and then quickly slips out again several times until it finally locks-in.

If several strong noise pulses appear together with the synchronizing pulses, they might cause a sudden change in error voltage and, therefore, a change in oscillator frequency. To avoid any sudden and momentary changes, special precautions are taken. The error voltage is a varying d-c voltage, and some capacity or a regular R-C filter is used to keep it d.c. The final section shown in *Fig. 2,* is the horizontal sawtooth generator which is to be controlled by the AFC system.

Two basic types of sawtooth generators are used in television. One is the multivibrator circuit and the other, most widely used for the horizontal sweep, is the blocking oscillator type. Both circuits are really square wave generators and require an R-C discharge network to change the square wave into a sawtooth. Multivibrator circuits are more economical because they require no blocking oscillator transformer. The disadvantage of multivibrators, however, is their somewhat critical adjustment. Furthermore, they are not easily controlled by a variable bias as required for AFC, and for direct synchronization their stability with different synch pulse amplitudes is not too good. Multivibrators are used in inexpensive small screen receivers, usually where electrostatic deflection is employed.

Practically all television manufacturers use some kind of blocking or relaxation type oscillator in their magnetically deflected models. Some of these circuits are a combination sine wave and square wave oscillator, some use the principles of a multivibrator, but all can be identified by the fact that they contain a coil or transformer in the oscillator tank circuit. These oscillator circuits lend themselves to AFC and even without this added feature their frequency can be con-

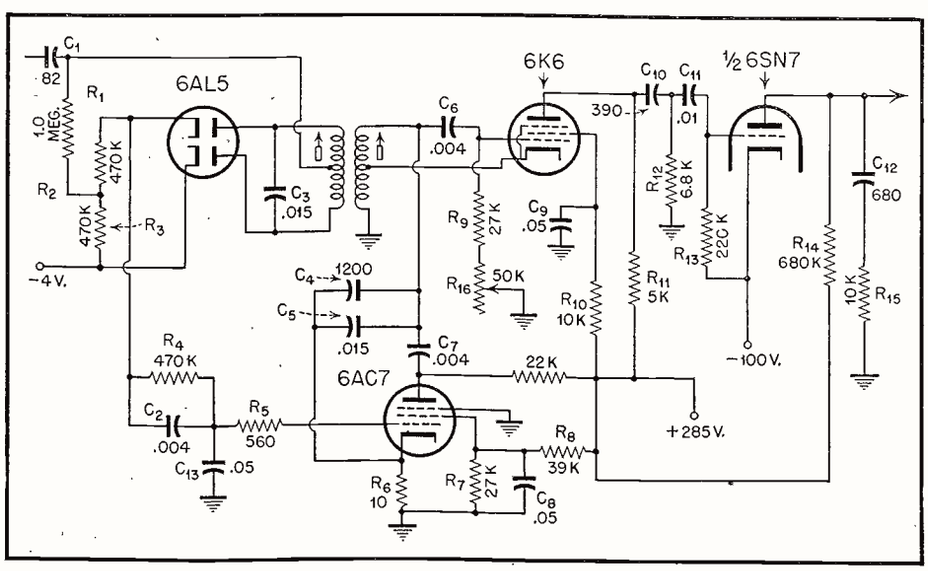


Fig. 3. Synchrolock a-f-c circuit.

trolled smoothly by varying a d-c voltage. Like the multivibrator, these oscillators generate a square wave which is changed into a sawtooth voltage by means of a discharge network.

In the beginning of this article, one of the main reasons for using AFC was shown to be the effect of noise on the horizontal sweep. Another aspect is the lock-in action at low signal levels. Smooth automatic control of any change in frequency as well as simplicity of adjustment are also important features of any good AFC system. In the following paragraphs each of the three main systems used in present day receivers is discussed with respect to these features and finally the actual circuits are described in detail.

Three main types of AFC systems

The first AFC system to be in really wide use was the circuit found in all RCA 630 type receivers. In the manufacturer's literature this circuit was called "Synchrolock" and most television engineers still refer to it by that name. The synchrolock circuit has long been considered the most satisfactory AFC system as regards performance. Its operation is really stable, its noise immunity excellent and its performance on weak signals, leaves nothing to be desired. The adjustment of the synchrolock type of AFC circuit is not very simple, but if the correct procedure is followed it is possible to adjust it once for a long time. The range of the horizontal hold control is relatively small. If the AFC is set properly, the picture will lock in automatically at any setting of the horizontal hold control, except on very weak signals.

The main reason why the synchrolock circuit has been abandoned in later model receivers is the large number of tubes required. In addition to the four tubes shown in the circuit of *Fig. 3*, most receivers have three stages preceding the synchrolock section. These three stages are the synch pulse clipper, separator, and limiter. The synchrolock transformer with its two tapped windings and powdered iron core also increases the expense of this AFC system.

The synchrolock circuit is used in all RCA 630 and 830 models, as well as all 630 type chassis and is also employed in the Admiral 30A1, Zenith, Ansley and most other 30 tube receivers. The advantages of the synchrolock could be summed up in its excellent performance, and the disadvantages in its cost.

The second main type of AFC is often referred to as phase detector because that is the principle on which it functions. There are many variations of this circuit in use today but they are all characterized by the presence of a double diode, usually a 6AL5, and the absence of a tapped oscillator transformer.

The performance of this AFC system is characterized by good stability in most versions, good lock-in range on weak signals, but its noise immunity is only fair. The range of the horizontal hold control is not as limited as in the synchrolock. It will be possible to let the picture go out of synchronism at either or both ends of the hold control. This means that the customer might have to re-adjust the horizontal hold control occasionally and be sure to do so correctly, otherwise the picture might slip out of

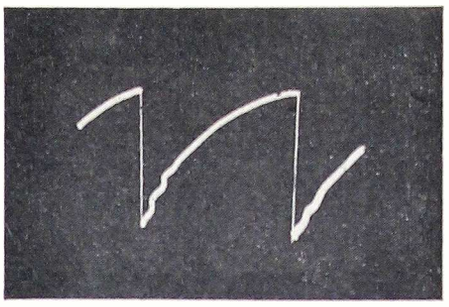


Fig. 4. Output wave shape from synchrolock circuit in Fig. 3. (60 volts peak to peak)

synchronism at a change of signal strength. To minimize this the inductance of the oscillator circuit must be tuned very close to the proper frequency and there are several components which must be held to close tolerances. In spite of this, the phase detector system is much less expensive than the synchrolock since it requires only three tubes, including the clipper and limiter.

The phase detector type of AFC became well known after its description in an RCA license bulletin describing a "Novel 10 Inch Receiver." Today this AFC system is used in the Admiral model 20A1, Teleking, Motorola-Emerson and General Electric receivers. The last three manufacturers have modified the phase detector somewhat. The main difference of their respective systems with regard to the one shown in *Fig. 5*, is in the oscillator circuit. General Electric uses a single tapped oscillator coil in a Hartley oscillator circuit which produces a sine wave which is then changed into a sawtooth. Emerson and Motorola employ a blocking oscillator transformer, similar to the one used in the vertical sweep section. The system of controlling these oscillator circuits is identical to that shown here.

The advantage of the phase detector can be summed up as economy and good performance and its drawbacks are critical adjustment and only fair noise immunity.

The third, and at the present the most widely used type of AFC, goes under the name of Synchroguide, a name stemming again from RCA. This circuit appears to be the most economical and stable AFC system to date. It is being used in all RCA sets other than the 630 and 830 line. In addition it has long been part of Philco models and is now employed in the new Admiral, Olympic, Airking, Teletone, and many other well known receivers. The earlier versions of the Synchroguide were slightly different from the one illustrated here. At first a fre-

[*Continued on page 32*]

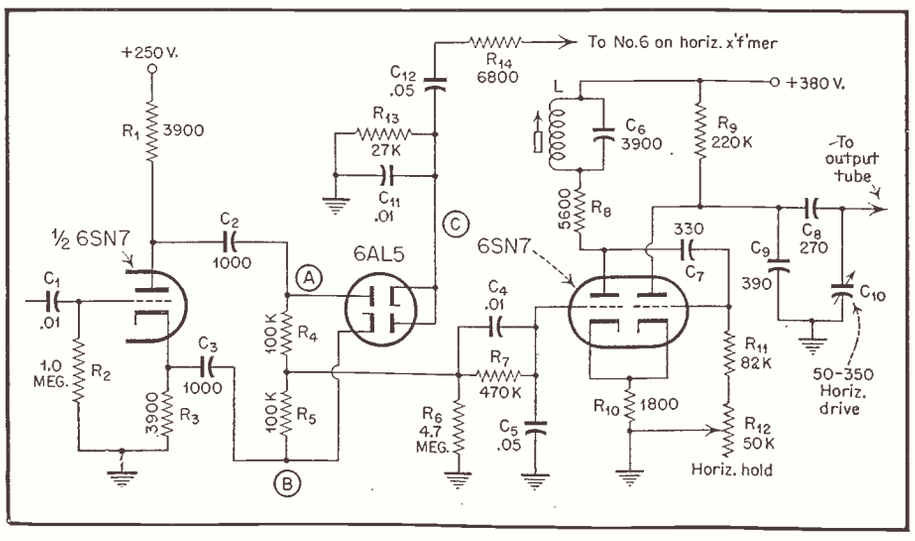
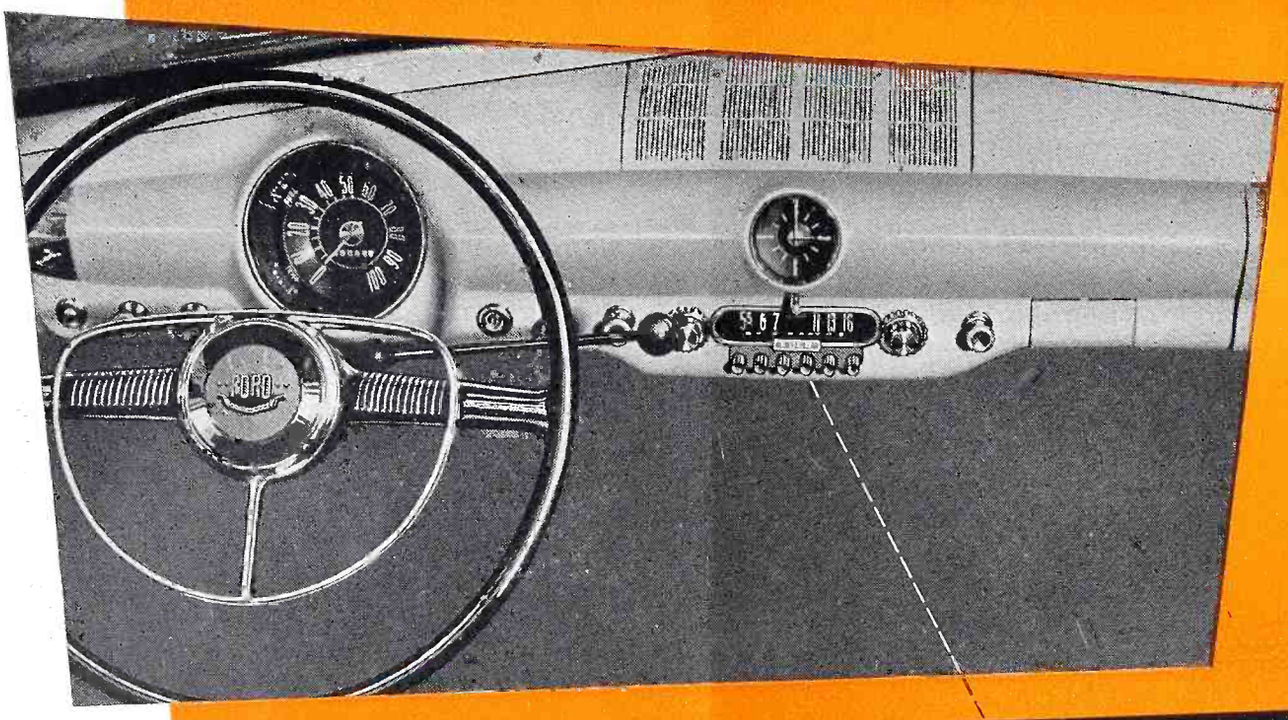
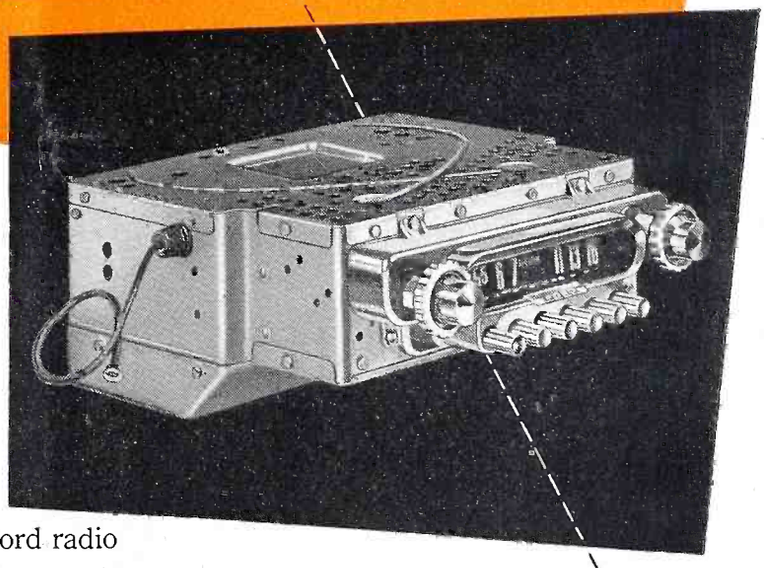


Fig. 5. Phase detector—a-f-c.





