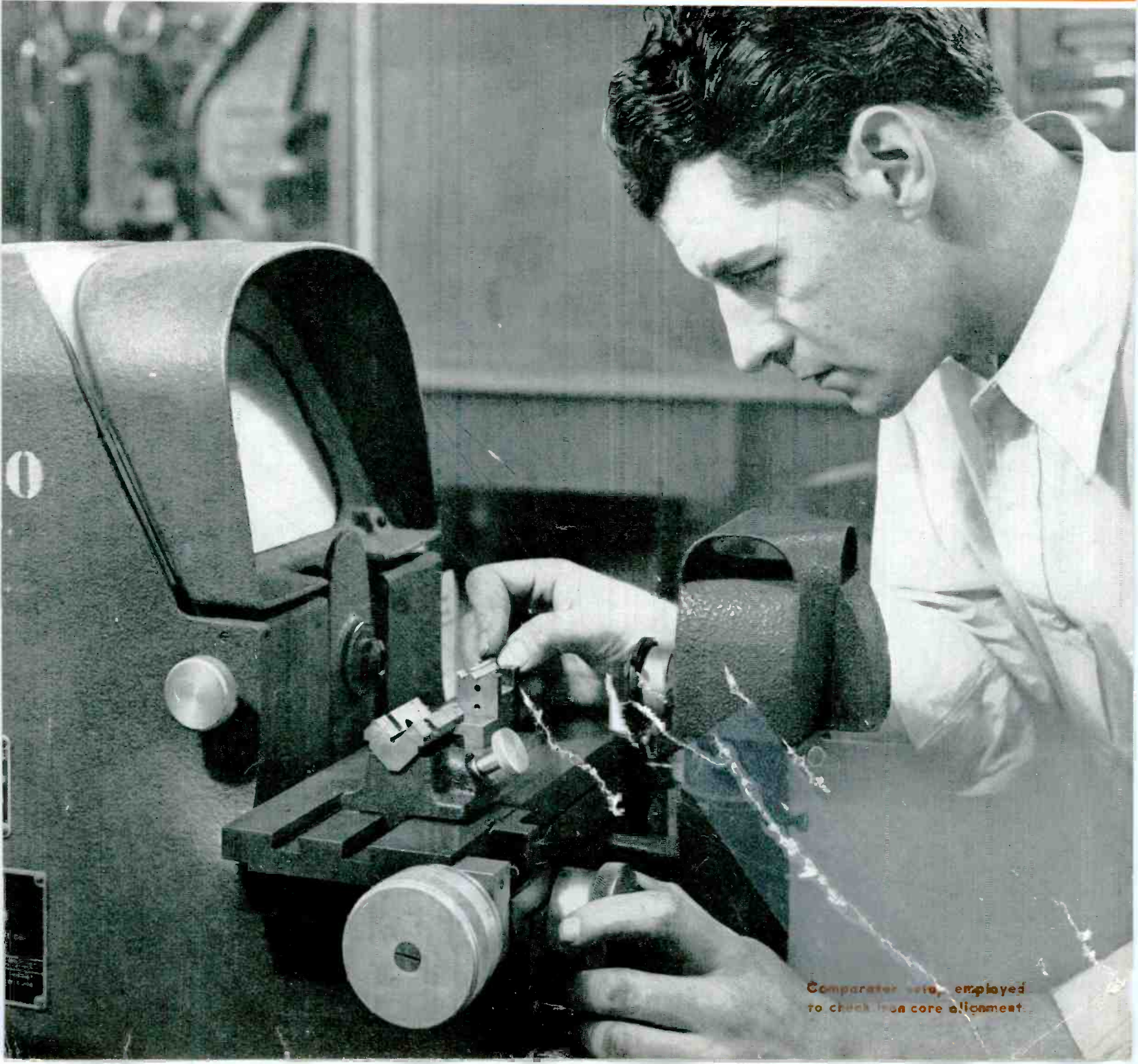
TELE-VISION ENGINEERING

JUNE, 1950



Comparator setup employed to check iron core alignment.

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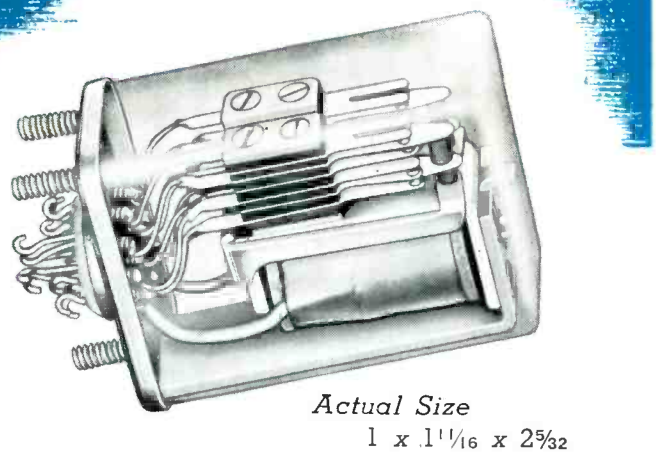

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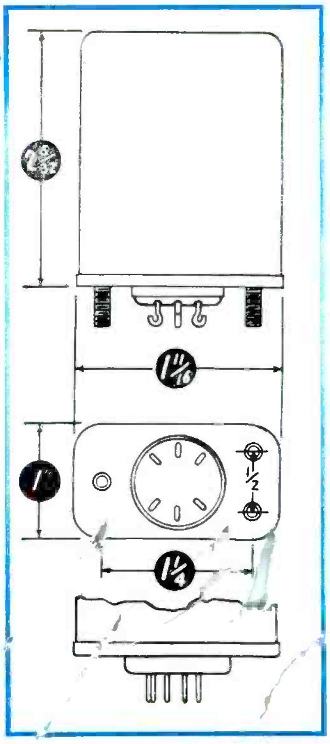
NEW MT ASSEMBLY saves inches . . . permits more design freedom in your product!

● New Potter & Brumfield MT (Miniature Telephone) hermetically sealed assembly saves more than 1/3 of chassis mounting space. Available with windings from a fraction of an ohm to 22,000 ohms for operation up to 230 volts, AC or DC.

Note features of the exclusive new P & B development listed on this page. *Write for full information on your particular needs!* Progressive P & B engineering service is available to solve every relay problem. New catalog free on request.

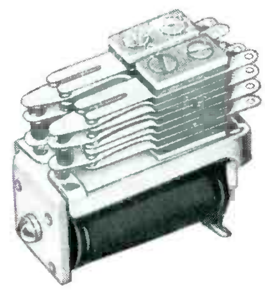
THE CLOSURE



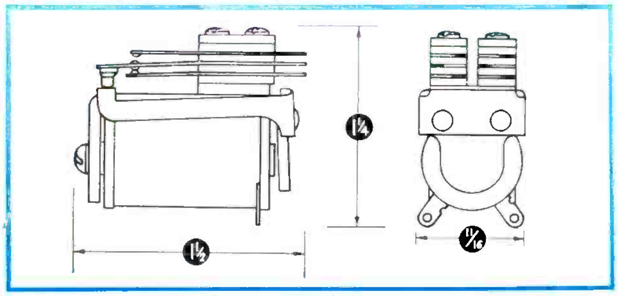
Potter & Brumfield "M" type enclosure (illustrated) was especially developed for the MT relay . . . will accommodate the MT with maximum contact stack and can be fitted with all headers except standard octal plug. . . . All P & B enclosures for hermetically sealed relays are deep drawn steel, hot tin dipped and painted as specified. Headers are glass insulated with high thermal shock resistance and minimum leakage resistance of 10,000 megohms at 50% humidity. . . . Up to 14 hot-tin-dipped solder terminals and plug-in connectors for 9 pin standard miniature or 14 pin special*. . . . P & B "K" type enclosure 1 5/8" x 1 13/32" x 2 1/16"—(not illustrated), will take any "MT" or P & B "KR" series with any header including standard octal plug. The "K" can is provided with three 6/32" mounting studs centered on 15/16" x 1 3/16" dimensions. . . . Hermetically sealed relays are desiccated at high temperature and sealed in one atmosphere of nitrogen, which eliminates oxidation and reduces contact arcing. Leakage test by immersion in pure water at 200°F.

*We can supply sockets for 14 pin special.

THE RELAY
(Actual Size)



Dimensions of the open relay are only 11/16" wide by 1 1/2" long and 1 3/8" high . . . with 12 springs in dual stack. . . . Minimum operating power .050 watts per pole, permitting sensitivity of 1.5 Ma. in a single pole relay with 22,000 ohm winding. Maximum coil power 4 watts for the unenclosed unit. . . . Mounting of the open relay is by 4 holes in end of frame on 3/8" centers tapped 3/48 or 4/40 if specified. . . . Dual stack with contacts of any arrangement up to 16 springs (8 per stack) with a limit of six movable poles. . . . Contacts .094" spherical No. 18 gauge, Code 3 pure palladium welded to nickel-silver springs and rated at 2 amps, or on special applications higher contact ratings and lower contact resistance may be provided with silver rivet contacts on phosphor bronze springs. Tin dipped solder terminals. . . . Stack insulation, laminated paper-base phenolic or molded class G2 melamine per JAN-P-14 as specified. Anti-fungus treatment of insulation and coil when ordered. . . . Core and frame of high permeability steel, ground to micrometer dimensions after assembly to insure maximum performance. . . . Open relay coils thoroughly baked and varnish impregnated against moisture and mechanical damage. Hermetically sealed relay coils protectively coated with cellulose acetate unless otherwise



specified. . . . Armature hinge, heat treated berylium copper tested and proven to exceed 100-million operations. Eliminates wear and loose hinge. . . . Vibration and shock resistance to better than 10G with minimum of 1.5 watts in coil. . . .

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Research . . . Design . . . Production . . . Instrumentation . . . Operation

VOLUME 1 **JUNE, 1950** **NUMBER 6**

MONTHLY FEATURES

Cover Illustration

Application of comparator in the checking of iron cores with studs for run-out; alignment of center axis of core and screw. Procedure prevents binding and breaking of core when assembled in coils. Comparator features lens with magnification of thirty, enlarged image being viewed on ground-glass screen suitably scribed with measurement scales. [See page 19, this issue, for additional iron-core processing details.] *(Courtesy National Moldite Co.)*

Editor: LEWIS WINNER

ABC

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TELE-VISION ENGINEERING
LEWIS WINNER, Editor

June, 1950

The Coy Reports

WITH TV spearing ahead to unparalleled peaks of popularity daily, and a need for expansion, with new construction throughout the land, more urgent than ever, official views on the blockade problems from the seven guardians of the spectrum in Washington have been sought by many. The past few weeks have witnessed an abundant flow of these views from none other than the spokesman for the seven-unit assembly, Wayne Coy. Speaking with vigorous earnestness, he has revealed more bluntly than ever, what the Commission faces and what they propose to do.

Before the annual meeting of the RMA in Chicago, Coy told the manufacturers that . . . "We seek the same objectives. We want to lift the freeze as soon as it is practical so that construction of stations can resume. The freeze has already lasted more than a year and a half. We want to employ channels in the ultrahigh frequency band so that we can have many more stations and give the public, by means of a proper distribution of station assignments, a truly national and competitive television broadcasting system. We want to have color, if it is feasible. To use only black and white pictures when color is feasible would not be maximum utilization of the spectrum."

Detailing the extensive hearing program scheduled to follow the color sessions, Coy stated that every facet of the problem will be probed: The ultrahighs, antenna heights, power, spacing between stations in the veryhigh and the ultrahigh, classification of stations (metropolitan, rural, community and perhaps some intermediate classes), directional antennas, offset carrier, carrier synchronization, service areas, oscillator radiation, stratovision, polycasting, the reservation of channels for non-commercial educational stations, metered television, and the allocation of channels in both the veryhigh and ultrahigh bands to specific communities throughout the country.

And when all this is completed emphasized Coy, the Commission will . . . "proceed with the processing of applications as speedily as possible." And everyone fervently hopes that, that moment will come soon, very soon.

The Microphone Wins a New Standard

TWO STANDARDS, for which there has been been a long concerted search, have finally been evolved, thanks to the persistent efforts of the Acoustical Society of America, cooperating with the ASA and other allied groups.

The new standards covering lab standard pressure microphones should enable agreement on calibrations by different laboratories within .2 db (± .1 db) over the audible frequency range. Employing a reciprocity technique, both miniature crystal and condenser microphones, of a variety of physical configurations, can be calibrated. The method requires a reversible transducer, a microphone, an auxiliary sound source, and a small coupling chamber capable of being filled with hydrogen. The microphones to be calibrated, may act as the reversible transducer.

Correction factors have been included in the standard for heat conduction at the cavity walls, for the shunting effect of the acoustic impedance of the diaphragms on the acoustic impedance of the coupler cavity, and for the capillary tubes used to introduce hydrogen.

Three basically different types of standard microphones are described; types *L*, *M* and *H*. The type *L*, for the audible frequency range, may have a pressure response as low as —60 db relative to one volt per microbar. The type *M*, designed for the medium frequency range up to about 50 kc, may have a pressure response as low as —95 db, and the type *H*, for operation up to about 250 kc, may have a pressure response as low as —110 lb.

This new specification should be of significant value to manufacturers of microphones, speakers, electro-acoustic equipment, as well as to research labs.

High-Voltage Caution

IN EFFORTS to prevent those frightening, disastrous high-voltage accidents, mentioned in these columns last month, there has been quite a move to the initiation of complete safety programs, covering all facilities from heavy fixed gear to mobile.

We have been told by Scott Helt of DuMont, that all of the TV stations in the DuMont network have been following a very strict set of safety rules, which even include the camera chains and monitors. To avoid accidents here, transmitter engineers are told that: Power switches on individual units of equipment are not to be depended upon where high potentials are present. If the hand of the worker is actually to be extended inside the equipment, the power cord should first be disconnected, and all high-voltage capacitors discharged before working on high-potential circuits or other circuits, where it is possible to come in contact with high potentials. Such capacitors are apt to retain a charge which may prove lethal. . . . When measuring high voltages with test prods, cords should be adequately insulated for the maximum potentials employed. . . . No equipment in the camera chain in which high potentials are present should be serviced, unless another person capable of practicing resuscitation is present.

In a section on the caution which must be exercised in the operation and maintenance of transmitting equipment, the DuMont manual reveals that the use of grounding sticks, rubber gloves and electrician's rubber blankets are particularly important in the safety program.

According to the manual . . . "There are no spare parts for the human body . . . only artificial ones." A wise slogan to remember.—L. W.

J. B. Epperson, who prepared that excellent safety bulletin for the Scripps-Howard radio system, described last month, is chief engineer of WEWS and the system, which operates WCPO-FM, AM and TV in Cincinnati, and WNOX in Knoxville, Tennessee. Morris Pierce is president and general manager of WDOK, the station referred to in the bulletin described last month.

Behavior of Resistors

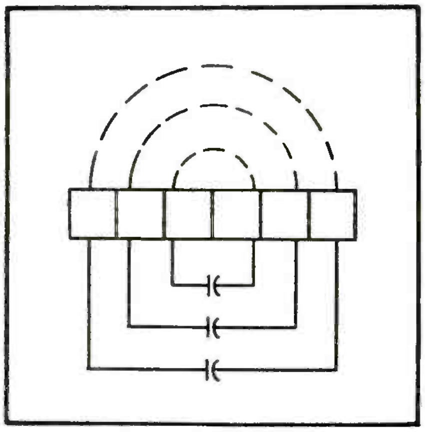
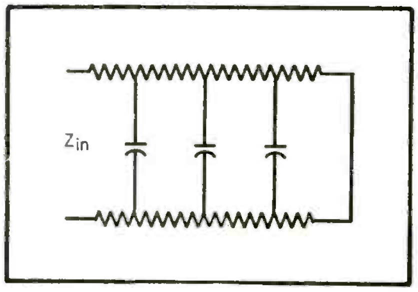


Figure 1
Diagram of the field and capacitance of an isolated rod.

Figure 2
The equivalent circuit of an isolated resistance rod.



TO MANY ENGINEERS, resistance appears to be a quantity independent of frequency. However, in the frequency region above ten megacycles this assumption is far from correct. Various types of resistors exhibit different characteristics with frequency depending on their physical size, nature of resistance element, and physical location. A number of theories have been given to explain this behavior. Several of these theories can lead to contradictory results if their limitations are not carefully examined.

Theoretical Considerations

The analysis of an isolated resistance element was first considered by Howe[1] and later refined and verified by Hartshorn[2]. In these instances, the self capacitance of the resistor was calculated, considering it as an isolated rod. The rod was divided into sections as shown in Figure 1, and under the assumption of linear charge distribution, the potential distribution was computed. The capacitance of each section was then obtained as the quotient of the charge and the potential difference. An average value of this capacitance was thus obtained and the resistor then considered as a short-circuited transmission line with uniformly distributed capacitance and resistance; Figure 2. By using a transmission line formula, the input impedance of the resistor may be written as:

$$Z = Z_o \tanh \gamma l = \sqrt{\frac{r}{jwC}} \tanh \sqrt{jwCr}\, l \qquad (1)$$

Where:

l = resistor length

r = *dc* resistance per unit length

C = capacitance per unit length

$\gamma = \sqrt{jwCr}$

$Z_o = \sqrt{\dfrac{r}{jwC}}$

Equation (*1*) may be written as

$$Z = \sqrt{\frac{r}{wC}}\,\angle{-45^\circ}\ \tanh\ (l\sqrt{wCr}\,\angle 45^\circ) \qquad (2)$$

or in more compact form

$$Z = \frac{R_{dc}\ \tanh\ \Theta}{\Theta} \qquad (3)$$

where R_{dc} = *dc* resistance of the resistor

$$\Theta = \sqrt{wCr}\ l\ \angle 45^\circ$$

Equation (*3*) indicates that for each value of *w*, there is a value of *Z*, such that

$$Z = Z' \angle \phi \qquad (4)$$

[1] Howe, G. W. O. *Wireless Engineer*; June, 1935.
[2] Hartshorn, N. H. *Wireless Engineer*; July, 1938.

