ELECTRONIC design

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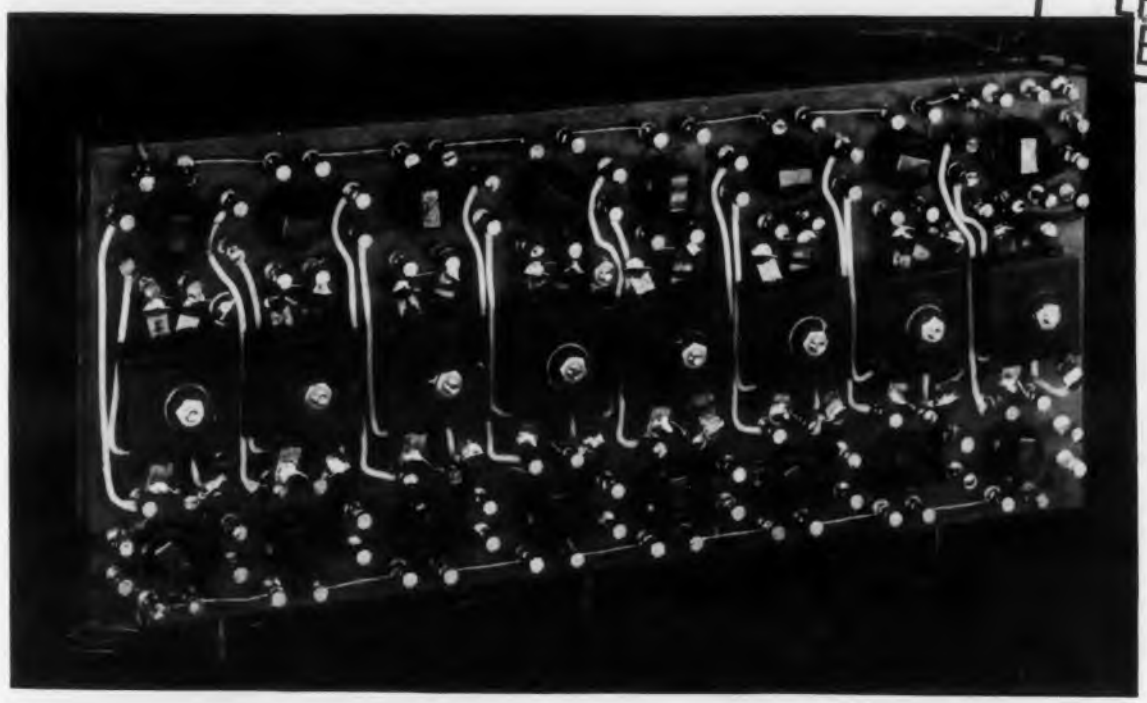

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For Computers or Control Equipment

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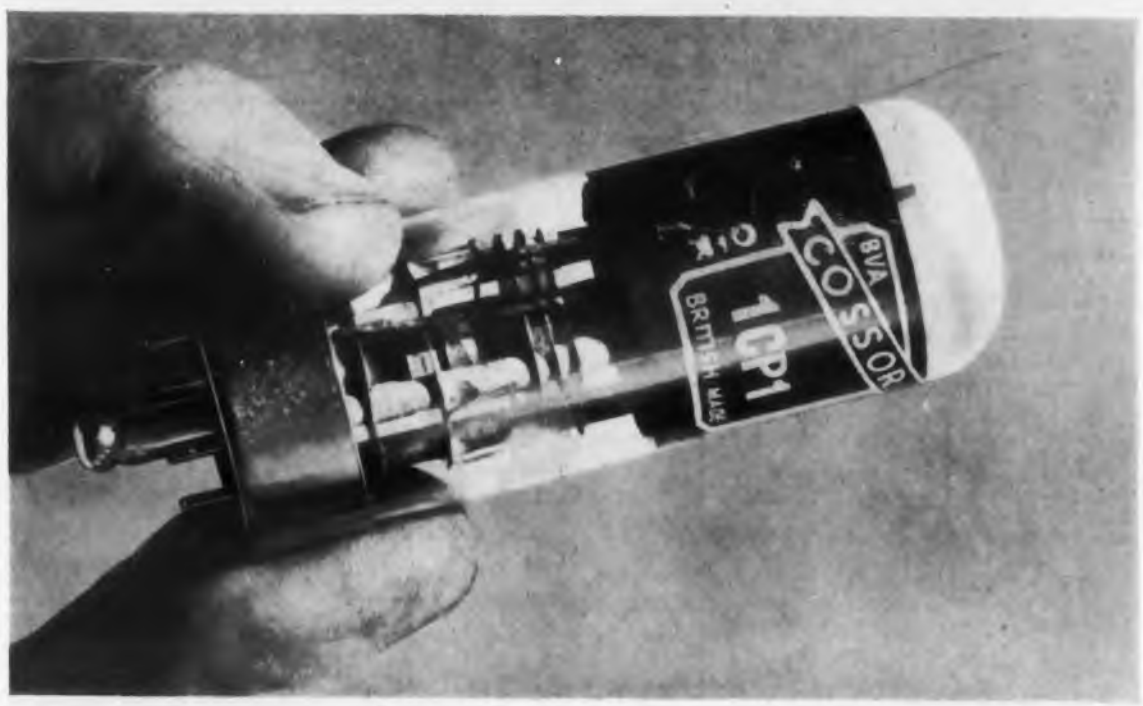
CIRCLE ED-1 ON READER-SERVICE CARD FOR MORE INFORMATION



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CIRCLE ED-2 ON READER-SERVICE CARD FOR MORE INFORMATION

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CIRCLE ED-4 ON READER-SERVICE CARD FOR MORE INFORMATION

Editorial . . .

This is the third issue of ELECTRONIC DESIGN. So far, we have had very gratifying response to our magazine. Our readers apparently like what we are doing.

Besides receiving well over 20,000 direct inquiries on the product, literature items, and advertisements that appeared in our first issue, we have had many expressions of keen interest in our editorial concept—to publish exclusively that material which is of direct interest to electronic design, development, and research engineers.

The best possible insurance for maintaining this editorial policy is to publish the material you want to read. Accordingly, we solicit your suggestions on the kind of articles and the specific subjects you want covered.

We also welcome contributed articles which fit our editorial policy. They should be brief (3000 words or less) and informative, with practical design information of direct value to the electronic designer. Design data sheets (similar to the one appearing on pages 10 and 11 in this issue), in the form of charts, graphs, nomographs, tables, etc., are especially desirable.

A brief outline of the article you have in mind will bring a quick response from us as to whether or not we can use that type of material. On request we will be glad to send prospective authors detailed specifications covering our editorial requirements.

Whether or not you plan to send us articles, we want your suggestions, comments, and criticisms. With these before us, ELECTRONIC DESIGN cannot help growing in usefulness to the electronic industries with each succeeding issue. This will keep our readers happy and will give us the satisfaction of a job well done.

Edward E. Grazda

Engineering Review . . .

Electronic Flowmeter . . . A new type of electronic flowmeter capable of measuring the air currents in a still room or the rapid flow of fluids in pipes utilizes the change in velocity of sound waves as a measure of fluid flow. It has a very fast response and does not obstruct the fluid currents to make the measurement. Furthermore, the signal-to-noise ratio is sufficiently high to permit measurement of very small velocities.

In the device, a sound wave is transmitted over a fixed distance through the flowing fluid, and the phase of the received wave is compared with that of the transmitted wave. The sound energy is imparted to and taken from the fluid through the walls of the containing vessel, and no part of the measuring system need come in direct contact with the medium under study.

The transmitter and receiver of the instrument are exchanged periodically (without changing their location) by using identical magnetostrictive or piezoelectric exciters as transmitter and receiver and switching their connections alternately to the receiving and transmitting channel. The phase meter then displays two phase shifts alternately: one a function of the sound velocity plus the fluid flow, and the other a function of the sound velocity minus the fluid flow. The difference between the two phase shifts is a measure of the velocity of the fluid. This arrangement eliminates errors that might be caused by changes in distance or propagation velocity when measuring fluid flow in instances other than those involving extremely high velocities.

Nylon Thermistor Tubing . . . Extruded Nylon tubing about the diameter of an ordinary lead pencil is being used to encase one type of glass enclosed bead thermistor used in time-delay circuits. The thermistor is inserted in a length of tubing, and the ends of the tubing are pressed flat under heat in a hydraulic press for a given time to give the nylon the "set" desired. Connecting leads extend outside the nylon casing.

The tubing provides mechanical protection of the glass bulb, electrical insulation (no metal caps are required), and protects against straining the glass bulb when the connecting leads are flexed. The nylon readily takes the shape desired and is heat resistant. Assembly of the unit is rapid and simple, and cost reductions have been achieved by using this tubing instead of a phenolic cartridge with metal end caps

"Mylar" . . . A recently developed synthetic plastic film known as "Mylar" shows promise of becoming a chief contender for replacing paper as the dielectric in capacitors. Investigation of the material has shown that it has excellent insulation resistance, temperature coefficient of capacitance, and operating temperature range characteristics.

"Mylar" (polyethylene terephtalate) is unusually strong. It has a high softening point and is available in very thin films which make it especially suitable for capacitor insulation. Compared to mineral oil impregnated paper capacitors, unimpregnated "Mylar" capacitors show higher dielectric strength, higher insulation resistance, and can be operated at higher ambient temperatures. Their loss characteristics are comparable with those of impregnated paper units, and capacitance stability over the usual range of ambient temperature approaches that of mica capacitors.

Design Note . . . In the design of small radio sets that incorporate "ON-OFF" pilot lights, it often is not possible to place the lamp at the point where the light is needed and still make the lamp accessible for replacement. In one set, this problem is solved by using "Lucite" rod to pipe the light to the desired location.

In order to conform with Underwriter Laboratory specification and to make the lamp accessible for replacement, the pilot lamp was placed at the top of the chassis near an opaque speaker cone. The bent "Lucite" rod pipes the light from the pilot light through the chassis and around a 90° bend to a "jewel" pattern clear escutcheon at the bottom of the front panel of the cabinet. This escutcheon lights up whenever the set is in operation. Mounting of the rod is accomplished by means of a rubber grommet in the chassis.

Radio Propagation Laboratory . . . A major laboratory of the National Bureau of Standards is being constructed at Boulder, Colorado. It will house the Bureau's Central Radio Propagation Laboratory and will be equipped with complete and modern facilities for research on the propagation of radio waves as well as the expanded utilization of the radio spectrum now being used for F-M, TV, facsimile, and radar.

V-H-F Transistor Transmitter . . . A tiny transmitter, built around a single point-contact developmental transistor, has been used in a regular amateur transmission to contact three "ham" radio operators in the New Jersey area. The transmitter, operating on a frequency of 146Mc, was powered by a small 22-1/2v hearing-aid battery, and a quartz crystal was used to control the frequency. Each of the operators contacted reported the signal strong and clear, and the farthest station contacted was 25 miles away.

Needle Drag Distortion . . . A recent study indicates the existence of a type of distortion which sometimes occurs in phonograph record players. It has been found that if a phonograph needle can move longitudinally (tangentially) with respect to the groove of an ordinary laterally recorded disc, the needle will not follow perfectly the lateral excursions of the groove, and "drag distortion" will result. When records are played, this distortion can result in spurious tones of greater amplitude than the tones originally present.

Several possible causes are suggested for the longitudinal motion of the needle which produces the distortion. One is the well-known "pinch" effect caused by uneven width of the record groove. Another is the varying force which the sides of the record groove exert against the stylus. A third is the change in friction with changes in the pressure and velocity of the stylus in the groove. It also appears probable that a form of drag distortion can arise in the recording operation if the recording stylus is not sufficiently rigid.

It is interesting to note that the investigation of this phonograph needle distortion was a by-product of a military research program. Telemetered information from experimental weapons often is recorded on discs, and the distortions introduced in the recording and reproducing processes can become serious enough to cast doubts on the significance of the indicated measurements. Analysis of possible sources of error in these recorded measurements led to the study of distortion introduced by phonograph needle drag.

Scholarship Fund . . . A scholarship fund has been established with the purpose of stimulating interest among high school graduates who intend to select electrical or electronic engineering for their profession. The scholarships are to be given in both Los Angeles and San Francisco, and the institutions receiving the awards in 1952 and 1953 include California Institute of Technology, Stanford University, University of California in Los Angeles, and University of Southern California. Freshmen are eligible for the awards which will be made solely by the deans of the schools of engineering in the respective institutions.

A Precision Transistor Oscillator

AS PART OF A PROGRAM devoted to the improvement of measuring and calibrating standards, the National Bureau of Standards has developed a crystal oscillator that is small, portable, dependable, and accurate over long periods of time. The new oscillator unit, developed by Peter G. Sulzer of the NBS staff, utilizes a junction transistor as the source of driving power for a high-stability quartz crystal unit. All components of the circuit, including the power supply, fit into a metal tube less than 2″diam and about 7″ long. At an operating frequency of 100kc, the long-period drift in the first model was about 3 parts in 10^9 per day.

Basic to most work in research, development, and engineering is an accurate reference or standard to which time-intervals and frequencies may be precisely compared. In an attempt to reach a majority of the investigators who need these references, the National Bureau of Standards maintains radio stations WWV (Washington D.C.) and WWVH (Territory of Hawaii), which transmit standard frequencies (2.5, 5, 10, 15, 20 and 25Mc) and standard time intervals continuously, night and day. The frequencies that are transmitted are accurate to 2 parts in 10^8, and constant to better than 1 part in 10^9 per day.

To obtain the most precise operation of conventional laboratory type frequency standards, the signals from WWV or WWVH are used in the calibration procedure. The greatest continuous accuracy is achieved by making the calibration at those times when the received standard frequencies are most efficiently propagated by the ionosphere. But laboratory type standards of the highest stability are expensive to buy and to operate, and their use has been generally limited to the larger laboratories and research centers. In addition, these standards normally involve such auxiliary equipment as lead-acid batteries, voltage regulators, power supplies, a multiplicity of components, complex temperature controls, and also require large floor space and highly trained operating personnel. The use of transistors in oscillators, counters, amplifiers, etc., shows great promise of making a high precision frequency standard and crystal clock available when needed. With the development of the transistor oscillator, that part of a compact, high-precision crystal clock is now a reality.

The major components of the transistor oscillator are a Type 2517 junction transistor, a high-precision 100kc GT-cut quartz crystal unit,[1] and a long-life mercury cell. The dry cell supplies power to the whole unit (1.35v at 100μamp), and has an active life, under these conditions, of five or more years.

