

FM-TV
THE JOURNAL OF

RADIO COMMUNICATION

★ ★ Published by ★ ★
Milton B. Sleeper

The Berkshire Eagle

Outdoor Facsimile Bulletins

Enforcement of FCC Rules
Developments in Communications
Plan for Taxicab Radio System
Pattern for TV Profit

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

Engineered today for your needs tomorrow!

MYCALEX

PRECISION-MOLDED MYCALEX 410

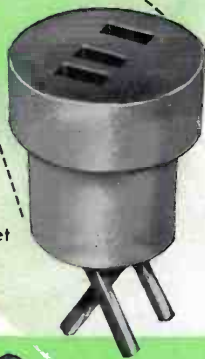
TRANSISTOR SOCKETS

— now in the pilot production stage
— engineered in advance of actual need

In keeping with the MYCALEX policy of progressive design in advance of needs, these Transistor Sockets were engineered months ago and are now in small scale pilot production. They'll be available in quantity in advance of actual needs.

Mycalex 410 Transistor Socket shown actual size

Mycalex 410 Transistor Socket enlarged to show detail

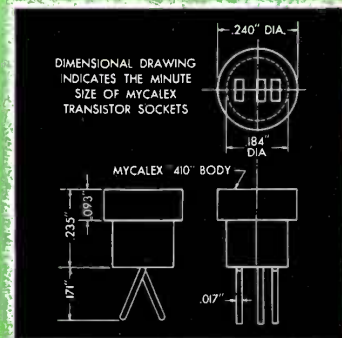


Achievement in PRECISION MOLDING!

The production of Mycalex Transistor Sockets is a real accomplishment of precision molding in miniature. The holes for the leads are the smallest ever molded. All tolerances are exceedingly close. Mycalex production engineers are proud of their achievement . . . particularly because low-cost, mass production techniques can be adhered to.

The body is precision-molded of MYCALEX 410, glass-bonded mica insulation for lasting dimensional stability, low dielectric loss, immunity to high temperature and humidity exposure combined with maximum mechanical strength. The loss factor is only 0.014 at 1 MC and dielectric strength is 400 volts/mil.

Contacts can be supplied in brass or beryllium copper. The sockets are readily solderable. The socket bodies will not warp or crack when subjected to high soldering temperature. They function in ambient temperatures up to 700° F.



Mycalex Low-loss Tube Sockets and Multiple Headers

A complete line of tube sockets including sub-miniature types is available in Mycalex 410 and Mycalex 410X glass-bonded mica insulation. Comparative in cost to ordinary phenolic sockets they are far superior in every respect. Dimensional accuracy is unexcelled. For complete information on standard

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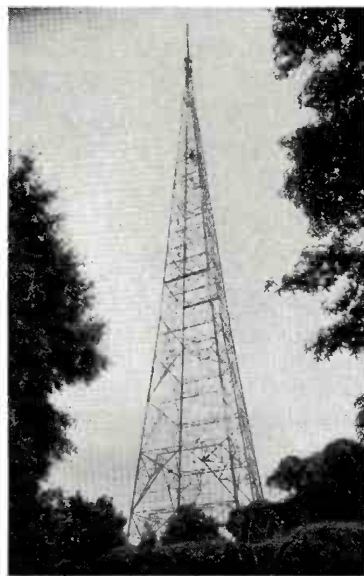
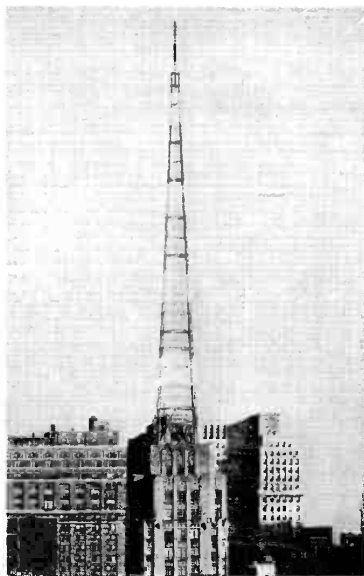
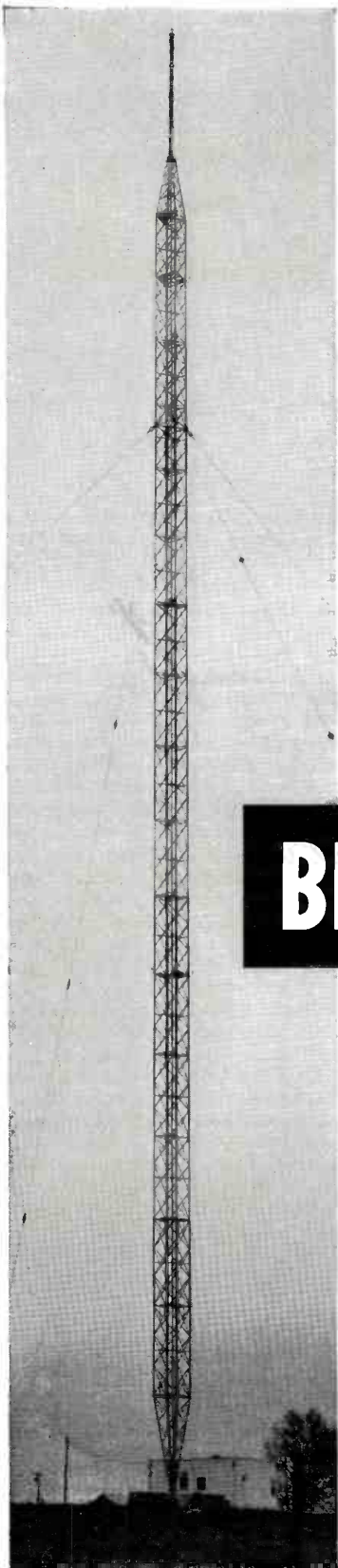
Years of experience—more than four decades, in fact—have given Blaw-Knox the edge in designing, fabricating and erecting antenna towers for any purpose and any location. Blaw-Knox TV towers are on the job in widely separated geographical areas . . . in wide open fields, atop buildings in crowded cities and even grounded in salt water. Some have TV antennas already mounted—others have built-in provisions for TV when licenses are granted—all are heavily galvanized for longer life.

Whether you need a 100 ft. self-supporting structure or a 1000 ft. guyed tower to meet your requirements—whether for AM, FM, TV or Microwave—write or call today for capable engineering assistance with your plans.

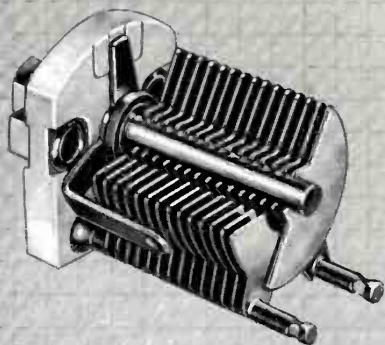
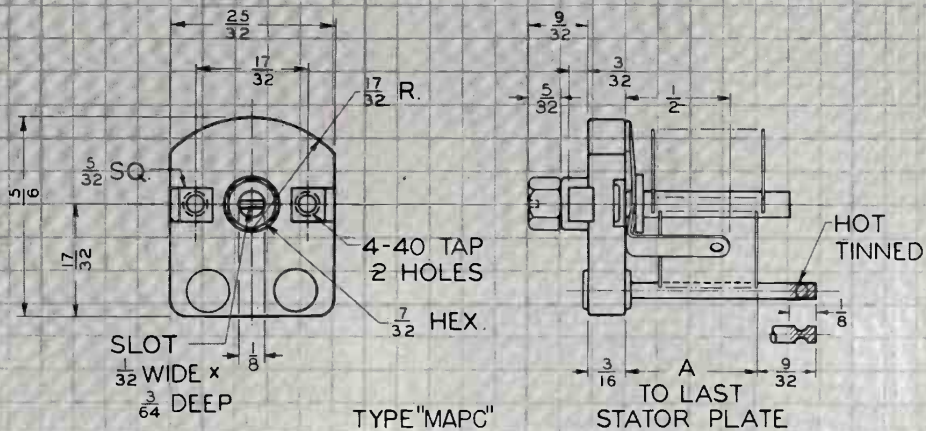
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Blaw-Knox Division
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BLAW-KNOX ANTENNA TOWERS



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This trimmer capacitor, the "MAPC", exemplifies Hammarlund's continuing efforts to meet the demand for smaller dependable components. A scaled-down version of the popular "APC", originated by Hammarlund more than 20 years ago, it has everything reduced except the quality and performance characteristics.

The Hammarlund *complete-line* of variable capacitors, carried by carefully chosen distributors from coast-to-coast, makes it possible for you to pre-select a capacitor that meets all your requirements of construction and operation.

Write today for the 1952 Capacitor Catalog

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FM-TV RADIO COMMUNICATION
TELEVISION ENGINEERING

Formerly *FM MAGAZINE* and *FM RADIO-ELECTRONICS*
 Now incorporating *TELEVISION ENGINEERING Magazine*

VOL. 12 NOVEMBER, 1952 NO. 11

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RADIART **VIBRATORS**
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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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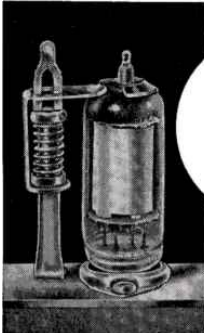


CIRCULATION AUDITED BY
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BIRTCHE TUBE CLAMPS

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!

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Set Production

IN September, according to RTMA statistics, television set production zoomed to 755,665, the highest figure for any month since March '51. To a large extent, this was in anticipation of sales impetus resulting from the presidential campaign. Very likely October will show a drop in consequence, although the few post-freeze stations to come on the air before the end of the year, and the usual Christmas buying will help to keep production up during the last three months of the year. Meanwhile, serious preparations are being made to meet a substantial up-coming demand for UHF sets that will deliver performance equal to that on VHF channels.

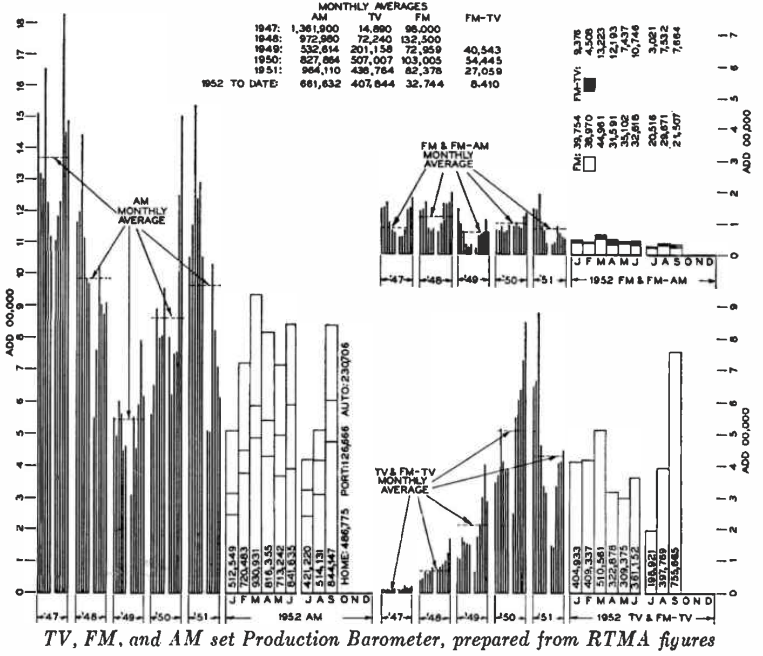
Audio broadcast receivers did not fare as well. While the September figure for TV sets was double that of last June, audio receivers were under the June total. Nevertheless, clock models reached an all-time high of 183,495. This amounted to 56% of the 324,786 home radio models, while home and clock models combined were less than two-thirds of the TV set production.

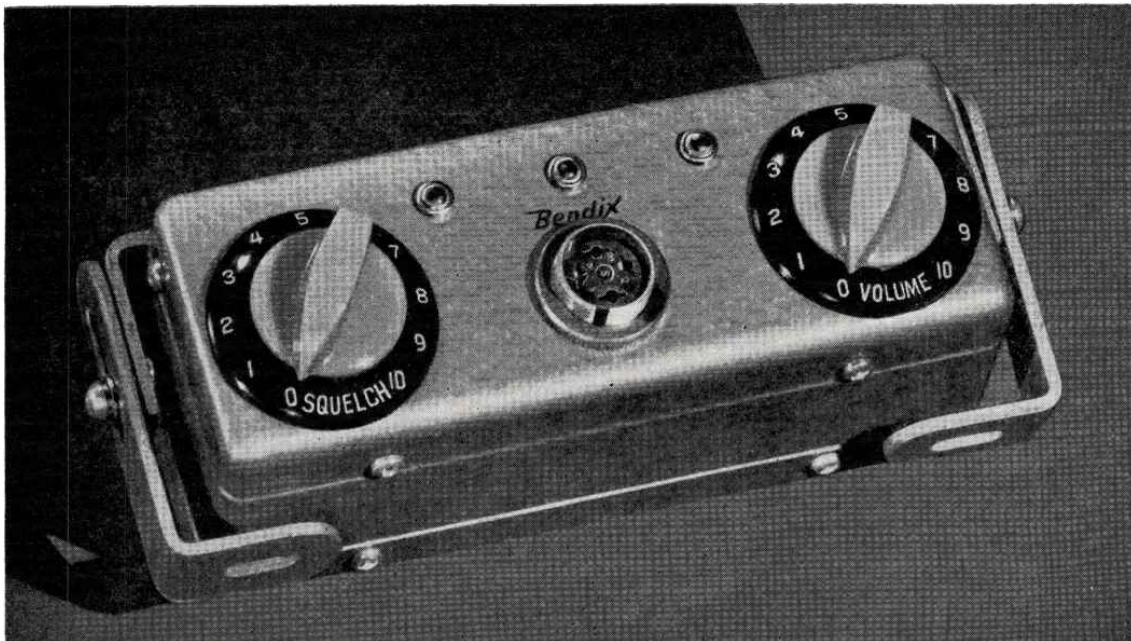
From this it might be inferred that the industry is just about out of ideas for promoting audio receivers or, what is more likely, the industry is just running true to form, by pursuing the easy

course. Looking back over the years, it seems amazing that such a dynamic art should be so limited by bird-brained sales promotion.

As for FM receivers, they limped along at less than 20% of the clock-radio production. At an RTMA meeting in New York on October 30, it was proposed that non-members join in reporting FM tuner production. (At present, RTMA does not report any FM tuner production.) Little encouragement was given this idea, however. There seemed to be a feeling that RTMA members took no notice of the high-fidelity business until it had been built to substantial proportions by the smaller independent concerns. Now, RTMA's sudden interest in FM tuners and hi-fi equipment might mean that the big companies may want to climb on the bandwagon and upset the market with fancy claims for cheap merchandise of inferior performance.

Incidentally, while most exhibitors at the New York Audio Show had no way of making quantitative measurements of buying interest this year as compared to last, we can contribute one exact check expressed in dollars: subscription sales of **HIGH-FIDELITY Magazine** at the Show were a little over three times the 1951 figure.





No Chopped-up Messages in Fringe Areas with New Bendix 2-Way Radio!

NEW ELECTRONIC SQUELCH IS THE SECRET!

How'd you like to talk to your driver . . . clear as home radio . . . when he's 20 or more miles away? No chopped up signals! No blurring! All signal . . . and no noise!

Today you can get all this in the revolutionary 2-way Bendix Trafficmaster. It gives you dozens of advantages over ordinary mobile radio . . . but doesn't pull any more amps than a headlight!

Electronic Squelch the Secret

Bendix engineers have perfected an electronic squelch with a delayed action that gives you *all* the signal . . . none of the noise. It works just as well in the densest downtown traffic too.

Your Bendix 2-way is new, it's rugged. Easier to service and maintain. (Bendix, for instance, uses Selenium stacks instead of rectifier tubes. They never wear out.) Your Bendix is completely accessible for service or adjustment. The transmitter, receiver and power supply are all on one chassis . . . separately slotted for easy 3-way removal . . . pivot, straight up, or straight out.

From hand sets to land stations

In addition to the latest type of mobile equipment . . . Bendix offers a complete line of fixed stations from 2½ to 250 watts. As well as accessories from hand

sets to speakers, antenna to shock mounts . . . plus all technical help in obtaining license and complete system engineering.

Write today . . . because you too can now afford the best in 2-way radio. Bendix costs you no more than ordinary equipment. Get all the information.

BUY ON INSTALLMENT PLAN

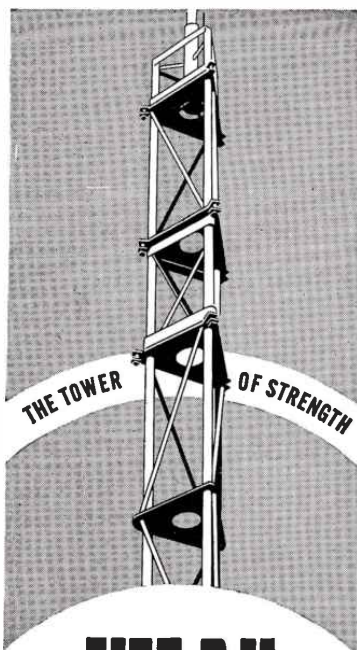
Bendix has developed with local banks, what has been called one of the finest financial plans anywhere. You pay for your new Bendix 2-way radio . . . as you use it and as it makes money for you. Write for complete details to the address below.

Bendix MOBILE *Radio*

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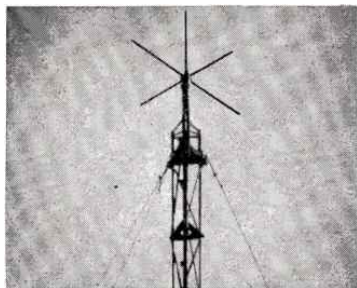


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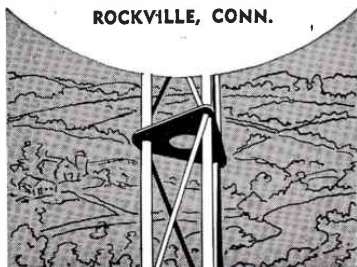
VEE-D-X Sectional Tower

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



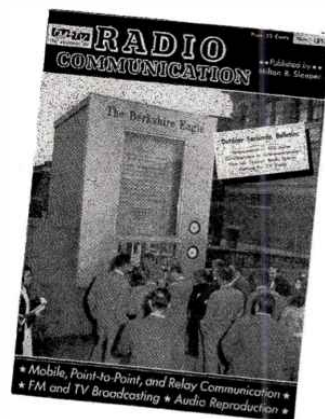
Actual photograph of VEE-D-X Sectional Tower installation showing 152 MC ground-plane antenna ideally suited for ground-to-plane, ship-to-shore, and mobile communications.

**THE LaPOINTE-PLASCOMOLD CORP.
ROCKVILLE, CONN.**



THIS MONTH'S COVER

On the main street of Pittsfield, Mass., this king-size facsimile recorder keeps the citizenry informed as to the latest news developments. The scanner is located in the newspaper offices of *The Berkshire Evening Eagle* a few blocks away, and is connected to the recorder by wire lines. First of its kind in the world, the equipment was developed and installed for *The Eagle* by Alden Products Company of Brockton, Mass. (Brockton's other claim to fame: Rocky Marciano).



SPOT NEWS NOTES

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

Audio Quality on TV:

One thing that impressed owners of TV sets who visited the New York Audio Show was the fine quality they heard on speech and music, compared to what they get on their television receivers. They seemed to think that because they have 21-in. tubes, they should have the best in audio quality as well as picture size.

Elmira, New York:

Machinery and equipment is being installed at the Westinghouse vacuum tube plant, and production will be under way soon. The building, of 365,000 square feet, has such modern features as fluorescent lighting, air conditioning, dust precipitators, acoustic ceilings, and asphalt tile floors. It is located on a tract of 114 acres.

Dr. William E. Taylor:

Chosen to head a group of engineers investigating materials suitable for transistor and diode applications at Motorola's Phoenix laboratories. Dr. Taylor has been associated previously with the University of Tennessee, Oak Ridge Laboratories, and Purdue University.

Wyoming's Communication System:

When *RADIO COMMUNICATION* is split into two parts effective with the January issue, one of the feature articles in *COMMUNICATION ENGINEERING* will describe the Wyoming Highway Department's unique communication system designed to cover 98,000 square miles, connecting with patrol cars and maintenance equipment which operate on 5,500 miles of highways. Also, mountain-top relays provide communication with county sheriffs and local police. There are several features of this system that can be

adapted for use by other communication services.

Underwriters' Approval:

The complexities of getting Underwriters' approval on radio and TV sets are being further confounded by lack of coordination between the Chicago and New York offices. Apparently sets that aren't approved at one place can be passed at the other. In addition, some manufacturers are putting UL labels on all their models, just because they have had one or two models approved. At least, UL doesn't have any record of approving certain sets that carry the UL label.

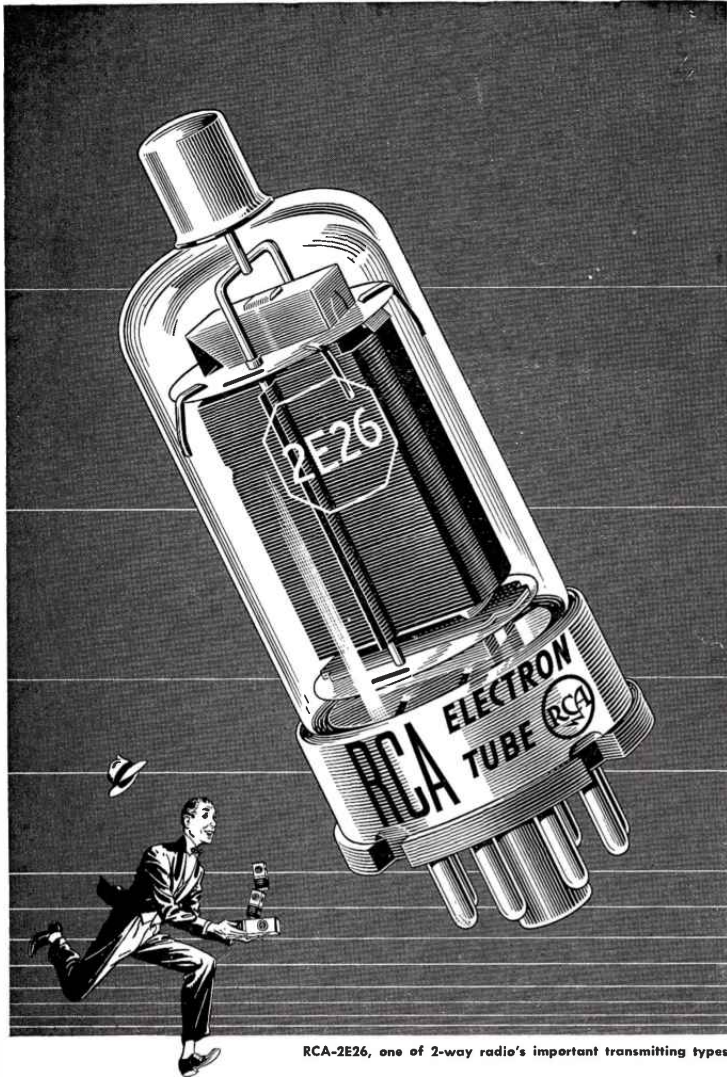
Radio Equipment:

A new catalog of 236 pages, listing 18,000 items, has been issued by Allied Radio Corporation, 833 W. Jackson Boulevard, Chicago 7. Included are equipment for broadcast and communication stations, ranging from replacement tubes and test instruments to patch cords and tower lights. Copies are available without charge.

FM Broadcast Quality:

With orders for FM tuners running far ahead of production schedules, the manufacturers have a new headache. Customers are complaining that their tuners do not give good performance on certain parts of the FM band. Investigation has disclosed that the poor performance comes from particular FM stations, and not the tuners. And the largest number of complaints are coming from Chicago, where listeners say: "My tuner only works well on one or two stations." That raises the question: why doesn't the FCC tighten up on FM stations which are not meeting the Commission's Standards of Good Engineering Practice?

(Continued on page 8)



RCA-2E26, one of 2-way radio's important transmitting types

For best service—buy locally For best tubes, buy RCA

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.



RADIO CORPORATION of AMERICA
ELECTRON TUBES

HARRISON, N. J.

SPOT NEWS NOTES

(Continued from page 6)

Engineering Dept. Expansion:

As the first phase in the expansion of its research and engineering activities, Electro-Voice has built an addition to its laboratories, and has added to its staff Dr. Carl F. Moen, Norman Friedman, Lynn Talbott, James Wendt, Frank James, and John English.

UHF-TV in Connecticut:

Equipment for UHF station WICC-TV at Bridgeport will be supplied by Federal Telecommunication Laboratories. Initial effective radiated power of 20 kw. will be increased subsequently to 200 kw. Tower will be 435 ft. high.