Figure 3
Plot of R/R_{dc} versus $flCR_{dc}$, where f = frequency and C = capacitance per unit length of rod.

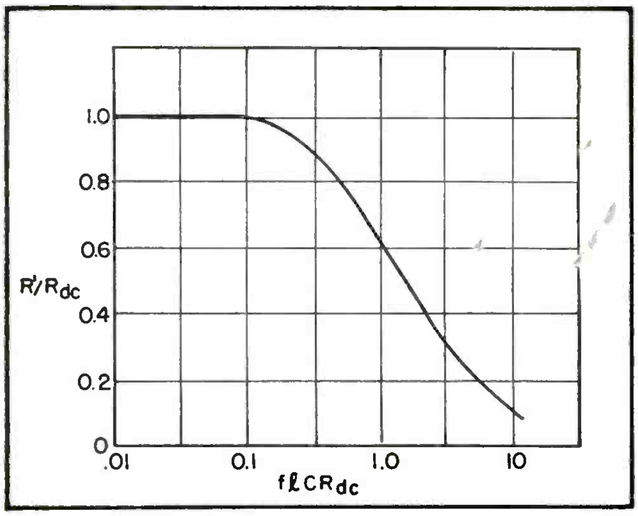
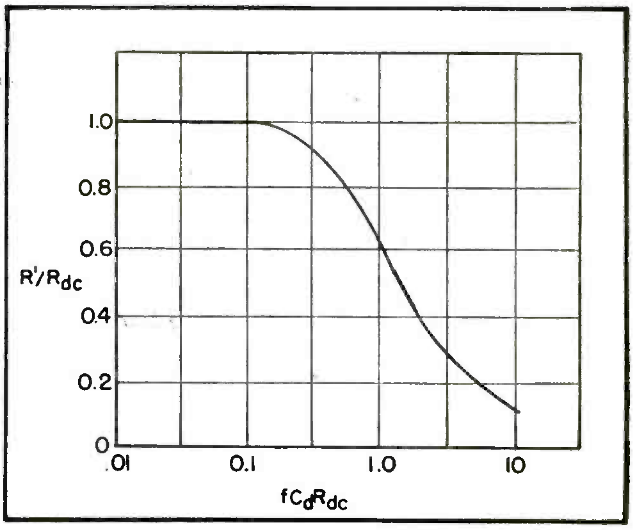


Figure 5
Plot of R'/R_{dc} versus fC_dR_{dc} where C_d takes the place of C in Figure 3.



at High Frequencies

Summarization of Results of Recent Investigation on the Behavior of Carbon Resistors as a Function of Frequency, Spectrum Covered Involving the 5 to 60-mc Region. Types Studied Included Carbon Block, Composition, Wire Wound and Resistors with Carbon Coating on Insulator, with Impedance Measurements Made on Variety of Resistors Rated at 2 Watts or Less.

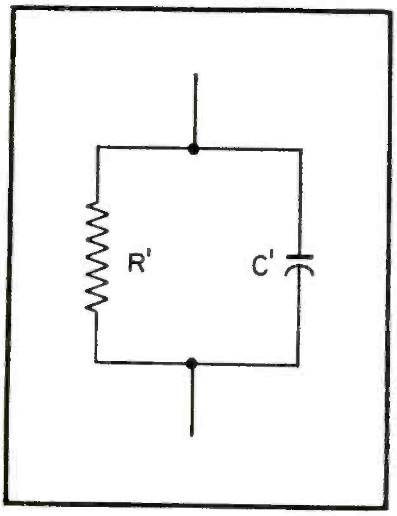
by GEORGE R. ARTHUR and SAMUEL E. CHURCH*

Instructor in Electrical Engineering, Yale University — Bell Telephone Laboratories

From a table of complex hyperbolic functions it is possible to compute values of $Z'\ \phi$ for various frequencies using equation (2). It is then simple to express an R' and C' in parallel at each frequency. That is, for each w, there is an R' and C' which in parallel are equivalent to the resistor at that particular frequency. A plot of R'/R_{dc} versus f, then provides the behavior of the effective resistance with frequency. It is possible to obtain a general curve for any resistor by plotting R'/R_{dc} versus $flCR_{dc}$, where f = frequency and C is capacitance per unit length of rod; (Figure 3). In this instance, C is the capacitance of the *isolated* rod. Hartshorn[3] has suggested that resistors are normally operated in close proximity to other elements, thus disturbing the electric field of the rod and resulting in a capacitance that is extremely difficult to calculate. Generally, this value is considerably higher than that of the isolated rod. It is with this value of capacitance that predictions of resistor behavior should be made.

Figure 4

Equivalent circuit for the resistor, plotted in Figure 3.



The question of determining this value of capacitance may be solved in two ways. If a calculation of the self capacitance of an isolated rod is made using Howe's methods, and if from this calculation the equivalent parallel R' and C' are computed for various frequencies using equations (3) and (4), it will be found that C' is constant for frequencies below four megacycles. It will also be found that for several resistors this constant value of C' is approximately equal to $C/3$ where C is the total distributed capacitance of the isolated rod, computed by the Fig. 1 method. This may be verified in a straightforward manner by using a series expansion for the input impedance of the line shown in Figure 2, as follows:

Since

$$\tanh x = x - x^3/3 + \frac{2x^5}{15} + \ldots \quad (5)$$

Equation (1) may be written as

$$Z = Zo\left[\gamma l - \frac{(\gamma l)^3}{3} + \frac{2(\gamma l)^5}{15} + \ldots\right] \quad (6)$$

*Coauthored during tenure at Yale University.

[3]Loc. cit.; p. 366.

The substitution of the relations of equations (1) into (6) yields

$$Z = \left(\frac{r}{jwC}\right)^{1/2}\left[\sqrt{jwCr}\,l - \frac{(jwCr)^{3/2}l^3}{3} + \frac{2(jwCr)^{5/2}l^5}{15} + \ldots\right] \quad (7)$$

$$= rl\left[1 - \frac{jwCrl^2}{3} + \frac{2}{15}(jwCr)^2l^4 + \ldots\right] \quad (8)$$

But $rl = R_{dc}$, the total *dc* resistance, and $Cl = C_d$, the total distributed capacitance. If w is small, equation (8) becomes

$$Z = R_{dc}\left(1 - \frac{jwC_dR_{dc}}{3}\right) \quad (9)$$

Now suppose we consider the circuit, shown in Figure 4, whose impedance may be written as

$$Z' = \frac{R'}{1 + jwR'C'} = R + (-jR'^2wC') + \ldots \quad (10)$$

For small w, the first two terms are sufficient and

$$Z' = R'(1 - jwC'R') \quad (11)$$

If $R' = R_{dc}$ and $C' = C_d/3$, then $Z' = Z$ and the circuit of Figure 4 is the equivalent circuit for the resistor as shown in Figure 3. As mentioned, C'

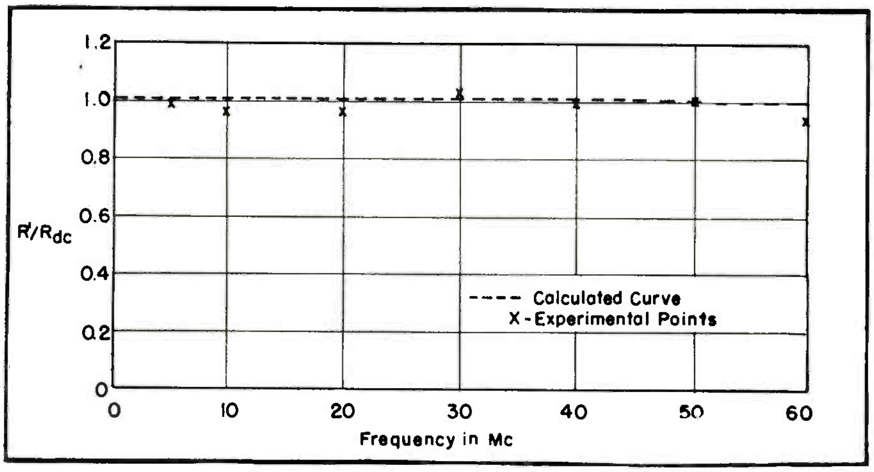
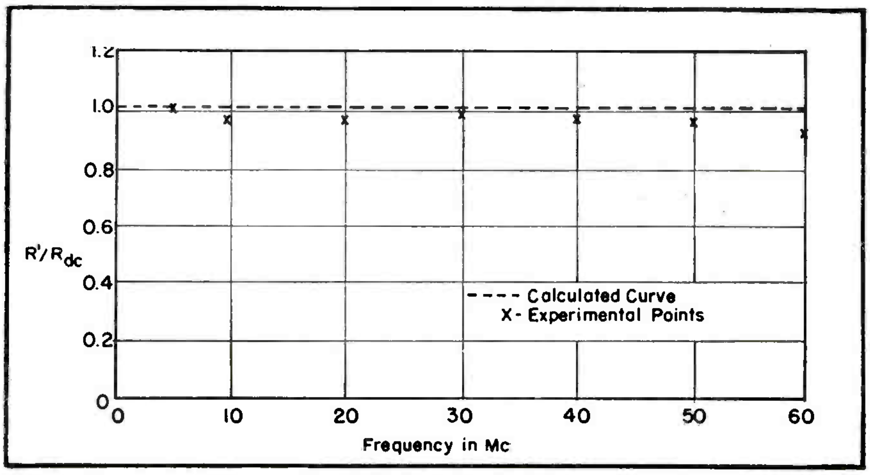


Figure 6
Plot illustrating calculated curve and experimental points of one type of resistor with $R_{dc} = 510$ ohms.

is constant at low frequencies. Therefore, the value of C', which can be measured directly at low frequencies, is simply one-third of the total distributed capacitance. Thus, if measurement of C' is made at low frequencies, C_d can be determined. The proximity effects of other objects and surfaces will have been included since the measurement of C' was made on a resistor that was not isolated. Using this value of C_d, it is now possible to plot R'/R_{dc} versus $fC_d R_{dc}$ as shown in Figure 5, where C_d takes the place of C in Figure 3. The resistor behavior may now be computed with due allowance for the effects of other apparatus and elements in the vicinity.

It has been found that this theory agrees quite well with the experimental values. However, there is another theory that many[4] have used to explain the falling off of the resistance with frequency; the *Boella* effect, named for its originator, Mario Boella.[5] This theory states that the molecules of which the composition resistor is made are separated by minute capacitors. For example, in a composition consisting of carbon, fine sand, and a binding material, the sand separates the carbon particles, thus causing the small capacitances mentioned. This is strictly a qualitative theory and would be extremely difficult to analyze on a quantative basis. It is the belief of the writers that this effect is completely negligible in resistances of less than one megohm at frequencies under 100 mc, and that the transmission-line analysis is a complete one. This is based on the fact that the higher resistances contain much more non-conducting material, giving rise to more of the minute capacitances. It is believed that above one megohm, this capacitance is appreciable relative to the self capacitance, and causes the resistance to drop off sooner than would be predicted by the transmission line analysis.

Figure 7
Plot illustrating results of a 510-ohm resistor of another manufacturer.



Experimental Procedure and Correlation

In measuring resistors, two bridges were employed. One was an *rf* bridge[6] suitable for resistances in the 1 to 1000-ohm range, at frequencies up to 60 mc. The second was a twin-t type bridge[7, 8] for resistances above 1000 ohms at frequencies up to 50 mc. The resistors were measured as they would be used in a circuit, yet keeping the leads as short as possible.

A large number of resistors of various types were measured. A few of the results are presented along with predicted data to show the agreement of experiment with theory. The predicted values were found by taking the value of shunt capacitance of the resistor at 2 mc, and multiplying it by three. This provided C as explained previously. With this value and the *dc* resistance value, Figure 5 may be used to find R'/R_{dc} for any frequency.

Calculation of Predicted Data

Four types of carbon-block resistors were checked. The R_{dc} of one = 510, its physical size was very small, and C' at low frequency = .000193 mmfd.

C_d then is

.000579 mmfd = $.579 \times 10^{-15}$ *f*.

f Mc	$fC_d R_{dc}$ $= (fC_d 510)$	R'/R_{dc} *from curve*	R'/R_{dc} *experimental*
5	1470×10^{-9}	1	1
10	2940×10^{-9}	1	.995
20	5880×10^{-9}	1	.980
30	8920×10^{-9}	1	1.03
40	11760×10^{-9}	1	1.02
50	14700×10^{-9}	1	1.09
60	17640×10^{-9}	1	.94

The second solid carbon block R_{dc} = 510, physical size was small, X_c' at 2 mc = —90,000, C' at low frequency =

[4]Puckle, O. S. *Wireless Engineer*; p. 303; June, 1935.
[4]Miller, J. M., and Salzberg, B., *RCA Review*; April, 1939.
[5]Boella, Mario, *Alta Frequenza*; April, 1934.
[6]G-R 916-A.
[7]G-R 821-A Twin-T.

.00886 mmfd and X_c' at 5 mc = –36,700.

Thus C_d = 3 x .00886 = .02658 mmfd = .266 x 10^{-13} *f*.

f Mc	*fC_d (510)*	*R'/R_dc from curve*	*R'/R_dc experimental*
5	680 × 10^{-7}	1	1
10	1360 × 10^{-7}	1	.984
15	2042 × 10^{-7}	1	.974
20	2720 × 10^{-7}	1	.975
30	4080 × 10^{-7}	1	.985
40	5440 × 10^{-7}	1	.955
50	6800 × 10^{-7}	1	.950
60	8160 × 10^{-7}	1	.88

The third carbon block was 1⅜" long, 3/16" diameter. R_{dc} = 26,000, C at 2 mc = .2 mmfd and C_d = .6 mmfd.

f Mc	*f C_d R_{dc}*	*R'/R_dc from curve*	*R'/R_dc experimental*
5	.077	1	1
10	.154	.99	.97
20	.308	.92	.90
30	.462	.89	.87
40	.616	.81	.77

The fourth carbon block was also 1⅜" long, 3/16" diameter with, however, R_{dc} = 77,000, C at 2 mc = .2 mmfd, and C_d = .6 mmfd.

f Mc	*f C_d R_{dc}*	*R'/R_dc from curve*	*R'/R_dc experimental*
5	.231	.93	.84
10	.462	.84	.77
20	.924	.68	.70
40	1.848	.51	.68

The tabulated results show the values for R'/R_{dc} obtained both by calculation and by experiment. Curves for these data are given in Figures 6 to 9.

Conclusions

Other resistors of approximately the following values 50, 500, 1000, 10,000 and 50,000 ohms were measured experimentally and their equivalent resistances calculated by the transmission line method. They yielded data quite similar to that cited in the foregoing tables. Several different makes of commercially available resistors of each value were checked including carbon, composition and special high frequency resistors.

Except possibly for special high-frequency resistors, the equivalent resistance of a resistor has been found to decrease more rapidly with frequency, the higher the value of the *dc* resistance. Also for the same *dc* resistance, the smaller the physical size of the resistor, and thus the smaller the capacitance, the better are its high-frequency characteristics.

The carbon block type of construction was found to be superior for high frequency work to the composition type. Better than both of these is a resistor employing a carbon coating on an insulator. Wire-wound resistors were found to be too reactive above 10 mc to serve as resistances. All resistors measured conformed within ten per cent to predicted results. It may be concluded that the behavior of almost any resistor of less than one megohm may be predicted with reasonable accuracy from the curve of Figure 5, while the drooping characteristics of resistors greater than one megohm may be explained qualitatively by combining this and the *Boella effect*.

The results of this paper are particularly applicable where a resistor is to be used in a wide-band network. For narrow-band application at a high-frequency, a resistor may be selected for the required equivalent resistance at that frequency. For wide-band use, however, a resistor with a constant resistance and negligible reactance over a band of frequencies is desired.

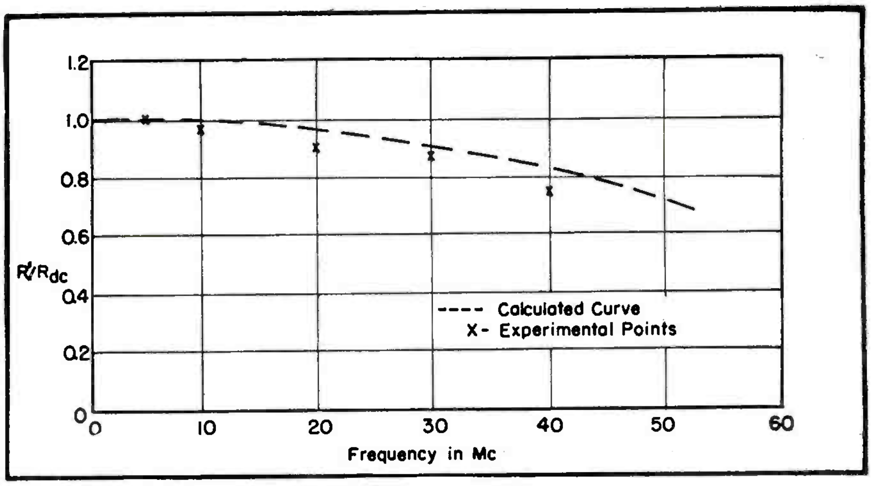
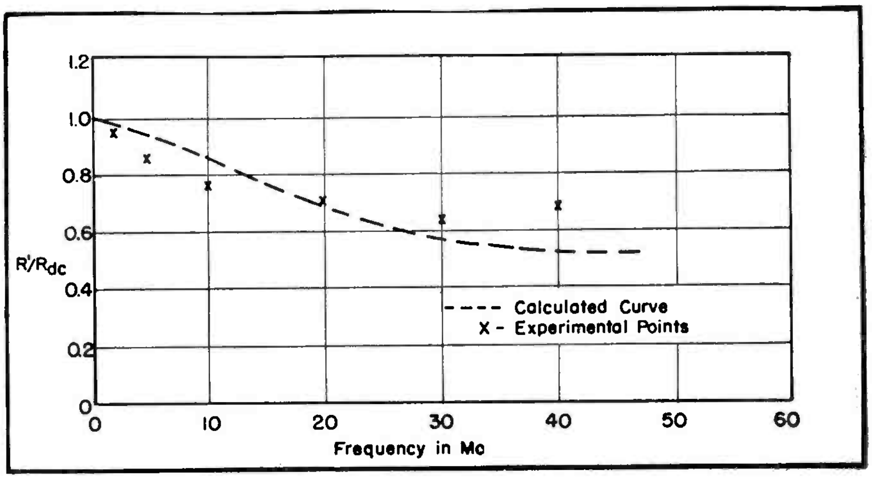


Figure 8
Plot of results of a 26,000-ohm carbon-block resistor.

