

ELECTRONIC

design

ELECTRONIC

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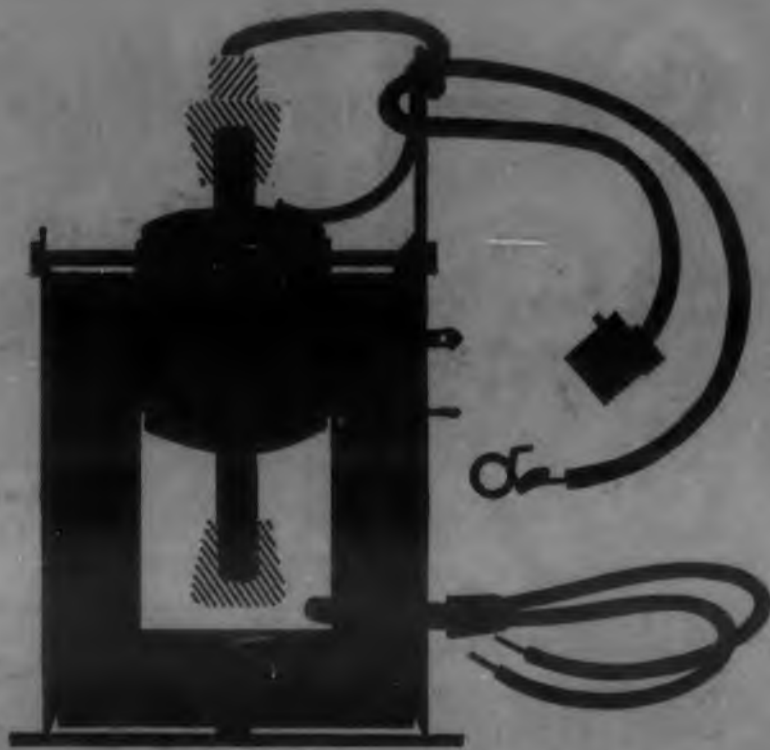
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ELECTRONIC *design*

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Editorial . . .

What does an electronic designer have to know in order to do an effective job of translating basic ideas into saleable, profit-making products? A complete answer to this question would fill pages and pages of copy. Let's consider just a few classes of information that should be in every electronic designer's "kit of tools".

Of course, the electronic designer should be thoroughly grounded in basic physics and electrical engineering principles, with special emphasis on electronic topics. He must also have a sound knowledge of mechanical principles, for the design of virtually every electronic device involves mechanical problems.

He needs a broad background in materials—their physical, chemical, and electrical characteristics. The economics of manufacture, mass production techniques, customer preference, how to interpret specifications intelligently, how to describe his efforts or progress on the project either orally or in writing, and many other knowledge skills also are important.

Now some of these knowledge skills he acquires in engineering school and also in his first years on the job when he is a cadet engineer. Much of the other information he cannot get out of books—the picture changes too rapidly from day to day. His only source, aside from associates who may happen to have the necessary "know-how", are technical periodicals, such as *ELECTRONIC DESIGN*, which furnish him with data on products, materials, new design ideas, short cuts in solving problems, etc.

It has been our desire to fit *ELECTRONIC DESIGN* to the electronic designer's needs. With each issue we believe we have come closer and closer to this goal. A card or letter with your suggestions for articles, criticisms, etc., will help keep us on the right track in our chosen task.

Edward E. Grayda

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Engineering Review . . .

Noise-Free Gas Tubes . . . Gas tubes have not been used in many applications where their high efficiency would have made them desirable because of their inherent noise. According to an IRE technical paper, ("Low-Noise Hot-Cathode Gas Tubes" by E. O. Johnson, W. M. Webster, and J. B. Zirker of the RCA Laboratories, Princeton, N. J.), with proper design, these tubes can be operated so as to generate a minimum of noise. By designing tube structures in which the arc discharge inside the tube was made to occur in a narrow region so close to the anode surface that the anode appeared to glow, the noise level was made comparable to that of an equivalent vacuum tube.

More Power Line Carrier . . . A great increase in the use of supervising control in power companies by means of a power line carrier indicates a trend toward centralized control of power systems according to an AIEE Technical Paper ("Multi-Station Supervisory Control Over Single Frequency Carrier", by E. W. Miller and W. M. Larson of the Control Corp., Minneapolis, Minn., and J. G. Wright of the Kansas Power and Light Co., Topeka, Kan.). It has been found that supervisory control over single-frequency carrier channels is economical from the standpoint of cost and use of carrier frequencies.

An installation at the Kansas Power & Light Co. provides oil circuit breaker control and indication, alarm indication, telephone communication, and mobile radio control and operation. Only the single carrier frequency of 74kc is used to send and receive control and indication signals in both directions and for five substations.

Human Engineering Institute . . . A five-day "Human Engineering Institute" for engineers, designers, and members of related professions has been organized to take place during the week of August 3, 1953 in Stamford, Conn. Proper design of instruments and controls, and many other phases of human engineering, which will be covered in roundtable and laboratory sessions, are of direct interest to electronic designers (see "Human Engineering Aspects of Electronic Design", *ELECTRONIC DESIGN*, April 1953, pages 6 and 7). The enrollment will be limited and further information can be obtained by writing to Dr. Jerome H. Ely, Human Engineering Institute, Dunlap & Associates, Inc., Box 1070, Stamford, Conn.

More Transistors from Germanium Ingots . . . Dr. Robert N. Hall of the General Electric Research Laboratory has developed a means for producing as many as 100 thin layers of specially treated germanium in a 6" ingot. Other methods produce only one or two of these layers, each of which contains germanium mixed with a trace of gallium. They are separated by thicker regions of germanium containing minute amounts of antimony.

One section of the "gallium-doped" layer in each transistor does the work of the grid in a vacuum tube. The "antimony-doped" layers take the place of the cathode and plate in a tube. The method, still in the laboratory stage, is expected to improve transistor performance and reduce costs because it permits producing several thousand transistors from each ingot.

Compression—Expansion of Speech . . . Experiments have shown that because of the redundancy in verbal speech, alternate sampling and discarding of the signals in intervals of the order of 0.05sec can retain the original intelligence when the sampled intervals are reproduced successively. A device has been developed at the University of Illinois, Urbana, Ill. (by G. Fairbanks, W. L. Everitt, and R. P. Jaeger), which will do this automatically with any desired ratio of sampled to original time.

The resultant output can either produce speech with the original frequency spectrum, in which the speaker appears to talk more rapidly (and therefore uses less time), or the information can be transmitted in the same time over a correspondingly lower frequency band. The device also can be used for time or frequency expansion. By repeating successive samples, the intelligence can be delivered at the normal time rate and with normal frequency spectrum.

With the device it is possible to compress a 17min recorded speech to fit a 14min broadcast period, and so long as the compression (or expansion) is small, there is no loss in intelligibility, reproduced speech does not seem faster (or slower), and there is no change in pitch. It also is possible to compress speech into a narrower frequency band for transmission over a channel of more limited bandwidth than normally used. Then the speech can be reconstructed without delay at the receiving end by means of expansion so that it sounds normal to the listener.

Color TV Design Challenge . . . According to B. Abrams, president of Emerson Radio and Phonograph Corp., color TV sets will be available early in 1954, and their cost will be two to three times higher than black-and-white receivers of similar size. This offers a real challenge to TV set designers.

To protect purchasers of black-and-white receivers against the advent of color telecasting, he recently announced a special "money-back" offer, good until June 30, 1954. The plan states that a purchaser of any 1953 Emerson TV model, upon surrender of the set before June 30, 1954, will receive the total purchase price paid, as partial payment for any color receiver regardless of make, which he may buy before the expiration date of the offer.

"Loudspeaker" Clutch . . . A fast-acting clutch that works on the same moving-coil principle that is used in an electrodynamic loudspeaker has been developed by Jacob Rabinow of the National Bureau of Standards (Washington 25, D. C.). The clutch is activated by applying direct current to a coil located in a constant magnetic field. The force produced by the interaction of the coil current and the magnetic field moves the coil and causes the clutch output disc to be pressed against the rotating input members. In an experimental model, full output-shaft torque (10 in-oz max) was attained in less than a third of a millisecond after application of the activating voltage.

This new type of clutch is inherently capable of a faster response than conventional electrical or magnetic friction clutches because in conventional units, time as well as energy is required to build up a field after the activating voltage is applied. In the loudspeaker clutch, the necessary magnetic field is already present before the clutch is activated. The inductance of the moving coil is usually small, and by means of "bucking" or compensating coils, can be made negligible. This means that the time for the coil current to build up to activate the clutch can be made equally negligible. Possible uses for the new clutch include rapid starting and stopping of magnetic wire or tape recording media in high-speed electronic computers, and high speed switching in telephone dial systems.

Ball Bearing Radio Noise . . . Scientists of the Naval Research Laboratory have investigated an unsuspected source of radio noise which was found to be coming from antifriction (ball) bearings. Their report (No. PB111034), titled "Antifriction Bearings as a Radio Noise Source", points out that this noise occurs when stray voltages picked up by the rotating shaft causes irregular current flow through the lubricating film in the bearing. The report also makes recommendations for reducing or eliminating this source of noise. It is available from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C., at 50 cents per copy.

THE electronic engineer responsible for a reproducible equipment design faces a problem that is not found in the design of equipment to be built as a single model only. Whereas the experimenter may "tailor" his model by selecting the optimum component value for each application, the product designer is allowed to specify each component only to within a certain tolerance, and any component within this tolerance must operate satisfactorily in the equipment. Where a large number of separate components contributes to an effect that must be held within relatively narrow limits, it is seldom practical to specify individual component tolerances sufficiently narrow to guarantee the desired overall result regardless of how individual components may vary within their separate tolerance limitations.

The dangers of such a casual approach to the tolerance problem are that it may lead either to a design that is unnecessarily expensive to manufacture or to one that fails to provide reproducible performance.

Tolerance and Probability

In searching for a better solution to tolerance problems, the designer often resorts, consciously or otherwise, to the concept of probability. If he is concerned with the joint effect of the values of several components, he may reason that it is unlikely that all components will vary by the maximum tolerance simultaneously, and may even hope that variations will be such as to compensate.

Among the concepts of probability theory which can be most helpful to the product design engineer are those of the probability density distribution and its integral. To illustrate these ideas, suppose that measurements were made of the actual values of a large number of resistors, each having a nominal value of 1000 ohms and an absolute tolerance of $\pm 10\%$.

Fig. 1(a) shows a typical bar graph which might be plotted as the result of such measurements. The bar graph can be replaced by a smooth curve which passes through the tops of the bars and whose ordinate can be called "Probability Density", the scale of the ordinate being chosen such that the total area under the smooth curve is equal to unity. The result, which can be seen in Fig. 1(b), is the probability density distribution of the values of the resistors. If the resistors measured were a representative sample from a large lot, then the smooth curve is the probability density distribution for all resistors in the lot.

The value of the integral of the probability density curve between two resistance limits, the integral of the complete curve being unity, specifies the probability that the value of a particular resistor will lie between these two limits. In the distribution shown in Fig. 1(b), for example, it can be determined from the shaded area that the probability is approximately 86% that the value of a particular resistor will lie between 950 and 1050 ohms.

The relation between the probability density dis-

Tolerance Considerations In Electronic Product Design-1

Raymond C. Miles

Airborne Instruments Laboratory, Inc. Mineola, N. Y.

tribution and a statement of absolute tolerance is now apparent. In terms of a distribution such as that shown in Fig. 1(b), the absolute tolerance specifies the limits between which the integral of the distribution must be unity without giving any information as to the shape of the curve between these limits.

Fig. 2 illustrates the quandary of the product designer who attempts to employ a probability approach to tolerance problems while restricted to statement of component tolerances in absolute terms. Each of the distributions shown, as well as an infinite variety of others, fulfills the requirements of nominal value V_n and decimal tolerance T .

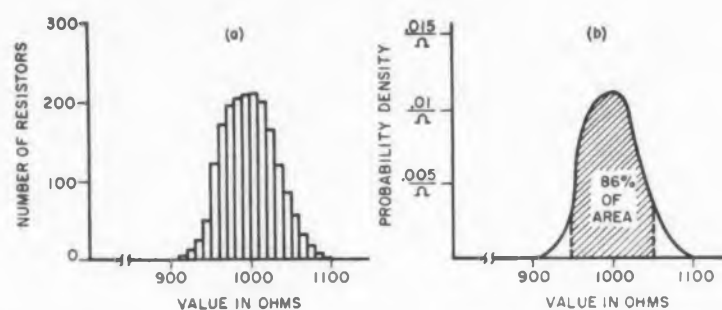


Fig. 1. Bar graph of values and corresponding probability density distribution of many 1000 ohm resistors.

In order to make any appreciable headway with the problem, it is necessary to have some convenient means of distinguishing and treating mathematically, various forms of the probability density distribution.

Characteristics of the probability density distribution that will be helpful in making the desired distinction include the mean value and the standard deviation. The mean value is essentially the center of gravity of the distribution and the standard deviation is a measure of its spread. In Fig. 2, the mean value of each distribution is shown as V , and the standard deviation as σ . It will be seen that these two characteristics of the probability density distribution represent a significant step toward distinguishing among distributions of various forms.

The usefulness of the mean value and standard deviation criteria becomes even more apparent in the usual practical case in which the values of two or more components combine to control an overall effect.

In a simple case which is of considerable importance in practice, concern is with the distribution of the sum of two or more individual component values. In such a case, the mean value of the probability distribution of the sum is the sum of the individual mean values. The standard deviation of the sum distribution is the square root of the sum of the squares of the individual standard deviations.

Practical Probability Distribution

Although Fig. 2 shows a wide variety of possible forms of the probability density distribution, there are two forms which will be found of particular interest. These are the rectangular distribution and the so-called normal, or (Gaussian), distribution, which are illustrated in Fig. 3.

The rectangular distribution, Fig. 3(a), is the one that would be expected if a large lot of components were manufactured in the complete absence of manufacturing control, and if those components whose values fell between two desired limits were then isolated from the complete lot by a process of post-manufacture selection.

The normal probability distribution, Fig. 3(b), typifies a component manufacturing process in which efforts are made to control component values.

A common case in practice is one in which components are produced by a loosely-controlled manufacturing process which yields components of relatively wide tolerance. This is followed by a selection process that separates the components into groups of first narrow and then progressively increasing tolerance. Whereas the entire lot of components from such a process can be expected to have an approximately normal distribution of values, the narrowest tolerance group resulting from the subsequent selection process may approach a rectangular distribution quite closely.

Although the rectangular and normal distributions shown in Figs. 3(a) and 3(b) have the same nominal value and standard deviation, this would ordinarily not apply in practice to components meeting the same absolute tolerance requirements. The reason for this is that an excessive number of the components having a normal distribution would fall outside the tolerance limits. As can be seen from Fig. 3(c), only 92% of

the normally distributed component values lie within the absolute tolerance limits. The corresponding rejection ratio of 8% is prohibitive for most component manufacturing processes.

To shed some light on the practical matter of the standard deviation of a normal distribution of component values, Fig. 4 shows the distribution of transconductance values of type 6CB6 tubes from three separate small lots and from a complete year's production of the tubes. In each of the four parts of Fig. 4, the bar graph shows data from actual sample measurements, and the smooth curve represents the normal distribution approximation to the bar graph. Tube lots A, B, and C are each one full day's production on days several weeks apart.

The distribution for the entire year's production is the one which would be of principal interest to the product engineer, who would ordinarily not be designing on the basis of tubes from a single small production lot. The standard deviation for the complete year's production is about 0.28 times the absolute tolerance, roughly one-half the standard deviation of a rectangular distribution between tolerance limits.

Fig. 5 illustrates the effect when components having individual values whose probability distributions are normal are combined so that their values add.

Thus Fig. 5(a) shows a typical normal distribution of values of a single component. Fig. 5(b) is the distribution which results when the values of two components, each characterized by the distribution of Fig. 5(a), combine in additive fashion. The scale of Fig. 5(b) is normalized to that of Fig. 5(a). Hence, the shape of the curve in Fig. 5(b) is that which would be obtained by adding two components to yield a given result, as contrasted to the distribution of Fig. 5(a), for the same result from a single component, when all components have the same fractional, decimal, or percentage tolerance, T . Fig. 5(c) further illustrates the tolerance advantage of achieving a given result from three components rather than from a single one of given tolerance.

Fig. 5(d) shows the probability that the sum of one, two and three values will lie within various limits symmetrical about the respective means. This curve illustrates the progressive increase in the probability of sums well within the absolute tolerance limits as the number of combining components increases.

Fig. 6 is similar to Fig. 5, except that it deals with the sums of component values whose individual distributions are rectangular rather than normal. In addition to the progressive narrowing of the curves as the number of added components is increased, the sum distribution becomes a progressively closer approximation to a normal distribution.

The author is grateful to Messrs. J. R. Steen and H. A. Hammel of Sylvania Electric Products, Inc., for making available the data presented in Fig. 4.

(Editor's note: Part 2 of this article, with specific applications, will appear in the next issue).