Two of the requirements that must be met in developing a high-stability crystal oscillator are con-

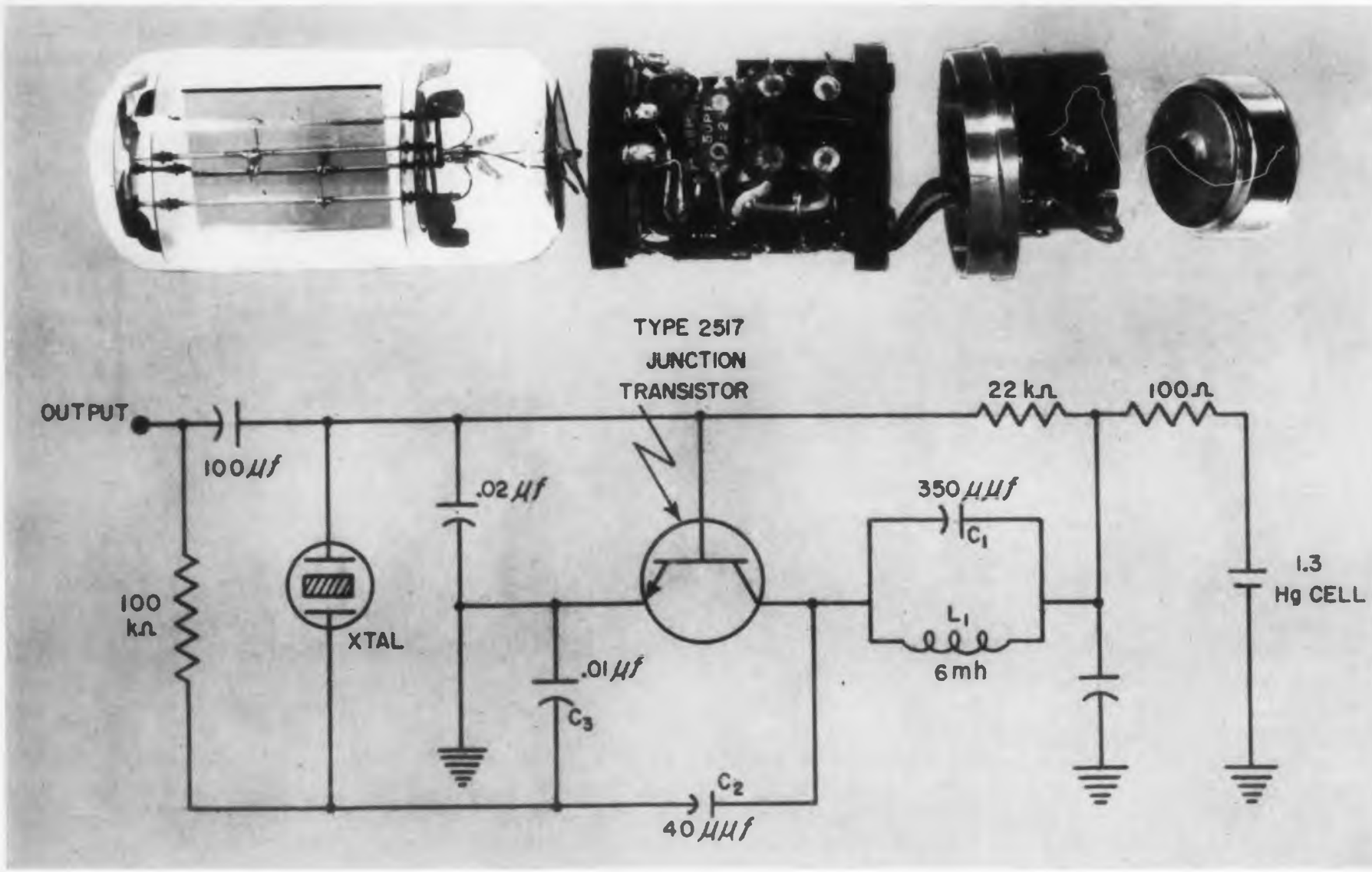


Fig. 1. Exploded view and circuit diagram of the transistor oscillator. The unit fits into a metal tube less than 2" diam by about 7" long. The mercury cell at the right furnishes all the power required by the oscillator (1.35v at 100μamp). The circuit components, including the transistor, are lumped together in a bakelite form (center) which can be "potted" in a casting resin for rigidity.

Fig. 2. Basic components of the oscillator, showing the transistor (left) and the quartz crystal unit (right).

stancy of phase shift in the feedback loop associated with the crystal and constancy of the amplitude of oscillation. A constant phase shift is obtained by using large, stable "swamping" capacitors at both crystal connections and by using highly stable components in the remainder of the circuit. Excellent amplitude stability is achieved by operating the transistor in such a manner that collector-voltage limiting is produced.

The transistor is used in the grounded-emitter connection. It produces an output of 0.8v across a tuned circuit connected to the collector electrode. The tank circuit, composed of a 350mmfd capacitor and a 6mh coil, is designed to oscillate at 100kc; however, the magnitude of the voltage is too high to be applied directly to the crystal unit. Consequently, the voltage is reduced by means of an attenuator, which consists of a 40mmfd and a 0.01mfd capacitor in series from the collector electrode to ground. The driving current (less than 100μamp) for the crystal is taken from the junction between these capacitors. The crystal voltage is coupled to the output through a 100mmfd capacitor.

Over half of the space in the 1-3/4″diam x 7″ metal tube is consumed by the crystal, which is mounted in an evacuated glass envelope. The transistor, coil, capacitors, and resistors are supported on a bakelite frame that may be "potted" in casting resin to add to the rigidity of the section. The mercury cell, only about 1/2″ deep, is at the base of the assembly and is insulated from the metal "can" by a bakelite shield.

Determinations of the frequency stability with changes in temperature and supply voltage have indicated that the frequency varies approximately 1 part in 10^8 per °C, and 1 part in 10^8 per 0.10v. The transistor oscillator was also compared with the standard oscillators controlling the transmissions of WWV. Short time variations were about $\pm$ 3 parts in 10^{10}, and the long interval drift (in days) indicated changes of about 3 parts in 10^9 per 24 hr. These figures are comparable to those obtained from vacuum tube standard oscillators, particularly at the time of their initial installation. Fortunately, frequency drift in the quartz-crystal unit of a conventional type standard oscillator normally decreases with age. It should also be noted that because the oscillator has just recently been developed, no data exist in regard to long-time stability in terms of years.

The compactness of the unit lends itself to more convenient and portable temperature control measures. Heretofore standard quartz oscillators or quartz clocks have required relatively complex temperature control apparatus (operating at temperatures up to 60°C) and special high-reliability power sources.

Tests were conducted on the new oscillator with the complete unit operating at 0°C. Reasonable temperature stability was achieved by merely placing the oscillator in a "Dewar" flask containing crushed clear ice. Among the results was an indication that the reduced temperatures were responsible for reducing drift and increasing the Q of the quartz crystal unit. Thus, it now becomes possible to make available a readily-portable continuously-oscillating frequency standard that may be carried to all parts of the world.

[1] High Stability Quartz Crystal Unit for Frequency Standards, J. P. Griffin, *Bell Lab. Record*, Vol. 30, No. 11 (1952).

TV Interference—A Design Problem

Eugene A. Anthony

General Electric Company, Marketing Services Division

THE general problem of TV interference is becoming increasingly important as the number of TV receivers in use increases, and as utilization of the ultra-high frequencies advances. It is a two-pronged problem involving both the generation and the reception of interference. The relative importance of these aspects is a matter of viewpoint; it depends upon whether you happen to be a TV viewer at the moment, or whether you are listening to a "conventional" radio receiver. In either case, the problem is growing and will continue to grow in magnitude unless development keeps pace with the situation.

Part of the problem-growth results from the sheer weight of the ever-increasing number of sets in use and with the increase in picture sizes. Utilization of the u-h-f channels also increases interference problems. TV sets soon will be operating at frequencies much higher than those of present v-h-f channels. Present services operating at frequencies above v-h-f channels have not constituted an interference problem. However, they may represent a potential source of u-h-f interference. The advent of color TV may also introduce new interference elements.

In view of these future prospects, as well as presently existing conditions, it is of prime importance that our engineering talent be directed toward reduction of the two-pronged threat to TV health. The RTMA is presently engaged in serious consideration of the problem, and is trying to develop specific recommendations for its solution. It is reasonable to suppose that these recommendations will be limited by practical consideration of the state of the art, so that development toward the objective of interference reduction will continue to be of great importance.

It is with these thoughts in mind that the following material is offered. The immediate objective is to stimulate constructive thinking on the problem rather than to provide an exhaustive treatment of the subject. It is obviously beyond the scope of this article to do the latter.

How TV Influences the Design of High-Frequency Communication Transmitters

The advent of widespread use of TV sets has resulted in increased exacting demands on the design of high frequency communication equipment, particularly the type intended for use within a TV area. Amateur, police, and similar transmitters fall within this classification. The signal produced by these transmitters must be free of harmonics or spurious output to be "clean". If the signal is not "clean", the possibility of "TVI" (TV interference) looms.

Often, these transmitters employ oscillators at a frequency below the required signal frequency, and multipliers are used to generate the final frequency. Each of these offers an interference possibility.

Many techniques are employed to clean up the signal. These include shielding and filtering to a far greater degree than had been previous standard practice. Generally, the equipment requires much more engineering design effort and material expense.

Tank circuits, for example, have ceased to be simple in conception. Now, v-h-f and u-h-f resonances must be tracked down and eliminated and traps may be needed. Coupling techniques are changed; capacitive coupling is being replaced by inductive coupling, usually through links so that more tuned circuits, components, controls, and space are required to do the same job.

Operating characteristics of r-f amplifier tubes are becoming more important and more critical. Very often, sacrifice in efficiency is made by driving these tubes more like Class B amplifiers rather than like Class C types, so as to reduce the amplitude of harmonics.

Antenna feed systems have changed. Now, complex filters are common, and open wire transmission lines are being replaced by coaxial cables.

Taking all this into account, TV hasn't improved the lot of the high frequency transmitter designer or purchaser. Perhaps there is no need to sympathize with him, however, since we can observe simply that his heyday is over. Once there was a wide expanse of frequencies that no one cared about, and if you happened to spill some harmonics there, it did not matter much. Today, countless people are watching pictures on these frequencies with broad-band receivers, which are very sensitive to these maverick signals; so, out they must go.

There is little question but that most transmitter people recognize their responsibility in this connection, and that specific steps are being taken to meet it. New techniques are being developed every day to do an even better job.

Table I. Harmonic Relationship of TV Sweep Frequency with New York City Broadcast Stations.

15.750kc Harmonic No.	Frequency (kc)	N.Y.C. Broadcast Station	Beat
35	551.25		
36	567.00		3kc with WMCA
—	570.00	WMCA	Primary, Plus Many Secondary Beats
37	582.75		12.75kc with WMCA
38	598.50		
39	614.25		
40	630.00		
41	645.75		14.25kc with WNBC
—	660.00	WNBC	Primary, Plus Many Secondary Beats
42	661.50		1.5kc with WNBC
43	677.25		
44	693.00		
45	708.75		1.25kc with WOR
—	710.00	WOR	Primary, Plus Many Secondary Beats
46	724.50		14.50kc with WOR

The TV Receivers as a Source of Interference

The lay TV enthusiast is very sensitive to interference in his reception produced by outside sources, but knows little of the interference generating possibilities of his own receiver. His attitude (the typical layman) on these matters is worth the consideration of the TV designer. It has two distinct parts: when he is the victim of outside interference he holds the manufacturer responsible, and usually does so with some emotion; when his receiver is creating interference, and he is so advised, he holds the manufacturer responsible and usually remains aloof from the problem. In other words, he believes that the designer is responsible for what happens.

The mere fact that there are relatively few specific complaints against this phase of TV design is no indication that the problem is not widespread. In most instances, the interference is not traced to the offending set because of the difficulty of doing this.

In the average apartment house or thickly populated TV community, it is rather common to have ordinary broadcast receiver operation marred by a background of squeals. In some instances, particu-

larly when loop-antenna receivers are located in apartment houses, it is almost impossible to get good, clean, squeal-free reception during TV broadcast hours.

This interference originates, of course, from the horizontal sweep system of the TV set at a base frequency of 15,750cy. The nature of the sweep circuit is such that harmonics are not only enhanced, but are required (to produce a good sawtooth wave), with the result that a great many harmonics appear through the broadcast band and even beyond. These are generally strong in the broadcast band, often are heard well into the short wave bands, and have even been heard as high as 100Mc (and higher). They are so close together that where one squeal leaves off, the other begins on a broadcast set, so that the only escape is by choosing a signal strong enough to overpower the interference. One die-hard radio listener observed that if TV can't kill radio through its greater appeal, it can do it with squeals!

As an example of this situation, Table 1 lists the harmonic relationship of the sweep frequency to a portion of the broadcast spectrum, showing how it affects several broadcasting stations in New York City.

Although the harmonic number is high, the amplitude of these harmonics is appreciable. The reason for this is twofold: (1) we are dealing with a complex waveform which is necessarily rich in harmonics, and (2) the generating circuit operates at a high power level.

The 15kc problem is a serious one and deserves the careful attention of designers. Appreciable harmonic energy can be generated, in the sweep amplifier, damper, and high-voltage rectifier stages, and radiated into space as interference. These are all non-linear circuits and operate at relatively high power. They can easily include, and sometimes undoubtedly do, a combination of leads, capacitors, and other components which exhibit resonance at frequencies employed for broadcast use, and thereby enhance those nearby harmonics. As picture tubes become greater and utilize wider deflection angles and higher anode voltages, the sweep energy required also increases, as does the magnitude of the interference.

The interference may be coupled into the antenna system and radiated strongly over a wide area, it may be coupled into the power line with the same results, or may be radiated directly from the generating circuits themselves. Elimination of the interference may require better shielding, filtering, and/or component layout, wiring, and geometry, and requires the serious attention of the electronic designer.

Another common source of interference in a TV set is the local oscillator. Its victim is generally other TV sets. It is most common in these areas employing many channels. An excellent example of its magnitude can be found in New York City. Here, WATV is received on channel 13 and is located in New Jersey. The signal, in the greater part of New York, is from good to poor, being just fair in most parts. Good reception, however, is difficult in almost every part of the city because the signal is generally marred by local oscillator interference from other sets (usually tuned to channel 9). Consequently, channel 13 is not considered a reliable signal by a great many New York viewers.

The same situation holds true in fringe and semi-fringe areas with channel 13, as well as other channels. It is all too common to require elaboration here.

While the shifting of i-f frequencies to the 40Mc range does not prevent oscillator radiation, it does offer a partial remedy in that the oscillator frequencies then fall outside the TV channels, and interference with other TV sets is eliminated. The likelihood of interfering with other communication services is very much smaller than it is with TV, in that the channels are much narrower, and almost exact coincidence is needed to produce interference. Interference is thus a smaller mathematical probability. When it does occur, however, it is no less severe.