Quartz Crystals:

Forty-five types of crystals for broadcast and communication use are listed in a new catalog available from James Knights Company, Sandwich, Ill.

New FM Receiver:

It isn't official, but you can be reasonably certain of seeing a new model of the famous REL 646-B receiver before very long. Considerable development work has been done on FM circuits, and the 646-C will present some unique design features. It will not have the 10-watt amplifier provided in the 646-B, but the price will be about the same, for it is intended to serve as a standard of FM receiver performance. To that end, it will represent the finest type of commercial design, suitable for monitoring, or for use in laboratory work.

Explosion Hazard:

We'd like to suggest that all operators of mobile radio systems adopt a strict rule against carrying gasoline cans in baggage compartments where transmitters are mounted. We have received another report of an explosion due to the leakage of gasoline, probably from a can tipped over by a sudden stop. In this case, there were two explosions, one when gasoline vapor was ignited by a spark from relay contacts, and a second when the can was heated to the exploding point. The sad part of this case was that it happened in a highway patrol car which carried extra gasoline to help stranded motorists.

Dr. Robert E. Samuelson:

Appointed chief engineer of Motorola's research laboratory at Phoenix, Ariz. Previously, he was head of the communication research section at Phoenix.

WTVR, Richmond:

A 500-watt DuMont installation will be
(Continued on page 9)

SPOT NEWS NOTES

(Continued from page 8)

used by WTVR at its new transmitter location. This will serve as the driver for a 25-kw unit to be delivered later. The new antenna is 1,044 ft. above average terrain. Meanwhile, the original 5-kw. DuMont transmitter, which has been operating continuously since April, 1948, will serve as a spare.

British Industries Fair:

Some 2,500 British manufacturers will have exhibits at this annual affair, to be held in 1953 from April 27 to May 8. Special facilities will be provided for American visitors. Detailed information can be obtained from Hewitt, Ogilvy, Benson & Mather, 575 Madison Avenue, New York 22.

Tetrode for High-Power TV:

Engineering and design data is now available on a new power tetrode from Eitel McCullough, Inc., San Bruno, Calif. This is a 20-kw. radial-beam design, intended for TV transmitters operating on frequencies up to channel 13. A combination of water and air cooling is employed for this tube.

Studio Lighting:

Under an arrangement recently concluded, Kliegl lighting equipment for TV studios can be ordered through the Television Transmitter Division of DuMont Laboratories.

Jacob J. Mucher, 1881-1952:

Jacob Mucher, one of the three brothers who founded the Clarostat Manufacturing Company, passed away at the home of his daughter, Mrs. Gladys Chamberlain, at Dover, N. H., on September 11. Born in Odessa, he came to this country in 1905, founding the Clarostat Company in 1921. He served as treasurer and chief tool designer until his retirement in 1946. He is survived by three sons, George, Victor, and William, and two daughters.

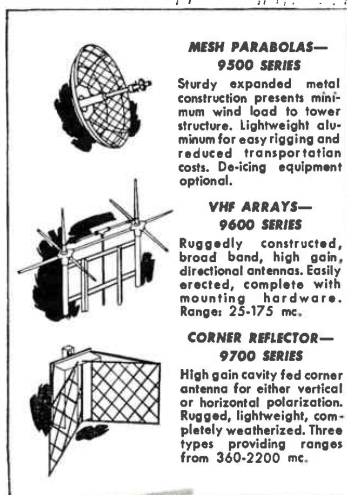
Audio Equipment:

A number of very interesting design features are illustrated in a catalog of audio amplifiers, power supplies, racks, and mounting frames, just released by Cinema Engineering Company, Burbank, Calif. Extremely compact, high performance plug-in units include pre-amplifiers, microphone and line amplifiers, equalizers for magnetic film playback, oscillators for magnetic recorders, and 3 types of power supplies. A bridging amplifier and 50-watt power amplifier for rack mounting are also shown. The plug-in shock-mounted chassis and

(Concluded on page 11)

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Physically Dependable — Electrically Absolute



MESH PARABOLAS— 9500 SERIES

Sturdy expanded metal construction presents minimum wind load to tower structure. Lightweight aluminum for easy rigging and reduced transportation costs. De-icing equipment optional.

VHF ARRAYS— 9600 SERIES

Ruggedly constructed, broad band, high gain, directional antennas. Easily erected, complete with mounting hardware. Range: 25-175 mc.

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High gain cavity fed corner antenna for either vertical or horizontal polarization. Rugged, lightweight, completely weatherized. Three types providing ranges from 360-2200 mc.

TO 2200 MCS

PRODELIN Microwave Antennas are manufactured to meet maximum requirements for physical and electrical service. They operate continuously over difficult terrain regardless of weather or temperature exposure. They are consistently reliable in the most critical services. There is a type for most military and commercial needs at frequencies up to 2200 megacycles.

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307 Bergen Avenue, Kearny, New Jersey

Manufacturers of Antennas, Transmission Lines and Associated System Facilities



True VTVM

FREQUENCY TO 300
MEGACYCLES



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ACCURATELY MEASURES CAPACITANCE

1mmf to 1000 mf

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- Large 9" meter with zero-center scale
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Professional 16mm Sound-On-Film Motion Picture Cameras for Television Newsreels, Commercials and other Television Filming.

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

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DIVISION OF
THE GABRIEL COMPANY

Specialists in
High-Frequency
Antennas



Endicott Street
Norwood, Massachusetts
Norwood 7-3300

SPOT NEWS NOTES

(Continued from page 9)

mounting frames are available separately.

Reminder to Subscribers:

As announced last month, RADIO COMMUNICATION will be split into two bi-monthly publications, effective in January. Your subscription will be completed with either COMMUNICATION ENGINEERING or TV & RADIO ENGINEERING, as you prefer. If you are a subscriber, you should have received already a letter explaining this change, and a postcard on which you can fill in your choice as to which magazine you want us to send you. If you have not mailed your card, please do so now. In case the letter addressed to you has not come to your attention, please advise us so that we can send you a duplicate. If we do not hear from you, your subscription will be completed with COMMUNICATION ENGINEERING.

Portable Oscilloscope:

A lightweight oscilloscope, 9¾ lbs. complete, particularly intended for servicing mobile radio equipment, is being produced by Cossor of England, and imported by Beam Instruments Corporation, 350 Fifth Avenue, New York 1. All necessary circuit controls are provided, yet the case measures only 5½ by 4½ by 11½ ins. The price is \$167.50 in the USA.

TV Transmitters:

Complete specifications on a basic 500-watt TV transmitter and coordinated amplifiers of 5, 10, and 20 kw. are presented in a bulletin issued by Standard Electronics Corporation, 285 Emmett Street, Newark 5, N. J.

MEETINGS and EVENTS

DECEMBER 3-4, IRE CONFERENCE
PROFESSIONAL GROUP ON VEHICULAR COMM.
Hotel Statler, Washington, D. C.

DECEMBER 10-12,

AIEE-IRE-ACM COMPUTER CONFERENCE
Park Sheraton Hotel, N. Y. C.

JANUARY 14-16,

IRE-AIEE MEETING ON HF MEASUREMENTS
Washington, D. C.

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WEST COAST AUDIO FAIR
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APRIL 28 - MAY 1,

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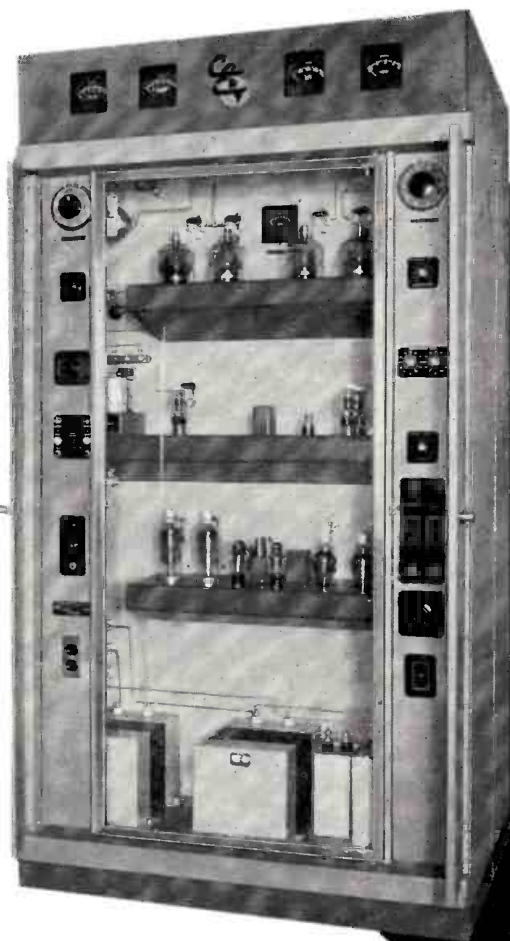
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Complying With the FCC Rules

THIS DISCUSSION, PRESENTED AT THE A. T. A. CONVENTION IN CHICAGO, IS OF INTEREST TO ALL MOBILE RADIO LICENSEES — By CHARLES I. FONGER*

I am going to discuss briefly the matter of FCC Rules governing the taxi radio service, and effects of violating these Rules. It may seem that certain of my remarks are unkindly, but I can assure you that any comments I make will be directed to the best interests of the taxicab companies individually, and as an industry represented by the American Taxicab Association.

As you may know, the Federal Communications Commission was established by an Act of Congress known as the Communications Act of 1934. This was enacted into the law, thereby establishing the Commission and the duties which it is charged to perform, including those related to the licensing and regulation of telecommunication facilities.

A basic consideration geared to each rule and regulation is the collective interests of each industry or user group. Public interest, convenience, and necessity are also paramount considerations.

FCC Staff Engineers:

It may interest you to know that a considerable number of engineers on the Commission's staff, prior to their employment with the FCC, were engaged in engineering work related to the construction and operation of mobile radio facilities under circumstances where they were responsible for the operation of such facilities in accordance with the Commission's Rules.

I mention this to indicate that, although they are presently occupied with duties related to the regulatory functions of the Commission, these staff members are not without experience in the problems of complying with FCC Rules.

Uniform Dispatching Procedure:

In the course of my own experience, I have observed that each new radio-user group undergoes an indoctrination period during the integration of radio communication into their regular procedures. As an example: by trial and error, in many instances over a considerable period of time, the needs and benefits of employing uniform dispatching practices become apparent, and in the end a greater degree of usefulness and faster service are attained from the radio system.

*Land Transportation Engineer, Safety & Special Radio Services Bureau, Federal Communications Commission, Washington, D. C. This text is based on an address at the A.T.A. Convention at Chicago, September 6, 1952.

That is the way it almost always works out in practice, notwithstanding the fact that the FCC Rules set forth a *requirement* that a uniform dispatching procedure shall be employed, and that transmission time shall be limited to the minimum. Dispatching handled in any other way constitutes a violation.

It is important to note that, without exception, the companies which have achieved a high degree of efficiency in their use of radio dispatching facilities are those which maintain very strict dispatching procedures. And they recognize the necessity of holding transmission time down to absolute minimum, as indicated by the fact that they are presently handling between 4,000 and 5,000 calls daily. Their dispatching procedures, and methods of handling incoming calls are highly refined, and the slightest departure from established practice would result in a serious disruption of their entire operations.

I would like to make reference to the railroad industry, to illustrate a point regarding the regulation and supervision of operations. This industry is accustomed to functioning in all phases of its operations under detailed instructions and close supervision. However minor the particular operation may be, it is carried out under specific, written instructions.

Thus the railroads, on an industry-wide basis, have had long experience in conducting their operations in accordance with firmly-established practices, and even if a particular function seems to be relatively unimportant, no departure from the rules is permitted. This general pattern has carried over, and has been maintained, in their use of radio communication facilities.

A contributing factor would appear to be the fact that the railroads function industry-wide as an integrated activity with respect to their overall operations. In contrast, the taxicab industry is composed mainly of a great number of operators functioning quite independently of one another. Your American Taxicab Association, however, serves as a clearing house to which you can submit your problems, including those which stem from your use of radio communication facilities, and as a means of solving these problems on an industry-wide basis.

Mr. Jeremiah Courtney, in his capacity as counsel for the A. T. A., has prepared and has made available a consider-

able amount of helpful material¹ for the express purpose of acquainting Association members with the requirements of the Commission Rules, insofar as they relate to the use of radio in the taxicab service.

Revocation of Licenses:

I would like to discuss briefly the matter of license revocations in the taxicab radio service. Since mid-'50, several licenses in this service have been revoked. I am certain that, were you acquainted with the factors in each case, you would agree that the licensees, by their own actions, left no alternative to the FCC.

When it is brought to the attention of the Commission that a station is being operated in violation of one or more of the Commission's Rules, the Field Office directs an Official Notice to the licensee. This Notice sets forth the particular section of the Rules involved and, further, states in detail the nature of the violation.

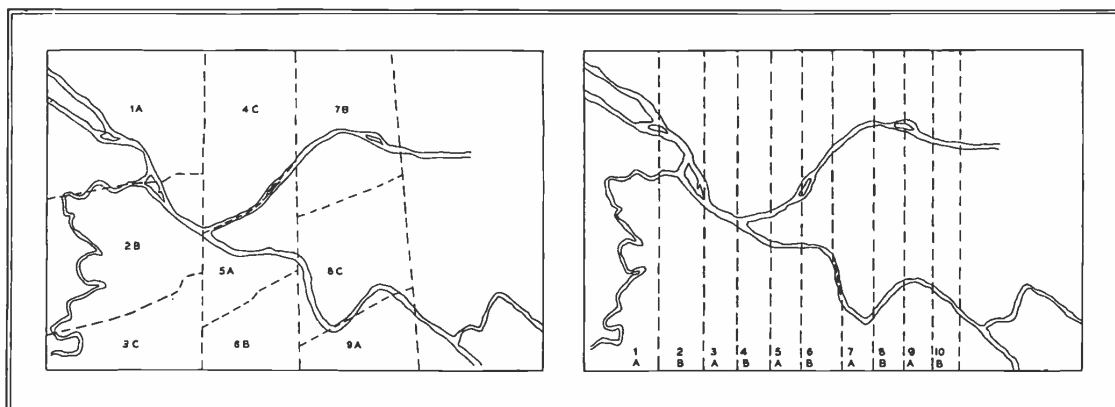
Although the Rules require that a written *answer* be made within three days from receipt of the Notice to the Office originating it, the Rules further provide that an *acknowledgment* within three days will be considered satisfactory in those cases where the licensee is unable to prepare a complete reply within three days.

Such an acknowledgment should state that an answer will be made at the earliest practicable date, and that the answer will set forth the steps taken to prevent a recurrence of improper operation. The initial violation has seldom been the basis for revoking a license, and most commonly the violation is of a minor nature. In those cases where illness or other unavoidable circumstance does not permit an answer or acknowledgment within three days, the Rules provide further that answer or acknowledgment be made at the earliest practicable date with a satisfactory explanation for the delay.

However, failure to either reply or to acknowledge receipt of an Official Notice is in itself a violation of the Rules. In those cases where a licensee fails to respond to a Notice, a second Notice is sent 15 days from the date of mailing the original Notice. Although this is a general practice, it should be noted that

(Continued on page 26)

¹Available from the American Taxicab Association.



FIGS. 1 AND 2. PLANS FOR DIVIDING A GIVEN TOPOGRAPHICAL AREA FOR 10 DISPATCHING CHANNELS USING 3 AND 2 FREQUENCIES, RESPECTIVELY

Dispatching for Large Taxi Fleets

FOUR BASIC DISPATCHING SYSTEMS WHICH MAKE PRACTICAL THE USE OF RADIO BY LARGE TAXICAB FLEETS — *By A. VALLARINO AND S. W. LEWINTER**

THE shortage of radio-frequency channels has been one of the major impediments to the application of radio dispatching for large taxicab fleet operations. There is an upper limit to the number of taxicabs that can be handled as a group on one radio channel. The exact number depends on the type of control used in the system.

In order to use radio successfully with a large taxicab fleet, the communication load must be divided into noninterfering groups. If the division is attempted by assignment of separate frequencies to each group, then the number of frequencies required usually exceeds the number presently assigned to taxicab radio service by the FCC. Methods of dividing the communication load of a single radio channel on a geographic basis by means of directional antennas are known. These are never entirely satisfactory, since the directivity patterns that can be obtained are never sharp or stable enough, and interference in boundary regions is inevitable. Moreover, reflections from neighboring objects aggravate this interference.

This paper describes methods of frequency and space allocations with which a taxicab fleet of any size can be served by an interference-free radio system, using not more than four radio channels. In most cases only three channels are required and, in many cases, two are adequate. These solutions are practical from both technical and economic standpoints. It is believed that the methods

described are of fundamental importance and of sufficient generality to be of value in dealing with the communication problems of any large taxicab company.

Typical Operation:

At the present time, radio is used mostly by taxicab companies having fleets of fewer than 125 cabs. Beyond that point, the difficulties of dispatching cabs by radio multiply rapidly. The technical problems posed by these larger operations center about the dispatcher's capacity to retain large amounts of continually-changing information, and on the shortage of radio channel space allocated to the taxicab industry.

A description of the operating methods of a typical small radio-controlled taxicab fleet will show why it is not possible to extrapolate directly to obtain operating procedures for the larger fleet operators.

This company operates, let us say, a fleet of 50 radio-controlled cabs. The dispatching is handled by two operators using a single radio-frequency channel. One operator receives incoming telephone requests for taxis and relays the information on slips of paper to the radio operator. The radio dispatcher calls the vacant cab that is closest to the location of the pickup, and records the information on a slip of paper of another color. Both slips are filed on a board which contains numbered receptacles corresponding to the cab numbers. These slips are a record of the position and status of every cab in the fleet. The number of cabs that can be handled with this system is limited by the ability of the dispatcher to avoid a nervous breakdown

on rainy days when everyone wants a cab. Either human or channel load capacity, or a combination of both, limits the extension of such a system to fleets of several hundred cabs.

Large-System Needs:

A radio communication system to meet the needs of a metropolitan cab company of 350 cabs will be outlined. The experience of several taxicab operators using radio systems in which the detailed movements of the fleet are controlled will be used in planning the system.

Under normal traffic conditions, one unassisted dispatcher is capable of controlling a maximum of about 70 cabs. At the busiest times, this number shrinks to about 35 cabs. If the dispatchers work independently, each assigned to a sector having approximately the same number of cabs, ten dispatchers and ten channels will be required to handle peak loads. The term *channels* as used here does not necessarily mean ten two-way frequencies. A channel is any device by which calls from base stations to mobile units and mobile units to base stations can be segregated into mutually non-interfering groups. In considering the general problem of radio dispatching to taxicabs, channels can be obtained either by frequency or space allocation, the latter to be accomplished by directive antennas. Combinations of the two methods are often the most practical solutions to the channel problem. In any of these methods, ten channels require ten base-station installations.

System Development:

The radio communication load for the

*Federal Telecommunication Laboratories, Inc., Nutley, N. J. This paper was given before the AIEE 1952 Winter General Meeting and appeared also in *Electrical Engineering*.

example given must be divided into ten approximately equal parts in order to permit handling the necessary volume of messages. One way of accomplishing this is by frequency allocation, transmitting over the entire city from ten base stations on ten frequencies, and one-tenth the cabs receiving any given frequency. To divide the incoming messages, ten cab transmitting frequencies are needed, with ten receivers used at the base station. In calling a given cab, the dispatcher must transmit at the frequency to which the receiver in that cab is tuned, and he must expect an answer from the proper base-station receiver. This method is impractical since it requires ten duplex channels, more than the total number presently assigned to the taxicab radio service.

The other extreme in dividing the communication load is by space allocation. One duplex channel is used, with the city divided into ten areas in which the volume of cab business is approximately equal. By the use of selected transmitting sites and directional antennas, an attempt is made to restrict the coverage of each base station to the assigned area. The same antennas are used to receive the taxicab transmissions. By this means, and also by restricting the power radiated by the cabs to as small a value as is consistent with reliable operation, the messages from the cabs are divided into ten groups. This method always results in a certain amount of interference in the boundary zones between areas. The directive patterns of the antennas cannot be made sharp enough to prevent overlap; moreover, there are reflections from buildings and other topographical features that produce interference zones.

A combination of frequency and space allocation can result in a system which

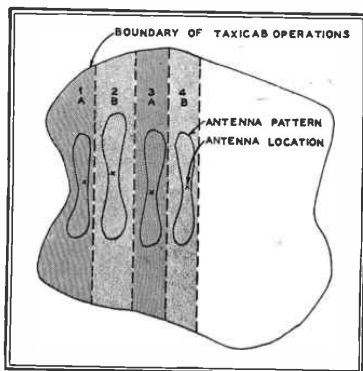


FIG. 3. STRIP PATTERN FOR 2-FREQUENCY PLAN

is efficient in the use of radio-frequency channels and yet does not create zones in which the transmissions from the various areas interfere with each other. The region served by the taxicab company is divided into ten areas. Each area has a

base-station transmitter, and antenna pattern and power are adjusted to confine the radiation into that area with a small amount of overlap into adjacent areas. The base stations in adjacent areas transmit on different frequencies, and these stations are designed also to cover their areas plus some overlap. A mobile receiver in the boundary zone between adjacent areas can receive either base station, *but they will be received on different frequencies*. The cab receiver and transmitter must be designed for multichannel operation, so that the driver merely flips a switch the moment he crosses the boundary line.

Each base station contains also a receiver tuned to the channel used by the taxicab transmitters when they are in that area. The base receivers are connected to the same antennas as the base transmitters through an antenna relay, or they are permanently connected to separate antennas having the same directive properties.

The boundaries between areas are marked off on a map and the drivers can be required to memorize the boundary locations. A driver crossing an area boundary would notify his dispatcher and then switch over to his new frequency. The dispatcher would then transfer his number to the dispatcher for the new area. Two examples of this combination system are shown in Figs. 1 and 2. In these diagrams, area sectors are shown by numbers and radio channels by letters. Fig. 1 is a coverage system utilizing 3 frequency groups; Fig. 2 shows the same terrain divided for 2-frequency operation.

There remains the problem of setting up the areas in specific cases and determining how many frequency channels are required. The frequencies used by the base stations in any two areas having a common boundary must be different. The area boundaries must be drawn in such a way that the number of frequencies required is the minimum possible.

Fortunately, no more than four frequencies are ever needed for division of any city into areas of any desired size and shape. Perhaps four frequencies is the answer to very large cities such as New York and Chicago, if a taxicab operator of a major fleet wishes to provide a radio call service over the entire region. However, in most situations, only two or three frequencies are needed if the geometric layout of the areas is properly made. There are two basic patterns employing two frequencies. In one pattern, Fig. 3, the city is divided into a series of trapezoidal strips, with alternate strips using the same frequency. The base station is located at the approximate center of each strip. The second two-frequency pattern is the modi-

fied rectangular grid of Fig. 4. Adjacent boxes employ different frequencies. Some interference can be expected in corner regions, since the fields must overlap to some extent. Nevertheless, it may sometimes be possible to use this kind of pattern by varying the size and shape of the boxes so that the corners are placed at natural barriers. Fig. 4 shows how this can be done.

