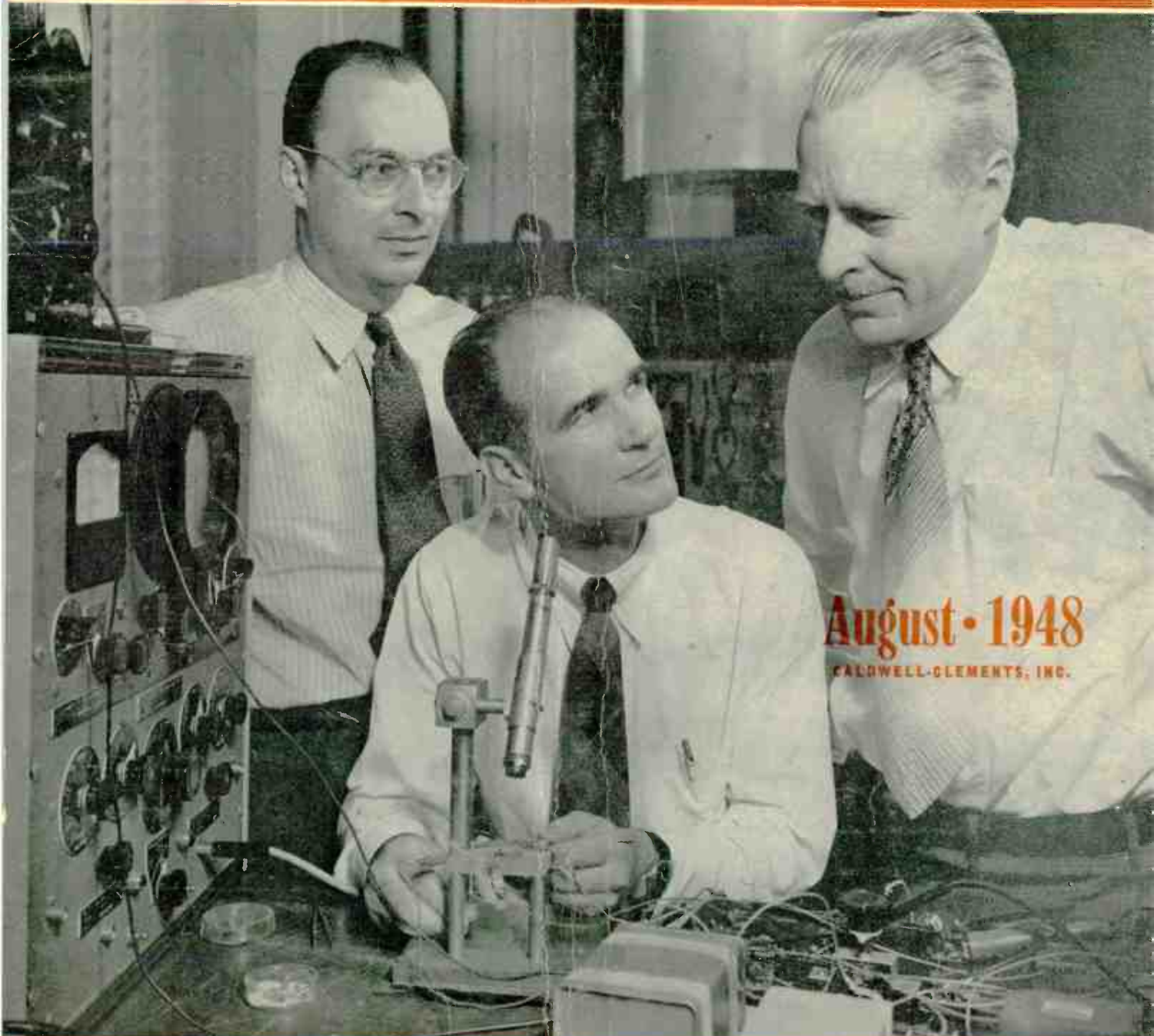
TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO



August • 1948

CALDWELL-CLEMENTS, INC.

Bell engineers, (l to r) Bardeen, Shockley, Brattain, who developed the new Transistor . . . . see page 18

Route this issue to others engaged in: **Management** ☐ **Engineering** ☐ **Design** ☐ **Production** ☐ **Purchasing** ☐ **Research** ☐

World Radio History

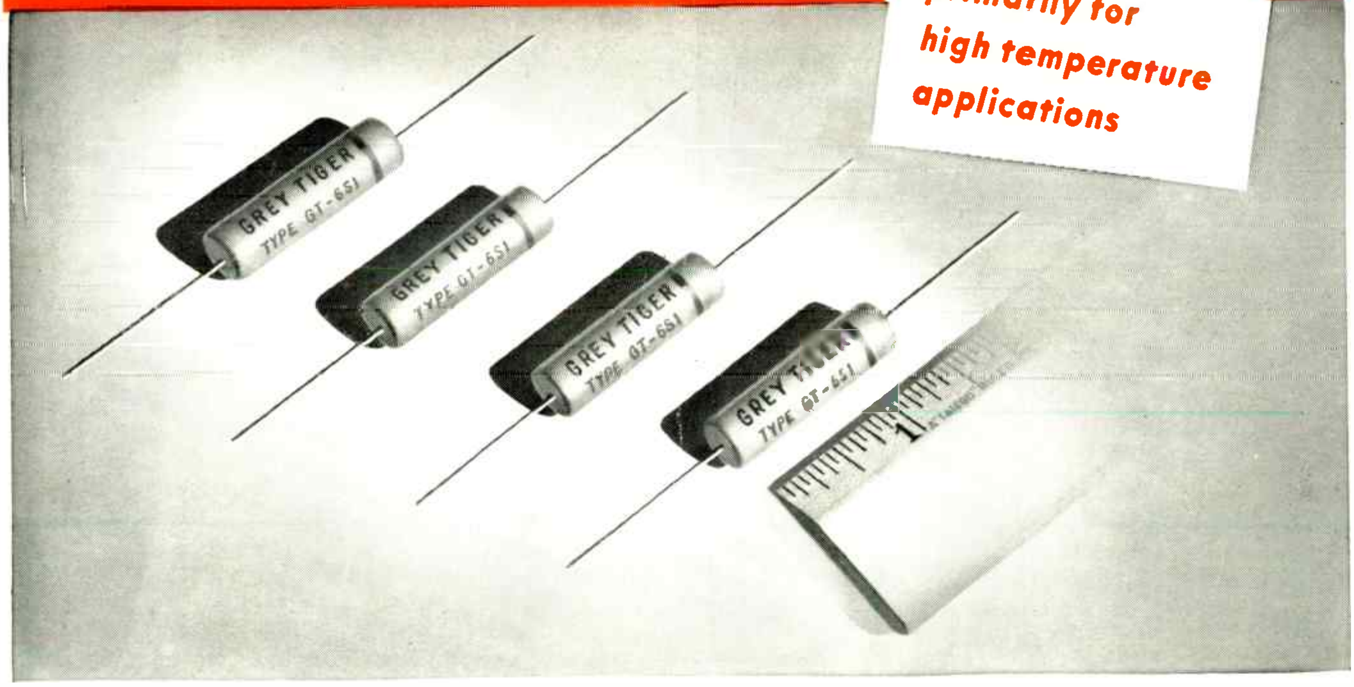
ENGINEERING TECHNICS — DESIGN • MANUFACTURING • OPERATION

Now another C-D first!

NEW HIGH TEMPERATURE PAPER TUBULAR CAPACITOR

TYPE GT "GREY TIGER"

Designed primarily for high temperature applications



C-D's new "Vikane" impregnated tubular capacitor—Type GT "Grey Tiger"—has won wide industry acclaim. "Remarkable durability"—the unanimous decision after many rigid laboratory tests. Write for samples today. Cornell-Dubilier Electric Corporation, Dept. J-8, South Plainfield, New Jersey. Other plants in New Bedford, Worcester and Brookline, Massachusetts; and Providence, Rhode Island.

- new "Vikane" impregnation assures extra long life at high operating temperatures,
- new moisture seal and tube impregnation designed to withstand temperatures to 100°C.,
- high insulation resistance: at 25°C. above 10,000 megohms per unit or 2,000 megohms per mfd.,
- low power factor; averages .35% at 1,000 cycles,
- eliminates need for stocking high and low temperature units,
- excellent capacity stability over wide temperature range,
- excellent electrical stability over life of unit,
- available in all commercial capacity and voltage ratings for maximum flexibility,
- one line to meet all your production requirements—whether for high or low temperature and humidity applications.

"GREY TIGER"

Capacity and DC Voltage Ranges

Capacity Mfd.	100 Volts	200 Volts	400 Volts	600 Volts	1,000 Volts	1,600 Volts
.001				GT-6D1	GT-10D1	GT-16D1
.002				GT-6D2	GT-10D2	GT-16D2
.003				GT-6D3	GT-10D3	GT-16D3
.005			GT-4D5	GT-6D5	GT-10D5	GT-16D5
.01			GT-4S1	GT-6S1	GT-10S1	GT-16S1
.02			GT-4S2	GT-6S2	GT-10S2	GT-16S2
.03		GT-2S3	GT-4S3	GT-6S3	GT-10S3	GT-16S3
.05	GT-1S5	GT-2S5	GT-4S5	GT-6S5	GT-10S5	GT-16S5
.10	GT-1P1	GT-2P1	GT-4P1	GT-6P1	GT-10P1	
.15	GT-1P15	GT-2P15	GT-4P15	GT-6P15	GT-10P15	
.25	GT-1P25	GT-2P25	GT-4P25	GT-6P25		
.50	GT-1P5	GT-2P5	GT-4P5	GT-6P5		
1.0	GT-1W1	GT-2W1	GT-4W1			

1910 C-D CORNELL-DUBILIER CAPACITORS 1948

MICA · PAPER DYKANOL AND ELECTROLYTIC CAPACITORS

CORNELL-DUBILIER
WORLD'S LARGEST MANUFACTURER OF
CAPACITORS

CORNELL-DUBILIER ELECTRIC CORPORATION, Department J-8
SOUTH PLAINFIELD, NEW JERSEY

GENTLEMEN: Please send Bulletin Number NB116 describing type GT tubulars.......... ☐
Catalog Number 200 .... ☐

Name.......... Title..........

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TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

Formerly the TELE-communications TECH-nical Section of ELECTRONIC INDUSTRIES

AUGUST, 1948

Editorial Contents

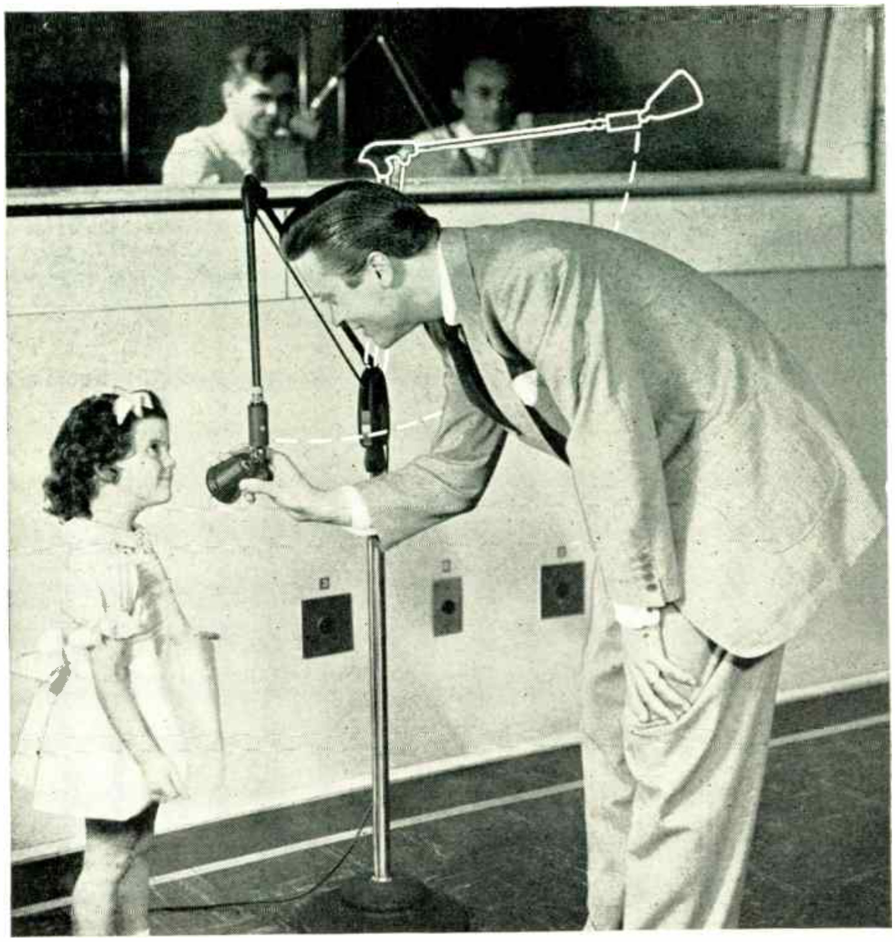
COVER: Drs. John Bardeen, Wm. Shockley and Walter Brattain, Bell Lab engineers who developed the new transistor. See story on page 18.

CALDWELL-CLEMENTS, INC., Publication Office, Orange, Conn., Editorial and Executive Offices 480 Lexington Avenue, New York 17, N. Y., Tel Plaza 3-1340

Publishers also of RADIO & TELEVISION RETAILING

World Radio History

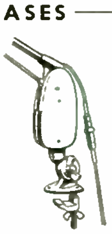
Handiest MIKE ARRANGEMENT YOU'VE EVER SEEN



MOVES FREELY INTO ANY POSITION AND STAYS PUT—*WITHOUT LOCKING*

CHOICE OF 2 BASES

UNIVERSAL



With this combination base the Dazor may be clamped or screwed to any surface —horizontal, sloping or vertical.

PEDESTAL

This base, a portable floor-type fixture, is equipped with rubber pads to absorb shock.

From up there to down here is just one *s-w-e-e-p.*

When your microphone is mounted on the Dazor *Floating* Arm, you get the flexibility of a hand instrument without the weight of holding one. A touch of the fingers *floats* the mike from the tall to the short speaker, from announcer to soloist, from interviewer to guest. Once it's placed, the mike remains in that position without fastening of any kind, due to a patented enclosed spring force.

The Dazor pedestal model, illustrated above, extends the reach of the emcee in the studio, auditorium or night club . . . gives him the welcome feeling that he is free from mechanical chores . . . keeps him on top of the program. A universal model, fastened to table, desk or speakers' stand, provides similar assurance for the individual broadcaster or small group.

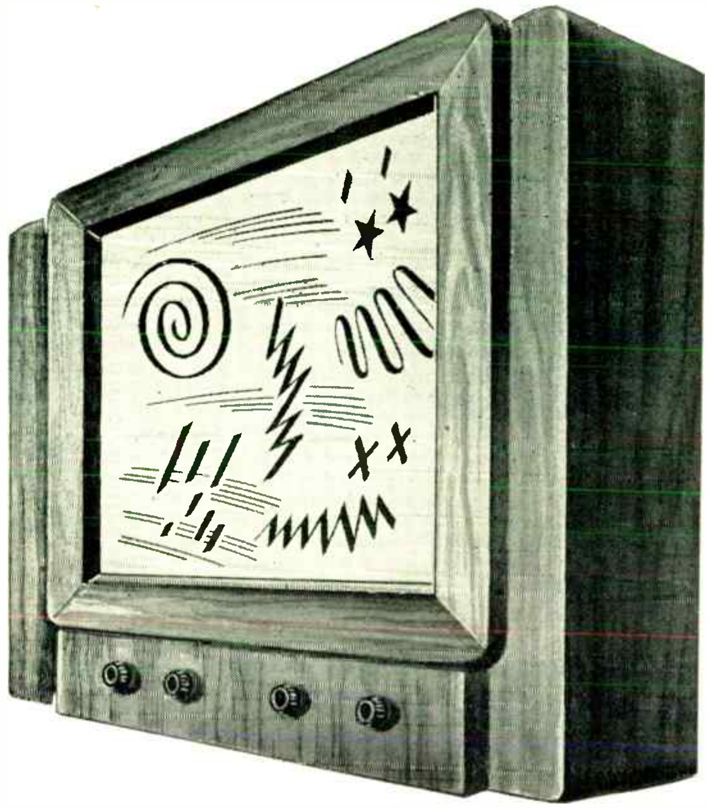
Plane, train and police dispatchers—who want hands free for writing, typing or chart operations—lose no time with mikes that are readied or pushed back in an instant. In addition to supporting the microphone of your choice, the Dazor *Floating* Arm can be individualized to meet any space or mounting limitations peculiar to your layout.

Phone Your Dazor Distributor for details. If you wish the name of this helpful supplier, write Dazor Manufacturing Corp., 4481-87 Duncan Ave., St. Louis 10, Mo. *In Canada* address inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ontario.

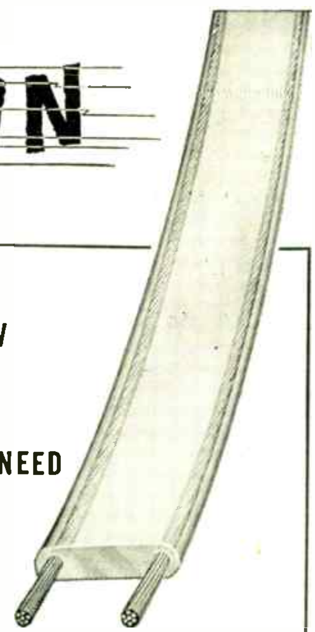
DAZOR FLOATING ARM FOR MICROPHONES

World Radio History

How to Smooth



ROUGH RECEPTION



ANACONDA Type ATV* Lead-In Lines go a long way towards bringing perfect reception to television and FM sets.

The effects of attenuation and impedance mismatch on reception are minimized by ATV lines. The satin-smooth polyethylene insulation of this line sheds water readily—thus avoiding subsequent impedance discontinuities. This insulating material also has high resistance to deterioration.

Count on Anaconda to solve your high-frequency transmission problems—with anything from a new type lead-in line to the latest development in coaxial cables.

48157

*Reg. U.S. Pat. Off.

A TYPE ATV LEAD-IN FOR EVERY NEED

Anaconda offers a complete selection of Type ATV lead-in lines for 75, 150 and 300 ohms impedance, unshielded and shielded lines of high impedance. For an electrical and physical characteristics bulletin, write to Anaconda Wire and Cable Company.

ANACONDA

Anaconda Wire and Cable Company

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What's your Problem?

Fine Wire? Tungsten? Molybdenum?

Problem 1

MR. N. AMMELLING needed 339,000 feet of .001 enamelled copper wire. He called Fine Wire Headquarters and in good time received a one - pound package . . . his 64 miles of wire enamelled to his specifications.

Problem 2

A customer's needs called for a material with a high tensile strength at elevated temperature. He called North American Philips and received ELMET Molybdenum which performed to his complete satisfaction . . . fulfilling every requirement.

Problem 3

MR. MUST B. PLATED, who required metal-clad wire for a specific application, phoned Fine Wire headquarters. We supplied the base material to provide the physical characteristics desired, and plated it to meet his exacting specifications for special surface qualities.

the answer

WHY not call Fine Wire Headquarters when you have a question about fine wire? We can't do the impossible, but we can do a lot of things that can bring you the right fine wire for the job.

So—when you have a problem on Fine Wire, Tungsten or Molybdenum — wire, phone or write to North American Philips, makers of NORELCO Fine Wires, and ELMET Tungsten and Molybdenum products.

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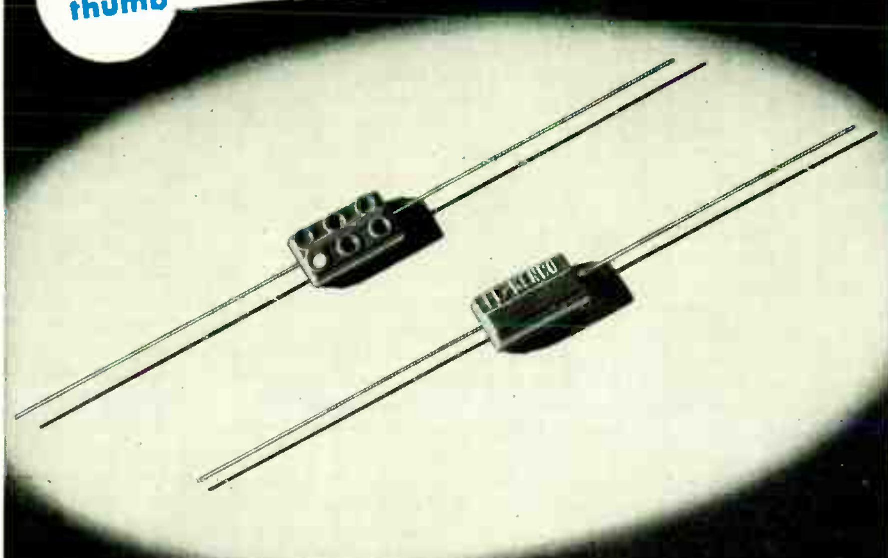
World Radio History

tom thumb CAPACITOR . . . . with "ATLAS" performance



actual size

EL-MENCO'S NEW CM 15

miniature capacitor

9/32" x 1/2" x 3/16"

This tiny capacitor for radio, television and other electronic applications combines compact design with *proven* performance. Molded in low-loss bakelite the CM 15 is famous for *dependability*. Impregnated against moisture, it delivers at maximum capacity under extreme conditions of temperature and climate.

CM 15 FEATURES

- 500 D.C. working voltage
- 2 to 420 mmf. capacity at 500v. DCA
- 2 to 525 mmf. capacity at 300v. DCA
- Temperature co-efficient 0 ± 50 parts per million per degree C. for most capacity values
- 6-dot color coded to Joint Army-Navy Standard Specifications JAN-C-5

***SPECIFY EL-MENCO* for your product . . .**

from the Tom Thumb CM 15 to the CM 40, all El-Menco capacitors give you – and your product – dependable performance, endurance, and accuracy. *Send* for catalog — *Specify* El-Menco Capacitors.

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CAPACITORS

World Radio History

THE TREND . . . is definitely toward single-sideband operation. Advantages are obvious. Elimination of a continuously running carrier saves power and reduces interference. In fact, a signal is put on the air only when something is said.

HOWEVER . . . it does present some problems. To reproduce voice and music the equipment must handle high peaks of power even though the average power is very low. Unlike conventional AM service, where the modulation level must be held down so that the high peaks will not exceed available carrier, single-sideband modulation levels because of the absence of carrier are unrestricted by peaks and in general are limited only by the average power an r-f amplifier can produce.

TUBES . . . which can handle high peak powers in excess of normal rating are a natural for single-sideband work.

EIMAC TETRODES ARE THE ANSWER

REMEMBER . . . the universal use of Eimac tubes in radar? They were specified because of their ability to handle high peak power. Now, this ability enables them to take the lesser requirements of single-sideband service in stride. Eimac tetrodes handle high peaks because of their inherent ability to take momentary overloads, their reserve supply of emission, and freedom from internal insulators.

IT IS FAR EASIER . . . to produce a single-sideband signal at a low power level. Here again Eimac tetrodes fill the bill. Because of their high power-gain, this valuable low-power signal can be built up from the modulator to high power in a single amplifier stage.

IN ADDITION . . . the single-sideband driver must "see" a constant load resistance, and Eimac tetrodes with their low driving-power requirement mean a minimum of swamping action. It is even possible to run up the screen voltage until no grid current is drawn and no changing load is presented to the driver.

DATA AVAILABLE

PICTURED . . . above is the popular 4-65A tetrode. A new complete data sheet on it has been prepared. You will find SSSC ratings and suggestions in it . . . write today. Other Eimac tetrodes suited to SSSC application include 4X150A, 4-125A, 4-250A, 4-400A and the 4-1000A.

Follow the Leaders to
Eimac TUBES
The Power for R-F

EITEL-McCULLOUGH, INC.
199 San Mateo Avenue
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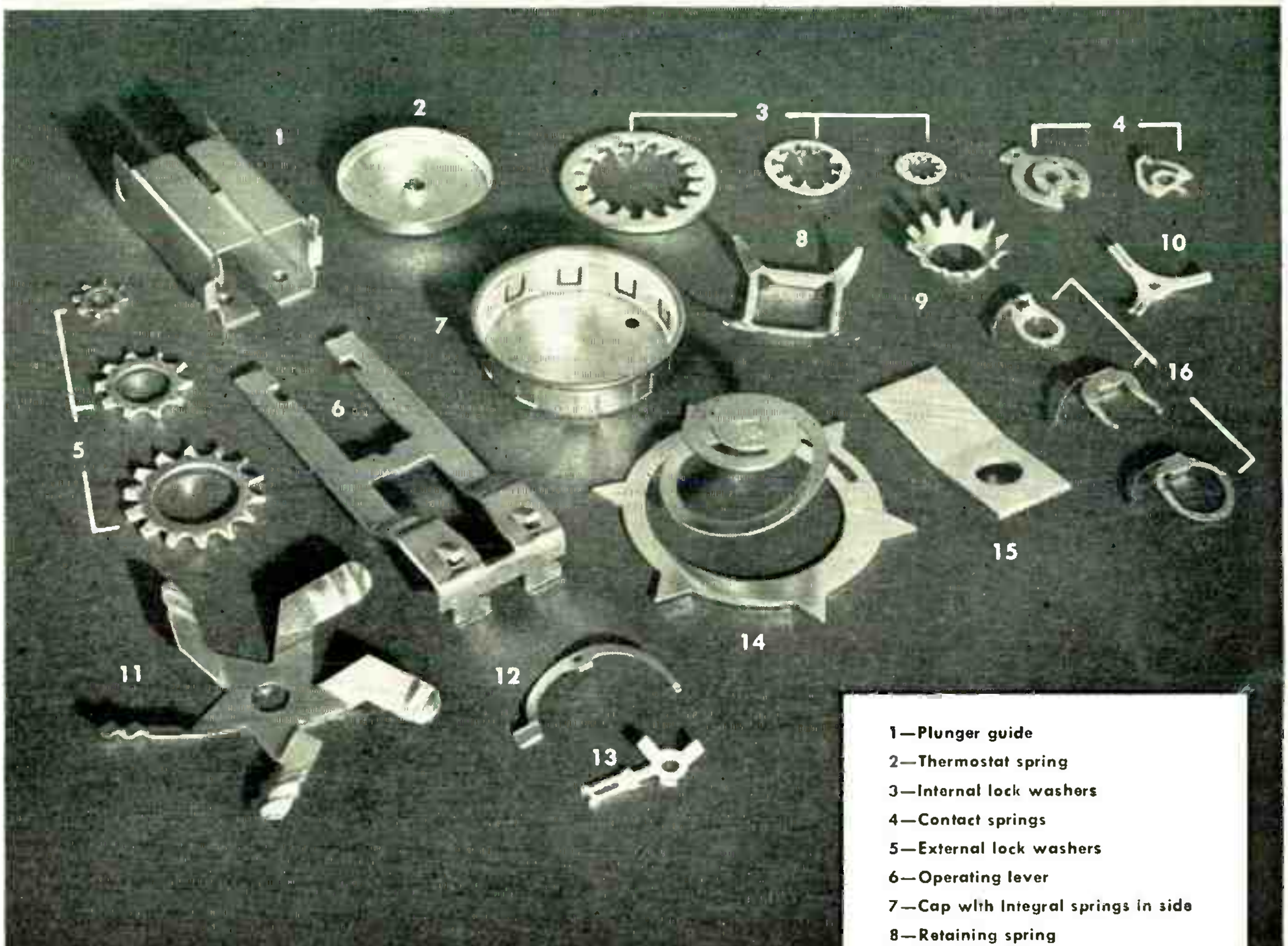
World Radio History

REVERE PHOSPHOR BRONZES
OFFER MANY ADVANTAGES



1—Plunger guide
2—Thermostat spring
3—Internal lock washers
4—Contact springs
5—External lock washers
6—Operating lever
7—Cap with Integral springs in side
8—Retaining spring
9—Countersunk external lock washer
10—Pressure spring for capacitor
11—Five-contact spring
12—Contact spring for radio part
13—Pressure spring and terminal
14—Involute spring
15—Contact point for solenoid
16—Contact springs
—made of Phosphor Bronze strip supplied by Revere

STRENGTH — Resilience — Fatigue Resistance — Corrosion Resistance—Low Coefficient of Friction—Easy Workability—are outstanding advantages of Revere Phosphor Bronzes, now available in several different alloys.

In many cases it is the ability of Phosphor Bronze to resist repeated reversals of stress that is its most valuable property. Hence its wide employment for springs, diaphragms, bellows and similar parts. In addition, its corrosion resistance in combination with high tensile properties render it invaluable in chemical, sewage disposal, refrigeration, mining, electrical and similar applications. In the form of welding rod, Phosphor Bronze has many advantages in the welding of copper, brass, steel, iron and the repair of worn or broken machine parts. Revere suggests you investigate the advantages of Revere Phosphor Bronzes in your plant or product.

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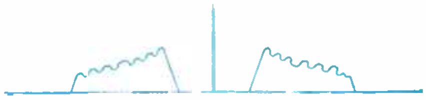
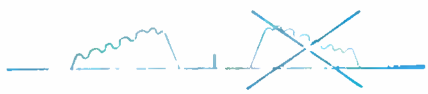
SINGLE SIDEBAND RADIO SYSTEMS . . .

How single sideband conserves power



THIS IS DOUBLE SIDEBAND

Voice modulation of carrier produces two beat frequencies—the sum and the difference of carrier and voice frequencies. Transmitter is called on to produce both sidebands in addition to carrier. This is inefficient in use of frequency spectrum and wastes power.



THIS IS SINGLE SIDEBAND *(carrier reduced)*

One sideband is suppressed by filters and carrier is reduced. Power thus saved is available for remaining sideband. This method of transmission conserves space in frequency spectrum, requires only a fraction of the power of double sideband, and provides *an improvement of 9 db in signal-to-noise ratio.*

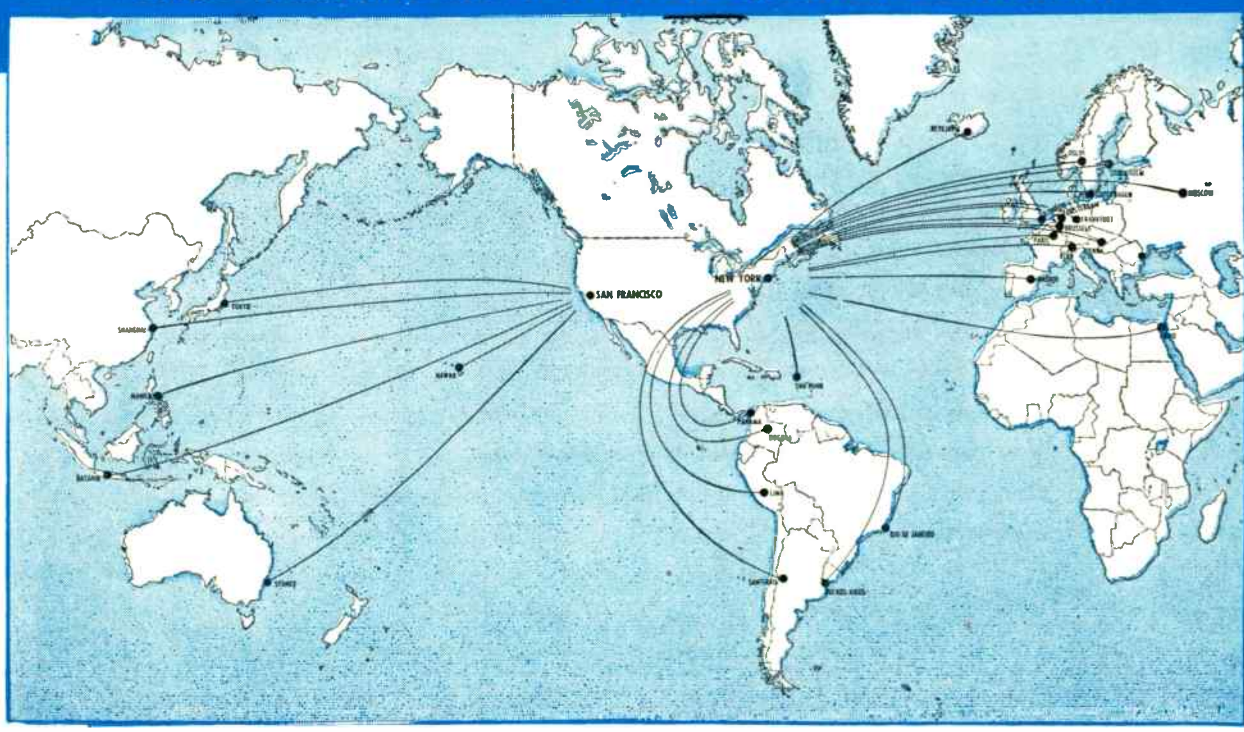
This system was originated and perfected by Bell Telephone Laboratories and Western Electric

THE RESEARCH that resulted in single sideband started at Bell Telephone Laboratories as early as 1915, when speech was first successfully transmitted overseas by radio. To improve the quality of voice reception, Bell scientists began studies of the fundamental nature of voice modulation. They proved that the radio transmitter was handling two similar versions of the voice (the sum and difference beat frequencies) in addition to the carrier.

Question: ***Could one of the sidebands be suppressed—thereby increasing efficiency?***

For the answer, new tools were needed and were forged by other Bell scientists: a balanced modulator that will reduce the carrier to any desired degree; an electrical

Single Sideband is used on these Bell System overseas circuits



BELL TELEPHONE LABORATORIES

World's largest organization devoted exclusively to research and development in all phases of electrical communications.

. . Bell System Voice Links with the World

wave filter that could accurately select one sideband and suppress the other; a very stable carrier frequency source and many other devices were originated. This accomplished, first transatlantic test of single sideband radio was carried out January 14, 1923.

1927 marked the entry of single sideband into commercial two-way long-wave radiotelephony, and the development by Bell Laboratories of crystal-controlled oscillators soon made possible its extension to short-wave communications.

Today one single sideband transmitter can simultaneously transmit as many as three separate radiotelephone conversations, using but little more frequency space than would be required for one double sideband voice transmission. Now, single sideband equipment—originated and perfected by Bell Laboratories, built by Western Electric—joins the U. S. with practically all major points throughout the world by radiotelephone.

The birth and growth of single sideband

1915. Bell engineers analyze nature of frequency band fed into antenna in voice-modulated transmission.

1918. Bell System makes first commercial application of single sideband, in carrier telephony.

1923. Bell System makes first transatlantic single sideband voice transmission.

1927. Single sideband enters radiotelephony field with opening of long-wave U.S.—England link.

1928. First commercial short-wave transatlantic single sideband radiotelephone circuit opened.

1930-1939. Single sideband service to South America, Honolulu, Paris, Manila.

1941-1945. Single sideband equipment built by Western Electric extensively used by Armed Forces, as well as government agencies.

1945-1948. Many more Western Electric single sideband radio systems put in service throughout the world.

Now... NEWEST IN SINGLE SIDEBAND

the economical, low-power LE System

LATEST development in single sideband is the compact, low-power Western Electric LE System. Like the higher-powered LC now in wide use, the new LE is built to Bell System specifications for operation with a minimum of maintenance.

The LE System consists of three self-contained units: transmitter, receiver and control terminal. New electronic speech privacy equipment is incorporated into transmitter and receiver.

With the LE System, the Bell System now makes use of the demonstrated advantages of single sideband in the field of medium-distance radiotelephony.

—QUALITY COUNTS—

LE-T1 Transmitter LE-R1 Receiver B4 Control Terminal

LE Single Sideband equipment is distributed outside the U. S., Canada and Newfoundland by Westrex Corp., 111 Eighth Ave., New York, N. Y.

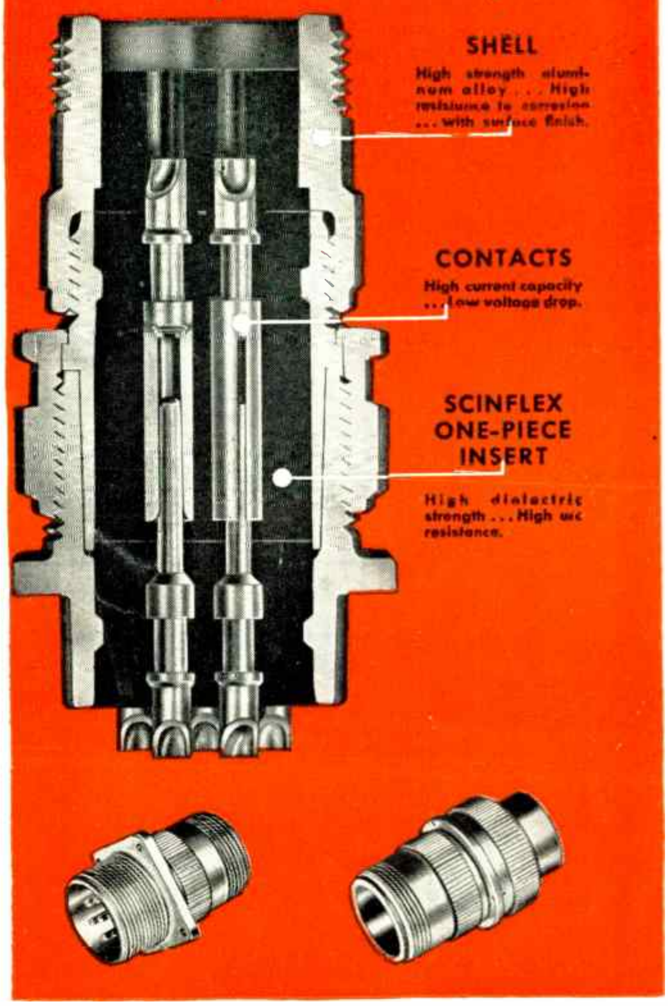
Western Electric

Manufacturing unit of the Bell System and the nation's largest producer of communications equipment.