The fundamental requirement is, of course, to reduce radiation of the oscillator itself. This may require better shielding, filtering, and better or more r-f stages. RTMA will, no doubt, recommend definite limits of oscillator radiated output so that work in this direction will become almost mandatory. Moreover, shifting the i-f will not provide the answer for harmonic interference with u-h-f channels; reduction in radiated oscillator power will be necessary.

TV Interference from External Signals

In addition to the generation of broadcast interference and of interference with other TV sets, the general problem of TV interference includes eliminating external interfering signals from the TV set itself.

One possible type of interference is an external signal within the i-f pass band. This has been rather effectively reduced or eliminated in recent receivers by means of an i-f trap or high-pass filter, and the problem is somewhat simpler than those mentioned above. No doubt, the rejection of such signals can be improved even more if necessary, by improvement in shielding.

A more provocative problem is that of r-f overloading by means of an external signal. When this happens, the amplifier becomes a good harmonic generator, and interfering harmonics can be developed before the tuned r-f circuits can effectively eliminate the fundamental. The harmonic may be within the r-f pass band, and it then will be amplified along with the signal.

A high-pass filter is not always the answer to this problem, since the fundamental signal may be above the low frequency cut-off of the filter. The interfering signal, or the harmonics generated in the r-f stage, may then mix with the incoming signal, or its harmonics, and produce interference. The possible combinations are many and need no elaboration.

The important point here is that some present designs provide little selectivity before the first r-f amplifier and thus permit the possibility of a strong foreign signal appearing at that stage to the degree that non-linear operation results. This phase of the problem deserves some thought. Perhaps the answer is to provide more channel-by-channel selectivity *before* the first r-f amplifier; perhaps modification in amplifier design will do the trick.

Conclusion

The preceding material is intended only to stimulate thought on the problems of TV interference, both radiated and observed. It is not intended to provide direct material for the designer. The objective is to point up the need for more concentration on this phase of TV design work in the interest of TV.

TV development must include programs for the improvement of the interference situation, so that the public can be better served and the manufacturers can realize a more rapidly expanding market.

"Hipersil" Design Data Curves

Paul Muchnick

Senior Development Engineer, Sorensen & Company, Inc.

IN MANY applications of magnetic amplifiers and saturable core reactors, "Hipersil" cores often are used because of economy and relative insensitivity to shock as compared to such materials as "Deltamax" and "Hypernik V." The user of "Hipersil", however, must be willing to sacrifice to some extent such characteristics as gain, linearity and predictability of characteristics. On the other hand, "Hipersil" reactors usually are lighter because they can be operated at higher flux densities than is possible with "Deltamax" and "Hypernik V."

The curves at the right show the average characteristics of 5 mil "Hipersil" taken on many samples of series connected reactors ranging from 50 VA up to 1500 VA units.

Errors in designing a reactor for a given operating point can occur because of the following reasons:

(1) An air gap is present in the core which varies from core to core. This introduces the greatest errors at low flux densities. The smaller the air gap, the steeper will be the rise of the curve before the "flat" portion is reached.

(2) The amount of iron in a given core is not constant. The core areas used in the calculations were obtained from the manufacturer's dimensions, which, naturally, have tolerance. The largest errors caused by this factor will occur at high flux densities where saturation occurs.

(3) Minor errors also are introduced by such factors as the geometry of the core, core losses, frequncy, etc., but these are usually of secondary importance as compared to (1) and (2) above.

The writer has found that errors between actual and calculated operating points of reactors designed from these curves are usually less than 10%, but may occasionally be as high as 20%.

An example of the use of the curves is given below:

1. Design a saturable core reactor to have a constant impedance of 500 ohms over the frequency range of 200cy to 500cy. The voltage across the reactor is 200v and the maximum control current available is 25ma.

Try Westinghouse core H-38 (1)

$A_c = 0.063$; $l_c = 4.40$

Let $\beta_{200} = 1.7$ at 200cy (2)

and $\beta_{500} = \frac{200}{500}(1.7) = 0.68$

$$N_A = \frac{420E_A}{2A_c f \beta} \quad (3)$$

$$= \frac{420(200)}{2(0.063)(200)(1.7)} = 333 \text{ Turns};$$

$$I_A = \frac{200v}{500 \text{ Ohms}} = 0.4\text{amp}$$

$$\frac{N_A I_A}{l_c} = \frac{333(0.4)}{4.40} = 30.2 \quad (4)$$

From the curves (5)

$$\left.\frac{N_c I_c}{l_c}\right]_{\text{at 200cy}} = 18;$$

$$\left.\frac{N_c I_c}{l_c}\right]_{\text{at 500cy}} = 27.4$$

Let $I_c = 0.025$; then (6)

$$N_c = \frac{(27.4)(4.40)}{0.025} = 4840;$$

use 5000 turns

Layer wind both a-c and d-c coils. Use No. 26SF wire for a-c windings and No. 37SF wire for d-c windings. Check the build to see if component can be made. (7)

It should be noted that these curves apply to 5 mil "Hipersil" and should not be used on other size laminations. Attempts to use these curves on 13 mil "Hipersil" have resulted in errors running as high as 50%. If it is necessary to plot a load line, the generalized impedance that should be used is $\frac{420R_L l_c}{2N_c^2 A_c f}$, where R_L is the load resistance in ohms.

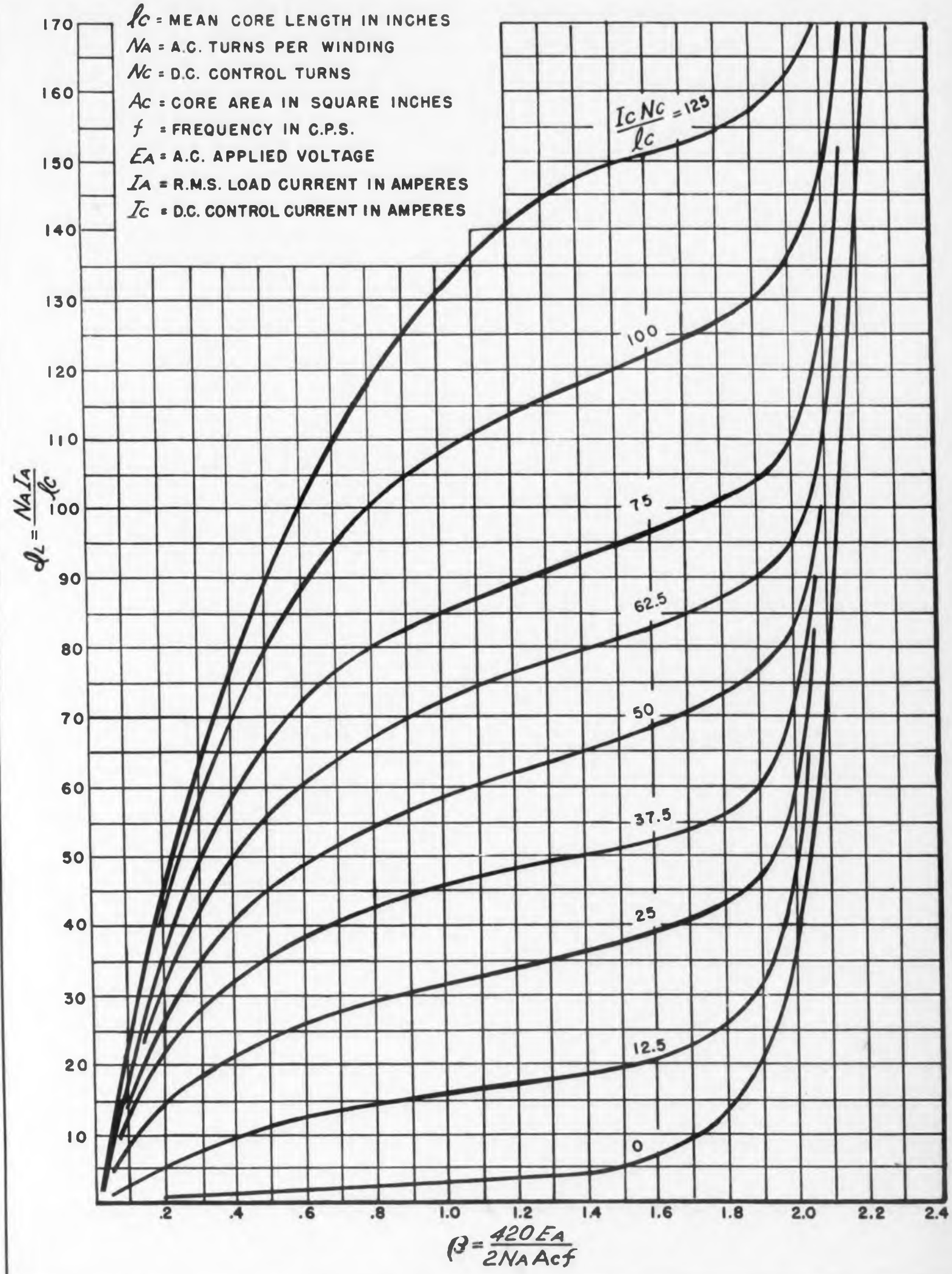


Fig. 1 (right). Generalized curves for 5-mil "Hipersil" saturable core reactors.

New Products...

Pulse Forming Network

Only 1-7/16" x 5/16"diam

The Type PFN 7030B Pulse Forming Network, designed for use on radar, missile, and computer applications, measures only 5/16"diam x 1-7/16" length. Its small size, plus two convenient 1-1/4" No. 22 solid copper-tinned leads make mounting easier, especially when they are used in miniaturized circuits.

The unit has an impedance of 1050 ohms and forms a pulse of 0.15μsec when used in a suitable circuit. It is also available with pulse widths from 0.02 to 20μsec, and will operate satisfactorily in ambient temperatures from —65°C to +105°C. Special models can be constructed to withstand a temperature of +200°C.

A special resin potting compound gives the device greater resistance to corrosion and moisture, improves the electrical and physical characteristics, and makes it almost indestructible. PCA Electronics, Inc., Dept. ED, 6368 De Longpre Ave., Hollywood 28, Calif.

CIRCLE ED-8 ON READER-SERVICE CARD FOR MORE INFORMATION

Sharp-Cutoff Pentode

"Premium" Version of Type 6AK5

Type 5654 is a "premium" version of the miniature Sharp-Cutoff Pentode, Type 6AK5, designed for use as a broad-band r-f or i-f amplifier in mobile and aircraft receivers. It is constructed and processed to meet military requirements.

The compact structure is specially designed to provide increased mount strength against shock and vibration. A pure-tungsten heater provides long life under conditions of on-off switching.

Like the Type 6AK5, the Type 5654 has high transconductance, low interelectrode capacitances, high input resistance, and high signal-to-noise ratio-features contributing to its performance in r-f and i-f applications.

For Class A1 operation, maximum ratings are a plate voltage of 200v, a grid-No. 2 (screen) voltage of 155v, a plate dissipation of 1.85w, a grid-No. 2 input of 0.55w, a cathode current of 20ma, and a peak heater-cathode voltage of 100v. Radio Corp. of America, Dept. ED, Harrison, N. J.

CIRCLE ED-9 ON READER-SERVICE CARD FOR MORE INFORMATION

Frequency-Time Counters

Measure Frequencies to 1Mc

Four new models comprising a complete line of Frequency-Counting equipment have been added to the company's line. These instruments are of two types, designed to satisfy distinctly varying requirements: the simplified frequency counter Models 820 and 830 for rapid and accurate production test measurements; and the universal frequency-time counter Models 840 and 850, which incorporate all the flexible circuitry necessary to perform any known function in counting, timing, or frequency-measurement.

The Models 840 and 850 frequency-time counters contain all the timing, gating, and switching facility necessary for the widest possible range of measurement functions. These include direct counting of frequencies up to 1Mc, or timing the period of a cycle with 10μsec. Elapsed time is measurable in increments variable from 10μsec up to 1sec. Two unknown frequencies can be compared to obtain a ratio or an external standard introduced for a higher accuracy time base. For use as a secondary frequency standard, outputs are provided from a frequency divider at 100kc, 10kc, 1kc, 100cy, 10cy, and 1cy.

For speed, accuracy, and simplicity, the Models 820 and 830 frequency counters suit the production line and are useful for calibrating oscillators, for measuring flow and pressure with appropriate pickup devices, and for obtaining rpm data on engine test stands, among other applications.

These new models are smaller, lighter, and less expensive than previous types. Their panel layout has been planned for maximum ease and convenience in operation.

A choice between two types of panel indication is provided: either the 1-2-4-8 decimal readout or the conventional 10-lamp 0-9 readout, if desired. Potter Instrument Co., Inc., Dept. ED, 115 Cutter Mill Rd., Great Neck, N. Y.

CIRCLE ED-10 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Delay Line

Continuously Variable

The Type 507 Continuously Variable Delay Line is a miniature unit capable of providing continuously variable time delay from zero to several hundred millimicroseconds. Because the amount of equalization is made exactly equal to its correct optimum value, the transmission characteristics are superior to those of an ordinary commercially available delay line of distributed or lumped-parameter type. Outstanding features include fast rise time, excellent stability, hairline accuracy, and complete freedom of time jitter.

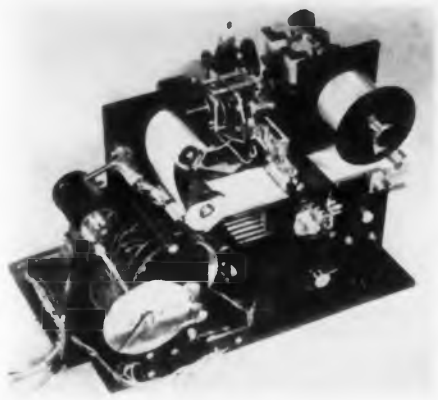
The device is essentially a condensed radio frequency cable with one conductor changed into a long, thin coil and the other conductor spaced closely to the first, thus producing a large amount of time delay, yet maintaining low attenuation at high frequencies.

The time delay is continuously variable from 0 to 0.8μsec, and the rise time is 0.0012 $\sqrt{t}$ μsec, where t is the amount of delay in milliμsec. Characteristic impedance is 390 ohms nominal, and the attenuation in db per 100milliμsec delay is essentially zero below 3Mc, 0.5 at 8Mc, and 1 at 15Mc. Size of the unit is 1" x 4" x 4", and its weight is 14 oz. Advance Electronics Co., Dept. ED, P. O. Box 394, Passaic, N. J.

