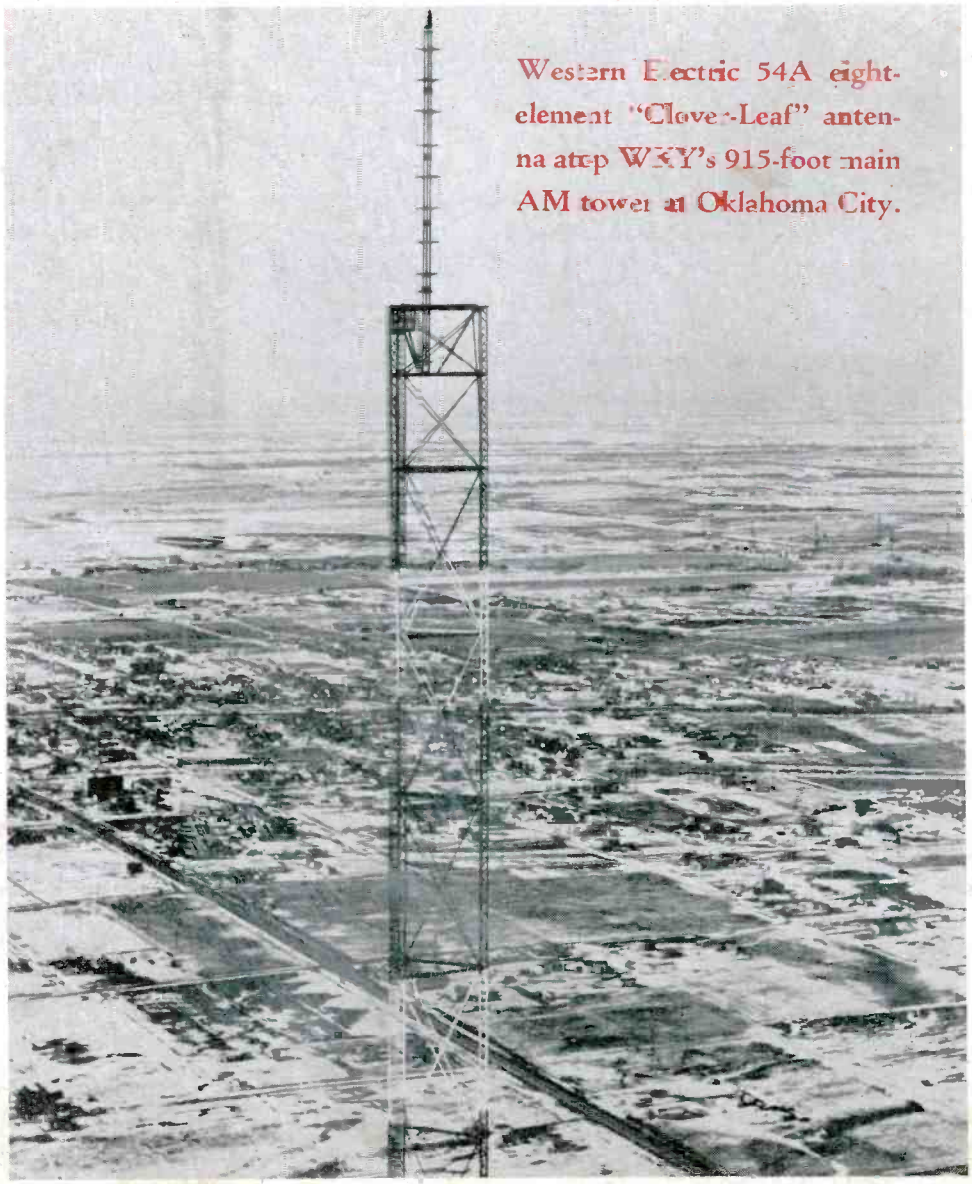
THE BROADCAST ENGINEERS' JOURNAL
ED. STOLZENBERGER, EDITOR
116-03 91ST AVENUE, RICHMOND HILL 18, N. Y.

Gehres

F. A. Gehres

OFFICIAL PUBLICATION OF THE NATIONAL ASSOCIATION OF BROADCAST ENGINEERS AND TECHNICIANS

The Broadcast Engineers' Journal



Western Electric 54A eight-element "Clover-Leaf" antenna atop WKY's 915-foot main AM tower at Oklahoma City.

APRIL
1947

VOL. 14 No. 4

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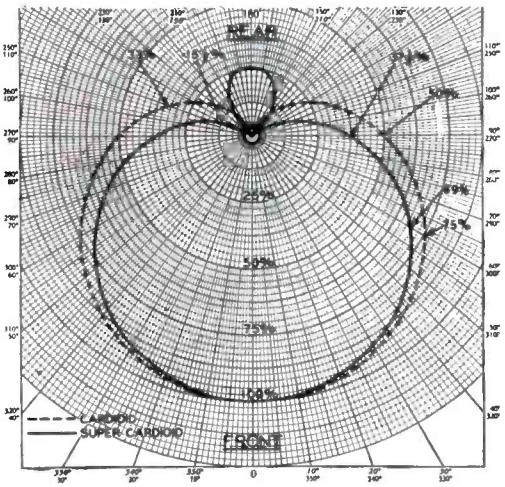

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THE BROADCAST ENGINEERS' JOURNAL

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TABLE OF CONTENTS

THE BROADCAST ENGINEERS' JOURNAL
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NATIONAL N.A.B.E.T. OFFICE
Room 501, 66 Court Street, Brooklyn 2, N. Y.
A. T. Powley, President

NABET ACTIVITY

* The NABET Negotiating Committee handling the NBC-ABC-WOR contract negotiations arrived in New York March 2nd. The Committee consists of NABET President Powley, NABET VP Jim Brown of Hollywood, John McDonnell of San Francisco, Frank Schnepper of Chicago, NABET attorney Tom Dunn; Messrs Payne, Gavigan, Penner, Mac Reid, Clark, and DaCosta of WOR, Reid R. Davis for Television, and C. L. Bennis of New York. The wheels are in motion; . . . the results will be announced by President Powley.

* According to Variety, the RWG-NBC Hollywood newsroom men concluded negotiations Feb. 13th, with a 33 1/3% hike from former $270 month minimum, to new $360 month minimum.

* Rochester NY IATSE members who retire after 25 years service, automatically become members of IA "advisory board" and draw $15. per month, just voted by its members, most of whom it is said, are in the "elderly" category.

* Ass'n of National Advertisers (ANA) is reported to feel that it should have a voice in the formulation of network policy on censorship, talent, labor, rates, etc., etc., because **their** money is feeding the networks; further, ANA feels network policy on commercials should be stricter to avoid destroying the advertising value of the medium.

* A bill is pending before Congress that would declare radio a public utility.

* CRAC (Council of Radio Arts & Crafts—Hollywood) has been formed to keep all segments informed and up-to-date on all matters of mutual interest, as reported in our last issue. The seven participating unions and assocations have now ratified CRAC and plan national expansion.

* Deadline for Long-Lines telephone strike is April 7th; workers are asking for a living wage.

* Discussion of possible merger of AFRA, Equity, AGVA, etc., is under way. Lower dues and wider employment opportunities is the talking point.

* NABET has obtained a 15% increase for the WWJ Detroit Engineers, from $90. to $103.50 per week, including television jurisdiction.

* AFRA has obtained a 35% increase for its St. Louis actors and singers. Announcers former minimum was $55. week; this was increased 45% to $80. minimum.

* FLASH—FCC has given black-and-white television the much-needed nod, by way of refusing to anchor the industry to the suggested mechanical color system standards. The decision is in line with preponderance of evidence and expert testimony by the nations' best authorities on the subject.

* Deadline—2nd of every month, as usual.

Upcoming Yearbook:—

Attention coordinators and salesmen. If you have any suggestions for further streamlining and increasing efficiency of handling Yearbook, drop me a note very soon, as we start drawing up the Instruction sheet in a few months. In general, this is the test: If it minimizes the overall workload, it's a good idea; if it minimizes possibilities of error, it's a good idea; if it will keep the salesmen happy (or happier)—and still leaves us enough do-ra-me on which to operate the next eleven isues—it's also a good idea. Jot down the ideas now—EdS.

National Association of Broadcast Engineers and Technicians

The only Union that is 100% Of, By and For the BROADCAST ENGINEER

Attention Broadcast Engineers!

- NABET is a dignified union *worthy* of your support.
- NABET is an *effective* union, Of, By, and For the Broadcast Engineer *exclusively*, operated upon and dedicated to the principle that every member has a *right* to know what is going on in the union's "front office."
- NABET is controlled by its *members;* they have the right to vote on all matters of union policy. As a NABET member, you would have the *right* to Okay any actions which your President might take.

Contact any of the following officers for further information

A. T. Powley, President
Harry C. Hiller
Nat'l Sec'y-Treasurer
66 Court Street
Brooklyn 2, N. Y.

James H. Brown
Vice President
6000 Sunset Boulevard
Hollywood 28, Calif.

Cliff Gorsuch
National Representative
66 Court Street
Brooklyn 2, N. Y.

Charles L. Bennis
Apt. DA-2
117-14 Union Turnpike
Kew Gardens 15, N. Y.

Harold V. Brandt
19 Elm Street
Brecksville, O.

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18 Squirrel Hill Road
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217 E. North Street
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9312 Sudbury Road
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William Justin Flanders
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Wm. H. Johnson
100 E. Manda Road
Havertown, Pa.

C. Edward Jung
1405 Carswell Street
Baltimore 18, Md.

John R. McDonnell
252 Oakdale Avenue
Mill Valley, Calif.

Mark L. McGowan
2703 Spalding Street
Omaha, Neb.

Don Morey
Apt. 26-A, 3 Circle Lane
Albany 3, N. Y.

Donald A. Muir
1200 W. Colvin Street
Syracuse 7, N. Y.

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Forest Hills, N. Y.

Clyde M. Reed
363 Olancha Avenue
Brentwood, Pgh., Pa.

Frank C. Schnepper
3508 West 97th Street
Evergreen Park, Ill.

Charles Synder
106 Pembroke Street
Rochester 7, N. Y.

The 1947 Winter I. R. E. Meeting

Largest Radio Engineering Show Ever Held — 118 Technical Papers — Over 10,000 Engineers Attend Four-Day Technical Meeting

By Ed Stolzenberger

CONVENING to consider problems ranging from latest electronic developments to professional status, an estimated ten thousand radio engineers attended the 1947 annual convention of The Institute of Radio Engineers, held at the Hotel Commodore and Grand Central Palace building, New York City, March 3-6.

More than 120 technical papers were read covering all fields of radio and electronics, including such allied fields as radiography, particle accelerators for nuclear studies, and nucleonics instrumentation, in addition to technical committee sessions and other convention functions.

A major feature of the convention was the Radio Engineering Show at the Grand Central Palace, in which 168 manufacturing industrial and research organizations, along with the Army, Navy, and other government agencies, displayed the latest in radio and electronic equipment and techniques. Along with apparatus ranging from complete radio transmitters to minute components used in vacuum-tube manufacture, demonstrations of processes such as gem coloring by electronic methods were given. Army and Navy displays alone occupied over 2500 square feet of space.

Dr. W. R. G. Baker, President of the I.R.E., made several pertinent remarks at the press luncheon, Monday, March 3d, at the opening of the 1947 I.R.E. National Convention, which should help to keep all of us "on course"; he said,

" . . . Regardless of hopes, ambitions, and desires, an industry can advance no faster than its engineers and its productive facilities can make available the actual products on which new systems and services must depend . . . ", and further,

"It may be well to call your attention to a simple fundamental concerning the art and science of electronics. Back of all the countless developments of electronics and basic to all the applications regardless of whether industrial or entertainment is the electron tube in a circuit. This holds true whether we are considering the most simple form of broadcast receiver or the most complex radar equipment. The electron tube which can detect, identify, amplify, regulate and control is the common denominator of the electronics industry."

Summaries of Technical Papers

No papers are available in preprint or reprint form nor is there any assurance that any of them will be published in the "Proceedings of the I.R.E.," although it is hoped that many of them will appear in subsequent issues.

PARTICLE ACCELERATORS FOR NUCLEAR STUDIES

Chairman, J. R. ZACHARIAS
(Massachusetts Institute of Technology, Cambridge, Mass.)

1. Particle Accelerators for Nuclear Studies.

G. W. Dunlap

(General Electric Company, Schenectady, New York.)

The history of accelerators is traced from the discovery of charged particles, through the development of the cascade rectifier, Van de Graaff generator, cyclotron, betatron, linear accelerator, synchrotron, and synchro-cyclotron. The distinguishing characteristics and uses of these are listed and the present trend toward higher energy units is reviewed.

2. Frequency-Modulation Cyclotron.

W. Salisbury

(Collins-Radio Company, Cedar Rapids, Iowa.)

The frequency-modulation cyclotron accelerates nuclear particles to a velocity for which the relativistic mass increase throws them out of resonance with a fixed-frequency oscillator. The need for radio-frequency fields between large conductors implies high-Q circuits for economy of operation. The problems arising in the production of these fields with a frequency variation of 40% or more at a cyclical rate up to a few thousand times per second open a new region for the radio engineer.

3. The Betatron.

T. M. Dickinson

(General Electric Company, Schenectady, New York.)

A statement of the basic principles of the betatron is presented and the requirements of the associated electronic circuits required for successful operation are discussed. Typical circuits which meet these requirements are described.

4. A 70-Million-Electron-Volt Synchrontron.

A. M. Gurewitsch, H. C. Pollock, R. V. Langmuir, F. R. Elder, and J. P. Blewett

(General Electric Company, Schenectady, New York.)

A 70-million-electron-volt synchrotron built by the General Electric Company under a Naval Office of Research contract is described. The phenomenon of phase stability, which is of importance in synchrotron machines, is briefly discused, and differences between betatron and synchrotron principles are pointed out. Some design details and performance data of the 70-million-electron-volt machine are given.

5. The Linear Accelerator.

J. C. Slater

(Massachusetts Institute of Technology, Cambridge, Massachusetts.)

The linear accelerator consists of a wave guide loaded so that the phase velocity of electromagnetic waves equals the velocity of the particles which are therefore continuously accelerated, a power source to set up a high electromagnetic field, and a source of particles. A microwave accelerator for electrons will be discussed.

