

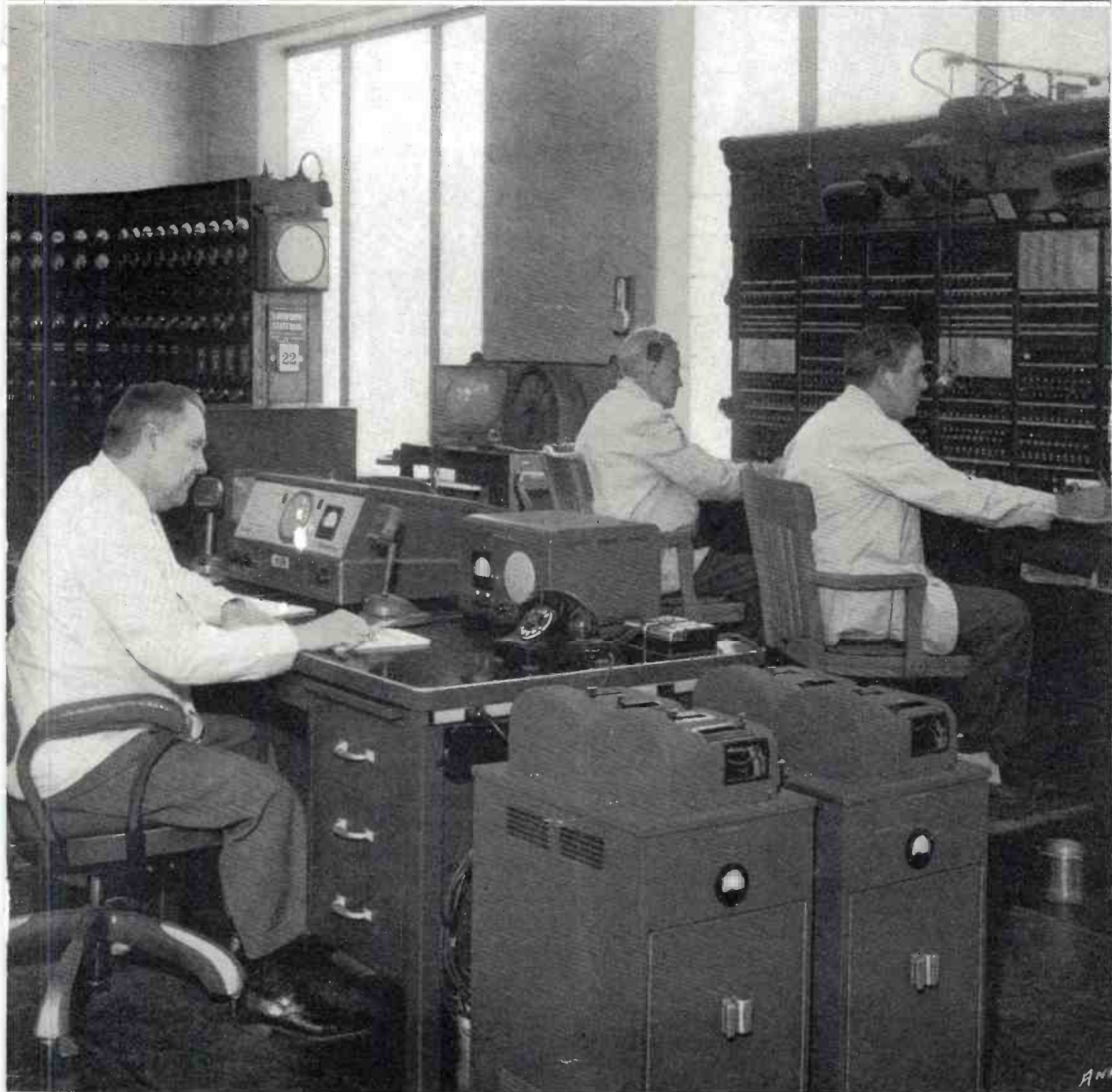
Price 35 Cents

July 1952

FM-TV
THE JOURNAL OF

RADIO COMMUNICATION

★★Published by★★
Milton B. Sleeper



★ Mobile, Point-to-Point, and Relay Communication ★
★ FM and TV Broadcasting ★ Audio-Reproduction ★



most experienced builder of communication radio systems

Bendix

announces

the finest Mobile Radio ever built

with clear channel construction



THE TRAFFICMASTER
Mobile Communications Equipment

Here at last is the final answer to your Mobile Radio Communication problems. This new Bendix* Command-Air Series, operating on the VHF band, combines every desirable construction and performance feature to meet not only today's requirements, but to anticipate the needs of tomorrow's operating conditions.

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In addition to this latest type of mobile radio equipment, Bendix now offers a complete line of land stations from 2 1/2 to 250 watts output as well as accessories such as handsets, microphones, speakers, antennas and shockmounts—plus all technical assistance in obtaining licenses and complete systems engineering.

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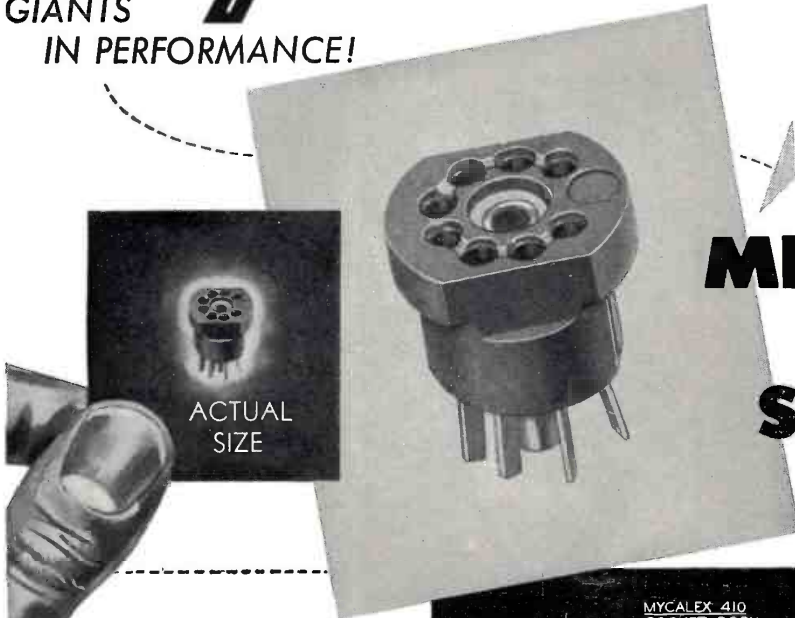
THE MOST TRUSTED NAME IN

Radio

MINUTE
IN SIZE...
GIANTS
IN PERFORMANCE!

MYCALEX 410

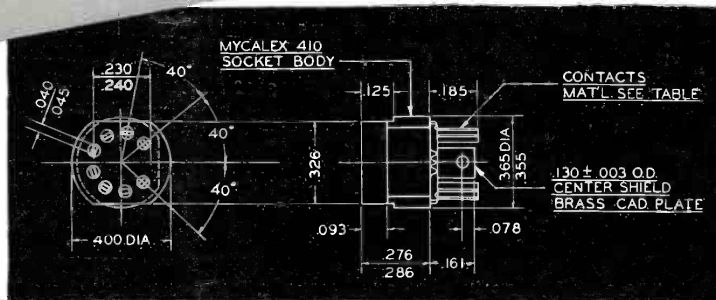
8-PIN SUB-MINIATURE TUBE SOCKETS



TOP
VIEW



BOTTOM
VIEW



- LOW LOSS FACTOR OF .015 at 1 MC.
- INSULATION RESISTANCE (min.) 50,000 Megohms
- ARC RESISTANCE, ASTM SECS. 250+
- OPERATING TEMPERATURE 135°C (limitation due to contact metal)
- Q-value at 40°C—50% RH—not less than 1000
- Q-value at 40°C—90% RH min.—not less than 333

WRITE FOR DATA SHEETS

Mycalex 8-Pin Sub-Miniature Tube Sockets are fully described in the new Data Sheets. Other catalogs are available on Mycalex Insulation for every electronic or electrical application.



New MYCALEX 410 Sub-Miniature Tube Sockets are designed for use in electronic and electrical equipment where space is at a premium. Because they are extremely compact, these sockets offer a ready solution to numerous design problems involving spatial limitations. Installation is simple, mounting being accomplished without screws or rivets in shaped chassis holes.

Improved electrical performance and greater mechanical protection for the tube than are available with ordinary insulating materials are afforded by this socket through the use of MYCALEX 410 glass-bonded mica. MYCALEX 410 is rated Grade L-4B insulation under N.M.E.S. JAN-I-10. It offers superior electrical and mechanical properties in combination with practical cost per unit.

MYCALEX TUBE SOCKET CORPORATION

Under Exclusive License of
MYCALEX CORPORATION OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

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*"Boy! What a
signal we have!"*

That's how George D. Robinson, Manager of WSUN, St. Petersburg, Florida, expressed his satisfaction with the performance of two new Blaw-Knox Antenna Towers that help extend the coverage of WSUN's transmitting facilities. These AM and FM* towers, grounded in salt water are subject to high winds and unusually corrosive atmospheric conditions. Consequently the extra sturdy construction of Blaw-Knox Types H40 and CH, plus the protection of hot dip galvanizing were prime factors in determining their selection for this site... If you are planning telecasting facilities we would be pleased to discuss your tower requirements at an early date.

**BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
2062 Farmers Bank Building
Pittsburgh 22, Pa.**

**Tower at left is designed to accommodate TV antenna when authorized.*

BLAW-KNOX ANTENNA TOWERS

FM-TV RADIO COMMUNICATION

Formerly FM MAGAZINE and FM RADIO-ELECTRONICS

VOL. 12 JULY, 1952 NO. 7

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The Complete Replacement Line

Radiart solves all the problems on the vibrator side of the radio communications picture with the complete RUGGED SERVICE line that has been the leader for years. Exclusive design plus quality controlled manufacture deliver vibrators that are completely dependable! No short-lived performances... they work perfectly even under the most adverse conditions BECAUSE THEY ARE BUILT TO "TAKE IT"! Make a comparison and you, too, will agree RADIART VIBRATORS ARE THE STANDARD OF COMPARISON!

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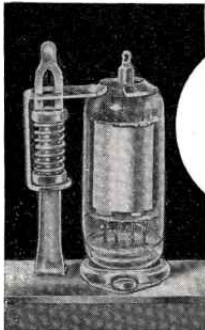
BIRTCHE TUBE CLAMPS

Hold Tubes in Sockets
under all Vibration,
Impact and
Climatic
Conditions

83
VARIATIONS
FOR
STANDARD
TUBES



NEW
CLAMP
FOR
MINIATURE
TUBES



You can't shake, pull or rotate a tube out of place when it's secured by a Birtcher Tube Clamp. The tube is there to stay. Made of Stainless Steel, the Birtcher Tube Clamp is impervious to wear and weather.

BIRTCHE TUBE CLAMPS can be used in the most confined spaces of any compact electronic device. Added stray capacity is kept at a minimum. Weight of tube clamp is negligible.

Millions of Birtcher Tube Clamps are in use in all parts of the world. They're recommended for all types of tubes: glass or metal—chassis or sub-chassis mounted.

THERE'S A BIRTCHE TUBE CLAMP FOR EVERY STANDARD AND MINIATURE TUBE!

Write for samples, catalogues and price lists.

THE BIRTCHE CORPORATION
4371 Valley Blvd.
Los Angeles 32, Calif.



WITH RTMA figures showing FM, AM, and TV set production in 1952 substantially below last year's averages, it can hardly be said that this segment of the radio industry is flourishing.

Of course AM sets have been sold during recent years in a virtually saturated market. Nearly one-third of the May production was automobile sets which, by nature of their use, are relatively short-lived. Clock radios, the only new gimmick that has come out in quite a while, dropped from 176,000 in April to 115,000 in May.

TV sets are running under the 1951 average, which was lower than 1950. Production will probably continue to fall off until a significant number of new stations can be put in operation.

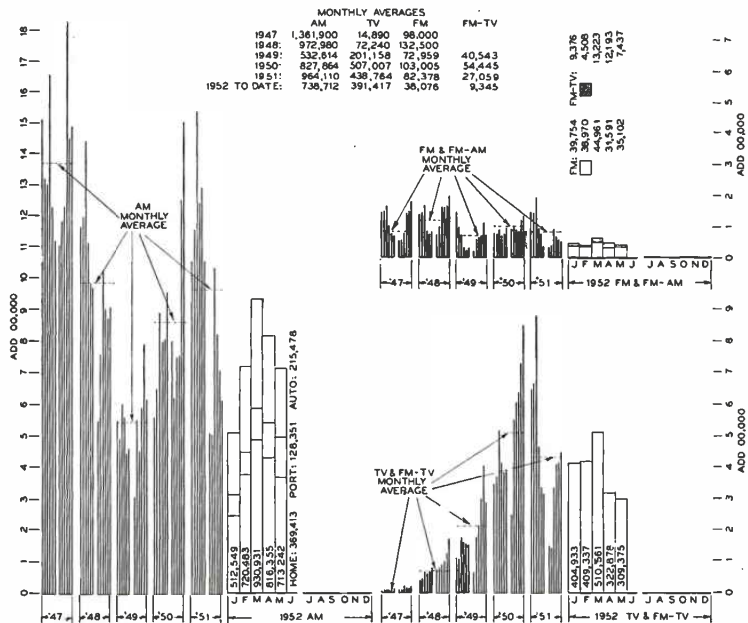
So it's no wonder that more and more manufacturers are eyeing the market for high-fidelity equipment. We are aware of this because an increasing number of companies are asking for market data. Several sales executives have traveled all the way to Great Barrington to discuss the growing demand for equipment, and the nature of the people who are buying it.

It is significant that manufacturers in the hi-fi field are selling directly to the dealers. Thus the only intermediate ex-

pense reflected in retail prices is the commission for the factory representatives. To enter the hi-fi business, a dealer must 1) buy in reasonably large quantities, and 2) have a credit rating acceptable to the manufacturers. This, of course, eliminates most of the radio and TV dealers, because they are not set up to do a serious job on hi-fi, and so would not carry the inventory required. And few of them are willing and able to tie up the very substantial amount of capital represented by an adequate stock of equipment and related components.

Indicative of the increasing number of critical listeners who own installations capable of wide-range reproduction is the growing demand for plain turn-tables. Extended bass response results in complaints that record-changers cause rumble.

So far, the record companies have done more to promote interest in high-fidelity, by substantial improvements in the quality of recordings, than broadcasters have done to make better music available over FM. Currently, however, there is definite progress in that department in certain sections of the Country, although broadcasters do not seem to realize the extent to which the public is turning to records for home musical entertainment.



TV, FM, and AM set Production Barometer, prepared from RTMA figures.

HAMMARLUND

WORLD-FAMOUS SUPER-PRO 600

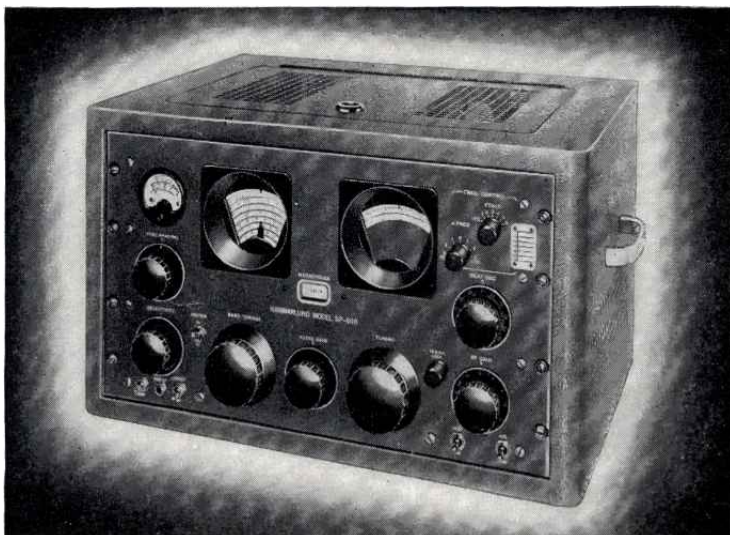
The Hammarlund "Super-Pro 600" communications receiver has gained world wide recognition as the finest, best performing receiver available anywhere at any price. It is used in large quantities by the U. S. Army, Navy, and Air Force, other governmental

agencies, airlines, the press, maritime and commercial services, for both single channel and diversity reception. Only recently has it become available for amateur use where it achieved immediate popularity because of its high performance abilities.

FIRST CHOICE FOR:

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- **COMMERCIAL**
- **AIRLINES**
- **MARINE**
- **AMATEURS**

SP-600-JX



Designed for Dependable Performance!

The "SP-600-JX" is a completely new receiver in both electrical and mechanical concept and incorporates the experience of more than 40 years of manufacturing communications equipment. Every component in the Hammarlund "SP-600-JX" is conservatively rated to do a specific job. Quality performance was the first and only consideration in its design and manufacture. So flexible is this receiver it would require a number of individual receivers, each specifically designed to do a certain job, to equal its performance.

This magnificent receiver is a 20 tube dual conversion superheterodyne covering the range of 540 kc to 54 mc

in 6 bands. The power supply is an integral part of the receiver chassis. Operation on any of six crystal controlled fixed frequency channels within the range of the receiver is immediately available at the flip of a switch. Stability is .001 to .01 percent depending on frequency to which receiver is tuned, image rejection is 80 db to 120 db down, and spurious responses are at least 100 db down. Sensitivity is 1 microvolt CW and 2 microvolts AM, while selectivity for the three calibrated crystal and three non-crystal ranges is from 200 cycles to 13 kc. Radiation is negligible with no cross-talk in multi-receiver installations.

Write to the Hammarlund Manufacturing Company for further details.

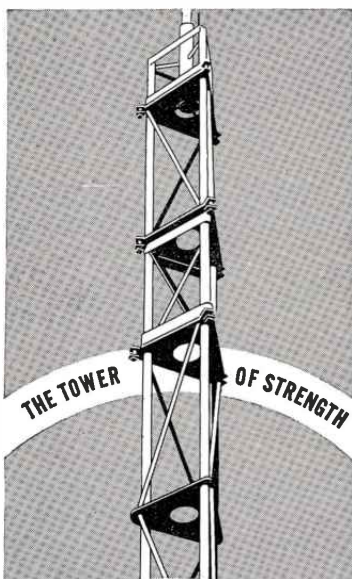


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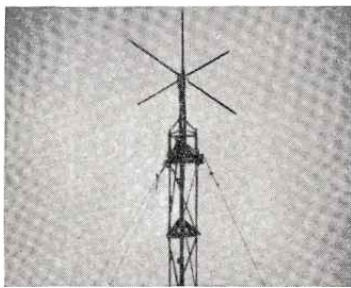
THE HAMMARLUND MANUFACTURING CO., INC.

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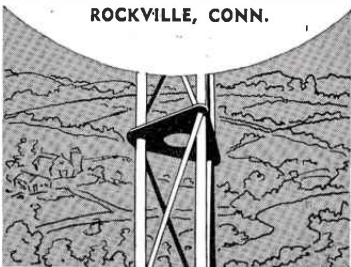
VEE-D-X Sectional Tower

**MOST ECONOMICAL FOR
MICROWAVE • FM • TV
COMMUNICATIONS • RADAR**



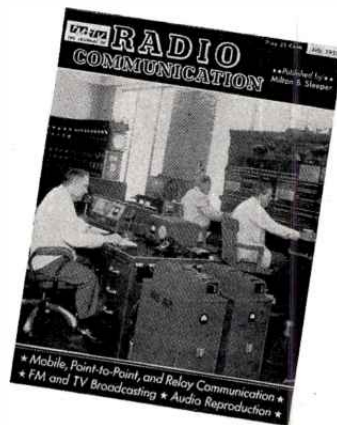
Actual photograph of VEE-D-X Sectional Tower installation showing 152 MC ground-plane antenna ideally suited for ground-to-plane, ship-to-shore, and mobile communications.

THE LaPOINTE-PLASCOMOLD CORP.
ROCKVILLE, CONN.



THIS MONTH'S COVER

For a long time, fire departments were reluctant to even consider the use of radio because, strictly speaking, it is not fail-safe in design. Then, slowly, they came to recognize that, as one chief put it, "You know it's working if you get an answer." Currently, fire departments rank fifth in number of applications filed for base stations and mobile units. This month's cover shows the control console at Fire Alarm Headquarters in Kansas City, Mo. Fire Chief Harvey Baldwin also has a console at his office. This is part of the municipal system described in this issue by Supervisor of Communications Roy De Shaffon.



SPOT NEWS NOTES

ITEMS AND COMMENTS, PERSONAL AND OTHERWISE, ABOUT PEOPLE AND COMPANIES CONCERNED WITH RADIO COMMUNICATION

New TV Stations:

Up to June 27, TV applications were filed with the FCC for 104 VHF and 64 UHF stations. Average cost of these stations is estimated to exceed \$360,000, with first-year operating costs estimated to be over \$290,000, and revenues slightly over \$300,000. Figures shown in applications disclose that 42 stations will cost less than \$200,000, while 7 will cost from \$.9 million to nearly \$2 million.

Radio Paging:

FCC has assigned 35.58 mc. to radio paging service, in addition to 43.58 mc., which is already in use. Keep an eye on this service. It is due for rapid expansion.

Six Issues Next Year:

In response to the demands of readers and advertisers, HIGH-FIDELITY will publish 6 issues annually. The Fall Issue will be out on September 15, according to the original schedule, but the Winter Issue will be advanced to November 1. Thereafter, it will appear on January 1, and on the first of every other month. The Winter Issue will be a special Audio Show number, and will be mailed to subscribers in advance of the show.

Nighttime Rates & Coverage:

Only way that audio broadcast stations can offset loss of nighttime audience is to put full promotional effort behind FM to 1) recover listeners who have come to prefer phonograph records as a source of good music, and 2) reach listeners who are beyond range of TV stations.

New York Audio Show:

Will be held at Hotel New Yorker, October 29 to November 1. Anticipating an even larger attendance than the crowd

that packed the show last year, it will be extended this year by starting a day earlier. Information can be obtained from manager Harry Reizes, 7 W. 44th Street, New York City.

Research Facilities:

Raytheon has launched a \$2 million transistor program with the dedication of a new building on Seyon Street, Waltham, Mass. This program is being handled by the receiving tube division, of which vice president Norman B. Krim is the manager.

Glen McDaniel:

Has resigned as the first full-time, paid president of the Radio-Television Manufacturers Association, effective October 1. Reason given was that "personal considerations require that I return to New York." Committee comprised of Robert Sprague, Max Balcom, Paul Galvin, and Lester Muter was appointed to recommend a successor to Mr. McDaniel.

Color Television:

Little interest was shown by manufacturers in the National Production Authority's easing of the ban against producing color receivers. Meanwhile, in reply to an RCA request for authorization to air compatible color TV during regular broadcasting hours, FCC Chairman Walker said that the Commission has maintained a strict policy against such experimentation, although it recognizes that "deviations from this policy will be necessary on occasion to permit full-scale experimentations and field testing."

West Coast Audio Show:

Since NARTB has settled on Hotel Biltmore, Los Angeles, for their annual con-
(Continued on page 8)



2-WAY RADIO



It alerts... It activates... It ties together—your entire Civil Defense Communications Network!

GE Civil Defender

A Receiver for all defense applications!

WHEN you need command control of all the elements in your civil defense area, let electronics work for you—like this:

Install a Civil Defender receiver with each group to be reached. This receiver is a slave unit. It hears only what you want it to hear. It allows civil defense headquarters to broadcast messages to all groups at once, or to separate groups individually. The receiver is inactive until turned on by headquarters.

The Civil Defender, a unique G-E development, is activated at the press of a button. You can use it to start and stop air raid warning devices automatically and simultaneously.