CIRCLE ED-11 ON READER-SERVICE CARD FOR MORE INFORMATION

Analog Data Recorder

Prints Numerical Values



The Analog Data Recorder simplifies the measurement and numerical printing of analog quantities. A basic unit can be adapted to print the numerical value of a great variety of measurements such as rpm, distance, and many other analog quantities capable of being converted into a corresponding voltage (through various sensing devices).

Typical sensing devices employed are Tachometer generators (for rpm measurement), thermocouples (for temperature measurement), and photocells (for light intensity measurement).

Other features that can be incorporated into the instrument include multi-channel operation, automatic print actuation, time index print, identification index print, zero balance adjustment, and visual dial.

In addition to recording physical quantities, various components can be added to extend its use to computing (addition, subtraction, division, multiplication, integration, etc.). Streeter-Amet Co., Dept. ED, 4101 Ravenswood Ave., Chicago 13, Ill.

CIRCLE ED-12 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Resistor

4w, Completely Insulated Unit

The Type PW4 Power Resistor, rated at 4w, has been added to the company's line. It is completely insulated with an inorganic core material molded in a high temperature plastic, which does not support combustion.

The wire element is wound uniformly and tightly on a glass fibre core with axial leads 1-1/2" long x 0.036"diam. Body dimensions are 1-3/4" long x 21/64"diam, and the unit is available in resistance values from 1 ohm to 8200 ohms in ±5% and ±10% tolerance. International Resistance Co., Dept. ED, 401 North Broad St., Philadelphia 8, Pa.

CIRCLE ED-13 ON READER-SERVICE CARD FOR MORE INFORMATION

High Vacuum Diode

Only 2" long x 3/4"diam

The Type 6269 High Vacuum Clipper Diode and rectifier tube is only 2" long (without leads) and 3/4" diam. Maximum peak voltage is 16kv, and peak current is 250ma. Although developed primarily for military radar applications, the tube has interesting possibilities for use in the high voltage electronic field where space requirements are critical.

Designed as a miniature, ruggedized version of the larger Type 3B29, this new, external diode operates under more stringent conditions than its prototype tube. The Type 6269 tube is cooled by liquid-immersion (silicone oil). Amperex Electronic Corp., Dept. ED, 230 Duffy Ave., Hicksville, L. I., N. Y.

CIRCLE ED-14 ON READER-SERVICE CARD FOR MORE INFORMATION

Motor Selecting Slide Rule

For 1/2000 hp to 1/2 hp Motors

Useful for guiding electronic designers in the selection of motors for servo and other control applications, this Motor Selecting Slide Rule provides detailed information on 35 "EMC" and "CYCLOHM" fractional motors in ratings from 1/2000 hp to 1/2 hp. Simple to use, the pocket-sized Motor Selector gives most of the vital statistics and specifications contained in the company's catalog and saves many hours of research.

The Selector chart shows at a glance the motor type, continuous and intermittent horsepower, the full load rpm, full load current (continuous and intermittent), full load efficiency (continuous and intermittent), ventilation, core size, winding type and voltage on EMC d-c and shaded-pole motors.

On "CYCLOHM" induction motors the information provided is frame type, poles, full load speed, horse power, pull in torque, pull out torque, starting torque, and starting torque with relay. Also shown is full load current duty at 40°C ambient. This slide rule is available without charge on written request. Howard Industries, Inc., Dept. ED, Racine, Wisc.

CIRCLE ED-15 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Radio Interference Filter

Withstands Shock and Vibration

The Type 1558 miniature Radio Interference Filter has been constructed to withstand the shock and vibration of aircraft service. It is hermetically sealed in a drawn, metal case with ceramic terminals.

Occupying a space of 1-1/4" x 1-1/8" x 1-3/4", this unit provides more than 86db attenuation from 0.6Mc to 30Mc and handles 5amp at 130v, 0-1000cy, with a voltage drop of only 0.25v at full load. The filter is designed for bulkhead mounting, with input and output terminals on opposite sides of the bulkhead. Tobe Deutschmann Corp., Dept. ED, Norwood, Mass.

CIRCLE ED-18 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Variable Resistor

Performs Like Larger Units

Although only 3/4"diam, the Type 70 Miniature Variable Resistor is fully equal in performance to larger type units. It is designed for use in TV sets and small personal radios, as well as in many other types of electronic equipment where space is at a premium.

Wattage rating is 0.3w for resistances through 10,000 ohms, and 0.2w with 350v max across end terminals for resistances over 10,000 ohms. Angle of rotation is 300° ±5°. A variety of resistance tapers is available.

The unit is arranged for mounting with a 1/4" diam, 32-pitch threaded bushing and is provided with a 1/8"diam shaft, which can be knurled for finger adjustment and flatted or slotted for knob or screwdriver adjustment. Chicago Telephone Supply Co., Dept. ED, Elkhart, Ind.

CIRCLE ED-19 ON READER-SERVICE CARD FOR MORE INFORMATION

High Voltage Rectifier

50% Smaller Than Type 1616

The Type X-22 High Vacuum Rectifier is a reduced size version of a current JAN preferred list tube, which has been developed to make possible compactness and weight reduction of airborne radar, etc. It has been designed to replace the Type 1616, with a saving of about 50% in cubic space occupancy.

Maximum ratings for rectifier operation include a filament voltage of 2.5v ±5%, a peak plate voltage of 6.0kv, an output current of 130ma d-c, and a surge current of 2.5amp. Maximum height is 5.5", and maximum diameter is 1.57". The tube employs a medium 4-pin phenolic base and has a small C1-1 cap. United Electronics Co., Dept. ED, 42 Spring St., Newark 2, N. J.

CIRCLE ED-20 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Pulse Transformer

Provides 0.005 milli-μsec Rise Times

New design techniques and a special iron core in the Type MPT 101-0.1 Pulse Transformer make possible 0.1μsec pulse widths and rise times of less than 0.005 milli-μsec when used in certain circuits. Weighing less than 0.03 oz, it is slightly smaller than a pea in size, which makes it specially suited for miniature assemblies.

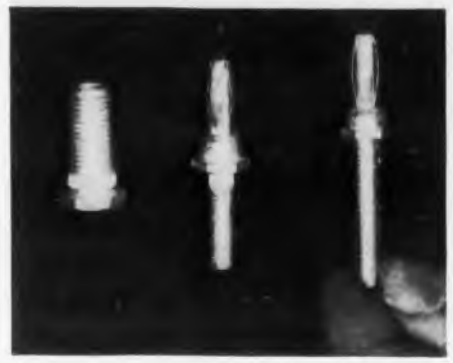
The unit meets MIL-T27 test specifications, including Table 1A humidity resistance tests. It can operate indefinitely at temperatures ranging from —70°C to +125°C, and will operate normally for a short time at +150°C.

The device is impregnated and imbedded in an epoxy resin which does not support combustion. It is hermetically sealed and practically indestructible. Leads coming from the transformer will withstand a 5 lb pull. Designed for pulse forming, the unit has wide application in missiles, computers, and computer circuits, and also can be used for pulse coupling. P C A Electronics, Inc., Dept. ED, 6368 De Longpre Ave., Hollywood 28, Calif.

CIRCLE ED-21 ON READER-SERVICE CARD FOR MORE INFORMATION

Banana Plugs and Jacks

With Very Low Contact Resistance



These silver-plated Banana Plugs and Jacks, designed for use in military, industrial, and commercial equipment, require very low contact resistance.

Plug No. 428 (left) has a straight threaded shank 1-1/8" long. The No. 429 plug (center) has a combination shank 3/4" long, with a knurled collar for force-fit in a panel hole, and a threaded section in addition. Both plugs have contact springs of beryllium copper.

The No. 431 banana jack (right) is machined of solid brass. It has a knurled shoulder and a threaded body. The hex head measures 7/16" across flats, and the shank is 3/4" long. Insuline Corp. of America, Dept. ED, 3602 35th Ave., Long Island City 1, N. Y.

CIRCLE ED-22 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniaturized D-C Relay

6pdt, Operates on 26.5v

The Type RCA-203W1 Miniaturized D-C Relay is intended for general use throughout the electrical and electronic systems of military aircraft. The unit, a 6pdt relay, is hermetically sealed and has palladium contacts rated to handle 2amp with a resistive load at 26.5v d-c or 1amp with an inductive load at the same voltage.

Contacts are arranged in a break-before-make sequence, and the miniaturized type design features sturdy and compact construction, moisture-free-gas filling, and long operating life. The unit is designed to meet the requirements of Spec. MIL-R-5757, and provides long service under extremes of temperature, humidity, shock, vibration, and voltage variations. It weighs only 3 oz and can be operated in any position. Maximum pull-in and drop-out voltages are 18.0v and 13.0v d-c, respectively. Radio Corp. of America, Dept. ED, Harrison, N. J.

CIRCLE ED-23 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Power Supply

150v, 100ma Output

Model A-1220 is a compact (2-1/4" x 4-1/4" x 3-11/16"), light weight (1 lb. 14 oz), high frequency vibrator type Power Supply designed to meet severe military standards of vibration, shock, temperature range, humidity, and altitude.

The vibrator and power supply are hermetically sealed, and the vibrator attaches with snap fasteners. The output of 150v, 100ma is filtered to 1% peak ripple. Three standard units for 6v d-c, 12v d-c, and 26.5v d-c input are available, and on special order, units with output power up to 20w, output voltages up to 300v, and input voltages between 4v d-c and 110v d-c can be furnished.

The Model A-1220 vibrator power supply permits a maximum of reliability, ease of installation and vibrator replacement. Airpax Products Co., Dept. ED, Middle River, Baltimore 20, Md.

CIRCLE ED-25 ON READER-SERVICE CARD FOR MORE INFORMATION

Permanent Magnet Kits

Available in Two Assortments

"You-Try-It" Permanent Magnet Kits are now available, enabling designers to devise their own new uses for permanent magnets. These alnico magnets have already found many uses in various electronic devices, and these kits include several varieties for experimental applications.

Two kits are available. Shop package No. 1 contains 48 permanent magnets in 8 styles. These magnets have up to 2 lbs. of "pull" for each unit. Shop package No. 2, contains 18 larger magnets in 4 styles, and these units have a "pull" of from 3 to 12 lbs. Carboloy Dept., General Electric Co., Dept. ED, Detroit 32, Mich.

CIRCLE ED-26 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Potted Pulse Transformers

5/16"diam x 1/8" thick, Weighs 1/100 oz

Embedded in a cylinder of a special temperature-resistant thermo-setting plastic for protection, these miniature Potted Pulse Transformers measure 5/16" diam x 1/8" thick and weigh 1/100 oz, complete. They are designed for application in digital computers, radar, telemetering systems, pulse-type radio communication systems, etc.

A novel mounting means, consisting of a pin passing axially through the transformer, is provided to fasten the transformer to a mounting panel.

By applying a square pulse to the primary of one of these units (through an input resistance of 50 ohms and with the secondary shunted by a 1500 ohm resistor), a pulse having a pulse length of 1μsec, and a rise time of 0.1μsec, can be produced.

Standard units are available with a 1:1 turns ratio, and transformers with special windings can be furnished on special order. The Jacobs Instrument Co., Dept. ED, Bethesda, Md.

CIRCLE ED-28 ON READER-SERVICE CARD FOR MORE INFORMATION

Measuring Instrument

Checks Vector Relations of A-C Voltages

The Type 202 "Vectorlyzer" permits unusual speed and accuracy ($\pm$2% through panel binding posts, and $\pm$1db through probe) for measuring vector relations of alternating voltages. This versatile instrument also may be modified to suit specialized applications, such as to measure vector sum or difference of two voltages, the phase angle between two voltages, and imaginary and real components of an unknown voltage in terms of a reference voltage. In addition, it can be used for measurement of a voltage across two points which are both above a-c ground potential, and (in conjunction with an oscillator), to determine the magnitude and phase angle of an unknown impedance.

Frequency range for the Type 202 is 8cy to 2Mc through panel binding posts and 20kc to 500Mc through the probe. The input impedance at the probe is 2.5mmfd shunted by 100,000 ohms. Coaxial arrangements for matching low impedance cables are available. The input impedance at the panel binding post is 14mmfd shunted by 1 megohm. The voltage range through panel binding post is 0.06v, 0.6v, 6.0v, 60.0v, or 600v full scale. The voltage range through the probe is 0.6v, 6.0v, or 60v full scale.

The phase angle range is 0—180°, or 180°—360°. Other phase ranges with better angular sensitivity can be arranged through panel adjustment. Advance Electronics Co., Dept. ED, P. O. Box 394, Passaic, N. J.

CIRCLE ED-29 ON READER-SERVICE CARD FOR MORE INFORMATION

Coaxial Terminal Triode

For r-f Heating and Transmission Uses

The Type ML-6257 is a water-cooled ring seal Triode Coaxial Terminal incorporating an integral anode water jacket. Designed specifically for r-f heating application in the 2kw to 3kw range, this unit is also adaptable to a-m, f-m, and TV transmission.

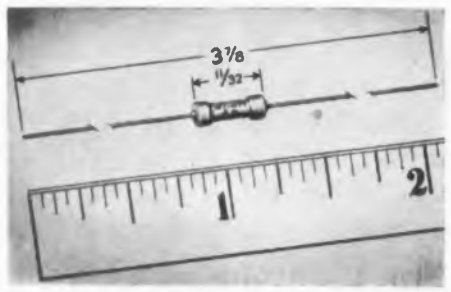
Plate input and dissipation ratings are 7kw and 5kw respectively, and the stress-free thoriated tungsten filament operates at 12.6v, 27amp. Maximum ratings apply to 110Mc.

The tube is also available in a forced-air cooled model. Machlett Laboratories, Inc., Dept. ED, Springdale, Conn.

CIRCLE ED-30 ON READER-SERVICE CARD FOR MORE INFORMATION

High Stability Carbon Resistors

With 1%, 2%, and 5% Tolerances



A subminiature line of "Welwyn" High-Stability Deposit Carbon Resistors now is available in a range from 10 ohms to 1 megohm, with dimensions of 1/8"diam x 15/32" long. Furnished in tolerances of 1%, 2%, and 5%, these resistors have precision applications where the current flow is small.

These resistors are conservatively rated at 1/8w, under which conditions the temperature rise does not exceed 40° over ambient temperature. They may also be safely used at 1/4w ratings, where a temperature increase of 100° is permissible.

The units have a high order of stability and retain their characteristics over widely changing conditions of load, temperature, voltage, and aging processes. Inductive and capacitive reactances, as well as thermal noise, are exceedingly low to extremely high frequencies.

Designed to insure permanent contact between pigtail terminals and resistor element, the resistors are constructed of crystalline carbon deposit on porcelain rods, to which machined end-caps are firmly attached, and into which the tinned copper terminal wires are staked and then soldered for double protection. Rockbar Corp., Dept. ED, 209 E. 37th St., New York, N. Y.