ELECTRONIC MEASURING EQUIPMENT

Chairman, J. E. BROWN
(Zenith Radio Corportation, Chicago, Ill.)

6. A Method of Determining and Monitoring Power and Impedance at High Frequencies.

J. F. Morrison and E. L. Younker

(Bell Telephone Laboratories, New York, N. Y.)

A method and newly developed devices for determining and monitoring power and impedance levels in transmission lines at high frequencies will be explained. Practical considerations influencing accurate determination of power and impedance levels are analyzed, and the previous and newly developed methods of monitoring these important quantities under changing conditions of load are compared.

7. Theory of Measurement of Dielectric Properties at 10,000 Megacycles per Second.

C. V. Larrick
(General Electric Company, Hanford, Washington.)

Mathematical formulas for use in measuring the loss factor and dielectric constant of dielectric materials at 10,000 megacycles are derived.

It is demonstrated that the dielectric properties may be extracted once a measurement of admittance is made, and formulas both for coaxial and for wave-guide equipments are derived.

8. A Coaxial-Line Diode Noise Source for Ultra-High Frequency.

H. Johnson
(RCA Laboratories Division, Radio Corporation of America, Princeton, New Jersey.)

A developmental diode of coaxial-line construction is described which is readily adapted to wide-range coaxial-line circuits over most of the ultra-high-frequency range with a maximum transit-time reduction of noise of 3 decibels. Operation of the diode as a standard noise source provides a particularly simple means of measurement of receiver noise factors.

9. A New Reactance-Tube Distortion and Noise Meter.

C. W. Clapp
(General Electric Company, Schenectady, New York.)

A new distortion and noise meter covering the range from 50 to 15,000 cycles per second is described. The instrument utilizes a bridged-T rejection filter employing a reactance-tube circuit of novel design in place of the inductance arm. Other applications for the reactance-tube circuits are suggested.

10. Cathode-Ray Presentation of Three-Dimensional Data.

O. H. Schmitt
(Airborne Instruments Laboratory, Inc., Mineola, New York)

Electrical information in three variables is transformed by relatively simple electrical means into two different cathode-ray images which, when presented separately to the two eyes, yield a vivid three-dimensional picture. Flexibility in choice of co-ordinate systems, scale of presentation, and observers' viewpoint makes this general technique widely applicable.

RADAR AND COMMUNICATION SYSTEMS

Chairman, E. M. DELORAINE
(International Telephone & Telegraph Corporation, New York, N. Y.)

11. Shipboard Radar Fire Control from the System Viewpoint.

R. M. Page and J. B. Trevor, Jr.
(Naval Research Laboratory, Washington, D. C.)

The task before the system engineer is to follow the flow of target information from the search radar, which originally detects the target, through the various steps by which the original low-precision target-position information is finally transformed into high-precision gun orders. The factors affecting data accuracy at each step of the process are discussed.

12. System Considerations in the Design of Very-High-Frequency and Super-High-Frequency Communication Circuits.

E. Fubini
(Airborne Instruments Laboratory, Inc., Mineola, New York.)

The problem of determining the optimum frequency and type of modulation for a particular communication channel is considered in its broad outline. Some of the parameters for the optimum design of the system are calculated. Examples of comparisons between different frequency channels and different systems of modulation are given.

13. Portable Military Communication Set.

C. E. Sharp
(Coles Signal Laboratory, Red Bank, New Jersey.)

A detailed description is given of the design features embodied in oscillator cavities and a single-antenna radio-frequency radiating system which enable simultaneous transmission and reception over an integral but highly portable radio communication set operating from 2000 to 2400 megacycles. Interference-free amplitude-modulation communication is shown to be obtainable at these frequencies with exceedingly simple circuits.

14. Carrier-Current Dialing Over Long-Distance Telephone Circuits.

I. Molnar
(Automatic Electric Company, Chicago, Illinois.)

A carrier telephone system suitable for automatic operation has been developed. Connections are established and dial pulses extended through the carrier associated with the voice-transmision channel. The paper will discuss this system, with brief descripton of general features and transmission characteristics and details of the newly developed signaling systems, including data on its operating performance.

15. Cesium-Vapor Lamps in Infra-Red Communication.

M. C. Beese
(Westinghouse Electric Corporation, Bloomfield, New Jersey.)

During the war there arose a need for a secret communication system using an infra-red beam of light as the carrier for voice and code signals. A cesium-vapor lamp was developed which formed the modulated source of a searchlight-beam transmitter with a range of about 8 miles. Operating characteristics and construction details will be given for several sizes of lamps.

FREQUENCY-MODULATION RECEPTION

Chairman, M. G. CROSBY
(Paul Godley Company, Great Notch, N. J.)

16. Frequency-Modulation Detector Systems.

B. D. Loughlin
(Hazeltine Electronics Corporation, Little Neck, L. I., New York.)

The general performance characteristics of frequency-modulation detector systems, with a brief mention of the specific characteristics of systems using grid-bias limiters, locked oscillators, and ratio detectors, are reviewed. This is followed by the analysis of new detector systems with details of their general performance characteritics. One detector system has a variable-level threshold and one has no distinct threshold.

17. Broad-Band Frequency-Modulation Detector for Multi-Channel Communication.

W. J. Albersheim
(Bell Telephone Laboratories, Inc. New York, N. Y.)

To meet the wide-band and low-distortion requirements for a multichannel frequency-modulation receiver, limiters. coupling networks, slope circuits, and demodulators were engineered as a unit. Distortion was maintained less than 1 per cent with 5-megacycle swings and 15-decibel input-level fluctuations. Suppression of amplitude modulation was enhanced by push-pull detection. The slope circuits utilized the distributed reactance of coaxial lines.

18. A Method for Measuring the Instantaneous Frequency of a Frequency-Modulation Oscillator.

L. E. Hunt
(Bell Telephone Laboratories, Inc., New York, N. Y.)

The frequency-modulation signal is compared with a calibrated continuous-wace signal. This is done by gating the two signals alternately into a frequency-modulation detector and observing the oscilloscopic pattern produced. The horizontal line thus formed by the continuous-wave oscillator is shifted vertically by varying the frequency, and may be lined up with prominent parts of the frequency-modulation pattern which appear simultaneously.

19. Linearity in a Tuned-Transformer Frequency Discriminator.

H. R. Summerhayes, Jr.
(General Electric Company, Schenectady, New York.)

An analysis is made of the linearity of response of a frequency-discriminator circuit. The effect of the deviation from linearity in producing audio distortion when demodulating a frequency-modulated signal is discussed. A description is given of the design and testing methods for a low-distortion discriminator used in a frequency-modulation station monitor.

(Continued On Page Twenty-Four)

The Clamp Circuit : Part II

By C. L. Townsend

The theory, purpose, and function of a "clamp" in television circuits was thoroughly covered by Mr. Townsend in Part I, which appeared in our January 1947 issue.

Circuit Design

AN ACTUAL clamp circuit is shown in Figure (7). It is presented as being fairly typical, and offering a basis for discussion of circuit design. The lower-right hand portion shows an interstage coupling circuit commonly used in television, which is to have a clamp applied to the grid of V_5. A source of pulses is provided at the terminals marked "Pulse Input". These may be derived in many ways: from skimmed supersync, from the horizontal deflection yoke retrace stroke, or from a separate oscillator. The pulse source is not of present concern, except as it provides properly timed and polarized pulses of constant amplitude. The problem, then, is to utilize the pulses to correct the low-frequencies of the wave applied to the grid of V_6.

Usually the input pulses are of fairly low amplitude. V_1 is used as an amplifier and phase reverser, needed to provide large amplitude and proper polarity for the differentiation to take place on the input to V_2.

Differentiation is usually required in clamp service in order to obtain a narrow pulse through inherently narrow-band triode amplifiers. Such amplifiers might otherwise widen and distort the wave shape too greatly to be tolerated. Differentiation also permits the selection of a delayed part of the wave, useful in applications in which the clamp pulse is too early.

To obtain such differentiation the coupling between V_1 and V_2 includes a voltage divider whose factor of division is an inverse function of frequency. This divider is C_2 and R_5 in series. The value of C_2 is made such that its reactance at the low frequencies of the pulse wave is high in proportion to the value of R_5, causing a large voltage division. For the high frequencies of the pulse wave, however, the reactance of C_2 is reduced, and since the value of R_5 is constant, the voltage division is small. Thus the steep portions of the wave, where its high frequency components add in-phase, are passed on to the grid of V_2 with little division, while the horizontal portions are greatly attenuated.

Capacitor C_3 and resistor R_6 are merely a long time-constant coupling circuit provided to permit V_2 to be run partially self biased. If the pulses on the grid of V_2 take a small amount of grid current the lowest possible plate resistance is obtained in V_2, desirably reducing the source impedance for the clamp pulses. Also some small automatic gain control is obtained, tending to hold constant the output pulse size with variations of input or circuit constants. If the pulse amplitude at the grid of V_2 is smaller than is required to overcome the negative bias resulting from the presence of R_7, it may be necessary to return R_6 to a positive potential of appropriate value.

The differentiation circuit results in a wave shape similar to that drawn above V_2. The leading edge of the negative pulse drives negative, and the trailing edge drives positive. Since the grid of V_2 is self biased to some extent, the trailing edge voltage will lie on its normal operating characteristic, and if the pulse amplitude is great enough the leading edge voltages will fall below grid cut-off. This will result in only the trailing edge of the original pulse being used to drive the clamp. This will provide a delay which is assumed to be desirable. If no extra delay is needed the opposite polarity of input pulse will result in the use of the leading edge only, and minimum delay will result.

V_2 provides push-pull output. The output voltage waves are shown above the plate and cathode connections, and should be precisely similar waves of opposite polarity. To obtain equal amplitudes R_7 and R_8 are usually somewhat different in value, and these values should be adjusted to provide good equality in pulse output. If this is done no great trouble will be experienced in adjusting the "clamp balance" potentiometer R_{12}. Exact symmetry of pulses should not be expected, however. Due to the presence of R_7 the plate resistance of V_2 is quite high, making plate-to-ground capacitance more effective than is ussual in rounding the pulse corners. The source impedance of the pulse from the cathode of V_2, on the other hand, is very low, giving good high-frequency reproduction. This inherent difference in the wave shapes will not adversely affect the clamp operation under ordinary conditions.

The two output pulses are coupled to the dual diode V_3 through blocking condensers C_4 and C_5. Their values are such that C_5 and R_{11} in series with one half R_{12} produce a time-constant long in proportion to a pulse cycle. Similarly, $C_4(R_{10}+R_{12}/2)$ should be larger than $1/f$.

As previously explained, a bias builds up across R_{10}, R_{12}, and R_{11} in series. Point "A", the arm of the "Clamp Balance" potentiometer, will be at the same potential as point "B" during the diode-conducting times, since "A" and "B" are similar points of a bridge circuit. If, then, the arm of the "Clamp Balance" potentiometer is set at the electrical center of R_{11}, R_{12}, and R_{10} in series, this will be at zero potential, and point "B" will be clamped to zero. In certain applications, however, it is desirable to clamp "B" to some point other than zero potential. In such a case, the desired voltage is inserted at the point marked "Y". Such a voltage would be required, for instance, when the clamp is used in the grid circuit of a kinescope for DC restoration, if brightness control by grid bias is desired.

The "Clamp Balance" potentiometer R_{12} provides, also, some control of the ac balance of the clamp. The wave at point "B" should be watched closely while the potentiometer is operated, leaving it set at that point which results in minimum residual output. Even when the diode circuit balance is best some pulse from the clamp current is likely to appear at point "B". This pulse will be at least partially integrated by C_5 through R_{15}, producing a saw-tooth waveform. This saw-tooth should reverse polarity as the "Clamp Balance" potentiometer arm is moved through the balance point. This minimum saw-tooth obtainable should be very small if the design is good.

Those circuits which have very low video levels at the clamp point require a more accurate adjustment of balance than the high level circuits. Often it is difficult to obtain a residual sawtooth below .01 volt especially if external bias is added at point "Y". Any conductance in the grid circuit of V_5 will produce a sawtooth, since the capacitor

