

COMMUNICATIONS

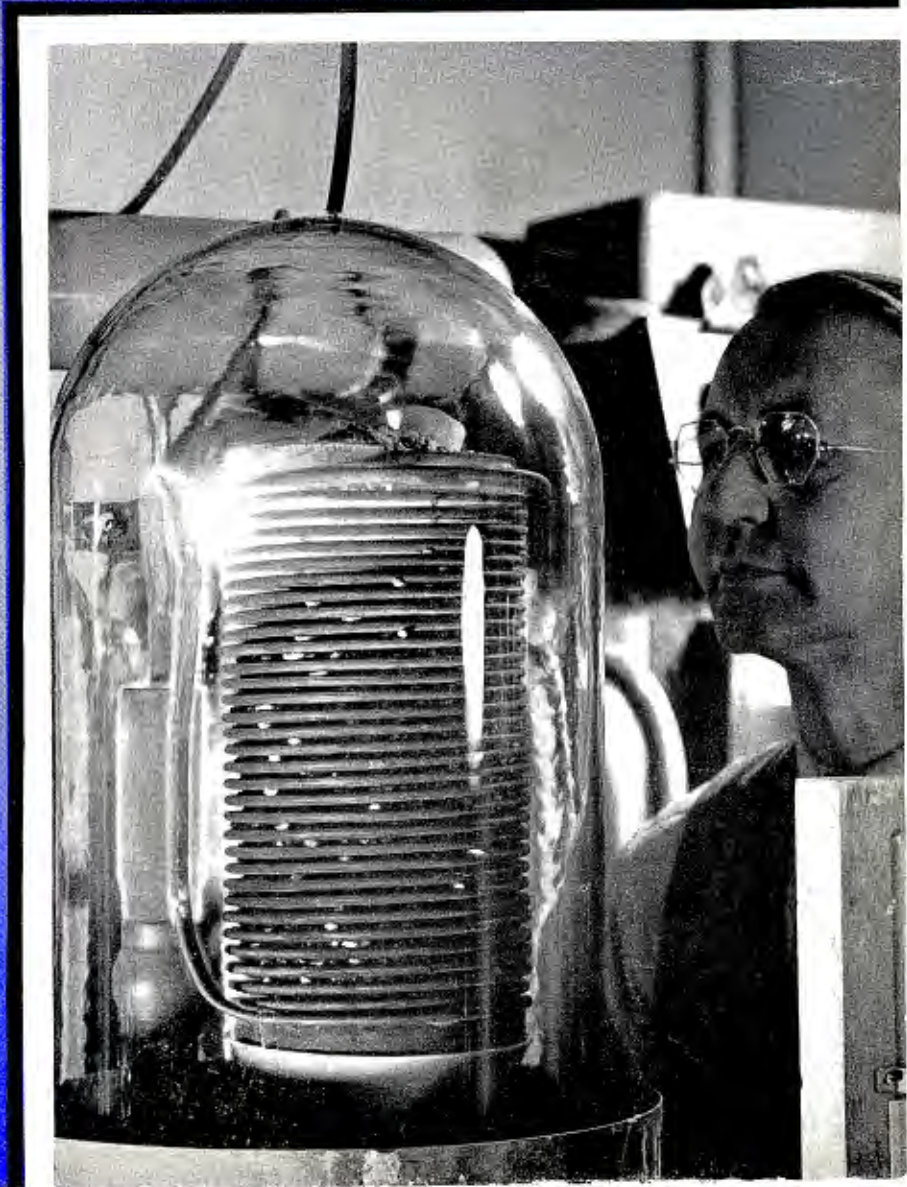
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**NEW DIAL CALIBRATION
METHODS**

**TRANSMITTER MAINTENANCE
DATA**

**BROADCAST ENGINEERS
AS F-M SALESMEN**

**APRIL
1942**



To former manufacturers of commercial
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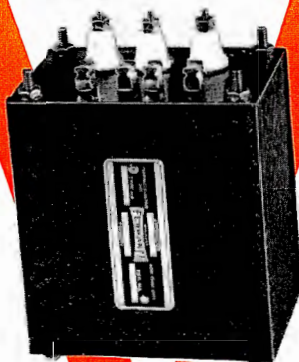
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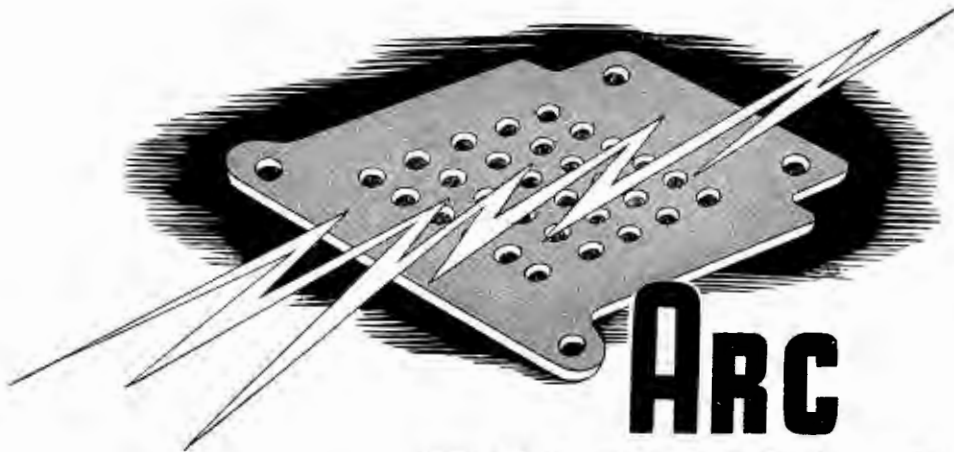
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LEWIS WINNER, Editor
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COMMUNICATIONS

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APRIL, 1942

VOLUME 22 NUMBER 4

We See...

THE WAR AGAINST SABOTAGE is being waged with increased fury with communications systems in the thick of the fight. In studios and at the transmitters, throughout the country, there are all-out efforts to provide protection . . . unprecedented protection against the piercing tragedies of sabotage in wartime. In the field, in the vast acreages where transmitting equipment is located, trenches are being dug for intricate alarm systems; huge fences are being erected; electronic systems are being installed; code-communications-guard systems are being prepared. You'll find guns, sealed doors, protected glass, armed guards. And in the studios, similarly thorough protective means have been adopted. American communications will not be found asleep by saboteurs. There'll be no Pearl Harbor here!

SHELLAC . . . VITAL TO MANY INDUSTRIES . . . and particularly to the manufacturers of discs, now looms as a critical material. Already responsible for a reduction in disc making, shellac may cause further drastic curtailment because of conditions in the Far East and particularly India. For it is from this country that this material is found in the purified form of lac, a resinous substance secreted by an insect which lives on the trees of India. Many solutions are rapidly being introduced, among these being the increased use of scrap records, with campaigns being waged for increased collection of such scrap from dealers and consumers. In present methods a percentage of scrap finds its way into the plastic composition of a record as a filler, serving as an excellent binder. Thus an increased use of scrap will necessitate less shellac, conserve the stockpile of shellac and permit adequate manufacture of discs.

—L. W.

COVER ILLUSTRATION

Dr. T. D. Yensen, manager of the magnetic division of Westinghouse Research Laboratories and his amazing development that affords a reduction of the carbon content of iron to one-thousandth of a percent, thus further extending the important uses of iron in communications and allied fields today. By drawing off the carbon and oxygen from metal heated in a h-f induction furnace and carrying it out of the furnace by means of a vacuum system, this reduction is accomplished.

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Filament Emission

Makes the Modern World Go Around

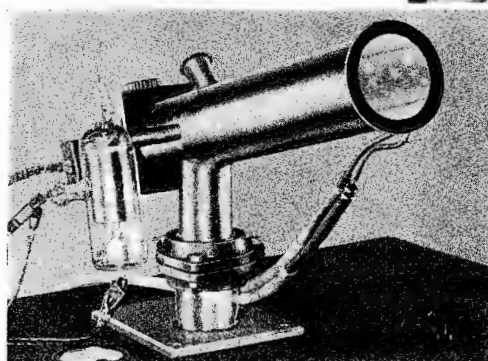


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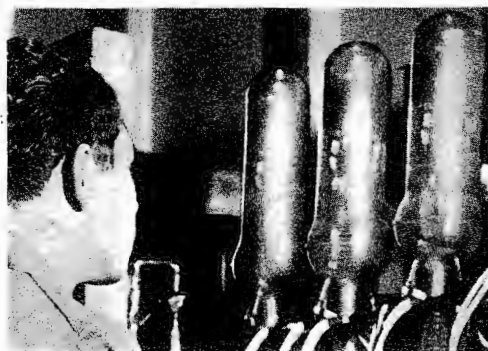
HE life of radio communications hangs by a tiny thread of filament wire. If the steady flow of electrons from the vacuum tube filaments ceases, the transmitter is off the air no matter how excellent the other components may be performing. To assure peak emission under the most severe operation conditions, many exacting tests are conducted during the process of manufacture.

Above is an Eimac technician checking an Eimac tube on the Peak Emission Tester. This device, designed and constructed in the Eimac laboratories, measures the flow of electrons emitted from the completed tube. Of a long series of filament tests conducted at various stages of manufacture, this test is the final. Other important controls are illustrated at left.

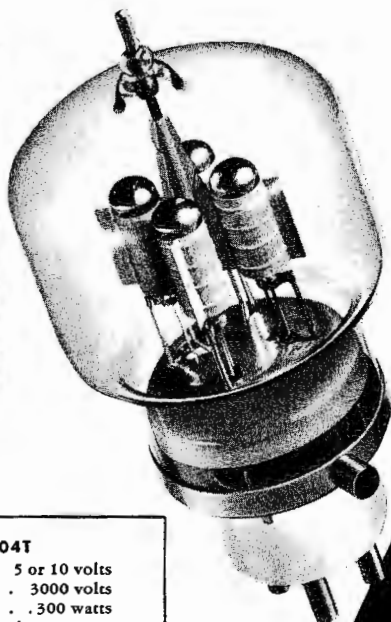
From beginning to end, Eimac tubes are designed and constructed to give vastly superior performance. The proof that they do is made clear by the fact that Eimac tubes enjoy first choice in the minds of leading radio engineers throughout the world.



Close observation of the flow of electrons from a heated filament is made possible with this Electron Microscope. This instrument, designed and constructed in the Eimac laboratories, virtually gives a motion picture projection of the electron movement.



Before filaments are sealed into the triode they are placed in a temporary vacuum where they undergo their first emission test. Thus faulty filaments may be weeded out without further processing.



EIMAC 304T	
Filament Voltage . . .	5 or 10 volts
Plate Voltage (D.C.) . . .	3000 volts
Plate Dissipation . . .	300 watts
Power Output 3000 volts at 75% eff.	900 watts

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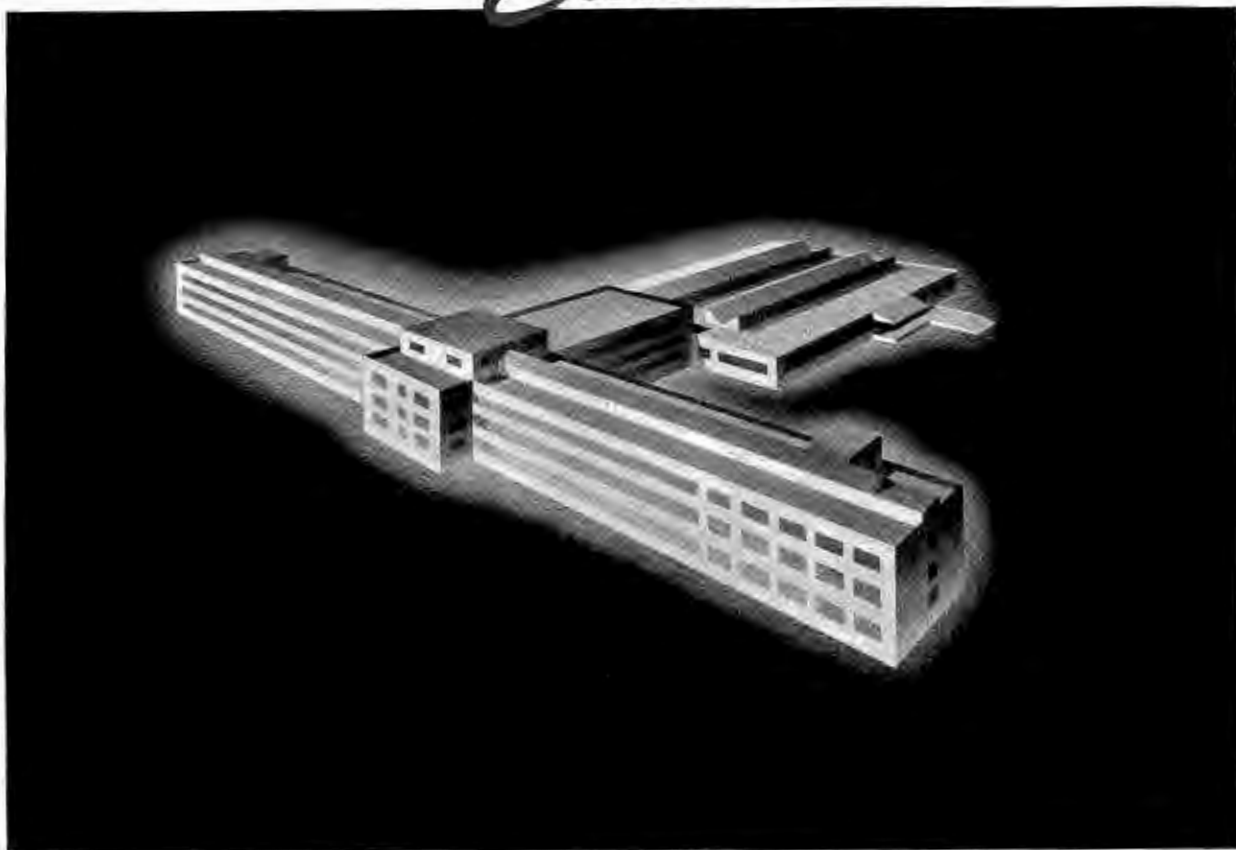
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TUBES

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FOREIGN DIVISION: FRAZAR & CO., LTD. 301 CLAY ST., SAN FRANCISCO, CALIFORNIA, U. S. A.

This is the House *Electrons* are Building



“**G**REAT OAKS from little acorns grow”—
In radio, great services from little electrons grow. Electrons—tiny bits of electricity—are corpuscles of science in the lifeblood of radio progress.

Electronics took wireless out of the spark gap and put it into the vacuum tube oscillator; it lifted radio off the cat-whisker of the crystal detector and placed it in the electron tube, acting as both detector and amplifier. Electronics gave wireless a voice—the radiophone, now called broadcasting.

Today in the Electronic Age, a new structure—RCA Laboratories—is being built on 260 acres at Princeton,

N. J., planned to be the foremost radio research center in the world. Here in surroundings that inspire clear thinking and research, scientists of RCA Laboratories will seek new truths. They will develop new inventions and services for radio, for industry and for people everywhere, because Electronics is an ever-broadening field.

The main section of RCA Laboratories—the House that Electrons are Building—will be ready for occupancy in the Spring of 1942. And with its opening, a new gateway to the future of radio swings wide for the benefit of America and all the civilized world.



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COMMUNICATIONS

LEWIS WINNER, Editor

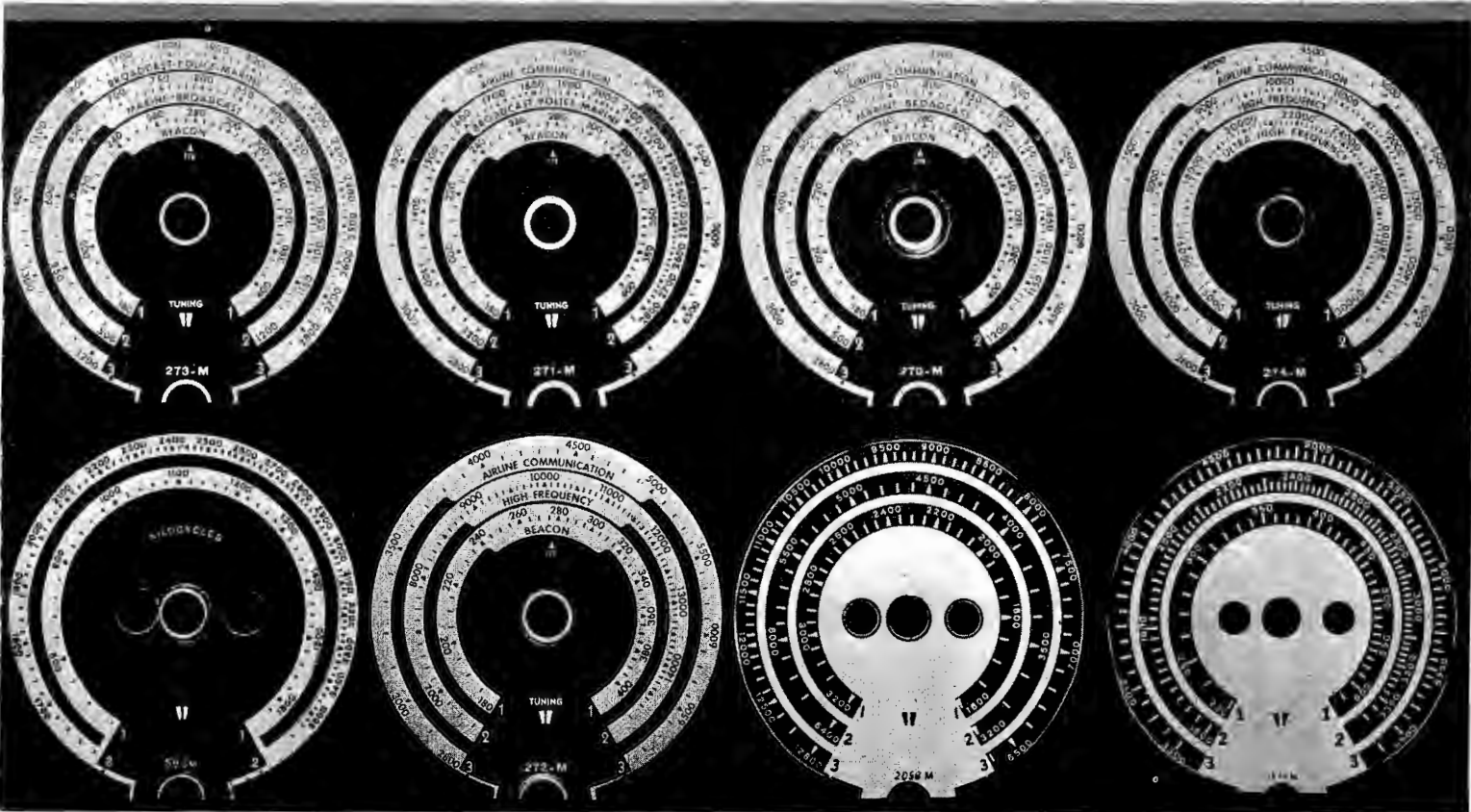


Figure 1

NEW DIAL CALIBRATION SYSTEM

by **ROBERT L. DRAKE**
and
ROBERT R. SCHMIDT

Lear Avia, Inc.