World Radio History

BENDIX-SCINTILLA

the finest ELECTRICAL CONNECTORS money can build or buy!



AND THE SECRET IS SCINFLEX!

Bendix-Scintilla* Electrical Connectors are precision-built to render peak efficiency day-in and day-out even under difficult operating conditions. The use of "Scinflex" dielectric material, a new Bendix-Scintilla development of outstanding stability, makes them vibration-proof, moisture-proof, pressure-tight, and increases flashover and creepage distances. In temperature extremes, from —67° F. to +300° F., performance is remarkable. Dielectric strength is never less than 300 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. Bendix-Scintilla Connectors have fewer parts than any other connector on the market—an exclusive feature that means lower maintenance cost and better performance.

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Write our Sales Department for detailed information.

• Moisture-proof, Pressure-tight • Radio Quiet • Single-piece Inserts • Vibration-proof • Light Weight • High Arc Resistance • Easy Assembly and Disassembly • Less parts than any other Connector

Available in all Standard A.N. Contact Configurations

BENDIX SCINTILLA

SCINTILLA MAGNETO
SIDNEY, N. Y.
DIVISION OF
Bendix AVIATION CORPORATION

TELE-TIPS

WILL THE MIND FUNCTION AS A CR TUBE? Something new in "communications" are electronic devices being developed to aid the blind to see. Among those working towards this end are RCA Laboratories, Brush Development Co., Stromberg-Carlson and the Hoover Co. They are making use of the radar principle whereby an instrument carried by a blind person will emit signals and register back in the form of mild electric shocks. Science's goal is to train the mind to interpret electronic impulses into a picture pattern so that a blind person can identify objects in his mind and thus receive directional guidance. RCA has already developed a device which scans black letters and emits specific sounds which can be identified for reading purposes. To "televise" pictures or positions on a blind person's mind will be an achievement of the first order.

PHILCO is embarking on a gigantic program to make it the leading producer. Plans anticipate a $300,000,000 volume in 1949—more than the $250,000,000 volume the company hopes to do this year, and the highest in its history. So that its various divisions will operate without reservations, the television and radio groups are being instructed to develop their respective operations without regard to each other. Philco distributors and dealers are being advised that their television business will be twice that of radio so that their total future volume will be three times the present level. Philco further aims to produce alone as many television sets in 1949 as the entire industry expects to produce in 1948—750,000 sets!

ZENITH plans for television in the Fall were revealed in July when president E. F. McDonald informed stockholders that "The company's new line of television receivers to be placed on the market this Fall will contain many improvements and advanced features. Provision will be made in all models for the incorporation of "Phonevision," Zenith's exclusive new development in television. . ."

COWLES 1530-FT. TOWER planned for Des Moines, Iowa, would be a triangular structure of uniform sections, tapering to a point at the base, and held by 3 sets of guy wires. Only one bid for its construction has been received—a price of when the project was planned. If erected, $600,000—which the bidder admits is 3 times what the cost would have been the tower will be the highest in the world, topping the Empire State building by 270 ft.

S. G.

World Radio History

TELEX MONOSET

Successor to the Headset...

Stethoscope design eliminates headachy ear pressure—swings lightly under the chin. Wear for hours without fatigue! Delivers sound directly *into* the ear—blocks out background noise, aids weak signals. Built-in volume control—adjust from where you sit or as you move about. Magnetic receiver—sensitivity 88 d.b. above .00024 dynes per sq. cm. for 10 microwatt input. Weight: 1.2 oz.—durable polished Tenite. 5-foot tinsel cord and standard plug.

NAME	DESCRIPTION	PART NUMBERS 128 Ohms	500 Ohms	2000 Ohms	LIST PRICE
Standard Monoset	Monoset with cord and plug (without volume control)..........	2570	2569	2568	$12.50 ea.
Standard Cord Only	Cord and plug for Standard Monoset (without volume control)...	2548	2548	2548	$ 3.75 ea.
Volume Control Monoset	Monoset with volume control cord and plug......................	2843	2842	2841	$16.50 ea.
Volume Control Cord Only	Cord with volume control and plug for volume control Monoset...	2846	2845	2844	$ 7.75 ea.

HEARING AT ITS BEST

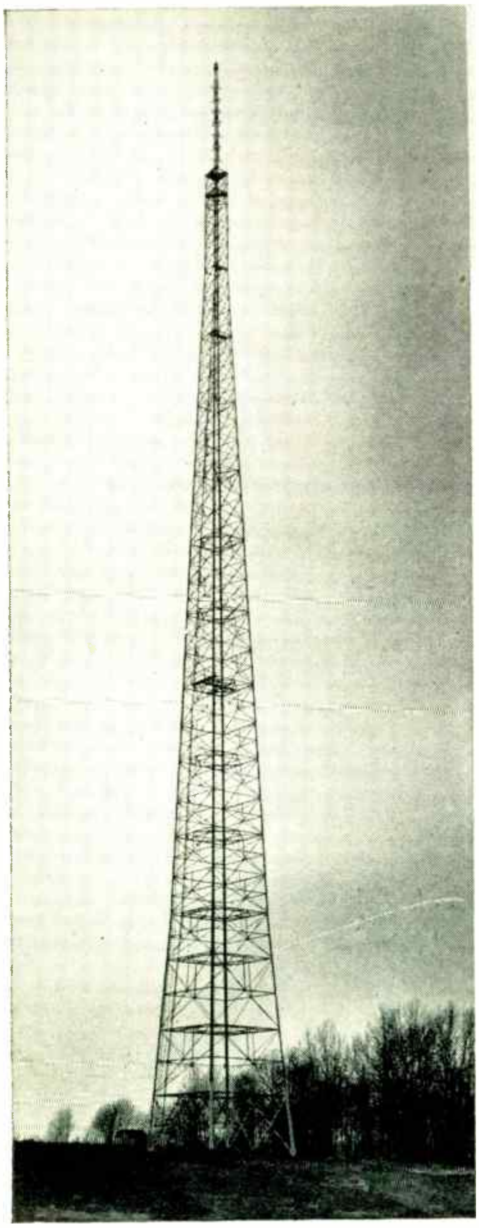
TELEX

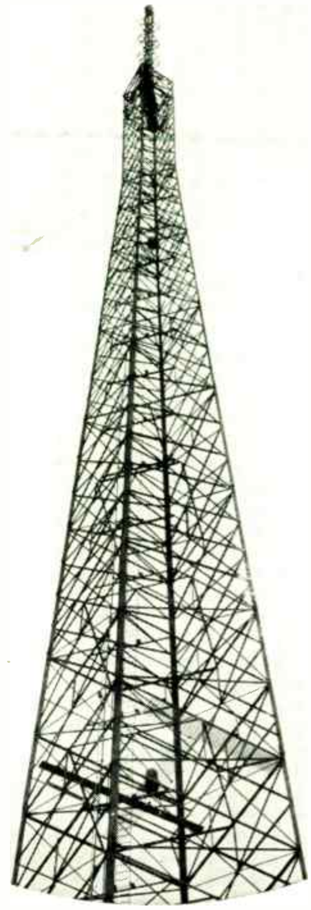
ELECTRO-ACOUSTIC DIVISION

TELEX PARK

Minneapolis, Minn.

World Radio History





Performance—PLUS
Maintenance—*MINUS*

Add hot-dip galvanizing to Blaw-Knox construction, and you've got the utmost in tower performance with maintenance costs close to zero. Illustrated is a new Blaw-Knox Type N-16 insulated, self-supporting tower with "lifetime" protection of a heavy zinc coating on all members as well as on inside climbing ladder and Electroforged Grating platforms. Painting to conform with CAA regulations is all that is required.

Hot-dip galvanizing is available on Blaw-Knox Antenna Towers of any height . . . We invite discussion on your plans for future station improvement.

BLAW-KNOX DIVISION
of Blaw-Knox Company
2028 Farmers Bank Building • Pittsburgh 22, Pa.

BLAW-KNOX ANTENNA TOWERS

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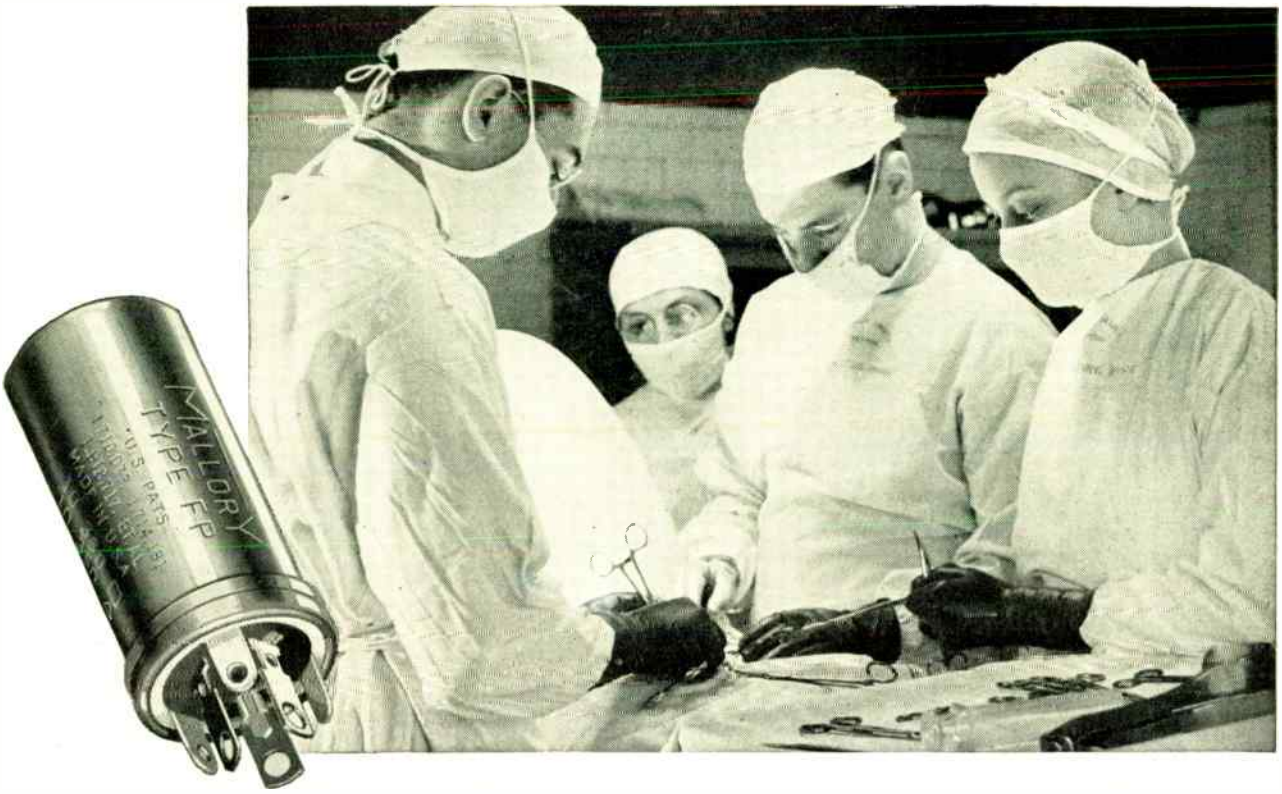

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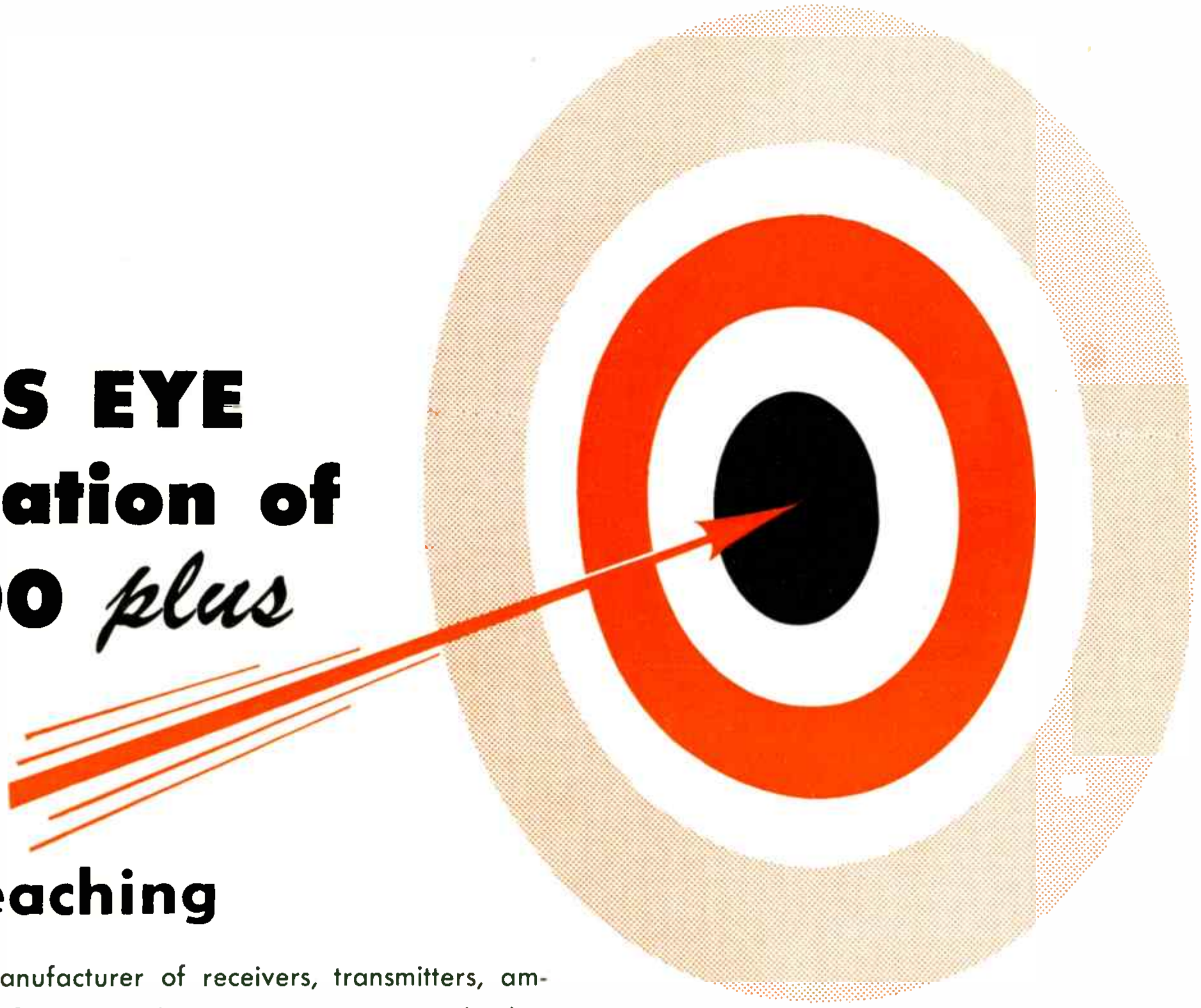

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This guaranteed market coverage is, plainly, a big step ahead in business paper service. It is collateral to an expanded publishing activity which began with the July issue of TELE-TECH and has for its aim a still greater engineering magazine designed to match the technical and producing potentialities of the field.

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World Radio History

the tele-communications market

Believing more firmly than ever that a specialized magazine is a necessary and realistic aid to the industry, Caldwell-Clements is moving in two coordinate directions: first, to make TELE-TECH even more specialized, more authoritative and more enterprising. It will hew to the best traditions of technical journalism, presented with new vigor and new vitality.

Second, to give advertisers access to every buying unit in the industry. Just as the editors always endeavor to give readers the most complete and usable service minus non-essentials, so the publishers recognize their obligation to the advertiser not to inflate the circulation with unimportant people as such action would result inevitably in an increase in advertising rates.

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Since every manufacturing and operating unit in the entire communications field is licensed either by the FCC or by the holders of basic patents, and therefore officially listed, this is the one industry in which a controlled circulation can furnish 100% coverage of the manufacturing and operating units. It is therefore a matter of (1) meeting the great cost of such unparalleled coverage, and (2) building a magazine that will command reading by the men of top initiative and buying authority.

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WHEN your advertising has reached the key men in every company that is licensed to manufacture, and every station licensed to operate, as well as a handpicked list of component makers, you have achieved complete coverage of the tele-communications market. And only TELE TECH can give it to you.

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"At last we components can live wherever our jobs say we should—instead of all of us being pushed around to let a few tubes sit behind windows. That's why we like this TRANSVIEW design as much as you do!"

That's right! In the Western Electric line of FM transmitters, the position of each component is determined *solely* by the requirements of good circuit design. There's no need to stretch leads and extend controls to provide visibility for a few major components, because with TRANSVIEW design, you see the whole works.

This straightforward functional design results naturally in a clean-cut equipment layout—and, with full-length glass doors to show it off, provides an unusually attractive over-all *appearance.*

A further result of this unique TRANSVIEW design is maximum visibility during operation, *accessibility* for speedy inspection, maintenance and replacement.

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World Radio History

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

STILL HIGHER POWER FOR BROADCASTING—A realization of the advantages of increased power for broadcasters seems to be permeating the whole radio world, whatever the thinking of apprehensive politicians. In recent FCC discussions of clear channels, transmitter powers of 750 kw have been freely discussed. It was significant that even regional groups, advocating more low-powered stations scattered over the U.S.A. on the clear channels also recommend to the FCC that a few Class I-A channels be assigned to real high-power stations in order to serve large areas which can not support local stations. But why stop at 750 kw? Why not go up to 1,000 kw (or 2500 kw as in Russia) and endeavor to render the best service possible under present-day limitations of materials, equipment and engineering knowledge?

HIGHER TV POWER BADLY NEEDED—In television broadcasting, why be satisfied with the present usual 10 kw? The many sources of interference that exist to plague TV set owners who live in areas of low signal strength were discussed at a recent FCC engineering conference on this subject. The best general remedy suggested was that of higher transmitter power. As technical progress is made in developing transmitter tubes for high-power operation on the high frequencies used for TV, transmitter power should be increased beyond the present maximum of 50 kw. and high-gain multiple-bay antennas should be employed to increase the radiated power to the greatest practical degree.

NEW G LAYER, 250 MILES UP—Several years ago we presented our readers with an elaborate cross-section chart in color of the ionosphere's radio reflecting layers, showing the E1, E2, F1 and F2 layers and the radio frequencies they turn back. The highest, of course, was the F2 layer, at an elevation of 175 miles, with an indicated temperature of 1000 deg. C. Now comes Dr. Donald H. Menzel of Harvard with some pretty positive evidence, based upon recent radar-reflection measurements, that *above* the F2 layer exists a G layer at about 250 miles. The temperature of this region, he thinks, is even far in excess of 1000 deg. C. Dr. Menzel's theory ascribes the production of this G layer to the sun's ultra-violet rays stripping electrons off nitrogen atoms and so electrifying them. The G layer also establishes itself as another radio sieve, passing extremely short waves but turning back relatively longer waves—as do the lower layers, each with its own critical frequency. Readers who have on the wall somewhere that earlier ionosphere chart of ours, will be interested to note that the new G layer falls clear above the top margin of the diagram. Thus our ionosphere expands, along with our radio spectrum!

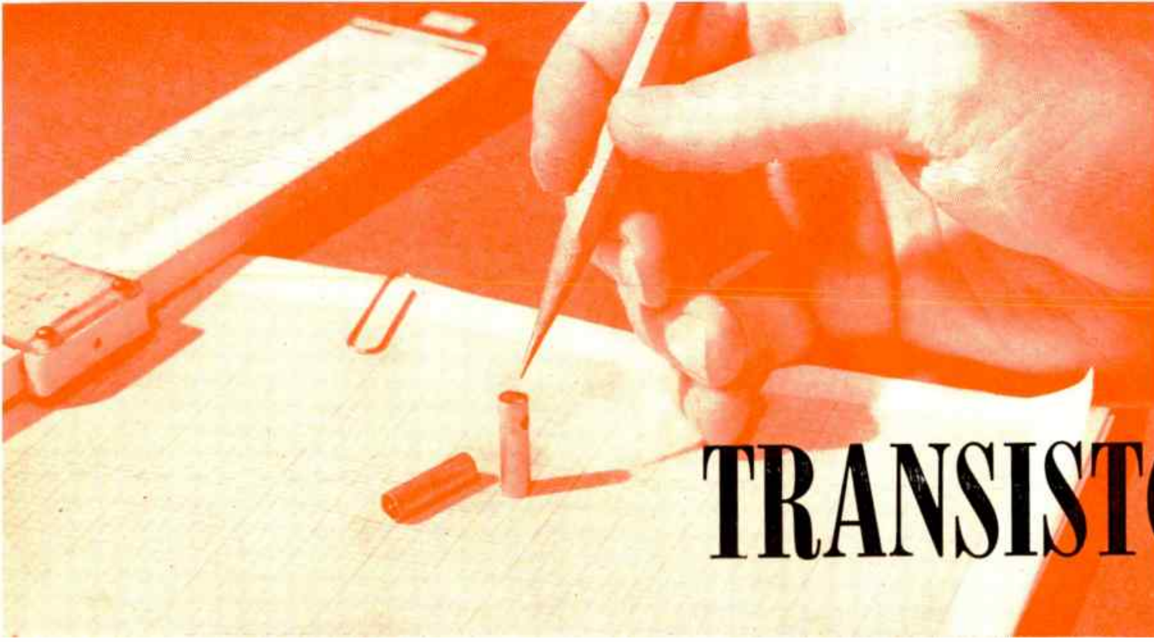
GETTING BACK TO EARTH after spending an evening listening to efficiency experts discuss means of approaching that elusive 100%, the thought came to us that some of the most important effects we use involve energy expenditures so low that they can hardly be measured. The speaker's own voice was an example. It was once computed by M. Y. Colby in his *Sound Waves and Acoustics* that a man would have to talk continuously for a few thousand years directly at a cup of cool coffee for it to absorb enough sound energy to warm it up enough to drink!

NO TV CHANGES PLANNED until after the September hearings on the high-frequency channels,—that is the reassuring message that comes to the television industry after all the recent uproar and excitement growing out of some off-hand remarks by an FCC technician. The reassurance is made official by a statement from the FCC chairman, completely refuting the widespread impression that the commissioners might be trying out some already-formed views, even though September hearings had been called to get industry testimony. So now again TV marches ahead in an orderly manner.

Television Receiver Specifications

Coming in September—the industry's latest and most authoritative specifications on television receivers will be published in TELE-TECH. It will be the key to receiver design, circuits, characteristics, capacities. Watch for this special chart coming next month.

World Radio History

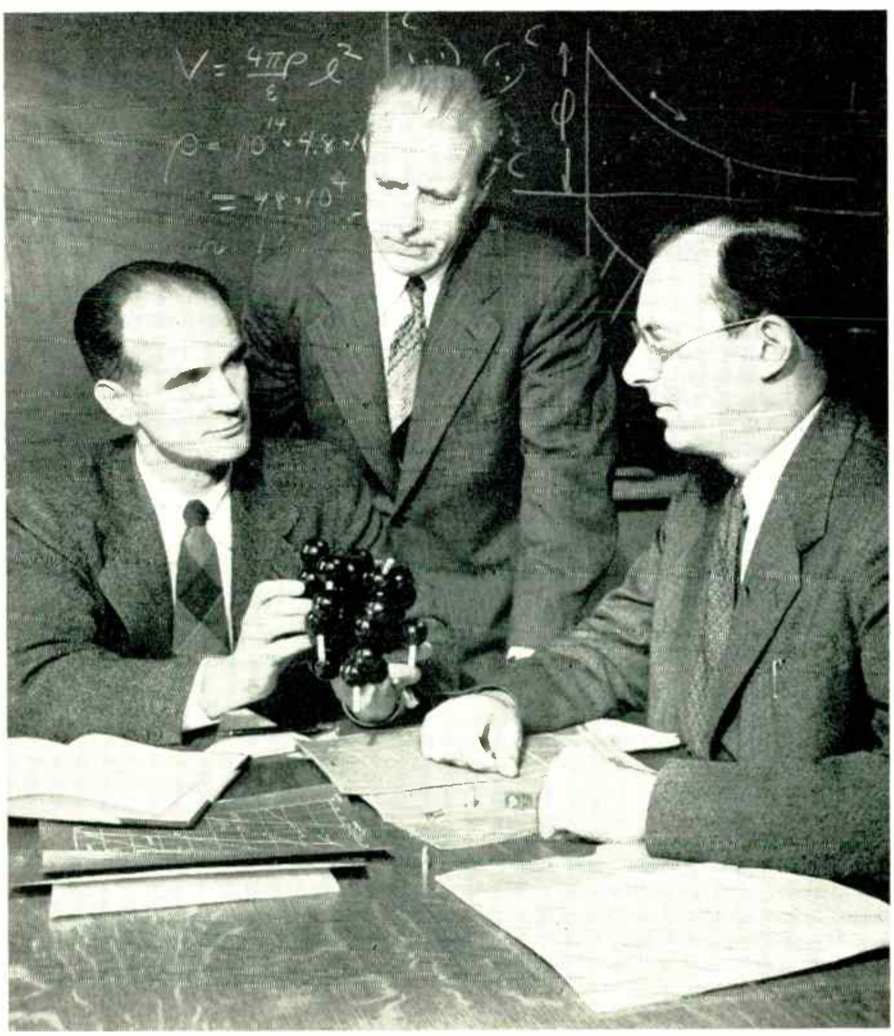


TRANSISTOR May

WHAT may prove to be one of the most important electronic developments of the year was revealed last month by the Bell Telephone Laboratories in New York with the introduction of a new crystal device designed to perform efficiently nearly all the functions of an ordinary vacuum tube.

Known as the Transistor, the new amplifying device works on an entirely new physical principle discovered by members of the Laboratory staff in the course of fundamental research into the electrical properties of solids. It may have far-reaching significance in military and commercial communications and in industrial electronics.

Dr. Wm. Shockley, Dr. W. H. Brattain and Dr. John Bardeen (l to r) discuss crystal structure of semi-conductive materials. Such studies led to their development of transistor principle



The new device is not unlike the well-known germanium or silicon crystal in appearance, being housed in a cylinder less than an inch long. It will serve as either an amplifier or an oscillator. It has no vacuum, no glass envelope, no grid, no plate, no cathode and therefore no warm-up delay.

Two hair-thin wires touching a pinhead of a solid semi-conductive material such as germanium or silicon soldered to a metal base, are the principal parts of the transistor. These are enclosed in a simple metal cylinder not much larger than a shoe-lace tip.

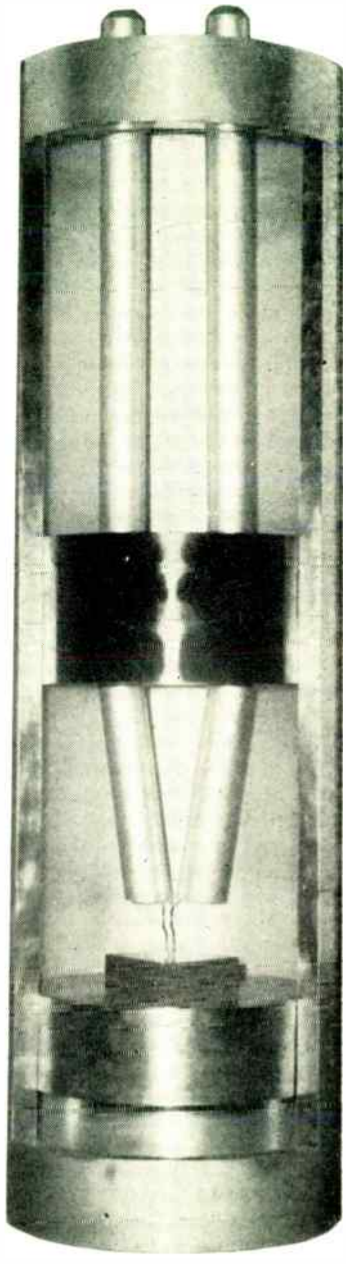
Tests indicate that the transistor shows a power amplification of at least 100 times (20 decibels). Some test models have been operated as amplifiers at frequencies up to 10,000,000 cycles per second. The general research program leading to the transistor was initiated and directed by Dr. William Shockley and key investigations which brought the transistor to reality were carried out by Dr. John Bardeen and Dr. Walter H. Brattain, all members of the Bell Lab technical staff.

Transistor action depends upon the fact that electrons in a semi-conductor can carry current in two distinctly different ways. This is because most of the electrons in a semi-conductor do not contribute to carrying the current at all. In-

World Radio History

Bell Lab demonstrates germanium crystal device which amplifies and oscillates. Inventors display tubeless radio receiver. Observers suggest transistor might replace some tubes in TV sets; industry comments pro and con

Replace Vacuum Tubes



stead they are held in fixed positions and bind the atoms together in a solid. Only if one of these electrons gets out of place, or if another electron is introduced in one of a number of ways, can current be carried. If, on the other hand, one of the electrons normally present is removed, then the "hole" left behind it can move like a bubble in a liquid and carry current!

As shown in the circuit sketch, two "catwhiskers" are applied to a small block or flake of, say, a germanium alloy. These contacts touch the crystal at points about 0.002 in. apart. The input circuit is applied to one contactor with a bias of about one volt (positive). The input impedance of the transistor is low — 100 to 1000 ohms. The output circuit is similar except that it is fed with a low-voltage source of power (30-40 volts) with the positive grounded.

In effect, the presence of the input contact wire carrying the input signal may be said to inhibit the effectiveness of the load circuit. A substantial amount of voltage gain is produced thereby in the load. The output is limited in present designs to about 50 milliwatts. The output impedance of such a transistor is from 1000 to 10,000 ohms.

Laboratory demonstrations made so far at the 463 West Street building emphasize some of the many uses the transistor may have in wire communication, as well as it ready adaptability to the electronic technics of radio and television.

In one demonstration, a transistor was used to amplify the electrical speech waves traveling between two telephones, a function now performed by vacuum tubes.

In another, the audience heard a radio broadcast from a commercial radio set rebuilt so as to operate entirely without vacuum tubes, but using, instead, several of the tiny transistors to provide amplification.

A transistor was also used to generate a standard frequency tone, thus demonstrating its role as an oscillator.

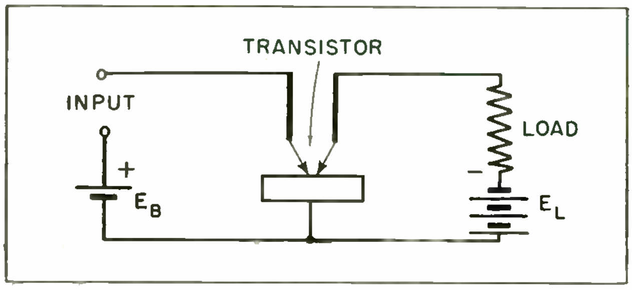
The demonstrations showed that these new devices are useful in a regular broadcast receiver to replace all tubes when a power output level of more than 50 milliwatts is not required. For larger outputs a vacuum-tube amplifier stage of the usual type can be added. The transistor would replace any of the tubes in a television set for example, where the 50-milliwatt, 10-megacycle limit was not exceeded.

The transistor answers a question scientists have been pondering for many years — how to make semiconductors amplify and thus provide a simpler, more rugged, smaller device that can perform the functions of a vacuum tube.

In the transistor, two-point contacts of the "cat's whisker" or detector type, familiar to radio

(Please turn to next page)

Above right is a cut-away of an accurate mock-up of the transistor showing position of two wires on a dot of semi-conductive material enclosed in a metal tube the size of a lipstick (see photo opposite page). The circuit is shown on right



amateurs, are made to the semi-conductor only two-thousandths of an inch apart. Input power delivered to one of these contacts is amplified at least 100-fold and transmitted to the other terminal where it is delivered to an output circuit. The transistor is energized by voltage supplies, such as batteries, which apply bias voltages to the two points. The power actually consumed in the transistor is less than a tenth of that used by an ordinary flashlight bulb.

The amplification process can be understood in terms of the discovery made by Bell engineers that the input point is surrounded by an "area of interaction." Within this area the electronic structure of the semi-conductor is modified by the input current. Now, if the output point is placed in this area, the output current can be controlled by the input current.

The germanium is prepared in the same way as for high back-voltage rectifiers, with tungsten or phosphor-bronze wires with precisely formed points (usually by the electro-forming process.) The contact area diameter may be the order of .001 in. The input contact which becomes the "grid" is called the "emitter" and the output contact the "collector," which may become important items in an engineer's vocabulary. The high reverse current applied to the collector is large enough to make the output current as great as or greater than the emitter current.

In semi-conductors, such as silicon and germanium, some metallic oxides and other compounds, there may be as few as one current-carrying electron for every million atoms. But — and this is the significant feature — this number of carriers may be varied 1,000-fold or more by changing the electronic structure of the materials. Hence the current flowing through the semi-conductor can be controlled.

In critically examining the implications of the prevailing theory of electrical conduction in semi-conductors, Dr. Shockley has predicted that it should be possible to control the meager supply of electrons inside a semi-conductor by influencing them with an electric field imposed from the outside without actually contacting the material. Realizing the practical limitations of such a possibility, he devised some experiments to test his hypothesis but was unable to secure positive results. The electrons seemed to get trapped in the surface of the material and did not behave just as anticipated.

But the outlook for the transistor is pretty definitely established. Having a long (yet undetermined) life, instant operation (no filaments to heat up), small compact size, and requiring only moderate voltages in the power supply, these transistor units will have many radio and communication applications when they pass from the research laboratory and get into production. The latter will occur in the future.

Engineers Comment on Transistor Significance

From a number of leading engineers especially experienced in vacuum tubes and in radio-set design, the editors of Tele-Tech invited comments on the transistor—particularly the limitations, difficulties, complications and drawbacks which could be foreseen for the new device, in comparison with the electronic tube.

Several interesting and valuable comments were obtained, and these are reproduced herewith.

May Assume Certain Tube Functions

A great deal of interest has been aroused by the Bell Laboratories' press release of July 1st which has had wide newspaper circulation. These accounts varied in the degree of dramatization that was given to the development, and some of the implications have left the impression that vacuum tubes are on the way out.

It is our opinion, after discounting the more radical implications, that the development is a significant one. For the past several years Sylvania has been one of the leading suppliers of silicon and germanium crystals. Although the principal uses to which these crystals have been put have been for rectifying and modulating purposes, the possibilities of using germanium for oscillators and even amplifiers has been anticipated for a number of years.

Some early work was done in this field by Purdue University, Lafayette, Ind., and studies were well underway in the Sylvania Special Products Division before the termination of the war. Articles by Cornelius of Sylvania appearing in the November, 1945, issue of Electronic Industries (predecessor of Tele-Tech) and the February, 1946, issue of Electronics, indicated that a fair understanding of certain properties of these semi-conductors was had at that time.

Although there is no cause for expecting that these developments will result in a wholesale replacement of the existing vacuum tubes, it does seem likely that certain tube functions may be taken over by transistors as has been done already by silicon and germanium diodes.

Of course, a very important factor that will have to be considered before wide scale use is the one of economics. Our experience in the manufacture of both germanium diodes and vacuum tubes indicates that some time will probably elapse before germanium diodes and amplifiers are fully competitive with those tubes whose functions they can replace.

E. Finley Carter, Vice-president
Sylvania Electric Products, Inc.

Limited Radio Application

The new Bell Laboratories' transistor has some exceedingly interesting possibilities for the designer of radio sets, also some definite limitations. Its inherent low input impedance will necessitate transformer or cathode-follower coupling in many applications. When used with transformers the passband is naturally limited. Also, transistor noise-level presently is higher than that of equivalent vacuum tubes. On the other hand, the low battery drain and high gain result in dramatic advantages for many applications. Thus, one of the more obvious immediate applications for these units can be as amplifiers in central television antenna system installations, such as in apartment houses. Hearing aids and like devices can also be effected. But, I am told, considerable time will have to elapse before the new transistor units will be generally available for large-scale use.

Dorman D. Israel,
Executive Vice-president
Emerson Radio & Phonograph Co.

Problems of Coupling

At the present stage of development, the transistor will not substi-

(Please turn to page 60)

World Radio History

George Fyler, Motorola television engineer adjusts antenna designed for taxi television set

TAXI TELEVISION

Experiments with converted model VT-71 suggest practical application to vehicles; tests furnish engineering data

TAXI television is likely to become as common as the radio if Motorola's experiments in Chicago continue successfully. Field tests were recently performed with a standard model VT-71 converted for taxi installation by television engineer G. W. Fyler. Results indicated that (1) on low frequency channels a satisfactory signal is received in most parts of Chicago and at distances up to 30 miles away; (2) higher channel signals seem to have more standing waves and ghosts. Standing waves are greatest near a large metallic object such as a bridge although the signal may be perfectly stable under a bridge. In flat open country signals are quite stable; (3) slight ghosts appeared in a few flat, open country areas where there were no overhead wires or other objects to cause reflections (!). The reason for this effect is not known as yet; (4) The video and audio signals seem to have different standing wave patterns.

It was also found that in any given locality the dipole antenna should be roughly normal to the station direction to minimize standing wave, ghosts and other interference effects. In this test a modified all-band antenna, with its ends cut off and a revised cut-down center section was found to operate fairly well on both high and low channels.

In order to convert model VT-71 for use in a vehicular installation it was necessary to replace all 12 and 25-volt tubes with six-volt similar types. The AGC circuit had to be modified to permit a very fast action in the presence of standing waves and still be slow enough to avoid losing too many of the low frequency components, including the vertical sync pulses. The time constant presently used is approximately .01 seconds. A separately mounted Mallory vibrapack feeding through series-connected voltage regulator tubes provides the necessary B+ requirements. Separate mounting of the vibrapack prevents hum components from appearing in the picture. Additional rf filtering for television frequencies was included in the revised power supply. No special shielding had to be added to the receiver circuits, but the use of ignition suppressors and additional generator filters were found to be desirable.