Every alert community official should see this remarkable device in action. The G-E office near you will arrange a demonstration. For bulletins, wire or write us: *General Electric Company, Section 1071, Electronics Park, Syracuse, New York.*

**Your G-E Communications Man will demonstrate.
Why not call him now?**

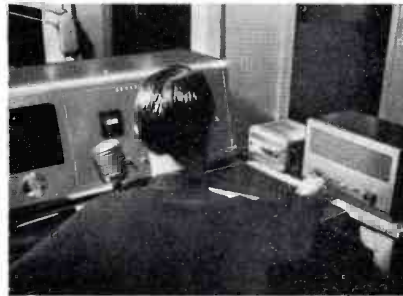
You can put your confidence in—

GENERAL  ELECTRIC

July, 1952—formerly FM, and FM RADIO-ELECTRONICS



At TAXI Dispatching Boards . . .



at HIGHWAY Departments . . .



at POLICE and FIRE Headquarters!

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PIONEERS IN THE CORRECT USE OF ARMSTRONG FREQUENCY MODULATION

MULTIPLEX

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Operating on 50 to 1,000 Mc.

One of the basic lessons learned from field experience with multiplex point-to-point and relay installations is that the method of modulation is the determining factor of system performance.

Furthermore, field experience with various types of modulators has shown conclusively the superiority of the REL Serrasoid, distinguished for low distortion, low noise, and long-time stability.

For example, REL multiplex radio installations using Serrasoid modulators are being operated as links in telephone land lines. In this service, they are delivering performance equal or superior to that of standard telephone channelizing equipment. Specifications for this type of service are the highest and most exacting that any radio communication equipment is called upon to meet.

REL manufactures standard, basic units suitable for practically any type of multiplex point-to-point or long-distance relay system, suited to operation under topographical or climatic conditions encountered in any part of the world. Special types can be designed and built to suit unusual requirements. Rel multiplex equipment is now in use by telephone companies, railroads, broadcasters, government services, and other operators, of communications systems. Consultation service is available to those planning new installations or the modification of present facilities. Address:

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36-40 37th Street, Long Island City 1, N. Y.

SPOT NEWS NOTES

(Continued from page 6)

vention at the end of April, it might be advisable to hold the West Coast Audio Show at the same time and place, rather than tying it in with the WCEMA convention which may not have enough room for extra exhibitors. Also, it might be useful to let the broadcasters see the extent of public interest in hi-fi. No organization has been set up for a West Coast Audio Show, but Howard Grove of WCEMA is the logical man to line up the project. His address is 5873 W. Jefferson Boulevard, Los Angeles 16.

Failures in 1952:

RTMA reports that 3 manufacturers of radio-television sets failed in 1951, in addition to 3 assemblers of commercial or military equipment, and 6 producers of components. Total liabilities were \$11,610,000. There were 14 failures in 1950.

Chicago Plant:

Zenith Radio has added a 3-story building to an adjoining 2-story structure at 1500 N. Kostner Avenue, Chicago, making a total of nearly 1/2 million square feet of new factory space for the production of radio components.

Hi-Fi Equipment:

Pilot Radio Corporation, Long Island City, N. Y., is bringing out a new line of FM-AM tuners and amplifiers for delivery in August. Pilot was one of the first Armstrong licensees, and produced an outstanding line of FM-AM-phono combinations before the war. National distribution of the new line will be handled by Adolph Gooss Associates, 45 W. 45th St., New York 36.

WDET-FM Detroit:

Has been acquired by Wayne University. It is being operated as an educational station, on 101.9 mc.

AC from Storage Batteries:

For operating tape recorders and other AC equipment from 6 to 64 volts DC, a Change-A-Cycle frequency control has been added to converters manufactured by Carter Motor Company, 2641 N. Maplewood Avenue, Chicago. This built-in control compensates for frequency change due to input voltage drop. On 6-volt models, for example, 60 cycles can be maintained at 5 to 6.2 volts input.

HR Receiving Tubes:

High-reliability tubes developed by GE in cooperation with Aeronautical Radio Inc., are now available as replacements for communication equipment. Used in (Concluded on page 11)

Extra Rugged—Light Weight
HIGH ARTICULATION

Mobil-Mikes



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E-V Mobil-Mikes are designed for the ultimate in speech transmission! You get high intelligibility, high output, more usable power level, less listener fatigue and other E-V features. *Proved in toughest service*. Used in public safety, aircraft, railroad and government communications. High impact phenolic case. Permanent finish. Weighs as little as 7 oz. Model 210 Carbon lists at \$28.50. Model 600-D Dynamic lists at \$38.50.

EXACT REPLACEMENT

Carbon Mobil-Mikes also available for exact replacement in current Motorola, RCA, G.E. and similar equipment. You get full advantage of E-V design and performance features.



NOISE-CANCELLING DIFFERENTIAL*



Close-talking, carbon type. Assures clear speech transmission under high ambient noise in any weather or climate. Blast-proof, waterproof, shock-resistant. Model 205 lists at \$34.50. Model 602 Differential Dynamic at \$45.00 list. (*Patent No. 2,350,010)

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HAND CARRY

HT-21 (25-50 Mc.)
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- FULL TWO-WATT ANTENNA OUTPUT*
- Weighs only 14 pounds!
- Complete, self-contained 2-way radio-telephone station!
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*On 25-50 Mc. • One-Watt output on 150-174 Mc.

CENTRAL STATION

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Same performance and specifications as the "Littlefone" Hand Carry.

- AC-operated Central Station
- Audio-amplifier, providing one watt of audio for loudspeaker
- Power consumption is 35 watts
- Plugs in any AC outlet (117 Volts)

Where one or more extra stationary receiving stations are desired, Hallicrafters economical 5-81 receivers may be added.

A new Hallicrafters product—the "littlefone"—is now ready for thousands of important uses in hundreds of industries.

This light, rugged, dependable radio-telephone will be offered through Hallicrafters distribution organization—by the men who know communications best.

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There are literally thousands of industrial uses for the "littlefone" radio—anywhere where powerful, dependable, "on the move" contact is required.

AMONG THE MORE IMPORTANT PRESENT USES ARE:

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- ROAD BUILDING
- SHIPPING (Deck Operations)
- CONSTRUCTION
- LUMBERING



Hallicrafters
"The Radio Man's Radio"

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Your local RCA Tube Distributor can handle your tube requirements for communications in the fastest possible time—save you hours, even days of time and effort. He knows what tube reliability means in 2-way radio—is prepared to back up your operations with the finest transmitting and receiving types ever made . . . RCA!

Call him up. His friendly service is just around the corner from you.



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WANTED

Quarter and one-kw. FM broadcast transmitters, fixed-frequency FM monitor receivers, used or new. Write to Box 10.

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SPOT NEWS NOTES

(Continued from page 8)

correctly-designed circuits, HR tubes have reduced failures to about 1/12 those of standard types. Identified by GE as the Five Star series, they are offered in the following types:

5-STAR	STANDARD EQUIVALENTS
GL-5654 6AK5	Sharp-cutoff RF pentode
GL-5670 2C51	HF twin triode
GL-5686	Beam power amplifier
GL-5725 6AS5	Dual-control sharp-cutoff RF pentode
GL-5726 6AL5	Twin diode
GL-5727 2D21	Thyratron
GL-5749 6BA6	Remote-cutoff RF pentode
GL-5750 6BE6	Pentagrid converter
GL-5751 12AX7	High-mu twin triode
GL-5814 12AU7	Medium-mu twin triode
GL-6005 6AQ5W	Beam power amplifier
GL-6072 12AY7	Twin Triode
GL-6135 6C4W	Medium-mu triode
GL-6136 6AU6	Sharp-cutoff pentode
GL-6137 6SK7	Remote-cutoff pentode
GL-6201 12AT7	Twin triode

TV in Venezuela:

A contract has been signed by the Government of Venezuela for the purchase a 10-kw. RCA television transmitter. The first in that Country, it is scheduled to go on the air next November.

Washington Law Office:

New association has been formed, specializing in radio and television matters before the FCC, by Daryal A. Myse and Frank B. Hand, Jr., at Mr. Hand's office in the Transportation Building, Washington 6, D. C.

Power Supply Vibrators:

An improved type of vibrator for power supplies in mobile radio equipment, identified as the angle-drive design, has been introduced by James Vibrapower Company, 4038 N. Rockwell St., Chicago 18.

27-in. Metal Tubes:

Now being produced by RCA at Lancaster, Pa. Weight is about 29 lbs., compared to approximate weight of 41 lbs. for all-glass design. Slightly shorter than the 21-in. metal tubes, the new type will be available for 1953 receivers.

MEETINGS and EVENTS

SEPTEMBER 19-20,
IRE COMMUNICATION CONFERENCE
Roosevelt Hotel, Cedar Rapids, Iowa
SEPTEMBER 22-25,
NEDA CONVENTION & CONFERENCE
Atlantic City, New Jersey
SEPTEMBER 29-OCTOBER 1,
NATIONAL ELECTRONIC CONFERENCE
Hotel Sherman, Chicago
SEPTEMBER 29-OCTOBER 2, IMSA CONVENTION
Hotel Statler, Boston, Mass.

Professional Directory

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Consulting Radio Engineers

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Washington, D. C.

GEORGE P. ADAIR

Consulting Engineers

Radio, Communications, Electronics

1833 M St., N.W., Washington 6, D. C.

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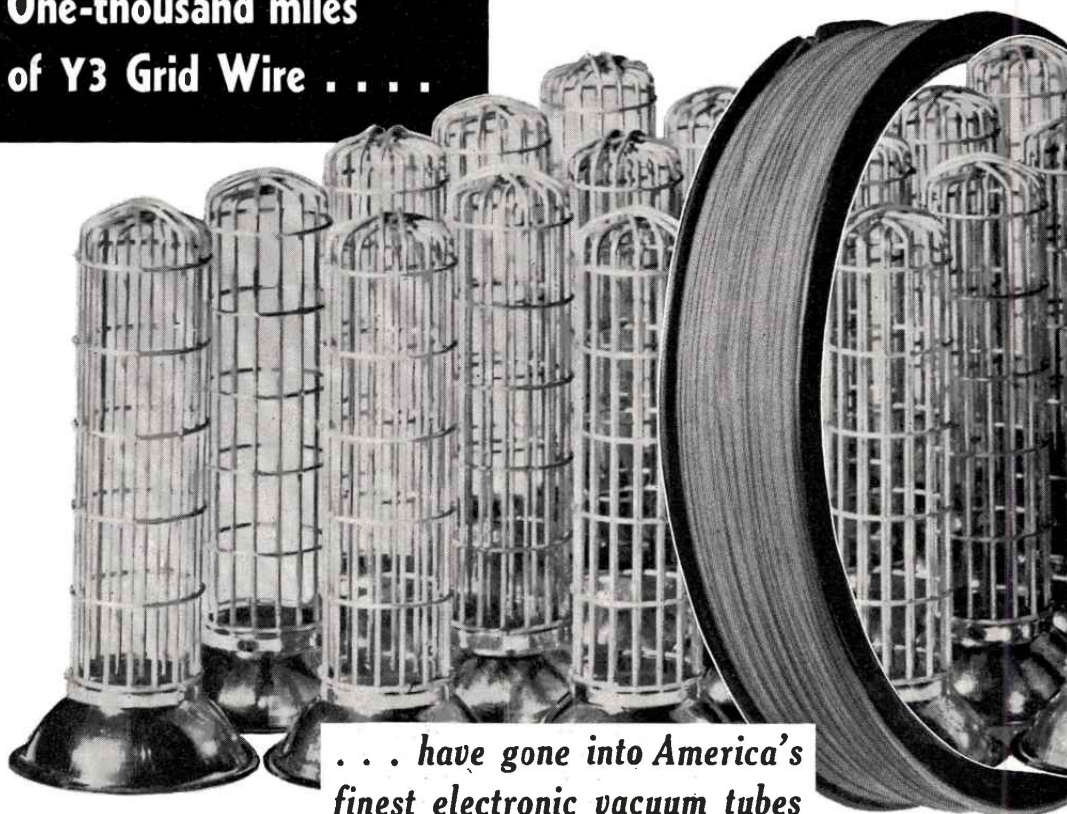
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John M. van Beuren
Specialists in the Design and
Development of Electronic Test Instruments
BOONTON, N. J.

Radio Wire Television Inc.

Specialists in high-fidelity audio equipment of all standard makes. Send for Catalog R-51. Complete stocks are carried at each of these Audio Headquarters stores:

100 Sixth Avenue, New York City
110 Federal Street, Boston, Mass.
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**One-thousand miles
of Y3 Grid Wire**



*. . . have gone into America's
finest electronic vacuum tubes*

● **Withstands high
temperatures**

● **Adaptable to hand
or machine winding**

● **No substantial
primary emission**

Outstanding performances by many, many thousands of electronic vacuum tubes utilizing Y3 grid wire have followed years of research by Eimac engineers. Uniquely treated Y3 grid wire suppresses primary emission by nullifying thorium contamination. It maintains rigidity at high temperatures—has a ductility that makes it adaptable for hand or machine winding and is ideal for spot-welding techniques. Eimac's Y3 is superior to molybdenum or tantalum grids operated in similar tubes and conditions. Intended for use with thoriated tungsten filaments, Y3 has long life and no substantial primary emission up to 1300° centigrade brightness temperature. Type Y3 grid wire is produced by Eimac and is available in quantity lots of 100, 500, 1000, 5000 and 10,000 meters.

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TUBES

City Radio Serves Nine Departments

HOW THE TRAFFIC OF NINE DEPARTMENTS, WITH 271 RADIO-EQUIPPED VEHICLES, IS HANDLED ON 3 TWO-WAY SYSTEMS — By ROY DeSHAFFON*

THE increasing use of two-way radio communication is illustrated in a striking way by the Kansas City system which was put into operation in June, 1951. That marked our twentieth year of

CITY SERVICES TRANSMITTER (56 VEHICLES)

FIXED & MOBILE, 153.53 MC.

1. Water Department
2. Department of Streets & Sewers
3. Welfare Department
4. Department of Public Works

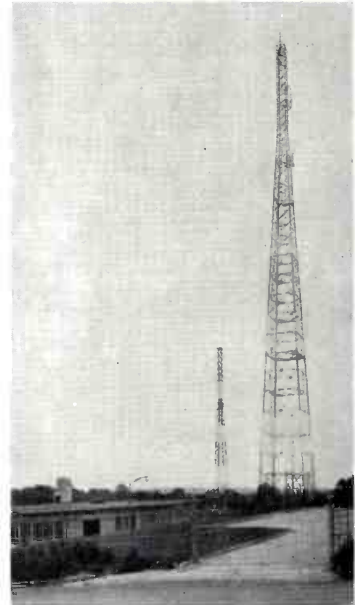
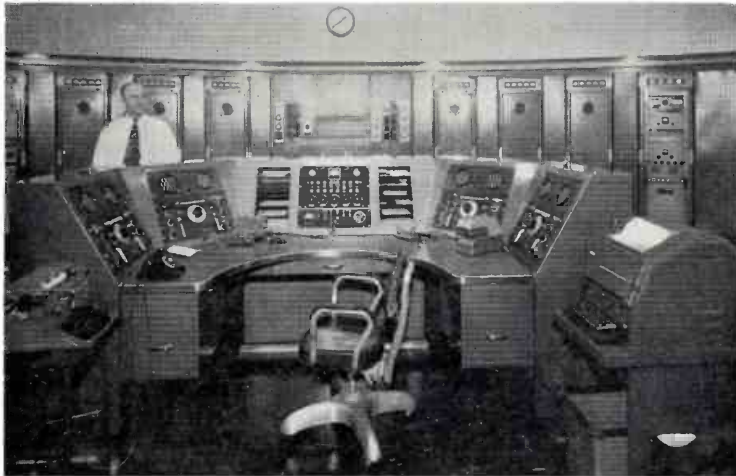


FIG. 1, RIGHT: HEADQUARTERS BUILDING AND THE TOWERS. FIG 2, LEFT: FROM THIS CONSOLE, USING THE INTERZONE CW TELEGRAPH, THE OPERATOR CAN REACH BUFFALO, DENVER, AND NEW ORLEANS. AT THE REAR ARE SIX 250-WATT MOTOROLA FM TRANSMITTERS, PROVIDING A SPARE FOR EACH SYSTEM

experience in the use of radio, for we went on the air in June, 1931 with a 250-watt transmitter on 2.422 mc., which provided one-way communication with our police cars.

At that time, as far as I can remember, the use of what we later came to call mobile radio was limited to municipal police.

By way of contrast, we now operate 3 separate 2-way FM systems in Kansas City, plus the interzone CW police telegraph transmitter, and we hope to obtain authorization for another 2-way system, as will be explained. This installation cost \$176,000 for the equipment and \$240,000 for the Communication Headquarters building.

Kansas City Radio Services:

Our use of radio for the municipal departments is divided in the following manner:

POLICE TRANSMITTER (150 VEHICLES)

FIXED, 155.61 MC. — MOBILE, 155.85 MC.

1. Municipal Police
2. Health Department
3. Liquor Control Department
4. Jackson County Sheriff

FIRE TRANSMITTER (65 VEHICLES)

FIXED & MOBILE, 154.13 MC.

1. Fire Department Exclusively

* Supervisor of Communications, Police Department, Communication Headquarters Building, Kansas City, Mo.

There are some serious problems of system engineering in planning an installation to serve nine city departments in order to obtain maximum efficiency from an operating standpoint, and at the same time to meet the requirements of nine

department heads, with a frequency-utilization setup acceptable to the FCC. In situations of this sort, diplomacy may be as important in attaining the required degree of frequency utilization as engineering skill.



THE AUTHOR HAS HIS OFFICE AT THE POLICE RADIO COMMUNICATION HEADQUARTERS BUILDING



FIG. 3. THREE DISPATCHERS, WORKING AT IDENTICAL CONSOLES, HANDLE THE POLICE TRAFFIC

Fig. 1 shows the Kansas City communication headquarters building, with the 300-ft. Blaw-Knox tower for the 3 two-way systems, and the 75-ft. tower for our interzone transmitter. The building provides space for the transmitter room, Fig. 2; the operating room, Fig. 3; drive-in shop for the cars, Fig. 6; radio service

FIG. 4. OTHER EQUIPMENT IN DISPATCHERS' ROOM



FIG. 5. THE POLICE RADIO SYSTEM CAN BE OPERATED FROM EACH ONE OF THE THREE CONSOLES

shop, Fig. 7; and a repair and machine shop not illustrated, in addition to offices, and a basement room for meetings and instruction classes.

Our municipal radio system is probably unique in that it provides service to so many different departments which handle their own dispatching, as will be explained, yet the Police Department is

responsible for the operation and maintenance of the entire system.

Transmitter Room:

In the transmitter room, Fig. 2, there are duplicate 250-watt Motorola transmitters for each of the three 2-way systems, with the 500-watt Western Electric CW transmitter in the center. Racks

at the extreme left and right carry the frequency monitors, and amplifiers which feed eight 500-ohm lines running to different parts of the City where incoming police calls are monitored. Either transmitter of each pair can be connected to the associated antenna by shifting the coaxial connectors at a junction box where the antenna leads enter the building.

The console, handled by the operator in charge of the transmitter room, has 4 National receivers which monitor a corresponding number of interzone frequencies. At the center panel are the

CW transmitter control which selects any of 9 frequencies, and level controls on the microphone circuits from the dispatching room. These are necessary because of the differences between the voices of the dispatchers. The teletypewriter provides direct communication with the Detective Bureau.

Dispatching Room:

Only traffic for the Police, Liquor Control, and Health Departments and the County Sheriff's Office is handled in the operating room at Communication Headquarters, although the other services can be monitored there if the occasion arises. Normally, three dispatchers are on duty at identical consoles, as can be seen in Fig. 3, yet the acoustic treatment of the walls and ceiling, and the carpeted floor create an air of quiet that is not disturbed even when all the operators are in action. It should be explained that all three operators are using the single police transmitter, picking up calls in turn as they come in by radio or over the telephone. Ordinarily, they handle about 400 messages in 24 hours, but this number is doubled when special conditions arise.

Fig. 5 is a closeup of one position. The

bank of switches at the left controls the lights on the car-location map; the center section has controls for the Motorola reversible line amplifier and preamplifier; and at the right are key switches for incoming telephone lines. At each position there is a gain control on the telephone for use when it is not possible to understand the person calling in, or when there is a whispered report of an intruder.

Also located in the operating room are duplicate Dictaphone units which record incoming and outgoing radio messages, a teletype used principally for reporting pickups and cancellations from the Detective Bureau, the Diebold bank-vault alarm annunciator, and a telautograph, connected to the Auto Theft Bureau, for checking automobile licenses.

Police Radio System:

In addition to the main police transmitter, there is a 60-watt emergency transmitter at City Hall. This can be cut in and operated from the consoles at Communication Headquarters. While this is

speaker. Or, if a radio message involves the need of an ambulance or fire apparatus, it is not necessary to make a telephone call to the General Hospital or the Fire Department, since they will have heard it over their monitor speaker.

Fire Radio System:

The main fire transmitter is operated

from Fire Signal Headquarters, where an emergency 60-watt transmitter is located. In addition, Fire Chief Harvey Baldwin has a console at his office from which he can talk directly to his sedans and fire apparatus. Chief Baldwin had an unusual introduction to the use of radio, for the new system was hardly in operation when the 1951 flood swept into



the only point from which messages can be dispatched to the police cars, lines run from Communication Headquarters to loudspeakers which monitor both sides of police transmissions at:

- City Hall (30 speakers)
- 4 Precinct Stations
- General Hospital
- Fire Department Headquarters
- Fire Signal Headquarters
- Jackson County Sheriff's Office

If, for example, the Sheriff wants a message delivered to one of the cars, he calls Communication Headquarters on the phone. The message is taken by one of the dispatchers, and is put out on the radio. Then the Sheriff hears his message delivered and gets an acknowledgment or an answer over his monitor

FIG. 6, TOP: DRIVE-IN RADIO SHOP AT THE HEADQUARTERS BUILDING FOR CHECKING AND INSTALLING MOBILE UNITS. PANEL TRUCK IS EQUIPPED FOR OUTSIDE SERVICE WORK.

FIG. 7, CENTER: RADIO SHOP & SERVICE FOREMAN CHARLES OGILVIE HAS A WELL EQUIPPED LABORATORY FOR MAINTAINING HIGH PERFORMANCE STANDARDS FOR THIS SYSTEM

FIG. 8, RIGHT: KANSAS CITY ALSO USES MOTOROLA EQUIPMENT FOR MOTORCYCLES AND THE THREE-WHEELERS



Kansas City. For five days, the three main transmitters were on the air continuously. During this emergency, the coordination of the various municipal services made it possible to save hundreds of lives and to reduce property loss and damage by millions of dollars.

The use of radio has not only given the Chief a new means of administrative control over the Fire Department, but

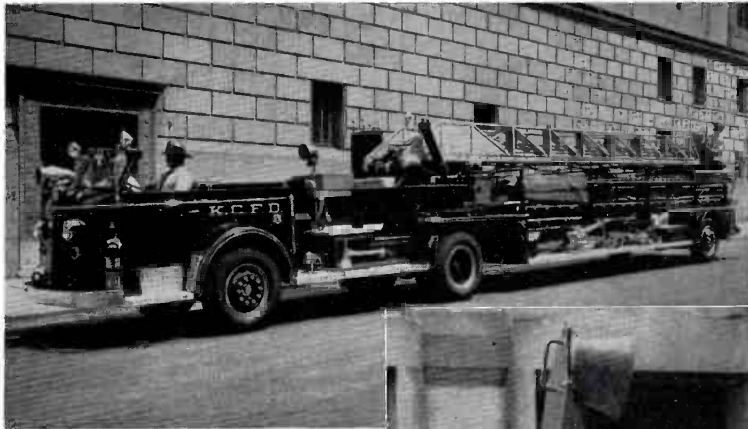


FIG. 9. ALL FIRE APPARATUS CARRIES RADIO

has made it possible for him to increase the protection afforded by the apparatus under his command.