THE calibration of the dial of a superheterodyne receiver may be accomplished wholly by mathematical means, completely eliminating cut and try methods. This has been proved in actual practice and application, by successfully calibrating receivers such as the Lear RCBB series used by many private pilots. All Lear automatic direction finders also use this system, including the ADF-8 used by the Pan American Grace Airways. Using the same tuning condenser, the receivers are supplied with any one of eight dials (Figure 1), according to the fre-

quency coverage desired.

There are two main advantages to this method of dial calibration. A dial calibration arrived at by this method is a true average of the tuning curves that will be obtained from all production variation in gang condensers. A calibration obtained by cut and try can never be other than an average for the number of sets used in obtaining the dial data. The use of the mathematical method permits the design of the dial for the new tuning range to be started as soon as a decision on the band to be covered is decided upon.

With experimental calibration methods dial calibration can't be started until all other radio and electrical design details have been completed.

Since radio dials are usually purchased from an outside supplier, it is desirable to be able to release the cali-

bration data to him as soon as possible if the dials are not to be bottle-necks in the production schedules.

This is an exact mathematical solution; the accuracy being limited only by the deviation from the average curve of incremental capacity for the tuning condenser.

To apply this solution, the following data should be available:

- (1) Frequency range to be covered.
- (2) Table or curve supplying incremental capacity through 180 degrees for the tuning condenser to be used.
- (3) Degrees rotation of pointer on escutcheon.
- (4) Ratio of mid-band to i-f frequency.

To illustrate the process of calibrating the dial, a numerical problem will be solved and the necessary equation derived in proper order.

Example:

- Band "1"... 200 kc. to 410 kc.
- Band "2"... 410 kc. to 850 kc.
- Band "3"... 850 kc. to 1750 kc.
- (Max. permissible overlap at low end5%)
- (Max. permissible overlap at high end2½%)

The purpose of adding overlap to the ends of the bands is to insure having the desired end frequencies within the band and not just outside.

Manufacturer's Condenser Tables

Manufacturers of tuning condensers supply tables containing values of incremental capacity for every ten percent of rotation of their tuning condensers through 180 degrees. This information is the "perfect" curve of that particular condenser model and their production units shoot at that as a goal.

From the table supplied by the manufacturer of the tuning condenser, a curve may be plotted for percent of rotation versus incremental capacity as shown in Figure 4. For greater accuracy, values for every 5 percent are found by interpolation. (See column 2 of work sheet, Figure 3).

Frequency Ratio Selection

The frequency ratio of each band must be calculated and if possible, a frequency ratio should be selected that will satisfy all bands, thus simplifying calculations and eliminating extra



Figure 2

A circular type dial wherein the number of degrees through which the pointer moves is independent of the number of degrees through which the condenser rotates.

trimmer condensers or unnecessary padding of trimmer condensers.

The frequency ratio $F_r = \frac{F. \text{max.}}{F. \text{min.}}$ (1)

is determined by first finding

- (F. max = upper limit of band)
- (F. min = lower limit of band)

F_r , with no overlap for all bands. Knowing the frequency limits and maximum permissible percent of overlap for each band, a value of frequency ratio can be determined which will satisfy all

bands, if the frequency coverage of each band has been thoughtfully planned in advance.

(1) The band limits with overlap are then as follows:

- Band "1"... 191.9 kc. to 418.1 kc.
- Band "2"... 396.2 kc. to 863.8 kc.
- Band "3"... 817.6 kc. to 1782.4 kc.

The overlap at the end of each band was chosen to lie within the limits specified and to result in three bands having exactly the same ratio of maximum to minimum frequency.

A knowledge of the frequency ratio is all that is necessary to determine the total minimum capacity for the particular frequency range. The capacity ratio C_r is equal to the square of the frequency ratio F_r , as shown:

$$F_1 = \frac{1}{2\pi \sqrt{L C_1}}$$

$$F_2 = \frac{1}{2\pi \sqrt{L C_2}}$$

$$\frac{F_2}{F_1} = \frac{2\pi \sqrt{L C_1}}{2\pi \sqrt{L C_2}}$$

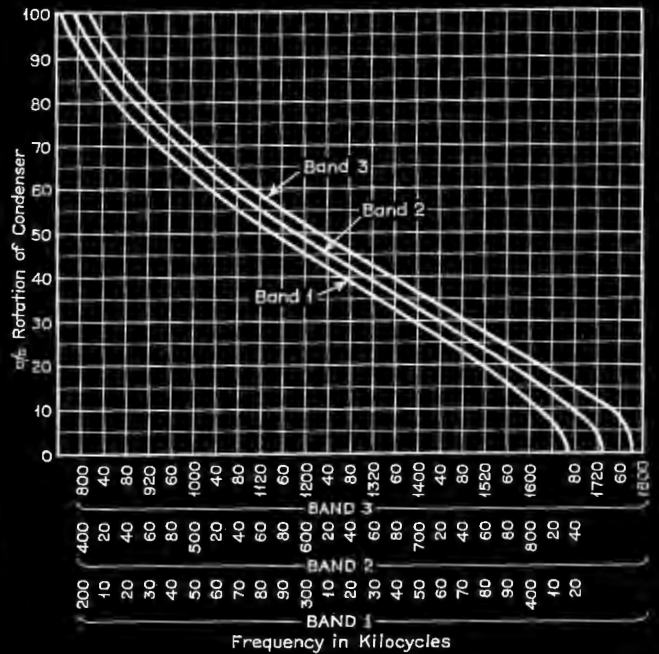
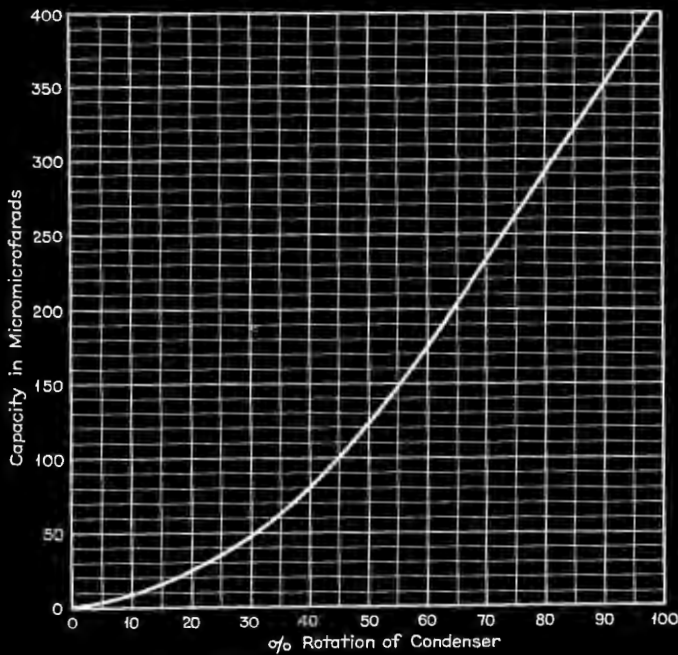
$$\frac{F_2^2}{F_1^2} = \frac{C_1}{C_2}$$

$$F_r^2 = C_r$$

(2)

% ROTATION	Δc	$\Delta c + C_{min}$	Log $(\Delta c + C_{min})$	Log CAP. RATIO	Log F RATIO	BAND I		BAND II		BAND III	
						Log f	f Kc.	Log f	f Kc.	Log f	f Kc.
0	0	108.3	2.03463	0	0	5.62128	418.1	5.93641	863.8	6.25100	1782.4
5	1.9	110.2	2.04218	0.00775	0.00378	5.61750	414.5	5.93263	856.3	6.24722	1767.1
10	5.5	114.8	2.05994	0.02531	0.01266	5.60862	406.1	5.91375	839.0	6.23834	1731.2
15	14.1	122.4	2.08778	0.05315	0.02658	5.59470	393.3	5.90983	812.5	6.22422	1676.6
20	24.3	132.6	2.12254	0.08791	0.04396	5.57732	377.9	5.89245	780.6	6.20704	1610.8
25	35.2	143.5	2.15685	0.12222	0.06111	5.56017	363.2	5.87530	750.4	6.18909	1545.6
30	48.0	156.3	2.19396	0.15933	0.07967	5.54161	348.0	5.85674	719.0	6.17133	1483.7
35	62.3	170.6	2.23198	0.19735	0.09868	5.52260	333.1	5.83773	688.2	6.15232	1420.1
40	80.1	188.4	2.27508	0.24045	0.12023	5.50105	317.0	5.81618	654.9	6.12077	1351.3
45	100.0	208.3	2.31869	0.28406	0.14203	5.47925	301.5	5.79438	622.8	6.10897	1285.2
50	122.5	230.8	2.36324	0.32861	0.16431	5.45697	286.4	5.77210	591.7	6.08669	1220.9
55	147.5	255.8	2.40790	0.37327	0.18664	5.43464	272.0	5.74977	562.0	6.06436	1159.7
60	175.1	283.4	2.45240	0.41777	0.20889	5.41239	258.5	5.72752	534.0	6.04211	1101.8
65	203.8	312.1	2.49429	0.45966	0.22983	5.39145	246.3	5.70658	508.8	6.02117	1050.0
70	233.9	342.2	2.53428	0.49965	0.24983	5.37145	235.2	5.68658	485.9	6.00117	1002.7
75	263.0	372.0	2.57064	0.53591	0.26796	5.35332	225.6	5.66845	466.1	5.98304	961.7
80	293.0	401.3	2.60347	0.56864	0.28442	5.33686	217.2	5.65199	448.7	5.96658	925.9
85	322.0	430.3	2.63377	0.59914	0.29957	5.32171	209.8	5.63684	433.4	5.95143	894.2
90	351.7	460.0	2.66276	0.62813	0.31407	5.30721	202.9	5.62234	419.1	5.93693	864.8
95	379.2	487.5	2.68797	0.65334	0.32667	5.29461	197.1	5.60974	407.1	5.92433	840.1
100	406.2	514.5	2.71139	0.67676	0.33838	5.28290	191.9	5.59803	396.2	5.91262	817.6

Figure 3



Figures 4 and 5

The tuning condenser table supplied by the manufacturer may be used to plot percent rotation versus incremental capacity (Figure 4). The percent rotation from the aligning point as located on the curves for each of three bands can be determined for either circular or straight line type of dials (Figure 5).

L = Inductance of r-f coils
 $C_1 = C$ max.
 $C_2 = C$ min.
 $F_1 = F$ min.
 $F_2 = F$ max.

Substituting in equation 1, the capacity ratio is

$$C_r = \frac{C \text{ max.}}{C \text{ min.}} \quad (3)$$

To find the minimum capacity of the circuit:

$$C \text{ min. } C_r = C \text{ max.}$$

$$C \text{ min. } C_r = \Delta_c \text{ max.} + C \text{ min.}$$

$$C \text{ min. } C_r - C \text{ min.} = \Delta_c \text{ max.}$$

$$C \text{ min. } (F_r^2 - 1) = \Delta_c \text{ max.}$$

$$C \text{ min.} = \frac{\Delta_c \text{ max.}}{F_r^2 - 1} \quad (4)$$

Δ_c = incremental changes in capacity

(C max. = max. cap. of tuning cond. + tube cap. + trimmer cap. + stray cap. due to wiring.)

C min. = min. cap. of tuning cond. + tube cap. + trimmer cap. + stray cap.)

Calculations Depend on Minimums

These calculations depend only on the total minimum capacity and are independent of any one of the individual capacities that make up the total minimum.

In this problem:

$$\Delta_c \text{ max.} = 406.2$$

sub in (4)

$$C \text{ min.} = \frac{406.2}{(2.18)^2 - 1} = 108.3$$

Arranging Data in Tables

It is convenient to arrange the data for the dial determination in the form of a table.

Since (C min. + Δ_c) will be needed in finding the capacity ratio at any particular setting of the tuning condenser, it is tabulated (Column 3 of Figure 3). (C min. + Δ_c is entered as column 4,

in Figure 3.)

$$C_r = \frac{C \text{ min.} + \Delta_c}{C \text{ min.}}$$

$$\text{Log } C_r = \text{Log } (C \text{ min.} + \Delta_c) - \text{Log } C \text{ min.} \quad (\text{See Column 5, in Figure 3}).$$

$$\text{Log } F_r = \frac{1}{2} \text{log } C_r \quad (\text{See Column 6 in Figure 3}).$$

$$\text{Log } F_r = \frac{1}{2} \text{Log } (C \text{ min.} + \Delta_c) - \text{Log } C \text{ min.}$$

Knowing the upper limit of each band, the frequency for any point on the dial will be $F_k = \frac{F \text{ Max.}}{F_r}$, F_r being the

(Continued on page 32)

Figure 6
 The model RCBB receiver that employs a calibrated dial prepared by the exact mathematical methods described here.



TRANSMITTER MAINTENANCE*

by CHARLES H. SINGER

Technical Supervisor, WOR-W71NY Transmitters

As Told to LEWIS WINNER, Editor



The measuring equipment panel in the WOR measuring equipment room that plays a major role in maintenance.

and other essential acts are part of the daily routine.

Measurements and Maintenance

Measurements constitute an important phase of maintenance. Accordingly a strict schedule of operations has been set up at WOR, a schedule that is followed religiously. This procedure includes a list of available data on measurements, that appears in specially prepared operating and maintenance manuals. These data include chapters on measuring instruments (general discussion), r-f bridge set-up, r-f bridge condenser capacity measurements, r-f bridge resistance measurements, impedance measurements at r-f. Illustrative diagrams on methods of connecting r-f bridge to points of measurement, a complete set of short cut-tables computed at 710 kc for quick use at WOR, data on r-f harmonic distortion measurements, impedance, resistance, capacity and inductance measurements at 1 kc and a list of measuring and test equipment on hand, are also included.

In discussing the various operations of measurement, reference is, of course, first made to the equipment to be used. In the case of a r-f bridge set-up, for instance, it is a GR type 516-C r-f bridge. The discussion then continues with the method of application. Capacitors, for instance with values between 40 mmf. and 1180 mmf. may be directly measured on this instrument, the discussion states. In measuring resistance, the same instrument is used, the manual states, with resistors from zero to 111 ohms. These points are, of course, quite fundamental, but essential nevertheless in insuring effective maintenance. Included in the manual, also is such data as the use of calibration tables for the GR 724-A precision wavemeter.

Other Data in Manuals

Among other explanations given in the manual is that on measurement of

THERE are three main classifications of transmitter maintenance—day, night and special. Day maintenance consists of the work which may be done with the transmitter on the air. Night maintenance entails the necessary work on the transmitter itself, while special maintenance pertains to work which is seasonal or annual.

At WOR, the night maintenance

*From the discussion at the transmitter maintenance round table at the 5th Annual Conference of Broadcast Engineers at Ohio State University.

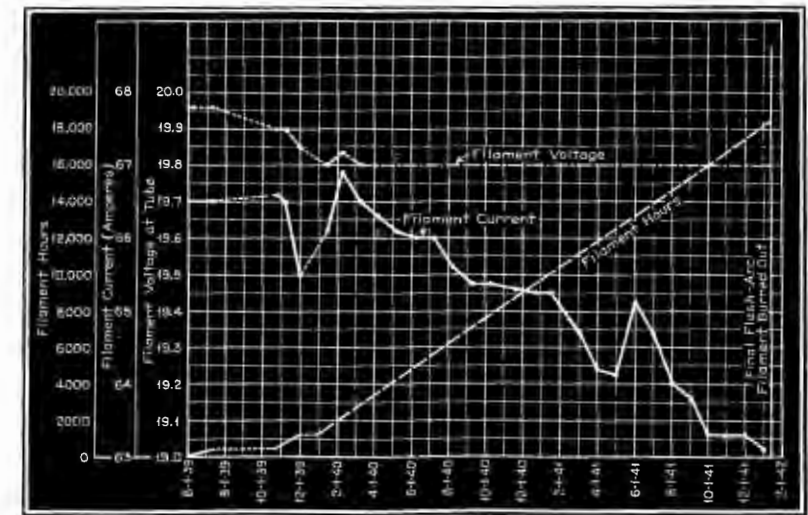
items are typical of those for any transmitter. A total of 16 hours is available, equalling 36 man-hours of maintenance, required for a 50 kw station.

A 10 kw station can maintain its transmitter in 10 hours per week; a 5 kw station in 8 hours per week and a 1 kw station in 6 hours per week. Stations of lesser power can effectively do their maintenance in 4 hours per week. Such maintenance is, of course, predicated on the fact that continuous inspection, attention to circuit changes,

percentage modulation. It is shown how measurement of modulation may be made on continuously varying audio signals and one or more given audio signals (constant amplitude). The explanation goes on further to say that 100% modulation is seen when the audio frequency syllabic or sine wave increases the rectangle of light in width equal to one half of the actual width of this rectangle before the audio was applied. This is 100% modulation of the positive peaks.

Instruments Used at WOR

Some of the instruments used in measurements at WOR are: Weston model 45 d-c voltmeter; Weston model 45 d-c ammeter; Weston model 663 volt-ohmmeter; Jewell model 171 d-c voltmeter; Jewell model 171 d-c ammeter; Weston 772 analyzer; Weston model 155 a-c ammeter; Weston portable model 598 a-c voltmeter; GR type 726-A vacuum tube voltmeter; RCA type 161 sidanalyst; Weston tube checker model 773; Weston model 674 tube checker; GR portable power level vu meter; GR type 273 modulated oscillator; GR type 684-A modulated oscillator; RCA beat-frequency oscillator type TMV 134-A; GR type 516-C r-f bridge; GR type 650-A impedance



The WOR transmitter tube record for a WE type 342-A used in the 3rd PA positions. The total number of filament hours afforded by this tube were 18,386. Since the tube cost \$480.00, the net filament cost per hour was 2.66c. The per cent increase of life of this tube over the guarantee was 1,738.

bridge; GR decade resistance box; GR type 916-A bridge, and GR type 605-B standard signal generator.

