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This transformer is tunable... ideal for signal frequency amplifiers.

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This Varitran supplies fixed filament and bias voltages, as well as variable plate voltage all in one unit.

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MAY • 1943

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CHANGES OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
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Director of Circulation:
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To ..........................................

Signed ........................................
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May 1943 — ELECTRONICS

ELECTRONICS — May 1943
There are no bright sides to war. But from the efforts expended to win the war, is coming a harvest of great things.

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5. Giant Photo-cell Tube
6. 3-inch Straight Projection Cathode Ray Tube
7. 12-inch Cathode Ray Receiving Tube
8. Sound Film Photo-cell Tube
9. 7-inch Straight Projection Cathode Ray Tube
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May 1943 — ELECTRONICS — May 1943

Homecoming day 194X

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Some day soon, those untiring warriors and workers will be coming home from the firing line and the war plant. Like the fighting men and the working men and women whose jobs they have expedited, they’re going to look around this new America of ours for work to do!

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May 1943 — ELECTRONICS
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Applications

Engineer Data

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Acceptable Revisions:

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Perhaps we can talk about a coil problem... how thoroughly we're organized to help you on such a problem only military censorship forbids telling now. Or it may be that you manufacture your own coils and will be interested in discussing magnet wire—any shape—any insulation.

As a matter of fact, perhaps we can get together now, but if it happens we can't, remember we have a date in and for the future.

When we meet we can talk about a coil problem... how thoroughly we're organized to help you on such a problem only military censorship forbids telling now. Or it may be that you manufacture your own coils and will be interested in discussing magnet wire—any shape—any insulation.

As a matter of fact, perhaps we can get together now, but if it happens we can't, remember we have a date in and for the future.
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WE HAVE THEM

We have provided additional facilities to accept orders according to your specifications for prompt delivery.

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NEWARK, N. J.

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Applications of vinyl chloride-nitrocellulose resins for coatings include consumer linings, surface coatings for electrical equipment, corrosion-resistant linings for processing equipment, wall-finish coats, heat-sealing paper coatings, ceramic finishes, and waterproof cloth coatings. Coatings based on vinyl butyral resins are also used for most rough and smooth, in use in microscopic, hospital dressing, paper, and inadhesive equipment. Coatings based on these latter resins can be made heat-curing through proper modification.

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Unusual toughness, resistance, and impact resistance are characteristics of adhesives made of Vinylite Resins. These resin adhesives are widely used as bonding agents for such materials as metal, paper, cloth, wood, and plastic, and they are available as powders for the compounding of adhesives, or as solutions sold under the trade name “Vinyl Cells.” The latter are especially recommended for bonding impervious materials, such as metals, and the area and phenolic plastics. Their bonding strength is comparable to that obtained with solid adhesives. An outstanding example of their use is the limitation of voids in small metal castings. By the addition of plastifiers, adhesives based on Vinylite Resins can give almost any degree of flexibility desired.
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...Veterans in Freedom's Cause!

...WHEN YOU'RE IN THE THICK OF IT
You Realize the Value of Superior Equipment

Long before America herself was at war, Taylor Transmitting Tubes proved they could stand up under the grueling stress of actual combat on many Allied battle-fronts.

Today, thousands of Uncle Sam's lighting communications men know the assurance of Taylor dependability - know that Taylor Tubes deliver maximum power and extra hours of performance far beyond the needs of normal service.

With each passing day, the growing production of Taylor Tubes becomes an increasingly decisive contribution toward Victory. With this goal attained, Taylor will again supply many advanced types of "More Watts Per Dollar" tubes to peace-time America.

Taylor TUBES INC., 2312-18 WABANSIA AVE., CHICAGO, ILLINOIS

May 1943 — ELECTRONICS — May 1943
problem is obtained by connecting, with a straight edge, two important design quantities and reading the third on some additional scale. In several cases, where complicated functions are involved, a series of such straight edge operations may be required. There are also a few charts in which the reference or index turning point necessarily takes the form of a curve rather than a straight line.

Undoubtedly the use of nomographs in which a numerical solution is quickly arrived at by means of the proper placement of a straight edge on a number of scales considerably speeds up numerical computation, particularly if many similar operations are to be performed. The abacs have the further advantage of giving a visual indication of the manner in which the desired results may vary as many of the individual parameters in the problem are varied. A further advantage is that with such nomographs it is frequently possible to obtain optimum circuit conditions much more rapidly by graphical than by purely algebraic means.

For each individual nomograph, a separate page is devoted to the correct method of using the chart. However, in only the simplest cases does the author indicate the fundamental equation from which the nomograph has been derived. Thus, the engineer or designer who may be mentally curious as to whether or not the abac in question applies precisely to the particular problem at hand, has no way of checking his results analytically, from the data in this volume.

The thirty abacs in this volume comprise the more commonly employed formulas used in radio engineering, such as those for Ohm's law, wavelength and frequency relation, resonant condition of inductances and capacitances, the relationship between power ratios and decibels, design of iron core chokes, design data for power transformers, and the impedance of a parallel tuned circuit at resonance. The selection of topics and charts has been wisely made for the average radio designer. Each nomograph is well executed and is approximately 6x8½ inches in size. The book has a plastic binder so that the sheets lie flat on the desk when the volume is in use. The designer of typical radio equipment should find the use of these abacs a valuable aid in saving time and elimination of errors due to replacement of the decimal point._H.B.

Essential Mathematics

THE MATHEMATICS required by the average skilled worker is presented by the authors in this almost pocket-size book with extreme emphasis upon practical examples and problems and with a minimum of abstract theory. As such, the book can be of real value to beginning high school students who plan to become skilled workmen, to those who do not have the time to take the several different courses required for a general knowledge of shop mathematics, and to men in industry who desire to review mathematics and have a reference book. Subjects covered include arithmetic, algebra, geometry, trigonometry, use of the slide rule, logarithms, and graphs, as applied to practical problems of the airplane industry, the machine shop, the sheet metal shop and the radio industry.—J.M.
NOW HOPE HAS A HELPER

The hopelessness of waiting on a cruel sea for days or weeks—with help just over the horizon—will probably not be experienced by another crew from another disabled bomber. Now emergency life rafts are equipped with radio transmitters with a kite and a length of antenna wire. Now a call for help will travel over the ocean to friendly ears... and the shipwrecked have something more reassuring than a bare hope of rescue.

Belden Wire is used in this life saving apparatus... as well as in a thousand other types of electro-mechanical war equipment.

Belden WIRE

May 1943 — ELECTRONICS — May 1943

THE "GLOBE" IN GLOBE WIRELESS

GLOBE WIRELESS has long been the major avenue of communication throughout the entire Pacific basin, handling radio messages between continents, countries, islands, and ships at sea.

"Our equipment has transmitted millions of words since it was designed for us by Heintz and Kaufman," states Globe's President R. Stanley Dollar.

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A typical Globe transmitter, such as daily puts San Francisco in contact with Chungking, has two HK-654 Gammatrons in the first. Operating on high frequencies with an output of 3 kilowatts, Globe's signals can readily be heard around the world.

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HEINTZ AND KAUFMAN, LTD.
SOUTH SAN FRANCISCO • CALIFORNIA, U.S.A.
Gammatron Tubes
RESEARCH
THE SOURCE AND SENTINEL OF
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In the design and manufacture of transformers, reactors and rectifiers— for war and industry— Amertran moves steadily forward through research.

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Continuous research, in the field as well as in the laboratory, helps to keep Amertran out in front in radio and electronic applications. It also supplies the background for an intelligent approach to your problems.

Whether your problem is a finished product, ready for service, or a component for your own assembly, you may have the full benefit of Amertran research through our engineering cooperation.

AMERICAN TRANSFORMER COMPANY, 176 EMMET ST., NEWARK, N.J.

AMERICAN MANUFACTURING SINCE 1911 AT NEWARK.

SLATER ELECTRONIC TUBES

... in Front at the front...

Thousands upon thousands of Slater Electronic tubes are faithfully serving our armed forces everywhere. And such confidence is truly a tribute to Slater's electronic research and precision manufacture. For the name Slater on an electronic tube is synonymous with dependability of performance under the severest conditions.

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A Slater Engineer will gladly confer with you regarding your electronic problems.

SLATER ELECTRIC & MFG. CO.
BROOKLYN, NEW YORK

Manufacturers of Special Precision Electronic Tubes and Equipment.

Also manufacturers of Incandescent Street Lighting Lamps.
Every one of us at Thomas & Betts was honored recently to receive the Army and Navy "E" Award for outstanding production of War materials.

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We feel an even greater honor. That is, the privilege of making unspectacular but essential electrical fittings for the War machinery used by our fighting men on land and sea and in the air. Our supreme honor is the opportunity to help our armed forces win the War.

And so we cannot rest on our laurels. To us the Army and Navy "E" Award says: "So far, so good; but go faster and do better."

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MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899

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ELECTRONIC
AC VOLTMETER
AND ACCESSORIES

This enormous range of voltages—five hundred million to one—is accurately covered by one Model 300 Electronic Voltmeter and some of the accessories shown above. Frequency range 10 to 150,000 cycles. Accuracy 2½% over most of the range. AC operation. Five-decade ranges with logarithmic scale make readings easy. Uniform decimal scale also provided. Over a thousand of these instruments are giving excellent service in Government, commercial and university laboratories and factories.

Send for Bulletin 8

BALLANTINE LABORATORIES, INC.
BOONTON, NEW JERSEY, U.S.A.

May 1943 — ELECTRONICS
SALUTE TO THE WORKERS OF TOMORROW

DESIGNERS
AND MANUFACTURERS
of all types of precision electrical apparatus including
D.C. & A.C. Motors for specialized purposes
Aircraft Generators
Aircraft Engine Starters
Alternators
Motor Generators
Electric Pumps
Motors with Governors
Vvvs, etc.

Planes may become as commonplace as today's motor cars.

WITHOUT VISION, THE PEOPLE PERISH.

But we have a vision of a brave new world—wherein all men are free and all men share in the rewards of a more glorious civilization.

What the face of this world will be like, none can know. Will factories be of revolutionary design—lighted by the health rays of artificial sunlight? Will the workers travel to and fro in their own planes—with ample leisure for education and relaxation?

This much we know. Out of modern, forward-looking industries such as Small Electric Motors (Canada) Limited, come electrical equipment, for ships and planes, for factories and homes, of revolutionary design.

For here is a new company in Canada—with new ideas and ideals. Now engaged solely in original designing and precision making of essential war equipment, Small Electric Motors (Canada) Limited looks confidently to a brilliant post-war future.

Small Electric Motors (Canada) Limited
and its subsidiary
Semco Instruments Limited

Circuit Protection?

Put it up to

HEINEMANN
MAGNETIC
CIRCUIT BREAKERS

These breakers provide the ideal combination of time delay (to prevent nuisance tripping on harmless starting surges) and high speed interruption of short circuits. The tripping action is made to occur when the current is zero. Amperage ratings between 500 milliamperes and 50 amperes may be matched accurately to the load by proper wire size and ammeter turns on the mho-coil. 3600 amperes short circuit interrupting capacity is accomplished by magnetic through action.

HEINEMANN CIRCUIT BREAKER CO.
Subsidiary Heinemann Electric Co., Est. 1888

LEASIDE • TORONTO 12 • CANADA

May 1943 — ELECTRONICS — May 1943
The new R.C.P. Model 553 Cathode Ray Oscilloscope fills the need for an extended frequency 3" scope. The compactness, comparative light weight, sturdy construction and low power consumption of this instrument makes it ideal for field work. All controls and terminals are positioned on the front panel. Switching arrangements will connect input either directly to deflection plate or to amplifier. Position and stable locking of image can be obtained with either internal or any external signal. Built-in sweep bas the widest range consistent with good linearity.

Input impedance through either amplifier is 0.5 megohms and 20 mmfd. Input impedance without amplifier is 2.2 megohms and 40 mmfd. Maximum deflection sensitivity through amplifiers is 0.6 volt, r.m.s., per inch. Without amplifiers: deflection sensitivity is 35 volts, r.m.s., per inch. Frequency response is flat within 5 db from 20 to 120,000 cycles. Sweep frequency range is 25 to 22,000 cycles. Internal 60 cycle synchronizing source is provided in addition to terminals for connecting an external source.

Model 553 Cathode Ray Oscilloscope is supplied in a black crinkle non-corrosive steel case, 12 1/2" x 8 1/2" x 13 3/4". The scope operates on the standard 110 volt a.c. and 110 volt 60 cycle A.C. power supply and has a power consumption of 50 watts. Supplied complete, ready for operation with convenient carrying handle. Net $76.00.

Other instruments in the complete line of R.C.P. electronic and electrical test instruments described in catalog material available on request. If you have an unusual test problem that cannot be logically solved by the instruments described in these catalogs our engineers will be glad to cooperate in finding the most efficient solution.
War is destructive but not all effort that goes into the big fight is wasted. Some of it is going to pay mighty big future dividends. That is especially true of the war work that is going on in the country's laboratories.

At Formica this work has resulted in the development of new insulating materials with new and valuable characteristics which will be doing important jobs in American electrical products long after the war is over.

Three new grades MF, FT-10 and FT-41 accomplish things that could not be done previously with this laminated insulation. MF is a glass mat base for applications requiring low loss at radio frequencies (Power Factor .01; Dielectric Constant 4.5; Loss Factor .05 at 1 Megacycle).

F-12 is Fiberglas fabric base material combining good dielectric strength and heat resistance. And FT-41 is designed to resist arcing.

These materials have a new and important usefulness. At present they are available only for the most essential war uses. But later they will be widely applied.
We are not jealous here at Sylvania to be the largest in our field. We had rather be known for excellence than for size. You have heard of the man so paintstaking that to his talented fellows of larger fame he is known as the writer's writer, the painter's painter, or the singer's singer. We understand that, and it seems to us that there could be no higher praise. So in all the things we build—incandescent lamps, fluorescent lighting equipment, radio and electronic tubes—we aim uncompromisingly high, high as we possibly can. The function of these things, conceived as they are to amplify the indispensable miracles of human sight and hearing, seems to us to deserve the very best that can be given. So believing, it is only natural we should seek in all our work to attain the highest standards anywhere known.

SYLVANIA ELECTRIC PRODUCTS INC.
EMPIRE BUILDING, BABYLON, N. Y.
MAKERS OF INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, CATHODE RAY TUBES AND ELECTRONIC DEVICES

INDUSTRIAL ELECTRONICS is doing much to help win the war on the production front, but can do a great deal more by more widespread application. Sylvania Electronic Tubes for devices that can automatically gauge, count, control, actuate, test, detect, protect, guide, sort, magnify, heat, transform, "see," "feel," and even "decide" are tested and available. The more electronic "know how" is put to work to make precision war production swifter and more precise, the sooner the Victory.

GULLIVER...fresh from travels to his fabled land of giants...might readily have taken this for a mammoth musical instrument, its strings stretching skyward fifty feet or more. The scene, however, is an interior "close-up" at the huge Auto-Lite plant in Port Huron, where wire and cable for essential commercial uses is in mass production. Here is a "run" of industrial wire being coated with synthetic enamel.

Auto-Lite's Wire Division is a major source for countless types of wire and cable employed by electrical manufacturers in various fields. Auto-Lite's research and engineering facilities are constantly perfecting products to meet the most baffling applications. Keen interest today is focused on newer wire insulation developments. Butyrate Tape and Vinyllite are two types being used for lighting and low tension circuits in radio production, aircraft construction and other vital war needs.

Whatever your problems...no matter the shapes, sizes or performance characteristics...feel free to write us for authoritative recommendations.

PORT HURON, MICH.  THE ELECTRIC AUTO-LITE COMPANY  SARANIA, ONTARIO

AUTO-LITE ELECTRICAL WIRE and CABLE

WHAT HAVE WE HERE...A Brobdignagian HARP?
IT WILL SAVE A LIFE

but it will not work without tubes!

ONE of the greatest developments in modern radio lighting is the pump communications unit, enabling farmers to keep in constant communications with their chief... not only does this unit provide the means of instant direction of men and equipment but it saves time and lives!

New tube application are almost a daily occurrence as RAYTHEON'S vast wartime effort progresses... RAYTHEON'S engineering skill and manufacturing facilities are responsible for RAYTHEON tubes being in the vanguard of tomorrow's match of progress.

MORRISON'S 45 YEARS
THE ELECTRICAL INSULATION HEADQUARTERS

FREE FOR THE ASKING!

Write today for your Free Card of Varnished Tubing with samples ranging from size .02 to 20 to fit wire from .05 to .375 inches... other valuable aids, are the M-R Guide Book of Electrical Insulation... the Wall Chart with resistance tables, electrical symbols, allowable capacities of conductors, dielectric averages, thicknesses of insulating materials and tap drill sizes... and the M-R Waxed and Compound Guide Book... they are full of valuable information... write for them on your letterhead.

MITCHELL-RAND INSULATION COMPANY, INC.

51-A MURRAY STREET

CORTLANDT 7-9264

NEW YORK, N.Y.

RAYTHEON MANUFACTURING COMPANY

WALTHAM AND NEWTON, MASSACHUSETTS

DEDICATED TO RESEARCH AND THE MANUFACTURE OF TUBES AND EQUIPMENT FOR THE NEW ERA OF ELECTRONICS.

ELECTRONICS — May 1943
As millions of controls are Electronically tested...

DuMONT CATHODE-RAY TUBES score over 5000 hours of trouble-free service

* Hour after hour, day-in-day-out, DuMont cathode-ray tubes check Clarostat controls coming off the production line. The single-dot trace meandering diagonally across the screen in response to resistance vs. rotation, provides "all the answers" at a glance for inspectors and engineers alike.

In several Clarostat-designed test positions, DuMont tubes check controls ranging from 1000 ohms to 10 megohms. Resistance curve, taper, hop-off, transition points or ink blends, flaws or cracks, possible noise sources, useful rotation — these are checked visually, positively, quickly; far better than with the usual earphone test.

In such service for several years past, DuMont tubes have already scored well over 5000 hours each, and are still going strong, without a single failure or replacement. Compared with the 50-hour life expectancy of early tubes, this tells the story of a decade of remarkable engineering and production refinement, as well as the exceptionally high vacuum of DuMont tubes.

Altogether a typical industrial application which, because of the hour-after-hour operation, provides convincing evidence of DuMont tube life. And especially significant today when such tubes are used for many continuous-service functions.

ALLEN B. DU MONT LABORATORIES, Inc.
Passaic, New Jersey
Cable Address: Westapel, New York

FLEXIBLE VARNISHED BIL L TUBING

Feautured in locomotive interiors and features the highest of resistance standards, assures complete, safe insulation, with Amel, etc.

EXTRUDED PLASTIC TUBING

Corresponding the most required high class in the plants art, it makes it possible to produce a tubing of a uniform diameter, without any visible imperfection, and is not wet.

VARNISHED GLASS TUBING

Correspondent to extremely high quality, and specially suited for varied data, industrial, scientific work, and other similar applications.

WIRE IDENTIFICATION MARKERS

Suited to meet various specifications, ease, flexibility, use, height or other factor, and are used on TURBO product. May be supplied for electrical, mechanical, or other applications, non-phonograph, non-jewelry, etc.

TURBO is carrying the ball in this game, too!

And that's only part of the story. The behind-the-scenes role is another. Research, experimentation, testing for innumerable applications ... for extremes in operating conditions ... for increased efficiencies and dependability—that's the other side.

When bombers fly for commerce again, when ships ply the sea lanes with travelers and cargoes, and tanks return to foundry melting pots ... TURBO will endow new meaning to all-purpose electrical insulation.

Industrial equipment, tools and machines, appliances, radio, television, civil aeronautics, therapeutic and surgical devices, laboratory apparatus, etc.—all will benefit from the new electrical and mechanical advantages, properties and characteristics of TURBO ... gained now when they are needed most.

Specimen boards, with samples of each TURBO product, together with a list of standard sizes, will be sent promptly on request. Write now.

WILLIAM BRAND & CO.
174 FOURTH AVENUE, NEW YORK, N. Y.

Turbo tubing, Satin Tube, Cables, Cloth, Plastic, Glass, etc.
Dependable, Low Loss
Steatite Insulators

"STEATITE" has become a magic word. It is not a copyrighted trade name, but is the geologic name for massive talc, a magnesium silicate, used in the production of "radio grade" ceramic insulators. However, Supakoff Steatite Insulators, for low loss at high frequency, are superior in quality and dependability.

The dependability of Supakoff Steatite Insulators is the result of a combination of important factors. They include the absolute control over raw materials, modern manufacturing facilities equipped with precision tools, correct engineering, and most important of all, the invaluable experience and knowledge gained through years of producing ceramic insulators.

Our ceramic manufacturing facilities are devoted entirely to the production of Supakoff Insulators for equipment used by the Signal Corps, Army and Navy. Never before has it been so important to have radio and electronic equipment perform with such a high degree of dependability. With this thought in mind, extra precaution is taken throughout our entire manufacturing process, so that Supakoff Steatite Insulators will function under the most severe conditions.

STUPAKOFF CERAMIC AND MANUFACTURING CO.,
LATROBE, PA.

Improved in War!
... for Better
Peace-Time Reception

The rigors of modern warfare are the world's finest proving grounds for communications equipment. Constant usage and unusual operating conditions in every climate are a severe test of the communications receiver. Hallicrafters equipment is proving its high quality performance capabilities with our armed forces.

Hallicrafters communications receiver Model SX-28 (illustrated) 15 tubes, 6 bands, delivers outstanding reception... your peace-time model will be worth waiting for.

Hallicrafters
CHICAGO, U.S.A.
The World's Largest Exclusive Manufacturer of Short Wave Radio Communications Equipment
Radio transmitters and receivers are fine, sensitive instruments. But they aren't delicate—at least not the ones military service. The terrific jolting and jarring received are tanks battling over desert terrain, and the tremendous stress encountered in bombers diving at enemy positions require that can really take it. And that's just what the U. S. Army Signal Corps and radio manufacturers have developed. Such an achievement called for skillful design and construction, and materials can stand the gaff. Delicate elements in radio tubes are made of tough, durable nickel. The following high mechanical properties of nickel count for its wide and successful use in tube elements.

**INCO NICKEL ALLOYS**

- **MONEL**
- **"K" MONEL
- **"N" MONEL
- **"N-6" MONEL
- **INCONEL
- **"F" NICKEL
- **"PH" NICKEL

Sheet... Strip... Rod... Tubing... Wire... Cables

---

**TEMPERATURES—**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Tensile Strength (ksi)</th>
<th>Elastic Modulus (ksi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room</td>
<td>97,100</td>
<td>111,000</td>
</tr>
<tr>
<td>-110</td>
<td>103,460</td>
<td>112,900</td>
</tr>
</tbody>
</table>

**Elasticity**

- Young's Modulus: 15 x 10^6 in./lb.
- Approximate elastic limit: 8%.

**STRENGTH AT ROOM TEMPERATURES**

<table>
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</tr>
</tbody>
</table>

**HIGH MODULUS OF ELASTICITY**

A measure of Young's Modulus. Nickel's Young's Modulus is 15,000,000,000 psi. This means minimum elastic deformation of about 1%. This, plus the high damping characteristics, make Nickel the ideal metal for many electronic applications.

**STRENGTH AT HIGH TEMPERATURES**

- Normal annealed Nickel retains its strength at high temperatures, the drop in yield strength occurring at about 700° F.
- Nickel remains ductile up to about 1500° F.

**STRENGTH AT ARCTIC TEMPERATURES**

- Nickel is hard at both high and low temperatures, and retains its high strength at temperatures as low as -100° F.

---

30 to 50% WEIGHT

IN RADIO TRANSFORMERS AND OTHER ELECTROMAGNETIC APPARATUS WITH HIPERSIL* CORES

On a soldier's back or in a plane, ounces quickly become pounds. That's why a new material that can cut weight and increase efficiency is important news.

Hipersil, the new magnetic steel, does just this. It increases flux-carrying capacity ½... saves 30 to 50% weight.

At present, Hipersil cores are used in a steadily increasing variety of communication applications... in radio transformers, chokes, relays, reactors and loading coils. They should be used wherever high permeability is wanted at both high and low densities, and where high fidelity and light weight are of greatest interest.

Hipersil makes possible these design improvements:

- **SMALLER SIZE** of core cross sections and coils... ideal for airplanes, tanks, submarines, "walk-up" sets.
- **WIDER RANGE OF LINEAR RESPONSE**. Knee of the saturation curve for Hipersil is higher than for ordinary silicon steel. It gives approximately 50% greater straight-line response for winding and core cross section.
- **Simplified Construction.** Split-core design makes coil and core easy to assemble, saves man-hours. No laminations—just two or four pieces to handle.

Ask your Westinghouse representative about standard Hipersil core sizes now available.

---

**GET THE FACTS ABOUT HIPERSIL**


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**Westinghouse**

Plants in 25 cities... Offices everywhere

**May 1943 — ELECTRONICS — May 1943**
"Survivors sighted... proceed to rescue"

Through the blue comes the message that tells men in the air what to do... where to go. These messages must not, cannot, fail, for the whole operation of our Army and Navy Air Forces depends upon the vital artery, Communications.

Streamlined for this most exacting job, ROLA is devoting all of its facilities and its energies to the production of wartime electronic equipment—transformers, headsets, chokes, coils, and related devices. And, thanks to its long experience in this field, ROLA has been able to develop machines and methods to speed production, prevent spoilage and improve performance...all to the end of better communications for our fighters in the air.

Today, all these developments belong to the War Effort. Later, we are confident, they will be of great significance in the field of peacetime Electronics. 

ROLA has done an outstanding job, both as prime contractor, and as subcontractor for other manufacturers and it can further utilize its expanded plant equipment, its increased knowledge and skill, in the War Effort. If you have a wartime receiving problem, we suggest you write us, or ask our representatives to call. THE ROLA COMPANY, INC., 2330 Superior Avenue, Cleveland, Ohio.

There are several Government-approved oxide-coated finishes for aluminum, which may be applied by the Alumilite® process. Each has its own identifying symbol and name. You'll certainly run across them in your war work, if you're making aluminum plane or instrument parts which require protective finishes.

Some of these finishes serve as base coatings for paint, providing surfaces to which the paint is highly adherent. All offer increased resistance to corrosion. Some look like uncoated aluminum. Some are colored or black.

If you are stymied by lack of information on Alumilite finishes—what their symbols and names mean, where the finishes should be used, how they are applied—get in touch with us.

Or, if you're puzzled with some question about aluminum alloys and their fabrication, come direct to us, too. Alcoa engineers have spent a lifetime finding the answers to just such questions. ALUMINUM COMPANY OF AMERICA, 2136 Gulf Building, Pittsburgh, Penna.
Hickok Engineers have been busy making improvements on present models and designing new meters and test instruments for the use of our Armed Services.

Production Facilities have been greatly expanded to turn out this equipment in large enough quantities to meet War Time Requirements.

All of us here at Hickok are working to win the war as soon as possible so that we can all enjoy the peace which will follow.

As soon as the present emergency is over all of these new meters and instruments will be available for all peace time purposes.

Let's get this straight...

General Ceramics Steatite Insulators are available NOW...

There are adequate raw materials to meet the demand...

Our production facilities are greater than ever...our backlog of Steatite orders has been melted down...there's no basis for the belief that there is a current shortage of General Ceramics Steatite Insulators.

Sure, there was a shortage...a serious one, but we at General Ceramics met the problem with the "do-it" spirit which typifies American War Production...by the location of new sources of supply, rapid plant expansion, procurement of necessary equipment and the training of new employees—all in record time.

As a result, delivery time on General Ceramics' Steatite Insulators has been cut in half. Here is our record on that:

June 1942—delivery time—four months.
April 1943—delivery time—two months on standard parts from stock.

General Ceramics Steatite Insulators are available for you NOW

If you have any insulator problem—whether specialized or standard—we'd like a shot at it. Your request will be given prompt, individual action.
Philco had more than manufacturing skill and experience to offer in producing the radio, communications and electronic equipment they are building for the Army and Navy. They had scientists, laboratories and their years of pioneering research in radio and television ready to serve the nation at war.

So Philco was given assignments worthy of the engineers whose achievements have won leadership in the radio industry. With their background of knowledge, experience and accomplishment in the theory and practical application of radio, television and ultra-short-wave principles, Philco engineers are at work today on urgent and vital projects in the realm of research and engineering development.

* * *

AFTER THE WAR...

What the scientists of the Philco laboratories contribute to victory must remain a military secret until the dawn of peace and the Age of Electronics. Then the discoveries they have added to the sum of man's knowledge in electronic science will enable Philco leadership, once more, to serve the homes and industries of the nation.

OUR WAR PRODUCTION PLEDGE:

More • Better • Sooner
1,000,000 INSERTS SAVED!
Proof it pays to consider Parker-Kalon Self-Tapping Screws for Every Assembly

By questioning the efficiency of the fastening method in use, this war material manufacturer discovered a serious waste of precious man-hours, and corrected it by switching to P-K Self-Tapping Screws. This job is typical of the large percentage of metal and plastic assemblies on which P-K Self-Tapping Screws can provide greater ease, speed, and security.

Look for P-K Savings in Every Type of Assembly Operation. Whatever your product, and whatever material you are working with—plastics, die-castings, sheet steel, aluminum, brass, or bronze—there's a saving probable with P-K Self-Tapping Screws.

They eliminate costly time-consuming tapping and tap costs when replacing machine screws. They are easier to use and cost less than nuts, bolts and lockwasher assemblies. When they replace riveting and welding, they make equipment available for other needs. When used in plastics they do away with costly inserts and slow molding.

Change to Self-Tapping Screws Overnight. There's no interruption in production when you change over to P-K Screws. No special tools or skilled help are required.

Call in a P-K Assembly Engineer today over fastening jobs with you. He can search out all opportunities to apply Self-Tapping Screws. And, he'll recommend them only when they'll do the job better and faster. If you prefer, mail in assembly for recommendations. Parker-Kalon 192-194 Varick Street, New York, N. Y.
Yes, we specialize

This is a specialized war. It requires great quantities of very special technical equipment. That is where a company like Ceinite fits in. We have been making radio and electronic connectors of all kinds since the war started. We specialize in designing, making and putting them together...from soup to nuts.