To cite two examples: Since additional apparatus can be called out so quickly by radio, if it is required, it has been found practical to reduce the amount of equipment sent out on a first alarm. This is an important measure of conservation particularly in cases of false alarms, and it reduces the number of vehicles rolling through the streets to that actually required at any alarm of fire.

The use of radio has made it possible to increase the number of inspections, and to promote public cooperation in fire prevention. Instead of releasing men from the fire houses to make inspections, the crews go out with their apparatus. In case of an alarm of fire, they can be directed to the scene by radio.

City Services System:

The city services operate a sort of party-line radio, since the system can be operated from 6 consoles at various locations. At City Hall, there are consoles at the Commissioners' offices at the Public Works, Streets and Sewers, and Water Departments. Since these offices are closed over the week-ends, the Water Department has a console at its pipeline division building, and there is another at the public works garage. In addition, the Welfare Department has a console at the Municipal Farm, where the City Jail is located.

We find that the Water Department makes the greatest use of the city services system. In fact, we hope to obtain authorization for another transmitter and a separate frequency for handling their traffic exclusively.

Hand-Carried Equipment:

This description of the Kansas City installation would not be complete without a mention of the Motorola Walkie-Talkies. During the flood, they were used on

even carried to high points of ground and used as temporary communication headquarters in the flooded areas.

Conclusion:

It has been a very gratifying experience to take part in the expansion and modernization of the Kansas City Radio system. Where such an investment would have been considered a rank extravagance years ago, radio has come to be recognized as a means of increasing the

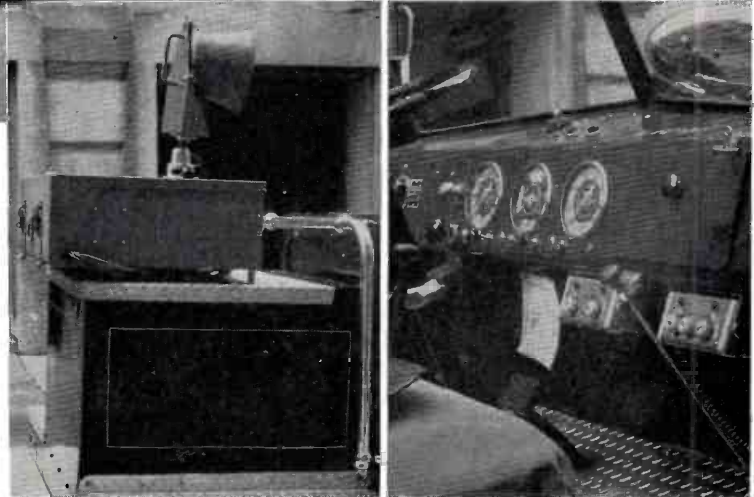


FIG. 10. LEFT, P.A. SPEAKER ON RADIO UNIT. RIGHT, RADIO AND P.A. AMPLIFIER CONTROL HEADS

bridges by spotters who watched for capsized boats and people clinging to floating wreckage, and to call fire apparatus when freight cars drifted into gasoline tanks, or high-tension wires caused fires. Flood conditions along the dikes and viaducts were reported over Walkie-Talkies, and they were used to dispatch workers to vulnerable points. They were

efficiency of municipal departments, with an actual reduction in administrative expense. And if our installation appears to be over-elaborate in the facilities provided, experience in its operation has shown over and over again that the importance of the public service it provides calls for maintaining continuously the very highest standards of performance.



CHIEF HARVEY BALDWIN CAN HANDLE THE FIRE DEPARTMENT'S RADIO SYSTEM FROM HIS OFFICE

Equipment For Telemetry Systems

PART 1: RESUME OF THE OPERATING PRINCIPLES AND USES OF TELEMETERING SYSTEMS — DESCRIPTIONS OF SOME COMMERCIALY-AVAILABLE EQUIPMENTS

THEMETERING, defined broadly, is any system of measurement in which an indication or record of the measurement is made at a point remote from the location where the actual measuring process takes place. Such a system can be mechanical, pneumatic or hydraulic, or electrical. Ordinarily, electrical systems have advantages in speed, accuracy, and versatility over other methods of information transmission, and are being used widely to increase the operating efficiencies of industrial and public utility plants as well as for experimental and development work on aircraft, guided missiles, and other military projects.

Remote measurements of electrical quantities, pressure, position, flow, vibration, and practically any other measurable quantity can be obtained through telemetering techniques. This equipment can increase the speed and accuracy of many control functions by providing required information instantaneously and continuously at a central control point. For instance, in an electric power generating system telemeters can provide, at the load dispatcher's office, up-to-date and detailed information concerning water levels, gate positions, voltage, current, and power at generating plants and substations throughout the system. Also, data on the amount and direction of current flow and power at tie lines is available to him, as well as totalized measurements.

Pipeline systems, gas distribution companies, and processing plants find that centralized indication of conditions

throughout the system increases flexibility and efficiency. Beside offering convenience, telemetering makes possible measurements that could not otherwise be obtained because of dangerous or inaccessible locations.

Telemeters are valuable tools in preventative maintenance. Records of operations taking place a few feet or many

spotted immediately, and steps taken to correct the trouble before it results in equipment outage.¹

The simplest telemetering system consists of 3 parts: the measuring device, consisting of a primary detector and a transmitter, equipment for transposing the data to the remote location, and a receiver or device for indicating or recording the measurement.

This discussion is limited to electrical telemetering systems. Therefore, the measuring device must have an electrical output which varies according to the input, whatever the nature of the quantity being measured. In many cases, such as for the measurement of pressure, rotation, or position, the primary detector must be a transducer. The electrical output of the primary detector may vary in frequency, DC level, or pulse-length if an impulse-duration system is used, according to the magnitude of the input.

Wire lines, a radio circuit, or a carrier-current system can be used as the transmission medium for the electrical signal. Usually, the signal need only be amplified for wire-line transmission; when carrier-current or radio transmission is employed, suitable terminal equipment is required. Since telemetering signals do not ordinarily require excessive bandwidth, it is practical to add one or more telemetering channels in an existing voice-frequency channel, or to multiplex several telemetering channels with other signalling channels in the space normally occupied by one voice channel.

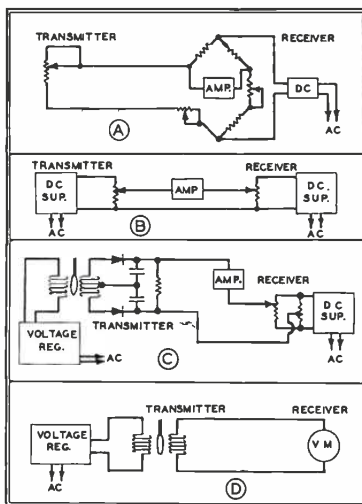


FIG. 1. BASIC TELEMETER SYSTEMS BY BAILEY

miles away can be seen as they are made, and abnormal conditions can be analyzed and corrected long before they would otherwise be known. Radio equipment, in particular, is quite likely to suffer progressively worsening deterioration in performance before it fails completely. This deterioration is imperceptible or unnoticed, in many cases, for some time after it begins. Thus, in the case of remote unattended installations such as control equipments, relays, and repeaters, a faulty unit usually fails before its condition is known. And it may not be known for some time afterward that the equipment has actually failed! When the difficulty is finally noticed, it may take considerable time for a maintenance man to reach the remote installation and repair the trouble. However, when strategically-placed telemeters are installed at the remote location, with indicators or recorders at the central station, any standard condition can be

¹At least one warning device is available for this specific purpose. See "Future Failure Warning Alarms," by J. K. Kulansky, *RADIO COMMUNICATION*, September, 1951.

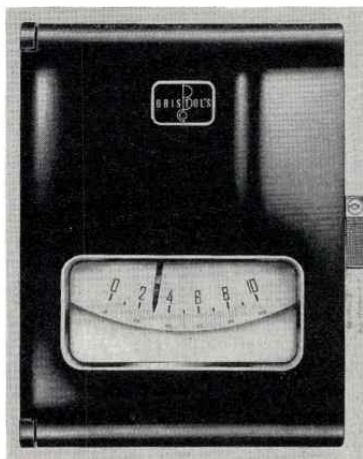


FIG. 2. THE BRISTOL METAMETER TRANSMITTER

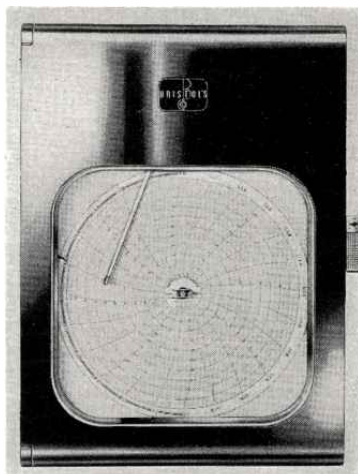


FIG. 3. METAMETER RECEIVER-RECORDER UNIT

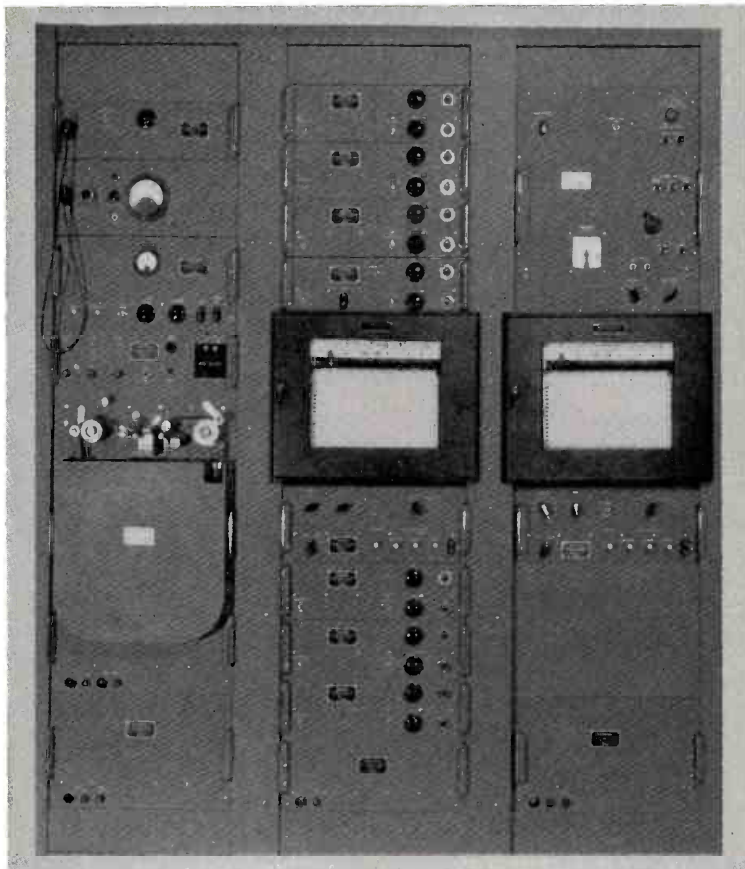


FIG. 5. TAPE PLAYBACK UNIT, INCLUDING AUTOMATIC HARMONIC ANALYZER AND STRIP RECORDERS

At the receiving end, the signal is routed through the terminal equipment if required and applied to the receiver. This may be a simple indicating device, a recorder, or a combination of the two. In some instances there may be automatic control equipment operated by the receiver. In many systems, multiple receivers can be employed; in some cases, the signal is applied to more than one receiver for totalizing purposes.

Measuring systems which have outputs of either the variable-frequency or self-synchronizing impulse-duration type are easily adaptable for transmission through carrier-current or radio systems (usually microwave point-to-point equipment). Those which have a variable DC output are best suited for transmission over wire lines, but can usually be adapted for power-line carrier or radio transmission through the use of converters. Some systems require synchronizing pulses for proper operation, or the receivers must be operated from the same AC power source as the transmitter. Up to 5 wires must be employed in these systems. Obviously, they are not suitable for radio or carrier-current transmission, and are not described here.

quires a very simple transmitter. Two DC potentiometer circuits, operating on the null voltage balance principle, are shown in Fig. 1B and 1C. A simple AC voltmeter circuit is given in Fig. 1D.

THE BRISTOL COMPANY, *Waterbury 20, Conn.* Bristol's Metameter telemetering system is extremely versatile, in that it can be operated over any wire circuit not used for dial signaling, circuits selected by supervisory control systems, ground-return circuits, carrier-current channels, or by radio transmission, without special conversion equipment.

The transmitter, Fig. 2, provides a signal of the impulse-duration type. This signal, varying in duration according to the magnitude of the quantity being measured, is repeated every 15 seconds (equipment with 5-second cycles are also available). The impulses can be of any frequency desired, or of any reasonable magnitude, according to requirements. Since the accuracy of the readings is a function of a time ratio rather than of received-signal magnitude, the system is substantially unaffected by varying conditions of attenuation or of voltage supply. There is no limit to the operating distance because the impulses can be repeated as many times as is necessary without loss of accuracy.

The transmitter is equipped with a standard measuring element of the type required for whatever quantity is to be measured. Standard units are available for the measurement of pressure, liquid level, flow, temperature, mechanical motion and position, speed of travel and rotation, voltage, current, power, and totalized power.

At the receiver, shown in Fig. 3, the impulses operate an electromagnet. The ratio of energized to deenergized time determines the position of a pointer, which is controlled by an arm attached to two trains of gears driven by a motor. A simple indicator unit can be employed, or circular or strip-chart recorders. Automatic control models are available also.

Equipment Descriptions:

BAILEY METER COMPANY, *Cleveland, Ohio.* This company makes several types of systems, all intended for use with wire transmission lines. Little specific information was obtained on these systems; however, the four types which are operable with a 2-wire connection are shown in Fig. 1. At 1A is the basic circuit of a DC resistance bridge system, which re-

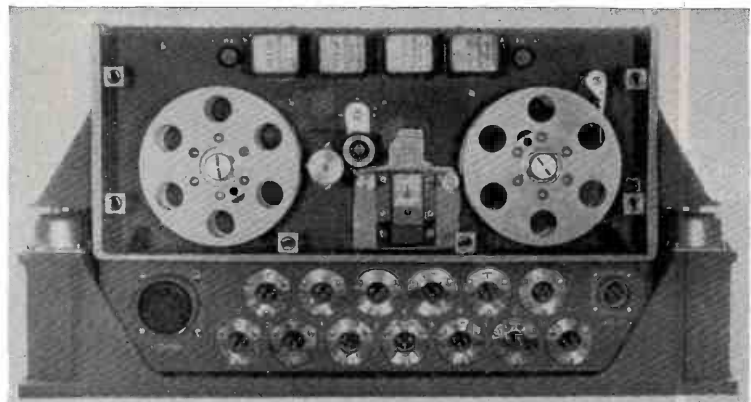


FIG. 4. DAVIES 14-CHANNEL TAPE RECORDER, INCORPORATING PLUG-IN SUBCARRIER OSCILLATORS

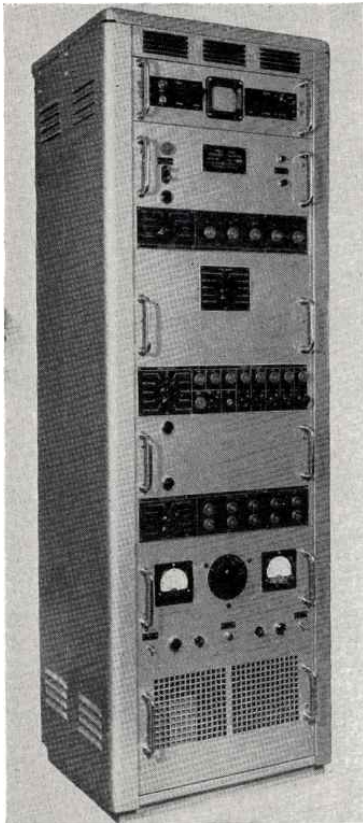


FIG. 7. THE EMR FM/FM 3-POINT CALIBRATOR

Several receivers can be operated by one transmitter or, in some cases, the outputs of two or more transmitters can be recorded on a single chart by one receiver.

An interesting variation of this system is the Metaphone, which consists simply of a modified transmitter connected to a telephone exchange and assigned a regular telephone number. When this number is called, an audible tone is heard whose duration is a function of the magnitude of the measured quantity. The signal is repeated from 3 to 5 times for each call, so that an accurate indication of the measurement can be obtained with a stop watch.

DAVIES LABORATORIES, INC., *Riverdale, Maryland*. This company has developed a vibration recording, measuring, and analyzing system which is used by the US Air Force. Several of the components should be of interest, since they can be adapted easily for other telemetering applications.

The system as originally designed consists of 3 principal parts: a 14-channel magnetic tape recorder with a remote control, designed for airborne operation; a playback unit, which reproduces the original waveforms; and an automatic harmonic analyzer, which provides a chart of amplitude vs. frequency of the

harmonic components, proceeding automatically through all 14 channels.

A front view of the recorder is given in Fig. 4. In order to accommodate a frequency range from 3 to 2,000 cycles, each input signal frequency-modulates a 10-kc. carrier which is recorded on the tape. An input of 1 volt produces 20% carrier deviation. The 10-kc. signals are produced by small oscillator units which plug in at the bottom. Each oscillator unit employs a subminiature tube in a phantastron circuit, with another subminiature amplifier stage to provide isolation and to produce sufficient recording current. The circuit is said to be very flexible, and adaptable over a wide range of carrier frequencies, deviations, and input frequencies down to DC. It is likely that these units could be adapted for use as subcarrier oscillators in an FM/FM telemetering system.

In this system, a 10-kc. signal is recorded on one of the 14 tape channels. It is generated by a 200-kc. crystal-controlled oscillator with dividing circuits, in a unit similar in size and shape to the carrier oscillators. This is to provide servo control of the playback mechanism, so that dimensional changes in the tape can be compensated for, and the playback speed can be made identical to the record speed.

The complete playback and analyzing equipment is shown in Fig. 5. The tape transport mechanism and servo control system is contained in the rack at the left. Either spools or a continuous loop can be handled. Ordinarily, a loop will be employed, since very short recordings are made at various intervals. These can be cut and spliced to form a loop, which can then be played continuously. The center rack contains one strip-chart recorder and the subcarrier discriminator panels. Another recorder and the wave analyzer are held in the rack at the right.

ELECTRO-MECHANICAL RESEARCH, INC., *Ridgefield, Conn.* The subcarrier dis-

criminator for FM/FM systems shown in Fig. 6 was developed for the US Navy Bureau of Ordnance, for use in testing flight characteristics of developmental aircraft. A new type of discriminator circuit is employed which provides the linearity and distortionless demodulation required for extremely accurate measurements. Other advantages of the circuit, which utilizes as an output the rectified plate waveform of a multivibrator triggered in synchronism with the input frequency, are exceptional frequency stability and high output voltage. Amplitude modulation of the subcarrier, it is claimed, has no effect.

A cathode-follower input stage provides an input impedance of 1/2 megohm, so that the bandpass input filter is not loaded excessively when the receiver is connected to many discriminator units. A push-pull direct-coupled cathode-follower output stage provides zero output at center frequency, and provides for DC output as well.

The subcarrier center frequency can be on any one of 19 channels in the range from 400 cycles to 70 kc. Operating frequency is determined by a simple plug-in unit. Intelligence frequencies range from DC to 8 cycles on the lowest bands and to 7,500 cycles on the higher bands. Deviation can be as much as 20%, depending on the plug-in unit employed.

Fig. 7 shows a three-point frequency calibrator for use in FM/FM systems. This unit provides 18 simultaneous accurate frequencies for each position of a 3-way calibrate control switch. One group of 18 frequencies consists of the center-frequencies for an 18-channel system, and the other two groups of frequencies represent 2/3 of maximum deviation above and below the center frequencies. The output can be connected directly to a telemetering receiver, to the receiver output, or to a transmitter if it is desired to calibrate the complete system (exclusive of pickup equipment).

(To be continued next month)

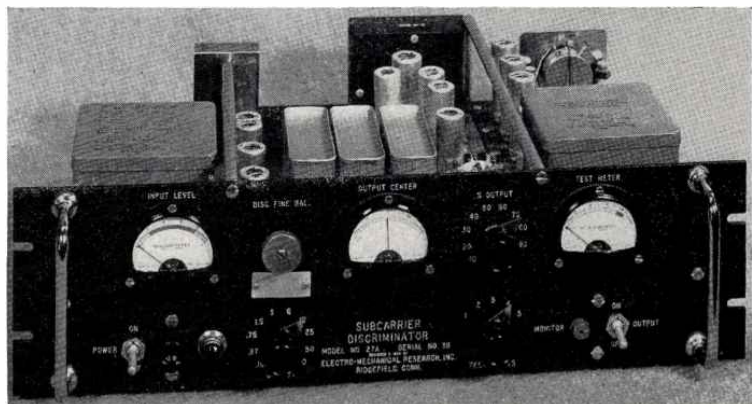


FIG. 6. EMR SUBCARRIER DISCRIMINATOR UNIT EMPLOYS RECTIFIED PULSES FOR DEMODULATION



WHEN INSTALLATIONS IN THE OIL FIELDS REQUIRE 6-VOLT OPERATION, COMMUNICATIONS ENGINEERING COMPANY OF DALLAS USES G.E. MOBILE UNITS, ASSEMBLING THEM IN THIS MANNER

Communication News

FOR THOSE WHO ARE CONCERNED WITH MOBILE, POINT-TO-POINT & MICROWAVE RELAY SYSTEMS

JUDGING from readers' comments, the breakdown of applications for new facilities, published in our May issue, not only provided valuable and much-needed information, but disclosed a considerable margin of error in various first-quarter guesstimates that had been made as to the number of new base and mobile installations. If you missed the tabulation by services, it was on page 34. A similar summary of applications for the second quarter of this year will be published in August.

Special Industrial Services:

In Dallas recently, we heard a discussion of the FCC's reluctance to authorize systems that call for connecting industrial operations in remote areas with company offices in cities of $\frac{1}{4}$ million population or more. It's very easy to misinterpret Commission policies, and it is very difficult to obtain specific interpretations of those policies from FCC headquarters.

However, upon inquiry at Washington we were told 1) that special industrial authorizations are granted when operations are being conducted in a remote and sparsely-settled region, and 2) that communication between such remote operations and company offices in large cities has been authorized.

Specifically, a grant was issued last April to Freeport Sulphur of New Orleans, for a system connecting Grand Ecaille, Bay Ste. Elaine, and Garden Island Bay with company offices in New

Orleans. It should be noted, however, that this is a microwave relay system, on 6,585 to 6,645 mc. Also, this is the first microwave installation in the special industrial service. Dow Chemical Company has applied for a similar microwave system to connect some of its remote operations in Texas with its Houston headquarters.

Split-Channel Operation:

It looks as if the petroleum-pipeline

being reduced by using split-channel operation for new installations, instead of putting in standard-channel transmitters on frequencies already used in nearby area.

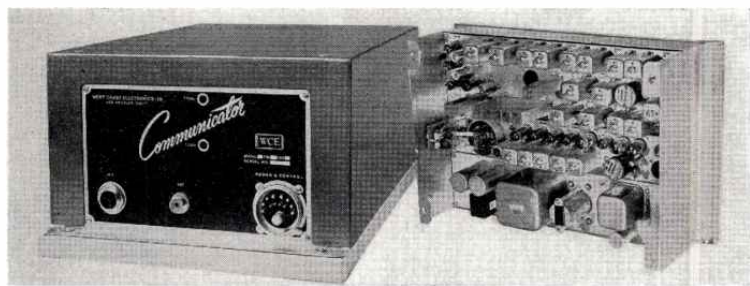
While nothing has been finalized by the FCC in this connection, split-channel operation has proved entirely practical and satisfactory, and its adoption in some services is being forced by crowded conditions. Only special problem encountered in practice is the necessity for more careful maintenance control of center frequency and modulation.