102 Items Checked

In checking the transmitter and associated equipment before officially

taking over the watch, 102 items must be inspected at WOR by the operating technicians. Such care has prevented many potential breakdowns in the past. This practice is also based on the principle that the man coming on watch is physically and mentally fresh. He will notice changes readily, which his colleague, who has been working for 8 hours, may fail to note.

Measuring Room Checked First

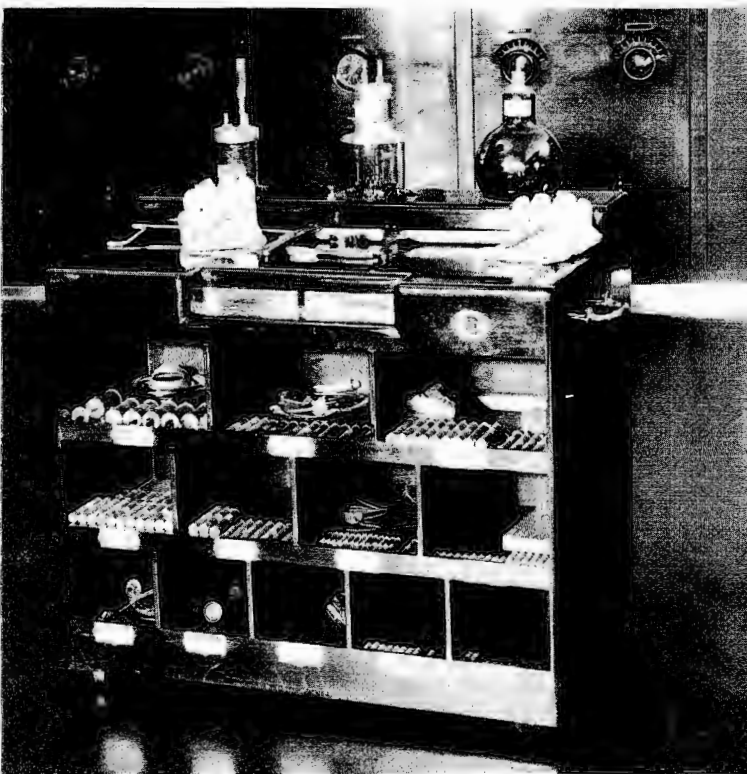
The measuring equipment room, where the monitoring equipment is located is the first concern of the man coming on the job. There he checks the modulation monitor and associated equipment, cathode ray oscillograph, operation of all receivers.

Meter Inspection

In continuing the check on the 50 kw transmitter, a careful inspection is made of the meters on the master control panel, water cooled tubes, water cooling connections, the meters which indicate input to the last stages, the antenna extension ammeter readings and antenna coupling unit meter readings. Proceeding down the back of the transmitter unit, all visible parts are scrutinized for even the slightest change from normal.

Temperature Test in Basement

While in the basement the man on the maintenance tour must "take the temperature" of the entire plant. First, he reads the Tel-Temp thermometers



The unique portable fuse-rack-table in use at WOR, that facilitates maintenance.

(Continued on page 22)

ENGINEERS AND F-M SELLING

by **W. H. GREEN**

Radio and Television Department
General Electric Company

“EVEN if you're on the right track you'll get run over if you just sit there.”

If the f-m industry takes that reasoning to heart, f-m will bind itself to a sky-rocket that will be touched off by the last incendiary of World War II. If f-m keeps a chin-up attitude, it will really be ready to go places when the smoke clears away and war factories turn back to peace-time production.

Frequency modulation is on the right track. To put it plainly, the f-m industry—the broadcasters, the manufacturers, and the press—will determine whether f-m just sits there, or whether it keeps moving forward.

At the outset, it is well to point out that most of the f-m progress during war time will—in fact, must—come from the broadcasting industry itself, from stations that are now in operation or planning to get started with equipment still available. Activity in the manufacturing industry, of course, is limited chiefly to military needs. The stations, on the other hand, continue to serve the public, and so long as they do, have an opportunity to step forward.

F-M Needs Missionaries

In the heart of the f-m industry there is a solid group of enthusiasts—believers, if you will—that have no doubt about the future of this new and better system of broadcasting. It is these men who will generate the progress that will occur between now and peace. But around the edges of this group are a great many casual observers whose speculations for the future range from supreme optimism to black despair. They are people f-m needs—on the right side. For they are missionaries. They can spread the good word. Frequency modulation stations, in particular, can serve as sources of enthusiasm to keep these satellites of f-m on the right track. It is a sales job—and one

that engineers naturally inherit. Practically every major advance in the history of broadcasting has been the result of an engineering achievement: tube transmission that made broadcasting practical; thoriated tungsten filaments that made home radio practical; regenerative and super-heterodyne receivers; a-c tubes; single-dial tuning; network broadcasting; highpower amplifiers and mercury-vapor rectifiers; automatic volume control, and so on.

Each pyramided on the last; each gave radio a new impetus; each arrived because it was sound engineering. But not all had an easy job arriving and the engineer, being the father of each, had to see that the proper acceptance was gained. He was, of necessity, a salesman.

A New Job for Engineers

So it is with f-m. The engineering job isn't done even when the station is on the air and the audience begins to

grow. It is on the engineering advantages of this new system translated into benefits that it will be sold.

Station operating engineers in particular—who are nearest to the f-m “firing line” during these war times—can do the most effective job in putting these advantages across and thus help keep moving forward. Some are doing this job most effectively.

Number one job for any man whose station is already on the air is, of course, to see to it that his station lives up to the standards of f-m, especially freedom from “static” (both natural and man-made), high fidelity, low noise level and full dynamic range. Let's look into these, one at a time, to see what may be done.

Freedom from “static”—virtual freedom, that is—is the big drawing card for the summer. At first glance, there isn't much that can be done beyond the possibilities of the system itself. But “freedom from static” will never be be-

The new 3-bay turnstile f-m antenna that is used at the General Electric station W2XOY in Schenectady. In this area, built-in antennas afford adequate reception of this station and W47A.



lieved if your listeners are victims of inadequate f-m receiver installations. Your listeners may never tell *you* about it, but they will tell their friends that this "freedom from static" is a myth.

See Dealers First

The place to get at the problem is through the dealers who sell f-m receivers in your area. Call it a selfish axe to grind, perhaps, but you are doing an inestimable service to the man who invests in an f-m receiver if you can see that he spends the few dollars extra to get his full money's worth. That better antenna will make him a better listener and a better booster. And it will save the dealer some complaints—the kind he has to answer with "Well, for just a few dollars *extra* I can fix that up for you."

Missionary work with dealers can bear rich fruit, and that's not just theory. Some station engineers are actually going into the matter extensively—a practice which in a-m broadcasting was never considered within their province. In the old days of a-m, of course, no installation was complete without a rigging above the house that today would be the envy of the barrage balloon over London. Over a period of years, however, a-m antennas have shrunk and shrunk, until some are hidden in the 3 by 5-inch door of a pocket-portable. Little wonder that it may be hard to sell outside antennas.

But so long as there is an f-m set on a dealer's shelf, or a set without a proper antenna, the contacting of dealers is a good activity. Let us make "freedom from static" mean *all* it should.

Educational Program Important

In some cases, it might be profitable to get the program department's cooperation in putting on an educational campaign—station-break announcements, for example—plugging freedom from static and how to be sure to make the most of it.

In the Schenectady area, built-in antennas will give adequate reception of both W2XOY and W47A. But by the addition of a well-placed dipole, W43B at Paxton will saturate the limiter in favorable locations. This means that a good antenna increases the selection of f-m programs considerably and tends to make for more f-m listening. From the standpoint of building an f-m audience, then, good antennas in some areas will make f-m a much more attractive proposition to the listener.

Interference Freedom and F-M

Freedom from interference between



Lloyd Krause (left) discussing the engineering details of ST relay equipment recently installed by W47A, with D. S. Hoag, chief engineer of the station.

stations has no doubt been a potent reason for f-m's ready acceptance by broadcasters, for now they can offer local service without the jamming that nightly creeps up to their a-m doorsteps.

The High Fidelity Topic

High fidelity, full dynamic range—there's always a question as to just how much these mean to the lay listener. But there is this about improved quality—there are those who *do* want and appreciate it. And because it is an as-

set, every possible means should be used to obtain it.

In a-m broadcast reception the higher audio frequencies have been shunned, for most listeners associate noise and distortion with such frequencies. But there are certain inherent technical improvements in the f-m system which eliminate noise and distortion in the higher audio frequency range, thus making high fidelity both practical and pleasant to listen to.

From the technical point of view, the assurance of high fidelity should include the conversion of studios and speech input equipment to meet the high standards of transmitting equipment. While there are several stations virtually completely equipped, there are others which depend at least in part on facilities of existing a-m affiliates. There is a job to do here improving existing equipment to cover the frequency range of 30 to 15,000 cycles. And some form of regular quality testing should be employed.

Improving Programs Essential

This done, most engineers might well interest themselves more in programming than ever was necessary in a-m. This embraces not only studio and control room techniques—mike placing,



Frazier Hunt (center), who is heard over the American f-m network on the GE news programs, gets some electron facts from Dr. W. D. Coolidge (left), famed GE research director, and Dr. Guy Suits, assistant.

acoustics, etc.—but actual programs themselves. Choice of program material offers a lot of opportunity for study and improvement. Musical arrangements are affected. Transcription quality, of course, has already come in for pretty thorough discussion. The quantity of programming from a-m sources should be held down, both from the standpoint of low quality due to line limitations and the difference in results due to arrangements.

Steps in Programming

In this matter of programming, engineering counsel is almost a necessity, for the steps to attain high quality are not fully understood by programming departments, even though there may be a strong desire to attain high quality.

In addition to these problems which may be fairly well under control by broadcasters who have been in the f-m field for awhile, there is always the opportunity to pass along their findings to the newcomers in the business. Far too little has been written or said to date about this matter of programming. Many of the contributions that might be made to the art have yet gone unsung.

Square Wave Testing

Little need be said about maintaining low noise level. The testing procedure that is set up to check frequency response of studio equipment might well include noise level tests at the same time.

Square wave testing may well be a solution that will become more common among broadcasters as more is learned about its use, for it offers an instantaneous check on the performance of any single piece of equipment, or upon an entire system from microphone input to antenna, or even to monitor output.

Network Possibilities

Network f-m, still in its early stages, is getting its feet on the ground. W43B (Paxton) and W39B (Mt. Washington) operate regularly as a "network" with the signal of the Paxton station feeding the relay receiver at the Mt. Washington station. The American network and certain independent stations, totaling eight in all, are now carrying the G.E. radio news program with Frazier Hunt three times weekly—the first sponsored f-m network show. This hook-up extends from Philadelphia to Mt. Washington (in Northern New Hampshire) with 2WXMN acting as the originating station for the network.

As problems are overcome, f-m net-

work operation will no doubt be extended. The possibilities still bear investigation wherever possible, and it has been suggested that these air relays could be of some significance in defense activities.

The Engineering Point of View

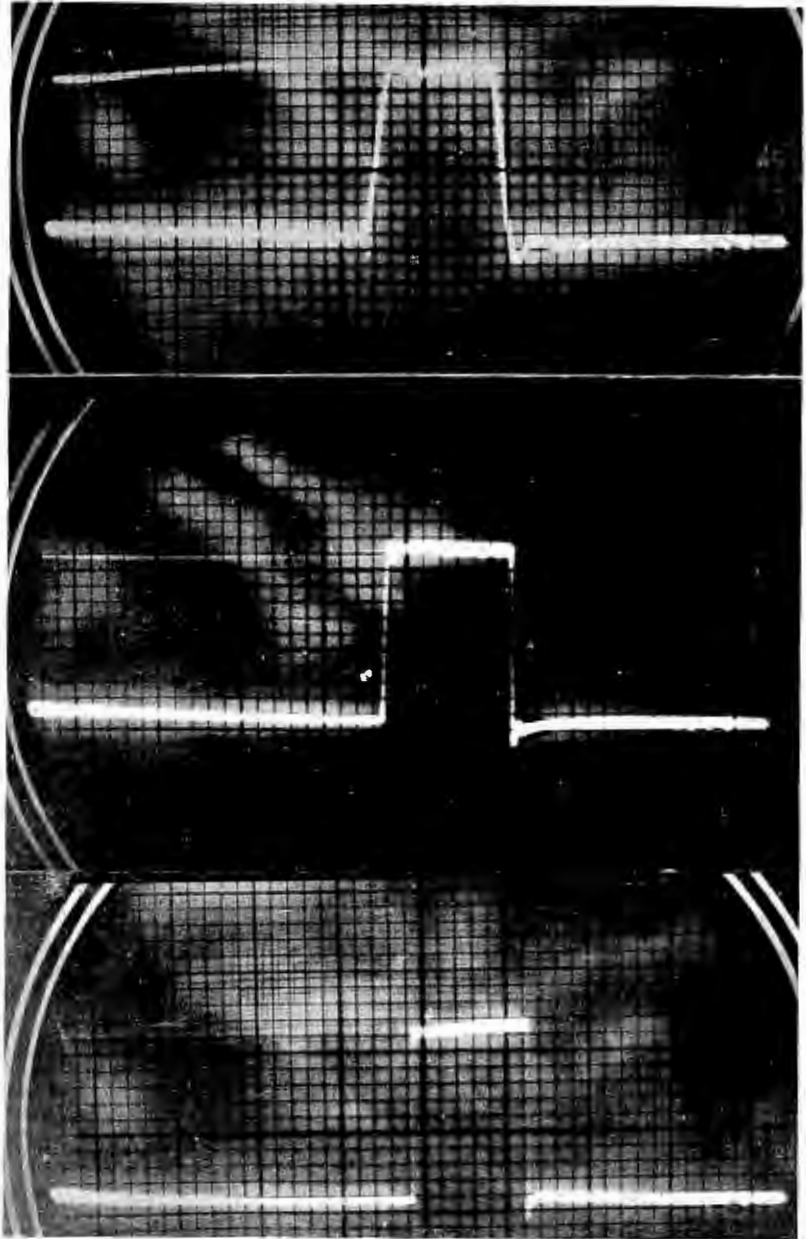
From the engineering point of view, of course, the size of the f-m audience is relatively unimportant in ironing out technical problems. But because the engineer has always been the man who had to do the first sales job, he has a broad interest in f-m and its progress.

Current f-m broadcasters are taking

the attitude that it is their job in times like these to make progress, to justify the trust that has been placed in f-m by the FCC. "We want more than merely to maintain our position and reputation," is the general feeling. "We must improve them." It is no time to pull in their horns, they believe. If the broadcasters who went into this business as pioneers don't demonstrate their faith now, they cannot expect public support to increase materially. That is the attitude which will put f-m across.

As this is written, receiver produc-

(Continued on page 34)



The square waves shown here are typical of those produced by the square wave generator in testing the overall performance of an f-m system, from speech input to the monitor output.

THE JOSEPH HENRY CENTENNIAL

by DONALD McNICOL

PAST PRESIDENT, IRE

ON JUNE SEVENTEENTH, 100 years will have passed since Joseph Henry, the eminent scientist, sent his famous paper to the American Philosophical Society discussing the electric discharge in a Leyden condenser, a discussion that has served as the basis of many an important contribution to communications.

Excerpt from Paper

In his paper Henry said: "The discharge (electric) whatever may be its nature, is not correctly represented by the single transfer from one side of the jar (Leyden jar condenser) to the other. The phenomena require us to admit the existence of a principal discharge in one direction, and then several reflex actions, backward and forward, each more feeble than the preceding, until equilibrium is obtained." From what it suggests, it may be noted that in the announcement no reference is made to the nature of the circuit, or medium, through which the discharge takes place, when it is oscillatory.

Savary's Theory

In the year 1827, Felix Savary submitted an hypothesis which suggested that the electric flow of discharge from a Leyden jar might in truth be oscillatory. As early as the year 1840, Henry produced high-frequency currents with which he continued to experiment until the time of his important announcement of 1842, and later.

Controlled Electricity

Communication engineers of the present time who succeed in a useful degree in keeping abreast of advancing electrical knowledge, continue persistently to grope for elusive answers. The peculiarities of controlled electricity, electricity guided by conductors, will in all probability continue to engross the thinking of engineers throughout time. Nearly a century elapsed from the time the word "electricity" was introduced

until slowly accumulating knowledge made possible the announcement of the distinction between quality and quantity of electricity, and with this much accomplished, the pioneer laboratories of the mid-eighteenth century began to erect the edifice of useful electrical knowledge which in time has been reared to the heights known to physicists and engineers today.

18th Century Correspondence

Numerous important revolutionary discoveries were made which, so far as the discoverers could foresee, had no immediate or prospective commercial value. Priority of discovery had value in personal satisfactions peculiar to the times, peculiar to an age in which scholastic attainment was prized in terms other than those of emolument. As was the letter correspondence between Benjamin Franklin and Peter Collinson, it is an enlightening commentary on the free exchange of information customary between savants in the eighteenth century, that Muschenbroek, Cunens, Kleist, Bevis, Watson and others, tinkering with the Leyden jar in the late seventeen-forties each contributed something toward an understanding of its action. Progressing from the procedure of filling a jar with water, placing a hand on the outer surface of the vessel, Doctor Watson went the whole distance by coating both inside and outside of the jar with tinfoil.

The Leyden Jar in 1747

With the Leyden jar condenser as a laboratory tool in the year 1747, it is something to ponder over that seventy-five years passed before the nature of the electric discharge from the jar was identified. In this three-quarters of a century lived and labored Volta, LeSage, Coulomb, Van Marum, Galvani, Reiser, Caballo, Salva Hauy, Cruikshank, Soemmering, Davy, Schilling, Oersted, Schweigger, Wollaston, Ronalds, de la Rue, Ampere, Seebeck, Far-

aday, Sturgeon, Ohm, Gauss, Peltier, Weber, Lenz, Jacobi, Daniel, Page, Wheatstone and Morse, all of them engaged in electrical experiments, and most of them identified with important discoveries.