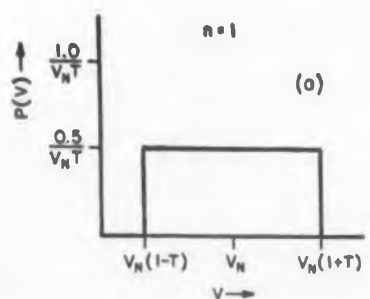
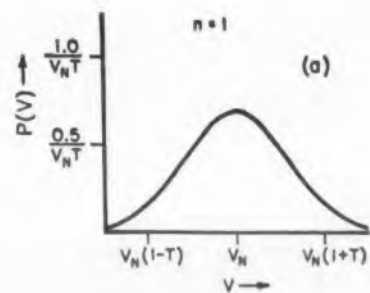
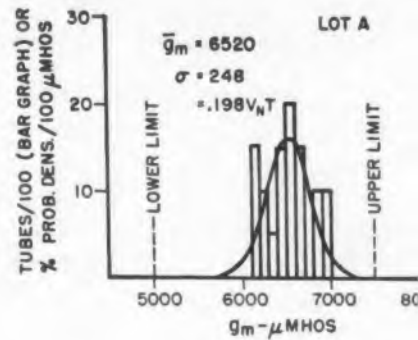
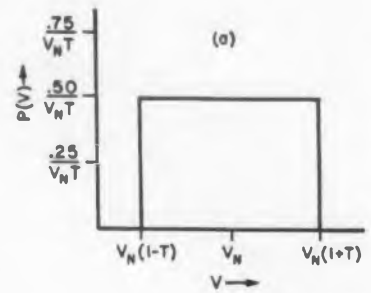
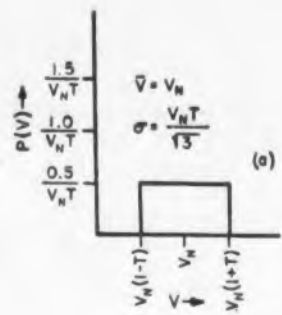
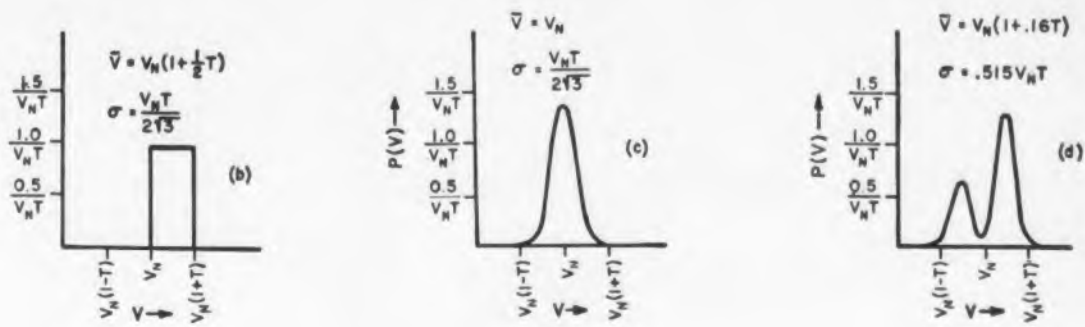
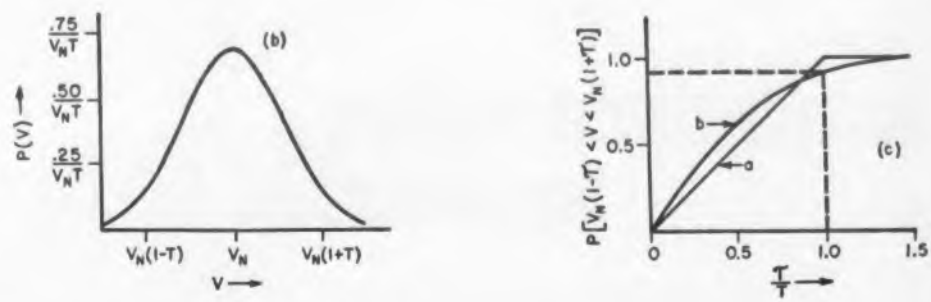


Fig. 2

Fig. 3



2. Illustrative forms of the probability density distribution.



Rectangular and normal distributions of identical mean and σ .

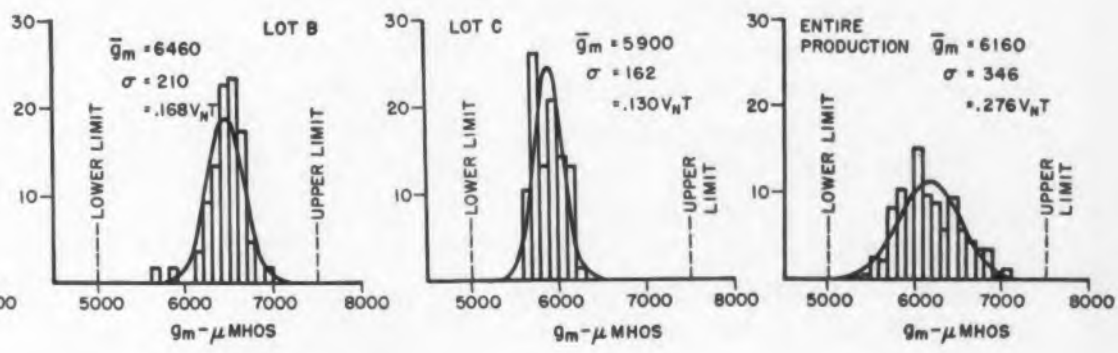


Fig. 4. Distributions of tube transconductance.

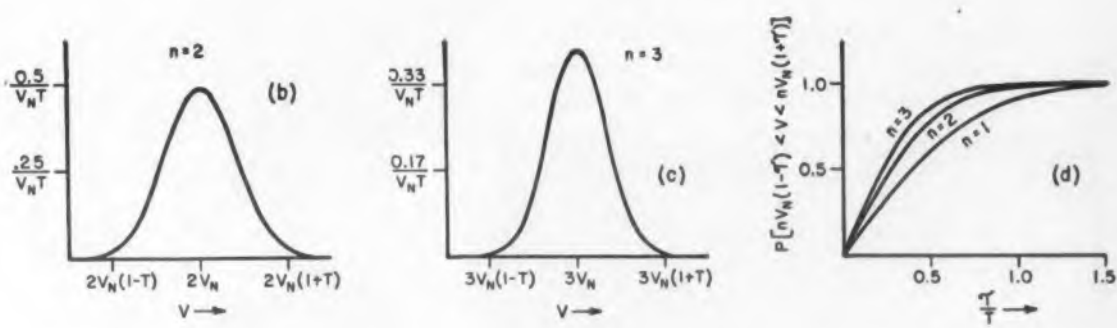


Fig. 5. Sums of normally distributed values.

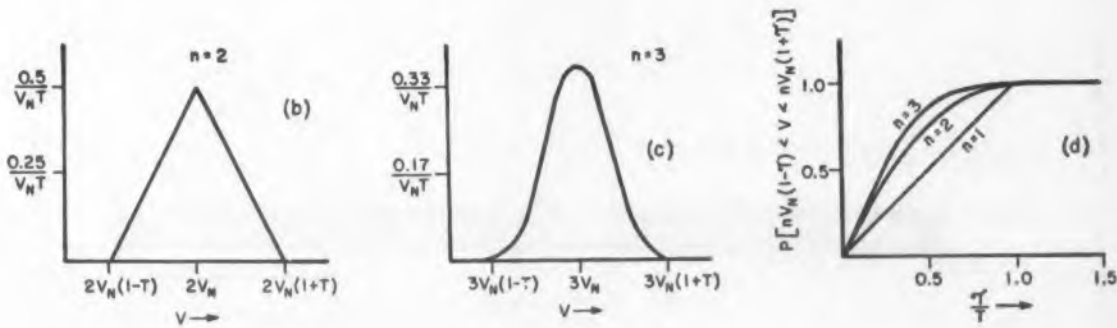


Fig. 6. Sums of rectangularly distributed values.

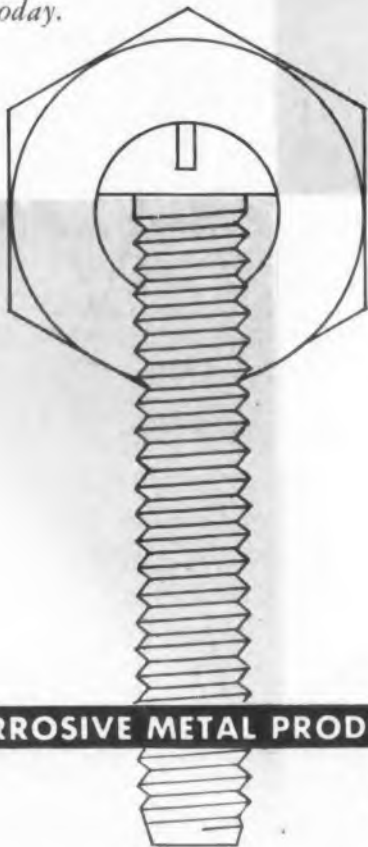


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Internal Magnetic Focus TV Picture Tube



Fig. 1. The internal magnetic focus tube.

MAJOR savings in parts and assembly operations, considerations of paramount importance to TV receiver designers, are made possible with the General Electric Company's new "IMF" (Internal Magnetic Focus) TV Picture Tube (Fig. 1). It employs an internal magnetic focus gun which eliminates the need for an external focus coil and an ion trap magnet, as well as the associated bulky mounting brackets.

Magnetic devices providing these functions have been added to the electron gun within the tube. The gun contains an internal compensating focusing lens which maintains focus over a wide range of operating voltages. A simple magnetic focus trimmer sleeve is used to increase this range. No external focusing control requiring set owner adjustment is needed.

Fig. 2 shows a comparison of the new internal magnetic focus system at the left with a conventional external magnetic focusing installation at the right. The simplicity of the former is readily evident.

In place of the usual focus coil and ion trap magnet, a centering magnet and a magnetic focus trimmer sleeve (neither of which requires any electrical connection) are employed. Besides simplifying the installation, the reduced bulk of the new components permits better ventilation of TV cabinet interiors.

The first tube in which the new gun has been incorporated is the Type 21-JP4, a 21" rectangular, cylindrical-face tube with a 70° deflection angle. It provides a 19-1/8" x 13-7/8" picture for

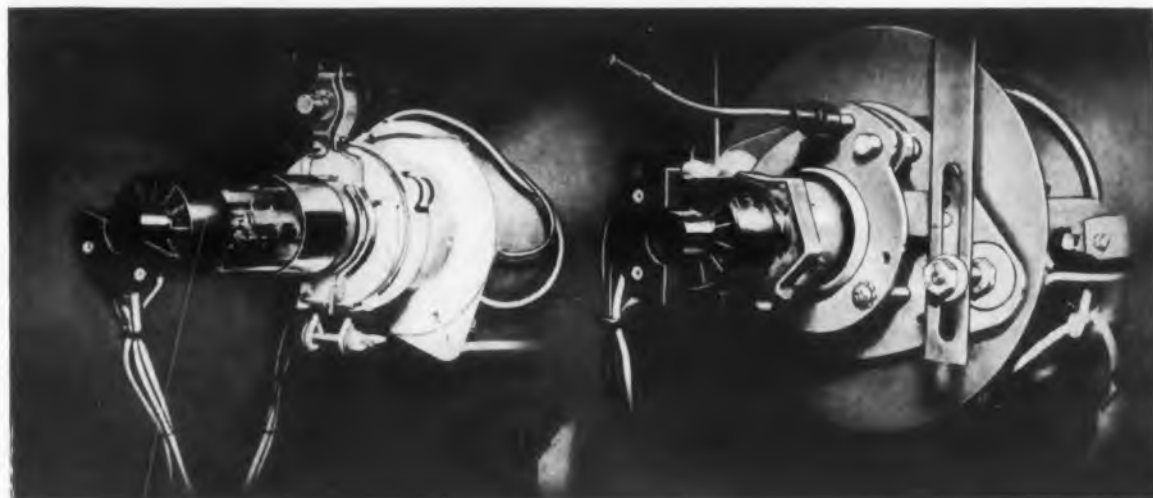
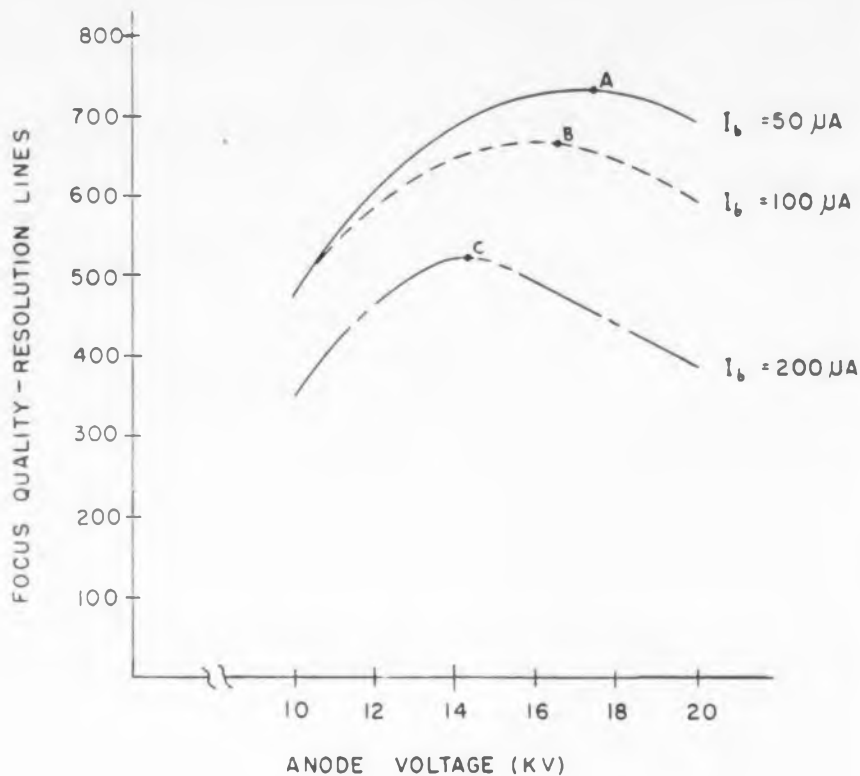


Fig. 2. The "IMF" Tube (left) compared with a conventional installation.

Fig. 3. Type 21-JP4 focus regulation characteristic curves. Beyond points A, B, and C, no shunt sleeve is needed for focusing. As the anode voltage decreases below these points, more and more shunting is needed, with the maximum occurring at 10kv.



television receiver applications.

The following table lists maximum ratings (design center values) for the Type 21JP4 "IMF" tube:

Anode Voltage	20,000v d-c
Anode Input (anode voltage x anode current)6w
Grid No. 2 Voltage	500v d-c
Grid No. 1 Voltage	
Negative-bias value	125v d-c
Positive-bias value0v
Positive-peak value2v
Peak Heater-Cathode Voltage	180v

Recommended operating conditions include an anode voltage of 14,000v \pm 2000v, a grid No. 2 voltage of 300v, a grid No. 1 voltage of -33v to -77v, and a maximum grid No. 1 circuit resistance of 1.5 megohms.

Overall length of the tube is 23-1/32", and greatest bulb dimensions are 21-7/32" (diagonal), 20-1/4" (width), and 15-9/16" (height). The base is a small shell, duodecal 5-pin, B5-57 type, and net weight of the tube is 28 lb.

The shunt sleeve used with the "IMF" tube can be eliminated if the TV set designer increases the anode supply to provide adequate voltage for optimum focus. For a given beam current, optimum focus is achieved at the voltage that the shunt sleeve can be removed from the focus structure. This occurs at points A, B, and C in the focus regulation

characteristic for the Type 21JP4 "IMF" tube shown in Fig. 3. The shunt sleeve is not needed at anode voltages above these points. However, if the voltage decreases, appreciably increasing amounts of shunting are required, the maximum occurring at 10kv when the shunt sleeve is directly over the focus structure.

The centering device may be necessary for the same reason that it is used with present electrostatic focus picture tubes. It provides an adjustment for those cases when the center of the transmitted video picture is not coincident with the center of the raster on the picture tube face. Although it is possible to adjust this by additional electrical phasing in the receiver circuit, it usually is less expensive to accomplish this externally by means of a simple adjustable centering magnet.

The basic gun design employed in the "IMF" Tube also can be applied to cathode-ray tubes for radar, industrial TV, or studio monitoring equipment. The gun also may eventually be designed into tubes which can be used as replacements for tubes now in use.

The focusing and ion trap devices in the gun make use of four "Alnico 5" magnets. Three of these, 5/8" long x 1/4" diam, are used in the focus assembly. The fourth, 1/8" long x 1/8" diam, is used in the ion trap unit.

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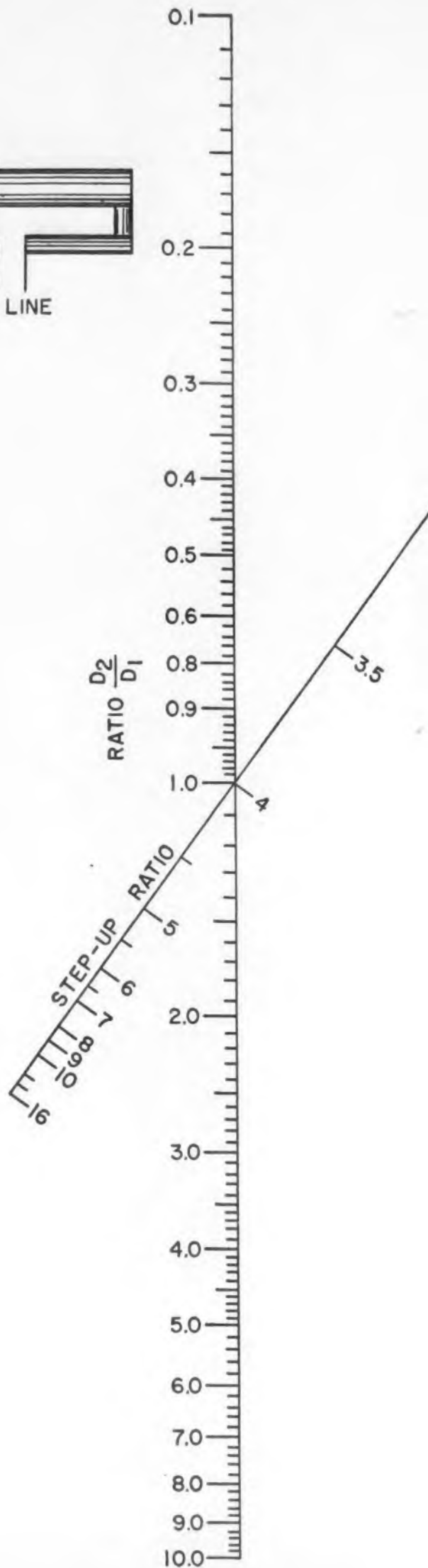
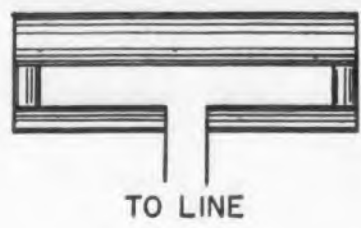
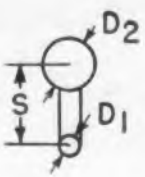
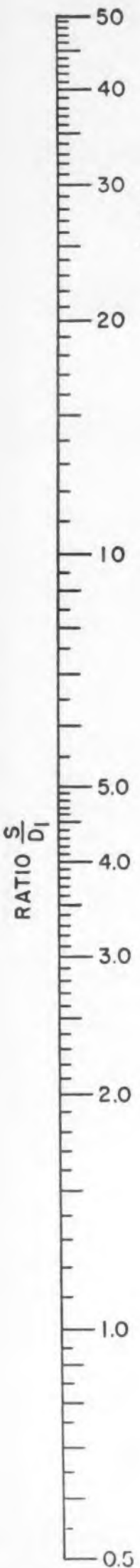
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Impedance Step-Up of Folded Dipoles

W. P. Mueller

Section Head, Advanced Applications Section
Sylvania Electric Products, Inc., Emporium, Pa.