What do you need? Co-axial cable connectors? Radio frequency connectors? Ceramic sockets? Banana pins and jacks? They are our stock in trade. Our production men specialize on turning them out fast...and to all of your specifications.

Have you some special problem? Put it up to our engineers. They specialize in solving the tough ones.

The UCINITE CO.
Newtonville, Mass.
Division of United-Carr Fastener Corp.

Specialists in RADIO & ELECTRONICS
CERAMIC SOCKETS - BANANA PLUGS - JACKS - PLUGS - CONNECTORS

YOURS FOR THE ASKING...

PYRANOL CAPACITORS
FOR D-C APPLICATIONS

NEW, TIME-SAVING CATALOGS
on Small Pyranol Capacitors
for Built-in Applications

Valuable for Engineering, Drafting,
or Purchasing Departments

These publications make it easy for you to select Pyranol capacitors for applications such as electronic devices, communications equipment, control, motors, and transformers.

This technical information is up to the minute, easy to use. Covers all the standard types and sizes generally required—all those that have been found most desirable with respect to ratings and dimensions.

You'll find it easy to design with G-E capacitors, because: (1) Pyranol, the treating material, makes these units small and compact—often you can reduce the size of your equipment and save critical material; (2) many of the ratings are available in cylindrical, oval, or rectangular cases; and (3) they can be operated in any position.

Get your copies of these comprehensive, time-saving publications.

Pyranol is the G-E trade name for inert—a synthetic, nonflammable resin.

General Electric Company, Section H 407-49
Schenectady, N. Y.

Please send me complete information on small Pyranol capacitors for built-in applications.

For D-C Applications (GEA-2531A)
For A-C Applications (GEA-2027B)

Name
Company
Address
City, State

Pyranol Capacitors
FOR A-C APPLICATIONS

Pyranol Capacitors
FOR D-C APPLICATIONS

General Electric Company

May 1943—ELECTRONICS—May 1943

[Image and text related to Pyranol capacitors and applications]
In 27 months, there has been an increase of 13,572% in the shipment of Amphenol A-N connectors for electrical, radio, and communications equipment used by the armed forces. Similar increases have been made in the war production of other Amphenol products: molded plastics, high frequency cables, radio sockets, plugs, and microphone connectors. Actual production figures cannot be released, but these facts—typical of the resourcefulness of American industry—can give no comfort to the enemy.

AMERICAN PHENOLIC CORPORATION

CHICAGO

LAPP GAS-FILLED CONDENSERS

In any high-frequency high-power circuit, lamp capacitance can most efficiently be provided by Lapp gas-filled condensers. They are ruggedly built to maintain their electrical characteristics under all conditions. Fixed and variable capacitance models are available over a wide range of power and capacitance ratings. Here is Unit No. 3931, consisting of two No. 26541 units. The assembly provides plating for condensers, arranged so that the units may be used singly, in series, or in parallel, providing capacitance continuously variable from .0022 mF to .1122 mF. Each unit is rated at 200 amp., 6500 volts, capacitance variable .0055 mF to .1122 mF; the combination in series 200 amp., 1300 volts, 2022 to 3025 mF; in parallel, 400 amp., 6500 volts, 2025 to 4055 mF. The small unit in the girl's hands is No. 23722, rated at 50 amp., 7500 volts, capacitance .000045 mF to .000075 mF.

ANY REQUIRED WATTAGE AND CAPACITANCE
ZERO LOSS
NO CHANGE WITH TEMPERATURE
COMPACT
PUNCTURE PROOF
SOUND, TROUBLE-FREE CONSTRUCTION

Lapp porcelain water-coolers, porcelain pipe and fittings provide a highly efficient means for cooling high frequency tubes. Soldering is eliminated and, with it, need for water changing and periodic cleaning of the cooling system.
Every manufacturer of equipment in the communications, aircraft, radio, and electronics industries faces the problem of keeping a steady flow of components feeding a production line which is seemingly always hungry.

On that lifetime of continuous, uninterrupted production is the Eby organization — one of the oldest, most experienced manufacturers in the country. Today you can count on Eby for far more than the established line of products for which we are so well known in peacetime — binding posts, sockets, jacks, plugs, terminal strips, etc.

We have broadened our production facilities and engineering departments so that they encompass the complete range of communication components, major and sub-assemblies.

By careful planning, our abilities cut across the heart of Signal Corps, Air Corps, and essential telephone and telegraph requirements. Where before we served one industry, we are now engaged in feeding the production lines of all of our nation's communications industries. If it is a standard Eby part or a specially designed assembly, take advantage of the Eby organization's skillful production facilities.

**A SPECIAL SERVICE**

It is difficult at times to define the completeness of the integrated services which the Eby organization is giving manufacturers of communications and allied equipment. We are set up to take the entire responsibility for the assembly of complete units to existing commercial and governmental specifications. Such work necessarily should be discussed thoroughly with our Engineering and Production Departments. Don't hesitate to send preliminary or complete information. Your problems will be given our prompt attention.

**If it is in a Circuit... Eby components and services will help you do it better.**

Hugh H. Eby
Incorporated
18 W. Chelten Ave.

---

Here is radio communication equipment built to the highest standards of American engineering efficiency. Increasing use of TEMCO units by the Armed Forces in all parts of the world contributes added proof of TEMCO'S uniformly reliable performance. Behind TEMCO'S precision products is painstaking research... inspired design, meticulous attention to quality in materials, and the most skilled craftsmanship available.

**TEMCO CRAFTSMANSHIP INSURES THE ULTIMOST IN PERFORMANCE**

A 2-way radio telephone system, comprising 6 TEMCO Model 100-MHz 100-watt output transmitters and Model 500 500-watt transmitter, both for telephone and telegraph operation.

---

May 1943 — ELECTRON
**DUNCO “MEMORY” RELAYS**

**MECHANICAL LATCH-IN**

A Duncos Mechanical Latch-in, Electrical Reset Relay never forgets! Energizing the lower coil closes the armature which is automatically latched in place until it is re-opened by energizing the upper coil. Thus, the contact “remembers” unassailably which coil was last energized, and remains in position until it is released by energizing the other coil.

These units are made in both the large (Series 5) and “midget” (Series 51) sizes and with practically any contact arrangement that may be required. Together with hundreds of other Relays and Timers for a wide variety of uses, they are described in the 48-page Duncos Catalog and Relay Data Book. Copy gladly sent upon request. Please mention company connection.

**ELECTRICAL RESET**

With these “midget” (Series 51) units, TRUMPETERS and TIMERS can be arranged in every conceivable way. For instance, it is possible to close hundreds of other Relays and Timers and place them in the sequence that may be required. Together with the other coils, they are described in the 48-page Duncos Catalog and Relay Data Book. Copy gladly sent upon request. Please mention company connection.

**TRANSPORTATION—a vital war factor**

The effectiveness of our armed forces and civilians alike depends on the efficiency of our transportation.

In a battle of Twain entered its final phases, with the British and American forces massing hundreds of thousands on both sides of the Rhine nothing was more important to the success of the British and American forces than the timely and accurate delivery of supplies to the front lines. In a war of movement, the transportation of men and materials is the key to victory.

The railway system has become a vital factor in the war effort. The efficiency of our transportation system is evidenced in the reduction of travel time and the increase in the number of goods transported. The railroads have been able to move troops and supplies more quickly and efficiently than ever before.

As the war continues, the need for an effective transportation system grows. The continued success of our armed forces depends on the ability of our transportation system to move troops and supplies quickly and efficiently. The efficiency of our transportation system will be a key factor in the outcome of the war.
I understand more than 900,000 barrels per day. By the end of the year they are shooting for the goal of one million barrels a day.

Unlike Germany we have not attempted to control the development and growth of motor transportation according to the "intuitions" of one man but have wisely left it in the hands of experienced competition. That is why our highway transportation system came into being. Growing public acceptance has made it an essential part of our national economy.

The motor vehicle, its limitations set by the improved highway and the supply of fuel and rubber, has developed to unprecedented proportions. Up to a year ago private automobiles consistently moved more people and goods miles than all public carriers combined. They have become an accepted means of mass transportation. Local electric and interurban railways in many cases were converted to bus lines, and trucks took over the local freight service. Under these imposed operating conditions traffic volume increased. When the war in the Pacific made it necessary for us to conserve our supply of rubber and the U.S. Departed in the Atlantic thwarted the flow of gasoline to the eastern seaboard, our motor transport was forced to grapple with the toughest problem that ever had confronted it since it became so vital a factor in the everyday transportation.

The "share the road" idea recognizes the need of conserving gas, oil, and rubber. It particularly applies to buses, for when group travels can be assembled for a common destination, buses can be used most effectively.

The intensity has performed for the rural areas the same service that the local bus renders for the residential areas of our cities.

Recognition of railroad schedules, adoption of motor transport, rearrangement of working hours, all have contributed to provide a flexible transportation service for men and materials to meet the critical needs of the war effort. Twenty thousand intercity buses are handling 55 million passengers a week which is 69 per cent more than in 1941. The fact that these buses carry a relatively large percentage of the total passenger business than their seating capacity would indicate suggests that here, too, we are getting a more efficient use of these vehicles in terms of passenger loads carried.

It is fortunate to note that the geographic location of most intercity buses does not coincide with that of the roads but rather supplements it.

The contribution which the urban transport industry is making to the war effort becomes apparent when we consider that buses, trolley buses and street cars today carry passengers at a rate which promises to exceed the impressive total of 21 billion, as compared with 31 billion in 1942 and 32 billion for the period 1936 to 1941. And this the industry is accomplishing with a minimum of added equipment and despite a serious drain on its manpower.

The truck lines, too, are setting all-time records.

They have rearranged their schedules, eliminated cir-

 Electronic briefs: FM

is simply a method by which the intensity of electrical energy is transmitted through the air by varying the intensity or frequency of an electrical wave. This signal can be created by the same method by which dash codes or voice and music are being transmitted through the radio wave in the form of electrical energy. The characteristics of the electrical circuits can be varied in order to vary the intensity of the radio wave. These characteristics are determined by the frequency, phase, and voltage of the radio wave. The frequency can be varied by changing the amplitude of the radio wave, and the phase can be varied by changing the phase of the radio wave. The voltage can be varied by changing the voltage of the radio wave.

Static and other man-made electrical disturbances are identical in character to the amplitude modulation signal. Hence these disturbances are extremely bothersome to AM listeners. On the other hand, electrical disturbances are not always present in frequency and consequently do not interfere with FM transmission. Another fortunate

Eimac tubes have the distinction of being the first choice of most of the leading electronic engineers throughout the world. They have consequently been in the most important new developments in electronics—FM, for example.
WASHINGTON FEEDBACK

The current farm radio battery shortage is receiving the attention of the Consumers Durables Goods Division of WPB which promises some relief through readjustment and rescheduling of battery production, depending on temporary lags in other battery requirements. It is estimated that battery-operated radios on farms have increased in numbers from a pre-war 2,250,000 to a present total of 3,000,000. Pre-war production of radio batteries approximated 4,000,000 sets of batteries, sufficient to service about two sets of batteries per year per radio. Even return to production on a pre-war scale—utterly impossible at present—would not meet this year's battery demand at the ratio of two-battery-sets-per-radio annually. As one step to improve the situation, which is serious, producers are urged to run off their backlogs as rapidly as possible with every assurance from WPB that military and indirect sales of $290,934,000 to the government in 1942 with the Electronics Research and Development Agency (ERSA) of WPB, an all-purpose receiver capable of handling FM, color television and facsimile is anticipated by Commissioner Fly. With such a receiver, a person would listen for a while to FM broadcasts, switch to television at appropriate hours, and from time to time to ear-off the news reports. "I look for one very thorough-going and efficient form of broadcasting," says Chairman Fly. "It will be a chain operation carried by radio relay;—these relay problems are almost as important as the military problem."

ERSA—Laboratories working on radio problems for the army or navy will be able to get from a central source of supply the critical electronic components not quickly available in commercial channels, according to the Electronic Research and Development Supply Agency formed by the Defense Supplies Corp., at the request of the Armed services, the OSRD, and WPB to supply research men with the electronic components vital to their work.

This new agency will make it unnecessary for the laboratories to build up their own complete stockpiles of components. WPB officials pointed out that laboratory stockpiles are made up of components which do not meet standards preferred by the army and navy. The agency will be able to direct laboratory purchases to the preferred types. Operating without profit, the agency is managed by an executive committee on which the army, the navy, and other government agencies are represented.

However, the end of the year found $886,103,000 of unfilled government orders on the company's books.

FCC—Post-war development of an all-purpose receiver capable of handling FM, color television and facsimile is anticipated by Commissioners Fly. With such a receiver, a person would listen for a while to FM broadcasts, switch to television at appropriate hours, and from time to time to ear-off the news reports. "I look for one very thorough-going and efficient form of broadcasting," says Chairman Fly. "It will be a chain operation carried by radio relay;—these relay problems are almost as important as the military problem."
A good many of them are engineers—and the bugs they hunt are performance flaws in vital production. Mallory contact engineers have been making some nice records in quickly “getting the bugs” out of tricky contact problems.

There was, for example, the case of an unusually designed aircraft relay, used in propeller control mechanism. The relay used contacts which butted together, rotating against each other during operation. Ordinary facing materials ground off fine particles which shortly formed an insulating layer to make the contacts inoperative.

It was up to Mallory to find an answer…and quickly. Actual conditions of operation were set up one material after another tested, new alloys originated. Mallory experience and “know how” speeded the solution to a prompt conclusion with a complete contact assembly. A new material was developed, a suitable backing evolved and shortly the contact relays functioned perfectly. Another cog in War Production mechanism was in good working order. It sounds very simple and matter of fact.

But what made the result seem so simple was the applied technique of many years of research and experiment. Mallory engineers have pioneered so long in the contact field that their knowledge brings prompt results as a matter of course.

Nowadays, when a contact or complete contact assembly problem arises, it is only natural to call in Mallory. Their services are at your disposal.

P. R. Mallory & Co., Inc.
INDIANAPOLIS
INDIANA
Cable Address—PELLUNALLO

Electrical Contacts and Contact Assemblies… Non Ferrous Alloys
Powdered Metal Alloys

Electronics—Keith Henney Editor—May, 1943

CROSS TALK

TALK

PATENTS… The fact that Thurman Arnold is a judge in the U. S. Circuit Court of Appeals and no longer head of the Justice Department’s Antitrust Division should not lull to sleep those who fear that patent office reform was only a passing interest. Bills to revamp the patent system are always before Congress. They make appellate platforms for those who wish to air their case.

Judge Arnold appeared recently before the subcommittee on technological mobilization of the Senate Military Affairs Committee. He charged, once again, that domestic and international cartels control research and invention, causing wartime shortages in a number of critical materials. He regretted what he has so often said, namely that there is only way to free the nation’s economy is to take up the patent pools”. He endorsed the bill moved by Senator Harley M. Kilgore (D. West Virginia) for the establishment of an office of technological mobilization, stating that this bill is designed to break the corner on research and experimentation enjoyed by private groups.

While saying that he did not want to discourage basic research, Judge Arnold added, “Only the government can provide opportunity for the technicians and engineers who do not choose to work individually for the benefit of a private group. That is why the government is trying to get control of the market if it can.”

The bill would give the government authority to appoint a “national early warning board” to promote such research. When asked by Senator Kilgore, chairman of this sub-committee, for suggestions he replied that it should draft that “blitzkrieg” sciences suite would be permitted against inventors.

Furthermore, the virtual abolition of the National Defense War board by Congressional refusal to install a new board was the subject of a bill. Thus many people have probably overestimated the fact that revamping of the patent laws would completely revamp the system and also a hint for continuation of suppressed patents by the government were among the hundreds of suggestions for post-war planning on a gigantic scale set forth by this body.

A great deal of attention, however, will be given to the findings of the National Patent Planning Commission whose report was completed and will probably be sent to President Roosevelt within a month. The Commission is made up of Charles Kettering, chairman, Commissioner Conway C. Cox, Executive Secretary, Owen D. Young, Francis Gains, Chester Davis (now Food Administrator) and Edward Grady.

Present thinking in Washington indicates that any extensive overhauling of the patent system will not take place this year.

ESSENTIAL SOUND… Certain difficulties between one large maker of inter-communicating equipment and a government agency recently resulted in shutdown of the plant for an indefinite period. Th ere may or may not have been justification for this drastic action but there appeared to be none for shutting down another factory in the same field for a week as a precautionary measure while the first case was under examination. Nor is there now any reason for curtailing the activities of all manufacturers in the sound business with thinly veiled suspicion just because one of their number allegedly did some finagling.

Rapid, stop-saving communications between departments, bolstering of worker morale and the protection against sabotage inherent in many installations represent truly essential function of inter-communicating apparatus in industrial plants—not to mention the essential sound applications to the military. What is needed is more sound equipment; not less.

DISEASE… There may be nothing but coincidence in this, but it looks like a sign of occupational disease to us. Sound-effects man giving a talk before Radio Club of America audience on many phases of his job, wound up his talk within 15 seconds of the hour allotted to him, without ever looking at a time piece.
Post-War Planning Problems

Future development of the commercial market must be a second priority today because many men are still thinking about tomorrow in whatever time the military production program allows. Here are some of the things manufacturers are discussing:

One manufacturer, who has been working in the electronics field for many years, has no immediate practical application for the market for electronic gear. Many of the bright young men who have been working on the job for some time now are looking to the future, not quite so apparent, is the market for electronic gear. Many of the bright young men who have been working on the job for some time now are looking to the future, not quite so apparent, is the market for electronic gear.

There are many questions to be answered before the war period to compensate for increased.

Questions to Conjure With

HOW MANY electronic military developments are applicable to the commercial market?

HOW MUCH of this new war equipment will be under wraps indefinitely by the Army and Navy?

HOW DIFFERENT are broadcast receivers likely to be when the shooting stops?

HOW FAST will commercial application of UHF, VHF, FM and Television equipment expand?

HOW MANY of the proposed industrial uses for electronics will prove practical?

HOW MANY of the proposed industrial uses for electronics will prove practical?

HOW MUCH will the commercial market pay for parts with improved characteristics?

HOW MUCH competition will there be for new component competition?

HOW MUCH time will it take to convert from wartime to peacetime production?
KTKC Builds a 5-kw Transmitter IN WAR-TIME

by BERT WILLIAMSON

Chief Engineer, Station KTKC
Visalia, California

When war shortages endangered completion of their long-sought new transmitter, KTKC engineers made a whirlwind shopping trip through the East for necessary parts, then built the entire 5-kw transmitter themselves in 105 days. Many amateur radio parts were used, complicated the equipment, but more chance there would be for trouble. A further complication was the fact that provisions to be made to insure continued operation under the extremely high temperatures encountered during the summer months.

Fortunately, it was found possible to secure a complete Collins oscillator unit on a standard rack panel. By following this as a buffer stage using two 812's, the number of r-f driver stages was reduced by at least one. The Collins unit is fully capable of driving the 813 buffer stage, since these beam power amplifier tubes require almost negligible driving power. A single 6922 in the plate-modulated power amplifier stage completed the r-f tube line-up, delivering the required 5 kw of power to the transmission line. The circuit arrangement is shown in Fig. 1.

The automatic equipment included in many 5-kw transmitters to reduce power to 1 kw was omitted in the interests of simplicity, and also because the old 1-kw transmitter would be available intact as an auxiliary unit as soon as the 5-kw job went on the air. Mechanical bugs were installed to indicate overloads, in place of the customary electrical drops or interlocking signals, with a further reduction in parts and wiring. The a-f section of the transmitter is more or less conventional in design. The input from the 900-ohm studio-transmitter line feeds the first a-f stage, using a pair of 6L6G's in push-pull. These in turn are resistance-coupled to a pair of 847's in push-pull, serving as the driver. The modulator likewise is push-pull, with a pair of 891's which operate...
Errors or fuses and meters are installed in the most efficient positions at appropriate points to indicate abnormal circuit conditions. The use of modernistic stainless steel trim strips, running horizontally across all five cabinets, gives the appearance of a single front panel. No attempt was made to include any dials or indicating plates on the panels. All controls were installed on a narrow panel of 6-inch dural backed with steel. Engraving placed on the lacquered dural panel stands out without filling.

The banks of cabinets 2, 3, and 4 face into a screened room enclosing also the separately mounted high-voltage components. The door of this screened room and the doors of cabinets containing high-voltage circuits are electrically interlocked.

FIG. 1—Simplified schematic of the 5-kw transmitter built during war-time by ETEC engineers. It uses broad-area transistors, with a modulator capable of supplying 2500 watts of radio power for the plate circuit of the type 942A tube in the power stage. A module of this type was used in the 10-kw transmitter employed during World War I. The schematic shows the over-all layout of parts, the position of the major components, and a few of the many circuit connections that make up the complete power supply system.

Protection Provisions

All primary power circuits are protected with either circuit breakers or fuses, and meters are installed at appropriate points to indicate abnormal circuit conditions. The protective equipment is in general quite conventional, the noteworthy fact being that the required meters and overload devices actually were obtained in war-time by diligent search.

Many new transmitters have automatic overload reset systems, which give the circuit a definite number of chances to get back to normal without disturbing the power permanently. The commercial version was not obtainable, but a highly satisfactory improvisation was worked out with easily obtainable parts centering around a "Soft-Start" monitor switch originally designed for automatic changing of bands on amateur transmitters. This switch has two banks, each with four contacts 90 deg. apart. Contacts 1, 2 and 3 are tied together and 4 is unconnected in one bank.

Each overload relay in the transmitter has one pair of normally open contacts and one pair of normally-closed contacts. The normally-open contacts are in series with the auxiliary starting relay for the 4500-volt main power supply, while the normally-closed contacts are in parallel and are so connected that when an overload occurs, one pair of these contacts will close and energize the ratchet switch coil. This moves the switch arm up 90 deg. and opens contact 2. Contacts 1, 2 and 3 are all connected to another relay which closes the "plate start" switch and power is reapplied to the rectifier.

If the overload still exists, the cut-out overload relay will open and the ratchet switch arm will move to contact 3. If the overload relay again trips, the ratchet switch arm will move to contact 4. If the overload relay again trips, the cut-out overload relay will open and the ratchet switch arm will move to contact 3. If the overload relay again trips, the cut-out overload relay will open and the ratchet switch arm will move to contact 4. The relay will then trip and power will stay off. Plate start button must then be put into the circuit to turn on the relay again manually and put power on the air. The relay bank of contacts on the ratchet switch is used to operate indicator lights which show the position of the switch at all times.

Transmitter Cabinets

The five cabinets which make the 5-kw transmitter are designed as 1, 2, 3, 4 and 5 on the transmitter building floor plan in Fig. 2. Each cabinet contains a high-voltage transformer, a rectifier, a filter choke, a plate circuit, and a control panel. The cabinets are set on 4x4-inch concrete blocks which form a base and support the cable trench under the cabinets. The doors of the cabinets contain high-voltage circuit controls, which were obtained with great difficulty. The cabinets were built so any part can be removed without disturbing other parts.

FIG. 2—Floor plan of the new ETEC transmitter building. From the master control console a single operator-transmitter can handle transmitted programs himself.

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Air cooling for the modulator and power amplifier tubes is provided by a multi-vane blower driven from a three-phase motor in the Visalia, a duct system running under the transmitter cabs. Air enters the air-cooled tank condenser, travels through a two-section spun glass filter to reduce accumulations of fins and on insulators. The blower is turned on during the transmitter is in use, and is turned off by a fan control switch located in each modulator and power amplifier tube duel.

A synchronous clock relay is connected to the blower, and it allows the blower to be turned off automatically in case of power failure.

**Master Control Panel**

Since routine operation is carried on with combination operators, it was decided that the master control panel was adapted to the master control console. Off-board control was designed so that the operator at the master control panel can always control his remote circuit even when the program is being broadcast for another location. The master control panel contains a number of controls that are used when the program is broadcast for another location.

**Over-all Performance**

The over-all performance of the new KTOK transmitter is flat within plus-or-minus 1 db from 40 cycles to 12,000 cycles. Distortion at all audio frequencies is well under the FCC limits for broadcasters. Operating costs for the new 5-kw transmitter are only about 20 percent higher than for the 1-kw transmitter. All in all, the performance of this new transmitter is very good, and it has been highly satisfactory during its more than 5,000 hours of service. Only one minor change was made. This is to date due to technical difficulties, and three of these were during the first month of operation. Much credit for this record is due to manufacturers who constructed the equipment exactly according to specifications and met delivery promises in spite of difficult war-time conditions. The station went on the air 105 days after the cabinets arrived.

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Electronic Tubes for ULTRAVIOLET RADIATION

Like other electronic tubes, the best tube for a given ultraviolet in particular industrial or research work or for a discharge in a medical job and explains why vapor requires on the practical relations between gas pressure and factors involved in ultraviolet output.

The modern electrical engineer who is familiar with electromagnetic waves ranging in wavelength from many thousand meters down to a few centimeters often has a decidedly less clear concept of that part of the electromagnetic spectrum which covers the ultraviolet radiations. Yet, many of the basic concepts applying to electromagnetic waves are equally useful in the field of ultraviolet radiations. Whereas the present lower limit for radio wavelengths is around one cm, the ultraviolet spectrum ranges from about 6,000,000 cm down to about 0.000 000 01 cm (from 4000 Angstroms down to 1000 Angstroms). The short ultraviolet waves are highly effective in destroying microorganisms and are therefore useful for bacteriological applications. The wavelengths giving optimum results in these three important commercial processes are indicated by the spectral response curves in Fig. 1. Once the spectral response of a process has been obtained by plotting on a percentage basis the effectiveness of each ultraviolet wavelength, a generator of ultraviolet radiations can be selected or specially designed to give the most efficient and economical results for the particular application in mind.

The importance of choosing the most suitable ultraviolet source and of matching the spectral emission characteristics of the source to the spectral response characteristics of the process to which it is to be applied can hardly be emphasized enough. Indeed, many a project involving the application of ultraviolet rays may have been abandoned prematurely because its originators failed to thoroughly investigate the problem of selecting or designing a tube for installation and the ultraviolet generator best suited for the application on a large scale for their project. As an example, before discussing the different tubes available, it might be mentioned that the type of ultraviolet tubes for general industrial use is essentially a high-voltage arc discharge tube. However, this type of lamp has been known for many years, but it was not until recently that it was realized that the arc lamp was the high-voltage lamp that was well suited for the production of ultraviolet radiations, while the arc lamp was well adapted to the production of visible light. Since the arc lamp was well adapted to the production of visible light, it was realized that the high-voltage lamp was well suited for the production of ultraviolet radiations.

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Hydrogen discharge tube which operates at an input of about 1 kw and a gas pressure of 2 mm. Cylindrical carbon electrodes are used, and water cooling is required to keep the gas pressure sufficiently low. The gas used is hydrogen.

Factors Affecting Wavelength

The ultraviolet rays generated by excitation processes must travel first through the gaseous atmosphere until they reach the boundary, then through the envelope which encloses the discharge and through gaseous or solid media, filters, etc., before they reach the substance on which they are supposed to act. Obviously the absorption and reflection characteristics of all these media impose between the source and the destination of the ultraviolet rays will affect again the quantity and quality of the radiation at the receiving end.

Thus we have briefly enumerated three of the major factors determining the spectral characteristics of the output of an ultraviolet generator, namely:

1. The nature of the gas (or vapor).
2. The pressure of the gas (or vapor).
3. The transmission characteristics of the envelope.

Inasmuch as this paper deals with electronic tubes we propose to confine the following discussion to those types of ultraviolet sources in which an electrical discharge or arc is used in a tubular envelope and which has attained by far the greatest importance and the widest application of all available filling substances. When mercury vapor-discharge tubes are excited by an electric discharge, it offers the most efficient and economical source of ultraviolet radiation of a wide variety of wavelengths. Inasmuch as the mercury arc is superior to that of the ultraviolet arc and consequently a lower input of electrical energy is required to produce the same output, these important ranges of the medium arc are superior to those of the mercury vapor. We therefore leave out of consideration the open areas such as carbon and spark discharge lamps which cannot be classified as ultraviolet generators.

The electronic tubes which discussed here have a numerical outstanding advantage over these arcs. For instance, the much higher efficiency in transforming electric energy into ultraviolet energy makes the installation of cooling and desiccating apparatus unnecessary. Greatly facilitate the wide use of electronic ultraviolet technology by an evacuated envelope, and glass in which a small amount of mercury has been sealed in.

The pressure of the mercury vapor in the envelope phase depends on the temperature of the mercury in the liquid phase as long as a liquid phase exists, i.e., before all of the mercury has been evaporated. This is illustrated by the curve of Fig. 2, in which pressure of mercury vapor is plotted against temperature. At temperature below about 100 deg. C the pressure is very small; for instance, at 20 deg. C it is \(2.8 \times 10^{-3}\) mm. Hg, and at 90 deg. C it is \(6.1 \times 10^{-4}\) mm. Hg. At higher temperatures the pressure rises rapidly, and reaches 1 atmosphere (760 mm Hg) at 356.7 deg. C.

As the temperature is increased a point is finally reached (point 1 in Fig. 2) at which all the mercury originally sealed into the tube is evaporated. If the temperature is increased beyond this point the mercury becomes unsaturated and practically follows Gay-Lussac's Law.

The pressure then rises in proportion to the absolute temperature of the wall. This is illustrated by the straight solid line 1-2 in Fig. 2.

It is worth noting here that the slope of the solid line 1-2 is much less than that of the saturated branch. This means that a mercury vapor lamp which operates in the unsaturated state (with all the mercury evaporated) is less sensitive to fluctuations in temperature than a lamp operating in the saturated state.

High-pressure mercury vapor tube 5 feet long, with rated input power of 4.5 kw, for use in a blueprint machine.
liquid phase)· h

We are now ready to discuss the effect of the pressure of the mercury vapor on the spectral distribution of the light emitted by a high-pressure mercury vapor discharge. If we consider the initial low-pressure discharge at 0.01 mm Hg and plot the spectral distribution as a function of the pressure of the mercury vapor, we obtain the characteristic shape of the output spectrum. The intensity of the ultraviolet (for instance, the 2537-A line) is almost negligible.