On 150 to 174 mc., most systems serve relatively small areas, with the mobile units operating near the transmitters. Thus, split-channel operation in this band is complicated by trouble from desensitization and random noise. This calls for further development work.

Airinc-Type Tubes:

While we're on the subject of maintenance: companies handling the servicing of communication systems on a contract basis report that they are finding it cheaper in most instances to pay the price of Airinc-type tubes¹ manufactured by GE and Raytheon, in order to reduce the number of trips they make to replace standard tubes. Also, we notice that specifications for new installations frequently call for furnishing Airinc-type tubes as original equipment.

Other service organizations have adopted the practice of cooking standard tubes for 50 hours, with the rated voltages applied to the elements. This eliminates replacements due to short-time failures which would otherwise occur when new tubes are first put into service.



THIS SINGLE-UNIT EQUIPMENT IS PRODUCED BY WEST COAST ELECTRONICS COMPANY, LOS ANGELES

service will take the lead in putting split-channel equipment to work. General Electric has delivered such units in the Texas area, and preliminary reports from Jerry Stover of Communications Engineering Company indicate highly successful performance on 20 kc. channels in the 30 to 50-mc. band, using 6 kc. modulation.

No channels have been cleared for this purpose. However, interference is

Transmitter Output Ratings:

Several readers have commented on the fact that our monthly listings of applications for new facilities sometimes show ratings of mobile transmitters of 100 watts or more. Since mobile units

¹See "Reliable Electron Tubes for Aircraft Communication" by E. K. Moore, RADIO COMMUNICATION, Dec. 1950. This paper included a list of Airinc-type tubes available.

aren't made to deliver such high values of output power, it appears that the listings are not correct.

On investigation, we found that some applicants show the watts drawn from the storage battery, instead of output power. Since our data is taken directly from the applications, there is no way we can correct these seeming discrepancies.

Incidentally, we learned that some applications are made out in such a confused manner that we don't know how the FCC examiners can figure them out. As headaches, they run to a 6-aspirin rating.

Los Angeles Activity:

West Coast Electronics Company, now installed in a beautiful factory at 5873 Jefferson Street, Los Angeles, has been all out on military production but, as a hedge toward the future, this concern is getting back into the manufacture of mobile equipment and monitors. There is need for a source of supply in Southern California, as Kaar Engineering, at Palo Alto, is the only other company in this field west of the Mississippi.

Some idea of the activity in communications through the area from Louisiana to Texas, Arizona, and on up to California can be gained from the fact that those four states account for more than 15% of the U. S. circulation of this magazine.

Radio vs. Telephone Practice:

Radio and telephone engineers have grown up in worlds apart, each group going its separate way without much interest in what the other has been doing. In the last few years, that situation has been changing gradually, because radio and telephone techniques are being joined in multiplex radio relay installations. In fact, matters have progressed to the point where Bell System companies, as well as the independents, are buying equipment from radio manufacturers.

Impetus to this change was contributed by Bell Laboratories and Western Electric engineers when they stole a march on the radio industry by developing and manufacturing the equipment used for the transcontinental microwave relays.

Still, the gap between the two groups has not been closed, nor will it be in the foreseeable future. Radio engineers look at the telephone installations and say: "I could have built it at half the price." Telephone engineers raise their eyebrows over radio installations and shake their heads in silent dismay.

That reminds us of a comment from the engineer in charge of one of the radio relay systems. He said he had

not had trouble from electrical failures, but he had had some serious outages from three sources: 1. The wind had shifted reflectors on the towers enough to swing the transmitted beam away from the next receiving point. 2. The ground had settled under one tower, thereby shifting the direction of transmission. 3. Emergency engine-driven

G.E. 2-WAY RADIO IS USED ON 24 JEEPS FOR MAINTENANCE AND PROTECTION OF THE 1,000 SQUARE MILES OF NEW YORK CITY'S WATERSHED



NEARLY 100 PORTABLE MOTOROLA UNITS WERE IN USE AT OMAHA DURING THE RECENT FLOOD

MUTUAL AID DIRECTOR JOHN STEPHANS CO-ORDINATES WAYNE COUNTY FIRE DEPARTMENTS FROM HEADQUARTERS AT LYONS, NEW YORK

generators did not start when the outside power failed.

Lights on Remote Antennas:

CAA is clamping down on tower-lighting of antennas at remote locations. Many such antennas are at places where there is no way to observe the lights and report failures. Accordingly, CAA wants warning systems installed that will monitor the lights and report failures by radio signals. Hughey & Philips, 4075

Beverly Boulevard, Los Angeles, has developed equipment for this purpose. If the failure occurs at a time when the transmitter is inaccessible because of weather conditions, it will still be possible, if the radio warning signal is received, to notify the nearest CAA office, so that pilots can be advised.

Amplifier for Mobile Use:

To meet the needs of police, fire, and other services for operating loudspeakers on cars and trucks, a 12-watt amplifier and weatherproof speaker combination has been brought out by the HK Communication Equipment Division of H. Robert Dollar Company, 50 Drum St., San Francisco. The amplifier, operating from 6 volts, is carried in a shock-mounted case 13½ by 7¾ in., by 6½ ins. high. Current drain is less than 4 amperes standby, and 8 amperes for talking. A steady tone can be cut in as a warning signal. As it does not vary in pitch, it cannot be mistaken for a siren. Cables, microphone hanger, and remote control head are all designed to facilitate installation on cars and trucks.

Microwave Systems:

Principal argument of the telephone engineers in favor of wire lines vs. radio relays is based on the dependability of the former. Actually, they are betting that more outages will result from the radio equipment itself than from the telephone lines.

This all comes down to differences in design practice between systems that are leased, and those that are sold outright. Also, there is inevitably a difference in the design of equipment that is to be serviced by the user, and that which is to be serviced and maintained by the company that supplies it.

The effects of the growing competition between radio manufacturers and the telephone companies, as they show up in apparatus design, will be interesting to see, and well worth watching.

FIELD SERVICE NOTES

Every radio system, at the time of installation or in the course of operation, presents special problems which must be solved by communication engineers or maintenance men.

In response to many requests, we shall provide a new department, under the title of Field Service Notes, where such experiences can be exchanged. If you have met and solved a problem, of installation, operation, or maintenance, or if you are seeking help with a difficulty you haven't been able to lick, write a letter about it, include pencil diagrams if necessary, and send it to Field Service Notes, RADIO COMMUNICATION, The Publishing House, Great Barrington, Mass.

To encourage this exchange of ideas and information, payment of \$5.00 to \$10.00 will be made for each letter published. Be sure to give your complete name and address.

PATTERN FOR TV PROFIT

PART 3 — HOW LIGHTING AFFECTS PICTURE QUALITY — REQUIREMENTS OF TV LIGHTING EQUIPMENT — DESCRIPTIONS OF TYPICAL COMMERCIAL FIXTURES

By ROY F. ALLISON, in collaboration with A.B. CHAMBERLAIN, RODNEY D. CHIPP, RAYMOND F. GUY, THOMAS E. HOWARD, and FRANK L. MARX

TV Lighting Requirements:

BECAUSE the new, efficient image orthicon camera tube is now employed almost universally for live-pickup work, this discussion is concerned with lighting equipment for studios wherein image orthicon cameras are used.⁶

Of the four types of lighting equipment in use today — incandescent, fluorescent, carbon-arc, and mercury-vapor — only the first two are suitable for general-purpose television use. Mercury-vapor light sources are affected by line voltage, require too much time to reach full brilliance, cannot be controlled in intensity, and have a discontinuous illumination spectrum. They are used only for special effects, in general. Carbon arcs are expensive to operate and maintain, and are limited in application.

Output from fluorescent lighting units at the blue end of the spectrum is about 40% greater than that of incandescents. However, the condition is reversed at the red end of the spectrum, where the relative outputs of incandescent and fluorescent sources are in the ratio of about 2 to 1.

⁶Much of the information in this section was furnished by George Gill, of Kliegl Bros. Universal Electric Stage Lighting Company, Inc., 321 West 50th Street, New York 19, N. Y.

When combined with the response curve of the new image orthicon tube, an incandescent source produces an overall color response which resembles closely that of the human eye. Thus, with such a combination, colors reproduce normally in gray-scale rendition. With fluorescent light, on the other hand, there is a deficiency in red response, which causes dark skin-tones.

Curiously enough, the serious lack of radiation at the red end of the spectrum is responsible for the one real advantage of fluorescent lights. Since infra-red radiation is associated with heat output, fluorescent lights produce substantially less heat than incandescent units of the same lighting capacity. When fluorescent lighting can be employed, a very significant reduction can be made in the cost of air-conditioning equipment to handle the studio lighting heat load. The reason for this is apparent on consideration of the following table:

RELATIVE RADIATION

	INCAN- DESCENT	FLUOR- ESCENT
VISIBLE LIGHT	12%	20.5%
INFRA-RED	70%	26.5%

It will be noted that fluorescent units radiate approximately equal amounts of visible and infra-red light, while incan-

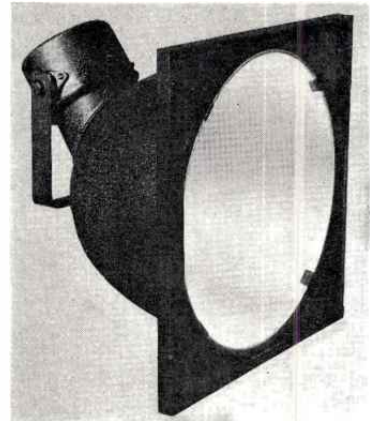


FIG. 14. SCOOP WITH FRAME FOR A DIFFUSER

descents produce almost six times as much infra-red as visible light. Also, the overall efficiency of incandescents is considerably lower than that of fluorescents. It can be appreciated readily, therefore, that fluorescent lights are much cooler and impose a much less severe load on the air-conditioning system.

On the other hand, fluorescent fixtures are larger, more cumbersome, and more difficult to control. Also, they have very low source brightness, which limits the total obtainable output. Reflectors must be large to obtain the required directional light control, and even then are inadequate for spotlighting purposes. Initial installation costs are higher than for incandescent units, as are maintenance costs. Fluorescent units are heavier and do not lend themselves easily to readjustment. For these reasons, most studio lighting installations are composed of incandescent units entirely, or a combination of both types.

Where both types are employed, the fluorescent units are usually utilized for general illumination or base lighting, and the incandescents for purposes which require more rigid control and flexibility. In some installations, however, the heat load is so important that fluorescents are used almost entirely, despite the decrease in flexibility.

It is advisable to use filters on the cameras in cases where a preponderance

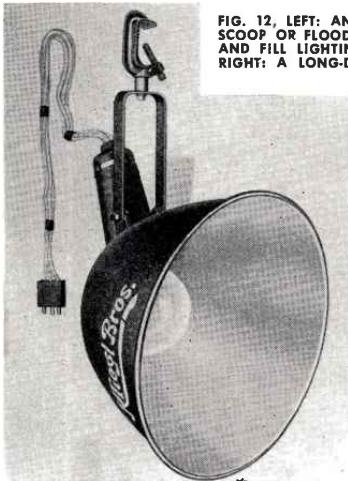
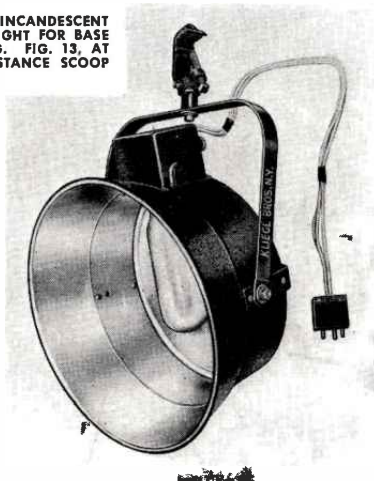


FIG. 12, LEFT: AN INCANDESCENT SCOOP OR FLOODLIGHT FOR BASE AND FILL LIGHTING. FIG. 13, AT RIGHT: A LONG-DISTANCE SCOOP



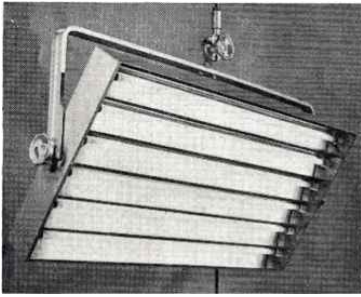


FIG. 15. AN OVERHEAD FLUORESCENT PAN UNIT

of fluorescent lighting units is employed, in order to provide good gray-scale rendition. A widely-used filter suitable for that purpose is the Wratten No. 6. This has transmission loss which produces very little effect on the radiation from incandescent lights, but subdues the excess blue and ultra-violet components present fluorescent radiation.

Image orthicon tubes of greater sensitivity have reduced markedly the light levels required to obtain adequate signal-to-noise ratios in TV pictures. This has permitted more general use of incandescent units with greater versatility, so

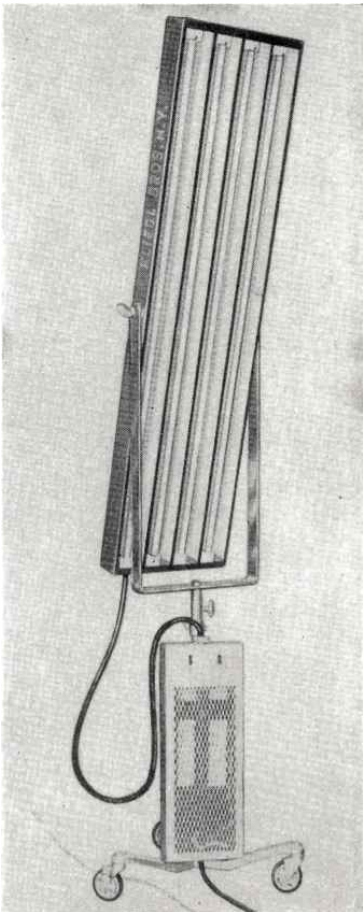


FIG. 16. MOBILE FLUORESCENT SLIMLINE PAN

that emphasis can now be placed on operative techniques and artistic effects. Thus, the lighting installation should be extremely flexible in application, with units that can be moved easily and adjusted quickly without wasted time. With the general shift toward the use of incandescent lighting, the need for fast, rigid control of lights individually and in groups has arisen.

Range of Light Levels:

As in photographic work, the light-level requirements for television are dependent on the lens apertures employed. The aperture employed for any given pickup is determined by the required depth of field. Therefore, the characteristics of the scene must be related to the amount of light needed for a good technical picture.⁷

Lens stops most often employed are in the range from $f:5.6$ to $f:8$. Where it is necessary to cover a great depth of field without refocussing, however, smaller stops must be employed, and more light must be provided. On the other hand, if lighting equipment is inadequate in quantity or flexibility, large apertures must be used, thus limiting the available field depth.

As a general rule, lighting equipment should be capable of providing incident light levels of at least 200 foot-candles. This can be obtained in most cases with equipment drawing 25 to 35 watts per sq. ft. of floor space. Some estimates depend on the size of the studio. Where an ordinary studio is concerned, of less than 4,000 sq. ft., 30 to 40 watts per sq. ft. are recommended; for auditorium studios 20 to 30 watts per sq. ft. may be sufficient. In the later case, of course, this will be distributed strategically, with most of the equipment used in the stage area.

It should be pointed out that these figures are for maximum capacity, which may be employed very seldom. Total wattage figures optimum for any specific installation will depend on other factors also, such as the height of the supporting structures, the percentage of fluorescent units employed, the degree of physical and electrical control provided, and the intended uses of the studio.

Lighting Functions:

Studio lighting equipment can be classified according to its function in contributing to the effects desired by the program director. It is most conveniently divided into five categories, as follows:

⁷ For an excellent discussion of TV lighting considerations and techniques, on a relatively non-technical level, see "CBS Television Staging and Lighting Practices," by Richard S. O'Brien, *SMPTE Journal*, September, 1950.



FIG. 17. FRESNEL UNIT GIVES SOFT LIGHT BEAM

- 1) Base and fill light
- 2) Key light
- 3) Modeling light
- 4) Back light
- 5) Special-effects light

Base lighting is the general all-round illumination on a particular set. It provides the minimum light level over all parts of a scene that is necessary to produce an acceptable picture. Floodlights of fairly low intensity are commonly employed for this purpose. They may be either fluorescent or incandescent units.

Fill light falls in a special subcategory. It is employed with base lighting after the accent lighting has been adjusted properly, in order to fill in objectionable shadows. It is used also to reduce the contrast range of the finished picture. The contrast range is usually from 15 to 1 to 25 to 1. Contrast is increased electronically through the transmission chain to compensate for the camera's limited range.

Key light is motivating light—the type of light the viewer expects subconsciously for the setting. It is ordinarily the principle illumination on the subject, and it may come through a window for an indoor daytime scene, or from table lamps and a fireplace for an evening scene. Bright, sunny light or gray, cloudy light would be expected for an outdoor daytime scene.

Modeling light is used to make a sub-

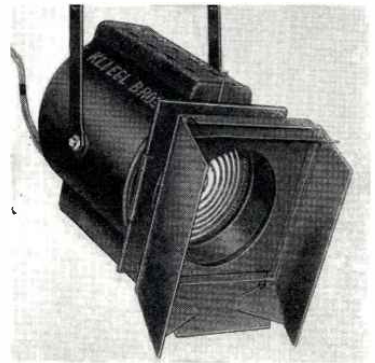


FIG. 18. BARN DOORS PREVENT LIGHT SPATTER

ject as attractive as possible, to create a three-dimensional effect by judicious shadowing, and to hide flaws or imperfections in an artist's features while emphasizing his best points.

Back light is employed very often to provide highlights for artistic effects, and is extremely effective in creating an illusion of depth. Restricted light from some sort of spotlight should be employed, and care must be taken to avoid obviously unrealistic lighting effects.

Special effects light may be incidental to scene identification or may accompany the action. It is used to provide illusions of animated clouds, snow, rain, searchlight beams, lightning flashes, and firelight, among other purposes.

Typical Lighting Units:

Sometimes described as the work-horse of the studio, Kliegl's⁸ floodlight shown

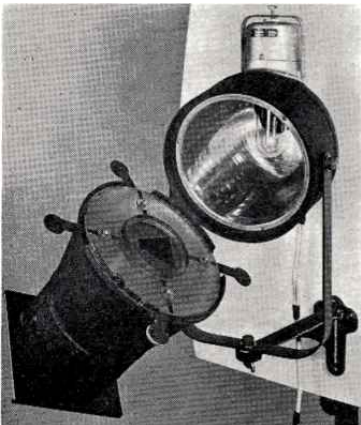


FIG. 21. INTERIOR VIEW OF A PATTERN LIGHT

in Fig. 12 can be mounted overhead or on a floor stand. It is available in two diameters: 15 ins. for 300 or 500-watt

⁸Kliegl Universal Electric Stage Lighting Company, Inc., 321 West 50th Street, New York 19, N. Y.



FIGS. 19 AND 20. TWO FRESNEL-LENS SPOTLIGHTS, USED FOR KEY, MODELING, AND BACK LIGHTING

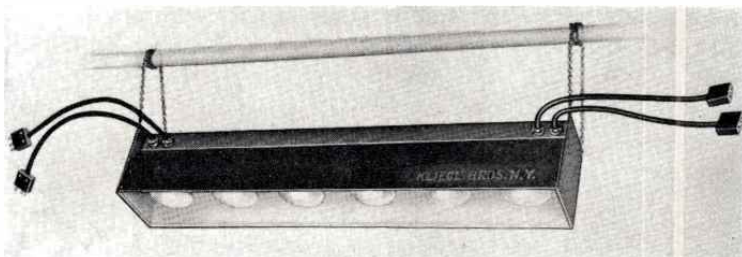


FIG. 23. AN INCANDESCENT STRIP-LIGHT ASSEMBLY, OFTEN USED FOR SPECIAL LIGHTING EFFECTS

lamps, and 18 ins. for 750 to 2,500-watt lamps. Incandescent floodlights are called *scoops*. Fig. 13 shows another variety, the long-range scoop. This is a unit having a considerably narrower beam width than a standard scoop, and is intended for the same purpose at a greater distance.

Fig. 14 is a view of Century's⁹ 14-in. ellipsoidal flood light, fitted with a diffuser frame. Capacity is 300 or 500 watts. It can be mounted overhead or on a floor stand, as can the 16-in. model for 750 to 2,000-watt lamps.

Fluorescent light units are also used extensively for base and fill lighting purposes. A typical overhead slimline assembly is shown in Fig. 15. This unit by Century consists of 6 thin fluorescent tubes in a frame 42 ins. long. A three-section ballast box is built into the assembly, permitting intensity control. These units can also be mounted on floor stands. Fig. 16 shows a Kliegl 4-element slimline unit mounted on a casted floor stand. They can be provided with built-in or separate ballast boxes, and in 4 or 6-element assemblies. The 6-element units are available in either single-intensity models or for operation at 1/3, 2/3, or full intensity.

Fresnel spotlights are employed for key, modeling, and back lights. Such a

spotlight consists of a high-intensity lamp with a concentrated filament, backed by a spherical reflector, and a soft-edge Fresnel lens. They can be controlled closely as to beam diameter and are useful at any distance. Fresnel spot-



FIG. 22. PATTERN LIGHT HAS BEAM CONTROLS lights by Kliegl are shown in Figs. 17 and 18.

Fig. 17 is a view of an 8-in. model, for use with 1,000 to 2,000-watt lamps. Models are also available with lenses from 3 ins., for 100 or 150-watt lamps, to 16 ins., for 5,000-watt lamps. Casted floor stands can be provided for all models except the 3-in. types, which are furnished with table bases. A 6-in. model is shown equipped with barn doors in Fig. 18. These are essential for spotlights located so that spill light might strike a camera, and are useful also for beam-shaping.

Century manufactures a variety of Fresnel spotlights also, under the trade names of Fresnelite and Featherlite. A typical Fresnelite is shown in Fig. 19. This is a 6-in. unit, suitable for 250 to 750-watt lamps, with a beam angle adjustable from 15° to 60°. Featherlites, Fig. 20, are special light-weight, high-intensity lights, especially suitable for

(Continued on page 32)

New UHF-TV Antenna

PART 1—CONSTRUCTION AND PERFORMANCE DETAILS OF TFU-24B UHF ANTENNAS—By O. O. FIET*

SINCE World War 2, RCA has been active in research and development work on UHF television transmitting equipment, 1, 2, 3, 4, 5, 6, 7 and much work has been done on UHF transmitting antennas.^{1, 2, 6} Two experimental television transmitting installations were made with slotted-cylinder omnidirectional antennas. This experience, combined with that obtained with other high-gain, high-frequency broadcast antennas,^{8, 9} has contributed to the design of the new RCA type TFU-24B commercial UHF television transmitting antenna.

The TFU-24B antenna has the highest gain of any omnidirectional antenna yet developed for high-frequency transmission. Improvements in performance and simplicity of the TFU-24B antenna are readily apparent when comparison is made with its prototype antenna installed at Bridgeport, Connecticut during 1949,⁶ which has been in continuous, trouble-free operation for more than three

years. The many features of the Bridgeport antenna which contributed to its reliability have been incorporated in the commercial TFU-24 B antenna.