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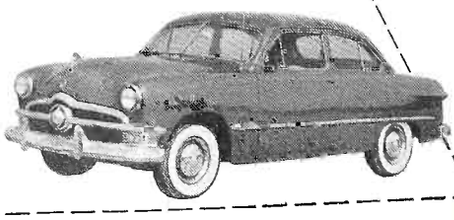

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Theory of TAPE RECORDERS

by C. A. TUTHILL

This is the first of a series of articles on tape recorders for Service Dealers handling tape machines. In subsequent articles operation, servicing, mechanical features, electrical circuits, and record duplication will be discussed.

TWO principal methods of magnetic recording were evolved during the *teething* days of development, — perpendicular and longitudinal. We deal here only with the presently popular longitudinal method.

Review of Magnetic Theory

The concept of a field of magnetic flux is accepted to explain the theory of magnetic action since we cannot see molecular motion. Lines of force never cross yet they are always completed within or without the magnetic medium. They either blend and produce a strong resultant, or counteract, producing a weak resultant. Since the direction and magnitude of a magnetic field determine its performance, it is fortunate that this phenomena can be controlled.

Magnetically *soft* materials, subjected to and controlled by alternating currents (audio modulation), and having high *permeability,* are required for recorders and reproducers. The degree of permeability is a function of the molecular motion within the magnet and within the crystal lattices or domains of the magnetic material on the recording tape as we shall see later. High permeability and a large saturation of flux density are essential so that the magnetomotive force (signal in recorder winding) and volume of material required for construction, can be held within economic practicability. Extreme constancy of permeability is imperative throughout the useful spectrum.

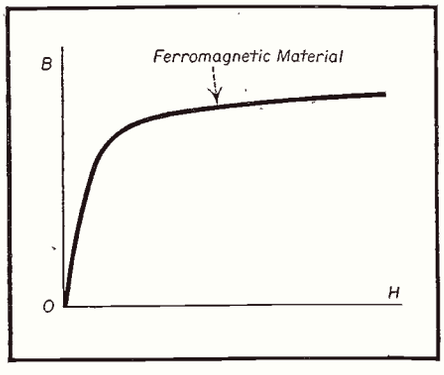


Fig. 1. Typical saturation curve.
B = Resultant Flux
H = Magentizing Force

Saturation

It has been found that, for low densities of saturation, the resultant flux (B) is proportional to the magnetizing force (H) (See *Fig. 1*) but, that beyond a certain point the flux density increases only slightly despite a very large increase in magnetomotive force. There is a *magnetic saturation point* for any material beyond which it cannot be further magnetized.

The magnetic characteristics of iron seem largely due to the random spin of electrons in orbital groups of the iron atom. Atoms adjacent to each other align themselves in the form of very minute permanent magnets called *domains.* Any magnetomotive force, applied externally, tends to orient these domains along the axis of that external force. Internal frictional forces tend to oppose any change in position of these domains. However, as an external force grows progressively larger, the domains gradually align themselves in accordance with the external influence. When all of the domains become so oriented, the magnetic material is said to be *saturated.* Similar sporadic action takes place on the surface of a conditioned tape during magnetic recording. Any substance made up of spontaneously magnetized and saturated domains is said to possess *ferromagnetism.*

Hysteresis

From an economic or from an engineering viewpoint, the most important characteristic of a magnetic material is the *density of flux it renders for a given magnetomotive force applied.* When intrinsic flux density "B", expressed in gauss, is plotted against magnetizing force "H", expressed in oersteds, the resultant curve for a complete cycle of reversing magnetic forces is called the *hysteresis loop.* Two such loops for present day alloys are given in *Fig. 2.* Standard texts should be reviewed for further details.

Fringing & Leakage Fluxes

When an air gap is inserted in a magnetic circuit, flux spreads out or *fringes* around the gap. The flux near the edge of the gap is called *Fringing Flux* (*Fig. 3*). Since the permeability of iron is several hundred times that of air, the reluctance of even a short air gap is large compared to the metallic portion of the magnetic circuit. This sets up the reason why recorder heads are designed for a minimum of gap width.

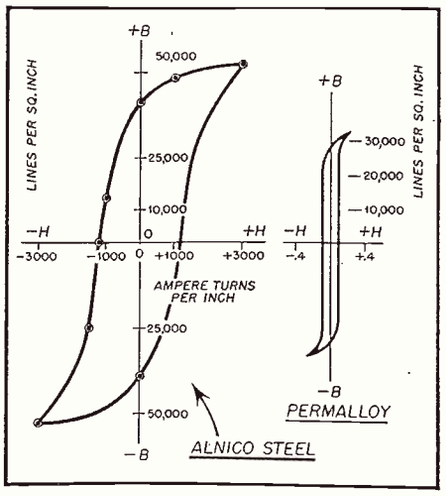


Fig. 2. Hysteresis curves of Alnico steel and Permalloy.

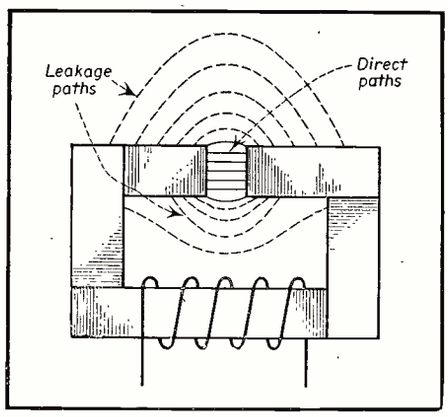


Fig. 3. Fringing and leakage losses. Solid lines indicate a direct path, dotted lines a leakage path.

Basic Recording Problems

When an early steel tape (*1900 vintage*) passed before a single recording pole longitudinally, the tape was subjected to saturation at right angles to its planer surface, and, being a permeable metal, was left with a north and south pole of polarity. Such a tape, carried past a recording pole piece where alternating signal flux was introduced, obviously produced a highly distorted record since only half cycles were recorded. The highly polarized tape caused only one side of the magnetization curve, (*Fig. 4*) to be used.

Biasing (D-C)

Improvement was gained by application of a bias current. At first a direct current was used to *steer* the recording flux to a more linear portion of the curve at point *"n" Fig. 4.* A *d.c.* erase or wiping current of some magnitude was required to obliterate records and for re-saturation of the tape.

One advantage gained was that the steel tape was returned to a neutral magnetic condition during moments of zero signal input. However, the overall picture was far from good. Distortion prevailed and the background noise content (with d-c bias) increased as a function of steady state magnetization until, at saturation, it reached a noise value 20 db above that found at zero signal.

AC-Bias

Today the universally adopted method of tape recording combines a supersonic *a-c* bias with the audio currents induced into the tape. This results in less distortion and a greater signal-to-noise ratio than is derived from other methods. In addition to aiding signal transfer from poles to tape, the high frequency current also erases any previous recording upon the same tape. When the domains within the magnetic coating of the tape are thus neutralized and at once subjected to varying magnetomotive forces from the recorder poles, they become oriented in compliance with that recording magnetomotive force.

But there are greater functions involved, when recording with *a-c* bias, than the mere transfer of signal from recorder head to tape. To visualize the process it is well to assume a *stop-motion* in the proceedings. For example, — there is an abrupt change of magnetic action when a cross-section of the tape leaves the recording gap. A highly effective *demagnetization* force sets in at the bias frequency. This action is explained:

1. When a tape is subjected to a magnetizing force (H), as in *Fig. 4,* the value of "H" is the result of that force combined with any force resulting from free polarized domains within the tape at that instant.

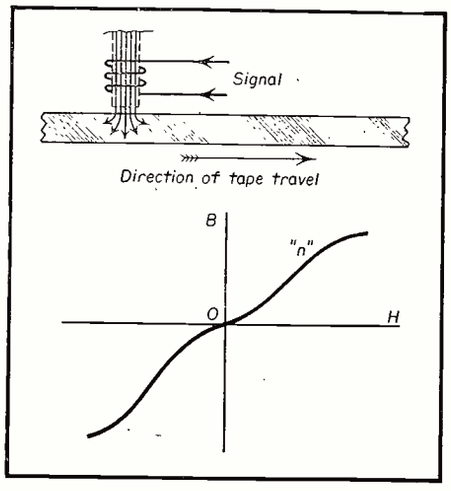


Fig. 4. Early single pole magnetization (longitudinal), and typical magnetization curve shown below.

2. Forces produced by these domains are in opposition to externally applied magnetic forces (the signal). Therefore when the applied forces are removed (when the tape leaves the gap) the effect of the opposition from within the tape is to *demagnetize* somewhat the crossed-over or induced signal from recorder to tape.

3. The remnant induction within the tape, (the finished record) becomes the difference between the positive and negative half cycles of the bias wave. This difference is a function of the audio signal and is shown graphically as curve *e - f* in *Fig. 5.* Proper control of bias and of audio signal level results in a cross-over to the tape in compliance with the linear portions (*b* and *c*) of the curve *a - d* of *Fig. 5.* The point where curve *a-d* cuts the vertical axis, (where H is zero) determines the final residual induction *Br* as shown in the figure.

It is evident that the final signal transfer is not highly efficient, yet, this method of recording is linear enough to avoid undue distortion. Furthermore, where the audio signal is zero at (*e*), a low noise level is derived since at that point the tape is almost completely demagnetized. The inductive output from the recorder head, and subsequently from the tape, is shown to be a line drawn through the zero points of each oscillation of the bias frequency. This is shown as the curve *e-f* of *Fig. 5.*

The principal requirement for *a-c bias* is that the mean value of induction over one cycle of the bias frequency be proportional to the magnitude of the field produced by the audio signal. Essentially the bias oscillator must produce a stabilized current of sine wave form although its frequency is not critical. It *is important* that the bias frequency be high enough so that any intermodulation between bias and harmonics from the audio current will fall above the audio reproduction spectrum. As a typical commercial example, the new RCA tape recorder, type RT-11A, provides a bias adjustment to accommodate differences in tapes and uses a frequency of 90 to 110 kilocycles.

Recording Media

There are many magnetic recording mediums but our subject is tape recording. The tape can be of various bases, for example the German Magnetophon used a tape of prestretched vinylite base covered with red iron oxide powder (Fe_2O_3). Black iron oxides (F_3O_4) on paper bases give equal results. Both can be synthetically produced. The uniformity in thickness of plastic base tapes has boosted their popularity.

Requirements for the magnetic material coated upon a tape should be considered as severe. For a good output against noise; and for a good low frequency response, it should have a

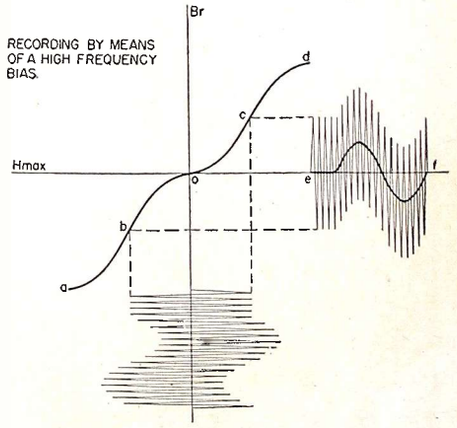


Fig. 5. Remanant induction as a function of the audio frequency signal.

high *remanence,* i.e., a high flux density remaining after external magnetic forces cease. A remanent pattern of every detail is the desired optimum. Next, for good high frequency response, and for good stability and permanence of record the medium must have high *coercitivity* (i.e. it must be able to respond to reversed magnetic forces which will reduce its magnetisim to zero). This latter characteristic makes possible thorough erasure immediately prior to a new recording. Furthermore the two above characteristics must be developed at relatively low fields of external magnetic force otherwise the tape is difficult to magnetize and difficult to erase. The particles forming the coating upon the surface of the tape must be so minute as to form a smooth homogeneous medium conducive to a low content of ambient noise.