Figure 9
Results obtained with a 77-ohm carbon-block element resistor.



[8]Sinclair, D. B. *The Twin T. A New Type of Null Instrument*, Proc. IRE; July, 1940.

A Report on the Washington

F. J. Given of the Bell Telephone Labs, delivering the address of welcome at the opening session of the conference.

Fred R. Lack, vice president of Western Electric Co., delivery the keynote address at the component conference.

A. V. Astin, National Bureau of Standards, who served as chairman of a session on "Dependability in Electronics," during the conference in Washington.

WITH THE increasing complexities of electronic gear structure, particularly in TV, has come a variety of problems of component design, processing and application, problems involving the attention of the engineering fraternity on many fronts in the radio and electrical engineering circles. Reviewing these growing complications in the laboratories, in the field and at professional society meetings, it appeared to many that the time was ripe for a national symposium on the subject. As a result of this mounting interest, such a symposium was organized and programmed for sessions in Washington.

Held a few weeks ago, under co-sponsorship of the IRE and the AIEE, the affair was a significant success, with a host of outstanding papers heard by a large audience.

Symposium Theme

All papers were basically prepared to assist in delineating a three-point symposium message:

(*1*)—The electronics engineer and electronics industry have a challenging need for raising the performance quality of their product from the customers' viewpoint to attain, if possible, a parity with the products of other engineers such as engines and refrigerators.

(*2*)—This need can be met by better quality components.

(*3*)—It can also be met, in part, by packaging of components in appropriate groups in such a way as to facilitate field servicing and repair.

The Weeks' Paper

Among the interesting papers offered was one by P. T. Weeks, chief engineer of Raytheon's receiving tube division, covering the important subject of the design and control factors affecting life and reliability of miniature and subminiature tubes. Reviewing the features of the three members of the smaller-tube family, the bantam, miniature and subminiature, Weeks said that percentage-wise the reduction in length has been less than the reduction in diameter, and in some of the important dimensions the subminiature is closer to the miniature than the latter is to the bantam. This, he noted was notably the case with the spacer-to-seal dimension.

Spacer-to-Spacer Dimensions

Commenting on spacer-to-spacer dimensions, Weeks indicated that it is typically low in the subminiature, because the subminiature line does not include counterparts of the high-wattage types and it is made up mainly of tubes designed for high frequency use where a short structure has important electrical advantages.

Reviewing ruggedness, the audience was told that these characteristics were apt to be improved by scaling-down processes. The ratios of strength to mass and moment in the grids and other parts of the structure were, we were told, greater in the miniature and subminiature tubes than in the larger tubes. Expanding on this point, Weeks said that the low center of gravity of the mount, the short spacer-to-spacer distance, the short space between grid rods are all inherently favorably for ruggedness with respect to shock. Continuing, he said that even with the fine grid wire and close spacings of the high G_m types typical of the later miniature and the subminiature tubes, this inherent ability of the parts to withstand shock is still retained.

External Structure Differences

Analyzing the differences in external structure, particularly where the miniature and the subminiature differ distinctly from the bantam, the type of lead was described as the single variable. In the bantam, it was learned, flexible leads are soldered to base pins that are rigidly attached to the bulb by means of the base shell. This means that the lead is protected from handling and bending and can exert no strain on the glass structure, and thus there are off-setting chances of basing and soldering defects. However, said Weeks, in the miniature tube the contact pins are rigid and supported only by the glass button. Therefore, any distortion or bending of the pin

Conference on Improved Quality Electronic Components

Highlights of Symposium Activities . . . Review of P. T. Weeks' Presentation on the Design and Control Factors Affecting the Life and Reliability of Miniatures and Subminiatures.

by WYN MARTIN

results in strain on the glass and, because of the rigid nature of glass, there may be glass breakage if carried beyond a certain point. Pointing out that this was a serious field trouble in the early years of miniature production, the Raytheon expert described how careful control of the glass working operations at stem making and sealing and continued control on these operations plus careful control of the stiffness of the pins, the proper design of the sockets, plus the proper techniques in use of the sockets have combined to reduce the glass breakage from this source to a low level.

Commenting on the point that a major reduction in tube size obviously introduces many problems in connection with wattage rating, bulb-temperature, and quality factors involving emission, gas, and life, Weeks declared that two items stood out conspicuously; the large percentage reduction in bulb surface area in the smaller tubes and the large increase in permitted wattage per square inch of bulb area or, in other words, permitted bulb temperature.

Higher Bulb Temperatures

Revealing that there has been a continual trend toward higher bulb temperatures, Weeks showed that in one or two instances, tubes have exceeded the bounds of what had formerly been considered safe dissipation and bulb temperature, and there may remain some differences of opinion as to whether the manufacturing art has caught up with this tempertaure level or will be able to in terms of long life and reliability. At any rate, he said, this level represents approximately the upper safe limit for the present state of the art.

Probing operation at a high ambient, Weeks stated that a provenly permissible bulb temperature severely limits the wattage input. But, he added, since the bulb temperature itself is the primary limitation it is obvious that suitable means for increasing the rate of heat removal from the bulb will improve the situation. We were told that metallic shields or holding clamps conductively attached to the chassis are effective and a variety of other methods are applicable. However, said Weeks, the ultimate removal of the bulb heat from the tube compartment or the chassis itself is still another problem. Any forced or conductive method of bulb cooling of course introduces the hazard of a fault in the cooling mechanism, perhaps by poor thermal contact, and consequent tube damage or failure.

D. E. Noble, vice president, Motorola, Inc., discussing "Commercial Electronic Equipment" at the Washington conference.

Summary

Summarizing, Weeks stated that the small tubes, miniature and subminiature, are dependent, for long life, ruggedness and reliability, on the same basic design and control features as are the larger tubes. The reduction in size has, he said, unavoidably resulted in some increased difficulty in mount assembly, tied up with the absolute size of parts, and has thus resulted in different relationships between total bulb wattage and bulb temperature and has reduced the safe limit on total bulb wattage. However, he added, it has improved, rather than harmed, tube ruggedness, and it has introduced certain new, but controllable, items affecting quality, and has eliminated or benefited others. Concluding, Weeks said that small size has proved to be entirely compatible with long life and reliable performance.

FLUORESCENT LIGHTING of TV Studios

Study, Involving Relationships of Light Source Energy, and Pickup Tube and Eye Sensitivity, Reveals How Banks of Fluorescent Tubes on Ceiling Can Be Used to Provide Effective Basic Lighting in Studios.

by **GEORGE CLARK** and **WILLARD ALLPHIN**, Sylvania Electric Products, Inc.

Coolness and efficiency, characteristic of fluorescent lighting, have accented the value of this type of lighting in TV studios, where a substantial flood of light is often essential.

In installing such systems, where banks of tubes are normally mounted on the ceiling, there are several intriguing factors to consider. For instance, in one installation in WBAL-TV a warm-type[1] of lighting was found to be preferred, because of the more natural appearance of colored objects. It was also noted that such lighting affords a blend with any incandescent lamps which may be necessary for spotlighting. The application of this type of lighting was preceded by a careful probe of optics and spectral response. In studying, for instance, what happens when we see, it was necessary to consider first the direct viewing of a small spot on an object. Thus, for a particular wavelength of red light:

Energy acting on eye from red component of spot = Light source energy at red wavelength *x* Reflectance of spot at red wavelength *x* Eye sensitivity at red wavelength (*1*)

For every other color or wavelength, the equation is the same and the eye rapidly sums up or integrates the total energy.

[1]Warmtone.

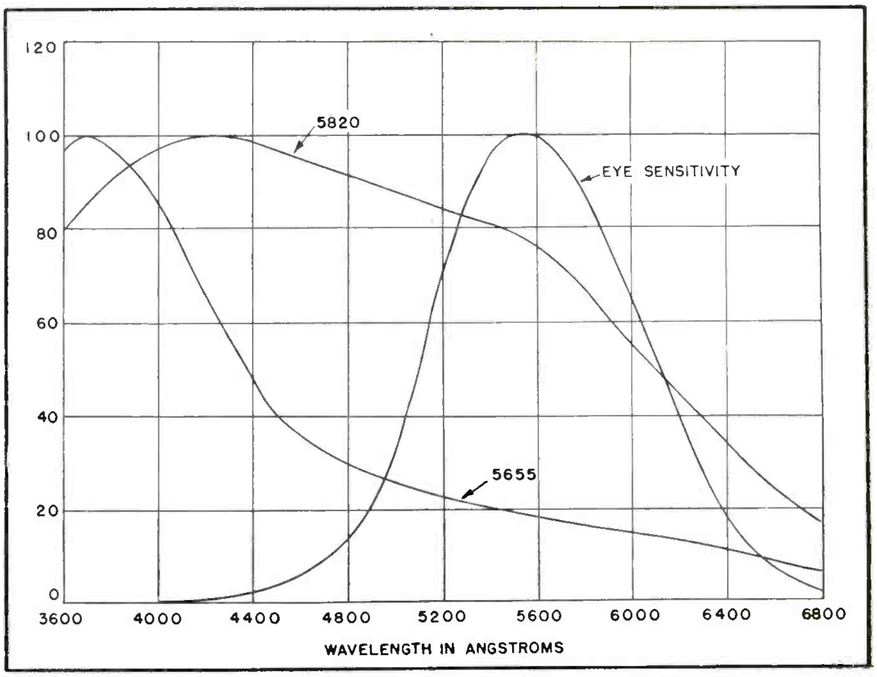
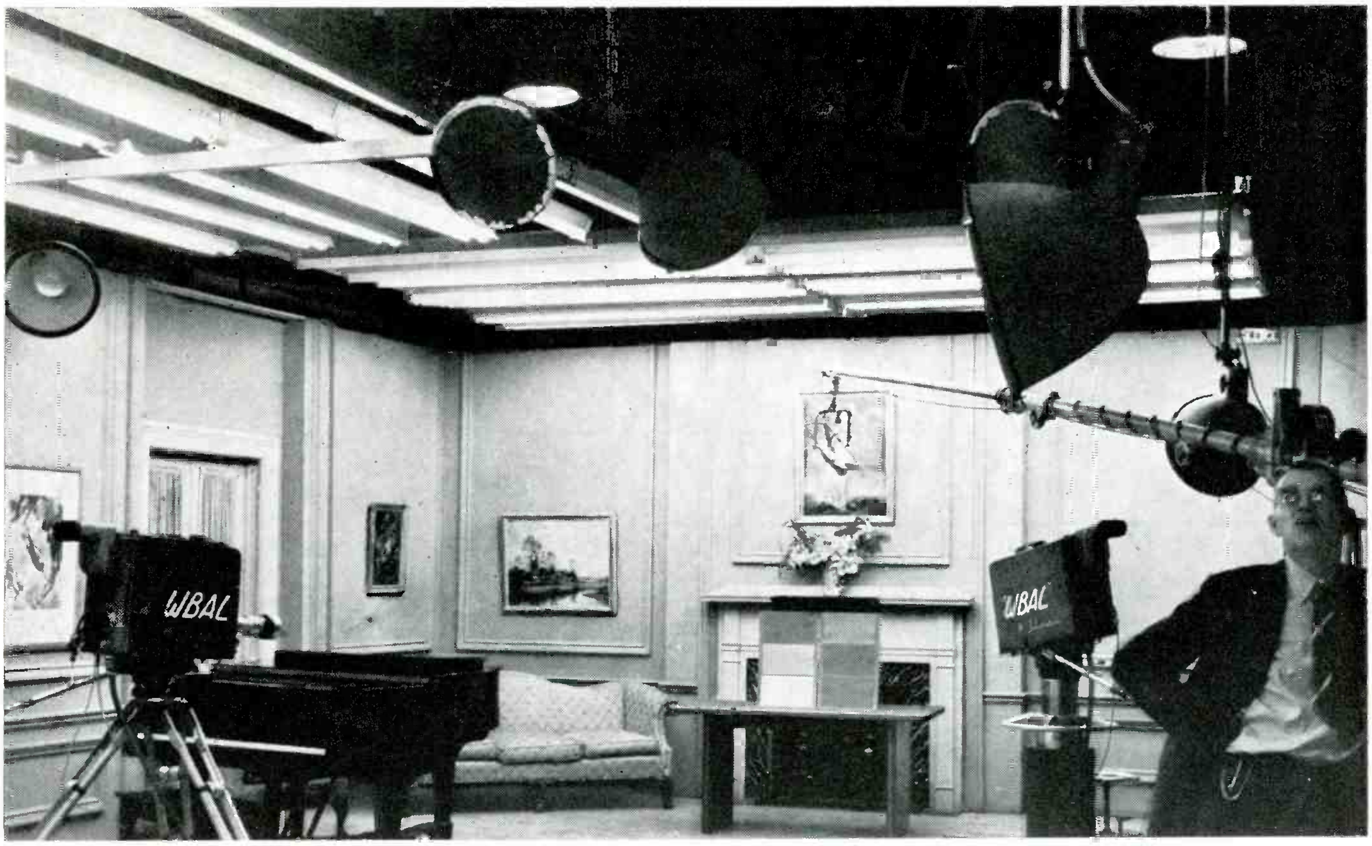


Figure 1

Plot of the spectral sensitivity of TV pickup tubes.



General view of studio at WBAL-TV with fluorescent bank lighting.

Now if we view the same spot by television, and assume that the sweeping beam of electrons has paused at the spot, while we study its action, we find for the same wavelength of red light:

Energy acting on eye from red component of spot = Light source energy at red wavelength x Reflectance of spot at red wavelength x Pickup tube sensitivity at red wavelength x Eye sensitivity to spectral output of image tube (*2*)

The last term of equation (*2*) represents a fixed relationship for a given TV tube, its color being entirely independent of the color of the light source of the object.

Pickup Tube-Eye Match

Ideally, therefore, the sensitivity of the pickup tube should match that of the eye throughout the entire spectral range. This is not the case, as Figure 1 reveals. It must be remembered, however, that the final result will be a black and white image and that through long familiarity with photographic prints, we have come to accept some inaccuracy in the translation of colors into appropriate shades of gray.

Since equation (*1*) equals equation

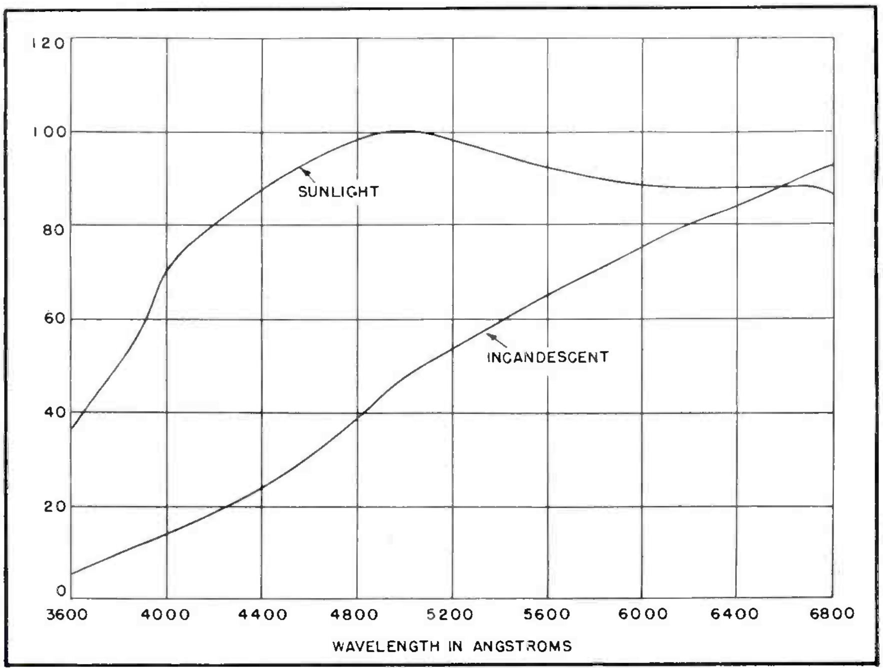


Figure 2

Spectral energy of light sources; sunlight and incandescent lighting.