Construction:

The new antenna is of slotted tubular steel construction, as shown in Figs. 1, 2, 3, 4, and 5. Each radiating layer consists of 1-in. wide slots approximately 1.3 wavelengths long, parallel to the axis of the cylinder, and spaced equally around the circumference of the cylinder. Adjacent layers of slots are staggered or rotated 60° to obtain maximum mechanical strength and a circular horizontal pattern. The energy is distributed to the 16 to 18 layers of slots by means of a single coaxial line feeder system within the self-supporting slotted-cylinder radiator. The inside of the radiator serves as the outer conductor, and a coaxial copper tube within the cylindrical radiator serves as the inner conductor. A coaxial line is installed within the inner conductor to provide center feed, with attendant benefits of adjustable vertical

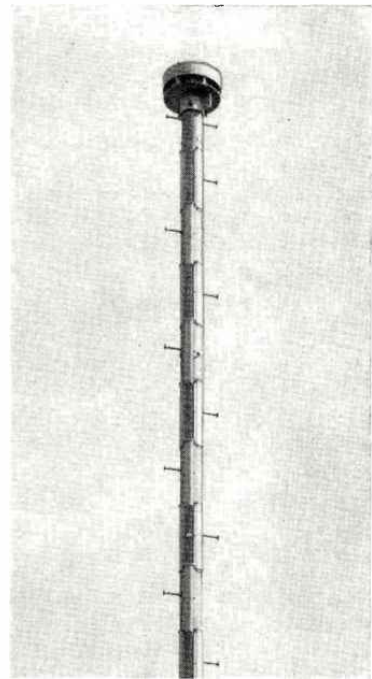


FIG. 1. TOP SECTION OF A TFU-27BH ANTENNA. ABOUT HALF THE 16-BAY ANTENNA SHOWS HERE

pattern tilt, symmetrical patterns for any frequency, and greater bandwidth than that obtainable from an end-fed antenna.

*Engineer, Radio Corp. of America, Broadcast Transmitter Engineering Section, Camden, N. J.

¹"Comparative Propagation Measurements; Television Transmitters at 67.25, 288, 510, and 910 Megacycles," G. H. Brown, J. Epstein, and D. W. Peterson, *RCA Review*, June, 1948.

²"Field Test of Ultra-High-Frequency Television in the Washington Area," G. H. Brown, *RCA Review*, Dec., 1948.

³"UHF Television Field Test," R. F. Guy, *Electronics*, April, 1950.

⁴"Bridgeport UHF-TV Test Results," R. F. Guy, *FM-TV Radio Communication*, May, 1950.

⁵"Experimental Ultra High Frequency Television Station in the Bridgeport, Connecticut Area," R. F. Guy, J. L. Seibert, and F. W. Smith, *RCA Review*, March, 1950.

⁶"Ultra-High-Frequency Antenna and System for Television Transmission," O. O. Fiet, *RCA Review*, June, 1950.

⁷"A new Ultra-High-Frequency Television Transmitter," J. R. Bennett and L. S. Lappin, *RCA Review*, June, 1950.

⁸"8-Bay Pylon Antennas," O. O. Fiet, *Broadcast News*, Aug., 1948.

⁹"Measured Characteristics of the Pylon Antenna," O. O. Fiet, *Broadcast News*, Dec., 1947.

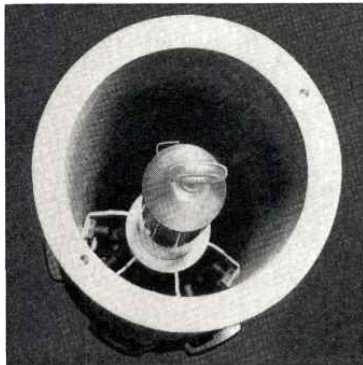


FIG. 2. TOP VIEW, BEACON MOUNT REMOVED. RING CAN BE USED TO MOVE HARNESS FOR TILTING BEAM.

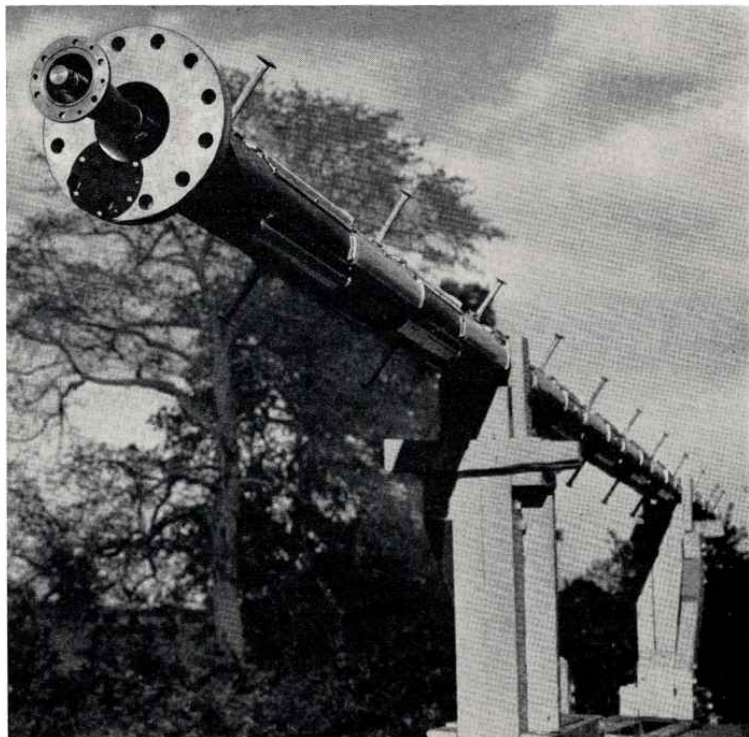


FIG. 3. SETUP FOR VERTICAL PATTERN TESTS

Many of the mechanical features are not found in any other high-frequency broadcast antenna. The slotted cylinder is constructed of hot-rolled open hearth structural steel, hot-dip galvanized to provide a structural life expected to exceed 50 years. The outer fiber stress for the highest wind loading (50/30 lbs./sq. ft.) is less than half that permitted by most building and structural steel codes, as shown in Fig. 6 and the accompanying table.

ANTENNA SPECIFICATIONS

Channel	Low	Medium	High
Freq. Band, Mc.	470-625	625-750	750-900
Type Number	TFU-24BL	TFU-24BM	TFU-27BH
Weight, lbs.	2,300	1,900	1,600
A, ins.	10 $\frac{3}{4}$	8 $\frac{5}{8}$	6 $\frac{5}{8}$
B, ins.	39	32	25
C, ins.	15 $\frac{1}{4}$	13	10 $\frac{5}{8}$
D, ins.	17 $\frac{1}{2}$	15	12 $\frac{1}{2}$
E, ins.	1 $\frac{1}{8}$	1	$\frac{7}{8}$
No. of holes	16	12	12
H, ft.	40	37	34
H1, ft. & ins.	21-6	19-4	18
H2, ft. & ins.	20	18-6	17
R1, no ice, lbs.	1,200	960	630
Wind load moment, ft.-lbs.	26,000	18,500	12,000
Gain, tentative	24	26	28

Particular attention has been given all sections of the antenna to assure maximum durability; all parts and materials were selected for high corrosion resistance and galvanic compatibility. Slot cover end caps are of cast aluminum; small hardware and metal parts, aluminum or stainless steel; pole steps, hot-dip galvanized forged steel; mounting flange bolts, stainless steel or hot-dip galvanized high strength alloy steel; leveling plates, hot-dip galvanized steel; transmission line, copper with brass or bronze parts and Teflon insulators; coupling loop capacitors, Teflon; shorting plugs, brass and bronze; beacon mounting and ventilator, aluminum or hot-dip galvanized steel; and slot covers, polyethylene with additives to improve durability.

The pole mounting flange is of special high strength alloy steel having high impact resistance at a temperature of -60°C. This is particularly important since ordinary carbon structural steel

does not have very good impact resistance at low temperatures. The weld neck mounting flange is welded to the structural tube by an automatic machine, and the weld is then "gamma rayed" by means of a radium capsule within the tube and a photographic film around the outer circumference of the weld. The weld exceeds requirements of the American Welding Society.

Slots are cut in the steel cylinder by an automatic oxyacetylene cutting torch. This process is fast, less expensive, and produces a finish with tolerances comparable to those of milled slots. The automatic cutter utilizes a photo-electric or magnetic device which follows a master template or layout. The semi-circular slot ends are cut without drilling holes at each end of the slot.

The entire antenna is a complete one-piece assembly which will be shipped to the customer completely tested and adjusted. Experience has indicated that UHF antennas shipped "knocked down"

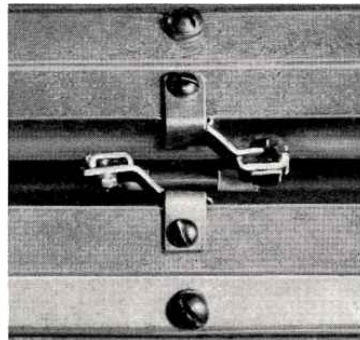


FIG. 5. COUPLING LOOP AT CENTER OF A SLOT

will require a great amount of adjustment and test after installation in order to obtain satisfactory performance for UHF television. The cost of such extensive field adjustment and tests greatly exceeds the small additional shipping

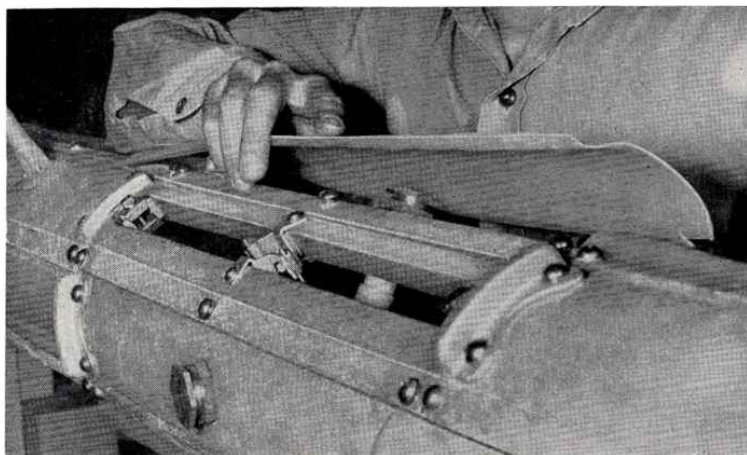


FIG. 4. ONE OF THE TFU-27BH ANTENNA SLOTS. NOTE TEFLON SUPPORT INSULATOR FOR HARNESS

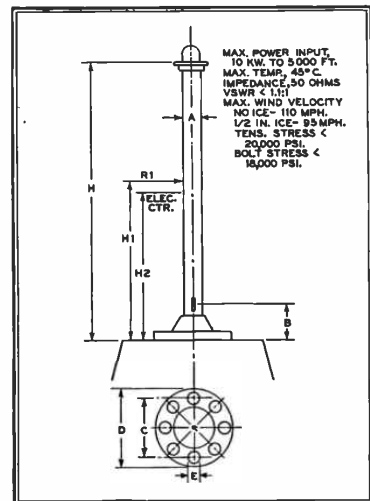


FIG. 6. IMPORTANT ANTENNA CHARACTERISTICS

cost of an antenna completely assembled and tested. Because of the critical nature of UHF antenna equipment, it is recommended that a qualified factory-trained service engineer check the antenna system on arrival and after installation to assure a minimum of installation trouble and expense.

The TFU-24B antenna, as can be seen in Fig. 6, is quite easy to erect. In most cases it can be installed in one or two hours after the rigging is set up. Two wedge-shaped disk leveling plates are utilized under the antenna mounting flange to provide a level base for the antenna mounting. The leveling plates can be adjusted before installation by using a sensitive machinist's level to obtain a very accurate adjustment. If desired, the antenna can be tilted mechanically, by using a level and feeler gauges to adjust the leveling plates to the required slope. Electrical tilt can be incorporated by shifting the harness a few inches during or after the initial installation. The simplicity of this adjustment permits determination of optimum tilt by field experiments after the antenna has been put into operation. A combination of mechanical tilt and electrical beam tilt is desirable for many terrain conditions existing at typical sites suitable for a UHF television antenna.

Because both types of beam tilt adjustment can be made, the high gain of the antenna can be utilized to give the best possible coverage for a variety of terrain conditions. It is possible, where suitable mountain sites about 5,000 feet above average terrain are available, to obtain the maximum permissible ERP of 200 to 300 kw. by using the TFU-24B antenna and a 10-kw. transmitter. The minimum permissible ERP for the largest cities is also obtainable at 250 to 300-

(Concluded on page 32)

BROWNING Model MD-33: *A Completely New* MODULATION MONITOR

Before you buy any type of modulation monitor, study carefully the specifications of the BROWNING Model MD-33 Universal Modulation Monitor. This is a completely new design, engineered to meet all present and future requirements of communication systems¹ operating on any channels in the band from 25 to 174 mc.

CONTINUOUS COVERAGE, 25 TO 174 MC.

By employing the latest techniques developed for continuous VHF tuning, the BROWNING Model MD-33 has been designed for use on all communication channels between 25 and 174 mc. This entire range is covered with only two bands. The accuracy of this monitor meets or exceeds all FCC requirements, yet it is independent of crystal control.

BOTH STANDARD and SPLIT-CHANNEL SYSTEMS

With split-channel operation already coming into use, a modulation monitor intended only for 15-kc. modulation may well become obsolete before its cost can be written off. Accordingly, the BROWNING Model MD-33 has been designed for both standard and narrow-band modulation. A simple switch adjusts the peak-modulation flasher for either range. The modulation meter has straight-line calibration from 0 to 20 kc.

COVERS SCATTERED FREQUENCY ASSIGNMENTS

The advantages of the tremendous tuning range of this instrument are immediately apparent to the technician maintaining several installations with frequency assignments scattered throughout the widely separated bands. This one instrument checks FM modulation swing at any frequency from 25 to 174 mc. without crystal or coil changing inconvenience. The carrier is tuned in and readings made in a few seconds. Automatic frequency control locks instrument to station frequency for continuous monitoring.

WRITE FOR COMPLETE ENGINEERING DATA

Before you decide on the purchase of a modulation monitor, get the complete engineering information on the BROWNING Model MD-33. See for yourself how the unique design of this monitor 1) assures long-time precision and stability, 2) how this single instrument covers *all* communication channels, and 3) how it can be used for both standard and split-channel transmitters.

¹ FCC Rules require that each fixed and mobile transmitter in every radio system be checked for modulation every 6 months, and whenever an adjustment is made that might affect the modulation. Records of these tests must be entered in the station log, where they can be seen by the Radio Inspector.

Browning Laboratories

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In Canada: Measurement Engineering, Ltd., Arnprior, Ont.

BROWNING LABORATORIES, Inc.
700 Main St., Winchester, Mass.

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 Standard Frequency Meters for Mobile Systems

Name

Address

BBC Pulsed-Glide Acoustic Displays

PART 2 — AN EXPLANATION FOR SOME LOW-FREQUENCY ACOUSTIC EFFECTS — INTERPRETATION OF DISPLAYS — By T. SOMERVILLE AND C. L. S. GILFORD*

Part 1 of this article, which appeared last month, described equipment and methods for making a new kind of acoustic test developed by the BBC.

Some examples of the photographic records thus obtained are shown in Fig. 5. The level scale is logarithmic with increasing level upward, and the time scale is linear from left to right. The frequency increases from each decay curve to the one on its right. Because of the logarithmic scale of the tone source, equal horizontal distances along the record represent equal frequency ratios. The frequencies of the brightened markers are indicated by the figures in the margin. These records are called pulsed glide displays.

It should be understood that there are many difficulties in the detailed interpretation of the pulsed glide displays. The information in these displays is, as it were, coded; it requires elucidation both qualitatively and, to some degree, quantitatively. The families of displays make up complete patterns which can be regarded as characteristic of the overall behaviour of a studio, and which give also a coded pictorial representation of the behaviour of the studio under test in specific frequency domains. The fine structure of the patterns can be correlated to some extent with subjective effects observed by the listeners. This is proving to be of great value. An account is given in the following sections of the progress made so far toward interpreting such patterns.

General Characteristics:

The appearance of the display varies between that of Fig. 5A, in which the decay curves change slowly with frequency and produce horizontal structures, and

Fig. 5B, in which complete changes take place between one pulse and the next. Fig. 5A is characteristic of small rooms at low frequencies, and 5B of large rooms at high frequencies. This trend is to be expected upon a consideration of the eigentone spacing, the mean value of which varies inversely as the square of the frequency and inversely as the volume of the enclosure. At the lowest frequencies in a small studio there may be many pulses in the frequency band between two successive eigentones; consequently, the decay curve changes slowly. A mathematical study of the changes in the decay curve in the frequency regions of separated eigentones is in progress.

Confining attention first to the low-frequency part of the display, another important general characteristic can be observed. Many of the horizontal features are determined by the position of the microphone, and change completely as the position of the microphone is changed. Such acoustic features are described as adventitious. Others can be observed in more than one microphone position, perhaps even in all positions, indicating that they are intrinsic features of the room acoustics. Figs. 6A and 6B are displays obtained at two microphone positions in the same room. A number of adventitious features are apparent, together with an intrinsic feature at 100 cycles.

Low-Frequency Formations:

The processes of sound built-up and decay in a room have been described in an extremely useful way by Mayo.⁹ Briefly, the build-up with a steady source can be represented as the successive addition of an infinite series of diminishing vectors, random in phase at first, but eventually

degenerating into an equiangular spiral which represents the eigentone regime. This is diagrammed in Fig. 7A. When the source is removed, the process is reversed; the steady-state level OA changes first to a value represented by OB, then to OC, and so on in succession. This concept facilitates the explanation of many of the acoustic features, particularly the adventitious ones in the low-frequency displays.

The fluctuations in the upper part of each decay curve represent the random echoes from nearby surfaces, and the lower parts represent the regular eigentone patterns. It might be thought that the first echoes would not be very sensitive to frequency, although it is apparent that they are. A similar difficulty was noted by Mason and Moir,¹⁰ who sought to explain the frequency variations in short-pulse pictures by reason of possible changes in the polar diagram of the loudspeaker. Reference to Fig. 7A shows this to be incorrect, because the sound level corresponding to any point X on the diagram is determined by OX; any slight change of frequency causes a change in the angle of the spiral and, therefore, an appreciable change in level.

During the decay, the disappearance of the direct sound and the first few echoes may cause a decrease in level as in Fig. 7B or an increase as in Fig. 7C. Thus, the decay curve will show an initial fall or rise, as in Fig. 7D and 7E. The extent and direction of this initial change, for any particular microphone position, varies with frequency. It is a maximum or a minimum when the direct and reverberant components are in or out of phase respectively. Examples of the formation produced in this way are

(Continued on page 30)

*Engineers, British Broadcasting Corporation, Nightingale Square, London S.W. 12, England. This article appeared in the *BBC Quarterly* also.

⁹C. G. Mayo, "Standing Wave Patterns in Room Acoustics," *Acoustica*, (In publication).

¹⁰C. A. Mason and J. Moir, "Acoustics of Cinema Auditoria," *IEE Journal*, Vol. 88, Pt. 111, Sept. 1941, page 183.

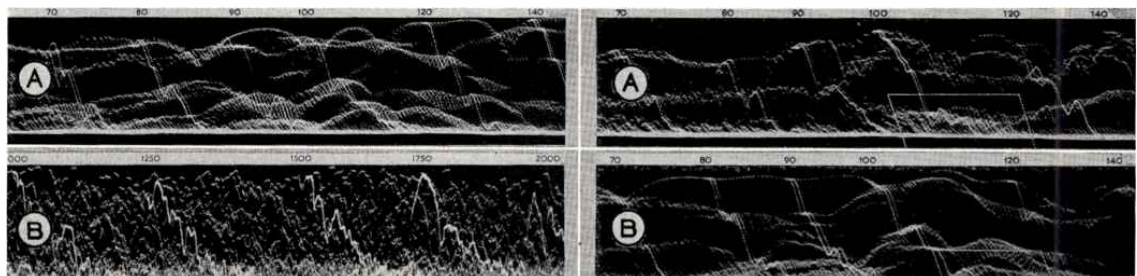


FIG. 5. TYPICAL PATTERNS FOR LOW AND HIGH-FREQUENCY DISPLAYS. FIG. 6. PATTERNS OBTAINED AT DIFFERENT POSITIONS IN THE SAME ROOM

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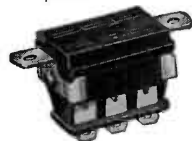
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antenna research, development facilities

The 420-acre ANDREW Research Center, including a mile-long testing range, is devoted entirely to antenna research and development. In addition to the many Andrew standard models which have been developed here, several research and design problems have been undertaken on both prime and sub-contracts. The use of these facilities can be of material assistance in the design and manufacture of systems, associated equipment or in the development of custom antenna equipment.



◀ The testing range utilizes this platform and various towers for antenna field testing. Recently, a full-scale model of the Empire State Building's conical upper section was built on the platform for testing television transmitting antennas. The ANDREW "Skew" antenna developed from the tests is now in use on the Empire State Building.



◀ At this large, well equipped Center, a wide range of equipment and set-ups are available, both indoors and out. Antenna problems are solved by antenna specialists—equipment and experience cover 50 KCS to 20,000 MCS—these enable ANDREW to accept a wide range of antenna development and engineering responsibilities.



◀ The large indoor laboratory has provisions for handling large equipment and is equipped with complete machine shop and metal working facilities. Testing is done in the upper portion of the building where the all-wood construction and elimination of metallic surfaces permit undistorted operation of the test set-up.

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ACOUSTIC DISPLAYS

(Continued from page 28)

shown in Fig. 8 at the points A and B.

Fig. 9 shows the anti-phase case produced artificially by passing tone pulses through the circuit of Fig. 10 to the logarithmic amplifier and oscilloscope.

The upper envelope of the curve thus represents the steady-state level or the

is fairly uniform in sound-absorbing properties. Fig. 11 is a display obtained with a microphone at one end of an undamped tube 4 ft. long, with the loudspeaker at the other end. The maxima corresponding to the eigentone frequencies and the uniformity of slope are well illustrated.

An extension of the use of simple models to build up such idealised dia-

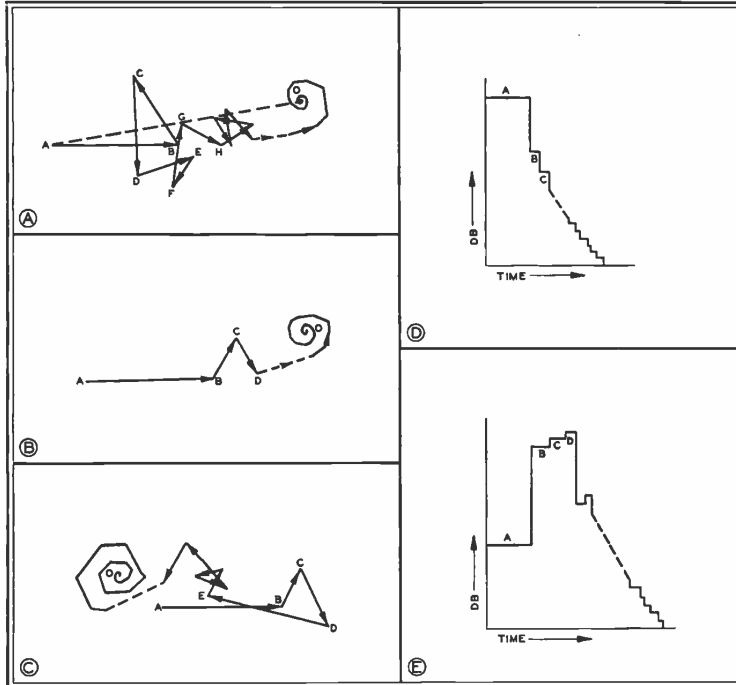


FIG. 7. REFLECTED SOUND MAY ADD TO OR SUBTRACT FROM DIRECT SOUND, DEPENDING ON PHASE

reverberant sound level, whichever is the greater. The steady-state curve itself appears as a recognizable line which coincides normally with the envelope, but occasionally drops below it as at B in Fig. 8. Ordinarily, the frequencies of maximum steady-state level represent eigentone frequencies. There is no change of slope in the curves associated with the eigentone frequencies, provided the room

grams is proposed. Further work will be carried out on this in due course.