The 2537 line carries relatively little energy when compared with the longer wavelengths. However, it is the principal source of ultraviolet radiation in the discharge. The intensity of the ultraviolet radiation is strongly absorbed by the atmosphere, and the intensity of the high-pressure mercury vapor discharge at the axis and the wall of the tube is strong in the medium ultraviolet region, as shown in Fig. 3. A high-pressure mercury vapor discharge at 3000 volts has a wavelength of about 1800 Angstroms, for instance, and this energy is not transmitted beyond the 3500-A region.

The table of Figs. 3 and 4 shows the quantitative relations between the high-pressure mercury vapor output at 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, and 700 Angstroms and the pressure range of about one atmosphere or higher. The temperature of the glass also has an important bearing on the transmission of the discharge. The transmission of the glass decreases rapidly with increasing temperature and becomes negligible at about 900 deg. C.

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Measuring Coil Characteristics Without an Impedance Bridge

By R. D. Brailsford, Underwriter, Submarines, Inc.

Use of the cathode-ray oscilloscope to measure inductance, Q, impedance, power factor, effective resistance of coils—especially useful when changes are being made in the coils and measurement. Method also may be useful demonstration set-up for technical school.

![Diagram of a cathode-ray oscilloscope](image)

**Measuring Method**

To measure the inductance of a coil, use a variable inductor, Fig. 1, a variable resistor, and a power factor meter. The variable resistor is to be adjusted to a value of 180 degrees, and the variable inductor is to be adjusted to a value of 0 degrees. The power factor meter is to be adjusted to a value of 0 degrees, and the variable resistor is to be adjusted to a value of 180 degrees.

**Calibrating the Horizontal and Vertical Amplifiers**

The methods to be described require an equal deflection sensitivity for the vertical and horizontal amplifiers in the oscilloscope. To make this calibration, the horizontal and vertical deflection limit terminals should temporarily be connected together and a deflecting voltage of any convenient value applied between these terminals and ground. The horizontal and vertical amplitfer gain controls are then adjusted so that the pattern appears as Fig. 1, that is, a straight line intersected at an angle of 45 degrees.

**Resistance Comparison Method**

The circuit for direct impedance measurement is given in Fig. 2; if a variable resistance is used, the pattern becomes a circle. In Fig. 4 is shown the change in appearance of the pattern when a variable resistance is interposed in the circuit. The general equation of the ellipse, which is the pattern in this case, is given by

\[ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \]

where \(a\) and \(b\) are the maximum horizontal and vertical displacements, respectively.

**Reversing Method**

The circuit employed to determine inductance is given in Fig. 3. A variable oscillator will be required of appropriate frequency range. The coil to be measured is connected in series with a power or sine capacitor of known value. A tuned R is adjusted to give a convenient vertical deflection. The oscillator is started at its lowest power factor and the pattern becomes a circle. In Fig. 5 is shown the pattern of the circuit in Fig. 3 when the coil has a low power factor. The ellipse will be of a form similar to that obtained with a coil of known impedance, but the pattern is not a circle. At zero power factor, that is, at 180 degrees, the pattern becomes a straight line, as of Fig. 3. At zero power factor, that is, at 180 degrees, the pattern becomes a straight line, as of Fig. 3.

**Power Factor**

The power factor can be determined by finding the position of the resistance in the circuit. The power factor can be determined by finding the position of the resistance in the circuit. The power factor can be determined by finding the position of the resistance in the circuit.
Effective Resistance. Refer to Fig. 6, the amount of horizontal deflection $h$, as stated, is due to voltage drop across the effective distance of the coil at resonant frequency. (Condenser looks like a short circuit through the audio frequency range.) Measure this directly by adjusting $R$ until the voltage drop again equals the horizontal deflection, at which position equal to the effective resistance at the frequency at which the measurement is made. For coils below a fairly high Q, the effective resistance may be quite small and a reasonably accurate reading of the output voltage of the oscillograph should be increased to explain pattern.

Inductance Measurement by Parallel Resonance. Where the inductances under investigation are very high, the exact resistance may more easily be measured by connecting capacity parallel with the inductance. The predetermined technique is the same, differencing being that at zero voltage across the LC circuit a maximum and the cathode is substantially more sensitive to frequency shifts, thus making it easier to set the oscillograph at the resonant frequency.

When using the shunt method it should be borne in mind that the distributed capacity of the coil will be, in effect, that of the tuning condensers, the indicated inductance being higher than the true value. Reason coils having a high inductance may be measured by series resonance. The coil of Fig. 3, for example, which was a 1000-turn layer wound, measured 180 million microhenries by shunt resonance. The tuned circuit was 10 microfarads in the vertical, 10 in the horizontal X, 10 in the horizontal E-W and 10 in the horizontal N-S respectively. The inductance being moderately high, the frequency is usually 1 megacycle. Whether the concentration of millions of tons of masonry forces remains on a relatively limited area of the earth is the cause of earthquakes, and whether they have any adverse effect safety of these large dams, these and other engineering and scientific reasons, a number of Benioff seismographs developed especially for the purpose at the California Institute of Technology have been set up by the U. S. Bureau of Reclamation in the vicinity of three of the largest dams—Boulder, Grand Coulee and Shasta. The instruments are now being operated by the Bureau in cooperation with the U. S. Coast and Geodetic Survey.

How a Seismograph Works

A seismograph is fundamentally an instrument for recording data from which the time and direction of arrival of an earthquake wave and the distance from the disturbance can be determined. It usually also provides a record of the waveform and amplitude of each arriving wave. To secure this data, a seismograph must have three seismometers, each responsive to earth movements in one of three directions at right angles to each other. These seismometers must provide individual traces on which the time at any point can be determined accurately. In practice, the directions used are horizontal N-S, horizontal E-W and vertical.

Seismometers generally employ the pendulum principle. A mass having considerable inertia is supported by a Cardan hinge (a suspension which permits almost frictionless movement in one direction only) in such a manner that the mass is initially stationary during movements of its supports due to earth vibrations or earthquakes. Being critically damped, the mass eventually moves with and amplifies the earth movement. The mass (usually a metal cylinder) is called a pendulum even though it does not normally move, because the oscillation between the seismometer pendulum and its supports during an earthquake is
much the same as the relative motion of an ordinary clock pendulum with respect to its support.

**Coils Used to Measure Motion**

A comparative measure of the motion of the earth with respect to a pendulum is obtained in the Bureau of Reclamation seismometers by attaching an extension arm to the pendulum and mounting on the far end of this arm a coil which is positioned in the annular gap of a powerful, doughnut-shaped permanent magnet. For purposes of explanation, this permanent magnet can be considered as attached to the pier, and therefore moving with the earth, while the coil can be considered as a stationary body of reference. Movement of the earth will then induce in the coil a voltage which produces a graphic trace of earth movements. The pendulums of the three seismometers are positioned essentially horizontally.

FIG. 1—Simplified diagram illustrating method of mounting on pendulum and coils of the three seismometers. The cylindrical masses and attached coils are initially stationary; even though the earth moves, movement of the earth is comparatively slow. At the instant of an earthquake, the pendulum is displaced, and thus the coil is rotated slightly toward the permanent magnet, causing a voltage to be induced in the coil.

The principal coil is connected to a potentiometer, which, in turn, is connected to a recording galvanometer. At the instant of an earthquake, the pendulum is displaced, causing the coil to rotate slightly toward the permanent magnet, inducing a voltage in the coil. This voltage is provided between coil and galvanometer, automatically increasing its sensitivity when the pendulum is displaced, just as a gate will open and close automatically if its supporting pin is tilted slightly toward the necessary.

The maximum usable sensitivity of an instrument is limited by the maximum voltage the coil sets up in the coil, which produces a graphic trace of earth movements. This constitutes a lower limit of the sensitivity, and is found against gravity by a leaf-type spring. To be pointed out, however, is the fact that if the pendulum is displaced, the coil will rotate toward the permanent magnet, producing a voltage which interacts with that previously set up in the coil. This results in a decrease in the sensitivity of the instrument, and therefore, a decrease in the sensitivity of the recording galvanometer.

**Recording Galvanometer**

As a result, small square-cornered waves in the paths of all light beams are produced on the light beam traces of all three seismometers. These waves are produced by the light beam traces of all three seismometers. The waves are produced by the light beam traces of all three seismometers. The waves are produced by the light beam traces of all three seismometers. The waves are produced by the light beam traces of all three seismometers. The waves are produced by the light beam traces of all three seismometers.

**Time-Recording System**

No amplification of the signal between a pickup coil and its recording galvanometer is necessary, since the signal is sufficiently large. Therefore, no amplification is required. The recording galvanometer is connected to a second galvanometer, which is connected to a potentiometer, which is connected to a recording galvanometer. The recording galvanometer is connected to a second galvanometer, which is connected to a potentiometer, which is connected to a recording galvanometer. The recording galvanometer is connected to a second galvanometer, which is connected to a potentiometer, which is connected to a recording galvanometer.

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FIG. 2—Circuit used to receive Navy time signals for comparison with similarly recorded seismometer signals in the Benioff film recorder.
The Emissive Power

Of Typical

Grid and Plate Surfaces

by RAYMOND SYZMANYOWITZ

Technic Director, EK Tech, Port Huron, Michigan

It is customary in the manufacture of radio receiving and transmitting sets, where heat dissipation is important, to roughen and/or carbonize the grids and plates, thereby increasing the thermal properties of the surface. This increase in thermal properties is due to the fact that carbonization increases the emissive power of the material. The emissive power of a surface is a function of temperature and the surface area. The emissive power of a surface is given by the equation:

\[ P = \frac{A \cdot T^\alpha}{\sigma} \]

where:
- \( P \) is the emissive power (in watts per square centimeter)
- \( A \) is the area of the surface
- \( T \) is the absolute temperature of the surface (in Kelvin)
- \( \sigma \) is the Stefan-Boltzmann constant (0.171 W cm\(^{-2}\) K\(^{-4}\))
- \( \alpha \) is an exponent that varies with the material and surface treatment

The emissive power of a surface is a function of the temperature of the surface, the area of the surface, and the emissivity of the material. The emissivity of a material is a measure of its ability to emit radiant energy. Materials with high emissivity, such as carbonized surfaces, have a high emissive power, while materials with low emissivity, such as polished metals, have a low emissive power.

It is important to note that the emissive power of a surface is not affected by changes in the external environment, such as air temperature or humidity. The emissive power of a surface is determined by the properties of the material itself. Therefore, in the design of radio receiving and transmitting sets, it is important to select materials with high emissive power to ensure efficient heat dissipation and prevent overheating of the components.
The Precision Tuning Problem in U-H-F Broadcasting

By S. Young White

Between 60 and 200 Mc there are 1000 channels if allocations are on a 0.1 percent basis but there are 14,000 if allocations are on a 10-ke basis. Means are suggested for securing the necessary precision of tuning to use these channels.

The technical advances of the last war led directly to broadcasting in the present 1000-ke band. The technical advances of this war foreshadow a post-war radio art that is greatly freed of its limitations as to the number of channels of communication available by proper utilization of the great new world of UHF. The key to unlock these possibilities is precision of frequency to a degree hitherto unattained; and the responsibility of forging this key lies with the radio engineer.

Very probably the first excursion into UHF will be in the region of 60 to 200 Mc, a band 140,000 kc wide. If allocations are on a 0.1 percent basis there will be slightly over 1000 channels available, but with our old familiar 10-ke channel allocation there are 14,000 channels available. These extra 13 channels are a prize well worth striving for. They bring that day closer when every man can have his own transmitter as well as receiver.

This band of frequencies is quite attractive when compared with 5000 Mc for instance, as the antennas of reasonable size, giving good pick-up and reduction and absorption of signals. Phenomena are less pronounced. We have some instrumentation available, also, and more or less standard tubes are operative in this region.

A concrete problem in precision tuning setting of a variable receiver would be a universal broadcasting set 50 Mc wide on 50 transistors. If we spaced them 20 kc apart, we would have 50 channels to the megacycle, and if they were side by side, we would cover any band from 150,000 kc to 181,000 kc. The transmitter would be in 5 kc of assigned frequency, as allowed by present crystal Practice.

The problem on manufacturing a receiver capable of picking out a desired channel in such a case is to be attacked in two ways: by electronics and by scanning. Discrepancies in the second method due to the possibility of obtaining all of the possible channels of order must be eliminated until after the war, but are more important.

**Values of Scanning-Type Receivers**

The scanning receiver is quite simple—so simple that a patent which stops a modern receiver was issued to an old idea which has been superimposed on the oscillator and, some modifications. The receiver is made up of a number of transformers, each one varying the bias of the tube which the receiver would operate through the desired channel until it encounters a carrier. Since the receiver would pass a number of frequencies in this manner, it would not have the immediate frequency which distinguishes the desired from other frequencies. Having located such a frequency, the receiver remains receptive to the receiver until either the frequency or the carrier is turned off.

The output end of the intermediate frequency amplifier must be a "direct detector" or, for instance, direct FM detector with the diodes giving positive voltages on one side of the receiver and negative voltage on the other side. The receiver acceptance band will be 1 kc well as tuned.

As the carrier is passed the constant frequency amplifier will become a "direct detector" and, when the number of channels must be heard to, a transducer must be used to identify a particular carrier. This has been done by the use of a swinging contact switch which responds to changes in the frequency of the carrier as it passes over, thus providing a signal to the receiver which may well be heard sufficiently loud to interfere with the speech transmission.

**Receivers of the broadcast type often have a cut-off of 4000 cycles as the upper limit of the audio band received. The identifying tone frequency may, therefore, commence at 5000 cycles, and may continue on up indefinitely, say to 20,000 cycles or still higher.**

The advantage of having the tone on the air in the entire band is especially marked in mobile work, where it is desirable to have the radio sensitive to pick up a tone instantly as a receiver, and an example of the grid circuits. This means that the signal must be hidden in a shadow so that the receiver will lack the necessary sensitivity in the receiver of the desired carrier. When returning in the sweep of the opposite direction will pick it up.

In high speed scanning receivers of the tone identified type the action of the AVC device should be either extremely fast or extremely slow. If it has some intermediate value, it will cause the receiver to lose sensitivity for a time, and this effect is particularly serious if the tone were not, there, the receiver would not lock on the carrier.

Thus, there may well be that once a receiver is designed to respond to this identifying tone impressed on the desired carrier, it will be realized that once a receiver is designed to respond to this identifying tone impressed on the desired carrier.

This "tone" can be of sub-audible, audio or super-audible frequency. The sub-audible range is rather unsatisfactory due to the low time interval required for one cycle and for filter voltage build-up, as well as the size and weight of the filter. The tone may well be in the audio range, but if it is desired that the tone be on all the time, the above objections will not be so serious.

**LIST OF TUBES AND VALUES**

<table>
<thead>
<tr>
<th>Function</th>
<th>Type</th>
<th>Grid</th>
<th>Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscillator</td>
<td>955</td>
<td>22000</td>
<td>10000</td>
</tr>
<tr>
<td>Control Tube</td>
<td>955</td>
<td>0.5</td>
<td>0.25</td>
</tr>
<tr>
<td>First Audio</td>
<td>9NT</td>
<td>0.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Output</td>
<td>8KT</td>
<td>0.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Filter Amp.</td>
<td>955</td>
<td>0.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Filter Res.</td>
<td>9RT 6K</td>
<td>0.1</td>
<td>0.25</td>
</tr>
<tr>
<td>Director Driver</td>
<td>EKT</td>
<td>0.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Director Diode</td>
<td>156</td>
<td>0.6</td>
<td>0.25</td>
</tr>
</tbody>
</table>

**CONTRIBUTIONS—May 1943**

May 1943—ELECTRONICS—May 1943

95
Iquired for full resonant voltage to
weight of such a filter is considerable.

...the signal must be locked
selectivity is to use as highly reso-
...selectivity must be of such
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Electronic Control of D-C Motors... Part I

Direct-current motors are based on the electromagnetic principle that a conductor through which current flows, and which is exposed to a magnetic flux, is subjected to a deflecting force. If such secondary influences an excitation, and armature-reaction, are disregarded, the basic performance characteristics of d-c motors can be explained by the following simplified relations:

1. Torque is proportional to the product of armature current and field current.
2. Counter emf is proportional to the product of speed and field current.
3. Counter emf is equal to line voltage minus IR drop.

Continuous capacity is governed primarily by heating limitations. In the case of duty cycles, the rms values of motor horsepower have to be calculated for a complete operating cycle to determine the equivalent continuous rating. Overload capacity is determined by the maximum torque the motor is able to deliver and by the commutation limit.

The limited speed range of 3 to 1 or 3 to 2 by field control is sufficient, this speed range can be widened considerably if the armature voltage is varied independently of the field excitation, but this method of speed control is not obtained from a constant potential d-c distribution system unless a d-c to d-c generator set is used to obtain the variable armature voltage.

When an a-c network is the only power supply, some form of d-c to a-c conversion equipment must be used to provide a d-c supply for the motor. Otherwise, the alternative is a special a-c motor of limited speed range or a constant speed a-c induction motor coupled through a mechanical variable speed transmission or an electromagnetic coupling device.

Where d-c power is available, a simple d-c power supply from which operate all d-c motor might be an a-c to a-c circuit using a rectifier. However, so element of a circuit would require the following additions to become commercially practicable: (1) A filament transformer is needed to provide the voltage, high-current filaments for the tubes. (2) A time delay relay to permit the motor to reach required operating temperature. (3) Anode capacitors to limit the effect of circuit currents in both the a-c and d-c circuits. (4) Inductive windings to protect the remaining tubes from voltage surges which result from the anode transformer in the event of circuit currents in both the a-c and d-c circuits. (5) Thyristors to control the d-c voltage supplied to the motor.

A complete control circuit is shown in Fig. 2 and the photograph of a typical panel in Fig. 3. The same panel may be used with different a-c power transformers to supply d-c motors of 115, 230, or 550 volts, each side of midline, and 440, 480, and 550 volts, 50/60 cycles in many applications the autotransformer of Fig. 1 may be substituted for the rectifier and field windings. Therefore, it is desirable to standardize the frequency and voltages for the excitation of all control devices and to provide taps for this voltage on the secondary of the anode transformer, the taps being spaced equidistant each side of the neutral midpoint for the purpose of grid control, if used. The 3-phase motor, 200/60 cycle supply is a convenient type of supply upon which to standardize.

Many of these auxiliary devices are much the same for a given size or complement of tubes, irrespective of a-c supply voltages and/or output voltage within the rating of the tubes. Therefore it is desirable to standardize the frequency and voltages for this voltage on the secondary of the anode transformer, the taps being spaced equidistant each side of the neutral midpoint for the purpose of grid control, if used. The 3-phase motor, 200/60 cycle supply is a convenient type of supply upon which to standardize.

Most frequently used are the various types of d-c power supplies which output of a form of voltage transformation in order to operate standard d-c motors from standard voltage a-c systems. The fixed ratio of a-c to d-c voltages, which the type of circuit itself determines, is not the ratio of the standard a-c or d-c distribution systems. For example, the circuits of Figs. 1 and 2 require a midline a-c voltage of approximately 275 volts rms at each side of midline in order that the rectifier d-c output will be 230 volts and this particular voltage ratio, namely, 350/275 volts, is not a common for distribution transformers.

Gaseous discharge tubes are basically current-regulated devices whose maximum current is determined by the nature of the cathode and the geometry of the tube and whose continuous current rating is a function of the tube's ability to dissipate the heat generated within its structure.
use the d-c power supply but a control for larger motors must include a current-limiting means external to the motor itself. The control of Fig. 4 includes a push-button operated motor starter which, in this case, consists of a resistance \( R_s \) connected in series with the motor armature and a contactor \( K_a \) so arranged that at a certain definite time after the starting is initiated the contactor will drop and short-circuit the series resistance \( R_s \) and will simultaneously cause another contactor \( K_f \) to release full-field shorting around the rheostat so as to allow the motor speed to rise to whatever speed weak-field setting of the rheostat determines.

Overload protection is by means of a thermally actuated relay \( O_L \) which responds approximately to the heating of the motor armature. For stopping, a resistor \( R_{st} \) is connected across the motor armature to dissipate the energy of the armature and its shaft load and thus prevent rapid dynamic braking of the motor and to a low value from which it may be mechanically braked dead stop if the frictional load is not sufficient to bring it to a stop in a reasonable time.

Motor-starter unit is shown in Fig. 3; an even smaller size enclosure is used for the d-c motor-starter unit in Fig. 4; this panel in combination with an anode transformer is approximately half the volume.
providing excitation for a 1-hp motor. The armature voltage must be reduced to below the rated value at speeds below basic speed, because of the reduced air cooling effect on the armature windings. This is true whether the motor is operated from external sources or a generator.

When the control setting of 0.5 in Fig. 6 is used, the armature voltage control is reduced to a point where the speed is reduced but the torque is constant at full-load voltage, the speed is decreased as the field is weakened, the horsepower output of the motor remains constant throughout the decrease in speed at rated armature current flows. The speed decreases as the field is weakened to increase the back EMF of the motor, keeping the load voltage constant.

The control setting of 0.7 in Fig. 6 provides a variable armature voltage as well as variable field voltage for the d-c motor. The excitation for the d-c motor is determined by the armature voltage applied to the motor. The field is at full strength from basic speed up to the rated speed of the motor, then weakened to zero at full load when the load is removed.

In Fig. 6, a wide range of variable speeds is available at all speeds. At very low speeds, the armature current must be reduced below the rated value at basic speed, because of the reduced air cooling effect on the armature windings. This is true whether the motor is operated from external sources or a generator.

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Narrow Band-Pass Filter

For control or experimental purposes, filters of the type which pass only narrow bands are often used. These filters may be symmetrical (constant $K$) or unsymmetrical in general type; the characteristics of the two types differ somewhat, and it is to the advantage of the engineer to be able to determine quickly which type he should employ. By means of certain simplifications in method, it is possible to use the nomograms given and derived here without much loss in accuracy.

In addition to symmetrical band-pass filters with constant $K$, unsymmetrical filter types III and IIIa as shown in Fig. 1 are of considerable importance. Although the attenuation characteristics of these two types are not as steep as those of the constant $K$ type, their inherently lower insertion loss at the midband frequency makes their use desirable for certain applications. This is especially true in the very narrow band-pass filters where the insertion losses at the midband frequency of the symmetrical filter become too large. The attenuation of either of the two types of filters is not symmetrical, the attenuation being much greater at frequencies above the pass band, with type III, and below the pass band with type III. Because of the higher impedance at frequencies away from the pass band, the type III is used in preference to type IIIa.

The performance of these filters may be predetermined either from the relation

$$\tan a = 1 + (Z_1/Z_2)$$

or graphically from $Z_1/2Z_2$. It is, however, felt that both of these methods are too lengthy, and much quicker methods can be used.

Considering filter type III, and neglecting dissipation in the condensers, the following relation may be obtained for the series arm impedance $Z_1$ at any frequency $F$:

$$Z_1 = 2aP_{FL} - \frac{[gP_{FL}]^2 + a^2}{2}$$

$\alpha$ is the dissipation factor and $r$ is the resistance of the coil.

Inserting the expressions for $L$ and $C$, from Fig. 1, and simplifying, the following is obtained:

$$Z_1 = -\frac{2PF - P_{FL}}{2} + \frac{2PF}{Q(F - P_{FL})}$$

Similarly, the shunt arm impedance is

$$Z_2 = \frac{2PF - P_{FL}}{2} + \frac{2PF}{Q(F - P_{FL})}$$

For this case

$$\tan a = 1 + \frac{Z_1}{Z_2} = -\frac{2PF + P_{FL}}{2PF - P_{FL}}$$

and $\alpha$ is a minimum.

Solving

$$\frac{PF - P_{FL}}{PF + P_{FL}} = -1$$

gives the attenuation at any frequency $F$.

The two alignment charts in Fig. 2 are constructed using relations (1) and (3) for $Z_1$ and $Z_2$, and may be used for a quick determination of the theoretical performance of type III filters since $F_1$ gives the attenuation at any frequency in the pass band and $F_2$ gives the minimum insertion loss.

Unlike the constant $K$ section, the lowest insertion loss for this type filter does not occur exactly at band, but takes place when $\tan a = 0.707 \sqrt{F_1 F_2}$.

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We have \( F' = 0.5 \cdot F \), or the point of minimum insertion loss takes place for a frequency
\[ F = \frac{0.707 \cdot F'}{ \sqrt{F' + F}} \] (4)

At the point of minimum attenuation
cosh \( \alpha = \frac{F' + F}{2} \) \[ \frac{F' - F}{Q(F' - F)} \] (5)
The nomogram shown in Fig. 3 is based on this equation. At the cutoff point where \( F = F' \),
the attenuation may be expressed as
cosh \( \alpha = 1 + \frac{F'}{Q(F' - F)} \) (6)

while at the cut-off point \( F = F' \),
the attenuation may be expressed as
cosh \( \alpha = -1 + \frac{F'}{Q(F' - F)} \) (7)

Alignment charts in Fig. 4 may be used to find the insertion loss at the cut-off points.

Now the entire response curve of the filter may be found by using Fig. 2 to determine the attenuation

\[ Z_1 = \frac{2 \cdot F' \cdot F}{Q(F' - F)} \] (8)

where \( F' \) is the frequency for which the attenuation is to be determined.

This expression is somewhat complicated, it can be handled quite easily. In the method just outlined, the imaginary part of the expression \( Z_1^2 \cdot Z_2 \) is used mainly to calculate the performance at \( F \), and \( F' \), and the minimum insertion loss from Eq. (8).

When \( F = F' \),
\[ Z_1 = \frac{2 \cdot F' \cdot F}{Q(F' - F)} \] (9)

and when \( F = F' \),
\[ Z_2 = \frac{2 \cdot F' \cdot F}{Q(F' - F)} \] (10)

Equations (9) and (10) are the same as (6) and (7) except that the

insertion loss at \( F' \), for type III, is the same as at \( F \), for type III, and at \( F' \), the same as \( F' \). The alignment chart in Fig. 4 may then be used for both types except that the values for \( F' \) and \( F \), are interchanged when applying to a type III, filter.

In the same manner, the real part of Eq. (8),
\[ 2F' \left( Q \left( \frac{F}{F'} - \frac{F'}{F} \right) + F' \left( \frac{F}{F'} - \frac{F'}{F} \right) \right) \] (11)

compares with the real part of Eq. (10) which can be written as
\[ 2F' \left( Q \left( \frac{F}{F'} - \frac{F'}{F} \right) + F' \left( \frac{F}{F'} - \frac{F'}{F} \right) \right) \] (12)

This is similar to Eq. (5), and the nomogram in Fig. 3 may be used.

Thus we see that the performance of both filter types may be obtained from the same set of alignment charts.

Application to Constant K Filters

The charts in Figs. 5, 6, 7 are obtained in the same manner for use with the constant K type filter, and are especially applicable in calculating the performance of narrow band filters. None of these charts take into account reflection losses. The actual attenuation in the constant K type and type III, will be greater than obtained at points away from the midband. The performance near the midband will depart greatly from the values obtained by means of these nomograms.

To compare the performance of the two types of filters, calculated performances of type III, and of the constant K type are shown in Fig. 8.

The Q of the coils were assumed to be 50 and the ratio \( F/F' \), for the two types was selected so as to give the same midband insertion loss. The ratios are 1.09 for the constant K type and 1.04 for the unsymmetrical type. From the curve we can see that if the performance in the vicinity of the midband is more important, the unsymmetrical filter may be used. The saving in space, weight, and cost will be approximately 20 percent.
**Television Aids OCD**

Symptomatic for the duration of the war insofar as commercial application is concerned, transmitters and receivers are being put to good use training civilian defense workers in the proper performance of their important duties from a central point.

**Traffic**—Specially trained by head-officers and assisted by a local police officer, a group of correspondents focus on NBC cameras and practice on his operating knowledge of how to handle crowds during an emergency.

**Demolition**—Experts show distant defense workers how best to use a handy wall and huge dangerous battery electric wire.

**Boundaries**—One picture is worth a thousand words, but when it comes to instructing workers in the art of establishing a more modern town.
Fluorescent Lamps Show Standing Waves on Lines

By P. M. Honigsberg

The use of a rarefied gas tube (such as neon) to demonstrate the presence of high-frequency standing waves on Lecher wires is not entirely satisfactory from the standpoint of visibility, especially when demonstrating these effects to large audiences. By utilizing fluorescent lamps in place of neon tubes, however, striking and spectacular displays which are clearly visible to a group consisting of as many as five hundred people can easily be secured. This application is made possible by the fact that fluorescent lamps become luminous when placed in a high-frequency field, due to the so-called "inductive" ionization of the mercury vapor with resultant activation of the phosphor coating of the lamp. Since the ionization and resulting lamp luminosity are roughly proportional to the electric field intensity in which the lamp is placed, a better terminology for this phenomenon might be "capacitive ionization" or "electric field ionization."

Waves on Lecher Wires

Standing potential waves along an energized Lecher wire system (or transmission line) can be made clearly evident by holding a fluorescent lamp at right angles to the line. As the lamp (maintained constantly at right angles to the line) is moved along the length of the line, maxima and minima of the potential waves are strikingly shown. At potential antinodes the fluorescent lamp glows brilliantly; at potential nodes the fluorescent lamp is extinguished.

In Fig. 1 the vertical lines indicate the potential wave distribution symbolically. It should be noted that the fluorescent lamp becomes luminous only over that portion of its length immediately adjacent to the Lecher wires (where the field intensity is a maximum), in contrast to the usual full-length brilliancy of such lamps when utilized for illumination.

Waves on Loaded Lines

Standing waves on uniformly loaded lines, having impedances uniformly distributed along their length, exhibit shorter physical lengths for a given frequency than do non-loaded conductors.

A typical form of loaded conductor is a long thin solenoid. This phenomenon is nicely demonstrated by placing a spaced-turn winding on the fluorescent lamps themselves, thereby making them the cores of the solenoids. A loaded line of this character is shown in Fig. 2, with the standing potential wave distribution again shown by the vertical lines.