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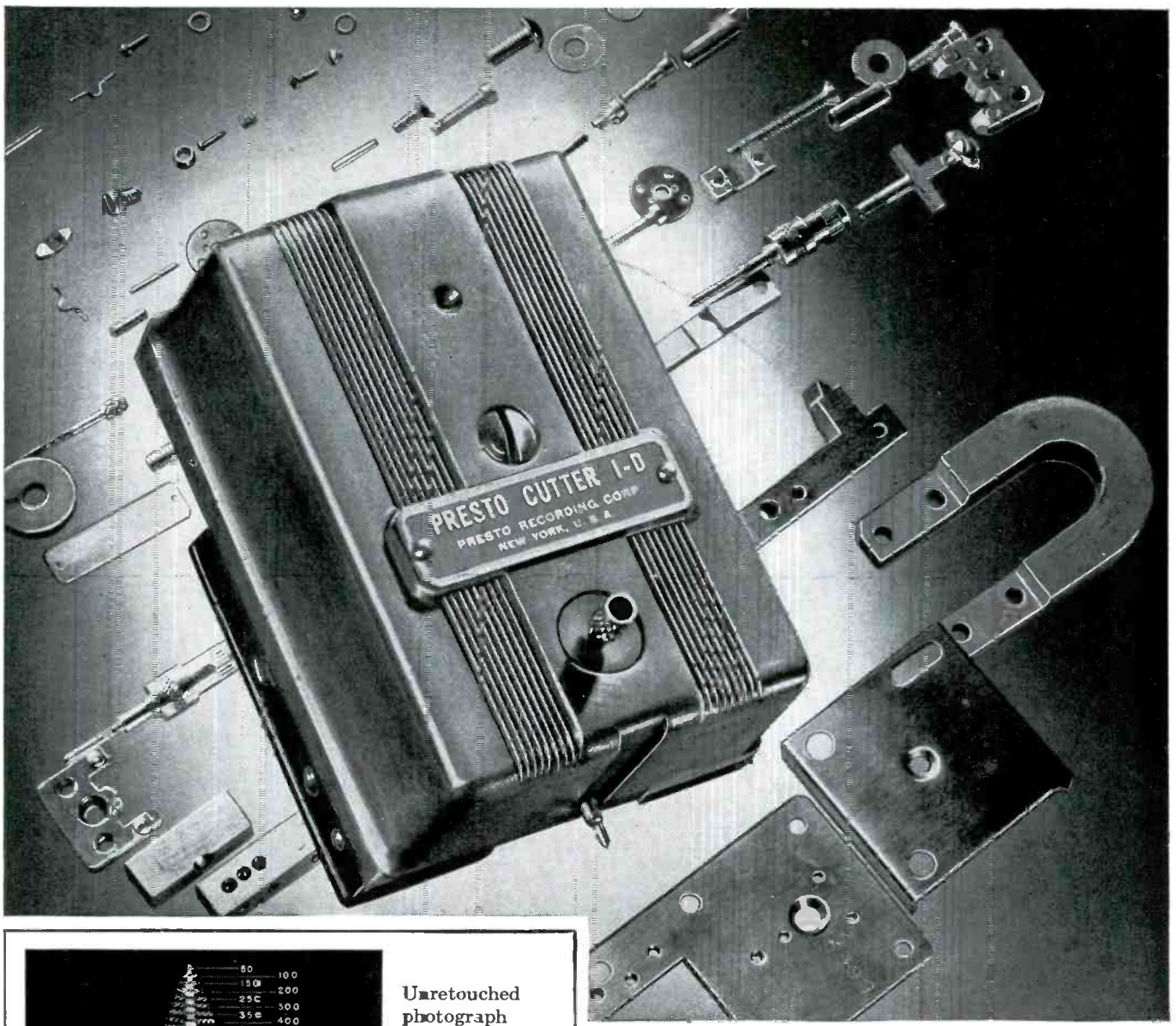
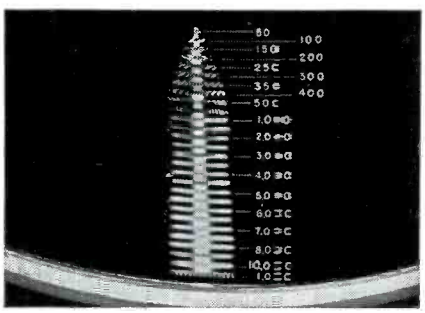
▶ The new Presto 1-D Cutting Head offers: *wide range, low distortion, high sensitivity* and *stability through a temperature range of 60°-95° F.* The Presto 1-D Cutting Head is a precision instrument made entirely of precisely machined parts, expertly assembled and carefully calibrated. These factors, plus its sound basic engineering design, produce a cutter unequaled in performance by any other mechanically damped magnetic device.

▶ Note from the light pattern below: The correct location of the cross-over point at 500 cycles, the 6 db per octave slope below this point, and flat response above 500 cycles, which is free from resonant peaks. The range of the cutter is 50-10,000 cycles. The Presto 1-D is damped with "Prestoflex" which is impervious to temperature changes between 60 and 95 degrees Fahrenheit.





Unretouched photograph showing the light pattern. Notice correct location of the cross-over point at 500 cycles.

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C_6 is charged during the clamp-closed period to the bias voltage. If some conductance causes this bias to leak off appreciably during the clamp-open period, a steep charging current will be required at the start of the next cycle, and the sawtooth will be present. Also, even when no external bias is needed a sawtooth may appear due to the action of V_5. This appears to be a function of the amount of gas in V_5. Positive ions go to its grid, making that electrode appear like a source of positive voltage. The action of the clamp forces this voltage to charge C_6 between pulses, and removes that charge during the pulse-on time, creating a sawtooth. Sometimes a very high value of resistor connected from V_5 grid to ground will load down this new voltage source to a point where it is negligible. The value of this resistor is usually from six to twenty-five megohms, depending on the tube. A low value of resistor will defeat the clamp action, and if external bias is needed, *no* resistor should be used as it would be a grid-circuit conductance, as mentioned above.

Given a maximum peak swing of either polarity on the grid of V_5 of twenty volts, the pulses from V_2 should be reasonably greater than 20 volts. A safe value of peak pulse amplitude would be 35 to 40 volts, a value easily realized with conventional triodes.

In all well-known video coupling circuits, R_{13} will be a value below three thousand ohms, fulfilling adequately the low source impedance requirement. The value of C_6 depends upon the actual tubes used, but in general it should be only large enough to provide a flat horizontal pedestal with the clamp working; the time-constant of C_6, and the circuit leakages should be long in proportion to the clamp cycle.

It is generally considered good practice to derive at least part of the grid bias for the clamped stage from a cathode resistor. In the case shown, V_5 is a cathode-coupled stage, with R_{14} and the load resistance providing the required potential drop. During the period between pulses the grid circuit resistance of such a stage is quite high, making cathode bias advisable. If additional bias is required, it should be inserted at the point marked "Y".

Limitations of the Circuit

In any circuit there are possible adverse effects which should be understood, and against which safeguards should be raised. The following discussion lists some of these in order that they may be avoided at once, rather than as the result of experience.

It has become quite usual to combine R_{11}, R_{12}, and R_{10} into one potentiometer. The entire bias developed by the diodes therefore appears across the "Clamp Balance" potentiometer. This bias is always large in proportion to the grid bias of the clamped stage. Accidential or rough adjustment of the potentiometer may result in its arm being far from electrical center. In such a case the clamped grid is held at the potential of the point at which the arm rests. Since one side of the potentiometer is highly positive, the clamped tube may lose its bias, or be biased highly positive, resulting in overload of associated resistors and possible ruin of the tube. Or, if the potentiometer arm is off-center negatively, the stage may be biased enough to produce saturation or complete cut-off. To avoid such difficulties the resistors R_{10} and R_{11} are inserted as fixed limits on the potentiometer. They are dimensioned to permit the use of a potentiometer large enough to care for normal tube and resistor tolerances, but too small to permit large errors of adjustment. Adjustment of the potentiometer is facilitated if a plate current indication for the clamped stage is provided. As a preliminary setting the potentiometer should be set in such a way that there is no change in the plate current when pulses are applied to the clamp. No video signal should be present during the adjustment. The direct current balance-point of the potentiometer may be quite different from the alternating-current balance point. This

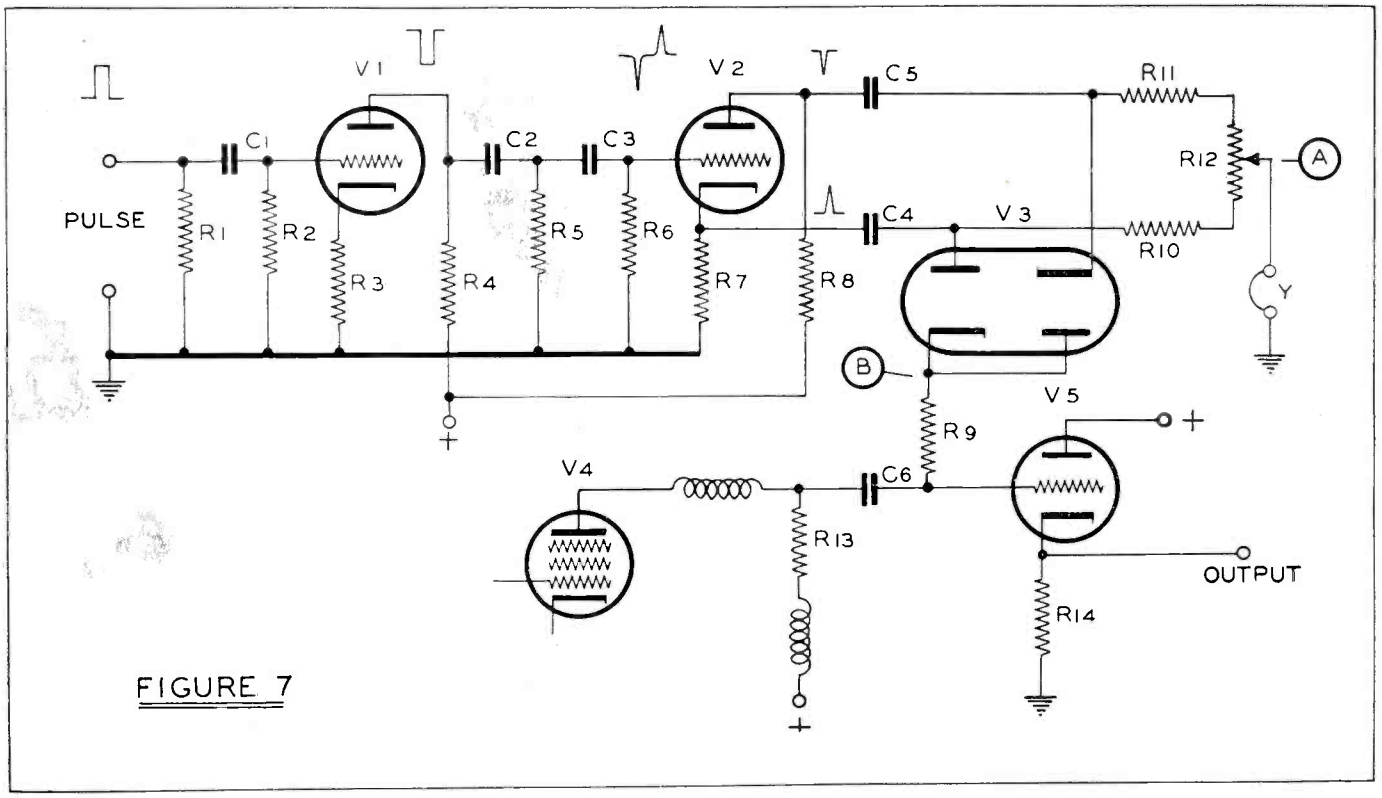


FIGURE 7

will be true when the two pulses supplied to the clamp are of different amplitudes. Since final adjustment is usually made to provide best ac balance, the dc balance should be acceptable at that point. Careful equalization of pulse amplitudes will accomplish this result.

It should be borne in mind that interfering frequencies close to the pulse frequency cannot be controlled adequately by the clamp. Attempts to eliminate frequencies having large change of amplitude during the time of the clamp cycle will result in "horizontal tilt" during certain portions of the field period, producing stripes of annoying intensity. Although all lines will begin at the proper black level, during that period when the interfering wave is increasing positively, the lines will shade toward white on the right hand side of the picture. When the interference is of negative polarity they will shade toward black. However, proper design of the amplifier preceding the clamp circuit should provide sufficient attenuation of these frequencies to eliminate their effect almost entirely, and permit the clamp to function only as an instrument for re-establishment of vertical pedestal and blanking.

Pulse timing may be critical in some instances due to a peculiarity of the clamped wave shape. If it is the intention to clamp on a narrow flat portion of the wave, the pulses should always be derived from the wave itself if this is at all possible. Use of a multivibrator, or deflection yoke pulses under automatic frequency control conditions may introduce shifts in pulse timing which would cause the clamp to operate when the input wave is not flat. In such a case the whole following line will be clamped to the wrong potential, producing stripes of polarity opposite to that of the signal at the clamping instant. If, for instance, the clamp time is so late as to get into picture time, and there is a white area on the left edge of the picture, the lines which should start white will be clamped to the black level, and a dark streak will appear to smear away from the white area, across to the right edge. When a steep portion of the input wave itself is used to make clamp pulses, timing once set will always be good. The problem then is the simple one of provision of proper fixed delay.

Although, due to bias on the clamp diodes, only the pulse tips are actually used, it is generally desirable to provide clean pulses. If the pulse waves are erratic in shape, it is difficult to get good mirror symmetry. In such a case, steep portions of the wave will be transmitted to the video circuit even though the diodes are cut off. This is due to the diode capacitance. The clamped tube grid circuit is very high impedance during the cut-off period, making the few micro-microfarads capacitance of the diodes a fair coupling capacitor. Pulse "troughs" should be free from rapid rates of change.

The use of R_9 is optional. It is included in the circuit diagram as an indication of a means by which the capacitance of the two diodes may be isolated from the video line. In extremely wide-band circuits this may be of some importance. A value of approximately 10,000 ohms is usual. The use of this resistor may produce inferior results if the clamp pulses are of too short duration to permit complete discharge of C_6. The discharge path impedance is usually near 7500 ohms. With C_6 set at 250 micro-microfarads, 63% discharge is obtained in about 2 microseconds. Usually more complete discarge is required, making necessary at least twice the clamp-closed time. With R_9 added to the discharge path, the discharge time becomes 4.2 microseconds for 63% discharge, and about eight microseconds for even fair performance. Under some circumstances the flat portion of the signal wave may not have a duration sufficient to permit such a wide pulse as R_9 makes necessary.

A rather serious problem arises if the clamp circuit is used when random high frequency "noise" is present. Ordinarily, noise appears in a television picture as short black or white lines having a duration equal to the noise period. However, when a clamp is used it is possible that a noise burst will occur during the clamp period. If that noise has a large energy content, it may add or subtract from the effective blanking amplitude, and the clamp level will be changed, making the whole following line differ from its proper brightness in the opposite polarity from the noise pulse. Consequently an interference which would ordinarily be a short white dash becomes a dark line across the whole raster. Thus noise, in some instances adding to the black level, and in others subtracting from it, can produce a field of rapidly changing stripes one line wide, affecting both contrast and definition adversely.

The presence of resistor R_9 may tend to reduce the effect of noise upon the clamp. R_9 and the distributed capacitance at its terminals may be thought of as forming a low-pass filter, effectively supplying to the clamp a band wide enough to establish the horizontal pedestal but not wide enough to permit the clamp to "see" the noise. In those instances in which R_9 is permissible a reduction in noise streaks may be obtained in this manner. Further investigation is necessary to demonstrate the usefulness of other low-pass configurations which may not seriously reduce the effectiveness of the clamp.

Figure (7) has shown triodes as pulse amplifiers. For the sake of clarity of function, some circuit details are omitted. Among these are oscillation suppressor resistors in both grid and plate leads. It is recommended that where large positive pulses appear on grids a resistor of two or three hundred ohms be used immediately at the socket terminal. Plate parasitic suppressors need not be used if point-to-point wiring with no interposed wires is used. If terminal board mounting of plate resistors is used, a suppressor of value of fifty to one hundred ohms provides a useful safeguard.