In operation, it was found important to maintain adequate heater voltage in order to stabilize synchronization, and it is also important to have low set and low car noise during minimum signal in the standing wave pattern. The converted receiver requires 70 watts of power.

World Radio History

Analyzing Electromagnetic

Instantaneous solutions to electrical characteristics of cavity resonators and transmission systems possible by analyzer designed on Kron principles

THIS network analyzer has been designed according to principles enunciated by Kron for the solution of electromagnetic field problems.[1,2,3] The particular network constructed gives solutions of the wave equation in two-dimensional cylindrical coordinates for cases of rotational symmetry, making it possible to determine all of the electrical characteristics of cavity resonators and transmission systems which lie within this category. Solutions are given completely, instantaneously, and automatically. It requires but a short time to deduce the desired characteristics from the information presented by the network.

The network consists of a lattice of inductances with capacitances from every junction to ground. It may be thought of as consisting of two interconnected transmission lines, one transmitting waves in the axial direction and the other in the radial direction. Each section of the transmission line is then a low-pass pi filter section consisting of a series inductance and two shunt capacitances. The transmission lines which support waves in the axial direction are uniform in their characteristics, though their characteristic impedance increases with radius. The radial transmission lines are constructed so that their characteristic impedance increases radially. Both sets of transmission lines have a constant velocity of propagation for frequencies below the cut-off frequency of the equivalent filter. The Kirchhoff's law relations for the network relating voltage and current are of the same form as the Maxwell curl equations relating the components of electric and magnetic fields. Accordingly, voltages and currents on the network correspond to electric and magnetic field components in the wave analogy.

The physical form of the network is shown in Fig. 1. It has an open construction so that various points on it bear the proper physical relation toward one another. The network was designed to operate at a mid-frequency of 100 kc but exhibits the characteristics of a low-pass filter; that is, it is operable from zero cps to approximately 300 kc. It has 25 elements per wavelength at the mid-frequency at

*This is a report of work done under the sponsorship of the Office of Naval Research on Contract N6-ORI-106 Task III.

[1] Kron, Gabriel; Equivalent Circuit of the Field Equations of Maxwell.

[2] Whinnery, J. R., and Ramo, Simon; A New Approach to the Solution of High-Frequency Field Problems.

[3] Whinnery, J. R., Concordia, C., Ridgway, W., and Kron, Gabriel; Network Analyzer Studies of Electromagnetic Cavity Resonators.

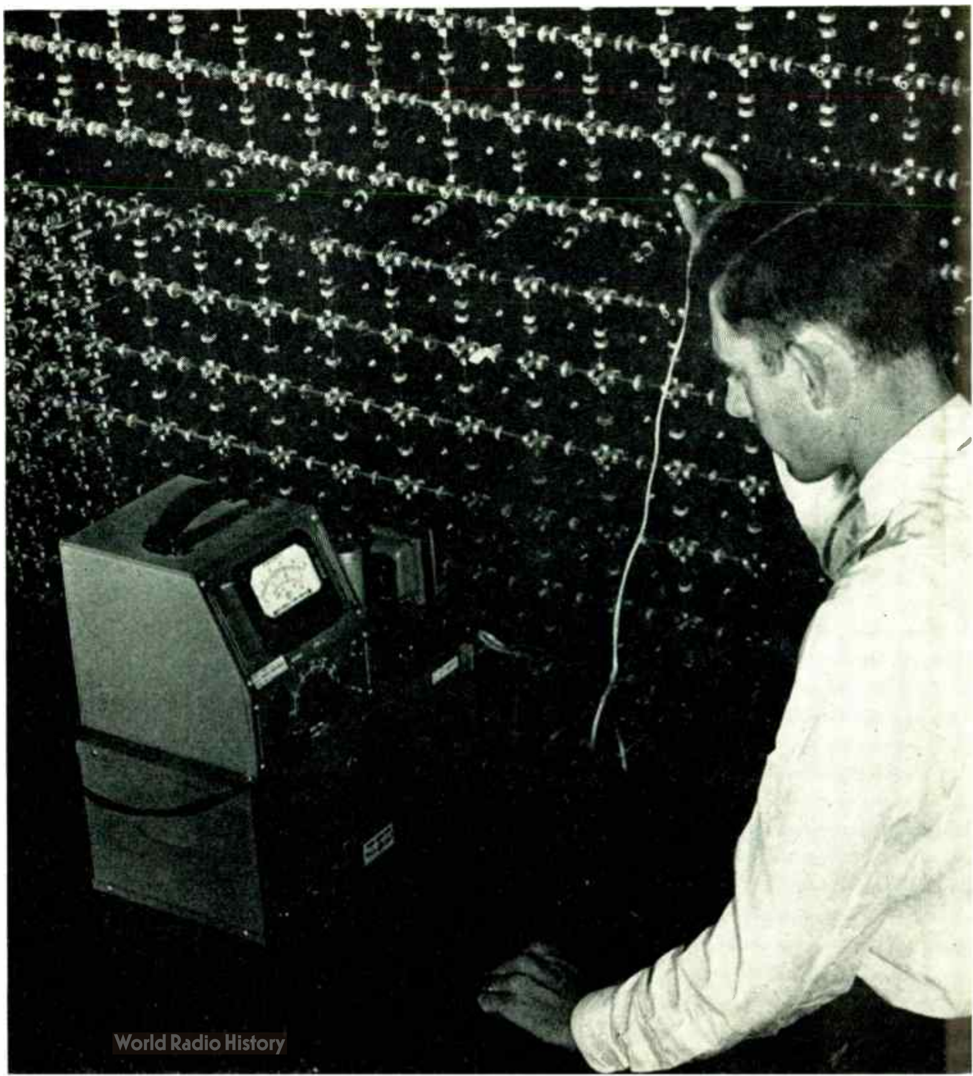


Fig. 1 (right): Voltages and currents in lattice network correspond to the electric and magnetic field components in electromagnetic wave

World Radio History

Field Problems

By KARL SPANGENBERG, GLENN WALTERS and FREDERICK W. SCHOTT

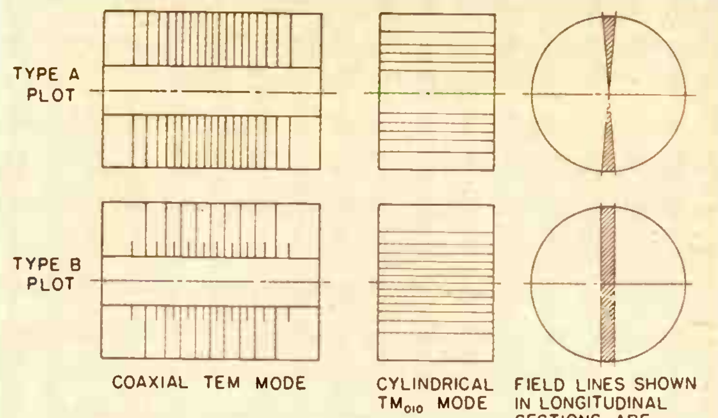


Fig. 2: Field plots of two resonance modes

which it is ½-wavelengths in radius by 1½-wavelengths in length.

The inductances are built so that they may be plugged in like fuses. Contours of the resonator or line structure under study are imposed upon the board by open-circuiting the network for TEM and TM modes or shorting it to ground for TE modes. Losses in a system may be represented by insertion of resistance at points corresponding to the losses in the actual system. Also, with this arrangement, it is easy to represent dielectrics by inserting special inductances in place of the normal ones. The capacities are simple trimmer condensers connected between the junctions of the inductances and a ground plane on the back of the board.

The analogy between network and field quantities for TEM and TM modes is given in Table I which shows that components of an electric field are represented by currents in the network coils, whereas the magnetic field is represented by the voltage across the condensers divided by the radial distance. In addition, a requirement for proper representation of cylindrical fields is that the series inductance elements of the network increase linearly with radius whereas the shunt capacities vary inversely with the radius. These properties of the inductances and capacities give a phase velocity which is constant over the entire board and a characteristic impedance which increases

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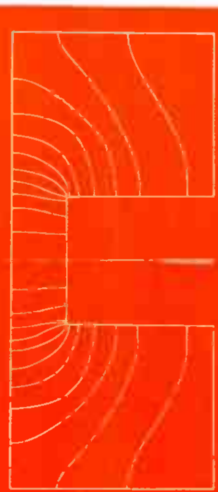
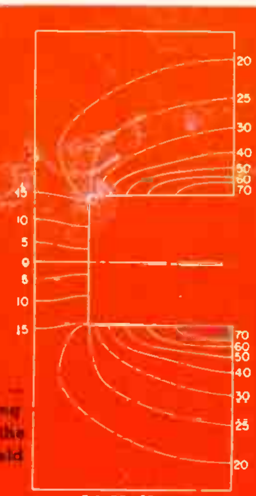


FIGURE 3A

Electric field configurations for the lowest resonant frequency of simple reentrant cavity

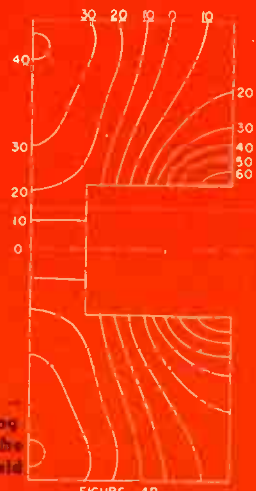


Corresponding contours of the magnetic field

FIGURE 3B

FIGURE 4A

Resonant configurations for 1½ wave resonance between 2 diagonally opposite corners of the large section of the resonator



Corresponding contours of the magnetic field

FIGURE 4B

World Radio History

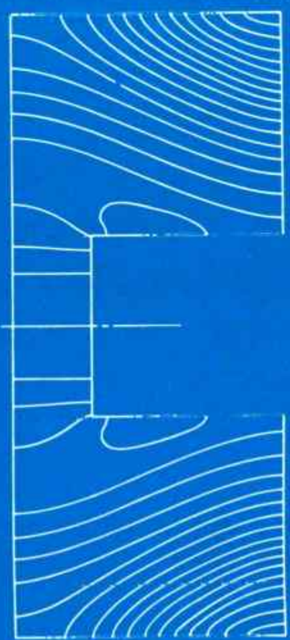


FIGURE 5A

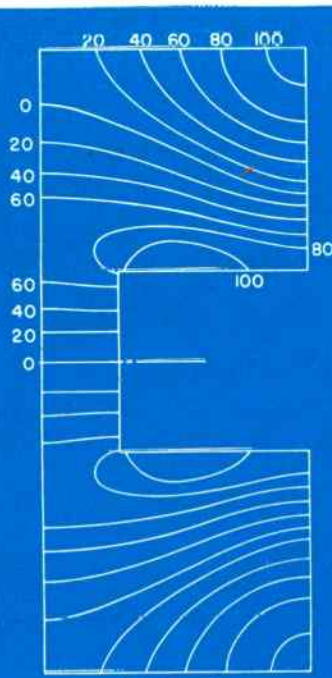


FIGURE 5B

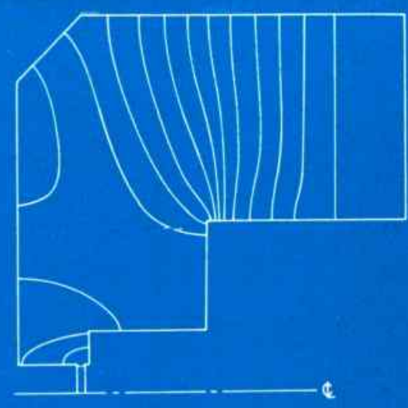


FIGURE 6

Fig. 5: Configurations corresponding to a ¾ wave mode in the reentrant cavity. Electric field is shown in (A) and magnetic field in (B). There is no nodal surface of electric field in this case. Fig. 6: Field plot of cavity resonator with irregular wall surfaces

linearly with the radius. The relative dielectric constant of different sections of a given problem may be represented by altering the series impedance of the network elements.

TABLE I

TEM and TM Modes Only

Field Quantity	
Radial component electric field	$= E_r$
Axial component electric field	$= E_z$
Radius times magnetic field	$= rH_\phi$
Network Quantity	
Axial coil current	$= -I_z$
Radial coil current	$= I_r$
Voltage from junction to ground	$= V_\phi$
Impedance of radial coil $= j\omega\varepsilon r$	$= Z_r$
Impedance of axial coil $= j\omega\varepsilon r$	$= Z_z$
Admittance to ground at junction $= j\omega\mu/r$	$= Y_\phi$

In these relationships the M.K.S. system has been used and ω represents the angular frequency, ε the dielectric constant, μ the permeability and r the radius to the point under consideration in the cavity.

For TE modes only, the network field relations are as given in Table II. Here the analogy is direct in that components of current through the network inductances correspond to components of magnetic fields while the voltage across the shunt condensers corresponds to the electric field multiplied by the radial distance.

TABLE II

TE Modes Only

Field Quantity	
Radial component magnetic field	$= H_r$
Axial component magnetic field	$= H_z$
Radius times electric field	$= rE_\phi$
Network Quantity	
Axial coil current	$= -I_z$
Radial coil current	$= I_r$
Voltage to ground at junction	$= V_\phi$
Radial coil impedance $= j\omega\mu r$	$= Z_r$
Axial coil impedance $= j\omega\mu_r$	$= Z_z$
Admittance to ground at junction $= j\omega\varepsilon/r$	$= Y_\phi$

In use, the boundary of the problem to be studied is plugged into the board and the section of the network that is so isolated is excited from a low-frequency oscillator by applying a voltage between any point and ground through a resistance which is high compared to the network impedance at that point. By such means the fields within the test section can be easily studied. For example, to determine the field within a cavity resonator operating on a TEM mode, it is only necessary to open the circuit at points corresponding to a scaled representation of the boundary of the actual cavity. The isolated section of the network is then excited and the voltage from every junction to ground is measured and recorded. Since the voltage to ground corresponds to the magnetic field multiplied by the radial distance, it is only necessary to divide the voltage values by the radial distance in order to obtain values proportional to the magnetic field strength at any point. Through such values, contours of constant magnetic field strength are readily drawn.

The electric field of a line or resonator can be obtained in two ways. From voltage measurements across the coils the current components corresponding to the electric field components can be deduced, or the magnetic field data can be used. In practice the latter method proves to be preferable because it is not necessary to deal with vector components and because some very simple relations between the electric and magnetic field configurations exist.

The presentation of the electric field plot presents something of a problem because there are two conventional types of representation in common use for two dimensional cylindrical fields having rotational symmetry, each of which is subject to some limitations. The two conventional representations are illustrated in Fig. 2 showing the field plots of two commonly encountered resonance modes, the coaxial TEM

World Radio History

and the cylindrical TM_{010}. For fields which have flux lines which are predominantly radial the field representation is commonly that shown as Type A. This is obtained by showing all the lines contained between two planes through the axis making a small angle with each other. This gives a representation which is excellent for the coaxial TEM mode but which gives an apparent zero electric flux density on the axis of the cylindrical TM_{010} mode. In this representation the flux density is obtained by dividing the line density of the representation by the radial distance.

For field configurations which are predominantly longitudinal in form the representation designated as Type B is commonly used. In this representation the line density is directly proportional to the electric flux density. This representation is excellent for the cylindrical TM_{010} resonance but is not very good for the coaxial TEM resonance because the electric flux density varies inversely with radius. In this representation which is obtained by showing all the lines between two closely spaced parallel planes about the axis it is necessary to show some radial lines as abruptly terminated in space in order to achieve a line density proportional to the flux density. In fact, it is *impossible* to construct a field plot in which the line density is proportional to the electric field when the field is a two dimensional cylindrical one having rotational symmetry and when the electric field has radial as well as longitudinal components.

Type A Field Plots Preferred

In order to have a consistent mode of representation which will cover all cases, the field plots presented will be of the Type A described above. Field plots of this type are preferred because:

a. This is the only type of plot for cylindrical modes with rotational symmetry in which the lines representing the electric flux are continuous and terminate either on conductors or on themselves.

b. In this type of plot there is a consistent relation betwee nline density of the representation and actual flux density, namely that the flux density is equal to the line density divided by the radius.

c. Contours of constant voltage-to-ground as obtained from the network become automatically a field plot of the Type A. It must be remembered in using field plots of the Type A that the electric flux density is equal to the line density divided by the radius. When there are electric lines with predominantly longitudinal components near the axis, the electric flux density tends to be constant near the axis with rotational symmetry.

The fact that a field plot of the Type A results when there are plotted contours of constant voltage-to-ground on the network is apparent from a study of the network circuit equations and the corresponding field curl equations. To see this it is only necessary to compare the expression for the gradient of the network voltage which is proportional to the magnetic field multiplied by the radius, with the actual expressions for the electric field components in terms of the magnetic field.

As a result of this observation the construction of field plots from network data is very simple. It is only necessary to record data of voltage-to-ground at every network

(*Continued on page 58*)

Fig. 7: Tuning curves with plunger changing dimensions of resonant cavity. Boundaries set up on network are changed to simulate plunger motion

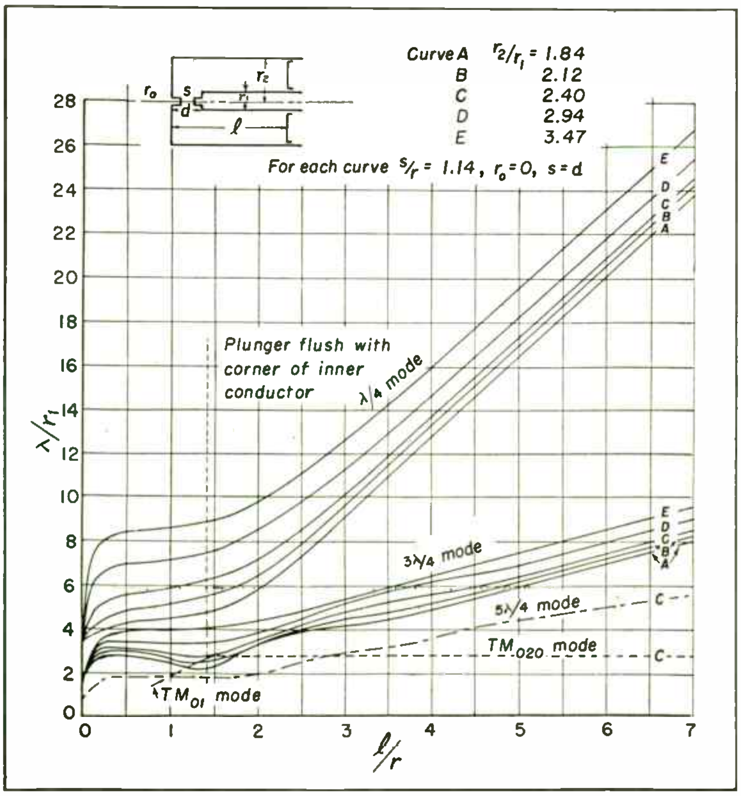
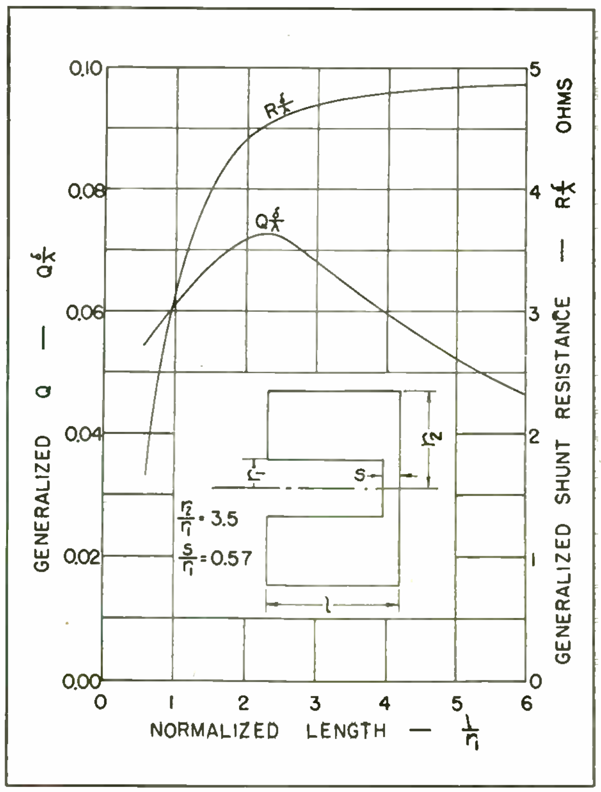
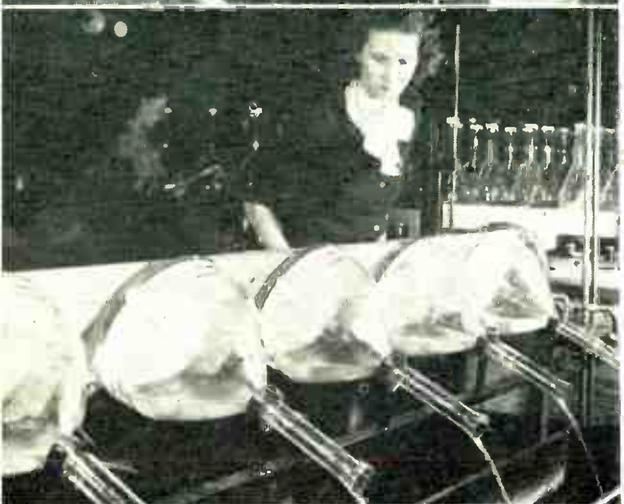
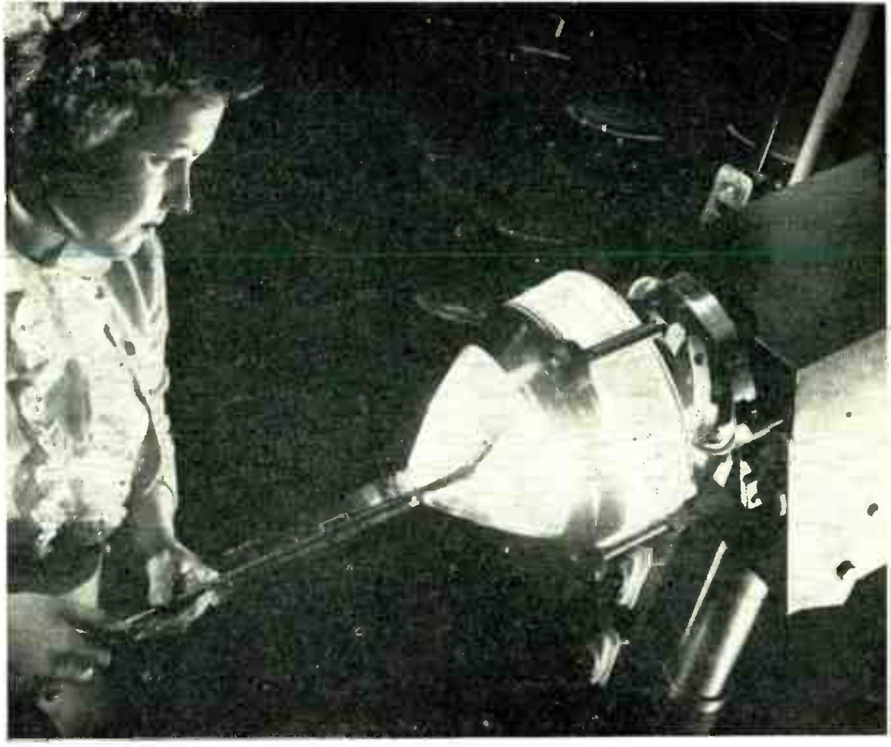


Fig. 8: Curves are shown of shunt resistance and Q of a simple reentrant cavity as axial length of cavity is changed







Inside walls of CR tube shown being coated with graphite which serves as part of high voltage anode and improves screen contrast. Bulb turns on a lathe

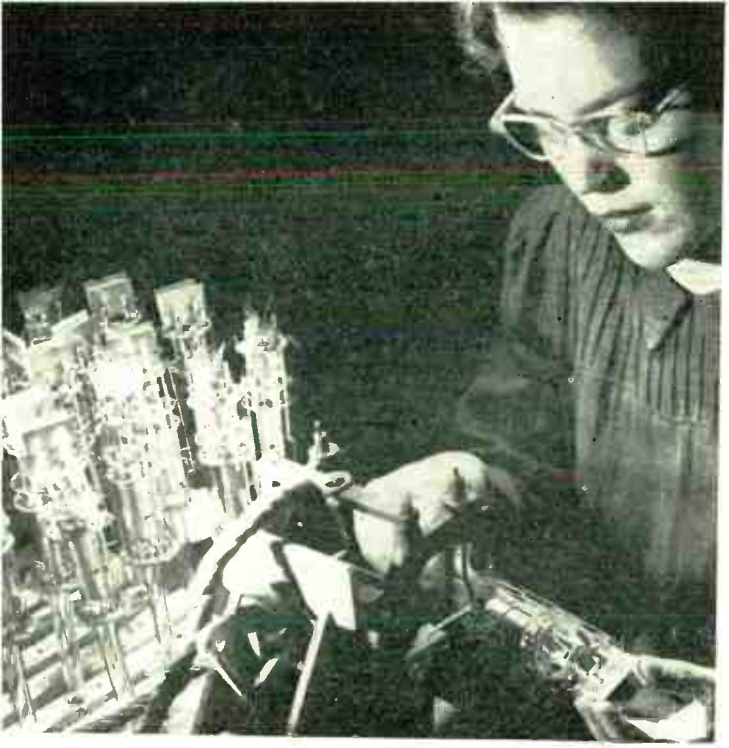
Mechanization

Sylvania prepares to meet increased demand for CR picture tubes by streamlining production and mechanical operations; new facilities and building underway; photos are of Emporium, Pa., plant

Above: Top photo shows CR tubes in preparation to receive fluorescent screen material in solution which is allowed to settle. Center photo shows solution slowly decanted in automatically operated pouring rack. Bottom photo shows circulating air drying rack. Note drying element in opening. Tubes are then marked for positioning of internal graphite coating as next step

Right: Tubes pass through this 85-ft. lehr where high temperatures remove organic material in graphite coating. This machine is also used to anneal bulbs not yet graphite coated

World Radio History

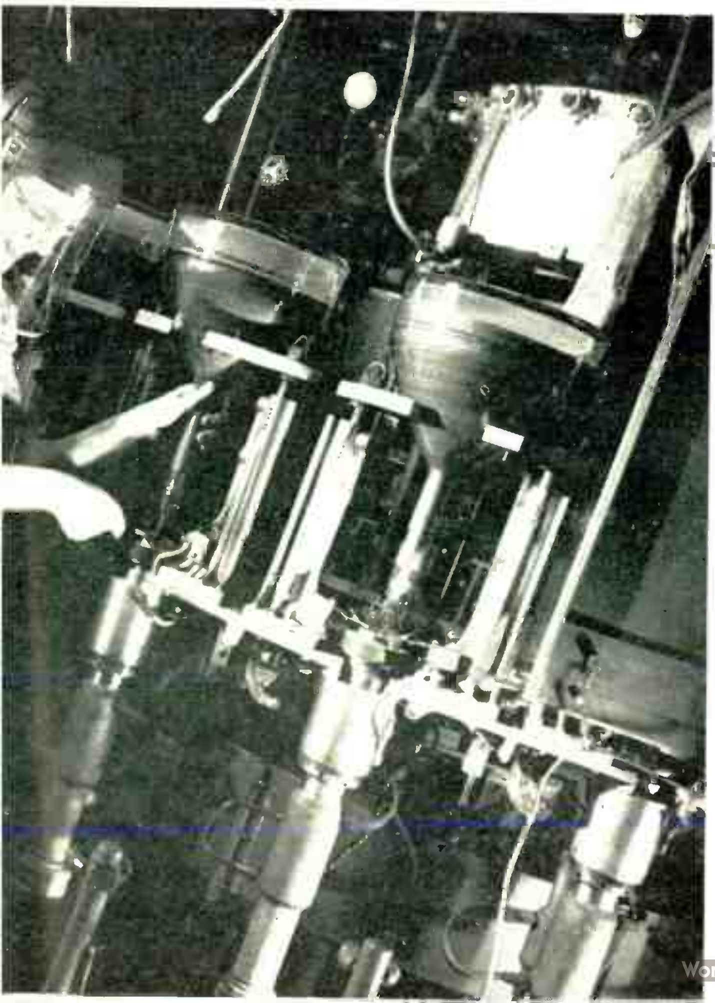


Finished cathode-ray guns are mounted on glass headers by spot-welding. Gun parts and deflecting plates are stainless steel

Automatic sealing machine. Tubes are preheated in circular rack at left of operator, then placed in machine; handles 7 and 10-in.

Steps-Up CR Tube Production

High vacuum pumping operation for exhausting tube. This automatic exhausting unit handles tubes up to 15 in. Shown are 10-in.



Light output is checked for brightness after electrical tests are made. Samples are operated at maximum voltage for 500 hrs.

World Radio History

Dynamic Impedance Circuit

New amplifier circuit based on principle of negative feedback functions as a variable resistance, reactance or impedance; made of standard parts

By Y. P. YU, Associate Professor, E.E., State College Station, Fargo, N. D.

HERE is a dynamic impedance amplifier that fulfills the need for a circuit capable of behaving like a variable linear resistance, reactance or impedance. Operates on the principle of negative feedback, it overcomes the undesirable features found in similar devices such as the wide percentage of impedance variation in reactance tube circuits and the driving power, weight and space requirements of motor-driven variable capacitors and saturable reactors. The values of R, L, C or Z obtained depend upon a control voltage drawing practically no current from the controlling source. Variations up to 10 times the minimum value are permissible. The circuit can be constructed of standard parts.

A block diagram of the dynamic impedance circuit is shown in Fig. (1). Here E_2, developed by an ordinary odd-stage amplifier, is 180° out of phase with E_1 and equal to $-AE_1$, where A is the gain of the amplifier. The low effective input admittance of the cathode follower (1) prevents falling off of amplification of the odd stage amplifier when the plate resistance of tube T_v is reduced. Cathode follower (1) is also used to supply direct current to tube T_v. The resistor R and the plate resistance r_p of T_v, act as

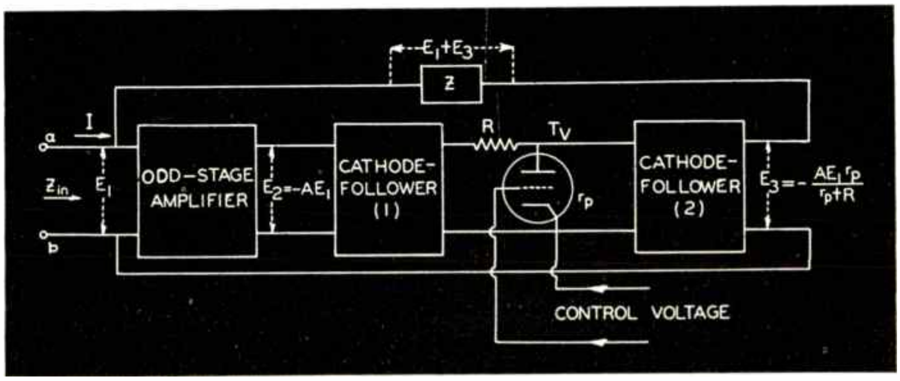


Fig. 1: Diagram of dynamic impedance circuit. Varying control voltage increases values 1+A times

Fig. 2: (A) practical wiring diagram: (B) variation of impedance

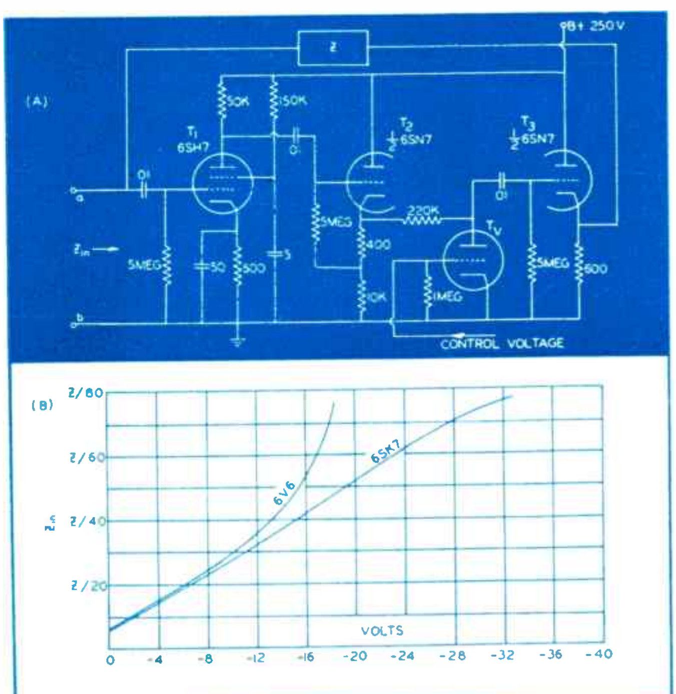
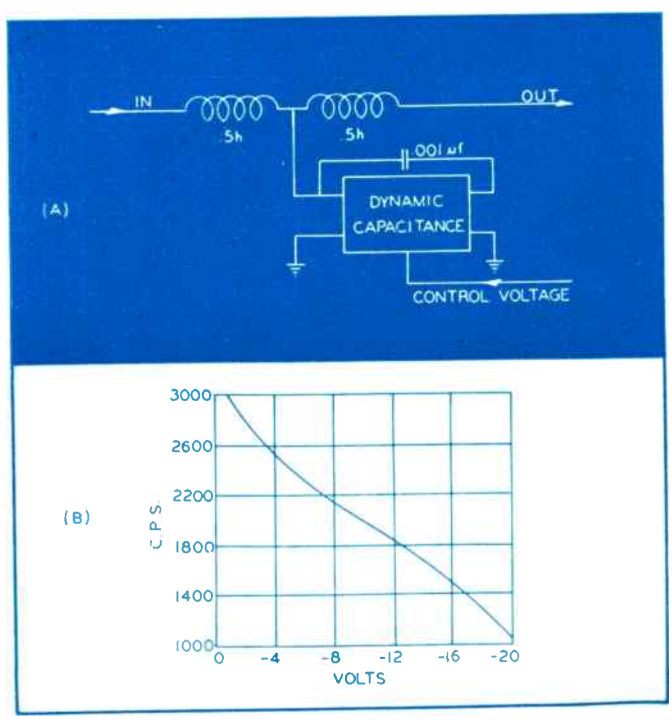


Fig. 3 shows (A) lowpass filter circuit; (B) cutoff frequency variation



World Radio History

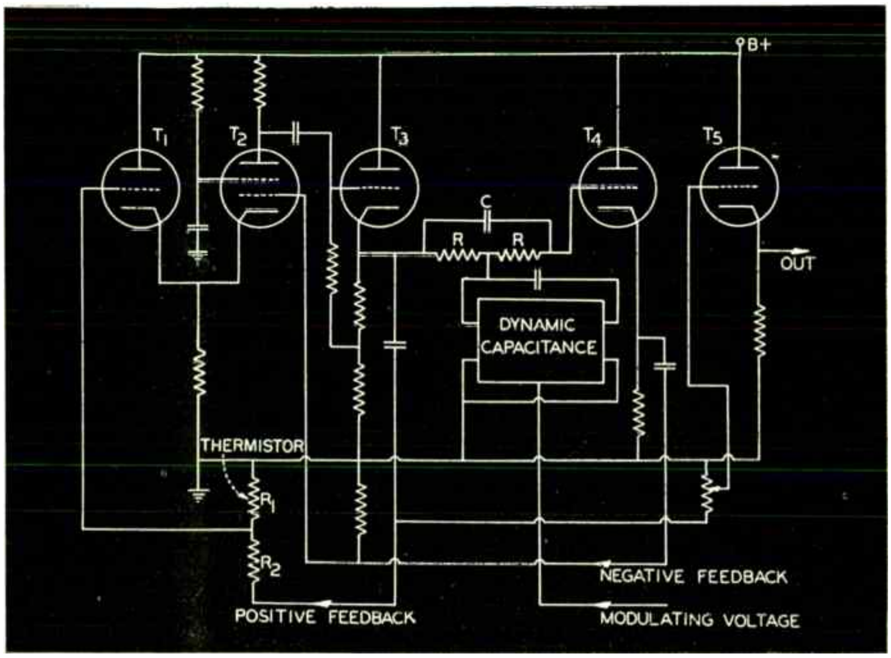


Fig. 6: Frequency-modulated oscillator capable of producing linear frequency variation over 50% of its carrier. Automatic amplitude is accomplished by using thermistor R_1. Full details of circuit in story

a voltage divider. Cathode follower (2) is employed solely for the purpose of impedance transformation. For simplicity, let us assume unity voltage amplification in each cathode follower. Output voltage, E_0, is equal to $-AE_1r_p/(R+r_p)$, and the voltage developed across impedance Z is E_1+E_3. If the input impedance of the odd-stage amplifier is very large, input current, I, becomes $(E_1+E_3)/Z$. Then the impedance, Z_{in}, appearing across terminals a-b is $Z/[1+Ar_p/(r_p+R)]$.

It is well known that the plate resistance of a triode can be varied from infinity to a small value by varying its bias voltage from cut-off to a value slightly above its plate-cathode potential. Thus, by decreasing the negative control voltage, Z_{in} can be increased to approximate (1+A) times its minimum value.

The manner in which Z_{in} varies is determined by the characteristics of the triode T_v. In order to prevent the plate current of T_v from distorting the output wave form, the value of resistor R should be very large compared with the output impedance of cathode follower (1).