WITH the advent of multi-element antennas in TV applications, it often becomes necessary to transform impedances at the antenna, so as to permit reasonable values of quarter or three quarter wave matching sections to be used either to stack several antennas, or to match the feed line.

A time-saving chart (Fig. 1) has been devised to simplify impedance matching by means of special

Fig. 1 (left). Impedance step-up chart for a folded dipole antenna. Using this nomogram simplifies the job of impedance matching by means of special folded dipoles.

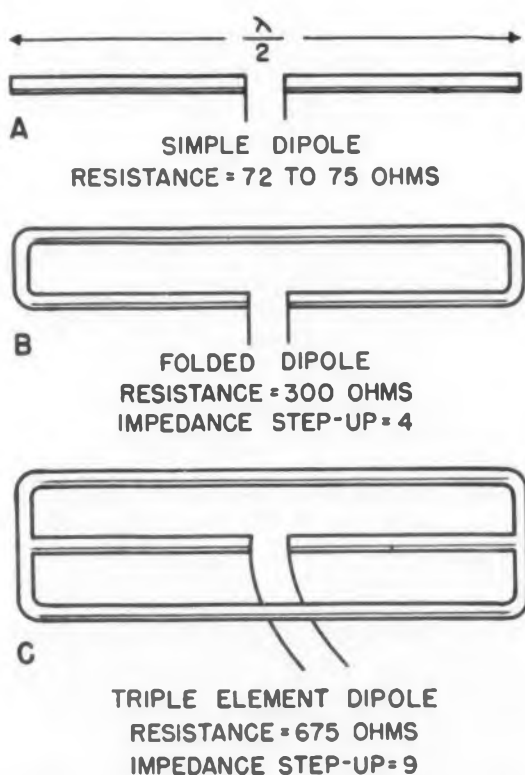


Fig. 2. Various types of dipole antennas, showing how increased impedance is obtained by using multiple elements. In each instance, the diameter of the elements is the same.

folded dipoles. Before explaining the chart let us review very briefly the fundamentals of dipoles and folded dipoles. In Fig. 2 are shown several configurations of dipole antennas which are electrically a half wavelength long at the frequency for which they are designed. The simple dipole is shown as Fig. 2A. The radiation resistance of this antenna is about 72 to 75 ohms. The "folded dipole" is shown in Fig. 2B.

It can be shown either theoretically or by measurement, that this configuration which has elements of equal diameter results in an impedance step-up of four times that of the simple dipole, so that the resistance is 300 ohms. It is also true that if three elements are used as shown in Fig. 2C, a step-up of 9 times is obtained, or a resistance of 675 ohms. Likewise four elements have a step-up of 16 times, and so on. The use of a multiple element dipole is perhaps the easiest way to obtain large impedance step-ups. However, it has the disadvantage of increasing the step-up by discrete "step" values if the elements are of equal diameter. This may be overcome by using unequal diameter elements.

Going back to the simple dipole of Fig. 2A, if we add a reflector about a quarter-wave behind the dipole, the resistance of the dipole will be decreased. If we bring the reflector closer, the resistance will go down more, and if we add directors, as in a Yagi antenna, it will go down still more. Since the actual value of the resistance of the dipole is so dependent on the type array in which it is used, it is convenient to be able to design dipoles for any impedance step-up ratio. If elements of unequal diameters are used in a folded dipole, the spacing may be adjusted to give almost any desired impedance step-up. The nomogram in Fig. 1 permits the spacing S to be determined with a minimum of effort.

Three scales are shown on the chart: one showing the ratio of the diameters of the conductors used in the folded dipole; one the ratio of the spacing S to D_1 (the diameter of the conductor which connects to the transmission line); and the last gives the impedance step-up over the existing value at the dipole.

To use the chart, lay a straight edge across it connecting the points of diameter ratio D_2/D_1 and the desired impedance step-up which will intersect the other scale at the correct value of S/D_1 . Note that D_1 is the diameter of the element to which the transmission line is connected. If the ratio D_2/D_1 is greater than one, the step-up is greater than four. If D_2/D_1 is less than one, the step-up is less than four.

For example, in a particular Yagi antenna, the dipole impedance is 25 ohms and it is desired to feed it with standard 300 ohm twin lead. The dipole is made of 1" diam tubing. If we use 1/4" tubing for the other conductor, the spacing is quickly determined as follows: The required step-up is $300/25$ or 12. The dipole size ratio $D_2/D_1=1/(1/4)=4$.

Using a straight edge, line up 4 on the right scale with 12 on step-up scale and read 5 on S/D_1 scale. Then by substituting, $S/(1/4)=5$; so $S=1-1/4$ ".



"God: Give me the strength to smile..."

Smile, and hold back your tears: SHE must not see them.

Keep secret the voice that is crying inside of you: SHE must not hear it.

Smile... that she may sense no echo of the voice you heard this morning—the surgeon's voice, gentle and hopeless. "I'm sorry. I'm afraid we're too late."

"Too late..." Cancer, the most terrible scourge of all, last year killed 70,000 Americans who would have lived if treated in time. Few indeed are the Americans whose lives will never be shadowed by this monstrous and implacable enemy. It may be you. Your wife, your parents. Your children . . .

"Too late..." The bitter, pitiful truth

is that we Americans—the most generous people on earth—have not yet contributed adequately to the war against cancer. And some are paying immeasurably in agony and grief, because there is not enough money.

Is there hope—? Hope of a final, certain cure for cancer—?

Yes, there is hope. Night and day our medical laboratories are forging the swords of knowledge. But not as fast as we all wish and pray they were—there is not enough money . . .

Far from enough! Last year, the American Cancer Society was able to allocate only \$4,100,000 for cancer research—less than three cents per American per year! Yet, as things stand today, 22 million Americans will die of cancer—for cancer strikes

one out of five. How long can we remain so indifferent to this monstrous thing—how many lives can we afford to throw away—?

Won't you please contribute—now, before you forget again? Please let your contribution be as large as your faith, and as heartfelt as your prayer . . . that, working together, we can lift this sorrow not only from our own time and nation, but from all the ages of man to come . . .

AMERICAN CANCER SOCIETY
GENTLEMEN: Please send me free literature about cancer.

Enclosed is my contribution of \$..... to the cancer crusade.

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ADDRESS.....

CITY..... STATE.....

Simply address the envelope:
"CANCER" c/o POSTMASTER
NAME OF YOUR TOWN

Strike Back! Give to Conquer Cancer!

New Products . . .

High Frequency Test Set Measures Frequency and Power



Shown here (and on the front cover) is the Model AET-117 portable, High Frequency Test Set for measuring operating frequency and making relative power measurements of microwave transmitters or signal sources. The unit also can be used

for pulsed transmitters, as well as continuous wave systems.

A novel feature of the instrument is the combining of either transmission or reaction type measurements in one instrument. Two inputs are provided, so that either method may be selected, thereby eliminating the need for two separate pieces of test equipment.

Specifications include a frequency range of 2400 Mc to 3400Mc, an accuracy of $\pm 0.1\%$, a temperature range of -40°C to $+55^{\circ}\text{C}$ ($\pm 0.05\%$), a Q of over 1000, and a sensitivity of 2mw (absorption) and 3mw (transmission). American Eneastic Tiling Co., Inc., Dept. ED, Kenilworth Ave., Lansdale, Pa.

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

Miniature Balance Panel For Multiple Channel Tests



The Model BP-2 is a Miniature, 15-channel Balance Panel designed especially for use in flight test instrumentation and in other applications where multiple

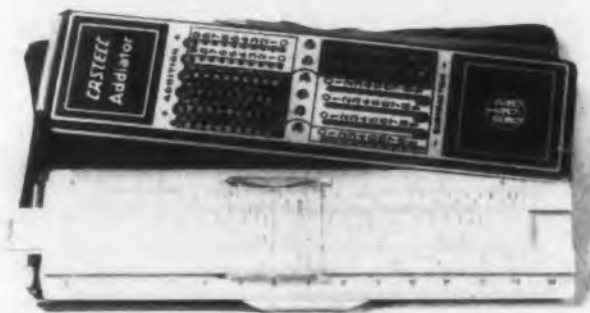
channel data recording is required. It is useful where the weight and size of the instrumentation equipment must be kept at a minimum, such as in guided missiles, light aircraft, etc. Other applications include sensing devices and circuit balancing.

The unit incorporates miniature, ten-turn balancing potentiometers which have a linearity of $\pm 0.5\%$. Precision, wirewound resistors used for calibration having an accuracy of $\pm 0.1\%$ are supplied with the unit. In conjunction with the resistors a miniature, ten-position, rotary switch is used. The panel is equipped with one output and two input plugs having 34 pins each. These plug contact pins are gold plated for positive, low resistance contact, and the plugs are polarized and self-aligning. Dimensions of the panel are $6\text{-}1/8'' \times 3\text{-}1/4'' \times 3\text{-}3/16''$, and its weight is 1.5 lb. American Helicopter Co., Inc., Dept. ED, 1800 Rosecrans Ave., Manhattan Beach, Calif.

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

Slide Rule

Has Provisions for Adding



Electronic design engineers and mathematicians will find the "Addiator" Slide Rule useful for many types of calculations including addition and subtraction. Available in three different styles and two lengths (5" and 10"), it has a wide variety of useful scales to speed computations.

The No. 67/54R System "Darmstadt" style, which is especially useful for electronic and electrical calculations, has the usual A, B, C, D, and CI scales, as well as a cube scale, common logarithmic scale, a Pythagorean scale ($\sqrt{1-X^2}$), trigonometric scales, and a log-log scale. In addition, to the back of the rule is attached a compact adding machine which is operated with a metal stylus that is held at the side of the unit by a clip when not in use. This feature is very handy when computations involve adding long columns of figures as well as multiplications and divisions. A. W. Faber-Castell Pencil Co., Inc., Dept. ED, Newark 4, N. J.

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

Magnetic Tape Handler For Digital Data Handling



The Type 901A high-speed Magnetic Tape Handler has been designed for digital data handling and general computer recording and playback. Other applications for the instrument include data reduction, high-speed recording of scientific phenomena, and digital telemetering.

A special feature of the device is its ability to start and stop intermittently within 5 milliseconds from external signals, making it possible to record, playback, or compare blocks of information. Fully reversible drive at speeds of 15"/sec and 30"/sec is provided.

New photoelectric proportional servo tension controls provide uniform tape tension over the recording head at all speeds. Independent reel drives, controlled by the servo systems, assure freedom from tape breakage or spilling on quick reverses. Power requirements are 115v a-c, single phase, 400w. Potter Instrument Co., Dept. ED, 115 Cutter Mill Rd., Great Neck, N. Y.

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

Special Purpose Motors In Three Sizes



Three special purpose Motors, Type DM-51 (large), Type DM-81 (small), and Type DM-80 (center), have been added to the company's line. They are designed for a wide range of servomechanism applications. The Type DM-51 is a d-c Tach Servo Motor rated at 6 oz-in, 60 to 15,000rpm, a tachometer output of 1v/100rpm, a clutch rating of 3 lb/in-

min, and a brake holding ability of 5 lb/in-min. The unit measures $6'' \times 3\text{-}1/2''$ diam.

The Type DM-81, a reversible actuator motor, has an input rating of 28v d-c at 8amp. Further specifications include a rating of 0.4 lb/in at 10,000rpm with a brake holding ability of 0.4 lb/in(min). It measures $3\text{-}1/8''$ long $\times 2''$ diam.

Also a reversible actuator motor, the Type DM-80 has an input rating of 28v d-c at 1.4amp and is rated at 5 lb/in at 10,000rpm, with a clutch rating of 10 lb/in-min and a brake holding ability of 11.5 lb/in(min). Bill Jack Scientific Instrument Co., Dept. ED, Solana Beach, Calif.

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

Shielded Cable

Has Minimum Microphonic Noise Characteristics

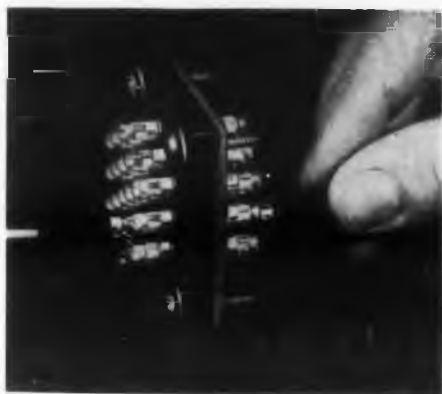
The Type BIW No. 626 Shielded Cable has been designed particularly for application in electronic circuits where the generation of internal noise by vibration, shock, or compression is undesirable. It is especially useful with piezoelectric type instruments and in applications subject to severe shock such as telemetering and shock wave measurements.

Its small size (0.150" OD) enables the cable to be used in the wiring of small instruments. Construction consists of a center conductor, two concentric shields with "Teflon" insulation, and the outer cover of silicone-treated whiteglass braid. Temperatures ranging from 400°F to -60°F have little effect on this wire. The voltage rating is 600v a-c between the conductor and inner shield. Boston Insulated Wire and Cable Co., Dept. ED, 63 Bay St., Boston 25, Mass.

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

Disconnect Panels

Interchangeable with AN Type Connectors



These Miniature Disconnect Panels, interchangeable with standard AN type connectors for shell size mounting dimensions, have wide application in pressurized Army and Navy aircraft. The devices are built of pressure-

tight, fungi-resistant, molded plastic with silver-plated socket assemblies, and circuit identification is achieved by means of painted letters for each socket.

The devices are available in 10, 19, 22, 26, 37, 62, 73, and 163 sockets in various sizes. Silver-plated connector pins to match the socket size of each panel can be rapidly indented onto wire levels with simple terminal tools. These pins are then inserted into sockets molded into the pressure-tight panel, and are locked securely into the socket by socket springs. Connections and disconnections may be made rapidly and safely from either side of a pressurized bulkhead. A variety of pin types is available. Burndy Engineering Co., Inc., Dept. ED, Norwalk, Conn.

CIRCLE ED-16 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • May 1953

New!

UNITED High Voltage Power Diodes

Much Smaller—Same Ratings



TYPE 577
New small version
of 371-B



TYPE 578
New small version
of 8020



TYPE X-22
New small version
of 1616

Illustrations show relative sizes

AIRBORNE radar and other electronic equipment can be made much smaller and lighter by use of these modern, smaller tubes. UNITED has designed types 577, 578 and X-22 as exact elec-

trical replacements for JAN preferred list types 371-B, 8020 and 1616, in applications where space and weight conservation is important.

Write for full specifications.

UNITED  **ELECTRONICS, 42 Spring Street, Newark 2, N. J.**
(TRANSMITTING TUBES EXCLUSIVELY Since 1934)

CIRCLE ED-17 ON READER-SERVICE CARD FOR MORE INFORMATION



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

(Advertisement)

BUILT-IN CONSTANT VOLTAGE POWER SUPPLY for Plate and Filaments at Moderate Cost . . .



The Sola Type "CVE" Constant Voltage Transformer delivers filament and plate voltages regulated within $\pm 3\%$ or less, with line voltage variations of 100-130 volts. All windings are on the same core, providing a compact moderately priced unit.

They are available from electronic distributors in three capacities: 42 V.A., 75 V.A., and 210 V.A.

Like all Sola Constant Voltage Transformers, they are completely automatic, instantaneous, and continuous in regulation . . . have no moving parts or tubes and are self-protecting against short circuit. These Sola Constant Voltage Power Supply Transformers are made for chassis mounting.

For further information on this and other Sola CV Transformers write for bulletin P-CV-142.

SOLA ELECTRIC COMPANY

4633 West 16th Street

Chicago 50, Illinois

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

New Products . . .

Vacuum Capacitors

For Medium and High Power Systems



These high voltage, high current Vacuum Capacitors have been designed especially for medium and high power oscillatory systems. Compact and self-contained, they are self-healing under wide

conditions of overload, have low inherent inductance (high Q), and exhibit very low temperature coefficients of expansion. In addition, factors such as dust, humidity, pressure variations, and fungi do not affect operation.

With applications in the fields of induction and dielectric heating, diathermy, industrial oscillators, transmitters, and communications and broadcast services, these units permit high operating temperatures because of the "Pyrex" glass enclosure. Additional characteristics include no r-f pick-up, hard operation under load, and a compact, rugged design for heavy duty application. Dolinko & Wilkens, Inc., Dept ED, 1901-7 Summit Ave., Union City, N. J.

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

Magnetic Contact Relay

Sensitive, Versatile Instrument



Model 723 "Sensitrol" Magnetic Contact Relay has been added to the company's line. Sealed against moisture, with a self-shielded core magnet mechanism and a built-in solenoid release device, the unit has many applications

for the electronic designer.

Available in a variety of ranges with double or single magnetic contacts for either increasing or decreasing values, the unit has a sensitivity as high as $2\mu\text{amp}$ for full scale deflection either way from the zero center. Both a-c and d-c voltage ranges can be supplied self-contained up to 500v. Contact capacity of the parallel magnetic contacts is 100ma at 120v a-c or d-c. The built-in solenoid can be used for resetting the magnetic contacts.

Accuracy of the instrument is within $\pm 5\%$ for d-c and about 10% for a-c, depending on circuit conditions. The unit is equipped with a sealed zero corrector, solder terminal connections, and a removable bezel for special mounting requirements. Weston Electrical Instrument Corp., Dept ED, Newark, N. J.