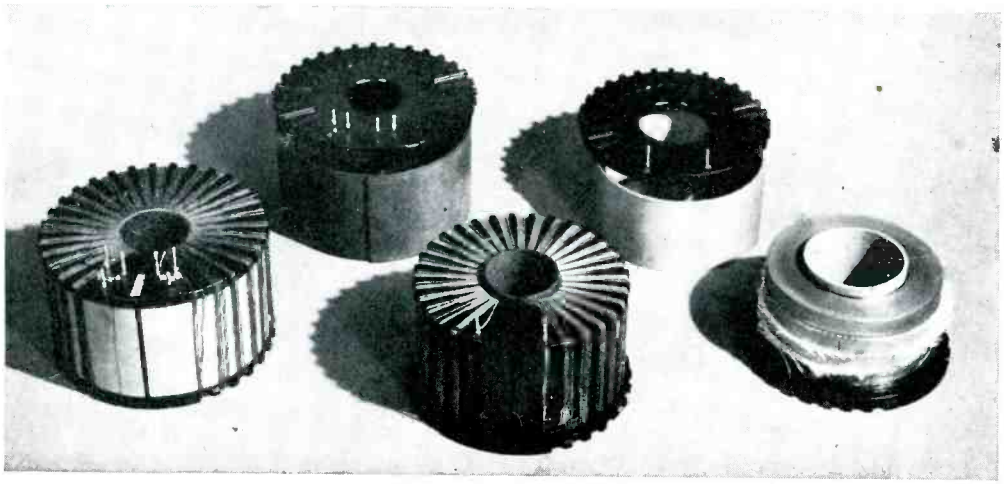
Conclusions

With care in design and good judgment in application, the clamp circuit described will give excellent performance of a type not duplicated by any other circuit. The advantages accruing to the user of a clamp circuit in simplification of low-frequency design, reduction in low-frequency interference, reduction in the number of large circuit elements, control of amplifier operating, points and saturation effects, and accurate direct current component restoration, make this circuit an important asset to the video designer. Its simplicity and ease of design should provide an ample basis for broadening application as new circuits and new uses are discovered.

Non-Linear Coils For Pulse Generators

By H. A. Stone, Jr.

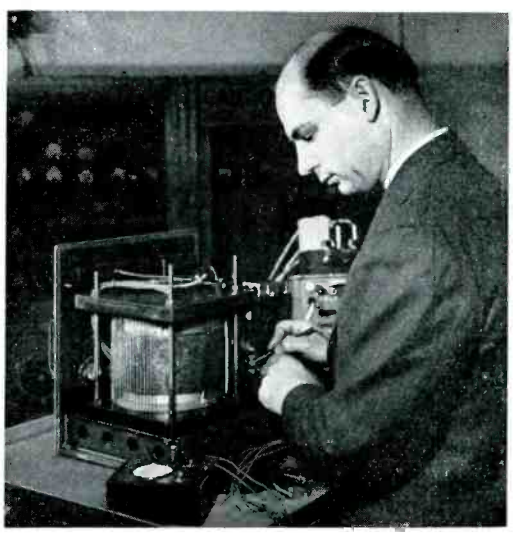
Transmission Apparatus Engineering, Bell Telephone Labs. (Reprinted from the Dec. '46 Bell Lab. Record)



Steps in assembling a non-linear coil shown from the stacked core at the right to the finished coil at the left

In electromagnetic apparatus, the term "non-linear" is usually applied to a coil with a core of high permeability that saturates at a relatively small current. Because the transition from the non-saturated to the saturated condition of such a coil is very abrupt—being accomplished by a very small change in applied field—such a coil may be treated as having two values of inductance: a high inductance at small currents and an extremely low inductance at large currents. The ratio of these inductances may be several thousand to one. Applications for such coils had been found prior to the war, notably as harmonic generators for carrier telephone and telegraph systems,* and as tone generators for dial and busy signals.† The non-linear coil made an early entry into the war as a phase modulator and harmonic generator for the SCR-508 and SCR-509 radio transmitters.‡

Another important contribution of the non-linear coil to the war was in its application as a pulse generator for radars. A requirement common to all radar transmitters is a source of high power in the form of short bursts, which may be the order of one microsecond in duration and repeated at the rate of a few hundred to a few thousand times per second. Vacuum-tube circuits were used in some early radars to form these pulses, and in others the pulses were obtained from the successive discharges of a condenser through a rotary spark gap. Although both of these methods were used with considerable success, each entailed certain disadvantages. The early vacuum tubes required frequent replacement, and were limited in the power they could handle. Burning of the points in spark gap mechanisms introduced instability in the timing, and the moving parts were subject to wear. To avoid these difficulties, attention was turned to non-linear-coil circuits to obtain the required pulses. Practical circuits have been developed and are in wide use. Non-linear coil pulse generators are characterized by comparatively long life, good stability, and operation from a relatively low-voltage power source.



Several different circuit arrangements have been used, but the simplified schematic on the opposite page will illustrate the principle employed. As shown here, the non-linear coil has two windings, one of which is supplied from a d-c source, and serves to magnetize the core to saturation in one direction. In other circuits, a single winding performs the functions of both the windings of the coil illustrated.

At the beginning of a cycle, there is no charge on the condenser, and no currents are flowing except the d-c in the bias winding, and the core will be saturated in what may be called the positive direction. As the plate circuit of the switching tube, which is controlled by a square-wave generator, becomes conducting, current supplied by the rectifier builds up through both the linear and the non-linear coils as indicated by the light solid arrows. The direction of flow through the non-linear coil is opposite to that of the biasing current, and the current is great enough to carry the core through the unsaturated region and then to saturate it negatively.

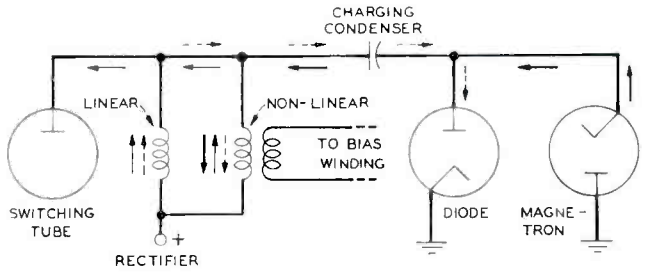
When the switching tube cuts off, the energy stored in the field of the linear coil, which is much greater than that of the non-linear coil, develops a very high voltage across the coil. A rush of current flows to the condenser, charging it through the diode to ground, and a smaller amount flows through the non-linear coil in a reverse

*RECORD, July, 1937, page 357. †RECORD, February, 1942, page 152. ‡RECORD, March, 1946, page 102.

direction. Current flow at this time is indicated by the dashed arrows. This latter current again carries the core of the non-linear coil through the non-saturated region and saturates it positively. The condenser has become heavily charged by the time the non-linear coil becomes positively saturated, and as the saturation point is reached, the non-linear coil acts as a short circuit to ground, and the condenser discharges through it and the magnetron at the right, as indicated by the heavy solid arrows. A magnetron voltage of about 25 kv can be obtained in this manner from a 6,000-volt rectifier, and the peak power of the pulse may reach 1,000 kw.

Non-linear coils for pulse generators are, as might be expected from the magnitude of the power handled, much larger and quite different in design from the harmonic generators for radio and telephone use, although both operate on the same principle of saturation. For contrast, the non-linear coil in a typical radio-telephone transmitter contains two hundredths of a gram of core material, whereas the coil in the SV radar has a core weighing 13 kilograms; six hundred and fifty thousand times as much! More than two miles of molybdenum permalloy tape go into each SV core.

The design of practical coils of this type is complicated by numerous conflicting requirements. The core is built up of thin magnetic tape which is highly sensitive to strain. It must not be clamped too tightly, and the edges of the tape must be protected from damage. Yet, in service it must be able to withstand severe shock and vibration without tearing loose from its support. Magnetic considerations dictate that the windings lie close to the core and to each other, while the high internal voltages demand generous separations to reduce the destructive effects of corona. Because of the power they handle, these coils are inherently large, yet since they are used in restricted places, severe limitations are placed on their over-all size. One example of the extent to which it has been necessary to go to realize small savings in space is illustrated by the coils that are shown on the next page and in the X-ray view. This non-linear coil was widely used in several radar systems. It will be noticed that the core and the coil are eccentric. This unusual construction was employed to provide the necessary spacing between the high potential winding ends and the core, and to reduce the spacing at the center of the winding where the voltage is negligible. The conventional concentric construction providing equal voltage protection would have resulted in an eighteen per cent increase in the coil volume. In most of the later coils, however, it was found possible to secure adequate separation without resorting to eccentric coils, and since the concentric types are easier to manufacture, the concentric coil is used wherever possible.



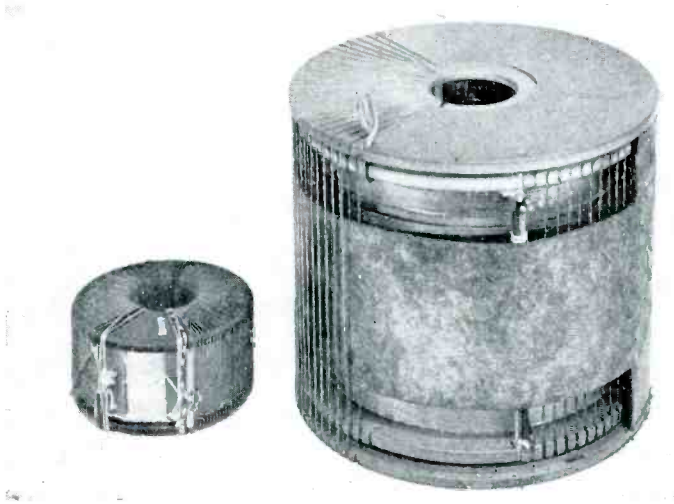
Simplified schematic of pulse generating circuit showing the position of the non-linear coil.

Molybdenum permalloy is used for the core material in all of the non-linear coils for radar pulse generators. Its high initial permeability, low hysteresis loss, and easy saturability at low fields make it by far the most suitable of the available magnetic materials. It is used in the form of tape one mil in thickness and $\frac{3}{8}$ to $\frac{1}{2}$ inch wide. The tape, insulated with a film of silicic acid, is wound into tight sections from 3 to 6 inches in diameter and weighing from 200 to 1,500 grams. From two to ten of these sections are stacked one above the other to form a core of the desired size, as shown on the opposite page. A slotted fibre tube inserted into the stack and sprung against the inner periphery prevents the core sections from moving out of alignment. The tube also provides support for the winding heads, as shown in the photograph.

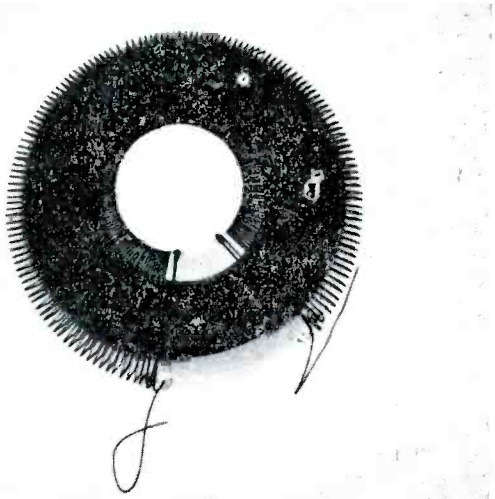
Glass cloth is used for cushioning between the core sections, and inner and outer cylindrical insulators of phenol fiber are placed around the core between the heads.

(Continued On Page Fourteen)

At left, a non-linear coil with an eccentric core; at right, a non-linear coil for the SV radar.

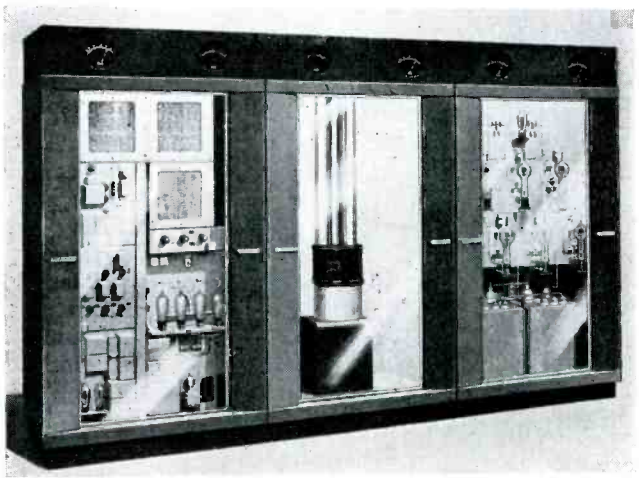


X-ray photograph of non-linear coil that is shown at the extreme left.



Latest Western Electric Equipment at I.R.E. Show

* "Transview" is the name given the new 10 kw FM transmitter, because of its unique styling. Full length front doors of glass provide continual view of the equipment during operation. The 506B-2 "Transview" transmitter uses a



grounded plate amplifier, having a gain of ten. Distortion for ±75 kc swing is less than ½% from 30 to 15,000 cycles. The photo illustrates the trade name very well.

* The 6BP portable Audiometer, for measuring hearing ability, and diagnostic tests.

* The Traveling Wave Tube, a development of Dr. J. R. Pierce of the Bell Laboratories; experimental results show a power gain of 10,000 over a bandwidth of 800 megacycles! (See our March issue for complete article on this revolutionary device.)

* The Model 64 Hearing Aid; features higher power output, greater sensitivity, smaller size, reduced battery drain.

* Deposited Carbon Resistors—not to be confused with carbon composition or "metalized" carbon resistors. Deposited Carbon Resistors consist of a very thin film of vapor-deposited carbon on the surface of a specially developed ceramic core; features high stability and precision, and are heremetically sealed in a glass envelope. General use resistors are not sealed; instead are coated with an insulating varnish which affords mechanical protection. These resistors are manufactured in values from 1 ohm to 50 megohms, and in power ratings from 0.5 to 600 watts for free air cooling. The 600 watt unit will dissipate 4,000 watts when subjected to forced draft of 200 cu. ft. of air per minute. Tolerance as close as ±½% can be obtained. These resistors feature extremely low capacity and inductance.