Three types of intrinsic features have been recognized. The first consists of a series of violent fluctuations in slope, illustrated in Fig. 12A. This is probably caused by non-uniform damping of different eigentones. It has not been correlated with any subjective effect. The second is a phenomenon which usually

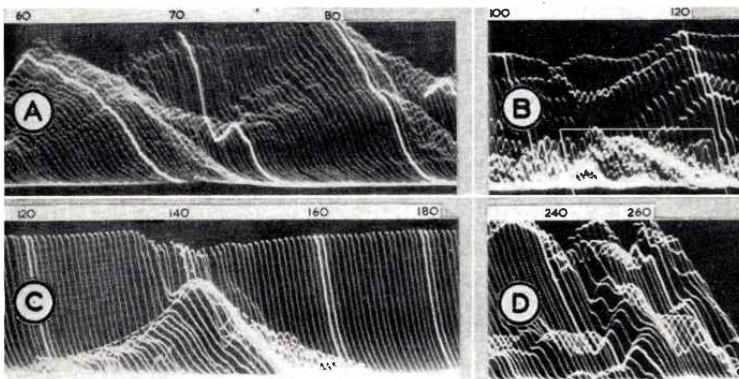


FIG. 12. THREE TYPES OF INTRINSIC FEATURES THAT MAY BE FOUND IN LOW-FREQUENCY DISPLAYS

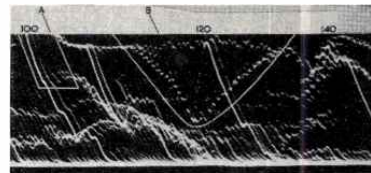


FIG. 8. STEADY-STATE BELOW INITIAL LEVEL

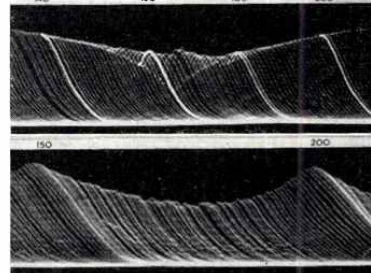


FIG. 9. ABOVE: ARTIFICIAL ANTI-PHASE CASE

FIG. 11, BELOW: PEAKS AT EIGENTONE POINTS

occurs well down in the decay curves, and consists of a sudden disturbance reaching a maximum at a particular frequency. This is almost invariably associated with an audible coloration to speech. Fig. 12B shows such a feature occurring in the display from an announce studio. This should be compared to Fig. 12C, which shows curves of a non-reverberant room containing six sim-

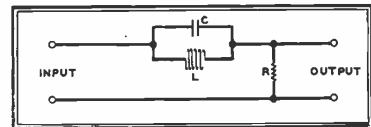


FIG. 10. CIRCUIT PRODUCING EFFECT OF FIG. 9

ilar Helmholtz resonators. Examples of correlation with subjective effects will be given in the next section.

The third intrinsic feature consists of a spread in the curve spacing at a particular frequency, as shown in Fig. 12D. This has been found to coincide often with a structural resonance which, in some cases, has caused coloration.

(To be continued)

NEW USE FOR TAPE RECORDERS

GENERAL Electric engineers have found an ingenious way to avoid taking heavy sound-analyzing equipment to the sites of operating transformers for hum measurement and analysis. Instead, a Magnecord tape recorder is used with a sound-level meter to obtain an accurate record of hum at various locations. Appropriate technical information and a standard sound for calibration purposes are recorded also. The tape is then brought back to the laboratory for analysis. This method provides more consistently accurate results.

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Wide band vertical amplifier useable beyond 2MC. Polarity reversing switches. Push-pull amplifiers. Direct connections to horizontal and vertical plates. Fixed sweep frequency for accurate viewing of wave forms 30 and 7875 cycles. Recurrent linear sweep 3 to 50,000 cycles. Astigmatic focus control for sharper trace. Horizontal amplifier 0 to 100 KC. Sweep oscillator 3 to 50 KC.

You'll like this Model 670. It's a perfect companion to the 610A for accurate TV alignment; or the Model 630 for accurate wave form analysis. Write for complete technical details.

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Models 611 and 612 are popular instruments in research and design laboratories, vacuum tube plants, transmitter manufacturing plants, and in fixed and mobile communication services.

They are ruggedly built for portable use, and are as simple to use as a D.C. voltmeter. The power absorbing load resistor is non-radiating, thus preventing transmission of unwanted signals which interfere with message traffic in communication services.

Frequency range: 30 to 500 MC (30 to 1,000 MC by special calibration)

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Accuracy: Within 5% of full scale

Input connector: Female "N" which mates with UG-21 or UG-21B. Adapter UG-146/U is supplied to mate with VHF plug, PL259.

Special Scale Model "61s" are available as low as ½ watt full scale, and other models as high as 5 KW full scale.

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2. What has he actually done in the microwave field?

Again, RCA has rolled up an impressive record. Installed and operating are more than 19,000 channel miles of RCA microwave systems, for pipelines, power utilities, turnpikes, and government agencies. One system is over 1000 miles long, extends from New York to Washington and Pittsburgh. And after three years' continuous experience, expansion is being planned . . . proof enough of *outstanding RCA performance*.

3. Is he equipped to install microwave?

Again, with RCA, the answer is "yes." RCA will handle your installation for you . . . will even furnish you with a detailed aerial survey of the microwave route.

4. Is he equipped to maintain microwave?

Again, RCA is out in front, with a nationwide service organization geared to handle your microwave maintenance on a 24-hour basis. It's the *RCA Service Company*—already well known for its service to industry on other types of electronic equipment. It's available to you when you specify RCA.

5. Is the equipment designed with an eye to the future?

Yes . . . if it's RCA equipment.

For instance—consider the matter of adding additional voice and signal channels. Thanks to RCA's "eye to the future" design, you can add or drop channels at any station with a minimum of cost . . . a minimum of equipment.

Why settle for less than RCA MICROWAVE?

When you start talking about microwave, you're talking about *money*. So isn't it just good sense to be sure you invest in the best? With RCA, you're dealing with the leading name in radio . . . with men who *know* microwave. *So specify RCA—and be sure.*

You get these 7 plus features with RCA Microwave

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5. Service channel with signaling available at each repeater and terminal station.
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Please have an RCA Microwave Engineer call on me.

NEW UHF-TV ANTENNA

(Continued from page 26)

foot heights with a 1-kw. transmitter.

The antenna's gain of 24 to 27 also provides for obtaining the upper limit of 1,000 kw. ERP, for transmitting antenna heights of 2,000 feet or less, by using a 50-kw. transmitter.¹⁰ Thus, the lower and upper limits for ERP in the UHF band permitted by the FCC¹⁰ can be obtained with this antenna and with transmission lines and transmitters that will be available.

(To be continued)

¹⁰FCC Sixth Television Allocation Order and Report 52-294," Released April 14, 1952.

PATTERN FOR TV PROFIT

(Continued from page 24)

portable use, and where frequent relocation is contemplated. The corrugations on the frame provide rigidity and increased heat dissipation area.

It will be noted that all the spotlights have brackets for mounting barn doors, diffusers, or filters.

A wide variety of electro-mechanical and electrical units is available for special-effects lighting. Projection machines for such purposes can handle still slides or painted moving discs for simu-



FIG. 24. SHUTTERS FOR MECHANICAL DIMMING

lating all types of clouds, rippling water, fire and smoke, and many other effects.

Pattern lights are special spotlights that produce sharply-defined, high-intensity beams of any desired pattern. Fig. 21 is an interior view of the Klieg-light, showing the four individually-adjustable framing shutters. Adjustable iris shutters can be used also. These units are available for floor-stand or overhead mounting, in sizes from 250 watts to 2,000 watts. Dyna-beam Klieg-lights are similar in design, but employ 3,000-watt lamps and have an extra beam-spread lens which can be inserted when desired.

Century makes a similar type of unit, shown in Fig. 22. Called the Lekolite, it is available in four sizes. Lens diameters range from 4½ to 12 ins., and lamps from 100 to 3,000 watts. Adjustable

framing shutters or an iris can be provided on each model. Also, shadow pattern templates can be used.

Strip lights, as shown in Fig. 23, can be used for special effects or for various other applications. They are useful as a substitute for stage-type border-lights or footlights, and to illuminate cycloramas or murals.

Fig. 24 shows a dimmer which fits over the lens of a spotlight. The slat-type shutter can be varied smoothly from the wide-open to the closed position by adjusting the knob at the upper left-hand corner. Of course, it is impractical to attempt to dim groups of light simultaneously by this means.

Lighting fixtures for TV are manufactured by other concerns in various sections of the Country. Bardwell-McAllister, Burbank, Calif., has furnished equipment for many west coast installations.

(To be concluded next month)

New FCC Applications

This list includes applications for mobile, point-to-point, control, and relay communication facilities filed with the FCC from May 24 to June 20, 1952.

This listing, provided as a regular monthly feature, is made possible by the cooperation of the Federal Communications Commission. Each listing shows the name and address of the applicant. If the transmitter is to be located in a different city, the name of the city appears on the second, indented line. The number and type of facilities are shown, with the operating power, frequencies, and the make of equipment for which applications have been filed. These may, of course, be changed before licenses are issued. Explanation of the code letters used in this listing appears below.

WEEKLY REPORTS

For the benefit of those who want to receive this data in advance, RADIO COMMUNICATION can furnish weekly reports. Requests for information on this service, and questions concerning these listings should be addressed to the Registry Editor.

CODE LETTERS

The following letters indicate the type of facilities for which applications have been filed. Unless indicated otherwise, FM operation is to be employed:

a AM operation	q Control station
b Base station	r Repeater or relay
m Mobile unit	s Fixed
mm Marine Mobile	t Temporary
p Portable unit	u Operational
	w Watts

Make of equipment is indicated by one of these letters:

AA Aircraft Radio	M Motorola
A Hallicrafters	N Gen. Railway Signal
B Belmont-Raytheon	NN Ntl. Aero. Corp.
BB Northern Radio	O Farnsworth
C Comco	P Philco
D Doolittle	Q Collins
E W. Coast Electronics	R RCA
F Federal Tel. & Radio	S Railway R. & S.
G General Electric	SS Sonar
H Harvey	T Bendix
J Comm. Equipment	U Western Electric
K Kaar	W Westinghouse
L Link	WW Wilcox
	X Miscellaneous

AERONAUTICAL & FIXED

Aeronautical Radio Inc 1523 L St NW Washington DC
 International Falls Minn 1b 50w 130.9 WW
 Alexandria Minn 1b 50w 130.9 WW
 Fergus Falls Minn 1b 50w 130.9 WW
 Austin Minn 1b 50w 130.5 WW
 Yankton SD 1b 50w 130.5 WW
 Beckley W Va 1b 50w 127.3 WW
 Hickory NC 1b 9.9w 127.3 T
 Kinston NC 1b 9.9w 127.3 T
 Rockford Ill 1b 25w .275 WW

(Continued on page 34)



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... tells in non-technical language what 2-way radio is and what it does ... shows how it works. You'll see how management can know at all times what's going on because it has voice contact with roving crews and with men at remote locations.

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repair crews fast, and to prevent disruption to production cycles.

... also covers the survey facilities offered by RCA to determine the 2-way radio system that best meets your business needs ... includes a digest of the FCC rules regulating industrial radio service ... reveals how to co-operate with industry's frequency allocation committees.

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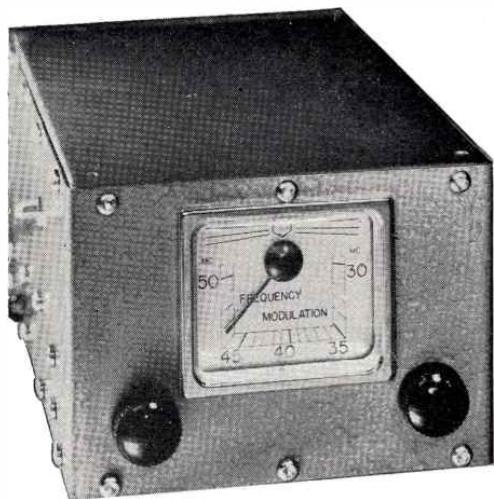
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"I think you have a receiver that is well built, and I see no reason why it should not be in demand by all public works departments that have a transmitter available."



Users of FM 2-Way Radio Communications equipment throughout the entire nation, find Polic-Alarm and Monitoradio a welcome innovation to low-cost mobile communications radio . . . receiving units that every municipality can afford! With them, channel neighbors are monitored for pertinent information—all staff members are constantly alert to communications while driving on or off duty, or at home . . . Polic-Alarm and Monitoradio are invaluable to vital communications systems expansion and development.

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NEW APPLICATIONS

(Continued from page 33)

Alaska Airlines Inc Box 2200 Anchorage Alaska
Alakonek Alaska 1s 100w 2.922, 5.622, 5.652,
200-285, 325-405 NN
St Michael Alaska 1b 100w 2.922, 5.622, 5.652,
200-285, 325-405 NN
Unalakleet Alaska 1s 100w 2.922, 5.622, 5.652 NN
Holy Cross Alaska 1s 100w 2.922, 5.622, 5.652,
200-285, 325-405 NN
Alaska Aeronautics & Communications Comm
Box 121 Juneau Alaska
Ophir Alaska 1b 20w 2.632, 2.986, 3.190, 5.622,
5.652 X
Reeve Airways Box 559 Anchorage Alaska
Unalaska Alaska 1s 75w, 75w 2.922, 2.648, 5.310,
6.622, 11.695 A

FLIGHT TEST

Lear Inc 110 Ionia Ave Grand Rapids Mich
Los Angeles Calif 1s 15w 123.1, 123.3, 123.5 X
Grumman Aircraft Eng Corp Bethpage LI NY
2m 8w 150.12, 132.92 X

FLYING SCHOOL

Dixie Aviation Co Columbia SC 1b — — NN

5 Models For All Systems

6 VOLT MOBILE

M-51
Tuneable 30-50 MC
M-101
Tuneable 152-163 MC

115 VOLT AC-DC

PR-31
Tuneable 30-50 MC
PR-8
Tuneable 152-163 MC

AIRCRAFT

AR-1
AM Tuneable 108-132 MC
115 Volt AC-DC

AERONAUTICAL NAVIGATIONAL

City of Vicksburg Miss 1 Beacon 50w .382 X

AERO MOBILE UTILITY

City of Dayton Ohio 15 E Monument Ave
10m 6w 121.9 SS

AIRDROME ADVISORY

Arthur V Turner Prospectville Pa 1b 4w 122.8 NN
Arthur R Otis Box 416 Grand Rapids Mich
1b 4w 122.8 NN
City of Gordon Neb 1b 10w 122.8 NN
Jacoby Air Service Sterling Ill 1b 4w 122.8 NN

CIVIL AIR PATROL

CAP Hdqtrs Kans Wing 434 Maple Wichita Kans
Russell Kans 1b 75w 4.585, 4.507X; 1b 15w
148.14 T; 15m 15w 4.585, 4.507X; 10m 15w
148.14X
CAP Cent Fla Sqdn Box 235 Winter Park Fla
Orlando Fla 3b 75w 2.374, 4.325, 4.585 —
CAP Wash Wing Walla Walla Flight Box 237
Walla Walla Wash 4s 35w, 46w 4.507, 4.585 U;
1s 1w 5.500 X; 6m 1w 5.500 U; 5m 2.25w 4.585,
4.507 X; 1m 8.5w 4.585, 4.507 X
CAP Powell Wyoming 1s 150w 4.507, 4.585 X
CAP Sheboygan Flight 5th Grp Wis Wing
Sheboygan Wis 1b 1w; 4m 1w 5.500 X; 2b 75w;
1m 75w 4.507, 4.585 X; 1s 10w; 1m 10w 148.14 T

CAP Green Bay Flight Wis Wing
Green Bay Wis 1b 1w; 4m 1w 5.500 X; 1b 10w;
1m 10w 148.14 X; 2b 75w; 1m 75w 4.507, 4.585 X
CAP Eau Claire Flight Wis Wing
Eau Claire Wis 2b 10w; 3m 10w 148.14 T; 1b 1w;
3m 1w 5.500 M; 2b 75w; 1m 75w 4.507, 4.585 X
CAP Athens Sqdn Georgia Wing
Athens Ga 1b 75w; 1m 75w 4.325, 4.585 X;
1b 1w; 4m 1w 4.325, 4.585, 5.500 X; 1b 10w;
2m 10w 148.14 X; 3m 10w, 1m 35w, 2m 15w
4.325, 4.585 X
CAP Minn Wing 114 Fed Cts Bldg Minneapolis Minn
Pipesstone Minn —m 15w; 1s 15w 4.507, 4.585 X
CAP Nevada Wing Las Vegas Nevada 1b 150w
2.374, 4.585, 4.507; 2b 1w, 15w 4.507, 4.585,
5.500, 148.14 TM; 24m 1w, 15w 4.507, 4.585,
5.500, 148.14 A
CAP Clawson Sqdn Mich Wing Berkeley Mich
1b 9w, 60w 2.374, 4.507, 4.585, 148.14 X
CAP Ohio Wing Northfield Ohio 1b 75w 2.374,
4.507, 4.585, 148.10; —m 6w 4.507, 4.585 X
CAP Indiana Wing Indianapolis Ind 5s 95w 4.507,
4.585 X
CAP Indiana Wing 777 N Meridian Indianapolis Ind
Winona Lake Ind 1b 75w 4.507, 4.585 X

POLICE

Town of Riviera Bch Fla 1b 120w; 15m 30w 155.85 M
City of E Tawas Mich 1m 50w 42.78, 42.58 G
Town of Scituate RI 1m 60w 39.78 M
City of Galena Kans 1b 60w; 10m 60w 155.13,
154.89 M
Sheriff of Morrow County Mt Gilead Ohio
1b 120w; 10m 60w, 6m 20w, 5w 39.58 M
Sheriff of Turner Cty Ashburn Ga 4m 60w 42.02 G
Calhoun County Sheriff Morgan Ga 4m 60w 42.02 G
Barrier County Sheriff Nashville Ga 3m 60w 42.02 G
Colorado State Police Patrol 1950 31st St Denver Colo
Park Point Colo 1b 150w 42.46; 1r 120w 154.77 P
Cortez Colo 1q 120w 156.69 P
City of Oconto Wis 2m 30w 39.58 M
Village of Waverly NY 1b 60w; 6m 30w 39.18 —
Henderson County Sheriff Oquawka Ill
1b 150w 39.5 M
Calif State Police Sacramento Calif 3tb 150w; 1tb
500w 42.34 G
El Centro Calif 1b 150w 42.43 G
Berkeley Calif 1b 60w 155.67 —
San Luis Obispo Calif 1b 150w 42.34 G
Sheriff of Blaine County Watonga Okla
1b 120w; 6m 60w 156.69 M
Town of Phillipston Mass 1b 10w; 5m 10w 37.26 M
Village of Turtle Lake Wisc 2m 30w 39.34, 39.42 M
NJ State Police Box 1420 Trenton NJ
1b 150w 44.94 M
Sheriff of Westchester County White Plains NY
4m 3w, 4m 60w 39.18 M
City of Cloquet Minn 1b 120w 155.25, 155.37 M
Jefferson T Police Dept Dover NJ, 1m 50w 158.79 X
Town of South Hadley Mass
1b 120w; 1m 60w 158.79 M
Town of Pelham N H 3m 60w 155.13 M
City of Honey Grove Tex 1b 35w; 2m —w 37.18 L
Sheriff of Clay County West Point Miss
1m 120w 42.18, 42.02 M
City of Fort Bragg Calif 1b 120w; 15m 120w 39.5 G
Village of Bartonville Ill 1b 30w 155.19 M
Sheriff of Wheeler County Wheeler Tex
8m 120w 37.18 M
Scott County Sheriff Shakopee Minn
1b 120w 155.01 B; 10m 120w 155.01 M
Town of Ellcott 19 N Work St Falconer NY
1m 50w 39.18 M
Washington County Sheriff Washington Kans
1b 140w; 8m 60w 39.58 M
Logan County Sheriff Russell Springs Kans
1m 140w 44.82, 44.98 M
Village of Robbins Ill 1b 30w; 6m 30w 155.19 M
Town of Palm Beach Shores
Box 676 Riviera Beach Fla 5m 30w 45.70 M
City of Homewood Ala 1b 140w 45.7 M
City of Quitman Ga 1b 25w; 5m 25w 155.31 G
City of Williston ND 1b 140w; 10m 140w 33.9 M
City of Merkel Tex 1m 60w 47.18 R
Village of Wellington Ohio 1b 120w 39.58; 4p 1w,
6m 30w; 6m 60w 39.58, 39.66 M
Comm of Kentucky News State Office Bldg Frankfort
Williamstown Ky 1b 150w 44.62, 155.37 M
Town of Ludlow Mass 1b 120w; 10m 60w, 5m 30w
155.79 M
City of Wyoming Ohio 500 Grove Ave
Wyoming (Cincinnati) 5) Ohio 2m 10w 2455 X
City of Pryor Okla 1b 20w; 10m 20w 156.69 M
City of Moultrie Ga 1b 30w; 15m 10w 158.79 M
City of Warren Ohio 122 Franklin St
4m .2w Speedmeter X
Dallas County Fordyce Ark
1b 120w; 6m 120w 37.10 M
State of Indiana Stout Field Indianapolis Ind
Fr Wayne Ind 1b 150w 42.42 M
Evansville Ind 1b 150w 42.42 M
City of Dayton Ohio 15 E Monument Ave
1m 4w 2455 —
City of Gooding Idaho 1m 75w 42.54 M
Minn State Dept of Hways Patrol Div 1279 Univ Ave
St Paul Minn
3 mi No Beaver Bw Minn 1b 30w 73.22 M
Littlefork Minn 1b 30w 73.22 M
Rural Douglas Minn 1b 30w 73.22 M
Rural Cass C Minn 1b 30w 73.22 M
Nr Hawley Minn 1b 30w 73.22 M
Nr Windom Minn 1b 30w 73.22 M
Nr Roosevelt Minn 1b 30w 73.22 M
City of Newark NJ 1b 550w 156.21 M

FIRE

City of Grand Prairie Texas 1b 75w; 3m —w 33.98 XR

Wissahickon Fire Co Ambley Pa
1b 120w; 7m 60w 154.13 P
Fire Dist Wantagh NY
1b 120w 46.1; 8m 60w 46.22, 46.1 R
Fire Dept Comstock Mich
1b 120w; 10m 20w 154.43 M
City of Los Angeles Dept of Fire Calif
1r 6.25w 955.87; 1q 6.25w 952.37 M
Newport County Fireman's League Portsmouth RI
1b 120w; 35m 30w 46.06 M
Town of Westport Conn
1b 120w; 10m 30w, 2p 1w 46.42 M
County of Sacramento Calif 1b 120w 154.19 L
City of Lakeland Fla 1b 120w; 6m 60w 154.19 M

FORESTRY

Georgia Forestry Comm Box 811 Waycross Ga
Sylvania Ga 1b 30w 159.39 M
Dept of Forestry Savings Bank Bldg Chillicothe O
Nr Tupper Plains Ohio 1b 30w 31.34, 31.46 M
Tex State Game & Fish Comm Walton Bldg Austin Tex
Crockett Tex 1b 150w 31.22 M
SC State Forestry Comm Box 357 Columbia SC
Nr Moncks Corner SC 2b 30w 159.27 M
Nr Georgetown SC 1b 30w 159.27 M
Nr Elko SC 1b 30w 159.27 M
Nr Jackson SC 1b 30w 159.27 M
Forestry Dept Box 120 Tallahassee Fla
Lake Butler Fla 1b 30w 159.27, 159.33 M
Texas State Dept of Forestry Walton Bldg Austin
Lufkin Tex 1b 120w 31.22 M
Texas Forest Service A & M College Lufkin Tex
Montgomery Tex 1b 30w 170.42 M
State of Missouri Jefferson City Mo
1b 30w 42.06; 1b 30w 31.42 M
State of Calif State Capitol Sacramento Calif
Merced Calif 1b 30w 159.27, 159.33, 159.39
159.45 R