Where corner interference cannot be tolerated, the three-frequency pattern of

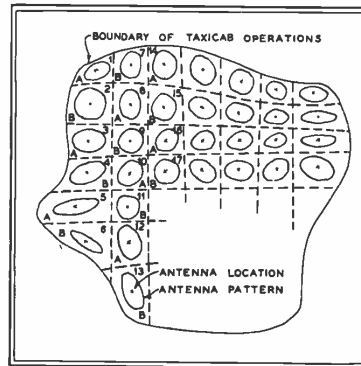


FIG. 4. TWO-FREQUENCY CHECKERBOARD SYSTEM

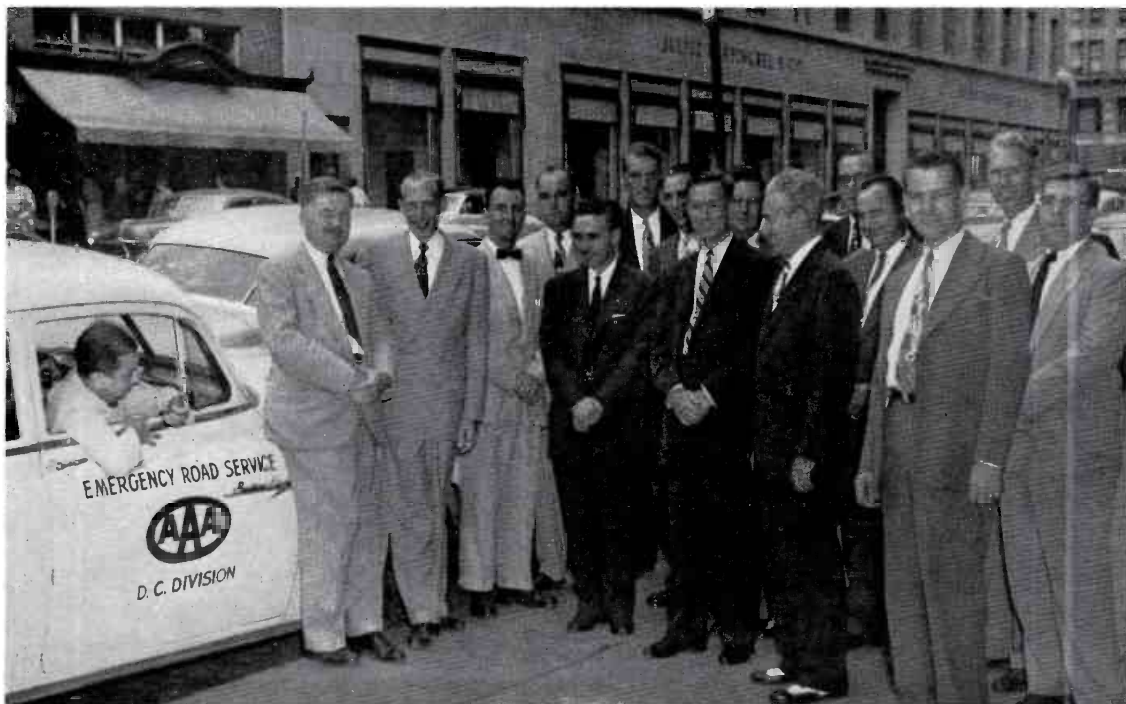
Fig. 5 can be used. The basic pattern resembles an arrangement of bricks in a wall, but this can be modified as is shown in the illustration. A second three-frequency method is shown in Fig. 6. Here the pattern resembles the spokes of a wheel with alternate sectors being assigned the same frequencies, and the hub assigned the third frequency.

Four basic patterns of area and frequency allocations have been shown. In designing a radio dispatching system for a specific case, the choice from among the four patterns will be determined by local factors. Some of these are:

- 1) Street layout and traffic flow pattern.
- 2) Topography, including hills, cliffs, tall buildings, and open spaces such as rivers and parks.
- 3) Availability of base-station sites.
- 4) Number of radio-frequency channels available.
- 5) Comparative costs.

As an example of the advantages and disadvantages of a particular pattern, consider the radial pattern with the central hub. A centralized location for the base stations and antennas is required. This raises certain technical problems. The distances to be covered along the radii are much greater than the distances in a plan using decentralized base stations. Dead spots and distortion of the sector shapes by reflections from cliffs and tall buildings must be avoided. Care must be taken to minimize the directive antenna secondary-lobe interference, which can be expected.

(Concluded on page 26)



THESE SMILES ARE WARRANTED BY THE OUTSTANDING SUCCESS OF THE 450-MC. 2-WAY FM EQUIPMENT BEING TESTED BY THE AAA IN WASHINGTON, D. C.

Communication News

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

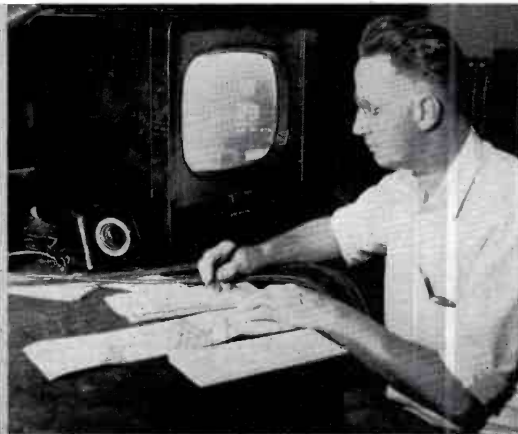
DICK Tracy and RCA are introducing industrial television to services which are large users of radio communication equipment. At this time of writing the former has a small TV camera hidden in the ceiling of Newsuit Nan's apartment to keep an eye on her activities. The latter has been demonstrating the use of the tiny Vidicon camera tube for checking freight cars in the Baltimore

& Ohio yard at Chicago. Perhaps that is where Dick Tracy got the idea, for the miniature camera illustrated here is no larger than a 16 mm. home movie type, and can take whatever lens is required for a specific application. An 18-conductor cable runs to a small case which contains the monitor, power supply, and control circuits. Operating on 115 volts, 50 or 60 cycles, the total power consump-

tion is 230 watts. Clear images of 525 lines are obtained under average daylight conditions. An idea of the simplicity of the equipment can be gained from the fact that the camera contains only 2 tubes in addition to the Vidicon, with 20 additional tubes in the associated unit. Microwave transmission can be used if the system is to be operated at a distance that is too great for the cable connection.

450-Mc. Installation:

Initial tests of the 450-mc. system installed by the American Automobile Association at Washington, D. C. are attracting considerable attention from communication engineers and the FCC. The

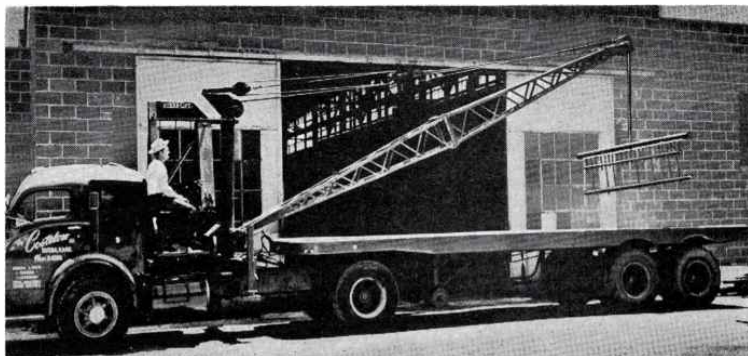


INDUSTRIAL TV EQUIPMENT IS ADAPTABLE TO AN INFINITE VARIETY OF APPLICATIONS, CENTRALIZING CONTROL AND DECREASING MANPOWER EXPENSES

20-watt Motorola base transmitter is located on the roof of the Skyline Tower Building at Wisconsin and Massachusetts Avenues, a location somewhat higher than average terrain in the northwest part of the City. The building is 100 ft. high, and the antenna, with a power gain of 8 db., is mounted on a 20-ft. pipe. The mobile transmitter used in the tests, also of 20 watts output, works into a quarter-wave rooftop antenna of conventional design. For purposes of comparison, the 35.7-mc. equipment which the AAA has been using was left in the test car.

It is reported that 2-way communication on 450 mc. was maintained throughout northwest Washington, Bethesda, and into Rockville, Md. Along the steep banks of the Potomac River, and across Chain Bridge to Tyson's Corner and Falls Church, Va., no dead spots have been noted. Even three floors under ground, in the sub basement of the Kennedy-Warren Apartment Hotel, there is no difficulty on 450 mc. Principal difference between 450 and 35-mc. communication was the absence of ignition interference on 450 mc. in some of the suburban locations.

The accompanying photograph was taken during one of the tests. Douglas Anello, of the FCC's Industry & Com-



pany; and Robert Tall, Mobile Safety Radio.

Radio at the World Series:

One of the accompanying illustrations shows the set up used by International News Photo for taking pictures at Ebbetts Field during the World Series. Using 2-way portables for communication, managing editor Ed Stein, located under the stands where a darkroom had been set up, talked with the men who operated cameras with Big Bertha lenses aimed at first base and third base. Although the managing editor could not see the field, he was able to order shots by watching the plays over television. As

quate power levels, and is capable of transmitting a band up to 135 kc. Fewer channels can be used for a narrower band width. The frequency division, single sideband method of operations facilitates dropping or inserting channels at intermediate points in a relay system.

The channels are spaced at 5-kc. intervals, since the problem of channel coordination with wire-line carrier operation is not involved in straight radio operation. Frequencies up to 135 kc. or up to 150 kc. can be used. Each channel includes a speech band of 300 to 3,400 cycles, with provisions for out-of-band signaling at 3.9 kc.

(Concluded on page 24)



ABOVE: HERE IS AN INGENIOUS RIG FOR TRANSPORTING AND ERECTING ANTENNA TOWERS. THE UNIT IS IN USE CONSTANTLY

LEFT: INS SETUP FOR TAKING PICTURES DURING WORLD SERIES. PHOTOGRAPHERS WERE DIRECTED BY EDITOR VIA 2-WAY PORTABLE

RIGHT: A VERSATILE LINE OF MULTIPLEXING EQUIPMENT FOR RADIO CARRIERS PERMITS ADDING CHANNELS AS NEED ARISES

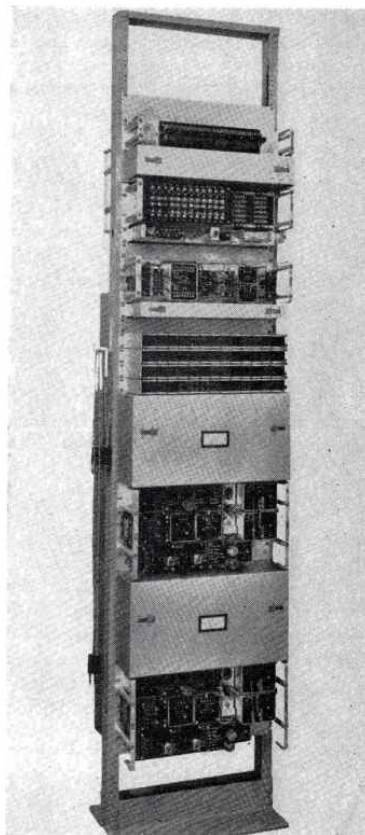
merce Division of the Safety and Special Services Bureau is seated in the car. Standing, are Col. Edwin White, Chief, Safety and Special Services Bureau; Harris Robinson, Motorola's regional manager; Wilson Switzer of Radio Communications Service; Leverne Johnson, Washington division manager of the AAA; Fred Roberts of Phelps-Robert Corp.; Gus Preno, manager of emergency road service, AAA Philadelphia division; Jeremiah Courtney, Washington attorney; William Watkins, FCC Safety & Special Services; James Reardon, Director, AAA National Automotive Service; Ken Graham of Motorola; James Simon, assistant manager of emergency road service, Washington division; Fred Shaw and W. E. Darnell, Pennsylvania Bell Telephone

fast as pictures were developed and printed in the darkroom, captions were written and the pictures were transmitted by facsimile to newspapers all over the Country which subscribe to INP service. It seems as if there is no end to new uses for radio communication.

Radio Carrier System:

Very flexible equipment for multiplex radio circuits has been developed by Lenkurt Electric Company, San Carlos, Calif. The equipment illustrated employs frequency division to obtain three groups of 8 broad-band voice channels. A single group can be installed initially, and others added as the traffic load increases.

A 24-channel system can be used with any radio installation which has ade-



PATTERN FOR TV PROFIT

PART 4 CONCLUDED — BRIDGE AND NOTCH DIPLEXERS — GUYED AND SELF-SUPPORTING TOWERS — COAXIAL TRANSMISSION LINES AND UHF WAVEGUIDE

By Roy F. Allison, in collaboration with A. B. Chamberlain, Rodney D. Chipp, Raymond F. Guy, Thomas E. Howard, and Frank L. Marx*

DIPLEXERS

Since two distinct transmitters are actually involved in a television "transmitter," as has been explained, two separate antennas are required or some means must be provided to combine the aural and visual transmitter outputs for common feed to a single antenna. For obvious reasons of economy, the latter is utilized except for very unusual circumstances. The combination must be achieved without interaction between the two transmitters. Each must be terminated properly and, at the same time, feed a common load while remaining completely isolated from the other. A diplexer is used to accomplish this isolation-combination task.

Diplexers are of two basic types: bridge diplexers, which feed the output power equally to two transmission lines; and notch diplexers, which have a single output for feeding only one line to the antenna.

Bridge diplexers are more common, especially for VHF, than the notch type. It is the simpler of the two and can be used with any antenna having two equal input circuits, such as turnstile antennas. The bridge diplexer, together with the two transmission lines and the two halves of the antenna, form a Wheatstone bridge circuit. The visual transmitter is fed across one diagonal of the bridge and the aural transmitter across the other diagonal. Since no tuned traps or tank circuits are involved, the power loss in a bridge diplexer is very small, on the order of .5%. The power handling capacity is correspondingly high.

A notch diplexer, on the other hand, consists of two bridge units connected back to back, with tuned traps for isolation purposes. The insertion loss of a notch diplexer may be as high as 2% for the visual power and 10% for the aural power. For that reason, these units have definite power-handling limits, and may require blowers for forced-air cooling. Most notch diplexers are constructed of sections of transmission line

which, at VHF frequencies, may take up considerable space. They are usually custom-designed for mounting next to the ceiling, in order to permit connections to the transmitters to be made as short as possible.

Notch diplexers are used for two applications, as follows:

1) For antennas which require single feed lines. It is impossible to use a bridge diplexer in such a case, since its operation depends on the utilization of two halves of the antenna as bridge arms.

2) For split-feed antennas located so far from the transmitter that a dual transmission-line run is economically impractical. This is discussed in greater detail in the following sections.

TOWERS

It has been demonstrated many times that antenna height is a deciding factor in both radius and solidity of coverage. Increases in ERP improve a station's signal strength within its line-of-sight area, but have very little effect on the size of the area. Only by increasing antenna height can a really significant gain in actual coverage be obtained. Also, the effects of propagation shadows and reflections due to high buildings and terrain are decreased. Subject to restrictions imposed by antenna gain considerations, as concerns close-in coverage, and by the transmission line loss, it can be stated emphatically that the higher a TV transmitting antenna, the better.

Tower Characteristics:

Antenna towers are classified as guyed and self-supporting types.³ Self-supporting towers are ordinarily very wide at the base and have pronounced tapers toward the top, since the tower structure itself must bear not only its own weight and that of the antenna, but the bending moment of the wind load as well, which may be tremendous for high towers. A typical self-supporting tower can be seen in Fig. 16.

Fig. 16 shows very well the primary advantage of self-supporting towers — they occupy relatively little space in comparison to guyed towers of the same height. Therefore, they can often be used at locations where land for a guyed tower is unavailable or prohibitive in cost. However, they are much more expensive than guyed towers. The difference in cost ranges from roughly 50% for low towers to 100% for moderately high towers. Towers of greater height than about 600 ft. are virtually never self-supporting, because of the cost.

Guyed towers, as can be seen in Fig. 17, have little or no taper and are often constructed so as to have a single bearing surface at the bottom. Rigidity is imparted by 3, 4, or even more sets of guy lines attached at various elevations. Usually 3 lines are attached at each elevation, spaced at 120° intervals around

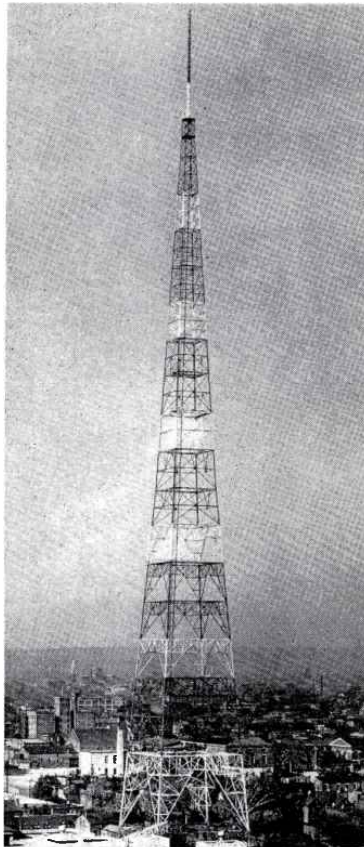


FIG. 16. SELF-SUPPORTING TV ANTENNA TOWER

*Collaborators are, respectively: Chief Engineer, CBS Television, New York; Director of Engineering, DuMont Television Network, New York; Manager, Radio and Allocations Engineering, NBC, New York; Chief Engineer, WPIX, New York; and Vice President in charge of Engineering, ABC, New York.

³See "Radio Towers, Masts, and Aerial Systems," published by British Insulated Calendars Construction Company, Ltd.

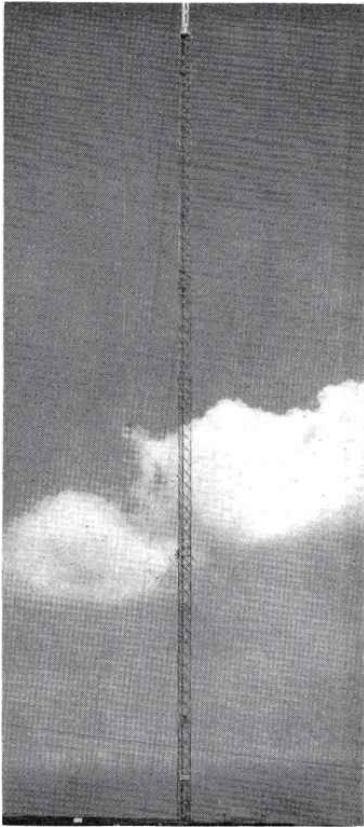


FIG. 17. GUYED TOWERS NEED PLENTY OF SPACE

the tower. Common practice is to anchor all guy wires attached to the same side of the tower at one place on the ground, so that 3 anchors are employed, spaced equidistant from the tower base and at 120° radially from each other.

It has been pointed out that guyed towers are less expensive to construct than self-supporting types. They can also be built much higher. Although the highest guyed tower now in use for television broadcasting is slightly over 1,000 ft., it is the consensus of opinion that the practical upper limit is 2,000 ft. or more. Finally, they require much more land than a self-supporting tower. While the actual land areas required for towers of the same height vary somewhat according to design, for estimating purposes the distance from the tower base to the guy foundations is about .7 times the tower height. Thus, for a 700-ft. guyed tower, the minimum land required would be a triangular-shaped plot 490 ft. on each side.

If land is not available for erection of a guyed tower, one of the self-supporting type must be used. If, on the other hand, land is available then the station builder must still consider both possibilities, because the cost of a guyed tower plus that of the land may total more than the cost of a self-supporting tower

of the same height. Even then, the most economical choice may not be permitted by local civic regulations.

Towers are designed usually to conform with RTMA specification TR-116. According to this recommendation, a tower must be able to withstand a wind pressure of 20 lbs. per sq. ft. if it is 600 ft. high or less and is located in a non-congested area. Towers in congested areas, and all towers over 600 ft. high, should be designed to withstand at least 30 lbs. per sq. ft. Although not specified, it would probably be wise to design towers of 1,000 ft. or more for 40 lbs. per sq. ft. In any case, towers over 1,000 ft. should be analyzed individually to determine proper design procedure in each case.

Wind pressure cannot be related accurately to wind velocity, because of indeterminate factors such as turbulence and changes in wind velocity and density at various heights. However, the formula $P = .004V^2$ has been used as a nominal relationship for approximations, where P is the pressure in lbs. per sq. ft. on a flat surface, and V is wind velocity in miles per hour. Using this formula, and assuming a design safety factor of 1.85 based on the yield point of the structural material, the ultimate wind velocity a 20-lbs.-per.-sq.-ft. tower could withstand is about 100 mph.: for 30 lbs. per sq. ft., about 120 mph.

Rigidity and resistance to sway under severe wind loads are important for any tower to be used with high-gain antennas. Some manufacturers state that guyed towers exclusively should be used to support UHF antennas, although others assure that properly-designed towers of either type can be kept within the required deflection limits.

Costs:

As with many other costs involved in

TV station construction, the costs of towers cannot be given on a general but only on a typical basis, because of the many variable factors affecting such costs. Thus, the table below should be taken as representing neither maximum nor minimum figures, between which there may be a wide range, but approximately average costs for towers of the stated heights. Figures are not given for self-supporting towers above 600 ft. because of the extremely unfavorable comparison with the guyed-tower type.

TOWER COSTS		
HEIGHT, FT.	SELF-SUP.	GUYED
400	\$38,000	\$28,000
500	43,000	43,000
600	98,000	57,000
700	72,000
800	90,000
1,000	130,000

Manufacturers of antenna towers for television broadcasting include the following:

American Bridge Division, United States Steel Company, 525 William Penn Place, Pittsburgh 50, Pa.

Blaw-Knox Division, Blaw-Knox Company, P. O. Box 1198, Pittsburgh 30, Pa.

Ideco Division, Dresser Equipment Company, 875 Michigan Avenue, Columbus 8, Ohio.

Lehigh Structural Steel Company, 17 Battery Place, New York 4, N. Y.

LaPointe Plascomold Corp., Rockville, Conn.

Lingo & Son, Inc., 28th Street & Buren, Camden, N. J.

Stainless, Inc., 50 Church St., N. Y. City.

Truscon Steel Company, Youngstown 1, Ohio.

Wincharger Corporation, 7th & Division Streets, Sioux City, Iowa.

TRANSMISSION LINES

Transmission lines for television use are
(Continued on page 22)