* Silicon crystal rectifiers. Feature low impedance in one direction to an applied alternating voltage, are usable in modulation, detection, rectification, and conversion of signals. Their advantages over electron tube diodes include smaller physical size, lower power consumption, smaller input and output capacitances, the absence of electron transit time effects, and the reduction of noise voltages and inter-electrode reactances, particularly at micro-wave frequencies.

* Quartz crystals from 1,200 cycles to 350 kc, in evacuated glass envelopes. Crystals ranging from 90 kc to 15 mc, in a very small hermetically sealed holder. Crystals between 1 mc and 4 mc also available in phenolic holders. The high frequency range from 15 mc to 50 mc is covered by crystal units in hermetically sealed holders employing a coaxial type of construction. This latter group of crystals depends upon mechanical harmonic output of the crystal itself, rather than electronic harmonic generators. Small temperature controlled ovens are also available, which will maintain frequency stability of these crystals to .001 percent.

* A high-speed, high-frequency double-triode triggering tube, oscillated up to 800 mc in open-line resonant line circuit, with the two sections in parallel. Tube is ⅞" diameter, 1¾" high. An internal shield is built in, permitting operation of each triode section in different circuits. 6.3 volt heater, 300 volts at the plate at 18 miles per section, maximum plate dissipation 1.5 watts per section.

* Other WE tubes: 10kw FM tube, type 5541, with full ratings to 100 mc. Type 5530 is similar, but for grounded-grid applications to 110 mc.

* Three lines of output Auto-transformers. 25A, 26A, and 27A types, rated at 4, 16, and 64 watts, 50 to 15,000 cycles. Taps are provided for power output reduction. This apparatus intended for loud-speaker distribtuion matching, etc.

* AC operated pre-amplifiers and main amplifiers for public address and sound distribution; preamp power is obtained from the main amplifier. Frequency response meets FM requirements.

* An AC-DC amplifier that may be grounded. No special grounding arrangement is required, and amplifier noise is not a function of ground connection. Underwriter approved, and may be used to feed or feed from telephone lines without isolating coils.

* Program distribution system developed for railroads and other carriers. One to four channels are provided for passengers' choice. Crystal controlled radio receivers, and high quality magnetic wire reproducers provide the program source. Provision is also made for train announcements, etc., of interest to the passengers. Each of the two wire recorders provide three hours of continuous entertainment.

* A new, Wired-Program console for wired-music distribution systems. Includes two, two-speed turntables, clock, and volume indicator. Accessories available: loud speakers, switches, volume controls.

* Relay Program Dispatching Equipment, will transfer outputs from ten different studios to any of six different outgoing lines. Provision is built in for Master Control switching, or remote switching from studio engineer's console. Presets for upcoming programs are made from the Master Control position.

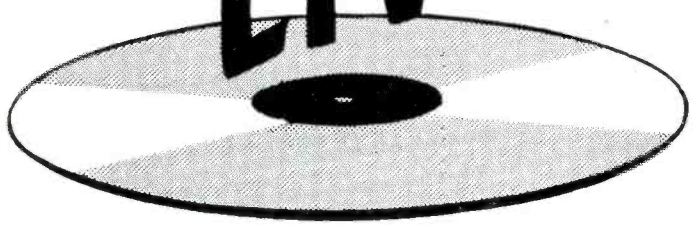
* Control Room Consoles are individually constructed to meet individual requirements. Low and high-level jack fields are separated to minimize cross-talk. Plug-in construction facilitates removal and replacement of components for maintenance.

* Microphones—the 640AA, 639, etc., are completely described and illustrated in our March issue article, "Microphone Theory & Data."

* Portable 22-D Speech Input Equipment for nemo and remote pickups. Features a large VU meter with a choice of scales; line-shorting keys to permit program loop resistance checks prior to transmission; compact and light weight; frequency response ±1 db from 30 to 10,000 cycles.

(Continued on Page Fourteen)

THE "LIVE" ARTICLE . . .



IT NEED not be wishful thinking when you dream of making your next recording sound like the "live" article. It's done every day by studio engineers who use Advance Recording Blanks. These splendid blanks have a high rating for tone, cutting action, long life and consistent uniformity. A try-out will prove it to you like all get-out!

Advance
Recording Products Company

36-12 34th STREET · STillwell 4-7837 · LONG ISLAND CITY, N. Y.

W. E. Equipment

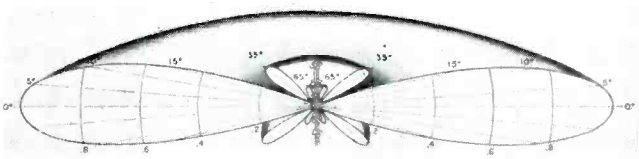
(Continued from Page Twelve)

* Type 248A, 250 watt Marine Radiotelephone, is complete from handset to antenna, with instant selection of thirty optional frequencies between 2 and 20 megacycles.

* The new 1304A Turntable, with a unique motor-reversal method of driving two different clutches and pulley systems, to attain 33 and 78 rpm. Speed is stated to be constant ±½% over long periods. The pickup is a combination vertical-lateral; the swivel end of the pickup arm is equipped with a simple but effective mechanical limit which makes it impossible for the pickup stylus to hit the turntable when a record is not in position. The turntable top is mechanically isolated from the cabinet, and it is possible to bump the cabinet while a record is playing, without danger of the pickup arm skating across the record or so much as hearing a thump on the monitoring loud speaker. Average flutter including "wow" is stated to be less than ±0.1% at either speed.

* Loud Speakers. The 757A is said to have uniform response from 60 to 15,000 cycles; it is a dual-unit complete with cross-over filter. The 755A is a single unit, 8 watt speaker with a response of 60 to 13,000 cycles.

* Thermisters are thermally sensitive resistors having an unusually high negative temperature coefficient. They react equally to changes in ambient temperature, and to current flow thru them. They are small, inexpensive, and have indefinitely long life. Ideally suited for temperature measurement, control, and compensation; power indicators, delay devices, surge suppression; volume limiters, compressors and expanders, automatic gain controls, etc.



* The Cloverleaf FM antenna type 54A provides horizontal polarization with circular azimuth pattern. Designed to handle up to 50 kw, and comprises an array of two or more stacks. The gain of the 54A with a maximum of eight stacks is 4.7. The photo shows the radiation pattern for a five-unit array.

COILS

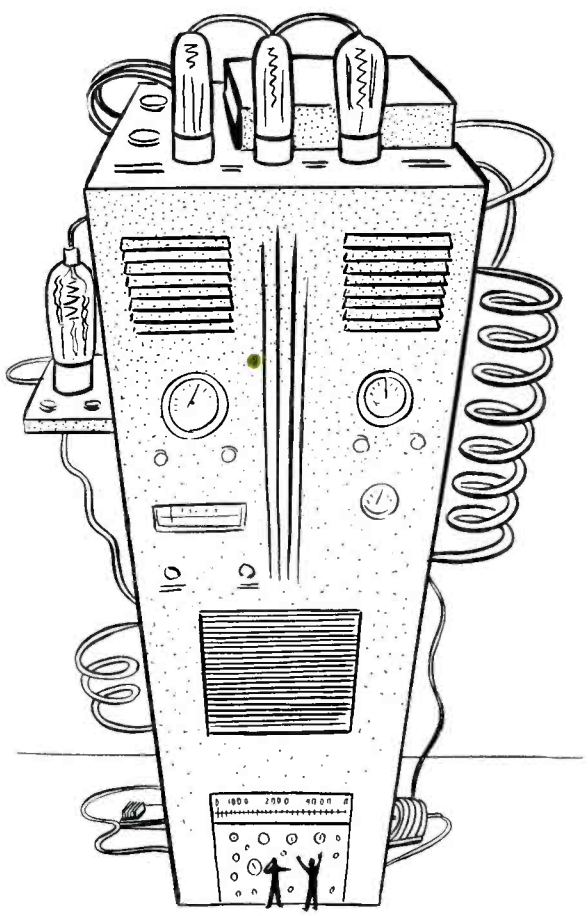
(Continued from Page Ten)

After the two heads and the insulation are in place, the inner, or pulsing, winding is put on the core assembly and connected to terminals as shown second from the right in the illustration. After the inner winding is completed, a similar set of insulating heads and tubes is placed over it to support the outer, or biasing, winding. The cylindrical insulation around the inner winding extends over the inner heads, and only the outer heads and insulation are visible. Holes in the outer head permit the terminals from the inner head to project through them, while terminals for the outer winding are mounted on the outer head directly. Both inner and outer heads are provided with radial projections between which lie the turns of the windings. This permits the whole assembly to be firmly clamped without damage to the windings.

The coil that is illustrated has a 1,000-gram core, and a 20-kv pulse is generated across the inner winding. For larger coils, with operating voltages up to 40 kv and more, phenol plastic insulators are unsatisfactory. Although the entire assembly is immersed in oil, corona rapidly disintegrates this type of material, and most organic materials are affected to some extent. The coil for the SV radar operates at 42 kv across the inner winding. The winding heads are machined from glass-bonded mica, and the cylindrical insulators are a built-up material of mica flakes bonded with a small amount of resin. Since this material becomes soft at high temperatures, it cannot be used as a bearing member, and in this coil a brass tube through the center of the core stack is used for support of the winding heads.

To save the space that would be required for many separate components individually sealed and each provided with its own high-voltage terminals, the non-linear coils are wired into a common chassis with the other elements of the pulser network, including the charging condenser, linear coil, magnetron filament coil and several small coils and condensers whose function is to "shape" the generated pulses by providing resonances in the circuit. The entire assembly is immersed in oil in a welded steel can. Such a chassis with the non-linear coil is shown in the photograph at the head of this article.

Radars equipped with non-linear coil pulse generators are widely used for search and firecontrol on surface vessels and submarines. Nearly ten thousand non-linear coil pulse generators have been manufactured by Western Electric for the Navy.



"Look, Joe, here's a new gimmick hot from the IRE show—an "all-electronic" income tax computer!"

AIRBORNE TELEVISION NETWORKING

Stratovision

TELEVISION and FM radio waves travel in a straight line and, for all practical purposes, stop at the horizon. This means that television broadcasts from the highest practical tower erected on the ground can be received only from 35 to 50 miles away.

The Stratovision system simply puts the antenna and transmitter in an airplane flying in lazy circles 30,000 feet above the earth, out of sight of human eyes. The shortwaves sent out from this airborne antenna would blanket the earth's surface like a great inverted ice cream cone, covering an area approximately 422 miles across, or equal to about the combined area of New York, Pennsylvania, and New Jersey.

Reception of Stratovision broadcasts would be practically free from interference and distortion, caused normally by reflected ground waves and the numerous amplifications or relaying stages required by any previously proposed system to carry television and FM broadcasts over a comparable area.

First studies of the Stratovision system were made by C. E. Nobles, 28-year-old Texas born engineer, with several highly confidential radar developments to his credit, late in 1944 and early in 1945. Full scale development was begun by Westinghouse with cooperation of The Glenn L. Martin Company, pioneer designers and builders of fine aircraft, in the fall of 1945.

Under flight test since late 1945, Stratovision has delivered a usable signal over a distance of 240 air-line miles from an altitude of 25,000 feet, using only 250 watts of power.

Early Estimates Verified

Transmission characteristics of both television and FM have been studied during airborne tests. Television work has centered around the problem of "ghosting"—the annoying out-of-register viewing which occurs when a receiver picks up a signal by two different wave paths, one in direct line from the transmitting antenna, the others by reflection from some intervening object.

FM data have been obtained on transmission in the new band above 100 megacycles by a constant recording of field strength of a carrier wave, both modulated—that is, with voice or music superimposed—and unmodulated.

Although tests are far from complete, findings to date are verifying the early and optimistic estimates of Stratovision possibilities.

This article on Stratovision was prepared by the Westinghouse Co., and appears here to provide our readers with the latest authoritative information on this interesting and possible form of networking—including AM, FM, Television, Facsimile, etc. The first stage of the exhaustive testing is now complete, and was concerned with measurements of field strengths as a check against the theory. The planes used had a ceiling of 20,000 feet. The second phase of the testing will be done with a super-fortress type of plane, with a 30,000 foot ceiling; these tests will check actual FM and Television program transmission quality and stability. Additional information will be presented in accordance with reported progress.—Ed. S.

The system promises to make coast-to-coast television and FM broadcasting possible at a reasonable cost and permit these services to be broadcast to even the most isolated farm homes many years ahead of any previously suggested system.

This would be done by reducing the astronomical expenditures which have hampered all earlier concepts of nation-wide television service.

The Stratovision system is the most economical one yet proposed. The startling fact is that as the height of a television or FM antenna is increased, the amount of power required to deliver a usable signal throughout the 422-mile-wide receiving area covered by a plane-borne transmitter 30,000 feet in the sky, is only one-fiftieth as much as is needed by a 50 kilowatt transmitter on the ground covering an area only 100 miles in diameter.

The Westinghouse Stratovision system would employ a low-powered ground transmitter to beam television and FM broadcasts to a specially-designed high-altitude plane circling slowly overhead. The plane would be equipped with receivers and transmitters for rebroadcasting these programs back to the earth.

System Is Flexible

As now conceived, the plan would employ four television and five FM transmitters on each plane. This combination, however, is predicated only on economy of operation and could be changed at will without altering technical aspects of the system.

A coast-to-coast network for relaying television and FM programs from plane to plane between New York and Hollywood would simply require stationing eight such stratosphere planes above strategic areas spanning the continent. To provide comparable service by ground installation would require approximately 100 costly relay towers and hundreds of transmitters; or a coast-to-coast coaxial cable network which is estimated to cost at least $100,000,000.

The eight planes in the Stratovision relay system might fly over New York, Pittsburgh, Chicago, Kansas City, Curtis, Neb., Leadville, Col., Salt Lake City, and Los Angeles, linking logical talent centers in New York and Hollywood. By adding six more planes over Durham, N. C., Atlanta, Memphis, Dallas, Sacramento, and Portland, Ore., it would be possible to provide Stratovision coverage for 51% of the nations' area and 78% of its population. Similarly, 100% coverage might be attained by adding more planes.