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

Laminated Plastic Insulation

Provides Protection Against Fire

Grade 11542 "Textolite" Laminated Plastic Insulation is a paper base material developed especially for TV, radio, and other electronic components where fire hazards exist and the mechanical and insulating properties of laminates are needed. It is self-extinguishing even after three months' ageing at 130°C and has a low 1Mc power factor.

Other features include low moisture absorption and excellent properties, including high insulation resistance under humid conditions. The material is available in natural light tan color in thicknesses ranging from 0.015" to 0.25". General Electric Co., Dept. ED, Pittsfield, Mass.

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

Slotted Measuring Line

Has 50Mc to 250Mc Frequency Range



The Type 3100 Slotted Measuring Line is designed for measuring voltage standing wave ratio (VSWR) at radio frequencies between 50Mc and 250Mc. It also may be used for measuring absolute impedance, velocity, characteristic impedance, and other factors describing the performance of antennas, transmission lines, and terminations.

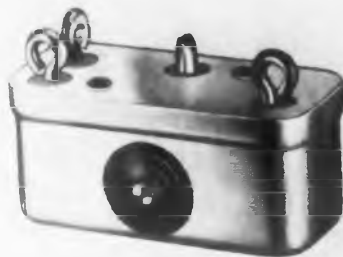
An outstanding feature of the unit is its outer conductor, which consists of a specially drawn brass tube, square on the outside and round on the inside, providing precision and uniformity at a reasonable cost. The detector slides on the slotted upper surface of the square tubing and is aligned by two pins projecting into the slot.

The detector consists of a non-conducting probe, a parallel resonant tuning circuit, incorporating a continuously variable inductor, a type 1N21 crystal rectifier, and a d-c microammeter with a range of $20\mu\text{amp}$. The unit's sensitivity permits full scale deflection when used with most commonly available laboratory oscillators. Characteristic impedance for

the unit is 51.5 ohms. Andrew Corp., Dept. ED, 363 East 75th St., Chicago 19, Ill.

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

Hermetically Sealed Switch Has Sensitive Snap Action



The Model 7102 Hermetically Sealed Switch has been designed for aircraft and missile applications. It can withstand changes in pressure and temperature, exposure to high rates of acceleration,

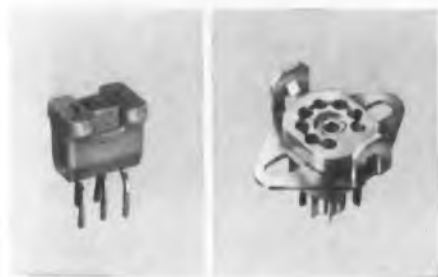
shock and vibration, and exposure to moisture, dust, fungus, and corrosive atmospheres.

Features of the unit include a one-piece, heavy duty beryllium copper switch blade which increases contact life up to 300%; true snap break and make with 20% higher contact pressures; rapid contact traverse rate with negligible contact bounce; excellent shock and vibration resistance through 10G's and 7000ey; and small size and light weight (0.04 lb). The solder type terminals which accommodate two No. 20 stranded wires, are hermetically sealed, and the hermetic enclosure withstands 100psi pressure differential.

Resistive ratings from 0 to 50,000 feet include 28v at 10amp, 110v at 10amp from 60ey to 400ey, and a minimum life of 100,000 operations at rated load. Haydon Switch Co., Dept. ED, 232 No. Elm St., Waterbury, Conn.

CIRCLE ED-24 ON READER-SERVICE CARD FOR MORE INFORMATION

Sub-Miniature Tube Sockets Rectangular and Round Styles



Rectangular and round Sub-Miniature Tube Sockets, designed for conventional and printed circuit application, have been added to the company's line. The

rectangular unit is made in 5, 6, 7, and 8 pin types with contacts in two lengths. The round style is available with or without saddle.

Contacts are of beryllium copper silver plated, tin dipped, or gold flash over silver. Bodies are of low-loss mica-filled phenolic, and the saddle is nickel-plated brass. Hugh H. Eby, Inc., Dept. ED, 4756 Stenton Ave., Philadelphia 44, Pa.

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

Hermetically Sealed Resistors Have Ratings From 1/4w to 2w



The CE Series containing 45 types of Hermetically Sealed Resistors have been designed to exceed specifications JAN-R-93, Type A and MIL-R-93. The units are encapsulated in

cast epoxy, and the bobbins and encapsulating material are of low thermal expansion plastic.

The series are available in three general types, using radial terminal lugs, radial pigtail leads, and axial leads. Cinema Engineering Co., Dept. ED, Burbank, Calif.

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

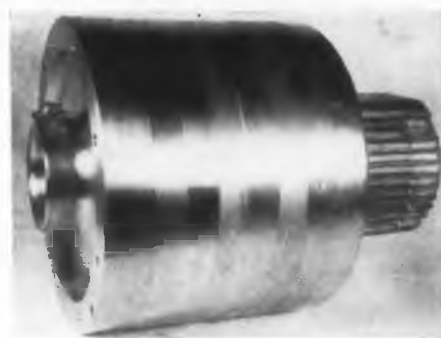
Miniature Metal Tubing 0.010" OD with 0.0010" Walls

A variety of Miniature and Sub-Miniature Metal Tubing, for use as component parts of transistors and other advanced electronic equipment, has been added to the company's line.

The tubing is available in many metals to meet specifications that include OD's as low as 0.010", walls as low as 0.0010", and tolerances as close as 0.00025". Uniform Tubes, Inc., Dept. ED, 1220 Level Rd., Collegeville 2, Pa.

CIRCLE ED-27 ON READER-SERVICE CARD FOR MORE INFORMATION

Axial-Flow Blower For Cooling Electronic Equipment



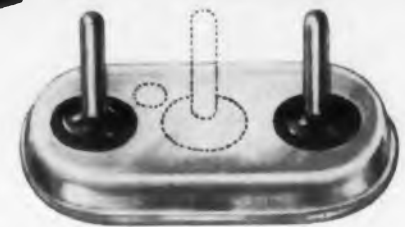
A small, lightweight, direct-driven, brushless Axial-Flow Blower (turbine) has been designed for use in electronic and instrument cabinets, where high pressures are re-

quired in combination with relatively low volumes.

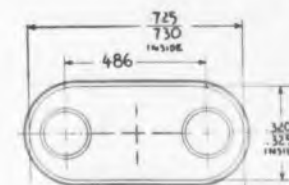
The units are powered by wholly enclosed induction motors built on a single shaft, and are furnished for single-phase, 2-phase, and 3-phase operation at 50-60-400ey and variable frequency. The device measures 7-1/4" diam, and pressures range from 5" to 28" of water. Rotron Mfg. Co., Dept. ED, Schoonmaker Lane, Woodstock, N. Y.

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

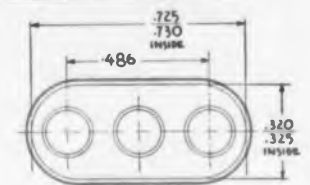
CRYSTAL FUSITE CAN HEADERS



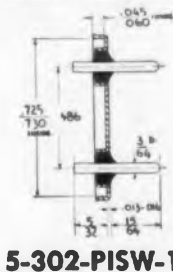
1500 V (RMS)



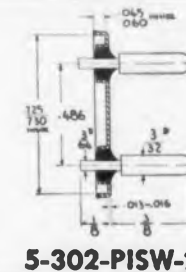
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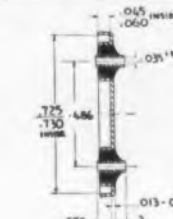
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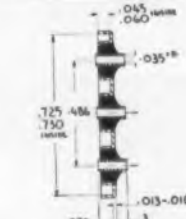
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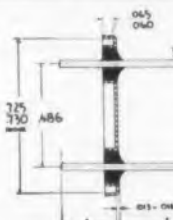
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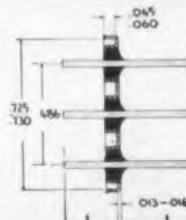
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5-303-SHT



5-302-SW



5-303-SW

Fusite's design of Crystal Can Headers combines the ruggedness of a metal base with large size glass areas surrounding the electrodes, assuring a safe rating of 1500 V(RMS). Several of the terminals shown are available with attached crystal springs to your specification. They fit standard crystal cans. As an optional feature these terminals can be furnished with adjusting hole for thermostat applications.



Write for FREE samples
to Dept. L-3

THE FUSITE CORPORATION
6000 FERNVIEW AVENUE
CINCINNATI 13, OHIO

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

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TUBES • PARTS • BATTERIES
TEST EQUIPMENT



New Products...

Plug-In Meters

In Wide Range of Calibrations



This line of Plug-In Meters, available in a wide range of calibrations, has been designed for use in such applications as control panel, and field and laboratory test units.

The units, supplied in 3" or 4" sizes, can be pulled out and replaced by hand in a few seconds. In this way, changes in specifications can be accommodated quickly with very little loss of time and no tools are required. Cole Instrument Co., Dept. ED, 1320 S. Grand Ave., Los Angeles 15, Calif.

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

Conductive Paint

For Shielding C-R Tubes and Meters

Type RS12 Conductive Shielding Paint is intended for static shielding of C-R tubes, meters, high-voltage power supplies, and high-voltage generator windings. Special features include low cost, high conductivity, excellent adhesion and durability, heat resistance, and a viscosity suitable for spraying.

The material is furnished in conventional containers, ranging from 4 oz bottles to 5 gallon drums. Micro-Circuits Co., Dept. ED, New Buffalo, Mich.

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

Metal-Ceramic Seal

Withstands 650°C



A new method known as "Process AV55" is used to produce a Metal-Ceramic Seal, which will withstand operating temperatures of 650°C, surpass

JAN thermal shock requirements, and maintain a vacuum-tight seal under a wide range of temperature and pressure combinations.

Applications include high-quality electronic and electrical devices such as r-f fittings, and a wide variety of components for aircraft, missiles, etc. In many applications, non-magnetic conductors can be used, resulting in lower loss factors at high frequencies. Plating upon the metallized surface will not

peel or blister. Advanced Vacuum Products, Inc., Dept. ED, P. O. Box 197, Southport, Conn.

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

Miniature Precision Motors

High Efficiency, Long Life Units



These Miniature Precision Motors have been designed to operate fans, blowers, instruments, controls, and low-power drives, and are very useful in confined areas where

minimum size and weight are essential. Only 1" diam, they are built to provide high efficiency and long-life.

The units can be used for single-, 2-, or 3-phase 400cy operation, at running speeds of 10,500rpm, and 21,000rpm, and for single- or 2-phase 400cy operation at 7,000rpm. They can also be used for variable frequency service. Power ratings of 1/100hp can be obtained with the 400cy unit, and maximum input is 115v. Modifications include high ambient and high altitude versions, as well as servo, hysteresis synchronous, and gear motors. Eastern Air Devices, Dept. ED, 585 Dean St., Brooklyn 17, N. Y.

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

Matched Diode Pairs

With One Unit of Reversed Polarity



The Type 1N23BMR Matched Silicone Diodes include one unit of reversed polarity for low noise circuitry applications. The use of such a matched pair of diodes simplifies both the mechanical and electrical design requirements of mixer and i-f input circuit.

Both the Standard 1N23B pairs, the 1N23BM, and the 1N23BMR with one 1N23B paired with a selected 1N23BR are now available. Both types are matched within narrow limits for conversion loss, and r-f and i-f impedance. Computing Devices of Canada, Ltd., Dept. ED, P. O. Box 774, Ottawa, Ontario, Canada.

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

(Advertisement)

Miniature Continuously Variable Delay Lines



Miniature continuously variable delay lines are capable of providing continuously variable time delay from zero to several hundred microseconds. Time delay is made constant from 0 to over 20 megacycles by means of optimum equalization. As a result, the transmission characteristics are superior to those of an ordinary commercially available variable delay line distributed—or lumped parameter type. Other features include fast rise time, excellent stability, hairline accuracy, and complete freedom of time jitter.

Time delay is continuously variable from 0 to 0.25 in Type 506, 0 to 0.8 microseconds in Type 507, and 0 to 0.45 microseconds in Type 508. The rise time is less than 10% of the time delay at any point in all types. The small size and weight of these units make them particularly suitable for incorporation in any instrument where a continuously variable delay line is needed. Write Dept. ED1 for data: Advance Electronics Company, P. O. Box 394, Passaic, New Jersey.

Time delay is continuously variable from 0 to 0.25 in Type 506, 0 to 0.8 microseconds in Type 507, and 0 to 0.45 microseconds in Type 508. The rise time is less than 10% of the time delay at any point in all types. The small size and weight of these units make them particularly suitable for incorporation in any instrument where a continuously variable delay line is needed. Write Dept. ED1 for data: Advance Electronics Company, P. O. Box 394, Passaic, New Jersey.

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

Paper Capacitor

Operates at 125°C Without Derating



The Type ADZ "Meteor" Capacitor has been designed to operate at temperatures from -65°C to $+125^{\circ}\text{C}$ without derating. It has many uses in radio, TV, communication, and other

similar electronic applications.

Available in the JAN-C-25 bathtub case styles, the units are furnished with glass-to-metal terminals to insure the hermetic seal and dependable operation at high temperatures and altitudes.

Multiple, as well as single section capacitor construction can be obtained, with terminals positioned as required. Astron Corp., Dept. ED, 255 Grant Ave., E. Newark, N. J.

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

Selenium Rectifier Kit

For Electrical-Radio-TV Designers

This "build-your-own" Selenium Rectifier Kit contains all the necessary components for assembling any one of four different types of selenium rectifiers (half-wave, full-wave center tap, full-wave bridge, and full-wave battery charger types).

The units can be easily assembled and disassembled, and the parts used to produce other rectifier types. Sufficient components are provided to build any one of 12 rectifier stacks for use in a wide range of experimental or prototype applications. Federal Telephone and Radio Corp., Dept. ED, Clifton, N. J.

CIRCLE ED-38 ON READER-SERVICE CARD FOR MORE INFORMATION

TV Picture Tubes

With Increased Picture Area



Two TV Picture Tubes, Type 21Y-P4 and Type 21Z-P4A, have been added to the company's line. They have a spherical face bulb designed to provide for an increase in picture area. Both units

are the directly-viewed type, with a nominal bulb diagonal of 21".

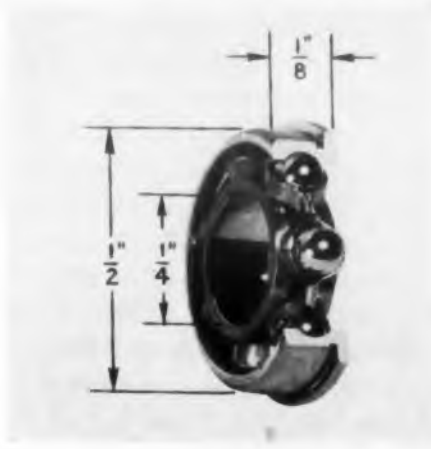
Reflections within the face plate are minimized by the spherical face of neutral gray glass, resulting in improved picture contrast. An external conductive

coating provides a filter capacitor when it is grounded, and both types employ an external single-field ion-trap magnet.

The Type 21YP4 employs low voltage electrostatic focus and magnetic deflection; the Type 21ZP4A uses magnetic focus and magnetic deflection. Westinghouse Electric Corp., Electronic Tube Div., Dept. T-070, Box 284, Elmira, N. Y.

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

Instrument Ball Bearing For Low Torque Applications



The "Micro" FR-188 flanged Instrument Ball Bearing has been designed for gimbals and general precision instrument assemblies, and its balanced design is especially useful where low and uniform running torque and quiet

operation are desirable.

Features of the unit include a straight rather than tapered OD, refined processing to super-precision (ABEC Class 5 and higher) tolerances, and a two-piece, cone-controlled, cylindrical-pocket, pressed metal cage. Very light in construction, it is available in all-stainless steel (type 440) as well as conventional SAE 52100. New Hampshire Ball Bearings, Inc., Dept. ED, Peterborough, N. H.

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

Miniature Tube Sockets

With "Kel-F" Insulators



The series of "Chemelec" 7 and 9-pin Miniature Tube Sockets with injection molded "Kel-F" insulators has been designed to withstand high performance, thermal or mechanical

shock, and vibration in installation and service. Furnished in both saddle and can types, the units are impervious to oil and most chemicals, and are non-flammable.

Electrical characteristics include a dielectric constant of 2.3, a service temperature range from -320°F to $+390^{\circ}\text{F}$, and zero water absorption. U. S. Gasket Co., Dept. ED, Camden, N. J.

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

Simplify design...simplify production

with **MINIATURE** **Metron** Speed Reducers

Available
in volume in three
Classifications

You can use ready-to-go Metron speed changing components in your products at a saving in cost and space—and speed production at the same time.

FIXED RATIO

Only 1.050" in diameter, anti-backlash and hobbed gear types, available in STANDARD RATIOS from 10:9 to 531,441:1! Special ratios to 2,000,000:1! Completely enclosed, permanent lubrication, ball bearing input and output shafts. Ask for Bulletin 100.



Shown 1/2 actual size

VARIABLE SPEED DRIVES

Only 4-5/32" long, smooth and accurate, cover infinitely variable speeds from 1:5 step up through 1:1 to 5:1 step down. Permanent lubrication, plus your choice of 6 adjustment controls. Speeds up to 10,000 RPM, nominal output .025 HP. Ask for Bulletin 99.



Shown 1/2 actual size

COMBINATION UNITS

... variable and fixed ratio speed reducers as integral units. Available for any motor input speed with adjustable output as low as a fraction of an RPM. Send us your combination requirements for detailed data.



Avoid the expense of designing gear trains and producing them for your products...count on versatile, dependable Metron Speed Changers to do the job for you at a saving. Write today for information about how Metron miniature speed changers can fit your plans and products.

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



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

FOR TOP-QUALITY FORGINGS FOR THE DC-6

Douglas counts on FLASH-O-LENS inspection



Soundness of forgings for the DC-6 can be determined more readily by using FLASH-O-LENS, reports Douglas Aircraft Co.