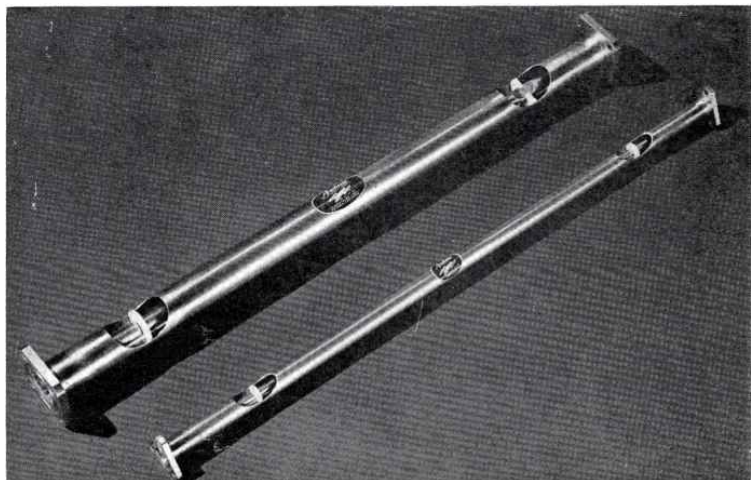


FIG. 18. RIGID COAXIAL AIR-DIELECTRIC TRANSMISSION LINES, USED IN MOST TV INSTALLATIONS

RECEIVER						TRANSMITTER					
2ND MIX.	LO IF	LIMS.	DISC.	SQ. & AUDIO	AF OUT	SPCH. AMP.	OSC.	MOD.	MULTS.	LIMS.	OUTPUT
1/2 12AT7*	6BH6 412AX7*	216BH6	6AL5*	212AX7*			6AH6		6AH6 6AQ5* 2E26		829B's or 2E26's
6BH6 6BH6	216BH6 216BH6	216BH6 216BH6	6AL5* 6AL5*	6AQ6 6BH6 6AQ6 6BH6	6AQ5* 6AQ5*	12AX7* 12AX7*	1/2 12AX7* 1/2 12AX7*	1/2 12AX7* 1/2 12AX7*	216BH6 5763 216BH6 5763 6AK6	6AL5* 6AL5*	6146 6146
12AW6 12AW6	212AW6 212AW6	212AW6 212AW6	12AL5 12AL5	6AQ6 12AW6 6AQ6 12AW6	6AK6 6AK6	12AX7* 12AX7*	1/2 12AX7* 1/2 12AX7*	1/2 12AX7* 1/2 12AX7*	216BH6 6AQ5* 216BH6 216AK6	6AL5* 6AL5*	2E26 2E26
6EB6	216CB6	6J6	6AL5*	6AQ6 6J6	6AQ5*		1/2 12AT7*	1/2 12AT7*	1/2 12AT7* 315B12	1/2 12AT7*	215812
1/2 12AT7*	316BH6	316BH6	6AL5*	212AX7*	6V6	6BH6 1/2 12AU7*	6AK6	1/2 12AU7*	6AH6 2E26 216AQ5*	12AX7* 6AQ5*	829B
6BE6	216CB6	216CB6	6AL5*	6AQ6 12AT7*	6AQ5*	12AX7* 12AT7*	5763	5763	415763 2E26	6AL5*	829B
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6*	1/2 12AU7*	1/2 12AU7* 6BH6 6AQ5*	12AX7*	807 or 21807
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6*	1/2 12AU7*	1/2 12AU7* 216BH6 316BJ6*	12AX7*	807 or 21807
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6	6C4*	216BH6 316BJ6*	12AX7*	6AK6 or 2E26
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6	6C4*	5763 216BJ6*	12AX7*	829B or 212E26
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6*	1/2 12AU7*	1/2 12AU7* 5763 2E26 1/2 12AU7*	12AX7*	21807 21807
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6*	1/2 12AU7*	1/2 12AU7* 6BH6 6AQ5*	12AX7*	21807 & 214D21/4-125A
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6*	1/2 12AU7*	1/2 12AU7* 6BH6 6AQ5*	12AX7*	21807 & 214-1000A 829B
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AX7*	6AQ5*		6BJ6	6C4*	1/2 12AU7* 6BH6 216AQ5*	1/2 12AX7*	829B
1/2 12AT7*	6BH6	216BH6	6AQ7	6AL5* 12AT7*	6AQ5*		6BJ6	6C4*	216BJ6* 5763 2E26 216BJ6*	12AX7*	829B & 214D21/4-125A
6BH6 6SS7	6BH6 6SJ7	6BH6 6SJ7	6AL5* 6H6	6BH6 6AQ6 216S27	6V6GT 6G6G		6AK6 3A4	Direct Direct	416AK6 313A4	6AK6 3A4	6146 21HY69 or 21HY-1269 21807
6SK7*	6SJ7	6SJ7	6H6	216SQ7	6K6G		6V6GT	216V6GT	316V6GT	6V6GT	807 4-250A 2E26 2E26
6BH6 6BH6	6BH6 6BH6	6BH6 6BH6	6AL5* 6AL5*	6BH6 6AQ6 6BH6 6AQ6	6V6GT 6V6GT		6AK6 6AK6 6AK6	Direct Direct Direct	416AK6 6AK6 5763 316AK6 2E26	6AK6 6AK6 6AK6	214-65A or 214-125A
6BH6	416BH6	6BH6 6BJ6*	6AL5*	6BH6 6AL5* 12AX7* or 12AT7*	6AQ5*	12AX7* or 12AT7*	6AK6	7V7	7V7 2E26 217C5	6AL5*	212E26 or 829B
1/2 12AT7*	316CB6	12AT7*	6AL5*	2112AT7*	6AQ5*	12AX7* or 12AT7*	6AK6	7V7	7V7 2E26 217C5	6AL5*	212E26 or 829B 2E26
1/2 12AT7*	316CB6	12AT7*	6AL5*	2112AT7*	6AQ5*	12AX7* or 12AT7*	6AK6	6AU6*	6AK6 2E26 216AU6	6BG7	2E26
6BH6	416BH6	6BH6 6BJ6*	6AL5*	6BH6 6AL5* 12AX7* or 12AT7*	6AQ5*	12AX7* or 12AT7* (some)	6AK6	7V7	7V7 2E26 217C5	6AL5*	212E26 or 829B
1/2 12AT7*	316CB6	12AT7*	6AL5*	2112AT7*	6AQ5*	12AX7* or 12AT7*	6AK6	7V7	7V7 2E26 217C5	6AL5*	212E26 or 829B
6BH6	416BH6	6BH6 6BJ6*	6AL5*	6BH6 6AL5* 12AX7* or 12AT7*	6AQ5*	12AX7* or 12AT7* (some)	6AK6	7V7	7V7 2E26 217C5	6AL5*	212E26 or 829B
6CB6	416BH6	6BH6 6BJ6*	6BG7	6BH6 6BG7 12AX7* or 12AT7*	6AK6	12AX7* or 12AT7*	6AK6	6AU6*	6AK6 2E26 216AU6*	6BG7	2E26
1/2 12AT7*	316CB6	12AT7*	6AL5*	2112AT7*	6AQ5*	12AX7* or 12AT7*	6AK6	6AU6*	6AK6 2E26 216AU6*	6BG7	2E26
6BH6	416BH6	6BH6 6BJ6*	6AL5*	6BH6 6AL5* 12AX7*	6AQ5*	12AX7*	6AK5*	7V7	7V7 2E26 217C5	6AL5*	829B
6BH6	316BH6	6BH6 6BJ6*	6AL5*	6BH6 6AL5* 12AT7*	6AQ5*	12AX7*	12AT7*	6CB6	6CB6 5763 2E26 2C39A	6AL5*	2C39A
6BH6 6BH6	416BH6 416BH6	216BH6 216BH6	6AL5* 6AL5*	212AX7* 212AX7*	6AQ5* 6AQ5*		1/2 12AX7* 1/2 12AX7*	1/2 12AX7* 1/2 12AX7*	216BH6 216AK6 6AK6 6AQ5*	6AL5* 6AL5*	6AQ5* 215516 5516
control-1AD4		CK5678	crystal	31CK5678	3V4		1U4	1U4	216BH6 41U4	crystal	3V4 3A5
6BH6	416BH6	216BH6	6AL5*	6BH6 6AL5* 12AX7*	6AQ5*	12AU7* 12AX7*	1/2 12AX7*	1/2 12AX7*	6AQ5* 5763 316BH6	6AL5*	832A
6BH6	416BH6	216BH6	6AL5*	6BH6 6AL5* 12AX7*	6AQ5*	12AU7* 12AX7*	1/2 12AX7*	1/2 12AX7*	6AQ5* 5763 316BH6	6AL5*	832A or 829B
6AU6*	216AU6*	1N34A 216AU6*	6AL5*	12AT7* 12AX7*	6V6	12AX7*	6AU6*	12AU7*	6AU7 5763 2E26	12AX7*	212E26

Transmitter: 6C4*, 6AL5*, 6X8, 11/2 12AU7*, 12AX7*, 5763, 6146

1116BH6, 216C4*, 12AU7*, 212AX7*, 5763, 807.
 1016BH6, 216C4*, 12AU7*, 212AX7*, 5763, 21807
 Transmitter: 316BH6, 6AQ5*, 212AU7*, 12AX7*, 5763, 21807. Rectifiers: 5Y3GT*, 215R4GY.
 ter-516BH6, 6AQ5*, 212E26, 12AX7*, 024A or CK-1024
 6AL5* 2-6J6, 212AU7*, 212AX7*, 215763, 312E26
 6AQ5*. Transmitter: 212AU7*, 6BH6, 215763, 12AX7*, 216CB6, 2E26, 829B. Rectifiers: 5Y3GT*, 215R4GY

PATTERN FOR TV PROFIT

(Continued from page 19)

made up almost invariably of rigid coaxial cable, Fig. 18, which is manufactured in 20-ft. sections. Standard pre-fabricated elbows, expansion joints, and hangers are available for assembling these sections.

Flange-type couplings fitted with gaskets are utilized, so that an air-tight seal is obtained at each joint. When used inside heated buildings, the line is normally not pressurized. For the run between diplexer and antenna, however, the line is filled with dry air or nitrogen and a relative pressure of about 5 lbs. per sq. in. is maintained. If such pressurization is not provided, the line will sweat with temperature variations. This causes rapid moisture accumulation, with eventual breakdown.

Rigid Cables:

Three sizes of line are used almost exclusively: 1 5/8, 3 1/8, and 6 1/8 ins. These figures refer to outside diameters. As the diameter of the line increases, its attenuation decreases, while its power-handling capacity and cost increase also.

Power-handling capacity is determined by the voltage breakdown rating, and temperature rise because of I²R power loss. As operating frequency is increased, the transmitted current is restricted more and more to the surface layers of metal, thereby causing an increase in current density. This is the familiar "skin effect." Copper loss is, therefore, increased at higher frequencies for a given input power, and attenuation is increased. For that reason, the temperature rise usually governs cable power ratings above 10 mc. if AM or FM is employed. For pulse modulation, of course, voltage breakdown is often the limiting factor.

Where temperature rise controls the power rating, as for a television signal,

then the average power is significant. It has been explained that television transmitters are rated in terms of peak visual power. The *average* visual power rarely exceeds .5 peak; usually, it is about .4 peak for a gray picture. The aural power, since it is FM, is constant at about .5 peak visual power. The total average power at the output of the diplexer, then, is from .9 to 1.0 peak visual power, and the rated power of the transmitter can be taken as the power-handling requirements of the transmission line.

Voltage standing-wave ratio (SWR) affects the power rating of a transmission line also. This is a measure of power reflected from the load, and it is determined by the physical uniformity of the transmission line and the degree of impedance match obtained between the power source, the line, and the load (in this case, the antenna). In order to avoid serious distortions, especially with long lines, the SWR must be kept very low, so that this is not an important factor in line power-rating considerations for a television installation.

Standard coaxial line is manufactured in all three sizes with either ceramic insulators (Steatite or Alsimag) or Teflon insulators. Although the Teflon-insulated line has less attenuation and somewhat greater power-handling capacity, the ceramic-insulated line is more sturdy and is less expensive. However, the ceramic lines have lower cutoff frequencies. Because of these characteristics, ceramic lines are used extensively for VHF, and Teflon is employed for both VHF and UHF. In accordance with RTMA recommendations, VHF transmission line is designed for 51.5 ohms nominal impedance; and UHF line, 50 ohms. The impedance of some UHF 6 1/8 in. line is 75 ohms.

Waveguide is also being manufactured for UHF television applications. Two

sizes are available: type 1500 (15 by 7 1/2 ins.) for channels 14 to 52, and type 1150 (11 1/2 by 5 3/4 ins.) for channels 53 to 83. Power-handling capacity of the waveguide is adequate for any contemplated TV use, since it will handle well over a megawatt safely. Attenuation is extremely low when compared to other types of transmission line at applicable frequencies. Its disadvantages include high cost, which approaches twice that of 3 1/8 in. Teflon line on long runs, and increased wind loading on towers. Wind loading is an important factor; however, it is also true that a lower tower might be as satisfactory if waveguide were used, insofar as equivalent coverage is concerned, because of the greater power available at the antenna. It is quite possible that the use of waveguide would result in a lower initial cost.

Figs. 19, 20, and 21 show the transmission efficiencies of VHF ceramic and Teflon lines in 1 5/8, 3 1/8, and 6 1/8 in. sizes for various lengths of run from diplexer to antenna. Transmission efficiencies for various lengths of run of UHF 1 5/8 and 3 1/8 in. Teflon lines are given in Figs. 22 and 23. Corresponding data for UHF waveguides and for 6 1/8 in. Teflon line are presented in Fig. 24. Finally, Fig. 25 shows how power-handling capacity varies with frequency for ceramic and Teflon lines of all sizes.

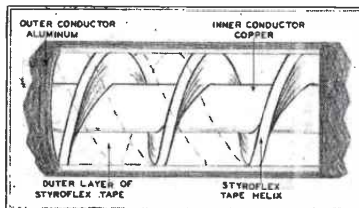
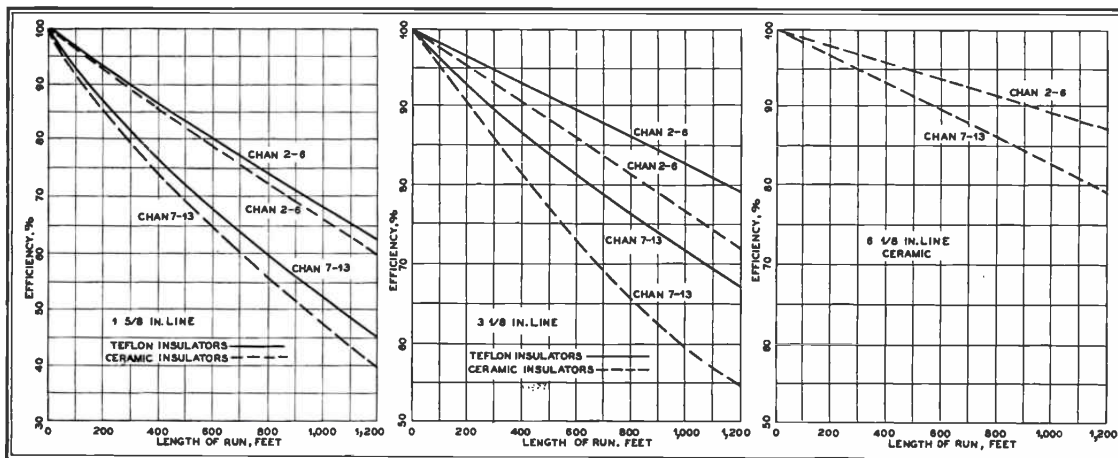


FIG. 26. CROSS-SECTION OF STYROFLEX LINE

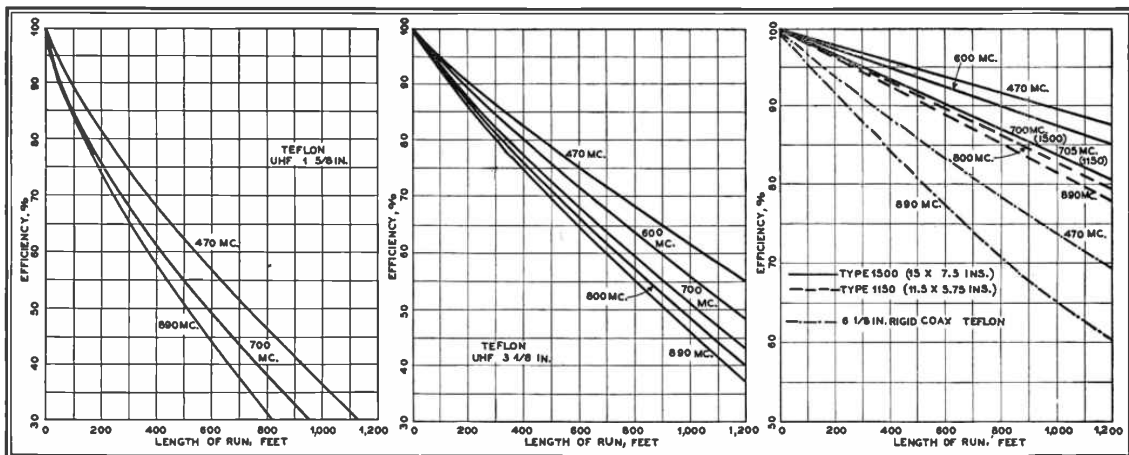
dling capacity varies with frequency for ceramic and Teflon lines of all sizes.

Styroflex Cable:

A new type of coaxial transmission line



FIGS. 19, 20, AND 21. EFFICIENCY VERSUS LENGTH OF RUN FOR VARIOUS SIZES OF VHF TRANSMISSION LINE USING TEFLON AND CERAMIC INSULATORS



FIGS. 22, 23, AND 24. EFFICIENCY VERSUS LENGTH OF RUN FOR VARIOUS SIZES OF UHF LINE AND WAVEGUIDE AT REPRESENTATIVE UHF FREQUENCIES

has been introduced recently to this country. Called Styroflex cable, it consists of an inner conductor of copper about which is wound a continuous helical insulator built up of many thin layers of polystyrene tape, as shown in Fig. 26. This is covered completely by a thin layer of wider polystyrene tape, and the whole is enclosed within an aluminum sheath which serves as the outer conductor. The cable is manufactured by a continuous process, so that no joints between diplexer and antenna will be necessary in most installations. It is quite flexible, and can be coiled without disturbing the centering of the inner conductor.

A German development, the cable is now being made in this Country and is offered in sizes up to 3 1/8 ins. It can be obtained in continuous reels up to 1,000 ft. in length. Electrically, its characteristics are roughly equivalent to or slightly better than rigid ceramic-insulated line within the comparable operating range. Its cutoff range is beyond that of rigid Teflon line; within the operating range of Teflon line, however, it is not quite so efficient as Teflon. Its power-handling capacity appears to be about the same as Teflon line. It is claimed that Styroflex line, because of its complete lack of electrical discontinuities, has a better SWR than other types of lines. Another property claimed is extreme ruggedness.

One of its most important advantages, however, is that, according to the makers, it requires no pressurization. There are no joints except at the antenna and diplexer. Consequently, an absolutely airtight seal can be made for the life of the line.

Thus, the advantages of Styroflex cable for TV applications can be summed up as follows, not necessarily in the order of importance:

1. Flexibility. This makes for ease of handling and installation, since the cable

can be bent easily to clear obstructions and to follow any desired path.

2. Continuous construction. This also facilitates installation, since air-tight joints need not be made every 20 ft. as with rigid line. No special couplings or elbows are required.

3. No pressurization is required. Maintenance of the line is, therefore, negligible.

4. Ruggedness and durability.

Its electrical advantages over the Teflon line appear to be very slight for television purposes. Disadvantages are high relative cost and the fact that, as yet, 6 1/8 in. line is not available.

Choosing the Right Line:

It should be kept in mind, when choosing the transmission line for a transmitting installation, that its primary purpose is to deliver the transmitted power at least cost with as little attenuation as possible. Almost invariably it will be found that there are many possible combinations that can be used. Finding the optimum one may not be the easiest task imaginable, but it will be time well spent.

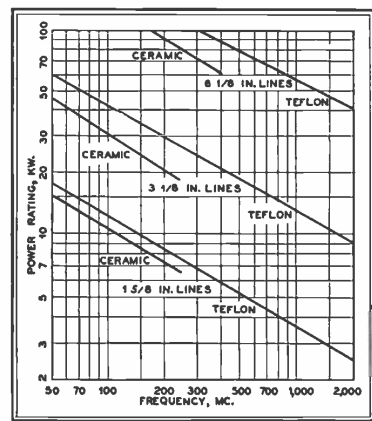


FIG. 25. RIGID-LINE AVERAGE POWER RATINGS

For most VHF installations, those in which a dual antenna feed system is employed, two methods of connection are possible:

1) A bridge diplexer feeding two identical transmission lines which run to the antenna together.

2) A slot diplexer feeding a single transmission line to the antenna. Just below the antenna, an adaptor is employed which splits the power for feeding the two halves of the antenna.

The total attenuation to the signal is the same in either case, assuming equal distances to the antenna and the same type and size of transmission line used. One method will probably cost less than the other, however. Although the line itself costs less for the single-feed system, a slot diplexer and adaptor costs considerably more than a bridge diplexer. Obviously, the dual-feed system would be less costly for short runs, and more costly for very long runs.

The crossover point depends on whether the VHF channel is high-band or low-band, since this determines the relative costs of the diplexers, and on the size of the line employed.

If a dual line is run to the antenna, the power is split equally between the lines. Thus, if a given line is capable of handling, say, 14 kw. at the operating frequency, then it could not be used in a single-line system at the output of a 20 kw. transmitter, but could be employed in a dual-line system — provided it was satisfactory otherwise. Another point is that emergency operation is possible with one line of a 2-line setup.

After the minimum possible line is determined which is capable of handling the power, the next consideration should be that of the minimum-cost setup for permissible attenuation. Typical costs for various types of line are given below. These include installation as well as hangers, fittings, and dehydrators.

(Concluded on page 24)

COMMUNICATION NEWS

(Continued from page 17)

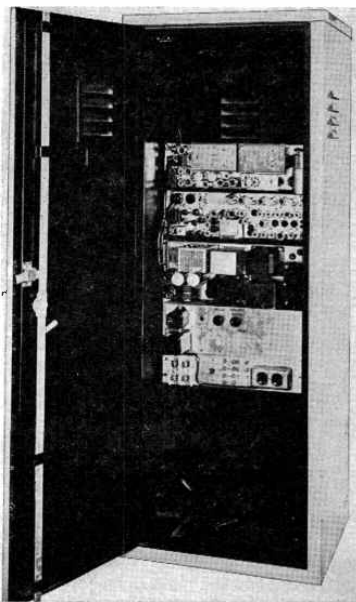
For Tower Erection:

A very useful type of truck-mounted crane is used by the John A. Costelow Company of Topeka, Kan., for erecting antenna towers. Tower sections are transported to the site by loading them on the Fruehauf flat-bed trailer. Then the hydraulic crane picks up one section at a time in proper sequence, and swings it over, in an upright position, to the base of the tower. From that point, each section is lifted by ropes to the gin pole.

Relay for the Santa Fe:

On October 13, a Philco pulse amplitude-modulated multiplex relay system was put to service by the Gulf, Colorado & Santa Fe Railroad between Galveston and Beaumont, Tex., a distance of 68.5 miles. Repeaters are located at Patton, White Ranch, and Morey. The first hop is over water, the second over swamp land, and the third and fourth over farm country. This system replaces 315 miles of open wire lines.

Eight duplex voice channels are provided. One channel is used as a party line connecting all stations, and includes a fault alarm which indicates whether regular or standby power and RF equipment are in use. This system operates



A 450-MC. REMOTELY-CONTROLLED BASE STATION

in the 6575 to 6875-mc. band. It was installed under the supervision of L. R. Thomas of the Atchison, Topeka & Santa Fe, James L. Lee of the Gulf, Colorado & Santa Fe, and under the general direction of J. A. Parkinson, supt. of communication for the Santa Fe System.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933 OF FM-TV RADIO COMMUNICATION, published monthly at Great Barrington, Massachusetts, for October 1, 1952

State of Massachusetts
County of Berkshire, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Milton B. Sleeper, who having been duly sworn according to law, deposes and says that he is the publisher of the FM-TV RADIO COMMUNICATION Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Milton B. Sleeper, Great Barrington, Massachusetts; Editor, Roy F. Allison, West Egremont, Massachusetts; Managing Editor, none; Business Manager, none.

2. That the owner is: Radiocom, Inc., Great Barrington, Massachusetts. The names and addresses of the stockholders owning 1 per cent or more of total amount of stock are Milton B. Sleeper, Monterey, Massachusetts, Charles Fowler, South Egremont, Massachusetts, Ethel V. Sleeper, Monterey, Massachusetts.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) MILTON B. SLEEPER, Publisher
Sworn to and subscribed before me this First day of October, 1952.

[SEAL] LILLIAN BENDROSS, Notary Public
Commission expires July 1, 1954.

of line may have an actual life expectancy of about 10 years, while a more expensive installation might be expected to last 25. The value of money available at the time the station is built may be quite different than at some later date.

Therefore, there can be no specific rules to cover all cases. Such decisions must be reached individually in each case on the basis of the specific circumstances. As a general guide, it can be stated that the choice for transmission line attenuation has ranged from 15 to 25% on most installations.

Manufacturers of transmission lines include the following:

Andrew Corporation, 363 East 75th Street, Chicago 19, Illinois.

Communication Products Company, Inc., Marlboro, N. J.

Phelps-Dodge Copper Products Corp., Habirshaw Division, 40 Wall Street, New York 5, N. Y. (Styroflex)

Product Development Company, Inc., Kearny, N. J.

RCA Victor, Camden, N. J.

FCC Television Grants

RADIO COMMUNICATION Magazine is presenting each month data on television station CP's, channel changes, and power increases granted by the FCC. Actions listed below are for the period from September 29 to October 17, 1952.

Information given for CP grants consists of the city, channel number, visual and aural ERP's, estimated cost of construction, and principal owner or owners. If grantee controls audio broadcast station, call letters are given in parentheses.

Grants are listed alphabetically by states. A star preceding a channel number indicates that the authorization is for a non-commercial educational station.

CONSTRUCTION PERMITS GRANTED

	CH.	KW.	COST
St. Petersburg, Fla.	38	83-42	\$328,500
City of St. Petersburg (WSUN)			
Ann Arbor, Mich.	20	1.75-.93	\$108,000
Washnetew Bcstg. Co. (WPAG-AM-FM)			
E. Lansing, Mich.	60	245-125	\$461,500
Mich. State Bd. of Agriculture (WKAR)			
Saginaw, Mich.	57	17.5-12.3	\$186,000
Lake Huron Bcstg. Corp. (WKNX)			
St. Joseph, Mo.	2	52-26	\$428,400
KFEQ			
Springfield, Mo.	10	12.5-6.4	\$175,000
Independent Bcstg. Co. (KTTS)			
Lincoln, Neb.	10	56-28.5	\$300,800
Cornbelt Bcstg. Corp. (KFOR)			
Lincoln, Neb.	12	21.5-11	\$195,100
Cornhuskers Rad. & TV Corp. (KOLN)			
Asbury Park, N. J.	58	100-50	\$367,800
Atlantic Video Corp.			
Raleigh, N. C.	28	280-145	\$296,500
Sir Walter TV & Bcstg. Co.			
Youngstown, Ohio	21	170-85	\$326,000
Polan Industries			
Harrisburg, Pa.	55	240-120	\$362,000
WHP Inc. (WHP)			
Wilkes-Barre, Pa.	28	1,000-500	\$438,600
Louis G. Baltimore (WBRE)			
Wilkes-Barre, Pa.	34	250-130	\$397,500
Wyoming Valley Bcstg. Co. (WILK)			
Amarillo, Texas	10	56-30	\$312,200
Amarillo Bcstg. Co. (KFDA)			
Amarillo, Texas	4	100-50	\$700,000
Plains Radio Bcstg. Co. (KGNC)			
Lubbock, Texas	11	92-46	\$342,100
Bryant Rad. & TV Inc. (KCBD)			
Lubbock, Texas	3	31-15.5	\$469,700
Texas Telecasting, Inc.			

PATTERN FOR TV PROFIT

(Continued from page 23)

LINE INSTALLATION COSTS

	1%	3%	6%
CERAMIC, DUAL RUN	\$1,700+ \$6.50/ft.	\$2,000+ \$12./ft.	\$4,000+ \$35./ft.
CERAMIC, SINGLE RUN	\$1,100+ \$3.75/ft.	\$1,800+ \$7./ft.	\$2,500+ \$19./ft.
TEFLON, DUAL RUN	\$1,800+ \$7./ft.	\$2,300+ \$16./ft.	\$5,000+ \$45./ft.
TEFLON, SINGLE RUN	\$1,200+ \$4./ft.	\$2,000+ \$10./ft.	\$3,000+ \$25./ft.