Costs Reduced

By cutting costs, the Stratovision system places television and FM transmission on a sound and economically justifiable business footing for the first time. It precludes the tedious city-to-small-town growth necessarily envisioned by all earlier plans, and it promises to make both services available to isolated rural homes which could not expect them for years, if ever, by any other system.

It holds promise, too, of a mighty bulwark of employment as expanded television and FM coverage creates the need for receivers with which to enjoy these new services. Its influences on everyday living may well become as far-reaching as those of radio broadcasting itself, which was introduced by Westinghouse at KDKA just 26 years ago.

Development of the system is based upon electronics "know how" which has been vastly increased by Westinghouse work on military radio and radar, and on aviation experience gathered by the Martin Company over the years and greatly augmented by war production.

Experiments show that the system is completely workable in any of the several television and FM frequency allocations by the FCC. Operation improves, however, in the higher frequencies and

this means that the system will hasten the day of practical color television.

Radar-type Link to Be Used

Discussing details of the system, Mr. Nobles, its young creator explained, programs would be originated in conventional ground studios connected with plane transmitters by a special beamed-type ultra-shortwave radio link, much like those used in radar. Similarly beamed plane-to-plane connections would be employed to form the nationwide high-altitude relay network.

The only advantage in mounting several transmitters in the same plane is to provide greater choice of programs and for economy of operation, since each transmitter would function as a separate station.

Contributing to economy of the system is the fact that as the height of a television or FM antenna is increased, the amount of power required to deliver a usable signal throughout its line-of-sight area is sharply reduced. Thus, power to operate all nine transmitters and all monitoring and relaying equipment can be provided by each plane's engines.

"Ghosting" Problems Reduced

The system would bring television and FM to millions of new viewers and listeners, but in addition it would greatly improve these services for audiences—old and new.

For example, best reception requires that the antenna of each receiver have directional characteristics and be pointed directly toward the transmitter antenna. This means that, for best results, the antenna for each ground receiver must be movable, and each receiver equipped with a mechanical device for bringing its antenna to bear exactly on the transmitter of each new station from which a program is desired.

Stratovision eliminates this need since one fixed antenna installation at the receiver can be beamed so as to cover the entire small-circle course of one plane flying at 30,000 feet, keeping it constantly in "view". Such an installation will insure access at all times to all programs of every station operating a transmitter in that plane.

Another distinct advantage resulting from Stratovision's high-altitude operation will be a sharp decline in "ghosting".

Repeater Amplification Minimized

Stratovision reduces the possibility of these reflections because its high-altitude operation will enable receiver owners to point antennas into the air—above mountains and other ordinary sources of ground reflection.

In addition, movement of the plane will make any reflection which might occur of only very brief duration—so brief, perhaps, as to be undetected by the eye.

Still another advantage of the plan—one of special interest to engineers concerned with television and FM relay systems—is the fact that Stratovision will drastically reduce distortion resulting from repeated amplification.

Each repeater station adds its quota of distortion to a television or FM program and any ground system because of its many repeaters would, of necessity, build up a great amount of accumulated distortion. On the other hand, Stratovision, requiring only fourteen relay points to serve 78% of the population, would all but eliminate this problem.

The real key to Stratovision operation is its ability to take an antenna high into the sky. William K. Ebel, Engineering Vice-President of the Martin Company, readily admits that the Stratovision system is one to stir the imagination; but he doubts that it presents any radical problems of aircraft design or operation. He regards the system as opening a new frontier to aviation, and points out that Stratovision transmitters for television and FM service represent one more in the long list of major services which aviation is providing for mankind.

Slow Airplane Required

One of the most unusual features of the Stratovision system is its need for a slow airplane. After years of striving for progressively greater speed in all design and construction, the Martin Company finds it intriguing to be asked to build a huge heavy-load plane to fly only fast enough to remain safely aloft at very high altitudes. Yet, by the very nature of its operation, that is all the system requires.

Present plans call for all-metal, low-wing monoplanes with completely supercharged cabins and power plants similar to those proven in wartime operation of the B-29. They will carry the most modern blind-flying, radar, and anti-icing equipment, and take-offs and landings will be accomplished, when necessary, under bad weather conditions.

Each plane will carry a four-hour reserve fuel supply. This will provide a 50% safety factor in any emergency, and, in addition, will make it possible—in the event of unusually bad weather at any operating base—to serve the storm-bound area from planes operating out of adjacent bases and flying to and from the broadcast location above the storm.

Tentative operational schedules call for take-offs at staggered four-hour intervals with each plane remaining at 30,000 feet for eight hours—four hours of broadcasting and four hours as a standby. This means that four planes will be required for each operating area—with two in the air and two on the ground at all times.

In addition to its nine transmitters and monitoring and relaying equipment, each plane would afford galley space and a lounge for the flight crew of three and six radio technicians.

In most cases planes would be based at their broadcast locations, although in some instances those serving adjacent areas might be based at a common mid-point for convenience and economy. Such a joint base might be located on the eastern seaboard where planes serving broadcast locations at New York City, Pittsburgh, and Durham, N. C., could operate out of a common base at Washington, D. C.

In addition to its four high-altitude planes, each broadcast location would have a smaller plane equipped to act as a flying remote pickup unit. This plane would be available to cover any special event or emergency within the location's 103,000 square mile area, relaying television and FM programs to the parent plane for local broadcast or for nationwide network presentation.

About Rochester

By George W. Wilson

SO, THERE was not a word about Rochester in the last issue of the Journal. Of course not, how could there have been? I didn't write one. No alibi's at all fellas—nothing appeared—there was nothing written and that's that.

It seems there has been a bit of discussion lately on the subject of what kind of news the local column should contain. Some say no Ham talk—some say no personal items—some say no description of the local flora and fauna, and when it is all boiled down there remains nothing at all to write about—yet if a column is missed everyone yells a mighty protest. Hence, from now on, and with the able assistance of Don Anderson, who by the time the next column appears should be back on the local job, this news will contain stuff about any subject which the writers and members think news-

worthy. If Craig Williams ever comes to work without a days growth of beard, we'll tell you. If a native gal in the South Seas answers Al Keltz when he calls CQ, you'll know about it. Or, if Bert Allis finds a new litter of pups in his house, you may be sure it will make head-line news.

The Lynch brothers, Ed and Walt, are re-living their high school days. In fact they are noticing things in the feminine department of the present generation which they feel they didn't fully appreciate during their years in the halls of learning. The two boys have been doing remotes from vicinity High Schools for the past several months, and each time return to the studios with some new and highly descriptive observation. Tisk, tisk, m'lads.

Yup, there is a new radio station in Rochester. It's WRNY, a 250 watt daytime job—they are really doing a fine job, and 'twould seem the engineers have a friendly leaning toward NABET. We all wish the station the best of luck.

The names mentioned above are all from WHEC—and as Don Anderson will be adding to this column next month I'll let him bring the WHAM angle up to date at that time. So, until then, 73.

FM News

* Production of combination FM-AM receivers rose sharply over prior months. (51,000 units in January). ***
* Some talk of FM inter-channel interference. This is not new to those familiar with the problems, and was thoroughly covered by Mr. Raymond F. Guy, FM authority, in an article titled, "The How and Why of FM" which appeared in the Sept. 1941 issue of this Journal. Some of present trouble claimed to be insufficient selectivity in some of the FM receiver models. FMA and RMA are huddling for an early solution. ***
* Higher price for equivalent FM receivers still the big sales deterrent; present minimum about $60. A $40. model is reported in production. ***
* WTMJ has on order an RCA 50 kw Type BTF-50A FM transmitter, which features motor-driven tuning, air cooling of intermediate and final stages which utilize grounded-grid circuits, and a novel overload circuit which re-applies power three times, and locks out after the third re-application of power, and remains locked out until manually reset.

A recent publication on television said an engineer must be combination of artist, photographer, philosopher, and psychologist! At the request of Carlos Clark, Walter Mullaney, Tambo Tamburri, Bob Potter, Mac McArdle, Hal Bowdin, and Bill Waterbury, we hereby present a facsimile of the combination ready for a mobile pickup. We're sorry the loaded dolly doesn't show.

New York Television News

By Jack Irving

CONGRATULATIONS are in order to Tommie Lyman, the latest to join the ranks of the benedicts at East Orange January 9th. She is the former Harriet Carol Golbas of Rome, N. Y.

This is the story of the two gentlemen at West Point. During the football season when the field group was televising Army flattening everything in its path, the group was quartered in a bungalow near the Bear Mountain Inn. The bungalows, incidentally, are part of the Inn. Upon arriving at the bungalow Bob Long and your scribe entered the cabin slowly, enjoying the beautiful setting in the pine forest. After picking ourselves up from the floor where we were thrown in the mad rush by Mullaney and Snell, we found them in possession of the only two good beds. It seems they had been there before.

One of the interesting shows done by the Blue Division was the racing and fancy skating at the Brooklyn Ice Palace. Among the minor troubles encountered was lack of lights so flood lights were installed and everything looked fine. A few minutes before air time the switch was thrown and out went two rows of lights and the lights in the lobby and box office. This made ticket sales a matter of intuition. The 30 amp fuses on our distribution panel were all right so after a further check a 15 amp fuse was found blown in the main feeder in the basement. McArdle claims he saw the house electrician head for the basement with the replacement fuse—a crow bar.

Alfie Jackson provided the horrible example for Ollie Fulton and Mr. and Mrs. Ed Read on their skiing trip to St. Adele Lodge in the Province of Quebec recently. Jackson, who hadn't been on skiies in five years, was doing all right by the time the party left. We don't know how Mr. and Mrs. Read got home but the trials and tribulations attending Fulton and Jackson on their motor trip back are far too many to chronicle here.

The Lincoln Day dinner had its exciting moment when one of the engineers went out on the roof at the Waldorf on the 18th floor to lower the

coax. A house dick, seeing him go through a window to the roof, had him covered by a .32 when he inquired what he was doing out there!

Oggie Bowman, the inveterate pipe smoker in the field, gave off strange odors at the Newark Armory. It was some time before Oggie discovered the lighted pipe he put in his handkerchief pocket had burned its way to the bottom of his jacket. Many of those close by contended it was far better than the tan bark and chocolate bars Bowman usually smokes.

Frank McArdle, a member of the New York Athletic Club, felt in an expansive mood the other morning when leaving the steam baths at the club. He left a quarter to the attendant and another quarter to the hat check girl. Mac went to the Automat for lunch and discovered his luncheon companion was the steam room attendant.

Al Protzman, who after the last NABET meeting kept everybody at the bar 'til the wee small hours, had reserved a room at the hotel so didn't care about the time himself. Protz contends we are unfair in not writing about the studio and maintenance gang. We will be very glad to, if youse guys will give us some informaiton instead of the standard "nothing ever happens here."

Entering the Barbizon-Plaza by the front door just to do it once, Walter Mullaney and Tiny Carson sauntered across the lobby as reasonable facsimiles of men about town. The portrayal was completely ruined when the bellhop, in response to their sotto voce question, loudly directed them to the freight elevator.

Bob Galvin, "B.B." to the field, will soon be passing out the cigars. We hope this rates us one.

Television News

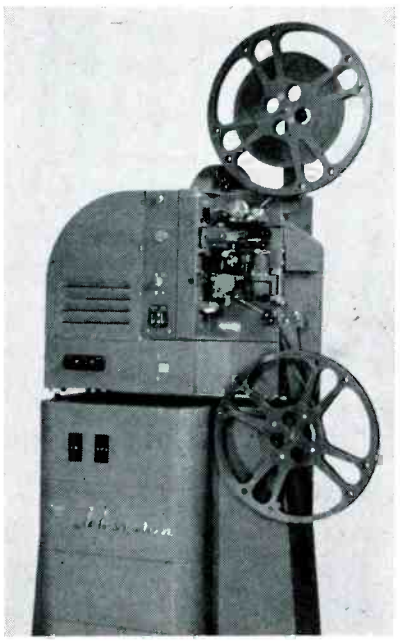
* 5,000 table-model television receivers were manufactured during January.*****

* WNBT, NBC-New York tele outlet, is planning hike in rate card based on estimated 20,000 receivers in its service area; original rate card structure based on 5,000 to 7,500 receivers. Some sources expect television to be self-supporting within 3 years, and show profit in 5 to 6 years. In 5 years, all of the Bell System's projected coaxial cable installations, planned ten years ago, will have been installed and available for nation-wide television networking.*****

* WTMJ, Milwaukee Journal station,

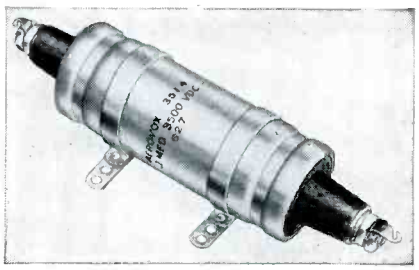
has contracted to purchase complete RCA Television studio and broadcasting equipment. Includes two image orths, field pickup equipment, 5 kw transmitter, 16mm motion picture projector, film pickup camera, and 3-bay turnstile antenna.*****

* Dr. DuMont anticipates great industrial, safety-device, and public institution (prisons, hospitals) use of television. Now, where only a small group of students can see and hear an outstanding authority and lecturer, the television medium permits a limitless classroom. In the application to highway safety alone, infra-red television installations could pay for themselves in a few years, thru reduced accident claims, reduced automobile insurance premiums, and less cluttering-up of hospitals and cemetaries with automotively-maimed bodies.*****



* This new 16mm motion picture projector, developed by RCA especially for telecasting purposes, will facilitate the use of newsreels, a wide variety of short film subjects, and film commercials, contributing to low-cost television programming. The new projector, RCA Type TP-16A, projects regular 16mm motion pictures onto the light-sensitive element of the electronic pick-up tube in a television camera. The projector uses an F.2 projection lens and features the famous RCA rotary stablizer on the sound drive. Mounted in the lightweight pedestal are 115-volt single-phase and 220-volt three-phase circuit breakers and the field supply for the special three-phase motor.*****