HIGHWAY MAINTENANCE

W Va State Highway Dept Box 410 Buckhannon W Va
Weston W Va 1b 120w 72.54 G
Nr Parkersburg W Va 1b 124w 37.98 G
Keyser W Va 1b 120w 72.54; 1b 500w 37.98;
1q 120w 74.02 G
Multnomah C Hway Dept Portland Ore
1b 60w 161.13 M

STATE GUARD

Conn State Guard State Armory Hartford Conn
1b 150w 2.726 X
New Haven Conn 1b 150w 2.726 X
Waterbury Conn 1b 150w; 56m 50w, 4m 150w
2.726 X
Texas State Guard Box 613 Refugio Tex
1b 45w 2.726 X

SPECIAL EMERGENCY

Ladd L Heldenbrand Parkersburg W Va
1b 60w; 1m 60w 47.46 M
Leman Vet Clinic Warrensburg Ill
1b 120w; 6m 80w 47.5 M
Lowell A Osborn DVM Hampton Iowa
1b 60w; 2m 30w 47.46 M
A L Maxfield DVM St Joseph Mo
1b 41w; 5m 41w 47.58 M
Kenneth W Covey Mahanoma Minn
1b 50w; 1m 50w 47.54 G
Dr J R Wagoner & Dr T C Brown Delphi Ind
1b 60w; 3m 30w 47.58 M
Dr Mark R Crandall Gloversville N Y
1b 120w; 1m 40w 47.58 M
Norman R Slavik Coldwater Ohio 1b 120w; 2m 60w
47.5 M
H Alme Amery Wis 1b 120w; 1m 60w 47.46 M
Helen Callahan Van Dyke Mich
1b 70w; 5m 40w 47.66 G
Rogers' Veterinary Hospital Smithfield Va
1b 120w; 4m 120w 47.5 M
W F Coppage DVM Williamston NC
1b 120w; 1m 60w 47.66 M
Belvedere Physicians Ambulance Serv E Los Angeles
1b 114w; 10m 57.8w 47.62 R
W F Hillstrom Markeson Wis
1b 120w; 1m 80w 47.46 M
Dr W L Taylor Arab Ala 1b 120w; 1m 120w 47.5 M
E J Capesius Whittemore Ia 1b 60w; 2m 30w 47.58 M
R S Miskimins Kimball SD 1b 120w; 1m 60w 47.5 M

POWER UTILITY

Montana-Dakota Utilities Co 831 2nd Ave S
Minneapolis 2 Minn
Rapid City SD 1b 80w 75.66; 1b 50w 48.26 G
Belle Fourche SD 2b 80w 75.66 G
Lead SD 1b 250w 72.58; 1b 250w 48.26 G
Camp Crook SD 1b 50w 48.26 G
Nr Baker Mont 1b 50w 48.26 G
City Electric System Key West Fla
1b 120w; 20m 60w, 5m 3w 47.98 M
Kansas City Pr & Lt Co Kansas City Mo
2b 30w, 40w 37.74, 153.71 M
Carolina Pr & Lt Co Raleigh NC
Silver City NC 1b 150w 37.62 L
Wadesboro NC 1b 510w 37.62 L
Ala Electric Coog Inc Evergreen Ala 1b 10w 48.5 M
Ohio State Dept of Pub Works Akron Ohio
1b 30w; 6m 3w, 8m 30w 47.82 M
Northern Indiana Pub Serv Co 5265 Hohman Ave
Hammond Ind
Wolcottville Ind 1b 120w 37.78 M
Community Pub Serv Co 1501 Electric Bldg Ft Worth
Kermit Tex 1b 120w 48.3 M
Ft Stockton Tex 1b 120w 48.3 M
Pecos Tex 1b 120w 48.3 M
Clifton Tex 1b 120w 48.3 M
Gatesville Tex 1b 120w 48.3 M

1952 ELECTRICAL DEMANDS

CALL FOR Leece- Neville ALTERNATORS

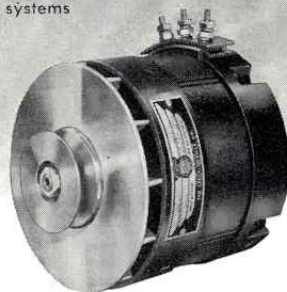
Today's accessory load takes more current from the battery than conventional d.c. generators can put back in. Batteries fail . . . vehicles break down . . . costs mount.

For 1952 performance, replace out-dated d.c. generators with the Leece-Neville AC-DC Alternator System, that gives you

25 TO 35 AMPS WITH ENGINE IDLING

There are Alternators for 6 and 12 volt systems with capacities from 50 to 150 amps.

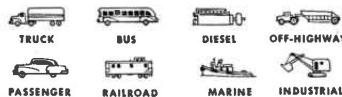
Write the Leece-Neville Company, Cleveland 14, Ohio. Distributors in principal cities Service Stations everywhere.



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RELY ON

Leece-
Neville

ALTERNATOR SYSTEMS • GENERATORS STARTING MOTORS • REGULATORS • SWITCHES FRACTIONAL HP MOTORS

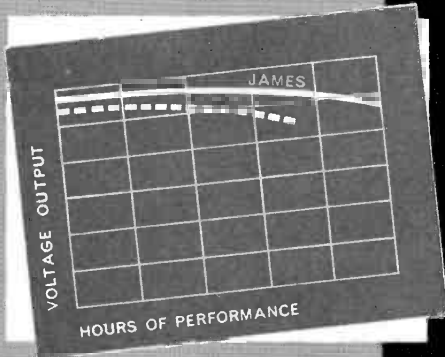


Hamilton Tex 1b 120w 48.3 M
NE Missouri Elec Power Coop Palmyra Mo
New London Mo 1b 120w 48.46 R
W Va Water Serv Co 179 Summers Charleston W Va
1b 50w; 50m 30w 47.98 G
Orange & Rockland Elec Co Monroe NY
1b 120w; 15m 60w, 5p 2w 47.9 M
Ky Utilities Co Danville Ky 1b 150w 48.3 G
St Louis County Water Co St Louis Mo
1b 120w; 50m 80w 158.13 M
Town of Hudson Mass 1b 120w; 5m 60w 48.38 M
Mountain States Power Co Albany Ore
Tillamook Ore 1b 120w 158.13 M
RE Fleming-Mason ECC 225 Water St
Flemingsburg Ky
Tollensboro Ky 1b 150w 37.62 G
Rosebud Elec Assoc Gregory SD
Bonesteel SD 1b 60w 153.65 M

PIPELINE PETROLEUM
The Texas Co (Producing Dept) 135 E 42nd St
New York
Louisiana area 5b 120w 48.94 M
Nr Iberia La 1b 120w 48.94 M
Sohio Petroleum Co 1300 Skirwin Tower Bldg
Oklahoma City Okla
Glasscock Camp Tex 1b 60w 33.3 M
Seismic Engineering Co 6111 Maple Ave Dallas Tex
2m 10w 1.652 X
United Gas Pipeline Co Box 1407 Shreveport La

Morgan City La 1b 140w 48.78 M
Union Oil Co of Calif 1134 Commerce Bldg Houston
Houma La 1b 120w 48.66 M
Moran Bros Inc 350 Nacoll Bldg Wichita Falls Tex
151b 120w 153.23 M
Sun Oil Co Box 2831 Beaumont Tex
21b 150w 49.06 M
Gulf Coast Div 21b 750w; 49.06 GM
Odessa Tex 1b 150w; 21b 150w 49.06 M; 21b
150w 49.06 L
Pennant Drilling Co 622 1st Nat'l Bank Bldg
Denver 2 Colo 21b 120w; 15m 120w 30.74 M
Union Oil Co of Calif 1134 Commerce Bldg Houston
Abbeville La 1b 120w; 1m 120w 48.66 M
Esso Standard Oil Co Baltimore Md
1b 153.35 120w; 115m 120w 153.35 M
Owensboro-Ashland Co Owensboro, Ky
St Joseph Ky 1b 60w 49.06 M
Sun Pipeline Co Box 2831 Beaumont Tex
11b 150w 48.62 G
Leonard Pipeline Co Mt Pleasant Mich
1b 250w; 30m 30w 49.02 M
Panhandle Eastern Pipeline Co 1221 Baltimore Ave
Kansas City 6 Mo
Nr Adams Okla 1b 125w 48.7 M
Humble Oil & Refining Co Box 2180 Houston Tex
Nr Midland Tex 1b 150w 48.86 L
Farmers Union Central Ex Box 2100 Billings Mont
Nr Thermopolis Wyo 1b 124w 48.86 G
(Continued on page 36)

7 OUT OF 10 MAJOR POLICE DEPARTMENTS USE



high receiver voltage insures high system performance

JAMES "Red Ball" design results in higher voltage output, lower "hash" influence ... your assurance of longer life and increased receiver performance. Try the JAMES model designed for your specific communications equipment and you will know why JAMES' is specified where "vibrators must not fail"

JAMES



See your Distributor or write directly for FREE booklet on "Improving Vibrator Life Through Good Maintenance."

JAMES VIBRAPORW COMPANY
4038 N. Rockwell St. - Chicago 18, Ill.

NEW APPLICATIONS

(Continued from page 35)

Thermopolis Wyo 1b 124w 48.86; 10m 124w 48.86 G
Ketchum-Whan Drilling Co Cushing Okla 1b 60w 158.43 L
Tide Water Assoc Oil Co 79 New Montgomery St San Francisco Calif
Avon Calif 1b 120w; 10m 60w, 10m 1w M
Interstate Petroleum Communications Inc Box 2648 1319 Shell Bldg Houston Tex
Lovington New Mex 1b 120w 48.66 M
Nr Denver City Tex 1b 120w 48.56 M; 2lb 120w 48.66 M
Sinclair Pipeline Co Independence Kans 1s 12w 456.15 M; 1s 250w 153.17 R; 1b 12w 457.85 M

FOREST PRODUCTS

Baldwin Lumber Co Cornelia Ga 1b 12w; 3m 12w 49.5 M
Nr Grove Ga 1b 12w; 3m 12w 49.5 M
Quaker City Tree Surgeons Inc 6325 Chew St Philadelphia Pa 6m 15w 158.37 A; 8m 1w 158.37 R
Owen S Smith Grangeville Idaho 1b 124w; 20m 124w 49.54 G
Picco Logging Co 126 Pioneer Ave Montesano Wash Nr Montesano Wash 1b 124w; 8m 124w 49.62 G
Brooks-Scanlon Inc Box 1111 Bend Ore Sisters Camps Ore 1b 150w; 20m 120w 49.5 G
Flodin Lumber Co Plains Mont Nr Thousand Falls Mont 1b 120w; 12m 30w 153.05; 1sq 30w 74.02; 1rs 30w 73.1 G
Weyerhaeuser Timber Co Box 420 Centralia Wash Nr Enumclaw Wash 1b 60w, 1b 30w 153.35 M
Aborigine Lumber Co Box 71 Longview Wash Fort Bragg Calif 1b 124w 49.58 G
Albion Creek Logging Co Box 3305 Seattle 14 Wash Snider Ranger Station Wash 1b 120w; 20m 60w 153.17 M

SPECIAL INDUSTRIAL

oim: Venture Contractors Pickstown SD 1b 30w; 12m 12w 152.99 M
ompsom-Arthur Paving Co Greensboro NC 1b 124w 49.86 G
Danville Va 1b 124w; 50m 124w 49.86 G
ira A Huffman El Centro Calif 1b 120w; 10m 60w 152.99 M
Wm Gehring Inc Kentselaer Ind Newland Ind 1b 120w; 25m 25w 152.93 G
Walker Bros Inc Springdale Ark 1b 20w; 5m 20w 154.47 M
Lane Construction Co Box 911 Meriden Conn 20lb 40w 43.02 M
Santa Cruz Farms Eloy Ariz 1b 120w; 10m 60w 152.87 M
Shaw & Sibley Levelland Tex 1b 250w; 25m 250w 43.02 M
Permian Mud Serv Inc Box 43 Midland Tex Big Lake Tex 1b 120w 27.43 M
Lovington New Mex 1b 120w 27.43 M
Electro Metallurgical Co 30 E 42nd St NYC Marietta Ohio 2b 3w 152.87; 152.93 12m 3w 154.49 154.57 M
Noel Co Bay City Tex 1b 120w; 10m 120w 43.1 M
Walter E Brown Grant Neb 1b 12w; 5m 12w, 5p 1/2w 43.1 M
Nr Kingsley Dam Neb 1b 12w 43.1 M
Blythe Bros Co Box 989 Charlotte NC 5lb 120w; 50m 60w 49.9 M
Halferty Bros Plattsburg Mo 1b 120w 49.94 M
Dearborn Mo 1b 30w; 6m 30w 49.94 M
Propot Constr Co Concord NC 1b 124w; 30m 124w 49.98 G
Nr Midland SC 1b 124w 49.98 G
Crookham Co Caldwell Idaho 1b 124w; 10m 124w 49.98 G
Gen Mote Research Corp 3044 W Grand Blvd Detroit Pontiac Mich 1b 30w; 30m 10w 152.93 M
Old Dominion Power Co Norton Va 1b 150w; 6m 150w 48.3 G
Mid-States Constr Co Box 417 Mt Vernon Ill 1lb 60w; 10m 60w 43.1 R
Porter Lard Co of Calif Box 393 Bakersfield Calif Nr Arvin Calif 1b 120w; 10m 60w 152.99 M
Hewitt Contracting Co Box 1372 Columbia Ga Shumaker Ark 1b 30w; 10m 30w 152.87 B
A V Taurasi Co Inc Somerville Mass 1b 120w; 30m 120w 49.94 M
Broadway Maintenance Corp 2643 Penn Ave Pittsburgh Pa 1b 100w 456.15; 50m 45w 457.65 L
Chestnut Hill Excavating & Constr Co 1250 E Mermaid Wyndmon Pa 1b 120w; 6m 60w 43.06 G
Campanella & Cardl Hillgrove RI 1b 60w; 25m 30w 43.06 R
Providence RI 1b 60w 42.03 R
Farley Farms Holville Calif 1b 124w; 30m 124w 49.58 G
Currier-Denny Inc Mitchell Neb 1b 60w; 10m 60w 43.18 M
J A Terteling & Sons Inc Box 1428 Boise Idaho Nr Superior Neb 1b 150w 30.58 M
Anaconda Copper Mining Co Yerington Nevada 1b 124w; 40m 124w 49.86 G
Macco Corp 14409 S Paramount Blvd Paramount Calif Roll Ariz 1b 120w; 20m 30w 49.9 M
Roy Dugger Co Corpus Christi Tex 1b 120w; 15m 120w 49.94 M
Georina P Yeatman Beaufort NC Open Grounds Farm 1b 250w; 21m 250w 152.87 K
Woodrich Constr Co 201 18th Ave Hopkins Minn

(Continued on page 38)



Measurements Corporation MODEL 82

STANDARD SIGNAL GENERATOR

20 Cycles to 50 Mc.

FREQUENCY RANGE: 20 cycles to 200 Kc. in four ranges. 80 Kc. to 50 Mc. in seven ranges.

OUTPUT VOLTAGE: 0 to 50 volts across 7500 ohms from 20 cycles to 200 Kc. 0.1 microvolt to 1 volt across 50 ohms over most of range from 80 Kc. to 50 Mc.

MODULATION: Continuously variable 0 to 50% from 20 cycles to 20 Kc.

POWER SUPPLY: 117 volts, 50/60 cycles. 75 watts.

DIMENSIONS: 15" x 19" x 12". Weight, 50 lbs.

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"Small Unidyne"
Ultra-Cardioid
Dynamic
Microphone

This is the original "old faithful" mobile hand microphone. Used for rugged field and car duty more than all other makes combined! Features high speech intelligibility and ruggedness. Stands up under heavy use and abuse.



The
"100 Series"
Carbon
Hand-Held
Mobile
Microphone

This Controlled Reluctance Microphone Cartridge is an ideal service replacement for the Model 520SL Dispatcher and for use in special hidden microphone applications. Practically unaffected by heat and humidity.



Model R5
"Controlled
Reluctance"
Microphone
Cartridge

This dispatching unit handles the most severe field requirements of paging and dispatching systems. Supplied with 2-conductor shielded cable, and wired to operate both microphone and relay circuits. Features "Grip-to-Talk, Slide-to-Lock" long-life switch.



Model 520SL
"Dispatcher"
Complete
Dispatching
Unit

Designed for use with small portable and mobile transmitters. Only 2" in diameter and 1 1/2" thick. Has 3-conductor coiled cord, metal-spring strain relief, and Push-to-Talk switch. Has same operating characteristics as "100 Series" Carbon Microphones.



Model 115
Carbon
"Pack"
Microphone

A Controlled Reluctance Microphone and desk stand assembly—ideal for mobile and fixed-station use in all types of communications work. Has a built-in switch for controlling both the microphone circuit and an external relay or control circuit.



Model 510MD
"Controlled
Reluctance"
Microphone
Assembly

SHURE BROTHERS, INC.

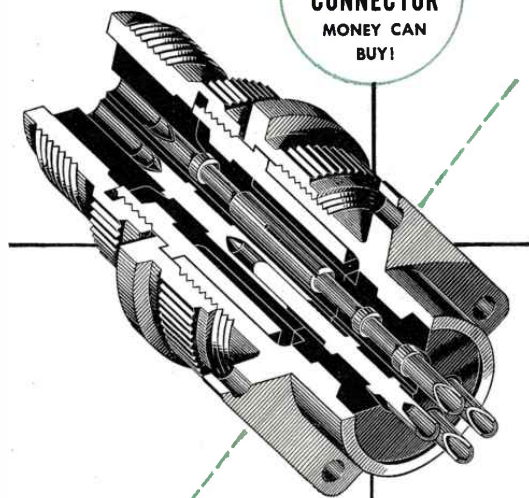
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and Acoustic Devices



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• Moisture-Proof • Radio Quiet • Single Piece Inserts • Vibration-Proof • Light Weight • High Insulation Resistance • High Resistance to Fuels and Oils • Fungus Resistant • Easy Assembly and Disassembly • Fewer Parts than any other Connector • No additional solder required.

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- CONDENSERS

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Micas, Silver Micas, Ceramic, Variable, Trimmer

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- FUSES & MOUNTINGS
- GENERATORS
- GROUND RODS
- HEADSETS
- IF COILS
- JACKS
- JACK BOXES
- KEYS, Telegraph
- KNOBS
- LAMPS
- LORD MOUNTS
- LUGS

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- RECTIFIERS

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- SELSYNS
- SOCKETS
- SWITCHES

Aircraft, Micro, Switchettes, Taggle

TIMERS

TUBING—Flexible

TUNING SHAFTS

TRANSFORMERS—All Types

- VIBRATORS
- WALKIE TALKIES

Available Now!

A complete signal corps stock number listing of items in our stock. Write for listing No. SG-200. (For government agencies and contractors only.)

Manufacturers and distributors—write for Radio-Electronics Catalog No. H 501.

Write, Wire, Phone Your Requirements

all phones: **SEeley 8-4143**



833 W. CHICAGO AVE., DEPT. E., CHICAGO 22, ILL.

NEW APPLICATIONS

(Continued from page 36)

- 1lb 120w; 6m 60w, 152.87; 2m 30w, 1m 3w 153.87 M
- Clarence Waterfall Co Ogden Utah
- 1b 30w; 10m 30w 49.94 M
- August Winter & Sons Co Appleton Wis
- 1b 30w; 6m 30w 154.49 M
- Keco Lard Co Rupert Idaho
- Nr Rupert Idaho 1b 40w; 6m 40w 27.31 X
- Heidrick & Bros Box 1215 Rte 1 Woodland Calif
- 1r 120w 154.49; 15m 30w 152.87 M
- Amis Construction Co Oklahoma City Okla
- 1b 560w 30.62 G
- Ferrigo Foundation Co Hartford Conn
- 1b 85w; 6m 60w 25-50 mc band K
- Virgil J Feezell Mabton Wash 1q 110w 72.22 G
- Bickleton Wash 1r 110w 74.50 G
- John Kai Marano Ariz 1b 115w; 15m 115w 152.93 G
- Roy Costa Yuba City Calif
- 1b 60w; 10m 30w 40-50 mc band M
- Ken's Woodworking Co Whitman Mass
- 1b 120w; 6m 120w 43.1 G
- Warren Bros Roads Co 1900 Hayes Nashville Tenn
- 1b 124w; 15m 62w 43.06 G
- Master's Contracting Corp-Montrose Pa
- 1b 40w 43.06 M
- The Silliman & Godfrey Co Bridgeport Conn
- 1b 120w; 15m 60w 49.94 R
- Transit Mix Concrete Co 444 E Castilla
- Colorado Springs Colo 1b 140w; 25m 40w; 4p 2w 152.99 M
- M Simon Zook Honey Brook Pa
- 1b 120w; 10m 60w 43.18 L
- Perry Constr Co 825 Olive St Scranton 10 Pa
- Throop Pa 1b 27.7w; 15m 24.8w 154.49 R
- Cane Bros Contracting Co. Box 1301 Tampa Fla
- 1b 120w; 1p 120w; 50m 60w; 10p 3w 49.86 M
- Kingston Bituminous Products Co Kingston NJ
- Lamberville NJ 1b 120w 43.06 M
- Pennington NJ 1b 120w 43.06 M
- Kerr-McGee Oil Inc Kerr-McGee Bldg Oklahoma City
- Shiprock New Mex 1b 120w 49.9 M
- Cortez Colo 1b 120w; 10p 1w, 10m 120w 49.9 M
- B F Goodrich Co Akron Ohio 1b 60w; 15m 15w 152.93 R
- Guerin & Jacobus Inc Melbourne Fla
- 1b 120w; 10m 30w 43.1 M
- Mullinix Construction Co 1433 NW 5th St
- Oklahoma City 1b 30w; 5m 12w, 5p 1w 154.49 M
- J Lee Murphy Woodbridge Va
- 1b 120w; 5m 120w 49.86 M
- New Mex Construction Co 112 N 8th St
- Albuquerque New Mex 1b 40w; 10m 40w 42.02 M
- 1b 40w 42.02 M
- Berenz & Son Asphalt Co Bloomington Ill
- 1b 60w; 8m 60w 43.06 M
- Jas D Green 306 S 1st St Grangeville Idaho
- 10m 150w 49.98 G
- Dunn Construction Corp 2508 3rd Ave N
- Birmingham Ala 1b 60w; 2m 60w 43.02 M
- Carl Ellston & Co Sayer Wis
- 1b 120w; 6m 60w 49.9 M
- Chas E Hipp Box 26 Graham Tex
- West Tex & Eastern New Mex 4tb 70w 43.02 G
- Cecil C Brock 206 Central Ave Hot Springs Ark
- 10p 12w; 1m 12w 154.57 M
- The Collier Construction Co 710 Film Exchg Bldg
- Cleveland 14 Ohio 4p 120w; 25m 120w 152.87 M
- Scribner & Rickardson Arenas Pass Tex
- 1b 180w; 1m 40w, 4m 25w, 10m 5w, 6m 30w, 5m 10w 2.292 X
- Carl Frederic Schuster San Juan Tex
- 1b 120w; 5m 120w; 10m 30w 49.7 M
- Joe Maggio King City Calif 1b 115w 152.99 G

LOW POWER INDUSTRIAL

- Harry M Miller 232 E Main St Lexington Ky
- 1p 1w 35.02 A
- G McL Cole 4753 N Broadway Chicago Ill
- 2p 1w 154.57 A
- Ina Island Rod & Gun Club Inc Alexandria Bay NY
- 2p 1w 35.02 L
- Richard W Griffiths 21-15 Bridge Plaza N
- Long Island City NY 6p 1w 154.57 A
- Alarm Corp Box 3455 Carmel Calif 2p 1w 154.57 M
- Material Service Corp 308 W Washington Blvd
- Chicago Ill 10p 3w 154.57 M
- Daniel J Terlaak 16006 Detroit Ave Lakewood Ohio
- 1p 1w 154.57 A
- Miller Compressing Co 510 S Muskego Ave
- Milwaukee Wis 16p 3w 154.57 G
- Pequannock Sand & Gravel Co 631 Main Passaic NJ
- 2p 3w 42.98 X
- Robert H Morris 8451 Whiteoak Northridge Calif
- 2p 1w 154.57 M

RELAY PRESS

- United Press Assoc 220 E 42nd St New York NY
- Bloomington Ill 1b 60w; 8m 60w 43.06 M

COASTAL & MARINE RELAY

- Esso H Smith Stevenson Wash 1p 15w 2.738 X
- Crowley Launch & Tugboat Co Berth 82
- San Pedro Calif 1m 100w 156.6 G
- Magnolia Petroleum Co Box 900 Dallas Tex
- 1tb 50w 2.134, 2.206 K

RADIO LOCATION

- Lorac Service Corp Box 1590 Tulsa Okla
- Pearlington La 1b 300w 1.766 A
- Larose La 1b 300w 1.752 A

(Concluded on page 40)

Information about

HIGH-FIDELITY

This fall, HIGH-FIDELITY Magazine will release an entirely different and still larger promotion campaign in consumer publications.