THE REASON: This handy device *spotlights* the work and *magnifies* it in sharp detail. Interpretation of grain structure — key to forging quality — is speeded up ... results are more accurate.

You too may find that FLASH-O-LENS will save inspection time and improve product quality. Battery and plug-in models available — write for literature.

E. W. PIKE & COMPANY

492 NORTH AVE.

ELIZABETH, N. J.

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

New Products...

Multiplier Phototubes

Have High Stability and Low Leakage Current



The Type 6291 and Type 6292, 10-stage Multiplier Phototubes have been designed for high efficiency operation in many types of industrial and scientific applications. The two tubes are identical in electrical characteristics, but vary in physical dimensions. The Type 6291 has a 1-1/2" diam, while the Type 6292 has a 2" diam, and both units are 4-3/4" long.

The units are the end-window type with a spectral response predominantly in the visible region. Optimum photo-electron collection, resulting in excellent signal-to-noise ratio at low light levels, is obtained by adjusting the potential between the shield and the photocathode by means of individual exterior connections.

Special features include a low leakage current due to the long leakage paths in the units, as well as an improved construction of the dynodes that provides longer stability. Potentials as high as 190v/stage may be applied for maximum amplification and sensitivity in applications where these factors are important. Allen B. Du Mont Labs., Inc., Dept. ED, 760 Bloomfield Ave., Clifton, N. J.

CIRCLE ED-45 ON READER-SERVICE CARD FOR MORE INFORMATION

Recording Camera

For Cathode Ray Oscilloscopes



The Type M.731 Universal Recording Camera, designed for cathode ray oscilloscope recording, is an easily operated instrument providing for a very wide range of applications and, at the same time, for highly economical performance. Still picture, continuously moving film, and drum photography recording of cathode ray oscilloscopes are all possible with this

compact and versatile recording camera.

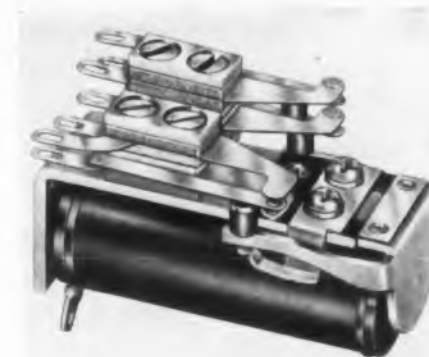
The continuously moving film mode of operation provides for speeds from 0.4" to 100" per sec, while the drum speeds are from 4" to 1200" per sec. Up to 25' of film may be used in the continuous feed operation, while drum type records are 20" in length. Both types of units are rapidly interchanged.

The driving unit is a 6v, shunt wound motor with a wide range of speeds obtained by varying the voltage from 2v to 12v. Electrical contacts are provided to trigger an external beam suppression circuit on the oscilloscope, in order that the drum type record may be made for only one revolution of the drum. A second electrical circuit permits the synchronization of an external event. J. A. Maurer, Inc., Photographic Instrumentation Div., Dept. ED, 37-01 31st St., Long Island City 1, N. Y.

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

Telephone Type Relay

Insulated to Withstand 1000v a-c



The Type T-J Telephone Relay has been designed for use in complex circuits involving pull-in and drop-out time delay.

The units are available with coils for standard voltages up to 110v

d-c; contact combinations up to 4pdt or 6pst; standard contacts in fine silver rated at 150w, 3amp non-inductive load. They are thoroughly insulated to withstand 1000v a-c, and metal parts are heavily plated to resist corrosion. Comar Electric Co., Dept. Ed, 3349 W. Addison St., Chicago 18, Ill.

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

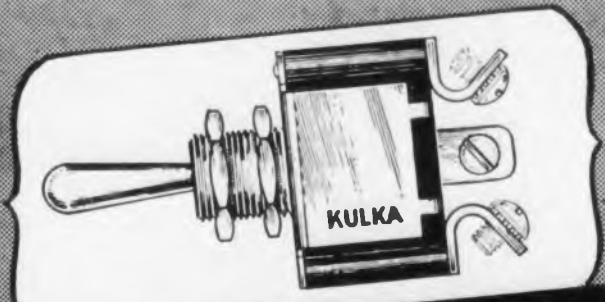
High Temperature Insulations

Meet All Class "H" Requirements

Two High-Temperature Insulation products, meeting all Class "H" requirements, have been added to the company's line. "Sil-Thin-Glas" .002 and .003 and "Sil-Thin-Bestos" .003 to .0035 possess high dielectric and tensile strength. Their thinness, flexibility, and lightness of weight permit compact construction and weight reduction in electronic equipment.

Available in rolls, sheet, or tape form, the materials can be used in coil and relay insulation, layer and barrier insulation for transformers, and coil wrappings for fields and stators. Electro-Technical Products Div., Sun Chemical Corp., Dept. El, Nutley 10, N. J.

CIRCLE ED-48 ON READER-SERVICE CARD FOR MORE INFORMATION



Single and Double Pole "Toggle" Handle Type
AIRCRAFT SWITCHES
For Electronic and Communications Use

Made to joint Army and Navy specifications (JAN-S-23). For DC, or AC circuits up to 1600 cycles. Switching characteristics provide for changes in electric circuits by use of spst, dpst and dpdt. Has bake-lite housing and only one mounting hole. Nuts and sleeve lock-washers supplied. Available with screw terminals (No. ST-40 series, Single Pole, and ST-50 series, Double), and with solder lugs (No. ST-42 series, Single Pole, and ST-52 series, Double).
Write Dept. 105 For Bulletin

KULKA ELECTRIC MFG. CO., Inc.
MOUNT VERNON, N. Y.

CIRCLE ED-49 ON READER-SERVICE CARD FOR MORE INFORMATION

**Shocking News About
Super Davohm Resistors**



Only Daven uses a stranded lead wire to connect the resistance wire to the solder terminal of the Super Davohm Precision Wire Wound Resistor.

Result: Super Davohm Resistors are more rugged, can withstand more vibration, rougher treatment and abnormal shocks because all stress, strain, heat or pressure, applied to the solder terminal, is absorbed by the heavy lead wire so that the resistor is not adversely affected in any way.

This is only one of the many exclusive features which make DAVEN the leader in the resistor field.

EXCELLENT DELIVERIES • Write for detailed bulletin

THE **DAVEN** CO. 169 Central Avenue
Newark 4, N. J.

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

Miniature Ball Bearing For Computers, Instruments, etc.



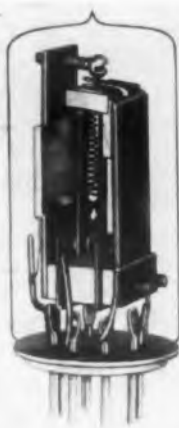
This Miniature, Conrad type Ball Bearing, an addition to the RMB "Filmo seal" series, has a capillary film of lubricating oil which forms between the tapered outer surface of the inner race and the edge of a precision enclosure to provide effective sealing. The device is useful for indicating and recording meters, precision instruments, computers, and any small mechanism where low torque and long life with minimum attention are required.

Measurements are 0.1969" OD, with a bore of 0.0591". The film of oil seals the unit against dirt and moisture, and prevents loss of the lubricant, without any significant increase in frictional torque.

Characteristics include small and constant friction for long periods of time and through a wide range of speeds; satisfactory operation at extremes of temperature; an automatic adjustment to variations in pressure and temperature; and simplified handling, installation, and maintenance. Landis & Gyr, Inc., Dept. ED, 45 W. 45th St., New York 36, N. Y.

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

Thermal Time Delay Relay Has Positive Snap Action



The "Snapper" Thermal Time Delay Relay is a spdt unit with applications for the design, development, and research engineer. Features of the device include its snap action, small size, low heater current, low operating temperature, high contact rating, consistent timing, and strong mechanical structure for consistency and long life.

Ratings for the unit include 6.3v, 26.5v, and 115v (a-c or d-c); power input of 3w; 6amp contacts; an ambient temperature range of -60°C to $+80^{\circ}\text{C}$; and vibration endurance up to 30G's at frequencies of 5cy to 55cy. An impact of 50G's does not damage the unit. It is gas filled to produce an arc quenching atmosphere, and has a glass-metal header for satisfactory seal and no leakage. Eureka TV and Tube Corp., Dept. ED, 69 Fifth Ave., Hawthorne, N. J.

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

NEW! PERKIN Magnetic Amplifier Regulated POWER SUPPLY



RESPONSE TIME 1/10 SEC.!



Write the factory
for literature
and quotations

345 Kansas Street
El Segundo,
California

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

(Advertisement)

Humidity-Resistant Miniature Hermetic Terminals

Utilize Teflon's* Zero Water-absorption Factor



Teflon* is used in the New series 199 Lundey Miniature Hermetic Terminals, to give excellent performance under conditions of high humidity. On a given test, the insulation resistance at 90% relative humidity at 80°F was one million megohms as against three million megohms at 50% relative humidity.

These terminals are the solution to miniature terminal problems created by high-humidity conditions.

The construction, using Teflon* for external member and silicone rubber internally, takes advantage of the elastic memory of Teflon* to give an effective spring loading to the assembly, with a resultant hermetic seal.

The terminals are mounted in simple drilled or punched holes, eliminating the need for expensive secondary operations such as extrusions. Minimum mounting distance is 15/64" on center, still providing ample wiring space after assembly. Three electrode styles are available. Other sizes in these terminals will be available. Manufacturer: LUNDEY ASSOCIATES, Dept. EDM, 694 Main Street, Waltham 54, Massachusetts.

* Teflon is DuPont's trade name applied to the polymers of tetrafluoroethylene.

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

Now available
in **TWO** versions

The AJ Series Helipot

...**TINY** 10-turn Helipots
with **BIG** performance

12 times the resolution of conventional units!

In all airborne and many other modern electronics applications for precision potentiometers, miniaturization, light weight and circuit simplification are key objectives. And you get these features—and more—in Helipot's new AJ Models... compact potentiometers the diameter of a penny, yet with 12 times the resolution of conventional potentiometers of the same diameter. Announced only a few months ago, the original AJ has proven so popular that it is now made in two versions to meet the requirements of its many users—the original AJ mounting with a threaded bushing... and the new AJS mounting for servo applications. Also, the AJS is available in two bearing arrangements—AJS with sleeve bearings, and the AJSP with ball bearings.



(Left)
Model AJ
Bushing Mounting

(Right)
Model AJS
Servo Mounting

All units have these important features...

SMALL SIZE—LIGHT WEIGHT: All AJ Models are only $\frac{3}{4}$ " in diameter (small as a penny) $1\frac{1}{2}$ " long—weigh 1.0 oz. They require a minimum of valuable panel space!

HIGH PRECISION—CIRCUIT SIMPLICITY: On many applications an AJ Series will replace two conventional potentiometers, providing both wide range and fine adjustment in one

unit. The 18" slide wire gives a resolution of 1/3000 in a 100 ohm unit—1/6500 in a 50,000 ohm unit!

RELIABILITY: The AJ models are rugged and simple—built to close tolerances with careful quality control. Their performance and reliability reflect the usual high standards of Helipot quality.

Advanced Construction

For light weight, unusual compactness, high accuracy and resolution, coupled with utmost reliability, investigate the AJ series...

- ▶ All types have bearings at each end of the shaft to assure precise alignment and linearity at all times.
- ▶ Either single or double shaft extensions can be provided to meet individual needs... also, ball or sleeve bearings, special shaft lengths, flats, screwdriver slots, etc.
- ▶ By means of a unique Helipot welding technique, tap connections can be made to only ONE turn of the resistance winding, and can be provided at virtually any desired point on the resistance element.
- ▶ New improved terminals are rigidly anchored in place to prevent twisting and coil failures due to fatigue. These anchor-locked terminals are used both at the taps and at the coil ends.

Meet Rigid Helipot Standards

Helipot—world's largest manufacturer of precision potentiometers—has built an enviable reputation for its high design and construction standards, and the AJ models meet these standards in every way.

The resistance elements are made of precision-drawn alloys, accurately wound by special machines on a heat-dissipating copper core.

Each coil is individually tested, then permanently anchored in grooves precision-machined into the case. Slider contacts are of long-lived Paliney alloy for low contact resistance and low thermal e.m.f.... and all terminals are silver plated and insulated from ground to pass 1,000 volt breakdown test.

In spite of light weight and compact design, all AJ models are built throughout for long life and rugged service. Potentiometer life varies with each application, of course, depending upon rotation speed, temperature, atmospheric dust, etc. But laboratory tests show that under proper conditions, all of the AJ series have a life expectancy in excess of one million cycles each!

Get full details from your nearest Helipot representative—or write for Data File #519.

THE Helipot CORPORATION

A subsidiary of Beckman Instruments, Inc.

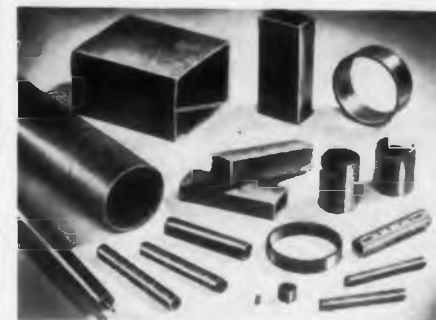
SOUTH PASADENA, CALIFORNIA

Field Offices: Boston, Rochester, New York, Philadelphia, Cleveland, Detroit, Chicago, St. Louis, Los Angeles, Seattle, Dallas, High Point, N. C. and Fort Myers, Florida. In Canada: J. S. Root, Toronto. Export Agents: Fratham Co., New York 36, New York.

New Products...

Resinite Tubing

With Increased Wall Strength



"Resinite" Tubing, available in all shapes, widths, and lengths, has been designed to provide increased wall strength, improved dielectric strength, and chemically resistant properties.

This tubing is used in flyback transformers, as screw insulators in relays and transformers where high quality insulation is essential, and in electronic and electrical shaft applications.

Inner diameters range from 0.125" to 3", with wall thicknesses from 0.006" to 0.100". The tubing is available threaded inside or outside, slotted, punched, or embossed. Threaded coil forms incorporate a special 3-row design to afford axial pressure in excess of 25 lb. Torque can be controlled to ± 1 in-oz, a feature that eliminates wobble or freezing of cores.

Other features include a power factor of 0.0312, a dielectric strength (short-time) of 2600v (average at 0.012 wall thickness), and a moisture absorption of 2.86 (average after 72 hours at 100% relative humidity). Precision Paper Tube Co., Dept. Z-3, 2035 W. Charleston St., Chicago 47, Ill.

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

Miniature Decade Amplifier

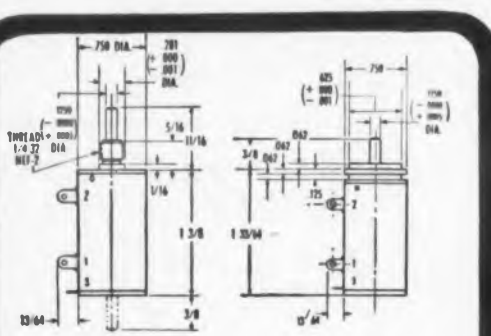
Has 1Mc Frequency Response



The Type 140-A miniature Decade Amplifier is a laboratory voltage amplifier with a 1Mc frequency response and stabilized voltage gains of 10 and 100. Typical applications are to extend sensitivities of oscilloscopes, vacuum tube voltmeters, and other indicating or recording devices.

A low-flux-density transformer permits the amplifier to be used without effect on nearby equipment operating at low signal levels. The amplifier is resistance coupled, and no peaking coils or compensating networks are used which might cause undesirable transient effects.

A low-flux-density transformer permits the amplifier to be used without effect on nearby equipment operating at low signal levels. The amplifier is resistance coupled, and no peaking coils or compensating networks are used which might cause undesirable transient effects.



AJ

AJS

CONDENSED SPECIFICATIONS

Number of turns	10
Power rating	2 watts
Coil length	18"
Mechanical rotation	360° + 12° - 0°
Electrical rotation	360° + 12° - 0°
Resistance ranges	100 ohms to 50,000 ohms
Resistance tolerance	$\pm 5.0\%$
Linearity tolerances:	
All values	$\pm 0.5\%$ (standard)
5000 ohms and above	$\pm 0.1\%$
Below 5000 ohms	$\pm 0.25\%$
Starting torque	0.75 oz. in.
Net weight	1.0 oz.

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

Frequency response is flat from 2cy to 1Mc. ± 0.1 db. The equivalent input noise is less than $8\mu v$, and the maximum undistorted output voltage is 40v. Maximum output current is 1ma, and phase shift and distortion are negligible. The unit has a built-in 117v a-c power supply, and line voltage variations between 70v and 130v cause less than 0.1db changes in output.

Input impedance is 1 megohm shunted by 10mmfd. An accessory high-impedance vacuum tube probe is available where even slight loading of sensitive circuits is to be avoided. Herman Hosmer Scott, Inc., Dept. ED, 385 Putnam Ave., Cambridge 39, Mass.

CIRCLE ED-57 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Selenium Rectifiers

With Ambient Range of $-55^{\circ}C$ to $+100^{\circ}C$



These miniature Selenium Rectifiers are designed for industrial and government equipment applications. They can be used in small relays, solenoids, and precipitators, as well as in electronic, blocking, computer, signal, magnetic

amplifier, communication and control circuits.

The assemblies have an ambient temperature range of $-55^{\circ}C$ to $+100^{\circ}C$. At an ambient temperature of $35^{\circ}C$, the single-stack rating ranges from 0.5ma d-c at 26v rms to 25ma d-c at 5200v rms, and higher ratings can be obtained by combining the stacks.

The units are mounted without spacer washers. Although standard design is for lead mounting, the cells also may be bracket mounted. General Electric Co., Dept. ED, Schenectady 5, N. Y.

CIRCLE ED-58 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Motor-Generator

For Servomechanism Applications



This 400cy Motor-Generator, weighing 4 oz and measuring 0.9" diam, has been designed for use in servomechanisms. Phase voltage of the motor is 26v, with a

maximum stall power of 2.6w per phase and a minimum stall torque of 0.3 in-oz.

Output of the generator is 0.34v/1000rpm

with an excitation power of 2.0w maximum.