Waveguide installations with type 1500 cost about \$2,400 plus \$20 per ft. No. 1150 costs about \$2,000 plus \$17 per ft.

Together with the other charts given in this section, which provide information on attenuation, it should not be difficult to calculate the most reasonable combination for the required performance. According to some methods of reckoning, the decision as to line size is based on the cost of producing the extra power consumed by the less expensive line versus the difference in cost for the two lines being compared, this difference in cost being amortized in 10 years. Such a method may be open to question however, because of its very simplicity. Who can say in a general way what the actual value of 40 kw. ERP is as compared to 55 kw.? Other factors enter the picture also. For instance, one type



G-E CIVIL DEFENSE FILM AWARDED FREEDOMS FOUNDATION PUBLIC SERVICE MEDAL

**Outstanding public service release currently available
for civic and industrial showings**

MORE than 10 million people have seen General Electric's civil defense film showing how a city prepares its communications network for vital disaster service. A dramatic documentary, the 22-minute motion picture stresses the role of communications in everyday life, depicts an atomic blast over Syracuse, N. Y. and demonstrates how the existing communication systems of a city and a county can be coordinated in an emergency. The film is a part of the nation-wide Communications Advisory Service, a G-E organi-

zation of electronics engineers whose consultation services are available to communities and industries of every size.

One of the most popular films in G-E history, "Voice" is being sponsored by civic and industrial groups across the nation to stimulate public interest in civil defense. If you want it for your community at only nominal cost for mailing, call the CAS* man at the G-E office near you, or write us. *General Electric Company, Section 43112, Electronics Park, Syracuse, New York.*

**Communications Advisory Service*



Freedoms Foundation president Kenneth D. Wells, presents award scroll to Roy D. Jordan (center), secretary of G.E.'s Electronics Division CD Committee, and Neal F. Harmon, G.E.'s CD Coordinator.



The film shows evacuation of residents from the city by taxicab after the atom "blast" plus many other eye-opening scenes. Will your city be prepared? Be sure to see this timely civil defense film.



Lt. General Willis Crittenger, commanding First Army, with G.E. Vice-President W. R. G. Baker on nationwide TV showing of film. More than 30 TV stations have screened the picture as a public service.

GENERAL ELECTRIC

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

25

TAXI DISPATCHING

(Continued from page 15)

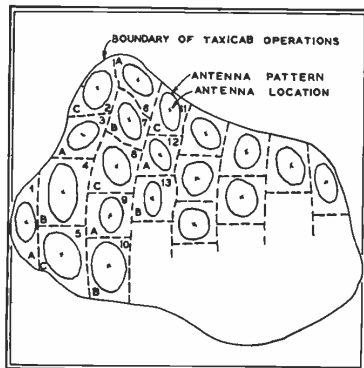


FIG. 5. ONE OF 3-FREQUENCY OPERATING PLANS

This plan may be very useful in a city that is relatively flat, that does not have many tall structures, and that is built around a central point where a number of important traffic arteries converge. Washington, D. C., is a good example.

This plan would be a very poor choice for a large sprawling city composed of a number of distinct and almost self-contained districts. Philadelphia is such a city. The type of pattern illustrated in Fig. 5 might be an excellent choice for Philadelphia. This pattern has one distinct advantage in that it permits use of omnidirectional antennas in place of the highly directional type required for the radial pattern.

Selective Calling:

Selective calling equipment permits a dispatcher to call any one cab, any group of cabs, or all cabs by operating a push-button control board. The call is heard only by the cab or cabs to which it is directed.

Selective-calling equipment is not essential to the operation of the communication system that has been outlined, but its use provides certain distinct advantages. These will be summarized briefly.

Elimination of nuisance interference: The area and frequency allocations will have been set up so that the base station signal within a given area is always stronger than interfering signals from other areas on the same frequency. In the presence of both signals, the receiver will respond to the stronger one and no appreciable interference will be heard. However, in some places the weaker station may be audible when the strong station is not transmitting. Selective calling would eliminate this nuisance interference as well as all other calls not directed to a particular cab or group of cabs.

Reduction in driver fatigue: Without selective calling, a driver must pay con-

stant attention to all dispatched calls. Undoubtedly, this will affect his efficiency and may make him miss a call once in a while.

Increased passenger comfort: Taxicab operators report that passengers often object to the radio chatter, and they request the driver to turn off his receiver.

Conclusion:

Four practical solutions requiring either two or three radio-frequency channels and combining geographic and frequency subdivision of the communication load have been described. The particular solution that would be most appropriate will depend, for the most part, on local conditions.

Each mobile equipment is designed for the number of frequencies required by the system so that the driver can select any one of them by means of a switch. The city is divided into areas that are so arranged that no interference zones exist when each area is assigned the proper frequency. Each area contains a base-station transmitter and receiver

with their antennas. Land lines connect these stations to the main dispatching office. Whenever a driver crosses an area

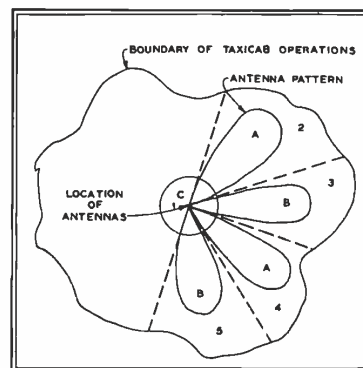


FIG. 6. AN ALTERNATE 3-FREQUENCY DIVISION

boundary, he switches to the correct channel for the new area. As many radio dispatchers as there are areas can be used during busy periods. The force can be contracted during slow periods by combining the operation of several areas under one dispatcher.

THE FCC RULES

(Continued from page 13)

the Rules do not require this leniency on the part of the Commission.

Upon receipt of the second Notice, the licensee becomes involved in a somewhat more serious difficulty. In addition to being cited for the violation which was the basis of the initial Notice, he is also cited for failing to reply to the Official Notice. If no reply is made within 15 days from the date of mailing the second Notice, the case is then referred to the Enforcement Unit, and it is no longer in the hands of the Field Office which originated the Notice.

The Enforcement Unit, established by the Commission in mid-1950, is responsible for the planning and execution of the Commission's enforcement program. This Office has established very firm procedures, and one of its functions is to make the final recommendation regarding a revocation. I say "recommendation" because the final action can be taken only by the Commission.

When a case is referred to the Enforcement Unit, it originates correspondence directed to the licensee. If no reply to such correspondence is received within 15 days, the operator's license may be in jeopardy since, in all probability, the initial action will be taken which may lead to the revocation of the licensee.

Most Common Violations:

For your information, here is a list of some of the most frequent violations which have been brought to the attention of the Commission:

1. Failure of the carrier-on indicating device. This is a matter of a burned-out pilot lamp that could have been replaced in 15 seconds.
2. Failure to keep proper operating log-books and records of transmitter performance measurements.
3. Making changes in equipment, location of station or control point, antenna location, or antenna supporting structure, thereby altering overall antenna height, without first obtaining the required authorization to make the change.
4. Transfer of control of a corporate held license or making assignment of a license held by a partnership or individual.
5. Operation of a base station by unlicensed personnel.

It is important to bear in mind that each authorization is granted on the basis of information submitted in response to questions asked in the application for permission to construct and operate a radio station. On the basis of the information submitted, the Commission determines if the applicant is qualified to be the licensee of a radio station.

Your license, therefore, is personal to you. The authorization to operate a radio station may not be transferred without first obtaining the authority to do so, as provided by the FCC Rules. Further, when you filed your application, you indicated the latitude and longitude of the proposed base station to an accuracy of one second. You also showed the type and number of transmitters to be used, the frequency desired, the antenna height, and the location of the con-

trol point. The terms of your authorization are therefore geared to this information.

In response to one of the items in your application for a license, you stated that construction was completed in exact accordance with the terms of your construction permit. Thus it is imperative that you make no changes, without prior authorization, that would result in the operation of your station in a manner which is not in accordance with your existing authorization.

Your license conveys to you not only a firm right, but an equally firm responsibility. This is something you cannot sell or dispose of as you might sell or transfer the assets of your business, except in accordance with the FCC Rules governing such changes.

Frequency Allocations:

At this point it may be in order to comment on the problem of frequency availabilities. This is a matter of concern to all the radio services. The present frequency allocations for the various services were made after lengthy and involved proceedings, during which representatives of each user-group presented arguments in support of requests for more channels than were available. Accordingly, it is in the best interests of the taxicab industry as a whole, and of each operator individually, to use the frequencies available in such a manner as to justify your continued use of them in the public interest.

Efforts in that direction must not be relaxed because the problems of effective frequency use are becoming continuously more difficult as the number of taxicab companies using radio continues to increase from month to month. Looking to the future, I would like to remind you that there are ten channels available to the taxicab service in the 450 to 460-mc. band. Up to this time, their use has been explored to the extent that they show promise of alleviating, at least to some extent, the congestion which is being experienced on 152 to 157 mc.

FCC Rules, Part 16:

Finally, I would like to refer you to Part 16 of the Commission's Rules, and the importance of this Part with respect to the use of radio by the taxicab industry. Part 16 of the Rules is not voluminous, and the information contained therein can be understood readily.

In my opinion, many of the difficulties and problems experienced by licensees in the taxicab service with respect to the use of radio stem from lack of familiarity with these Rules. They are available to you, and they should be read by each member of your organiza-

(Concluded on page 28)

Communication Registries

WHATEVER information you need about any U. S. communication system in any service group, you will find it in one of the Registries of Communication Systems listed below. These Registries, revised annually from data contained in the original license files at Washington by permission of the FCC.

Each system listing shows the name and address of the licensee, location and type of each transmitter, number of mobile units, call letters, frequencies, type of modulation, and make of equipment used.

Systems are grouped by services in accordance with FCC practice, and are listed alphabetically by states. Currently, facilities added since the previous Registry are so identified.

These Registries are invaluable for reference use by system supervisors, maintenance organizations, allocation committees, engineering consultants, and manufacturers' field engineers.

REGISTRY OF TRANSPORTATION SYSTEMS

Listing all mobile, base, relay, mobile relay, and point-to-point transmitters licensed in the following services:

- | | | |
|-----------|-----------------|-------------------|
| TAXICABS | HIGHWAY TRUCKS | TRANSIT UTILITIES |
| RAILROADS | INTERCITY BUSES | AUTO EMERGENCY |

Most active services in this group are the taxicab, railroad, and auto emergency systems.

REGISTRY OF TRANSPORTATION SYSTEMS, postpaid.....\$1.00

REGISTRY OF INDUSTRIAL SYSTEMS

Listing all mobile, base, relay, mobile relay, control, and point-to-point transmitters licensed in the following services:

- | | | |
|-----------------|-----------------------|-----------------|
| POWER UTILITIES | PIPELINES & PETROLEUM | FOREST PRODUCTS |
| RELAY PRESS | LOW-POWER INDUSTRIAL | MOTION PICTURE |
| | SPECIAL INDUSTRIAL | |

This Registry has the largest number of new listings, because it includes the relay and point-to-point stations installed by the public utilities and pipe lines. Many listings have been added for the special industrial, forest products, and low-power industrial services, also.

REGISTRY OF INDUSTRIAL SYSTEMS, postpaid\$2.00

REGISTRY OF PUBLIC SAFETY SYSTEMS

Listing all mobile, base, relay, mobile relay, portable, control, and point-to-point transmitters licensed in the following services:

- | | | |
|---------------------------|-------------------|-----------------------|
| MUNICIPAL & COUNTY POLICE | STATE POLICE | FORESTRY CONSERVATION |
| ZONE & INTERZONE POLICE | FIRE DEPARTMENTS | HIGHWAY MAINTENANCE |
| | SPECIAL EMERGENCY | |

A large number of new police, fire, and special emergency systems are listed in this Registry. State police systems have been expanded greatly. Interzone police networks now cover practically all the U. S. This is the only CW telegraph service listed in any of the Registries.

REGISTRY OF PUBLIC SAFETY SYSTEMS, postpaid\$1.00

AIR-GROUND AND COMMON CARRIER SYSTEMS

Listing all mobile, base, relay, mobile relay, portable, control, and point-to-point transmitters licensed in the following services:

- | | | |
|-------------------|-------------------|----------------------|
| CARRIER AIRCRAFT | AIRDROME ADVISORY | MOBILE UTILITY |
| AIR OPERATIONAL | FLYING SCHOOL | COMMON CARRIER |
| OPERATIONAL FIXED | FLIGHT TEST | COMMON CARRIER RELAY |
| AIRDROME CONTROL | | MISC. COMMON CARRIER |

This Registry lists all transmitters operated in commercial aircraft, and all those used for air-ground communication. Also included are the AT&T relay stations which carry television network programs.

AIR-GROUND & COMMON CARRIER SYSTEMS, postpaid\$1.00

RADIOCOM, Inc.
Great Barrington, Mass.

Please send me the following Registries of Communication Systems, for which I enclose —
 \$1.00 Registry of Transportation Systems \$1.00 Registry of Public Safety Systems
 \$2.00 Registry of Industrial Systems \$1.00 Registry of Air-Ground, Com. Car. Systems

Name
 Address

THE FCC RULES

(Continued from page 27)

tion who has any connection with the use of your radio system. It is important to remember, and I would like to emphasize this point, that strict compliance with the Rules by each individual operator is necessary in the collective interest of the taxicab industry. To that end, close and continuing management review of station operation is required to assure this compliance in every respect, at all times.

Amendments to FCC Rules:

New forms No. 400 and 400-A announced in RADIO COMMUNICATION last month as forthcoming, were adopted by the Commission September 10, and their use will become effective on January 5, 1953. Form 400 is to be used for applications for radio station authorizations in the public safety, industrial, and land transportation services, while 400-A is for

requests for the amendment of radio station authorizations in the same services.

Form 401-A will be continued in use to describe antenna structures in cases where the proposed structure will 1) exceed an overall height of 170 ft. above ground level, except where the antenna is mounted on a man-made structure and does not increase the height by more than 20 ft., or 2) where the antenna structure will exceed an overall height of 1 ft. above the established airport elevation for each 100 ft. of distance from the nearest boundary of the landing area, except where the antenna does not exceed a height of 20 ft. above the ground, or is mounted on a man-made structure or natural formation and does not increase the height more than 20 ft.

In the Commission's Order of September 10, very extensive amendments were made in Parts 1, 10, 11, and 16 of the Rules. One significant statement of policy governing the assignment of frequencies was added as Section 11.8 (b)

in Part 11: "Each applicant shall use the highest order of frequencies available, compatible with the operational requirements of the particular radio system involved, and the actual channel loading of the bands in each area. Differentials in first cost and maintenance expense are factors which will not be considered as conclusive by the Commission in approving a choice between the ranges 1.6 to 6.0, 25 to 50, 152 to 174. and 450 to 460 mc."

In the new text for Section 11.56 of Part 11 appears the statement: "Unless otherwise directed by the Commission, each application for renewal of license shall be filed during the last 60 days of the license term. In any case in which the licensee has, in accordance with the Commission's Rules, made timely and sufficient application for renewal of license, no license with reference to any activity of a continuing nature shall expire until such application shall have been finally determined."

New FCC Applications

This list includes applications for mobile, point-to-point, control, and relay communication facilities filed with the FCC from September 13 to October 17, 1952.

	Mobile Units	W.	Mc.	Sta.	W.	Mc.	Fixed
AERONAUTICAL & FIXED							
Robt C Reeve 559 Anchorage Alaska	2	400					1,695 NN 2,648 2,922 5,310 5,622
Airinc 1523 I St NW Washington 5 DC				1	50		130.50WW
PI Dodge Ia				1	9.9		128.30 X
McAlester Okla							
AIRDROME CONTROL							
Fairchild Aircraft (Div of Engine & Airplane Corp)	1	50					130.10 X
Hagerstown Md	1	25					200.00 T
FLIGHT TEST							
Schwelzer Aircraft Corp Elmira N Y							
pl .. 123.30							X
Lear Inc 11916 W Pico Blvd Los Angeles 64 Calif				1	15		123.10 X
Raytheon Mfg Co Waltham Mass				1	10		123.10 T
North Amer Aviation Intl Airport Los Angeles Calif				1	8		133.74 X
Edwards AFB Calif				1	8		133.74 X
AERO MOBILE UTILITY							
Lehigh-Northampton Airport Auth 523 Hamilton St Allentown Pa				6	121.90		X
Columbia Univ Dept of Psychology New York 27 N Y				1	121.90		T
J R Hime Elec Co 277 S County Rd Palm Beach Fla				10	10		121.70 C
AIRDROME ADVISORY							
W C Donaldson Dodge Center Minn	1	4					122.80 NN
Lewis College of Science & Tech Lockport Ill				1	4		122.80 NN
Mun Airport San Jose Calif				1	30		122.80 X
E J Small Pekin Airport Pekin Ill				1	4		122.80 NN
J W Swart Box 285 Rome Ga				1	..		122.80 NN
Dolhun's Air Service Inc Lake Tomahawk Wis				1	4		122.80 NN
Morehead Co Box 460 Rte 3 Chico Calif				1	15		122.80 X
Roberts Flying Service Box 1011 Lakeland Fla				1	4		122.80 NN
CIVIL AIR PATROL							
CAP Mass Wing Hanscom Field Bedford Mass				1	12		4.585 1 40 2.374 RH
Newton Mass							4.507 4.507 4.585
				1	..		2.374 4.507 4.585
				1	1		4.585 1 1 4.585 M
							5.500 5.500
				2	30		148.14 1 30 148.14 T
CAP Mich Wing Wayne Sqn 3355 Wash Rd Wayne Mich							

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, power, and operating frequencies for mobile facilities are shown on the left, and for fixed stations on the right, together with 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 Kaer	W Westinghouse
L Link	WW Wilcox
X Miscellaneous	Y Budelman

Detroit Mich	2	10	148.14	1	10	148.14	X
	10	12	4.507				X
			4.585				
			5	10	some		
CAP Mich Wing 1st Grp 6367 Pierson Rd Flushing				2	150	2,374	X
Flint Mich						4,507	
						4,585	
				1	10	148.14	X
CAP Mich Wing Sqn 635-2 Rte 2 Dalton Mich				1	10	148.14	X
				1	38M	2,374	H
						4,507	
						4,585	
CAP Conn Wing Bridgeport Sqn 308 Old Point Rd				2	10	148.14	1 10 148.14 T
Milford Conn				4	1	5,500	1 1 5,500 M
				2	45	4,507	X
						4,585	

CAP Red Oak Sqn Red Oak Iowa	2	25	148.14	10	3.5	148.14	X
	3	1	4,507	1	1	4,507	M
			5,500			5,500	
	2	10	148.14				T
POLICE							
Prince George's C.S. 5012 R I Av Hyattsville Md				1	30	39.90	L
P.D. 44 West Nine Mile Road Hazel Park Mich				8	10	155.01	1 60 155.01 M
P. D. 1592 Lonsdale Ave Lincoln N J				6	30	158.73	1 120 158.73 M
P. D. Eno Memorial Bldg Simsbury Conn				4	60	45.78	M
P. D. 106 W Washington St Summerville Ga				8	10	156.63	1 30 156.63 M
P. D. 401 N Gray St Killen Texas				10	140	37.18	1 140 37.18 M
P. D. N Judson Ind				2	60	154.89	155.13 M
P. D. 85 Market St Hartford 3 Conn				1	2	245.5	Speedmeter
Highlands C. S. Sebring Fla							
Venus Fla				1	120	46.02	M
P. D. Oxford Ohio				5	30	154.89	1 80 155.13 155.37 M
				80		154.89	M
				p2		154.89	M
P. D. St Maries Idaho				1	30	42.54	M
P. D. City Hall Park Falls Wis				2	120	39.58	M
						39.66	
Carlton C. S. Carlton Minn				3	60	155.25	M
Panna Turnpike Comm 11 N 4th St Harrisburg Pa				150	159.21	1 107	957.00 R
Willow Grove ml							
Leake C. S. Carthage Miss				2	120	42.02	G
						42.18	
P. D. 419 SW Market St Portland 1 Ore							
						25	33.98 AM
						500	2,442
Green Haven State Prison Stormville N Y				5	3	155.07	1 30 155.07 M
Green Haven N Y				1	120	39.18	R
P. D. Town Hall Babylon N Y				1	120	39.18	R
P. D. 1450 N Lyndhurst Dr Speedway Ind				1	50	155.13	M
						155.37	
Kern C. S. Bakersfield Calif				us2		.1	6705 M
Nr Bakersfield Calif				us1		.1	6585 M
P. D. Univ Heights 2300 Warrenville Center Road Cleveland Ohio				1	2	245.5	Speedmeter
St Bernard Parish Sheriff Chalmette La				10	124	39.50	1 500 39.50 G
Josephine C. S. Box 579 Grants Pass Ore				5	60	155.01	M
P. D. Milton Fla				2	60	158.85	1 120 158.85 M
				2	30	158.85	M
Vinton C. S. Market St McArthur Ohio				6	80	39.58	1 140 39.58 M
				6	30	39.58	M
Met Dist Comm 20 Somerset St Boston Mass				1	80	39.58	M
Framingham Mass						39.66	
P. D. 786 Chenango St Port Dickinson N Y				6	48	39.18	1 48 39.18 L
Ward C. S. Courthouse Minot N D				4	120	42.26	M
						42.38	

(Continued on page 30)

AURICON

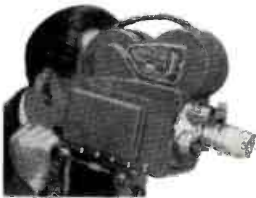
16mm Sound-On-Film

for TELEVISION

Auricon 16mm Sound-On-Film Cameras provide ideal working tools for the production of Television Newsreels, film commercials, dramatic inserts and local candid-camera programming. Ask our distributor or write direct for free illustrated catalog.

CINE-VOICE

\$695.00 (and up)
With 30 day money-back
Guarantee



Photograph a sound track along one edge of your picture film with the Auricon "Cine-Voice" 16mm Camera. Same film cost as old-fashioned silent movies! Edit your own talking pictures on any make of 16mm sound projector.



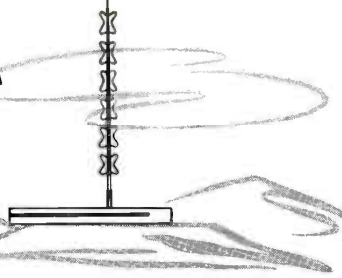
AURICON
BERNDT-BACH, INC.

7349 BEVERLY BLVD., LOS ANGELES 36, CALIF.

Auricon
Hollywood

MANUFACTURERS OF SOUND-ON-FILM RECORDING EQUIPMENT SINCE 1931

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



AURICON-PRO

- ★ 200 ft. film capacity for 5½ minutes of continuous sound-on-film.
- ★ Self-blipped for quiet studio operation.
- ★ Synchronous motor for "single" or "double-system" sound-recording.
- ★ Studio Finder shows large upright image.
- ★ \$1310 (and up) with 30 day money-back Guarantee.



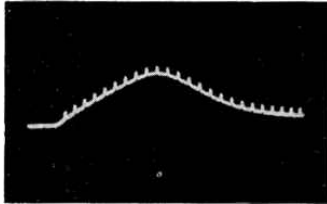
SUPER-1200

- ★ Two independent Finder Systems plus instant Ground-Glass Focusing through the Camera lens.
- ★ Self-blipped for quiet studio operation.
- ★ 1200 foot film capacity for 33 minutes of continuous recording.
- ★ Variable Shutter for fades or exposure control.
- ★ \$4315.65 complete for 16mm sound-on-film... lenses additional. Also available without sound for \$3377.90.
- ★ Sold with 30 day money-back Guarantee. RCA licensed sound.

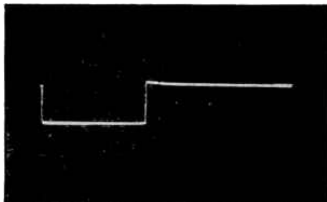
FOR MAXIMUM FLEXIBILITY IN WAVEFORM TIMING



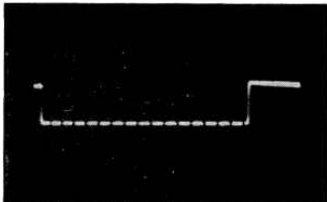
The Browning Model GL-22A Sweep Calibrator is designed to free its users from limitations encountered in the use of crystal calibrators.



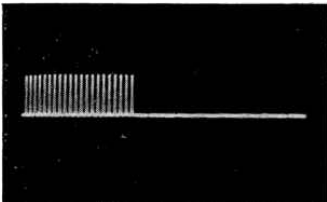
Positive pulse with markers to provide deflection—modulated display.



Negative gate pulse.



Negative pulse with markers used to blank sweep.