CIRCLE ED-31 ON READER-SERVICE CARD FOR MORE INFORMATION

Compact Switches

"Push-Push" and Rotary Types

Illustrated are two styles of compact, lightweight, durable switches which can be incorporated in a wide range of electronic devices, business machines, aircraft equipment, and similar applications. They are designed to assure positive snap action with strong leverage to break contact welding that may result from accidental overloads.

The Type J100 Switch is a push ON-push OFF" unit with a cam-roller contactor design operated by a sturdy escapement-type push-button action. Positive contact is obtained even under adverse operating conditions, and the unit is made so that the switch cannot be "teased off" contact. The switch is designed for operation at either 28v d-c or 115v a-c, 60cy, and is conservatively rated at 20amp resistive.

Contact surfaces are heavily silvered and an insulating spacer prevents arcing between terminals. The Type R1000 is a similar unit except that it is designed for rotary action with an indicator knob. Both switches utilize approved plastic materials and are housed in anodized aluminum cases. Hetherington, Inc., Dept. ED, Sharon Hill, Pa.

CIRCLE ED-32 ON READER-SERVICE CARD FOR MORE INFORMATION

Standard Inductors

100μh to 1h Range

Now available is the Type 1482 Standard Inductors as replacements for the long-used Type 106. Available in 1-2-5 unit values, these toroidal inductors are wound on a low thermal expansion ceramic core having an elliptical cross section to avoid sharp bends in the winding and are hermetically sealed to insure a high degree of stability. Before shipment, they are adjusted to a nominal accuracy of $\pm$0.1%.

Specifications for these units include an inductance range of 100μh to 1h, inclusive, and a maximum input power of 3w for a 20°C rise. Dimensions are 6-1/2" x 6-1/2" x 8" height overall, and the unit weighs 11-1/2 lbs. Additional inductors of 10h, 5h, and 2h also are available. General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge 39, Mass.

CIRCLE ED-33 ON READER-SERVICE CARD FOR MORE INFORMATION

Multiplier Phototube

Compact, 10-Stage Unit

Type 6199 is a compact, 10-stage Multiplier Phototube intended for use in scintillation counters and in other applications involving low-level, large area light sources. Its small size makes this tube suitable for portable and fixed equipment where space considerations are important.

The tube's spectral response covers the range from about 3000 to 6200 angstroms with a peak value at about 4000 angstroms, making it highly sensitive to the blue-rich light emitted by excited organic phosphors such as anthracene and inorganic materials such as thallium-activated sodium iodide.

Design features include a semi-transparent cathode with a diameter of 1-1/4" on the inner face end of the bulb, a face with a 1"diam flat surface to facilitate the mounting of flat phosphor crystals in direct contact with the surface, and 10 electrostatically focused multiplying stages. The tube is capable of multiplying weak photoelectric current produced at the cathode by an average value of 600,000 times when operated with a supply voltage of 1000v. Output current is a linear function of the exciting illumination under normal operating conditions. Radio Corp. of America, Dept. ED, Harrison, N. J.

CIRCLE ED-34 ON READER-SERVICE CARD FOR MORE INFORMATION

Twin Tetrode

For u-h-f and v-h-f Applications

The Type 5894-A u-h-f and v-h-f Twin Tetrode is a smaller and mechanically and electrically improved version of the company's AX-9903/5844 tube. It is designed for wide band operation as an r-f amplifier, modulator, and frequency doubler or tripler.

Improved high frequency performance is made possible because the cathode and grid structure is supported at the top as well as at the bottom of the tube, keeping the two sections of the tube in closer electrical balance. The construction of the tube enables it to withstand greater shock and vibration.

Power output is 85w at 250Mc and 45w at 500Mc. Filament ratings are 12.6v at 0.9amp (series) and 6.3v at 1.8amp (parallel). Amperex Electronic Corp., Dept. ED, 230 Duffy Ave., Hicksville, Long Island, N. Y.

CIRCLE ED-35 ON READER-SERVICE CARD FOR MORE INFORMATION

R-F Interference Filters

Compact, Single or Multiple Section Units

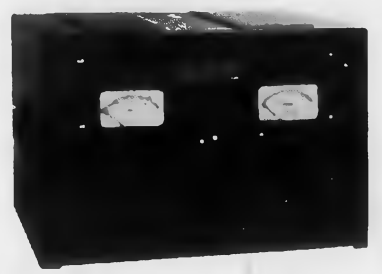
The use of metallized paper capacitor elements and inductances made with special windings on high permeability core materials has effected reductions of from 40% to 50% on the company's r-f Interference Filters. These filters are useful in high temperature and high altitude applications and have characteristics of high impedance, low voltage drop, and minimum heating.

Designed to meet all government specifications, the filters are available in single or multiple filter sections for suppressing conducted and radiated noise on one or more power lines, and for noise attenuation from 14kc to 1,000Mc. Astron Corp., Dept. ED, 255 Grant Ave., E. Newark, N. J.

CIRCLE ED-36 ON READER-SERVICE CARD FOR MORE INFORMATION

Magnetic Power Supply

Rated at 5v to 32v D-C, 15amp



The Model No. MR532-15 Magnetic Amplifier Regulated Power Supply is rated at 5v to 32v d-c at 15-amp continuously and employs no tubes. It has many electronic design applications, especially in engineering laboratories.

In addition to a regulation accuracy of $\pm$1% for d-c load variations from no load to full load, the unit also is stabilized for a-c line variations from 105v to 125v a-c. It has a maximum ripple of 1%, and also is provided with a 4-1/2" Ammeter and Voltmeter. Overall dimensions are 22" x 17" x 14-1/2".

The unit is mounted in a bench-type cabinet, which also can be used for 19" rack panel mounting. In addition to the power supply a-c ON-OFF switch, the unit has a magnetic type circuit breaker on the d-c side with a time delay. Perkin Engineering Corp., Dept. ED, 345 Kansas St., El Segundo, Calif.

CIRCLE ED-37 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Variable Transformer

Provides 7v to 13v at 4amp

Model No. 226 is a versatile Variable Transformer for general experimental use in engineering design laboratories. With an input of 117v a-c, 50w, the secondary provides an output of 7v to 13v a-c (continuously variable) and 4amp continuous duty. The unit can be used for 6v to 12v lamps, small motors, heater elements, and for operation of a-c relays and solenoids. It will stand high overloads.

Weight of the transformer is 3 lbs. Its dimensions are 3-1/2" x 4" x 3-1/2" high. Each unit is supplied with a 6 ft. a-c cord and is finished in gray wrinkle. Pacific Transducer Corp., Dept. ED, 11921 West Pico Blvd., Los Angeles 64, Calif.

CIRCLE ED-39 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Thermoswitch

For Precise Control, Overheat Detection

This Miniature Thermoswitch has been designed for precise temperature control and overheat detection in instruments and precision mechanisms where minimum volume and weight are important. It is available in both rectangular and cylindrical models (as illustrated) for design convenience.

Depending on the thermal and electrical characteristics of the particular system, temperature control to within 1°F is readily attainable, because the inherent thermostat sensitivity is actually less than 1°F. Either model may be set at any temperature in the range from 0°F to 200°F by the adjusting screw.

A high resistance to vibration permits the miniature units to maintain accurate control under vibration conditions of 5G's at 50—500cy. Both models are rated 2.5amp at 115v a-c or 2amp at 28v d-c. The electrical contacts of both models open when rising temperature reaches the set point. The body dimensions of the rectangular thermostat (left) are 3/4" x 3/8" x 11/32". The cylindrical model (center) has a body diameter of 3/4" and is 11/32" thick. Various types of mountings are available for both models. Fenwal Inc., Dept. ED, Ashland, Mass.

CIRCLE ED-40 ON READER-SERVICE CARD FOR MORE INFORMATION

Anti-Capacity Switching Key

For Airborne Equipment

Weighing only 2-1/6 oz, this miniature, ruggedly constructed Anti-Capacity Switching Key has been designed to meet military requirements. It provides many contacts in less space and is especially useful in airborne and other types of equipment where compactness and light weight are important factors.

The unit consists of four sets of transfer contacts on each side, providing good transfer. The key, nonlocking in both directions, is mounted on an aluminum frame with four screws and can be easily removed from the key frame for inspection and adjustment.

Other features include a molded spring nest and a special restoring spring which is heat-treated for maximum life and endurance. Federal Telephone and Radio Corp., Dept. ED, Clifton, N. J.

CIRCLE ED-41 ON READER-SERVICE CARD FOR MORE INFORMATION

Ultrasonic Delay Lines

In Bandwidths of 12Mc, or Greater

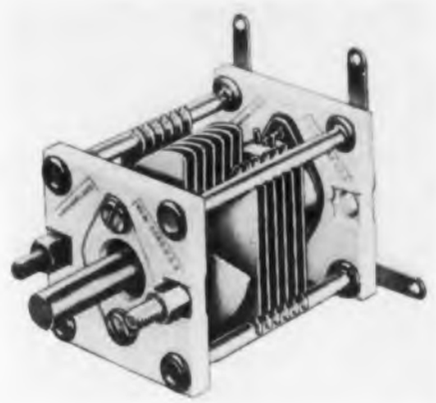
A series of fused quartz Ultrasonic Delay Lines is available for radar and electronic computer applications. With a bandwidth of 12Mc or greater, these lines feature a low ratio of spurious signals to desired signals (as low as 50db).

Characteristic insertion losses are kept at 34db to 50db, depending on the terminating impedance necessary. Andersen Laboratories, Inc., Dept. ED, West Hartford, Conn.

CIRCLE ED-42 ON READER-SERVICE CARD FOR MORE INFORMATION

Variable Capacitor

Can Operate at 3200rpm



This butterfly-type Variable Capacitor is capable of continuous operation at speeds as high as 3200-rpm. Designed for sweep circuits and other applications requiring alternating capacity values, the unit eliminates rotor contact springs and uses commercial ball bearings in addition to a novel alignment and end-thrust take-up device.

Soldered brass rotor and stator assemblies, nickel or cadmium plated, are employed. Units are available with series effective capacity values ranging from 5.4mmfd to 17.0mmfd (nominal). Air gap between plates is 0.030" (nominal). Outside dimensions of each silicone-treated steatite base are 1-3/8" x 1-3/8". Hammarlund Mfg. Co., Inc., Dept. ED, 460 W. 34th St., New York 1, N. Y.

CIRCLE ED-43 ON READER-SERVICE CARD FOR MORE INFORMATION

Decade Inductance Units

Available in Four Ranges

This series of Decade Type Inductance Units is available in four ranges from 1.0mh to 10h. They can be furnished as single units which can be conveniently connected together to give an inductance range of from 1.0mh to 10,000mh.

The inductors are wound on toroidally-shaped powdered molybdenum permalloy cores. Quality factors (Q) as high as 250 are obtainable with these units. Switching is performed by the use of high current capacity, low resistance, instrument type switches. The units have a wide range of applications in electronic laboratories. Torocoil Co., Dept. ED, 1374 Mobile Court, St. Louis 10, Mo.

CIRCLE ED-44 ON READER-SERVICE CARD FOR MORE INFORMATION

He Asked Permission to Stay

Major William E. Barber, USMC
Medal of Honor

EIGHT THOUSAND marines lay besieged at Yudam-ni; three thousand more were at Hagaru-ri, preparing a breakthrough. Guarding a frozen mountain pass between them, Major Barber, with only a company, held their fate in his hands. Encirclement threatened him. But he asked permission to stay, and for five days he held the pass against attack. When relief came, only eighty-four men could walk away. But Major Barber had saved a division.

"I know," says Major Barber, "that you realize what hard jobs our men are doing in America's armed forces. Maybe you *haven't* realized that you're *helping* those men—whenever you invest in Defense Bonds. For Bonds strengthen our economy—to produce the arms and food and care that make our men secure."

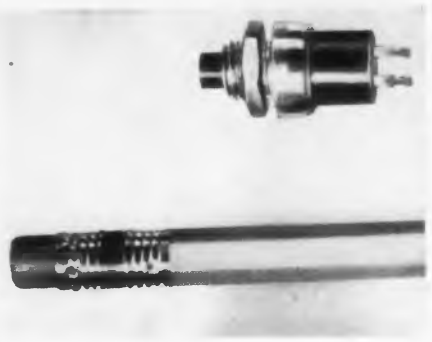
Peace is for the strong! For peace and prosperity save with U.S. Defense Bonds!

Now E Bonds pay 3%! Now, improved Series E Bonds start paying interest after 6 months. And average 3% interest, compounded semiannually when held to maturity! Also, all *maturing* E Bonds automatically *go on* earning—at the new rate—for 10 *more* years. Today, start investing in U. S. Series E Defense Bonds through the Payroll Savings Plan at work.

The U.S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America.

Pushbutton Switch

1.047" Long, 1/2"Diam



The Series No. 23 Pushbutton Switch measures only 1.047" from the end of the plunger to the end of the terminal tips. This switch is only half the size of the company's Series 4000 switch, previously designated miniature.

The unit has a 1/2"diam. Its contact resistance is 0.007 ohms max before use and 0.015 ohms max after approximately 200,000 operations.

Normally open, the switch has a spst momentary contact arrangement. It is rated at 1/4amp, 115v, a-c, non-inductive. The bushing, which provides single hole panel mounting, has a 5/16-32 thread. Grayhill, Dept. ED, 4524 W. Madison St., Chicago 24, Ill.

CIRCLE ED-46 ON READER-SERVICE CARD FOR MORE INFORMATION

Medium-Mu Twin Triode

Low-Noise, Miniature Type

Type 6BQ7-A is a miniature medium-mu Twin Triode designed for application as the first r-f amplifier tube in v-h-f TV receiver tuners. It also can be used as a low-noise i-f pre-amplifier tube in u-h-f TV receivers employing a crystal mixer. Compared with the older, superseded Type 6BQ7, this tube features somewhat higher transconductance while retaining the same low input capacitance, low input loading, and low plate-to-cathode capacitance.

These features are particularly useful in the direct-coupled r-f stage of TV receivers utilizing a driven r-f grounded-grid amplifier circuit or in the cascode type of circuit. In such circuits, the tube provides a reduction in noise with the result of improved receiver sensitivity.

Characteristics for Class A amplifier use include: a plate voltage of 150v; a cathode-bias resistor of 220 ohms; an amplification factor of 39; a plate resistance of 6100 ohms; a transconductance of 6400-μmhos; a plate current of 9ma; and grid volts of —10v (approx) for a plate current of 10μamp. Radio Corp. of America, Dept. ED, Harrison, N. J.