When tapes are used, stability of relationship between tape and pole-pieces during motion is easily maintained with good mechanisms. Identical relationship with poles during playback can also be maintained thus offering one insurance against distortion. Multiplication of original tape recordings, by means of high frequency contact transfer, will be dealt with later in this series.

High Frequency Erase

The purpose of the erase head is to remove signals previously recorded and leave the tape in a demagnetized or neutral condition. Therefore a greater amplitude of high frequency field is used than required for h-f bias during recording. Here again the frequency is not critical beyond the fact that below a certain frequency minimum noise cannot be expected. Some manufacturers use a d-c erase but the residual noise remains higher than obtained when high frequency methods are used.

The erase gap is usually wider than the recording gap, e.g., 20 mils. This allows the flux to fringe and thus subject the tape to decreasing magnetic intensity as it leaves the erase head. This type of erasure is stable and easily applied.

This phase of magnetic recording emphasizes one of the greatest commercial arguments for this method of recording. Ferromagnetic materials may be reduced to a neutral state if a series of fields, alternating in sign and decreasing in magnitude, are applied. Tapes, then, may be erased hundreds of times without deterioration whereupon they are immediately and equally usable again. Network stations have proved this to be true. Neither disc nor film recording can even approach this claim. Both of the latter require processing.

It should be noted at this point that an overloaded recording head will partially erase its own signal. The reason, —its saturated field fringes away from the gap. As a direct result the tape,

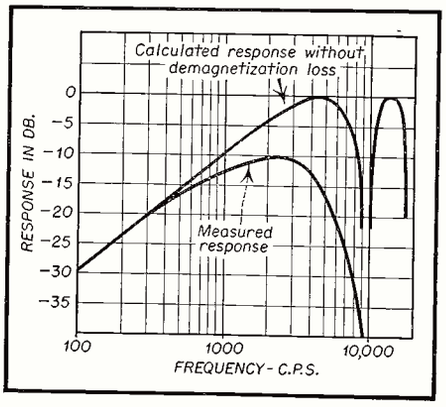


Fig. 7. Curves showing effect of demagnetization upon frequency response.

in its travel, is subjected to receding magnitudes of bias fields which tend to wash out the previously crossed-over signal.

Frequency Response

The frequency response of a magnetic tape recording system is dependent mainly upon three things: (1) the speed of tape travel (see *Fig. 8*); (2) the magnetic characteristic of the tape used: (3) the width of the playback gap.

In commercial examples, reproducer or playback heads run from ½ mil to 1 mil in width. A voltage is developed in the pickup coil which is proportional to the time rate of change of induction in the tape adjacent to and passing the pickup gap. Flux lines within and external to the recorded tape, (*Fig. 6*) are intercepted by the low permeability gap and core of the reproducing head. In their transit through the core, the flux lines thread through the pickup coil thus inducing

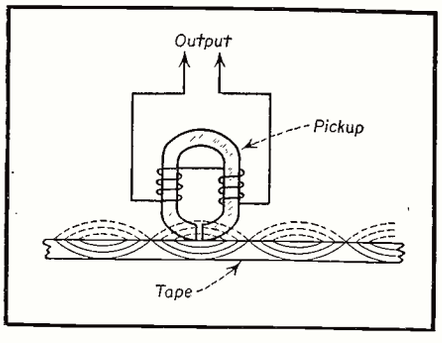


Fig. 6. Interception of tape recording of a sine wave. (From Wetzel)

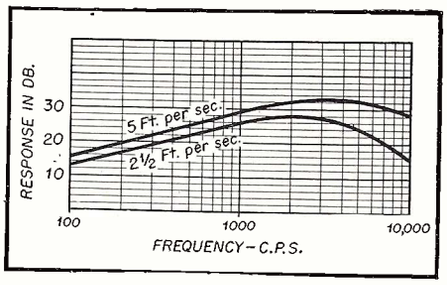


Fig. 8. Response/frequency characteristics.

in it a voltage comparable to the audio signal originally introduced.

Frequency response does not depend upon recording gap width since remanent induction within the tape, as the result of recording, is largely determined by the demagnetizing force at the moment the tape leaves the recording gap. Gap widths of 1 to 2 mils are average. Misalignment of tape travel across either recorder or playback gap will of course introduce losses.

The time rate of change of magnetic flux induced into the reproducing heads is proportional to the frequency and theoretically rises at the rate of 6 db per octave. Actually this holds only for low frequencies. The wavelengths on the tape are very long for low frequencies compared to reproducer air gap length hence demagnetization may be considered unharmful to "lows." However, the demagnetization factor impairs high frequency response since demagnetization is proportional to residual flux density. It has been shown that, for the decreasing wavelengths of ascending frequenices, some of the flux lines find the air path the path of least reluctance. Such flux lines never traverse the core or winding of the reproducer. Instead, they represent a voltage loss, during playback. This condition grows with increase in frequency until a point is reached where wavelength equals gap width whereupon the output of the reproducer suddenly falls to infinity, see *Fig. 7*. The actual measured response is shown in the lower curve. Both equalization and an increase in tape speed offer cures.

Equalization

It is obvious from the above curves that improvement can be gained from pre-emphasis and post-emphasis equalization so well known to disc recording. With reference to the middle range, both high and low frequencies must be corrected. With proper handling, a gain in signal-to-noise ratio of 5 db may result. Such equalization is known to the trade hence will not be given space here.

Build This

ERECTION OF

by **RANSOM**

Describing the construction and operation of a winch operation, requiring a minimum of manpower. This de

THE serviceman installing TV in remote fringe areas is often faced with the necessity of erecting tall towers with compex bulky arrays mounted on top. A three or four man crew can pull up a tall tower with considerable hazardous effort. A truck can pull it up too, but most often it isn't convenient to place the vehicle in an advantageous position for this work.

The difficulties of erecting towers in these fashions and the troubles of taking them down for repairs, prompted me to design the winch pictured here. With this winch I've raised a 36-foot tower, with a heavy rotator and 4-bay conical antenna twelve feet high, from ground to its vertical position in about five minutes. The physical effort involved was no greater than getting a drink from the town pump. Previously it took four men to lift this tower and array into position with considerable time and difficulty.

While I have not tried taller towers with large arrays, this winch should easily raise a 70' tower with a 4-bay array and rotator on top.

Construction

The winch pictured here cost about $10 in labor to build. (See *Fig. 1*). Fortunately all metal parts were salvaged from discarded farm implements, steel fence posts, and an old windmill tower. However angle iron and gears can be purchased from junk dealers quite reasonably. A local welder can assemble the unit in about two hours.

The gears, handle, and bearings were from a discarded hand corn sheller. Gears from a discarded pump jack may be used (used on farms for transmitting power from a motor to an ordinary hand pump). In selecting gears it must be remembered that the larger the ratio of diameters of the gears, or the larger the ratio of the number of teeth in the gears, the greater the mechanical advantage. This winch has 88 teeth on the large reel gear and 18 teeth on the small handle gear. The ratio of 88 to 18 is a mechanical advantage of approximately 5. Likewise the ratio of the diameter of the large gear, 14", to that of the small gear, 3", is approximately 5. If 100 lbs. is to be lifted 1 ft., then with a mechanical advantage of 5, 20 lbs. must be exerted through a distance of 5 ft. (The 36' tower used weighed 36 lbs., the rotator and supporting pipe 20 lbs., and antenna 20 lbs.)

The main frame on which the gears are mounted was built of 2½" x 2½" angle iron from an old windmill tower; the legs were of 1½" I.D. water pipe; and the braces were 1½" x 1½" angle iron from old steel fence posts. The frame should be welded first. (See *Figs. 1* and *2* for dimensions and details). The gears and reel can then be positioned on the frame and mounted appropriately.

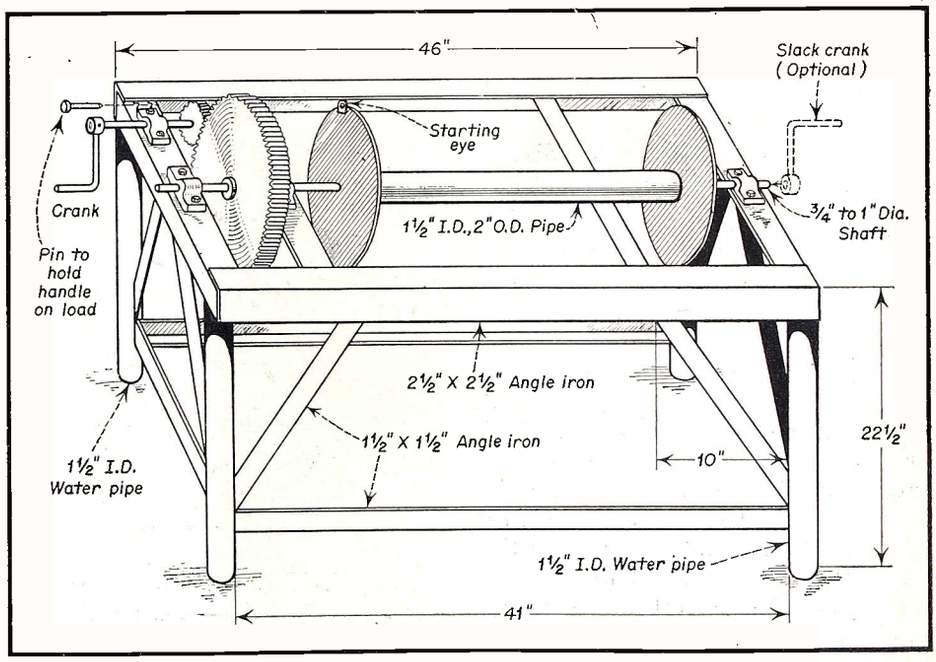


Fig. 1. Illustrating winch described in this article. Parts were made from discarded farm implements, etc.

In building the reel the highest grade steel must be used for the shaft; otherwise the shaft will bend when pulling a heavy load. In the unit built, the drive shaft from a Model T Ford was used. Any automobile axle will serve as well. (The reel details are in *Fig. 2*). An eye of ¼" or ⅜" iron rod should be welded to the periphery of one of the reel sides to anchor the beginning end of the rope or cable. The reel ends should be first welded to a 1½" I.D. or 2" I.D. pipe. Then the shaft of ¾" or 1" dia. steel can be inserted and welded to the outside of the reel. Large washers with ¾" or 1" hole and 2" O.D. welded on the outsides and then to the shaft will improve the strength of the reel. This reel will hold about 150' of ¾" rope which has a breaking strength of approximately 5000 lbs. If a smaller frame and reel are desired ¼" steel cable of the same breaking strength may be used.

The bearings can be purchased from a large hardware dealer, farm machinery store or machine shop if none can be found on discarded equipment.

Winch For TV TOWERS

BEERS

Designed to make the raising of high towers an easy one is of immense value to the installer of such towers.

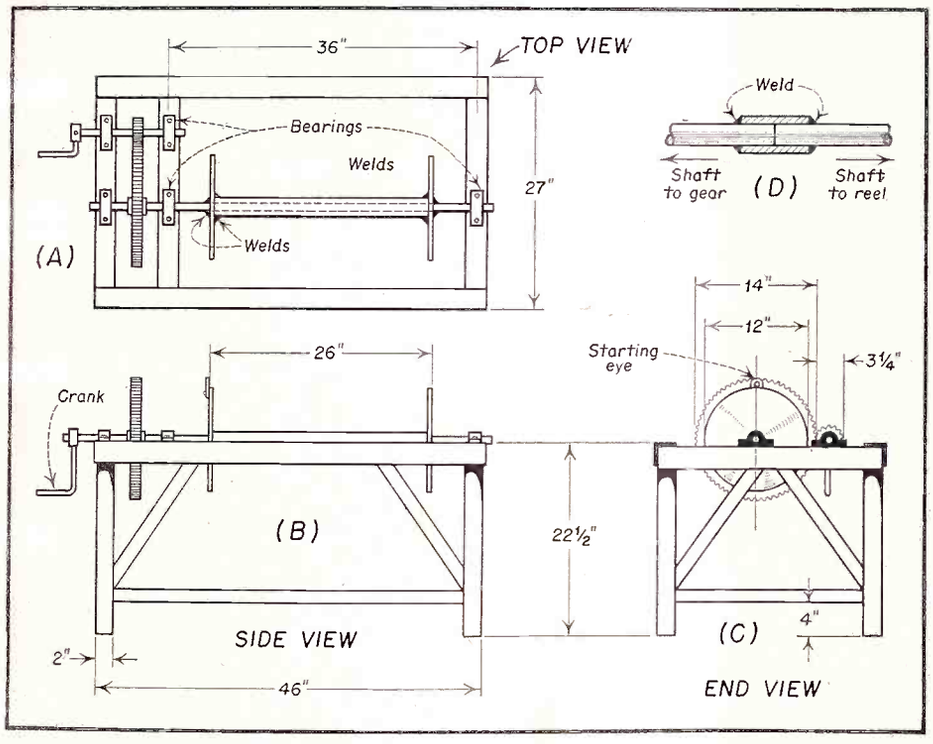


Fig. 2. Side and end views of winch shown in Fig. 1. Reel details are also given in this figure.