Generator characteristics also include a phase shift of 5° working into a 100,000 load, and a 20 mil null with a 10 mil swing. Transicoil Corp., Dept. ED, 107 Grand St., New York 13, N. Y.

CIRCLE ED-59 ON READER-SERVICE CARD FOR MORE INFORMATION

Solders and Fluxes

For Transistor Applications

Solders and Fluxes specially designed for transistor applications have been added to the company's line. Among these are "Diveo" No. 335, a flux that can be used to solder copper-plated, unplated-etched, or unplated-unetched germanium; "X-25", a rosin core solder that provides flux activity at a temperature even before the solder is completely molten; and "Diveo" No. 233 printed circuit solder, which is a silver saturated tin-lead alloy with a melting point below the tin-lead eutectic. This material provides improved electrical conductivity and ideal production properties in all phases of subminiaturization. Also available is a low toxicity rosin flux remover that prevents waste of solvent, and is fire resistant and efficient in residue removal. Another material is the No. 276 printed circuit solder, especially made as a high temperature solder for two-stage ordinary or subminiaturization assemblies. Division Lead Co., Dept. D, 7742 W. 61st Place, Summit, Ill.

CIRCLE ED-60 ON READER-SERVICE CARD FOR MORE INFORMATION

Sealed Precision Resistors

Can Operate at $-65^{\circ}C$ to $+125^{\circ}C$



Sealed Precision Resistors, immune to immersion and high humidity, have been added to the company's line. These units meet all requirements of MIL-R-93A and JAN-R-

93 and are useful to the electronic designer.

Completely encapsulated and bonded, the units have an operating temperature range of $-65^{\circ}C$ to $+125^{\circ}C$. They also have reversed and balanced pi windings for low inductance. A feature of these units is their internal section cross-over wire, which is insulated from winding by a 2000v insulation.

In addition, there is a special metal molded connecting feature, which bonds the end of the winding and terminal in a non-corrosive and mechanically secure manner, without the use of a solder or flux. For easier and more secure soldering, the units contain rigid hot solder coated brass terminals. Mepeco, Inc., Dept. ED, Morristown, N. J.

CIRCLE ED-61 ON READER-SERVICE CARD FOR MORE INFORMATION

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with scientific accuracy

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With gold plating methods developed by Technic Inc., you can now achieve accurate control of quality, evenness, thickness, color, and hardness of gold deposits. Through cycle plating that is practically automatic in operation, we have virtually converted the old art of plating gold to an exact science.

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When you refer plating problems to Technic Inc., we solve them by application of a thorough service — consisting of specifications for a complete installation or correction of faults in your present installation, schedules for solutions and timing, assignment of an engineer who stays with the job until your installation is working at full efficiency.

Write for

"ELECTROPLATED GOLD"

Technical Data Sheet

Without obligation, write for our informative new Data Sheet which details fully the advanced Technic Inc. gold plating methods and services for platers outlined above.

For reference, you will also receive a list of leading industrial concerns — many with production problems resembling your own — which rely on Technic Inc. controlled gold plating installations to improve production while reducing cost.

Our Controlled Gold Plating methods result in complete dependability, elimination of waste of precious metal, high increase in production, better appearance of product — together with significant reduction in operating personnel, rejects and all-over costs. Send us your plating problems for review, or call in a Technic engineer for consultation. No obligation is involved.

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CIRCLE ED-62 ON READER-SERVICE CARD FOR MORE INFORMATION

CANNON PLUGS

for
hermetic
sealing



SUB-MINIATURE U Series plugs for miniature switches, relays, transformers, amplifiers and other sealed components have steel shells and Silcan insulation, cable relief and moisture resistant sleeve. Bayonet-lock coupling method. Rated 1700 v. D.C.; 5 a.—Have 3, 6, and 12 contacts—one plug style and two receptacles. Refer to U-2 Bulletin.

GS TYPES (Top, right) and **RKH Types** (Bottom, right) have fused vitreous insulation providing a true hermetic seal for relays, position indicators, etc. Cadmium finish steel and bleached Iridite shells with



Dural coupling nut. Resist thermal shock—300°F. to 600°F.; pressures 200 to 900 psi—specials to 7500 psi. See GS-3 section in AN-8 Bulletin and KH-1 section in K Bulletin.

CANNON ELECTRIC

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CIRCLE ED-64 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products...

Germanium Diodes

Can Withstand up to 75°C Operation



These point-contact Germanium Diodes (19 types) have been designed for computer applications, video detectors, u-h-f mixers to 900Mc, and for similar electronic design applications. The

encasing cartridge is composed of a plastic material that is impervious to moisture and has excellent electrical characteristics and mechanical stability at high temperatures.

The stiff terminal pins permit clipping of the unit into spring terminals for test or circuit applications, and the flexible leads permit soldering if desired.

The units withstand severe temperature and humidity cycling. Operation to 75°C is permissible without permanent effect on the characteristics. National Union Radio Corp., Dept. ED, Hatboro, Pa.

CIRCLE ED-65 ON READER-SERVICE CARD FOR MORE INFORMATION

Potentiometer Element

Has Resistance of 20,000 ohms



The Type 2028 Potentiometer Element has been added to the company's line. This unit is a rectilinear model of 20,000 ohms resistance and has an active length of 10" and a linearity of $\pm 1\%$.

The unit has particular application where the advantages of extreme wear resistance and substantially infinite resolution are important. It has excellent operational reliability when used in conjunction with the input-output analog computer tables. Markite Corp., Dept. ED, 155 Waverly Place., New York 14, N. Y.

CIRCLE ED-66 ON READER-SERVICE CARD FOR MORE INFORMATION

Copper Clad Steel

For High Conductive Spring Parts

"Conflex" Copper-Clad Steel, a spring material with spring properties comparable to hardenable steel, is a composite metal consisting of a layer of medium-carbon steel with a relatively thin layer of electro-

lytic copper clad to one or both sides. Its primary advantage is its low cost, in comparison with hardenable copper alloy metals.

Features of the material include high electrical and thermal conductivity, excellent ductility for extreme forming, good spring properties after heat treatment, resistance to corrosion, and ease of electroplating.

Flexibility in electrical conductive properties is obtained by varying the thickness of the copper layers; this material with a 10/80/10 thickness ratio has a conductivity better than 30% when compared with solid copper. Widths up to 8" and thicknesses from 0.050" down can be furnished. Applications for the material include fuse clips, thin blade springs, and electrical connectors. General Plate Div., Metals & Controls Corp., Dept. ED, Attleboro, Mass.

CIRCLE ED-67 ON READER-SERVICE CARD FOR MORE INFORMATION

High Resistance Thermistor

Has 60 Megohms Resistance at 0°C.

The Type 71A2 High Resistance Thermistor is available in quantity Production. Among its applications is that of making the period of electronic R-C timing circuits independent of changes in ambient temperature.



The device is sealed in a glass rod and has a temperature coefficient of -7% per degree Centigrade at 0°C. Its resistance at 0°C is 60 megohms and drops to 3 megohms at 50°C. Victory Engineering Corp., Dept. ED, Springfield Rd., Union, N. J.

CIRCLE ED-68 ON READER-SERVICE CARD FOR MORE INFORMATION

Synchronous Motors

For Low Speed, Light Load Uses



The Circle B Synchronous Motors have been designed for applications where very low speed at light loads is required. Known as the S-200 Series, the units are available at speeds from 10 revolutions per hour to 1 revolution per month.

The unit features an additional exposed low speed gear train and will handle a continuous load up to 1 in.-lb. Characteristics include a size of 2" diam x

1-5/8" deep, and a torque limited by gear train to 1 in-lb continuous and to 5 in-lb intermittent use. Vocaline Company of America, Inc., Bristol Motor Div., Dept. ED, 239 Coulter St., Old Saybrook, Conn.

CIRCLE ED-69 ON READER-SERVICE CARD FOR MORE INFORMATION

R-F Inductor Electrically Controllable



The Type 65BA1 current Controllable Inductor is especially suitable for frequency sweep oscillators, remote tuning control, etc. Compact in size, the unit is electrically controllable and has no moving parts.

It has a wide range frequency shift or inductance variation between 1Mc or lower, and about 2.5Mc or higher at zero control current. At least a 7 to 1 variation of frequency is obtainable, and the upper frequency limit with maximum control current is about 30Mc.

Other features include a maximum inductance of 30 μ h at zero control current, and a rising Q characteristic that reduces bandwidth variations. A control winding and a signal winding are arranged in such a way that negligible electromagnetic and electrostatic coupling exist between them. When current is applied to the control winding, the inductance gradually decreases in the signal winding. C.G.S. Labs., Inc., Dept. ED, 391 Ludlow St., Stamford, Conn.

CIRCLE ED-70 ON READER-SERVICE CARD FOR MORE INFORMATION

Pulse Transformer For μ sec and Fractional μ sec Ranges



The Type PT-2 "Labtrans" Pulse Transformer is a versatile unit for use in the μ sec and fractional μ sec ranges. Compact and convenient to use, it is built in an octal tube base. Its windings comprise six sections, of which two pairs are connected in series, and the other two sections

are individually connected to base pins.

The device has applications in blocking oscillators and other pulse circuits. When tested as a coupling

transformer with 1-8 and 2-7 windings in parallel as primary, and 3-4 and 5-6 in parallel as secondary, the characteristic impedance was 100 ohms, with a rise time of 0.04 μ sec, and a droop in 1 μ sec of 20%.

Further specifications include a diameter of 1.372" max, an overall height of 1.657" max, and a core of wound, uncut, magnetic material. Berkshire Labs., Dept. ED, 578 Beaver Pond Rd., Lincoln, Mass.

CIRCLE ED-71 ON READER-SERVICE CARD FOR MORE INFORMATION

Plug-in Binary Counter Has Frequency Range of 0-3Mc



The Type M1553 high speed Binary Counter is designed for use in all types of counting and frequency division to rates in excess of 3Mc sec. The unit, a plug-in type, has an 11-prong octal type base plug which allows access to all tube elements and other important circuit points.

Electrical specifications include a frequency range of 0 to 3.0Mc, an input of 75v negative pulses with a rise time of 0.2 μ sec, an output of 125v with a rise time of 0.2 μ sec, and a power requirement of 17ma at 250v. The unit is 1-1/4" diam and weighs 3.2 oz. It operates over an ambient temperature range of -40°C to +70°C. The Walkirt Co., Dept. ED, 145 W. Hazel St., Inglewood, Calif.

CIRCLE ED-72 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Blower Delivers 22cfm Free Air



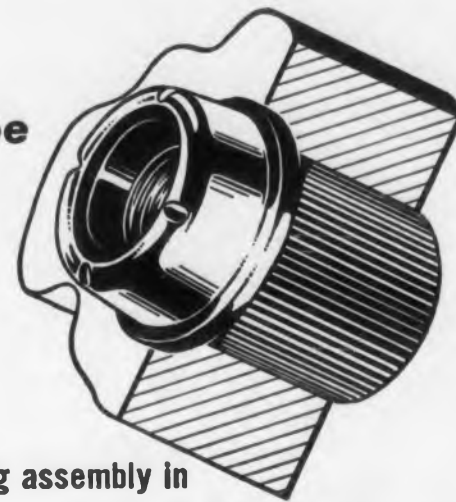
The Type BC16-15B-12 Miniature Blower, designed to meet rigid Air Force specifications, has many applications in cooling radar equipment, amplifier units, transmitters, oscillators, and other electronic equipment. It has been designed to deliver 22cfm free air at 115v, 60cy, single phase power supply.

Weighing only 26 oz, the unit operates over a temperature range from -65° to +85°. The motor is built to close tolerances to assure steady performance. All rotating parts are dynamically balanced, and precision shielded ball bearings are used to assure long life. Induction Motors Corp., Dept. ED, 55-15 37th Ave., Woodside 77, N. Y.

CIRCLE ED-73 ON READER-SERVICE CARD FOR MORE INFORMATION

spline-type

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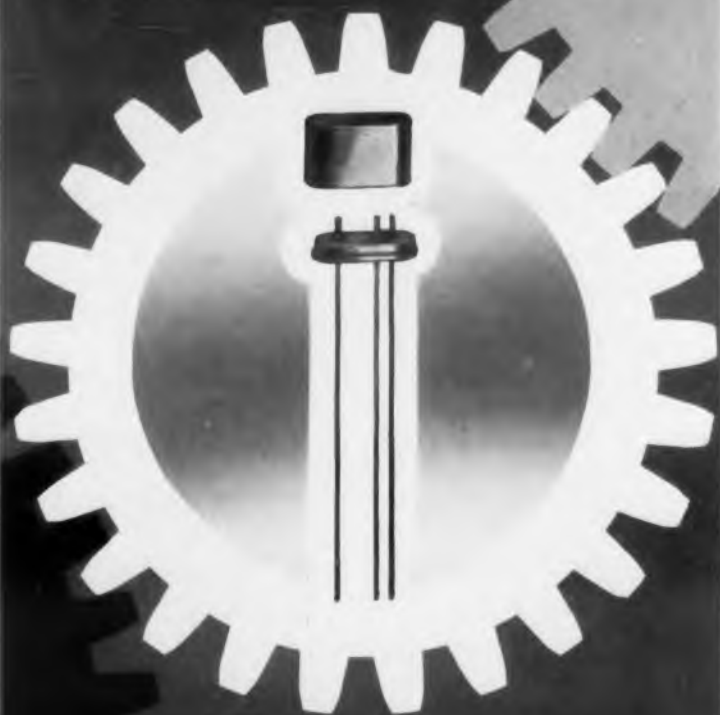
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CIRCLE ED-75 ON READER-SERVICE CARD FOR MORE INFORMATION

Now Geared for Vacuum Sealed TRANSISTOR MOUNT Production



Constantin Glass to Metal Vacuum Sealed Transistor Mounts are Now Available for Volume Production.

These mounts are engineered so that the germanium block can be permanently sealed in either a vacuum or inert gas. This allows complete protection against variations caused by moisture, dirt, or changing atmospheric conditions.

The rugged construction and diminutive size of the mount make the finished transistor ideal for use in most military or other equipment that is subjected to conditions of heavy vibration and extreme temperature changes.

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CIRCLE ED-76 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products...

Electrolytic Capacitors For Miniature Applications



Type 999 Electrolytic Capacitors are available in a range of sizes and ratings for use in the circuits of very small amplifiers, hearing aids, transistor devices, etc.

The units are metal cased with tinned wire terminals, and their maximum temperature rating is 65°C. They are available in ratings from 0.05mfd at 50v d-c (0.175"OD x 1-1/32") to 3mfd at 3v d-c (0.175"OD x 1-1/32"). Micamold Radio Corp., Dept. ED, 1087 Flushing Ave., Brooklyn 37, N. Y.

CIRCLE ED-77 ON READER-SERVICE CARD FOR MORE INFORMATION

Potting and Casting Resin

Withstands High and Low Temperatures

"Aritemp" is a heat resistant Potting and Casting Resin with a wide variety of applications for embedding and encapsulating circuit assemblies. It also finds use in the manufacture of transformers, coil windings, controls, and other electronic components meeting specification MIL-T-27.

Extremely resistant to both high and low temperatures, the resin has good impact strength, a marked adhesion to metals and resistance to water vapor transmission, and excellent electrical properties.

The material is solid at room temperature and melts to a mobile liquid at 100°C to 110°C. R. S. Arics & Associates, Dept. ED, 400 Madison Ave., New York 17, N. Y.

CIRCLE ED-78 ON READER-SERVICE CARD FOR MORE INFORMATION

Hermetically Sealed Connectors

Withstand 200psi to 900psi



Type KH and Type RKH Hermetically Sealed Connectors are designed for use in relays, position indicators, direction finders, tachometers, etc. Chief feature of the steel shell in these units is the heavy duty special

Aeme thread. KH receptacles mate with standard K plugs, and RKH plugs with RK receptacles. The hermetic seal is achieved by the special vitreous insulation around the steel contacts and fused to the shell.

The KH units withstand 200psi to 900psi, depending on size and contact complement. Temperature operating range varies from -320°F to +600°F, and the units meet all MIL-C-5015 vibration and thermal tests.

Various flanges may be adapted to the KH receptacle to meet mounting requirements. Eyelet type terminals are standard, and a wide variety of contact arrangements is available. The units are finished in cadmium plate and bleached "Iridite." Cannon Electric Co., Dept. ED, 3209 Humboldt St., Los Angeles 31, Calif.

CIRCLE ED-79 ON READER-SERVICE CARD FOR MORE INFORMATION

Insulated Flexible Coupling Injection Molded as Single Unit



This Insulated Flexible Coupling is injection molded as a single unit, instead of having the typical riveted strap assembly. This new method of assembly eliminates back lash and materially shortens

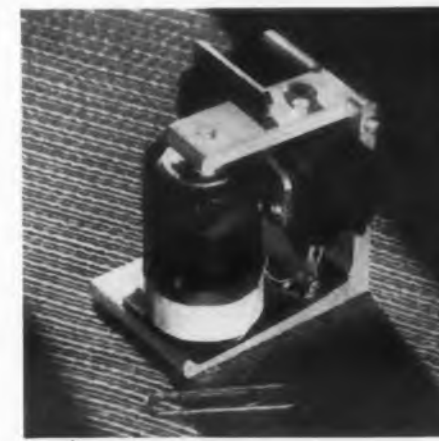
the overall length of the coupling.

It also increases the electrical leakage path, and substantially increases the voltage breakdown rating over conventional couplings, while maintaining a high degree of flexibility and a great accuracy of hub alignment. James Millen Mfg. Co., Inc., Dept ED, 150 Exchange St., Malden, Mass.

CIRCLE ED-80 ON READER-SERVICE CARD FOR MORE INFORMATION

Snap-Action Relay

Operates in Thyatron Plate Circuits



The Type C Snap-Action Relay, designed to operate with a 2mfd bypass capacitor, has performed successfully in the plate circuits of such thyatrons as the Types 2050, 2D21, and 502A. The unit employs a Type

BA2R snap-acting switch having characteristics particularly suitable for inductive loads and those involving high inrush current. This construction makes the relay practically immune to the effects of

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These latest of all Carter DC to AC Converters are specially engineered for professional and commercial applications requiring a high capacity source of 60 cycle AC from a DC power supply. Operates from storage batteries, or from DC line voltage. Three "Custom" models, delivering 300, 400, or 500 watts 115 or 220 V. AC. Wide range of input voltage, 12, 24, 32, 64, 110 or 230 V. DC. Unequaled capacity for operating professional recording, sound movie equipment and large screen TV receivers. Available with or without manual frequency control feature.