Fig. (2A) shows a practical wiring diagram of the dynamic impedance circuit. A pentode 6SH7 is used as an ordinary resistance coupled amplifier. A double-triode 6SN7 serves as two cathode followers. Control voltage is used to vary the plate resistance of T_v, a 6V6 connected as a triode. Z may be a resistance, reactance, or impedance network. A blocking capacitor is needed when the dc resistance of Z is not infinite. Experimental results show that the impedance at terminals a-b can be varied from Z/7 to Z/75 by varying the control voltage from zero to −18 volts, or it can be increased to Z/2 when the control voltage becomes slightly positive. If a remote cutoff tube 6SK7 (triode connection) is used instead

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Fig. 4: (A) bandpass filter circuit; (B) varying control voltage effect

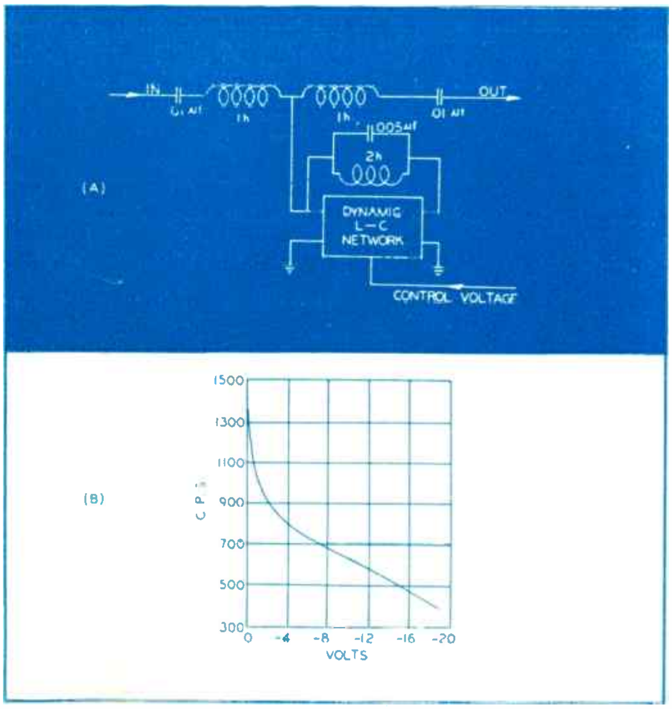
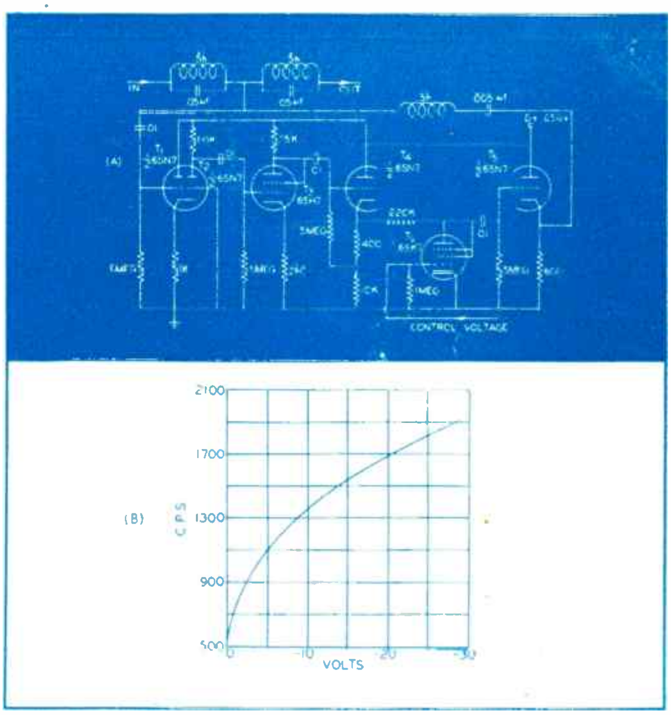
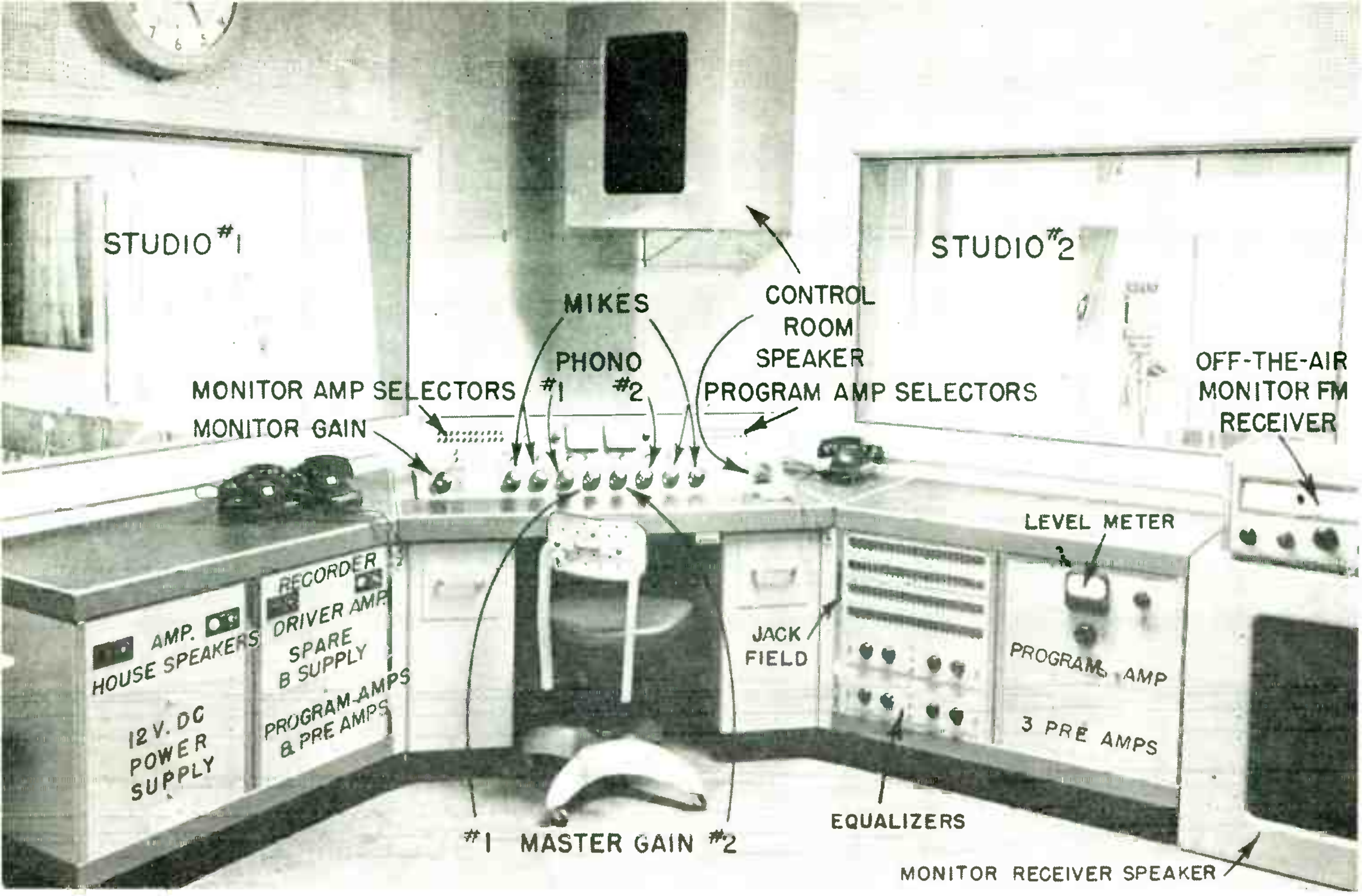


Fig. 5: (A) band-elimination filter circuit; (B) varying voltage effect



World Radio History



Master control room overlooking studios 1 and 2. Various equipments identified. REL control conscle shown on the top of the center desk

WFAS

Engineering an FM-AM Station

BY BERNARD F. OSBAHR, Assistant Editor, Tele-Tech

ENGINEERING of WFAS, independent AM-FM station in White Plains, New York, is an outstanding example of efficient installation and operation of broadcast equipment. The station operates on an FM frequency of 103.9 mc and an AM frequency of 1230 kc. Studios are maintained in the city while transmitter and 450-ft. tower are three miles away on top of a 400-ft. hill, thus providing an antenna height 850 ft. above sea level.

Engineering supervision is exercised by chief engineer Frank A. Seitz with the assistance of Lewis Rudofsky (audio) and Jack Pearson (transmitter). The station boasts three floating studios acoustically treated with transite and sanacoustic in irregular patterns. Windows permitting an outside view float in floating studio frames.

Studio illumination is achieved through the use of recessed Rambush-type conical fixtures, except in the transcription studio No. 3 where special lighting is provided for easy identification of records stored in wall racks.

The transcription studio contains 25,000 recorded works used to feed the Presto type 62 transcription turntables, (two in studio No. 2, two more in studio No. 3 and another pair in the transmitter control room) while for recording purposes a Presto model 28M will be installed shortly. The turntables in the studios use individual lateral and vertical Paraflux reproducing heads. The installation of a Western Electric type 23-B console permits studio No. 3 to function either as a live talent studio, a transcription studio, and a sound or special effects room. This console controls two microphone inputs from studio No. 2 and from studio No. 3 and also the two transcription turntables in studio No. 3. It can also be used as a control point for audition or rehearsal purposes while studio No. 1 is on-the-air.

Altec Lansing 15-in. speakers are also in general use with type 600B being used in studios 1, 2, 3 and in the reception room; while in the master control room a type 604B is used as an off-the-line monitor and a type 603-B has been connected to the REL type 646 monitor receiver. Volume level for each of these speakers is individually controllable.

RCA type 44-BX microphones are used in all of the studios. Mike location problems are facilitated by having a considerable number of desk and floor type mike stands available and a boom stand permits special effects as desired. For remote work either RCA types 74 or 88A are employed.

Intercommunication telephones connect the three studios, the master control room, chief engineer's office and the program director's office. Push buttons actuate "ringing" circuits which are either buzzers or flasher lights depending on location. Microphone talkback facilities are also provided between the master control room and studios 1 and 2 and between studios 3 and 2.

A sponsor's consultation room is located next to the master control room and the speaker can be connected to the program output or to a transcription turntable in the room to review commercials, etc.

The console in the master control room is a modified REL type 603, capable of handling eight studio microphones and both a local and remote announce position. A feature of this setup is the complete independence of handling the AM and FM channels if occasion demands it.

A six-channel mixer circuit in conjunction with a push-button selector switch permits any one of six remote lines or two turntables to be tied in with one of the two mixer circuits. Two program amplifiers can connect to either of the two mixer output busses and feed two outgoing program lines. The bus feeding the monitor amplifier derives its signal through the second bank of push-button switches which connects channel 1 or 2, mixer bus 1 or 2, advance turntable cue (permits pre-setting tone arm at the start of recording on transcriptions), 5 cue lines, talk-back studio 1 or 2, and talk-back remote.

Transmitter room showing Presto recorders, Jensen speakers, AM-FM transmitters

Audio Facilities

The Jack panels in the master control room provide for 96 circuit terminations and are designed to give operators a wide flexibility in the selection of available equipment and in the cross connection of incoming audio lines from both studios and remote sources. Circuits appearing at the terminations include 12 remote, five cue, two phono, 10 microphone, and two outgoing program lines. Terminals for two equalizers, a recorder, AM receiver, FM receiver, monitor and house amplifiers, monitor speaker, sponsor's room speaker and two speaker bus lines are also provided.

In operation, it is possible to feed two separate programs through the console and patch panels to the transmitters, one for FM and the other for AM, using all studios and

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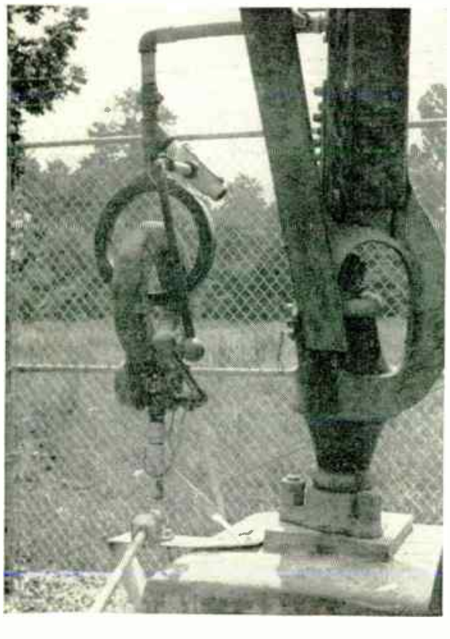
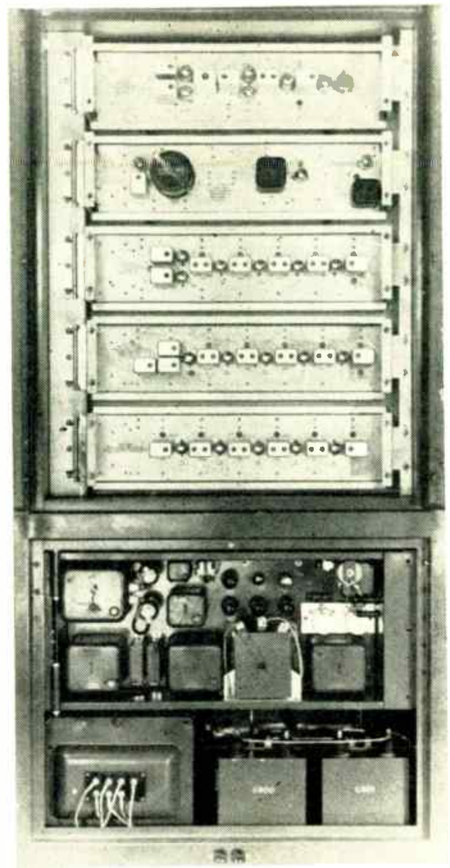
Austin transformer and Lapp-type insulator



Studio No. 1 showing accoustical pattern on the ceiling and table for family programs



a number of different equipment items at the same time. For example: If a live talent show in studio No. 1 was to broadcast on FM using turntables or microphones in studio No. 2 for dubbing or special sound effects, while studio No. 3 was transmitting an AM transcription or live talent program, and a remote pickup on line 12 had to be recorded for a later broadcast, the control room operator might feed mikes 1 and 2 in studio No. 1 through the console pre-amps and mixers 1 and 2 to mixer bus 1. Mixer bus 1 would then feed master gain 1 and program amp and outgoing line 1. Studio No. 2 or turntable could be connected through pre-amp 3 to mixer bus 1 through mixer 5. The output of the 23-B console in studio No. 3 could be patched to master console line input 5, through mixer 3 and mixer bus 2 to master gain, program amp and line 2 if desired, or directly to the outgoing line. Remote line 12 would be patched to equalizer 1 and its output is patched into the cutter amplifier for recording.

Two audio circuits connect the transmitter control room with the master control room. One is the normal program line and is equalized to 15 kc. The other is an emergency line and is equalized to 8 kc. The console at the transmitter is similar to the one used in the master control room. Again extensive patching facilities are available and include provision for 15 remote lines, two equalizers, an emergency line amplifier, turntables, local announce, transmitter monitor, compressor, etc. An incoming signal is applied through the console to the input of one of the two AM transmitters and to the FM transmitter. All transmitters have a 250-watt output. The main AM transmitter is a Western Electric model 451, but a WE 310-B is set up as a standby. Radio Engineering Labs provided the model 549A-DL FM unit, and the single overall facade for the complete transmitter group.

The phase modulated FM transmitter uses 4-125A Eimac type output tubes. Loctal types are generally used throughout the rest of the transmitter, and are standard in all Radio Engineering Laboratory transmitter designs.

The audio input level required for 100% modulation is 12 dbm ±2 dbm and the input impedance is 600 ohms balanced to ground. Overall response between 50-15000 cps at 25, 50 and 100% modulation is ±1 db. Signal to noise ratio below 100% modulation is 70 db for FM and 60 db for AM. Distortion is less

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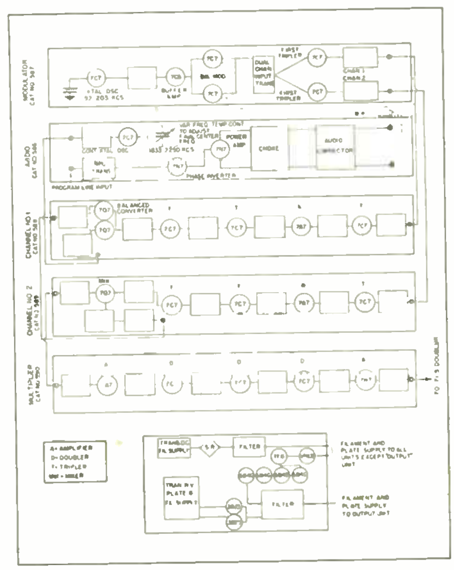
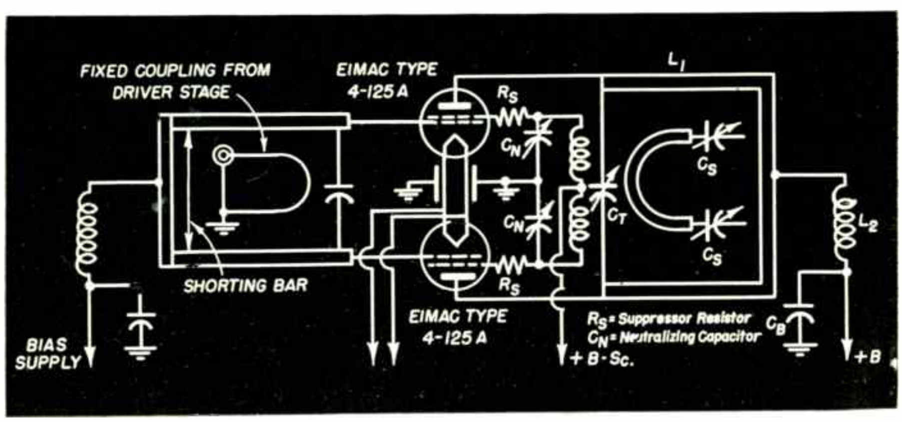


Left: REL final power output stage—(FM) transmitter. Below: Schematic of final power output stage. Right: Block diagram of modulator stages. Sections parallel those shown in the photo of the FM transmitter above



World Radio History

Report on TV Hearing

FCC proposes new television channel allocation plan; engineers gird for 475 to 890 mc hearing in September

By ALBERT FRANCIS

Dr. T. T. Goldsmith (right) and Robert Wakeman, Allen B. DuMont Labs, study FCC's proposed allocation plan. DuMont plan increased by 20 the number of channels—some of them are now held by the military

THE Federal Communications Commission and the industry's engineering and legal representatives gathered in Washington for the June 29th FCC hearing on TV frequency allocation faced with the prospect that more channels in the 475 to 890 mc band is the only solution to the crowded condition of the present television band.

It was disclosed at the hearing that the FCC proposed to amend in their Rules, Section 3.606 so as to increase the number of channels already assigned to some cities and to provide channels for about 300 cities and towns not previously on the list.

The FCC television engineering department, under acting head Hart Cowperthwait (in the absence of Curtis Plummer) drew up the new proposed allocation plan. The new list was not based on marketing areas; in fact, economics was forgotten and FCC allocation engineers started with maps showing all the AM broadcast transmitters, overlaid this with a map of all FM stations, then added to the list of cities and towns thus obtained those of fair size that have had no broadcasting facilities but which were large enough to want TV stations sometime in the future. One of the hard things to do is to guess correctly just where the TV station demand is going to arise.

It is evident that there is no one and only correct solution to TV channel assignments for the U. S. There are as many solutions as there are different moves that will win a chess game. However, some conclusions can now be drawn as to the most efficient mechanics to secure a meeting of minds on any proposal. The subject is an engineering one and the consulting and other engineers working on the problem are the men who produce the ideas. The process of exchanging these ideas through the cumbersome, legal method of testimony and cross-examination; of passing them along hindered by legal rules and the like was demonstrated in the present hearing. Once again it was found to be tedious, costly and time-consuming.

A series of engineering conferences leading to an integrated, national plan, which had the welfare of the TV customer at heart, not the individual desires of some broadcaster, would have cut the time in half. Such streamline planning should be welcomed by the FCC and certainly by the TV executives who can not spare their top engineers for days on end, while waiting to testify in a slow-moving hearing in Washington.

What will come from this hearing? One good thing is that everyone has had a chance to have his say. In general it can be predicted that a modified allocation plan, changed over the "proposed plan" in those places where the FCC considers that a just request for change has been placed in the record, might prove acceptable. It is possible that those who make the greatest noise will get the most attention but only if they convince the Commission that their present demands for a channel (as compared with its future use at a different location) is for the public good.

If the flood of applications from the smaller cities does not represent over-optimism in TV broadcasting but represent sound growth, then it is felt that the far-sighted step to take now is to allocate channels with the knowledge that the future TV broadcasters will be in the 475-890 mc band where they will find about 21 channels of 20 mc width available. Experiment and propagation tests in this band should be rushed so that the knowledge gained will be available before permanent assignments are frozen in the lower commercial band. Even before the September 20 hearing on the higher band, engineering plans as to how to parcel out these channels should be begun.

THE MAJOR RESULT of the FCC hearing last month on television channel allocation seemed to be the general agreement that the hearing scheduled in Washington for September 20, when recommendations will be received regarding use of the 475 to 890 mc band, will mark the real engineering effort towards a solution of the TV channel problem.

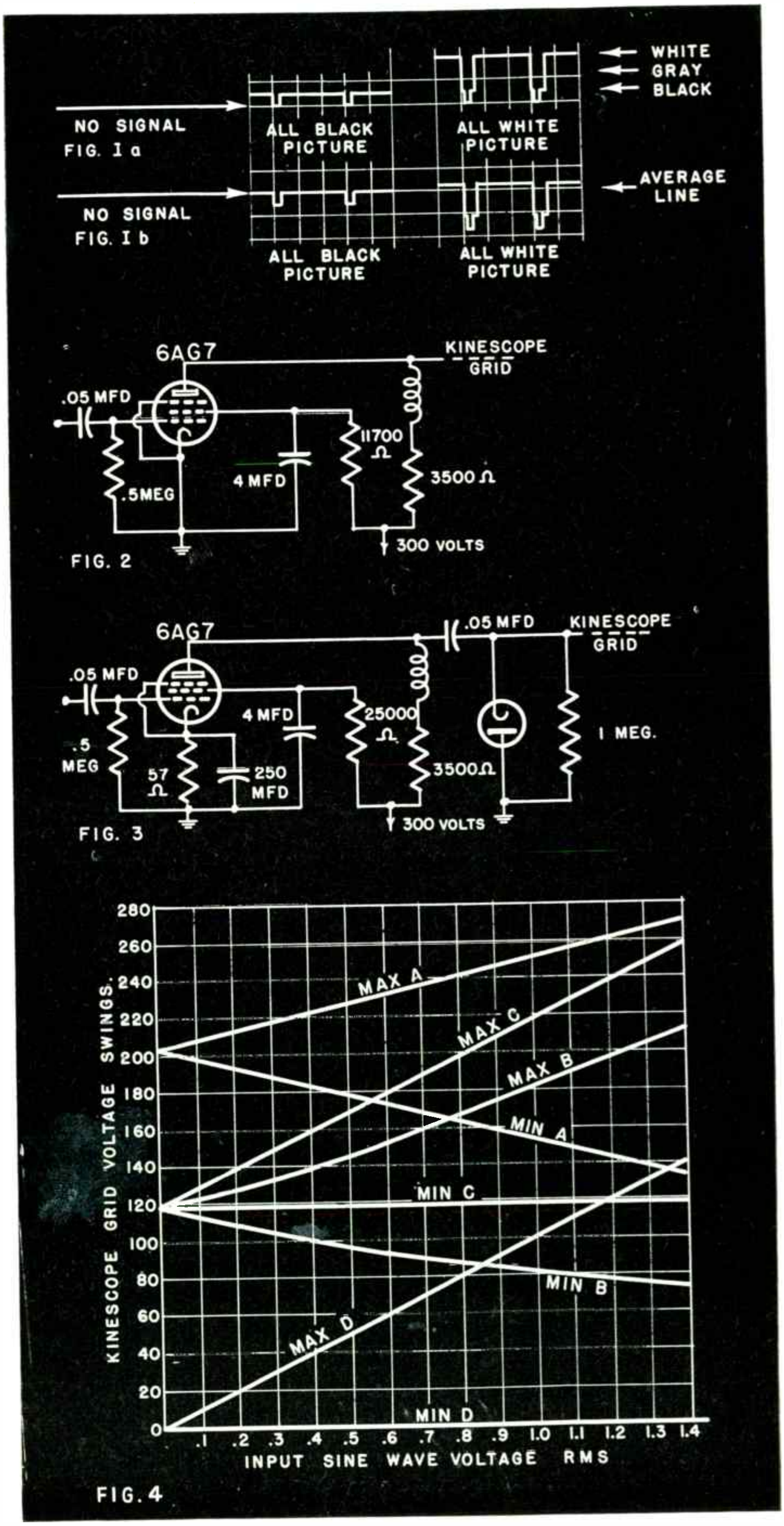
By that time, industry representatives will have had time to study the various plans submitted by several groups; others will have an opportunity to prepare comprehensive recommendations of their own; the FCC proposed allocation plan will have been thoroughly digested.

The new allocation plan offered by the FCC during the hearings did not satisfy the engineers. It merely increased proposed assignments in the present band from 408 stations to 955! It generously proposed to give channels in areas not considered economically ripe for television.

Examples are the proposed assignment of 30 stations to Montana with its total population of half a million! While such a plan would let more people into television, who would want to brave the economics of it? Another example is the assignment of six stations to Grand Junction, Colorado; or five to Boise, Idaho, while Chicago would lose one from seven to six!

The engineering problem, apparently ignored so far, is to make room for stations in metropolitan areas (concentrated population centers), rather than to specify allocations for every whistle stop.

DC Restoration Methods



By SID DEUTSCH, *Instructor, New York Technical Institute, Newark, N. J.*

THE need for a dc restorer in television arises out of the fact that coupling capacitors in the video section of a receiver cause the video signal to have equal positive and negative areas about the average line. At the grid of the kinescope, the three conditions of no signal, an all-black picture, and an all-white picture should have the voltage levels indicated in Fig. 1a. With no dc restorer action present, the signals will have voltage levels indicated in Fig. 1b.

Therefore, it is not possible to assign correct densities to the voltage levels. If the brightness control is correctly adjusted for a black picture, a white picture will appear too dark. When correctly adjusted for a white picture, a black picture will appear too light; in fact, retrace lines will become visible. In short, without dc restorer action, the average color of the kinescope picture will be constant for any particular setting of the brightness control.

When good dc restorer action is present, the raster will appear black with no signal coming in, and will have correct density for black or white pictures. The two standard methods of dc restoration — the grid leak bias and the diode methods — are illustrated in Figs. 2 and 3, and are compared, using the values shown, in the curves in Fig. 4. Here curve A shows result of applying a sine wave to the 6AG7 so that no dc restoration has taken place. The kinescope grid then swings equally positive and negative about the no-signal voltage of 202 volts. When the input is 1.4

Fig. 1a: Video signal levels at the kinescope grid with correct DC restorer action. Fig. 1b: Signal levels without the DC restorer action. Fig. 2: Typical grid leak bias restorer circuit with poor screen grid voltage regulation. Fig. 3: Typical diode DC restorer and video output amplifier circuit. Fig. 4: Relation between kinescope grid voltage swings with respect to ground vs input sine wave voltage to 6AG7 grid using circuits in Figs. 2 and 3

World Radio History

in Television Receivers

Study shows that grid leak bias and diode methods of DC restoration in television are equally effective with specific advantages to each system

volts rms, the 6AG7 plate swings from 271 volts down to 133 volts.

Curve B is the grid leak bias restorer with poor screen voltage regulation, the circuit being that of Fig. 2. Regardless of the amplitude of the input signal, grid leak bias automatically keeps the positive peaks of input signal at about the zero grid to cathode voltage level. Phase reversal of the tube makes this equivalent to keeping the negative peaks of output signal at the same level regardless of input amplitude. However, the action for curve B is not perfect, because as the signal amplitude increases, grid leak bias increases, screen current decreases, and the resulting increase in screen grid voltage acts in opposition to the restorer action. For Fig. 2, the screen voltage would increase from 125 volts to 163 volts. As a result, the minimum 6AG7 plate voltage swings and instead of remaining at 118 volts it decreases to 75 volts.

Curve C in Fig. 4 results from maintaining the screen grid voltage constant at 125 volts in Fig. 2. Now the theoretical plate voltage swings would vary from a minimum of 118 volts to a maximum of 258 volts. Similarly, curve D comes from the circuit of Fig. 3. The action of the diode restorer is such that the kinescope grid coupling capacitor, in addition to having the usual +B voltage charge, is also charged up by the negative peaks of the video-signal from the 6AG7. The voltage corresponding to this additional charge (equal to the negative peaks below the average line) makes the kinescope grid positive with respect to ground. The total voltage at the kinescope grid — the video signal plus the restored dc voltage — is shown as curve D, Fig. 4. When the input is 1.4 volts rms, the kinescope grid would swing from zero to 140 volts.

The conclusion is that insofar as restorer action is concerned, the diode and grid leak bias methods are equivalent, provided the screen grid voltage regulation in the latter system is good. In practice, this condition is not easily obtained. If the screen grid is returned directly to B+ the plate voltage will be appreciably lower than screen voltage because of the plate load resistor, and this may cause distortion. A bleeder circuit provides good screen regulation but greater waste of power from the supply circuit.

Another solution is the use of a triode as a video output tube. If dc restorer action could be as perfect as curves C and D of Fig. 4, a video amplifier would need plate-gain and time-delay response only from 15,750 cycles upwards. In other words, the restorer would not only reestablish the correct bias levels, but inject all frequencies up to the horizontal sync pulse frequency of 15,750 cycles, assuming the video signal contains those pulses. Suppose that in Fig. 5 "a" is the undistorted video signal. For simplicity, the black picture has been represented as a constant voltage, while the white picture signal is only interrupted by horizontal synchronizing pulses that are .07H wide, H being the width of a horizontal picture line.

(Continued on next page)

Fig. 5: Idealized representation of video signal output of second detector. A full explanation is given in the text

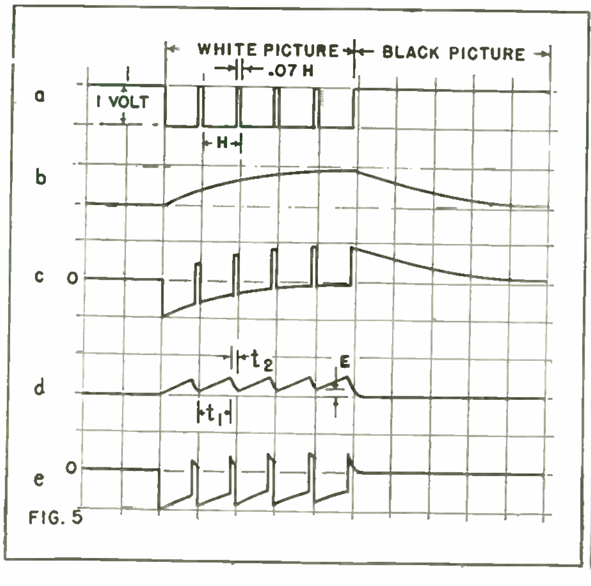
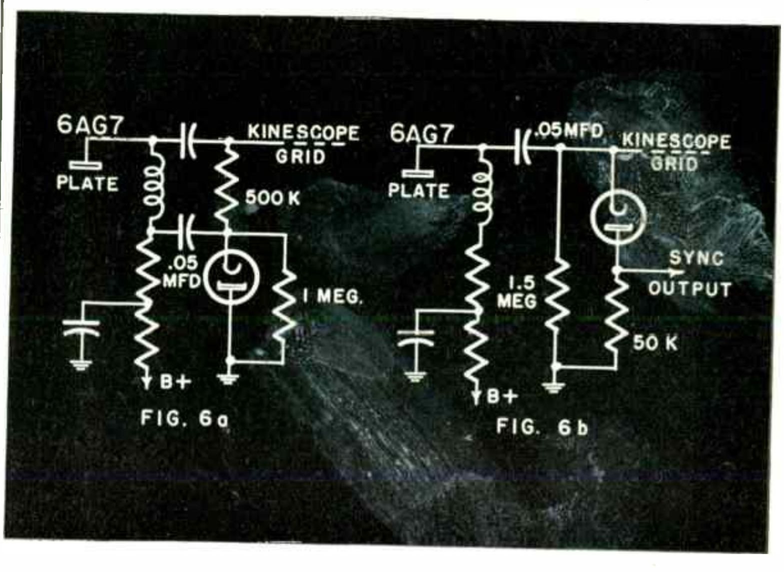


Fig. 6a. Diode DC restorer circuit to minimize stray capacitance effects of diode. Fig. 6b: Diode DC restorer circuit used to supply synchronizing pulses



World Radio History

If a condition of poor low frequency response exists (whose effect is exaggerated in Fig. 5) frequency and phase shift distortion take place so that the signal reaching the 6AG7 grid will have the shape shown in Fig. 5c. The cause of poor low frequency response lies in too small a value of grid rc time constant. The charge on the coupling capacitor should remain fixed, but because of the small time constant it exponentially charges and discharges, (Fig. 5b). The original signal voltage (5a) plus the coupling condenser voltage (5b) must equal the signal voltage reaching the grid (5c).

If perfect restorer action was available, the horizontal sync pulses would not be allowed to rise above the zero line, and the original undistorted video signal (Fig. 5a) would be obtained at the 6AG7 grid. This process requires that sufficient grid current flow during the .07H sync pulse time to completely cancel out the coupling capacitor charge accumulated during the preceding .93H picture interval. Complete cancellation of charge is impossible because the grid current itself flows exponentially, so that the actual charge on the coupling condenser see-saws back and forth as shown in Fig. 5d.

It may be shown that, if the peak-to-peak signal amplitude is one volt, the coupling capacitor voltage E will finally reach a value given by

$$E = (e^a - 1)/(e^{a+b} - 1) \neq t_1R_2/t_2R_1$$

where $a = t_1/R_1C$ and $b = t_2/R_2C$ with the latter relation holding fairly closely with typical component values in a video amplifier, where t_1 is picture information and blanking time (.93H), R_1 the ohmic path through which C charges during t_1, C is the coupling capacitance, t_2 is horizontal sync pulse time (.07H), R_2 is the ohmic path through which C charges during t_2. E should be as small as possible. There is no control over t_1 and t_2. R_1 is mainly the grid resistor, and as usual should be as large as the tube type permits. R_2 is mainly the resistance of the cathode-grid path when the grid is positive, plus the plate or diode load resistor of the previous stage, and should be as small as possible. With typical values of 500,000 ohms for R_1 and 10,000 ohms for R_2, E becomes approximately .25. In short, dc restorer action is far from perfect. The actual signal present at the 6AG7 grid is shown in Fig. 5e.

The above discussion has been based on the grid leak bias system. It applies equally well to the diode system. However, R_1 is then the kinescope grid resistor, which may have a typical value of 1.5 megohms. Other things being equal, E would then be approximately .1, so that on this point a diode restorer system should be superior to the grid leak systems.

Since restorer action is not perfect, the gain and time delay response of the amplifier should be constant down to 60 cycles, although the restorer action in itself greatly aids lf response, and makes compensation less necessary. A grid leak restorer circuit does not require lf compensation at all because of the direct connection between 6AG7 plate and kinescope grid.

Restorer Circuits Compared

Still other comparisons between the two types of restorer circuit may be made. The B+ supply regulation must be good for the same reason as screen supply regulation. This means that plate circuit decoupling cannot be used.

Since there is no bias developed without an incoming signal with a grid leak restorer, the zero signal plate current is very high (52 ma for a 6AG7). With the diode restorer system, the average 6AG7 plate current is only 28 ma, and is constant because of the fixed cathode bias. With grid leak restorer the kinescope grid is at a high positive voltage with respect to ground because of the direct connection with the previous plate. This results in a reduction of the 2nd anode voltage available. For instance, the following voltages with respect to ground may be observed: kinescope grid, 120 volts; kinescope cathode, 200 volts; 2nd anode, 2000 volts. The effective 2nd anode-to-cathode voltage is then 1800 volts. Under similar conditions using a diode restorer, the voltages with respect to ground noted were: kinescope grid, 0 volts; kinescope cathode, 80 volts; 2nd anode, 2000 volts. Now the 2nd anode-to-cathode voltage is 1920 volts.

Because of the coupling capacitor between video output tube plate and kinescope grid, the diode restorer circuit may introduce poor lf response and require compensation. Also, the additional stray capacitance introduced is detrimental to good high frequency response. This may be partially avoided by using the circuit shown in Fig. 6a, where a half megohm resistor isolates the diode capacitance, and a .05 mfd capacitor is the component charged up by the negative peaks of plate signal.

It may be pointed out that a slight variation of the basic diode restorer circuit allows the diode to act as a clipper circuit to remove the picture signals from the sync pulses, Fig. 6b. Here, the 50,000 ohm resistor impairs the restorer action by increasing the ohmic resistance of the coupling capacitor charge path during sync intervals. Furthermore, the amplitude of sync pulse output continually changes in accordance with changes in diode restorer current which may cause loss of synchronization when the picture suddenly changes from white to black. For the grid leak restorer, the phase of the signal at the video output tube grid must be such that sync pulses are positive. The diode restorer is not restricted, however, since if the signal phase is reversed the diode may be inverted.

The cost and size of a diode restorer is of course greater than that of the grid leak restorer. However, instead of using a vacuum tube, a crystal may be used as the diode. Here it should be remembered that the kinescope's positive grid voltage may be as great as 70 volts, and the crystal must withstand this as an inverse voltage. However, if the circuit of Fig. 6b is made use of, no additional circuit components are actually required.