They are usually known as pillow boxes by machinists. The bearings should be mounted with at least ⅜" bolts. Smaller bolts will hardly carry the load safely. If the shaft through the reel is not of the size of length to permit mounting of the large gear also, the two shafts can be joined together by welding a piece of pipe over and between the adjoining ends as shown in *Fig. 2D*.

Application

To use the winch it can be chained with a log chain or tow chain to a tree or post. In erecting towers it is quite necessary to employ a gin pole. (See *Fig. 3A, 3B* and picture.) A discarded light pole or telephone pole can be employed for this purpose if not too badly decayed. New creosoted poles can usually be purchased for $5 to $10 from small town lumber companies. A 20′ to 25′ pole set about 5′ in the ground should be sufficient for most tower installations. The base of the pole can be started in the hole; and by pulling on the top with a rope connected to the winch, easily set in place.

After securing the base of the tower in a hinged fashion at the point of erection, the rope or cable is tied on the tower the same distance from the base as the pulley on the gin pole is above ground (See *Figs. 3A, 3B*). After treading the rope through the gin pole pulley and tying the opposite end to the eye of the winch reel, the tower is ready for erection. [Some constructors may prefer to put a second handle on the reel of the winch to facilitate quickly (see *Fig. 1*) winding up the slack in the rope.] When raising the tower, a second man should be placed on the opposite side of the tower from the winch to control one of the guy wires to the top, to prevent the tower from moving sideways as it is raised.

Temporary Installations

Selling TV in fringe areas is often quite difficult, as reception is quite variable. A temporary installation for the customer's approval will sell more units. The customer with TV in his own home knows before buying what he can expect. Once the temporary installation is made the customer will in most cases sell himself. With these factors in mind the unit in *Fig. 3A* was designed. The tower base is bolted to the timber which serves as a temporary base.

The tower hinge bolts can be taken out for easy dismantling. The brace irons hold the base to the gin pole securely. They too can be removed easily for disassembly. The long brace irons also prevent the tower from tipping sideways as it is being raised. As this dispenses with the man on the

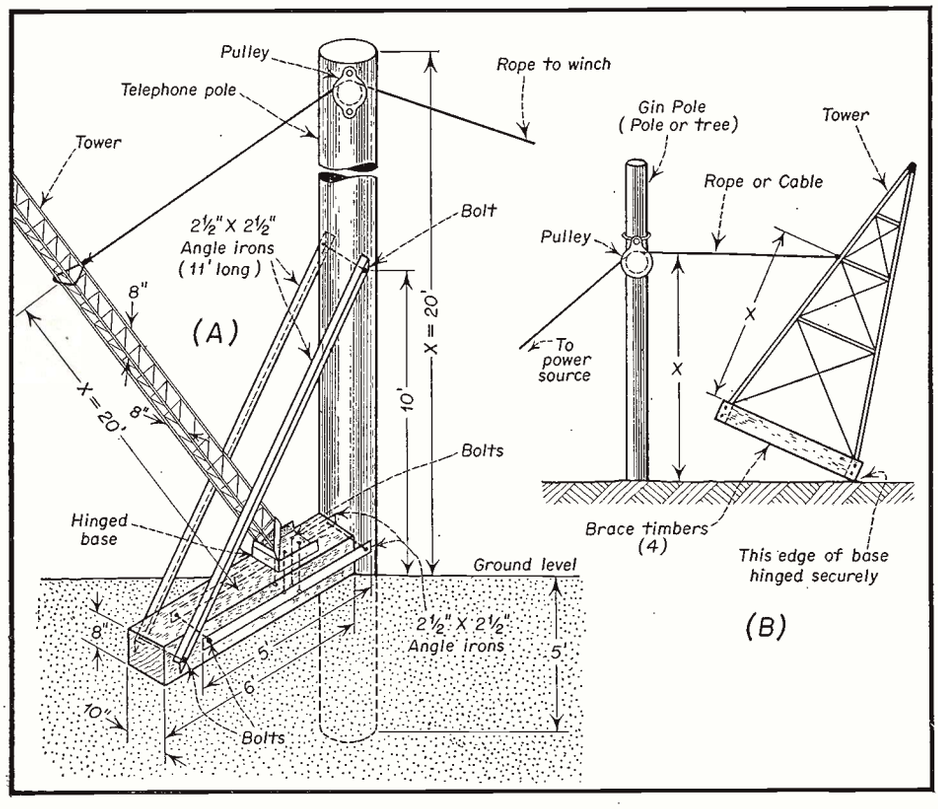


Fig. 3. Gin pole details, showing dimensions and relative position of gin pole and mast to be raised.

guy wire, one man can easily put a trial demonstration in a prospective customer's home.

Tips on Tower Erection

Often old windmill towers on farms may be used for TV antenna mounting. If the tower is taken down and moved, the tower should be unbolted at the base from its feet which are usually mounted in cement or on planks. Timbers about 2" x 8", depending upon the size tower, must be bolted to the base as shown in *Fig. 3B* before letting down or erecting to prevent bending of the frame.

This winch will probably not be capable of lifting the taller heavier windmill towers. Where a windmill tower is used a tractor is usually available and can be used to pull the heavier load. If available it would be wise to use a large tree for a gin pole for heavy loads. If a large 4-bay array is to be mounted on top of a windmill tower, it is a good policy to put a railing around the tower platform. This affords an effective safety measure when the antenna or rotator needs to be repaired (See *Fig. 4*).

If trouble develops with an antenna or rotator on a small tower, it is quite easy to let the tower and all down. With a windmill tower this is not practical. For erecting or taking down a heavy array from a windmill tower the small boom shown in *Fig. 5* can be used to advantage. It can be quite simply welded together. If desired, the stationary pulley can be substituted for a rolling pulley using the lower part of the room as a track. An eye is mounted in the top of the antenna mast. A hook on the end of the rope, passing through the pulley on the boom, can be quickly dislodged from the eye on the antenna mast by a long wooden pole when the antenna is in place.

The boom is made in two pieces and put together at the top of the tower *Piece A*, the boom, is pulled to the top over the side of the tower and *Piece B*, the boom mast, is pulled up through the middle of the tower to the top. A bolt quickly joins the two concentric pieces, and the complete boom can be raised into place and chained to the top of the tower until the antenna is in place (see *Fig. 5*). In raising the antenna, or any article to the top of the tower, a second rope should be tied to the bottom of the article and held by a man on the ground to prevent the article from catching in the frame of the tower (see *Fig. 5*).

As strong winds bend tall light masts on multi-element arrays quite excessively, water pipe of 1" to 1¼" diameter can be used for a mast when the array is mounted on a windmill tower. In *Fig. 4* is a suggested method of employing a heavier mast. Mounting the rotator further down the tower on a wide platform relieves the rotator of much strain in a heavy wind as well as makes it easier to service.

The height of a tower is quite important for good remote fringe TV reception. Doubling the height usually doubles the incoming signal strength. If many trees are present in the reception path or at the installation it is very advisable to have the antenna mounted above them. Most trees usually do not exceed 60' height.

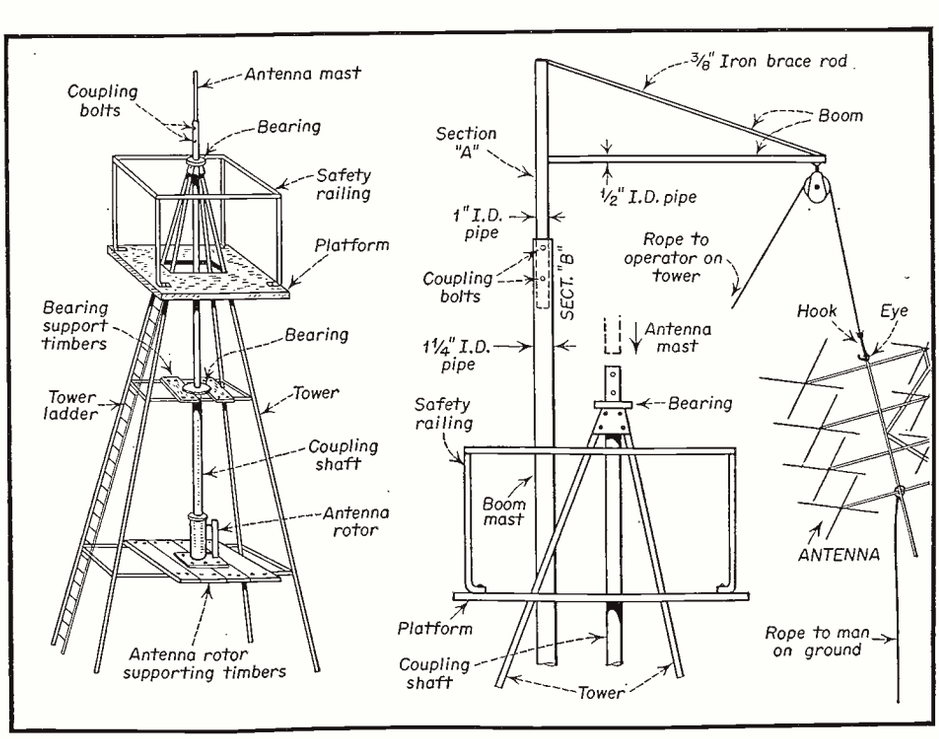


Fig. 4 (left). Position of railing around platform.
Fig. 5 (right). Using a small boom for erecting or taking down a heavy array from a windmill tower.

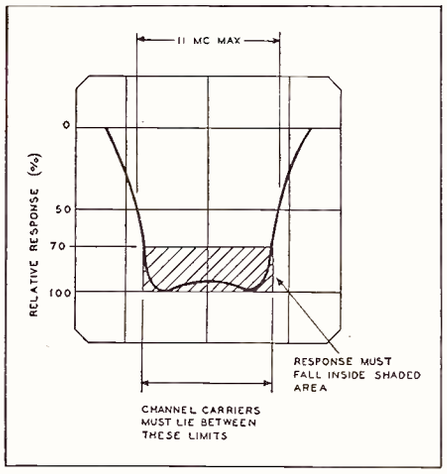
FRONT ENDS

by Samuel L. Marshall

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

Part 2

THE Front Ends of TV receivers must substantially pass a band of frequencies 6 mc wide at each dial setting of a channel. A typical response curve indicating this band 'pass is shown in *Fig. 3-11*. Notice that the response must fall inside the shaded area shown, which is 70% or more of the maximum response amplitude. Thus, if the video carrier corresponds to a 70% reading, and the audio carrier to a 100% reading, the curve is acceptable; and vice versa.



Courtesy Philco Corp.

Fig. 3-11: Typical r-f response curve.