For this purpose, two series of full-page advertisements will be run in publications selected on the basis of our experience with 26 magazines and newspapers used during the past year.

One series of advertisements will feature records and tape as sources of fine musical entertainment at home.

The other will present the idea that "radio sets" are being succeeded by "high-fidelity FM, record, and tape installations" in homes of discriminating people.

This campaign has been planned to serve the dual purpose of building circulation for HIGH-FIDELITY, and of providing basic promotion of the whole hi-fi idea.

If you are interested in any of the aspects of the hi-fi field, you should be a HIGH-FIDELITY subscriber. Use the coupon below, or your company purchase order.

Charles Fowler, Editor
HIGH-FIDELITY Magazine
Hi-Fi Publishing House, Great Barrington, Mass.

Please enter my subscription to HIGH-FIDELITY, for which I enclose:

- \$5.00 for 1 year (6 issues)
- \$10.00 for 3 years (18 issues)

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OF

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EAS Air-Coupler for Bass Reinforcement

Good News . . . The Dual Air-Coupler for bass reinforcement is in stock, ready for delivery. This is the improved model described in Radio Communication last October, and in the Winter Edition of High Fidelity.

As more and more of the most critical audio experts install Air-Couplers in extended-range systems, reports of remarkable performance continue to pour in. One of the most enthusiastic owners is Paul deMars, former chief engineer of the Yankee Network, and a pioneer in high-quality reproduction. He said: "I have never heard such magnificent tone from records and dual-talent FM as I am getting from my Air-Coupler in combination with a dual speaker for intermediate and treble frequencies."

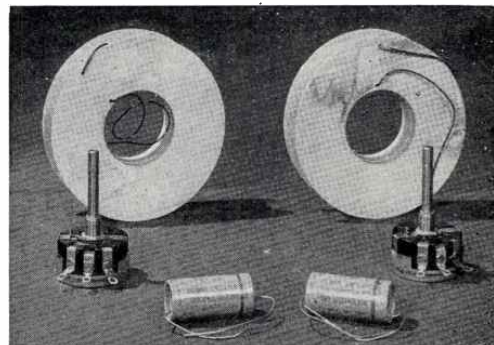
For your convenience . . . the Air-Coupler is available in both knock-down form, so that you can assemble it with a screwdriver, or completely assembled, ready to mount the speaker. Made entirely of first-quality 3/4-in. plywood, with each piece cut to precision fit.

DUAL AIR-COUPLER, COMPLETELY ASSEMBLED . . . now only **\$7.50**
The Air-Coupler is supplied completely assembled and finished in a truly professional manner, with front panel in place, ready for the speaker. Illustration shows assembled Air-Coupler, before front panel is mounted. Opening is cut for any 12-in. speaker, the recommended size.

DUAL AIR-COUPLER, IN KNOCK-DOWN FORM . . . now only **\$34.50**

MISCELLANY: we carry in stock . . . Altec 600-B 12-in. speaker for the Air-Coupler, \$46.50; Peerless S-230Q output transformer, \$26.00; Peerless R-560A power transformer, \$16.00; Peerless C-455A power choke, \$10.00; English KT-66 output tube, \$4.95; Racon CHU2 tweeter, \$23.10.

Crossover Networks for Any System of Two or More Loudspeakers



By a judicious selection of associated components, the three coil sizes on which G.A. has standardized enable our customers to secure low-cost crossover networks which will operate at 14 different crossover frequencies! For the experimenter, that means a wide range of choice without having to break the bank to buy dozens of coils. For the man who wants to install his system once and for all, it means money saved, because G.A. saves money by making only three coil sizes (10.2, 5.1, and 1.6 Mh) — and it passes on those savings direct to its customers.

If you want to use three speakers with crossover points at 350 and 1,100 cycles, for example, just order two of the networks listed above (for an 8-ohm system, with rapid crossover attenuation, it would be No. 6 and No. 8).

As most everyone has found out by now, G.A. is headquarters for crossover networks. As far as we know, we're the only organization stocking networks specifically designed for use with Air-Couplers.

If you are in doubt about the selection of a network for your particular speakers, send 10c for the G.A. Network Data Sheet, from which you can determine your requirements exactly.

RAPID ATTENUATION NETWORKS

12 db droop per octave. These networks use two inductance coils.

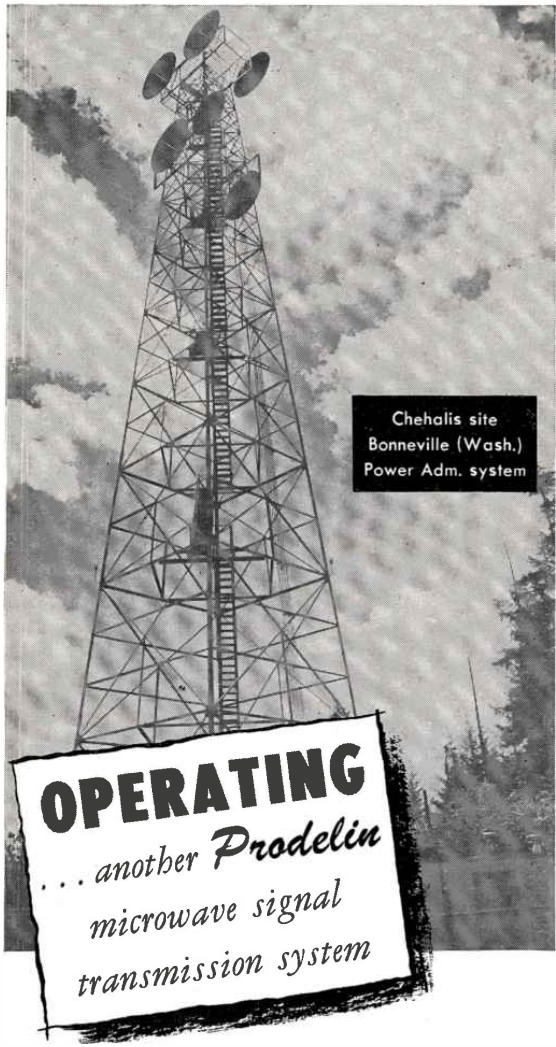
Impedance of low frequency speaker	Crossover Frequency	Order by Number	Price Only	Price Complete*
16 ohms	2,200	No. 1	\$7.00	\$11.50
	1,100	2	7.00	12.00
	700	3	12.00	16.00
8 ohms	350	4	12.00	17.50
	175	5	20.00	24.00
	85	6	7.00	12.00
4 ohms	550	7	7.00	13.00
	350	8	12.00	17.50
	175	9	20.00	24.00
2 ohms	85	10	20.00	26.50
	550	11	7.00	13.00
	275	12	7.00	15.00
1 ohm	175	13	12.00	19.00
	85	14	20.00	26.50

* Complete networks include necessary capacitors and level controls. Be sure to indicate whether you want just the coils or the complete network.

SAVE C.O.D. Charges! Send remittance with your order.

General Apparatus Co.

South Egremont, Massachusetts



**Chehalis site
Bonneville (Wash.)
Power Adm. system**

OPERATING
*... another Prodelin
microwave signal
transmission system*

With the fastest growing list of installations in the microwave signal transmission field, Prodelin offers you more than 35 years of combined development, production and field experience. Critical operating requirements to 3500 mcs., rugged terrain, erection hazards and extremes of heat and cold are but a few of the many problems solved by Prodelin engineering.

If you are contemplating the erection of a microwave signal transmission system, consult Prodelin first. Our engineers will be happy to show you how Prodelin microwave antennas, coaxial cables and associated system components can serve you best.

INSTALLATIONS

- Keystone Pipeline Co.
- Trunk Line Gas Co.
- Los Angeles Power & Light Co.
- Southern California Edison Co.
- Michigan-Wisconsin Gas Pipeline Co.
- Texas Eastern Gas Transmission Corp.
- Bonneville Power Administration
- U. S. Coast Guard

Prodelin "Job-Packaged Engineering" is a tried and proven service which places all your signal transmission equipment at your site—ready for operation—when needed. Write for details.

Product Development Company
ARLINGTON NEW JERSEY

NEW APPLICATIONS

(Continued from page 38)

Boothville La 1b 300w 1.788 A
Pecan Island La 2b 300w 1.761, 1.766 A
Johnson Bayou La 2b 300w 1.776, 1.793 A
Pte a la Hache La 1b 300w 1.752, 1.767 G
Creole La 2b 300w 1.761, 1.767, 1.788 A

ALASKAN FIXED PUBLIC

Alaska Aeronautics & Communications Comm Juneau
Ophir Alaska 1b 20w 2.632, 2.986, 3.190, 5.622,
5.652 X
H S Weidner Auke Bay Alaska 1p 20w 2.474, 2.512 X

ALASKAN COASTAL

Alaskan Glacier Sea Food Co c/o Northern Electric
314 Bell St Seattle Wash
Eno Petersburg Alaska 1b 100w 9 channels from
2.382 to 3.190 NN

MARITIME FIXED

Sun Oil Co (Gulf Coast Div) Box 2831 Beaumont Tex
1b 50w 2.134, 2.206 K

COASTAL & FIXED

Libby McNeill & Libby c/o Northern Elec Co
314 Bell St Seattle 1 Wash
W S Balcom Chacon Alaska 1b 40w 8 channels
from 2.382 to 3.190 NN

RAILROAD

Atchison Topeka & Santa Fe RR Co 80 E Jackson Blvd
Chicago 4 Ill
Albuquerque New Mex 2b 120w 161.37 T
Seaboard Air Line RR Co Sal Rk Blvd Norfolk 10 Va
Jacksonville Fla 1b 15w 160.89 X
Chicago Gr Western RR Co 303 W Harrison Chicago
Hartian Iowa 1b 60w 160.17, 159.57 X
Missouri Pacific RR Co 310 N 13th St St Louis Mo
1b 60w 160.41, 160.47 M
Pleasant Hill Mo 1b 60w 160.41, 160.47 M
Alexandria La 1b 60w 160.41, 160.47 M
Dupo Ill 1b 60w 160.41, 160.47 M
Sandy Hook Mo 1b 60w 160.41, 160.47 M
Blackwater Mo 1b 60w 160.41, 160.47 M
Kansas City Mo 1b 60w 160.41, 160.47 M
Warrensburg Mo 1b 60w 160.41, 160.47 M
Chicago RI & Pacific RR Co LaSalle St Sta Chicago
Little Rock Ark 1b 60w 161.61 M
El Reno Okla 1b 60w 161.61 M
Topeka Kans 1b 60w 161.61 M
Morris Ill 1b 60w 161.61 M
Joliet Ill 1b 60w 161.61 M
Peoria Ill 1b 60w 161.61 M
Linon Colo 1b 60w 161.61 M
McFarland Kans 1b 60w 161.61 M
Flagler Colo 1b 60w 161.61 B
Genoa Colo 1b 60w 161.61 B
Burlington Colo 1b 60w 161.61 B
Goodland Kans 1b 60w 161.61 B
Colby Kans 1b 60w 161.61 B
Dresden Kans 1b 60w 161.61 B
Norton Kans 1b 60w 161.61 B
Dalhart Tex 1b 60w 161.61 M
Stratford Tex 1b 60w 161.61 M
Guymon Okla 1b 60w 161.61 M
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Mead Kans 1b 60w 161.61 M
Mineola Kans 1b 60w 161.61 M
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Greensburg Kans 1b 60w 161.61 M
Herington Kans 1b 60w 161.61 M
McPherson Kans 1b 60w 161.61 M
Fruit Kans 1b 60w 161.61 M

Southern Railway Co Box 1808 Washington 13 DC
Ashville NC 1mr 80w 160.65; 1mr 80w 161.25 W
Detroit & Mackinac Railway Co Tawas City Mich
1b 120w 160.23 O
Detroit Toledo & Ironton RR Co 4921 Calhoun Ave
Dearborn Mich 1b 10w 161.43 M
Wyanndotte Mich 1b 60w 161.43 M
Atchison Topeka & Santa Fe Rwy Co Chicago 4
Gallup New Mex 2b 120w 160.65 T
St Louis-San Francisco Rwy Co Olive & Jefferson Sts
Springfield Mo
Kansas City Mo 1b 25w 161.13 W
Union Pacific RR Co 1416 Dodge St Omaha Neb
Granite Canyon Wyo 1b 30w 160.41 M
Atlantic & East Carolina RR Co 811 1/2 N Queen St
Kinston NC 1b 120w 159.57, 159.75 M
Goldsboro NC 1b 120w 159.57, 159.75 M
Havelock NC 1b 120w 159.57, 159.75 M
Morehead City NC 1b 120w 159.57, 159.75 M
New Bern NC 1b 500w 159.57, 159.75 M; 8p 1w,
60w, 6m 6w, 6m 20w 159.75 M

TAXICABS

Cortez Taxi & Transfer Co Cortez Colo
1b 40w 152.39; 3m 40w 152.39 M
Red Dot Cab Co Columbus Ga
1b 120w 152.33; 50m 30w 157.59 M
Checker Cab Co Enid Okla
1b 120w 152.45; 25m 30w 157.71 M
Party Taxi Co Huntington W Va
1b 120w 152.33; 10m 25w 157.59 M
Morty's Taxi Maynard Mass
1b 12w 152.39; 6m 12w 157.65 M
Johnson's Cab Co Jonesboro La
1b 30w 152.33; 10m —w 157.59 R
Broadway Taxi Inc Chelsea Mass
1b 120w; 10m 30w 152.27 M
Levittown Taxi Tullytown Pa
1b 120w 152.27; 6m 24w 157.53 G

Millside Taxi Wilmington Del
1b 120w 152.39; 6m 24.8w 157.65 G
B & D Taxi Victoria Tex
1b —w 152.39; 10m —w 157.65 G
Gibson Cab Jackson Ohio 1b 152.33; 8m 157.69 M
South Side Cabs Emporia Va
1b 60w 152.39; 10m 30w 157.65 M
Allen's Taxi Serv Manassas Va
1b 60w 152.39; 5m 30w 157.65 M
Zia Cab Gallup New Mex
1b 30w 152.39; 10m 1w 157.65 L
Milton Hall Savannah Ga
1b 30w 152.39; 10m 11w 157.65 M
Safety Cab Co Lawton Okla
1b 120w 152.33; 60m 30w 157.59 M
Acme Cab Co Dearborn Mich
1b 50w 152.33; 8m 12w 157.59 G
Safety Cab Co Maysville Ky
1b 120w 152.27; 6m 30w 157.53 M
Ace Taxi Service Passaic NJ
1b 120w 152.33; 6m 24w 157.59 G
S R S Taxi Corp Long Beach Ca
1b 120w 152.39; 10m 30w, 15m 15w 157.65 MT
C L Sullivan City Cab Co Punta Gorda Fla
1b 30w 152.27; 10m 30w 157.53 M
Station Taxi Service Corp Long Beach NY
1m 40w 152.39 B; 1m 15w 157.65 T
Yellow Cab of Fall River Mass
1b 15w 152.33; 15m 5w 157.59 R
Morris Taxi Haverhill Mass
1b 120w 152.45; 20m 30w 157.71 M
Boo's Taxi Mackinaw City Mich
1b 10w 152.33; 5m 10w 157.59 M
3 Star Cab Co Oscoda Mich
1b 10w 152.27; 4m 10w 157.53 M
Arrow Cab Co Greensboro Nc
1b 120w 152.45; 25m 50w 157.71 B
City Cab Co Greer SC
1b 120w 152.27; 15m 50w, 25w 157.53 B
Gainsboro Taxi Inc 60 Kilmarnock St Boston Mass
6m 15w 157.71 R
City Cab Co Edmond Okla
1b 30w 152.33; 5m 30w 157.59 L
Lea's Taxi Service 181 Myrtle Blvd Larchmont NY
6m 30w 157.71 M
A B C Taxi Co St Joseph Mo
1b 140w 152.45; 20m 40w 157.71 M
Vets Cab Co Inc Aberdeen SD
1b 12w 152.33; 6m 12w 157.54 M
Keystone Cab Co West Chester Pa
1b 120w 152.33 G; 18m 14.8w 157.59 TG
Yellow Cab Co Hewithome Calif
1b 120w 152.45; 14m 60w 157.71 L
Frank's Taxi Plainview Tex 1b 30w; 5m 30w 152.39 G
Comet Cab Co Spensard Alaska
1b 50w 152.27; 10m 6-12w 157.53 G
Creve Coeur Cab Co Creve Coeur Ill
1b 60w 152.27; 6m 12w 157.53 M
Yellow Cab Co of Del Rio Del Rio Tex
1b 60w 152.33; 20m 30w 157.59 F
Black & White Cab Co Kansas City Mo
1b 140w 152.33; 50m 40w 157.59 M
Burns & Church Yellow Cab & Baggage Co
Wheeling W Va 1b 60w 152.39; 18m 30w 157.65 M
Tolman Cab Inc Kansas City Mo
1b 140w 152.39; 50m 40w 157.65 M

AUTO EMERGENCY

Esposito Servicenter Newark NJ 1b 30w 35.7 M
Reliable Service Co Denver City Tex
1b 250w; —m 60w 35.9 M
Barnesville Motor Co Barnesville Ga
1b 70w; 10m 70w 35.7 G
Edsall Auto Service Topeka Kans
1b 120w; 3m 60w, 80w 35.7 M
Automobile Emergency Radio Serv Corp
Albuquerque NM 1b 120w; 10m 80w 35.7 M
Johnny Lords Wrecker Serv Cleveland Tex
1b 120w; 5m 120w 35.7 M
Reeves Stand Serv 22480 Northwestern Hwy Detroit
Birmingham Mich 1b 10w; 5m 10w 35.7 M
Wythe Tire Co Newport News Va
1b 124w; 10m 124w 35.7 G
V L Bunch Van & Storage Glendale Calif
1b 124w; 25m 124w 35.74 G
DeBerry's Butane Gas Co Ore City Tex
1b 120w; 4m 60w, 3m 120w 35.82 M

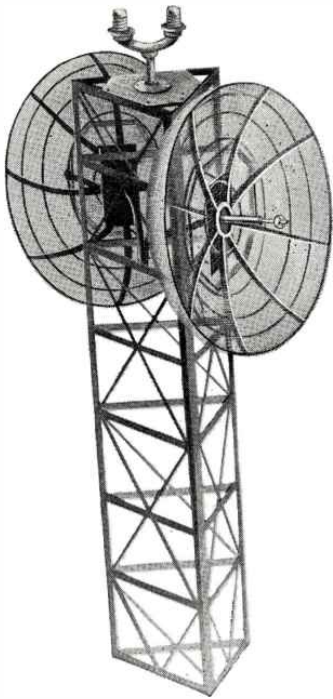
HIGHWAY TRUCKS

Bridgewater Ice & Coal Co Bridgewater Mass
1b 120w; 15m 30w 35.9 M
Ideal Gas Inc Levelland Tex
1b 70w; 10m 70w 35.86 G
Bowers Liquefied Gas Co Brownfield Tex
1b 120w; 10m 120w 35.9 M
Automatic Gas Co Gainesville Ga
1b 60w; 10m 30w 35.94 M
West Florida Gas & Fuel Co Panama City Fla
1b 120w; 40m 60w 35.9 M
Tallahassee Fla 1b 120w; 15m 60w 35.9 M
St Joe Fla 1b 30w; 3m 60w 35.9 M
Nicoletti Bros Dos Palos Calif 1b 124w 35.82 G
L P Gas Communication Assoc Box 146 Little Rock Ark
200m 114w 35.98, 35.94; 1b 114w 35.94 R
Similar installations in other Arkansas towns:

- | | | |
|--------------|---------------|---------------|
| Lake Village | Mountain Home | Heber Springs |
| Magnolia | Pine Bluff | Judsonia |
| Clarksville | Jonesboro | Clinton |
| Charleston | Camden | Batesville |
| Beebe | Harrisburg | England |
| Benton | Mena | Crossett |
| Conway | Des Arc | Yellville |
| Nashville | Marshall | Hot Springs |
| Warren | Ozark | Newport |
| Caraway | Caraway | Clarendon |
| Stuttgart | West Helena | El Dorado |
| Fisher | Forrest City | |

BETTER FOR RADIO RELAY

*- Because it's **Simpler!***



**FOR Pipelines, Utilities,
Railroads, Telephony,
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Federal PTM (PULSE TIME MODULATION) MICROWAVE

**Streamlined Circuitry and Fewer Tubes
Provide Greater Economy and Dependability!**

SIMPLICITY . . . that's the basis for the greater efficiency, reliability and economy of maintenance of Federal Pulse Time Modulation Microwave . . . for radio relay systems of any size, type or length . . . over any terrain.

Through *simpler* equipment—requiring *fewer* tubes—Federal PTM successfully meets all needs of telephone, teleprinter, telemetering, remote and supervisory control, VHF mobile radio and other services . . . for complete, simultaneous, dependable, all-weather voice and signal facilities.

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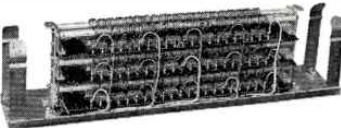
Federal PTM Delay Line —“Heart of the System”—

Remarkably compact and efficient . . . *has no tubes*. Maintains absolute synchronization between channels . . . provides non-shifting channel selection . . . eliminates crosstalk.



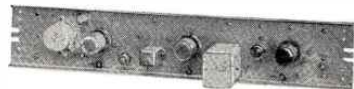
Federal PTM Pulse Generator

Supplies synchronizing pulse to delay line for simple, automatic channel synchronization, eliminating elaborate individual channel tuning provisions. Uses *fewer* tubes . . . greatly increases system dependability.



HERE are some of the Federal PTM multiplex elements that demonstrate the **Simplicity of Design** that makes **Microwave by Federal—**

“Microwave at its BEST”



Federal PTM Pulse Restorer

A valuable insurance factor in longer systems. Automatically cuts in and converts repeater into temporary terminal if adjacent repeater fails . . . maintains communication over remainder of system.



**Simplest
in the
Field!**

**Federal
PTM**



Modulator and Demodulator

Outstanding for minimum-tube design and interchangeability. Plug-connected for ready maintenance . . . greater economy in stocking of spare parts.

MICROWAVE MOVIE: Be sure to see Federal's new 16 mm. sound-color motion picture “*Modern Communications With Microwave.*” Prints shipped without charge for company or organization showings. Write to: Film Distributing Dept.



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WIRE AND RADIO TRANSMISSION SYSTEMS DIVISION
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