CIRCLE ED-47 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Panel Indicator Light

Only 1-5/16" Long Overall

The Type L1000 Panel Indicator Light is only 1-5/16" long from terminal tip to indicator lens and weighs about 1/4 oz. These features and its sturdy construction make the unit useful for many electronic devices where size and weight are important design considerations such as in aircraft applications.

The terminal is rigidly molded in place, and a removable plastic lens (available in amber, blue, green, red, or white), is held securely by a rubber "O" ring which also serves as an effective moisture seal. A standard 6v, 12v, or 28v No. 327 miniature lamp is employed. The unit is assembled in a nickel-plated brass case and is furnished with removable bushings, spacers, and ground terminal for either grounded or nongrounded type panel mounting. Hetherington, Inc., Dept. ED, Sharon Hill, Pa.

CIRCLE ED-50 ON READER-SERVICE CARD FOR MORE INFORMATION

Precision Potentiometer

In Single-Section Units

Suitable for applications requiring non-linear functional outputs without external taps, this 1-3/4" diam Precision Potentiometer (Model 85196) is now available in single-section units with either a synchro-type or screw-type mounting. Both sleeve bearing and ball bearing models are available with torque requirements of 0.5 oz-in for the ball bearing unit.

Standard linearity tolerance is ±3%, with better linearity units available on special order. Mechanical rotation is possible at 360° continuous, or stops can be provided for any rotation up to 330°.

Resistances from 2,000 ohms to 200,000 ohms are available with a power dissipation of 3w at an ambient temperature of +25°C. Operating temperature range is from −54°C to +71°C, and the unit will operate during 50G acceleration applied along any axis.

The case is black anodized aluminum, and close tolerances are held on all mounting surfaces. The sleeve bearing potentiometer weighs 2-1/2 oz, and the weight of the ball bearing unit is 3-1/2 oz. G. M. Giannini & Co., Inc., Dept. ED, 117 E. Colorado St., Pasadena 1, Calif.

CIRCLE ED-51 ON READER-SERVICE CARD FOR MORE INFORMATION

Radial-Beam Power Tetrode

Designed for 28v Electrical Systems

The Type 4X150D is a Radial-Beam Power Tetrode designed for use in commercial and military aircraft and other vehicular operation. This tube has a heater rating of 26.5v at 0.57amp, which makes it ideal for use in 28v electrical systems.

The unit is 2-1/2" long and is used as an oscillator, amplifier, or frequency multiplier into the u-h-f range. It has a plate dissipation rating of 150w in Class-C telegraphy or f-m telephony service. Eitel-McCullough, Inc., Dept. ED, San Bruno, Calif.

CIRCLE ED-52 ON READER-SERVICE CARD FOR MORE INFORMATION

Packaged Blocking Oscillator

Compact, Plug-In Unit

Rise times as short as 0.01μsec are provided by the Type PBO-1 Packaged Blocking Oscillator. It is a plug-in type unit which includes its transformer and employs a ferrite core transformer for fast rise time and high peak current.

Special features include the location of cathode and load resistors outside of the case, permitting adaption to different requirements, an easily replaceable vacuum tube, minimum under-chassis space required, low circuit design and layout costs, and a simple method of being held in place by means of an ordinary tube clamp.

Dimensions for this unit which plugs into a 9-pin noval socket are a maximum OD of 1-3/8", and a maximum seated height (including shield) of 4-5/16".

The specifications for the Type PBO-1 include a nominal pulse width of 0.1μsec, a rise time of 0.01μsec, a maximum pps (pin 9 at ground) of 100kc, a maximum B+ voltage of 300v, a 6AN5 vacuum tube, a minimum input trigger voltage (if used) of −15v, an output pulse amplitude of 150v across 470 ohms, and a pulse amplitude of 115v across 100 ohms (cathode resistor).

Also available is the Type PBO-2 unit, which has a nominal pulse width of 2.0μsec. American Machine & Foundry Co., Electronics Div., Dept. ED, 1085 Commonwealth Ave., Boston 15, Mass.

CIRCLE ED-53 ON READER-SERVICE CARD FOR MORE INFORMATION

"Teflon" Components

In Molded, Extruded, Machined Forms

Available in molded, extruded, and machined forms, "Teflon" Components are of interest to electronic designers because of their dielectric strength, low power factor, resistance to extremes of temperature, and high impact strength at both high and low temperatures. They have many electronic uses.

Characteristics of "Teflon" are a dielectric constant of 2.0 and a loss factor less than 0.0005 at practically all frequencies. Short time dielectric strength is high, volume resistivity greater than 10^{15} ohm-cm, even after prolonged soaking in water. It serves in temperatures from −80°F to 500°F, has good arc resistance, and does not carbonize under an arc discharge. Abbott & Biddle, Div. of Flexrock Co., Dept. ED-1, 2413 Federal St., Philadelphia 46, Pa.

CIRCLE ED-54 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature A-C Motors

For Servo and Control Applications

Designed for use in servo and control applications where reliability under extreme conditions is essential, the Type 665-50 A-C Miniature Precision Motors also are easily adaptable to drive such auxiliary equipment as blowers, etc. They can be furnished to meet rigid military specifications for

humidity, temperature range, vibration, and altitude.

Approximate dimensions of an average motor are 1.700"diam x 1-3/4" (less gear train). Length may vary according to specified motor characteristics.

Typical performance for a unit operating at 400cy at 8-115v, includes a no-load speed of 22,000rpm, a stall torque of 1.5in-oz, a stall watts per phase of 10.0w, and a rotor inertia of 10.5gm-cm^2.

Housings are made of either aluminum alloy or stainless steel, and can be modified to permit flange or ring mounting. On motors without gear train, housing diameter is subject to some variation. G-M Laboratories Inc., Dept. ED, 4300 North Knox Ave., Chicago 41, Ill.

CIRCLE ED-55 ON READER-SERVICE CARD FOR MORE INFORMATION

Beam Power Amplifier

Heater-Cathode Type

Type 12V6-GT, a Beam Power Tube of the heater-cathode type, has been designed primarily for use in the output amplifier of automobile radio receivers operating from a 12v battery. Construction of the tube makes it capable of producing relatively high power output with high power sensitivity.

A single unit operated with a plate and screen voltage of 250v can deliver a maximum-signal power output of 4.5w with a driving voltage of only approx 12v. Another feature of this tube is its relatively low plate-current drain.

Typical operating characteristics (single-tube Class A1 amplifier) include: a plate voltage of 315v; a grid-No. 2 voltage of 225v; a grid-No. 1 voltage of —13v; a peak a-f grid-No. 1 voltage of 13v; a zero-signal plate current of 34ma; a max-signal plate current of 35ma; a plate resistance (approx) of 80,000 ohms; a transconductance of 3750μmhos; a load resistance of 8500 ohms; a total harmonic distortion of 12%; and a max-signal power output of 5.5w. Radio Corp. of America, Dept. ED, Harrison, N. J.

CIRCLE ED-56 ON READER-SERVICE CARD FOR MORE INFORMATION

See the March Issue for a Preview of the New and Unusual at the Radio Engineering Show

Meetings

Feb. 18-20: 8th Annual Conference, sponsored by the Reinforced Plastics Div. of the Society of the Plastics Industry, Inc., Hotel Shoreham, Washington, D. C.

Mar. 9-12:NEMA (National Electrical Manufacturers Assn.) Edgewater Beach Hotel, Chicago, Ill.

Mar. 16-18: IEE (Institution of Electrical Engineers) Symposium on Insulating Materials, London, England.

Mar. 23-26: IRE National Convention, Waldorf-Astoria Hotel and Grand Central Palace, New York, N. Y.

Apr. 11: NEREM (New England Radio Engineering Meeting), University of Connecticut, Storrs, Conn.

Apr. 16-17: 9th Joint Conference of RTMA of United States and Canada, Ambassador Hotel, Los Angeles, Calif.

Apr. 18: IRE Seventh Annual Spring Technical Conference, Cincinnati, Ohio.

Apr. 26-30: SMPTE (Society of Motion Picture and TV Engineers) 73rd Convention, Hotel Statler, Los Angeles, Calif.

Apr. 27-May 8: British Industries Fair, Birmingham & London, England.

Apr. 28-May 1: NARTB (National Assn. Radio and Television Broadcasters) 1953 Convention, Biltmore Hotel, Los Angeles, Calif.

Apr. 29-May 1: Electronic Components Symposium, Shakespeare Club, Pasadena, Calif.

May 11-13: 1953 National Conference on Airborne Electronics, Hotel Biltmore, Dayton, Ohio.

May 18-21: 1953 Electronic Parts Show, Conrad Hilton Hotel, Chicago, Ill.

May 18-23: 3rd International Congress on Electroheat, Paris, France.

May 24-28: NAED (National Assn. of Electronic Distributors) 45th Annual Convention, Conrad Hilton Hotel, Chicago, Ill.

May 24-28: Scientific Apparatus Makers Assn. Annual Meeting, The Greenbriar, White Sulphur Springs, W. Va.

June 15-19: AIEE Summer General Meeting, Chalfont-Haddon Hotel, Atlantic City, N. J.

June 15-19: Exposition of Basic Materials for Industry, Grand Central Palace, New York, N. Y.

June 16-24: International Electro-acoustics Congress, The Netherlands.

June 20-Oct. 11: German Communication and Transport Exhibition, Munich, Germany.

Aug. 19-21: WESCON (Western Electronic Show and Convention), San Francisco Municipal Auditorium, San Francisco, Calif.

Aug. 29-Sept. 6: West German Radio and TV Exhibition, Duesseldorf, Germany.

New Books...

Instrument Engineering, Vol. 1 . . . By C. S. Draper, W. McKay, and S. Lees. 269 pages, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. $6.00.

Sub-titled "Methods for describing the situations of instrument engineering", this book develops a system of concepts, notations, diagrams, and mathematical forms for describing the performance of physical devices and variations in physical quantities. It is the first of three volumes whose object is to present a generalized method of attack on the problems of measurement and control.

The book begins with a description of the operating system covering open-and-closed-chain systems. Then various types of diagrams for describing operating systems are presented followed by a discussion of performance operators and performance functions for operating systems. Static and dynamic operating conditions and performance then are treated including such topics as static sensitivity, description of static performance, transient stability and instability, hunting, smoothing, and response time.

Other topics covered include derivation of performance equations, dimensional analysis, concepts and notation for the comparison of physical quantities and for the description of generalized operating system performance, and applications of statistical methods to instrument engineering.

One chapter deals with the representation of physical situations by mathematical forms. Here the information required to apply the simple power series, the impulse function, the Fourier series, and the Fourier integral to describe variations of the working variable as a function of the running variable is summarized from the standpoint of engineering applications. The various performance-describing forms and the auxiliary information necessary for engineering applications are summarized in a series of definition summaries and figures designed for ready reference by engineers concerned with practical applications rather than with the niceties of mathematical derivations. The last chapter deals with a description of performance of operating systems in terms of their sinusoidal response characteristics.

Practical Aspects of the R-J Speaker Enclosure . . . By W. Joseph and F. Robbins. Paper bound, 14 pages, Vol. 29, No. 4 of the *Proceedings of the Radio Club of America, Inc.*, Radio Club of America, 11 West 42nd St., New York 18, N. Y. $.50.

This paper, presented before the Radio Club of America last October, now is available in printed form. It includes a discussion of various speaker systems, a diagram of the R-J construction, and an impedance curve of a 12" speaker in the R-J enclosure. Also presented are a series of oscilloscope screen photographs which compare the R-J and bass reflex enclosure responses. The paper will undoubtedly be of interest to electronic designers who also are high fidelity enthusiasts.

Electronic Measurements . . . By Frederick Emmons Terman and Joseph Mayo Pettit; Second edition, 707 pages, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N. Y. $10.00.

This book succeeds "Measurements in Radio Engineering" (1935) as a reference book for the practicing engineer as well as a college text. This change in title reflects the increased scope of the present volume, which now covers measurement fundamentals in many fields beyond conventional radio, including TV, radar, and other pulsed systems, microwaves, and a number of techniques useful to engineers who use electronics in their instrumentation.

A number of new topics has been added including waveguides and cavity resonators; standing wave measurements; noise in amplifiers and receivers; f-m and TV

receivers; generation of special waveforms; generation of time delays; modern vacuum-tube-voltmeters; power measurement at microwave frequencies; antenna measurements in the microwave region; oscillators for laboratory signal sources covering the range from very low to microwave frequencies; transient and steady-state response of amplifiers and circuits; new oscilloscope techniques; stability of feedback amplifiers; etc.

The book is about twice as long as the previous volume, and many new illustrations have been added. For the practicing engineer, the book gathers together a wide variety of information on measuring techniques and equipment to help him handle new problems as they arise. Extensive footnote references are provided for those desiring further details on the subject, and in so doing, the book offers a rather complete guide to the pertinent literature in the field.

Fundamentals of Engineering Electronics . . . By W. G. Dow; Second Edition, 627 pages. John Wiley & Sons., Inc., 440 Fourth Ave., New York 16, N. Y. $8.50.

The basic aim of this book is to give the reader a reasonably complete understanding of the internal functioning of the electron devices that serve as the active elements in electronic circuits. Although primarily a textbook for undergraduate electrical engineering courses, it is quite useful as a reference book for practicing electron tube and electronic circuit engineers.

Some of the important changes in this second edition include use of the meter-kilogram-second system of units, modernization of the analysis of space-charge control tubes by the use of the equivalent grid plane potential and equivalent electrostatic circuit concepts; and an analytical treatment of the dependence of interelectrode and input and output capacitances on space-charge control tube geometry.

The author presents a statement of the basic new principles that must be employed in electron tubes designed for u-h-f and microwave frequency ranges. These include the effects of electron transit time on electron interaction efficiency, input loading, and input-to-output phase angles, the induced current concept, and an introduction to klystrons, magnetron oscillators, and traveling wave amplifiers.

The study of energy-level diagrams in metals has been extended to cover the basic aspects of semiconductor energy-level diagrams and their general relation to the behavior of transistors. The Fermi distribution function is presented, and the Fermi energy level is discussed.

An extensive bibliographical reference list is included and the reference items have been selected partly for general study, and partly to support statements in the text.

Electrical Measuring Instruments (Part 1) . . . By C. V. Drysdale and A. C. Jolley; Second edition revised by G. F. Tagg. 598 pages. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

First published in 1924, this book has been revised to incorporate the many advances made in the field since that time. It is directed to people concerned with the design, manufacture, and use of basic electrical instruments.