When the loaded line is energized at the proper frequencies to obtain pronounced standing waves, the fluorescent lamps glow with alternately bright and dark bands, indicating voltage anti-nodes and nodes respectively. The distance between nodes (or anti-nodes) is one-half wavelength, and is much less than the free-space length.

Voltage Distribution Along Antenna

Another striking demonstration shows the voltage distribution over a half-wave antenna. Such an antenna, driven by means of an oscillator (either directly or through the medium of an unbalanced Lecher wire feeder system, for example), will have a potential gradient along its length approximately as shown by the dotted curve in Fig. 3. Voltage maxima exist at each end with a voltage minimum at the center. A half-wave antenna operated at 125 mc will have a length of about 125 me.

In any dependable communication system there are important parts sure to be "CINCH." And each and every one is made for an important part in the job. Tested by exacting requirements of the foremost users of radio and communication parts, CINCH parts, sockets, connectors, etc., are performing consistently well wherever called upon under widely varied uses demanded of them today.
Surgical Applications for Electronic Metal Locator

COMMERICAL DEVELOPMENT of the experimental metal locator so dramatically used on Pearl Harbor victims has resulted in an electronic instrument sensitive enough to locate an ordinary steel needle at a depth of more than 11 inches. In use it has actually located a nonferrous metal fragment less than 1 inch in diameter lodged underneath the skin of a victim of a bomb explosion. Another victim was located at the factory (Waugh Laboratories, 125 E. 42nd St., New York City) and has been in frequent use in New York City hospitals for emergency operations.

The operation of the production model is essentially the same as that of the experimental device. The circuits are adjusted for zero meter reading with no extraneous metal in the magnetic field of the search probe.

Although a fluorescent lamp with a burned-out filament is ordinarily useless for illumination purposes, it is perfectly satisfactory for these demonstrations since no electrical connections are made to the lamp. As in all experiments of this kind, best results are obtained when the oscillator frequency is correct. A dark region will exist at the center of the lamp and both extremities will be brilliantly luminescent, indicating the voltage node and antinode respectively.

Practical Notes

As is well known, the temperature of the bulb has some effect on the ease of ionization of the mercury vapor in the lamp. If difficulty is experienced in getting the lamp to upset, the initial balance of the circuit engines can be measured automatically and accurately by adding a light source, optical system, photo cell, relay and a pair of adjustable dials to the standard platform scale on which the fuel tank is placed.

One flag is set at the scale reading, and the other is set below this reading by an amount equal to the quantity of oil or fuel for which the test is to be run. The light beam system is then set at the lower flag, in such a way that the scale pointer indicates the level of fuel in the tank at the end of the run. The photoelectric circuit can be connected to sound an alarm bell, stop a timer, or indicate in some other way how long it took the engine to consume the quantity of oil or fuel corresponding to the interval between the flags. The device is ideal for determining the amount of oil consumption of any given degree of intensity.

From the time of its earliest use in hospital operating rooms, the handling of most inhalation agents has been fraught with danger of fire or explosion from static sparks. However, this risk did not receive serious recognition until recent years when accepted engineering principles were applied to this aspect of anesthesia and surgery.

The introduction of cyclopropane and other newer types of gases has been fraught with danger of fire and explosion from static sparks. However, this risk did not receive serious recognition until recent years when accepted engineering principles were applied to this aspect of anesthesia and surgery.

The magnetic field produced by the search coils in the probe used for locating metal objects has an effective range of several inches.

The probe contains tiny search coils which produce a magnetic field essentially as indicated in the diagram. Any metal, ferrous or nonferrous, in this magnetic field will set up the initial balance of the circuit and give a meter indication.

With a probe brought near a metal particle, the meter pointer moves up, and reaches a maximum when the probe is closest to the metal object. One probe being used is essentially as indicated in the diagram. Any metal, ferrous or nonferrous, in this magnetic field will set up the initial balance of the circuit and give a meter indication.

With the introduction of cyclopropane and other newer types of gases, further attention was focused on the elimination of this hazard. How could the electrical potentials be eliminated of the anesthetists, the patient and the apparatus be equalized to eliminate the possibility of spark?

The answer was found in factoring the group together by means of silver chains and other conductive materials. Connected into the circuit, a device consisting of high resistances prevents the formation of a static charge of any importance.
Now, we're not being nasty—but it is possible that some day we'll all be able to see in the dark. And when we say, "see in the dark," we mean not only actual physical darkness—but also the ability to see beyond natural obstacles to sight. It is quite conceivable that the cathode-ray tube will be one of the implements to provide us all with cat's eyes. A short decade ago, this new commonplace industrial tool was a rarity—a laboratory curiosity. Pioneered by the Allen B. DuMont Laboratories, the commercial cathode-ray tube of today is speeding production, reducing waste and helping make an all-around better product.

To insure maximum reliability and durability under all operating conditions, DuMont depends on Callite Tungsten for welds, tungsten leads and other tube components.

Calleite research and Callite experience combine to assure dependable quality, uniformity and stamina in the manufacture of welds, lead-in wires, filaments, grids, plates and other metalurgical products. If you have a problem involving the use of tungsten, molybdenum, silver, platinum and other metals of a similar character, why not consult with our engineers today?

Two New Invar Alloys for Electronic Devices

In applications where the tendency of metals to expand with heat must be overcome or minimized, a 36 percent nickel alloy known as Invar has heretofore been extensively used. Application of this alloy to electronic products has now been limited by machining difficulties, however. This problem has now been overcome by The Carpenter Steel Company, Reading, Pa., with the development of a new machining grade of Invar. The new property was secured by adding a small amount of selenium to the alloy, giving a new low-expansion alloy known to the trade as Carpenter Free-Cut Invar "BC".

Standard Invar alloys are non-magnetic, but a special Invar-like magnetic alloy known as Magnetar has recently been developed by the General Electric Research Laboratory specifically for use in tuning forks.

Combustion Indicator Tests Diesel Engine Exhaust Smoke

The clearest of the exhaust smoke from a diesel engine is a dependable indicator of the quality of combustion, but visual observations of the exhaust are at best insecure during daylight and are practically impossible to secure at night. The development by Photovolt Corp., New York City, of a smoke meter capable of registering smoke density from 0 to 20 percent by photoelectric means now makes it possible to monitor engine combustion accurately and even automatically if desired.

A typical smoke meter installation on a diesel engine is shown in Fig. 1.

Fig. 1—Combustion efficiency of this diesel engine is indicated in terms of exhaust smoke density when a suction fan pulls part of the exhaust gas through a beam of light in an inch tube mounted on the engine.

Someday we'll all have cat's eyes

Calleite Tungsten Corporation

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ELECTRONICS - May 1943

One basic symbol...
No RF Circuits and plenty of output
in this stable, accurate audio frequency oscillator

and the operating principle is illustrated by the diagram in Fig. 2. The system is also applicable to oil burners, which have correspondingly low smoke densities under normal operation.

For this instrument, the percent smoke density has been defined as the percent reduction in light passing through an 18-inch column of exhaust gas. The exhaust gas enters at the upper right-hand cock in Fig. 2, travels through the tube, and is pulled out by a suction fan through an outlet near the other end of the tube. The photovoltaic cell and light source are at opposite ends of the tube. The instrument is adjusted to give full-scale deflection on the meter when clean air is in the tube, and the meter is calibrated to read smoke density in percent when the tube is filled with exhaust gas. Glass windows are provided at the ends of the tube to protect the lamp and the photovoltaic cell from smoke particles. Windows are hinged for cleaning purposes; cleaning is necessary only when the instrument can no longer be adjusted to zero for clean air. The window on the inlet side carries a beating coil, to prevent moisture from condensing on the glass.

Animated Motion Picture Explains Telephoto Process

By LYLE B. WESCADER
A PICTORIAL PRESENTATION of the basic principles involved in sending wire-photos has recently been made available in the form of a one-reel sound motion picture film entitled "Spot News". It is produced by the Jam Handy Organization of Detroit on 16-mm safety film.

The sound track on the film furnishes musical and sound background while the story is told with commentary and dialog. The film starts by showing a wire-photo crew photographing an airplane taking

ARMY OVERSEAS EXECUTIVE OFFICE

FOR OUTSTANDING MERIT
IN MICROPHONE PRODUCTION

The Army and Navy "E", symbol of outstanding achievement, has been awarded to Shure Brothers. It is the highest badge of honor for the victories of the soldiers on the production front that must come before the victories of the soldiers at the fighting fronts. Shure Brothers are united in the determination to do their utmost to shorten the day of final victory for the democratic forces.

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controls the current and sets a G.E. Circuit Breaker to guard the electrical circuits against dangerous overloads and shorts. This device does the work of two; it saves valuable space and weight, important factors to our new sky fleet.

where increased range, armament and fighting power must be considered above everything else. Yes, they do the work of two devices, but that's not all. They are dependable, accurate and completely enclosed.

The MCM911, one of a series of quick-make and quick-break circuit breakers for 14-volt service with ranges from 120 amperes down to 60 amperes. Breakers 125 volts A.C. or D.C. are also available. They have a special trigger construction to prevent dust infiltration and can be obtained in either luminous or plain tip. Others are made for ratings down to 2 amperes.

For further information and a copy of our Circuit Devices Catalog for Mobile Military Equipment, write Section P312-116, Appliance and Machine-Tool Department, General Electric Co., Bridgeport, Connecticut.

TWO "KNOW HOWS" ARE BETTER THAN ONE

"Know how" proof #9...more each month

Your war production or post-war products will be as good as the "know how" (and the special or standard fastenings) you put into them. The products of your own "know how" will be even better if their standard or special fastening devices are the result of Scovill's many years of experience in Design and Production.

Scovill proves its Fastenings leadership with work, not words. The stud illustrated was made from copper wire by three cold forging operations, plus clipping, drilling, roll-threading. It is but one of the many jobs we have "engineered" into minimum metal—money—motions. And this same "know how" goes into the wide range of standard fastenings we offer.

Scovill Fastenings experts in the offices listed below can help you with the Fastenings end of both your current production problems and your post-war planning. Just as in your own case, we are busy with war work but we will give you a prompt, above-board picture of when and where we can serve you. It will pay you to see what Scovill says.

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ELECTRONICS — May 1943

May 1943 — ELECTRONICS
The Arnold Engineering Company is proud to receive the Army-Navy "E" award for great accomplishment in the production of war equipment. We realize that this award carries with it not only honor, but a responsibility. The management and personnel of The Arnold Engineering Company will continue with the same high devotion, energy and skill to turn out products for the war effort.

The tenancy of glass or transparent plastic materials to become doubly refracting upon application of pressure is the basis for a new system of light modulation which is capable of handling large quantities of light, and requires only simple, easily constructed apparatus.

The method of utilizing this photoelastic property of glass is shown in Fig. 1. Pressure is applied to the edges of the central plate of glass by squeezing it between the two-section iron core of an electromagnet. The amount of pressure is varied in accordance with the desired a-f modulation by feeding the output of an a-f amplifier to a modulation coil surrounding one section of the iron core. This coil produces flux alternately aiding and opposing the fixed flux of the magnet coils, thus varying the attractive force be-

Wish we could talk about some of this

The mid-western job, with photos, would make a honey of an ad. It’s the largest high altitude test chamber in the country. Unusual specifications, too... Or the steel-saving, time-saving concrete altitude chamber that everybody said was impossible... And the small unit that brought a manufacturer’s testing time on production runs down to 8% of his previous average...

Most of this information, if published, could be very helpful to manufacturers of equipment requiring Army or Navy high altitude and temperature tests. True, we are permitted to furnish government prime contractors with full particulars, when they ask for it. But all of them can’t possibly know whether their special problems are within the scope of our activities... unless they write, and enable us to recommend solutions.

But, boy, will we have plenty to say to the entire field when the war is over and we can open our lab records!
HOW TO ORDER
PRESTO RECORDING DISCS,
NEEDLES AND REPLACEMENT PARTS
and get prompt delivery

1. Place your order with your distributor for the discs and needles you will need during the next 90 days. The distributor will stock them and deliver as your convenience. He will need your orders to determine his stock requirements which he must estimate 90 days in advance.

2. Apply to your purchase order the AA2X preference rating which you have received under the revision of War Production Board order P-133 dated February 4, 1943, par 3037.

3. In ordering replacement parts or equipment renewals give your distributor the serial number of the equipment to be repaired or replaced and the part number as shown in your instruction book. Apply the AA2X priority to your order.

Buy Presto produces through leading radio distributors or any branch office of the Graybar Electric Company.

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AS QUICK AS SHE CAN SAY JACK ROBINSON...

There's a break in the power line... and Jack Robinson is lost in the acres of machinery.

Yet he's found in a flash—thanks to Straight-Line Communication.

It's a signal that can't miss... it reaches individuals, groups, or the entire plant quickly, clearly.

But the amazing thing is that many modern plants still rely on time-wasting indirect methods of communication—despite the fact that paging by Straight-Line Communication does it better and quicker than by any other means. It more than pays for itself in a short period of time.

If your factory or plant has any communications problems whatever...

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Our 8 years' experience in this field can help solve them. In sound systems, radios and telephones, "there is nothing finer than a Stromberg-Carlson." Why not get in touch with the Sound Systems Division of the Stromberg-Carlson Company, 100 Carlson Road, Rochester, New York. Write for free booklet No. 1390.
Out of the fiery crucible of war will come new devices that will amaze the world...radio sets that are revolutionary...electronic equipment that will create new standards of living. The battlefronts of the world are the proving grounds for these new developments.

Sentinel, pioneer builder of receiving sets since the birth of the radio industry is right in the thick of the battle...producing equipment exclusively for the use of our fighting forces - equipment that is meeting the rigorous standards of our Army and Navy. Equipment that is given the acid test of war and is coming through with flying colors.

Meanwhile we can't plan the time of the war's end — But we can plan what Sentinel's going to do and what the new Sentinel Radio is going to be like. This much we can say now: There will be new Sentinels that will surpass every present radio...Electronic devices that will stagger the public's imagination...Mechanization that promises a new era of prosperity for Sentinel Dealers.

-SENTINEL RADIO CORPORATION
2020 Ridge Ave., Evanston, Ill.

Fig. 2-Computed response curve for LeClair light modulator

Audio frequencies. One factor limiting the amount of light which can be handled is the safe operating temperature of the Polaroid lenses, but here air cooling can greatly increase the handling capacity.

Relation Between Light Intensity and Coil Current

The formula for the angle of lag between the ordinary and extraordinary beams in the glass is

$$\tan^{-1}(1 - \frac{Z}{X})$$

where Y and Z are vertical and horizontal components, C is a constant for the glass and t is its thickness. Since C and t are constants and Y is zero, this simplifies to KE.

The force between the poles of a magnet is proportional to the product of pole strength divided by the square of the gap distance. Since the gap distance is substantially constant, the force is

$$F = K \left( \frac{X}{d^2} \right)$$

The intensity of light in terms of unity polarized light leaving the second polaroid is

$$I = \sin^2 \left( \phi \right)$$

where \( \phi \) is the flux.

Assuming that operation is on a linear magnetization curve, the flux is proportional to the coil current,\( \phi = K_i \). Therefore, \( F = K \left( \frac{X}{d^2} \right) = K_i \).

The frequency response of the system is principally dependent upon the mechanical design and the material used in the pressure valve. A number of different plastics have been employed in place of the glass with good results.

HOW TO MAKE TUBES LAST LONGER ON THE JOB...

RCA advertising, for months past, has been devoted to operating tips on making tubes last longer. This valuable material has now been collated into a booklet, copy of which will be sent upon request to Radio Corporation of America, Commercial Engineering Section, Harrison, N. J.

RCA TRANSMITTING TUBES
PROVED IN COMMUNICATION'S MOST EXACTING APPLICATIONS
RADIO CORPORATION OF AMERICA, RCA Victor Division, Camden, N. J.

RCA 849
R-F and A-F POWER AMPLIFIER, OSCILLATOR, MODULATOR
$120

LONGER LIFE instead of increased ratings

Ordinary, when a Transmitting Tube has been improved, its ratings are raised — but not in these extraordinary times!

Today, it is long life that counts—not spectacular "peak" performance. That is why, when the RCA-849 was materially improved over a year ago by use of the famous RCA zirconium-coated anodes, you heard nothing about it—even after months of actual use had shown that the improvement was such as to warrant a substantial rating increase in normal times. Instead of reflecting such an improvement in terms of higher tube ratings, we utilized it to make conservative RCA tube ratings still more conservative. This program, we felt, was far more in keeping with the war effort because it assured longer life for tubes that are difficult to replace. This has been done not only with the RCA-849, but with other RCA tubes as well.

The war has not stopped RCA engineering progress. It has only intensified it—a fact to which the thousands of hours of additional potential life now built into many RCA Transmitting Tubes testify to the most convincing proof.

RATINGS

- Plate Voltage: 2500 Volts, Max.
- Plate Dissipation: 400 Watts, Max.
- Plate Resonance: 400 Volts, 500 Watts, Max.

For above tabulation see wiring section.
The creation of the "DP" Series of connectors, designed with rectangular shell for special application to rack and panel equipment, is strictly a Cannon development... carried out in collaboration with airline engineering personnel.

Originally designed for aircraft use, the "DP" family of connectors is finding wide application in many fields where space is limited... where varied circuits must be plugged in and out with a minimum of effort.

There are many styles of "DP" connectors. Among them the "DP-D" for rack type equipment which covers a maximum of thirty contacts. In this unit there are inch arrangements for taking 10, 15 and 20 ampere contacts, and many variations are possible.

The decisive factor in many important battles is the shock action and mobile fire power of a tank charge. Success is dependent upon perfect timing, perfect coordination through instant and sure communication by voice radio between the various units.

Tank radios must be compact. Above all else they must be dependable - able to withstand terrific vibration, jolts and jars. They must operate under extremes of heat and cold. They must not fail.

That is why you find more and more tank radios of the Allied Nations equipped with AlSiMag stellite ceramic insulators .... compact, tough, dependable.
Embryo pilots must undergo final strict tests in Pre-Flight Training Schools before they earn their coveted Wings. So must the performance of your Air-Borne Equipment be pre-tested before going into active service under stratosphere conditions.

AMCOIL Test Chambers provide an opportunity to insure compliance of delicate instruments and electronic equipment with high and low temperature specifications prior to their use. AMCOIL completely automatic temperature test chambers combine mechanical refrigeration and electric heating, thermostatically controlling low and high temperature ranges from -70° to +70° C. (-95° F. to +160° F.). They have an exceptionally fast rate of pull down, (ambient to minus 50° C. in less than one hour, without productive load). Test conditions are easily controlled from a front panel board. Door has five thicknesses of glass, hermetically sealed and protected against moisture seepage, thus assuring clear visibility always.

Cubical contents of AMCOIL chambers range in size from 7 cu. ft. to 28.7 cu. ft. and are available with either mechanical or dry ice refrigeration; also special chambers for altitude and humidity testing.

Flaw Detection

Gamma rays generated by Westinghouse electronic equipment detected air bubbles in this steel turbine cylinder casting. Flow areas were chipped out and the man at work is sketching in these areas by means of a welding technique.

May 1943 — ELECTRONICS
FROM Mica Headquarters—

ELECTRONICS

MORE BLANKS from the same quartz

For highly consistent and accurate results DI-MET models 80 and 120 quartz cutting machines are equipped with the Felker Hydraulic Retardant. This retardant controls down-feed to a definite speed, which can be adjusted from a fraction of a foot to 10 feet per minute.

Cutting speed of the DI-MET Rimlock or DI-MET Resinoid blade is always well in advance of the feed rate, and the movable arbor is so balanced as to permit utilizing the most efficient blade pressure upon the quartz without forcing. Blinds will not bind or buckle because excessive and variable pressures are impossible, thus eliminating runouts and breakage of crystals.

Felker Retardant controls speed of the DI-MET machine without 'locking the feed out. It is an excellent code with which to control feed speed and maintain constant blade pressure upon the quartz. The Felker Retardant eliminates all external pressure regulation and permits the DI-MET machine to maintain constant blade pressure upon quartz throughout the entire run length.

Felker Retardant is controlled by the Manual Feedmeter shown in Fig. 1. The beam of the feedmeter is divided into 10-minute increments, each of which is 0.5 foot in length. The feedmeter incorporates a 360° dial for instantaneous reading, together with a variable-meshing dial for controlling the feed rate at any desired speed.

Felker Retardant is easy to handle, easy to store, and easy to apply. It is supplied in a convenient carrying case, and can be applied to the DI-MET machine by simply placing the case on the machine and adjusting the feedmeter to the desired speed.

Felker Retardant is also easy to apply to the DI-MET machine by simply placing the case on the machine and adjusting the feedmeter to the desired speed.

Felker Retardant is a highly consistent and accurate retardant that controls down-feed to a definite speed, which can be adjusted from a fraction of a foot to 10 feet per minute.

Felker Retardant is an excellent code with which to control feed speed and maintain constant blade pressure upon the quartz. The Felker Retardant eliminates all external pressure regulation and permits the DI-MET machine to maintain constant blade pressure upon quartz throughout the entire run length.

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Felker Retardant is also easy to apply to the DI-MET machine by simply placing the case on the machine and adjusting the feedmeter to the desired speed.
Those green-colored (for identification) power resistors found more and more in severe-service electronic, radio and electrical assemblies these days are Greenohms. They are extra-rugged, as proven by impartial tests and the service records out in the field. The extra safety factor is due to the exclusive inorganic cement coating in which the resistance winding is imbedded and protected. This coating provides improved radiation of heat for cooler operation. Also, this coating will not crack, flake or peel despite severe overloads and heat shock.

Standard types in 5 to 200 watt sizes as fixed resistors, and 10 to 200 watt sizes as adjustable resistors. Special types in widest range of terminals, mountings, taps, sliders, etc.

Bounceless Relay Contacts

The fact that a steel ball partly filled with metallic powder will not bounce has been utilized by Westinghouse engineers to eliminate bouncing and chattering in the contacts of fast-acting relays. The relay contacts themselves are made hollow and are partly filled with metallic powder, or special hollow powder containers are attached to the moving contacts or to an extension of the contact arms.

Recording Sunlight Intensity

Continuous records of variations in sunlight intensity throughout the day are being obtained at the greenhouses of Ohio State University by a photo-electric cell mounted above the peak of the greenhouse roof and connected directly to a Leeds & Northrup Micromax recorder. The resulting light data is being used in connection with the study of soilless horticulture. An Eppley pyrheliometer may be used in place of the photocell if desired.

N.Y.A. TRAINS WAR WORKERS

A pre-employment program of work experience in organized shop training for young people between the ages of 16 and 24 is being offered by the National Youth Administration to those interested in entering war industries. Hundreds of skilled workers are being trained at N.Y.A. Quinty Village School, Eastport, Maine, each month direct to war factories. William Greenwood, student, is welding on a 250-watt transmitter under the supervision of Robert Disney, instructor.

SPEED NUTS are truly the commandos of the assembly lines. They are tough — and fast in action. They are now being rushed into aircraft factories where they are vitally needed on the assembly lines.

Spring Steel SPEED NUTS are approved by the U. S. Army Air Forces and the Bureau of Aeronautics for most all non-structural attachments. Conversion to the use of Speed Nuts on all approved applications releases critical bar stock steel for other important uses.

Our Engineering Dept. will be glad to assist you in determining the proper approved locations where SPEED NUTS may be used. Request for information or assistance will receive immediate attention.

TINNERMAN PRODUCTS INC. 2106 FULTON ROAD, CLEVELAND, OHIO

IN ENGLAND: TINNERMAN PRODUCTS LTD. 117 FIELDS, LONDON, W. 8

IN CANADA: TINNERMAN PRODUCTS LTD., LEAF BY LEAF, MONTREAL

SPEED NUTS are the fastest thing in fastenings!
Post-War Planning

(Continued from page 73)

competition. Such competition appears certain in view of the fact that
until quite recently the government found it desirable to induce factories
never before in the field to enter it.
Where especially critical bottlenecks
occurred, old established plants fre-
quently helped to set up their own
future competition, supplying advice
and at times engineering personnel
and even machinery.

Some of the newcomers may auto-
matically drop out of the picture
when Washington orders dwindle but
a considerable number will naturally
carry on and make at least a tempo-
rary dent in the commercial market.
A few will undoubtedly become im-
portant factors. To offset this com-
petition, manufacturers with brand-
names well entrenched before the
war and since kept alive will have
vastly increased production facilities
and the attractive prices which vol-
ume purchasing permits.
Size is not an unmixed blessing,
however, as the old-time manufactur-
ers are likely to be simultaneously
engaged in something of a struggle
among themselves because of this
selvish expansion in production facili-
ties.

Contrary to popular opinion, it
appears from discussions with men
in many branches of the business
that while radically new products
will receive their share of attention,
these are for the most part thought
of as future sidelines, to be developed
gradually rather than overnight.
Varying in importance, they will
probably play second fiddle, at least
in the immediate post-war period, to
products for which their manufac-
turers were best known before De-
cember 7, 1941. There may be so-
me complete change of direction on
the part of established firms will be the
exception rather than the rule.

Time Element

The problems detailed above and
their subdivisions are those at pres-
tent most frequently discussed among
manufacturers. Accompanying
interpretations contain, of course,
sharing of the thinking of the reporter
and are subject to the usual human

Dimensions AND Facts

For Designers and Operating Men

The extensive line of Roller-Smith instruments contains just the one
you need . . . in the size and accuracy you need it—whether it be
ameters, milliammeters, or voltmeters. And these Roller-Smith catalogs
pre pared by engineers give Electronic Engineers and operating men
the information on Measuring and Control instruments required for their
work in Communications, Industry or the Laboratory.

Accordingly, ranges . . . scale divisions, volt-ampere burdens, as well
as extensive sketches showing necessary dimensions and mounting
details are given in full.
The construction, operating principles and accuracy of Roller-Smith
Panel Instruments merit your close scrutiny. So we suggest
that you write us on your Company letterhead, listing those instruments or equip-
ment in which you are interested—either now or for post-war work. We
will combine the requested data in a loose-leaf book especially com-
piled for you.

ELECTRICAL INSTRUMENTS

Panel Instruments
A.C. and D.C. Ammeters, Milli-
ammeters, Voltmeters, Gauss-
meters, Galvanometers and Pyrometers

PORTABLE INSTRUMENTS

Small, Medium and Large
For remote measurements, as
professional equipment, in
Frequency Meters and Power
Factor Meters.

POCKET SIZE INSTRUMENTS

For any required measurements
Circuit Testers

SWITCHBOARD INSTRUMENTS

including Power Factor Meters,
and Synchroscopes

PRECISION VOLTMETERS

for accurate, rapid readings up to
500 volts or 50 amperes

ELECTRICAL MEASURING AND PROTECTIVE APPARATUS

ROLLER-SMITH COMPANY

BETHLEHEM, PENNA.

Electrical Measuring and Protective Apparatus

ROLLER-SMITH COMPANY

BETHLEHEM, PENNA.

For Designers and Operating Men

May 1943 — ELECTRONICS

May 1943 — ELECTRONICS
"SHORTING" Switches

This is the shorting type. As the arm is rotated from one position to another the adjacent contact points are "shorted" (bridged).

"NON-SHORTING" Switches

This is the non-shorting type. As the arm is rotated from one position to another, the arm lifts up, and only one contact is touched at a time.

**SHALLCROSS**

Switches use solid silver contacts, because solid silver...

1. Has the highest conductivity of materials available.
2. Is superior to silver-plating which wears off, resulting in high resistance contacts.
3. Should it corrode the sulphide formed does not appreciably increase the contact resistance.

Tubes for Ultra-violet Radiation

(Continued from page 85)

the current is first carried by the starting gas only. It should be noted, therefore, that during each starting cycle the tube first operates at a low-pressure discharge between electrodes that are "cold" at the beginning. As a relatively high starting current is demanded from the electrodes a considerable strain is put on them during each starting cycle, thus noticeably affecting the life of the tube. The electrodes warm up rapidly to incandescence under the ion bombardment, but it takes several minutes for enough mercury to evaporate and to produce a pressure sufficiently high to protect the electrodes from rapid disintegration. These starting conditions, therefore, have to be carefully considered in the design of high-pressure tubes.

As the tube warms up and the pressure increases, the mercury vapor takes over more and more of the discharge. Finally, after all the mercury has been evaporated, equilibrium is reached between the input of energy and the dissipation of heat. The tube has then attained maximum intensity. The arc is confined to a brilliant narrow cone in the axis of the tube, this being char-

error. Comment, for this reason, is particularly invited. The important objective at the moment, second only to prevention of the war, is stimulation and coordination of whatever post-war planning effort the pressing production problems of today leave time for.

The need for heavy duty electronic power equipment used by certain raw material processing industries is already tapering off as giant plants near their maximum practical productive capacity. While no such decline in demand is noted in connection with "expendable" gear used on the battle fronts and manufacturers still appear to be feeding this gear into a vacuum, it is a fact that firm orders on the industry's books rarely date beyond the fall. No one knows precisely what the requirements will be next year. This uncertainty alone suggests that it is not too early to do a little quiet thinking about the future... W. MAC.

**SHALLCROSS ROTARY SELECTOR SWITCHES USE SOLID SILVER CONTACTS, BECAUSE SOLID SILVER**

- Has the highest conductivity of materials available.
- Is superior to silver-plating which wears off, resulting in high resistance contacts.
- Should it corrode the sulphide formed does not appreciably increase the contact resistance.

**SHALLCROSS MFG. CO.**

COLLINGDALE, PENNA.
acoustic of the high-pressure arc after it has reached the steady state condition.

The quartz tube of Fig. 7 may be enclosed in a second glass tube having certain filter characteristics. For instance, Corning T glass may be used if it is desirable to exclude the short-wave ultraviolet which produces ozone and if a high output in the medium and long ultraviolet is wanted.

High-pressure quartz mercury arc tubes are used extensively as generators of therapeutic and prophylactic ultraviolet. Their high output in the medium and short-wave range of the spectrum makes them the most efficient and most versatile source of therapeutic ultraviolet radiations.