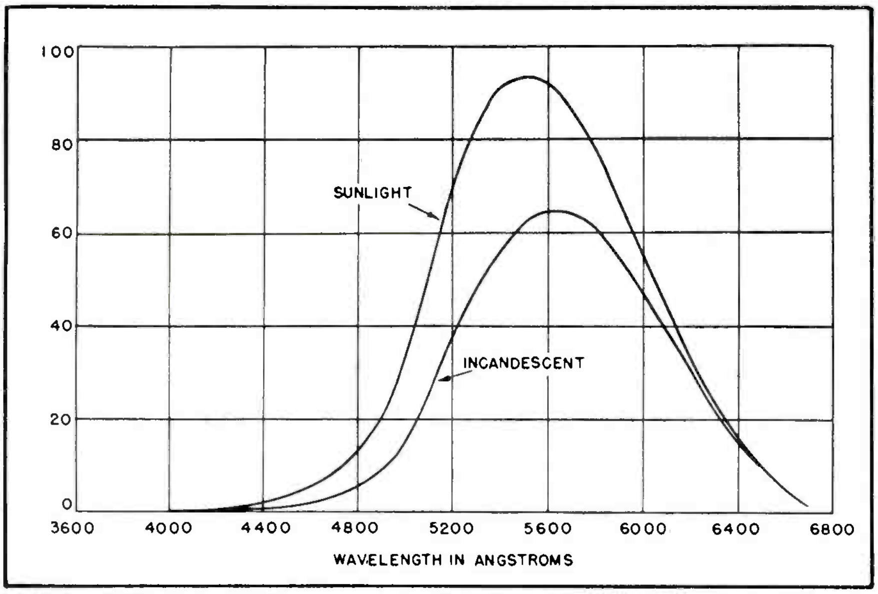


Figure 3
Plot illustrating characteristics of light sources multiplied by eye-sensitivity curve.

(2), similar terms can be dropped. The last term of (2) can also be dropped because for a given image tube, it is, in effect, a constant. We thus have the fact, that for televising in a studio, best conditions can be obtained when:

Light source normally expected on scene x Eye sensitivity = Light source in studio x Pickup tube sensitivity (*3*)

Light-Source Evaluation

In other words, the expected light source, as it would be interpreted to the brain by the eye, should match the studio light source as translated into electrical impulses by the pickup tube.

Sunlight-Incandescent Lighting Curves

Typical curves for sunlight and incandescent lighting appear in Figure 2; these curves after having been multiplied by the eye sensitivity curve assume the form shown in Figure 3.

White Fluorescent Results

In the Figure 4 curves (solid) are represented results of two common types of pickup tubes when their sensitivities are multiplied by the spectral distribution curves of various *white* fluorescent lamps.

Thus, Figure 3 represents the left-hand side of equation (*3*) and the solid lines in Figure 4, the right-hand side. When the curves are most nearly similar, appearances will be most realistic. The incandescent curve from Figure 3 has been included in Figure 4 as a dotted line, and it will be seen that its resemblance to the 5820-*warmtone* curve is quite close. If it is necessary to filter out most of the radiation below 4800, it will be noted that less energy will be lost in filtering this tone type of lighting than other colors.

To clarify the filtering problem, let us consider an example near the limit of radiation in the blue end of the spectrum. Suppose that a 5820 tube is scanning under 4500° white illumination, an object which has no reflectance above 4400 Angstrom, but high reflectance in the deep violet, between 4200 and 4400. To the eye, the object would appear very dark gray or black because of the lack of eye sensitivity below 4400.

However, as we note in Figure 4, a 4500° white lamp, which has considerable energy in this band, would pass along the energy to the 5820 tube. This, in turn, would send electrical energy to the image tube and cause it to glow brightly. The object would, therefore, be seen in the image tube as very light gray or white in color.

Use of Filters

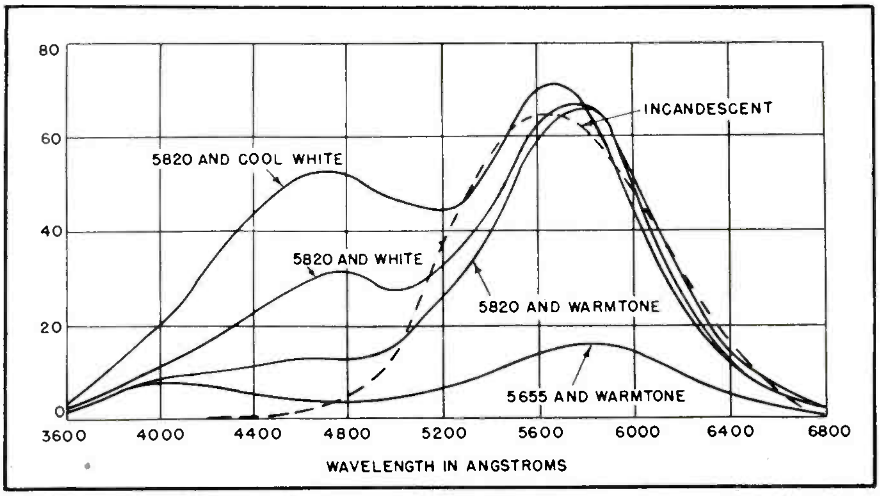
To remedy for this false rendition a filter can be placed over the pickup tube which will cut out the energy below 4400. However, this means an appreciable loss in the overall output of the tube. The use of a warm-tone type tube has been found to be more effective since it emits less energy in the blue-green and more in red-yellow.

In designing the layouts for the tubes, the strip fixtures are placed so that they are close together on the ceiling. For example, to produce 150 footcandles of maintained vertical illumination continuous rows of T-12 slimline lamps are placed 12" apart.

Ballast Mounts

Although ballasts can be mounted in another room, it is simpler and less expensive to use standard fixtures with the ballasts in the fixtures. It has been found that with microphones, such as the RCA 77-D, ballast hum is not picked up, even with maximum gain, unless microphones are within three feet of the ballasts, which would not occur with a reasonably high ceiling.

Figure 4
Plot revealing characteristics of combinations of fluorescent lamps and pickup camera tubes.



TV TUBE *Developments*

Design and Application Features of 14″, 16″ and 17″ Rectangular Picture Tubes . . . Twin Triodes . . . Half-Wave High-Voltage Rectifiers . . . Double Triode Subminiatures

by P. B. LEWIS

Two 16″ AND 14″ rectangular tubes[1] have been announced, both featuring 65° viewing angles.

One, a 16KP4, provides a 10⅛″ x 13½″ rectangular picture. Features a face plate having an integral neutral gray filter, and has a tilted-beam type gun, requiring a single-field ion trap. The tube is identical to the 16TP4 except for an increase in neck length to 7½″. The manufacturer states that the tube can be substituted for the 16RP4 in most applications.

The second tube, 14CP4, provides a 8⅝″ x 11½″ rectangular picture. In other respects it is similar to the 16KP4, having the 7½″ neck length.

The tube has a tetrode type electron gun for use with an external, single field ion-trap magnet. An external conductive coating, when grounded, functions as a filter capacitor and also serves as a shield against external electrostatic fields.

Focusing coil current, approximately 90 *ma dc;* secured with JETEC standard focus coil *109* with the combined grid *1* bias voltage and video-signal voltage adjusted to produce a highlight brightness of 30 foot lamberts on a picture area of 11 9/16″ x 8 21/32″. Distance from reference line of bulb to center of focus coil air gap must be 3″.

TV Twin Triodes

A twin triode,[2] for use as a combined vertical oscillator and vertical-deflection amplifier in television receivers, is now available. The tube, the 6SN7GTA, is paid to be electrically and mechanically interchangeable with its prototype, the 6SN7GT.

The principal difference of the 6SN7GTA from its prototype is said to be increased maximum ratings. The plate dissipation rating is 5 watts per plate or 7.5 watts for both plates as contrasted with the previous rating of 2.5 watts per plate or 5.0 watts for both plates. The plate voltage rating has been increased from 300 to 500 volts, and the heater-cathode rating has been increased from 90 to 200 volts.

In addition, the 6SN7GTA carries a peak positive-pulse plate voltage rating of 1,250 volts and a peak negative-pulse grid voltage rating of 200 volts for television applications.

17″ Rectangular Picture Tube

A 17″ rectangular picture tube,[3] the 150, has been developed. Tube is said to provide a viewing area of 150″.

Features bent-gun construction.

Half-Wave High-Voltage Rectifier

A miniature filamentary-type rectifier[4] has been designed for service as a high-voltage rectifier supplying power to the anode of the picture tube. Identified as the 1X2A, and designed and rated primarily for use in flyback type of power supplies, when used within its maximum ratings, it is a replacement for 1B3GT/8016 at *dc* output potentials up to 14 to 15 kv.

Medium-Mu Twin Triode

A double triode,[4] having semi-high perveance units, has been developed for use in receivers and other applications where the use of two similar triode sections in a single envelope is desirable from a viewpoint of space consideration and for lower cost.

The tube, a 12BH7, is said to feature an increase in perveance over tubes like the 6SN7GT or 12AU7, and thus make it possible to use one section of the tube as a vertical deflection amplifier in receivers using picture tubes with wide deflection angles. The tube is designed to withstand relatively-high peak positive plate potentials, and accordingly is specifically rated for use in the vertical deflection amplifier socket, and for usual class *A1* applications.

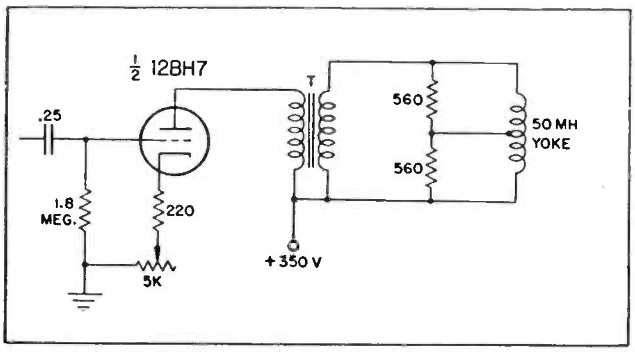
Double-Triode Subminiature

A double-triode subminiature[5] is now available with pigtail leads as type 6BF7, and with short pins for socketing as 6BG7. Supplied in a T-3 bulb measuring .400″ in diameter and 1½″ long.

Tubes are supplied with separate cathodes for each triode section so that each section may be operated independently.

Electrical features: transconductance, 4,800 micromhos; amplification factor per triode section of 35 when 100 volts are used on plates; maximum plate dissipation per section of 1 watt; grid-to-plate capacitance per section of 1.5 mmfd; input capacitance per plate of 2.0 mmfd; output capacitance of 1 mmfd.

Circuit of a vertical deflection circuit, where transformer T has a ratio of 10:1, minimum, and a primary impedance of 18,000 ohms at 1000 cps.



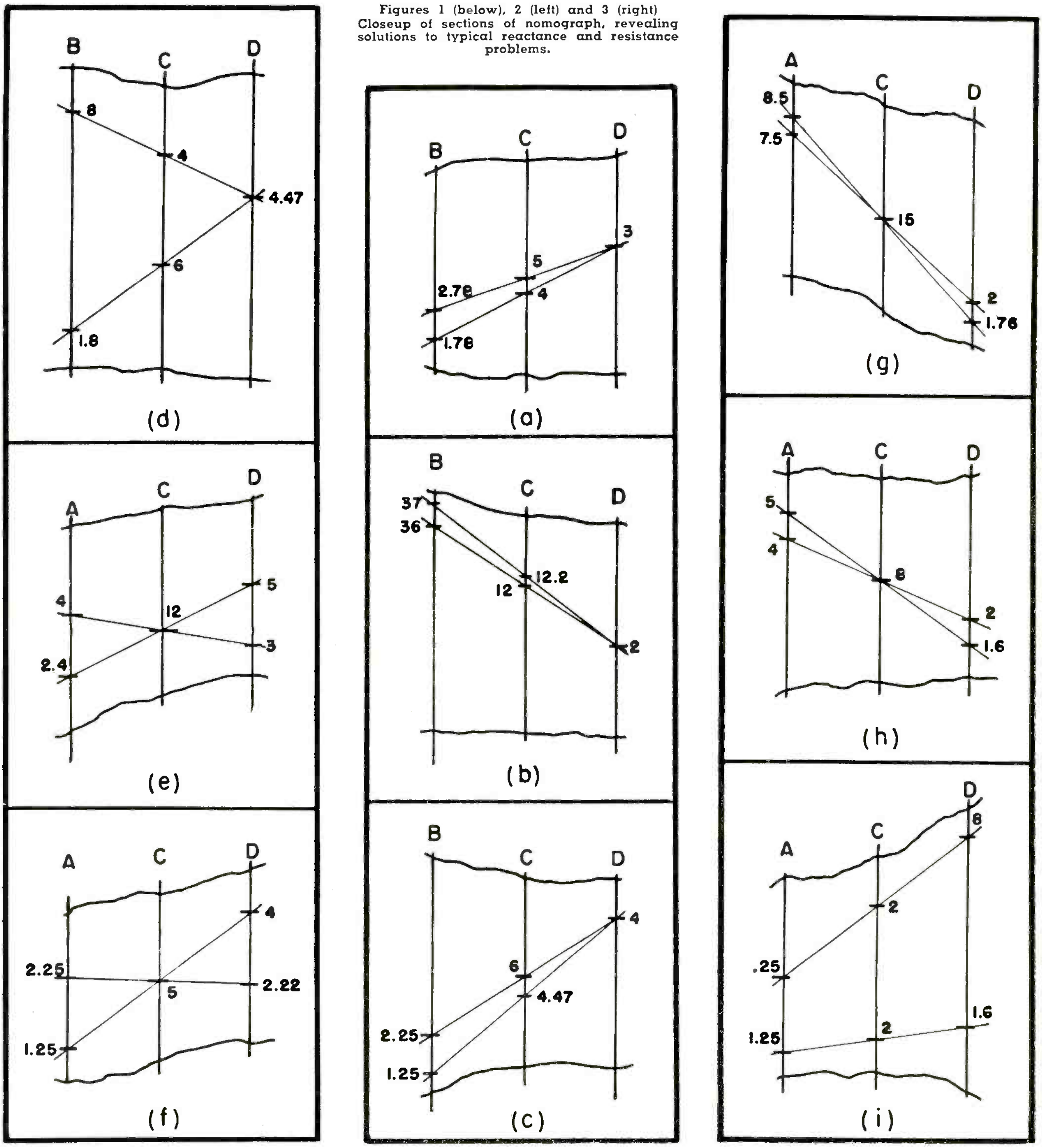
[1]*National Union Radio Corp.*
[2]*General Electric.* [3]*DuMont.*
[4]*Hytron.*
[5]*Sylvania.*

IMPEDANCE

Computation of the joint impedance of a reactance and a resistance, connected in series or in parallel, involves the solution of the right-triangle vector diagram of the form $Z = \sqrt{R^2 + X^2}$, a rather complex procedure. In an effort to streamline this operation, an impedance nomograph was prepared, and found not only to facilitate the solution, but provide answers to problems involving the joint resistance of parallel resistors or the joint capacity of series capacitors.

Examples

To illustrate application possibilities of the nomograph, let us take a case where resistance, $R = 3$ and a reactance $X = 4$, are connected in series, and we would like to find the joint impedance $|Z|$. Then $|Z| = \sqrt{3^2 + 4^2}$, which can be written $|Z| = 3\sqrt{1 + (4/3)^2}$. To solve with the nomograph, a straight line is drawn through 3 and 4 on scales



Figures 1 (below), 2 (left) and 3 (right) Closeup of sections of nomograph, revealing solutions to typical reactance and resistance problems.

NOMOGRAPH

Nomograph Expedites Computation of Joint Impedance of Reactance and Resistance Connected in Series or in Parallel, which Normally Involves Solution of a Right-Angle Vector Diagram. Chart Also Provides Joint Resistance of Parallel Resistors or Joint Capacity of Series Capacitors.

by ROBERT C. PAINE

D and C, and we locate $(4/3)^2 = 1.78$ on scale B (opposite $4/3 = 1.33$ on scale A); Figure 1(*a*). Mentally adding *1* to 1.78 we have the answer 2.78. Then a line is drawn through 2.78 and 3 on scales B and D and the answer $|Z|$ 5 will be found on scale C. Of course, decimal points are determined, as in slide-rule operations.

Now let us take up the problem where $R = 2$ and $X = 12$. The solution $|Z| = 12.2$ is revealed in Figure 1(*b*). This problem necessitates use of the upper decade of scale C to locate 12.

Suppose now that we have a condition where $R = 4$ and we want to find a series reactance resulting in the required impedance of $|Z| = 6$. Then $X = \sqrt{Z^2 - R^2}$, or $|X| = \sqrt{6^2 - 4^2} = 4\sqrt{(6/4)^2 - 1}$. A corresponding solution is shown in Figure 1(*c*) where the required reactance is found to be $|Z| = 4.47$.

If the reactance $X = 4.47$, and the series resistance is required to produce the impedance $|Z| = 6$, the Figure 2(*d*) procedure can be followed.

Often we have the condition where $R = 3$ and reactance $X = 4$ (Figure 2(*e*) are connected in parallel, and we'd like to find the joint impedance. The corresponding equation is $Z = RX/\sqrt{R^2 + X^2}$ or $|Z| = (3 \times 4)/\sqrt{3^2 + 4^2}$. This equation can be solved in three steps. First, $\sqrt{R^2 + X^2}$ must be found and we have $\sqrt{3^2 + 4^2} = 5$, as in first example. Then $3 \times 4 = 12$ is found in the second step, and in the third and final step the answer, $|Z| = 12/5 = 2.4$ is obtained.

The problems of parallel resistors or series capacitors, where the equations are, for joint resistance, $R = R_1 R_2/(R_1 + R_2)$ and for joint capacity, $C = C_1 C_2/(C_1 + C_2)$ are quite interesting, too. Let us take one, where $R_1 = 4$ and $R_2 = 5$. Then $R = 4 \times 5/(4 + 5)$, or $5/(1 + 5/4)$. Two steps are involved in this solution as indicated in Figure 2(*f*): $5/4 = 1.25$, and $5/(1 + 1.25)$, or $5/2.25 = 2.22 = R$.