Positive marker output.

here are its advantages

It can be used as the triggering source, or can be triggered externally by the output of the device to be calibrated. The external trigger may be recurrent, up to 100 KC, random, or "one shot".

Using the internal trigger, the interval between successive markers is wholly independent of the trigger rate. The internal trigger is continuously variable from 200 to 5000 pulses per second.

The markers are produced through the keying action of a continuously variable gate, and thus can be restricted to the desired portion of an observed waveform. The gate pulse itself is also available as a useful output, of either polarity, and known duration.

The output markers, at 0.1, 1.0, 10, or 100 microseconds, accurate to $\pm 1\%$, of either polarity, can be continuously varied to 50 volts amplitude — sufficient for either intensity or deflection modulation use. The available intervals, in conjunction with the customary ruled screens, permit accurate measurement of intervals from 0.01 microsecond to several thousand microseconds.

Send for data sheet giving full details.



ENGINEERED
FOR
ENGINEERS

BROWNING
Laboratories, Inc.
Winchester, Mass.

NEW APPLICATIONS

(Continued from page 28)

Comanche C. S. Coldwater Kans	1	60	39.58		M
Gillespie C. S. Radio Sta WRR Fair Park Dallas Tex	4	160	37.18	1	160 37.18 M
Fredericksburg P. D. 302 Grant St Dennison Ohio	3	30	39.58	1	30 39.58 M
P. D. City Hall Beloit Kans	55	30	39.58	1	120 39.58 M
City Water Tr	10	500	39.58	1	500 39.58 M
St Joseph C. S. Centerville Mich	17	124	37.18	1	124 37.18 G
P. D. Vernon Tex	2	75	39.10		G
P. D. Southboro Mass	6	40	37.18	1	40 37.18 M
P. D. City Hall Rockdale Tex	1	120	37.18		R
Mitchell C. S. Colorado City Tex	2	120	37.18		L
	4	75	37.18		L
	2	75	37.18		G
P. D. New Market Va	2	60	39.50		M
Williams C. S. Court House Williston N D	5	120	42.26		M
			42.38		
			42.74		
P. D. Montrose Mich	1	80	42.58		M
Lake C. S. County Bldg Waukegan Ill	1	30	158.97		M
Castro C. S. Court House Dimmitt Tex	10	120	37.18	1	120 37.18 M
P. D. Govt of PR Box 3826 San Juan P R	p15	30	155.13		G
			154.89		
P. D. Big Timber Mont	1	30	39.82		M
P. D. Wake Forest N C	6	48	45.14	1	75 45.14 L
P. D. Wapato Wash	4	60	155.01		M
P. D. Sunnyside Wash	4	60	155.01		M
P. D. Tappanish Wash	4	60	155.01		M
P. D. Box 828 Fresno Calif				1	60 155.07 L
P. D. Dagsboro Del	1	45	39.50		L
			39.78		
P. D. Selbyville Del	1	75	39.50		G
			39.75		
Granite C. S. Phillipsburg Mont	5	75	39.82	1	120 39.82 M
Breward C. S. Court House Titusville Fla				1	150 39.18 G
Cocoa Fla 300 Brevard Av	4	75	42.54	1	150 42.54 M
Benevoh C. S. St Maries Idaho	4	75	42.54	1	120 39.50 M
Loudon C. S. Leesburg Va	10	120	155.19	1	120 155.19 M
P. D. Police Station Wood River Ill	10	120	155.19	1	120 155.37 M
P. D. Scott City Kans	1	60	39.58		M
Lake C. S. Court House Tavares Fla	p1	120	39.82		M
Bradford C. S. Box 325 Starke Fla	6	60	154.95	1	120 154.95 M
P. D. Village Hall Melrose Park Ill	5	80	155.49	1	60 155.49 PM
P. D. City Bldg Middletown Ohio	4	.2	2455		Speedometer
Wells C. S. Tessenzen N D	4	120	42.38	1	120 42.26 M
P. D. Village Hall Plymouth Ohio	2	60	39.58		M
	1	3	39.58		M
	2	20	39.58		M
State Hwy Patrol State Hwy Garage				1	140 37.18 G
Center Ossipee N H				1	500 42.58 M
State Hwy Patrol Harrison Rd East Lansing Mich				1	500 42.58 M
State Hwy Patrol 10th & Van Buren Topeka Kans				1	120 44.98 G
Dighton Kans				1	120 44.98 G
Great Bend Kans				same	
Pratt Kans				same	
Bonner Springs Kans				same	
Horton Kans				same	
Marion Kans				same	
State Hwy Patrol State Capitol Sacramento Calif	r1	150	42.34		G
Laughlin Ridge Calif	r1	120	74.14		G
Ukiah Calif	q1	150	42.34		G
	q1	120	74.10		G
Lakeport Calif	q1	150	42.34		G
Jackson Calif	q1	120	73.42		G
Hanford Calif	q1	120	74.50		G
Madera Calif	q1	120	74.50		G
Alturas Calif	q1	120	74.50		G
Nr Conby Calif	r1	150	42.34		G
State Hwy Patrol 905 Dexter Ave Seattle Wash				1	150 42.54 M
Nr Chehalis Wash				1	150 42.54 M
Issaquah Wash				same	
Pullman Wash	q1	160	156.03		M
Spokane Wash				same	
Collax Wash				same	
Nr Steproe Wash	r1	150	42.54		M
	r1	160	155.77		M
State Hwy Patrol 1117 E Broad St Columbus Ohio				1	150 39.10 G
Canfield Ohio				same	
FIRE					
Glenside F. D. 210 W Glenside Ave Glenside Pa	6	50	154.13	1	125 154.13 P
F. D. City Hall Colorado Springs Colo				1	120 154.13 M
Haverford Twp F. D. Twp Hall Havertown Pa	25	60	46.42	1	500 46.42 GR
W Webster Vol F. D. Box 26 West Webster N Y	10	5	46.42	1	500 46.42 GR
	3	30	154.31	1	30 154.31 M

County F D. 351 Arrowhead Av San Bernardino Calif	1	120	154.19	M	
Muscovy Calif	1	120	154.19	M	
F. D. Benton Twp 1056 Terr Rd Benton Harbor Mich	8	25	154.25	G	
			115	154.25	M
F. D. Eagleville Conn	p2	1	33.90	M	
		5	30	33.90	M
F. D. Andover Conn	p4	1	33.90	M	
F. D. 70 S Main Danlison Conn	3	30	33.90	M	
	p2	1	33.90	M	
F. D. W Wauregan Conn	3	30	33.90	M	
	p2	1	33.90	M	
F. D. S Coventry Conn	5	30	33.90	M	
	p4	1	33.90	M	
F. D. Niagara County Lockport N Y	110	120	46.10	M	
			46.22	M	
F. D. Durham 212 Mangum St Durham N C	20	60	154.25	M	
	p5	1	154.25	M	
F. D. Acton Mass	5	75	46.50	G	
F. D. 8 Ninth St Tracy Calif	14	30	154.31	M	
F. D. Div of Pub Safety 920 Broad St Newark 2 N J	50	110	154.13	G	
Hewlett Bay Fire Dist 25 Franklin St Hewlett N Y	6	60	46.10	R	
			46.22	R	
No Merrick Fire Dist Fire House Merrick L I N Y	5	80	46.22	M	
			46.10	M	
	p2	3	46.22	M	
			46.10	M	
Westchester Cnty Fire Emerg Plan Fire Hdqtrs	White Plains N Y	5	60	46.14	GL
			46.26	GL	
F. D. Muskegon Twp 1990 Apple Ave Muskegon Mich	3	60	154.19	M	
Ontario C Val Firemans Assn 74 Ontario St	Conaonaigua N Y	1	60	46.10	M
	p40	1	46.10	M	
F. D. Hudson N H	10	60	33.78	M	
Newport C Firemans League Little Compton R I	Melville R I	1	30	46.06	M
	Middletown R I	1	some	M	
	North Tiverton R I	1	some	M	
	E Tiverton R I	1	some	M	
	Tiverton R I	1	some	M	
	Newport R I	1	some	M	
F. D. 27705 Jefferson St Clair Shores Mich	8	120	154.13	M	
F. D. S Windham Conn	3	30	33.90	M	
	p2	1	33.90	M	
Hillside Twp F. D. Hollywood Ave Hillside N J	6	30	46.06	M	
	p3	2	46.06	M	
F. D. Warren Twp 22730 Van Dyke St Van Dyke Mich	8	10	154.13	M	
F. D. 708 Main St Anderson Ind	15	60	153.89	M	
F. D. 415 A St Santa Rosa Calif	p1	1	154.31	M	
		15	60	154.31	M
	p2	1	33.90	M	
		4	30	33.90	M
FORESTRY					
State Conservation Comm Jefferson City Mo	Gainesville Mo	1	150	31.30	G
				31.42	G
Tex Forest Serv A & M College Box 460 Lufkin Tex	Schwartz City Tex	1	30	170.42	M
State Dept of Forestry Walton Bldg Austin Tex	Victoria Tex	1	120	31.22	M
State Game & Fish Comm Walton Bldg Austin Tex	Carizzo Springs Tex	1	120	31.22	G
State Dept of Forestry Box 357 Columbia S C	Nr Laurens S C	1	30	159.27	M
	Nr E Loundaville S C	1	some	M	
	Nr Epworth S C	1	some	M	
	Nr Sharon S C	1	some	M	
	Nr Oakway S C	1	some	M	
	Nr Anderson S C	1	some	M	
	Nr Pickens S C	1	some	M	
	Nr Newberry S C	1	30	31.90	M
				159.27	M
	Nr Duncan S C	1	some	M	
State Dept of Forestry State Capital Atlanta Ga	Nr Tallapoosa Ga	1	30	159.39	M
	Stop Signal Mtn Ga	1	some	M	
	Nr Newnan Ga	1	some	M	
	Jefferson Ga	1	some	M	
	Nr Stonewall Ga	1	some	M	
	Nr Alpharetta Ga	1	some	M	
	Nr Ft Gaines Ga	1	some	M	
	Nr Lambert Ga	1	some	M	
	Morgan Ga	1	some	M	
	Nr Odum Ga	1	some	M	
	Nr Garnersville Ga	1	some	M	
Dept of Conservation 607 Monroe St Montgomery Ala	Carrollton Ala	1	120	159.45	G
Mass Div of Forestry 15 Ashburton Pl Boston Mass	Goshen Mass	1	48	31.34	H
HIGHWAY MAINTENANCE					
City of Winston-Salem N C City Hall	Speedometer	11	10	2455	M
State of Montana Highway Bldg Helena Mont	Nr Whitefish Mont	1	75	156.99	M
	Kalispell Mont	1	75	161.79	M
Comm of Mass 100 Nashua St Boston Mass		11	124	46.90	G
				46.98	G
City of Akron 166 S High St Akron Ohio		10	30	159.69	R

(Continued on page 32)



Members of the Barnard Fire Department which has outstanding record for efficient operation shown with Ed Masline of Masline Radio and Electronic Equipment Co., who handled installation of monitors.



MONITORADIO

LOW COST MONITORS

pay off in

2-way radio

POLICE

FIRE

REA

PIPELINES

MUNICIPAL

AIRCRAFT

FORESTRY

Use of additional listening posts will prove as effective as they have for Fire Chief Van Zile of Barnard, New York who writes:

"Speed in mobilizing a volunteer fire department determines the efficiency of that department. Today, thanks to radio and your PR 9 radio receivers, we are able to alert our entire personnel, informing them of the exact location of the alarm, and in most cases a number of firemen are at the scene, waiting for the apparatus.

"Our installation is very simple, consisting of a base station, three mobile units installed on the apparatus, and eighty PR 9 receivers located in the homes of the volunteers."

"The PR 9 receiver was selected for our department after several months of exhaustive testing of various makes, and I would highly recommend them to any department about to start on a similar program."



MODEL PR 9 for 152-174 MC Band

POLICEALARM

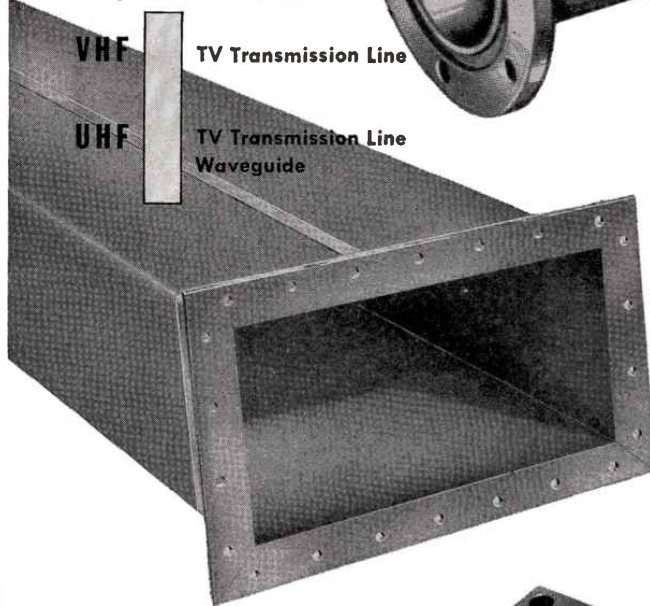
RADIO APPARATUS CORP.

55 N. NEW JERSEY ST. • INDIANAPOLIS 4

PHONE: ATLANTIC 1624

TRANSMISSION LINES FOR AM-FM-TV-MICROWAVE • ANTENNAS • DIRECTIONAL
ANTENNA EQUIPMENT • ANTENNA TUNING DEVICES • TOWER LIGHTING EQUIPMENT

Andrew's vast experience
produces the most advanced



VHF TV Transmission Line

UHF TV Transmission Line Waveguide

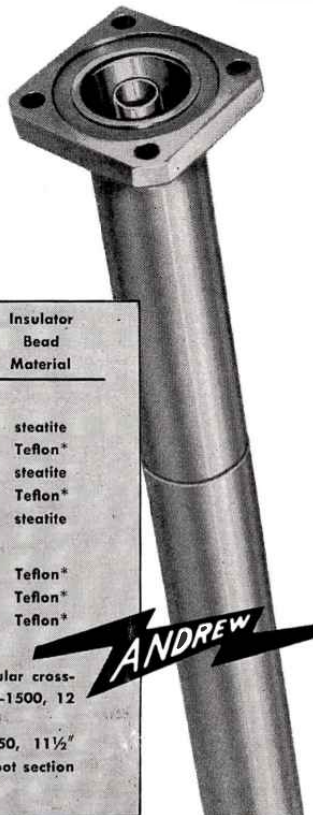
Request Andrew Nomographs in
Bulletin 81 for direct graphical
computation of efficiency of 10 to
2000 foot runs of line.

Andrew
CORPORATION

363 EAST 75TH STREET, CHICAGO 19
ANTENNA SPECIALISTS

ANDREW Type Number	Size	Impedance	Insulator Bead Material
TRANSMISSION LINE FOR VHF-TV			
451	1 5/8"	51.5 ohms	steatite
551-4	1 3/8"	51.5 ohms	Teflon*
452	3 1/8"	51.5 ohms	steatite
552-1	3 1/8"	51.5 ohms	Teflon*
T-453	6 1/8"	51.5 ohms	steatite
TRANSMISSION LINE FOR UHF-TV			
561	1 3/8"	50.0 ohms	Teflon*
562	3 1/8"	50.0 ohms	Teflon*
563	6 1/8"	75.0 ohms	Teflon*
WAVEGUIDE FOR UHF-TV			
M-14710	Aluminum 7 1/2" x 15" rectangular cross-section, RTMA designation WR-1500, 12 foot section		
M-14715	Aluminum waveguide WR-1150, 11 1/2" x 5 3/4" inside dimensions, 12 foot section		

*trademark for DuPont tetrafluoroethylene



ANDREW

NEW APPLICATIONS

(Continued from page 31)

State of Tenn	2200 Charlotte Av Nashville 3 Tenn	50	150	46.86		G
State of Calif	State Capital Sacramento Calif	r1	150	72.10	—	
	Nr Millard Calif	q1	150	75.78	—	
	Susunville Calif	q1	150	73.66	—	
	Quincy Calif	r1	150	73.30	—	
	Nr Virgilia Calif	r1	150	73.30	—	

SPECIAL EMERGENCY

Galt Vet Service Box 84 Galt Calif	1	60	47.62	1	120	47.62	M
J R Tweddle Pine Bush N Y	1	30	47.46	1	120	47.46	M
Grassland Hospital Broken Bow Neb	2	60	47.58	1	60	47.58	M
Lloyd G Minton 322 W Fulton St Wauwaca Wis	1	80	47.54	1	120	47.54	M
Dr Isidor Yasgur Jeffersonville N Y	1	60	47.62	1	120	47.62	M
Animal Hospital 207 College St Lubbock Tex	5	80	47.50	1	120	47.50	M
E S White 518 Gem St Tulare Calif	1	30	157.45	1	60	157.45	M
Wm R Dobbs Box 869 Albemarle N C	1	10	47.66	1	10	47.66	M
R M Keith Box 165 Kirksville Mo	2	40	47.58	1	40	47.58	M
Merrill Goodman DVM E Main St Washingtonville N Y	1	60	47.58	1	120	47.58	M
Dr W C Bowen 135 W Ottawa St Richwood Ohio	1	120	47.50	1	60	47.50	M
Lefler Funeral Home 160 N 1st Albemarle N C	8	30	160.71	1	60	160.71	—
P J Lieb 206 Elroy St Elroy Wis	1	60	47.50	1	120	47.50	M
C J Laridson 120 Bluff St Mauston Wis	2	80	47.62	1	120	47.62	M
Dr R M Bates DVM Battleground Wash	3	60	47.46	1	120	47.46	M
Dr J F Kantzer Rte 4 Marlon Ohio	2	60	47.46	1	120	47.46	M
A J Murphy 601 3rd St SE Waverly Iowa	2	30	47.54	1	60	47.54	M
N K Kinney 308 Moorhead St Ida Grove Iowa	2	30	47.54	1	60	47.54	M
E J Dahlquist Fayette Iowa	2	30	47.66	1	60	47.66	M
J B White DVM 305 E Locust St Davenport Iowa	2	30	47.50	1	30	47.50	M
Dr J G Egelman Womelsdorf Pa	1	120	47.62	1	120	47.62	M
Dr H M Keebler 16 RR St St Marys Pa	1	30	47.58	1	60	47.58	M
	p1	.75	47.58				M
McDaniels Vet Hospital Eastman Ga	2	15	47.50	1	15	47.50	M
Camden Clinic 121 Frazier St Camden Tenn	3	60	47.58	1	120	47.58	M
Dr J M Hogely Rte 45 Lancaster Ohio	1	30	47.58	1	60	47.58	M
R D Mackerth Kimball Minn	1	60	47.55	1	60	47.66	M
Dr R T Howard Kanawha Iowa	2	30	47.66	1	60	47.66	M
D F Stoppel Pine Island Minn	2	60	47.62	1	120	47.62	M
Alan Morrow DVM Little Falls Minn	1	60	47.46	1	120	47.46	M
Owens-Brundy Funeral Home 425 S Henderson St Fr Worth Tex	17	25	161.85	1	120	161.85	G
Hermon Lung DVM 811 N Cavin St Wigonier Ind	2	12	47.66	1	30	47.66	M
Harry Hulyk DVM Box 879 Greensburg Pa	3	30	47.58	1	60	47.58	M
D B Miller MD Crescent City Calif	5	60	47.50	1	90	47.50	K
Gerrit Beckening MD Edgerton Minn	2	60	159.51	1	60	159.51	G
			161.07			161.07	
Biggs Funeral Home 302 W Main St Willmston N C	4	20	47.54	1	120	47.54	M

STATE GUARD

Texas State Guard Box 613 Refugio Tex	11	125	2.726	R
Woodsboro Tex	11	25	2.726	U

POWER UTILITY

Warren Elec Coop Youngville Pa	sr1	120	73.19	M			
		1	500	48.26	M		
Greenville City Wtr Wks Box 687 Greenville S C	25	124	48.06	1	124	48.06	G
Nr Greenville S C				same			
Paris Mtn State Park S C				same			
Table Rock Cove lake				same			
Calif Water Service Co Box 1160 San Jose Calif	5	30	153.47	1	30	153.47	M
Marysville Calif	5	30	153.47	1	30	153.47	M
Laguna Beach County Wtr Dist Laguna Beach Calif	12	30	48.50	1	30	48.50	M
Tri County REC 22-26 Main St Mansfield Pa	1	120	48.06	M			
Nr Cloudersport Pa	1	60	75.82	M			
Cloudersport Pa	1	60	72.22	M			
City Pr & Wtr Dept City Hall Tahlequah Okla	6	10	153.53	1	10	153.53	M
Southwestern G & E Co Box 1106 Shreveport La	12	12	48.10	M			
Cent La Elec Co 528 Monroe St Alexandria La	1	120	47.98	M			
Nr Baldwin La	1	120	47.98	M			
Potomac Edison Co 55 E Washington Hagerstown Md	70	10	158.25	1	50	158.25	G
Dans Rock Md	70	10	158.25	1	50	158.25	G
Ariz Pub Serv Co 501 So 3rd Ave Phoenix Ariz	1	60	153.59	R			
Nr Yuma Ariz	usr1	75	72.66	R			

Yuma Ariz	usq1	75	75.50	R				
Washington Wtr Pr Co 825 W Trent Ave Spokane Wash								
Wallace Idaho		1	250	153.71	G			
Cent Pr & Lt Co 120 N Chaparral Corpus Christi Tex								
Hartlingen Tex		1	30	48.10	M			
Cal Elec Pr Co 3771 8th St Riverside Calif								
Palm Springs Calif	2	120	37.58	1	500	37.58	M	
Lower Colo Riv Auth Box 1153 Austin Tex								
Nr Giddings Tex		1	150	37.62	G			
Ky Util Co 114 W Main St Earlington Ky		1	150	48.30	G			
Ariz Pub Serv Co 501 S 3rd Av Phoenix Ariz								
McNeal Ariz		15	150	37.54	1	30	153.41	R
Pub Serv Co of N C 217 Hillsboro St Raleigh N C								
		20	20	48.98	1	120	48.98	M
		50	60	48.98				M
Carteret-Croven EMC Morehead City N C								
Havelock N C	10	60	153.47	1	120	153.47	M	
Newport News Water Wks City Hall Newport News Va								
		15	150	37.54	1	150	37.54	GK
El Paso Elec Co El Paso Tex								
Nr Organ New Mex		1	120	48.50	G			
Utah Pr & Lt Co Box 899 Salt Lake City Utah								
Preston Idaho		1	120	153.71	M			
MauI Elec Co Ltd Box 355 Wailuku Maui T H								
Kahului T H	15	30	47.74	1	30	47.74	G	
					1	50	47.74	G
City Elec System Union City Tenn								
	p12	3	153.53	1	60	153.53	M	
		4	21	153.53				M
Ky Utilities Co Upper St Augusta Ky		1	150	48.30	G			
Consumers Public Serv Co Brookfield Mo								
Princeton Mo		1	120	47.74	M			
S C Elec & Gas Co 141 Meeting St Charleston S C								
Beaufort S C		1	150	37.86	M			
Worcester County Elec Co 11 Foster Worcester Mass								
		11	50	48.22	G			
Washington Elec Coop Inc East Montpelier Vt								
South Barre Vt	usq1	70	73.50	M				
City Lt & Pr Dept 1601 1st Ave Opelika Ala								
		16	25	158.19	1	25	158.19	G
Flo Pub Utilities Co Box 272 Marianna Fla								
		15	60	37.66	1	120	37.66	M
Kans-Nebr Natural Gas 300 N St Joseph Hastings Neb								
North Platte Neb		1	15	37.50	M			
Phila Elec Co 1000 Chestnut St Philadelphia Pa								
Langhorne Manor Pa								
So Calif Edison Co 601 W Fifth St Los Angeles Cal								
Nr Mentone Calif	usr2	2	957.00	G				
			959.70					
Nr China Calif	usr1	20	457.45	M				
Ontario Calif	usq1	20	456.55	M				
Nr Bakersfield Calif	usq1	10	959.70	M				
		usq1	10	956.10	R			
B H Putnam Box 647 Marietta Ohio								
T J Carter Drilling Co 363 Rio Grande Bldg								
Dallas Tex	10	70	33.22	15	70	33.22	G	
Miller & York Box 1664 Bakersfield Calif								
		20	100	48.62	1	150	48.62	K
Michigan-Ohio Pipeline Corp 704 Nat'l Bank Bldg								
Grand Rapids Mich								
E Lansing Mich		1	60	153.35	M			
Samaria Mich		1	60	153.35	M			
Rochester G & E Corp 89 East Ave Rochester N Y								
Sodus N Y		1	60	37.62	M			
Belmont N Y		1	60	37.62	G			
Mt Morris N Y		1	60	37.62	G			
West Penn Pr Co Box 1736 Pittsburgh 30 Pa								
Connellsville Pa		u1	10	1.905	W			
Charleroi Pa		u1	10	1.955	W			
Pacific G & E Co 245 Market San Francisco Calif								
Hyonpom Calif		1	120	158.25	L			
Korbel Calif		1	120	158.25	L			
Tracy Calif		1	30	158.25	R			
Manicopa Calif				some				
Oakdale Calif				some				
Lodi Calif				some				
City Utilities 708 Main St Anderson Ind								
		15	60	153.59	1	60	153.59	M
		15	30	153.59				M
Sewerage & Water Bd of New Orleans Elec Dist								
System 526 Carondelet St New Orleans La								
		60	153.41	15	60	153.41	G	
N Y State Elec & Gas Corp 62 Henry Binghamton N Y								
Perryburg N Y		1	150	37.78	G			
Rutherford Elec Memb Corp Forest City NC								
Cherryville N C		1	124	37.78	G			
Water Dept So River St Marshfield Mass								
		5	30	48.42	1	60	48.42	R
Lincoln-Union Elec Co Alcester S D								
Lennox S D		1	120	158.25	M			
Cap Rock Elec Corp Stanton Tex		1	60	37.86	M			
Columbus & So Ohio Elec Co 215 N Front St								
Columbus 15 Ohio								
Waverly Ohio		1	150	47.78	M			
P R Aqueduct & Sewer Auth Box 2832 San Juan P R								
		1	30	153.71	M			
PIPELINE PETROLEUM								
Loffland Bros Co Box 1649 Tulsa Okla								
Odessa Tex	50	70	48.76	1	300	48.76	G	
Amerada Petroleum Co Box 1009 Williston N D								
Tioga N D		112	70	48.76	G			
Atlantic Seaboard Box 215 Falls Church Va								
Nr Seneca W Va		1	150	33.38	G			
Mathias W Va		1	160	33.38	G			
Matco Refineries Inc Box 660 Roswell N Mex		12	300	48.98	G			
Phillips Petroleum Co Bartlesville Okla								
Odessa Tex		1	60	33.38	M			
United Gas Pipeline Co Box 1407 Shreveport La								
Leeville La		1	150	48.78	M			
Sun Oil Co Sun Physical Lab Newton Square Pa								
		3	25	153.17	T			
Edison & Gwoltney Drilling Co Box 289 Washington Ind								
		6	60	33.34	1	60	33.34	M
United Fuel Gas Co 1033 Quarrier Charleston W Va								
Clendenen W Va		1	150	33.38	G			

(Continued on page 34)

Before you buy anybody's MICROWAVE SYSTEM

Consider these 5 facts!