Methods of Obtaining Wide Band Frequency Response

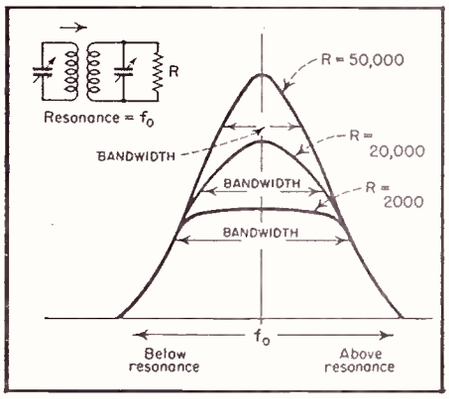
Recalling that the frequency response of an ordinary AM i-f stage is about 10 kc, it might be a little difficult to visualize how a 6 mc bandwidth may be obtained. In general, there are four methods of widening the bandwidth of an r-f transformer. These are:

1. Physical overcoupling of the resonant circuits in the primary and secondary.
2. Resistance loading of the primary or secondary, or both.
3. Band pass tuning (electrical overcoupling)
4. Stagger tuning

Overcoupling

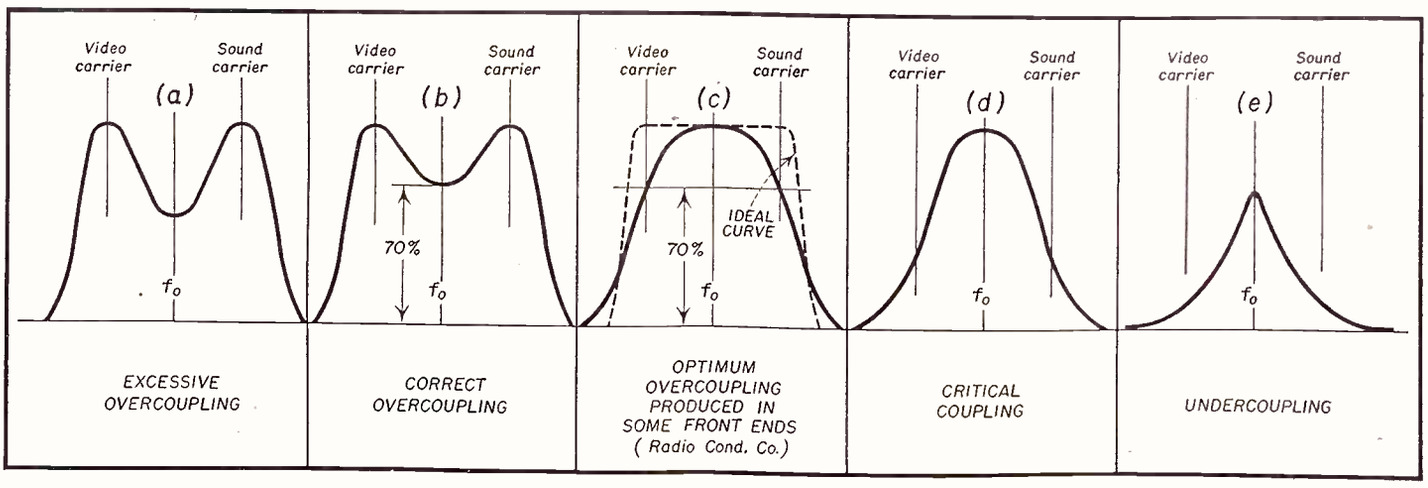
Overcoupling merely consists of bringing the transformer windings close enough together to permit the resonant response curve of the coil to include the desired frequency response. The manner in which the response curve varies with different degrees of coupling is shown in *Fig. 3-12*.

Notice that five conditions of coupling are indicated. The first condition (a), that of too much coupling, results in too large a dip at the center of the response curve; that is the dip extends below the 70% allowable minimum. The second condition (b), that of correct coupling, is one in which a slight dip occurs at the center. This



Courtesy Philco Corp.

Fig. 3-13: Effect of damping resistor on overall bandwidth.



Courtesy Allen B. DuMont Labs.

Fig. 3-12: Various curves produced by different degrees of coupling in front end of r-f circuits. An ideal curve is shown in (c).

curve corresponds to the one shown in *Fig. 3-11,* and is representative of many Front End response curves. The thid condition (c), is one in which maximum response is obtained at the center of the curve with the response gradually falling off at frequencies below and above resonance. Observe that the sound and video carriers are still within the 70% limits. This response is often referred to as *optimum coupling* and is obtained in many commercial Front Ends. Notice how this curve compares to a theoretically ideal curve. The fourth curve corresponds to *critical coupling.* Here, maximum amplitude is obtained at the center of the band, but the response falls or sharply on either side of the resonant frequency. It is evident that this response is unsatisfactory for broad band TV reception. Finally, a response curve in which the amplitude is reduced and the frequency response on either side of the resonant frequency considerably narrowed is shown in (e).

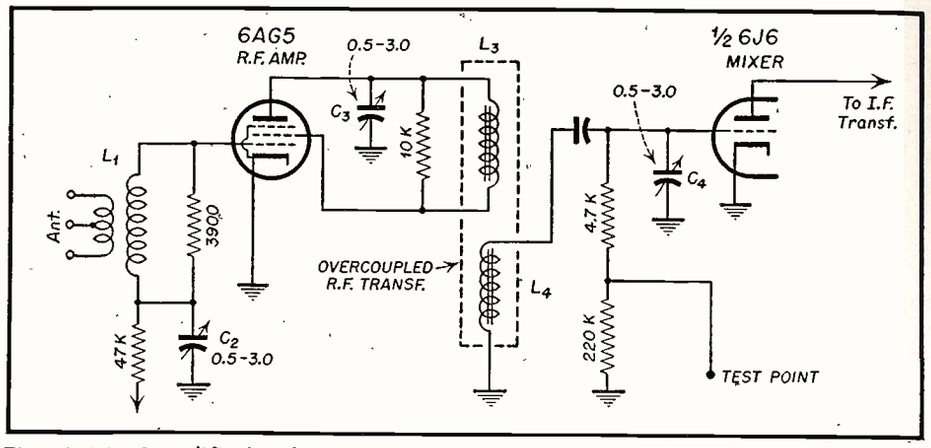
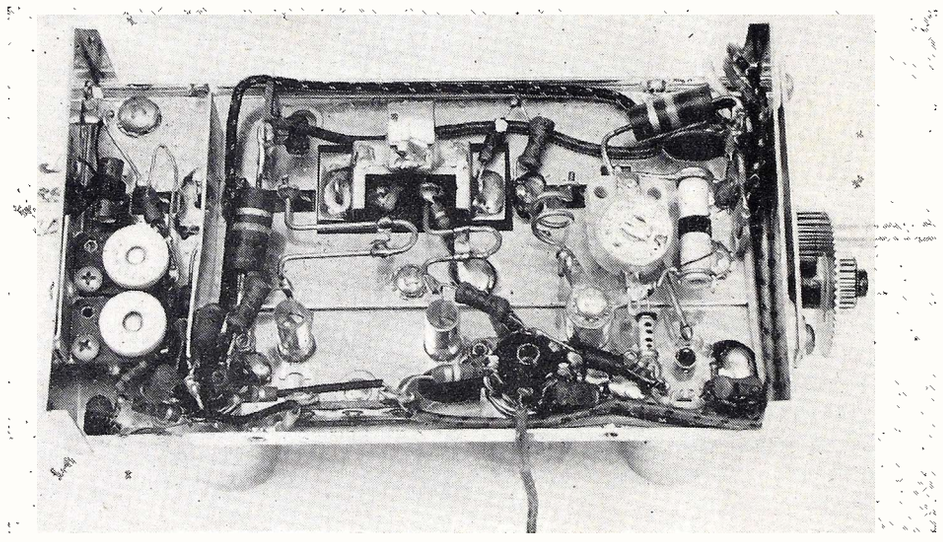


Fig. 3-14: Simplified schematic of r-f stage of Standard Tuner, illustrating simple overcoupled r-f transformer.



Courtesy Allen B. DuMont Labs.

Fig. 3-16: End inductors of Series T4A Tuner shown as trombone shaped coils in center of illustration.

Resistance Loading

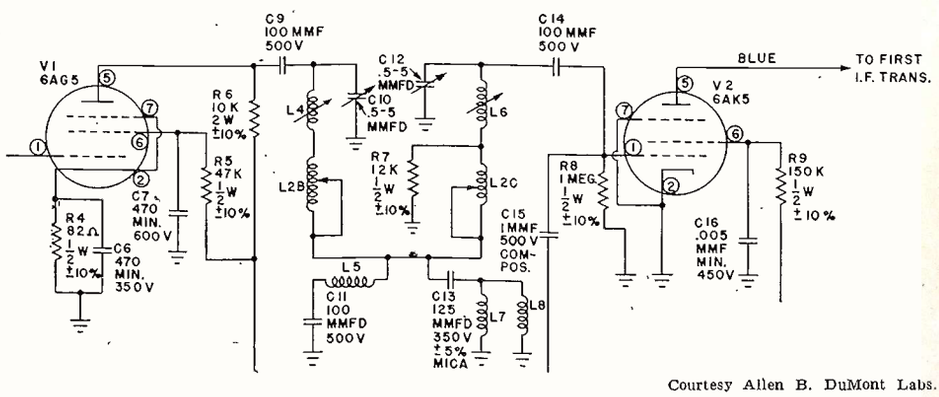
The resonance curve of an r-f transformer may be considerably broadened by shunting resistors across either or both coils, The effect of this operation on the response characteristic of a typical r-f transformer is shown in *Fig. 3-13.* From the figure it will be seen that the amplitude of the frequencies at and near resonance is reduced in much greater proportion than those far removed from resonance. This results in an overall flattening of the response curve. All TV receivers employ resistance loading in conjunction with physical overcoupling, band pass tuning and stagger tuning to effect a desired frequency response. Of course, the overall amplitude of the stage in which resistance loading is employed is reduced, but that can be made up in other ways, such as using tubes of the 6CB6 type which has a relatively higher gain and lower input capacitance, so that the short-circuiting effect of the loading resistor on the signal is not as great as in tubes of previous design.

Methods of Coupling

Two methods of obtaining an overcoupled condition are, 1) physically *3-14,* and 2) the use of a band pass circuit with an inductance-capacitance overcoupling the primary and secondary of a transformer as shown in *Fig.* combination as the coupling medium between plate and grid circuit coils as shown in *Fig. 3-15.*

Reference to *Fig. 3-14,* which is a double-tuned overcoupled circuit, will reveal that resonance in each inductance, L_1, L_3 and L_4, is obtained first by varying the small trimmers, C_2, C_3, C_4 which are connected across the coils, and then by adjusting the iron core slugs in each coil. In practice, the trimmers are adjusted for resonance with the coils tuned to Channel

[*Continued on page 30*]

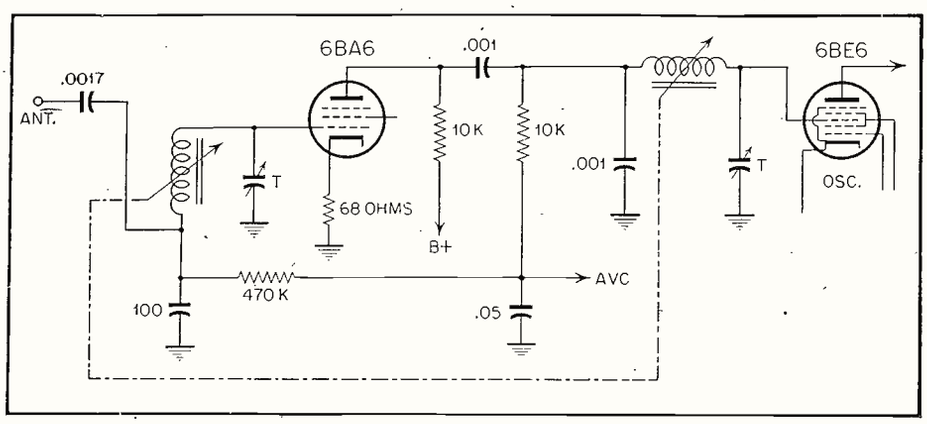


Courtesy Allen B. DuMont Labs.

Fig. 3-15: Partial schematic of DuMont 4-Section Inputuner, Series T4A, illustrating band pass circuit between 1st. r-f tube and mixer. *(See footnote)

*The DuMont 4-section Inputuner is a continuously turned Front End employing the Mallory-Ware miniature spiral-type Inductuner. A compact 4 circuit tuner (Series T3A) is now being developed by DuMont which will be mechanically and electrically interchangeable with switch type tuners for service modifications of TV receivers in the field.

CIRCUIT COURT



Truetone Model D 4842. Variable inductance tuning by means of iron cores is used in antenna, mixer, and osc. stages.

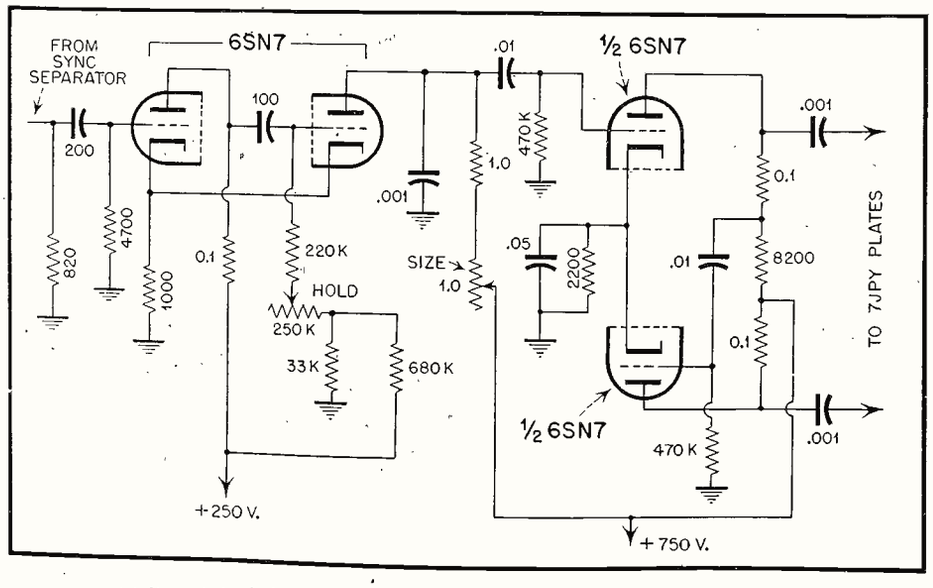
Truetone Model D4842

High gain is a mandatory feature of auto radio sets, having to work with short antennas. Modern tubes, coupled with the high impedances possible with iron core coils, particularly if tuned by variation of the inductance, assist greatly in this respect. This set incorporates these devices in a six tube circuit, one of which is a tuned r-f stage.