Now let us take up a problem, where we have a parallel resistance of 2 and 15, found as $R = 1.76$. This problem is similar to the previous one, but the upper

(*Continued on page 29*)

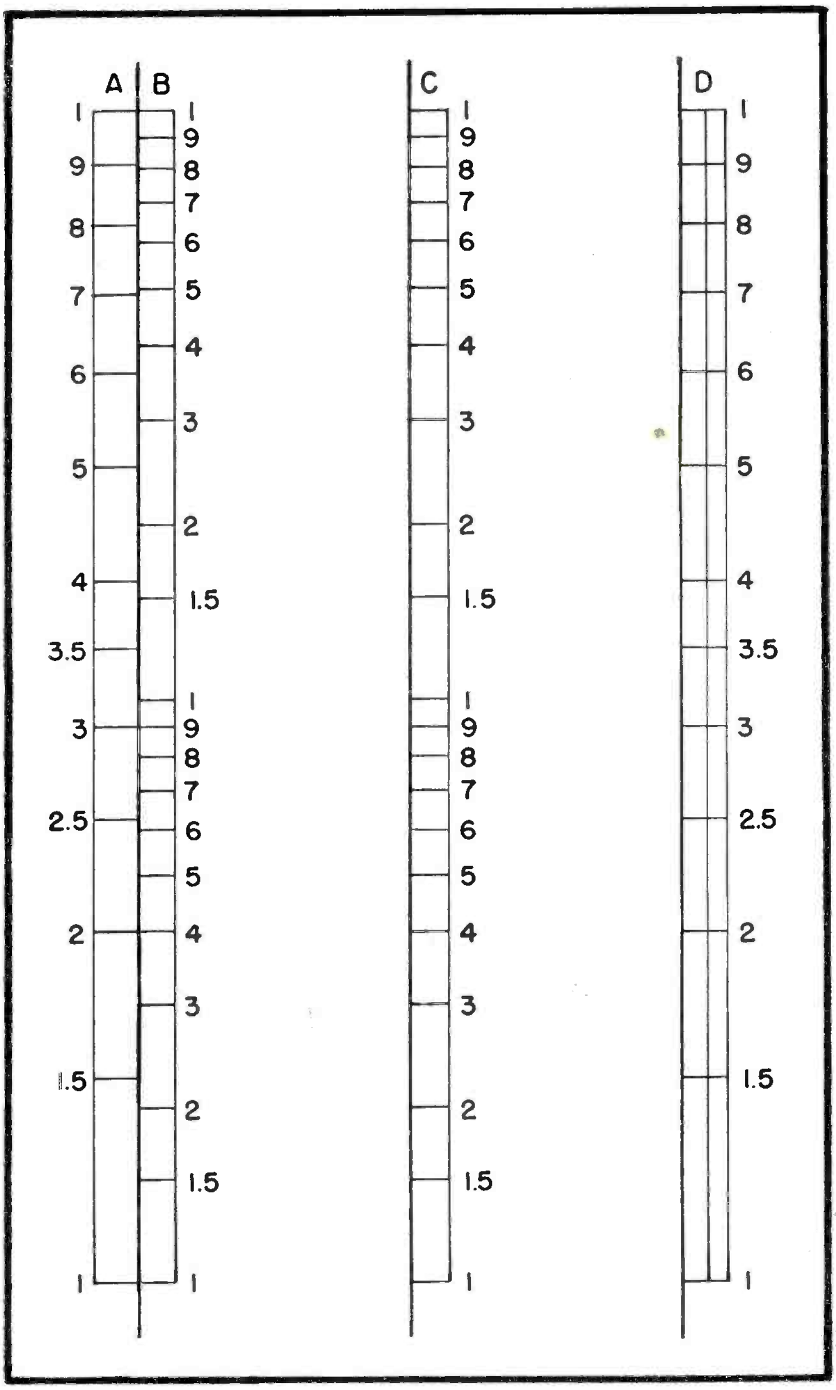
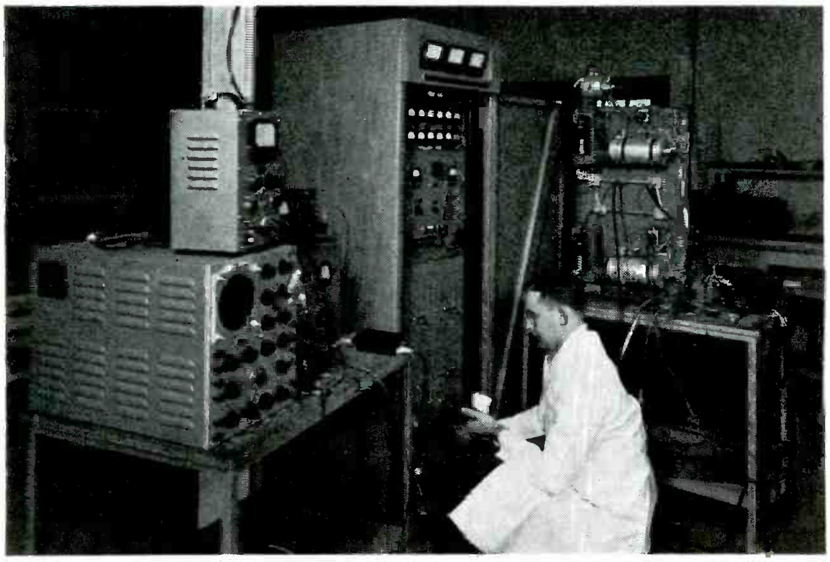
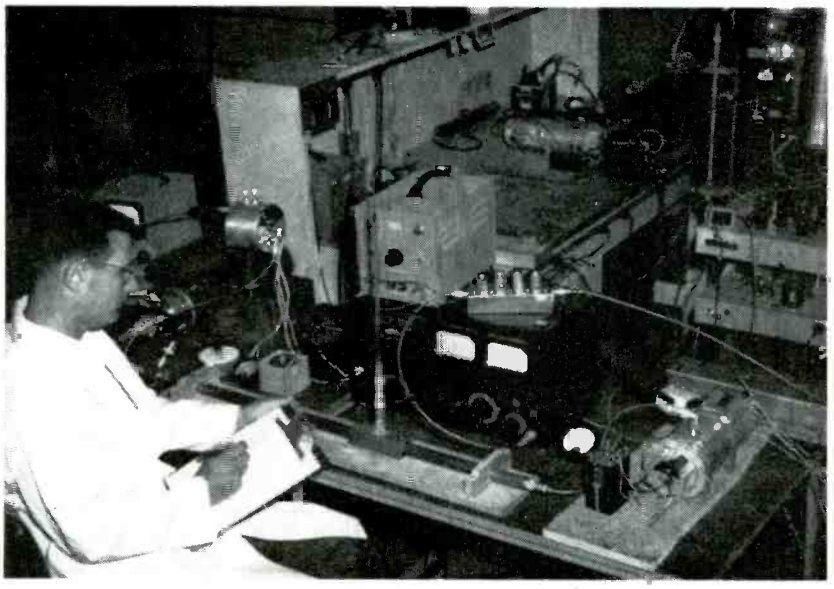
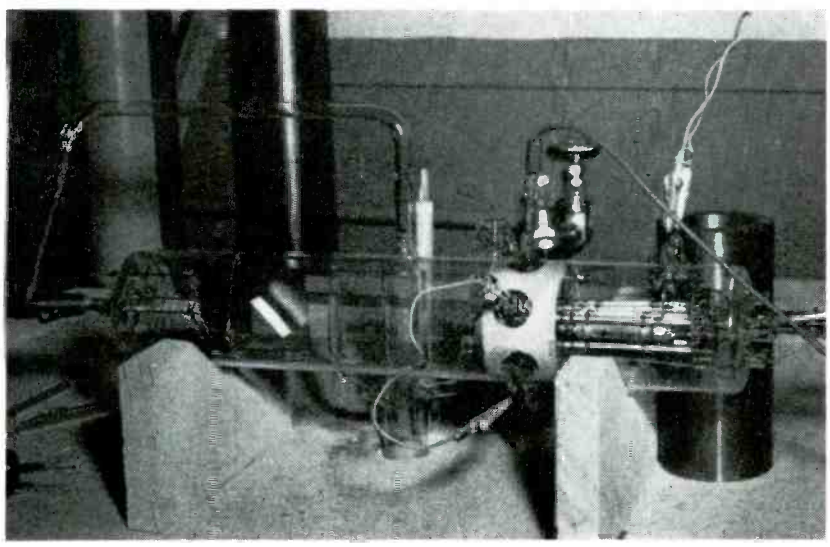


Figure 4
The Paine nomograph for reactance and resistance.

Phase-to-Amplitude UHF System







On the editorial page, last month, it was disclosed that a new phase-to-amplitude modulation system for TV had been developed by the Stanford Research Institute, which, it was claimed, permitted the attainment of high power levels with presently available *uhf* tubes which are difficult to amplitude modulate by any other means.

Reporting on the development, SRI engineers declared that while the transmitter (KM2XAZ) is at present radiating only 150 watts of power, it is capable of being amplified to powers in the tens of kilowatts using relatively simple *rf* amplifiers which have no requirements of amplitude linearity.

The *pta* transmitter is in reality two separate phase-modulated transmitters, driven from the same crystal oscillator and fed into a common antenna. The output is an entirely conventional amplitude modulated wave and is obtained by arranging the outputs of the two channels to add *in phase* for the modulation peaks and to oppose each other so as to effectively cancel out during the minima of amplitude modulation.

The video signal is introduced at low level, on the order of a few watts, and all amplification is done in high efficiency, saturated, class-*C* radio-frequency amplifiers. It is claimed that the phase-to-amplitude transmitter can make use of klystrons, resnatrons, and traveling-wave tubes. These tubes cannot ordinarily be used for amplifying AM directly, because of the nonlinear relation between input and output.

Each of the two channels of a *pta* transmitter carries a signal which is constant in amplitude and varying in phase according to the video modulation.

Since there are no modulation-frequency transformers in the phase-to-amplitude transmitter, it is possible to fully modulate the output down to zero frequency if necessary, and to an upper frequency limit determined only by the radio-frequency bandwidth of the power amplifiers. The heart of a transmitter of this type is the phase-modulator unit, which serves to advance the phase of one channel by exactly the same amount that it retards the phase of the other channel.

(Top, left)

View of the 150-watt phase-to-amplitude 530-mc transmitter recently developed by the General Electronics Laboratory at Stanford Research Institute, Stanford, Calif., for experimental TV station KM2XAZ at Long Beach, Calif.

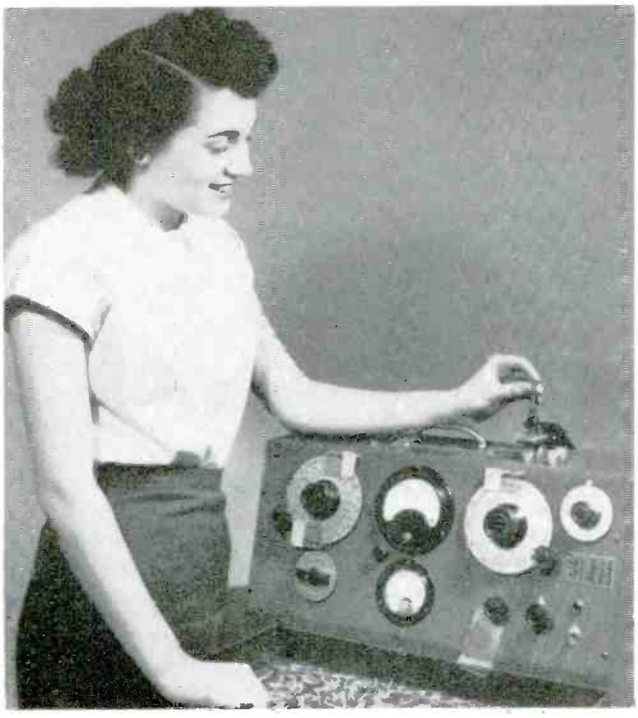
(Center, left)

Testing experimental uhf amplifier chain during an early phase of development work on the ultrahigh transmitter. A 1-milliwatt 265-mc input signal to the four-tube unit at the right center is being amplified to deliver 100 watts at 530 mc from the cylindrical cavity at left center.

(Bottom, left)

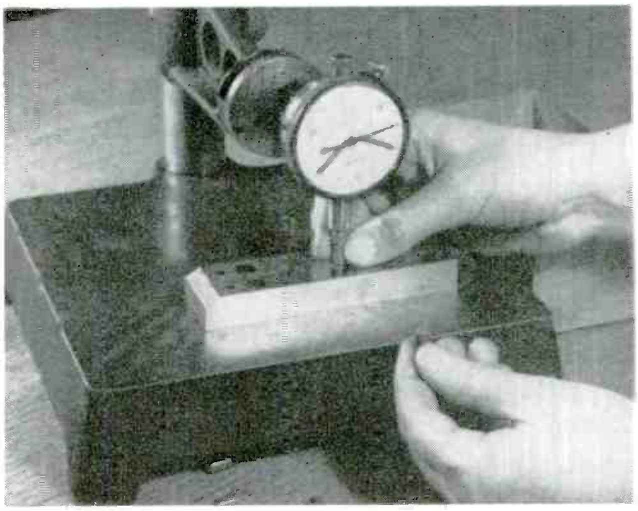
Special phase-modulator tube, designed by the vacuum tube laboratory staff at Stanford, for the phase-to-amplitude TV transmitter.

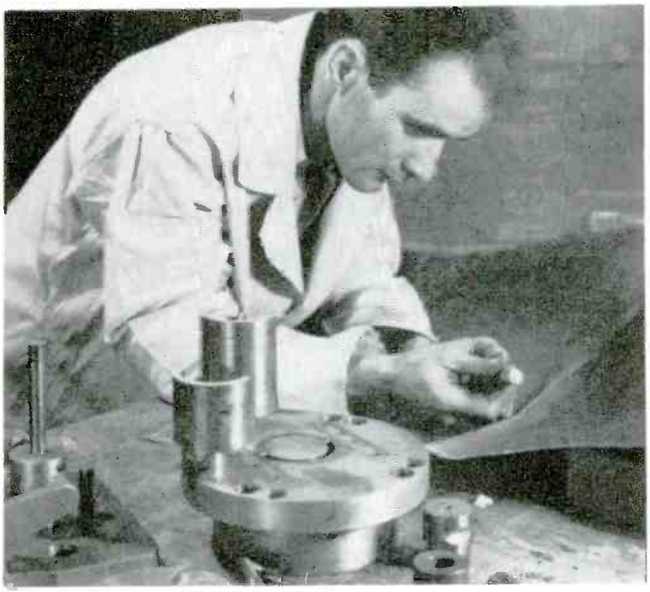
Powdered Iron Core Quality Control



Above: Molding test-control operation. A specially-designed permeability tester, part of standard equipment of each press, provides a tolerance check, normally ±1%. Presence of meter at press has been found to assure uniform production. In addition to this routine machine operator test, production testing is also carried on by a special production-test department.

Left: Checking production against established standards. In this operation, the test involves setting the instrument at 12 to 25 mc, and production control is held to ±2% or closer if required or specified.





Above, left: Checking tolerances for length. Critical core length specification is controlled in production by instrument which indicates to operator the limits of the tolerance. Above, right: Checking molds against a print of orignial design and fabrication. Also scrutinized are the special tools required for production. Machinists thoroughly familiar with tool design for core applications closely check each tool before releasing it to molding department.

One of a crew of specially-trained iron core metallurgists pre-testing powder mixes before releasing for product molding. Each mix must be carefully analyzed to assure adherence to customer specification. Illustrated are cores which have been made from sample batches, which will be retested to established standards. Upon approval powder mix will be prepared in bulk.

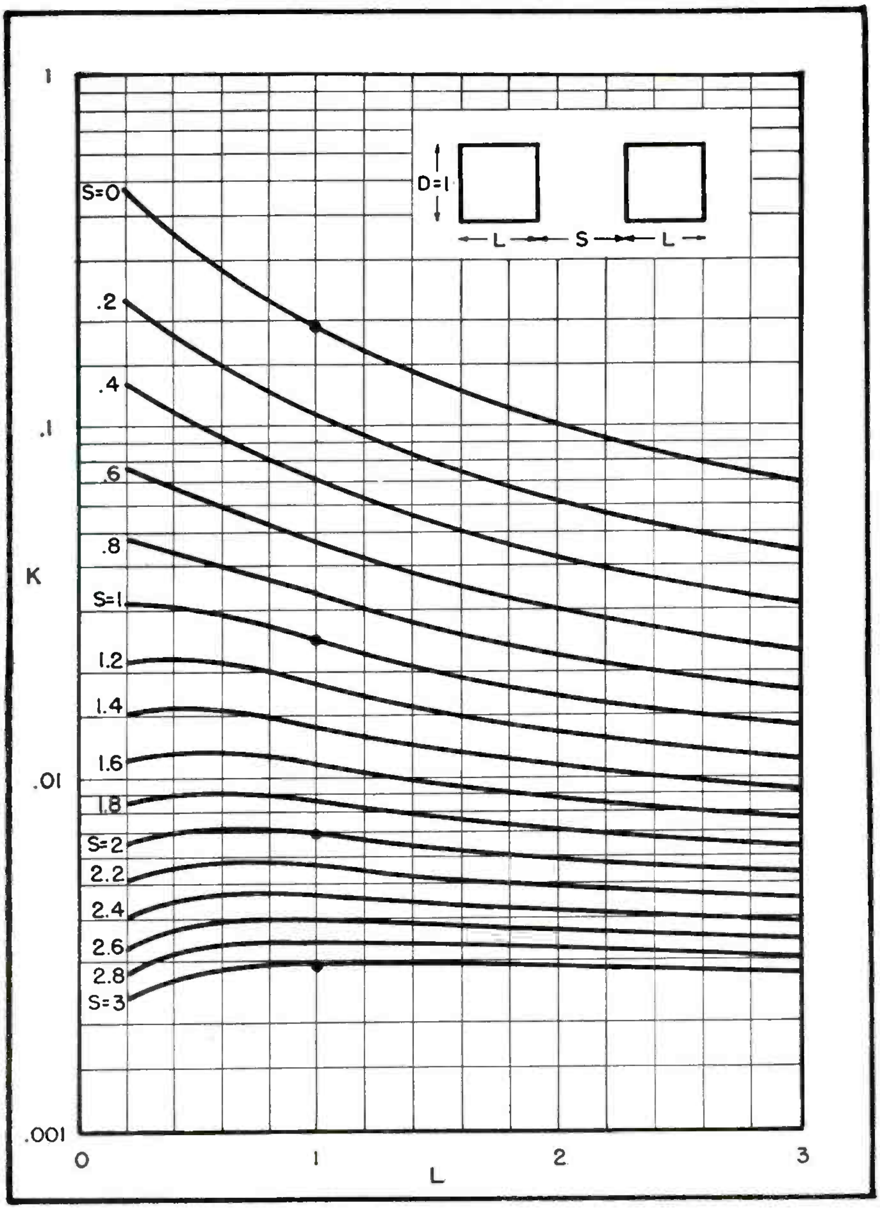
(All illustrations courtesy National Moldite Co.)