Importance of Discovery

Henry's discovery was of vastly greater importance than anyone guessed at the time. Reiss, Wollaston and Helmholtz were quick to duplicate Henry's experiments, but it was not until 1853 that William Thomson (Lord Kelvin) presented the first mathematical conception of the nature of the condenser discharge, stating the values of the factors inductance, capacitance and resistance as these separately, or in association, constituted the path of discharge. As has been true in the case of numerous other discoveries, the full utility of the condenser appeared only after other discoveries were made, and relationships identified between the condenser discharge and phenomena previously thought of as something apart.

Foucault's Demonstration

The announcements of Huygens in 1670, and Thomas Young in 1773, paved the way for Foucault's later demonstrations which proved the undulatory or wave theory of light, the latter following Newton's announcement of 1714 explaining the correct theory of fluids and the oscillation of waves. Henry's announcement of 1842, identifying the condenser's discharge as oscillatory, paved the way for Maxwell's work twenty years later in which the phenomena of electric waves in space were at once all herded together, measured, given names, and identified as to their sources and their characteristics. The twenty years of lag from the time of Joseph Henry to the time of the Heaviside-Hertz school of thinkers may have been a decree of destiny. Radio might have come too soon!

Low-Cost Rebuilt SPEECH AMPLIFIER SYSTEM

by W. J. PROVIS

FREQUENCY modulation has prompted a new wave of interest in high fidelity, prompting improvements in speech amplifiers in a-m transmitters, too. Such modifications have also served as a medium of preparation for f-m, should such systems be installed.

Three circuits recently re-developed and encompassing such wide-range improvements are shown in Figures 1, 2 and 3.

These amplifiers using negative feedback also afford a distinct reduction in distortion and noise. Because of the limitation of parts today, the circuit arrangements have been such that few new components are required.

Converted Turntable Booster

In Figure 1, is a converted turntable booster amplifier. These amplifiers are used in each turn-table and provide a gain of 25 db. The gain can be varied by increasing or decreasing the value of the feedback resistor. The frequency response around 10,000 cycles can be controlled by the RC combination in the first tube cathode circuit to suit the job on hand. The combination used in these amplifiers is shown in the diagram, and can be changed to suit each job. The low frequency response is flat down to 30 cycles. In our case the output of the pre-amplifiers was too high, so that a 10 db pad was included in the output of each amplifier. The feedback resistor was adjusted in all pre-amplifiers so that all the turntables had the same output. As a matter of fact, this feedback resistor can be made variable and used as a gain control. In these amplifiers the noise level was 70 or more db down and the distortion .3% maximum. If the pre-amplifiers are to be used with crystal pickups the input transformer is eliminated and the resistor changed to a volume control of 500,000 ohms. Some crystal pickups have a high output and the input should be adjusted to prevent the first tube from overloading.

Monitoring-Bridging Amplifiers

In Figure 2, is a converted monitor-
(Continued on page 16)

ing and bridging amplifier. Several of these units were built to serve as both monitoring and bridging amplifiers. In the case of the bridging amplifier the gain was 35 db and the distortion .3% with an output of plus 20 db. When this unit is used as a bridging amplifier a 20 db pad is used in the output to put zero level on the line. The frequency response was flat from 30 to 15,000 cycles.

The response in the upper end was controlled by the proper combination of the series resistor and condenser in the cathode of the tubes in the first stage.

In one monitoring amplifier more gain was desired so the tubes in the first stage are 6J7s and the output tubes are 6V6s as identified by V₁ and V₂ in the diagram. In this amplifier the distortion also went up to 1% but this

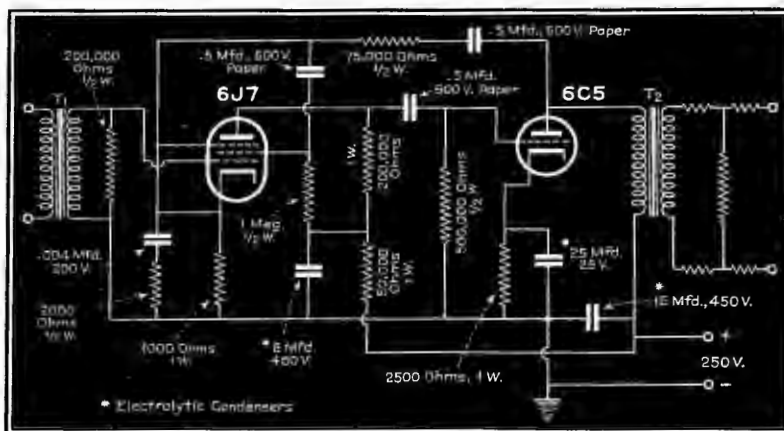


Figure 1
The transcription turntable booster amplifier in its revised state. T₁ and T₂ should match pickup and mixer inputs respectively.

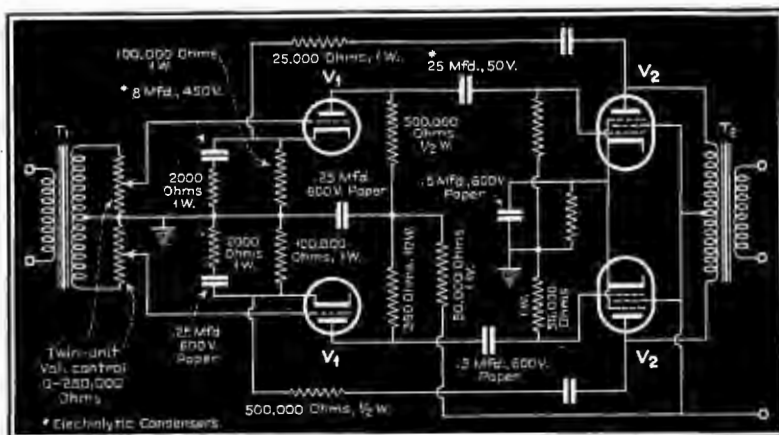


Figure 2
The converted monitoring and bridging amplifiers. As a bridging amplifier, a gain of 35 db is available, with a .3% distortion.

BOOK REVIEWS

ELECTRONICS

By Jacob Millman and Samuel Seely, Department of Electrical Engineering, College of City of New York . . . 720 pp. . . . New York: McGraw-Hill Book Co. . . . \$5.00.

This book has been prepared as a text for the advanced student in electronic principles and applications. A knowledge of higher mathematics is presupposed by the author.

The early chapters of the text deal with the motion of charged particles and with basic electron theory. The major portion of the text covers vacuum tubes rather thoroughly and coordinates physical theory and theory of operation of electronic devices. Many unique and original methods of presentation are employed, and complete treatments are given all subject matter generally covered but briefly in other texts. In view of this comprehensive treatment, the volume will be found to be extremely useful in the library as well as the classroom.—R. G. H.

A. S. T. M. STANDARDS ON ELECTRICAL INSULATING MATERIALS

By the A. S. T. M. Committee D-9 . . . 450 pp. . . . Philadelphia, Penn.: A. S. T. M. Headquarters . . . \$2.25 (heavy paper cover).

The latest edition of this annual publication is considerably enlarged by the inclusion of new specifications and tests and several reports and papers. It provides in their latest form as of December, 1941, 58 specifications and tests issued by A. S. T. M. covering this field. Outstanding activities carried on by A. S. T. M. Committee D-9 on Electrical Insulating Materials are covered in certain reports, one on punching quality of laminated phenolic sheet; a study of measurements of power factor and dielectric constant at ultra-high frequencies; a report on round-robin tests of power factor and dielectric constant for glass; and several discussions on the significance of tests of insulating materials, including dielectric strength.

Seven of the specifications and tests cover insulating varnishes, lacquers and their products and thirteen provide standardized test methods for molded materials. The section covering plates,

(Continued on page 35)

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REBUILT AMPLIFIERS

(Continued from page 14)

amount for monitoring proved negligible.

The Converted Program Amplifier

In Figure 3, is a converted program line amplifier. In this case a gain of 80 db was desired and as the old amplifier had an interstage transformer of wide-frequency response, it was decided to use a combination of the booster amplifier and the bridging amplifier and adjusting the feedback circuits for the desired gain. In adjusting this amplifier the last section was debugged first and then the first two stages added on.

At first, considerable trouble was experienced in the first 6J7 stage with a loud hiss. This was cleaned up by using wire wound resistors in the cathode circuits and picking out a quiet 6J7 tube. From a dozen 6J7 tubes tested, only two were found to be quiet enough to use. Special noise-free tubes were later installed with further reduction of the tube noise. In this amplifier the response was also flat from 30 to 15,000 cycles. In the case of the amplifier feeding the telephone line to the transmitter, a 3 db hump was put into the response at about 8,000 cycles. The job of equalizing thus was much easier;

the hump was broad and the final result at the other end of the line was a flatter response. This system may be also used on remote amplifiers for short lines from the control room, and the equalizer job eliminated.

Amplifiers Originally Several Years Old

Originally, these amplifiers had seen several years service and were of the type that used two stages of screen-grid tubes, triode-connected and transformer-coupled into a push-pull pair of pentodes triode-connected. The average distortion was 2% with noise level from 35 to 40 db down. The response was down 5 db at 50 cycles and down 5 db at 5000 cycles; 10,000 cycles was almost out of sight.

Rebuilt Amplifier Characteristics

The present response is flat from 30 to 15,000 cycles, within 1/2 db. The over-all distortion is .5%, with the noise level down 60 db or more.

How the Development Began

The development of these systems actually did not begin as a development, but rather as an attempt to clean up

the audio amplifiers. However, as we progressed with this 'clean-up' we started to make changes here and there and concluded by actually producing amplifiers with some very interesting characteristics. In all the amplifiers, the same transformers that were used in the old amplifiers were retained. The line amplifiers had the power transformers mounted in the amplifier of the old style. These were removed and mounted at a distance from the amplifiers.

Few New Parts Required

The only parts that were new in the reconstructed amplifiers were the small resistor and condensers for the extra circuits, the cost of which was very small. These amplifiers have been in service for some time, and have been most proficient during that period.

Although only in one specific instance, placement of parts is mentioned in this article, it is an important part of this rebuilding process. Every effort was made to set the various components up so that residual effects were as close to zero as possible. To increase the life of condensers, they were spotted as close to the minimum heat sections of the chassis, as possible.

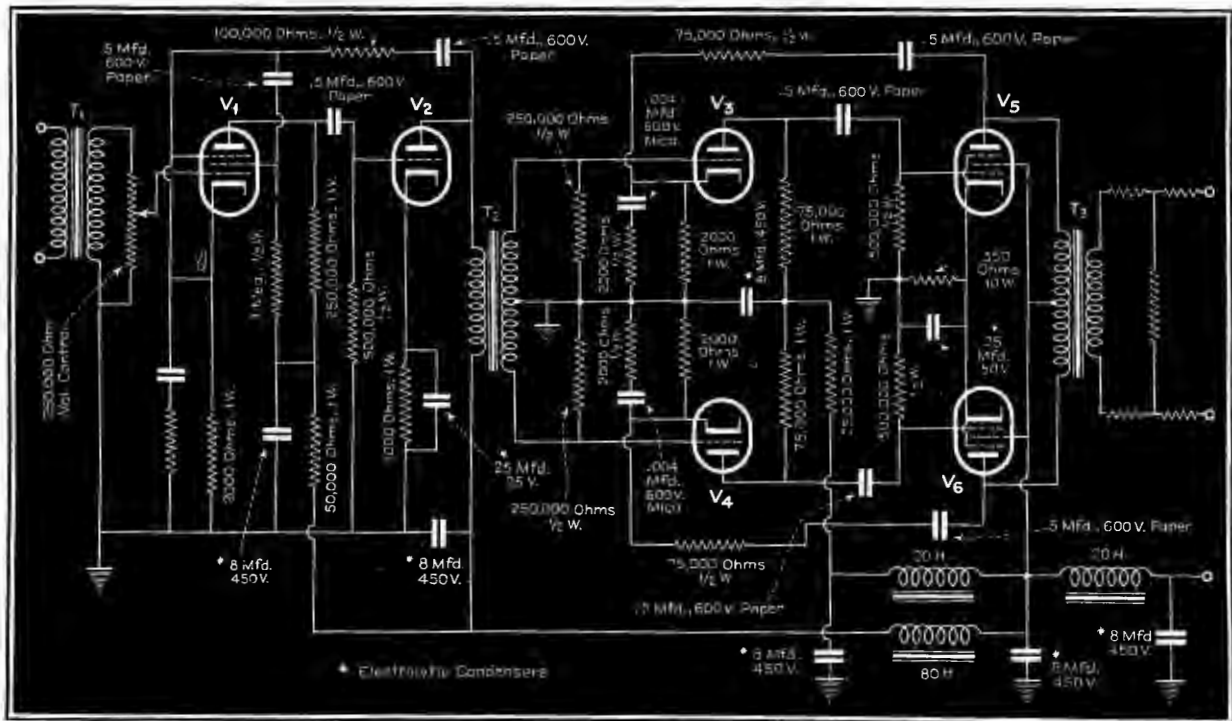


Figure 3
The modernized program amplifier that afforded a gain of 80 db; distortion .5% and a flat response within 1/2 db from 30 to 15,000 cycles.

The lampshade microphone was designed to prevent "mike fright." This is an early scene at WGY, this year celebrating its 20th anniversary.

Remember the Days of the Lampshade Mike?



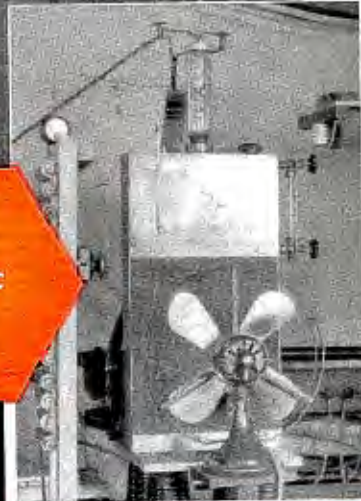
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- ★ **the screen-grid tube**
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20 YEARS AT WGY, one of G.E.'s proving grounds

THAT'S WHEN GENERAL ELECTRIC COOLED TUBES WITH A "MODEL T" RADIATOR



WHAT A DIFFERENCE! TODAY, HARDLY A HANDFUL GIVES 1800 WATTS OUTPUT



Discussing electronics in WGY's laboratory: (left to right) G.E.'s Dr. Irving Langmuir, inventor of the high-vacuum tube; Professor J. J. Thomson, the English physicist, discoverer of the electron; and Dr. William D. Coolidge, famous for his work in X-ray tube design, now director of the G-E Research Laboratory.



One of the immortals of science, Dr. Charles P. Steinmetz in one of his rare appearances before the microphone (at WGY March, 1922). Among Dr. Steinmetz's contributions while with General Electric were the solution of perplexing high-voltage problems in electrical transmission, and the analysis of the behavior of transient electric currents.



First use of crystal control on a broadcast transmitter for regular program service (WGY, September 19, 1925). Contrast this with G.E.'s new hermetically sealed G-30 Thermocell for precision temperature control. (Insert—cutaway view.)



The first use of "superpower"—100,000 watts in the antenna—August 4, 1927 (the tubes were ancestors of the GL-862). Other WGY "firsts" include the first broadcast of two-way communication with England, February 21, 1928, in co-operation with BBC; first remote television pickup on August 22, 1928; first round-the-world broadcast of voice transmission on June 30, 1930.



One of the earliest attempts to systematize sound effects. This self-contained unit, used about 1929 at WGY, included bells, buzzers, horns, sirens, and gadgets for simulating thunder, rain, a dog's bark, and a lion's roar.



WGY today serves about one million radio families, 24 hours a day. It was the first station in the Great Northeast; today it is the foremost.

*Photo shows the first application of a water-cooled modulator—in WGY's 1922 transmitter.

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VETERAN WIRELESS OPERATORS ASSOCIATION NEWS

W. J. McGONIGLE, President

RCA BUILDING, 30 Rockefeller Plaza, New York, N. Y.

GEORGE H. CLARK, Secretary

FROM our honorary president we have the following annual message that was delivered at the recent dinner-cruise in New York.

"Fellow Veterans of the Wireless:

"On your last cruise, as you may remember, I called on you as loyal men of the sea to send a rousing message of support to the "Old Man" up on the forward bridge.

"I'm in doubt as to just how enthusiastic a response that rallying cry then aroused. But it's very certain that tonight we all feel one hundred percent aboard this ship of State, realize at last in what great peril our proud vessel lies, over what dark and treacherous waters our Skipper is piloting her.

"Each one of us tonight is in spirit out there in the Wireless Shack, listening breathlessly for any faint SOS, and ready instantly to ourselves speed to the aid of all periled Americans anywhere on the seven sub-infested seas.

"Since the last cruise, the annals of heroic wireless men have been greatly lengthened. Your duty and privilege of inscribing other and yet other names on the tablets of hero operators is continually recurring. A few weeks ago the name of Kenneth W. Maynard was subscribed to our proud list—fortunately among those saved. Scarcely a day passes without some such added story to the saga of wireless in war.

"Not fear of shell, nor fire, nor drowning, nor starvation holds back our brave boys from the hard duty which now summons them.

"Proud, indeed, are we veterans to know such youth, to be able to claim for these the kinship of our ancient guild. Thus can we elders hold heads erect, eyes a-flash, in realization that the grand tradition of the American wireless operator of the past rests forever safe in these younger hands; that our mantle falls upon such sturdy shoulders, richly worthy to carry on.



Dr. Leo Stanton Rowe (left), director-general of the Pan-American Union, with the Marconi Memorial Service Award, presented at the recent VWOA dinner cruise by W. J. McGonigle (center). Looking on is G. W. Bailey, president of the A.R.R.L.

"A toast then: To the American wireless operators of this war and may they be able repeatedly to flash: 'Met Sub; Sank Same'—and to the Jap Navy: 'Bottoms up!'—73, Lee de Forest."