New TV Receivers

New models of television receivers brought out by various manufacturers in the past few weeks include the following: 20-inch "Teleceiver," Industrial Television, Inc., 359 Lexington Ave., Clifton, N. J;. model 9-407 "Spectator" with 12-in. direct view tube, retail price $375, Crosley Div., Avco Mfg. Co., Cincinnati 25, Ohio; model 348 CP "Deluxe Spectator," retail price $795, also made by Crosley Div. of Avco Mfg. Co.; model 1240, 12-in. direct view tube, retail price $425, Philco Corp., Philadelphia 34, Pa.; Fisher receiver with 2½-in. tube which projects a picture 16 X 12 in., Fisher Radio Corp., 41 East 47th St., New York 17, N. Y.; ac-dc Raytheon-Belmont table model, 7-in. direct view tube, retail price $179.95, Raytheon Mfg. Co., Inc., 60 East 42 St., New York.

World Radio History

Talk-Back System

Designed to facilitate on-and-off-the-air communication, switch is particularly applicable for FM broadcasting

By ADELBERT KELLEY,
Chief Engineer, Station WINR, Binghamton, N. Y.

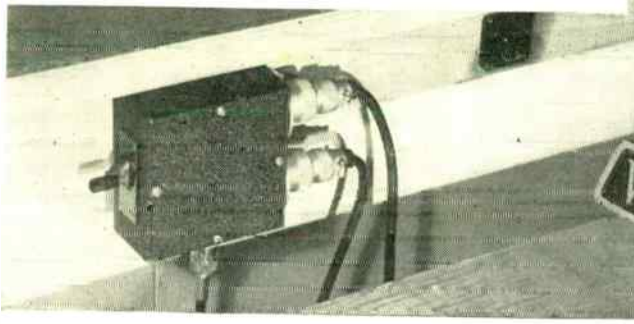


Photo shows proximity of talk-back switch to mike for ready use between or during program

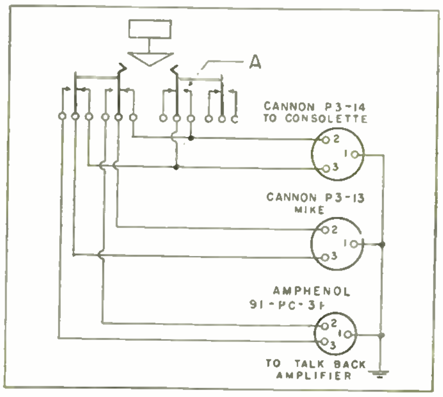
A STATION will usually find that installation of a special talk-back system will more than pay for itself in the convenience it provides. A system of this sort was set up at WINR, Binghamton, N. Y., as a talk-back mike and cough-mike for use even when the studio is on the air. For instance, the announcer can pause in the middle of a news broadcast to ask for more news copy without the engineer operating a mike switch or without disrupting the continuity of the program. Last but not least, the switching is absolutely silent in operation. There is no reason why it cannot be used with FM studio equipment.

The talk-back switch, a modified Western Electric type 471 lever key, was chosen because it is mechanically quiet in operation. It is of the non-locking type, an important item since announcers can not be depended upon to return the switch to neutral after use. A simple modification was to bend the contact that shorts the mike line to the console input so that it shorts *before* the leads leave the transfer contacts on the other portion of the switch. This eliminates the switching "click."

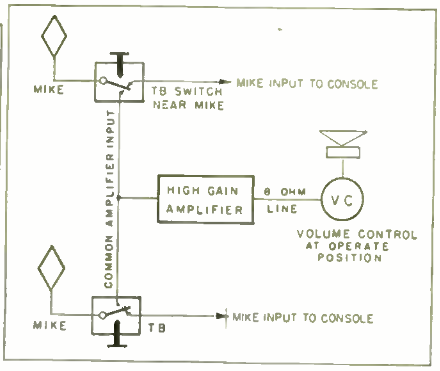
In sequence, the switching operation is this: Normally the mike is connected through to the console input. As the switch lever is operated downward the console input leads are shorted, and then the mike leads are transferred to the input of the talk-back amplifier. Upon release of the lever, normal operation of the circuit is restored. There is a slight click on the TB amplifier speaker when the switch is operated. This is desirable, however, since it identifies the talk-back to the control engineer. There is no click on the air.

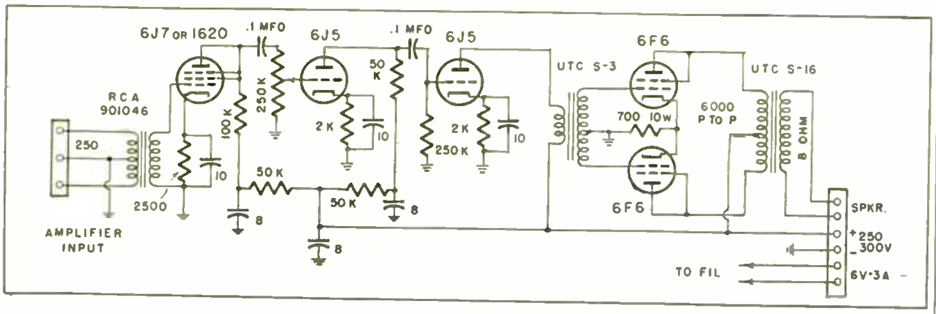
The amplifier used for this service should be crisp and clean in speech reproduction. While no great effort has been made to make this amplifier flat in frequency response, it does have an excellent response characteristic together with low distortion and noise level. No power supply is shown for use with the amplifier since there is usually a power source available that can be tapped for use. If none is available, one can be built easily.

Two talk-back positions are illustrated, but additional ones can be connected to the Amphenol connectors in parallel. The practical limit is determined by the confusion that exists if all the studios start talking to the control room at once.



Above: Detail of talk-back switch wiring. Below: Diagram showing the connections





Circuit diagram of amplifier system designed for use with the talk-back switch arrangement

World Radio History

WHAT THEY SAY ABOUT

Engineer Pay and Job Ratings

THE following group of letters are from readers commenting on our "Engineer Pay" series of articles. Readers also expressed themselves on the differences between "engineers" and "technicians."

SET UP PAY STANDARDS

Here are a few comments on engineering pay, from the viewpoint of one who has migrated from the electrical to the electronic field.

In the past, the usual attitude of front-office executives has been that "an engineer is nothing but an animated adding machine"; "good engineers may be had for a dime a dozen". On the other hand — "A good salesman is worth his weight in gold to our company, and certainly is worth a dozen good engineers or production men."

However, the bewildering pace of modern science and technology and the cramming of 10 or 15 years of progress into five short war years, has placed a premium on skilled engineering talent and developed considerable prestige and respect for the scientist and engineer. Top flight executives now openly admit that a nation's survival in another war will hinge about this nation's scientific and engineering ability, as well as its production potential. They concede also that a modern electronics corporation's leadership in its own field will largely depend upon its basic research and engineering development efforts.

Note that a bricklayer earns up to $3.50 per hour, and a building construction electrician (who may do nothing more than bend and kink conduit) earns up to $2.50 per hour. Some of the professions such as the legal, medical and entertainment fields, earn salaries far and above that of engineering and research workers. Compared on a knowledge, skill and training basis, it can be safely said that engineering talent is underpaid, as a whole—even admitting the fact that some engineers are of pathetic caliber and are prone to some mighty peculiar and unproductive behavior — and also admitting that many executive engineers earn very high salaries.

In looking over the heavy industries and mechanical trades fields, it might be said that one reason for the rise of labor bosses and monopolistic unions has been the labor abuses practiced by many large corporations and the ready acceptance of labor union boss rule by working men in a move for self-protection. The pendulum has swung the other way now and the very labor bosses who so loudly criticized the huge corporations, are now themselves guilty of far more excessive arrogance, greed, monopolistic control and disregard of public interest, which they accused the corporations of being addicted to.

Hence it appears that leaders in the radio and electronics fields might take a long-range view of the engineering and scientific worker pay status situation, set up schooling, experience and ability standards and corresponding rates of pay for the industry as a whole.

Ted Powell
Laboratory Technician
Amplifier Corp. of America, N.Y.C.

BRITISH PAY SCALE

I read with interest the average salary scales of engineers as published in your June issue. I am rather surprised at the figures as they do not compare very favorably with conditions in Great Britain when the relatively high cost of living in the States is taken into consideration.

The position at present is rather difficult to judge owing to the return of engineers who were in the services for a period of years — for these it is difficult to assess to what extent experience must be allowed.

Salary scales in Great Britain vary somewhat, but minimum wages are laid down at 21 by cooperation between the appropriate trade union (The Association of Scientific Workers and the Federation of British Industries). The larger industrial concerns pay slightly above the scales laid down, and on an average would run like this:

Weekly wage for engineering graduates:

At 25 £8—10.
At 30 £10—14.

Levelling off, except for executive positions, at 40.

There is growing a larger tendency to employ graduate engineers in the sales organization sections despite a shortage of trained personnel, and on the whole these are better paid than the research and laboratory grades some of whom are badly underpaid.

Peter E. M. Sharp, A.C.G.I.
Great Britain

REVISE FCC EXAMINATIONS

With reference to the past three articles in TELE-TECH concerning "engineer pay" there are several things that come to my mind. One is the simple word "engineer." First, may I say thanks to Ralph H. Langley, radio consultant, for his very true remarks in the June issue concerning this matter of just who is a radio engineer. My sentiments could never have been spoken plainer.

Since the end of the last war there has been an overflow of men who have studied the present "question and answer" books and have passed the FCC radio exams for commercial licenses. This has caused an influx of licensed personnel not justly qualified. These men consistently call themselves engineers, and I speak here in a general sense, but if they will note printed plainly on their license, it states that it is a radio *OPERATOR* license or permit, and the word "engineering" or "engineer" is never mentioned.

Anyone having the ability to study and a knowledge of mathematics can very easily pass the

World Radio History

Fourth in a series of articles on engineer pay evokes comment here and abroad and precipitates debate on pay scales, FCC examination methods, job ratings of engineers and BC technicians

present FCC examinations qualifying them for "radio engineer" positions. The sooner the FCC starts giving new examinations and requiring practical knowledge the better the commercial radio technician will be. The new license requirements by the Commission, that are now being set up, provide the most beneficial protection that the qualified technical man with the know-how has had for a good number of years. I am satisfied a new FCC program for licenses will weed out the unqualified men and give the man who knows a chance.

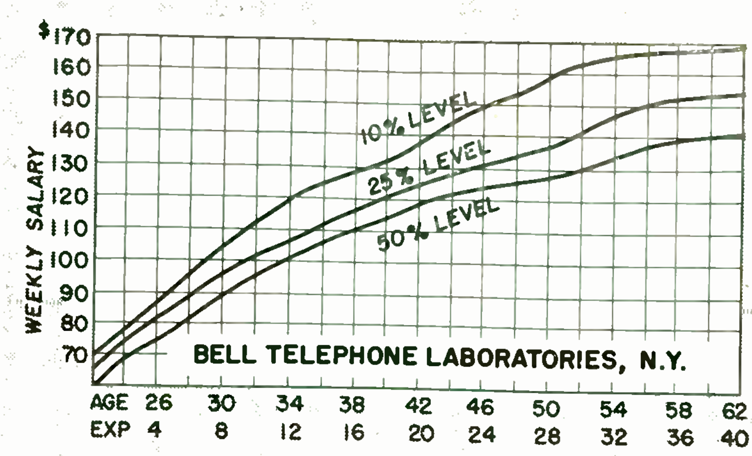
One of the greatest problems now existing in the commercial radio field concerning technical personnel is the misunderstanding by managements of the importance of the technical departments. The sooner management learns that the technical department is one of the most important and essential departments —if not the most—the better all commercial radio will fare.

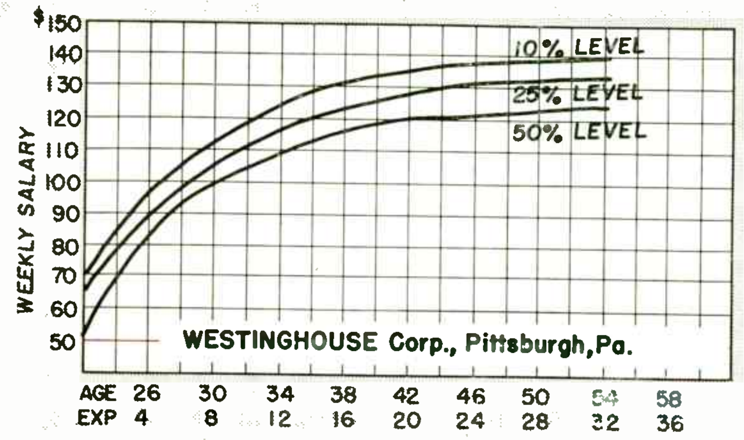
When scaling pay in the technical departments of radio stations the matter of service and time in the field should be taken very seriously into consideration. In grouping any technical staff one should try to vary pay with these qualifications: (1) schooling; (2) practical experience; (3) length of technical service; (4) initiative and ability.

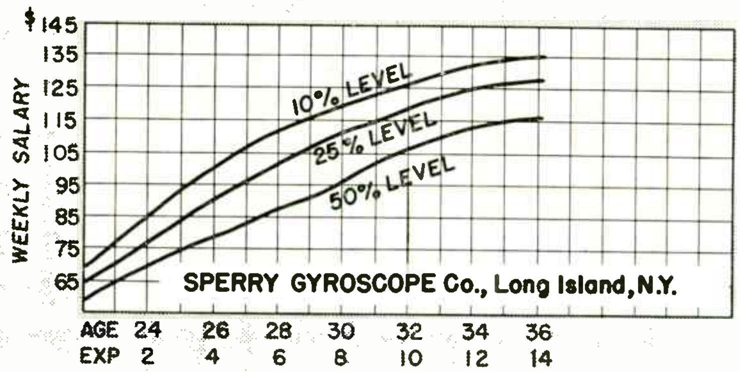
In commercial radio, engineers, as I see it, are not paid adequately. I speak of the word "engineer" in a literal sense in the foregoing statement. As Mr. Langley says, though, in his article of last month, "This situation cannot be cured, however, by putting a price tag on

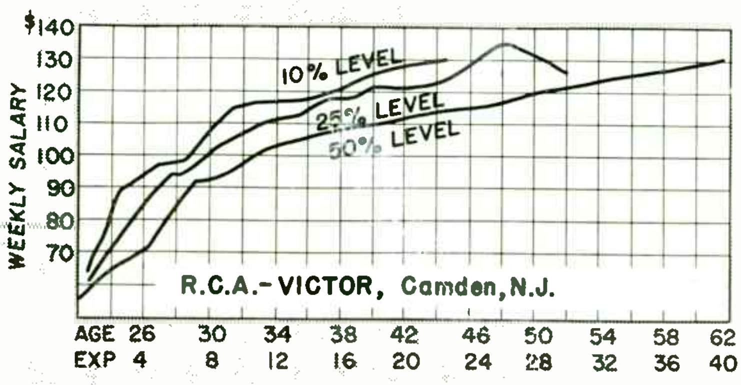
(*Please turn to page* 43)

'Four charts on the right are reprinted from an engineer pay survey conducted by the Eastern Conference Committee of Independent Engineers Organizations among the engineer employees of the companies shown. Tables indicate weekly pay levels by age and experience and indicate the percent of engineer employees in each pay level. The full report was published by the Council of Western Electric Technical Employees, P. O. Box 733, Newark, New Jersey





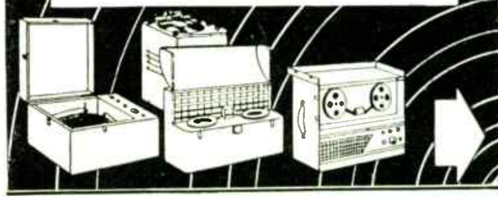




RECORDER SPECIFICATIONS

Home, Commercial and Broadcast Equipment

Compiled exclusively by the editors of Tele-Tech, a Caldwell-Clements publication. Omissions due to space or deadline limitations will be published in a future issue.



REMARKS: Accessory Legend: Amplifier—AMPL; Desired Program Spotter—CT; Equalizer—EQ; Filter—F; Footswitch—FS; Headphones—HP; Microphone—MK; Microscope—M; Speakers—SPK; Spiraling Devices—SP; Suction Equipment—SV; Telephone Pickup Unit—PP; Vibrator Supply—VB; Volume Indicator—VI.

HOME RECORDERS

Manufacturer's Name, Address and Model Number	Type	List Price (Dollars)	Portable	Power Reqd. (Watts)	Disc-Wire-Tape-Film Speed (RPM or Ft./Sec.)	Type Motor Drive	Ampl. Input Level (dbm)	Ampl. Output (Watts)	No. Input Channels	No. Mixing Circuits	Type Recording Head	Input Impedance (ohms)	Frequency Response cps to kc-db	Playback Facility	Cutter Angle Adjustable	Cutter Depth Adjustable	Lines in.; Channels/ Tape; Film Recorded	Disc cut outside in (O-I) Inside out (I-O)	Records both sides	Remarks
Air King Products Co., Inc., 170 53rd St., Brooklyn, N. Y.																				
A750	W	139.50	Yes	75	78	I	(f)				MAG			MAG			1	(f)	No	(f) Phono-Wire Recorder
4700	W	239.50	No	90	78	I	(f)				MAG			MAG			1		No	(f) Radio-Phono-Wire Combination
Allied Recording Products Co., 21-09 43rd Ave., Long Island City, N. Y.																				
Playback and or Recorders	D		Yes	55	33⅓ 78	I	(f)				(h)			(m)			(p)	O-I I-O	Yes	(f) Not Included; (h) (m) CRY or MAG (p) 96;112;120
Amplifier Corp. of America, 396-7 Broadway, New York 13, N. Y.																				
810-B	T	285.00	Yes	135	.63(d)	I	-65	5	2	1	MAG	1800(k)		MAG			2			(d) Has Turntable for Discs; (k) @ 1,000 CPS
910-B	T	459.00	Yes	135	.63(d)	I	-65	5	2	1	MAG	1800(k)	40-10±?	MAG			2		No	(d) Has Turntable for Discs; (k) @ 1,000 CPS
Audar, Inc., Argos, Ind.																				
RE-8	D	129.95	Yes	100	33⅓ 78	I			2		CRY	(k)	5	CRY				O-I	Yes	(k) Equivalent Capacity Appr. 55,000 MMF
RER-9	D	249.95	No	130	78	I			2		CRY	(k)	5	CRY				O-I	Yes	(k) Equivalent Capacity Appr. 55,000 MMF
Audio Industries, 1091 Green St., Michigan City, Ind.																				
PR-7	D	129.95	Yes	70	33⅓ 78	I		4 5	2	0	CRY		50 7 5	CRY	Yes	Yes	120	O-I	Yes	
Aurex Corp., 1117 N. Franklin St., Chicago 10, Ill.																				
(a)	W		Yes	100(c)	1	I	-58	3	2	1	MAG			MAG			1		No	(a) Cavity Recording Method (c) Approximate
	T		Yes	100(c)	.67	I	-58	3	2	1	MAG			MAG						(c) Approximate
Bell Sound Systems, Inc., 555 Marion Road, Columbus, Ohio																				
RC-47	D	150.00	Yes	75	33⅓ 78	I	-45	1	3		CRY	(k)	50 5	CRY	Yes	Yes	120	O-I	Yes	(k) 3,000 MMF Capacity
Brush Development Co., 3405 Perkins Ave., Cleveland, Ohio																				
BK 303	W	795.00	No	132	(d)	I	-44		1		MAG			MAG			1		Yes	(d) Variable
BK 401	T	229.50	No	150	(d)	I	43	1	1	0	MAG			MAG			1		Yes	(d) Variable
BK 403	T	375.00	Yes	150	(d)	I	43	1	2	0	MAG			MAG			1		Yes	(d) Variable
Calbest Engineering & Electronics Co., 828 N. Highland Ave., Hollywood 38, Calif.																				
844	W		No		2	B			1	0	MAG			MAG			1		No	
845	T		No		.67	B			1	0	MAG			MAG			2			
Crescent Industries, Inc., 4132-54 W. Belmont Ave., Chicago 41, Ill.																				
C 1000 (a)	W				2(d)	I					MAG	2240 (k)		MAG(m)			1		No	(m) (a) Chassis Only (d) Uses 78 RPM Disc Turntable (k) @1,000 CPS
E 1000 (a)	W				2(d)	I					MAG	2240 (k)		MAG(m)			1		No	(m (a) Chassis Only (d) Uses 78 RPM Disc Turntable (k) @ 1,000 CPS
Emerson Radio & Phonograph Corp., 111 Eighth Ave., New York 11.																				
529	D	74.95	Yes	90	78	I			2	0	CRY			(m)	Yes	Yes		O-I	Yes	(m) Not Included; Recorder Only
Gilfillan Bros., Inc., 1815 Venice Blvd., Los Angeles, Calif.																				
(a)	W		No								MAG			MAG			1		No	(a) For Radio-Phono-Recorder Combination 108-48C
(a)	W		No								MAG			MAG			1		No	(a) For Radio-Phono-Recorder Combination 68-48C
Harrison Mfg. Co., 1446-48 N. St. Louis St., Chicago 51, Ill.																				
P-59	W	134.50	Yes	85	2	I	87	4 2	2	3	MAG	5000 (k)	100 5±3	MAG			1		No	(k) @ 1,000 CPS
Hoffman Radio Corp., 3761 S. Hill St., Los Angeles, Calif.																				
710	D		Yes	40	78	I	80	3	2	2		3.2	50 5		Yes	Yes	100	I-O		
711	W		Yes	50	2	I	80	3	2	2			50 9				1			
Drawerecorder (a)	D		No							3	MAG			(m)				O-I	Yes	(a) Recorder & Associated Amplifier (m) Not Included
Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids, Mich.																				
Dynaport (a)	W	595.00	Yes		2	I	1 (f)	10			MAG		60-7±3	MAG(m)			1		No	(a) Available as Dynatrope FM-AM-Radio-Phono Combination (f) Push Button Switching (m) Uses CRY for Discs; Acces: HP
Magnecord, Inc., 390 N. Michigan Ave., Chicago, Ill.																				
PT 6-P	T		Yes	110	630-1 25	I		01	4	3	MAG		50-7 5 (r)	MAG			1		No	(r) @ .63 Ft Sec
PT 6-R	T		No	60	630 1 25	I	0	15	2	0	MAG		50-15±2	MAG			1		No	
AudiAd (a)	T		Yes						1		MAG		(r)	MAG			1		No	(a) Repeats Minute Tape Loop (r) Voice Range
Magnetic Corp. of America, 218 S. Wabash Ave., Chicago, Ill.																				
100	W	179.50	Yes	100	2	B	45	4	2	1	MAG		60 6	MAG			1		No	Accessories: AMPL; FS; MK; PP; SP
150	W	285.00	Yes	100	2	I	-45	4	2	1	MAG		40 10	MAG			1		No	Accessories: AMPL; FS; MK; PP; SP
Maguire Industries, Meissner Div., Mount Carmel, Ill.																				
9-1065	D	174.50	Yes	65	33⅓ 78	I	49	4	2	2	CRY	50M (k)	5	CRY	Yes	Yes	120	O-I	Yes	(k) @ 1,000 CPS
Majestic Radio & Television Corp., 900 N. State St., Elgin, Ill.																				
7 YR 752	W	164.95	No	95	78	I	18	1	2	0	MAG	2500 (k)		MAG			1		No	Crystal Playback for Disc; Radio-Phono-Wire Combo; (k) @ 1,000 CPS
7 YR 753	W	169.95	No	95	78	I	18	1	2	0	MAG	2500 (k)		MAG			1		No	Crystal Playback for Disc; Radio-Phono-Wire Combo; (k) @ 1,000 CPS
7 YR 772	W	225.00	No	95	78	I	-18	1	2	0	MAG	2500 (k)		MAG			1		No	Crystal Playback for Disc; Radio-Phono-Wire Combo; (k) @ 1,000 CPS

World Radio History

Miles Reproducer Co., 812 Broadway, New York 3, N. Y.																				
MRC	F	250.00	Yes	75	.4(d)	D'T	120	4	2	2	MAG	500	75 7	MAG	Yes	Yes	200		Yes	(d) 200 Hrs. Recording Time 16 MM Film
HM	F	750.00	Yes	125	.4(d)	D'T	-120	4	2	2	MAG	500	75 7	MAG	Yes	Yes	200		Yes	(d) 88 Hrs. Recording Time 16 MM Film
FR	F	890.00	Yes	125	.4(d)	D'T	-120	4	2	2	MAG	500	75 7	MAG	Yes	Yes	200		Yes	(d) 3 Hrs. recording on loop of film
CMT	F	1485.00	Yes	125	.4(d)	D'T	-120	4	2	2	MAG	500	75 7	MAG	Yes	Yes	200		Yes	(d) 24 Hrs. recording on loop of film
Molded Insulator Co., 335 E. Price St., Philadelphia, Pa.																				
MR-6	W	149.50	Yes	85	2	I	2	2	3	0	MAG		50-7	MAG			1		No	Export Models Available
Packard Bell Co., 3443 Wilshire Blvd., Los Angeles, Calif.																				
PhonOcord 1273	D	425.00	No	110	78	I	3	9	3	2	MAG	4		CRY	Yes	Yes	112	I-O	Yes	
PhonOcord 1472	D	595.00	No	188	78	I	3	15	4	3	MAG	4		CRY	Yes	Yes	112	I-O	No	
PhonOcord 1052	D	189.50	Yes	90	78	I	3	4.5	3	2	MAG	4		CRY	Yes	Yes	112	I-O	No	
PhonOcord 4580 TY	D	1295.00	No	480	33⅓ 78	I	3	24	4	3	MAG	4		CRY	Yes	Yes	112	I-O	No	
Peirce Wire Recorder Corp., 1328 Sherman Ave., Evanston, Ill.																				
55 B	W	400.00	Yes	110	2.5	B	-58	5	2		MAG			MAG			1		No	Accessories: FS; PP
Pentron Corp., 611 W. Division St., Chicago, Ill.																				
748	W	199.50	Yes	150	78	I		4	1	0	MAG	5000	100-7.5	MAG(m)			1		No	Accessories: HP; PP (m) Cry. Playback for Disc; Radio-Phono-Wire Combo.
Precision Audio Products, Inc., 1133 Broadway, New York, N. Y.																				
Wiremaster 1 A	W	295.50	Yes	180	(d)	I	-75	6	3	4	MAG	1000					1		No	(d) 78 RPM Turntable for Recording Disc to Wire
Premier Electronics Labs., 382 Lafayette St., New York, N. Y.																				
PR 10	W	269.75	Yes	130	78			10	4	4	MAG	3000(k)	40 10	MAG			1		No	Includes Broadcast Tuner and Disc Turntable; (k) @ 1,000 CPS
Radio Development & Research Corp., 26 Cornelison Ave., Jersey City 4, N. J.																				
1000	T	575.00	No	160		B	-45	8	1		MAG	200.	40-10±5 50-15±1	MAG			1		No	Uses Tape Loaded Magazine
Rek-O-Kut Co. Inc., 38-01 Queens Blvd., Long Island City, N. Y.																				
The Challenger	D	319.95	Yes	80	33⅓ 78	(c)		12	3		MAG	8	(r)	CRY	Yes	Yes			Yes	(c) Recorder Driven by Turntable (r) Ampl. Response
Simpson Mfg. Co., Mark, 32-28 49th St., Long Island City, N. Y.																				
RK-5	D	140.00	Yes	75	33⅓ 78				3	1	CRY			CRY		Yes		O-I	Yes	
RK 5M	D	145.00	Yes	75	33⅓ 78				3	1	MAG			CRY		Yes		O-I	Yes	
Speak-O-Phone, 23 W. 60th St., New York, N. Y.																				
HR 48	D	159.00	Yes	200	33⅓ 78	I	-4	5	2	2	CRY	60M	50-5	CRY	Yes	Yes	112	I-O O-I	Yes	Accessories: HP; MK
Universal Microphone Co., 424 Warren Lane, Inglewood, Calif.																				
RC	D	59.50	(b)	20	78	I	(f)				MAG	3.2	50-6	CRY	No	Yes	110	I-O		(b) Chassis Type (f) Ampl. Not Included
Wagner Recorder Mfg. Corp., 292 Madison Ave., New York, N. Y.																				
Wagner-Nichols P 14	D	500.00	Yes	60	14	B	-52	2	1	1	CRY	(k)	50-6±3	CRY (m)	No (n)	No	416	O-I	Yes	(k) Equiv. Capacity Appr. 1700 MMF (m) Uses 1 Cry. Playback and Record (n) Embossing
Wagner-Nichols TMP-1	D	159.95	Yes	60	33⅓	B	-52	2	1	1	CRY	(k)	50-6±3	CRY (m)	No (n)	No	416	O-I	Yes	(k) Equiv. Capacity Appr. 1600 MMF (m) Uses 1 Cry. Playback and Record (n) Embossing
Webster-Chicago Corp., 5610 Bloomingdale Ave., Chicago, Ill.																				
78	W	149.50	Yes	65	2	I			2	0	MAG	13,000		MAG			1		No	Accessories: AMPL
80	W	149.50	Yes	65	2	I		2½	2	0	MAG	13,000		MAG			1		No	Accessories: AMPL; VI
81	W	149.50	Yes	65	2	I		2½	2	0	MAG	13,000		MAG			1		No	Accessories: AMPL; VI
Webster Electric Co., Clark & DeKoven Ave., Racine, Wisc.																				
101	T	395.00	Yes	125	.63	I		5	1		MAG			MAG			1		No	
Western Sound & Electric Labs., 805 S. Fifth St., Milwaukee, Wisc.																				
R 2	D	59.50	Yes	17	33⅓ 78	D'T					CRY	8	-5	CRY			100	O-I	Yes	
Wilcox-Gay Corp., Charlotte, Mich.																				
Duo-Corder 6A10	D	149.50	Yes	80	33⅓ 78	I	-63		3	0	CRY	(k)	50-3.5±3	CRY	Yes	Yes	119	O-I	No	(k) Equiv. Capacity 3000 MMF
Recordette 8J10	D	89.95	Yes	75	78	I	-40		2	0	CRY	(k)	120-2.5±3	CRY	Yes	Yes	119	O-I	No	(k) Equiv. Capacity 1000 MMF
Recordio 8T11	T	249.50	Yes	105	.62	B	-51		3	0	MAG	1,000	70-8±3	MAG			1		No	Accessories: SPK
Towne 7D44	D	409.50	No	155	78	I	-58		2	0	CRY	(k)	50-3 5±3	CRY	Yes	Yes	119	O-I	No	(k) Equiv. Capacity 3000 MMF
WiRecorder Corp., 7055 Intervale Ave., Detroit 4, Mich.																				
PA	W		Yes				(f)				MAG	2200(k)	100-6	MAG			1		No	(f) Recording Unit Only (k) @ 1000 CPS
Wire Recording Corp. of America, 76 Varick St., New York 13, N. Y																				
Wireway WP	W	149.50	Yes	100	78	I	-58				MAG	2000	80-6 5	MAG(m)			1		No	(m) Cry. Playback for Disc.; Accessories: CT; FS; HP; PP

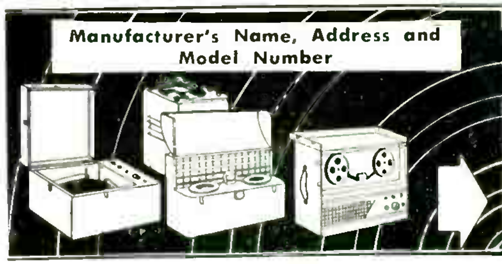
COMMERCIAL—RECORDING EQUIPMENT

Berndt-Bach, Inc., 7377 Beverly Blvd., Hollywood, Los Angeles 36,																				
Auricon-Pro CM 71	F	1095.00	Yes	20	(d)	D'T(e)	-70	5	2	2	(h)	50	30-8						No	(d) 24 Frames/Sec. (e) Gear Drive (h) Galvanometer
RT-80	F	858.00	Yes	20	(d)	D'T(e)	-70	.5	2	2	(h)	50	30-8						No	(d) 24 Frames Sec. (e) Gear Drive (h) Galvanometer
Television Transcription Camera	F	8000.00	Yes	50			-70		2	2	(h)	50	30-10						No	(h) Galvanometer
Dictaphone Corp., 420 Lexington Ave., New York 17, N. Y.																				
A 2M	(t)	925.00	No	145		B	-80	2	3	0	MAG	8	100-	CRY			200		No	(t) Plastic Belt Recorder
Time Master "A"	(t)	350.00	Yes	70	94	B					MAG			CRY			200		No	(t) Plastic Belt Dictaphone
Time Master Inventory Recording Machine	(t)	575.00	Yes	70 (c)	47	B			1		MAG			CRY			200		No	(t) Plastic Belt Dictaphone (c) AC Only
Gray Mfg. Co., 16 Arbor St., Hartford, Conn.																				
Audograph BIC	D	356.77	Yes	80		B	0	2	1		MAG		300 3	MAG		(o)	260	I-O	Yes	(o) Dictaphone-Embossing Recorder
Audograph BIXD	D	318.57	Yes	70		B	0		1		MAG		300-3	MAG		(o)	260	I-O	Yes	(o) Dictaphone-Embossing Recorder
Hart & Co., Inc., Frederick, 837 Main St., Poughkeepsie, N. Y.																				
Hartron 60	F	695.00	Yes	130	.5-1	B	-58	3	3	0	MAG	6	100-5	(m)	(n)		120		No	(m) Variable Reluctance (n) Embossing; Accessories: FS; HP; PP
Hartron VRF-3	F	890.00	Yes	120	.5-1	B				0	MAG	6	300-4.5	(m)	(n)		120		No	(m) Moving Coil (n) Embossing; Accessories: FS. HP; PP
Maurer, Inc., J. A., 37-01 31 St., Long Island City, N. Y.																				
10	F	4775.00	Yes	325			-72	.5	4	4	(h)	50	0-12				1		No	(h) Rec. Head Mirror Galvanometer
Nemeth, Inc., Otto R., 543 Diversey Parkway, Chicago 64, Ill.																				
Master Wire Recorder	W		No								MAG		40-15±1.5	MAG			1		No	
Press Wireless, Inc., Hicksville, N. Y.																				
Candid Recorder (a)	W	2.50	Yes	40	.21	D'T(e)	(f)				MAG	2000	200-3				1		No	(a) Concealable Unit (e) Mechanically Driven (f) Recorder Only
Candid Recorder Playback	W	150.00	Yes	60	.21	D'T	-35	1	1	0	MAG	2000	50-5	MAG			1		No	
Soundscriber Corp., The, 146 Munson St., New Haven 4, Conn.																				
Desk Model Recorder-Reproducer RH	D	315.45	Yes	50	33⅓	D'T	-75	3	1		MAG	4	(r)	DYN	(n)		220	O-I	Yes	(r) Speech Range (n) Embossing Recorder; Accessories: MK; PP; AMPL; HP
Portable Dual Recorder-Reproducer D	D	707.91	Yes	76	33⅓	D'T	-75	3	1		MAG	4	(r)	DYN	(n)		220	O-I	Yes	(r) Speech Range (n) Embossing Recorder; Accessories: MK; PP; AMPL; HP
Portable Recorder-Reproducer PX	D	324 94	Yes	50	33⅓	D'T	-75	3	1		MAG	4	(r)	DYN	(n)		220	O-I	Yes	(r) Speech Range (n) Embossing Recorder; Accessories: AMPL; HP MK; PP

B—Belt; CRY—Crystal; D—Disc; D'T—Direct; F—Film; I—Idler; MAG—Magnetic; T—Tape; W—Wire   (a), (b), (c), (d), (e), (f), (g), (h), (k), (m), (n), (o), (p), (q), (r), (s), (t): Refer to Remarks Columns.