COUPLING CHART For Solenoid Coils

Chart Facilitates Finding of Proper Spacing Between Coils, Having Given Desired Coefficient of Coupling. Method Applies to Coaxial Solenoids Having Identical Dimensions, But Not Necessarily Identical Numbers of Turns.

by PETER G. SULZER

Electronic Scientist
Ionospheric Research Section, Central Radio Propagation Lab.
National Bureau of Standards



Family of coil-chart curves, with K as a function of normalized spacing S and coil-length L. Quantities S and L are measured in terms of coil diameters.

In designing IF transformers, bandpass filters, and similar devices, it is often necessary to determine the proper spacing between two coils to secure a desired coefficient of coupling. The operation is not an easy one, but it can be simplified with a chart, which can be prepared through application of calculation[1] or direct measurement of accurately-constructed models.

The calculation method has been found to be very laborious, since one is concerned with small differences between large quantities. However, the measurement approach is comparatively simple, and was therefore employed in the preparation of the chart.

In developing the chart the following factors were evaluated: Two coils having inductances L_1 and L_2, were considered, a voltage E_1 being applied to the first with the second open-circuited. The current $I_1 = \frac{E_1}{jWL_1}$, if resistance was neglected. The voltage induced in the second coil is then $E_2 = jWMI_1$, where M is the mutual inductance. Substituting $M = k\sqrt{L_1 L_2}$ and rearranging, $k = \sqrt{\frac{L_1}{L_2}}\,\frac{E_2}{E_1}$. If the coils are made identical, $k = \frac{E_2}{E_1}$, which was the relation used. Assumptions were made that the Q of the coil was sufficiently high to permit its resistance to be neglected, and that the voltmeter used to measure E_2 would cause negligible loading. Both of these factors were checked, and were found, together, to cause an error of less than 1%. In addition, the voltage ratios $\frac{E_2}{E_1}$ were carefully standardized with a resistive attenuator. Considering all sources of error, K should be obtained to an accuracy of better than 5%. As a check on the measurements, K was calculated by the method cited in the Grover reference[1], for the four points shown in the figure. It will be noted that excellent agreement was obtained.

To allow maximum utility, the chart data are presented as a family of curves showing K as a function of the normalized spacing S and coil-length L. The quantities S and L are measured in terms of coil diameters.

Example

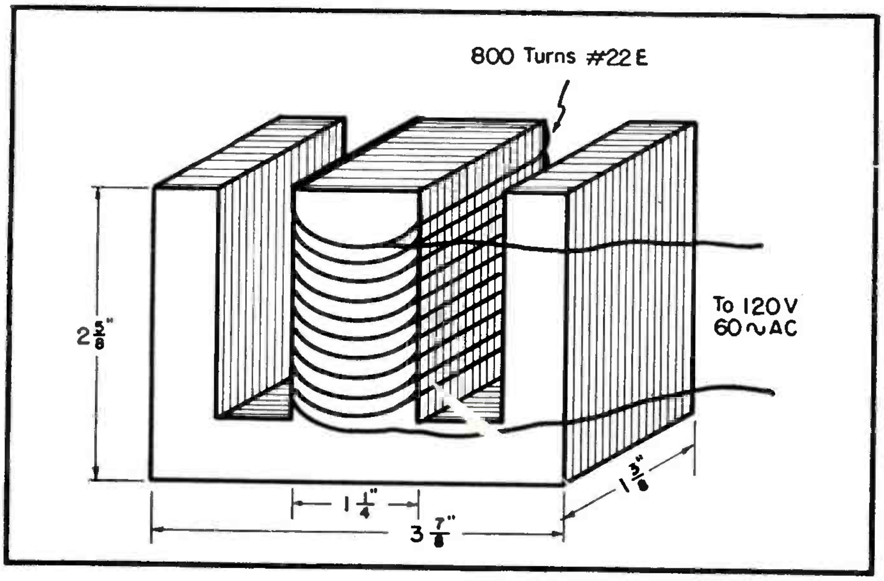
As an example, let us consider the design of a double-tuned, critically-

(*Continued on page* 31)

A Magnetic Tape Eraser

Power Transformer, with E and I Laminations, Rewound to Provide Magnetization Charge and Maximum Erasure of Signals on Tape.

by T. A. HILDEBRAND, Chief Engineer, KMBY, Billings, Montana



Cross-sectional view of rewound transformer used for magnetic tape erasing.

WITH THE DEVELOPMENT of magnetic tape-equipment with substantial wide-band properties, broadcasters have found the systems ideal for many purposes. To maintain the hi-fi characteristics, erasure control has been found to be extremely important. As a result several erasing techniques have been developed. In studying the problem at our station, it was found that a very satisfactory erasing unit could be built, using a rewound power transformer.

To create the required strong *ac* field, we selected a burned-out power transformer with *E* and *I* laminations. The old winding was removed, the *I* laminations discarded, and 800 turns of No. 22 enameled wire was wound to fit the winding space. Incidentally, it was found that the number of turns or the size of the core was not critical. However, the winding should have enough turns so that it will not burn up when 120 volts of *ac* are applied to the winding. Our rewound unit was found to become quite warm, but the heat was quite tolerable after five minutes of operation.

Operation

To erase a reel of tape, the coil is connected to the power supply and the reel of tape is gradually brought into the magnetic field, until the reel is in contact with the butt ends of the *E* laminations. The reel is then slowly rotated, first on one side and then on the other side of the reel to ensure complete demagnetization. The tape is then gradually removed from the field.

The supply voltage should not be disconnected while the reel is in the magnetic field, as this will cause a thumping sound to remain on the tape.

We found that the red-oxide coated tape will erase much more quickly than the black oxide tape. However, both can be erased.

Tape wound on metal reels will not erase properly and should be rewound on plastic reels. It was found that the erase head on most recorders actually recorded a slight noise back on the tape. Accordingly, for really *super* recordings, the tape can be erased with the coil and then the recording made with the tape recorder erase head disconnected or removed from contact with the tape. This will result in a recording with no perceptible background noise. It was also noticed that the recording head would sometimes become slightly magnetized causing a slight noise to be recorded on the tape. This trouble can be corrected by bringing the energized eraser coil in contact with the record head and then gradually removing it.

The erasure unit can be potted in a wood or fiber box. A metal box must not be used, as the *ac* magnetic field will cause an annoying vibration of the eraser. Even aluminum and copper were found to be unsatisfactory. If a cover is used over the pole pieces, it should be very thin so that maximum flux can penetrate the tape.

TV Broadcast Equipment

TV Mixer

A Mixer for automatic and manual fading, lapping and dissolving of television pictures, has been announced.

Mixer will take up to four non-composite inputs from camera channels and will fade or switch between any two of the four. The output of the video mixer is fed to a sync mixer and then to the output stage.

The signal input: four non-composite, 1-volt black negative-75 ohms; signal outputs are 2 volts composite, black negative-75 ohms, and 1.4 volts non-composite black negative 75 ohms. The monitor output level is .2 or .8 volt. Frequency response is said to be flat to 6 mc and is about 1 db down at 8 mc.—*Type TV-19-A; Commercial Equipment Division, General Electric Company, Syracuse, N. Y.*

G.E. TV mixer.

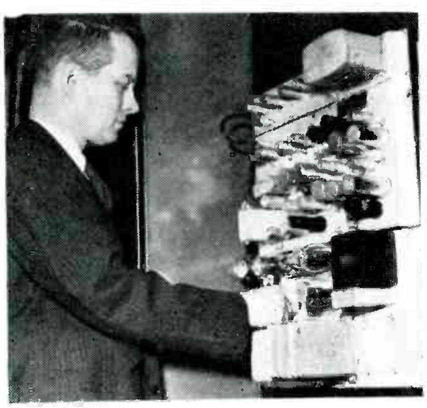
TV Visual Demodulator

A Visual Demodulator, which allows the transmitter operator to measure the transmitted signal, is now available.

The unit, which feeds both picture and waveform monitors simultaneously, is crystal controlled.

In addition to its primary use as a transmitter monitor, the demodulator can be used as a double sideband detector or a transient demodulator. By operating the *crystal* switch, the overall transmitter attenuation characteristic required for *proof of performance* tests can be measured. By switching out the sound rejection traps the unit can be used in connection with the study of transient response of a television system.—*Type TV-21; Commercial Equipment Division, General Electric Company, Syracuse, N. Y.*

G.E. visual demodulator.



Sync Generator Lock-In Control

Control Equipment which enables TV stations to switch, lap-dissolve, and superimpose remote programs with programs originating in the studios has been developed, the control being provided by automatic locking of the local sync generator in phase with the remote sync generator, without any manual phasing adjustment, and without the aid of additional transmission lines.

By locking the local sync generator, as a slave, to the remote generator, the unit is said to prevent *roll over* of the video picture. The remote signal, received at the main studio for feeding to the transmitter, is used for comparison with the local sync generator signal, thus providing an error signal which can be used by the new unit to control the operation of the local generator.

To secure automatic lock-in of signals, the unit combines two separate circuits which serve to provide control signals to the line frequency and field frequency sections, respectively, of the local sync generator.

The first consists of an *afc* discriminator which derives a varying *dc* error signal from the comparison of the horizontal driving signal from the local sync generator with the separated sync signal derived from the remote picture signal. This latter sync signal must be separated from the composite picture signal in some other equipment such as a stabilizing amplifier. No separator circuit is provided. The error signal is applied to the reactance tube in the local sync generator, thus directly controlling the frequency and phase of the master oscillator.

The second circuit compares the sync signals, one from the local sync generator and the other from the sync separator operating on the remote picture signal, and from this comparison derives an error signal in the form of a positive pulse recurring at field frequency. As long as the two field frequency signals are out of phase, the pulse exists, but as soon as they become coincident, the error pulse ceases to exist. The error signal is applied to the 7:1 counter circuit in the local sync generator in such a way as to cause it to miscount. As long as the error signal continues to recur, the local field frequency drifts at an accelerated pace, causing the two signals to approach in phase. At the instant of coincidence the error signal disappears and the counter circuit begins to operate normally. Thereafter the two signals remain in phase as long as the Genlock continues to function.

The operation of the line-frequency control circuit is said to be quite rapid, so that lock-in of the horizontal scanning circuits appears to be almost instantaneous. The field frequency control circuit, however, requires a variable amount of time to assume full control, depending on the initial phase difference between the two signals. Phase shift brought about by the control occurs at a definite rate of three scanning lines per field. The maximum amount of shift ever required is one full field, or 262.5 lines. Thus, the maximum time required to achieve control is about 1.46 seconds.—*Tye TG-45, Genlock; Broadcast Equipment Section of the RCA Engineering Products Department.*

1057-Foot Tower Installation

A tv-standard broadcast antenna tower, which is believed to be the tallest structure ever made, has been installed in Atlanta, Georgia, for WCON, by International Derrick and Equipment Co., 875 Michigan Ave., Columbus 8, Ohio. The tower including an RCA pylon rises 1057′ above the city.

Preparations leading up to actual erection operations involved six weeks of paper work by Ideco's engineering department. Design drawings had to be made of the tower foundation, actual tower, lighting circuits, and installation of coaxial-cable feed lines.

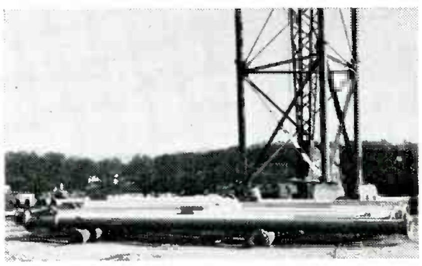
Tower legs were fabricated in 28′ lengths at the Columbus plant and then shipped to Atlanta for use in the tower. Approximately 200 tons of steel were used in constructing the tower.

The erection work, under the supervision of Ideco, was handled by an eight-man crew working with a three-drum power winch and a novel 100-foot gin pole. The gin pole, specially designed for this job, was used in hoisting tower sections into place.

Two guy wires on each side of the triangular-shaped tower provide support to the structure which was designed to withstand wind velocities of approximately 100 mph. Having 14′ widths (sides) to a height of 798′, the tower then tapers to 8½′ face widths which compose the top section. The top 200′ of the tower support the TV antenna.

An added feature of the tower is a one-man elevator for hoisting maintenance workers up to a height of 798′. An inside ladder runs the entire length of the tower. Circling the tower at elevations of 407′ and 798′ are four-foot steel platforms. In addition there are four rest platforms inside the tower at heights of 140′, 280′, 546′, and 686′.

To advertise the station, there are 14′ flashing letters mounted at a height of 400′. It is estimated that the call sign will be visible from a distance of 20 miles away.



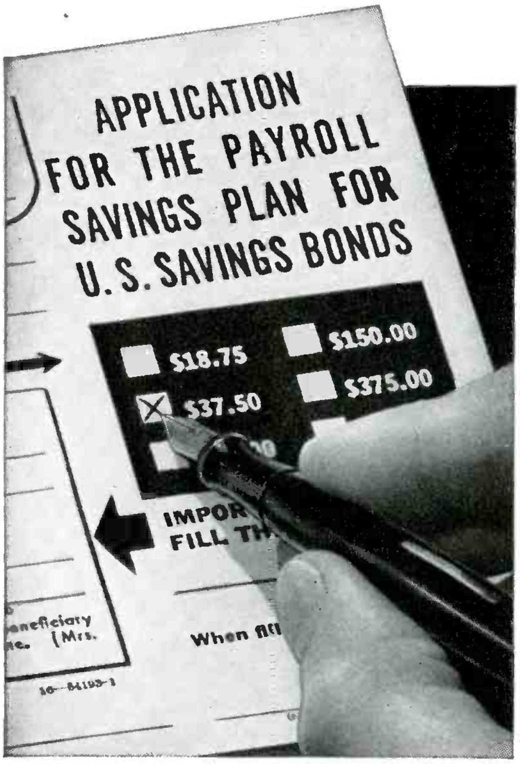
Above: WCON tower sections spread out according to master step-by-step erection plan.

Below: Planners and designers of tower: Bob Vaughn, chief engineer; L. E. Roelofs, assistant chief engineer, and Orville Pelkey, design engineer, all of Ideco.

It's EASY to install "Payroll Savings"

If you've put off installing the Payroll Savings Plan in your company because you feel it would be "a lot of work," then this advertisement is certainly for you! Because it's really *very simple* to give your employees the advantages of investing in U. S. Savings Bonds the easy, automatic "Payroll" way.

... and 20,000 companies' experience proves it pays!



HERE'S ALL YOU NEED TO DO

Appoint one of your top executives as Savings Bond Officer. Tell him to get in touch with your State Director, Savings Bonds Division, U. S. Treasury Department. Here's what happens . . .

The State Director will provide application cards for your employees to sign—plus as much promotional material and personal help as necessary to get the Plan rolling in your company.

Those employees who want Savings Bonds indicate on the applications: how much to save from their pay; what denomination of Bonds they want; and the inscription information to appear on the Bonds.

Your payroll department arranges to withhold the specified amounts, arranges to get the Bonds, and delivers them to the employees with their pay.

The Bonds may be obtained from almost any local bank or from the Federal Reserve Bank or may be issued by the company itself upon proper certification by the Federal Reserve Bank or Branch in the company's District.

THAT'S ALL THERE IS TO IT!

In case you're skeptical as to how many of your employees would like to have Payroll Savings, canvass your plant—and be prepared for a surprise. (Remember that pay-check withholdings for Bonds are *not* a "deduction"—the employee takes home his Bonds with his pay.) One leading manufacturer, who had professed little faith in the Plan, found his eyes opened when he asked the people in his plant whether they would like to obtain Bonds in this way. Within only six months after he installed the Plan, half his employees signed up. A prominent aircraft manufacturer, whose company had used the Plan for some time, was not aware of its potentialities until his personal sponsorship increased participation by 500% among his company's employees.

THE BENEFITS ARE BIG—FOR EVERYONE

The individual employees gain security—they know that the Bonds they hold will return $4 for every $3 at maturity. The company gains from the resultant increased stability and efficiency of its workers. The whole nation gains because Bond sales help stabilize our economy by spreading the national debt and by creating a huge backlog of purchasing power to boost business in the years ahead.