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CIRCLE ED-81 ON READER-SERVICE CARD

exposure to shock and vibration, or tilting.

Single-pole contacts, which can be wired for either normally-open or normally-closed conditions, are rated for 20amp steady state currents and 75amp inrush currents on voltages up to 460v a-c.

Features of the device are extreme mechanical stability and a large cross-section magnetic path, which makes it relatively insensitive to variations in operating voltage. Operating characteristics can be varied from 8ma to 12ma pull-in and 2ma to 6ma drop-out current. The standard actuating coil has a resistance of 3000 ohms. Thermo Instruments Co., Dept. ED, 1271 El Camino Real, Belmont, Calif.

CIRCLE ED-82 ON READER-SERVICE CARD FOR MORE INFORMATION

Variable Inductance Coil Kit

Inductances Range from 1 μ h to 590 μ h

A "Universal Substitution Kit", for use in video peaking, and r-f and i-f circuitry, has been added to the company's line. The kit contains 8 variable inductance coils, covering an inductance range from 1 μ h to 590 μ h.

The kit includes a spring clip mounting designed for a single 5/16" hole, and an extra terminal for tiepoint convenience. Crest Labs., Inc., Dept. ED, 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y.

CIRCLE ED-83 ON READER-SERVICE CARD FOR MORE INFORMATION

Recording System

Expandable to 6 Channels



The "Console" is a complete Recording System combined with an oscillograph recorder, and equipped with JAN rack and panel type, a-c, d-c, or carrier amplifiers. By the addition of recording galvanometers and amplifiers, it can be expanded from a 2-channel system

to 4 or 6 channels as required.

Ink-writing galvanometers cover a wide range of frequency response from d-c to 300cy. Recorder chart paper speeds are available in a range from 0.1mm/sec to 625mm/sec. An option of three or nine chart speeds permits recording flexibility. Ample space is provided for the use of chart rolls and/or accordian folded multi-channel chart paper.

Dimensions of the unit are 32" x 27" x 53". Edin Co., Inc., Dept. E-7, 207 Main St., Worcester 8, Mass.

CIRCLE ED-84 ON READER-SERVICE CARD FOR MORE INFORMATION



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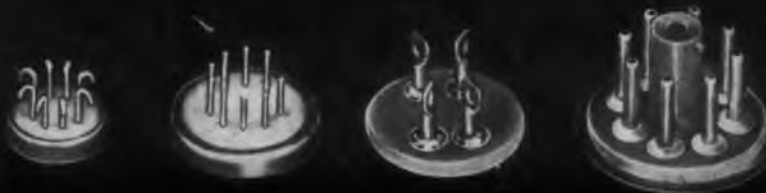
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CIRCLE ED-85 ON READER-SERVICE CARD FOR MORE INFORMATION

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... is completely electronic in operation and contains no moving parts. Recovery time can be considered instantaneous as compared with other types. Complete correction is effected in 3 to 10 cycles. Stabilization and regulation are excellent; waveform distortion does not exceed 3%. Available in numerous capacities and ratings.

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CIRCLE ED-87 ON READER-SERVICE CARD FOR MORE INFORMATION

(Advertisement)

New Wide-Range Capacitor



C.T.C.'s new CST-50 capacitor surpasses the range of others many times larger in physical size. This is due to a new and unusual tunable* element that practically eliminates losses due to air dielectric. As a result, a large minimum to maximum capacity range (1.5 to 12 μfd) is realized. Yet the CST-50 stands only 19/32" high when mounted, is less than 1/4" in diameter, and has an 8-32 threaded mounting stud. The mounting stud is split so that the tuning sleeve* can be securely locked without causing an unwanted change in capacity.

The CST-50 is provided with a ring terminal having two soldering spaces. The tuning sleeve* is at ground potential. All C.T.C. materials, methods and processes meet applicable government specifications. Send for details. Cambridge Thermionic Corporation, 457 Concord Avenue, Cambridge 38, Mass.

*Patent Applied For

CIRCLE ED-88 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature . . .

Electronic Equipment Batteries 89

Bulletins No. 1 and No. 2 (1953 Revision) present information useful to designers of battery operated electronic equipment. The information included in No. 1 applies to radio receivers, portable radio transmitters, audio amplifiers, test instruments, etc. The information in Bulletin No. 2 describes "A-B" battery packs for radio receivers using 1.4v tubes. Specifications are provided, along with terminal sketches, circuit diagrams, and photographs. National Carbon Co., Div. of Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Molded Capacitors 90

Bulletin TS-111 (4 pages) describes the advantages of "Humiditite", a high moisture resistance molding material for capacitor cases. Properties and characteristics of the material are described, and a comparison of capacitors using this material with units encased in other molding compounds is presented. Sangamo Electric Co., Capacitor Div., Marion, Ill.

Electronic Instruments 91

The company's electronic instruments (vacuum tube voltmeter, resistance limit bridge, and square wave generator), are described in a 4-page, 2-color brochure. Specification data are provided for each device, along with application information. Reiner Electronics Co., Inc., 152 W. 25th St., New York 1, N. Y.

Fasteners 92

A 36-page, 2-color brochure describes the company's line of fasteners, including quick-lock, spring-lock, roto-lock, link-lock, and dual-lock fasteners, of interest to the electronic designer. Each type is described, along with illustrations and application data. Diagrams also are included. Simmons Fastener Corp., North Broadway, Albany 1, N. Y.

Subminiature Amplifier Assemblies 93

A 4-page brochure describes the company's replaceable subminiature amplifier assemblies, for use in servomechanisms, pulse circuits, analog computers, and other compact electronic assemblies. Features of the units are described, and specifications and application notes are included. Diagrams illustrate typical circuits. Avion Instrument Corp., Highway No. 17, Paramus, N. J.

General Purpose Adhesive 94

A 24-page, 2-color brochure describes the company's "Pliobond", a general purpose adhesive which is useful for a wide variety of bonding conditions. Information includes a general description, types of bonds possible, general properties of the material, methods of application, and specifications. Data sheets provide further technical information. The material is useful for insulating coils and transformer windings, particularly at radio frequencies. Goodyear Tire & Rubber Co., Chemical Div., Akron 16, Ohio.

Hermetic Sealing 95

A 4-page, 2-color bulletin, entitled "The Why and the How of Hermetic Sealing", describes the process of hermetic sealing and its application to electronic and electrical components and assemblies. Advantages of hermetic sealing are discussed, and a brief description of the company's services is included. General Hermetic Sealing Corp., 99 E. Hawthorne Ave., Valley Stream, L. I., N. Y.

Conversion Slide Rule 96

A handy slide rule, known as the "Ballantine Rule", provides quick and simple conversions between a number of electrical quantities. On one side of the rule scales are provided to convert millivolts and volts to db readings, or vice versa. The other side presents the relationships existing between decibels, voltage, and current ratios (when a common impedance is involved), and power ratios. Extension of range information also can be obtained, as well as the square and square root, the reciprocal, and the logarithm of a number. It is available at no charge from Ballantine Labs., Inc., Boonton, N. J.

Electronic Wire and Cable 97

Catalog No. 63 contains a classified description of the company's electronic and electrical wire and cable. The catalog is divided according to items into the following main classifications: portable cords; heater cords; lamp cords and fixture wires; custom made cord sets; thermostat cables and annunciator wires; electronic hook up wires; and radio and electronic wire. Each item is illustrated, and specification and application data are included. The pages are enclosed in a spiral type binder for convenient study. Cornish Wire Co., Inc., 50 Church St., New York 7, N. Y.

A 2-page, 2-color bulletin describes and illustrates the company's Model BT time totalizer, designed for accurate measurement of elapsed time intervals. Applications for this instrument are provided, along with specifications (accuracy, shock, vibration, temperature, altitude, humidity, etc.), and features. Circuit diagrams illustrate the dimensions and wiring of this instrument. The R. W. Cramer Co., Centerbrook, Conn.

Selenium Rectifiers

99

A 4-page brochure describes the company's various types of selenium rectifiers: miniature electronic ("Plastisel"), open type assembly ("Rectisel"), sub-miniature encased ("Minisel"), hermetically sealed, and power rectifiers ("Powersel"). All have many commercial and military applications for the electronic designer. Photographs illustrate each type of unit, and charts provide specification data. Electronic Devices, Inc., 429 12th St., Brooklyn 15, N. Y.

Transformers

100

Catalog No. CT-153 is a 32-page, 2-color booklet describing the company's hermetically sealed transformers and filter reactors. Meeting all requirements of Grade 1, MIL-T-27 specification, the equipment described is useful in the fields of communication, broadcast, and electronic control equipment. A quick reference index is included. Chicago Transformer Div., Essex Wire Corp., 3501 W. Addison St., Chicago 18, Ill.

Manufacturing Facilities

101

A 6-page brochure describes the company's manufacturing and laboratory facilities and the personnel available for these services. Products they are equipped to produce include complete transmitters and receivers, test equipment, r-f and a-f amplifiers, power supplies, servo amplifiers and electronic actuators, vacuum tube testing equipment, junction and terminal boxes, electronic timing devices, etc. Palmer Products Inc., 236 Rhode Island Ave., East Orange, N. J.

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 give you unequalled freedom in design, still more
 power per pound, even longer life and
 greater reliability

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 has over 100 times the thermal life of the best
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 bakes without bubbling at 300° to 400°F;
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 Makes it possible to produce silicone-glass
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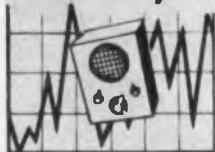
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TYPES: Standard Radio Octal, and 9-Pin Miniature.

PROBLEM? Send for Bulletin No. TR-81



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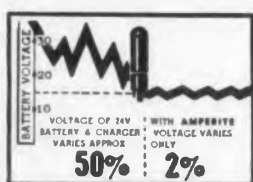


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- Hermetically sealed, light, compact, and most inexpensive.



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Write for 4-page Technical Bulletin No. AB-51



T9 BULB



AMPERITE CO., Inc. 561 Broadway, New York 12, N. Y.
In Canada: Atlas Radio Corp., Ltd., 560 King St., W., Toronto 2B

CIRCLE ED-103 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature ...

High-Temperature Insulation 104

The company's Class "H", extra-thin, high temperature insulation is described in a 4-page, 2-color brochure. These materials, designed to effect size and weight reductions in electronic and electrical equipment required to operate at Class "H" temperatures, are described. Information includes test data, and suggested uses. Electro-Technical Products Div., Sun Chemical Corp., 113 E. Centre St., Nutley 10, N. J.

Spiral Tubing 105

An 8-page, 3-color brochure presents the company's high strength spiral tubing, which can be furnished in round, formed, formed and notched, square, and rectangular shapes. Properties of the material are listed, along with an illustrated description of the applications. A chart indicates the standard size ranges. Continental-Diamond Fibre Co., Newark 115, Del.

Hermetically Sealed Transformers 106

A new line of hermetically sealed transformers, designed to meet MIL-T-27 specifications, is described in a 4-page brochure. Included in the brochure are military standard filament transformers, military standard plate and filament types, military standard audio types, and filter reactors. Detailed specifications are included for each type. Ferranti Electric, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Nylon Molding Powder 107

A 16-page, 2-color brochure presents 30 case histories of successful uses of nylon molding powder. Of particular interest to electronic designers are the uses in transmissions, cable, coil forms, heat-resistant lenses, and insulation equipment. Many illustrations are provided, along with a chart indicating the properties of the material. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.

Coils and Capacitors 108

R-f coils, and capacitors are described in a catalog, which consists of a series of data sheets. Each type is illustrated by diagrams and charts. Information for each unit includes a description, features, uses, dimensions, terminals, ratings, and range of values, impregnation, markings, etc. Many types of coils and capacitors are covered. Jeffers Electronics, Inc., Div. of Speer Carbon Co., Du Bois, Pa.

Electronic Components

109

A 16-page catalog contains detailed specifications, illustrations, typical circuits, and applications for the company's electronic components, including vibrators, vibrator power supplies, sub-miniature tubes, voltage regulators, current regulator tubes, and resistors. These units are designed for such applications as high impedance potentiometer circuits, stabilizing cathode-ray tube circuits, portable communications equipment, high impedance electron voltmeters, etc. The Victoreen Instrument Co., 3800 Perkins Ave., Cleveland 14, Ohio.

Precision Electronic Instruments 110

A 2-color catalog, consisting of a number of data sheets, describes the following precision electronic instruments: laboratory signal generators, precision r-f step attenuators, variable frequency power supplies, standing wave indicators, and oscilloscopes. Specifications for each model provide information that includes frequency and attenuation range, output and input impedance, attenuation accuracy, power capacity, dimensions, and weight. Photographs and diagrams illustrate each item, and application information is included. Trad TV Corp., 1001 First Ave., Asbury Park, N. J.

Electronic Test Equipment 111

"Establishing the Industrial Electronics Laboratory" is the title of an article by L. E. Garner, Jr. which comprises this 12-page brochure. The article discusses such factors in planning an industrial electronics laboratory as preliminary considerations, laboratory layout, selecting test equipment, tools and shop equipment, and stocking the laboratory. Various instruments described include an intermodulation analyzer, audio oscillator, audio and square wave generator, electronic switch, voltage calibrator, tube checker, etc. Heath Co., Benton Harbor, Mich.

Shock Mounting Systems 112

"Visualizer" Bulletin No. 750 is a 16-page, 2-color booklet illustrating the development of all-metal engineered mounting systems for maximum vibration isolation and shock protection of electronic equipment. Through the use of pictures and cartoons, the bulletin defines vibration and shock, shows the effect of vibration on equipment, what can be done about it, and covers the application of the company's "Met-L-Flex" (knitted stainless steel wire) as the resilient and damping element. The company's line of mounting systems is illustrated. Robinson Aviation, Inc., Teterboro, N. J.

Meetings

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

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

May 20-22: AIEE-IRE Telemetering Conference, Edgewater Beach Hotel, Chicago, Ill.

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

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

June 11-12: High Frequency Communication Symposium, IRE Professional Group on Communications Systems, Long Lines Auditorium, 32 Sixth Ave., New York, N. Y.

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

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

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

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

June 22-24: Symposium on Microwave Optics, McGill University, Montreal, Canada.

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

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

Sept. 1-3: International Sight and Sound Exposition and Audio Fair, Palmer House, Chicago, Ill.

Sept. 1-4: AIEE Pacific General Meeting, Hotel Vancouver, Vancouver, British Columbia, Canada.

Sept. 21-25: 8th IRE National Instrument Conference and Exhibit, Hotel Sherman, Chicago, Ill.

Sept. 28-30: National Electronic Conference, Hotel Sherman, Chicago, Ill.

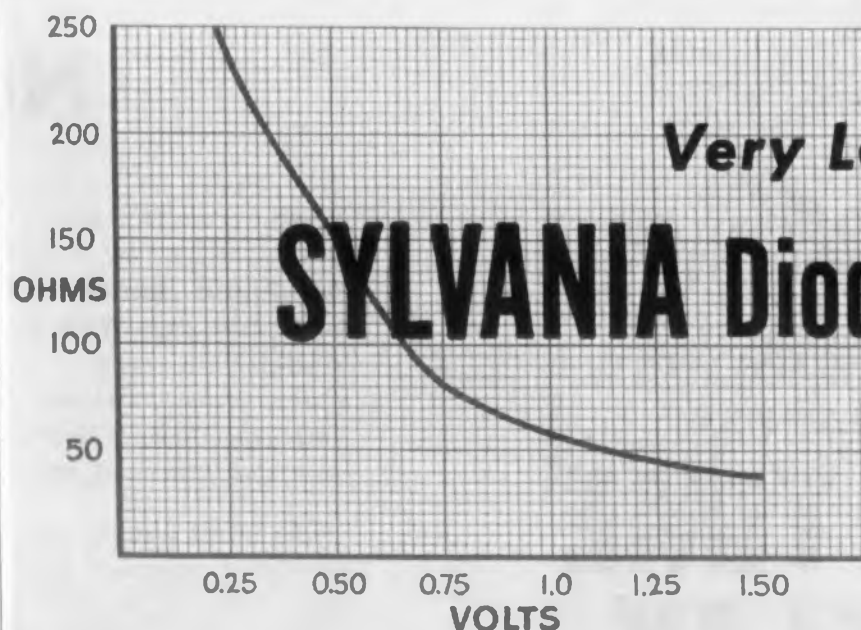
Oct. 26-28: RTMA-IRE Radio Fall Meeting, Toronto, Ontario, Canada.

Nov. 2-6: AIEE Fall General Meeting, Muehlebach Hotel, Kansas City, Mo.

1954

Jan. 21-23: SPE (Society of Plastics Engineers) 9th Annual Technical Conference, Hotel Statler, Boston, Mass.

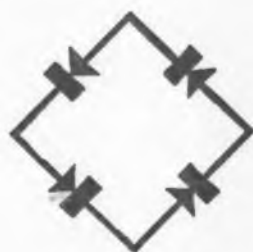
Feb. 4-6: 6th Southwestern IRE Conference and Electronics Show, Tulsa, Okla.



Typical 1N56 Forward Resistance Characteristic.



1N56 DIODE with potential of +1 volt will pass a current of 15 ma. or more. With a potential of -30 volts, less than 300 μ a will flow.



For Carrier Communications, 1N71 VARISTOR. The 1N71 consists of 4 matched low impedance diodes each of which, with +1 volt impressed, will pass a current of 1 ma. of the average current of the four.