(Turn to Next Page)

World Radio History



BROADCAST RECORDING EQUIPMENT

Manufacturer's Name, Address and Model Number	Type	List Price (Dollars)	Portable	Power Reqd. (Watts)	Disc-Wire-Tape-Film Speed (RPM or Ft./Sec.)	Type Motor Drive	Ampl. Input Level (dbm)	Ampl. Output (Watts)	No. Input Channels	No. Mixing Circuits	Type Recording Head	Input Impedance (ohms)	Frequency Response cps to kc-db	Playback Facility	Cutter Angle Adjustable	Cutter Depth Adjustable	Lines/in.; Channels/Tape; Film Recorded	Disc cut outside in (0-I) Inside out (I-O)	Records both sides	REMARKS
Ampex Electric Corp, 1115 Howard Ave., San Carlos, Calif. 200A	T	[illegible]	No	575	2.5	DT	4	[illegible]	1	0	MAG		30-15±1	MAG			1		No	Design for FM Broadcasting
Collins Radio Co., Cedar Rapids, Iowa 215 A-1	D					[illegible]	(f)				MAG	15	50-10±2		Yes	Yes	120	I-O O-I	Yes	(e) Turntable Driven (f) Not Included—Recorder Attachment Only
Ellinwood Industries, 150 W. Slauson Ave., Los Angeles, Calif RA 116	D		Yes	150	33⅓ 78	B		10	4	2	MAG		50-7	CRY	Yes	Yes	(p)	O-I I-O	Yes	(p) 96; 112; 120; 136
Fairchild Camera & Instrument Corp., 88-06 Van Wyck Blvd. Jamaica, N. Y. 523-JI	T	2585.00	No	[illegible]	33⅓ 78	DT	(f)				MAG	500	30-9		Yes	Yes	80-160	O-I I-O	Yes	(f) Recorder Only Accessories Included Accessories: AMPL; EQ
539-G1	D	[illegible]85.00	Yes	[illegible]	33⅓ 78	DT	(f)				MAG	500	30-9	DYN	Yes	Yes	(p)	O-I I-O	Yes	(f) Recorder Only (p) 96; 112; 120; 136; Accessories: AMPL; EQ; M; SP
539-KI	D	1395.00	No	100	33⅓ 78	DT	(f)				MAG	500	30-9	DYN	Yes	Yes	(p)	O-I I-O	Yes	(f) Recorder Only (p) 96; 112; 120; 136 Includes Accessories Accessories: AMPL; EQ
Gates Radio Co, Quincy, Ill. CB-8R	D	[illegible]35.00	No		33⅓ 78		(f)								Yes	Yes			Yes	(f) Recorder Only
Presto Recording Corp., P. O. Box 500, Hackensack, N. J. 6-N	D	735.00	Yes	[illegible]	33⅓ 78	I	(f)				MAG	(k)	50-10	MAG	Yes	Yes	(p)	O-I I-O	Yes	(f) Not Included (k) 15 & 500 (p) Variable; Acessories: AMPL
8-D	D	1[illegible]52.00	No	[illegible]	33⅓ 78	I	(f)				MAG	(k)	50-10	MAG	Yes	Yes	(p)	O-I I-O	Yes	(f) Not Included (k) 15 & 500 (p) Variable; Accessories: AMPL
8-N	D	1[illegible]83.00	No	[illegible]	33⅓ 78	I	(f)				MAG	(k)	50-10	MAG	Yes	Yes	(p)	O-I I-O	Yes	(f) Not Included; (k) 15 & 500 (p) Variable; Accessories: AMPL
K-8	D	348.00	Yes	[illegible]	33⅓ 78		-52	.6	1		MAG	8	50-8	MAG	Yes	Yes	112	O-I I-O	Yes	
Radio Corp. of America, RCA Victor Div., Camden, N. J. 73-B	D	1[illegible]50.00	No	[illegible]	33⅓ 78	I					MAG	15	30-10±2	CRY MAG	Yes	Yes	(p)	O-I I-O	Yes	(p) 96 to 152 Accessories: AMPL; EQ; FL; SU
MI-12775	W	130.00	Yes	[illegible]	2	D	-30	3	1		MAG	250	30-10±2	MAG			1		No	Accessories: AMPL; EQ; FL; SU
Rangertone, Inc., 73 Winthrop St., Newark 4, N. J R4	T	3000.00	Sem.	250	2.5	D T	-20	.001	1		MAG	500	30-16±2	MAG			1		No	Console Model R4 $3250
Robinson Recording Laboratories, 2022 Sansom St., Philadelphia 3, B	D	8[illegible]0.00	(b)	70	33⅓ 78	B	-20	10	1	0	MAG	500	50-9		Yes	Yes	(p)	O-I I-O	Yes	(b) Portable, Non Portable (p) 88; 96; 112; 128; 136; Includes Spiraling Mechanism

TRANSCRIPTION TURNTABLES

Manufacturer's Name, Address and Model Number	Type	List Price (Dollars)	Portable	Power Reqd. (Watts)	Disc-Wire-Tape-Film Speed (RPM or Ft./Sec.)	Type Motor Drive	Ampl. Input Level (dbm)	Ampl. Output (Watts)	No. Input Channels	No. Mixing Circuits	Type Recording Head	Input Impedance (ohms)	Frequency Response cps to kc-db	Playback Facility	Cutter Angle Adjustable	Cutter Depth Adjustable	Lines/in.; Channels/Tape; Film Recorded	Disc cut outside in (0-I) Inside out (I-O)	Records both sides	REMARKS
Collins Radio Co, Cedar Rapids, Iowa 213 A-5					33⅓ 78	I	(f)							(r)						(f) Full Speed ⅓ revolution (r) Western Electric or RCA
Gates Radio Co., Quincy, Ill. CB-11 (a)		158.00			33⅓ 78	I	(f)							(r)						(a) 17-in. record platter (r) Vertical-Lateral Reluctance Types (c) 1/40 HP Sync Motor (f) Full Speed ⅛ Revolution
Presto Recording Corp., P.O. Box 500, Hackensack, N. J. 10 A (a)		(c)		50	33⅓ 78	(g)														(a) 16-in. record platter (c) Chassis only (g) Rim drive
62 A (a)					33⅓ 78	(g)								MAG						(a) 16-in. record platter (g) Rim drive
64 A				75	33⅓ 78	(g)														(g) Gear drive
Radio Corp of America, RCA Division, Camden, N. J 70 D				35	33⅓ 78	DT								(r)						(r) Ribbon Type (a) 15½-in. record platter (f) Full Speed ¼ Revolution
Rek-O-Kut Co., Inc., 38-01 Queens Blvd, Long Island City 1, N. Y G 2 (a)					33⅓ 78		(f)							(r)						(r) Western Electric 9a
Robinson Recording Laboratories, 2202 Samson St., Philadelphia 3 Pa		375.66			33⅓ 78	B	(f)							(r)						(f) Full Speed ¼ Revolution (r) Reluctance Type (a) 16-in. record platter (c) 1/15 HP Sync Motor
Western Electric Co., 195 Broadway, New York 7, N. Y. 1504 A (a)					33⅓ 78	B	(f)							(r)						(f) Full Speed 1/9 Revolution (r) Western Electric 9

B—Belt; CRY—Crystal; D—Disc, D T—Direct, F—Film; I—Idler; MAG—Magnetic; T—Tape, W—Wire (a), (b), (c), (d), (e), (f), (g), (h), (k), (m), (n), (o), (p), (q), (r), (s), (t): Refer to Remarks Columns

Accessory Legend: Amplifier—AMPL; Desired Program Spotter—CT; Equalizer—EQ; Filter—F; Footswitch—FS; Headphones—HP; Microphone—MK; Microscope—M; Speakers—SPK; Spiraling Devices—SP; Suction Equipment—SV; Telephone Pickup Unit—PP; Vibrator Supply—VB; Volume Indicator—VI.

AUXILIARY EQUIPMENT

Telex, Inc., 1633 Eustis St., St. Paul, Minn.; **Telex Monoset**, Magnetic Type: $12.50, accessories extra

RECORDING DISC MANUFACTURERS

Advance Recording Products Co, Long Island City; **Aim Industries**, New York; **Allied Recording Products Co.**, Long Island City; **Audio Devices Inc.**, New York; **Carlton Co.**, Los Angeles; **Duotone Co.**, New York; **Gould Moody Co.**, New York; **Mirror Record Corp.**, New York; **Presto Recording Corp.**, Paramus, N. J.; **Recordisc Corp.**, New York; **Recotone Corp.**, New York; **Reeves Soundcraft Corp.**, New York; **Sonic Recording Products Inc.**, Freeport, N. Y.; **Sound Devices Co.**, New York; **Wilcox-Gay Corp.**, Charlotte, Mich.; **Willson Magazine Camera Co.**, Philadelphia; **Zephyr Products Corp.**, New York.

RECORDING TAPE MANUFACTURERS

Airdesign Inc., Upper Darby, Pa.; **Ampex Electric Corp.**, San Carlos, Cal.; **The Brush Development Co.**, Cleveland; **Cinema Engineering Co.**, Burbank; **Controls Labs. Inc.**, Worcester, Mass.; **Hastings Instrument Co.**, Hampton, Va.; **Indiana Steel Products Co.**, Chicago; **Miles Reproducer Co.**, New York; **Minnesota Mining & Mfg Co.**, St. Paul; **Molded Insulation Co.**, Philadelphia; **Rangertone Inc.**, Newark, N. J.; **Rowe Industries**, Toledo.

RECORDING WIRE MANUFACTURERS

National Steel Co., Pittsburgh; **Allegheny Ludlum Steel Corp.**, Breckenridge; **Permo, Inc.**, Chicago; **Spencer Wire Co.**, W. Brookfield, Mass.; **Webster-Chicago**, Chicago 39.

 (Continued from page 39)

each job." After the new FCC license program gets underway I think this situation will more or less have a tendency to even itself out.

B. G. Haire
Chief Engineer
Station WHIT, New Bern, N. C.

FCC RULE ON ENGINEERS

Radio technology constantly advances while requirements for broadcast operators remain static. I am glad TELE-TECH is dragging the subject out into the light. The classification of "engineers" and standards of pay could be improved by better FCC examination requirements for engineers. The newly proposed regulations are no improvement. I refer to a clause in the appendix which reads in part:

> Broadcast-engineer operator license:
>
> (1) . . . this class of license will be granted without further examination to any operator who presents satisfactory evidence of having had at least four years' experience in the aggregate in a standard, FM, facsimile television or international broadcast station, of which at least two years' experience in the aggregate shall have been within five years immediately preceding the date of application.

This proposed broadcast engineer operator license appears good from the examination viewpoint. However, the provision that four years' service will do in lieu of examination largely cancels raising of standards for operators in more responsible positions. Too many men, having gotten their first class license, put aside their textbooks and do a minimum of work, with the result that at the end of four years they know less of radio than when originally licensed.

K. Winston Bugg
Station WSFA, Montgomery, Ala.

ENGINEER VS TECHNICIAN

In reading the article "How Much Pay Is an Engineer Worth?" I noted the confusion which seems to exist in the minds of your writers. Most of the operating personnel in radio stations are not strictly speaking professional engineers but simply skilled technicians. Why are their salaries compared to professional engineers. . . . ?

It seems that it is about time that the use of the term "engineer" be restricted to the professional engineers only. Most of the states have registration laws which try to limit or bar the use of the word "engineer." You should try to prevent instead of furthering the existing confusion.

Edgar A. Harty
Marblehead, Mass.

ALLOWABLE SALARY RATES; OCCUPATIONS COVERED BY ASSN. OF PROFESSIONAL ENGINEERING PERSONNEL

Occupation	*Allowable Salary Rates* Minimum Wkly.	Minimum Semi-Monthly	Maximum Wkly.	Maximum Semi-Monthly
Engineer—Analysis, Design, Development, or Research—Class AA		218.83*		367.83*
Engineer—Analysis, Design, Development, or Research—Class A	76.24			242.36*
Engineer—Analysis, Design, Development, or Research—Class B	56.62		83.36	
Engineer—Analysis, Design, Development, or Research—Class C	52.00		61.99	
Engineer, Student	52.00		59.62	

*These salary rates are shown on a semi-weekly basis since salaries in excess of $96.14 per week are paid on a semi-monthly basis.

SUPPLY AND DEMAND

In a preliminary report issued in June, 1947, a committee of the American Society for Engineering Education presented its findings on the supply and demand for engineers over the next six years. Surveying engineering student registrations in the United States and the needs of industry, government, and other employers, the committee gave the balance of supply versus demand as follows:

Year	*Demand* Industry	*Demand* Gov't.	*Colleges*	*Total Demand*	*Supply*	*Shortage or Surplus*
1947	33,200	3,000		36,200	23,000	—13,200
1948	30,800	3,000	1,745	35,545	31,000	— 4,545
1949	28,200	3,000	1,565	32,765	36,000	+ 3,235
1950	26,900	3,000	1,130	31,230	58,000	+26,770
1951	26,100	3,000	1,160	30,260	54,000	+23,740
1952	25,800	3,000	1,100	29,900	—	—

FORMAL EDUCATION

	Bachelor's Degree	*Incomplete College Training*	*No College Training*
Bell Telephone Laboratories' Engineers	88%* *23% have Master's Degree * 8% have Doctor's Degree	8%	4%
Western Electric Engineers	73%* *9% have Master's Degree *.5% have Doctor's Degree	20%	7%

The three tables above: Allowable Salary Rates, Supply and Demand, Formal Education are reprinted from an engineer pay and employment study conducted by the Eastern Conference Committee of Independent Engineers Organizations and is published by the Council of Western Electric Technical Employees, Newark, N. J. Pay scale is based on CWETE pay contracts

World Radio History

Wideband Antenna Design

1 to 25 mc band uses double wire delta type antenna. Described at the URSI-IRE

NEW data on antenna design resulting from experiments in radiating pulses from vertical incidence ionospheric sounding was presented in a paper by H. N. Cones, National Bureau of Standards Central Radio Propagation Laboratory, before the recent URSI-IRE meeting in Wash., D. C. The paper was entitled "Experimental Broad-Band Antennas for Vertical Incidence Ionosphere Sounding".

Uniformity of impedance and maximum radiation efficiency was required over the continuous band from 1 to 25 mc. For ionosphere work a delta-type antenna, shown in Fig 1 has advantages. However, the single-wire delta varies as much as 300 ohms to 1200 ohms in impedance over the desired range of frequency.

Experiment showed that when the single wire was replaced by 4 No. 18 wires, in groups of two and the groups separated by 16 in. in the horizontal portion and the wires in the oblique portion were fanned-out by 3 ft. at the base, the variation of impedance was a minimum and of such value that a transmission line could be matched to it so that satisfactory operation could be obtained. Fig. 1 shows the experimental steps which lead up to this design. In Fig. 2 the impedance curve resulting from each change in wire-spacing is illustrated. It is interesting to note that the curves in Fig. 2 were made by the balanced recording impedance meter developed at the NBS and described at the Winter 1946-47 IRE Convention.

To obtain somewhat higher radiation efficiency a W-type antenna

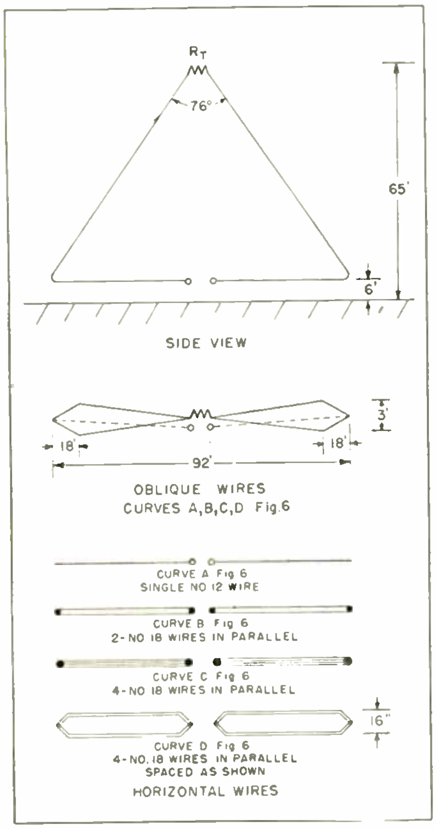


Fig. 1: Multiple-wire, delta-type antenna

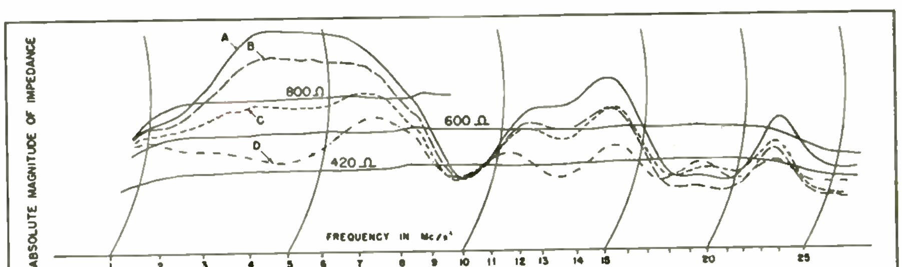


Fig. 2: Impedance curve of delta type. Each antenna terminates with 800 ohm resistor

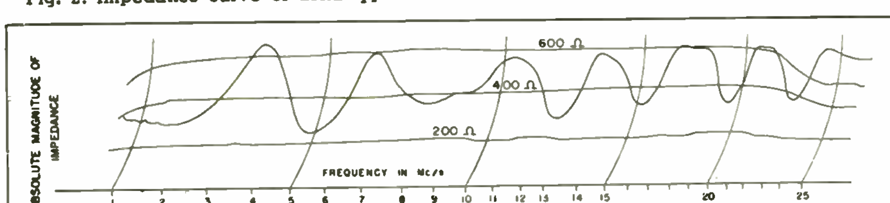


Fig. 4 (above): Impedance of multiple-wire antenna for optimum termination of 1000 ohms

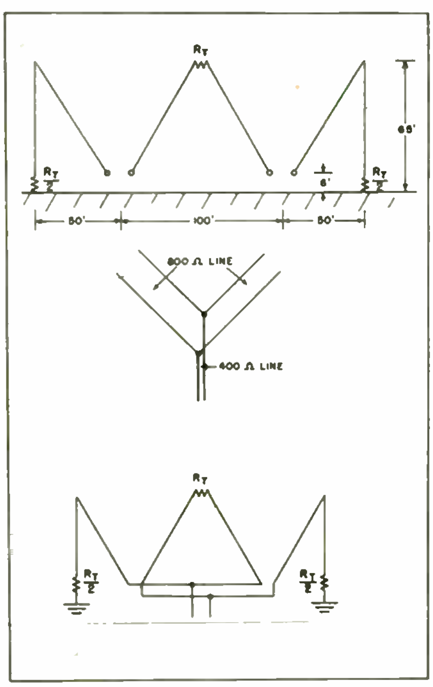


Fig. 3: Antenna and transmission line design

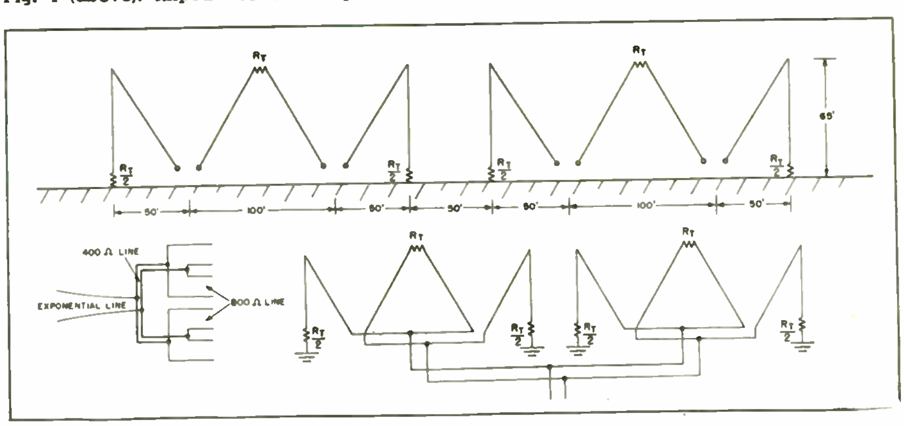


Fig. 5 (right): Construction of double antenna and associated transmission line system

can be used. This is shown in Fig. 3. More space and more supports are required for this type antenna. The impedance characteristic is shown in Fig. 4. Over most of the range the variation is not over 2 to 1. A double W-antenna was also tried. It's calculated efficiency was 39%. In this case the input impedance to the antenna array was 200 ohms, whereas the 10 kw transmitter required a 600-oms impedance. The solution here was the construction of an exponential-line transformer with a length of 88 meters and a cut-off frequency of .300 mc.

By the use of multiple wires a delta-type of antenna can be built which will have a satisfactory impedance characteristic over the range from 1-25 mc. The size and spacing of the wires parallel with the ground have a decided effect on the input impedance. The impedance variations of a double W-type of antenna are about the same as the single wire delta-W-type antenna, however the former affords higher radiation efficiency than the single-wire delta-type antenna, especially at the lower frequencies.

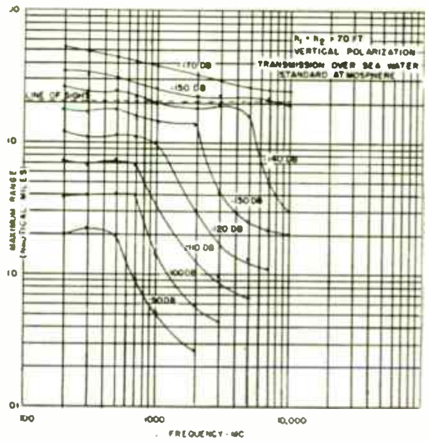
Radio Attenuation

Data for radio link designs employing frequencies from 200 to 10,000 mc was presented at recent URSI-IRE

INFORMATION helpful to those designing radio links employing frequencies from 200 to 10,000 mc are found in the accompanying curves. Note that they are limited to vertical polarization and transmission over sea water. This interesting data was presented by Harold J. Peake of the Naval Research Laboratory in his report "Calculation of the Attenuation of Electrical Field Strength" before the URSI-IRE meeting in Washington, DC.. in May.

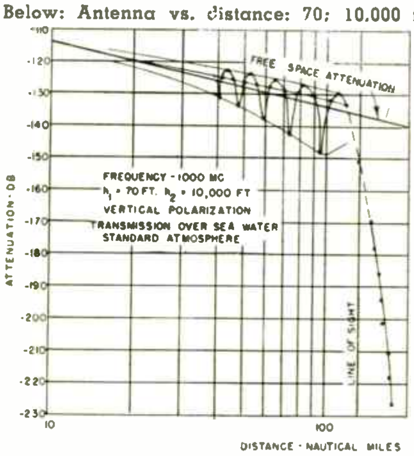
The three basic equations which cover the three regions discussed are: (1) The Interference Region (well within the line-of-sight); (2) The Horizon, (radio line-of-sight); (3) The Diffraction Region, (well beyond the line-of-sight). Norton's curves cover (1) and (3) and Pekeris covers (2).

A second part of Peake's report shows curves of the type illustrated which cover the frequencies 200 to 10,000 mc; antenna heights 30 and 70 ft., 70 and 70 ft., and 70 and 10,000 ft. From such curves the engineer can get data for other curves of different parameters. A study of the illustrated attenuation characteristics shows that an upper frequency limit exists for communication systems if they must operate within the line-of-sight and with a maximum specified attenuation.

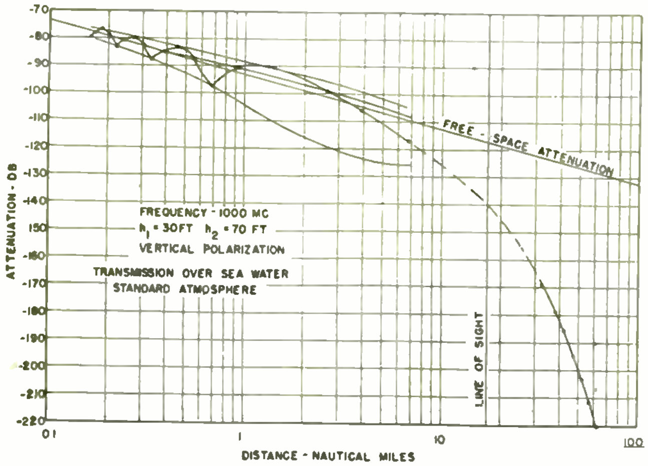


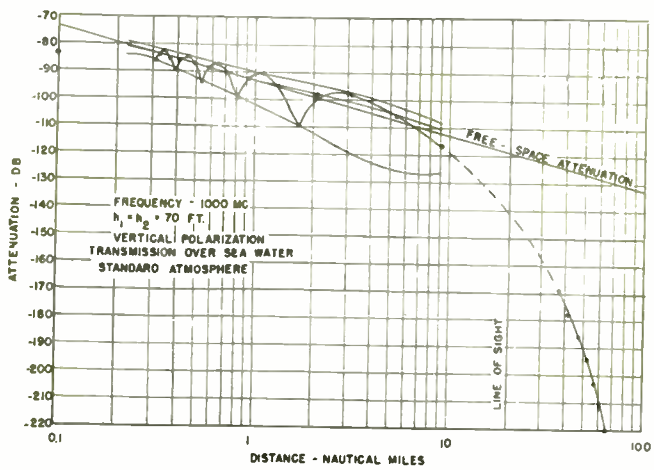
Above: Curves show range vs. frequency

Below: Antenna vs. distance: 70; 10.000 ft.



Attenuation between half-wave antennas vs. distance at antenna heights of 30 and 70 ft (left) and 70 and 70 ft (right)





World Radio History

WASHINGTON NEWS LETTER

TV CHANNELS UNCHANGED—The radio manufacturing industry has been assured by FCC Chairman Wayne Coy that television channels 2 to 13 will not be renumbered without careful consideration by the Commission, together with a full hearing and notice to the public. There is no present prospect that the FCC will take such a renumbering step because of the loss to television of channel No. 1 to give more spectrum space to the safety-emergency radio services like police, fire, forestry, etc. This advice was given the radio manufacturing industry in a letter from Chairman Coy to Bond P. Geddes, executive vice-president of the Radio Manufacturers Association. Meanwhile, the FCC staged a lengthy hearing in early July on its plan to expand the number of television channels allocated to cities and communities and some 125 television broadcasters participated in the proceedings. See page 33.

NEW CHAIRMAN IF G.O.P. VICTORY; FIRST WOMAN COMMISSIONER—If the November election produces a Dewey-Warren victory, look for a new FCC Chairman after Jan. 20—it will undoubtedly be former Republican Congressman from Ohio Robert F. Jones who has been on the Commission since September, 1947, and has exhibited marked ability in his decisions on communications and radio cases. Meanwhile, FCC gained its first feminine Commissioner, 43-year-old Miss Frieda Hennock, a New York corporation lawyer and active Democratic party city and state worker. She was confirmed as the final act of the 80th Congress and, incidentally, was one of the very few Truman appointees for a new government post sanctioned by the Senate.

NEW INDUSTRIAL MOBILE RADIO SERVICES SET UP BY FCC—Featured by the proposal to establish three new mobile radio service categories for the power utilities, petroleum and forest products industries, the FCC proposed frequency allocations, which are slated to become effective in final form by the end of this year, have stepped up the already-present spectacular advance of these services. There will be lengthy hearings, it is certain, during September on the various proposed allocations as the railroads are fighting the plan to remove 19 of their 60 channels due to alleged non-use, the telephone companies are dissatisfied with their allocation blueprint and the police radio services are upset over the provision against interference with maritime mobile frequencies. Of the spectrum allocations to the safety-special radio services—the safety group (police, fire, forestry and highway maintenance) received 50 percent; the industrial radio category (power utilities, petroleum, forest products and miscellaneous non-common carrier) got 35 percent; and the land transportation (taxicab, bus, truck, transit) 15 percent.

ARMED SERVICES PROCUREMENT—The radio-electronics manufacturing industry was the first industry in the United States to appoint a committee to survey its specific place in the mobilization picture. After its appointment by President Max Balcolm of the Radio Manufacturers Association, the eight-member committee, which is headed by Western Electric vice-president Fred R. Lack, held several sessions in July with the Communications-Electronics Committee of the U. S. Munitions Board, a body representing the Army Signal Corps, Air Force, Navy and Marine Corps, of which Col. Fred W. Kunesch of the Signal Corps is chairman.

The RMA committee is formulating a mobilization plan in which both large and small manufacturers can secure contracts under the $205.5 million procurement program of the armed services during the current fiscal year (July 1, 1948-June 30, 1949), and under which the least impact possible can occur for civilian radio-electronic production, particularly television transmitter and receiver output.

Other members of the RMA committee, besides chairman Lack, included Paul V. Galvin, president of Motorola and wartime president of the RMA; Frank M. Folsom, executive vice-president of the RCA-Victor Division; Harry A. Ehle, vice-president of the International Resistance Co.; H. L. Hoffman, president of the Hoffman Radio Corp.; W. A. MacDonald, president of the Hazeltine Electronics Corp.; and R. C. Sprague, president of the Sprague Electric Co.

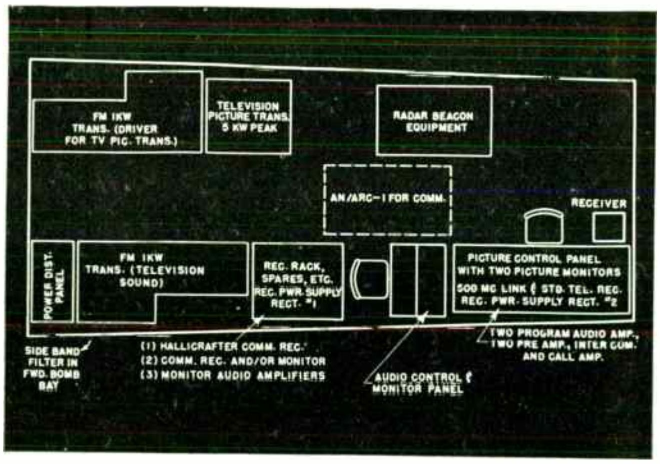
According to authoritative government sources, it was learned the RMA mobilization plan was in close agreement with the plans which have been recommended by the National Security Resources Board and the Munitions Board, respectively the top-level civilian and military mobilization planning agencies.

FCC UNDER INVESTIGATION—Radio broadcasting policies of the FCC, including television, with special emphasis on licensing authorizations to alleged "radicals" will constitute the main subject matter of a special House investigating committee. On the Senate side, however, a broad inquiry into broadcasting and television provisions of the present Communications Act and into international public service communications will be launched this fall in hearings by the Senate Interstate Commerce Committee.

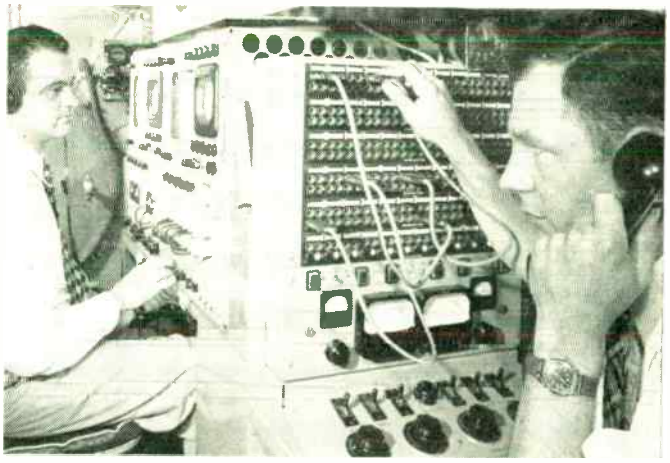
National Press Building

ROLAND C. DAVIES
Washington Editor

World Radio History



Layout of the stratovision airborne equipment in converted B-29



C. E. Nobles (left), originator of Stratovision at FM transmitter

Stratovision Meets First Test

Compact receiving and transmitting equipment is ingeniously installed in plane for public demonstration

TECHNICALLY, it may be said that stratovision is here. Whether or not it is here to stay will depend on the reception givon it by the FCC when it reviews Westinghouse's application for channel 8 in Pittsburgh.

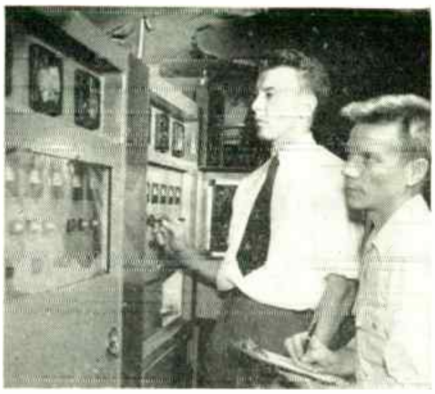
Stratovision was publicly demonstrated June 23. While reception was spotty due to several unavoidable circumstances, it was confirmed that a signal could be picked up by plane flying 25,000 ft. above a station and could then be rebroadcast over an area 500 miles in diameter to bring television to many rural communities.

The plane used in the demonstration was a converted B-29. The accompanying drawing shows the arrangement of equipment therein. All equipment was of a temporary type. When finally perfected (Westinghouse engineers say it will take 1 to 1½ years), it will be a compact, ingenious installation.

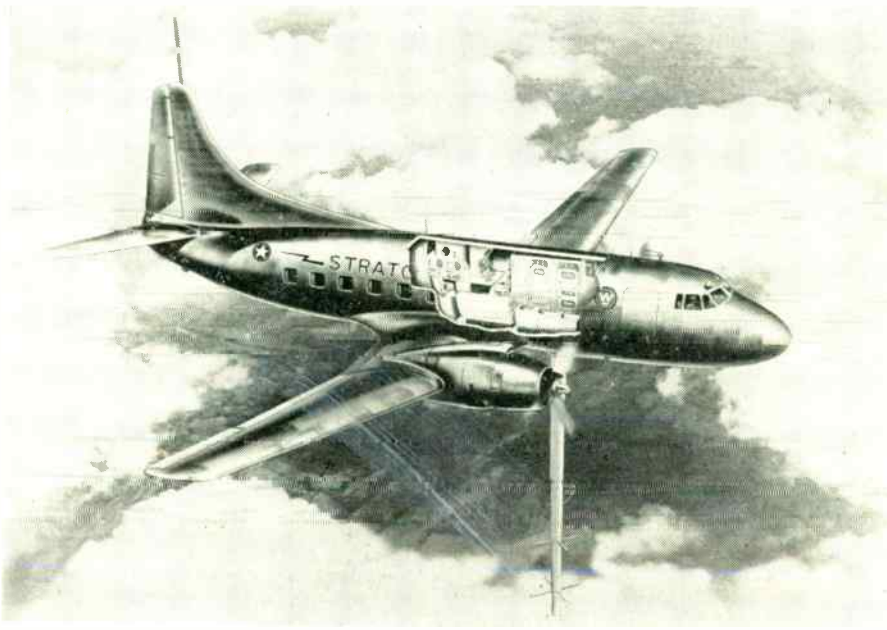
As described by C. E. Nobles, father of stratovision and designer of the special equipment, the signal is received by a special antenna in the tail of the plane and is rebroadcast from an antenna below the plane under the nose.

Westinghouse engineers claim they can overcome such obstacles as weather, mechanical failure of the plane, drift, design of special equipment, etc., and rebroadcast a television signal from a ground station directly below the plane. That would seem to put it up to the FCC as to whether or not it will remove channel 8 from York, Pa., and give it to Pittsburgh for Westinghouse. It also means a clear channel in a 500-mile area — something unheard of in television today.

In the final operation, the B-29 will give way to a fleet of Martin 2-0-2 airliners. The 2-0-2 has been specially tested for this operation and has been found satisfactory.



Above: Westinghouse airborne engineers in B-29 check television transmitting equipment. Below: Martin 2-0-2, designed to operate with stratovision. Note arrangement of equipment, receiving antenna in tail, sending antenna which is lowered under nose



World Radio History

TELE-TECH's NEWSCAST

Joint Technical Board Formed by IRE and RMA

A joint technical advisory committee to advise government agencies and other professional and industrial organizations on the technical aspects of radio has been formed by the RMA and the IRE. The committee will report to the boards of directors of RMA and IRE, respectively through Dr. W. R. G. Baker, director of RMA engineering department, and Dr. Benjamin E. Shackleford, president of IRE.

The members of the committee are: Philip F. Siling, chief engineer of the RCA Frequency Bureau of Washington, chairman; Donald G. Fink, editor of *Electronics*, New York, vice-chairman; Dr. Ralph Bown, Bell Telephone Laboratories, Murray Hill, N. J.; Melville Eastham, General Radio Co., Cambridge, Mass.; John V. L. Hogan, Interstate Broadcasting Co., Inc., N. Y.; E. K. Jett, former FCC Commissioner and now director of *The Baltimore Sun's* radio and television operations; Haraden Pratt, Mackay Radio and Telegraph Corp., N. Y. and David B. Smith, Philco Corp., Phil., Pa.

Audio Society Organized in San Francisco

The initial meeting of the San Francisco section of the Audio Engineering Society was held on June 22 in San Francisco's NBC building. The audio specialists named I. R. Ganic of Audiophone, Oakland, Calif., temporary chairman.

FCC Approves UHF TV Station in Washington

Permission for installation of an experimental ultra-high frequency television transmitter in Washington, D. C. by RCA has been granted by the FCC. The new station will be housed in the Wardman Park Hotel, site of NBC's commercial television station WNBW.

Hewlett-Packard Expands

The Hewlett-Packard Co., Palo Alto, Calif. has just completed construction of new plant facilities totaling 20,000 sq. ft. Buildings formerly occupied by the company will be remodeled and used as research laboratories, mock-up shops and general offices.

Television Lighting Meet

The Lamp Department of the General Electric Co. will hold its television lighting conference at Nela Park, Cleveland, Ohio, Sept. 13 and 14, to which will be invited representatives of television stations and lighting equipment manufacturers. Through demonstrations and talks, the latest advanced practice in television-studio lighting will be presented, using fluorescent and incandescent units.

Sign on traffic light at the corner of Hollywood Blvd. and Vine St., Hollywood, Calif. points the way to the Hotel Biltmore in Los Angeles, location of the West Coast Convention of the IRE on September 29-October 2

Denny Named Executive Vice-President of NBC

Charles R. Denny, vice-president and general counsel of the National Broadcasting Co., has been elected executive vice-president. Gustav B. Margarf, in charge of the Washington office of Cahill, Gordon, Zachry and Reindel and legal representative of NBC in Washington since 1942, was chosen by the board to succeed Mr. Denny as general counsel.

IRE and RMA Meeting On November 8-10

The 20th Rochester Fall meeting of members of the IRE and the RMA Engineering Department will be held on November 8, 9, and 10 in the Sheraton Hotel, Rochester, New York. Technical sessions will include up-to-the-minute papers on television, FM, and circuit developments.

"High-Voltage" Decals Free Upon Request

Decals inscribed "Danger High-Voltage" prepared by the Allied Radio Corp., are being made available free of charge to individuals and clubs for distribution to members. These two-color decals, measuring 2¾ x 4 inches will be supplied for as many pieces of equipment as requested. Simply address a postcard to C. W. Bailey, W9JJD, Allied Radio Corp., 833 West Jackson Blvd., Chicago 7, Ill.

Radio Technical Commission For Mobile Services

To aid in coordination of various mobile radio services, the FCC in future allocations blueprints and the National Military Establishment in the use of radio in civil defense, a foundation structure for the organization of the Radio Technical Commission for Land-Mobile Services was laid down at a Chicago meeting of groups operating the various mobile services, leading radio manufacturers and telephone companies. The RTCL will be like the Radio Technical Commissions for Aeronautics and for Maritime Radio Services. Only groups actually operating radio services will be eligible for full membership while manufacturers and telephone (common carrier) companies will only have associate non-voting membership.