* To meet the elevated voltages encountered in television receivers as well as in cathode-ray oscillographs, Aerovox Corporation of New Bedford, Mass., has extended the voltage ratings of several standard paper and oil-filled capacitor types. The well-known tubular paper capacitors, Series "84," are now made in ratings up to 10,000 volts D.C.W. The midget-can Series "89" and the round-can Series "12" and "14" are available in extended voltage ratings from 3,500 to 7,500. As a further safeguard in the satisfactory handling of elevated voltages, the Series "14" is available in the double-ended design or with pillar terminals at either end and with two adjustable ring mountings.*****



* The RMA Board of Directors accepted by unanimous vote a report from Dr. W. R. G. Baker, Director of the RMA Engineering Dep't, on the appearances of special RMA committee chairmen before the FCC in opposition to the establishment at this time of commercial standards for color television.*****

* One of largest and lucrative tele advertisers will be Chambers-of-Commerce and other co-op groups at the nation's numerous vacation-spots; hotels; railroads, steamship and air travel groups, tourist services, gasoline companies and travelers check groups. Travel films, and resort scenes and atmosphere reenacted in the tele studio will do the trick!*****

* DuMont Labs is perfecting modulated light-beam as means of point-to-point television relay. High power light source, capable of 5 mc light-intensity modulation, is reported by DuMont to be free of static and ghost-image effects, and works equally well day or night.*****

* KSD-TV, St. Louis Post Dispatch, is enthusiastic about its RCA image orths; pictures reported as excellent for studio use, thus avoiding high intensity lights needed with iconoscopes. Further, the 300 to 400 foot-candles needed for high-lighting, and general illumination permits the image-orth lenses to be stopped down, resulting in much greater depth of focus and greater overall detail. KSD-TV is also equipped with an RCA micro-wave klystron link, operating at any selected frequency between 6,500 and 7,050 mc.*****

* The Philips Labs delivered two papers before the IRE Convention relating projection television developments in Holland; summaries of these papers follow:

Cathode-Ray Tube and Optical System by H. Rinia, J. de Gier and P. M. van Alphen

The cathode-ray tube is 10 inches long and has a 2.5-inch diameter face. The face plate is accurately ground to satisfy the requirements of the optical system, and the phosphor is metal-backed to increase the light output, contrast and useful life. The small spot size required for the resolution of a standard 525-line television picture is achieved by using a high accelerating potential (approximately 25 kilovolts) in conjunction with unusually precise construction of the electron gun assembly and the tube neck. Efficient magnetic focusing and deflection are achieved by the use of a small neck diameter (13/16 inch).

The dimensions of the projected picture are 12 x 16 inches. A modified Schmidt optical system is employed. The insertion of a plane mirror between the spherical mirror and the correction plate increases the efficiency of the system and results in a very compact structure. This also permits the use of a simple method for the alignment of the correction plate. The diameter of the spherical mirror is 6.7 inches, and the linear magnification is 8.5. The correction plate consists of a gelatin layer molded to a flat glass disc by a simple process which does not require exceptionally close tolerances in the mold.*****

High Voltage Unit and Deflection Circuits by J. Haantjes, C. J. Siezen and F. Kerkhof

A voltage tripling interruption type high-voltage unit is used. Newly developed magnetic ferrite material increases the circuit efficiency and permits a substantial size reduction in the transformer. All high-voltage components, including the special rectifier tubes, are sealed in an insulating medium. A two-tube driver utilizes feedback to stabilize the high voltage output, giving a drop of approximately 1.5 kilovolts from no load to the peak current of 150 microamperes.

Highly efficient circuits for magnetic deflection have been developed. The output stage for the horizontal deflection comprises a power output pentode and

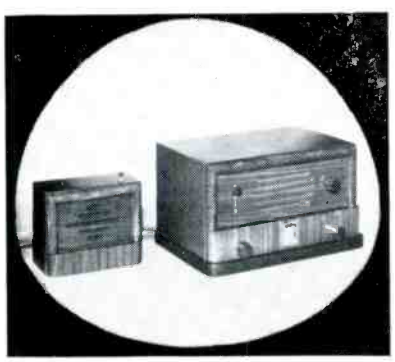
an efficiency diode. The latter is used in such a way that the power economy is very effectively increased, spurious oscillations are suppressed and the sweep linearity is improved. In the output transformer the use of the new magnetic material mentioned above adds to the power economy of the deflection circuit and results in a compact design.

The vertical output stage is coupled to the deflection coils by means of a transformer which for reasons of plate power economy is allowed to introduce some distortion of the sawtooth current. However, this is compensated by a phase correcting network in the grid circuit of the output tube.

To obtain perfect interlacing, the first reversed pulse occuring in the vertical synchronization signal is used for synchronizing the vertical sawtooth wave.*****

TRADE NEWS

* Electronics Laboratories, Inc., of Indianapolis, announces a combination radio-intercom; cabinet is finished on all sides, permitting placement without concern of the usual unfinished back-side of such cabinets. Receiver covers the broadcast band. Master unit and one slave unit to sell for about $90; additional slave units will sell for about $15. Operates on 110 v. ac or dc.

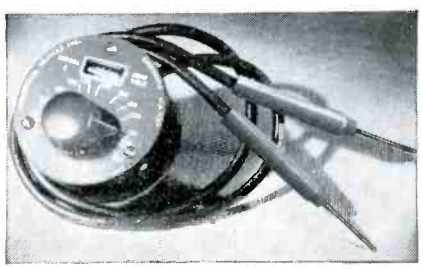


* A capsule-size photo-tube has been developed by RCA. It is about the size of a .22 calibre long rifle cartridge. This photo-tube is expected to have many industrial applications where the size of former photo-tubes was objectionable. Major application is expected in animated signs, resulting in greater picture detail.

* Clarostat Mfg. Co., of 130 Clinton St., Brooklyn, has made available free of charge, a complete cross-index guide for volume controls of different manufacture with the corresponding type numbers.

* RCA announces an electrifier for the conversion of battery-type farm radios, to operate from 110 volt 60 cycle ac.

* Industrial Devices Inc., of Edgewater, N. J., has introduced a unique neon-glow voltmeter, that indicates AC or DC voltages and is immune to mechanical and electrical abuse. AC calibration from 65 to 660 volts with an



impedance of ½ megohm. Same scale used to measure DC, multiplied by a factor of 1.15. Guaranteed for 10,000 hours of actual operation.

* A new, miniature beam power amplifier tube (35B5) has been announced by RCA. Capable of 1.5 watts output at usual AC-DC set voltages.

* RCA Communications has developed an automatic translator, to convert Morse to 5-unit code; translators are in operation in the New York RCAC Control.

* William C. Speed, President of Audio Devices, Inc., New York City, producer of recording discs, sailed recently on the SS Queen Elizabeth for Europe, where he will confer with leading recording and broadcasting companies in England and France on market conditions and technical advancements in sound recording. In an interview prior to his departure, Mr. Speed remarked that the sound recording industry has made great strides during the last few years—not only in radio broadcasting, where, now, approximately half the programs are recorded, but also in the phonograph record field, where the market is three times pre-war volume. "This large increase," Mr. Speed said, "is not only seen in this country, but abroad as well. Exports of recording discs have increased rapidly and now amount to more than 10% of domestic sales."

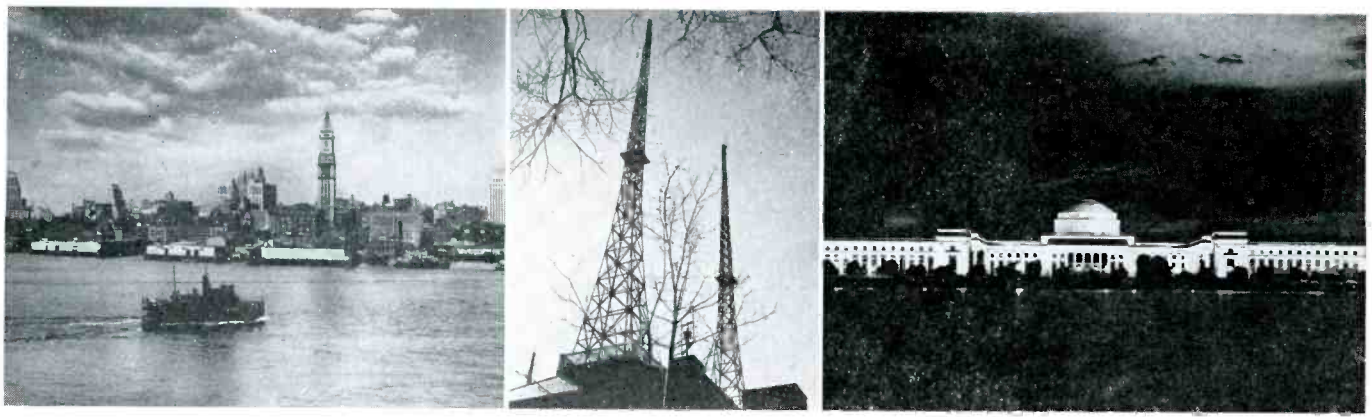
WILLIAM C. SPEED

* Sears-Roebuck is marketing a combination radio phonograph-wire recorder; price reported to be about $175.

* WFRL—Vincent S. Barker will soon be "on-the-air" in Freeport, Illinois, as the Freeport Broadcasting Co., operating on 1570 kc.

* Visitors—Ray Monfort of LA Times Television, related some of the problems of making a mountain top inhabitable; Johnny Fricker of KSTP, St. Paul; Hank Geist of Raytheon; Frank Jacobs of Radio Transceiver Labs; and many more.

* Jan King is Manager of KECK, Odessa, Texas, 1 kw on 920 kc. Assistant Manager is Bill Chambers. Both are former broadcast engineers, and known to many of our readers; good luck!



Left, Boston Harbor (Photo by Boston Chamber of Commerce); Center, Cruft Laboratory, Harvard University (Photo by W. H. Beal); Massachusetts Institute of Technology (Photo by MIT).

New England Radio Engineering Meeting—Cambridge, Mass.—Saturday, May 17, 1947

THE newly created North Atlantic Region of the I.R.E., made up of the Connecticut Valley Section and the Boston Section, will sponsor an all-day radio engineering meeting at the Hotel Continental in Cambridge, Mass., on Saturday, May 17, 1947.

This Regional All-New England Meeting is a new venture in cooperation among New England electronic specialists. It is designed to establish new and valuable associations between them and the rich background of industries, educational institutions, and research centers situated in the compact, highly developed New England area.

Scheduled for the day's meeting are six technical papers to be presented for the first time, on communications, micro-waves, frequency modulation and measurements. None of these papers will be given concurrently. A large space in the Hotel Continental will be devoted to a number of exhibits of radio and electronic products manufactured only in this region. New England manufacturers make a wide variety of electronic apparatus and the exhibit offers an excellent opportunity for New England engineers to acquaint themselves with these items and with their neighbors, the people who make them.

As part of the social amenities, a luncheon is planned at noon, with a banquet scheduled for the evening with entertainment technically and socially adapted to the humor and tastes of engineers and their families. Speech-making at the Banquet will be confined to an address by Mr. George W. Bailey, Executive Secretary of the I.R.E., who will bring greetings from National Headquarters.

Brief outlines of the papers to be presented at the technical sessions are given below.

1. **Low Drag Aircraft Antennas for Frequencies from 2 to 18 MC, by John V. N. Granger, Student, Harvard University, Cambridge.**

The difficulties involved in the design of efficient radiators for aircraft are discussed and deficiencies of conventional structures explained. Comparisons of the effects of polarization are given. Novel radiators, such as the plane's wings, are described and the mechanical and electrical performance confirmed with experimental data.

2. **The Commercial Design of Geiger-Mueller Counter Tubes, By Herbert Metten, Sylvania Electric Products, Inc., Boston.**

The subject of Geiger-Mueller Tubes will be introduced with a brief historical survey of conventional methods for detection of radioactivity, including GM tubes, followed by a simplified description of the mechanism involved in the detecting action of GM tubes. There will be a description of the effect of various gas fills on tube characteristics, with a comparison of self-quench and external-quench gas fills from the standpoint of tube-life, stability, operating voltage, and recovery time. The problem of windows for beta-ray counters will be considered. A discussion of pro-

duction methods and problems will include such subjects as types of cathode, purity of fill, use of high vacuum techniques, sealing of windows, and methods of finishing (basing and devices for mounting and protection). The presentation of some typical characteristics of GM tubes, together with demonstrations of the tubes in actual use, will conclude the talk.

3. Recent Developments in Frequency Stabilization of Microwave Oscillators, By William G. Tuller, M.I.T., Cambridge.

A review of the methods of stabilizing microwave transmitters shows the relative merits of the three generally used systems. The reference cavity stabilization scheme due to Pound is then considered in some detail, and recent developments in this circuit are considered. Among these are the development of a system operable over a wide frequency band and capable of modulation with good linearity. Inherent limits of this system in modulation frequency response, stability and distortion are given.

4. A V-H-F Bridge for Impedance Measurements at Frequencies Between 20 and 140 MC, By R. A. Soderman, General Radio Company, Cambridge.

A bridge has been developed for impedance measurements on circuits having either distributed or lumped parameters. The resistive and reactive components of the unknown are measured in terms of incremental capacitances. The resistance range is 0 to 200 ohms over the frequency range, and the reactance range is 0 to ±200 ohms at 100 MC and is inversely proportional to frequency. Coaxial, two terminal or ground plane measurements may be made. The circuit and errors will be discussed and typical measurements presented.

5. Design Problems of F-M Receivers, By Aldo Miccioli, Associate, Dale Pollack, New London.

The problems affecting the design of f-m receivers are discussed, including the relative merits of variable inductor and variable capacitor tuning. Stability and switching problems are considered, and a solution for a typical receiver presented, with provision for an a-m band oscillator. The relative merits of triode and pentagrid converters, and the problem of oscillator injection are considered. Coil design, r-f gain, bandwidth, and stability of i-f amplifiers are discussed. The problems of proper limiter and discriminator design are considered and overall performance of a typical receiver described.

6. Wartime Developments in Wave-Guide Theory, By Julian S. Schwinger, Professor, Research Laboratory of Physics, Harvard University, Cambridge.

This paper will treat rigorous and approximate mathematical approaches to the solution of problems of radiation from wave guides and the effects of structures within wave guides, with particular attention to general methods of solving for equivalent circuit parameters.