Variable inductance tuning by means of sliding iron cores is used in antenna, mixer and oscillator circuits. A schematic of the r-f and mixer stages is shown. The r-f tube is a miniature 6BA6 type, while the convertor is a 6BE6.

The use of inductance tuning gives rise to a problem in coupling the attendant circuits into and out of the resonant elements. It is desirable to and coupling technique is at the antenna terminal. With the grid of the r-f tube and the trimmer capacitor at the high end of the coil a high impedance is developed. The other end of the coil derives signal voltage from the antenna via a .0017 μf. capacitor, and is by-passed to ground by only 100 $\mu\mu$f. capacitor. This enables the antenna to be fairly well matched and little voltage lost across the bypass.

The plate of the r-f tube is shunt fed via a 10K resistor and the signal coupled to the low impedance end of the mixer grid coil by a .001 μf. capacitor. The high end of the coil goes to the mixer grid and is set to frequency by the trimmer capacitor. The voltage lost in the relatively low impedance plate circuit receives a substantial step-up to the next grid.



Airline Model 84GSE3011A. Horizontal deflection circuit.

Airline Model 84GSE3011A

This 21 tube portable type instrument contains several features designed for simplification and economy. Among them is a circuit for horizontal deflection, using only two tubes. The picture tube is the-type 7JP4, requiring sawtooth voltages on the deflecting plates.

Reference to the partial schematic will show that both tubes are dual-triodes, type 6SN7. One tube serves as an oscillator, the other as phase inverter and output stage. The oscillator uses a multi-vibrator circuit with feedback being provided by a cathode resistor common to both sections.

The frequency of oscillation can be varied above and below the required 15,750 cycles by a variable portion of the grid leak of the second section. Synchronizing pulses from the video amplifier are applied to the grid of the first section. The amplitude of the generated signal is controlled by varying the plate voltage for the second section. This constitutes the width control.

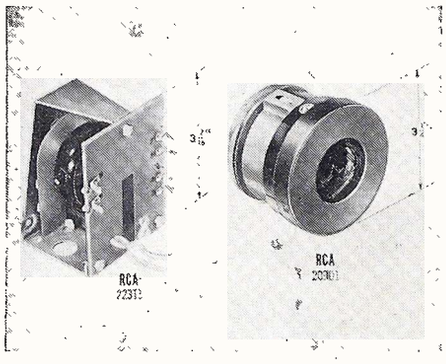
The oscillator output is capacity coupled to one section of the amplifier, the output of which connects to one deflection plate. Part of the output is taken from a resistive divider and applied to the grid of the opposite section where it is reversed in phase and amplified to feed the other deflection plate.

In order to obtain adequate sweep voltage and good linearity a potential of 750 volts is supplied to the last three tube plates.

NEW PRODUCTS

TV COMPONENTS

Tube Department, Radio Corporation of America, Harrison, N. J., announces the new Horizontal-Deflection-Output and High-Voltage Transformer RCA-223T1 and the new Deflecting Yoke RCA-209D1—each utilizing a ferrite core for superior performance—are offered for use with the 16GP4 and similar picture tubes having a deflection angle of about 70° and operating at an anode potential up to 14 kilovolts.

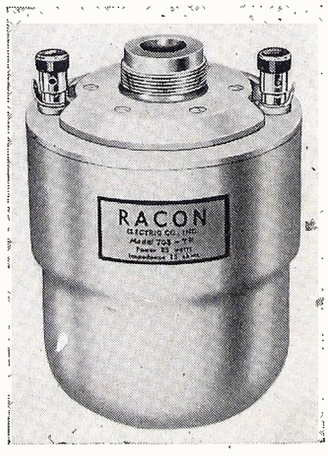


The 223T1 is designed for use with a single, horizontal-deflection amplifier tube, such as the 6AU5-GT, and a single, high-voltage rectifier tube 1B3-GT. Because of its ferrite core, the 223T1 makes possible the design of a horizontal-deflecton system which operates efficiently with a dc power supply of only 300 to 320 volts, and which provides full deflection of a 16GP4 kinescope.

The 209D1 deflecting yoke is coordinated in design to operate efficiently with the 223T1, and has good deflection sensitivity.

WEATHER PROOF DRIVER UNIT

Specifically designed as an all-purpose driver unit for speech and music, the new model PM-708TR, just released by Racon Electric Co., Inc., 52 East 19th Street, New York 3, N. Y. features a built-in 25-watt vacuum impregnated line matching transformer in addition to the other exclusive Racon characteristics. Available impedances: 15, 500, 1000, 1500, 2000 ohms.

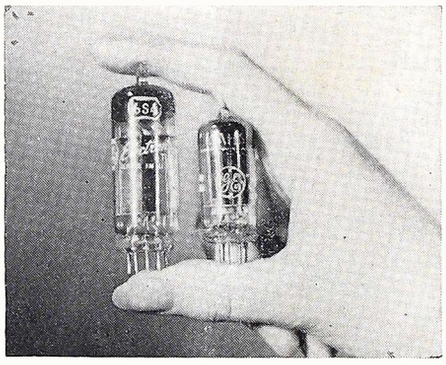


The voice coil is wound with aluminum wire for greatest effifficiency and coil terminals are welded instead of soldered. The voice coil lead is a strip of fatigue-resistant beryllium copper to withstand abnormal diaphragm excursion. The voice coil suspension is made of bakelized linen firmly cemented to the phenolic diaphragm with a thermo-setting plastic. Induction heating bakes the diaphragm, voice coil suspension and voice coil into an unbreakable bond.

NEW MINIATURE TUBES

Two new miniature tubes the 6S4 and the 6AH6, designed primarily for television and radio receivers, have been added to General Electric's production lines.

The 6S4 is a high perveance medium-mu triode designed primarily for use as a vertical-deflection amplifier in television receivers which employ picture tubes having a deflection angle up to 70 degrees and operating at anode voltages up to 14,000 volts. Ratings include a d-c plate voltage of 500 volts; a peak positive surge plate voltage of 2000 volts; and a plate dissipation of 7.5 watts.

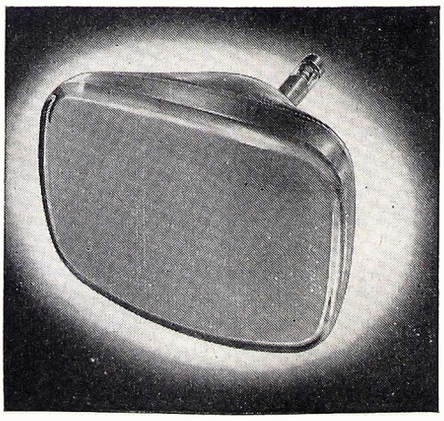


The 6AH6 is a sharp-cutoff amplifier pentode. Its high transconductance and low input and output capacitances adapt it to use as a wide-band amplifier and as a reactance tube for television and radio receivers. Under typical operating conditions it has a transconductance of 9000 microhms and plate current of 10 milliamperes.

Further information on these new tubes may be obtained from the Tube Divisions, General Electric Company, Schenectady, N. Y.

17-INCH RECTANGULAR TUBE

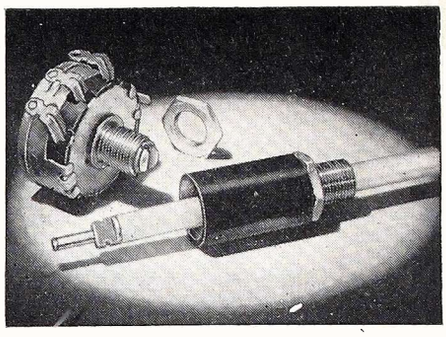
The Cathode-ray Tube Division of Allen B. DuMont Laboratories, Inc., 750 Bloomfield Ave., Clifton, N. J., announce the new 17" rectangular Teletron.



The new DuMont "150" rectangular tube provides an area of 150 square inches, and presents a rectangular picture in the same aspect ratio as the TV camera televises a scene.

H. V. COUPLER CONTROLS

Heretofore factory-fitted, the high-voltage coupler and spacer assembly, 59-186, with nylon insulator shaft, RN-3", for use in TV, oscillograph and other high-voltage circuits, is now made available in all Clarostat Pick-A-Shaft

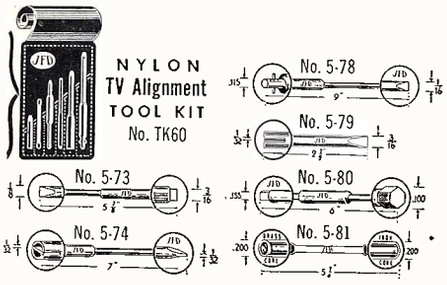


type controls, Types AM and AT, states Clarostat Mfg. Co., Inc., Dover, N. H.

This high-voltage coupler rounds out the current assortment of a dozen Pick-A-Shafts or attachable shaft types and may be purchased separately.

TV TOOL KIT

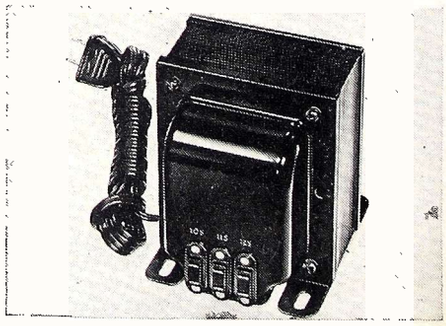
The JFD Manufacturing Co., Inc. of Brooklyn, New York announces the distribution of its new Nylon Television Alignment Tool Kit



No. TK60 designed to speed scores of television servicing operations. All tools are molded of unbreakable nylon to provide the best combination of strength, toughness and durability.

ISOLATION TRANSFORMER

A new isolation testing transformer has been announced by Standard Transformer Corporation, Chicago, maker of Stancor transformers and related components. This new unit is rated at 350 watts and is large enough to handle



almost any TV or radio receiver on test. May also be used to correct a high or low line voltage. Three standard receptacles provide output voltages of 105, 115 and 125, with 117 volts, A.C., from the line.

ALL-CHANNEL TV ANTENNA

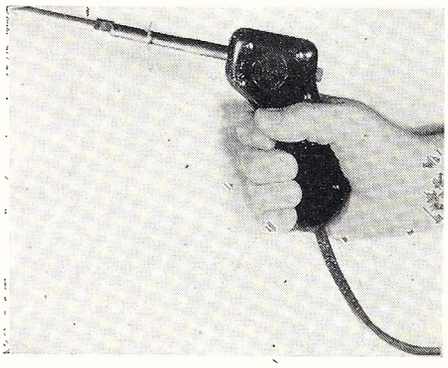
Technical Appliance Corporation, Sherburne, N. Y., manufacturers of TV, FM, and AM antenna systems, announce a new all-channel high-gain antenna designed to emphasize channels 11, 12 and 13 reception. Special noise-snubbers eliminate bothersome wind-whistle

effect. The forward angle of the antenna elements has been increased and a third antenna element added in between other antenna elements to provide the conical effect necessary for this type antenna.

DOUBLE-HEAT SOLDERING IRON

The "Vari Hot" soldering iron is unique in that it heats in 30 seconds and will idle at 500 degrees Fahrenheit whenever plugged in. Also, a conveniently located booster button on the handle offers extra heat, which can be varied as required.

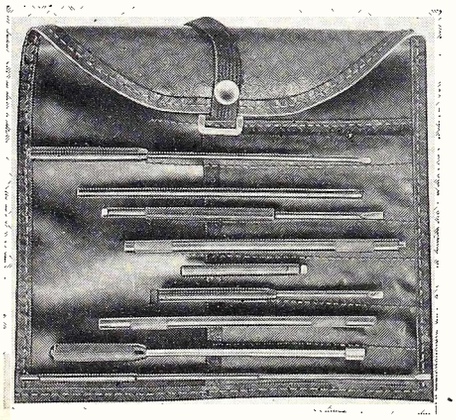
The iron has dual wire-wound heating elements which are located within the tip to reduce heat loss and thermal lag. When the booster button is pressed, 100 watts of electrical power is provided within the tip, increasing the heat (B.T.U.'s) being generated by 400%.



Available in a 110-115 volt model for standard power circuits. Also available in a 28 volt model for aircraft and marine use and a 32 volt model for farm power plant systems. All models operate equally well on AC and DC. Additional information will be furnished upon request by writing Dickson Engineering & Sales Co., 4701 Townes Road, Minneapolis 10, Minnesota.