Quite detailed and comprehensive in its scope, the book covers virtually all phases of electrical instruments. Unfortunately, since the original authors are English, the instruments discussed and illustrated are practically all British devices. Though the basic principles involved in their operation are the same as those used in American instruments, the slight differences in mechanical techniques and exterior appearances of many of the units may bother some American readers. Also the use of the decimal point in the center of a line (0·001amp) instead of at the bottom of a line (0.001amp) is somewhat disconcerting, though certainly not an insurmountable obstacle to using the book.

General electrical principles, mechanical design and construction, conditions for rapid indications, as well as properties of electrical materials, are treated in some detail. Then the various kinds of instruments (permanent magnet moving coil and soft iron instruments, dynammometer ammeters, voltmeters, and wattmeters, hot wire instruments, and electrostatic instruments) are discussed. Because the book deals only with fundamental instruments, electronic techniques are not discussed.

New Literature . . .

Servo Amplifiers 60

This 16-page bulletin offers a general description of the servo amplifiers illustrated, a classification according to d-c or a-c error voltages and 2-speed synchros, and applications for these amplifiers. Each model is illustrated, and specific information on specifications and applications is provided. A listing shows conversion factors for servo calculations. Also included is a data sheet for the purpose of defining individual servo performance requirements. Types of equipment described include a servo amplifier, dynamic analyzer, null detector, d-c millivoltmeter, and motor control. Industrial Control Co., Wyandanch, L. I., N. Y.

Nickel Alloys 61

A 26-page booklet describes the electrical and electronic properties of 18 high nickel alloys for electronic uses. Typical applications for these nickel alloys are in electron tubes, grid side rods, base pins, getter tabs, plates (anodes), cathode shields in rectifier tubes, woven wire mesh for grids, plates in high voltage vacuum capacitors, sliding contacts, high current furnace leads, spark gaps, magnetostriction devices, and resistance thermometer wire. General characteristics and availability of each type of alloy are presented. Other special grades of nickel for cathode sleeves, as well as various types of monel and inconel alloys, are discussed. International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

Variable Resistors 62

Data Sheet No. 164 lists a complete line of military and civilian variable resistors. Attached switches for the civilian line are illustrated, as well as a variety of concentric shaft tandem constructions with panel and rear sections operating separately from concentric shafts. Also shown is the new miniaturized Type 70 civilian control designed for use in new radio and TV sets. Military resistors featured include JAN-R-19 and JAN-R-94 types and special composition controls specifically designed for military communications equipment operating at extreme temperature and humidity ranges. Chicago Telephone Supply Corp., Elkhart, Ind.

Electron Tube 63

"Engineering and Application Data on Electronic Tubes" is a 22-page brochure describing the Type 6AJ4 r-f amplifier, a grounded-grid triode developed to operate over the wide u-h-f and v-h-f TV channels. Design features, circuit and measurement considerations, power gain measurement procedure, input impedance measurement procedure, and description and rating of this tube are discussed. Circuit diagrams present the important operating data, and graphs provide the average plate characteristics. Physical dimensions, terminal connections, maximum ratings, and average characteristics and typical operation are fully discussed. Supplements on the Type 6AF4 and Type 6AM4 tubes also are included. General Electric Co., Tube Dept., 1 River Rd., Schenectady 5, N. Y.

Insulation Tape 64

This 4-page, 2-color brochure on "Teflon" tape describes an insulating tape for use in motors, generators, coaxial cables, and other conductors. Electronic applications are mentioned, and the electrical, mechanical, and chemical properties are listed. A specimen of this tape in all the standard NEMA colors for polarity identification, is included. Raybestos-Manhattan, Inc., Plastic Products Sales Div., Manheim, Pa.

Selenium Rectifiers 65

Catalog B-1 (4-page, 3-color) presents this company's line of embedded selenium rectifiers, designed for use in applications where, because of environmental conditions or extreme altitudes, standard convection-cooled, painted rectifiers, are not suitable. A description of each type of rectifier is presented, including such data as altitude, efficiency, environmental conditions, temperature, thermal shock, construction, weight, and warranty. Circuit diagrams illustrate the construction of these rectifiers, and a table presents the specification factors for each type. Sarkes Tarzian Inc., Rectifier Div., 415 North College Ave., Bloomington, Ind.

Sampling Switches 66

"High Speed Multi-Channel Sampling Switches" is the title of a 4-page, 2-color brochure, which provides a representative cross-section of high speed multi-channel rotary sampling switches designed and fabricated by this company. These switches have application in industrial and airborne telemetering, drift compensation of d-c amplifiers, displaying parameters such as input-output character of electrical components for multichannel voltage comparison, sampling many thermocouples with a single alarm, generating pulse trains, etc. Photographs illustrate each type. Applied Science Corp. of Princeton, P. O. Box 44, Princeton, N. J.

Industrial Machines 67

"The Engineering Story" is a 28-page, 2-color brochure which presents in general terms the problems facing the designer, and subsequently the manufacturer, of industrial machines. Specific projects by the company are described: as, for example, the development of electronic control devices to keep machines functioning evenly and to insure uniformity of products. American Machine & Foundry Co., 1085 Commonwealth Ave., Boston 15, Mass.

Power Supplies 68

This 40-page, 2-color bulletin presents a listing with illustrations of this company's power supplies. The equipments featured are voltage regulated power supplies, dual voltage regulated power supplies, the Model 2000 "Super Regulator", a circuit panel (for experimental electronics), and a multiple power supply. Specifications for each model, including output voltage, output current, regulation, ripple voltage, output impedance, and fuse protection, are provided. Also included is filament supply information. Frequent charts indicate the operating range of each regulated power supply. Kepco Laboratories, Inc., 131-38 Sanford Ave., Flushing 55, N. Y.

Nuclear Resonance Magnetometer 69

This 8-page, 2-color bulletin describes the development and principles of operation of the Model 101 Nuclear Resonance Magnetometer, which accurately measures magnetic field strength using the principle of nuclear resonance. Specifications for the instrument are included. Laboratory for Electronics, Inc., 43 Leon St., Boston, Mass.

Mica-Dielectric Capacitors 70

Catalog 31 covers this company's transmitter-type Mica-Dielectric Capacitors, which are manufactured in accordance with JAN-C-5 specification. Characteristics, capacitance, tolerance, insulation resistance, voltage, current, and color code information is provided for the various types of capacitors by means of text, photographs, and circuit diagrams. Sprague Electric Co., North Adams, Mass.

Shielded Enclosures 71

Engineering Bulletin No. 3 (8-page, 2-color) contains a description of many types of shielded enclosures (screen rooms), that provide the high attenuation required for testing and evaluating sensitive electrical and electronic equipment without the influence of undesirable background radio interference. Applications for these enclosures are mentioned. along with information on attenuation characteristics, design advantages, service entrances, doors, line filters, and other pertinent data. Photographs and specifications are also included. Ace Engineering & Machine Co., Inc., 3644 North Lawrence St., Philadelphia 40, Pa.

Microwave Components 72

A 12-page, 2-color brochure lists and describes microwave components. The two types especially discussed are rigid and flexible waveguides, and various combinations of the two. Rigid waveguides are specifically recommended for installations where there is no movement, or for those portions of an assembly requiring the inclusion of complicated accessories. Flexible waveguides can be used for difficult connections caused by space limitations and misalignment. Photographs for each type are included, as well as circuit diagrams and charts indicating the specifications. Additional charts also list the rigid and flexible waveguides designed to meet MIL-T-85B Specification, along with detailed operational data. Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

Hermetically Sealed Resistors 73

Bulletin L-27 and Supplement 1 to this bulletin contain a guide to this company's precision wirewound resistors designed for military specifications. Differences between the new MIL-R-93A and the old JAN-R-93 specifications are explained, and a cross-reference table provides specifications of the various resistors. The supplement contains information on three additional hermetically sealed resistor styles and more information for the cross-reference table. Shallcross Mfg. Co., Collingdale, Pa.

Electronic Insulating Materials 74

This 12-page, 2-color brochure discusses "Turbonics", which deals with the study of insulation characteristics for insuring lasting performance. This information is especially useful for aircraft electronic design and development engineers and industrial manufacturers of electrical and electronic equipment. Insulation products described and illustrated are "Turbo" tubings and sleevings, general purpose hook-up wire, low tension aircraft wire, miniaturization wire, etc. Applications for these wires are mentioned. William Brand & Co., Inc., Willimantic, Conn.

Films for Capacitors 75

This 40-page catalog makes available a complete picture of the plastic films used as the solid dielectric in capacitors. Containers for the capacitors also are presented: bathtub, compact drawn rectangular, and glass types. Information includes voltage range, temperature range, resistance, dielectric absorption, power packs, as well as the requirements of pulse forming networks using the various capacitor types. Other specifications also are listed, and a section provides a discussion of special capacitors designed to meet individual needs. Plastic Capacitors, Inc., 2511 West Moffat St., Chicago 47, Ill.

Tantalum Capacitors 76

Bulletin 6.100 includes a list and description of a line of tantalum electrolytic capacitors ranging from 1.5 to 30mfd, with working voltages up to 125v d-c. These capacitors, intended for applications where unusually stable characteristics are required and space is at a premium, employ porous tantalum anodes. The bulletin lists 22 standard capacitors and contains a page of curves showing capacity and equivalent series resistance in relation to temperature and frequency. Fansteel Metallurgical Corp., North Chicago, Ill.

Low Frequency Oscillator 77

A 4-page brochure describes this company's Model "L" Oscillator, designed for low frequency coverage useful in the fields of Servomechanisms and ordnance research. Specifications for this instrument are included, along with a circuit diagram, photographs, and other information. Southwestern Industrial Electronics Co., P. O. Box 13058, Houston 19, Texas.

New Literature . . .

Hermetic Seals and Assemblies 80

S-53 is a 32-page catalog featuring photographs, diagrams, and operating data for more than 1600 stock seals and special assemblies. Also included are the company's line of electronic and electrical control systems, test equipment, components, and communication equipment. A description of each item is included, along with specifications of product lines, engineering and production achievements, and quality control. Schematic diagrams are provided to illustrate the operation of various seals. Sealtron Co., 9701 Reading Rd., Cincinnati 15, Ohio.

Stock Delay Lines 81

An 8-page bulletin lists all the custom built delay lines which this company now offers as stock items. Each model is listed, along with information on delay, bandwidth, and price. Types available include 50, 200, 500, 750, 1000, and 1300 ohm units. Electronic Systems Co., 578 E. 161st St., New York 56, N. Y.

Time Delay Relays 82

Publication No. 30, a 4-page, 2-color brochure, describes the Types RM and RO hermetically sealed, adjustable, rugged and precise thermal time delay relays, which can be used to delay application of plate voltage in electronic circuits until the cathodes have heated to operating temperature. Operation of the relay, time ranges, and performance information such as contacts, ambient temperature, insulation, altitude, vibration, extended range, critical voltage, etc. is included. Curves indicate various performance characteristics. G-V Controls Inc., 28 Hollywood Plaza, East Orange, N. J.

Industrial & Research Instruments 83

"Industrial and Research Instruments" is an 8-page catalog covering such types of industrial and research instruments as direct writing oscillographs, a-c and d-c amplifiers, vibration pickups, displacement amplifier, level recorder, beat-frequency oscillator, heterodyne voltmeter, frequency response tracer, and a deviation test bridge. Applications and operating data for each instrument are presented. Brush Development Co., 3405 Perkins Ave., Cleveland 14, Ohio.

Miniature Connectors 84

The Series "20" miniature precision connectors are described and illustrated in this 6-page, 2-color, fold-over brochure. These connectors, designed to meet the requirements for electronic instrumentation, are illustrated by circuit diagrams and photographs. Specifications for each type are provided, along with information on the company's terminals and terminal blocks. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

Wire Wound Resistors 85

Engineering Bulletin R-3C provides general and engineering information, alloy characteristics, time vs temperature load curves, for the company's line of precision wire wound resistors. This 14-page bulletin describes how to select the best resistor, and the general characteristics of these resistors, such as frequency, humidity resistance, tolerances, and power. The general resistor types described are the high stability resistors, the high precision resistors, matched resistors, JAN and hermetically sealed resistors, and "G" type resistors. A table indicates various alloy characteristics and a graph presents percentage of nominal resistance vs temperature for several alloys. Special types are also illustrated and described. Shallcross Mfg. Co., Jackson and Pusey Aves., Collingdale, Pa.

Metal-Cased Capacitors 86

Bulletin No. NB-147 describes the series of "Demicon" miniaturized, tubular, metal-cased capacitors, designed and processed to meet rigid operating requirements, particularly where space limitations are an important factor. Characteristics, including power factor, voltage breakdown, and internal construction are mentioned, along with physical and temperature characteristics. Photographs and circuit diagrams illustrate the various styles described. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

Oscillator 87

A general description, a simplified circuit diagram, and specifications of the Model MB-1 Oscillator are included in this 4-page, 2-color brochure. Such specifications as frequency ranges, distortion, calibration, frequency stability, amplitude stability, output, etc., are listed. Southwestern Industrial Electronics Co., P. O. Box 13058, Houston 19, Texas.

Tube Shields and Accessories 88

This 18-page, 2-color catalog presents the company's electronic components: tube shields, clips, caps, and rings. Standard and miniature tube shields are described and illustrated, and the major applications for each are pointed out. Many types of shields, such as fluted, lanced, seamless, etc. are indicated. The tube clips listed are standard and miniature, with types such as prong and tube ground. Two styles and sizes respectively of the caps and rings are shown. The Fred Goat Co., Inc., 314 Dean St., Brooklyn 17, N. Y.

Laboratory Test Equipment 89

A diversified selection of equipment designed for high standard inspection is contained in this 8-page, 2-color bulletin. Compiled to meet the needs of inspection departments in plants, laboratories, and generally throughout industry, this bulletin illustrates and describes the developments in scientific inspection aids, including Stereomicroscopes, illuminating magnifiers, micro-lights, many types of magnifiers, pocket microscopes, comparators, miniature lamps, and others. Specifications and applications are included for each item. Arthur S. La Pine & Co., 6001 South Knox Ave., Chicago 29, Ill.

Function Generator 90

"Dynamic Tape Tester" is an 8-page brochure describing a device whose application as a precise, coordinated function generator is in the computer and control field. A description of this instrument is included, along with an account of its operation. The instrument is illustrated by photographs. Taller & Cooper, Inc., 75 Front St., Brooklyn 1, N. Y.

Metal-Cased Capacitors 91

Miniature metal-cased, foil-paper capacitors are listed and described in an 8-page bulletin. Depending on the impregnant used, these tiny capacitors operate in temperature ranges from —40° to +85°C and from —55° to +125°C. Variations from the plain grounded-to-case design are presented including insulated-from-case units, plastic insulating sleeve types, threaded terminal types, as well as tangential mounting bracket capacitors. Also contained in the bulletin are standard listings, specifications, drawings, photographs, and other data. Aerovox Corp., New Bedford, Mass.