1. Who is the manufacturer?

When you specify RCA, the answer is easy. Because RCA is the world's greatest name in radio, television, and related activities. RCA has pioneered in high-frequency radio communications and really knows microwave from start to finish.

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

1. Uses conventional tubes throughout.
2. Easy to tune. Has built-in metering.
3. Handles large number of single side-band frequency division channels without excessive cross-talk.
4. Flexible. Any or all voice or control channels can be picked up or dropped at any station, repeater or terminal.
5. Service channel with signaling available at each repeater and terminal station.
6. Vertical space, provides ready access both front and rear.
7. Designed, built, and backed up, by RCA . . . world leader in electronics.



RADIO CORPORATION of AMERICA

MORE INFORMATION? MAIL COUPON TODAY

RCA Communications, Dept. 192K, Camden, N. J.

Without obligation, please send me more information on RCA Microwave for the specific application indicated: _____

Name _____

Position _____


Company _____

Address _____


City _____ State _____

Please have an RCA Microwave Engineer call on me.

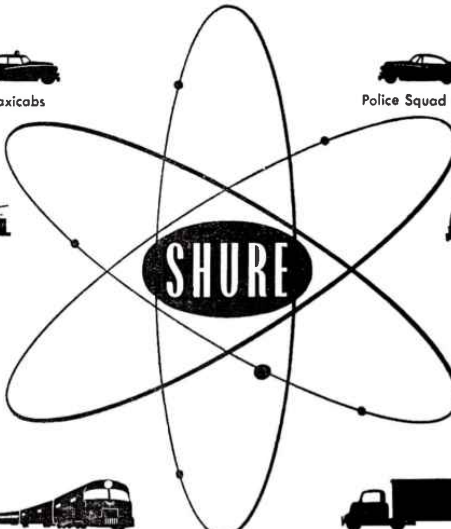
...nucleus of vital mobile communications!




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"100" Series




SHURE




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Police Squad Cars




Fire Trucks




Busses




Lift Trucks




Motorcycles




Railroads




Trucks



"520SL"



"510MD"



Industrial

NEW APPLICATIONS

(Continued from page 33)

N Y State Gas Corp 140 Stonwix St Pittsburg Pa					
Nr Export Pa	1	500	48.70	G	
Nr So Bend Pa	1	500	48.70	I	
Va Gas Trans Corp Box 215 Falls Church Va	r1	150	33.38	G	
Moran Bros Inc Nacol Bldg Wichita Falls Tex	1	120	153.23	M	
Amer Republic Corp Petroleum Bldg Houston Tex	1	30	153.17	M	
Lofflard Bros Co Box 1649 Tulsa Okla	113	70	48.76	G	
Midwestern Drillers 628 Wright Bldg Tulsa Okla	1	120	30.74	M	
Liberal Kans	1	60	72.62	M	
Union Oil Co of Calif 617 W 7th St Los Angeles	u1	60	75.86	M	
Circuit Calif	u1	60	75.86	M	
Nr Bell Calif	u1	60	75.86	M	
Pan American Prod Co Nellie Esperson Bldg Houston	1	120	153.11	M	
Charenton La	10	60	153.11	1	30
Franklin La	1	30	153.11	M	
3 States Nat Gas Co Kearns Bldg Salt Lake City	1	60	33.38	M	
Price Utah	20	60	33.38	16	60
Oklahoma Nat Gas Co Box B71 Tulsa Okla	150	58	48.78	r2	10
Chickasha Okla	1	114	48.78	R	
Depew Okla	1	114	48.78	R	
Oklahoma City Okla	1	114	48.78	R	
Shawnee Okla	1	114	48.78	R	
Muskogee Okla	r2	10	1855	R	
Sapulpa Okla	r2	10	1855	R	
Nr Chickasha Okla	r2	10	1855	R	
Nr Tuttle Okla	r2	10	1855	R	
Nr Sapulpa Okla	1	114	48.78	R	
Nr Prague Okla	1	114	48.78	R	
Nr E Tinker Air Base Okla	1	10	1855	R	
Nr Okla City Okla	1	10	1855	R	
Nr Depew Okla	1	10	1855	R	
Nr Coweta Okla	1	10	1855	R	
Bates & Cornell Box 1000 Lafayette La	1	250	33.22	M	
Mowata La	1	30	20	48.98	1
Pub Serv Co of N C 310 E Main Box 200C8 Durham N C	1	500	48.98	M	
Humble Oil & Refining Co Box 2180 Houston Tex	10	60	48.98	M	
Lake Sand Field La	1	150	48.86	L	
Texas Co Producing Dept 135 E 42nd St New York 17	s1	10	9.59	R	
Boulder Ill	s1	10	9.59	R	
Salem Ill	s1	10	9.59	R	
El Paso Nat Gas Co 1010 Bassett Tower El Paso Tex	r1	150	48.74	M	

RETURN YOUR CARD!

By now, you will have received a letter informing you of the division of **RADIO COMMUNICATION** into two new magazines, to be entitled **COMMUNICATION ENGINEERING** and **TV & RADIO ENGINEERING**. These will be published on alternate months beginning in January, 1953.

Enclosed with your letter was a card on which you were asked to indicate your preference for one of the magazines or both. If you have not returned the card already, please be sure to do it right away so that you will be sure of getting the magazine of your choice. If we do not receive your card, you will be sent **COMMUNICATION ENGINEERING**.

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the right part when you need it for production or laboratory requirements

This permanent, hard cover Official Buying Guide of the electronic-TV parts and equipment industry with its comprehensive detailed index, eliminates the need for maintaining files of small catalogs and manufacturers' literature. **RADIO'S MASTER** lists 90% of TV and electronic equipment. Not merely part number listings—complete descriptions, specifications and illustrations written and compiled by each manufacturer. Enables you to make comparisons or substitutions right now!



UNITED CATALOG PUBLISHERS, INC.
110 Lafayette St., New York 13

Sun Oil Co Box 920 Toledo Ohio	50	30	153.23	1	120	153.23	R
	15	2	153.23				R
Western Nat Gas Co C & I Bldg Houston Tex	1	300	49.00	G			
Rockport Tex	1	300	49.00	G			
Aronas County Tex	sr1	50	73.34	G			
Corpus Christi Tex	usq1	50	72.66	G			
Edinburgh Tex	1	70	49.00	G			
Oakville Tex	1	70	49.00	G			
Nr Nursery Tex	1	70	49.00	G			
Mirando City Tex	1	70	49.00	G			
Houston Tex	30	70	49.00	13	70	49.00	G
John W Mecom 2906 Gulf Bldg Houston 2 Tex	1	240	2,292	13	240	2,292	R
Nr Hitchcock Tex	4	240	2,292	13	240	2,292	R
St Helens Petroleum Corp 254 S Spring St Los Angeles	20	30	153.29	1	200	153.29	X
Bakersfield Calif	20	30	153.29	1	200	153.29	X
States Exploration Co 709 M & M Bldg Houston Tex	2	10	1,652				K
Pan Amer Pipeline Co Niels Esperson Bldg Houston	1	120	48.70	M			
Alvin Tex	1	120	48.70	M			
Humble Pipeline Co Box 2220 Houston Tex	1	50	48.86	G			
Nr Ballinger Tex	1	50	48.86	G			

FOREST PRODUCTS

Masonite Corp 50 4th Ave Laurel Miss	25	60	49.50	1	520	49.50	M
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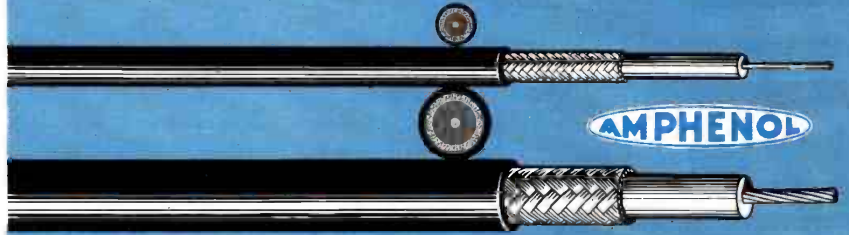
Waynesboro Miss	4	30	49.50	M			
Paulding Miss			same				
Collins Miss			same				
Richton Miss			same				
Coaston Lumber Co Box 822 North Bend Ore	1	120	49.58	M			
West Fork Millicoma Ore							
10	60	49.58	1	120	49.58	M	
p5	2	49.58				M	
danha Lumber Co Idanha Ore							
4	120	49.52	1	120	49.52	M	
8	80	49.52				M	
p2	3	49.52				M	
South Coast Lumber Co Box 327 Brookings Ore							
Nr Brookings Ore	6	60	49.22	1	60	49.22	G
Murphy Lumber Co 836 Pacific Bldg Portland Ore							
1	150					49.54	G
Galbraith Bros Deming Wash							
Whatcom County Wash	20	60	158.43	1	60	158.43	M
R R Crow & Co Saratoga Wyo							
Nr Hanna Wyo	1	70	49.46				G
Forest Radio Co McNary Ariz							
Overgaard Ariz	1	120	153.05				M

SPECIAL INDUSTRIAL

Thompson-Arthur Co Box 1197 Greensboro N C							
1	124					49.86	G
1	124					49.86	G
United Elec Coal Co 307 N Michigan Chicago Ill							
St Charles Ky	10	15	154.57	1	60	154.57	M
Vanadium Corp of America Durango Colo							
White Canyon Utah	2	100	2,292				X
L T Barber Box 270 Moultrie Ga							
10	3	154.49					M
Chase Groves Inc Box 291 Sanford Fla							
Windermera Fla	4	150	43.02	1	150	43.02	R
R L Cure Box 41 Pendleton Ore							
Umatilla City Ore	15	30	49.82	1	120	49.82	M
Jack Frost Inc 122 Munson St Granville Ohio							
10	120	49.58	1	120	49.58	M	
Centriline Corp 140 Cedar St New York							
10	120	49.58	1	120	43.02	M	
San Joaquin Vly Hay Growers Assn Box 63 Los Banos Calif							
10	120	49.98	1	120	49.98	M	
Whittle Contracting Co Box 5602 Dallas Tex							
10	200	43.02	1	200	43.02		—
Gen Elec Co c/o P D Andrews Electronics Pk Syracuse N Y							
Nr Buechel Ky	75	25	152.87	1	120	152.87	G
p12	3	152.87					A
Manhattan Const Co of Tex 2828 Pease St Houston							
10	30	43.14	1	120	43.14	M	
13	3	43.14					M
Tri-City Contracting Co 800 Marquette St Bay City Mich							
5	60	43.10	1	60	43.10	M	
Cherif Bros Constr Co Box 938 Ephrata Wash							
20	30	152.99	1	120	152.99	M	
Timken Roller Bearing Co Canton 6 Ohio							
Nr Canton Ohio	2	34	456.25	1	90	456.25	M
Utah Mud Inc Box 605 Aztec N Mex							
1	60	43.06					M
113	60	43.06					M
L W Richardson Constr Co Sputh Rice St Aransas Pass Tex							
10	120	49.54	1	120	49.54	M	
13	120	49.54					M
American Constr Co 100 Airport Rd Hartford Conn							
25	30	43.18	1	120	43.18	M	
Communications Equip & Serv Co 2906 Alder Circle Anchorage Alaska							
1	40	152.93					M
Halliburton Oil Well Cementing Co Duncan Okla							
El Dorado Kans	1	300	49.74				G
Nr Hays Kans	1	300	49.74				G
Hays Kans	a1	50	74.38				G
u1	50	72.78					G
Goodyear Farms Litchfield Park Ariz							
15	60	162.00	1	60	162.00	G	
F E Wilder Box 147 rte 11 Olympia Wash							
La Pine Ore	4	60	43.02	1	120	43.02	M
4	30	43.02					M
4	3	43.02					M
L G De Felice & Son Nestleton-Av North Haven Conn							
5	60	49.90	1	120	49.90	M	
15	30	49.90	14	120	49.90	M	
p5	1	49.90					M
Benton Cement Products Corp 1019 Grant Ave Prosser Wash							
10	124	43.18	1	124	43.18	G	
Chapin & Chapin Inc Box 413 Norwalk Ohio							
6	30	43.18	1	60	43.18	G	
Chas Schwartz Bin F Stratford Calif							
—	60	162.00	1	120	162.00	L	
Acme Concrete Corp Box 1000 Hialeah Fla							
Miami Fla	25	30	152.93	1	120	152.93	M
Squire Ranch Box 368 Corcoran Calif							
Stratford Calif							
1	12	49.86					M
lakeland Dustets Inc Box 926 Corcoran Calif							
5	10	49.54	1	60	49.54	M	
20	30	49.54					M
Newberry Elec Corp Box 565 Pickstown S D							
p5	20	154.49	15	20	154.49	M	
p5	1	154.49					M
Fairchild Aircraft Div Fairchild Engine & Aircraft Corp Hagerstown Md							
20	10	154.49	10	154.49	G		
Thompson King-Tate 701 E 7th St Lexington Ky							
1	30	49.90	1	60	49.90	L	
Ready Mix Concrete Co Box 200 Danville Ky							
1	30	49.90	1	60	49.90	L	
Long Constr Co Box 1290 Billings Mont							
20	60	43.02	14	120	43.02	M	
p5	3	43.02					M
Radio Schlumberger Inc Box 2175 Houston Tex							
Harvey La						49.90	G
Fulghum Contracting Corp Box 1181 Harrisburg Pa							
14	60	43.06	1	120	43.06	M	
Herigstad Engineering Co Rejand Iowa							
3	30						—
Tri-City Constr Corp 3217 Lawrence St Flushing N Y							
Tullytown Pa	6	60	49.90	1	120	49.90	R
Fish Meal Co Beaufort N C							
15	180	30.62	1	500	30.62	K	

(Continued on page 36)

RG/coaxial cables



Whatever the size RG coaxial cable you need, you'll get a better cable when you buy from Amphenol. Every stage of cable manufacture, from the testing and selection of raw materials through to the final loading and shipping, is done by Amphenol's experienced workers in Amphenol's own modern cable plant under the watchful eye of Amphenol's technicians and engineers. There is no opportunity for outside errors to creep in.

Amphenol RG coaxial cables are available with either high quality polyethylene or Teflon dielectric. The polyethylene cables are jacketed with tough, weatherproof vinyl to military specifications. The Teflon dielectric type cables have an outer covering of silicone varnish impregnated glass fibre for high temperature applications up to 500°F. These Amphenol cables satisfy every environmental need for military and civilian use from the Arctic to the Tropics.

Amphenol solid dielectric coaxial cables are providing the best in RF transmission, without maintenance expense, in communication service everywhere!

A few of the popular sizes of Amphenol RG/Coaxial Cables

MIL NUMBER	AMPHENOL NUMBER	NOMINAL IMPEDANCE	NOMINAL O.D.	DIELECTRIC MATERIAL
RG-122/U	21-441	50 ohm	.160	Polyethylene
RG-58/U	21-024	53.5 ohm	.195	Polyethylene
RG-59/U	21-025	73 ohm	.242	Polyethylene
RG-62/U	21-026	93 ohm	.242	Polyethylene
RG-8/U	21-004	52 ohm	.405	Polyethylene
RG-17/U	21-013	52 ohm	.870	Polyethylene
RG-87A/U	21-250	50 ohm	.425	Teflon
RG-141/U	21-382	50 ohm	.195	Teflon

This plastic cable and connector selector is designed to help the engineer or designer to choose the proper cable or combination of cable and connector. Listed on this selector are several hundreds of cables, connectors and combinations. This handy selector will be furnished at no charge to designers and engineers working with radio frequency cables and connectors. Address your request on your company letterhead to Department 13L.



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1830 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS

STANDARD SIGNAL GENERATOR

**MODEL
65-B
RANGE
75 KC
to
30 MC**



Individually Calibrated Scale

OUTPUT: Continuously variable, .1 microvolt to 2.2 volts.
OUTPUT IMPEDANCE: 5 ohms to .2 volt, rising to 15 ohms at 2.2 volts.

MODULATION: From zero to 100%. 400 cycles, 1000 cycles and provision for external modulation. Built-in, low distortion modulating amplifier.

POWER SUPPLY: 117 volts, 50-60 cycles, AC.

DIMENSIONS: 11" high, 20" long, 10 1/4" deep, overall.

WEIGHT: Approximately 50 lbs.

Catalog on request

MANUFACTURERS OF
Standard Signal Generators
Pulse Generators
FM Signal Generators
Square Wave Generators
Vacuum Tube Voltmeters
UHF Radio Noise & Field Strength Meters
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MILITARY COMPONENTS TO SPECIFICATIONS MIL-T-27 & ANE-19
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Self-contained and A.C. operated with electronically regulated supply. 1 megohm to 2 million megohms.

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NO. 1210 Null Detector and Vacuum Tube Voltmeter
NO. 1140 Null Detector Amplifier
NO. 1040 A.C. — V.T. Voltmeter
NO. 1250 Decade Condenser
NO. 1410 Harmonic Distortion Meter

Send for Complete Catalog describing all Freed Instruments and Transformers

FREED TRANSFORMER CO., INC.
1728 Weirfield St., Brooklyn (Ridgewood) 27, N. Y.

ZOPHAR WAXES

COMPOUNDS
Zophar Waxes, resins and compounds to impregnate, dip, seal, embed, or pot electronic and electrical equipment or components of all types, radio, television, etc.

Cold flows from 100°F. to 285°F.
Special waxes non-cracking at -76°F.

Compounds meeting Government specifications plain or fungus resistant.

Let us help you with your engineering problems.

ZOPHAR MILLS, INC.
112-130 26th Street,
Brooklyn 32, N. Y.

NEW APPLICATIONS

(Continued from page 35)

15	120	30.62		K
p15	2	30.62		A
Ariz Cotton Co	425 W 2nd St	Casa Grande	Ariz	
Nr Maricopa	Ariz	1	30	154.57 M
Dallas L Watson Jr	Box 247	Hartford	Ala	
5	114	43.02	1	114
N W Trask	Burton S C	6	60	43.13 M
Cone Bros Constr	Co Box 1301	Tampa	Fla	
Clearwater	Fla	1	30	49.86 M
Tarpon Springs	Fla	1	30	49.86 M
Standard Oil Co	Midland Bldg	Cleveland	Ohio	
13	30	152.99	1	30
Reid Contracting Co	Box 215	Woodbridge	N J	
15	120	43.18	1	300
			11	120
A P Weaver & Sons	Fryburg	Pa	1	50
Tippery	Pa			49.86 G
Bud Inc	Box 759	Watsonville	Calif	
El Centro	Calif	1	124	43.06 G
N W Iowa Tel Co	Sloan	Iowa		
10	12	50.00	1	60
Floyd Haake	111 Lovato Lane	Santa Fe	New Mex	
10	30	43.02	1	30
Cloyd & Teague	Treating Co	Kermit Hwy	Odessa	Tex
10	70	43.10	1	70
Schramm Ranches	Box 487	San Joaquin	Calif	
12	120	49.58	1	120
Dixie Elec Co	100 W Chase	Pensacola	Fla	
7	30	43.18	1	120
Sturgeon Elec Co	300 S Vallejo	St Denver	Colo	
4	80	43.06	1	120
4	40	43.06	1	120
	p4	2	43.06	M
Jarrett Ranches	Rte 2	Britton	S D	
10	120	49.90	1	120
G Bennett Const Co	3001 N 7th St	Trafficway	Kans	
40	60	43.10	1	60
6	60	43.10		R
J A Tobin Const Co	3701 Rainbow Blvd	Kansas City	Kans	
25	70	43.18	1	70
Williamson Well Serv	206 Nichols St	Odessa	Tex	
Midland	Tex	1	70	30.58 G
Peter Salvicci	55 Pond St	Waltham	Mass	
10	30	30.62	1	120
Palisades Contractors	Irwin	Idaho		
10	124	49.98	1	124
Sherry Corp	823 Davol St	Fall River	Mass	
10	150	49.54	1	150
Georgia Tech Res Inst	225 North Ave	NW Atlanta	Ga	
1	30	30.62	1	30
		30.58		30.58 X
			11	30
				30.62
				30.58
Adams & Wright Coal Loading Co	Shawneetown	Ill		
3	30	154.49	1	30
Magnet Cove Barium Corp	Box 6504	Houston	Tex	
San Juan	Calif	10	60	43.10
			1	60
				43.10 M

LOW POWER INDUSTRIAL

Columbia Univ	632 W 125 St	New York	27	N Y
	p2	2	154.57	M
Shelton Elec Co	110 4th St	Shelton	Wash	
	p3	3	35.02	X
Brunner Mfg Co	Utica	N Y		
	p4	3	154.57	M
N J Cooper	4617 N. Damon Ave	Chicago	25	Ill
	p2	3	154.57	A
Paul Mantz Air Serv	Hanger 1	Lockheed Air Term		
Burbank	Calif	p15	1.3	154.57 M
Los Angeles City	IBur of Engral	City Hall	Los Angeles	
	p20	1	154.57	T
Morris Paper Mill	Morris	Ill		
	p5	3	154.57	A
Clapp & Pollak	341 Madison Ave	New York	N Y	
	p2	3	154.57	M
	p6	2	154.57	M
Harlan Elec Constr Co	4820 Lewis Av	Toledo	Ohio	
	p5	1.3	154.57	M
	p16	2	42.98	M
Movietone News Inc	460 W 54th St	New York	N Y	
	p2	3	154.57	M
Bugg Radio Serv	Box 49	Taylorville	Ill	
	p2	3	154.57	A
Ed Doughty Elec Co	Box 467	Columbus	Miss	
	p2	2	25.51	A
Wheaton Radio & TV Inc	11266 G Ave	Silver Spg	Mich	
	p6	3	154.57	X
AEG Elec Co	Box 11	Esconaba	Mich	
	p2	3	42.98	A
Owens-Parks Lumber Co	2100 E 38th St	Los Angeles		
	p1	1.5	154.57	M
R M Miller	Rte 1	Duncannon	Pa	
	p5	3	154.57	A
A J Lund	206 High St	Wauposa	Wis	
	p1	12	148.10	X