SERVICING TOOL KIT

Nine specially designed television servicing tools are included in the new TV "Handi-Kit" offered by the Insuline Corporation of America, Long Island City, N. Y. They are furnished in a pocket-size leatherette carrying case.

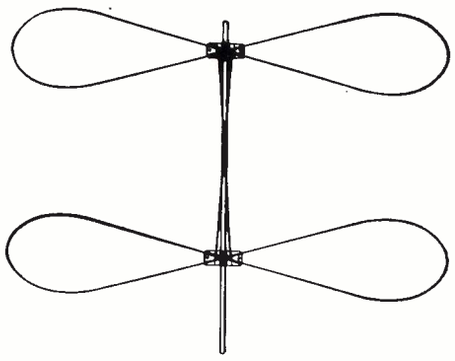


The tools will fit the adjusting screws of all types of r-f and i-f transformers, solder and trimmer condensers, used in most every TV receiver.

CLOVER-V-BEAM ANTENNA

Telrex, Inc., Asbury Park, N. J., manufacturers of Conical-V-Beams, has released for distribution its new, low cost, Clover-V-Beam, a high gain, stacked, bi-directional array for both TV and FM reception.

The Clover-V-Beam is a closed loop Conical-V-Beam incorporating many innovations and

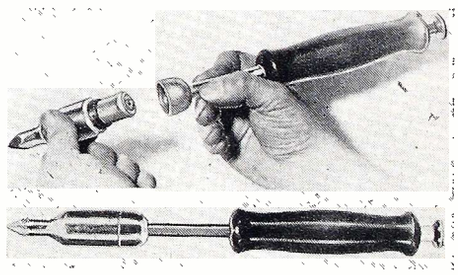


radical departures in TV antenna design. High gain and signal to noise ratio are obtained over the entire TV and FM bands, and especially at the high frequency channels, due to the flat impedance characteristics and complete absence of "lobe-splitting" over the full frequency range.

QUICK-SHOT SOLDERING IRON

John F. Rider Laboratories, 480 Canal St., New York 13, N. Y., announces their new "Quick-Shot" soldering iron.

Top—Quick-Shot Soldering Iron unscrewed at middle, showing the Quick-Shot cartridge inserted.

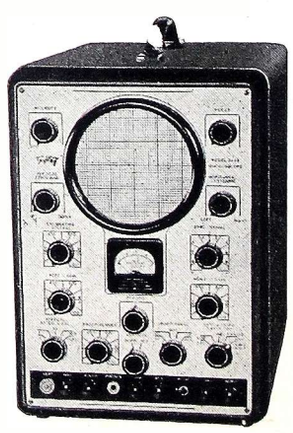


Bottom—The tip has been screwed into the handle. The Quick-Shot Soldering Iron is ready for use. To operate: the firing rod at the end of the handle is pulled back and released.

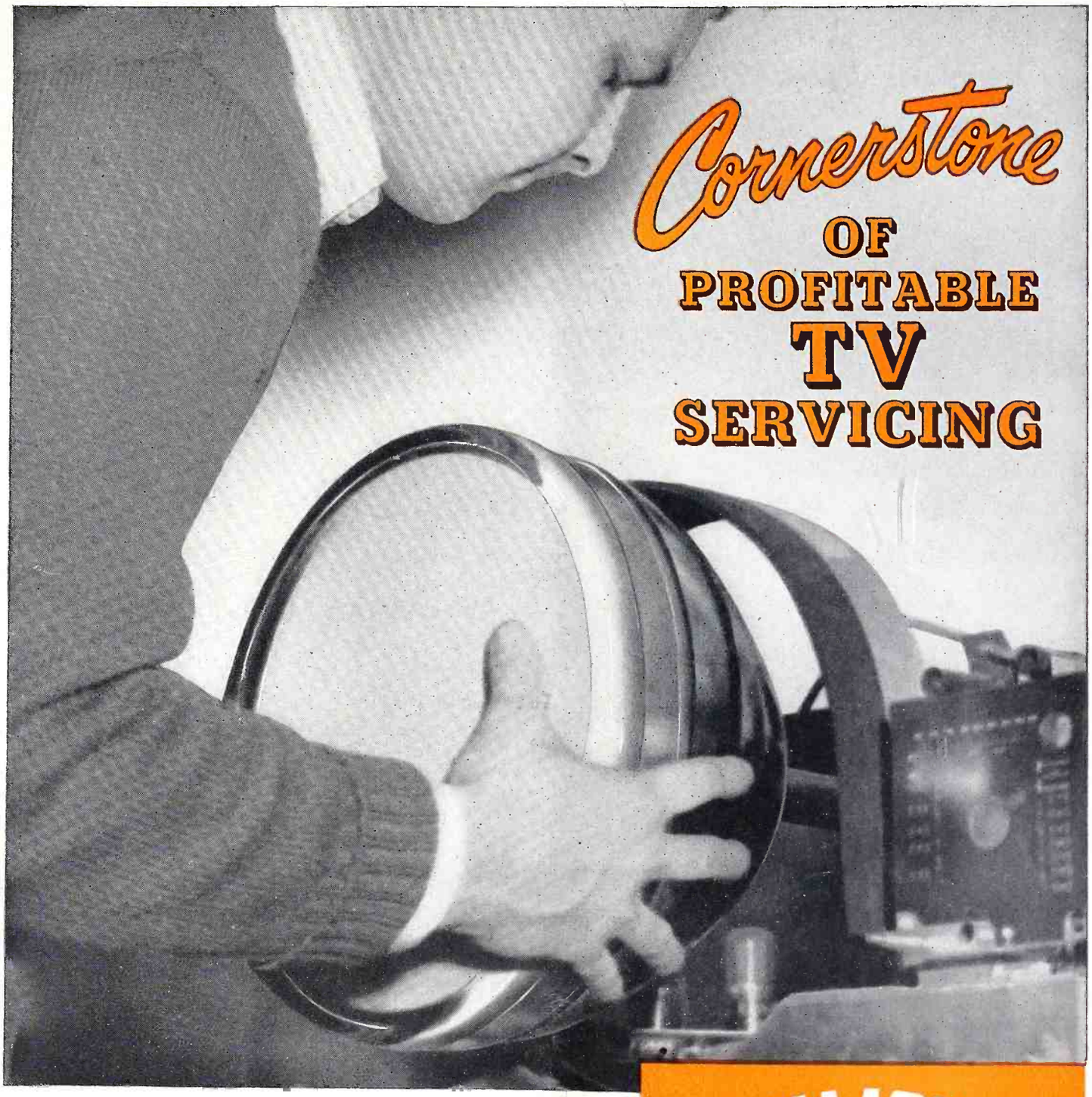
The Quick-Shot Soldering Iron is compactly built, measuring 12 inches, and weighs only 14½ ounces.

5-INCH OSCILLOSCOPE

The new Triplett Model 3440 5" Oscilloscope for TV and general use includes features including: an exclusive pattern reversing switch; calibrated meter for peak to peak voltage measurements; extremely high vertical sensitivity—.009 RMS volts (9 MV) per inch;



special built-in feature eliminates doubletrace in TV alignment by simply flipping a switch (Sync control to 0); conventional return trace eliminator; telescoping light shield; linear sweep voltages up to 60 KC; and wide frequency range—20 cycles to over 1 MC. A D-



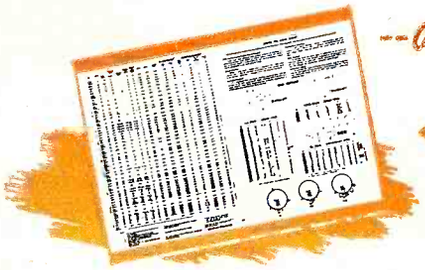
Cornerstone OF PROFITABLE TV SERVICING

"It's a Du Mont!" No further sales talk required. For everybody knows that Du Mont in tubes and sets alike means "First with the Finest in TV Tubes."

And by eliminating costly call-backs and adjustments often based on customer misgivings, your full profit margin is assured. Always remember that Du Mont Teletrons cost no more than lesser-known brands.

See your Du Mont jobber about this cornerstone of profitable TV servicing.

ASK FOR THE DU MONT CRT CHART --OR WRITE US



DU MONT

FIRST WITH THE FINEST IN T-V TUBES

Teletrons*

ALLEN B. DU MONT LABORATORIES, INC.

CATHODE-RAY TUBE DIVISION

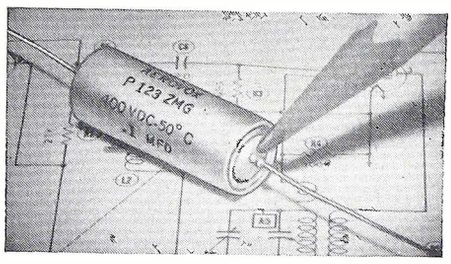
CLIFTON, NEW JERSEY

*Trade-mark.

modulator probe is also available for signal tracing. For further information write: The Triplett Electrical Instrument Co., Bluffton, Ohio.

MINIATURE CERAMIC TUBULARS

Extra-severe-service requirements in subminiature volume are met by the Type P123ZG Aerolite capacitors announced by Aerovox Corporation, New Bedford, Mass. The marked

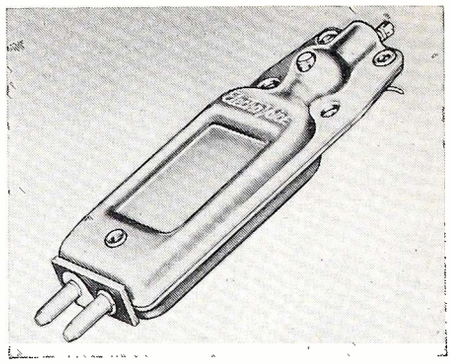


size reduction is attained primarily by the metallized-paper section which is Hyvol K or M impregnated and placed in a non-magnetic hermetically-sealed metal case with vitrified ceramic terminal seals. Operating temperatures range from —55° C. to +50° C. without derating, and again at ambient temperatures up to 95° C. with voltage derating. Power factor is less than 1% when measured at or referred to at a frequency of 1000 cps and an ambient temperature of 25° C.

Type P123ZG Aerolites are available in 200, 400 and 600 VDC, and capacitance values of .0005 to 2.0 mfd. Dimensions range from .175" dia. by 7/16" long, up to .670" dia. by 2-7/32" long. These bare metal-can units may also be had with plastic insulating sleeves, adding .062" to the diameter and 1/16" to length.

CRYSTAL PHONO CARTRIDGE

Electro-Voice, Inc., Buchanan, Michigan, announces the new model 60 Crystal Econo-Car-



tridge. It uses the Bimorph Crystal and will replace over 20 other existing models.

By inserting the appropriate 3-mil or 1-mil needle, it can be used for 78 rpm or for 33-1/3 and 45 rpm records. Tracking force is ¾ oz. on 78 rpm, and 8-grams on 33-1/3 and 45 rpm. Frequency response to 6000 c.p.s.

TRADE FLASHES

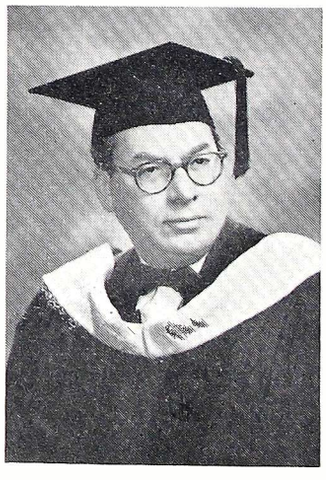
[*from page 8*]

Burton Browne Honored

The University of Hollywood honored Mr. Burton Browne of Chicago, Illinois, at a testimonial dinner, which was held on June 1st.

The dinner was held for the purpose of bestowing on Mr. Browne a Doctorate of Science degree in Business Administration.

The Board of Trustees of the University is conferring this honorary



degree upon Mr. Burton Browne in recognition of the valuable contributions he has made to the development of commercial motion pictures and industrial radio advertising, and the outstanding research work he has conducted in these two important fields of endeavor, and in further recognition of his compiling and publishing the all-important book entitled "Best National Advertising of the Year."

Electronics Dictionary

Allied Radio Corporation announces the publication of "A Dictionary of Electronic Terms" containing over

2,500 terms used in television, radio and industrial electronics.

Definitions cover mostly modern techniques and equipment, but range from many words no longer in general use, retained for historic reasons, to the new language of color television and the electronics of nuclear physics.

Available from Allied Radio Corporation, 833 West Jackson Blvd., Chicago 7, Illinois for 25c to cover handling and mailing costs.