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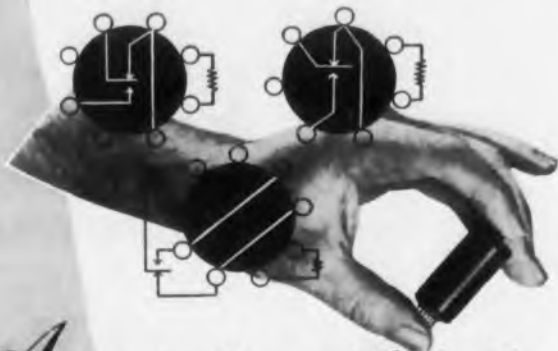
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NEW EUREKA "SNAPPER"

THERMAL TIME DELAY RELAY

FEATURES . . . SNAP ACTION. Single Pole Double Throw. Lightweight. Low operating temperature. Operates in any position. High contact rating. Gas filled. Low heater current. Durability and long life.

EUREKA PRESENTS POSITIVE
SNAP ACTION

The **ELIMINATION** of CHATTERING is accomplished with the incorporation of "POSITIVE SNAP ACTION" in the EUREKA "SNAPPER". . . LEADING ELECTRONIC MANUFACTURERS have acknowledged the new EUREKA "SNAPPER" as a major advancement in this field, and have already accepted this relay as a standard component of their latest equipment.

Voltage . . . 6.3, 26.5, 115 volts (A.C. or D.C.) or as required.

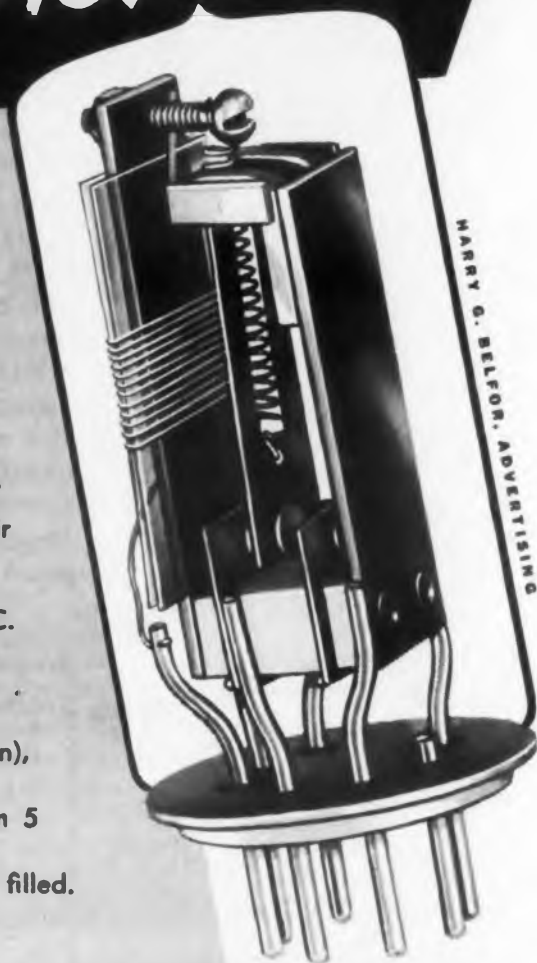
Ambient Temperature Range . . . -60°C. to + 80°C.

Envelope . . . Miniature (7 and 9 pin), or octal (8 pin) metal.

Time Delay Periods . . . Preset from 5 seconds up.

Vacuum . . . Evacuated, inert gas filled.

Height . . . 1 $\frac{3}{4}$ " maximum seated.



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New Books...

The Radio Amateur's Handbook 30th Edition, 1953 . . . *By the Headquarters Staff of the American Radio Relay League. 800 pages. American Radio Relay League, West Hartford, Conn. \$3.00.*

The latest edition of this standard manual of amateur radio communications lives up to the reputation of previous editions as being one of the biggest radio book bargains obtainable. It has been extensively revised to keep pace with the progress of amateur radio, including five chapters on v-h-f and u-h-f apparatus and techniques. A completely revised section on measurements has been incorporated, and as usual, the chapter on vacuum tubes (a very comprehensive source of information on this type of material), was given a very late deadline to make the data as up-to-date as possible.

In addition to the wealth of information on all phases of radio communications, a 180 page catalog advertising section is included which provides data on available products. Information is presented simply and clearly, and the book well deserves to be in any electronic engineer's reference library.

Radio Spectrum Conservation . . . *A report of the Joint Technical Advisory Committee of IRE-RTMA. 221 pages. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. \$5.00.*

This is the eighth in a series of reports prepared by JTAC and is subtitled "A Program of Conservation Based on Present Uses and Future Needs". The purpose of the book is to review the properties of radio transmission and to outline a course of action that will bring the benefits of radio transmission to the greatest number of the world's people.

The volume contains five chapters and a bibliography. The first of these is a historical survey which reviews the development of the radio spectrum from 1890 to the present time and outlines the activities of the international conferences which devised the present allocations. Chapter 2 summarizes the present state of knowledge of radio wave propagation from 10kc to 300,000Mc. Chapter 3 presents an ideal allocation table based on present knowledge, present and prospective needs, and current trends. Certain necessary assumptions (political and economic) are made to arrive at this ideal proposal. In Chapter 4 a critique of present allocations is made in view of present knowledge, trends, and present and prospective needs. Finally, in Chapter 5 specific suggestions are made for bringing the actual allocations more nearly in line with the ideal, including a "doctrine of conservation of spectrum resources" sufficiently flexible to deal with future developments.

Rare indeed is the electronic design man who would not profit by reading this thought provoking report.

Proceedings of the National Electronics Conference, Vol. VIII . . . *835 pages, National Electronics Conference, Inc., 852 East 83rd St., Chicago 19, Ill. \$5.00.*

The eighth volume of the NEC Proceedings includes (with only one exception) all the technical papers and luncheon speeches presented at last year's Conference (Sept. 29-Oct. 1, 1952). The papers (almost 100 in number) cover an extremely wide range of subjects including servomechanisms, electron tubes, audio, measurements, TV, equipment and component reliability, waveguides, transistors and semiconductors, computers, antennas, engineering management, circuits, and many others.

The editorial job appears to be well done, and the book is neatly done. The appendix contains a list of exhibitors at the Conference, and the contents of the previous seven volumes of the NEC Proceedings.

Amplifiers—The Why and How of Good Amplification . . . By G. A. Briggs and H. H. Garner. 215 pages. Wharfedale Wireless Works, Idle, Bradford, Yorkshire, England. Distributed by British Industries Corp., 164 Duane St., New York 13, N. Y. \$2.95.

According to the authors, this book is intended to supply the missing link between "Loudspeakers" and "Sound Reproduction", both books written by Mr. Briggs. These former works described the equipment used before and after amplification, and the present book tells the "in between" story in a very concise and easily readable manner.

After a brief explanation of how tubes operate and how they are used as voltage or power amplifiers, the authors discuss decoupling and instability. This is followed by a brief treatment of push pull amplification, negative feedback, phase splitters, and tone compensation.

Other topics discussed include pick-up input circuits, scratch filters, microphone and mixing circuits, power supplies, hum and noise, measurement of distortion, and a discussion of the circuit and tests on an amplifier designed by Mr. Garner. The book ends with a series of questions and answers on a number of points covered in previous chapters, as well as a number of useful tables.

Vacuum Tube Oscillators . . . By William A. Edson. 476 pages. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. \$7.50.

Although practically all of the work presented in the book has been published previously in various forms, the author has performed a valuable service by gathering it together from many scattered sources and integrating it into a single work with a uni-

form notation and several coordinated viewpoints in a logical sequence. The purpose of the book is to explain the behavior, design, and operation of vacuum tube oscillators.

To accomplish this task the author favors the viewpoint of design over that of analysis, and uses mathematics freely wherever it is helpful. The first five chapters lay the foundation for the material to follow, including such topics as transient behaviour of linear systems, negative resistance oscillators, nonlinear oscillations, and feedback systems and stability criteria.

Then follow chapters on various kinds of oscillators, their behaviour and operation under different conditions, and a discussion of various phases of oscillator design, including locking and synchronization, frequency multiplication and division, tube and thermal noise, modulation of oscillators, automatic frequency control, and long line and multiple resonance effects.

In circuit diagrams, the author uses the symbol ∞ to represent the value of by-pass capacitors, and choke coils to indicate that the corresponding admittance or impedance is effectively infinite. This is done to help concentrate attention upon the elements that actually control the behavior of the system.

An extensive bibliography as well as a name and subject index also are provided.

U-H-F Converters . . . 44 pages. Howard W. Sams & Co., 2201 East 45th St., Indianapolis 5, Ind. \$1.00.

This work contains detailed descriptions of the design and operation of the new u-h-f converters and tuners. All the popular converter designs are covered (21 models of 14 manufacturers), including circuit diagrams and descriptions of design details.

For the electronic designer the book is a quick and easy summary of the present commercial status of u-h-f TV. Also included is a table listing present TV channels and frequency allocations.

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It's simple! It saves space! It saves money!
... Actuated by electrical impulses, the Kellogg Magnetic Impulse Counter performs the counting and marking function of a chain of 10 to 20 relays or of a two-magnet ten-point stepping switch, in less space and with top reliability! It has a wide application in many fields—from industrial control to any system where trains of impulses, such as generated by a telephone dial are to be counted.

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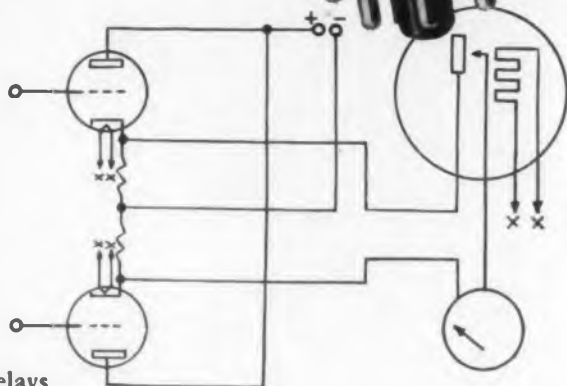
Sensitive Galvanometer Used in Guided Missile Research...



...Protected by an EDISON Time Delay Relay

Malfunction or failure of recording equipment when a guided missile is fired can result in the loss of invaluable research data. The requirement of complete reliability of components used in conjunction with this equipment resulted in the selection of an EDISON Time Delay Relay as a vital part of the Model 46A Sub-Carrier Discriminator manufactured by Electro-Mechanical Research, Inc., Ridgefield, Conn.

The Edison Time Delay Relay is used to protect the sensitive galvanometer in the associated oscillographic recording unit, by allowing the power tube filaments to reach proper operating temperature before the application of high voltage. The thermal action is independent of line voltage variations since the delay characteristics vary in the same proportions as the heating of the filaments. Because of their cooling rate, EDISON relays prevent loss of equipment operating time due to momentary power interruptions.



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Patents . . . By John Montstream

Tuning Indicator System . . . Patent No. 2,624,837. B. D. Loughlin, Lynbrook, N. Y. (Assigned to Hazeltine Research, Inc.).

Accurate tuning of a receiver for reception of amplitude modulated signals is usually based upon an indicator which is responsive to the magnitude of a unidirectional current or voltage which varies with the average amplitude of the signal. The average amplitude is greatest when the receiver is accurately tuned so that audible tuning provides a sufficiently accurate type of tuning. A frequency modulated receiver on the other hand has a response which is fairly uniform over a relatively broad frequency band; hence a tuning indicator responsive to the amplitude of the signal including audible tuning is not an accurate method of tuning such receivers.

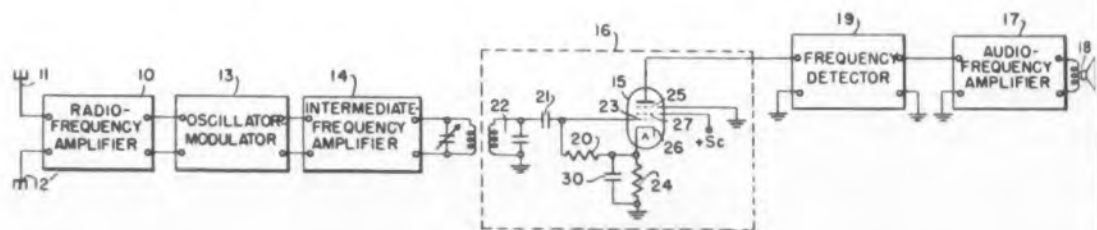
Many persons prefer tuning a receiver by ear at the maximum signal volume, ignoring any visual indicator and usually fail to achieve accurate tuning. The circuit of the patent enables an f-m type of receiver to be accurately tuned by ear and by means of an inexpensive circuit arrangement.

The circuit is illustrated in three forms, one of which includes a tube having cathode, anode, and three grids. The circuit comprises two portions, the first portion including a control grid (23) coupled through a capacitor (21) to an i-f resonant circuit (22), and the cathode (26) is

connected to the control grid through a grid leak resistor (20). The cathode is connected to ground through a resistor (24) and shunt capacitor (30). The control grid portion of the circuit is proportioned to develop a predetermined relatively fixed amplitude limiting level.

The second portion of the tube includes the screen grid (27) connected with a source of potential and the suppressor grid (25) connected with ground. This second portion is effectively independent of the first portion and is arranged so as to develop a virtual cathode at the suppressor electrode which in combination with the anode cathode electrodes controls the transconductance of the tube.

As the circuit is tuned towards the mean frequency of the signal, the control electrode becomes positive on the positive peaks of the signal. Control grid anode current results which charges the coupling capacitor and develops a negative potential across the grid leak resistor which in turn reduces the average current flow through the tube and the unidirectional potential across the cathode resistor. The latter is applied with a negative polarity to the suppressor grid whereby the tube transconductance is increased and increases progressively with the intensity of the i-f signal for all values larger than that at which the control grid becomes positive. The largest amplitude is developed when the circuit is accurately tuned and the circuit may be tuned by the volume of reproduced sound coming from the loudspeaker.



Measuring System . . . Patent No. 2,624,780. J. F. Byrne, Garden City, N. Y. (Assigned to Hewlett-Packard Co.).

An improved method for determining the impedance characteristics of a circuit or components at high frequencies is explained, and apparatus for making the determination is described. The equipment and method are intended to simplify making these measurements quickly by unskilled personnel.

The apparatus consists of two auxiliary coaxial lines coupled at the same point to the coaxial transmission line, which is connected with a load, the impedance characteristics of which are to be determined. One of the auxiliary lines is magnetically coupled to the transmission line by using a small loop probe, and the other auxiliary line is coupled electrostatically to the transmission line by using a disc like probe. Both lines are terminated by a resistor equal in value to the characteristic impedance of its respective auxiliary line so that there will be no standing waves.

The two probes are mounted in piston attenuators and connected together upon a carriage so that as one probe moves towards the transmission line increasing its coupling therewith, the other moves away thereby decreasing its coupling with the transmission line. By adjusting the relative attenuation, the currents in the two auxiliary lines are made equal and the other parameters are known so that by proper calibration of the relative position of the probes in the piston attenuators, or the position of the carriage, the relation between the transmission line voltage and current can be read directly.

In order to determine when the currents in the two auxiliary lines are equal, the ends of the auxiliary lines are slotted and a probe extends into each slot. The probes are mounted for movement together (on a carriage for example) and so that as one moves away from the end of its line the other moves towards the end of its line thereby shortening one line while increasing the length of the other. A point can be found where the currents in the two lines are 180°

out of phase. A transformer is connected between the probes, and a null indicator is connected with the transformer to read zero when the currents are equal. A balance can be secured by alternately adjusting the two carriages until a null position is secured.

Royalty-Free AEC Patents

As part of its program to make non-secret technological information available for use by industry, the United States Atomic Energy Commission has sent descriptions of 15 patents owned by the U. S. government to the U. S. Patent Office for registry and listing in the official register of patents. The AEC will grant non-exclusive, royalty-free licenses on these patents.

Of special interest to electronic design, development, and research engineers are the following six patents in this group:

Comparative Photometer; (Patent No. 2,626,989); A. A. Brown, inventor. This patent describes an improved method and apparatus for producing relative motion between a comparative photometry assembly and objects to be scanned. This improved combination and arrangement of electronic photometric apparatus, mechanical apparatus, and photographic images is useful in the simple and rapid production of comparative photographs.

Amplifier Circuit for Testing; (Patent No. 2,628,268); Q. A. Kerns, inventor. This patent covers improved electronic circuitry for automatically determining the current-voltage characteristics of an electrical device. The arrangement provides an input circuit for an amplifier having a negative feedback circuit whereby the input is distorted a minimum amount at the output.

Portable Voltage Supply for Radiation Counters; (Patent No. 2,628,338); C. D. Gould, inventor. This patent describes a portable, manually operated, adjustable high-voltage power supply for use in connection with a Geiger tube radiation measuring instrument. The invention makes use of a spring-powered generator adapted for manual operation as the energy source of the power supply which, by means of associated components and circuitry, is used to

recharge the capacitor power supply of the Geiger tube as needed.

The calibration on the carriage for the piston attenuators will be dependent upon frequency; however, a scale multiplying factor can be used to make the correction for other frequencies. Refinements of the apparatus also are described in detail.

recharge the capacitor power supply of the Geiger tube as needed.

Radioactive Resistor; (Patent No. 2,629,837); J. M. Benade, E. E. Goodale, W. P. Jesse, inventors. This patent describes an improved novel radioactive type resistor which does not exhibit any self-induced or self-generated voltage when no external source of voltage is applied to the electrodes. The unit comprises in part a sealed envelope containing an ionizable gas, a pair of electrodes, radioactive means for effectuating ionization of the gas, and a member of electrically conducting material disposed in contact with a portion of the surface of one of the electrodes. The latter is of such a nature that the self-induced voltage is of opposite sign and equal magnitude to the self-induced voltage of the electrode with which it is in contact.

Tachometer; (Patent No. 2,630,529); E. R. Mann, R. G. Hester, inventors. This patent describes an improved tachometer of the mechanical-electronic type adapted to produce an output voltage accurately proportional to the speed of a rotating shaft or the like over a wide range of speed.

Electrical Apparatus and Method; (Patent No. 2,633,540); V. C. Wilson, J. A. Simpson, inventors. This patent describes an electrical field reversing circuit employed in conjunction with a radiation counter tube, such as a G-M tube, which speeds up the collection of the positive ion cloud, thereby decreasing the dead time of the counter tube to values of less than 10⁻³sec and consequently making the counting tube faster.

Applicants for licenses should apply to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C., identifying the subject matter by patent number and title. Copies of these patents may be obtained from the U. S. Patent Office.

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