Of equal importance is their application to photo-chemical processes of many kinds in the industries. A few examples must suffice here to show their many commercial applications.

Tubes with a radiant length of four or five feet and of an input of several kw are used in thousands of photo-printing and blue-printing machines and in similar reproduction apparatus. Photo-sensitive coatings of the Diazo or ferro-salt type applied on papers for reproduction from transparent originals are particularly sensitive to the long ultraviolet, as indicated by the solid-line curve in Fig. 1.

Note. Many Advantages.

A powerful linear source of ultraviolet rays with uniform output over the entire width of the paper has many advantages over "point sources". Carbon arcs, for instance, require special reflectors to attain uniform intensity on the printing surface, and have to be carefully controlled to avoid flickering with resulting shadows on the prints. Carbon arcs also have to be trimmed regularly whereas high-pressure mercury vapor tubes ordinarily do not require any service after they are once installed.

The high efficiency in the spectral range of radiations which activates Vitamin D in sterols (about 2000-3000 Angstrom units) makes the high-pressure mercury arc in quartz the preferred source in apparatus for the irradiation of milk and other foods and for photochemical and pharmaceutical use. Of the many additional industrial applications of high-pressure tubes, only their use

May 1943 — ELECTRONICS
Here's Our Guarantee!
If, after trying "Black Seal," you are not convinced it is better than any you've ever used, we'll send you a refund at once.

Old Aluminum Blanks Recorded with the famous "Black Seal" Formula in 24 Fast Hours! Write for details of the brand new "Pat-Art" Shipping Container. Lightweight, corrosion-proof boxes that save wear, save records, reduce your shipping costs.

PLAX POLYSTYRENE
IN SEVERAL OF ITS FORMS AND USES...

High-frequency circuits insulated with Plax Polystyrene have the highest efficiency. This has been proved in the field.

Zero water absorption...complete freedom from adverse effects by acids, alkalis, alcohol, stack gases, weather, etc. . . the dielectric strength of high-grade mica...the low dielectric loss of fused quartz...all combine to make Plax Polystyrene in any of its various forms the best high-frequency insulation ever made.

Many companies buy Plax Polystyrene sheets, rods, and tubes to machine into antenna components, stand-off insulators, bus bars, windows, etc. Details regarding your own possible applications, and a bulletin on machining, are immediately available.

PLAX POLYSTYRENE
SHRIT, ROD, TUBE

PLAX POLYSTYRENE
Electrical Properties

May 1943 — ELECTRONICS

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**ELECTRONICS—May 1943**

**Encephalophone Converts Brain Potentials into Sounds**

AN ELECTRONIC INSTRUMENT which converts brain potentials of the order of 10 microvolts to audio tones is described by C. A. Beevers and Dr. F. P. Folt in the March 1943 issue of Electronic Engineering, a British publication. It is intended for practical clinical use in making surveys of large numbers of cases. From these aural indications, appropriate cases can be selected for further examination with conventional electrometric or cathode-ray oscillographs providing permanent records.

Conventional electronic methods of measuring brain potentials were described by Walter E. Bahn, Jr., in the article “A New Bio-Electronic Application — Electroencephalography” in the October 1939 issue of Electronics. Push-pull a-f amplifiers having a frequency response over the range from 1 to 45 cycles were used here to amplify brain potentials sufficiently to drive a second amplifier having a flat frequency response over the range from 1 to 45 cycles, provided here to amplify brain potentials sufficiently to drive a second amplifier having a flat frequency response over the range from 1 to 45 cycles, provided here to amplify brain potentials sufficiently to drive an improvised ink recorder. Examples of the resulting records are shown in Fig. 1. No brain waves of higher frequency had been reliably reported up to that time.

The person from whom a record is being taken is placed in a completely shielded room to minimize 60-cycle pickup. The electrodes used are discs of solder about 1 inch in diameter and 1/2 inch thick, recessed on one side to retain a small amount of conductive electrode jelly. The electrodes are held on the scalp with collodion, and it is not necessary to remove hair to secure a good contact. Any desired number of electrodes can be installed initially and connected to a rotary selector switch, to permit quick changeover to different parts of the scalp during observation.

The audio method to which the authors have applied the name "encephalophone" makes it possible to watch a non-cooperative patient and thus identify extraneous potentials arising from friction, body movements, muscle activity or eye lid movements. In visual methods it is not always easy to do this at the same time watch the voltage pattern on the screen or paper. The frequency of the audio tone varies in accordance with brain potential changes, and the resulting slow changes in must, pitch are easily heard for catalog and Engineering Manual No. 40. Gives helpful data on the selection and application of rheostats, resistors, tap switches.

** OHMITE Resistance Units...**

Consistent performance day-after-day in all types of critical applications...that's the story of Ohmite Rheostats and Resistors. This time-proved dependability has enabled them to meet the toughest requirements of military service. Today, they "carry on" above the clouds and below the waves—on land and on sea—in planes, tanks, warships and submarines—to help speed Victory. Tomorrow, these rugged units will be ready to meet new peacetime needs. Widest range of types and sizes assure the right unit for each purpose. Experienced Ohmite Engineers are glad to assist you on any resistance-control problem.

**Handy Ohm’s Law Calculator**

Helps you figure ohms, watts, volts, etc.—quickly. Solves any Ohm’s Law problem with one setting of the dial. All about are direct reading. Send for your—exclusive only to cities for handling and mailing. OHMITE MANUFACTURING CO. 4317 Plouner St. Chicago, Ill. 5 A.
UNIFORM ACCURACY VITAL IN TRANSFORMERS, TOO

Accuracy is more than a matter of design and construction—transformer accuracy and dependability of performance can only be assured when experience, specialized design engineering, modern manufacturing facilities, trained and skilled employees are combined in one organization.

From the earliest days of radio and communication systems, Jefferson Electric has specialized on transformers—working in the field, anticipating the requirements and new developments. Jefferson complete testing, developmental and engineering research laboratories leave nothing to chance. Modern manufacturing facilities with 250,000 square feet of space, and skilled craftsmen insure the uniform accuracy and dependability of performance that users associate with Jefferson Electric Transformers.

Jefferson Electric Line Includes Transformers For:

The specialized experience of Jefferson Electric engineers can be put to work for you—to save your time and insure the correct selection of the transformers you need. JEFFERSON ELECTRIC COMPANY, Bollwood Suburb of Chicopee, Illinois. Canadian Factory: 60-62 Oiler Ave., W. Toronto, Ont.

interacted by the observer in terms of potential changes.

Brain potentials vary so slowly that the frequencies involved are far below the range of audibility and can be amplified directly only with special r-f circuits. For this reason, a frequency modulation method was used. Two r-f oscillators, operating at about 5,000,000 and 5,000,500 cycles respectively, normally produce a 500-cycle beat frequency in a converter stage. If, for example, the brain potential is made to vary the frequency of one oscillator by 50 cycles, the beat note will also change 50 cycles, and the resulting change in audio tone will be easily recognized.

The circuit diagram of the instrument is shown in Fig. 2. The r-f signals are produced by triodes VT1 and VT2, each in a Hartley oscillator circuit. The outputs of these oscillators, of the order of 0.5 Mc, are electronically mixed in converter tube VT3, and the difference frequency in the plate circuit is transferred to the headphones through audio transformer T.

Frequency modulation is achieved in a conventional manner with variable-capacitance pentode VT4, which is in effect connected in parallel with the second r-f oscillator circuit. A change in the control grid voltage of this tube varies the plate impedance of the tube, thereby varying the frequency of the oscillator circuit across which it is connected.

It was found that a voltage of 0.1 volt applied to the grid of VT4 produced a change in tone easily recognized by anyone. Brain potentials, being of the order of only 10 microvolts, considerable amplification was necessary. In the experimental apparatus a separate two-stage preamplifier unit was used to feed the two resistance-capacity coupled amplifier stages using betrodes VT5 and VT6, respectively.

Because of the high value of the time constant of the amplifier, it takes about one minute for normal conditions to be re-established after the instrument is switched on or after the electrodes are handled. During this period the pitch of the tone changes, finally becoming steady. A charged insulator such as a fountain pen, waved in the air, feels away from the ungrounded electrode, transforms the steady tone to a trill.

The FIRST SILVER-GRAPHITE CONTACT ever molded from powders

Almost two decades have passed since Stackpole revolutionized circuit breaker and control equipment performance by producing a molded silver-graphite contact, as at the suggestion of Westinghouse engineers, which enabled a 50 amperes continuous-rated unit to handle 5,000 amperes on a short circuit.

Since then, molded contact developments have come thick and fast—and Stackpole engineering has continued to lead the field. Today, Stackpole offers a complete line for practically any application. Equally important is the wealth of contact engineering experience that is available to Stackpole customners. Whether your problem be one of contact design,attaching the contact to the arm, or re-designing the equipment itself in order to assure utmost contact efficiency, Stackpole engineers have the answers!

STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.
Disturbances due to nearby a-c lines cause a roughness of tone which makes perception of small changes in tone difficult. Hence the apparatus should be kept as far as possible from a-c lines, and nearby lines should be shielded.

If a more accurate indication of the magnitude of a brain potential is desired, an artificial source of very small potential changes can be incorporated in the instrument and made to produce the same changes in pitch as are observed. The voltage involved can then be read directly on a calibrated potentiometer.

New Frequency Meter

A new method of frequency measurement, capable of measuring power line frequencies to within 0.001 cycle without estimating fractions of a scale division, is described by H. L. Clark and J. E. Hancock in the Feb. 1943 issue of Instrumentation. A tuning fork is driven by the system frequency instead of being allowed to vibrate freely, and the phase angle between the motion of the fork and the applied line frequency is measured electronically to obtain an accurate indication of the line frequency.

When a tuning fork is so mounted as to be free to vibrate, and a small driving force is applied, the resulting motion can be predicted mathematically. When the disturbing force is much lower in frequency than the resonant frequency of the fork, the motion will be in phase with and proportional to the disturbing force. When the disturbing force is much higher than the resonant frequency of the fork, the motion will be 90 deg. out of phase with the applied force and very small. When applied and fork frequencies are the same, the resulting motion will be limited only by the damping in the system and will be 90 deg. out of phase with the disturbing force in the narrow frequency band surrounding the resonant peak, the phase angle changes rapidly and is proportional to the deviation of the applied frequency from the resonant frequency of the fork.

The accompanying diagram shows the basic circuit of the new frequency meter. Only a single condition is required to the 120-volt, 60-cycle power line.
...that the wave-lengths will open

Freedom from military despotism—this is the crusade in which Ken-Rad tubes are valiantly serving. When this objective is attained then will begin the crusade for final freedom.

Freedom from remaining despotisms in man’s environment or heredity

Ken-Rad is prepared for both crusades. Ken-Rad does not prophesy when the wave-lengths that will open the gates of freedom will be determined. We do say that the waves are getting shorter and that dependable Ken-Rad tubes will be ready for you.

Circuit of new super-sensitive frequency meter for power line frequencies

When the power line frequency is exactly 60,000 cycles (the resonant frequency of the fork), the phase shift is exactly 90°, and hence the 7CT tube is turned on in the center of each positive half-cycle, and turned off in the center of each negative half-cycle of the current flowing through the 7AT tube. Now the portion of the rectified positive half-cycle flowing

BETTER AIR INDUCTORS FOR TODAY’S JOBS

Fast deliveries on standard models and wartime adaptations

It is a matter of record that most of today’s exacting wartime inductor coil applications can be met—fully and completely—by standard B & W units, with perhaps only minor construction changes or adaptations to meet specific conditions.

It is also a matter of record that B & W is now producing Air Inductors by the most modern “line” methods—faster, better, in larger quantities than they have ever been made before.

We’d like to stack these greatly expanded facilities against your next coil order—whether it calls for standard or highly special units—and regardless of any “fixed for fighting” specifications. B & W delivers the goods—and that not only means promptly, but with rigid maintenance on our highest quality standards!

BARKER & WILLIAMSON
Manufacturers of Quality Electronic Components for 10 years
235 FAIRFIELD AVENUE, UPPER DARBY, PA.
For the preservation of these principles we are honor bound to release for constructive purposes the major role we and the radio-electronic industry are privileged to play in this struggle. The free world we are fighting for is exactly equal to the portion of the rectified negative half-cycle flowing through \( R_e \), no current flows through indicating instrument \( A \), and hence the pointer stands at the mid-scale point marked 60 cycles.

When the line frequency goes above or below 60 cycles, the phase angle of the generated voltage changes correspondingly, disturbing the balance between the rectified quarter-cycles of current flowing through \( R_e \) and \( R \). The resulting difference in current flows through the indicating meter, which is calibrated to read directly in cycles. Resistors \( R \) and \( R_e \) control the sensitivity of the circuit, hence shorting of \( R_e \) increases the sensitivity and narrows the indicating range.

A commercial model of the instrument as made by General Electric Co. has the normal range is 59.75 to 60.25 cycles, and the high-sensitivity range (with the shorting switch closed) is 59.875 to 60.125 cycles.

Rheostat \( R_e \) permits calibration of the instrument and compensation for any small frequency deviation in the tuning fork or the high indicating range. The tuning fork is made from Manganese, a malleable material developed by the General Electric Research Laboratory especially for the purpose and having well-balanced and very low temperature coefficients of expansion and elasticity. The stability of the tuning fork and the circuit are such that the over-all precision is limited only by the precision of reading the scale of the instrument. Tests indicate that a scale range of plus or minus 0.01 cycle is entirely possible if the instrument is mounted in a temperature-controlled compartment.

This supersensitive frequency meter was originally developed to provide a frequency record as a measure of the speed of a steam turbine while checking the operation of the governor. The recording microammeter is plugged into the shaft as shown in the circuit, thereby dis-connecting the indicating meter.

A possible application is in connection with power system load control, where it may be desirable to change the loading at a generating station automatically as response to extremely slight changes in the generated frequency. Here suitable relays would replace the meter.

We are proud of the major role we and the radio-electronic industry are privileged to play in this struggle. The free world we are fighting for is exactly equal to the portion of the rectified negative half-cycle flowing through \( R_e \), no current flows through indicating instrument \( A \), and hence the pointer stands at the mid-scale point marked 60 cycles.

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Supersonics in Biology

Since the original studies of Ward and Loomis, many workers have applied supersonic waves to biological research. In most cases on ordinary fat quartz crystal has been used, the crystal being excited to vibration by r-f power at its natural frequency. It has been found that most cells are rapidly destroyed and small animals killed by exposure to these vibrations.

The forces produced by supersonic vibration vary in direction and magnitude over the surface of a cell of ordinary size, producing a tearing effect. Unfortunately, bacteria in general are so small that they are affected by the wave as a unit, so that it is very difficult to kill them in this manner.

A method for focusing the sound, originated by Grutzman, has been applied to biological materials by J. G. Lynn, R. L. Zmener, A. J. Coll, and A. R. Miller, who report their results in The Journal of General Physiology, 26:175-188, 1942. They use a round concave quartz crystal, 5 cm in diameter, curved to focus at a point 5.6 cm from the crystal surface. About 150 times as much supersonic energy is concentrated at the focal spot as at a similar spot near the vibrating plate. The crystal resonates at 835 kc, and is energized by connection to the plate circuit of an r-f amplifier having an input up to 500 watts. The oscillator crystal is variable from 834 to 836 kc, so exact and stable tuning can be obtained.

The object of the study reported was to project a beam of focused ultrasound into tissue blocks and into the tissues and organs of experimental animals, producing a maximum change at the point of focus with little change in the tissues traversed before the focus is reached.

Paraffin blocks were used as the first test objects, and the effects studied by observing the melting effects produced in them. Heat dissipation was found to be greater at the focal point than near the crystal, because of the surrounding cool areas. This effect may be minimized by applying a large amount of power for a short time.

The absorptive capacity of beef liver blocks is so great that it was necessary to use full power instan-
Don't speak Russian? Then let us translate the words of a Russian General to an American War Correspondent:

"THEY'RE GOOD . . . THEY'RE EXCELLENT!"

You see, the Correspondent had just remarked upon the number of "Connecticut" field telephones in use by the famed Cossack Cavalry. . . . Like many an American industry, our reputation for know-how rests today on the performance of our products in the service of the United Nations, all around the world. . . . When we can again freely solicit your patronage, there will be no testimonial to which we shall point with greater pride than the commendation of the fighting Russians.

CONNECTICUT TELEPHONE & ELECTRIC DIVISION
MERIDEN, CONNECTICUT

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Survey of Luminescence

LUMINESCENT SUBSTANCES are broadly defined as materials capable of emitting light without the simultaneous emission of a sensible amount of heat—which definition applies to fireflies as well as the phosphors which have recently become so important in the field of electronics. Phosphors, however, are generally defined as materials capable of converting various types of
Sealed To Give Switch Contacts Positive Protection Against The Hazards Of Dirt, Dust, Sand And Oil

More than five years ago the Allied Control Company’s engineering staff anticipated the need of a sealed switch that would give positive protection to the contacts against the hazards of dirt, dust, sand and oil, the greatest factors in switch failure.

Today thousands of Allied A3 and A5 Sealed Switches are vital components in many of the newest types of aircraft and ground equipment and are giving reliable and dependable operating performances in such theatres of war as Africa, China and Alaska where climatic conditions cause failure of ordinary types of equipment.

The operating characteristics called for in many switch applications are so rigid that every component is micrometer checked and after final assembly all operating characteristics are individually precision inspected to insure dependable, long life operation.

THE BENWOOD LINZE CO. • ST. LOUIS, MO.

Todat thousands of Allied A3 and A5 Sealed Switches are being used to fulfill prime and sub contracts in connection with the War program. Fortunately, however, our production facilities at this time are meeting Uncle Sam’s needs — and still have available capacity for additional essential industrial business.

Write today for Bulletin R-45, giving full details on B-L Selenium Rectifiers.

THE BENWOOD LINZE CO. • ST. LOUIS, MO.
Oil Cooled Transformer

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SUBCONTRACT FACILITIES
at your service —
Our Subcontract Division has available floor space, machinery, skilled operators and experienced engineers to help you meet delivery needs on war production. Established long before Pearl Harbor, and clever at cutting corners without cutting quality, where time is the vital factor. Ingenious, too, at meeting a variety of exceptional manufacturing problems. Our facilities may be just what you need—a phone call will verify it.

Phone: BIGELOW 3-5600
NEWARK TRANSFORMER CO., 17 FRELINGHUYSEN AVE., Newark, N. J.

Is it a tough job of special transformer design? We have a 20 year record of success in licking jobs like that, and those 20 years of hard-won experience are valuable insurance of success on your job. Let's talk it over.

Is it a problem of quick delivery or standard dry type transformers? While we are not making wild promises, we do have the knack of getting things done, a reputation for getting them done on time, and usually maintain a stock of standard transformer quality components that helps us to do it. We won't make promises unless we can make good. Let's discuss it.

NEWARK TRANSFORMER CO., 17 FRELINGHUYSEN AVE., Newark, N. J.

SPRAGUE

Type PX-25, "VITAMIN Q"

FULL DETAILS ON NEWARK TRANSFORMERS, DRY TYPE OR OIL COOLED DISTRIBUTION TYPE, IN DESCRIPTIVE BULLETINS ON REQUEST.

HIGH VOLTAGE PAPER CAPACITORS

to Stand 5,000 to 15,000 Volts at 110° C.

Sprague has the answer to the problem of finding paper capacitors that will handle high voltages at high temperatures.

Typical of many other Sprague developments, these Type PX-25 units, with the exclusive "Vitamin Q" impregnant, have proved their dependability under the most rigorous war conditions. Voltages now available range from 5,000 to 15,000 volts, and ambient temperatures are on the order of 110° C. Used at low and ordinary temperatures, these capacitors give a tremendously increased safety margin over the ordinary commercial types.

Sprague engineers welcome the opportunity to cooperate in solving your capacitor problems. An exceptionally broad background of engineering experience in designing and producing dozens of highly specialized capacitor types for ultra-exacting war uses is freely at your disposal.

SPRAGUE SPECIALTIES COMPANY

SUB-CONTRACTORS, ATTENTION!
Sprague Specialties Company will be glad to hear from reliable firms having screw machine and metal stamping facilities available for subcontract work on high-priority orders; also from machine shops equipped to make up jigs and fixtures, having special help available.

F. W. McNAIRN, Purchasing Agent. Telephone: NORTH ADAMS (Mass.) 904

MANUFACTURERS OF A COMPLETE LINE OF RADIO and INDUSTRIAL CAPACITORS and KOOLOHM RESISTORS
Ultraviolet Flashes Stimulate Living Cells

Stimulation of cells by intense flashes of ultraviolet light is reported in the *Journal of General Physiology*, 25:401-444, 1942 by E. N. Harvey, Princeton Physiological Laboratory. The source of the light is a quartz sterilamp made by Westinghouse, through which is suddenly discharged a 3.3-μf condenser at high voltage by the breakdown of an air spark gap in series with the condenser, as shown in the diagram.

The usual setting of the spark gap was 6.1 mm, breaking down at 22,000 volts, and producing a flash with an electrical energy input of 728 joules. Lower voltages with less intense flashes are obtained by setting the spark gap closer. The spectrum produced is almost continuous in the visible and near-ultraviolet regions, with many lines in the far-ultraviolet.

Circuit used to produce an intense ultraviolet flash. The condenser should be rated above 23,000 volts to withstand the peak breakdown secondary voltage.

The quartz tube of the sterilamp is bent in a ring, 3 cm outside diameter, around a microscope objective and adjusted so that it is about 6 mm from the material on the slide. A copper mosquito gauze is placed between the lamp and the material to eliminate electrical effects on the cells.

It was found that intact frog skeletal muscle and sciatic nerve were insensitive to the flashes, but that single muscle fibers or small groups could be stimulated to contracture in about half of the trials. It is suggested by the author that the ultraviolet was absorbed by the sheath of the nerve or the fascia covering the muscle, or that only a few muscle fibers contracted, which would not decrease the mass of the muscle. The ultraviolet flashes appear to act directly on the contractile substance rather than on the excitatory mech-
"TELL 'EM WE COULDN'T DO WITHOUT THE PARTS THEY'RE GIVING UP"

"Yeah, the folks back home are helping us plenty by giving us those radio and communication parts. See—over there! There's a bridge there. We just bombed that out of it—cutting off an enemy tank column. With inadequate communication, we couldn't have done it!"

COMMUNICATIONS are vital in this war of rapid movement—where success demands co-ordination of widely dispersed units.

When a swift PT boat gets its radio orders to torpedo an enemy transport... when a bomber drops its eggs on a submarine base... when an allied tank column, keeping in contact by radio, speeds over Sahara's sands... Utah Parts are playing their role in this war of communications.

"...The Parts They're Giving Up"

Ultraviolet flashes were found to stop pseudopod protrusion in Amoeba proteus, oscillatory movements of isolated filaments of the blue-green algae, ciliary movement in the class and protoplasmic rotation in Nitella cells. With moderately strong flashes the stopping of protoplasmic rotation in Nitella was accompanied by local or propagated action potential.

In Vorticella (a microscopic organism, in appearance much like bluebell, frequently demonstrated in high school biology classes), flash caused the animals to expand and contract several times.

The possibility of these phenomena being caused by something besides the ultraviolet flashes was ruled out by interposing either a quartz glass filter. The results were unaffected by the quartz, but all of the responses were eliminated by quartz glass filter.—W.E.C.

New Type of Tungsten Cathode for Magnetrons

The life of a TUNGSTEN filament in a magnetron tube is less than 1 percent of the life obtained from similar filaments in other thermionic tubes, because many of the emitted electrons return to the filament over the action of the magnetic field and heat it by bombardment. The process of filament destruction was discussed in detail by M. D. Gunvich in the Journal of Technical Physics (in Russian), Vol. 11, No. 3, the paper being abstracted in the March 1943 issue of Wireless Engineer.

The author proposes a new type of tungsten cathode, in which additional tungsten filament smaller diameter is wound around the main tungsten filament for protection from the electron bombardment and for more equalized temperature distribution. It is stated that magnetrons with this type of cathode were operated for up to 10 hours without appreciable damage to the cathode and with filament current reduced to less than 50 percent of the conventional value. The original article in Russian suggests that this construction may also be applicable to high-power radio tubes, and gives methods for designing the new type of cathode.

"This symbolizes your Country's appreciation..."

There it flies
The covered Army-Navy "E"... There ic flies

The words of

The electronics research
...We can't tell you
That won it...

Every much about
Each footnote and
Wartime screens...

But this we can say...
In the words of
The Army and Navy
This patent
Represents
A great accomplishment
In the production
Of war equipment..."
The Men with Wings

...depend on Communications

CONSOLIDATED RADIO is proud to be making headphones for the men who fly the skies of the world for the United Nations. The lives of our men—indeed Victory itself—depend upon instant, uninterrupted communications, and CONSOLIDATED RADIO headphones are "delivering the goods."

Engineered for complete dependability, CONSOLIDATED RADIO headphones are withstanding the most grueling demands of battle...be it in the tropics, the arctic or in the stratosphere.

Consolidated Radio's Modern Mass Production Methods Can Supply Signal Corps and Other Headphone Units in Quantities to Contractors

CONSOLIDATED
Radio Products Company
360 West Erie Street • CHICAGO, ILLINOIS

SPECIALISTS IN MAGNETIC AND ELECTRONIC DEVICES

Oxide Cathode Mystery Solved

A PROBABLE ANSWER to the mystery of why electron emission from an oxide-coated cathode is so much higher than from a plain metal cathode is announced by Dr. Harvey C. Rentschler, director of research at the Westinghouse Lamp Division in Bloomfield, N. J. According to him, atoms of gas actually dissolve in the crystalline structure of some metal

Dr. Harvey C. Rentschler conducting an experiment in which copper gas is being dissolved in a strip of copper metal enclosed in the glass tube suspended directly in front of him.

just as salt dissolves in water. These gas particles then "boil off" the electrons in this structure, causing them to be emitted from the metal readily when heat or light is applied. With the action understood, the way is opened for development of radio tubes, x-ray, and power tubes requiring less filament current for heating purposes and hence having longer life...

Survey of Problems in Taking X-Ray Movies

AN EXCELLENT SHORT survey of x-ray cinematography is given in the December 1942, issue of The Lancet. Many radiologists have attempted to perfect cineradiography since the beginning of the present century, when both x-rays and cinematography were in an early stage of development. Despite the manifest clinical advantages of moving pictures in heart action, gastro-intestinal motility...

Precision Signaling With Micro Switch Precision

The Aldis type Portable Signal Lamp, manufactured by the Manhattan Marine and Electric Company, Incorporated, of New York City, is widely used by the air, land, and sea forces of the United Nations. Because an observer, more than six degrees off the angle of the beam cannot read the signals, this lamp provides safe communication in daylight, at night, and in mist or fog. It has a safe visibility range up to 15 miles. It is an ingenious combination of a range finder, a light and a tilting reflector.

The Aldis type Portable Signal Lamp permits extremely precise signaling through the use of Micro Switch with a double spring actuator which is fired into the grip of this lamp. Being small and compact, light in weight, rugged and dependable in operation, Micro Switch assures the necessary operating precision. To quote the manufacturer of the Aldis type Signal Lamp, "We are very pleased with the Switch for this unit."

This is but one of many applications through which Micro Switch is performing vital functions in all equipment going into our war program. Micro Switch is on every fighting front—machine tools and on production lines; on the surface and underneath the surface of the sea, on land, in the hot and the desert, and in Arctic cold.

If you have a problem of precision switching, you should consider Micro Switch—its precise, fast action—its ability to operate at exactly the same point for millions of operations.

Micro Switch measures only 11/16" x 3/4" x 1 1/2", weighs only one ounce, operates on minute movement and force differentials, and is listed by Underwriters' Laboratories with ratings of 1200 V.A. loads, from 125 to 600 volts A.C. It can be supplied in the Bakelite bushing as shown above, or in protective housings—in cast, sealed against oil and water; steel, for machine tool applications; aluminum for aircraft; and heavy cast iron for explosion-proof—all with a wide variety of actuating mechanisms.

Send for These Catalogs

The two catalogs illustrated here will give you the complete details—Number 60 which covers Micro Switch in general, and Number 79 which deals with specific Micro Switches for aircraft.

Micro Switch Corporation, Freeport, Illinois

The trademark MICRO SWITCH is our property and identifies switches made by Micro Switch Corporation.

MICRO SWITCH
Made Only By Micro Switch Corporation... Freeport, Illinois
DO CIRCUIT TROUBLES
TIE UP YOUR FINAL TESTS?

Thousands of circuits are being checked the Rocobridge way these days. The reason many of the country's largest producers of electronic equipment are installing Rocobridges in an increasing variety of applications is easy to see when you look at a typical Rocobridge inspection tag.

Simple?—of course. Fast?—you bet. (The ROCOBRIDGE checks a circuit per second.) The way that numbered tag accurately spots the location of circuit defects for the service department will delight every production engineer. In a word, the Rocobridge eliminates wasteful attempts to "prove in" defective equipment in a dynamic test, and speeds the repair of such equipment to an amazing degree.

There is more to the Rocobridge story— it is equally at home testing a single unit in mass production, or a variety of units or sub-assemblies in small quantities. Descriptive literature will be mailed on request, and our engineering department invites your correspondence.

We are pleased to announce our removal to new and larger quarters. After May 1st
Telephone: Cortlandt 7-2981
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Wherever man goes • • • after the war the two-way radiotelephone will find its place in the industrial, business and social life of all nations. At the moment, Jefferson-Travis equipment, with its many exclusive developments, is being used by United Nations throughout the world. With peace, this remarkable electronic device will once again be yours to know, use and enjoy.