In the dinner-cruise proceedings broadcast over the Red network of the National Broadcasting Company were our president, making the awards to Ted McElroy, who demonstrated his ability to copy 77 words per minute; Robert Thorp; Jack Berenbaum; George W. Bailey; Dr. Leo S. Rowe, director-general of the Pan American Union, who in a splendid address accepted our Marconi Memorial Service Award plaque on behalf of Our Neighbor Republics. The portion of the program broadcast over the Red network of NBC was also in-

cluded in a half hour transcribed program broadcast on Thursday, February 26, 1942, to South and Central American listeners over the combined facilities of WRCA and WBOZ, NBC short wave stations. Added to the transcribed program was a reading of the names of the presidents of each of the South and Central American Republics, each of whom shall receive through the usual diplomatic channels a medallion (a replica of the main theme of the Service Award) by Dr. Rowe; a message from Hon. Sumner Welles, Acting Secretary of State of the United States, by our president. The program was concluded by a greeting from our association to the Presidents of our neighbor republics, to the people of the South and Central American countries and 73 to the radiomen of all the nations below the Rio Grande.

A VWOA dinner-cruise was also held in Chicago. Among those present were P. Price, G. G. Crose, G. I. Martin, S. B. Cappell, J. C. Cadge, B. Friend, W. S. Halligan, W. F. Marsh, R. S. Higgins, H. Velten, J. M. Pearce, L. R. Schmitt, E. A. Beane, B. D. Schnable, and I. W. Bear. (See illustration at left.)



At the recent VWOA dinner-cruise in Chicago, with W. J. Halligan (center-rear) as toastmaster.





The Pathway Back to Earth... by IT&T

*Radio Instrument Landing System
Developed in Cooperation with the Civil Aeronautics
Administration by I. T. & T. Associate Company*

Through the fog the airliner of tomorrow will be able to glide toward an unseen landing field as accurately as if its wheels were taxiing down a gently sloping road.

* * *

In the log books of commercial aviation a new chapter starts with the words: *Radio Instrument Landing System developed by I. T. & T.'s associate, International Telephone & Radio Manufacturing Corporation, in cooperation with the Civil Aeronautics Administration.*

Utilizing ultra high frequency equipment, which incorporates I. T. & T.'s broad experience in the field, this new system places before the pilot—*on one dial*—all information needed to keep his ship on a correct landing course.

Having demonstrated its value in actual use the system will be installed in many of the Nation's principal airports during the coming year.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

67 Broad Street, New York, N. Y.

TRANSMITTER MAINTENANCE

(Continued from page 9)

which record the temperatures of the main breaker switch and the filament and bias generators. Tel-Temp thermometers are attached to every piece of machinery or equipment in the plant which may be injured by a temperature rise or in which a temperature rise may indicate a serious fault or possible breakdown. A red dot marks a maximum allowable point on each Tel-Temp thus warning the engineer inspecting them.

Filtered Air Heating

Enough heat is obtained for heating the entire plant by forcing filtered air through a series of pipes in which the water used for cooling the large power amplifier tubes circulates before returning to the cooler.

While on this tour, the main switch room is also inspected. This is the room where power from the mains enter the building and where the main distributing breaker switches are installed.

Pump Room Inspection

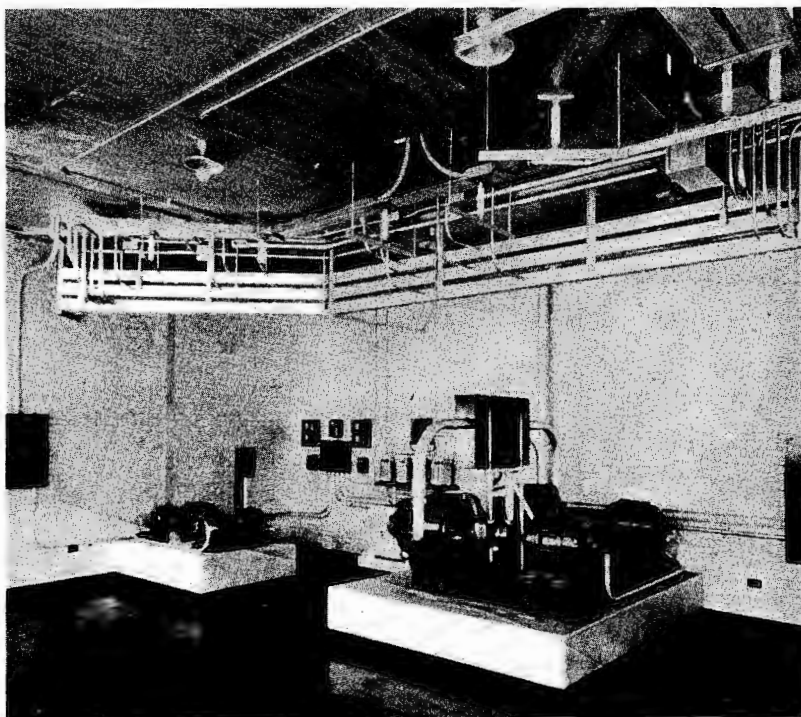
The pump room is another important stop on the maintenance schedule. This room contains the spray pond pumps, distilled water pumps, electric water still, water softener, storage tank for distilled water, and associated valves. Oil levels, temperature and general operating conditions of the various pumps, tanks and valves are checked. This basement tour also includes a check-up of high voltage transformers, voltmeters, voltmeter multiplier and thyrite protectors on the transformers.

While the first engineer travels about the basement, his colleague who stands watch with him, has been going through an identical inspection routine starting from the opposite end. Thus a double check is made of the entire plant at the beginning of each watch by two men who are rested and alert and responsive to the slightest change. This is an important point. This inspection tour takes place before the men actually go on watch.

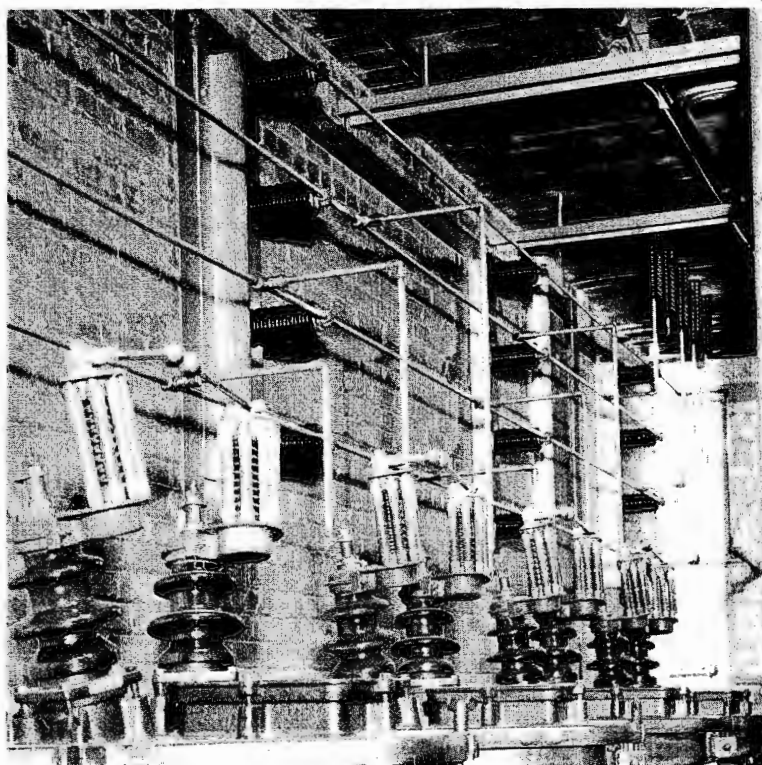
Transmitter Engineer Duties

An engineer designated as a transmitter engineer is given specific duties akin to such operation. For instance, he has immediate supervision of the 50 kw transmitter. Primarily, his duties consist of taking half hour read-

(Continued on page 28)



The 50 kw transmitter filament and bias generators at WOR.



The 50 kw transmitter transformer vault at WOR.



PROUD indeed is Hytron that its HY615 and HY114B have been selected for vitally important service in the armed forces. Built-to-order for exceptional performance on the ultra-high frequencies, these two Hytron designs automatically fell into Class I-A, and were found ideally "fit" for the most gruelling combatant service.

FIRST IN PEACE

During peace time, the radio amateur put the HY615 and HY114B through their paces. To the HY615 over one and a half years ago, went the still-unbroken, 135-mile world's record for reception and transmission on 224 mc; to the HY114B, instantaneous recognition as the tops for battery-operated U-H-F equipment. While records in themselves may mean little, that the HY615 record has remained unbroken over such a long period of time, added to the fact that the HY615 and HY114B were more widely used than any other types, indicates that Hytron U-H-F tubes were in first place before the war.

FIRST IN WAR

Now in war, engineers in the armed forces and in industry have found that the record-breaking performance and the national popularity of these two unique tubes were deserved. The amazing efficiency of these HY615 and HY114B tubes has, therefore, been promptly called to serve in many ingenious U-H-F applications designed for VICTORY. Prove to yourself that the same high quality and unequalled engineering design that made these little power houses record performers in peace, make them dependable and efficient in war. Select the HY615 and HY114B for your war-time U-H-F applications.

JUST

An Example

Among the host of HYTRON tubes selected for service in the Victory program, the HY615 and HY114B furnish but two examples. Consult Hytron first whether your tube needs are for standard receiving or transmitting types, U. S. Government types, United Nations types, or special types designed to fit your particular needs.

HYTRONIC LABS.

SALEM . . . MASS.

Manufacturers of Radio Tubes Since 1921



A DIVISION OF
HYTRON CORP.

NEWS BRIEFS OF THE MONTH... —

ELECTRICAL INSTRUMENTS BOOKLET

Portable switchboard and miniature panel instruments for a variety of applications are described and illustrated in a new 34-page Westinghouse booklet.

Somewhat the same in format as the popular and well-known quick-selector catalog, the new publication lists all instrument types for specific applications on an instrument selector chart. Special features, specification data, and full-scale range of standard ratings are included.

Design features and physical characteristics of meter pivots, springs, pointers, and cases are described. Reproduced in the booklet are 120 photographs, 44 representative meter dials and 13 types of strip and circular charts.

A copy of booklet B-3013 may be secured from department 7-N-20, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

* * *

SOUND EFFECT CATALOG

Standard Radio, 45 West 45th St., New York City, manufacturers of Super Sound Effects Records, has just brought out its latest catalog, listing new sound effects. The catalog, containing a complete cross index, has also a new numbering of records with related grouping, which facilitates the choice and use of the particular records needed.

* * *

CLARK NEW WESTINGHOUSE SALES HEAD

B. W. Clark, vice-president in charge of the Westinghouse Electric and Manufacturing Company's merchandising division, was appointed vice-president in charge of sales. He succeeds Ralph Kelly, who resigned to become executive vice-president of the Baldwin Locomotive Works.

* * *

BATT AT FINAL RCA RECEIVER PRODUCTION CEREMONIES

William L. Batt, Director of the Raw Materials Division of the War Production Board, was the guest of honor at ceremonies, on April 7, marking final production of phonographs and radios for civilian use for the duration at the Camden, N. J., plant of RCA.

Mr. Batt received the last phonograph-radio instrument as it came off the assembly line of the Camden factory, No. 17,991,547, representing the total number manufactured by RCA Victor and its predecessor companies in more than 40 years of continuous operations. The instrument was presented to the Georgia Warm Springs Foundation.

* * *

BOGGS PROMOTED BY SYLVANIA

C. P. Boggs has been appointed Director of Manufacturing for the Hygrade Sylvania Corporation.

Mr. Boggs has held executive positions in the manufacturing division of Hygrade Sylvania Corporation since 1932. Prior to his association with Hygrade Sylvania Corporation, Mr. Boggs was with the General Electric Company.

SAMPLE KIT OF ADHESIVES AVAILABLE

A complete kit of samples and detailed description of adhesives and chemicals, such as used by the radio and electronic trades, is available free to manufacturers of radio and allied products, laboratories, government agencies, etc., from Walter L. Schott Co., Dep't. 25, 5270 W. Pico Boulevard, Los Angeles, Calif.

Described and sampled are chemicals to prevent contact oxidation and noisy operation, adhesives for many purposes, such as speaker cement, thermo-plastic cement, cement for fabrics and plastics, etc.; also coil dopes and special chemicals for dial drives, etc.

Requests should be mailed on company or official stationery.

* * *

G. E. TELEVISION STATION NAMED FOR DR. BAKER

General Electric's television station in Schenectady has been designated by the call letters WRGB, in honor of Dr. W. R. G. Baker, vice-president in charge of the G-E Radio and Television Department and one of the pioneers in the broadcasting industry.

* * *

IRC GUIDE FOR SIMPLIFIED RESISTOR SELECTION AND USE

To save valuable time for designers, engineers, and users of resistors, a handy chart giving all of the essential data on over 122 sizes in 18 standard types of IRC fixed and variable resistors for defense and industrial requirements is now being distributed by the International Resistance Company, 415 North Broad St., Philadelphia, Penna. It is compact, suitable for wall hanging, desk use, or filing.

The chart contains up-to-the-minute information including wattage and voltage ratings, dimensions, maximum and minimum resistance values available, terminals, mountings, temperature rise, variations with time, tolerances, maximum operating temperature coefficients, inductive characteristics, prices in small lots for estimating purposes, availability of various types for army and navy use, etc.

Copies will gladly be sent upon request. Ask for the IRC Resistor Guide.



SMPE CONVENTION IN MAY

The annual convention of the Society of Motion Picture Engineers, will be held at the Hollywood Roosevelt Hotel, Hollywood, California, May 4th to 8th, inclusive.

* * *

L-F LINEAR-TIME-BASE GENERATOR BULLETIN

A bulletin describing the new Du Mont Type 215 low-frequency linear-time-base generator and its applications, is now available on request, from Allen B. Du Mont Labs., Inc., 2 Main Ave., Passaic, N. J. This accessory is used in conjunction with a Du Mont Type 175A cathode-ray oscilloscope or equivalent, and is said to permit screen studies requiring sweep frequencies as low as 1 cycle every few seconds, or more specifically, within its range of 0.2 to 125 cycles per second.

* * *

VAN VALKENBURGH WITH IRVINGTON VARNISH

J. D. Van Valkenburgh has been appointed assistant to the president of Irvington Varnish & Insulator Co., Irvington, N. J. For the past several years Mr. Van Valkenburgh has been associated with the Johns-Manville Corp., New York.

* * *

15 KW GENERATOR PLANT DATA

Power plants, affording 7,500, to 10,000 and 15,000 watts are described in a new data sheet released by the Kato Engineering Co., Mankato, Minn.

* * *

ACRO-SNAP CONDENSER CATALOG

A new 8-page condensed catalog covering Acro-Snap switches has just been issued by the Acro Electric Company, 3174 Fulton Road, Cleveland, Ohio.

* * *

NEW PAPER FOR AMMONIA DRY-DEVELOPED PRINTS

The Frederick Post Company, Box 803, Chicago, has recently produced an improved ammonia dry-developed printing paper—VAPOpaper. The new VAPOpaper is said to develop a deeper, sharper blue or red line print on a clean white background.

A feature of the new VAPOpaper is said to be that every roll in the same shipment or different shipments is entirely uniform both as to speed and color.

A free 5 yard sample is offered those who are equipped to produce ammonia dry-developed prints. In writing for your sample state whether you prefer blue or red line VAPOpaper in the regular or fast printing speed.

* * *

DUMONT TELEVISION AIDS AIR WARDENS

Allen B. Du Mont Labs., are assisting in the training of some 54,000 air wardens in the New York, Philadelphia, and Schenectady-Albany metropolitan areas, by television.

"Because our organization believes firmly, and has always felt from the beginning of our television pioneering, that video broadcasting has tremendous educational possibilities, we are happy indeed to

(Continued on page 26)



EXCELLENT OPPORTUNITY FOR OUTSTANDING MEN

THE FARNSWORTH Television & Radio Corporation is adding to its staff of research and development specialists—the closely knit group which has won recognition throughout the world for its developments in the field of electronics. These men know how to work harmoniously toward a common goal, for each realizes that his opportunity to succeed is controlled only by his ability and ambition.

The urgency for additional research and development of highly specialized electronic apparatus at this time enables us to solicit applications from qualified American

citizens, including junior and senior engineers and physicists having suitable qualifications.

Excellent opportunity to participate now in most important engineering developments as well as to qualify for responsible positions in post-war activities.

Replies, including complete statements of experience and training, references and photographs, should be addressed to this company, attention of Personnel Manager, at its main office at Fort Wayne, Indiana.

Personal interviews will be by appointment only.

FARNSWORTH TELEVISION & RADIO CORPORATION
FORT WAYNE, IND. MARION, IND.

Makers of

RADIO AND TELEVISION TRANSMITTERS AND RECEIVERS, THE CAPEHART, THE CAPEHART-PANAMUSE AND FARNSWORTH PHONOGRAPH-RADIO COMBINATIONS

PAN AMERICAN RADIO



is the good-will ambassador in the radio field between North, South, and Central America. It is written in the exclusive style of three languages—English, Spanish, and Portuguese—and is distributed all throughout the Western Hemisphere, which explains in part why it is rightfully considered the necessary link for inter-American broadcasting news.

Each issue contains articles by and of prominent radio personalities here and in the Latin Americas.

PAN AMERICAN RADIO is published monthly, at 45 West 45th Street, New York City. Yearly subscription is \$3.00 for U.S.A.; \$3.50 for Canada and Pan American nations; and \$4.00 for all other countries.

PAN AMERICAN RADIO,
45 West 45th Street,
New York City

Enclosed please find \$..... for my one-year subscription to PAN AMERICAN RADIO, to start at once.

Name

Street

City State

Country

NEWS BRIEFS

(Continued from page 24)

join NBC, RCA, GE and Philco in the present television training course for air wardens," states Allen B. Du Mont. "We have installed Du Mont television receivers, in collaboration with the other organizations, so as to equip the 84 precinct classrooms in the five boroughs of Greater New York."

* * *

CATALOG ON METAL DUPLICATING WITHOUT DIES

A 36-page catalog describing Di-Acro precision machines and the Di-Acro system of "Metal Duplicating Without Dies," has just been issued by O'Neil-Irwin Manufacturing Company, Minneapolis, Minn.

Typical parts and materials that can be formed with Di-Acro benders are illustrated in this booklet. In addition, answers to many puzzling metal duplicating problems are also presented.



* * *

NEW SAN FRANCISCO S-W STATION INSTALLATION BEGUN

O. F. Walker, radio engineer of the General Electric Company, is now in San Francisco supervising the installation of a 100,000-watt short-wave transmitter, which will be another gun in a kilocyclic battery "shooting" from the United States across the Pacific in the propaganda war with Japan.