Is it *good policy* to deprive your company of Payroll Savings—even one more pay day? Better at least have a talk with your U. S. Savings Bonds State Director, get the answers to your questions, and *know for sure.*

The Treasury Department acknowledges with appreciation the publication of this message by

TELEVISION ENGINEERING

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and The Advertising Council.

Instrument News

Wheatstone-Megohm Bridge

A WHEATSTONE-MEGOHM BRIDGE for direct-reading has been designed for accurate resistance measurements between 10 ohms and 1,000,000 megohms. Can be used to measure resistance elements and insulation resistance and to determine the volume resistivity of various materials.

Instrument is basically a Wheatstone bridge used in conjunction with a *dc* amplifier. Two built-in power supplies provide the correct bridge voltages for the high and low ranges. A regulated supply is used on the high ranges to counteract the effects of dielectric absorption.—*Model 635 A; Shallcross Manufacturing Co., Collingdale, Penna.*

Shallcross Wheatstone-Megohm bridge

Diode Modulator

A CRYSTAL DIODE MODULATOR has been designed to convert an oscillator, standard-signal generator, or other *rf* source into a test-signal generator for television receiver testing. Unit modulates the oscillator signal after attenuation, so that reaction on the oscillator frequency is negligible. Thus, it produces an amplitude-modulated signal with no significant incidental FM.

Range of modulating frequencies is 0 to 5 mc and carrier-frequency range is 20 to 1,000 mc, covering the proposed new *uhf* bands, as well as at currently used frequencies.

For receiver testing, a video signal can be conveniently derived from a TV receiver tuned to a local channel. With this video signal applied to the modulator, and an oscillator tuned to the desired carrier, a TV picture can be placed on any desired channel by tuning the carrier oscillator.

Equipped with coaxial connectors for *rf* input, output, and for modulation input. Adaptors are available for connection to other types of terminals. Impedance is 50 ohms for *rf* circuits, and coaxial 50-ohm attenuators and other accessories are available.—*Type 1000-P6; General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.*

VHF Frequency Meter

A VHF frequency meter with a 20 to 430-mc range is now available. Instrument reads the frequency directly.

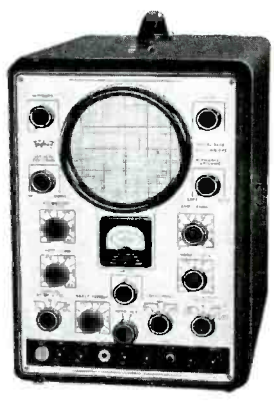
Unit is said to be guaranteed .005% within the temperature range of 32° to 120° F. Provision has been made to modulate carrier at approximately 30% at 1,000 cps.

Operated from dry batteries (included within the carrying case) or from regulated laboratory power supply.—*FM-1; Gertsh Products, Inc., 11846 Mississippi Ave., Los Angeles 25, Calif.*

5″ 'Scope

A 5″ 'SCOPE featuring a pattern reversing switch has been announced. Instrument also has a calibrated meter for peak-to-peak voltage measurements. Double trace in TV alignment said to be eliminated by a switch; sync control to 0. Has a return trace eliminator and telescoping light shield.

Linear sweep voltages up to 60 kc. Frequency range, 20 cycles to over 1 mc. Vertical sensitivity said to be .009 *rms* volt per inch. A demodulator probe is also available for signal tracing.—*Model 3440; The Triplett Electrical Instrument Co., Bluffton, Ohio.*



Triplett 5″ scope

Portable TV Waveform Monitor

A WAVEFORM MONITOR has been developed for waveform analysis and amplitude measurement of video signals in TV circuits. Said to have a wide-frequency response, high sensitivity, and large symmetrical horizontal expansion. Visual presentation is on a 5″ crt.—*Model TD-1; Polarad Electronics Corp., 100 Metropolitan Ave., Brooklyn 11, New York.*

Service-Type 'Scope

A 3″ SERVICE-TYPE 'SCOPE, which has a deflection sensitivity of better than 30 millivolts per inch is now available. Frequency response of the vertical amplifier is said to be flat within 2.3 db from zero to 500 kc, down 6.8 db at 1 mc, and useful beyond 2 mc.

Has a direct-coupled vertical amplifier which is used to provide flat low-frequency response. High-frequency square-wave response up to 100 kc. Less than 2 per cent tilt and overshoot are said to be produced.

Also has a frequency-compensated and calibrated step attenuator.

An accessory kit, which facilitates signal-tracing measurements, is available. Kit consists of a direct probe and cable, a low-capacitance probe, a ground lead, and a slip-on Mueller test clip.

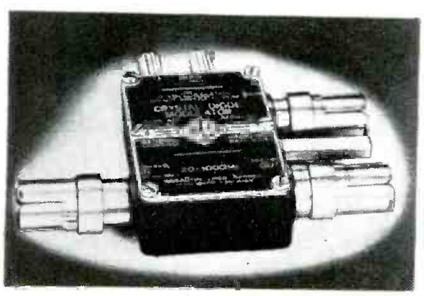
'Scope also features a linear sweep range from 15 to 30,000 cps with preset fixed sweep positions for viewing vertical and horizontal deflection-circuit waveforms, positive and negative synchronizing for lock-in of upright or inverted plus waveforms, and sweep direction-reversing switch for left-to-right or right-to-left traces. In addition, the instrument has a phase-controlled 60-cycle sweep. Traces may be expanded two times screen diameter for sweep-alignment applications.—*Type WD-57A; Test and Measuring Equipment Section, RCA Tube Department.*

Interference and Field Intensity Meter

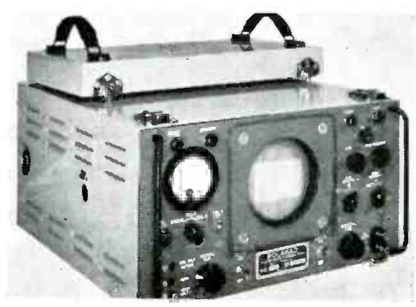
AN INTERFERENCE AND FIELD-INTENSITY meter, covering the 15 to 400-mc bands, has been developed to measure sine wave, pulsed *rf*, impulsive noise, and random noise. Average, quasi-peak, or peak values of complex wave-forms can be selected.

Dipole antennas permit field intensity surveys revealing information on the direction and plane of polarization of the signals in space. Loop probes allow studies of *rf* leakages in shielding and other enclosures. Line probe provides means for the measurement of conducted *rf* energy on lines of all types. Matching impedance for directly measuring the *rf* output of 50-ohm coaxial line terminated signal generators.

Typical applications include: Field intensity surveys; antenna radiation pattern studies; interference location and measurement; shielding effectiveness; radiation from incidental and restricted radiation devices in accordance with FCC requirements; and propagation studies. Other uses include: Measurement of *rf* noise; filter effectiveness; wave filter analysis; determination of attenuator characteristics; checking of signal generator.—*Type NMA-5, Stoddard Aircraft Radio Co., 6644 Santa Monica Boulevard, Hollywood 38, Calif.*



G-R diode modulator



Polarad waveform monitor

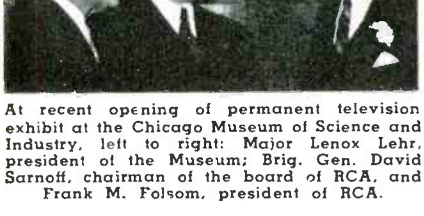
Stoddard interference meter

VWOA News

The Spring Meeting

WITH ONE of the industry's most colorful speakers, George G. Bradley of Radiomarine Corp. of America, as guest talker, and several vital reports also featured, the annual VWOA spring get-together held in New York City was found to be one of the most interesting on record. . . . Among those who listened to Bradley and the others were W. J. Gillule, Herman H. Parker, Fred McDermott, John V. L. Hogan, John J. Jeffords, W. A. Paul, C. H. Pfeifer, Fred Klingenschmidt, John A. Bossen, H. J. Horneij, George F. Duvall, prexy W. J. McGonigle, ye treasurer C. D. Guthrie, E. H. Price, R. J. Iversen, E. C. Cochran, John Lohman, Jonathan Eddy, Homer B. Black, Ben Beckerman, H. E. Ballantine, H. L. Cornell, L. B. Victor, secretary W. J. Simon, Sam Schneider, R. K. Davis, H. B. Kock, George N. Mathers, Rodney D. Chipp, J. L. Savick, E. N. Pickerill, Anthony Tamburino, R. L. Fischer, A. G. Cooley and George D. Burns, the latter two having only recently joined the ranks of VWOA. . . . Bradley's talk was fascinating, covering a new method of diversity transmission, Unicast, which has been successfully developed by RMCA. This system, it was reported, permits reception at many points without any appreciable amount of fading or degradation of signal strength. . . . Detailing the results of a conference with a New York City Park Department architect, involving plans for the replacement of the Wireless Operators Monument, ye prexy said that substantial progress had been made, and then presented a drawing of the Park Department's plan for the restoration of Battery Park, which illustrated where it is expected that the monument will be placed. . . . It was also revealed at the dinner-meeting that ye prexy and secretary were honored guests at a retirement luncheon tendered to VWOA second vp E. N. Pickerill by executives of RCAC. . . . Also disclosed at the meeting was the news that George W. Ahrens has reported that Galveston, Texas, now has a VWOA chapter under way, and thus far members include George, T. M. Gardner of RMCA and W. M. Vogt of Mackay. . . . It was also learned that E. W. Mayer is now with CAA in Santurce, P. R., and is quite busy moving station KP4KD into the heart of the city. . . . Major LeRoy Thompson is now in Japan. The Major and his wife are active hams, with call letters W4IKA and W4BRF. . . . Charles M. Hodge is now in Saudi Arabia, having flown from San Francisco, via London, Copenhagen, Rome, Damascus, Beirut and finally to Dhahran, in Arabia, in about eleven days. Quite a trip.

TV EXHIBIT OPENING IN CHICAGO



At recent opening of permanent television exhibit at the Chicago Museum of Science and Industry, left to right: Major Lenox Lehr, president of the Museum; Brig. Gen. David Sarnoff, chairman of the board of RCA, and Frank M. Folsom, president of RCA.

2,000 and 7,000-Mc TV Microwave Relays

by EARL D. HILBURN

Assistant Chief Engineer
WMAL, WMAL-FM, WMAL-TV

Part IV.

Beam-Bender Adjustments

In experimenting with the possibilities of beam benders, described in last month's installment, it was found possible to beam a signal from the roof of a mobile unit parked at the curb to the top of a building a block or so away, to the double-dish assembly. From this point, the signal can be redirected to the receiving point at the studios. The success of this system is dependent entirely upon getting an approximate orientation, so that the operator at the receiver can *call* the adjustments to each of the antennas. If a close initial alignment is not achieved, the man at the receiver has no signal indication. Under these conditions the operator adjusting the *beam-bender* could search for a long time without much chance of redirecting anything through the system. Telescopes for sighting are a definite *must* for this operation.

There are *several precautions* to follow, when applying this system. Conditions have been encountered where the position of the intermediate *beam-bender* was such that signals reflected from the walls of the building supporting the coupled dishes. The reflected signals not only confused the orienting procedure, but because of the phase difference, the signals arriving at the receiver resulted in distortion of the waveform of the demodulated signal. In view of this type of problem, it is recommended that an actual field test of this type of reflector be conducted over the proposed course, before scheduling a broadcast with this facility.

Ultimately perhaps, traveling-wave tube equipment will be available for TV microwave frequencies, in which case the double-dish system could include a broad-band amplifier at the intermediate point. Of course, this would greatly increase the range and reliability of this sort of device.

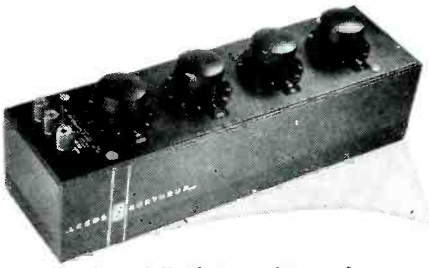
Production Aids

AC Resistance Boxes

RESISTANCE BOXES have been designed for use as adjustable standards for *dc* and for *ac* resistance measurements up to medium frequencies. Principal feature of the boxes is said to be a rotary switch with low and stable contact resistance, obtained through the use of solid silver switch contacts and silver alloy multiple-leaf brushes. Zero or contact resistance is said to be less than .002 ohm per decade and changes less than 0.0005 ohm per decade on accelerated life tests. Switches are equipped with adjustable indexing action.

Terminals are knurled, all-metal, and accommodate banana plugs, spade or spring clips, or bare wire of any size.

Available in 4-dial model with a range of 11,110 ohms in 1-ohm steps and 5-dial models covering 11,111 ohms in .1 ohm steps.—*Leeds and Northrup Co., 4934 Stenton Avenue, Philadelphia 44, Pa.*



Leeds and Northrup resistance box.

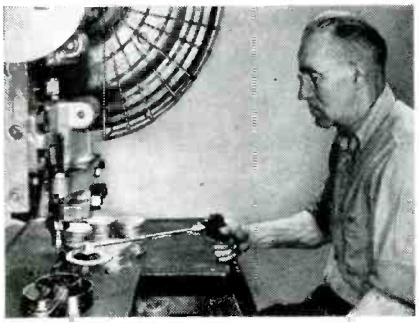
Switchboard Type Shunts

EXTERNAL SHUNTS for electrical instruments are now available in three styles and in 38 capacities from 10 amperes to 20,000 amperes and with physical dimensions from 3¾″ to 16⅜″ long. Shunts consist of special alloy strips, the ends of which are fitted into terminal blocks provided with means for connecting the shunt in circuit with the main conductor and with the instrument.

All lug blades are ¼″ thick and spaced ¼″ apart to receive ¼″ bus bar. These shunts can be furnished adjusted for 50, 75 or 100 millivolt drop. Ring or multiple range shunts can be supplied in any range combination within the standard capacities.—*Cole Instrument Company, 1320 South Grand Ave., Los Angeles 15, Calif.*

Safety Feeder

A SAFETY FEEDER device that produces a vacuum by passing compressed air through a venturi has been developed to hand-feed small parts into a press. The operator's hands are never in the danger area.—*Pres-Vac; F. J. Littell Machine Co., 4113 N. Ravenswood Ave., Chicago, Ill.*



Littell safety feeder

Carboloy Insert Self-Tapping Screw Sockets

IMPACT SOCKETS with screw drive openings formed of solid *carboloy* are now available. Life due to the *carboloy* surfaces which drive the screw is said to be at least ten times that of all steel sockets.

Two sockets are now available in ¼″ square drive with ¼″ and 5/16″ nominal hexagon openings. Both sockets fit hex, hex washer and oval hex washer heads. Finish is satin nickel.—*J. H. Williams and Co., 400 Vulcan St., Buffalo 7, N. Y.*

Voltage-Regulated Power Supply

A REGULATED *B*, regulated *C* and an unregulated filament supply unit featuring a low ripple content, and low output impedance has been developed.

The *B* supply is continuously variable from 0 to 300 volts and delivers from 0 to 150 milliamperes. In the range of 20 to 300 volts the output voltage variation is said to be less than ½% for both line fluctuations from 105 to 125 volts and load variations from minimum to maximum current; ripple is less than 5 millivolts.

The *C* supply is continuously variable from 0 to 150 volts and delivers 5 milliamperes. For all output voltages the output voltage variation is said to be less than 10 millivolts for line fluctuations of 105 to 125 volts. At 150 volts, the regulation is said to be less than ½% between 0 and 5 milliamperes. At other settings below 150 volts the internal resistance of the supply will increase to a maximum of 25,000 ohms.

AC output is 6.3 volts, 5 amperes, center-tapped, unregulated.—*Model 315; Kepco Laboratories, Inc., 149-14 41st Ave., Flushing, New York.*

Kepco voltage-regulated power supply

Armored Cable Connectors

A SERIES OF ⅜″ CONNECTORS for attaching armored electrical cable to ⅞″ openings in motor housings and castings of various wall thicknesses has been announced. Made of aluminum die-cast alloy.

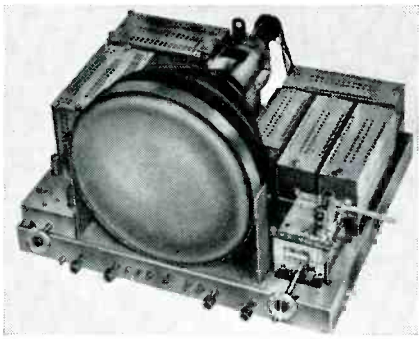
Connectors are made in two parts, each with a grooved lip which engages the edge and inside surface of a standard ⅞″ opening. Operating on the principle of a cam-wedge, they grip tightly when two standard machine screws are tightened. Only a screwdriver is said to be needed for installation. Positive positioning of the cable connector assembly in any desired direction is said to be assured. Each connector is stamped with the Underwriters' Laboratories seal of approval.—*Type LN; Unimatic Corporation, 52 East Centre Street, Nutley, N. J.*

Unit-Ized Chassis

A UNIT-IZED CHASSIS employing eight plug-in units has been developed.

Construction was developed to increase the collective perfection of the set by allowing individual testing of each unit. For repair or replacement, each unit can be removed without interfering with the rest of the set. Units are keyed to fit only their proper locations in the chassis.