JEFFERSON-TRAVIS
RADIOTELEPHONE EQUIPMENT
NEW YORK WASHINGTON BOSTON
The Kinney Model CVD Compound Vacuum Pump is not a new pump! It was brought out several years ago after extended experimentation and utilizes the working mechanism of the well known Kinney VSP and DVD Vacuum Pumps. To those experienced in the task of creating and maintaining high vacuums with mechanical pumps, the results claimed for this Kinney compound pump were astonishing. Laboratory readings, on an ionization gauge, of 0.5 microns (0.0005 mm) are regularly obtained and tests have shown readings on the McLeod gauge of better than 35 microns in the wavelength involved—i.e., at least 5 times as long. The chart has six scales, namely line length in yards and meters, frequency in hertz, and wavelength in meters, two-line impedance in ohms, coaxial impedance in ohms, wire diameter or coaxial cable diameter, and power loss in db. Four positions of the ruler are required to give the loss in db when the other factors involved are known. This chart shows that a two-meter line often gives a lower attenuation than more expensive coaxial lines.

Phonoelectrocardioscope

The introduction by C. E. Donovan of a phonoelectrocardioscope which permits simultaneous observation of two wave forms associated with the heart while listening to amplified heart sounds has been found to be much more satisfactory than a loudspeaker for this particular application.

Transmission Line Chart

A nomograph type of chart from which the attenuation of both two- and coaxial transmission lines can be obtained quickly and directly has been developed by J. B. O. Sommervell, and is presented in the Feb. 1948 issue of Wireless World, a British publication. It applies to lines which are long compared to the wavelength involved—at least five times as long. The chart has six scales, namely line length in yards and meters, frequency in hertz, and wavelength in meters, two-line impedance in ohms, coaxial impedance in ohms, wire diameter or coaxial cable diameter, and power loss in db. Four positions of the ruler are required to give the loss in db when the other factors involved are known. This chart shows that a two-meter line often gives a lower attenuation than more expensive coaxial lines.

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The frequency range of the sound channel extends up to 1,000 cycles, but this may be divided by means of filters so that any desired murmur or other sound may be differentially amplified. This should be of considerable value in teaching medical students what to listen for in the confusing jumble of sound heard on the first attempt at auscultation. The instrument should also be of use in teaching the correlation of various normal and abnormal sounds with the cardiac cycle as obtained by comparison with the electrocardiogram.

It is indeed surprising that some companies in this country have not produced a double-trace tube of this type available in England for several years, for which there should be many applications in war research as well as in other fields.

DESIGNING SPECIAL SLIDE RULES

Many equations which are tedious of solution even with conventional slide rules can be represented on a special slide rule in such a way that the solution can be had quickly and with reasonable accuracy by one simple setting of the slide and perhaps an addition. Special slide rules are not difficult to construct, and are effective in any field where numerous approximate calculations are made with the same formula.

Detailed instructions for constructing a slide rule for up to four variables are given in a paper by R. C. Odell, appearing in the March 1943 issue of the Allis-Chalmers Review. These instructions apply to any equation in which the relation among the several variables can be reduced to the form “the sum of several terms, each containing only one variable, equals a constant.” An example of an applicable equation is

\[ R = \frac{34.9 \times 10^7}{\tan F} \]

Although this has five variables, two of them can be lumped into one \( E/N = V \) (volts per turn). The equation can then be rewritten as

\[ \log A + \log f - \log V + \log B = 6.54 \]

which is the specified form for placing on a slide rule.

Constant voltage protection all the way

Ask the men who produce planes and the men who pilot them. They’ll tell you what vital part constant voltage plays in modern aviation. In the sky, it’s constant voltage on the directional beam which guides the ships through night and storms. In the shop, it’s constant voltage on the production line which maintains the split-second accuracy of precision airplane parts.

For the aircraft industry—and for your own—SOLA Constant Voltage Transformers provide this all-important stabilized power. They stand between costly equipment and destructive voltage fluctuations now common on overloaded power lines. Without supervision they instantly absorb power surges and regulate currents as great as 30%.

For unerring operation of precision tools, and protection of almost irreplaceable instruments and electronic tubes, put SOLA Constant Voltage Transformers on duty in your plant. They’re built in standard units from 10 VA to 15 KVA capacity—all protecting against short circuit and without moving parts. Special units can be built to specification.

Note to Industrial Executives: Find out how SOLA “GI” transformers can solve voltage control problems in your operations. Send for bulletins DCO-24.

Constant Voltage Transformers

Transformers for Constant Voltage • Cold Cathode Lighting • Mercury Lamps • Sodium Lighting • Fluorescent Lighting • X-ray Equipment • Luminous Tube Sign • Remote Ignition • Radios • Power Controls • Signal Systems • Door Bells and Chimes • etc. SOLA ELECTRIC CO., 322 East 54th Street, Chicago 1, Ill.

May 1943 — ELECTRONICS
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Here is a library of books that brings you advanced radio engineering knowledge in the form in which you can most readily assimilate it and put it to use. The books were carefully selected from among standard McGraw-Hill works to give the most complete, fundamental coverage possible, in a small number of concise, compact, reasonably priced volumes. Use these books to bridge the gap between your own radio training or experience and more advanced, engineering command of the subject—the genuinely technical knowledge that best meets today's practical needs.

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In two of these books widely-used advanced engineering texts have been obsoleted. To cover the most fundamental aspects of tubes and circuits and their applications, but in the simplified form suited to introduce the use of integral radio and electrical training in these subjects. Another volume further applies these fundamentals to practical communications apparatus, completing a wave of radio with which you can solve the technical problems met in a wide variety of situations. The fourth book gives you, at the same time, a progressive command of the radio and electrical mathematics from arithmetic to advanced principles necessary to using the formulas and computations of advanced technical work.

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Books are available on 12 monthly installments of $1.75 each. You can pay $30.00 now, get all four books and pay for them over an extended period. Get these advantages by ordering now to add these volumes to your radio library. All radio books for 90 days' free examination.

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Our new Megger is quickly, fully, economically.

To meet such conditions, Aerovox engineers redesigned the terminals of Type 12. One terminal became a short screw post. The other, a tall ceramic insulator with corona shield at top. Result: minimized surface leakage; minimized corona losses; greatly stopped-up breakdown voltage at high altitudes. The chart tells the story.

Ingenious revisions and adaptations of standard Aerovox types, such as this, are meeting unusual requirements quickly, fully, economically.

Write for latest Transmitting Capacitor Catalog. And try A.A.E.* on that tough capacitance problem.

* Aerovox Application Engineering
Measuring Coil Characteristics

(Continued from page 881)

element should be high with respect to that of the coil under test at the resonant frequency, otherwise the LC circuit will tend to generate harmonics. It will not then be possible to close the pattern which will have some an irregular configuration, the exact shape being a function of the order and amplitudes of the harmonics. For example, Fig. 8 illustrates the pattern obtained with an oscillator output impedance of 259 ohms as compared to the pattern of Fig. 6 obtained with an output impedance of 5000 ohms. The coil under test in this case had an output impedance of 240 ohms at the resonant frequency. Harmonics may also be excited by the application of too high a voltage.

When the Rays of Peace Pierce the Clouds of War

When that day comes, as it surely will, there will arise a new, peacetime demand for electrical products and services to meet the needs of a victorious people. Surely the better, brighter world for which we fight today will see many amazing applications of electronics. Just as surely, too, will a great many postwar advancements—in air conditioning, photo-electric apparatus, communication circuits, and home and automatic controls, for example—benefit by the efficiency of Adlake Plunger Type Mercury Relays.

Today the makers of Adlake Relays are engaged in vital war work. We are engaged in research, too—searching for new and better ways to design and manufacture relays. It is the sort of determined study you'd expect to be carried on by a company so well known for the dependability of its mercury relays ranging in contact ratings up to 100 amperes.

This is our way of planning for the future. In your planning for the future, consider the advantages of Adlake Relays (now obtainable only on priority orders) when they are once more available for unrestricted use by the nation's electrical engineers, designers, and manufacturers.
The technique has been thoroughly applied to the setup time and operating procedure of the United Nations war effort. Tomorrow, this knowledge will aid industry in creating a new world for free men.

Products for Victory include: Cathode Ray Tubes; Amplifier Tubes; Rectifier Tubes; Transmitting Tubes; Electronic Test Equipment; Oscillator Plates; Tungsten and Molybdenum in powder, rod, wire and sheet form; Tungsten Alloys; Fine Wire of all drawable metals; bare, plated and enamelled; Diamond Dies; X-Ray Apparatus for industrial, research and medical applications. (Philips Metallo Corporation.)

NORTH AMERICAN PHILIPS COMPANY, INC.
Electronic Research and Development

NORTH AMERICAN PHILIPS COMPANY, INC.
Boltzmann law and are typified by the accompanying curve.

For purposes of direct comparison at like temperatures, the following emission values were obtained by interpolation.

The tabular data agree remarkably well with the observations made during the use of these materials in radio tube manufacture.

Acknowledgments

The author is deeply indebted to Mr. William F. Little of the Electrical Testing Laboratories who designed and supervised the laboratory tests, and to Dr. L. E. Hendrick and Mr. H. T. Swanson of the RCA Victor Division of the Radio Corporation of America for preparing and supplying the test pieces.

At present available in three types, G. A. W. Carbonyl Powder — combining high effective permeability and highest Q value — is of increasing importance to leading core manufacturers supplying the carrier and high frequency fields where the highest efficiency is required.

Other powders now being developed. We will appreciate your letting us know your requirements.

Write for further information

GENERAL ANILINE WORKS
A DIVISION OF
General Aniline and Film Corp.
435 Halsey St. New York, N. Y.
Manufacturers and sole distributors

When You Want Them

SMALL and STEADY

...use KLIXON Snap-Acting Controls

KLIXON Controls are space-savers. More than that, they're trouble-savers. Actuated by a Spencer compacting thermostatic disc, these controls are the last word in simplicity, compactness and lightness in weight. They contain no fussy parts...no magnets...no relays...no toggles. And because of the snap-action of the Spencer Disc...shock, vibration or motion do not affect these controls regardless of their mounting position. You get a quick, clean break or solid make right at your control temperatures.

KLIXON Controls have been through the mill...they're thoroughly proven. Millions are now in use for motor and transformer overheat protection, electrical circuit overload protection, and temperature controls for radio equipment.
News of the Industry

Latest FM developments; Federal alphabet; London electronic newsletter; industry personnel changes; E awards; 1942 radio sales data; telegraph merger; Science Talent winners; UHF training

New Army-Navy Preferred List of Vacuum Tubes

A NEW LIST of preferred general-purpose tubes selected jointly by the Signal Corps and the Bureau of Ships was issued as of March 1, 1943, superseding the Army-Navy Ships was issued as of March 1, 1942, in Service equipment. Unclassified this list is to effect an eventual re- 

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Army-Navy Preferred List of Vacuum Tubes—March 1, 1943

RECEIVING TYPES

<table>
<thead>
<tr>
<th>Filet</th>
<th>Watts</th>
<th>Diodes</th>
<th>Diode Triodes</th>
<th>Triodes</th>
<th>Twin Triodes</th>
<th>Rectifiers</th>
<th>Sharp</th>
<th>Rectifiers</th>
<th>Converters</th>
<th>Power Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>1A5</td>
<td>1A11</td>
<td>1G6FT</td>
<td>3A5</td>
<td>1291</td>
<td>7T4</td>
<td>1H4</td>
<td>1L6A</td>
<td>3A1</td>
<td>901</td>
</tr>
<tr>
<td>5.0</td>
<td>5G6</td>
<td>5G8T</td>
<td>5G8T</td>
<td>6G6</td>
<td>6A4</td>
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<td>12G8T</td>
<td>12G8T</td>
<td>1629</td>
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TRANSMITTING TYPES

<table>
<thead>
<tr>
<th>Triodes</th>
<th>Tetrodes</th>
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<th>Pentodes</th>
<th>Rectifiers</th>
<th>Vacuum</th>
<th>Core</th>
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<tr>
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<td>907</td>
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<td>2D22</td>
<td>312</td>
<td>312</td>
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<tr>
<td>801-A</td>
<td>817</td>
<td>329</td>
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<tr>
<td>811-A</td>
<td>817</td>
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Army-Navy Preferred List of Vacuum Tubes—March 1, 1943

ARMY-NAVY PREFERRED LIST OF VACUUM TUBES—MARCH 1, 1943

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Your Screw Driving Army

MECHANIZE

Your Screw Driving Army

PHILLIPS SCREWS PERMIT FAST DRIVING METHODS!

Like our fast-moving fighting forces, your screw driving army can now be mechanized to set new speed records on the assembly line.

You can have the advantages of power or spiral driving on almost any job... by adopting Phillips Recessed Head Screws. Automatic centering of driving force in the Phillips Recess eliminates the driving troubles that often make fast driving methods impractical. Fumbling, wobbly starts... slant-driven screws... broken head screws... dangerous skidding of driver points... all are forgotten problems in plants that use screws with the Phillips Recessed Head.

Even "green hands" can do fast, skilled work. Savings of 50% in driving time are common. Such man-hour savings are important to the war effort, since so many workers in the average plant are driving screws.

They cost less to use! Compare the cost of driving Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense... that it actually costs less to have the many advantages of the Phillips Recess in your assembly work.

PHILLIPS Recessed Head Screws

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLT
CATHODE RAY TUBE AT WORK

The Cathode Ray Tube at Work is the accepted authority on the subject. The cathode ray tube in the Oscillograph and its application to electronic and industrial work is fully discussed. Profusely illustrated. 338 pages.

$7.50

184 pages

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CATHODE RAY TUBE AT WORK

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was reported to an FCC committee in the first conference between top executives of the two companies and a three-commissioner supervisory committee headed by Commissioner George Henry Payne. It is estimated that the minimum time necessary to complete the merger will be close to a year, if agreement can be reached on a satisfactory financial plan and the plan is approved by the FCC as required by the merger Act, then by the stockholders of the two companies. The original legislation is permissive, not mandatory, and hence does not compel consolidation of telegraph companies or operations.

Four-Wire Cable Provides Seven Signal Corps Circuits

IN A NEW Western Electric-Bell Lab development known as "Spiral-4," a single rubber-covered cable about the thickness of a fat lead pencil provides four telephone circuits and four telegraph circuits. The cable contains four spiralling wires, hence the name. It is made in quarter-mile lengths, the ends of which are fitted with waterproof connectors. Each length may be snapped into a companion section as fast as the cable can be paid off a moving Signal Corps truck. With amplifiers spaced ahead of the terminal point, distances up to 150 miles can be spanned.

Individual messages are combined with carrier currents at the transmitting end and sent to the carrier telephone, then through the cable as modulated carrier signals. At the receiving end, electronic equipment recovers the carrier signals and guides each signal into its own pair of telephone wires.

Unless equipped with a highly complex electronic device of special design, an enemy tapping the Spiral 4 cable ahead of the terminal point would hear nothing but an uninterpretable mixture of squeaks and squalls.

Federal Alphabet

FROM BUSINESS WEEK comes the following abridgment but still long list of government agencies which it is often known by their initials. With more and more alphabetic agencies cropping up, such a reference list is practically a must for engineers who must follow new governmental activities.

**Federal Alphabet**

**FROM BUSINESS WEEK**

**A** Agricultural Adjustment Agency  
**APA** Army Property Correction  
**BFC** Bell System Bookkeeping Division  
**BHC** Bureau of Economic Warfare  
**BM** Bureau of Foreign and Domestic Commerce  
**BLS** Bureau of Labor Statistics  
**BPH** Bureau of Public Health  
**BWC** Bureau of War Communications  
**CAS** Civil Aeronautics Administration  
**CIA** Central Intelligence Agency  
**CO** Combustion Control Corporation  
**GCA** Office of Control of Inter-American Relations  
**CN** Combined Undersea Warfare  
**CMS** Office of Communication and Office Works  
**CNP** Combustion Products  
**CFB** Combined Forces and Service  
**DF** Department of Defense  
**DNC** Department of National Defense  
**DSC** Department of the Navy  
**DUC** Department of the Interior  
**EAA** Office of Export Administration  
**ED** Engineering Division  
**EOD** Engineering Office for Defense  
**FA** Federal Art Board  
**FIB** Federal Bureau of Investigation  
**FIC** Federal Communications Commission  

**1942 RADIO RECEIver SALES BY FACTORIES**

<table>
<thead>
<tr>
<th>Factory</th>
<th>Value *</th>
<th>%</th>
<th>Total Value</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table Set</td>
<td>1,706,600</td>
<td>40.8</td>
<td>234,924,300</td>
<td>25.2</td>
</tr>
<tr>
<td>Console Set</td>
<td>271,240</td>
<td>6.1</td>
<td>14,464,600</td>
<td>1.5</td>
</tr>
<tr>
<td>Portable Set</td>
<td>233,025</td>
<td>5.4</td>
<td>9,194,000</td>
<td>0.9</td>
</tr>
<tr>
<td>Antenna Set</td>
<td>75</td>
<td>0.2</td>
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<td>0.9</td>
</tr>
<tr>
<td>FM Antenna Set</td>
<td>542,747</td>
<td>12.5</td>
<td>5,343,600</td>
<td>5.6</td>
</tr>
<tr>
<td>FM Receiver Set (Table or Console)</td>
<td>593,430</td>
<td>13.4</td>
<td>3,567,600</td>
<td>3.8</td>
</tr>
<tr>
<td>FM Receiver Set (Table or Console)</td>
<td>326,360</td>
<td>7.5</td>
<td>1,537,000</td>
<td>1.6</td>
</tr>
<tr>
<td>FM Receiver Set (Table or Console)</td>
<td>705</td>
<td>0.2</td>
<td>9,194,000</td>
<td>0.9</td>
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<tr>
<td>TOTAL</td>
<td>4,356,384</td>
<td>100.0</td>
<td>$162,686,700</td>
<td>100.0</td>
</tr>
</tbody>
</table>

* At manufacturers' selling prices.

**G.E. builds FM's future on these four facts**

**1942**

**RADIO RECEIver SALES BY FACTORIES**

**ELECTRONIC TUBES**

**ANTENNAS**

**RECEIVERS**

**TRANSMITTERS**

**STUDIO EQUIPMENT**

**GENERAL ELECTRIC**

**Electronics Department, General Electric, Schenectady, N. Y.**

Survey Proves Vast Increase in FM Acceptance

An independent consumer survey report that the public already strongly approves FM, 85%, calls it a definite improvement over conventional broadcasting. Present owners of G.E. FM receivers are the most enthusiastic of all FM owners... Electronics Department, General Electric, Schenectady, N. Y.
Scholarships Awarded in Science Talent Search

FORTY HIGH SCHOOL SENIORS share a total of $11,000 in scholarships as winners of the second annual nationwide Science Talent Search sponsored by Westinghouse and Science Service. These awards were based on the results of a special science aptitude test given to 15,000 students, an essay on the subject "Science's Next Great Step Ahead," and personal and scholarship record submitted by teachers. The 40 leading students in the contest were brought to Washington, D.C., for final examinations and individual interviews to determine the winners of the top awards.

Grand Scholarships of $2,000 each were awarded to Gloria Lauer of Ames, Iowa, and Raymond Schiff of
It's Thermatite Treated

Varioplex Telegraph Patent Is Granted with 107 Claims

For Continuing Achievement

_A STAR FOR WESTON_

--- evidence that the vital instrument situation rests in good hands! ---

A star now adorns the ARMY-NAVY "E" pennant awarded to WESTON just 6 months ago... the first such pennant awarded in this highly specialized instrument field.

Evidence that there is real meaning. Because, from the very beginning of our defense period, the responsibility for producing the largest quantities of instruments vital to the success of our country's efforts, has rested largely on the instrument leader.

This star signifies that the responsibility rests in good hands. "The men and women of the WESTON Electrical Instrument Corporation," writes the Chairman of the Navy Board for Production Awards, "have achieved a signal honor by continuing their splendid production in such volume as to justify this award... indicating their solid determination and ability to support our fighting forces with equipment necessary for victory."

But a great instrument task still remains... before victory is ours. So, WESTON workers continue reaching for new goals... with the same determination, the same painstaking devotion to the quality ideal, responsible for WESTON'S continuing leadership in the instrument field.
Highly specialized production lines that segregate the entire receiver circuit into its basic elements, plus simplified wiring, permit mass production with custom-built performance. Cell-unit assembly, according to functional requirements, limits repair stock and cases servicing. The 7-cell Harvey Receiver shown above measures only 10" high, 8" wide and 30" deep—and yet it provides four frequency bands, extreme sensitivity and a high degree of selectivity. Shown below are the general specifications of this advanced type Communication Receiver.

- **Frequency Bands:** 1.48 mc to 2.475 mc; 2.45 mc to 4.2 mc; 4.15 mc to 7.1 mc; 7.0 mc to 12.55 mc.
- **Sensitivity:** At a signal to noise ratio of 6 db, the sensitivity of this Harvey receiver is 4 micro-volts—with a carrier sine wave modulated 30% at 400 cycles, impressed at the antenna terminal through standard IRE dummy to give 50 mw output.
- **Image Rejection:** On the four bands enumerated above they are 55, 56, 54, and 46 db.

For further inquiries, address your letter to Harvey Mfg. Co., Inc., 6200 Avila Blvd., Los Angeles, Calif.

---

**May 1943 — Electronics**
R should be rugged. Since the demands of electronic circuits are quantitatively mechanical stability, ruggedness and stability in a resistor gives assurance that it will retain indefinitely its established resistance value under normal loading. A good resistor should withstand, without suffering a permanent change in resistance, the maximum accidental over-voltage of which it might be subjected in service. Moreover a resistor should be relatively free from microphonic effects, inductance affected by humid atmospheres. Moreover a resistor should be relatively which ratings and date of order. Nevertheless we quick glance the physical and electrical characteristics of the more commonly used industrial type "Globar" Resistors.

**FCC Releases Data on Salaries of Technical Radio Men**

Chief Engineers in radio stations averaged $65.50 per week during 1942, according to data released by the FCC. Technical employees in radio operating positions averaged $64.48 for 9 networks, and $46.94 for 791 individual stations. Technical employees doing research or development work averaged $64.80 in networks and $56.82 for stations, but only 105 men were listed in this category for both groups.

**London News Letter**

By John H. Jope

London Correspondent for Electronics

Subsidies. The British Radio Manufacturers Association has nominated zinc as a fair substitute for aluminum condenser vanes, providing it is of suitable thickness and is kept well away from anything containing linseed oil. Brass (soft drawn) has been classed as reasonably satisfactory but steel is not recommended owing to the difficulty of maintaining tolerances and keeping the wear of existing tools (made for aluminum) down to a lower degree.

Radio Relay Systems. Among thousands of English people there seems to be a distinct liking for the relay radio principle, wherein they receive programs over wires from a central point. Certainly it limits the choice of programs but it is surprising even in peace time, how most families stick to a few favorite stations. In June 1942, the latest date for which data is available, there were 398,985 wired radio sets and 278 relay exchanges. This represents an increase of 11,751 subscribers in three months.

**TELEGRAPH and RADIO KEYS**

Telegraph Keys to Signal Corps Specifications

Types now in production include

J-12, J-18, J-29, J-30
J-31, J-37, J-38, J-40, J-41-A
J-44, J-45, J-46, J-47, J-48

**DANNEMAN PRECISION DIE-SETS**

Precision Bored on Master-Plates

For accurate stamping of metal and mica film parts and components.

Of special interest to radio and radar, electronic and electrical, aviation and instrument manufacturers.

Swiss type die-sets for miniature parts.

Our experience in this field is your assurance of our ability to serve you well.

Literature on request.

Inquiries will receive prompt attention.

**MODEL 500A ELECTRONIC FREQUENCY METER**

Model 500A is a direct reading Electronic Frequency Meter to read the frequencies in the range between 10cps and 50kc. At the higher frequencies you can measure the frequency difference between two radio frequency signals. In Crystalline grinding you can quickly measure the deviation from standard. As with all -hp- instruments, simplicity and speed of operation plus high accuracy are prime virtues. Excellent accuracy, plus or minus 2% of the full scale value. Good sensitivity; variation of the input voltage from 0.5 volts to 200 volts will affect the meter by not more than plus or minus 1%. Readings are independent of line voltage since a variation from 105 volts to 125 volts will affect the meter by not more than plus or minus 1%.

Get full particulars about this new -hp- instrument today. Data sheets will be sent you promptly and without obligation. Ask, also, for your copy of the new -hp- catalog which gives full information about other -hp- instruments and explains many standard tests and measurements.
"Good Company on a journey makes the way seem SHORTER"

Manufacturers, like individuals, enjoy being in good company and usually associate themselves with other manufacturers whose dependable work and workmanship have given them a good name. Astatic's product engineering, precision in manufacture and performance in service, over many years, are now utilized in the manufacture of government approved Coaxial Cable Connectors, Multi-contact Plugs and Sockets and Dynamic Microphones for military radio equipment. Increased production now permits new radio manufacturer connections.

Explosive Magnetic Mines from the Air. The British Government has lately disclosed one of the best kept secrets of the war—how electricity was used to destroy magnetic mines.

"Wellington" bombers were the machines used because of the great weight of the equipment. Each was fitted with a large diameter circular casing, extending from nose to tail and containing heavy gauge cable. Power was obtained from a d-c generator driven by a Ford V8 engine built into the plane. Detonation of the mines was secured by reason of the relay mechanism being operated. In order to make the magnetic field of the coil trip the relay mechanism in the mine, it was necessary for the plane to fly within 60 feet of the water. At such a short distance the blast of the mines was considerable, but it was found that the plane could just escape the tremendous column of water with nothing worse than a severe jolt. Not a single "Wellington" was lost by mine explosions.

This method of destroying Nazi mines has now been discontinued, after being used successfully for about two years, but nothing has yet been released regarding the newer and better system which replaces it.

MINESWEEPER OF THE AIR

The minesweepers of the air are equipped with a hoop-shaped casing extending all around them and secured to their nose, wings and tail. The casing holds a magnetic coil and current is supplied by an auxiliary engine. This equipment was designed to set up a magnetic current which would not set off the mines. The mines are severally joined when the mines are exploded.

Here—in a new 16-page bulletin—are the latest facts about designing molded plastics parts. This information has been prepared by General Electric Engineers who turn the expert engineering staff of the Plastics Division, where stands the largest plastics molding plant in this country. Product engineers to whom we have shown this new bulletin declare that it is indispensable for men working with plastics. For copies write Section M-3, Plastics Department, General Electric Company, One Plastics Avenue, Pittsfield, Mass.
Death of Poulsen. From Denmark it was reported that the radio pioneer Dr. Valdemar Poulsen had died recently at the age of 63. His best known contributions to the radio art were the systems of arc telephony and continuous wave telegraphy.

Spare Cathode-ray Tube Screens. Patent No. 544,413 (British) was recently granted to J. L. Baird for a method of replacing screens in tubes without having to break the glass envelope. His method involves placing a pack of coated metal screens in the tube, and scanning from the front. When the first screen is "dead," it is moved into a well by an iron armature, operated externally by a solenoid, thereby exposing the next screen.

One-Farad Condenser. At a meeting of the British Institute of Radio Engineers, J. H. Coussens, an expert on electrolytic condensers, estimated that a one-farad electrolytic condenser could be mounted in the space of one cubic foot provided the maximum working voltage was limited to 3 volts. Looking at the question another way, this capacitance would be represented by the charge on a sphere the size of the sun, a fact first noted by the late Sir Oliver Jones.

Secret Ray to Stop Cars. Our old friend the "death ray" came to life again when a man at Manchester ascribed his bankruptcy as partly due to financing the development of a ray to stop motor cars and airplanes. Witnesses vowed for having seen a car stopped at a distance of two miles and oak trees destroyed at 70 feet. The financier himself admitted the ray could destroy a car at 6 miles and that the current could go through a thick wall or even rubber. Unfortunately, however, the military authorities were not impressed and seized the apparatus. The gentleman estimated his loss, very modestly, at $400,000,000.

Premax Gets Orders to the Forces

Premax Metal Antennas are maintaining communications between the armed forces on land and sea. Standard and special designs, complete with mountings, are shown in the Bulletin.

Premax Products

Division Chisholm-Ryder Co., Inc.
1922 Highland Ave., Niagara Falls, N. Y.

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1922 Highland Ave., Niagara Falls, N. Y.
GIVING ACCURACY TO FIRING POWER!

Equally important to modern war machines as guns and armor, are the electronic signalling and control devices which guide them to their target, speed them on their way when disaster threatens, and bring them safely home when the elements rage rampant.

DANIEL KONDAKJIAN tungsten and electronic tube components are serving in these vital capacities, helping to fulfill the inhuman tasks of today. Inquiries regarding present military needs, or post-war plans, are invited; write today.

THE ENGINEERING CO.
DANIEL KONDAKJIAN
37 Wright Street, Newark, New Jersey.

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In the sky or on the ground you can depend on

WALKER-TURNER FLEXIBLE SHAFTING

Many of the mechanical weapons of this war are "quicker on the trigger," because of WALKER-TURNER FLEXIBLE SHAFTING. Its action is as positive in the stratosphere as on land.

As one of the largest manufacturers of flexible shaft machines for industry, we have had ample opportunity to observe the performance of the shafting we produce. It is designed to give unfailing service under the most difficult operating conditions. That is one reason why aircraft manufacturers, and others who use flexible shafting for important applications, specify "Walker-Turner".

If you have a problem in remote control or power transmission, get in touch with us. We have the answers to a lot of questions in our files.

WALKER-TURNER COMPANY, INC.
1453 Berckman Street, Plainfield, N. J.

Announcing our latest publication

NEGATIVE TEMPERATURE COEFFICIENT RESISTANCE MATERIAL

KEYSTONE CARBON CO., INC.
Manufacturers of Precision Moulded Products
1935 State St., Saint Marys, Penna.

Radio Business News

An OPA warning states that any store or radio repair shop which refuses to sell tubes outright, requiring that the customer bring in his radio and pay a service charge, is violating the General Maximum Price Regulation unless that practice was customary with the store or shop in March, 1942.

WPB now permits swapping of goods by merchants when inventories are overly high in relation to local demand. The specific conditions under which controlled merchants may exchange goods on a barter basis are set forth in amendments to WPB Order L-214 (Consumer Goods Inventory Limitation). Communications regarding the order can be sent to the Wholesale and Retail Trade Division, 41 East 42nd St., New York City.