FCC Abolishes STAs

Special Temporary Authorities, heretofore issued by the FCC to AM broadcast stations will no longer be issued after August 16, the Commission has announced. The effect of the ruling will be to end the practice of stations broadcasting under an STA beyond the limit specified in their daytime license.

Stromberg Adds Bell Co.

Add to its radio interests a new company recently acquired by Stromberg-Carlson Co., this is the Liberty-Carillons, Inc., of New York, manufacturers of electronic church bells (look—no bells!). The company was acquired for $500,000 by Stromberg.

CONVENTIONS AND MEETINGS

August 20-29—First Annual All Electronic Exposition, Southern California Radio and Electrical Appliance Exposition, Pan Pacific Auditorium, Los Angeles.

August 24-27—American Institute of Electrical Engineers, (Pacific General Meeting), Spokane, Washington.

Sept. 6-7—Mathematical Association of America, Madison, Wisconsin.

Sept. 13-14—Television Lighting Conference, General Electric Co., Nela Park, Cleveland, Ohio.

Sept. 13-17—American Association for Advancement of Science, Washington, D. C.

Sept. 18-26—First National Television and Electrical Show, Chicago Coliseum.

Sept. 27-29—FM Association, Sheraton Hotel, Chicago.

Sept. 27-Oct. 1—Third National Plastics Exposition, Grand Central Palace, New York.

Sept. 29-Oct. 2—IRE West Coast Convention, Los Angeles.

Sept. 30-Oct. 2.—Fourth Annual Pacific Electronics Exhibit, West Coast Mfgs. Assoc., Biltmore Hotel, Los Angeles.

November 4-6—National Electronics Conference, Annual Technical Forum, Edgewater Beach Hotel, Chicago.

November 8-10—IRE and RMA Engineering Dept., Rochester Fall Meeting, Sheraton Hotel, Rochester, N. Y.

World Radio History

ASA Electronics Section

To expand national standardization activities in the communications and electronic fields, the Electrical Standards Committee of the American Standards Association has been reorganized and expanded to increase the representation of the electronic group.

Dr. W. R. G. Baker, (vice-president, G. E. Co.), representing the Radio Manufacturers Association, was elected vice-chairman of the committee to head a new communications and electronics section. Sidney Withington, (chief electrical engineer of the N.Y., N.H. & H. RR. Co.), representing the Association of American Railroads, was re-elected vice-chairman.

Members of the executive committee of the ESC include L. G. Cumming, technical secretary, Institute of Radio Engineers; J. J. Pilliod, assistant chief engineer, American Telephone and Telegraph Co., representing the American Institute of Electrical Engineers; and Col. L. J. Tatom, commanding officer, Army Electronics Standards Agency, representing the U. S. Department of the Army.

Balcom Re-elected

Max F. Balcom was re-elected president of RMA during the association's recent four days of business sessions. The board of directors voted to continue the Association's policy not to sponsor or endorse any public or trade shows of television or radio receivers.

Raytheon Ship Radar

Raytheon Mfg. Co., Waltham, Mass., has received an order for 21 Mariners Pathfinder radars from the Atlantic Refining Co., Philadelphia. The new units are the 10 cm type for oceanic use and will be provided with the new 12-foot antenna reflector.

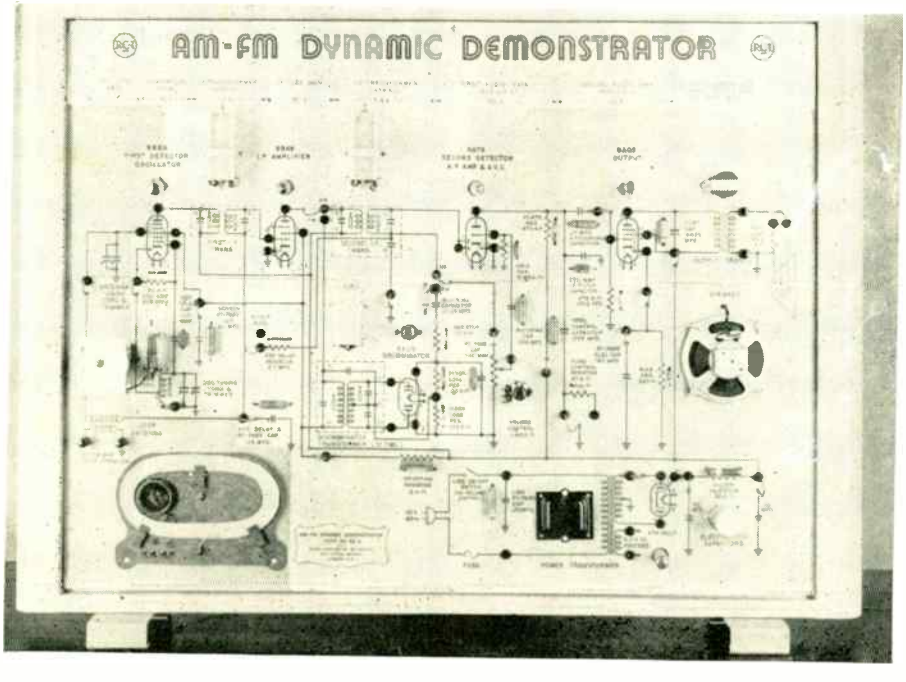
Florida FM Network

Plans for a state-wide network linking together the principal FM broadcasting stations in Florida was a major topic at the summer meeting of the Florida Association of Broadcasters held in Orlando June 18 and 19. As a starter, stations WHOO-FM in Orlando and WNDB-FM in Daytona Beach were linked together for a special demonstration in which a program originating in Orlando was picked up in Daytona Beach and re-broadcast for reception with all its original brilliance in the convention hall. Idea for the Florida FM network originated with Arthur H. Lynch, Florida representative of Radio Electronic Labs, New York.

W. G. McBride (WDBO), who has been secretary-treasurer of FAB was elected president of the organization. Other officers elected were: first vice-president, W. Wright Esch (WMFJ); second vice-president J. Garland Powell (WRUF); secretary-treasurer Jack Rathbun (WORZ); directors Reggie Martin (WFTL-WGOR-FM); Tom McCullough (WMBM).

Train Radio-Telephone

The New York Central System's "Twentieth Century Limited" passengers will be able to hold two-way telephone conversations with anyone anywhere while the train is traveling between New York and Buffalo. Nine radio links located along the New York Central's right-of-way are expected to be operating late this Summer. This new service will be the first railroad operation on the channels assigned to general highway mobile radio use in the 30-44 mc channel. FM transmissions from the "Century" will be on a different frequency than similar transmissions from fixed stations to the train.



Incorporating for the first time FM as well as AM radio receiver circuits, the new RCA "Dynamic Demonstrator" is a complete six-tube receiver with circuits and components mounted on a panel 45 inches long and 33 inches high. Background of the panel is divided into six large color blocks, defining the six basic functional sections of a six-tube AM-FM radio. Jumpers to close or break the circuit are inserted at selected points

NEW NAMES AND ADDRESSES

Leon Machiz and Seymour Schweber, formerly associated with the Sun Radio and Electronics Co., have announced the formation of Life Electronic Sales, 91 Gold St., New York 7, N. Y.

* *

Crown Capacitor Corp., 316 Stuart St., Boston, Mass., has been formed to produce fixed paper capacitors. Special sized units will be made to conform to limited space requirements as well as production runs of the standard units.

* *

The Aviometer Corp. has been reorganized as the Aviometer Div. of Roanwell Corp., 370 West 35th St., New York 1, N. Y. The new organization will continue to manufacture the products of the Aviometer organization.

* *

Eastern Transformer Co., Inc., will be the new name of the Gulow Corp., 99 Park Place, New York 7, N. Y., according to an announcement by John C. Hindle, the company's newly elected president.

* *

Murray G. Crosby has opened a consulting and development laboratory under the name of Crosby Laboratories, 126 Old Country Rd., Mineola, N. Y. He was formerly with Paul Godley Co., consulting radio engineers.

* *

Andrew Corp., 363 East 75th St., Chicago 19, has recently opened an eastern sales office in New York City at 421 Seventh Ave., James F. White, manager.

* *

Communications Research Corp., a newly-formed engineering organization, with headquarters at 60 East 42nd St., New York City, and laboratories at Mineola, Long Island is now engaged in applied research, development and engineering work in broadcasting and television.

* *

Raymond Rosen & Co. has announced the formation of a new wholly-owned subsidiary company, known as Raymond Rosen Engineering Products, Inc. President of the new company is Raymond Rosen. Louis P. Clark is vice-president and general manager.

* *

Antenna Research Laboratory, Inc., Columbus, Ohio, has been formed by a group of Ohio State University engineers to manufacture transmitting and receiving antennas for FM broadcasting and television.

* *

Formation of the Admiral Corp. Milwaukee Distributing Div., Inc., 3816 West Wisconsin Ave., Chicago has been announced by W. C. Johnson, sales manager of the Admiral Corp.

Audar Reorganizes

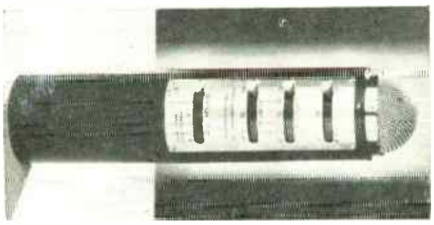
John S. Meck has resigned as president and director of sales of Audar, Inc., Argos, Ind., and the company's sales contract and affiliation with John Meck Industries, Plymouth, Indiana has been terminated.

World Radio History

New Lab and Test Equipment

High Sensitivity Test Set

Portable and compact, the Series 85 High Sensitivity Test Set incorporates the physical and electrical features of much larger equipment. 34 self-contained ranges provide for measurements up to 6,000 volts, 120 microamps, 12 amps, +70 db and 60 megohms. A 50 microampere meter is used and sensitivity is 20,000 ohms per volt dc and 1,000 ohms per volt ac.—**Precision Apparatus Co., Inc., 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.**



Sound Level Meter

Small and light enough to be carried conveniently in a coat pocket, the 410-A sound level meter covers the range from 34 to 140 db above the standard ASA reference level. All three standard ASA curves are provided: flat (C) and 70 db (B), and 40 db (A). The gain of the amplifier is standardized within ±1 db for absolute measurements and comparison accuracy is approximately ±0.2 db. Provision is made for using the microphone on an extension cable or with other types of microphones, and vibration pickups.—**Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge 39, Mass.**

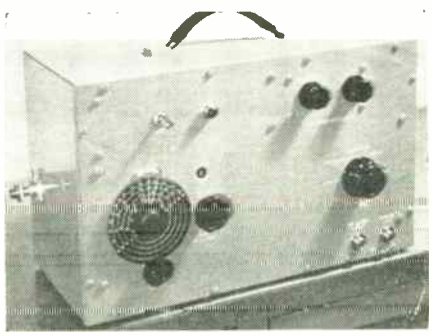
TV Marker Oscillator

Besides providing accurate sound carrier frequencies for all 13 television channels, the Mega-Marker Sr. can also be used for the alignment of the local oscillator by using the sound channel to indicate discriminator output. Each frequency is controlled by a crystal, accurate to 0.01%. The Mega-Marker Sr. operates on 117 volts, 60-cycle circuit. Dimensions are 16 x 8 x 8 in.—**Kay Electric Co., Pine Brook, N. J.**

Beat Frequency Oscillator

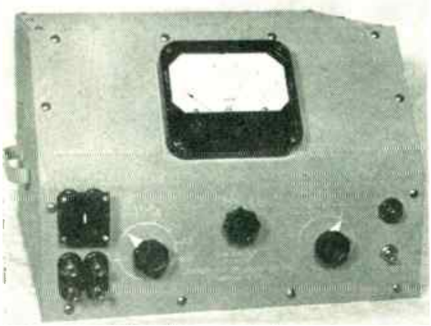
In order to provide better performance for the customer and for greater convenience in manufacture, the General Radio Co. has redesigned earlier beat frequency oscillator equipments and has improved their audio frequency microvolter. The new beat frequency oscillator is the type 1304-A and incorporates changes in oscillator design and tube lineup. Power consumption is 100 watts on 105-125 or 210-250 volts, 50-60 cps. Its frequency range is 20-2000 cps and its output impedance is 600 ohms either grounded or balanced-to-ground. A neon zero beat indicator lamp is used and normally the equipment delivers 25 volts open circuit output, or for a matched load, the output voltage varies by less than ±0.25 db, between 20-20,000 cps.

The chief improvements in the type 546-B Audio Frequency Microvolter are: a voltmeter which is more sensitive and has a better frequency characteristic and the adoption of the standard 600-ohm level for the input and output impedances. The microvolter when used in conjunction with an oscillator permits measurements of gain or loss, frequency characteristics, overload levels, hum levels on amplifiers, networks and other low frequency equipments.—**General Radio Company, 275 Massachusetts Ave., Cambridge 39, Mass.**



Signal Generator

Model 6G111 rf alignment signal generator produces rf and IF signals for the analysis, testing, and alignment of television and FM receivers. Sweep frequency output is in four ranges from 4½ to 25 mc. Radio frequency output, provided in six bands from four to 240 mc, is controlled by a trombone-type attenuator and may be used as precise marker frequencies or may be modulated with a video signal (from model 30G1) to provide a video-modulated television signal.—**Belmont Radio Corp., 5921 West Dickens Ave., Chicago 39, Ill.**



Wide Range Frequency Wattmeter

Volts, amperes, and watts over a frequency range of 20 to 200,000 cps can be measured with the model 101 VAW, an electronic, insertion type wattmeter. Voltage ranges from 0.1 to 300 volts and 10 current ranges of 0.001 to 30 amps. provide readings of 10 microwatts to 9 kilowatts. Power requirement is 117 volts at 6 cps—**Anderson-Fluke Engineering Co., Box 815 D, Springdale, Conn.**

Signal Generator

The new model 30, power type standard signal generator, provides five watts of rf output in one continuous range between 40-400 mc. A MOPA-type circuit is employed and frequency drift is less than 1/10 of 1% in an eight hour period at room temperature. Dial calibration is at intervals of 1% in frequency and can be read to 1/10 of 1%. External pulses, from 2-100 μ sec having an amplitude of 25 volts peak and repetition rate of from 50-5000 pps, can be employed to pulse-modulate the cathode of the tuned power amplifier. The 100, 400, 1,000 and 3,000 cps are fixed internal AM modulation frequencies. A VTVM is incorporated with an accuracy of 2% and indicates continuously adjustable modulation percentages from 0-80%. For the 0.01 μ volt to one volt output ranges, the source impedance is five ohms while for 0.1 μ volt to 10 volt ranges, a 50-ohm source impedance is used. A separate power supply operates from a 115-volt 60 cps source and the entire equipment uses 20 tubes.—**Rollin Co., Pasadena Calif.**

Combination Meter

Combining the functions of eight meters in a single, compact, portable unit, the WV-95A VoltOhmyst is a capacitance meter, ammeter, audio voltmeter, ac voltmeter, dc voltmeter, ohmmeter, FM discriminator, balance indicator and vhf voltmeter. A special electronic bridge circuit makes the meter virtually burnout-proof and the measuring circuits are not grounded to the case, permitting measurement of circuits where it is desirable to measure voltages or currents with the positive side of the circuit at ground potential.—**RCA Victor Div., Radio Corp. of America Camden, N. J.**

TV, Phonograph Cabinets

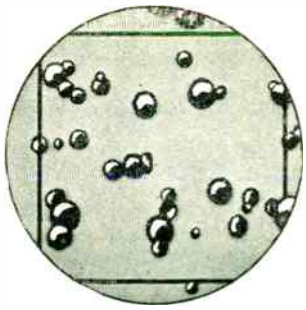
Console-model radio-phonographs, and 7 and 10-in. television sets may be housed in a new line of cabinets currently produced in 5 models. All standard record changers and most radio chassis can be accommodated.—**Jackson Industries, Inc., 1708 S. State St., Chicago, Ill.**

World Radio History

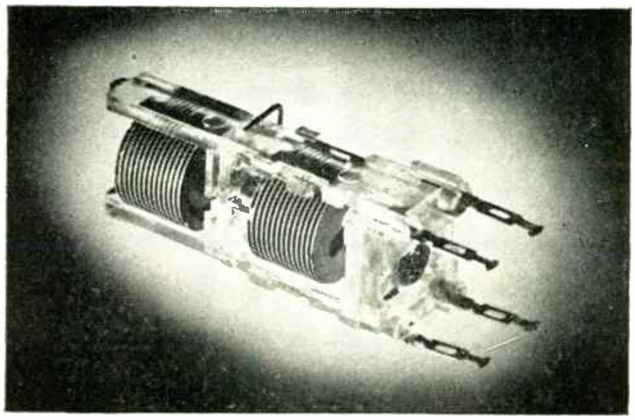
The "core" of Electronics

G. A. & F.

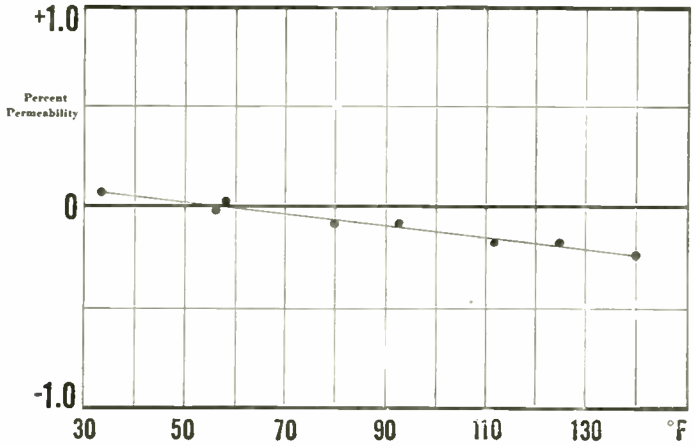
Carbonyl Iron Powders



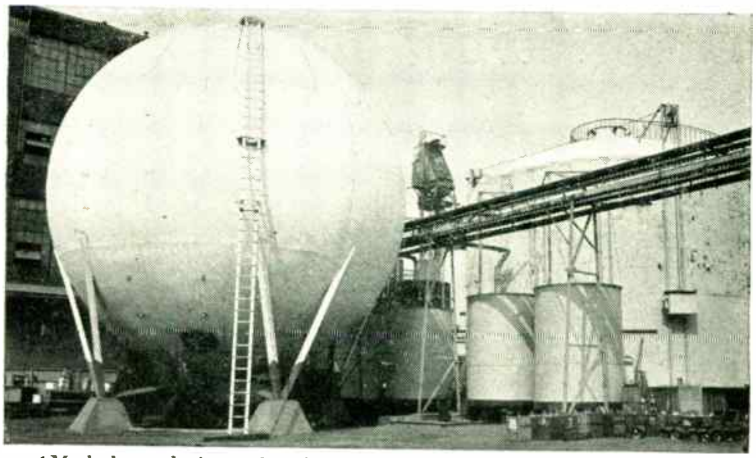
1. Used chiefly for cores in high frequency magnetic fields, G. A. & F. Carbonyl Iron Powders are especially high in iron content, and free from disturbing non-ferrous metals. The individual particles are spherical. Some grades contain agglomerates of several particles. Microphoto above: Grade TH at 350X. Average particles of this grade have a diameter of 5 microns.



2. I-F and H-F applications of G. A. & F. Carbonyl Iron Powders include: I-F transformer cores, H-F adjusting cores, AM inductance tuning cores, TV wave trap cores, short-wave transmitter tank coil cores, direction finder loop antenna cores, carrier telephony cores and cups. Photo above: "K-Tran," revolutionary top quality I-F transformer, only possible with cores of G. A. & F. Carbonyl Iron Powder.



3. G. A. & F. Carbonyl Iron Powder advantages: Low eddy current, residual, hysteresis losses (resulting in higher Q). Excellent temperature and magnetic stability. Savings (as against air-cored coils) in volume, weight, wire length. Graph above: the small permeability change due to temperature of uncompensated toroids of G. A. & F. Carbonyl Iron Powders, Grades E, TH and SF.



4. Made by exclusive carbonyl process: CO gas and iron ore form liquid iron penta carbonyl. Decomposed by heat into powdered iron, CO gas. Two unique results: *chemically pure* iron penta carbonyl and *spherical* iron powder particles. Photo above: Hortonsphere for storing CO under pressure.

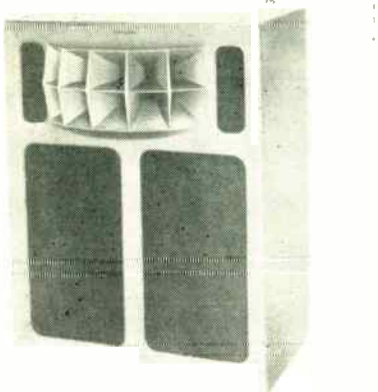
Ask your core manufacturer about Carbonyl Iron Powders. Or write to:

ANTARA PRODUCTS
444 Madison Avenue
New York 22, N. Y.
Department 84

Carbonyl Iron Powders are an Antara® Product of General Aniline & Film Corporation

World Radio History

Sound and Recording Equipment



Home Speaker System

Featuring the same components, engineering standards, and configuration of acoustic baffling used in commercial theatre equipment, model P-63HF 2-way speaker system has been designed for home installation. Rated at 30 30 watts to permit full dynamic impact at high levels of operation, the unit uses a 600 cycle crossover to relieve the 2 low-frequency drivers of high frequencies and consequent intermodulation and conc break-up.—**Stephens Mfg. Corp., 10416 National Blvd., Los Angeles 34, Calif.**

Wire Recorder

Push button controls for 4 "record" and "listen" positions are featured in model 78 wire recorder, a new unit which can be easily connected to existing amplifier circuits. An accurately calibrated recording level meter on the control panel assures correct recording volume.—**Webster-Chicago Corp., 5610 W. Bloomingdale Ave., Chicago 39, Ill.**

Tone and Transcription Arms

A tone arm (UPA-002) equipped with the GE variable reluctance cartridge, for playback of 10 and 12-in. records, and a transcription arm (FA-21-A for professional applications have been developed. The tone arm provides the best compromise between minimum tracking error and over-all dimensions and has a one-ounce stylus pressure. The transcription arm is completely adjustable for stylus pressure and has an easy-to-read scale calibrated in grams and ounces.—**Receiver Div., General Electric Corp., Syracuse, N. Y.**

Crystal Microphone

Equipped with a detachable "quick-lock" base, crystal microphone models 200 and 241 may be used as a hand or desk mike or mounted on a floor stand. Model 200 has a frequency response from 30 to 10,000 c.p.s. and model 241 with a similar range has rising characteristics between 1500 and 5500 c.p.s. for added brilliance in the speech range. Either model may be supplied with or without switch.—**Astatic Corp., Conneaut, Ohio.**

Audio Oscillator

Designed for testing radio receiver audio channels, public address systems, and intercoms, the YGA-4 audio oscillator features a low distortion output in 1 band over the audio spectrum from 25 to 16,000 cycles. Large illuminated dial facilities rapid checks of audio circuits and equipment for frequency response, distortion, gain, power output and phase shifts.—**General Electric Corp., Specialty Div., Syracuse, N. Y.**

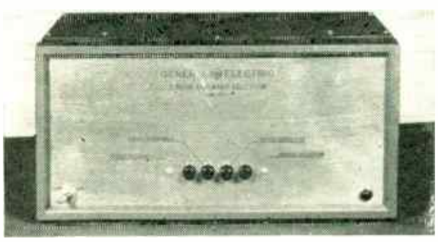
Wire Recorder

A frequency response of 40 to 10,000 cycles, twice the usual response of wire recorders is provided by the Wiremaster, a profesional high fidelity wire recorder with a built-in radio and phonograph. A speaker monitoring control facilitates adjustment of listening volume without affecting recording volume, which is regulated by another control. An automatic braking device which stops both spools from turning when current is cut off, prevents wire's unraveling and tangling. Spools also automatically shut off when either one is completely unwound. The recorder rewinds at an 8:1 ratio.—**Precision Audio Products, Inc., 1133 Broadway, New York 10, N. Y.**

Recorder Chassis

Facilities for recording monitoring, re-recording, stereophonic and expansion control are provided by the Twin-Trax tape recorder chassis. Recorder playing time is one hour with a standard 7-in. reel of ½-in. magnetic tape because two signal tracks are used on the tape instead of one. No rewinding is necessary as the Twin-Trax chassis plays continuously during forward and reverse travel. An automatic switch and solenoid instantly reverses the direction of tape travel at end of reel.—**Magnephone Div., Amplifier Corp. of America, 398-26 Broadway, New York 13, N. Y.**

Communications Components



Single Sideband Selector

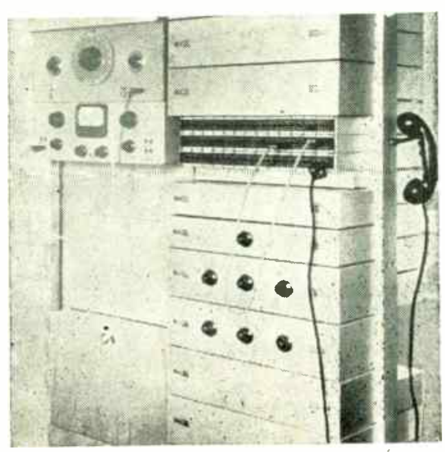
A single sideband selector, the YRS-1 provides improved reception in crowded amateur and communication radio bands without affecting the quality of the received signal. Featuring reduction of distortion due to selective fading for long distance reception of ordinary AM signals, the YRS-1 makes possible the selection of either sideband through simple pushbutton operation. It may be used with any receiver having an intermediate frequency of approximately 455 kc.—**Specialty Div., General Electric Corp., Syracuse, N. Y.**

Eleven-Channel Carrier ➡

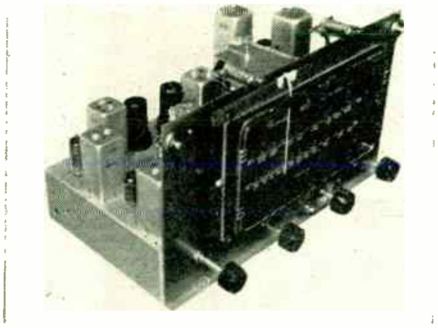
As many as 11 duplex voice channels may be carried on a two-way radio circuit when type 42 multi-channel radiotelephone link is used. The carrier equipment is shown in the right hand rack in the illustration, and the rack to the left contains measuring and telegraph gear. Carrier equipment is required only at the terminals of the radio link because intermediate repeater stations relay audio frequency only.—**Lenkurt Electric Co., 1116 County Rd., San Carlos, Calif.**

Packaged Aluminum Towers

Trig Towers, completely packaged aluminum antenna masts, are manufactured in self supporting and guyed types triangular in design and made of 61 ST 6 aluminum alloy. A ladder with a 15-in. rung spacing is integral with one side of the tower. Produced in 10-ft. sections, the free standing type comes in heights of 10-20-30 and 40 ft.; guyed type in heights from 10 to 100 ft.—**Rostan Corp., 202 E. 44th St., New York 17, N. Y.**

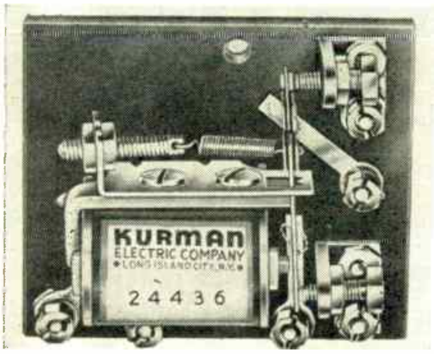


World Radio History



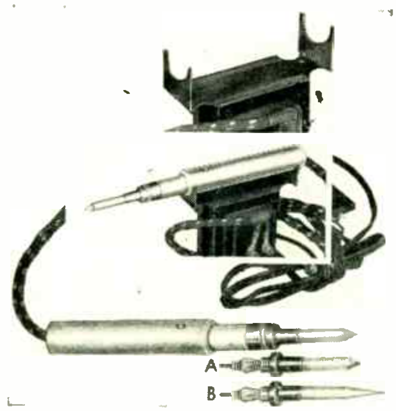
FM-AM Tuner

An rf amplifier is used in both FM and AM sections of model RJ-12A FM-AM tuner. The audio frequency response of the FM section is flat from 10 to 15,000 cycles ± 1 db and a drift compensating network eliminates drift after a 2 min. warmup period. AM section uses recently developed, triple tuned IF transformers and a high frequency extending network, so that the audio response is flat from 20 to 6600 cycles ± 3db. The FM antenna input is 300 ohms balanced to ground and connected in such a way that the entire FM antenna and feeder system also function as the AM antenna.—Browning Laboratories, Inc., Winchester, Mass.



Relay

A new relay, featuring a split armature, has been developed for automatic controls, keying, antenna changeover, burglar alarms and closed circuit applications. Rated sensitivity of the "24" relay as .014 watts dc, .3 va ac and it may be adjusted to operate at .005 watts, and from .01 to 115 watts dc or ac. Models are available with solid armatures or split with insulated sections.—Kurman Electric Co., Inc., 35-18 37th St., Long Island City 1, N. Y.



Soldering Iron

Featherweight model "Soldertron" weighs three ounces and features interchangeable tip heads, fingertip control and low current drain. Iron heats in about 20 seconds from a cold start and cools upon release of button. It has a cool-grip bakelite handle.—Transvision Inc., New Rochelle, N.Y.

NEW BUD *Featherlight* but Super-Strong Aluminum Chassis

MEETS YOUR NEEDS FOR QUALITY EQUIPMENT WITH THESE OUTSTANDING FEATURES:

- A new addition to the Bud Line, built to the same specifications of design and construction as Bud Steel Chassis. Etched aluminum finish.
- Featherlight but super-strong because they're made of high grade aluminum alloy of gauge heavier than that of steel chassis of same size.
- Tougher because they've SPOTWELDED on same type of welder approved by the government for spot-welding airplane parts.
- More practical for many chassis purposes because of the combination of greater ruggedness with lighter weight.

EXCEPTIONALLY LOW-PRICED
Now available in the following sizes:

Cat. No.	D	W	H	G	Dealer Cost	Cat. No.	D	W	H	G	Dealer Cost
AC-402	5	7	2	18	$ .63	AC-412	8	17	3	16	$1.47
AC-403	5	9½	2	18	.72	AC-413	10	12	3	16	1.44
AC-404	5	10	3	18	.90	AC-414	10	14	3	16	1.38
AC-405	7	7	2	18	.75	AC-415	10	17	2	16	1.38
AC-406	7	9	2	18	.90	AC-416	10	17	3	16	1.55
AC-407	7	11	2	18	.96	AC-417	11	17	3	14	1.98
AC-408	7	12	3	18	1.14	AC-418	12	17	3	14	2.00
AC-409	7	13	2	18	1.08	AC-419	13	17	2	14	2.10
AC-411	7	15	3	16	1.32	AC-420	13	17	3	14	2.31

We will gladly quote on special boxes and cabinets made of aluminum if production quantities are involved.

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COILS

FOR AM—FM and TELEVISION

SOLENOIDS and other types made to your specifications. Let us quote you.

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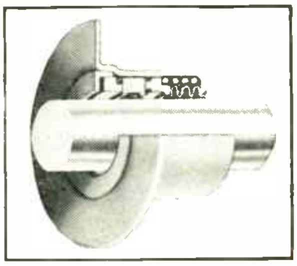
EAGLE ELECTRONICS, INC.
IRVINGTON, NEW YORK

World Radio History

New Cartridge Seal Solves Rotating Shaft Sealing Problems

Stepped-up efficiency in sealing of rotating shafts can now be accomplished with a new Cartridge-type Seal mounted on the shaft.

The Cartridge-type Seal shown above is mounted within a Tuthill Pump. The seal contains all parts in one housing cup and insures positive double sealing. A high grade permanent lubricant is contained within the inside chamber of the housing.



Cartridge-type Seal

Surfaces within the Cartridge-type Seal are lapped flat to within a few millionths of an inch to insure perfect mating. And, being a complete unit, only one mounting face is necessary. Clamps are eliminated, and adjustments or alignments are not required. Simply push the Cartridge-type Seal onto the shaft, tighten mounting screws and that's all.

Just as new engineering developments increase efficiency and performance, so can workers' efficiency be increased through the use of chewing gum. The act of chewing helps relieve nervous tension, thus helping to make the work go smoother and easier. That's why plant owners everywhere more and more are making Wrigley's Spearmint Chewing Gum available to all.

Complete information may be obtained from

Cartriseal Corporation
200 No. Laflin Street Chicago 7, Illinois

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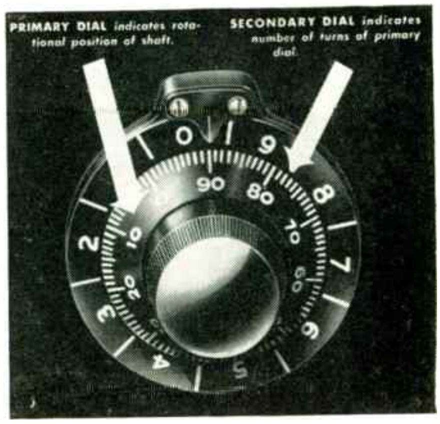
LENSES for TELEVISION

Now Available from BURKE & JAMES, INC.

Just a few examples from the world's largest lens stocks:

2"	F1.5	Hugo Meyer	coated
3"	F1.9	Hugo Meyer	coated
5"	F2	Schneider Xenon	coated
6½"	F2.7	Carl Zeiss (Jena)	coated
7½"	F3.5	Carl Zeiss (Jena)	coated
8"	F2.3	Astro Pan Tachar	coated
18"	F5.5	Magna Telephoto	coated

Lenses available in barrel with iris, straight focusing mounts, or fitted to your camera. Please advise your requirements. We will be happy to quote on 15 day trial basis All offerings subject to prior sale. Direct inquiries to Thomas E. Tell, Burke & James, Inc., 321 S. Wabash Ave., Chicago 4, Illinois, U. S. A.

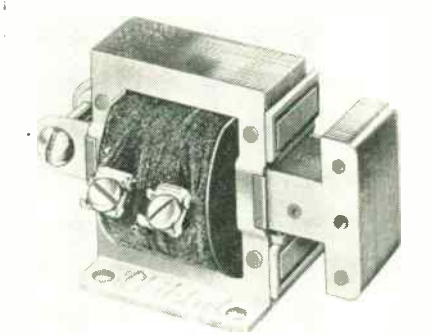


Multi-Turn Dial

A new type of multi-turn dial, known as the Duodial, has its primary knob dial geared to a concentric turn-indicating secondary dial and the entire unit requires a panel space only two inches in diameter. As the primary dial is rotated through each complete revolution, the scondary dial moves one division on its scale. Thus, the secondary dial counts the number of complete revolutions made by the primary dial. The Duodial incorporates only two moving parts and has no worm gears, facilitating operation from the shaft or knob end.—**Helipot Corp., 1011 Mission St., South Pasadena, Calif.**

Lamp Sealer

An improved single-head fluorescent lamp sealing machine averaging 50 to 75 seals per hour is now available for laboratories or work shops with moderate production schedules. The machine is mounted on a fabricated, study stand and consists of a special sealing head-holder for long tubing with driving mechanism, adjustable cross-fires with a gas-air mixer, an economizer, necessary rubber hose connection and a fractional hp electric motor with a three-step cone-pulley drive. **Eisler Engineering Co. Inc., Newark 3, N.J.**



Actuator

The new Phil-trol 51A actuator, 3½ in. x 1⅞ in. x 1 15/16 in., with a maximum stroke of one inch, will exert pulls from two pounds at ¾-in. stroke to 4.2 lb. at ¼-in. stroke. Although designed for continuous duty on 115 volts at 60 cps, windings for other ac voltages or for greater pulling action can be obtained. The T-shaped laminated plunger can also be adapted to push operations. Smooth operation and long life are assured by the use of non-magnetic steel side plates on the plunger and special brass plunger guides inside the frame, according to manufacturer's claims. Shaded rings and precision ground pole faces insure quiet operation on ac.—**Phillips Control Corporation, 612 N. Michigan Avenue, Chicago 11, Ill.**

Electrolytic Capacitor

Hermetically sealed in a hot tinned steel outer can and an inner aluminum container, type AVL electrolytic capacitor is especially serviceable in marine and aircraft applications. Terminal lugs are hot-tinned and the terminals themselves are well insulated with bakelite bushings. Type AVL can be supplied in a wide range of container sizes and capacities.—**Cornell-Dubilier Corp., S. Plainfield, N. J.**

World Radio History

NEWS . . .

Hertzberg Joins Tele-Tech

Colonel Robert Hertzberg, active in the radio field for 25 years as technician, writer and editor, has joined the staff of Tele-Tech as contributing editor.

One of the three original members of the radio staff of the N. Y. Globe and later the Sun, he served for several years as managing editor of *Radio News*. While with Pilot Radio, he participated in the design of the "Super-Wasp" a short-wave set that created international interest in the 30's. At Pilot he also worked with the late David Grimes and John Geloso on television receivers and transmitters, having a hand in the first video station (Coytesville, N. J.) ever to transmit TV programs on a regular schedule. Later serving with Lafayette Radio Corporation, he left to join Fawcett magazines as executive editor of the general-science publication *Mechanix Illustrated.*

Contract for Audio Equipment

Radio station WHN, New York, has awarded the largest single contract for custom-built audio equipment ever placed by an independent station to the RCA Engineering Products Dept. The specially designed equipment will be installed in WHN's new studios, now under construction, at 711 Fifth Ave., N. Y. C.

Television Lighting Package

A complete television studio lighting package is being offered by William A. MacAvoy Associates of 244 N. 10th Street, Philadelphia. The package includes gridiron for support of all lighting units, drapes, scenery and specially designed lighting equipment highly flexible with lighting of high intensity and low heat radiation. The package may be adapted to present broadcast studios or installed in new television studios at a later date.