Electronic Equipment 93

This company's 1953 catalog, No. H-53, lists a wide variety of electronic equipment designed for application in industry, laboratory, and radio and TV. Among the items listed and catalogued are electronic components, amplifiers, speakers, tuners, phonograph components, intercommunication systems, public address systems, microphones, antennas, batteries, chargers, power supplies, and quality and precision test equipment. An index by item provides a convenience in page-locating, and a JAN Cross-Reference Guide for mica capacitors is also included. Hudson Radio & Television Corp., 48 W. 48th St., New York 36, N. Y.

Hermetic Seal Bushings 94

"Hermetic Seal Bushings and Assembly Specifications" is the title of a 40-page catalog incorporating full technical descriptions and dimensional diagrams of the company's complete line of hermetic seal bushings. Also provided are technical data on studs, washers, steatite, convoluted steatite, and glands. Special sections are devoted to the cans and covers meeting the MIL-T-27 specification, and attention is focused on cover assembly service for electronic component manufacturers. Heldor Bushing & Terminal Co., Inc., 225 Belleville Ave., Bloomfield, N J.

Digital Converter 95

A non-pulsing digital converter, Type N.P., is described in this 4-page, 2-color brochure. Construction and operation of this instrument are presented, and a schematic diagram provides further illustration. Features and specifications are listed, as well as the applications of the converter. Taller & Cooper, Inc., 75 Front St., Brooklyn 1, N. Y.

Multi-type Relays 96

The company's 1953 Catalog contains a listing of basic relay types, along with information on voltage, ohmage, armature, and contacts. Some of the relays included are the standard telephone, short telephone, midget, timers, aircraft contactors, rotary, keying, hermetically sealed, voltage regulators and cutouts, differential and polarized, special, antenna and ceramic, motor and control, latching and interlocking, mechanical action, and ratchet and stepping relays. Unit prices are also included. Relay Sales, 4721 West Madison St., Chicago 44, Ill.

Patents . . .

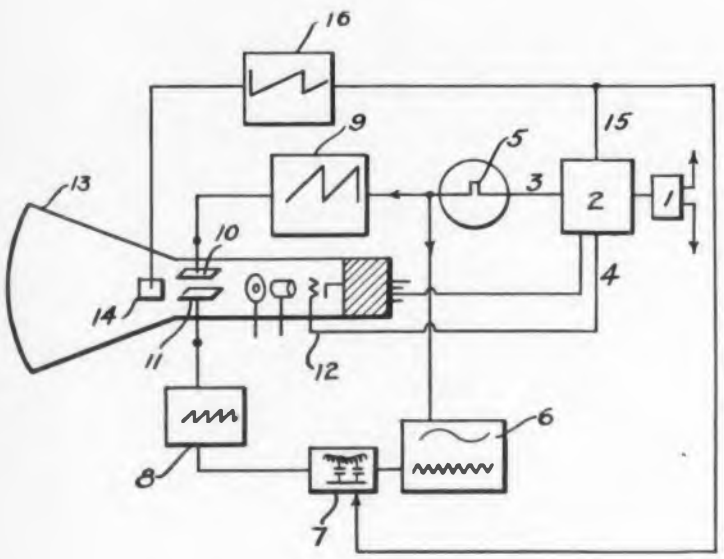
By John Montstream
Bohleber, Fassett & Montstream, New York, N. Y.

Electron Beam Deflection Control

Patent No. 2,623,196. P. M. G. Toulon, New York, N. Y.

(Assigned to Products and Licensing Corp.)

A control for deflecting the electron beam of a cathode ray tube is described in this patent. It has applications in television and especially in color TV apparatus. Specifically, the invention provides an improved apparatus for dot interlaced scanning,



whereby the beam remains on each point an appreciable length of time. As a consequence the beam may be effective in providing image-producing light on the screen of the tube as much as 98% of the time as compared with only 25% using presently known systems.

The beam of the cathode-ray tube may be deflected electrostatically or electro-magnetically. In electrostatic beam deflection for line scanning, the synchronizing signal (5) is supplied to the usual or primary saw tooth wave generator (9), the output of which is applied to one of the deflection plates (10) of the tube.

The line synchronizing signal (5) also synchronizes a multiplier (6), which produces a signal having a multiplication factor such as 300. For a 3-color TV system, the factor is preferably 300 plus a small proper fraction. The multiplier (6) is connected to a high frequency saw-tooth generator (8) through a phase shift device, a delay line (7), for example. The high-frequency saw-tooth generator is connected to the other line deflection plate (11). The two saw tooth generators (8 and 9) are mutually adjusted to have voltages of the same value and of the same polarity with respect to ground, whereby the difference of potential between the line deflection plates is momentarily maintained unchanged during the slow variation of the primary saw-tooth generator (9). The difference of potential between the line deflection plates is then a rising step-by-step variation, with no potential variation at each step and with an abrupt rise at the end of each step or each line of relaxation of the high-frequency generator.

The phase shift can be controlled without using a delay line if the high-frequency is not a multiple of the line frequency, but has a relation which shifts the beam a fraction of the unit area to scan different areas. A fraction of 1/3 may be used in a 3-color TV system to scan different color areas on the screen of the tube. Other relationships are also described.

Frequency Changing System

Patent No 2,621,289. G. W. Gray, Lambertville, N. J.

(Assigned to Radio Corp. of America)

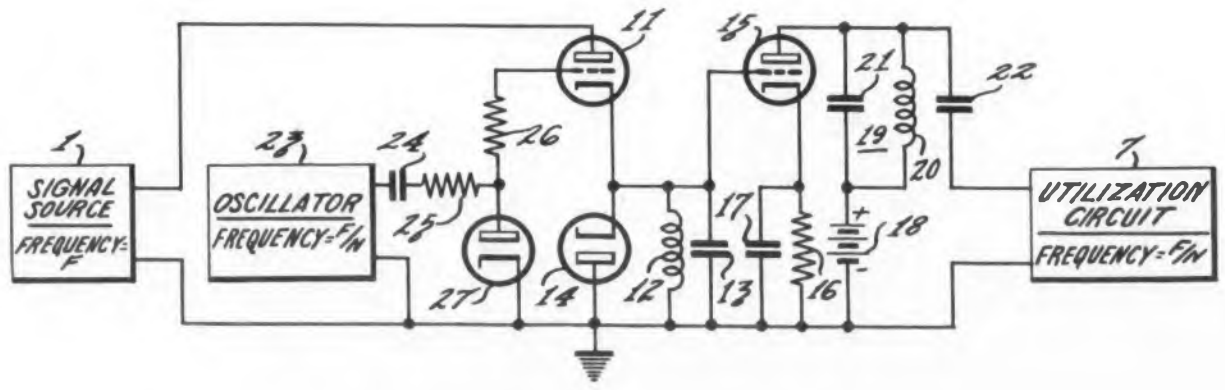
The circuit described converts a signal modulated carrier wave, of a predetermined relatively high frequency, into a similarly modulated wave at a relatively low frequency. A conventional circuit for accomplishing this result requires the use of a local oscillator having facilities for varying the frequency-determining circuits in order to vary the frequency of the output. Trimming devices usually are used to secure proper tracking between the tuning devices for the local oscillator and the radio frequency amplifying circuits. Image frequency rejection circuits are used to avoid interference from image frequencies. These provisions complicate the circuit and add to its cost.

The patent describes two circuits for converting an amplitude-modulated carrier wave into a correspondingly modulated carrier wave of lower frequency. One circuit uses a gating triode tube (11) having the signal source coupled with the anode and a local oscillator (23) having a fixed frequency F/N, lower than that of the signal carrier frequency, connected with the control grid by means of a pair of resistors (25 and 26). A diode (27), with its anode connected at the junction of the resistors and its cathode grounded, serves to prevent the control grid from being driven positive with respect to ground. The cathode of the gating triode is connected to ground through a coil (12) and capacitor (13) connected in parallel and tuned to the lower frequency. A diode (14) having its anode connected with ground also connects the cathode of the triode (11) with ground in order to prevent the cathode from being driven negative with respect to ground.

The cathode of the gating triode (11) is connected with the control grid of a wave-forming triode tube (15), the cathode of which is connected with ground through a biasing resistor (16). Anode potential is provided by a suitable power source (18) connected with the anode through a resonant circuit (19) tuned to the lower frequency F/N.

The gating triode (11) becomes momentarily conducting under the control of the local oscillator so that selected portions of the input wave are impressed on the impulse forming circuit (12 and 13) connected with the cathode. These pulses are amplified by the wave forming triode (15) and impressed on the resonant circuit (19) which develops a substantially sinusoidal wave at the low frequency which is necessarily modulated corresponding to the input wave.

The second circuit does not use a local oscillator connected with the control grid of the gating triode, but develops a lower frequency unmodulated pulse with an amplitude-limiting amplifier triode connected to the output of the wave-forming triode, and the pulse is fed back to the control grid of the gating triode.

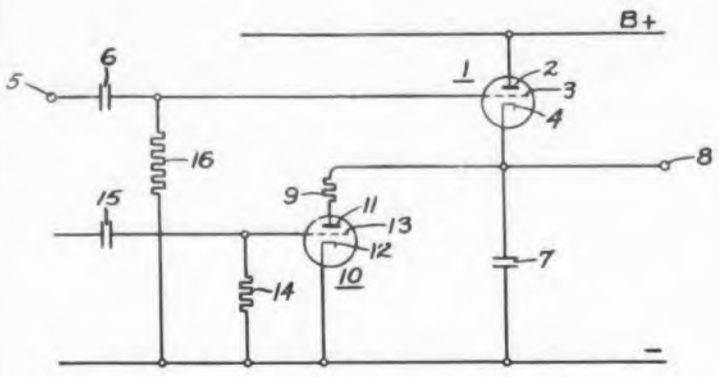


Pulse Amplifier

Patent No. 2,621, 263. G. J. Scoles, London, England.

(Assigned to General Electric Co.)

This circuit is used for indicating or recording variations in the amplitude of recurring r-f signals and has particular applicability in telemetering systems. Pulse systems use a capacitor which is charged



in accordance with the pulse amplitude and substantially maintains the charge between pulses. The amplitude of recurrent signals can be measured so long as they have a steady value or a progressively increasing value. When there is a reduction in value the capacitor must be discharged, which introduces a difficulty in prior circuits.

The circuit includes an electron discharge tube (1) having an anode (2), a control grid (3) and cathode (4). An input terminal (5) is connected with the control grid through a capacitor (6). A capacitor (7) is connected with the cathode of the tube (1), which controls the charging of the capacitor. Output terminals (8) are provided across the charging capacitor to which suitable apparatus may be connected for indicating and/or recording the amplitude of the last signal.

Should the signal amplitude be reduced, it becomes necessary to discharge the capacitor (7), which is accomplished by connecting a discharge tube (10) and a resistance (9) in series across the capacitor. This tube is normally non-conducting; however, within the duration of each signal pulse a control signal is applied to the control grid (13) to render the tube conducting. If the impedance of the tube (10) and resistor (9) is high compared to that of the charging circuit through tube (1), then for a steady or increasing amplitude input signal, the shunting effect of the tube (10) is relatively small. However, for a decreasing amplitude of signal the shunting effect increases and discharges the capacitor (7) until it reaches a voltage commensurate with the reduced signal amplitude. The output voltage at the terminal (8) is then an indication of the amplitude of the last signal, regardless of whether it is increasing or decreasing in amplitude.

The patent describes and illustrates the application of the circuit to a telemetry system in which the data at the receiving end are sorted out by locally generating a time base synchronized with the cycle of information.

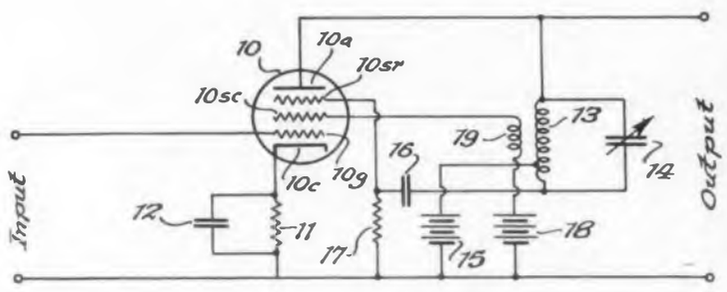
Neutralized Regenerative Amplifier

Patent No 2,621,264 C. A. Hultberg, Buffalo, N.. Y.

(Assigned to Sylvania Electric Products, Inc.)

This neutralized regenerative amplifier circuit obtains the benefits of regeneration with its drawbacks reduced or eliminated. A pentode tube, is employed and the regenerative action takes place between the anode of the suppressor grid, while a neutralizing voltage is applied to the screen grid in order to prevent undesired effects from appearing in the input circuit.

The cathode (10c) of the pentode is connected to ground through a resistor (11) shunted by a capacitor (12). The anode is connected to a tuned circuit, consisting of an inductance (13) and shunt capacitor (14), and to a source of anode potential (15). The suppressor grid (10 *sr*) is connected to ground through a resistor (17) and with the tuned anode circuit through a capacitor (16) which applies the r-f voltage generated thereby to the suppressor grid. The screen grid (10 *sc*) is coupled to the tuned circuit by an inductance (19), which is connected with a suit-



able source of potential (18). The input voltage is applied to the control grid and the output circuit is connected between the anode and ground. Two other circuits are described for securing the same results.

The circuits apply a regenerative voltage to the suppressor grid from the anode circuit and apply what may be termed a neutralizing voltage of a different phase to the screen grid which prevents the input circuit from being affected by the regeneration, which might interfere with or reduce the efficiency of the circuits feeding the input circuit.

Antenna and Matching Circuit

Patent No. 2,615,131. N. E. Lindenblad, Port Jefferson, N. Y.

(Assigned to Radio Corp. of America.)

This antenna has broad band characteristics and can be easily adjusted over a wide range of conditions to secure matching of a transmission line to the antenna.

The antenna includes a radiator in the form of an elongated hollow conductive shell which is closed at one end and positioned normal to a conductive ground plane which may be a metal roof on a building. The shell is about 1/4 wave length long, has a transverse dimension of about 1/8 wave length and is electrically connected with the ground plane.

A coaxial transmission line with an outer sleeve conductor and an inner conductor extends into the shell. The inner conductor extends above the sleeve conductor and hence extends a greater distance into the shell than does the sleeve conductor.

The transmission line forms a quarter wave antenna and the outer sleeve may extend about one third of the distance above the ground plane with which it is electrically connected. The distance with which the conductors extend into the shell is selected or adjusted by adjustable extensions so that the impedance of the shell matches the characteristic impedance of the transmission line.

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