The powerful transmitter, built by General Electric and operated previously at its Schenectady station WGEO for short-wave broadcasts to Europe and Latin America, will be operated in San Francisco under call letters KWID. Operators of the station will be Associated Broadcasters, Inc., operators of long-wave station KSFO. General Electric is completing another 100,000-watt transmitter for WGEO at Schenectady and meanwhile is on the air there with two other short-wave transmitters, WGEO and WGEA.

* * *

LEAD AND TIN ALLOY CATALOG

Lead and tin products of varying alloys, solders; extruded shapes, pipe and tubing and many specialties frequently demanded by defense orders are described in a folder released by Alpha Metal & Rolling Mills, Inc., 363 Hudson Avenue, Brooklyn, N. Y. Lead and tin alloy tables are also presented.

* * *

WESTINGHOUSE APPOINTS EVANS

Walter C. Evans has been appointed general manager of three major Westinghouse divisions that include radio, broadcasting and X-ray.

Lee B. Wailes is manager of the broadcasting division; the X-ray division is headed by Clair V. Aggers, and Carrol J.

Burnside, formerly sales manager of the radio division, is now manager.

* * *

DEFENSE BOND DRIVE AT RCA

With the recent opening of a new booth for the sale of defense bonds and stamps on the first floor of its administration building in Camden, the RCA Manufacturing Company announced a \$4,000,000 objective in bond sales as the 1942 goal for all five plants of the Company.

* * *

CINAUDAGRAPH SPEAKERS, INC., MOVES

The office, machinery, and equipment, Cinaudagraph Speakers, Inc., has been moved to a new factory building at 3911-3929 South Michigan Avenue, Chicago. The plant and offices were formerly located at 921 West Van Buren Street in Chicago.

* * *

AUTOMATIC EMERGENCY PLANT CATALOG

Emergency power service for communication applications are described in a folder just published by Kohler Company, Kohler, Wis.

* * *

PHILHARMONIC MOVES

The Philharmonic Radio Corporation has moved its engineering and production facilities to 216 William Street, New York City. Studios and offices will remain at 21 West 45th Street, New York City.

* * *

BILL HITT TWENTY YEARS WITH AEROVOX

In August W. C. Hitt of Los Angeles and San Francisco, manufacturers' representative, will round out twenty years with the Aerovox sales staff. Hitt started with Aerovox on August 1, 1923, when Aerovox was known as the Radiola Wireless Corporation. He is past president of the Radio Manufacturers Agents Association, of the Radio & Music Trade Association, and of the Radio Boosters Club, all of Southern California.

* * *

COUNTING, TIMING AND RECORDING DEVICE CATALOG

The Production Instrument Company, 708-12 W. Jackson Blvd., Chicago, has published a new 50 page illustrated catalog on counting, timing and recording devices. Mechanical and electrical counters; pre-determined electric counters, high-speed coil-winding counters, actuating switches for electric counters, signal-graph automatic timing and recording devices, and time totalizers, which measure and record the total operating time of alternating current circuits, are among those components described in this booklet.

* * *

NEW EDITION OF SPRAGUE INTERFERENCE ELIMINATION MANUAL

A new 1942 edition of the Sprague Manual of Radio Interference Elimination has just been announced by Sprague Products Company, North Adams, Mass. The booklet is available either direct or through Sprague jobbers at a net price of 25c.

The manual is said to be based on practical experience as gained by Sprague engineers in many years of field research—both separately and in conjunction with public utility specialists, radio servicemen and engineers.

The Manual also tells how to locate
(Continued on page 37)



AMERICA DEPENDS ON

RELAYS by GUARDIAN

★ *Better* relays and *more* relays for planes — ships — guns — tanks . . . Guardian is doing a 100% "all out" job for America.

GUARDIAN IS AN APPROVED SUPPLIER TO LEADING RADIO MANUFACTURERS OF SPECIAL CONTROLS REQUIRED TO PRODUCE GOVERNMENT ORDERS . . .

Strictly defense . . . Guardian is an authorized and standard source of supply for Signal Corps Specified Relays.

GUARDIAN'S CONTRIBUTIONS TO RADIO DEFENSE are in the "walkie-talkie," tank radios, radio directional navigation and a long line of special communications controls . . . ever-improving . . . ever producing to end the war speedily . . . conclusively.

TODAY—samples of Approved Controls by Guardian are immediately available, with production time open for war work only.

TOMORROW—keep a date with these *higher capacity* and *smaller size* Relays by Guardian. You'll find them better than ever for commercial production in 1942.

WRITE • WIRE • PHONE

GUARDIAN ELECTRIC

1623 WEST WALNUT STREET

CHICAGO, ILLINOIS

LARGEST LINE OF RELAYS SERVING AMERICAN INDUSTRY

COMMUNICATIONS FOR APRIL 1942 • 27

Another DuMont
"First" . . .

Giant-Screen CATHODE-RAY OSCILLOGRAPH



★ Designed particularly for lecture-room and demonstration purposes, this new DuMont Type 233 Cathode-Ray Oscillograph provides huge oscillograms on its 20-inch high-intensity screen. Also invaluable for critical laboratory investigations.

These features warrant your attention: Accelerating potential of 6000 volts; deflection amplifier response uniform from 75 k.c. to less than 1 c.p.s.; phase inverters and push-pull amplifiers provide symmetric deflection with single-ended input; d.c. positioning voltages insure instantaneous image location; Z-axis amplifier, enabling accurate determination of time intervals during sweep of trace, essentially uniform in response from 10 to 750,000 c.p.s.

Sturdy metal cabinet. Rubber-tired locking casters. Gray wrinkle finish. 60" h. x 28" w. x 36" d. 325 lbs. 60-cycle 115 v. 350 watts.

★ Write for Literature . . .



TRANSMITTER MAINTENANCE

(Continued from page 22)

ings from the log, seeing that the proper levels are fed from the New York studios; noting quality of outgoing programs; checking the start and finish of each program as scheduled by the program sheet; making sure that the auxiliary transmitter crystal heating units function properly, and taking readings and recording them on the master operating log every two hours.

Control Engineer Duties

Meanwhile an engineer designated as control engineer and working in conjunction with the transmitter engineer lists maintenance items to be done this particular day. Let us suppose that the day is Friday, and he finds that items 1 and 2 have been performed. During his watch and the following one, Friday "day" maintenance items 3, 4, 5, 6, 7, and 8 must therefore be completed. As taken from a page of the maintenance book, item 3, for example, reads . . . "all measuring equipment and test oscillators to be serviced." Item 4 reads . . . "test all short wave equipment." Item 5 reads . . . "check all loudspeakers internally." Each item is clearly specified and its performance unmistakably described in the manual.

Tower Maintenance

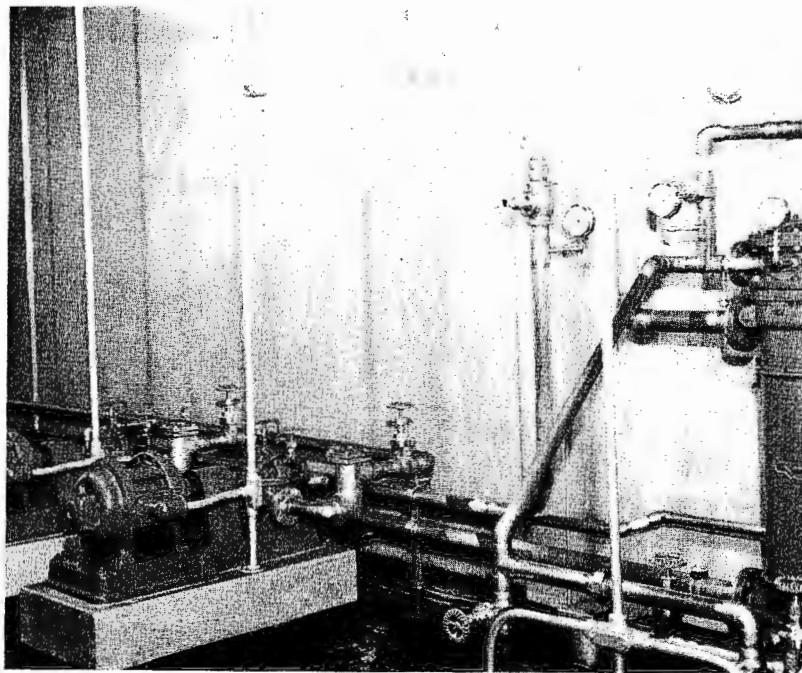
After the readings, two engineers go out to the towers, one taking his stand

at the East Tower and the other at the West tower. A third engineer remains at the transmitter. He checks the input of the concentric line and when the meter indicates 50 kw power, he phones the tower men in turn to read and report the antenna currents at their respective positions. These readings are recorded in the FCC log. One of the tower men then returns to the plant. The other makes the rounds of the three coupling houses, reads the antenna currents and phones them back to the transmitter room. He stands by at the center coupling house until he is advised that the 50 kw of power is completely shut down. Then he moves quickly, feeling all condensers for warm spots. From the center coupling house he hurries over to the two other towers to test for hot spots in the equipment in these units.

During this testing, engineers in the building test all condensers for excessive heat and place the auxiliary transmitter on pre-heat. Their next job is to measure filament currents, filament voltages, and bias voltages in accordance with the Sunday night maintenance list, while one tower man returns to take charge of the auxiliary transmitter.

Placing Transmitter on Air

At 5.00 A.M. the ritual of placing



The pump room at WOR for the 50 kw transmitter.

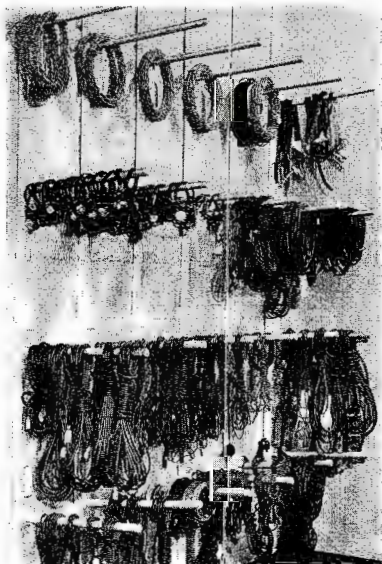
the 50 kw transmitter on the air begins. The transmitter technician refers to his starting log in which are listed the steps of operation. As he performs each step, he checks it on his log. While the filaments of the tubes are pre-heating, he steps inside the transmitting enclosure to make a general check. A second technician makes a similar check.

Making sure that the antenna is switched to the 50 kw transmitter, by checking the antenna transfer switch indicator light on the control turret, the transmitter technician puts the transmitter on the air for two minutes on low power. During these two minutes he takes FCC log readings and checks crystal deviation, too. Two engineers go inside the enclosure to quickly check the unit there, while the third man throws the high voltage switch from 10 kv to the 17 kv side. Then both men leave the enclosure and shut the door. The next step involves the application of 17,000 volts to the water cooled PA plates without any drive, for a degassing test. This lasts five minutes. Any flash-arcs or arc-backs during the test are logged on the back of the FCC log. And if none occurs, this, too, is recorded.

Other Maintenance Tests

While the transmitting technician goes through the degassing tests, his colleagues make a line and volume indicator test with master control, the latter feeding tone signals at a steady level. Results are recorded on the FCC log. Any deficiency in either of the two channels or in any of the am-

(Continued on page 38)



Neatness is exemplified in this wire rack at WOR.

Super-Cardioid Simplifies Sound Pickup Problems in Studio and Remote Broadcasting



Model 556A for 35 - 50 ohms, Model 556B for 200 - 250 ohms, Model 556C high impedance—at only \$75.00 list.



FEATURES

- ★ More unidirectional than the cardioid—yet has wide-angle front pick-up.
- ★ Decreases pick-up of reverberation energy and random noise 73%.
- ★ Improved wide-range frequency response—from 40 to 10,000 cycles.
- ★ Symmetrical axial polar pattern at all frequencies.
- ★ Highly immune to mechanical vibration and wind noises.



Patented by Shure Brothers

Tests prove it gives optimum directional performance under the great majority of acoustical conditions. This, together with other advantages of the Shure Uniphase single-unit moving-coil construction, offers a simpler solution to sound pick-up problems in studio and remote locations. The *Super-Cardioid* eliminates undesired noises more easily—simplifies microphone placement—insures better performance outdoors as well as indoors.

30-Day Free Trial. Broadcast Engineers: Try the *Super-Cardioid* for 30 days in your station without obligation. Prove it yourself. Write us today.



SHURE BROTHERS

Designers and Manufacturers of Microphones and Acoustic Devices
225 West Huron Street, Chicago, Illinois

THE INDUSTRY OFFERS....



**PRONG-BASE
ELECTROLYTICS**

• This already popular type is made still more popular because of certain Aerovox refinements. Indeed, it will pay you to check these refinements for yourself when considering prong-base electrolytics.

featuring...

- Square can shoulder instead of sloped. Cap or plug rests solidly in place. No sharp edges. No danger of shearing cathode tabs.
- Large rigidly riveted to bakelite disc which fits in cup-shaped soft-rubber plug.
- Slotted protrusions or sleeves in rubber plug surround and seal in the tabs and lugs. No electrolyte leakage. No terminal corrosion.
- No danger of bakelite corrosive effects since rubber sleeves protect raw bakelite slots and metal parts.
- Positive pin-hole vent instantly responds to excess gas pressure, yet normally self-closing.

• Check these features for yourself. Sample cheerfully submitted. Let us quote on your requirements. Literature on request.

AEROVOX CORPORATION

In Canada: AEROVOX CANADA LTD., Hamilton, Ont.
EXPORT: 100 Varick St., N. Y., Cable 'ARLAB'

BROWNING FREQUENCY METER

A frequency meter designed to check frequencies in any five bands (25 to 500 kc wide, depending on location in spectrum) from 1.5 to 60 mc has been developed by the Browning Laboratories, Inc., 750 Main Street, Winchester, Mass.

The device, known as type S-2, employs electron-coupled oscillators. A 100 kc crystal is used as a secondary standard, with the circuit being so designed that at least two points on any band may be checked against the 100 kc crystal oscillator.

To facilitate zero beat adjustments, a tuning eye is used. The tuning eye is also used to check the variable oscillator against the 100 kc crystal and the transmitter against the variable oscillator. It may be used also to check transmitter frequency deviation.

There are 200 divisions on a main 5½" tuning dial. At 1500 kc, the reading accuracy is said to be .004% with a band spread of 25 kc. Similar accuracy is said to be available at 30 mc, with a band spread of 500 kc.

It is portable and designed for a-c/d-c operation.



WARTIME PROTECTIVE COATINGS

Colored transparent finishes for use on polished metal, as a substitute for electroplating and bronze-powder finishes, is being produced by Mass and Waldstein Company, Newark, N. J.

This finish, which is marketed as "Platelustre", consists of a concentrated enamel, of the desired color, added to a clear lacquer. It is applied by spraying or roller coating and can be furnished for either air drying or baking.

Another development of Mass and Waldstein is a transparent protective coating for windows. Window glass or plate glass treated with this new coating, which is known as "Glassshield", is said to be turned into safety glass. A coated pane may break as the result of vibration but it does not shatter, according to the manufacturer. It is also stated that the coating does not interfere with vision or light transmission through the glass.

* * *

PROFILOMETER POWER PACK

An a-c power pack for use with Profilometers has been announced by the Physicists Research Company, 343 South Main Street, Ann Arbor, Michigan.

Profilometers, instruments used for the measurement of surface roughness and providing direct dial readings in true inch

units, until recently have been self-contained with batteries which permitted full portability. With the increasing need for their uninterrupted use in one location, particularly on three-shift inspection operations, the power pack has developed.

* * *

METAL-TAPE RECORDER AND REPRODUCER

The Mirrophone, a new recording and reproducing device, is now being manufactured by the Western Electric Company to record magnetically on a strip of metal tape, and play back.

The mirrophone already has a number of diverse applications to its credit. One mid-western radio station, for instance, has a mirrophone set up in its announcers' room. As each announcer comes on duty, he reads his commercial copy to the mirrophone, then listens to the playback.

The mirrophone permits continuous operation. As each recording is made, the previous one is automatically "eased" i.e. the tape is demagnetized.

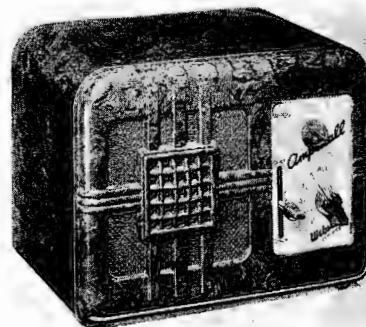


* * *

MULTIPLE STATION COMMUNICATING SYSTEM

A low cost communicating system for office and industrial application has been developed by the Rauland Corp., 4245 N. Knox Ave., Chicago, Ill.

The system consists of a master, or central control unit. Up to five remote, or outlying sub-stations can be used. The master of central unit can call and converse with any one of the five remote stations as selected. The master unit can call and "listen-in" or converse with all five remote stations at one time. This is done by means of the sixth, or "all" position on the selector switch.



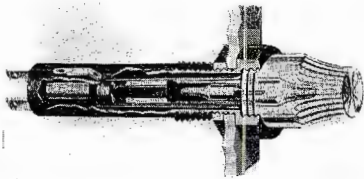
* * *

LITTELFUSE INDICATOR

A fuse indicator that lights instantly and reports a break in a circuit is now being

manufactured by Littlefuse Incorporated, 4757 Ravenswood Ave., Chicago, Ill.

When installed at a convenient or desirable point in connection with remote motor control the fuse works instantly, with a plainly visible signal to show "on" or "off". When the circuit breaker opens the light goes on. Available with 24 or 48 volt filament bulb, with which no resistor is used. Otherwise it uses a built-in 200,000 ohm protective resistor, in series with a neon lamp. The resistor prevents the lamp from blowing out, as ordinary lamps do, on unexpected high voltages. In the Littlefuse installation the lamp glows on currents as low as 100 microamperes.



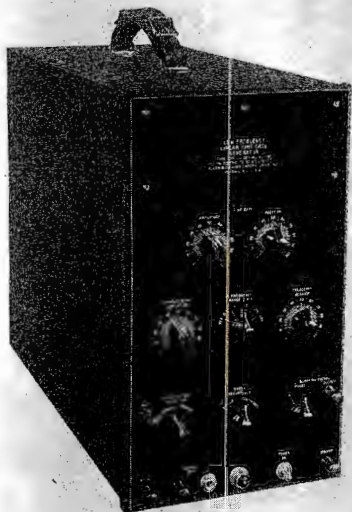
* * *

HIGH-SPEED LIMIT BRIDGE

Production testing of capacitors and resistors and inspection for conformance with tolerance specifications are possible with a high-speed limit bridge just announced by Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J.