Desk-Size Facsimile

A desk-size facsimile sending and receiving machine capable of handling up to 150 words in two minutes directly to and from the offices of the user will soon be offered to its customers by the Western Union Telegraph Co. Present plans call for installation of the machines without charge to the customer. One large central office receiver and transmitter will be required for each 10 units in service.

Jack Sadowsky

Jack Sadowsky, Manager of Electronic Components for the Equipment Sales Section of Radio Corporation of America Tube Department at Harrison, N. J., died Friday morning, July 2, at Lenox Hill Hospital, New York City after a three months' illness. He was 38 years old and is survived by his wife.

Jack Sadowsky was widely known, liked and respected and will be missed by a multitude of friends in the radio and electronic fields. He joined RCA in January 1939 as a commercial engineer, later became a tube application engineer and was subsequently promoted to the executive sales post he held at his death.

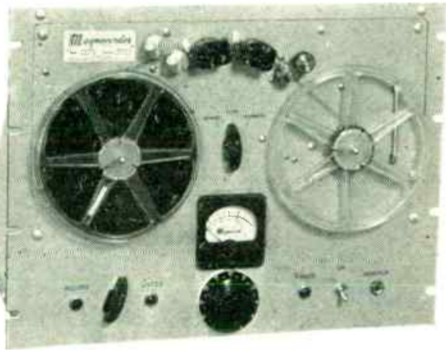
ONLY THE NEW *Magnecorder*

GIVES YOU

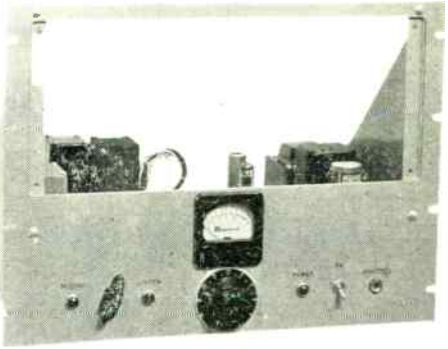
ALL

OF THESE FEATURES IN A FM QUALITY professional

TAPE RECORDER



Series PT6-A, the basic Recorder unit, combined with Rack Mount Amplifier, PT6-R, for studio application.



Series PT6-R Rack Mount Amplifier before Recorder PT6-A is applied.

Series PT6-P, Portable Mixer-Amplifier and cover, shown with basic Recorder mounted in carrying case for portable field operations.

Magnecorder unit construction and plug-in design using four basic units, broadens recording possibilities and simplifies the technique in studio, field, laboratory or institution.

Magnecorder combines fine FM quality and extreme VERSATILITY —
- PORTABLE
- STUDIO
- CONTINUOUS
- REMOTE

— and LOW COST, within the means of the smallest broadcaster.

Magnecord manufactured the first professional high fidelity, magnetic wire recorder and now has perfected this high fidelity tape recorder of unit design to fit any application.

Send for descriptive bulletin giving complete details and name of nearest representative.

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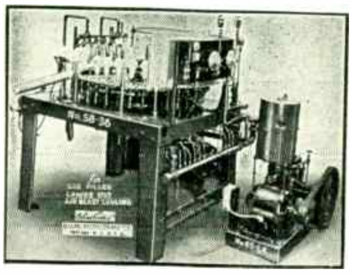
SPECIALIZES IN EQUIPMENT FOR THE COMPLETE MANUFACTURE OF

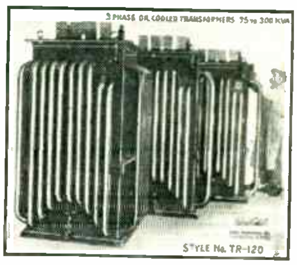


36 HEAD RADIO TUBE EXHAUSTING MACHINE WITH BOMBARDER

INCANDESCENT AND FLUORESCENT LAMPS, LUMINOUS NEON, RADIO, X-RAY, TELEVISION, AND ELECTRONIC TUBES OF ALL TYPES

SPOTWELDERS SIZES FROM 1/4 TO 250 KVA BUTT, GUN, ARC WELDERS

Large or Small Contract Spot and Butt Welding. Ask for Our Catalog



TRANSFORMERS FOR EVERY SERVICE FROM 1/4 TO 250 KVA SPECIAL TRANSFORMERS FOR ELECTRONIC DEVICES

EISLER ENGINEERING CO., INC., 778 So. 13th St., NEWARK 3, N. J.

World Radio History

NEW!

FM SIGNAL GENERATOR

MODEL 202-B

FREQUENCY RANGE

54 to 216 MEGACYCLES

The model 202-B is specifically designed to meet the needs of television and FM engineers working in the frequency range from 54-216 mc. Following are some of the outstanding features of this instrument:

RF RANGES—54-108, 108-216 mc. ± 0.5% accuracy.

VERNIER DIAL—24:1 gear ratio with main frequency dial.

FREQUENCY DEVIATION RANGES—0-80 kc; 0-240 kc.

AMPLITUDE MODULATION—Continuously variable 0-50%; calibrated at 30% and 50% points.

MODULATING OSCILLATOR—Eight internal modulating frequencies from 50 cycles to 15 kc., available for FM or AM.

RF OUTPUT VOLTAGE—0.2 volt to 0.1 microvolt. Output impedance 26.5 ohms.

FM DISTORTION—Less than 2% at 75 kc deviation.

SPURIOUS RF OUTPUT—All spurious RF voltages 30 db or more below fundamental.

Write for Catalog D

BOONTON RADIO *Corporation*

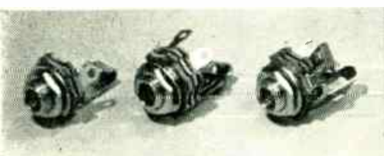
BOONTON · N · J · U · S · A ·

DESIGNERS AND MANUFACTURERS OF THE Q METER · QX CHECKER FREQUENCY MODULATED SIGNAL GENERATOR BEAT FREQUENCY GENERATOR AND OTHER DIRECT READING INSTRUMENTS

Recorder Users have found the difference—

SWITCHCRAFT INC. Dependable, simple, quick CONNECTORS

Switchcraft "LITTEL-JAX"
Recognized as today's leading jack for many applications:



Notched insulating washers mechanically interlock springs and solder lugs—eliminates (1) shifting—(2) "shorts"—(3) change in adjustment. V-Bend in tip firmly holds mating plug. Springs of Nickel Silver produced in dies of Switchcraft design provide long life. Requires minimum back of panel space—mounts in single 3/8" dia. hole in panels up to 5/32" thick. Available in many circuits.

Switchcraft "LITTEL-PLUG" *To make certain your equipment has the latest in plugs check these features.*

Dual purpose sleeve terminal—perfect for metal braid cable—easily soldered. One piece tip rod threads into tip terminal—staked to insure tightness. Terminals and body of plug interlock. High grade insulation—designed for less leakage. Handles and body only 1/2" dia. Handles available in black, or red Tenite or nickel plated brass.

★ Switchcraft Jacks, Plugs—push button, rotary and stack Switches are used in Public Address systems—Communications—Radio—Testing Equipment—Motion Picture Sound equipment—Electric Musical Equipment, etc. ★

SEND FOR FREE CATALOG NO. S-47.
Available at all leading Radio Parts Jobbers.

SWITCHCRAFT INC.

1328 N. HALSTED STREET
CHICAGO 22, ILLINOIS

IMPEDANCE CIRCUIT

(*Continued from page 29*)

of the power tube 6V6 for T_v, the variation is more linear but a higher control voltage is needed, see Fig. (2B).

The dynamic impedance circuit is well adapted to control the characteristics of wave filters. Fig. (3A) shows the basic circuit of a dynamic low-pass filter. When the circuit of Fig. (2A) is employed as the dynamic capacitance, the cutoff frequency of this filter can be shifted from 3000 to 1000 cps by varying the control voltage from zero to −20 volts. It is interesting to mention that the signal-to-noise ratio of an audio amplifier can be improved by placing a low-pass dynamic filter in tandem with a high-pass dynamic filter such that the width of the pass-band varies automatically in accordance with the nature of an input signal. Such an arrangement is known as the Scott dynamic noise suppressor.

Fig. (4A) shows the basic circuit of a dynamic band-pass filter. When the circuit of Fig. (2A) is employed in this circuit as the dynamic L-C network, the width of the pass-band can be changed from 1300 to 400 cps by varying the control voltage from zero to −18 volts. (Fig. 4B). The geometric mean of cutoff frequencies remains constant at 1590 cps.

Fig. (5A) shows the complete circuit of a dynamic band-elimination filter. Wide band frequency response is obtained by using a cathode-coupled amplifier (T_1 and T_2) followed by a current feedback amplifier (T_3). As the control voltage varies from zero to −30 volts, the width of the elimination band changes from 500 to 1950 cps and the geometric mean of cutoff frequencies remains constant at 1610 cps.

Many other types of wave filters can be constructed by employing the dynamic impedance circuit described.

Recently, frequency-modulated subcarriers capable of linear frequency variation over a wide range (often more than 50% of the carrier frequency) have come into widespread use in facsimile and other communication systems. Direct reactance-tube control of an L-C tuned oscillator is prohibited by the wide percentage of frequency deviation. The use of a heterodyne system is limited by lack of frequency stability, high percentage of harmonic content, and fluctuation of output level. The application of the dynamic impedance circuit makes it possible to design a frequency-modulated oscillator capable of producing linear frequency variation over 50% of its carrier. In addition, automatic amplitude control can be employed to prevent fluctuation of output level.

To understand the principles of its operation, first let us remember that the criterion for oscillation in a circuit is $A(B_1-B_2)\geq 1+j0$, where A is the amplification, B_1 and B_2 are respectively positive and negative feedback factors of the circuit. In Fig. (6), amplification is provided by the cathode-coupled amplifier, T_1 and T_2. Cathode follower T_3 allows a low-impedance circuit to drive the bridge-T network R-C-R. This network acts as a frequency selector which produces a high attenuation at a given frequency and results in a negative feedback voltage at all others. Therefore the circuit has a maximum gain at the frequency at which the negative feedback voltage becomes minimum. This will cause oscillations of the circuit at one frequency, if the positive feedback voltage which is introduced to the grid of T_1 is large enough to satisfy the above mentioned criterion for oscillation.

The amplitude of oscillation is controlled by means of a nonlinear resistance (Thermistor). An increase of the amplitude of oscillation will cause a current increase through R_1 and R_2. Because the resistance of R_1 decreases as the current increases, the ratio of R_1 and R_2 is changed in a direction so as to reduce the amplitude of the positive feedback voltage to T_1. This reduction in positive feedback causes the amplitude of oscillation to return to its normal value.

An expression for the oscillating frequency can be drawn from a consideration of the bridge-T network. Assuming that n is the ratio of the dynamic capacitance to the fixed capacitance C, we can find the oscillating frequency equal to $\sqrt{n}/2\pi RC$. Further study of the bridge-T network shows that a decrease in the value of n will increase the sharpness of the amplifier response curve. Experimental data suggests that a value of .0002 or smaller for n would produce negligible harmonic distortion and stable operation.

The dynamic impedance circuit described is also useful as a means of modulating the duty-cycle of a pulse generator. Other applications include measuring devices and automatic controls for various purposes.

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GENERAL ELECTRIC

ANALYZING ELECTROMAGNETIC PROBLEMS

(*Continued from page 25*)

junction. Contours of constant voltage-to-ground then constitute an electric field plot of the Type A. If the values of network voltage are divided by the radius, contours of V_ϕ/r give contours of constant magnetic field with the proper relative field strength. Some sample field plots are shown in Figs. 3, 4, and 5 which give the three lowest resonance configurations o fa simple reentrant cavity. Figs. 3A, 4A and 5A show the electric field and Figs. 3B, 4B and 5B show the corresponding contours of constant magnetic field. The field configurations of Fig. 3 are those of the lowest frequency of resonance and have the form expected from general considerations. The resonant configurations of Fig. 4 are some whose existence is ordinarily not suspected but which corresponds roughly to a half-wave resonance between two diagonally opposite corners of the large section of the resonator. The configurations of Fig. 5 correspond to a three-quarter wave mode in the reentrant cavity.

As an example of the complexity of problems which can be handled with the network analyzer, there is shown in Fig. 6 a field plot of a reentrant cavity resonator with irregular internal wall surfaces. It would be very difficult to obtain the field plot of such a cavity by any other means.

Tuning curves of resonant cavities, as one dimension of the cavity is altered, are readily obtained by setting up the boundaries of the resonator on the network and then observing the resonant frequency as the boundaries are changed to simulate a plunger movement. Results of such a test are shown in Fig. 7. It is noted that the curves have been extended to the point where an internal plunger has been pushed along the longitudinal section of the resonator until it completely fills the end space. Several interesting features of concentric line resonators with gap capacity loading are shown in these curves. Note that the wavelength of resonance ceases to be linear with cavity length before the plunger is flush with the end of the concentric line section. Also note that there is a minimum wavelength which can be achieved with this configuration, in that as the plunger is pushed against the end space the wavelength first decreases and then slightly increases. Some higher order modes also appear for short-line lengths and merge with the well-known cavity modes.

It is possible to measure the shunt resistance of cavities by applying terminal resistors around the boundary of the cavity to simulate wall losses. The resonant impedance of the cavity can be determined from the ratio of gap voltage squared to power required to produce this voltage and an analogous ratio can be found for the network. In making such a determination it is necessary to make two measurements of input power; one without the terminal resistors, and another with the terminal resistances. By this means the effect of power loss due to coil resistance can be eliminated.

Values of resonator Q can likewise be directly determined from the network by observing the sharpness of resonance of the network with and without the terminal resistance simulating the wall losses. This value of Q is readily scaled to its equivalent at any frequency. Fig. 8 shows curves of the shunt resistance and Q of a simple reentrant cavity as the axial length of the cavity is changed.

Use of the network analyzer described in this article makes the determination of resonant frequency, shunt resistance, Q, and field configuration of resonant cavities and transmission lines a straight-forward procedure which can be executed by people who are not skilled in the intricacies of field theory. Essentially, the network does the computing and gives the answer to the operator in such a form that it requires only a simple operation for its direct interpretation. The significance of this is that with the use of such a network it is possible to determine all the electrical characteristics of resonant cavities and other microwave structures in a very short time.

World Radio History

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GENERAL ELECTRIC

BULLETINS

Carbon-Graphite Specialties

Engineering and production data on carbon and graphite specialties is presented in a 44-page booklet by the Stackpole Carbon Co., St. Mary's Pa. One section analyses the physical and electrical properties of carbon and graphite in relation to industrial applications. (Mention T-T)

Pressuregraph

The Electro Pressuregraph is the subject of a bulletin published by the Electro Products Labs., 549 Randolph St., Chicago 6, Ill. Descriptions of Electro Products' knockmeter, synchronizer, detonation indicator, and pick up selector switch are included. (Mention T-T)

Instruments and Controls

A comprehensive buyers' guide of instruments and controls is offered by the Electro-Tech Equipment Co., 117 Lafayette St., New York 13, N. Y. Catalog 48 consists of 64 pages describing laboratory and portable test instruments, pyrometers, transformers, rectifiers, controls, counters, thermostats, motor starters, hardware and accessories. (Mention T-T)

Microphones

Electro-Voice Inc., Buchanan, Mich., has released bulletin 103, describing E-V models of microphones, stands and accessories. Cardioid unidirectional, dynamic, crystal, mobile, and velocity microphones are discussed. (Mention T-T)

Antenna Towers

The Rostan Corp., 202 East 44th St., New York 17, N. Y., has issued a bulletin describing its line of self supporting and guyed aluminum towers. Free standing towers are available in 10-ft lengths up to 40 ft. and guyed types are supplied in models up to 100 ft. high. (Mention T-T)

Sheet Metal Components

Sheet metal components for electronic, radio and electrical apparatus are described in a new catalog issued by Karp Metal Products Co., Inc., 129 30th St., Brooklyn, N. Y. Several highly intricate cabinets and housings for broadcasting transmitter apparatus, television equipment and electronic test equipment are included in this 16-page, two-color brochure. (Mention T-T)

WKOW Installation

A four-page brochure outlining the designing, equipping and installation of WKOW, Madison Wis., by the Andrew Corp., 363 East 75th St., Chicago 19 has just been released. Nighttime horizontal radiation pattern and a complete plot plan of the WKOW installation are included. (Mention T-T)

Transformers

Over 400 Stancor stock items including audio and power transformers, power packs, volt adjusters, radio transmitter kits and television components are listed in catalog 140-H, published by Standard Transformer Corp., Dept. A Elston Kodzie and Addison Streets, Chicago [illegible]. (Mention T-T)

Laboratory Instruments

Catalog 19-A is a handsome brochure recently released by the Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Calif. All types of electronic laboratory instruments and accessories are described. (Mention T-T)

Permanent Magnet Sub-Assemblies

How magnetic sub-assemblies eliminate assembly line rejects, the high cost of test equipment, breaking and chipping losses, and the expense of shipping semi-finished magnets are covered in booklet CDM-16, published by the General Electric Company's Metallurgy Division. Among the sub-assemblies illustrated are the magnetic focusing, the Titan valve, the magnetron, and the cable clamp. (Mention T-T)

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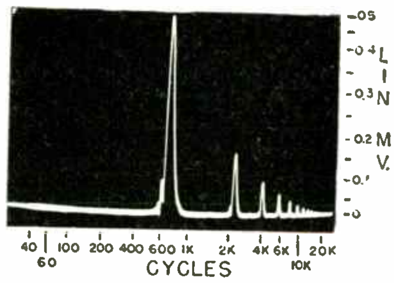

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World Radio History

TRANSISTOR

(Continued from page 20)

tute for all vacuum tube applications. Consider, for example, the case of an ordinary cascaded resistance-coupled amplifier. Normally the grid leak resistance of a succeeding stage is made as high as possible in value (commensurate with frequency-response considerations) to minimize its shunting effect on the plate resistor of the preceding stage. Cascaded transistors would require transformer, direct-tube, or some other form of coupling since the input impedance is only 1/10 or so of the output impedance. Again, because transistor output is limited to about 50 milliwatts, and since current portable battery receiver designs provide up to .25 watts of power for driving a loudspeaker, a vacuum-tube power amplifier would have to be included for these applications. An interesting and important feature in the use of transistors, however, is that since the input and output circuits are connected through the crystal element, no 180° phase reversal occurs between the two voltages, as is the case when vacuum tubes are employed. This can result in important design changes in television circuits where phase reversals produce positive and negative pictures when signal levels are sufficiently above transistor noise levels but below output power requirements.

Frederick Walters

New York, N. Y.

Transister Principles Discussed at URSI Meet

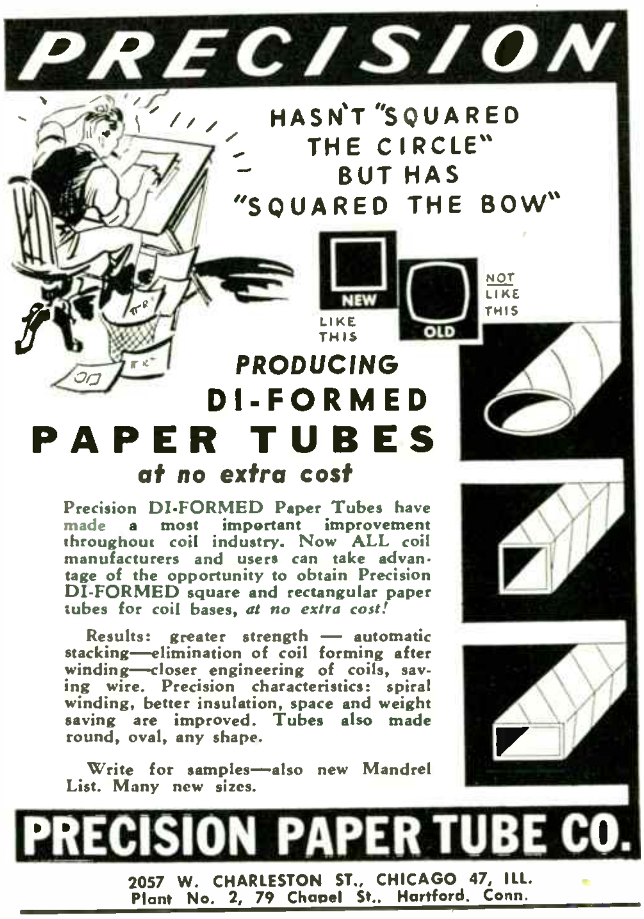
At the joint meeting of the International Scientific Radio Union and the Institute of Radio Engineers, held at Washington, D. C., May 3 to 5 of this year, two papers presented at the George Washington University session of May 5, related to the present topic of transistor principles and operation. These papers as abstracted in the official program, are described below:

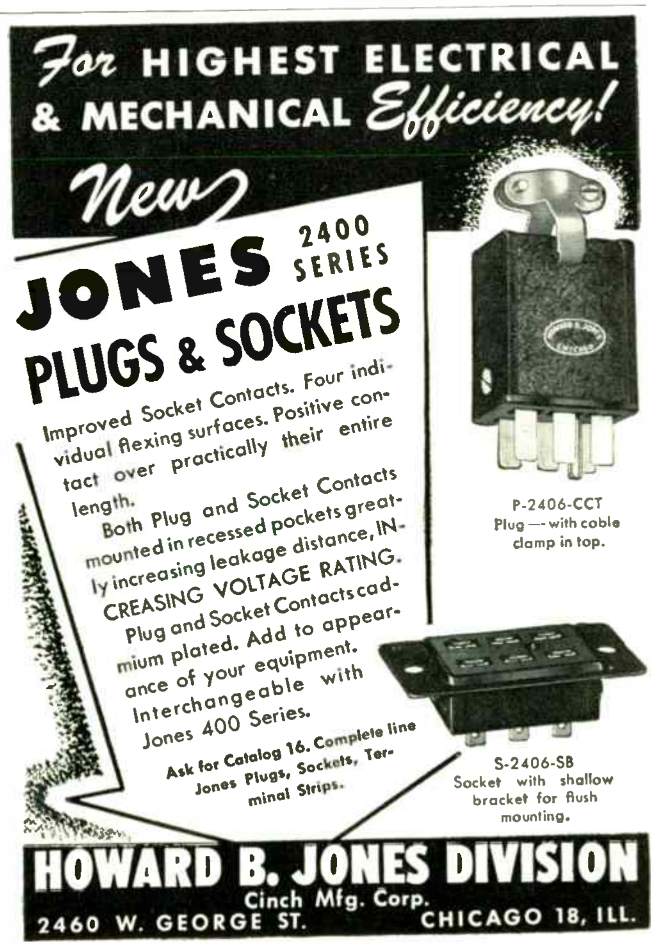
The Electrical Properties of Semi-Conductors—K. Lark-Horovitz, Purdue University, Lafayette, Ind.—From measurements of electrical conductivity, Hall effect, and thermo-electric power as a function of temperature, it can be concluded that at low temperatures the conductivity in semi-conductors is due to impurity electrons or holes, whereas at higher temperatures both impurity and intrinsic electrons and holes are effective. It can be shown, that from a knowledge of the properties of the semi-conductor such as dielectric constant, effective mass, ratio of mobilities of holes and electrons and the number of ionized impurity centers as a function of temperature, the behavior of the semi-conductor can be predicted theoretically throughout the whole temperature range of measurements. This has been verified by applications of these conclusions to germanium alloys.

Germanium High-Voltage Rectifiers and Photocells.—S. Benzer, Purdue University, Lafayette, Ind.—Germanium crystals show remarkable effects which make them useful for rectifiers, non-linear and negative resistance elements, photosensitive and temperature sensitive devices.

Under proper conditions of impurity content, surface treatment, etc., crystal rectifiers may be made which support high inverse voltages (as high as several hundred volts) at low current while passing large currents at low voltage in the low resistance direction. The inverse characteristic also has a voltage peak followed by negative differential resistance.

Germanium temperature sensitive elements and photoelectric cells of the photoconductive, photovoltaic, and trigger types, have been made.





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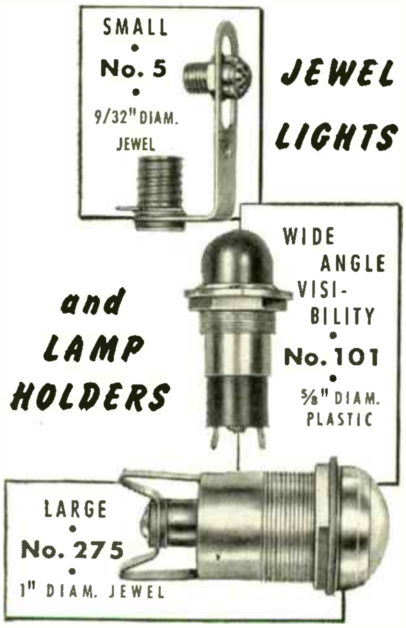

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PERSONNEL

J. H. Duncan has been named director of television engineering for WLWT, Cincinnati. Formerly he was acting director of television operations for the Crosley Broadcasting Co.

Harvey W. Smith has joined the engineering staff of Lenkurt Electric Co., San Carlos, Calif., and will be in charge of design and construction of Lenkurt transformers.

Harold A. Higgins, for 15 years a member of WCAU's technical staff, has been named an engineering supervisor at the Philadelphia station. He will head the engineering operation of AM, FM, TV and Facsimile.

Leo L. Helterline, Jr. has been named general manager of Sorenson and Co., Stamford, Conn. He joined the company early in 1946 as development engineer. He had been chief engineer before his appointment as manager

Dr. William J. Youden has been appointed to the staff of the National Bureau of Standards as assistant chief of the Statistical Engineering section. He was formerly with the Boyce Thompson Institute for plant research where he developed a type of experimental design called Youden Squares.

Louis L. Kwasniewski will assume direction of the recently organized laboratories of Triode Radio Inc., 348 Livingston St., Brooklyn, N. Y., manufacturers of electronic devices. The engineering and development laboratories will specialize in high frequency communications and high fidelity audio systems.

John M. Otter has been elected vice-president and general sales manager of the Philco Corp. He joined Philco in 1926.

Edward A. Sprigg, formerly vice-president in charge of engineering, has been elected vice-president and general manager of H. M. Buggie and Co.

Victor E. DeLucia is now associated with Northwest Research Inc., South Norwalk, Conn., as president-director.

Spangenberg Joins Navy

At the request of Rear Admiral P. F. Lee, chief of naval research, Dr. Karl Spangenberg, professor of electrical engineering, has been granted a year's leave of absence from Stanford Univ., Calif., to direct the navy's work in electronics. Dr. Spangenberg has been a frequent contributor to TELE-TECH.

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GENERAL ELECTRIC

WFAS—ENGINEERING AN FM-AM STATION

(Continued from page 32)

than 1½% for all signal frequencies. With 250 watts output, the input power required is obtained from a 208-230 volt, 60-cycle, single-phase source at 1550 va.

The cloverleaf FM antenna and the AM tower extend approximately 450 ft. above the ground. The structure weighs about 35 tons and the enclosure at the base of the tower surrounds a 40 ft. square copper ground mat. One hundred and twenty radials, each between ¼ to ½ a wavelength, extend in all directions away from the mat. These radials are of No. 6 copper wire and are buried in about one foot of earth. The four tower legs are supported by Lapp type conical insulators mounted on concrete blocks measuring approximately 3x3x3 ft. Each of the grounded portions of the tower legs is securely bonded to the ground mat with four copper straps.

Power for antenna lighting circuits is supplied by an Austin type isolation transformer at the tower base. Two 500-watt flasher lamps are installed at both the top and at the mid-point of the tower. At the 1/3 and 2/3 points four 100-watt traffic lights are used. Tower lights are turned on and off automatically by photoelectric control.

The antenna tower is approximately 150 ft. away from the transmitter house. The FM signal is fed to the cloverleaf antenna by a 1⅝-in. 51.5-ohm coaxial transmission line through an RCA type BAF-AA isolation unit. AM to the tower structure appears in a ⅞-in. coaxial line through a Western Electric D-97008 antenna coupling unit. Three ¾-in. conduits run parallel with the transmission lines from the transmitters house to the enclosure. One conduit contains a telephone line to permit intercommunication when adjustments are required. Another carries dc back to the transmitter house for an rf ammeter while the third provides the 2.8 kw required for tower lighting. Copper grounding straps are tied to the transmission lines and conduits about every 20 ft. and all leaders, gutters, etc. on the transmitter building are bonded to ground. An auto Dryaire unit model 46 maintains a dry air pressure of 10 lb. per sq. in. in the FM coaxial transmission line.

The FM transmitter feeds directly into the coaxial transmission line while the two AM transmitters are connected to the changeover-switch. This switch is operated from the console and connects the output of one transmitter to a 73 ohm 250-watt dummy antenna while the other is connected to the transmission line or vice versa.

Two power sources for the transmitters are also available, so that if one of the power services fails an automatic changeover-switch connects the feeder busses to the other service.

As a concluding feature, the studios and reception room of WFAS are air conditioned. Temperature setting in each studio is individually controllable and the system automatically changes over to heating instead of cooling when required. Appreciable operational savings are effected in the cooling system by using water from a nearby artesian well instead of from the city's water supply. The water in this well maintains a nearly constant 56° temperature and hence is ideally suited for air conditioning purposes.

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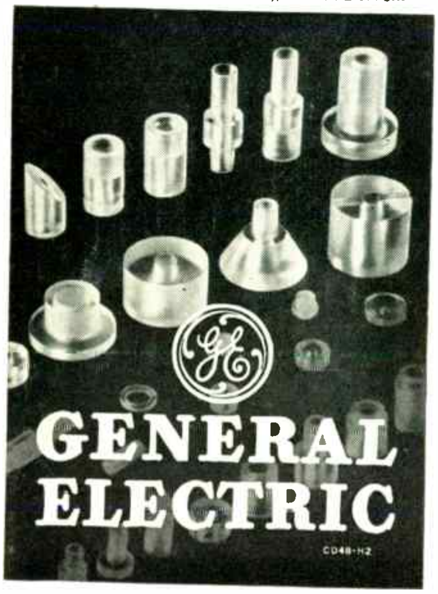

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BOOKS

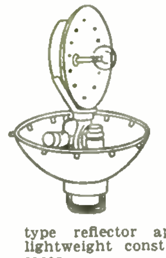
Ultra and Extreme Short Wave Reception, Principles Operation, and Design

By M. J. O. Strutt, (Philips Co. Ltd., Eindhoven). Published 1947 by D. Van Nostrand Co., New York. 387 + XI pages. Price $7.50.

This book deals with radio communication signal propagation in the range of 6 to 30,000 mc, and the equipment used in these channels. Written by a well known European authority, it covers not only practices in Europe in utilizing these frequencies, but gives a well selected review of American practices in addition.

Chapter I deals with the properties, propagation, reflection, and absorption of waves, including ionospheric data, with the aspects of amplitude, phase, frequency, and impulse modulation. Chapter II deals with noise of networks and tubes. In Chapter III the relevant properties and data on antennas are given a unified treatment. Chapter IV covers links between antennas and receiving sets: transmission lines, wave guides, and resonant devices. Chapter V contains a compilation of experimental and laboratory measuring devices. Chapter VI deals with important parts of receivers: the input stage, including amplifier, mixer, regenerative detector, and superregeneration stages.

MICROWAVE ANTENNAS



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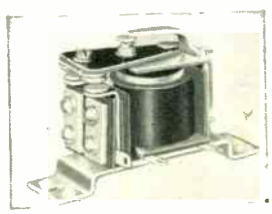

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If You'd WATCH YOUR INSTALLER

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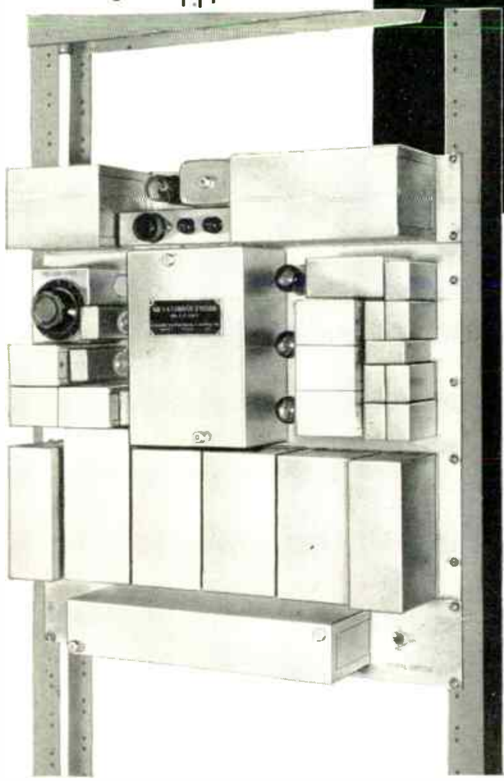

Important Facts About the Kellogg No. 5-A Carrier

Operates over a circuit 30db long (measured at 11 KC) and provides a 6db talking circuit. This is equivalent to more than 250 circuit miles of .104 copper wire. Ruggedly-built, with advanced circuit design for long, trouble-free service. Flexible in design for quick, easy circuit-changes and addition of units. Adding a second carrier channel requires only a few external connections. (Other models available too, to meet your every requirement).

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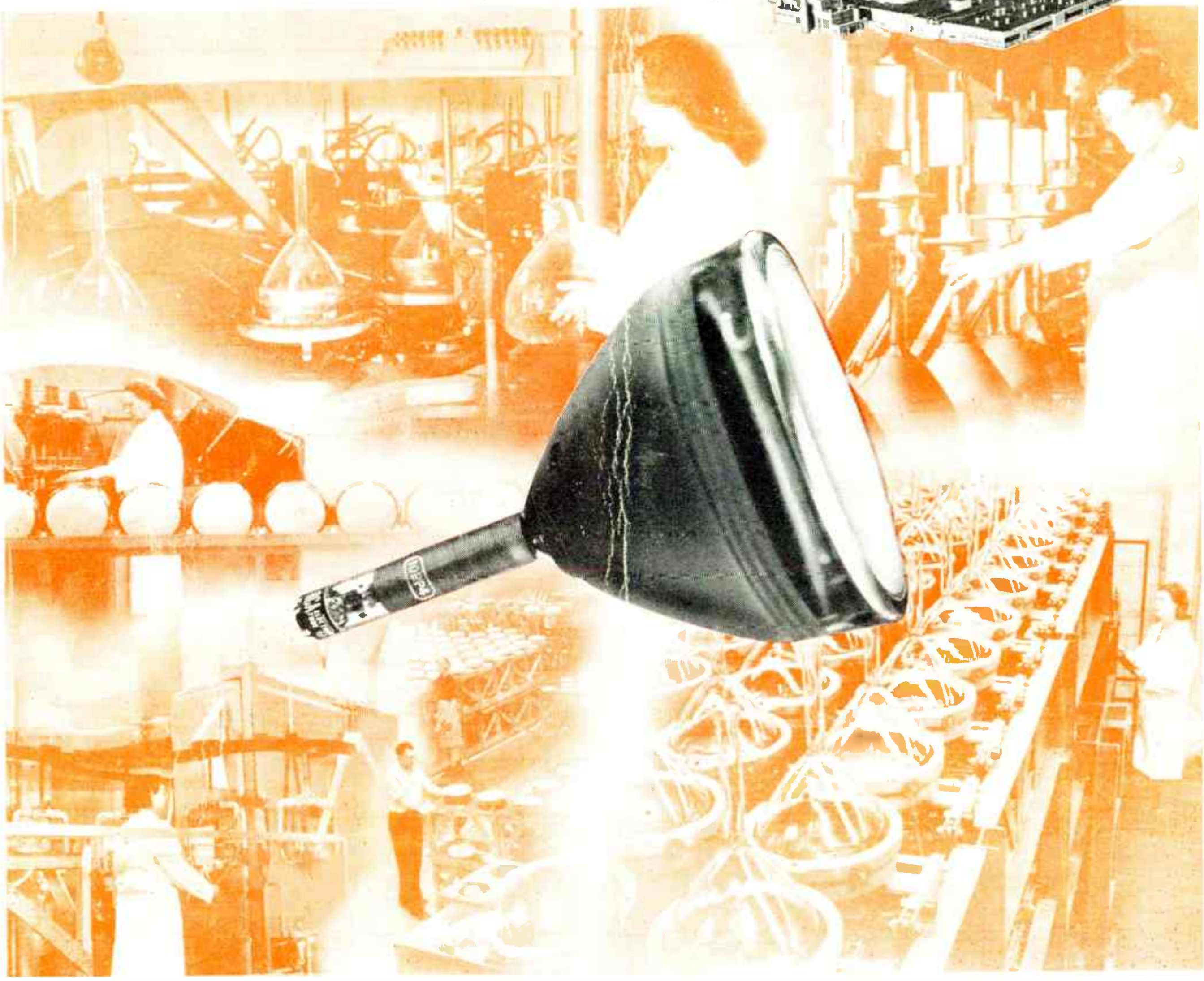

Every minute... another 10" kinescope...

by automatic mass production at RCA, Lancaster

THE STORY OF LANCASTER focuses dramatically on an elaborate array of automatic tube machinery for the mass production of television kinescopes. These intricate machines were conceived, designed, and built by RCA engineers as the answer to the problem of producing the vast quantities of kinescopes, at progressively lower cost, that are so vital to the rapid expansion of television.

Today this highly automatic equipment—unique in the tube manufacturing industry—is turning out *better* 10-inch kinescopes at the unprecedented rate of more than one a minute!

Now, in anticipation of television's continued growth, RCA is embarked on a million-dollar expansion program at Lancaster that will *double* present kinescope output . . . another step in RCA's continued leadership in the development and manufacture of high quality tubes at low cost.

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

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