Unit *A* is a TV channel selector with vernier tuning; *B*, the *if* amplifier with 4 stages of *if* and germanium crystal detector; *C*, the sound amplifier; *D*, the video amplifier, *agc*, and sync separator; *E*, the vertical sweep amplifier; *F*, the horizontal sweep amplifier with high-voltage supply; *G*, the main power supply; and *H*, AM radio tuner.—*Setchell-Carlson, Inc., New Brighton, Mass.*



Setchell-Carlson unit-ized chassis

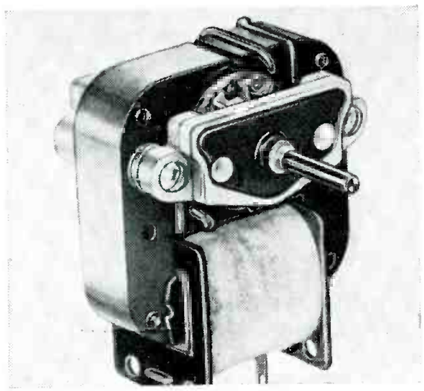
Clear Insulating Varnish

A CLEAR INSULATING varnish that is claimed to stay flexible after baking has been developed. Manufacturer says that varnished leads can be bent and twisted after the varnish is cured without danger of the conductor breaking or the varnish cracking.

Varnish is said to have high dielectric strength, high resistance to moisture, transformer oils, mineral oils and solvents, and exhibit good stability characteristics in the impregnating tank as well as in storage.—*No. 123; Irvington Varnish and Insulator Co., Irvington, N. J.*

Fractional Horsepower Motor

A FRACTIONAL HORSEPOWER motor (1/200 to 1/50 hp), which is said to have a flat speed torque curve and high starting and pull up torque, has been produced.—*Type 230; Raytheon Manufacturing Co., Motor Division, Russell Electric Co., Chicago, Ill.*



Russell electric motor

Personals

R. T. Pearson, who has been direct factory representative for the past year and a half for Standard Coil Products, Inc., has been appointed to supervise a new branch office at 1616 Walnut Street, Philadelphia 3, Pa., which will serve TV set manufacturers in Pennsylvania, upper New York, New Jersey, Delaware, Maryland, Washington, D. C., and surrounding territories, with the exception of Metropolitan New York and New England, which are represented by P. R. Fixel.

R. T. Pearson

James M. Blacklidge, formerly vice president of the Standard Transformer Corp., Chicago, has purchased controlling interest in The Gramer Company, 2734 N. Pulaski Rd., Chicago, and taken over the duties of president, succeeding Everett E. Gramer, who remains in a consulting capacity. Company manufactures Gracoil line of coil windings and transformers.

J. M. Blacklidge

Paul McKnight Deeley has been elected a director of the Cornell-Dubilier Electric Corp.

Vice president of the company since 1932, Deeley previously had been associated with Cornell Electric Manufacturing Co. since 1931.

H. Ward Zimmer has been elected executive vice president of Sylvania Electric Products, Inc.

Major General Roger B. Colton is now president of Federal Telecommunication Laboratories, Inc. General Colton succeeds *Harold H. Buttner*, who has been appointed vice president and deputy technical director of I. T. & T.

William Humphrey Doherty, of Bell Telephone Labs, has received an honorary degree of Doctor of Science from the Catholic University of America, in recognition of his work as an engineer and scientist.

Joseph W. Crownover is now section chief, in charge of the experimental and research electronics laboratory, of Electrical Reactance Corp., Franklinville, N. Y.

Sam Norris has been elected president of Amperex Electronic Corp.

Max F. Balcom, chairman of the board of Sylvania Electric Products, Inc., has been elected a director of Speer Carbon Company, St. Marys, Pa.

Robert J. Cannon is now president of the Cannon Electric Development Company, Los Angeles, succeeding *James H. Cannon*, who died recently.

R. J. Cannon

John G. Wilson, executive vice president in charge of the RCA Victor Division of RCA, died recently.

James N. Davis, formerly a senior research engineer for the Physics Laboratories of Sylvania Electric Products, Inc., Bayside, New York, has been appointed technical representative for the company in Washington, D. C.

Arthur L. Chapman has succeeded E. E. Lewis as general manager of the Colonial Radio and Television Division.

Lewis has resigned as vice president of Sylvania in charge of the Colonial Radio and Television Division to return to his industrial management consulting business.

Howard T. Souther has been appointed manager of the speaker division of Electro-Voice, Inc., Buchanan, Mich. Souther was formerly vice president of the Stephens Manufacturing Company.

Robert A. Starek, formerly commercial engineer for the Radio Tube Division of Sylvania Electric Products at Emporium, Penna., has been appointed field engineer.

Starek will make his headquarters in the Cincinnati office, located in the Terrace Plaza Building.

Walter Lefebre has been appointed acting field sales manager for the Sylvania television division of Sylvania Electric Products Inc.

Charley Golenpaul, recently celebrated his twentieth year with Aerovox Corp.

Golenpaul is now sales manager of the Aerovox distributor division.

John H. Ganzenhuber, formerly manager of broadcast sales for Western Electric, has been appointed vice president in charge of sales and product development of Standard Electronics Corp., wholly-owned subsidiary of Claude Neon, Inc.

J. H. Ganzenhuber

James C. Smith has been appointed industrial sales manager of Potter and Brumfield, Princeton, Indiana. Smith was formerly sales manager of Phillips Control Corp.

J. C. Smith

M. Charles Banca has been appointed manager of the newly created industrial television products group of the RCA Engineering Products Department.

S. M. Decker is now assistant chief engineer of the television department of Air King Products Co., Inc., Brooklyn, New York.

Percy L. Spencer has been named vice president in charge of Raytheon's power tube division. *Norman B. Krim* is now vice president in charge of the Raytheon receiving tube division and Ernest F. Leathem has been appointed assistant to the president of Raytheon.

Louis Kahn has become director of research of Aerovox Corp., New Bedford, Mass.

Benno Von Mayrhauser is now chief production engineer for The Turner Co., Cedar Rapids, Iowa.

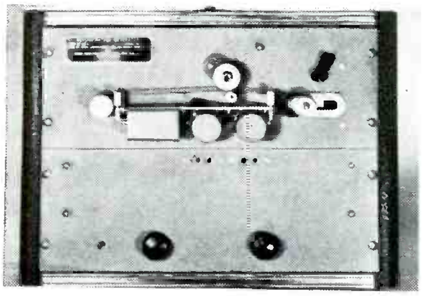
Warren L. Smith has been elected president of The M. W. Kellogg Co., Jersey City, N. J.

TV Sound Activities

Reverberation Generator

An artificial reverberation generator, featuring a magnetic tape delay system combined with a reentrant electronic system has been designed.

Input and output levels are at zero *vu*, and the frequency response is said to be suited to wide-range, live-program material. For use in other services, the generator is available with its own microphone preamplifier, isolation amplifier, control panel, *vu* meter, and sound effects filter.—*Audio Facilities Corporation, 608 Fifth Avenue, New York 20, New York, N. Y.*



Reverberation generator

Magnetic Tape Recorder

A magnetic tape recorder with three heads, permitting monitoring from the tape while recording, has been produced. Contained in a single housing, there are individual erase, record and reproduce heads, the latter two of which are each triple-shielded to eliminate cross-talk and hum. Monitoring is accomplished by the third head. These heads are separately alignable and can be replaced as required. Mechanism also has a two-speed hysteresis synchronous motor so that tape speeds can be changed from 15" per second to 7½" per second by a turn of the switch. Equalization for the two speeds is provided in the amplifier with another panel switch.

Frequency response is said to be flat from 50 to 15,000 cps, ±2 db at 15 ips; 50 to 7500 cps, ± 2 db at 7½ ips. The console amplifier has line and headphone output, switch for bias and permits equalization for 15" and 7½" tape speeds. Has a 4" *vu* meter.—*Model PT7; Magnecord, Inc., 360 W. Michigan Ave., Chicago 1, Ill.*

Magnecord tape recorder

Impedance Nomograph

(*Continued from page* 15)

decade of scale *C* must be used to locate 15; Figure 3(*g*).

Values of Resistors in Parallel

To find the value of a resistor in parallel with 8, resulting in a joint resistance of 1.6, we employ the following equations: $R_1 = R \cdot R_2/(R_2 - R)$, or $R_1 = 1.6 \times 8/(8 - 1.6)$, which can be written $8/(8/1.6 - 1)$. As the first step $8/1.6 = 5$ is found, and in the second step $8/(5 - 1) = 2 = R_1$ is located; Figure 3(*h*).

Problem Variation

The foregoing problem can be altered to involve a resistor which might be in parallel with 2 to give 1.6. Here, the first step is $2/1.6 = 1.25$ and in the second step $2/(1.25 - 1) = 2/.25 = 8$, the required value; Figure 3(*i*).

The solution of similar problems directly on a slide rule, has been offered previously by the writer.[1]

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[1]Paine, Robert C., *Impedance Problem Solutions on the Slide Rule*, Communications; December, 1943.

TV Parts and Accessory Review

Selenium Rectifier

A LOW-CURRENT selenium rectifier, which features a special plate for use on *dc* currents in the microampere range, has been developed. Rated up to 6,000 volts peak inverse. Can be connected in series for higher voltages.—*Model SF8LA; Bradley Laboratories, 82 Meadow St., New Haven, Conn.*

Coaxitube

A COAXIAL TUBE, which consists of an inner conductor, dielectric and a seamless tube forming a coaxial pair of conductors, has been developed for use in closely-coupled tank coils, shielded grid leads, and high frequency transmission lines. The dielectric can be polyethylene, DuPont Teflon, fibreglas, etc.

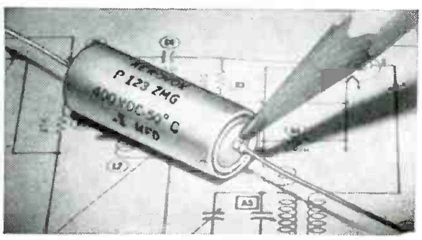
The continuous, seamless outer conductor is said to prevent stray *leakage* such as can occur through a braided coax and eliminate reflection that can arise, if pitch of braid is some important fraction of wavelength.

Produced in a range of sizes using a copnic, constantan, or advance inner conductor, suitable insulation, and a seamless copper outer shield. A copper-advance combination is usable up to about 350°, at which temperature it produces about 18 millivolts above its *emf* at 0° C. Outside diameter can be controlled from .023" to .100" or larger.—*Coaxitube; Precision Tube Co., 3824 Terrace Street, Philadelphia 28, Pa.*

Micro-Miniature Ceramic-Sealed Tubulars

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

Available in 200, 400 and 600 *vdc*, and capacitance values of .0005 to 2.0 mfd. Dimensions range from .175" diameter by 7/16" long, up to .670" diameter by 2 7/32" long. Bare metal-can units may also be had with plastic insulating sleeves, adding .062" to the diameter and 1/16" to length.—*Type P123ZG; Aerovox Corp., New Bedford, Mass.*



Aerovox micro-miniatures

Custom-Made Coils and Chokes

A LINE OF COILS and chokes adaptable to *tailor-made* specifications has been introduced.

Types include high Q *rf* chokes, progressively-wound slug-tuned broadcast coils and oscillator coils. The *rf* chokes may be made up as two separate coils having a specified coupling coefficient. High-permeability iron cores are sometimes used to provide greater inductance in a small unit.—*Shallcross Manufacturing Co., Collingdale, Pa.*

Adjustable, Regulated AC Supply

AN ADJUSTABLE, REGULATED, *ac* voltage supply has been designed for use with equipment that requires an adjustable source of constant *ac voltage* (from 0 to 130 volts) of undistorted wave shape. The supply is said to provide the voltage stabilizing characteristics of the standard constant voltage transformer; ±1% regulation for line input changes from 95-125 volts, with less than 3% harmonic distortion of the input voltage wave.

The voltage regulation is said to be automatic and substantially instantaneous (maximum response time 1.5 cycles). Except for the rotor of the autotransformer there are said to be no moving parts, no manual adjustments and no tubes or other expendable parts. Every unit is also said to be self-protecting against short circuit.—*Type CVL Solavolt; Sola Electric Co., 4633 West 16 St., Chicago 50, Ill.*

Coupling Chart

(*Continued from page* 20)

coupled *if* transformer for a 3-db-down bandwidth of 200 kc at 10 mc. Choosing coils of ½″ diameter and ½″ length, and a capacity of 50 mmfd, reference to a previous paper[2] discloses that 22 turns will be wound on each coil. A universal response curve[3] then indicates that a Q of 75 will be required, with a coefficient of coupling of .013. For $L = 1$ and $K = .013$, the chart will provide the required spacing as 1.45 diameters. Thus, the spacing between the coils will be 0.725″.

References

[1]Grover, F. W., *Tables for the Calculation of the Mutual Inductance of any Two Coaxial Single-layer Coils, Proc. IRE*; July, 1933.
[2]Sulzer, P. G., *RF Coil Design Using Charts*, COMMUNICATIONS; May, 1949.
[3]Terman, F. E., *Radio Engineers' Handbook*, pp. 160-161, McGraw-Hill, New York; 1943.

Industry Literature

Philco Corp., has published a 160-page book, *Television Components Handbook*, written by A. C. Matthews, television cost engineer for Philco.

Book is being distributed by the accessory division of Philco, C and Tioga Streets, Philadelphia 34, Pa., and by Philco distributors in principal cities. Price, $2.50 postpaid.

Electronic Measurements Corp., 423 Broome Street, New York 13, New York, have released a catalog describing pocket volometers, TV antenna orienters, extension cords, etc.

The Plastics Department of Rohm & Haas Co., Washington Square, Philadelphia 5, Pa., has published a 16-page booklet on *plexiglass* acrylic plastic molding powers. Covers series of heat-resistant, medium-flow, and general-purpose formulations. End products shown range from rigid packages to large molded letters and protective lenses for television picture tubes. Also included is a detailed table of properties for the company's various injection and compression molding powders.

Crest Transformer, 1834 West North Ave., Chicago 22, Ill., have published a catalog, No. 50, with a listing of equivalent parts for over 200 television sets made by over 50 TV manufacturers.

The Gray Research & Development Co., Inc., 16 Arbor St., Hartford 1, Conn., has released a 6-page catalog describing the Gray *Telop*, camera turrets, multiplexer and other equipment designed for TV broadcasting.

Sperry Products, Inc., Danbury, Conn., have published a bulletin, 90-109, covering power, audio, pulse and blocking oscillator transformers; filter, audio, and high Q reactors; and net works.

Haydon Manufacturing Company, Inc., Torrington, Conn., have published an 8-page catalog, No. 323, on electrical timing devices. The line includes units for time delay, interval, repeat cycle and elapsed time functions.

Minnesota Mining and Manufacturing Co., 900 Fauquier Street, St. Paul 6, Minn., have published a glossary of terms, *Time for Sound Talk*, used by tape recording technicians.

Included in the booklet are four pages of technical terms and definitions, plus details on various sizes and types of sound recording tape, dual- and single-track recording, and different tape recording speeds.

Triad Transformer Manufacturing Co., 2254 Sepulveda Blvd., Los Angeles 64, Calif., have published a catalog, TR-49A, describing a line of transformers, which are said to feature permanent and legible markings with full specifications and connection data.

Permoflux Corp., 4900 W. Grand Ave., Chicago 39, Ill., have released a catalog describing the 8T-8-1 *Royal Eight* speaker line.

Presented are construction details and laboratory response curves, as well as engineering information on totally enclosed baffles for use with the speakers. Technical data on multiple loudspeaker arrangements are also offered.

Briefly Speaking . . .

In a wide-scale effort to solve TV's current problems, including such acute factors as the freeze, network operations (cabling, radio-relaying and costs) and standardization of equipment, TBA has launched a ten-point national campaign. Released as a pledge to the industry, TBA has proposed that it will seek to bring about . . . "an end to the freeze . . . as soon as possible to insure resumption of licensing before the end of '50." TBA will also try to effect a . . . "speedy resumption of the FCC hearings with respect to the tariffs covering the interconnection of television stations and the various coaxial cables and radio relays." They will also seek to help . . . "standardize advertising practices with respect to the repair and maintenance of television receivers." And TBA also proposed that they will assist the RMA, IRE, SMPTE, ASA and others in establishing standardization of equipment . . . "to provide maximum flexibility for the broadcasters in their choice of equipment." . . . Over seven-million dollars will be spent by G.E. this year for new and specialized machinery and enlarged manufacturing facilities for increased production of TV receivers, cabinets and TV picture tubes. . . . Reporting on the tremendous strides of TV, during an annual meeting of stockholders, RCA's chairman of the board, Brig. Gen. David Sarnoff, stated that TV . . . "already has achieved the stature of a billion-dollar-a-year industry." He reported that TV now accounts for nearly 60% of RCA's gross income. . . . The Empire State Building multi-antenna project achieved an official status recently in the signing of a contract between RCA and representatives of Empire State, Inc., and NBC. The contract calls for the construction of antenna facilities for WCBS-TV, WABD, WJZ-TV, WPIX, WNBT, WNBC-FM, WJZ-FM and WCBS-FM. Present plans call for the use of RCA supergain antennas for channels 2, 5, 7 and 11 and a superturnstile for channel 4. . . . Henry L. Crowley and Co. have set up a joint operational plan with Republic Steel, and opened a new plant for the increased production of powdered cores for horizontal output transformers. The management unit for the plant will be known as the Crowley-Republic Corp. . . . The American Optical Co. are now producing 26", 90-pound spherical mirrors for use in RCA projection TV theater systems, which it is expected will afford pictures 15 to 20 feet. The mirrors feature an aluminized coating. . . . A patent covering plastic mounting and insulating rings and sleeves for metal TV tubes (No. 2,503,813) has been awarded to the Anchor Plastics Company, Inc., 533 Canal Street, New York. . . . The Crest Transformer Corp. are now located in a new building at 1834 W. North Ave., Chicago, Illinois. . . . A new alloy, dubbed *zncube*, composed principally of zinc, with small quantities of copper and beryllium added, which is said to have approximately the same strength and electrical characteristics of brass, and about eight times the useful strength of zinc alloys now in use, has been developed by Dr. R. H. Harrington of the G.E. research laboratories.

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