COASTAL & MARINE RELAY

Wis Tel Co	722 N Broadway	Milwaukee	2	Wis
			2	115
				161.90 G
Glenmore Wis				15 Ohio
Ohio Bell Tel Co	750 Huron Rd	Cleveland	15	Ohio
			2	115
				162.00 G
Valentine Trans Corp	220 E 42	New York	17	N Y
	10	60	156.90	1
			120	156.90 M
Ohio Bell Tel Co	121 Huron St	Toledo	Ohio	
	2	140	156.89	162.00 M
				162.00
Mich Bell Tel Co	1365 Cass Av	Detroit	26	Mich
Hancock	Mich	2	50	156.80 G
				161.90
Port Huron Mich				some
Esconaba	Mich			some

Marquette Mich			some				
East Towas Mich			some				
Nassau Fertilizer & Oil Co Box 767 Oldtown St							
Fernandina Fla	10	30	156.90	1	120	156.90	M
N Y Telephone Co 140 West St New York 7 N Y							
Buffalo N Y	2	150	156.80				G
			161.90				

ALASKAN FIXED PUBLIC

Stock & Grove Box 2051 Anchorage Alaska	2	100	2,566	NN
			2,382	
			2,986	
			5,167	

COASTAL & FIXED

Carl E Carlson Box 3073 Juneau Alaska				NN
p1 50	2,450			
	2,474			
	2,512			
	3,190			
	5,207			

MARITIME FIXED

Kerr-McGee Oil Industries Kerr-McGee Bldg Okla-							
homa City Okla	1	100	2,110	X			
			2,134				
			2,166				
			2,206				
	1	50	some	Q			

RAILROADS

N Y Chicago & St Louis RR Co Term Tower Bldg							
50 Pub Square Cleveland 1 Ohio							
p75	1	161.25					T
115	30	161.25					T
10	30	161.25	1	30	161.25	WT	
Conneaut Ohio			1	30	161.25	T	
Palmsville Ohio			some				
Bellevue Ohio			some				
Ashabula Ohio			some				
Ripley N Y			some				
Avery Ohio			some				
Erte Pa			some				
So Pacific Co 65 Market St San Francisco 5 Calif							
Stockton Calif	1	60	161.55	M			
			161.79				
Georgia RR Co 4 Hunter St SE Atlanta Ga							
20	60	161.67					M
220	2	161.67					M
Union Pacific RR 1416 Dodge St Omaha 2 Neb							
Cheyenne Wyo	1	12	160.14	M			
Nr Granite Canyon Wyo	1	60	161.79	M			
Mo Pacific RR Co 310 N 13 St St Louis 3 Mo							
San Antonio Tex	1	60	160.41	M			
Palatine Tex			some				
Kingsville Tex			some				
De Quincy La			some				
Birmingham Southern RR Co Box 579 Fairfield Ala							
Bessemer Ala	1	10	160.89	M			
Birmingham Ala			some				
Atchison Topeka & Santa Fe 80 E Jackson Chicago							
Nr Williams Ariz	2	120	160.65	T			
Cocanino C Ariz	1		some				
Ashfork Ariz	1		some				
Flagstaff Ariz	2		some				
Sunshine Ariz	1		some				
Chicago Gr Western Rwy Co 303 W Harrison Chicago							
Allison Iowa	1	60	160.17	X			
Dubuque Iowa	1	60	159.57	X			

TAXICABS

ABC Cab 585 E Hill St Wabash Ind	5	30	159.65	1	120	152.39	M
Clem's Taxi 55 Mt Vernon St Augusta Me	4	30	157.71	1	80	152.45	M
Riverside Cab Co 3501 W Jefferson Escorse Mich	10	10	157.59	1	60	152.33	M
Bill & Don's Taxi Serv 24 W State Redlands Calif	6	15	157.65	1	30	152.39	M
Royal Oak Vets Cab 410 W 4th St Royal Oak Mich	14	10	157.59	1	10	152.33	M
Safety Cab Co 123 E Lyman Winter Park Fla	10	15	157.71	1	45	152.45	R
Hart Taxi Co 103 Covington Ave Opp Ala	10	10	157.65	1	10	152.39	M
Lutz Cab Co 220 Commerce Lane Rockville Md			157.59	1	60	152.33	M
Wali's Taxi 238 Robert St Elmira N Y	5	10	157.59	1	30	152.33	L
John Chicorelli 2 W Liberty St Girard Ohio			152.33	1	25	152.33	M
Radio Cab 102 Church St Fountain City Tenn	8	60	157.71	1	120	152.45	M
Southington Taxi Co Box 25 Todd Rd Southington Conn	3	30	157.59	1	30	152.33	M
Central Cab Assoc Codrington Hwy Middleton R	15	30	157.71	1	120	152.45	M
McGrath Taxi Wollaston Mass	6	30	157.65	1	30	152.39	M
Deluxe Cab Co 701 Maple St Coffeyville Kans	15	30	157.59	1	120	152.33	M
Schek's Taxi Serv Ramsey Rd Covington La	1	30	152.33	M			
Q J Cucchi 369 High St Clinton Mass			157.71	1	75	152.45	P
Yellow Checker Cab Co 248 23rd St Richmond Calif	10	21	157.59	1	120	152.33	L
	10	54	157.59				
	10	20	157.59				
Veterans Serv Cab Co 2407 Iowa St Melrose Plt III	20	60	157.65	1	60	152.39	M
Hig's Taxi 15 Mill St Dexter Me	6	30	157.53	1	120	152.27	M
City Taxi Co 301 S Market St Jackson Tenn	20	10	157.71	1	30	152.45	T

(Continued on page 38)



**TERMALINE
DIRECT READING
R. F. WATTMETERS**

(DUAL RANGE)
MODEL 611—0-15 and 0-60 Watts
MODEL 612—0-20 and 0-80 Watts
IMPEDANCE—51½ Ohms

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)

Impedance: 51.5 OHMS—VSWR less than 1.1

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.

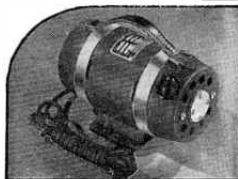
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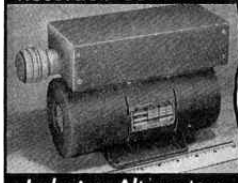
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Genemotors



Recorder Converters



Inductor Alternators



Magmotors

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Carter Rotary Power

Carter DC to AC Converters, Dynamotors, Genemotors, Magmotors, and Inductor Alternators (inverters) are made in a wide variety of types and capacities adaptable to communications, laboratory, and industrial applications, of many kinds. Widely used in aircraft, marine, and mobile radio, geophysical instruments, laboratory work, ignition, timing and many other uses.

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City _____ State _____



*Trade Mark Registered



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PIONEERS IN THE CORRECT USE OF
ARMSTRONG FREQUENCY MODULATION

HERE ARE FACTS about REL Multiplex Installations

The number of REL multiplex radio relay and point-to-point installations now in use, and the length of time they have been in service, provide ample evidence of their reliability and economy. Heart of REL installations is the Serrasoid Modulator, distinguished for low noise, low distortion, and long-time stability, delivering performance equal or superior to standard telephone channelizing equipment.

Among the companies using REL equipment in order to achieve that quality of performance are:

- Canadian National Telegraphs
- Canadian Pacific Railways
- Chesapeake & Potomac Tel. Co.
- Empresa Nacional de Telecomunicaciones, Columbia
- Israel Ministry of Communications
- Mutual Tel. Co. of Hawaii
- New England Tel. & Tel. Co.
- Pacific Tel. & Tel. Co.
- Panair do Brazil
- Quebec Telephone Co.
- Salt Lake Pipe Line Co.

REL manufacturers standard units for 70 to 2,000 mc., and modulation to 300 kc. for as many as 50 voice circuits. This equipment is 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 communication systems. Consultation service is available to those planning new installations or the modification of present facilities. Address:

Engineers and Manufacturers of
Broadcast, Communication, and
Associated Equipment since 1922

RADIO ENGINEERING LABORATORIES, Inc.

TEL: STILLWELL 6-2100 TELETYPE: N. Y. 2816
36-40 37th Street, Long Island City 1, N. Y.

NEW APPLICATIONS

(Continued from page 37)

Santora's Taxi 40 E LaGrange St	Raritan N J	10	152.39	M
Somerville N J				
Quick Service Taxi Box 207	Huntsville Tex	2	60 157.65	1 120 152.39
Dayton's Taxi 202 Boundary Ave	Cambridge Md	3	25 157.59	1 25 152.33
Dixie Taxi Serv 1903 Reynold Ave	Naval Base S C			
Charleston City S C		30	25 157.59	1 25 152.33
Wilmette Yellow Cab 415 Ridge Rd	Wilmette Ill	20	60 157.53	1 60 152.27
Custom Cab Co 408 W Franklin St	Chapel Hill N C			
Yuma Bur Co Box 348	Yuma Ariz	15	12 157.71	1 60 152.45
United Cab Co 215 E 6th St	Peru Ind	12	10 157.71	1 60 152.45
R & J Cab Serv 117 S 1st St	Miamisburg Ohio	6	10 157.65	1 10 152.39
Cedar City Cabs Mulberry & Cherry	Lebanon Ohio	6	30 157.53	1 140 152.27
Lincoln Cab Co 428 N 8th St	Fr Pierce Mo	3	20 157.71	1 20 152.45
Arrow Cab Co 100 N St	Marys St Beeville Tex	15	40 157.71	1 120 152.45
Art's Taxi Co 904 E Grand Av	Tower City Pa	10	25 157.65	1 20 152.39
City Cab Co 100 W Morris	Dalton Ga	20	119 157.71	1 25 152.45
Meter Taxi Co 1001 E Ash St	Sallina Kans	15	41 157.59	1 120 152.33
Yellow Cab Co 136 W Whittier	St Anderson S C	15	15 157.53	1 30 152.27
Beal's Taxi 189 Wilson St	Brewer Mo	4	30 157.59	1 60 152.33
Lonnle's Taxi 216 S Houston St	Cameron Tex	7	40 157.53	1 40 152.27
Twin City Cab Co 807 Cayuga	Iron River Mich	5	10 157.53	1 10 152.27
Radio Cab Co 480 S Grant St	Columbus Ohio	40	20 452.55	1 40 452.05
M E Sullivan 132 Cayuga St	Seneca Falls N Y	10	30 157.53	1 40 152.27
B & M Taxi 15 Main St	Haverhill Mass	8	30 157.65	1 120 152.39
Arbutus-Lansdowne Cab Co 1333	Sulphur Spg Rd	10	25 157.59	1 120 152.33
Arbutus Mid		10	25 157.59	1 120 152.33
Cape May Taxi Delaware & RR Aves	Cape May N J	1	25 157.65	1 25 152.39
Post Taxi Post Exchange	Fort Meade Md	15	25 157.71	1 120 152.45
Keystone Cab Co 6 St James Pl	Bradford Pa	12	25 157.65	1 60 152.39
McLaughlin's Taxi Water St	Skowhegan Me	12	30 157.65	1 60 152.39
Blue Cab Co 631 S 5th St	Las Vegas Nevada	20	30 157.53	1 120 152.27
City Cab Co 110 W Caney	Wharton Tex	10	15 152.53	1 15 152.27
Jolly Cab Co 612 Matthews	Sikesan Mo	10	30	1 80
Goshen Cab Co Hotel Goshen	Goshen Ind	5	10 157.65	1 10 152.39
Safety Cab Co 209 N Main Ave	Jameson Tex	5	12 157.65	1 12 152.39
Butter City Cab	Barron Wis	2	12 157.71	1 12 152.45
Grayhound Taxi Corp 902 Castle	Wilmington N C	12	3 452.55	1 90 452.05
Smith's Rantoul Yellow Cab 428 E	Champaign Rantoul Ill	6	60 157.65	1 60 152.39
City Cab Co 909 Marshall St	Elmhurst Ill	20	60 157.71	1 60 152.45
Yellow Cab Co 710 Market St	Knoxville Tenn	50	60 157.65	1 120 152.39
Black & White Cab Co Main St	Buford Ga	12	10 157.59	1 10 152.33
E Atlanta Car for Hire 529 Flat	Shoals Av SE Atlanta Ga	12	10 157.59	1 10 152.33
White Top Cab Co 321 W	Graham Dixon Ill	8	15 157.71	1 50 152.45
Paoli Taxi Serv 50 Woodbine	Ave Paoli Pa	6	15 157.65	1 45 152.39
Safety Cab Inc 2 Court House St	Newport R I	10	30 157.65	1 120 152.39
Courtesy Cab Co 218 Woodstock	St Crystal Lake Ill	10	30 157.53	1 60 152.27
Yellow Cab Co 411 Grant	York Neb	5	30 157.53	1 60 152.27
Parkville Cab 7711 Harford Rd	Baltimore Md	5	60 157.65	1 60 152.27
Courtesy Cab Co 107 E Bdway	Williston N D	6	30 157.71	1 80 152.45
Bub's Cabs Trion Ga		8	10 157.65	1 10 152.39
City Cab Co 56 S Main St	Martinsville Ind	3	30 157.53	1 60 152.27
Tracy's Taxi 7 Depot Place	Babylon N Y	7	30 157.71	1 30 152.45
Radio Cab Co 1014 Minor St	Seattle Wash	50	60 452.05	1 120 452.05
Service Cab Co 141 N Liberty	Spartanburg S C	20	15 157.65	1 30 152.39
Crossroads Cab Co 209 Isaquena	Clarksdale Miss	15	30 157.53	1 120 152.27
Kin's Taxi 71 Pleasant St	Middlebury Vt	6	30 157.53	1 120 152.27
Southall Taxi 522 Monticello	Charlottesville Va	20	50 157.53	1 120 152.27
Ideal Taxi Serv 80 Poplar Ave	Deal N J	3	10 157.65	1 50 152.39
Friendly Cab Co 21 S St	Marys St Marys Pa	5	10 157.59	1 60 152.33

(Concluded on page 40)



Low Power Radiotelephones for Industrial and Railroad Communication

25 to 50 and 152 to 174 mc.
Low power 2-way radio limits radiation to the approximate plant or yard area. Low power gives good coverage where wanted with minimum interference to others operating on the same frequency.



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Light weight, self-contained portable units for all services requiring communication with men on foot.

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Mobile units for all moving equipment operating within the plant or yard area.



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AC units for use at fixed locations and for the control point.

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FAS 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 live-talent FM as I am getting from my Air-Coupler in combination with a dual speaker for intermediate and treble frequencies."

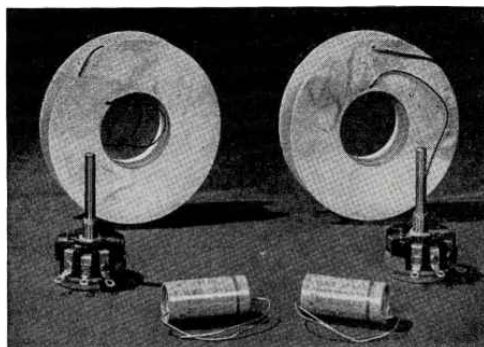
For your convenience . . . the Air-Coupler is available in both knock-down form, so that you can assemble it with a screwdriver, or completely assembled, ready to mount the speaker. Made entirely of first-quality 3/4-in. plywood, with each piece cut to precision fit.

DUAL AIR-COUPLER, COMPLETELY ASSEMBLED . . . now only 47.50
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 2 Coils 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
	350	4	12.00	17.50
8 ohms	1,750	5	20.00	24.00
	1,100	6	7.00	12.00
	550	7	7.00	13.00
	350	8	12.00	17.50
4 ohms	1,750	9	20.00	24.00
	85	10	20.00	26.50
	550	11	7.00	13.00
	275	12	7.00	15.00
	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.

Air-Couplers are shipped via Railway Express, FOB South Egremont, Mass.

Other items shipped FOB unless 75c is included to cover parcel post and insurance charges.

General Apparatus Co.

South Egremont, Massachusetts

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- CHOKES
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- CONDENSERS
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- CRYSTALS
- DYNAMOTORS & BRUSHES
- FILTERS
- FUSES & MOUNTINGS
- GENERATORS
- GROUND RODS
- HEADSETS
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- JACKS
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- LORD MOUNTS
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all phones: **SEeley 8-4143**

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Dept. E, Chicago 22, Ill.

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(Continued from page 38)

AUTO EMERGENCY

Wm Vogel Garage	403 S Park	Saginaw Mich			
	4 10	35.70	1	60	35.70 M
Clute's Garage	Rte 1 Box 199	Madisonville Tex			
	5 120	35.70	1	120	35.70 M
Raymond Auto Sales	215 N Main St	Adrian Mich			
	5 15	152.00	1	50	152.00 T
Stokey Towing Serv	519 N 4th St	Gresham Ore			
	5 60	35.70	1	120	35.70 M
Wiebelt Service	861 Hazel St	Akron Ohio			
	10 30	35.70	1	60	35.70 R
Horns Hi-Speed Serv	Co 204 S Winter	Adrian Mich			
	4 10	35.70	1	10	35.70 M
Adlers Super Serv	1186 Baldwin St	Pontiac Mich			
	4 10	35.70	1	60	35.70 M
Davis Home & Auto Supply	22nd & Olive St	Joe Mo			
	12 140	35.70	1	140	35.70 M
Abbotts General Serv	Wells Me				
	2 70	35.70	1	70	35.70 M
Melim Serv & Supply	Co Box 2080	Honolulu T H			
	7 60	35.70	1	60	35.70 G

HIGHWAY TRUCKS

Nally Oil Co	80 Bass Ave	Gloucester Mass			
			1	120	35.82 L
R. H. Bowles	Toppennish Wash				
	Wapito Wash		1	39	35.82 M
Allen Brune Co	East 9th St	Mission Tex			
	Rio Grande City Tex		1	120	35.90 M
			5	180	35.90 M
			5	30	35.90 M
Red-O-Gas & Elec Co	122 S Maple	Eldon Mo			
	5 120	35.94	1	120	35.94 G
Bovd Oil Co	Box 348	Concordia Kans			
	5 24	35.90	1	120	35.90 M
Southern Music Co	418 Margaret	Jacksonville Fla			
	10 30	35.74	1	500	35.74 M
Orlando Fla			10	60	35.74 M
F & S Oil Co	Box 826	Waterbury Conn			
	25 40	35.90	1	500	35.90 M
	10 60	35.90			M
Shay Service Inc	No Main St	Dansville N Y			
			1	500	35.82 M
			1	120	35.82 M
Rochester N Y					
Helferman Fuel Oil & Supply Co	Chittenango N Y				
			15	60	35.82 M
Naos Spreading Serv	3311 Rte 31	Spencerport N Y			
	6 60	35.82	1	120	35.82 M
Western Butane Co	Selling Okla				
	6 120	35.82	1	120	35.82 M
West Okla Butane-Propane Inc	Box 277	Geary Okla			
					M
Phil's Dry Cleaning	84 Montcalm Ave	Plattsburgh N Y			
	10 30	35.74	1	30	35.74 M
Susbauer's Fuel Oil	112 S 3rd St	Hillsboro Ore			
	1 120	35.90	1	150	35.90 K
Conservative Gas Corp	Jericho TnPk & Denton Av				
New Hyde Park N Y					
Riverhead N Y	20 60	35.78	1	120	35.78 R
Wyondanch N Y	same	same			
New Hyde Park N Y	same	same			
Bell Butane Supply Co	400 Miller St	Donna Tex			
	10 150	35.86	1	150	35.86 R
Merchants Motor Freight Inc	2901 W 31st St	Chicago Ill			
	50 30	35.78	1	250	35.78 R
Amis Butane Co	U S Hwy 80	West Las Cruces New Mex			
	10 30	35.78	1	60	35.78 M
G Tacci & Sons	355 Central St	Leominster Mass			
	6 40	35.94	1	40	35.94 M

ONE-WAY SIGNALING (Radio Paging)

N Y Tech Inst	207 E 8th St	Cincinnati Ohio			
			1	...	35.58 G
San Francisco Calif	728 Market		1	...	35.58 G
North Bergen N J			1	...	43.58 G
Brookline Mass	1101 Beacon St		1	...	35.58 X
G. R. Wrathall	Aptos Calif		1	...	35.58 X
W O Nelson	1521 S Webster St	Kokomo Ind			
			1	...	35.58 M
Telesecretarial Serv Inc	30 Huntington Ave	Boston Mass			
			1	...	35.58 X
R C Torrance	3818 Florinda St	Houston Tex			
			1	...	35.58 G
KJBS Broadcasters	1470 Pine	San Francisco Calif			
			1	...	35.58 X

MISCELLANEOUS COMMON CARRIER

Niles Radio Diso Serv	935 Cherry St	Niles Mich			
	15 ...	152.21	1	...	152.21 M
		158.67			158.67
Physicians Radio Mobile Serv	of Tacoma	306 S 31st			
	Tacoma Wash	20 ...	152.15	1	...
			158.61		158.61 M
D R Cannon	Box 893	Salt Lake City Utah			
	150 ...	152.15	1	...	152.15 G
		158.61			158.61
Flournoy Elec Co	323 16th St	Columbus Ga			
	100 ...	152.03	1	...	152.03 M
		158.49			158.49
Geo A Smith Jr	210 N Akard St	Dallas Tex			
	30 ...	152.21	1	...	152.21 G
		158.67			158.67
Medical Business Bureau Inc	132 No Main	Dayton Ohio			
	100 ...	152.15	1	...	152.15 G
		158.61			158.61
Radiotelephone Co	of Ind Inc	1521 S Webster St			
	Kokomo Ind	10 ...	152.03	1	...
			158.49		158.49 M

COMMON CARRIER

Northwestern Bell Tel Co	118 S 19th St	Omaha Neb			
	Nr Triago N D	300 ...	162.00	2	...
	Williston N D	some	some		GMU

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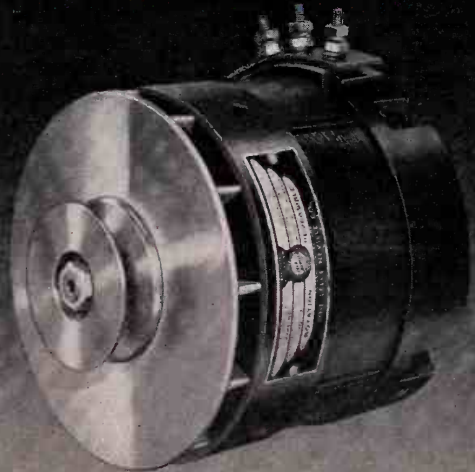
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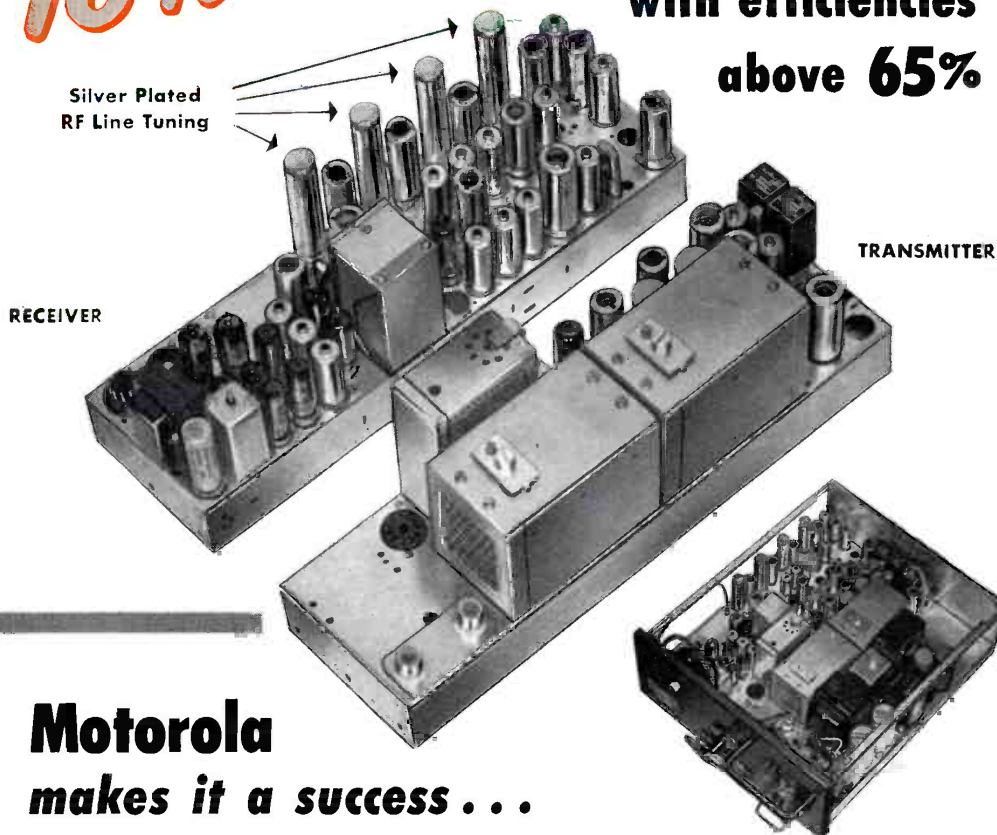


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