Advance registration is essential, since all facilities are limited. It is suggested that persons who do not receive registration forms by mail communicate by personal letter to Mr. H. H. Dawes, New England Radio Engineering Meeting, 275 Massachusetts Avenue, Cambridge 39, Massachusetts.

★ **Do We Have Your Zone Number?** ★

Walter 'The Wise Tyke' Shaver of WOR

By Pat Miller

WALTER SHAVER of our sound department may be tiny, but oh my, what a smooth operator. Where other members of the sound gang have fallen victim to the idiosyncrasies of some of the gruffer directors, Walt walks right in and beards the lion in his den—and makes him love it.

The boys in the sound department not only must know their ohms, volts, and turntables, but must also be verbal smoothies that can kid the tense director into a sense of a job well done as far as the sound is concerned.

Walt seems to be the Crown Prince when it comes to doing a good job combined with a smooth approach.

Thirty-four years ago, a hard-working carpenter up Schuylerville, New York, way sired a wailing male brat that he decided to name Walter. When christening him, he made another decision. He swore that he would see to it that the lad, by dint of hard work and discipline, would grow up to be a concert violinist and never handle a carpenter's plane or awl.

Walt's childhood saw many hours of bowing, fingering and trying to keep in tune under the baleful eye of Mother Shaver. Oddly, he wanted to be a math teacher and did not take kindly to the fiddle lessons. He finally won his father over when a broken arm put a finis to his chances of ever attaining the goal his dad had set.

He worked hard for the chance to go to Albany State Teachers College, but a flood of Nineties in the regents swamped his good, but no quite adequate 89 percent.

However, he did make the Teacher's Training School and graduated in 1931. He was assigned to a rural one-room school. He had 32 pupils of all grades. So diverse was his class he could only spend five minutes on each subject before going on to another course or to an advanced grade of the same subject. Despite this handicap, all his students got good marks.

This obviously poor school set-up, plus meagre wages, discouraged Walt in his dream of making teaching his career. Three years was enough, and he went off to Saratoga, where he obtained dates with various dance bands. He played the bass fiddle. After his fiddle career was cut short, he substituted the bass, as he had acquired an interest in music and wanted to keep up his studies. The pizzicato and bowing demands of the bass, being less rigorous, seemed to answer his need.

During a visit to a teacher's convention in 1930, he met a vivacious and shall we say an aggresive Miss named Helen Coffin. They found to their surprise that they had grown up only six miles apart. This common interest, plus what Helen thought was a twinkle in the shy eyes of Walt, decided her to set her sights on him. Natch, he was a sunk pigeon from then on in. Three years of strategic retreats on his part ended up in the inevitable surrender, with Walt meeting his Appamatox and laying down his sword of bachelorhood.

He took well to married bliss, and two strapping boys, Paul and Ivan, so far have been the result of the Shaver connubial labor.

With the mantle of married responsibility thrust upon him, he had to hustle. He found that his silver tongue helped him get band dates of a better grade as time went on. Soon the big town beckoned, and he was working for an Afro-Cuban rhumba orchestra at the Club Cubanacan. This job was followed by a road show with a group that were a follow up for the movie "Flying Down To Rio." This venture flopped, but it was just as well, as his next job was with a top rhumba band, Nano Rodrigo, at New York's famed "Havana Madrid." Here the wiley Xavier Cugat spotted him and made with the lucrative offers. Walt took the bait and a five year stipend with the colorful Catalan followed. But, like many musical folk, he found the pace too rugged. Road tours, bad hours and growing youngsters called for something less hectic.

His interest in things electronic, though confined to the construction and design of audio amplifiers, led the way to a job opportunity with WOR. He was among the group of war babies that filled the breach when the flood of war-bound technicians left WOR's technical talent closet perilously bare. His collaboration with another technician in the construction of a bass fiddle amplifier that really worked, convinced WOR that he would fit in and he was assigned to our sound department.

Yep, you guessed It, he fitted in with amazing speed. Pluggin hard at home study and on-the-spot observation soon found him assisting on such shows as Superman and Chick Carter. In less than six months he shed his utility role and was handling such shows as Nick Carter, House of Mystery, and Bulldog Drummond by himself.

Late in 1945, one of Mutual's top shows, "Exploring the Unknown" began at the Longacre. Walt was assigned to work with the very meticulous Sherman Dryer, the producer of the show. Here indeed was a trial of fire. Walt passed and has been performing that tough assignment with nary a bobble ever since. Indeed, when it comes to handling the tough jobs, Walt is on top of the list. He has really made a success out of a very responsible and trying job.

His home life is definitely on the maritime side. He lives on Big Egg Marsh, an island in Jamaica Bay, in a water-soaked community known as Broad Channel. The high tides have on occasion lapped the floorboards of his living-room. During the 1944 hurricane, the waves actually dashed over the roof of the house. Many is the morning when he has to wade to his car. His hobby? Fishing, of course!

I.R.E.

(Continued from Page Five)

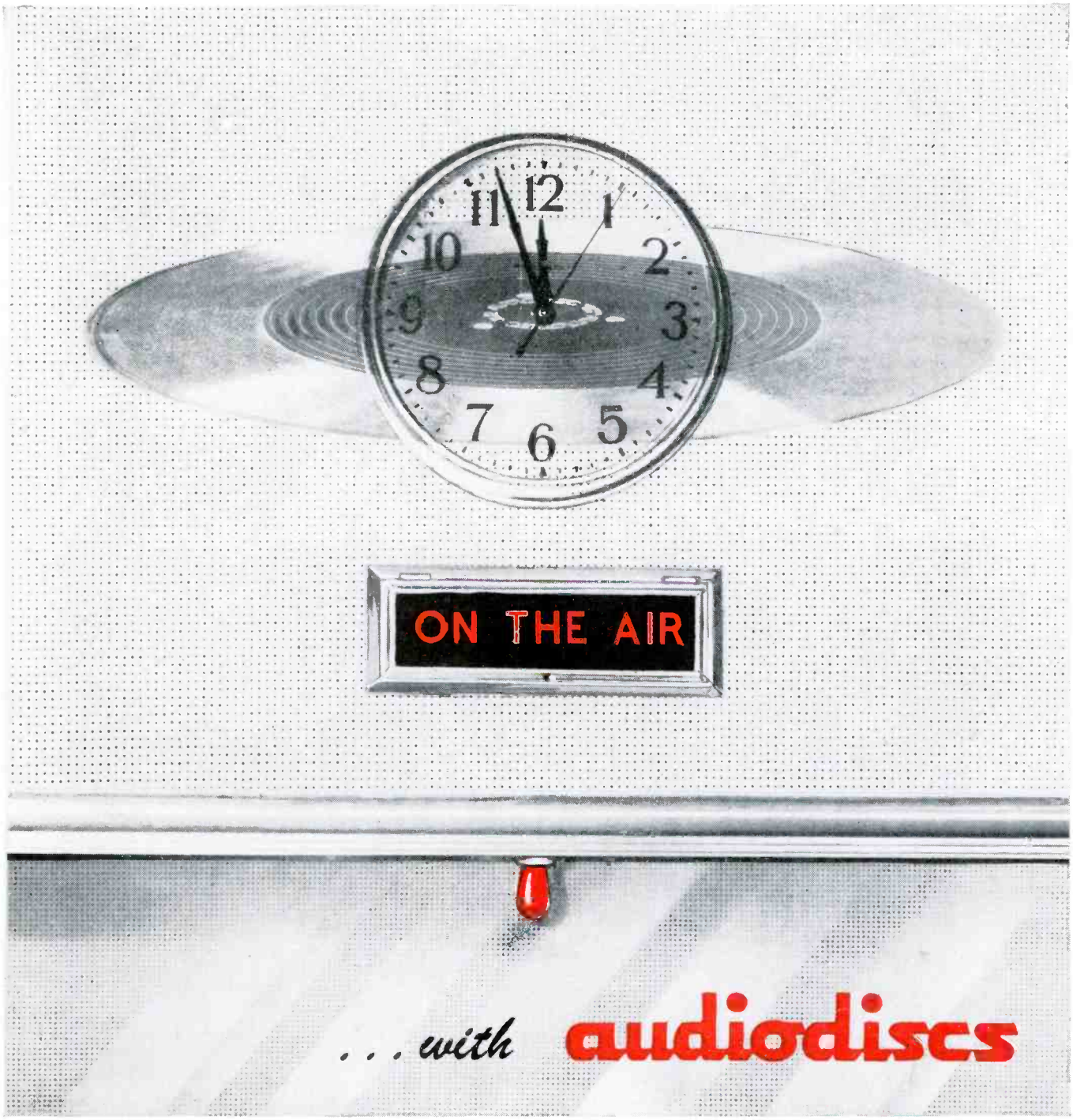
20. A Variable-Phase-Shift Frequency Modulated Oscillator.

O. E. DeLange

(Bell Telephone Laboratories, Inc., New York, N. Y.)

This oscillator conists of a broad-band amplifier, the output of which is fed back to the input through an electronic phase-shifting circuit. The instantaneous frequency is controlled by the phase shift through this latter circuit. True frequency modulation is obtained, in that frequency deviation is directly proportional to the instantaneous amplitude of the modulating signal and independent of modulation frequency.

(*Continued Next Month*)



The clock on the studio wall and the important warning signal below it are two ever-present reminders on which radio broadcasting depends.

Today, approximately half the time this warning signal appears in the broadcasting stations throughout the country, the studio clock is measuring the time of transcribed programs. This large proportion of broadcast time devoted to recorded programs is a significant tribute to the advancement in the quality of sound recording and reproduction.

In this spectacular trend of broadcasting, AUDIODISCS have played a basic role. These recording discs are the ones most extensively used for instantaneous recording, for the original sound recording in making pressings and for the Master discs used in the electroplating process

If it's worth recording—it's worthy of an AUDIODISC. See your local AUDIODISC distributor or write:

AUDIO DEVICES, INC., 444 Madison Avenue, New York 22, N.Y.

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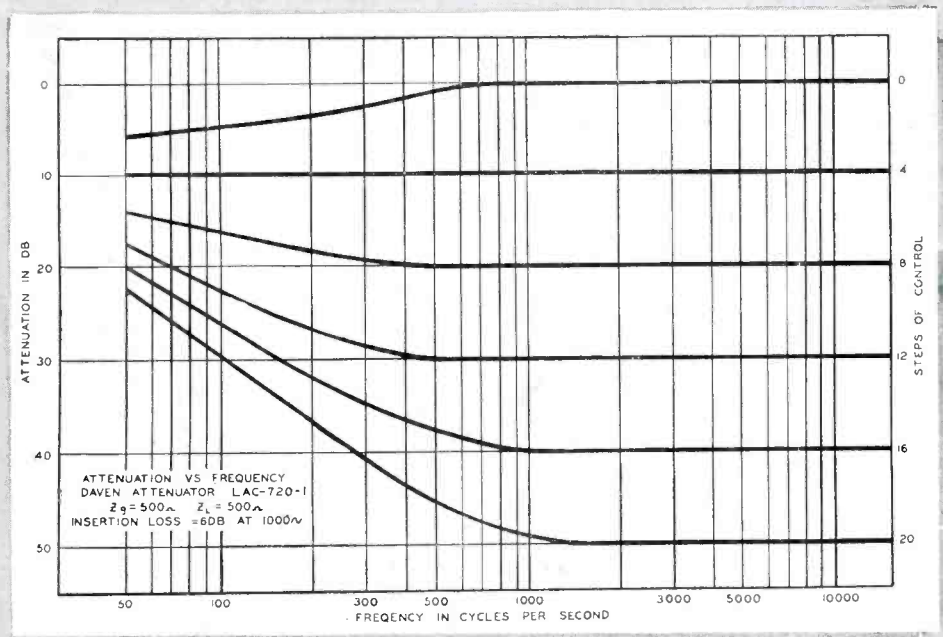
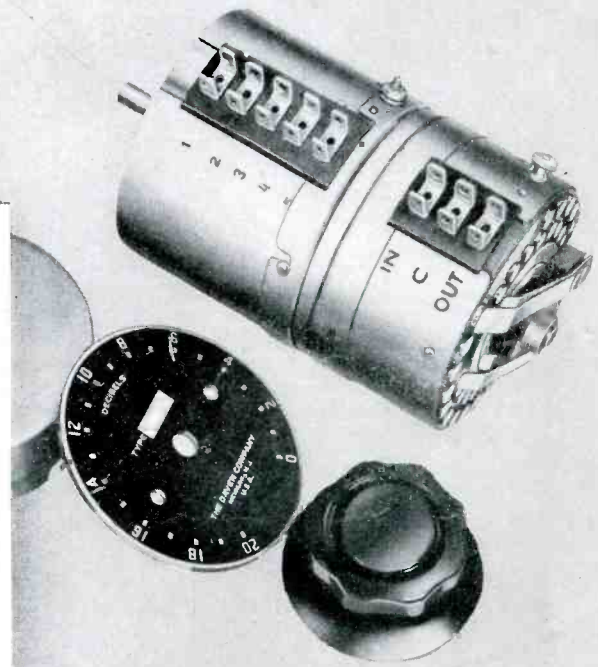
they speak for themselves audiodiscs

NEW DAVEN TONE COMPENSATING ATTENUATOR

TYPE LAC-720-1—This network, developed at the request of leading sound engineers, is designed to attenuate the musical spectrum to follow, very closely the perception sensitivity curves of the human ear. Base frequencies suffer smaller loss than the middle or upper registers . . . without rendering a false or "pumped" response.





By connecting the control from the IN, OUT, and COMMON terminals into the circuit, the attenuator functions in accordance with the illustrated curves. However, by externally wiring the 5 additional lugs, this unit can be converted to a straight ladder of 2.5 DB per step with a flat frequency response. By selecting several combinations of these terminals, a whole family of curve characteristics can be obtained to meet the user's individual requirements.

As always we welcome suggestions or comments from engineers in the industry, not only concerning this unit, but any special "family of curves" to meet individual needs or requirements.

Primary applications are in:

- **Quality reproduction of wired music** for restaurants and public gathering places
- **High fidelity broadcast monitoring amplifier controls**
- **Deluxe, custom-built home receivers**
- **Psychological testing and experiments in hearing perception**
- **Research and development in the study of music appreciation**

THE DAVEN CO.
191 CENTRAL AVENUE
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