For checking capacitors, the model LB-1 is used in conjunction with the DK-2A Decade Capacitor, having a range of .001 to 1.1 mfd. in .001 mfd. steps. However, the bridge can be used with decades of other ranges, or with independent capacitance standards. For checking resistors, Model LB-2 is used and supplied with a resistance standard having a range of 1000 ohms to 1.11 megohms.

For production testing, all that is necessary is to set the instrument's high-low dials for the desired plus-minus limits. The closing of the corresponding cathode-ray null indicator or "magic eye" gives immediate warning when limits are exceeded.



* * *

TURNER DYNAMIC MICROPHONE

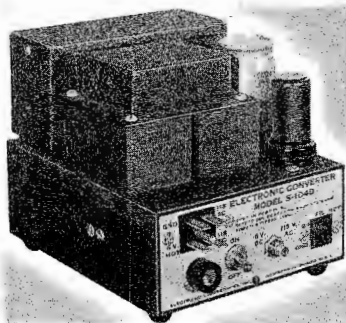
A dynamic Microphone, model No. 211, said to use a new type magnet structure and acoustic network, has been announced

Forward March

WITH ELECTRONIC POWER SUPPLIES FOR YOUR FM OR SHORT WAVE EQUIPMENT!

You in the rapidly growing and developing FM broadcast field have one problem you do not have to worry about! That's Power Supplies for your mobile transmitters and receivers, and for operation of station equipment from emergency power source.

● There's an Electronic Vibrator-Type Power Supply to meet your exact requirements. You will find Electronic Power Supplies unfailing and dependable, accurate and efficient. They use less current, reducing battery drain and prolonging battery life. They conserve weight and space, too. No lubrication is required, and servicing is seldom needed. Replacement is quickly and easily made.



Model S-1040—complete power supply for 112-megacycle emergency radio communication. Specifications: **INPUTS:** 6-volt DC, or 115-volt AC. **OUTPUT:** 300-volt DC, 100 Milliamperes. **FILAMENT SUPPLY:** 6-volt AC @ 2 1/2 amperes. **VIBRATOR:** Std. Electronic 120-cycle Heavy Duty. Tube filaments are fed from Converter. Switch permits instant change over, AC to DC, or DC to AC. Separate AC input connection for 115-volt operation.

Recently, George Grammer of the American Radio Relay League recommended specifications for 112-Megacycle Emergency Gear; and within thirty days Electronic was able to offer the S-1040—a complete Power Supply to meet these exact specifications! Electronic engineers are ready to do the same for you, too.

Impressive evidence of the satisfactory performance of Electronic products is their wide usage by the armed forces of the United States, Great Britain, and other United Nations, as well as in numerous commercial applications! Let Electronic answer your Power Supply problems for you!



ELECTRONIC LABORATORIES, INC.
INDIANAPOLIS, INDIANA

by the Turner Company, Cedar Rapids, Iowa.

The extreme lows are said to have been raised from 2 to 4 decibels in this new model to compensate for over-all deficiencies in loud speaker systems. It is equipped with tilting head, balanced line output connection and 25 feet of heavy duty cable.

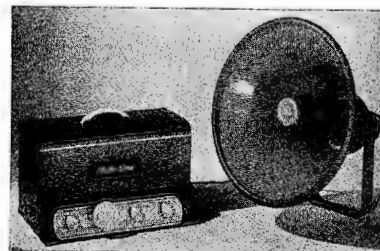
* * *

ELECTRONIC AIR RAID SIREN

An electronic type air raid siren has been developed by Audiograph division of John Meck Industries, 1313 West Randolph Street, Chicago. Called the "Electro-Siren", this unit makes use of a vacuum-tube generator which can either duplicate the rising and falling tone of a mechanical siren, or can be set at any pitch for best

audibility over traffic or manufacturing noises. It can also be used to send code messages to air raid officials by dots and dashes.

A microphone can be used for voice an-
(Continued on page 33)



G. A. W. CARBONYL IRON POWDER



Manufactured by
GENERAL
ANILINE WORKS
435 Hudson Street.,
N. Y. C.



Crowley "Magicore" cups, center core and coil. At left, typical permeability core or plunger

These are recent examples of iron cores produced by Henry L. Crowley & Co., 1 Central Avenue, West Orange, N. J.

This firm is a prominent user of G.A.W. CARBONYL IRON POWDER.

Typical Crowley "Magicore" permeability tuner cores or plungers, and fixed cores.



Distributor of G. A. W. Carbonyl Iron Powder.

ADVANCE
SOLVENTS & CHEMICAL CORPORATION
245 FIFTH AVENUE NEW YORK, N. Y.

DIAL CALIBRATION

(Continued from page 7)

frequency ratio for that particular percent of rotation of tuning condenser.

$$\text{Log } F_k = \text{Log } F_{\text{max.}} - \text{Log } F_r \quad (\text{See column 7 in Figure 3}).$$

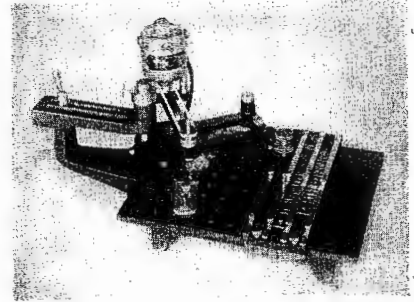
Results Available for Table

Thus the frequency has been determined for each 5 percent of rotation of the tuning condenser and may be included in the table. From these values, a curve may be plotted for percent rotation versus frequency, for each band, as shown in Figure 4.

Curves Provide Rotation Data

These curves in turn provide a means for determining the percent of rotation of the pointer on the dial for any particular frequency in any one of the bands which were calculated. The type of dial or control head may be the more common circular type as used on the RCBB series of receivers, or it may be the straight line type as used on the Lear ADF-8. If the circular type of dial is used, the number of degrees through which the pointer moves is independent of the number of degrees through which the condenser rotates. For example, if the escutcheon is so designed so that the whole band covers 270° of the dial (this type dial is shown in Figure 2), the percent rotation from the aligning point as located on the curve (Figure 5), for the frequency 1,500 kc (Band "3") is 75% or 202½ degrees. The degrees of rotation from the aligning point for any frequency

—MICO— ENGRAVER



For lettering panels of steel, aluminum, brass, or bakelite, or for marking finished apparatus.

A sturdy machine for routine production as well as occasional engraving.

Attachments increase its versatility to include large work on flat or curved surfaces.

Excellent engraving can be produced by an inexperienced operator.

Prompt delivery. Catalogue on request.

Priced from \$115 with Type

Mico Instrument Co.

18 ARROW STREET
CAMBRIDGE, MASS.

may be determined by first finding the per cent of rotation of the tuning condenser.

Straight Line Dial Data

If the straight line type of dial is used, as is used on the ADF-8, the distance over which the pointer travels for 180° of rotation of the tuning condenser need only be divided into per cent for plotting the various frequencies. For example, as found on the curve, 1,500 kc would be 75% or 10.5 inches from the aligning point. Thus the dial has been calibrated.

Figure 7

The ADF-8 control panel that uses the straight line type of dial calibrated in accordance with methods outlined within this text.



THE INDUSTRY OFFERS

(Continued from page 31)

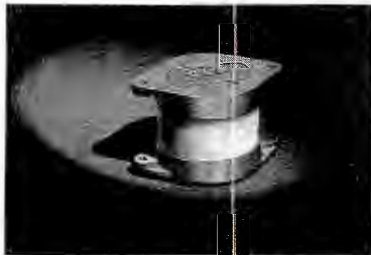
nouncements over the same system, which takes the place of a public address system.

* * *

HIGH-POWER TRANSMITTER CONDENSERS

Four types of heavy-duty mica capacitors for use in high-power transmitters are among the many types of mica capacitors described in the latest mica capacitor catalog 12, section E published by Solar Manufacturing Co., Bayonne, New Jersey.

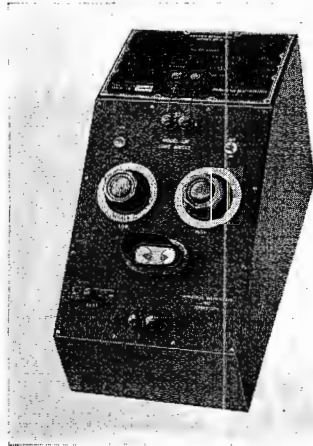
The types are designated as XPN, XPV, XPX and XPY and are supplied in capacities from .0001 mfd. to .05 mfd. Working voltages range from 6000 to 30,000.



* * *

L-F LINEAR-TIME-BASE GENERATOR

For those oscillographic studies requiring sweep frequencies as low as one cycle every few seconds, a Low-Frequency Linear-Time-Base Generator type 215, has been produced by Allen B. Du Mont Laboratories, Inc., Passaic, N. J. The device can be used in conjunction with an oscillograph provided with a long persistence cathode-ray tube, or with photographic recording methods. Vibration studies, stress and strain measurements, low-frequency electrical observation and electrocardiography are also possible with this new unit. The frequency range of the instrument corresponds to rotating speeds of 12 to 7500 rpm and the sweep frequency range is 0.2 to 125 cycles per second. For 115 or 230 volts a-c, rms, 40-60 cycles.

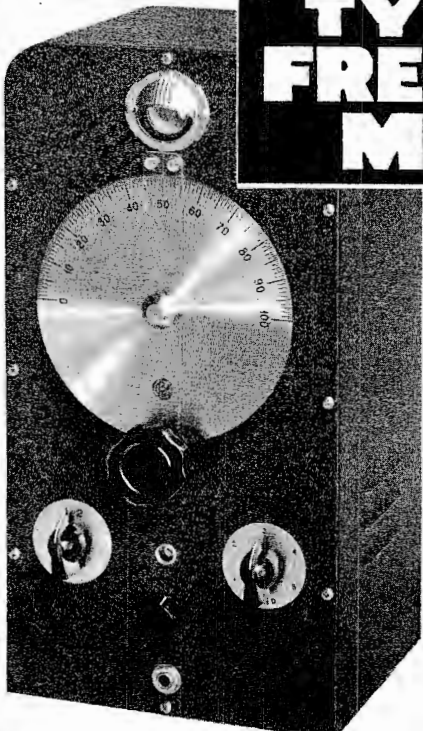


* * *

BLACKOUT SIGNS

To meet blackout exigencies, the Formica Insulation Company, Cincinnati, Ohio, has developed laminated plastic plates printed in phosphorescent and fluorescent inks, both of which glow brightly in the absence of visi-

BROWNING TYPE S-2 FREQUENCY METER




**✓ Check
FREQUENCY
ACCURATELY**

**Designed Especially for
Emergency, Police and
Similar Services.**

**This Instrument Is
Custom Built for
Individual Frequencies**

1. Accuracy better than .005%.
2. Will meet the F. C. C. requirements for checking the frequencies of any transmitter which requires a frequency meter accurate to .005%.
3. For more accurate zero beat setting a cathode ray indicator is employed. A jack is provided for aural indication of zero beat.
4. The Browning Frequency Meter is so designed that the precision of the apparatus at any time can be checked to at least fifty parts in
5. Custom-built for specified frequencies. Models from 1 to 5 bands inclusive.

SEND FOR FURTHER INFORMATION AND PRICES



BROWNING *Laboratories* INC

WINCHESTER·MASS·

Designers and Manufacturers of Electronic Equipment

ble light.

The phosphorescent type is activated by ordinary white visible light and will remain legible for two hours after the light is turned off. The fluorescent type is activated by ultra violet or "black," invisible light and remains legible as long as ultra violet light is thrown upon it.

These plates are printed in various colors. The lettering is carefully protected by plastic films which prevent the lettering from being injured by grease or cleaning solutions.

The process is available only where identical signs are required in considerable quantity and is not at present available where few of a kind are required.

* * *

MICRO-VOLT RELAY

To handle circuits carrying milliamperes

at microvolts in radio applications Struthers Dunn, Inc., 1355 Cherry St., Philadelphia, Pa., have developed a laminated frame relay type CX3318 that has sliding contacts and is likewise adapted for switching thermo-couple circuits. It is said to be constructed to withstand extreme vibration incident to aviation service and is tested for operation at high altitudes.

The new relay is 3 3/8" high x 2" wide and 2 1/4" deep and weight 9 1/2 ounces. Contacts are double-pole, double throw. Coils are for operation on a-c only, and are shielded from the contacts.

Dunco Bulletin P-249 describing this, as well as various other relays and solenoids for aviation uses, will gladly be sent upon request to the manufacturer.

ENGINEERS AND F-M SELLING

(Continued from page 12)

BOONTON FREQUENCY MODULATED GENERATOR

TYPE 150-A Series



Here is a signal generator developed specifically for use in the design of FM equipment. Built into it are the features requested by FM engineers. Both Frequency and Amplitude Modulation available separately or simultaneously. All controls direct reading. Expanded scale meters. Power line regulation optional.

Brief Specifications:

Output from 0.1 μ V to 0.1 Volt with attenuator, and 0.1 Volt to 1 Volt with special tap.

Deviation from zero to 200 KC
Internal AF-100, 400, 1K, 4K and 10K cycles.

RMA Pre-emphasis circuit.

Vernier F Control for selectivity.

Frequency Ranges

Type 150A	41-50mc and 1-10mc
Type 151A	30-40mc and 1-7mc
Type 152A	20-28mc and .5-5mc

New Catalog B now available.

BOONTON RADIO CORP.
Boonton, New Jersey, U. S. A.

tion is practically a memory, but estimates of inventories plus dealer stocks, indicate that sets available still give f-m a chance to increase its present audience by a sizeable percentage.

F-M and Cultural Effect

Frequency modulation stations continue to "scoop" some of the finest in music today—symphony, opera, the concert stage. And back of the raptures that listeners express on every occasion are engineers working on a better way to put this new tool to work.

Construction Increasing

Frequency modulation station construction, to date, continues at a favorable rate. Some 60 to 70 commercial construction permits have been granted by the FCC. More stations are soon to be on the air. Transmitting equipment of several ratings is still available; low power units for immediate delivery. Television has turned to f-m for the sound channel.

More Public Education Essential

Public education on f-m, unfortunately, is not yet taking on a large scale hold. Recent surveys show that even

in f-m listening areas more people think "f-m" is a government agency than know that it is a new kind of radio. Among newsmen, of course, the initials are fairly well known. For this reason, f-m in itself is no longer "news." Only unusual events and stories concerning this new system will make "news."

That means that the press relations man in every f-m station should be kept posted on anything with news value.

Luncheon clubs, schools, and various other groups—conventions and the like—offer a splendid opportunity for engineers to spread the story of f-m and its advantages. Demonstrations and other aids have been devised for such meetings, and it is often possible to get the cooperation of dealers in staging them.

All in all, the picture for f-m is encouraging. There are opportunities for advancement of the art so long as stations are on the air in the public service. The real danger to f-m progress is rumor, the kind that can make any of us skeptical if we hear enough of it.

But then—"Even if you're on the right track you'll get run over if you just sit there." And after all, we're pretty well convinced that f-m is on the right track. That leaves the rest up to us.



A square wave generator (left) being used to check studio speech input equipment. At right is a cathode-ray oscilloscope used to check the shape of the square wave after it has passed through the speech input equipment.

BOOK REVIEWS

(Continued from page 15)

tubes, and rods includes nine standards. There are six standards in the field of mineral oils, ceramic products and solid filling and treating compounds. Two test methods cover insulating paper; four apply to mica products. There are eight specifications—four each for various rubber products and textile materials. Four standards give tests and tolerances for various types of glass products and for woven tapes. Six standards give tests covering arc resistance, dielectric strength, power factor and related properties and tests.

This publication, which includes for the first time a detailed index, also includes two tables of contents, one listing standards in numeric sequence. The 1941 report of Committee D-9, with its recommendations on standards, is also given.

RADIO AMATEUR'S HANDBOOK (DEFENSE EDITION)

By the Headquarters Staff of the ARRL . . . 288 pp. . . West Hartford, Conn.: American Radio Relay League, Inc. . . \$1.00 (paper bound).

Designed to replace the standard handbook in defense radio training courses, this special edition retains everything from the regular edition that is useful to war work and has added new chapters on mathematics, measuring equipment and code instruction. It omits such sections as those on construction of amateur equipment and operation of amateur stations.

The nine basic theoretical chapters of the standard edition are retained intact. Brand-new is the first chapter covering the elementary mathematics necessary for the solution of all formulas and interpretation of graphs appearing throughout the text. This includes a review of decimals, method of extracting square root, algebraic notation and manipulation of formulas, laws of exponents, logarithms, a discussion of linear, power and exponential functions and their application to graphs, and the use of polar coordinates. Supplementing this chapter, a four-place log table is included in the Appendix.

The constructional chapters of the regular edition have been condensed into one new chapter in which representative types of radio equipment are featured. Data on and photographs of the more generally used commercial receivers and transmitters are included, along with selected equipment described

(Continued on page 36)

OHMITE Resistance Units Meet the Test!

... in Vital Communications Applications

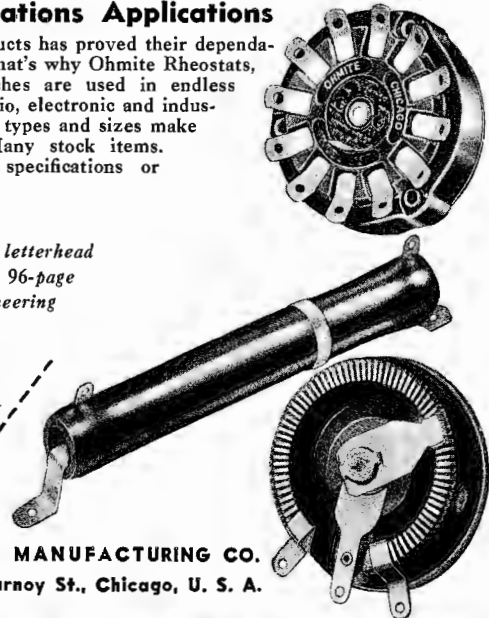
The service-record of Ohmite Products has proved their dependability on land, sea and in the air. That's why Ohmite Rheostats, Resistors, Chokes and Tap Switches are used in endless variety and number in military, radio, electronic and industrial applications. Widest range of types and sizes make it easier to meet each need. Many stock items. Units produced to Government specifications or engineered for you.