Price ceilings have been set on fixed capacitors of all types and sizes used for military radio equipment. The new ceilings are based on list prices effective on April 1, 1943, less any discounts, allowances or other deductions in effect on that date. Fixed capacitors have been exempt heretofore because of the necessity for increasing their production despite unstable conditions. Special provisions are included in the OPA order to cover future advances in costs of block mica and splitting and cutting sheet mica for mica condensers.

Quartz crystal production for radio transmitters, communications receivers, sound-detecting and locating apparatus for use against submarines and aircraft, range-finders and test instruments, is being maintained despite material and manpower shortages. Improved production techniques and closer grading of both cut and uncut quartz, the use of smaller-size and lower-grade crystals in Signal Corps sets when ever permissible, and the training of women and over-age men are factors which have contributed to elimination of the quartz crystal bottleneck.

AIRCRAFT ACCESSORIES CORP. has opened its seventh plant in the Kansas City area. This one will be devoted entirely to the production of aircraft radio equipment, and will be under the supervision of G. Melanger, general manager of radio production for the company.

WALKER-TURNER FLEXIBLE SHAFTING

For Remote Control and Power Transmission

Many of the mechanical weapons of this war are "quicker on the trigger," because of WALKER-TURNER FLEXIBLE SHAFTING. Its action is as positive in the stratosphere as on land.

As one of the largest manufacturers of flexible shaft machines for industry, we have had ample opportunity to observe the performance of the shafting we produce. It is designed to give unfailing service.

FLEXIBLE SHAFTING

May 1943 - ELECTRONICS

Electronics - May 1943
THE BAN ON VISITORS to broadcast stations and to plants engaged in manufacturing communications equipment has been relaxed to the extent that United States and Canadian citizens may now visit those plants if on legitimate business.

STROMBERG-CARLSON COMPANY is the shortened corporate name selected by stockholders of the Stromberg-Carlson Telephone Mfg. Co. The name was shortened to make it apply more appropriately to present radio broadcasting and manufacturing activities.

AEROVox Corp. has opened a second plant in Taunton, Mass., with some 60,000 sq ft of production space which will be devoted exclusively to the manufacture of mica condensers. This will virtually double the Aerovox mica capacitor output, now running well into hundreds of thousands of units weekly.

KEN-HAD will soon begin production in two new plants. One is located in Bowling Green, Ky., will cover 80,000 sq ft and employ 2300 workers, and will produce radio and secret ordnance equipment for the armed forces. The other is in Tell City, Ind., employing 1500 workers in manufacturing materials for the Army Signal Corps.

SYLVANIA ELECTRIC PRODUCTS reports a new sales high for 1942, resulting in a profit of $1,057,760, essentially the same as for 1941 despite a 91 percent increase in taxes. Taxes for 1942 represented 7.67 percent of income, whereas taxes for 1941 were 68.5 percent of income.

TUBES FOR CIVILIANS will carry brand names of manufacturers instead of the general designation, “Victory Line.” Most manufacturers have indicated that they will mark tubes also with the initials “M.E.,” for “Maintenance and Repair.”

UNITED ELECTRONICS Co. of Newark is combating absenteeism and employee turnover with a trust fund into which goes a proportion of current war-work profits, for distribution after the war to those who stay with the company until the end of the war or until called into military service. Government tax officials have approved the plan.

PyroFerric Cores of powdered iron or copper have no limitations in size, shape or insensitivity. PyroFerric are specification cores to fit any circuit.

PyroFerric Cores are being made in quantity for the electronic industry's war effort.

If you require Cores to speed the war effort send us your specifications and we will rush samples to you.

Try DALIS — wire, wire or phone...
H. I. DALIS, Inc.
Distributors of
RADIO & ELECTRONIC SUPPLIES
17 Union Square • New York, N. Y.
Phone: Longline 4-8447

**A prime requisite of precision spring making is the technician’s control of the exact composition of the metal used. He must know, for instance, to one-hundredth of one percent, the amount of carbon present in spring wire, since a slight excess in carbon content will increase tensile strength at the expense of ductility.**

In this analysis for carbon, pure oxygen is passed over a sample of steel chips. The oxygen combines with the carbon present in the steel to form carbon dioxide. This gas is then collected by absorption and weighed—an almost infinitesimal measurement indicating the amount of carbon present. Such painstaking thoroughness, from the selection of raw stocks to the inspection of the finished product, explains the high performance rating of Muehlhausen Springs.
Lafayette is doing its part to win the war... and the peace that must surely follow. We play the important part of speeding the war effort by supplying emergency requirements of radio, sound and electronic parts to all branches of the armed forces as well as to manufacturers and sub-contractors. Lafayette is in the fighting to save you time by supplying all of your needs in one order—quickly!

Now it is no longer necessary to comb the field to find the various parts you need. Due to Lafayette's extensive buying facilities and large, diversified stocks, one order (no matter how large or how small) will bring quick deliveries on all of your requirements.

Free catalog—Radio, Sound and Electronic Parts—Dept. 5G3

A COMPACT LEPEL
HIGH FREQUENCY INDUCTION HEATING UNIT
...performs all these operations quicker, simpler, more efficiently and at a fraction of the cost. Complete engineering data on your work is freely offered. Send samples, or write for catalog E today.

LEPEL
HIGH FREQUENCY LABORATORIES, INC.
39 West 60th Street, New York, N. Y.
PIONEERS IN INDUCTION HEATING

Latest FM Developments

Four Philadelphia FM stations have received FCC permission to try out a 50 day cooperative plan of broadcast rotation which will keep one station of the four on the air from 3 to 11 p.m. each day. Each station will have one regular day per week, and the remaining days will be rotated among the stations.

War-time shortages of manpower, critical materials, electric power, record libraries and transcriptions were advanced as reasons for granting the waiver from pre-war regulations requiring a minimum of six hours on the air per day per station. The stations involved (W49PH, W53PH, W69PH and W73PH) will pool all spare parts and equipment, and will set up a committee to co-ordinate and supervise the program.

A more general FCC action suspended until further order the ruling requiring FM stations to submit continuous field intensity records along several radials as a check on the actual service area. This type of survey requires the considerable time and service of skilled personnel and the use of measuring equipment installed in an auto or truck.

FM stations can now keep their licenses with a minimum daily service, except Sunday, of 6 hours during any portion of the broadcast day. The required 2 hours of programs unduplicated by other FM or AM stations can be during any part of the broadcast schedule. Hereafter at least 3 hours had to be between 6 a.m. and 6 p.m. and 3 hours more between 6 p.m. and midnight. At least one hour of unduplicated programs was required in each of these periods.

May 1943 — ELECTRONICS

—ALL we can
—the BEST we can
—as FAST as we can

This is America's simple formula for victory. Nothing less is good enough in the urgency of battle. And nothing less, on the home front, is worthy of our valiant fighting men. To them, we at Simpson make this report. We are manufacturing many times more Simpson Instruments than ever before... making them the best that skill and experience, and production, can produce... and turning them out at a pace we would have thought impossible just a short while ago.

SIMPSON ELECTRIC COMPANY
5200--5218 Kinzie Street, Chicago, Illinois
THE ADVANCE MICRO RELAY IS DOING A GREAT JOB

Time-tested in hundreds of applications from earliest to signal corps communications, the Advance Micro Relay has that vital qualification—RELIABILITY. One of the first small relays on the market, this dependable unit is doing a great job on all fronts. Maybe it is exactly what you need.

ADVANCED MICRO RELAY HIGHLIGHTS

* Available from Single Pole, Single Throw to Four Pole, Double Throw.

* Capacity: 2 to 220 Volts A.C., and 1 to 60 Volts D.C.

* Stationary Contacts mounted on heavy copper terminals minimize maladjustment.

* All Contacts insulated, positioned above Ground. Lug Terminals well spaced for easy soldering of connections.

* Good clearance between Contacts permits control of higher voltages.

* Weight: 3 oz.; Dimensions: 1 1/8” x 1”.

* All metal parts A & N plated. All Bakelite parts are wax-impregnated to prevent moisture absorption.

OTHER ADVANCE RELAYS are made for general circuit control applications. They include Ceramic Insulated Terminals (Double Pole, Single Throw or Single Pole, Double Throw) for antenna chokes or other R.F. Circuits.

Send Advance Relay local distributor immediate adjustment and operation. Close attention is given orders. Write for details today.

Advance relays

ADVANCE ELECTRIC COMPANY
1549-1551 West Second Street, Los Angeles, California

U.S. ARMY SIGNAL CORPS U.S. NAVY APPROVED

NATIONAL MICROPHONE CO. LTD.
414 WARREN LANE
INGLEWOOD, CALIFORNIA

Prompt Deliveries

Series 6 tunable receiver. 2 band model illustrated, range 550-4000 K.C.

Under chassis view Series 6 tunable receiver.

Series 2A, 4 channel fixed tuned receiver. Model illustrated not crystal controlled.

NAF-1136-4
PL-68, PL-54
PL-55, JK-26
JK-48, PL-29
NAF-212938

May 1943 — ELECTRONICS

RADIO

RECEIVER AND TRANSMITTER CHASSIS

FOR YOUR APPLICATION

SMALL: Various types of Receivers and Transmitters require a space only 7” wide, 10 1/2” deep and 7 1/2” high.

PERFORMANCE: Receivers with 1 microvolt sensitivity, high selectivity with a bandwidth of only 16 KC at 30 DB down. Tunable, multi-channel crystal controlled or combination models available.

Transmitters with up to four crystal controlled channels, built-in antenna matching networks, 20-25 Watts power output with 100% modulation capability on phone. 10 watt model with power supply on same small chassis also available.

VERSATILE: Operation on 6, 12, 32, 110 volts DC; 117 volts AC or various DC-AC combinations. Dynamo or Vibrator power supplies available for operation of transmitters and receivers.

Series 2A, 4 channel 1000-4000 KC. 20 watt transmitter.

Under chassis view Series 20 transmitter.

Series 6, 4 channel fixed tuned receiver. Model illustrated not crystal controlled.

PERSONNEL

Brigadier General Frank E. Stoner has been appointed to the post of Chief of the Signal Operating Services, which places him on a parity with Major General Roger R. Colton, Chief of the Signal Operating Services. Both are directly under the Chief Signal Officer.

General Stoner started his army career as a private in 1914. As director of the Army Communications Division during the past year, he guided the construction of the telephone carrier system lines along the Alcan Highway from Edmonton to Dawson Creek, the longest carrier system in the world.

Colonel Ira H. Treest takes over the directorship of the Army Communications Division to succeed General Stoner. Col. Treest had 11 years of practical communication experience with the Pacific Telephone and Telegraph Co. prior to joining the 8th Field Signal Battalion in 1917, and has remained in the Army in varied Signal Corps assignments since that time.

Rear Admiral Stanford C. Hooper retired from active duty March 16, 1946, after a varied career of over 30 years in the Navy and particularly in Navy radio work. He plans to devote the immediate future to assisting the electronics industry in every way possible as a consultant, in the present war effort as well as in preparing for post-war conditions.

Lionel E. Moore, X-ray application engineer with Westinghouse for the past 10 years, has been named by Westinghouse as X-ray Division manager for its Portland area.
Edward C. Cahill has been named president of a newly formed RCA subsidiary known as RCA Service Co., Inc., which will carry on all technical service activities of the RCA Victor Division. He was formerly manager of RCA Victor's sound equipment activities.

W. L. Jones, former manager of RCA Victor's Service and Installation Division, becomes vice-president and general manager of the new company, RCA Service Company, Inc., will devote a major part of its activities to the installation and servicing of vital radio and sound equipment for the armed forces, throughout the world.

Henry D. Moreland, who joined the Portland, Oregon, X-ray unit of Westinghouse in 1933 as a service man, has recently been appointed manager of the entire X-ray products, agency and specialties department of Westinghouse, with headquarters in East Pittsburgh.

Gerald E. Spates and Ash Wood have been elected Vice-Presidents of Littell Inc., manufacturer of aircraft and instrument fuses and accessories.

D. H. O'Brien, after 15 years with Graybar Electric Co., Inc., which brought him up to the position of Vice-President, has retired to devote himself entirely to work in the Signal Corps. He will head the new Field Service Division, and his civilian capacity will supervise the coordination of distribution of signaling equipment and spare parts.

A. E. Snyder has become Manager of the Industrial Electronic Division of North American Philips Co., now engaged in electronic research and development work for the government.

It may be that many months will pass before the blood you so generously gave will save a life... the place may be thousands of miles away.

The preparation of plasma from donor's blood is a meticulous process in which a special type centrifuge plays an important part. Centrifugal force developed at continuous speed, with smooth acceleration, packs down the red cells and increases the yield of blood plasma. This calls for sturdy equipment, built for continuous duty; for when blood is coming in, the centrifuges are working day and night.

The Ward Leonard pressed steel rheostat was selected as the motor controller because of its absolute dependability and its large number of accurate steps. An electric interlock designed by Ward Leonard assures a slow start irrespective of when the switch is closed. The centrifuge will not operate until the rheostat is in minimum speed position.
Dr. Charles M. Slack, research physicist, has been appointed assistant director of research at the Westinghouse Lamp Division in Bloomfield, N. J. in 1940, he and his associates introduced an experimental ultrahigh-speed x-ray tube which made it possible for the first time to secure an x-ray photograph of a human foot as it kicked a football. Army ballistic experts are now using this x-ray equipment to photograph high-speed bullets passing through the steel barrels of guns. Dr. Slack also developed a Lenard ray tube having a glass window as thin as a soap bubble, through which pass powerful streams of electrons suitable for treating local skin infections, for turning certain oils into solids and for other experimental purposes.

Bob Henry, distributor of short-wave communications receivers, has been appointed to the Radio Procurement Division of the Bureau of Ships, U. S. Navy.

Dr. Irving Langmuir, associate director of the General Electric Research Laboratory, has been elected to honorary membership in the Institute of Metals in London. Dr. Langmuir's recent investigations on surface films have been applied to the flotation process in separating metals from ores.

You may need this largest Variac for controlling voltage on motors, buister, flood lights, transmitter tube filament, rectifier systems, or process equipment. Wherever line voltage varies and operating voltage must be constant, you will find this manually operated, continuously adjustable auto-transformer gives smooth control and good voltage regulation at high efficiency. Designed for circuits of moderately high power, the Type 50 Variac is rugged, dependable and convenient. Prompt delivery can be made on priority rating of \( A \) 3 or better.

**TYPE 50 VARIAC SPECIFICATIONS**

- **Model:** Type 50-A, 115 volts; Type 50-B, 230 volts.
- **Input Voltage:** Range up to 117% of line voltage can be obtained. Connection can also be made for maximum output equal to line voltage.
- **Load Ratings:** 5 kva for the 115-volt model; 7 kva for the 230-volt model. Ratings are for 50 C. ft.
- **Output Power:** 50 watts for the 115-volt model; 70 watts for the 230-volt model.
- **Maximum Current:** 55 amperes for the 115-volt model; 80 amperes for the 230-volt model.
- **Regulation:** At output voltage ranging from 17% below to 17% above line voltage the full load regulation is less than 0.5%.
- **Shunt:** No load losses are about 1% of full load power; full load losses are about 2%; losses at half maximum output voltage are about 4%.
- **Driving Torque:** From 1 to 2 pound foot.
- **Gross Weight:** 85 pounds.
- **Dimensions:** Approximately 12 inches high x 16 inches diameter overall.
- **Price:** $100.00 F. O. B. Cambridge.
John Kelly Johnson resigned his position as senior engineer in Hazeltine Electronics Corp. to become special representative assigned to the Office of Procurement and Materiel of the Office of the Under-Secretary of the Navy.

Martin Codel, publisher of Broadcasting, is on indefinite leave of absence while serving in Africa as director of public information for the Red Cross in that military theatre.

Warren Bockwaltzer, principal engineer mechanic at the Signal Corps Laboratories in Fort Monmouth, died March 17 after 34 years of almost continuous employment in the laboratory.

Roy M. Smith has been appointed Chief Engineer of Roller-Smith Co., Bethlehem, Pa., manufacturers of electrical laboratory equipment.

Alva J. Carter, pioneer radio manufacturer and inventor of many radio and television products, died recently in Chicago at the age of 64. "Nick" was widely known in radio manufacturing circles, and was president of the Carter Motor Co.

Dr. T. D. Yeomans, scientist of the Westinghouse Research Labs, saved his "A" coupons by skiing two and a half miles to work on snowy mornings. He is shown displaying his pass to a Westinghouse policeman at the laboratories entrance. Dr. Yeomans is leader in the Western Pennsylvania Ski Patrol which has charge of patrolling the mountains and wooded areas in winter.

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The number of men in a plane or tank crew is kept to a minimum. Each man has his job to do. This minimum of manpower requires a maximum of power—motor-controlled apparatus that operates at the touch of a finger and functions with utmost accuracy. Ecor's D.C. Motors have been developed to a high degree of efficiency. They are remarkably light in weight for ancc of better motors at lower cost.

**FOR THE**

have been developed to a high degree.

Considerable simplification of this system can be had in several ways. The problem of picking out the desired carrier from such a closely spaced series as set up in our problem can thus be solved by "secondary" tuning, thus tuning the receiver as close as practicable to the desired carrier, then tuning the circuits of the filter to the tone identification of the first detector.

**Northern Industrial Chemical Company**

35 years of specialized skill and experience in the Custom Molding of Plastics—ready to serve you for immediate or for future planning and production.

**U-H-F Broadcasting**

(Continued from page 97)

audio tube is 10 volts, so the diode will rectify no signal of less value than 15 volts.

The system is so designed that a frequency at the microphone signal having 7500 cycle modulation will generate 20 volts peak across the input to the diode. The diode, being biased 10 volts, peak, ignores voltages lower than that, and gives 20 volts out as rectified.d.c. from the 20 volts input. A signal of any smaller voltage, modulated at 7500 cycles, however, is sharply limited by the first audio tube and generates only 9 volts or so, which is insufficient to overcome the bias on the diode and no output voltage at all results—an infinite ratio of selectivity.

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*U-H-F Broadcasting* (Continued from page 97)

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Considerable simplification of this system can be had in several ways. The problem of picking out the desired carrier from such a closely spaced series as set up in our problem can thus be solved by "secondary" tuning, thus tuning the receiver as close as practicable to the desired carrier, then tuning the circuits of the filter to the tone identification of the first detector.

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LOOK FOR THE ANTENNA

Radio equipment has become the symbol of the modern instrument of war.

The fast action, quick decisions and perfect coordination of today's war of movement demands perfect communications, and radio provides communication "on the move".

We are proud of the part that National Radio Equipment is playing.

REPLACEMENTS

Alfred and Yvonne, "Murphy's Are Better" and Chivalrous, McHenry Hill Book Co., 510 Broad St., New York, N. Y.


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Vertical Type

NEW YORK: 135 W. 46th St., P. L. 1100
CHICAGO: 712 S. Michigan Ave.
PHILADELPHIA: 211 Bourse Bldg.
LOS ANGELES: 1305 W. 7th St., P. L. 1100
KOLD HOLD MANUFACTURING CO.
414 N. Grand Ave., LANSING, MICH., U.S.A.

NATIONAL COMPANY
Malden, Mass.

Many Greek boys have volunteered for the Army on the island of Crete, where they are being trained by Americans.

In the development of this part, Richardson Plastics Limited, as recommended by the grade of Molded Insurol, best suited to meet various conditions of specifications. You will be glad to suggest the commercial or special grade which will meet all the conditions under which your present or plan products will perform.

Write for complete information.

HOW CAN YOU TELL That it's MOLDED INSUROL?

You can tell by the way it performs. Appearance, alone, may be deceiving and no indices of the physical or electrical characteristics of this part or one that may look just like it.

Men in ground crews, using portable floodlighting, and portable electrically driven tools know that heat and moisture have no effect on this Molded INSUROL electrical component. They know that it is sturdy — that it hangs on to all its intricate metal inserts for a vice.

In the development of this part, Richardson Plastics Limited, as recommended by the grade of Molded INSUROL, best suited to meet various conditions of specifications. You will be glad to suggest the commercial or special grade which will meet all the conditions under which your present or plan products will perform.

Write for complete information.
NEW PRODUCTS

Month after month, manufacturers develop new materials, new components, new measuring equipment; issue new technical bulletins, new catalogs. Each month descriptions of these new items will be found here.

VHF Transmitter, Modulator

Model AW-1042 radio transmitter is a low-powered, crystal-controlled, r-f unit designed for operation in the 28, 56 and 112 Mc bands. It is intended primarily for telephone or tone modulation but provision has also been made for cw telegraph keying. The unit weighs 135 lbs., is 15 in. wide by 22 1/2 in. high by 18 1/2 in. deep and contains its own built-in power supply. This unit is equipped with a crystal microphone input jack and an r-f oscillator tuned to 500 and 1,000 cps with provision for keying them. Output impedance is 4,000 ohms, which suits the requirements of the r-f unit with which it is primarily intended to be used. Power output is capable of 100 percent modulating the AW-1042 transmitter.

Hammarlund Manufacturing Co., Inc., 460 W. 34th St., New York City.

New Ceramic Plastic Used for Radio Tube Bases

A new porcelain, called Prestite, is made from raw materials found in quantity in this country. The porcelain material is a development of Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. Its use was a basic factor in high frequency radio tubes for military communication equipment that has been adopted by Heintz & Kaufman, Ltd., South San Francisco, Cal., to replace material formerly used in manufacturing bases and now on the critical list. Heintz & Kaufman state that adapting the ceramic plastic to production created no major problem and that no engineering design changes were necessary, and that the material possesses satisfactory mechanical and electrical characteristics and meets performance specifications with a high dielectric strength and a loss factor better than Navy Grade P requirements. The tube illustrated, is a standard commercial high frequency radio part which functions as an electronic relay governing the storing and releasing of as much as 12,000 volts of electrical energy at a rate of 1000 pulsations a second. The base withstands this voltage surge and faithfully permits measured current interruptions without undue heating. The new compound has a slightly higher loss factor than material formerly used, but its insulation requirement is more than is necessary. Under load tests the manufacturer states Prestite bases withstand more voltage than their ratings show, and

Hammarlund companion units

in. wide by 221/2 in. high by 18 in. deep and contains its own built-in power supply, drawing approximately 490 watts from a 117 v, 60 cps line. The tube lineup consists of a pair of 886A-866 mercury-vapor rectifiers in the power supply, two VR-150-30 voltage-regulators for stabilization of crystal oscillator anode and screen potentials, a 7C5-LT beam-power oscillator equipped with a 7-Mc crystal, four frequency-doublers utilizing a 7C5-LT in the first and HK-24's in the remaining three stages and pair of HK-24's in a push-pull final amplifier designed to deliver 80 watts of r.f. to a load. Model AW-1042-A is an a-f amplifier-modulator unit which makes an ideal companion for the AW-1042 transmitter. It weighs 43 lbs., is 191/2 in. wide by 22 1/2 in. high by 18 1/2 in. deep and contains its own 117 v, 60 cps power supply. This unit is equipped with a crystal microphone input jack and an r-f oscillator tuned to 500 and 1,000 cps tones with provision for keying them. Output impedance is 4,000 ohms, which suits the requirements of the r-f unit with which it is primarily intended to be used. Power output is capable of 100 percent modulating the AW-1042 transmitter.

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May 1943 — ELECTRONICS
no changes in other parts of the tubes are necessary. Prusite combines the electrical and mechanical strength of wet-process porcelain with the moulding qualities of dry-process porcelain. It is formed under heavy hydraulic pressure that imparts a dense grain structure, enabling it to stand electrical, mechanical, and chemical abuse. It is used in many products where intricate shape requirements must meet demands for high insulation.

**Lightweight Thyatron Tube**

For applications where weight and space are a consideration, a new thyatron (GL 502) with both a control and a shield grid for control applications. The tube is a little over 2 1/4 inches long, weighs about 2 ounces, is inert-gas-filled and of all-metal construction. It may be used in welding, soldering, or general control equipment. Some of its characteristics are high sensitiv

**LECTROHM SOLDER POTS for continuous operation**

- Designed for tinning small wires and leads with maximum efficiency and minimum cost in radio, motor, and other electrical equipment plants where individual solder pots are desired for each operator. A single-beam precision metal-arc-beating element, which can be quickly and inexpensively replaced when necessary, heats the pot. Operates on 110 v., o.c. or d.c., or 220 v. as requested. Ruggedly constructed for long, dependable service.

**AVAILABLE from STOCK**

1 3/4 and 2 Pound Capacity Solder Pots

- Designed for tinning small wires and leads with maximum efficiency and minimum cost in radio, motor, and other electrical equipment plants where individual solder pots are desired for each operator. A single-beam precision metal-arc-searing element, which can be quickly and inexpensively replaced when necessary, heats the pot. Operates on 110 v., o.c. or d.c., or 220 v. as requested. Ruggedly constructed for long, dependable service.

**LECTROHM INCORPORATED**

5127 W. 25th Street, Cicero, Illinois

**BEAT THE GREMLINS of fluctuating Voltage with RAYTHEON VOLTAGE STABLIZERS**

- **CONSTANT A.C. OUTPUT VOLTAGE ± 1/2%**
- **QUICK ACTION...stabilizes fluctuating voltage instantly. Variations can't be observed on ordinary volt meter.**
- **WIDE A.C. INPUT VOLTAGE LIMITS...95 to 135 volts—single phase. ENTIRELY AUTOMATIC—NO MOVING PARTS. Connect R. Forget it.**
- **STABILIZES AT ANY LOAD up to full RATING...output voltage held constant to ± 1/2%.**

**X-Ray Intensity Meter and Radiographic Exposure Control**

Radiator X is a portable, direct-reading indicating instrument which may be used for studying the intensity and uniformity of primary beam, effect of filters, pattern of stray or secondary radiation or for establishing radiographic and photo-fluoro

**RADIOGRAPHIC EXPOSURE CONTROL**

Meter R, is a device which can be adjusted to automatically de-energize the x-ray generator when the proper quantity or dosage of rays have reached the film. It is directly applicable to diagnostic and industrial radiography, where objects to be x-rayed differ from time to time and especially where thoroughly trained technicians are not available. It assures radiographic images of proper

**LITTLE BUT SO IMPORTANT to New War Developments**

Ships, planes, tanks and the forces in the field depend on the constant performance of Electronic Instruments for coordination by communication, detection, controls and other war-winning developments.

Transformers that are little and tough—designed and constructed to meet the most unusual requirements and conditions—are a vital part of these devices. There is never an hour, day or night, around this war-torn world that Transformers are not helping to win this war by being an important part of the Electronic Units that are doing so much to aid the Armed Forces.
Spectacular strides — as spectacular as the mosquito boat's record — have been made in applying electronics to war, but it wasn't an overnight job. Years of work, study, research and experiment came first. That's why Bell Sound Systems were so quick to contribute so much to wartime needs. Bell was among the first to probe the future of electronics by applying its principles to practical jobs, then, by pressing ahead with new ideas and improvements. Bell technicians gained years of priceless experience, and were ready to meet the new demands.

The electronic wonders that BELL Sound Systems are performing in war, promise even greater advances in sound amplification, transmission and recording for tomorrow. And BELL Sound Equipment will play a progressive role in peacetime as it has in furthering electronics' contribution to victory!

BELLmone communication systems offer every type of service for instant speaking contact between all executives in any business firm or manufacturing plant — executive between individual executives and any number of subordinate stations. Write for details.

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**Solve Your War Production Problems With This Plastics Check List**

- Insulation — electric and mechanical
- Cost of labor — engineered accuracy
- Weight of material — must be made
- Light conductors — other materials must be made
- Color range — metallic, check-

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**Electronics — May 1943**

**Mc.** The X-axis or horizontal deflection amplifier has a uniform characteristic from 10 cps to 100 kc. Both amplifiers have distortionless input attenuators and gain controls. Provision is made to connect signals directly with the deflection plates when frequencies to be observed are beyond the useful limits of the amplifiers.

The instrument has a removable front cover. The removable test probe, held inside the cover by clips, consists of a compensated 1%1 attenuation mounted in an insulated probe and supplied with a 3-foot length of coaxial cable and connector. This design permits connections to relatively high impedance circuits without serious loss, while minimizing stray pickup. Self-contained, operating directly on 60 cps, 115 volts, a.c., the instrument weighs 55 lbs. and measures 17 1/2x10x21 inches.

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**DINION COIL COMPANY**

**Caledonia, N. Y.**

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**Ready for the CALL!**

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**Shutters**

Known as the Gotthard Model 450 (with faceted jewel) and Model 451 (with plain jewel) these lights are available with red, green, amber, blue or white lens or with a polarized lens. A catalog which covers styles and models available for immediate shipment may be obtained from Gotthard Manufacturing Co., 1300 N. Ninth St., Springfield, Mass.

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**Oscillograph for Expanded Frequency Range**

A 5-Inch Screen oscillograph together with the inclusion of a X-axis amplifier to modulate the beam with any signal applied to its input terminals or with a return trace blanking impulse produced by the linear time-base generator, distinguishes this new Type 241 cathode-ray oscillograph from Type 224, announced in January, 1943. The oscillograph has a uniform Y-axis or vertical deflection response from 0 to 250 Vrms to 2.222
Photoelectric Controls and Light Sources

Series 70 PHOTOELECTRIC controls are adaptable to a variety of applications in control problems. In cases where separate mounting of photocell and control is mandatory, Series 70 may be used in conjunction with any of three photocell units available. Model 76 uses a 2-tube amplifier and

is designed for applications requiring high sensitivity. Model 72 operates on a minimum of 4 ft. candles, while Models 75 and 76 are rated at 8 ft. candles. Contact capacity of all four units is rated at 5 amps. For additional cost infra-red filters are available, as well as a non-inductive microswitch for mounting on the sensitive relay to increase the contact capacity to 10 amps.

Series 70 LIGHT SOURCES are supplied in two types (both of which have lens focal lengths of 2, 4 or 6 inches).

Model No. 18-A comes without a transformer and the operating current is supplied by the control. It is rated up to 32 candle-power, Model No. 18-B comes with a transformer and operates directly from 110 volts, a.c. Model 18-B is provided with taps to permit operation at various light intensities. It is rated up to 60 candle-power.