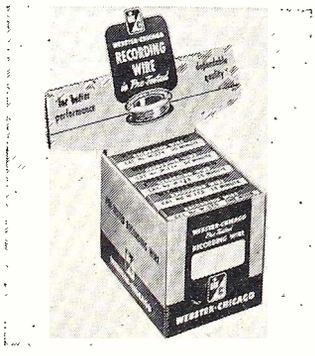
Booster Display

A new and strikingly designed point-of-sale display piece for "The Standard Booster," has just been produced by Standard Coil Products Co., Inc., Chicago, Los Angeles, and Bangor, Michigan. Suitable for both jobber and dealer promotion, the novel display is flexible enough to be used with or without a sample of "The Standard Booster."

Measuring 14¼" wide and 18¼" high, the easel-backed display takes up a minimum of valuable counter or window space. It may be obtained through factory reps, authorized jobbers, or by writing to Standard Coil Products Co., Inc., 2329 North Pulaski Road, Chicago 39, Illinois., or 2901 East Slausson Ave., Huntington Park, California.

Recording-Wire Display

A recording-wire merchandising kit for counter display is being offered by Webster-Chicago Corporation, manu-



facturers of the "electronic memory" wire recorder. The kit holds five spools: two 15-minute, two 30-minute and one full-hour spool. The spools are packaged in a counter display box in such a way that all the information the customer needs to select his own spools is immediately visible.

Antenna Booklet By Ward

An informative and comprehensive booklet on television and FM antennas entitled, "The Story of the Magic Wand", has just been published by Ward Products Corporation, 1523 E. 45th St., Cleveland, Ohio.

The 16-page booklet, which tells about development and application of antennas, is being distributed to TV installers and the general public. It contains 34 illustrations and three pages of definitions of the important terms used in connection with TV reception.

A copy of "The Story of the Magic Wand" may be obtained by writing Ward Products Corporation, 1523 E. 45th St., Cleveland 3, Ohio.

Telrex ups Ad Budget

Telrex, Inc. announces that their 1950 advertising budget now includes an appropration for direct to the consumer advertising via newspaper, TV and radio—time has already been purchased on TV station WPIX for a series of Sales and Tech Announcements starting May 15th.

Antennas Given Vibration Tests

Technical Appliance Corporation, Sherburne, N. Y., manufacturers of

TV, FM and AM antenna systems, have installed a special vibration test table designed to simulate the wind vibrations encountered in antenna installations. This test is based on similar ones required by the Army and Navy for life-testing ship and aircraft equipment.

Pix Tube Reference Guide

Vin Ulrich, Manager, Renewal Tube Sales Division, announces the publication of the National Union *TV Picture Tube Reference Guide*. This comprehensive guide lists 12 electrostatic-deflection and 73 electromagnetic-deflection type tubes.

In addition to giving the usual rating and characteristics data, this N.U. guide provides information necessary to show differences between various tube types which on the basis of less comprehensive data might appear to be completely interchangeable. Bulb outline drawings with dimensions as well as basing diagrams are included. Other significant data relative to anode terminal type and location, dimensions of outer conductive coating, ion trap field, focus coil, and length of neck on electromagnetic types will be found.

Rider Announces New Book

Announcement has been received received from John F. Rider Publisher, Inc., 840 Canal Street, New York 13, N. Y., that a new book entitled TV Installation Techniques by Samuel L. Marshall, Managing Editor of Radio Service Dealer Magazine and television instructor at George Westinghouse Vocational High School, will be released in July.

This book was written with a special purpose in mind, specifically, to furnish information of vital nature affecting television receiving antennas and installations, to all who are concerned with or who participate in this activity. In addition to information on proper methods of installation and safety, the book furnishes data concerning ice and wind loading, the proper means of guying, in fact, all details which will enable the accomplishment of a safe and successful antenna installation whether erected on the roof of a two-story private dwelling, the top of a 20-story building, or on top of an 80 foot tower.

FRONT ENDS

[*from page 22*]

12, following which resonance at each other channel is obtained by adjusting the individual slugs of the coils which are switched into the circuit.

In *Fig. 3-15* the method of coupling utilizing inductance-capacitance elements as the coupling mediums, provides a circuit in which the magnetic field of the primary combination, L_4, L_{2B}, and C_{10} is isolated from the secondary circuit, L_6, L_{2C}, and C_{12}. However, a mutual impedance coupling network is connected between these

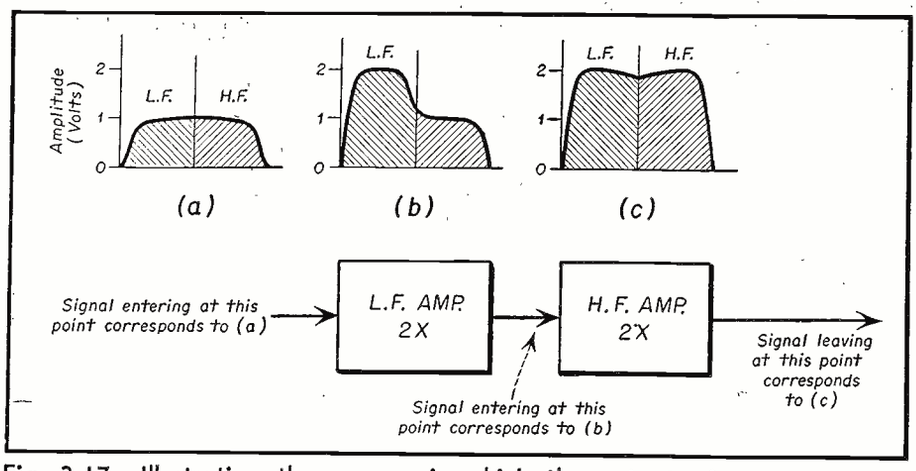


Fig. 3-17. Illustrating the manner in which the output of a stagger-tuned amplifier contains equal values of amplified high and low frequencies.

two resonant circuits so that a voltage transfer takes place between them through this network. The latter consists of L_5, C_{11}, C_{13}, L_7, and L_8. By varying the amount of industance and capacitance in this network more or less coupling may be obtained, so that any of the curves shown in *Fig. 3-12* may be obtained. This adjustment is done by the manufacturer to produce a desired response curve.

In practice, the purpose of the "end inductors", L_4 and L_6 shown in the center of *Fig. 3-16* as trombone-shaped coils is to track the r-f and oscillator frequencies at the highest frequency channel. Similarly, the purpose of C_{10} and C_{12} is to track the circuit at the lowest frequency channel. This tracking is analogous to the same operations performed with the trimmer and padder condensers in AM receivers.

Stagger Tuning

Up to this point we have discussed the following methods of obtaining wide band pass in r-f circuits: overcoupling (physical), resistance loading, and band pass circuits (electrical overcoupling). A fourth method is stagger-tuning. Defined briefly, stagger-tuning is the process of emphasizing a range of low frequencies in one stage and a range of high frequencies in a second stage, resulting in an overall output containing both high and low frequency ranges.

A simple illustration of how stagger-tuning works is shown in block diagram form in *Fig. 3-17*. Let us assume that a 1-volt broad band signal containing high frequencies (H.F.) and low frequencies (L.F.) enters the stagger-tuned amplifier shown represented in block diagram form. This signal corresponds to the waveform shown in (a). We will also assume that the first stage of the amplifier amplifies the low frequency portion of the signal to twice its original amplitude without affecting the gain of the high frequency portion of the signal. As a result, the signal leaving the first stage and entering the second has a waveshape corresponding to (b). As shown, the potential of L.F. is 2 volts and H.F., 1 volt.

In the second stage the high frequency portion of the signal is amplified to twice its original amplitude and the low frequency portion of the signal remains unaffected. The overall output corresponds to the waveshape shown in (c). Notice that both the

h-f and l-f portions of the signal have the same amplitude in the output. It is evident, therefore, that the net result of a stagger-tuned system is equal amplification of the entire band of frequencies.

[*To Be Continued*]

HORIZONTAL AFC

[*from page 13*]

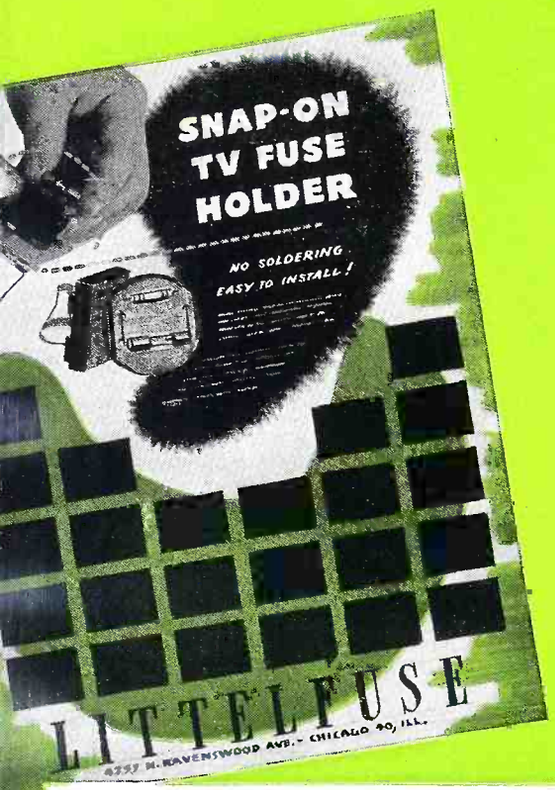
quent defect of this system was its lack of stability and its tendency towards microphonics which forced some manufacturers to mount the horizontal oscillator on a special shock-mounted socket. The addition of a stabilizing coil has eliminated this instability and shock mounting is no longer required.

The new Synchroguide features stable operation, good noise immunity and fair lock-in at weak signals. A characteristic of the Synchroguide is a slight bending of the picture at the top either on very strong or on weak stations. The range of the Synchroguide is not too great and as far as the horizontal hold control is concerned, in most receivers it will throw the picture out of synchronism at one extreme setting. As long as the hold control is set anywhere near the center the lock-in action will be satisfactory on weak and on strong stations. The entire Synchroguide circuit is contained in one tube, a 6SN7 double triode. The operation of this tube, however is largely dependent on the effectiveness of the preceding synchronizing pulse clipper, limiter and separator. If the AFC is to perform properly, the synchronizing pulses must be of constant amplitude. To accomplish this a single diode section is usually connected in the clipper circuit. The adjustment of the Synchroguide is not simple. Some manufacturers suggest the use of an oscilloscope for the original adjustment while others recommend a different method. In the paragraphs devoted to a detailed discussion of the Synchroguide both methods of adjustment will be described.

The Synchroguide is quite different in its operation from both the Synchrolock and the phase detector type in that it functions on a pulse width comparison between the incoming and the locally generated pulses. The advantages of the Synchroguide system can be summed up as economy, good performance and stability, and its drawbacks lie mainly in the adjustment procedure which is more complex than the others.

AD INDEX

SNAP-ON TV FUSE HOLDER!



DEAL NUMBER 1

Snap-on fuse holder for quick, easy replacement of TV pigtail fuses. Snap one side of holder on blown pigtail fuse in set. Snap regular replacement fuses in other side—the job is done. No more cutting out the pigtail. No more messy soldering. No more fuses blown by hot irons. Save time, save work, save the customer's money, and still make big TV profits. Service dealer cost, 15c each.

LITTELFUSE INC.
4757 N. RAVENSWOOD AVE., CHICAGO 40, ILLINOIS

2 TV PROFIT DEALS!

DEAL NUMBER 2

TV fuse kit—10 assorted fuses that service all TV receivers—Admiral, Philco, RCA, Zenith, Emerson, Hallicrafters, etc., etc., etc. The serviceman needs the right fuse in his box—it is in this kit when he needs it. Saves time, saves profit. Service dealer cost, 98c each.

LITTELFUSE INC.
4757 N. RAVENSWOOD AVE., CHICAGO 40, ILLINOIS

TV FUSE KIT

THE QUALITY OF RCA TUBES IS UNQUESTIONED

RCA for *Deflection Tubes*

. . . with dependability

Each standard by which you judge a tube in service is considered in establishing the design requirements of RCA tubes. Dependable performance of deflection circuits starts with *dependable* tubes. For example.

RCA-designed driver tubes, such as the 6SN7-GT and 12AU7—as well as the RCA-6K6-GT and RCA-6AQ5 vertical-deflection tubes—are exceptionally low in microphonics. They are built for *dependable* performance.

RCA-designed horizontal deflection tubes, such as the 6BG6-G, easily withstand peak plate voltages of 5000 volts, and as readily meet peak emission demands on the cathode. They, too, are built for *dependable* performance.

For these reasons, RCA tubes offer *dependability* beyond the average. With fewer service failures and fewer costly call-backs, there is, then, an additional hidden profit in every RCA tube and kinescope you sell.

Always keep in touch with your RCA Tube Distributor

RADIO CORPORATION of AMERICA
ELECTRON TUBES
HARRISON, N. J.