Write on company letterhead for complete, helpful 96-page Catalog and Engineering Manual No. 40.



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4870 Flournoy St., Chicago, U. S. A.



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For defense and communications service, Premax Antennas, strong yet light-weight and fully adjustable, meet the needs for ship-to-shore, marine, mobile, police and other uses. Send for special Bulletin showing telescoping Antennas and Mountings.



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This is why LITTELFUSES for instruments as well as all applications are standard and not "equivalents." The Locked Cap Assembly is a Littelfuse Patent (No. 1922642). Littelfuse Caps do not fly off and get lost. Littelfuse Twisted Element braces against severe vibration. Littelfuse Gooseneck takes up contraction and expansion. Make sure with Littelfuse. Send for Catalog with complete listings of fuses, fuse mountings and other Littelfuse products.



Sizes 1/100 to 8 amps
250 volts.
UNDERWRITERS APPROVED

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Dependable



... Accuracy and dependability are built into every Bliley Crystal Unit. Specify **BLILEY** for assured performance.

BLILEY ELECTRIC COMPANY
UNION STATION BUILDING ° ERIE, PA.

JONES 500 SERIES PLUGS AND SOCKETS

Designed for 5,000 volts and 25 amperes. All sizes polarized to prevent incorrect connections, no matter how many sizes used on a single installation. Fulfills every electrical and mechanical requirement. Easy to wire and instantly accessible for inspection. Sizes: 2, 4, 6, 8, 10, and 12 contacts. Send for a copy of Bulletin 500 for complete information. Write today.



HOWARD B. JONES
2300 WABANSIA AVENUE, CHICAGO



"RADIOCARB A"

is the accepted superior carbonized nickel for power tubes meeting the specifications of the U. S. Navy.

WILBUR B. DRIVER CO.
NEWARK, NEW JERSEY



BOOK REVIEWS

(Continued from page 35)

in the regular edition. Similar treatment has been given the chapter on measurements.

There is also a new chapter on learning the radio telegraphic code.

HANDBOOK OF CHEMISTRY AND PHYSICS (24th EDITION)

Prepared and edited by Charles D. Hodgman and Dr. Harry N. Holmes, in collaboration with 40 contributors . . . 2521 pp. . . . Cleveland, Ohio: Chemical Rubber Publishing Co. . . . \$3.50.

Ordinarily a book of this type would be of interest only to chemical engineers and the like. However, because of conditions today, and the variety of engineering data essential to design and practice, this handbook will be found to be extremely useful to many.

There are five general divisions of subject matter in the handbook. These are separated for convenience by divisional guides. On each guide is listed an outline of the contents of the particular section.

The first division contains some 30 mathematical tables. These alone are worth more than the cost of the entire volume, and cover all commonly used listings.

Properties and Physical Constants; General Chemical Tables; Specific Gravity and Properties of Matter; Heat and Hygrometry; Sound; Electricity and Magnetism; Light, as well as a host of other subjects, are covered in the other divisions. Of particular interest is the "Musical Scale" and a section on plastics.—O. R.

Research Today

The production of some by-products of coal tar as an alternate for plastics in speaker manufacture recently, is an excellent example of the efforts of research today. In this particular instance, it was necessary to fabricate a material that had physical mass and electrical properties that duplicated the properties of materials on the critical list.

The problem of the proper selection of materials may appear to be a puzzling one. However, specialists at the various fabricating plants have become exceptionally well schooled in the intricacies of their applications. In addition, engineers have been loaned to the research divisions of communications plants to expedite research today.

NEWS BRIEFS

(Continued from page 27)

noise-making devices, then how to determine exactly what filters are required, before any units are purchased or any permanent installation made. Described and illustrated are the correct filter circuits and parts required to reduce noise from electrical devices such as fluorescent fixtures, single or polyphase motors, d-c generators, alternators, switches, thermostats, sign flashers, arcing devices, oil burners, gas engines, vibrating contacts, mercury vapor lamps and many others.

* * *

MALLORY REPLACEMENT VIBRATOR GUIDE

A 28-page replacement vibrator guide has just been issued by P. R. Mallory and Co., Inc., Indianapolis, Ind. In this 1942 guide, appears, too, forty-nine base diagrams; external views (prong and lead arrangements) of vibrators; replacement vibrator specification chart; 1942 car installation data; 47 diagrammatic installation sketches; automobile battery ground chart; service data, etc.

* * *

SUN RADIO CELEBRATES 20TH YEAR

Sun Radio Co., 212 Fulton Street, New York City, one of radio's early pioneers, is celebrating the twentieth anniversary of its entrance into the industry.

Since its original establishment in 1922 on Vesey Street, the firm has twice found it necessary to move to larger quarters. In 1931 they moved to 227 Fulton Street, corner of Greenwich, and again in April of

1938 to its present quarters, a two story building. For its amplifier and public address department, Sun added to its facilities by acquiring the entire second floor of 210 Fulton Street, adjacent to its building, in June, 1941.

* * *

DESPRES CELEBRATES 9TH YEAR AS SYLVANIA DISTRIBUTOR

Maurice S. Despres, president of the Dale Radio Company, 1780 Broadway, New York City, celebrated recently his ninth anniversary as a Sylvania radio tube distributor in the New York area.

Mr. Despres has served with radio parts jobber organizations, with the Chicago Radio Trade Show, and of late, has counseled economic administrators in Washington on radio tube operations.

* * *

NEW TUBE PLANT FOR HYGRADE

The Hygrade Sylvania Corporation has recently purchased a new plant at Mill Hall, Pennsylvania, and are now in the process of putting it into shape for their use in the manufacture of radio tubes.

C. A. Haines, who has been superintendent of the Salem Tube plant, will be in charge of operations of the plant.

* * *

NEW SUPER-CARDIOID BOOKLET

An 8-page book on the Super-Cardioid microphone for broadcast and recording engineers has just been issued by Shure Brothers, 225 W. Huron St., Chicago, Ill.

This new book tells what Super-Cardioid means, how it works, and what it does for sound pick-up. It also gives complete specifications, technical data, diagrams and curves on the new Series "556" Super-Cardioid dynamic microphones for studio and remote broadcasting, recording, and public address.

A copy may be obtained by writing on your letterhead.

* * *

NEW RCA RADIO-TELEGRAPH PRINTER

Error from defective signals in radiotelegraph transmission is said to have been eliminated by a new error-proof radio printer recently put into operation on the direct radio circuit of RCA Communications, Inc., between New York and Buenos Aires.

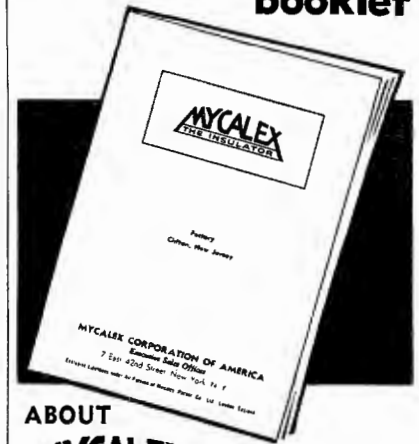
Product of RCA Laboratories, the new printer automatically rejects false signals and prints an asterisk in place of an incorrect letter. The printer may operate alone or with others over the same radio transmitter. When more than one printer is used, they are operated in conjunction with RCAC's "time-division" multiplex system, which provides two, three or four simultaneous message channels over a single radio transmitter. In sending messages, the output of the several transmitter-perforators is brought together in the multiplex equipment, scrambled, and delivered to a transmitter, which beams the aggregate radio signal to its destination. At the receiving end, the multiplex equipment unscrambles the signal and delivers the components to the several separate error-proof printers. The aggregate speed of the four-channel system is 248 words a minute.

* * *

ERRATUM

The formulas appearing in Figs. 4 and 5, page 8, March COMMUNICATIONS, should have read: % Increase = $100 \sqrt{1 + K^2}$ - 1] and % Shift = $100 \sqrt{\frac{2}{3} (1 + K)}$ - 1], respectively.

get this new, free booklet



ABOUT



the low-loss insulator that can be machined!

Trade Mark
Reg. U. S. Pat. Off.

MATERIAL NOW SUPPLIED from the NEW, LARGE PLANT of the EXCLUSIVE AMERICAN LICENSEES

under all British patents*

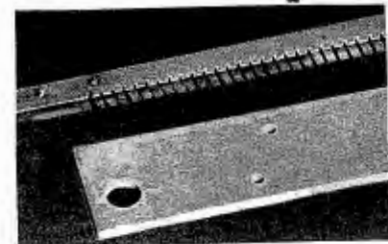
MYCALEX CORPORATION OF AMERICA

Sales: 7 E. 42 St., N. Y. Plant: Clifton, N. J.

*THERE IS A DIFFERENCE: MYCALEX insulating material IS LEADLESS. It offers improved insulating properties, and can be machined more easily and more quickly to accurate measurements. Mark your specifications: "LEADLESS" MYCALEX insulating material."

Send today for new, informative 12-pg. booklet, generously illustrated with factual photographs of sockets, coils, spacers, many other parts made of, or in conjunction with, MYCALEX insulating material. Contains helpful engineering data, description of properties, advice on machining, suggestions for new uses in your business. MYCALEX insulating material rates high among the world's leading electrical engineers, because of its great mechanical strength, its high dielectric strength and the comparative ease of its machining. To get full facts, mail coupon.

Examples of machined MYCALEX insulating material



Shows MYCALEX insulating material grooved for insulation and support of radio transmitter tank coils. Its extremely low loss at even ultra high frequencies makes it possible to use MYCALEX insulating material wherever needed for mechanical strength, regardless of position or bulk, in R. F. fields. Many users machine MYCALEX insulating material in their own shops; our own new, large machine shop at our Clifton (N. J.) plant is well-equipped to cut, drill, tap, machine, grind and polish MYCALEX insulating material to your exact specifications.

TEAR OFF COUPON NOW — before you forget

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7 E. 42nd St., New York, N. Y.
Please send illustrated booklet.

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City..... State.....

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You NEED your typewriter! But the Government, the armed services, and manufacturers of war supplies need typewriters too!

That's all right... you can make your typewriters last longer by letting us take care of them. Call us today. Our Royal-trained and Royal-approved service will make your typewriters run smoother and easier... and they will require less servicing and fewer repairs.

Call us, too, for Roy-type ribbons and carbon paper—made and guaranteed by the Royal Typewriter Company.

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Branches and Representatives the World Over



ULTRA HIGH FREQUENCY
Single Frequency
CRYSTAL CONTROLLED RECEIVER
Type 602A—Specifications

- Frequency Range—Any fixed frequency in the band 50 to 200 Megacycles.
- Sensitivity—5 Microvolts or better for 50 Milliwatts output.
- Signal-to-noise-ratio—10 to 1 in voltage at full sensitivity.
- Image—Image and spurious frequency rejection 60 DB or better.
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MAINTENANCE

(Continued from page 29)

plifiers at either end will be revealed by this test and a possible program failure is thus prevented.

Putting Carrier On

The technician then puts the 50 kw carrier on the air, regulating the input at the first PA, so that a proper current for the 50 kw will be read at the concentric line input ammeter. During the process one technician stands by the

concentric line input ammeter. When it reads correctly, he signals, whereupon the transmitter engineer takes a reading of all three extension antenna ammeters and records his on the back of the FCC log. He also takes a complete set of readings on the master operating log with no modulation carrier.

A double check is made of the input, output, monitor and vu keys on the control room turret.

Permanent Record Kept

A permanent record is kept of each

tube's current reading at WOR so that comparisons can be made from week to week. From past records, the approximate end of the tube's useful life can be predicted. Thus, instead of risking tube failures on the air, the tube may be removed from service before complete failure can occur. X-rays taken of tubes help the operators to understand more clearly just what happens when a tube fails.

The average tube life at WOR is 10,485 hours with a maximum tube life of 51,000.

THE 20th ANNUAL NAB CONVENTION

On Monday, May 11, the 20th Annual Convention of the NAB will convene at the Hotel Statler, Cleveland, Ohio. The keynote for the convention will be "Radio and the War." Archibald MacLeish, Director of the Office of Facts and Figures, and Byron Price, Director of Censorship, will make keynote addresses. Following this will be an informal clinic in which Major General A. D. Surles, Director of the War Department Bureau of Public Relations; Captain L. P. Lovette, Office of Public Relations of the Navy; Major General Beaumont-Nesbitt, former Director of British War Information, and J. Harold Ryan, Assistant Director of Censorship in charge of radio, will participate.

Technical Roundtables

On Tuesday, May 12, a series of breakfast roundtables is scheduled covering Wages and Hours, Technician Shortage and Training Program, Procurement and Priority Problems. There will also be an OFF breakfast, one portion of which will be devoted to the "Four Themes," discussion being led by William B. Lewis and Philip Wylie.

The subject, "Priorities: Men and Materials," and the "Selective Service Act" will be discussed by Brigadier General Lewis B. Hershey. The subject, "Material Priorities and Their Effect on Our National Economy," will also be analyzed by a field specialist.

On Wednesday, May 13, there will be another technical breakfast round table, featuring the work of the DCB. E. K. Jett, FCC chief engineer will preside. The protection of property from sabotage, fire and theft will be another of the topics covered. In the evening at 7:30, the annual banquet will be held.

Lt. Commander Thomas J. Keane, U. S. N., will speak on Wednesday on "The Navy, at Home and Abroad," and Edward M. Kirby, NAB Public Relations Director, now on leave of absence as Chief of the Radio Branch, Public Relations Division of the War Department, will speak on "Radio's Place in the War."

Broadcast Business Talks

Other important subjects that will be covered during the afternoons and evenings of May 11 to 14th include radio advertising, tax legislation, NAB amendments, listener reaction and the war effort, etc. The NAB board meeting will convene on Thursday, May 14th, following the election.

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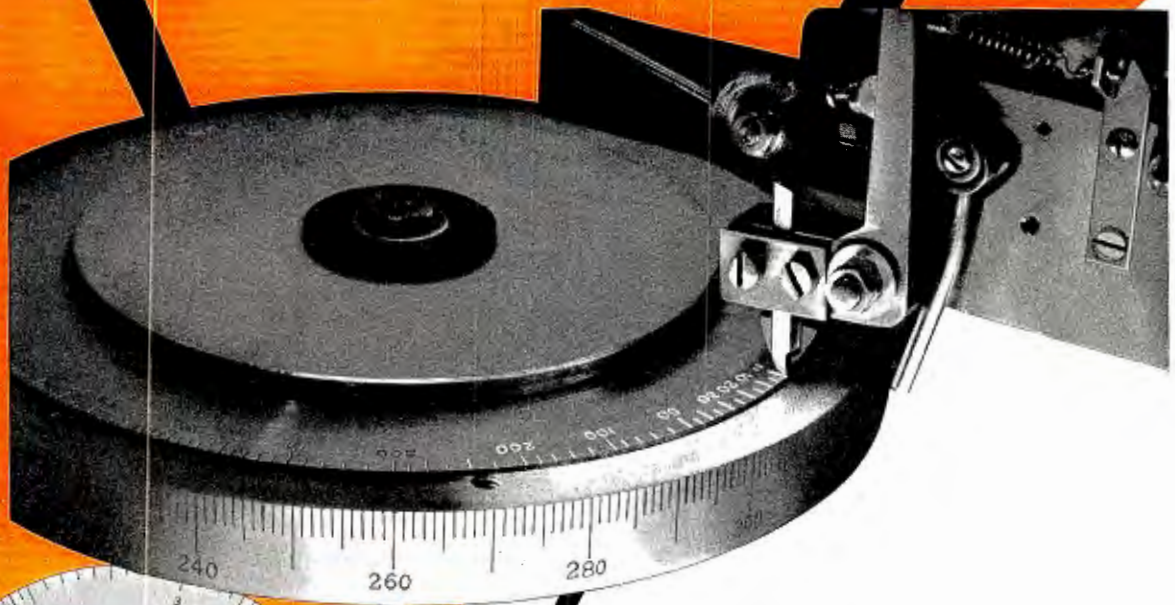
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ACCURATE CALIBRATION

EVERY ACCURATE calibration is furnished with many General Radio instruments. No matter how good the internal stability of any instrument, its usable accuracy depends upon the reliability with which the variable-control element may be reset after calibration. An incorrectly engraved dial or a dial with irregularities in its scale will immediately nullify the stability of the best electrical circuit.

Many General Radio instruments are equipped with dials, such as the logarithmic type, on which the scale divisions are not uniformly spaced. Most instruments of this type are individually calibrated in the laboratory, the setting for each calibration point being indicated on the dial by a fine pencil mark. The dials are then transferred to a hand-operated engraving machine (illustrated) where the divisions are carefully engraved over the pencil lines; they are then sent to the laboratory for replacement on the instruments, and for final checking.

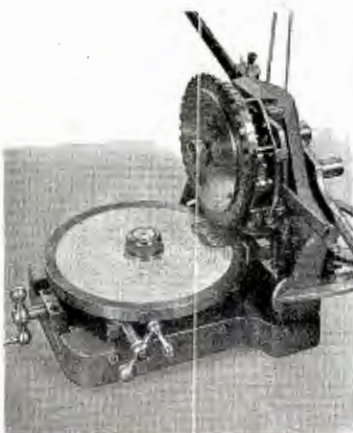
Other instruments require linear scales engraved with great accuracy. Dials with photo-etched scales do not have the necessary accuracy; hence, these scales are engraved on an automatic self-indexing engine divider on which a geared motor accurately rotates the dial through the required arc, the dial pausing in its rotation long enough for a steel tool to engrave the divisions.

Only through engraving of this type is it possible for General Radio to insure usable calibrations of the highest accuracy on precision variable-element instruments such as beat-frequency oscillators, standard-signal generators, precision variable condensers and wave analyzers.



Photo-etched dials (above) are used on some instruments where great accuracy is not required or when variations in scale uniformity can be compensated for by means of mechanical cams on the variable elements of the circuit.

(Below) This printing machine has been developed by G-R to print scale calibrations on a six-inch dial which is hand-marked at over 1,500 points on a scale whose effective length is fifteen feet.



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4. Availability Table for Contact Materials.
5. Mallory Individually Fused Type Contacts—a new development.
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7. Mallory Alloys for Current-Carrying Springs.
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