United Cinephone Corp., Torrington, Conn.

Can an Engineer Be a Businessman?

Let's talk sense.

We're not going to insult your intelligence or kid ourselves with a lot of meaningless words...

But...

If you are business-minded enough to realize, and want to capitalize on, the opportunities that are now available to every engineer who wants to take advantage of them...

Then, by investing a few hours of your spare time a week, and a small portion of your present income, you can start gaining the advantages of CREI home study. This is the advanced technical study that will bring your knowledge up-to-date...help you in your daily work, and develop your ability to cope with any technical radio problem.

In an industry that is expanding as rapidly as radio...CREI offers a proven procedure for personal advancement for the high calibre man that radio looks to for its efficient operation and progressive developments.

One CREI student, a broadcast engineer, recently wrote: "I found your course sufficiently advanced for a college graduate..." and of an engineering nature.

Now...if you're interested—

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If you are a professional radio engineer, but so prone the value of CREI study. To help us intelligently answer your inquiry, PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXCELLENCE, EDUCATION AND PRESENT POSITION.

The TIME YOU LOSE on Slow Deliveries of RADIO & ELECTRONIC Supplies

DON'T let slow deliveries of radio and electronic supplies rob you of precious time on vital work! Now you can often save days even weeks, with "W1 Emergency Service". Whether it's one or a hundred diversified stocks; picked technical parts...you have only one order to write and W1 Emergency Service delivers quickly. We've established at special war emergency service that "delivers the goods" faster than you would believe possible under present material shortages. Quickly, carefully...we supply diversified stocks; picked technical parts...special handling...every facility to eliminate delay and cut your minimum working stocks. Phone, wire or mail your order today! See what we mean by EMERGENCY SERVICE.

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CONTESTANT at the U.S. Signal Corps—U.S. Coast Guard Promotions of Well-known Technical Insurers in Industry

coke, N. Y.

ELECTRONICS — May 1943

Water-proofing Chemical for Ceramic Insulators

"DRI-FILM" is a new chemical compound whose vapors will make cloth, paper and other materials water-repellent. This was developed by Dr. Winton 1. Patnode of G-E Research Laboratory and will be marketed by Electronics Department of General Electric Co., Schenectady, N. Y. One of its most important uses is in the treatment of ceramic insulators for radio equipment. It is approximately nine times more effective than wax, or varnish. Dri-film is a clear liquid composed of various chemicals which vaporize at a temperature below 100 deg. C. Articles to be treated are exposed in a closed cabinet to the vapors for a few minutes. Then they are taken out and, if necessary, are exposed to ammonia vapor to neutralize corrosive acids which may collect during treatment.

High Voltage Plate Supply Transformer

AN ARMORED-INSULATION high voltage plate supply transformer which minimizes the effects of high voltage aging is available at a rating of 1.8 amperes secondary, 3300 volts. The unit is sturdy and constructed and is for transmitter service for die rectifier systems.

The Acme Electric & Mfg. Co., Cuda, N. Y.
Electrical Fault Limiter

This accessory is designed to protect aircraft and other electrical circuits against damage from short circuits. It does not clear ordinary overloads, and in no way limits the amount of current that passes through the circuit, but only limits the duration of heavy overload currents. It carries its nominal current rating indefinitely. When fault currents in the order of 4-to-6 times rated current are encountered, the limiter will clear the line promptly. It is normally installed in series with the reverse current relay, and when the reverse current relay fails to operate, the limiter clears the circuit, thereby preventing fires and the spreading of the fault. Another application is in protecting aircraft electrical circuits in multi-engine craft. Sectionalization of the circuit with fault limiters isolates the fault and prevents other sources of current from perpetuating it. These fault limiters are approved for use on aircraft, are lightweight and are made in several ratings. Type P15 is illustrated.

Bermidy Engineering Co., Inc., 459 East 133rd St., New York, N.Y.

Electronic Level Control

A new series of electronic level controls designed particularly for hazardous location mounting includes Type P15NHX (for high-level control) and Type P15NLX (for low-level control). The equipment is for use with conductive liquids of an explosive nature. Each model is furnished as a complete unit in a vapor-proof cast-iron housing for direct tank installation. High-level control is accomplished when the liquid rises and contacts a probe tip; low-level control is accomplished when the liquid drops below the probe tip. Both models incorporate a safety feature for operation of the relay in case of current or tube failure. The relay connections of Types P15NHX and P15NLX are those of a single-pole double-throw switch. The relay contacts are rated at 1000 volts a.c. Both models are available for operation on 230, 208 or 115 volts, a.c., 60 cps.

Kester Cored Solder

In the hundreds of vitally important jobs where solder is used today in production of vital equipment, there can be no compromise with quality. Only solder that holds with building grip—that won't let go—is good enough for the making work of war.

Kester Cored Solder presents electrical circuits for communication and control systems that can sustain the ravages of war. For production of vital military equipment, you must have Kester Cored Solder. Write for information and samples. Kester Solder Company, 4291 Wrightwood Avenue, Chicago, Illinois.
Impedance Matching Bridge

This unit will test all coils (r-f, antenna oscillators, i-f transformers, etc.) having inductance lying between 0.0025 mh to 100 mh. The percentage of accuracy may be adjusted between 3 percent to less than 0.01 percent. It provides a fast, accurate method for adjusting and checking coil inductances in production work. The bridge consists of an oscillator, amplifier, bridge proper and cathode ray indicator. It will compare capacitances and resistors; the setup may be changed over quickly from one coil to another; slide wires of rugged design are included oscillator and amplifier circuits are permeability tuned and have silver-mica condensers to minimize frequency and phase shift; visual method of indication reduces operator fatigue; only fixtures and jigs are required for connecting different coils to the test terminals; and finally, various parts of the unit are readily available for periodical inspection.

The Erwood Company
223 West Erie Street
Chicago, Ill.

The most widely used Plugs and Jacks in the U.S.A.

Air-Cooled Distribution Transformers

Simplification in installation and reduced initial and operating costs are some of the features claimed for the new type distribution transformers which utilize air-cooling instead of, for instance, oil as an insulating and cooling medium. Since fire and explosion hazards are eliminated, the transformers may be located anywhere indoors without the need of a protective vault, or the unit may be placed near its load center. Inspection and maintenance are simplified because valves, cooling tubes, liquid level gauges and gaskets have been elimiated in the construction of the transformers.

Quiet, Archimedes

Stop shouting, "Eureka"... If we yelled each time we found a few things, this little town would need more than an anti-noise stick. Every day, our staff, trained by many years of experience in purchasing and supplying technical radio parts, locates hard-to-find equipment that is needed in vital war jobs. In some instances, we can make immediate deliveries from the wide range of apparatus and components, saved from our normal pre-war stock for just such emergency orders. However, if the components are not on our shelves, we can quickly locate the source of whatever material you require, and expedite these deliveries.

"Hit-and-miss" methods of searching are costly. We can save both time and expense. Let Harvey find it for you.

May 1943 — ELECTRONICS
Marine equipment, insulating varnishes ... MP's vital to the Air... DOLPH'S Insulating Varnishes serve goods' co. che Axis. an important part in delivering the control / getting ex... you're yourself th... ac your electrical units are... DOLPH'S and assure Solid coil... STARTING RELAYS... Dolph's VARNISHES PROTECT... AIRPLANE CONTROL UNITS: Variable Pitch Propeller Controls Inverters--Starters MANUFACTURERS OF CHINALAK and SYNTHETIC Insulating Varnishes DOLCOTE Cable Enamels

This particular model is available in three types which include Model 410P (supplied in a case), Model 410C (open face bench type with an .4 inch meter), and Model 510V-V (upright instrument).

Radio City Products Co., Inc., 127 West 36th St., New York, N. Y.

Vibrating Reed Frequency Meters VIBRATING REED frequency meters are for use on engine generator sets, in labs, telephone, television, radio service, as well as in many types of electronic equipment. The meter consists of a dial, central mounting frame, series of spring steel reeds, reed mounting bar, individual driving coil, permanent magnet surrounding each bank of reeds, a series resistor, and terminal studs. In operation, the alternating current (or interrupted direct current) excites the driving coil. As each reed is adjusted to respond by resonance to but one frequency, the reed "in tune" with the frequency in the coil will respond by vibrating rapidly because of the permanent magnets, and induced magnetism from the coil. A series resistor adapts the instrument to specified operating voltage. The frequency of the current can be read opposite that reed on the graduated face of the instrument. If the frequency is fractional, for example, 60.9 cps—the 60 cycle reed will vibrate to about half its full amplitude, and the 61 cycle reed will vibrate similarly.

Some of the features claimed for the instrument include: full and half cycle increments; sharp or broad response; power consumption average less than 2 watts and as low as .1 watt; voltage range from 6 volts up to 425 cycles, depending on the model (an external series resistor is used above 600 volts); combination of reeds are available in frequency ranges of 20 cycles, or up to 425 cycles, (lower or higher ranges are available for special services); accuracy is ±.3 percent on full cycle increments, ±.2 percent on half cycle increments; (both at normal temperature); the instrument is not affected by wave form, normal temperature changes, or external magnetic fields.

Bulletin VF-43 contains complete information on the meters, and is available from the manufacturer, J-B-T Instruments, Inc., New Haven, Conn.

MAGNIFYING ATTACHMENT. The Magnifying attachment is This particular model is available for use in laying out tools and dies; measuring pin stock, checking tools, etc., in defense plants. It consists of a standard machine's scale divided into 64ths of an inch, and a magnifying attachment. The magnifier is a patented plastic lens mounted on a slide block which is used to check the lengths of parts, depths of holes, center distances in layouts, finishes of metal, etc. The scale will lie flat when carried in a pocket.

Leonard Engineering Company, Capitol View, Silver Spring, Md.
INDUSTRIAL APPLICATIONS

You will want a copy of this new Catalog which illustrates and describes the complete line of Standard Model Gothard Pilot Light Assemblies, giving dimensional diagrams and prices. If you have a special Pilot Light requirement—ask Gothard Engineers for a solution.

Seamless Plastic Tubing

"TULOX" TT SEAMLESS plastic tubing is now available in all diameters up to 2½ ins. O.D. Extruded from Tennessee Eastman cellulose acetate butyrate, this tubing is available from warehouse stocks throughout the country through Crane Company, Chicago, Ill., and Julius Blum & Company, Inc., New York City. The tubing is manufactured by Extruded Plastics, Inc., Norwalk, Conn.

Improved Electrolytic Condensers

The plug-in dry electrolytic condensers which are illustrated are for use in the elimination of low frequency ripple (2-300 cps). They are small, lightweight, easy to mount or remove, and are designed to perform efficiently under adverse temperature and climatic conditions. The condensers can be sealed, or they may be soldered or welded into the unit.


Tandem Controls

No. 42 SERIES Control was developed to meet radio and electronic requirements where simultaneous control of several circuits is necessary. A plurality of circuits (up to twenty-four) can be controlled by the single shaft of this unit. Case design permits nesting of all units into a compact stack. Metal end discs and tie rods hold the cases together and provide further rigidity. The single shaft passes through and locks with each rotor in the stack. Thus the finished assembly is really a single control with several independent sections for as many independent circuits. All units pass through the same degree of rotation as the single shaft is rotated. Individual units can be of any standard resistance, taps and hop-offs to meet individual circuit requirements.

Clarostat Mfg. Co., Inc., 285 North 6th Street, Brooklyn, N. Y.

Pampered Darlings

Don't look so sad, pooch. Before this war upset everything, many an ABBOTT was a "pampered darling" too... cozily nestled in a protected radio shack...

Now, ABBOTT transmitters and receivers are subjected to many front line rigors and inconveniences. But they are tough little units, none the worse for being locked around.

This is an ABBOTT TR-4, one of our standard models—a compact and efficient ultra high frequency transmitter and receiver. It is only an indication of the type of equipment that we can and do produce. Our facilities may be of assistance, if you have a problem within the scope of our activities.

ABBOTT INSTRUMENT INC.
5 WEST 16 STREET NEW YORK, N.Y.
Humor YOUR MICROPHONE
You'll Get More Out of It

Like a bottle of Suffer water, a mike deteriorates once it's been opened!

How TURNER Microphones Can Live to an Active Old Age . . .

Turner Microphones are precision engineered to give you long and faithful service. How to do so exposes the sensitive instruments, connectors for soft and hard cable, reducer connector, junction box, and other accessories for coaxial cable are described and illustrated. Gas equipment and dehydrated air equipment are explained. A new type of cable terminal, glass-to-metal seal especially suited for high frequencies is described and illustrated together with glass fittings for glass seals. The principle of operation and the features of a direct reading phase monitor for use in directional arrays and remote indicating antennas are also included. Bulletin available from Victor J. Andrew Co. 386 E. 70th St., Chicago, Ill.

Hairline Indicator

Hairline indicators (made to customer specifications) consist of a fine line engraved on a small sheet of Vinyline, plastic-inch filled. The indicator itself is a sheet of plastic 40/100 of an inch thick which can be supplied in any size, thickness or width of line (widths may be as narrow as 1/1000 of an inch, or heavier). The indicators maintain dimensional stability under all conditions of humidity and temperature. Information as to how these indicators may be adapted to particular needs of optical engineers or others may be obtained from the manufacturer, Prinlof, Inc., 36 Mercer St., New York, N. Y.

Literature

Coaxial Cable and Cable Accessories. In this 14-page bulletin, which is made up of a combination of several small bulletins, the performance, applications, dimensions, mechanical and electrical properties of coaxial cables are given. Sealed terminals for coaxial cable and attachments for sealed terminals, connectors for soft and hard cable, reducer connector, junction box, and other accessories for coaxial cable are described and illustrated. Gas equipment and dehydrated air equipment are explained. A new type of cable terminal, glass-to-metal seal especially suited for high frequencies is described and illustrated together with glass fittings for glass seals. The principle of operation and the features of a direct reading phase monitor for use in directional arrays and remote indicating antennas are also included. Bulletin available from Victor J. Andrew Co. 386 E. 70th St., Chicago, Ill.

Photocells. Bulletin GEA-1755E describes and illustrates photocell relays for automatic control. The general purpose relays illustrated are types CR7505-K2 relay, for indoor use on 110 v, CR7505-L16S relay, for indoor use on 115 v and CR7505-K10S outdoor relay.

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May 1943 — ELECTRONICS

235
Radio Communication Equipment. Government specified telegraph transmitters, dual frequency long range marine transmitters, traffic control transmitters, radio telephone transmitters, four band transmitters and PA systems, marine radio telephone equipment, uh-f transmitter-receivers are covered in this twelve page bulletin. Communication equipment for pleasure boats, yachts, tugs and large craft, radio telephone and telegraph equipment for general communication purposes, modern high fidelity transmitters for fixed and mobile operation and equipment for specialized applications are also covered. Available from Transmitter Equipment Mfg. Co., Inc., 345 Hudson St., New York, N. Y.

Cut-off Wheels. Rimlocks are a new development in diamond cut-off wheels, made especially for cutting brick, porcelain and vitreous products, glazed face brick, porcelain and material of similar construction. Other operational ideas are given and a stock list is included. Filed by Mfg. Co., Torrance, Calif.

Photocopy Machine. Apexo copying machine makes copies directly from blueprints, drawings, tracings, charts, maps, material, special wiring or mechanical diagrams, field plans, specifications, usable new copies of old tracings and departmental orders. Copies can be made up to 18 x 22 inches, weighs ten pounds and operates on either a-c or d-c. Available from American Photocopy Equipment Co., 2849 N. Clark St., Dept. 107, Chicago, III.

Reference Manual. Design data on cathode-ray equipment and factors upon which final specification rests are covered in this reference manual. Characteristics and descriptions of all DuMont cathode ray tube models, oscillographs plus application notes are included, also special equipment designed for particular laboratory and production testing projects. Copies available from Allen B. Du Mont Labs., Inc., 245 Madison Ave., New York City.

Automatic Ballast-Regulating Tube. In a four page folder the regulating characteristics, curves and circuits for automatic ballast-regulating tubes are given. Ampere Co., 561 Broadway, New York, N. Y.

Shiftograph. A perpetual week to week work schedule on a modified slide-rule basis showing executives how to operate equipment on various time schedules depending upon the number of crews, number of weekly hours and percent plant activity. Available to executives and plant managers from George S. May Co., 180 Broadway, New York, N. Y.

Automatic Control Units. Bulletin No. 140 describes and illustrates magnetic contactors, reversing controls, automatic reset timers, program clocks, remote control switches, and automatic transfer switches. The details of construction, latest improvements, applications and price lists are included. Zenith Electric Co., 152 W. Walton St., Chicago, Ill.

Dynamotors. The Copper Magneto-Motor House is a journal devoted to the operating, servicing and maintenance of dynamotors. This journal contains the latest dynamotor and generator developments, service hints, timely articles and round table discussions. Available from Carter Motor Co., 1608 Milwaukee Ave., Chicago, III.


Multi-contact Timers. Bulletin 3600 gives the applications, construction, standard features and motor style selection of type MC-60M multi-contact timers. This model is a controller for sequential operation of solenoids, valves, motors, machine tools, signaling systems, laboratory tests, mixing equipment and heating and ventilating systems. Bulletin 3500 available from R. W. Cramer Co., Inc., Centerbrook, Conn.
Tubes. "Tips on making Transmitting Tubes Last Longer" is the title of a booklet written as an aid to users of electronic tubes in the industrial and broadcast fields. Five general rules are listed; a chapter on how to double the life of tungsten filament tubes, another on how to make mercury-capsules tubes last longer, one on tube rest periods and one explaining why cooler tubes last longer. RCA, Victor Div., Camden, N. J.

RCA Tube Handbook All-Types HB-3 contains general information on receiving transmitting, and cathode-ray tubes, phototubes and miscellaneous tubes. Data for each type included in the handbook, is covered in the general section. Available on subscription basis. RCA Commercial Eng. Section, Harrison, N. J.

RCA phototubes for light operated relays, light measurements and sound reproduction are covered in this 16-page folder. The theory, construction and operation are explained. Circuits, curves and charts are included. RCA Commercial Eng. Section, Harrison, N.J.

"Radio and Electronics" is a booklet which describes the part played by radio and electronics in this war. The booklet points out how war speeds development, how electrons are produced, how radio tubes perform, and the outstanding results of research. Radio Corporation of America, 30 Rockefeller Plaza, New York, N. Y.

Revised edition of the RCA Guide for Transmitting Tubes, designed especially for radio engineers and technicians in the armed service and war industries. Commercial Engineering Section, RCA, Harrison, N. J.

RCA Tube Picture Book enables visual instruction in the constructional details of various types of vacuum tubes. The book consists of 16 pages; there are 8 charts which can be used for display mounting. Commercial Engineering Section, RCA, Harrison, N. J.

House Organ. In the February-March issue of Wheelco Comment there is an article "Prolong Instrument Life" which is a consolidated guide on instrument care. Available from Wheelco Instruments Co., Harrison and Poinsett St., Chicago, 111.

Making them for combat aircraft is a responsibility to which the Boes organization is holding its closest attention and best skills.

The success of every flying mission depends on the accuracy and reliability of electrical indicating instruments.

Cellular Graphite. A 4-page illustrated bulletin No. 422-EE illustrates and describes the use of "dug" cellular graphite as a starting compound. The uses of cellular graphite are pointed out and its application to aviation and deep sea diving equipment.


Corrosion Work Sheet. This work sheet acts as a check list for all factors influencing corrosive action. It permits comparison of a problem with similar ones which may be used as a guide for selecting materials possessing satisfactory resistance. Copies of the Corrosion Data Work Sheet may be obtained from Technical Service, International Nickel Co., 67 Wall St., New York, N. Y.

Welding and Brazing Aluminum. Instructions for welding processes are given in this booklet. The important welding methods which are covered are: fusion welding, including the use of gas, metal arc, automatic and manual carbon arc, and atomic hydrogen electric resistance welding, including spot, seam and butt-flash welding methods. Three brazing processes are described: furnace brazing, torch brazing and dip brazing. Booklet available from Aluminum Company of America, Pittsburgh, Pa.

Processing and Testing Machines. Catalog No. 431 contains information on "Kold-Hold" thermal, autotzero and stratosphere processing and testing machines. The catalog is broken up into two sections. The first section covers processes employed in industry and the ranges of temperatures and pressures encountered. The second section covers the machines manufactured by this company for providing these temperatures and pressures. Aluminum storage, aluminum sheet and parts storage, aircraft and other instrument testing, laboratory work, machine tools, etc. STAR STEATITE gets government specifications for grade G ceramics. It has a low loss factor, well suited for radio and television equipment.

Wm. J. Murdock Co.CHELSEA, MASS.
Brazing Alloys. Bulletin No. 12-A is a revised edition of a previous catalog on Sif-Fox and Easy-Fle brazing alloys. The application, uses and advantages of low temperature silver alloy brazing are given in this 16-page bulletin. Army, Navy, Federal and other specifications are given.

In the recent issue of Low Temperature Brazing News, No. 22, instances are shown where brazing alloys have simplified and speeded up war production. Bulletins are available from Handy & Harman, 82 Fulton St., New York, N. Y.

Glass Working Equipment. Catalog No. 41-B describes all types of gas, air and oxygen burners, economizers, gas and air mixers and glass rollers. The catalog is very thorough and contains over 750 illustrations. Available from Eiker Engineering Co., 730 South 13th St., Newark, N. J.


Capacitors and Design Data. In the August 1943 issue of The Aeronaut Research Worker contains an article "Capacitors in Control Circuits." This article deals with requirements for capacitors in motor acceleration and special purpose circuits.

In the September-October issue of The Aeronaut Research Worker Part I of "Design Data for H-Derived Type Filters" is presented. This is the first of a series to be presented. They will cover the design of metal-plate filters for ross-pass, high-pass, band-pass and low-pass applications. Available from Airworth Corp., New Bedford, Mass.

Hard Facing. Bulletin No. 133 describes "No-Wear," a cemented carbide to protect your wear plates. The method of application, types of material and physical characteristics is described and illustrated. Calife Tongsten Corp., Union City, N. J.


Fuses and Accessories. Engineering Bulletin No. 20l describes new fuses and accessories for use in conjunction with the Philips Metalux X-Quartz analysis apparatus. Fixtures described and illustrated in this bulletin are geometries and fixtures for x-ray measurement of quartz angles, crystal blank holders, rotating water and rotating crystal blank holders, edge correction holder, angle correction holder and Bragg angle scale. A bulletin which describes this equipment is available from Philips Metalux Corp., 419 Fourth Ave., New York, N. Y.

Spark Plug Bushings. Bulletin No. 207 gives the advantages and applications of "Hell-Coil" spark plug bushings. This is a hard, smooth stainless steel wire insert, used with the threaded spark plug. It comes in 18 mm and 14 mm sizes. Bulletin available from Aircraft Screw Products Co., Inc., 4723 25th St., Long Island City, N. Y.

Summary of important characteristics, physical form and type supplied, mechanical properties, electrical properties and applications are given in this 14-page booklet. Available from The Rawplug Co., Inc., 98 Lafayette St., New York, N. Y.

Plastics. Skyralloy 22, a new plastic, is suitable for electrical applications where both low and high temperatures are needed. The general characteristics, physical form and type supplied, mechanical properties, electrical properties and applications are given in this 14-page booklet. Available from The Dow Chemical Co., Midland, Mich.

A folder which illustrates the possibilities of plastic parts in war production applications has just been published by Creative Plastics Corp., Technical Sales Dept., Kent Ave., Brooklyn, N. Y.


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NEW BOOKS

Practical Course in Magnetism, Electricity and Radio
By A. F. Pukite and W. M. Lloyd
John Wiley & Sons, Inc.
404 pages, $5.50

PRINCIPLES OF MAGNETISM, direct current apparatus, modern current and radio are explained by means of over a hundred experiments. The presentation is sufficiently general to make the book suitable for college-level study, even though the setup is that of a laboratory manual.

The four major sections are preceded by general definitions and formulas which provide a survey of the associated theory as a whole. Some or all of the following topics appear in each experiment: statement of purpose; correlation with previous material; theory and formulas; apparatus required; experimental procedure; conclusions.

The use of British technical terminology and illustrations of British practice indicates that the book was originally written and published in England, though no direct statement to this effect could be found.

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New York, N. Y.
The Electron Microscope

By E. F. Burton and W. H. Kohl


The smallest particle which man can see with even the best optical microscope is limited by the wavelength of visible light to a linear dimension of at least 1/2500th of a inch. The invention of alternating light and photography permits pictures of particles about half this size, and this is the optical limit which has until now imposed on the microscope since about 1900. The development of the electron microscope has brought a new chapter, and hundreds of scientists with unsolved problems of microscopy are now seeing clearly objects which previously had been considered invisible or only dimly perceptible.

A complete and successful electron microscope was built in 1938 at the University of Toronto under the supervision of the authors of this book, Dr. Burton being head of the department of physics and Dr. Kohl having been associated with him at that time. The construction work was done by two post-graduate students, James Hillier and A. F. Freiheit, with James Powell now being in charge of electron microscope development at RCA Laboratories in Camden.

This is a detailed yet almost entirely mathematical exposition of how an electron microscope works, the authors start with the human eye, explain how it functions, and then use it as a guidepost for explaining the optical principles of ordinary microscopy. Step by step they demonstrate that there is a limit of magnification is reached with an optical microscope, using simple diagrams and analogies. Following chapters deal with the nature of light and with elementary electron theory. All in all, the first nine chapters appear intended to provide a background of the physics for the non-technical reader, and can well be skimmed or skipped by the engineer.

The basic theory of the electron microscope starts in the tenth chapter, which deals with the movements of electrons in uniform and non-uniform fields. Following chapters logically cover electron and magnetic lenses. After a brief historical interlude, the electron-tube electron microscope is taken up in detail, with considerable data on results obtained with different cathode guns in the electron gun. Finally, the commercial form of electron microscope, using magnetic lenses corresponding to those in an optical compound microscope, is explained.

The final chapter treats of the accomplishments of the electron microscope only sketchily because, to the authors of the book, "this book is not to be a technical text but rather an introduction to the subject of electron microscopy."

Illustrations include about 70 electron microscope pictures of botanical, biological and mineral specimens, but most of them are scattered through the book without regard for their relation to the text. Continuity of text is further interrupted by the use of full pages for captions alone.

J. M.

Communication Circuits

By LAWRENCE A. WARE, Associate Professor of Electrical Engineering, State University of Iowa, and HENRY B. REED, Professor of Electrical Engineering, State University of Iowa, John Wiley and Sons, Inc., New York, 470 pages, Price $6.50.

This book, while intended primarily as a first-course material for students of Communication Engineering, contains chapters on the newer ultra-high frequency techniques, particularly with reference to transmission lines and wave guides.

The first few chapters are devoted to the derivations of the important network theorems, together with simple examples illustrating their use in circuit analysis. Then follows a carefully developed outline of the theory of the infinite transmission line and the general transmission line. Special applications, such as the Ferranti effect and the method of locating impedance irregularities, are described, and a short chapter treats the overall efficiency of the line considered as a power transfer device.

Two sections on filters give the basic theory of constant K and m-derived filters. The presentation is continued to ideal filters (without distortion) and examples are worked out for several of the usual types. An excellent treatment of impedance transformation includes material on the reactive L- and T-sections, and the quarter-wave line as an impedance transformer. The gen-
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MICROWAVE TRANSMISSION


The PERIODICAL LITERATURE of microwave transmission has become quite rich during the past few years and with considerable effort it is difficult for the investigation, particularly one new to the field, to separate the significant material from the less important detail. With the intensive effort now going on in microwave work, the Professor's authoritative book, which summarizes and correlates existing knowledge on this new subject, will be of considerable usefulness to a busy physicist, engineer or student.

The section on antennas covers the patterns and radiation impedances of simple antennas, and of greater interest, a discussion of the directional antennas commonly used in microwave work. Included in this section is an interesting material on parabolic reflectors, which, as far as the author is aware, the equivalent is not found elsewhere in the literature.

The book might have added the usefulness of this book would have been a treatment of microwave propagation over the earth's surface. For references to this book may not be practical, and this might be more useful if some of these sections had been divided into subsections.

Radio Data Chart

By R. E. Beatty, Published by Electronics, Indianapolis, Ind., 30 pages. Price $1.75.

THE SERIES OF ARMS included in this volume was first published some years ago in The Wireless World and, with some modificaion, an earlier edition has been available in book form for a number of years. The present arrangement of arms have been brought up to date by the deletion of obsolete material, the inclusion of new material, and the rearrangement of the data to make it more easily accessible.

The present arrangement of arms have been brought up to date by the deletion of obsolete material, the inclusion of new material, and the rearrangement of the data to make it more easily accessible.

All of Mr. Beatty's charts are in the form of monographs in which the engineering solution to a specific view of which the writer is aware. Transmission line theory is not quite the same for the telephone and for the radio engineer. For one thing, the magnitudes involved are different; and for another, so far as the radio engineer is concerned, standarized transmission line is not an approximation of electromagnetic theory, which is often, but not always, sufficiently exact. In earlier textbooks the treatment is directed at power and telephonic applications. Since Slater's presentation is from the high frequency point of view, it is of value to all radio technicians, even those not directly interested in microwave work.

The treatment on antennas covers the patterns and radiation impedances of simple antennas, and of greater interest, a discussion of the directional antennas commonly used in microwave work. Included is an excellent non-mathematical discussion of parabolic reflectors, of which the author is aware, the equivalent is not found elsewhere in the literature.

All of Mr. Beatty's charts are in the form of monographs in which the engineering solution to a specific...
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Today's dizzy pace must seem frightfully strange to you. Don't feel too badly about it though, because a lot of us are looking at it with similarly unbelieving eyes.

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Here, as in other phases of Electronic development, the radio tube is the "magic brain" of the process—and the fountainhead of modern tube development and production is RCA.

Made in varied lines for almost any Electronic application, RCA tubes afford a broad engineering selection of types, each with a background of proved performance that assures long life, utmost dependability, and high efficiency.

In the Electronics of the future, as in the Radio of today, RCA Tube engineering will continue to lead the way—all the way!