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FM-TV RADIO COMMUNICATION

THE JOURNAL OF

★★Published by★★
Milton B. Sleeper

NOW INCORPORATING
TELE-TV ENGINEERING
VISION

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

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BLAW-KNOX ANTENNA TOWERS

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FM-TV RADIO COMMUNICATION

Formerly *FM* MAGAZINE and *FM* RADIO-ELECTRONICS

VOL. 12 MAY, 1952 NO. 5

INDUSTRY NEWS

BROADCASTING

AUDIO EQUIPMENT

COMMUNICATION

SPECIAL DEPARTMENTS

ROY F. ALLISON, *Editor*
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FRED C. MICHALOVE, *Eastern Manager*
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CAROLE WOOL, *Circulation Manager*
MIRIAM D. MANNING, *Production Manager*
LILLIAN BENDROSS, *Accounting*
HENRY GRANGER, *Art Director*

Publication Office: The Publishing House, Great Barrington, Mass. Tel. Great Barrington 500.

Chicago Office: 176 W. Washington Street, Tel. CEntral 6-0469.

New York Office: 6 East 39th Street, Room 1209, Tel. Murray Hill 5-6332

RADIO COMMUNICATION Magazine is mailed on the 15th of each month.

Subscriptions: Should be sent to Publishing House, Great Barrington, Mass.

Single copies 35c—Subscription rates: $6.00 for 3 years, $3.00 for 1 year. Add 50c per year in Canada; foreign, add $1.00 per year.

Contributions will be neither acknowledged nor returned unless accompanied by adequate postage, packing, and directions. nor will RADIO COMMUNICATION Magazine be responsible for their safe handling in its office or in transit.

Entered as second-class matter August 22, 1946, at the Post Office, Great Barrington, Mass., under the Act of March 3, 1879. Additional entry at Post Office, Boston, Mass. Prnited in the U. S. A.

CPA AUDIT

CIRCULATION AUDITED BY
HENRY R. SYKES
CERTIFIED PUBLIC ACCOUNTANT
SYKES, GIDDINGS & JOHNSON
PITTSFIELD, MASSACHUSETTS

SET production in March was at the highest level for the year in each category, according to RTMA figures. More TV sets rolled off the lines than in any month since March '51. AM sets were well up, too, as shown by the accompanying Production Barometer.

The number of home models continues to be unimpressive. Automobile sets accounted for 38% of the AM total. Clock radios, the new phenomenon of the radio business, rose from 106,000 in February to 175,000 in March. That was 33% of the total in home models! Performance-wise, they are pretty terrible, but the clock feature is proving to be a stopper for women buyers.

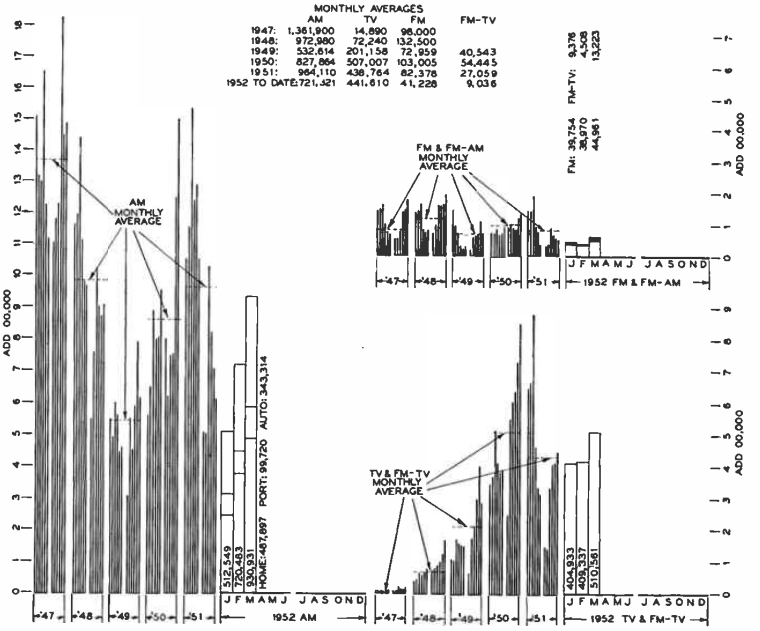
FM sets dragged along at 45,000. It's beginning to look as if manufacturers and dealers are falling back on the old routine of selling prices in both audio and television receivers. Single exception is Zenith, which continues to run full-page advertising on FM sets priced at two or three times the tags on average AM models.

Also, it appears that people who are concerned with performance are willing to go all the way, and put $500 to $750 or more into high-fidelity installations. This trade generally prefers to pay really high prices for the best equipment, rather than a modest amount for fairly good quality.

While the set manufacturers still look upon the hi-fi enthusiasts as representing a very limited market, the number of people in this group has grown to the point where some of the record manufacturers are planning to bring out popular discs in two types. The less expensive series will be of characteristics suitable for ordinary phonographs. The higher-priced series will be for use with high-fidelity equipment. Reason is that popular records, as they have been produced, are not suited to high-quality reproduction. Nor do the hi-fi records sound right on cheap phonographs.

TV manufacturers have an educational job to do at the local-newspaper level on UHF reception. It is getting a great deal of unfavorable publicity in cities where only UHF channels have been added to existing VHF service, or where only UHF frequencies have been assigned under the new FCC plan.

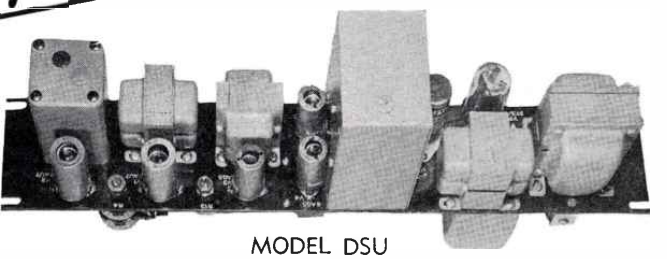
Statements are being published to the effect that UHF will not cover more than a 10-mile radius, and that little hope is seen for adequate TV service on UHF channels. The advantages of UHF should be brought to public attention promptly before serious harm is done.



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

HAMMARLUND

Duplex Signaling Unit



MODEL DSU

Now YOU CAN TRANSMIT AND RECEIVE MANY SIGNALS AT ONCE ON THE SAME AUDIO CHANNEL

The Hammarlund DSU Duplex Signaling Unit consists of a tone generator, a receiver, and a power supply. It sends and receives remote control and data transmission signals by wire line or radio. Independent and simultaneous transmission of a large number of signals on a single audio channel is readily accomplished by a multiple DSU system.

DSU SPECIFICATIONS ARE AS FOLLOWS:

FREQUENCY RANGE: Transmitter and receiver frequencies are factory set to any frequency between 2000 to 6025 cycles per second to meet the specified requirements of the installation.

CHANNEL SEPARATION: 100 cycles between 2000 and 3500 cps; 150 cycles between 3625 and 6025 cps.

OPERATING SPEED: Transmits and receives up to 14 pulses or 30 dot cycles per second.

STABILITY: Transmitter and receiver are stable within ± 5 cps when operating on 105 to 125 volts a.c. and between —30° and +60° C.

TRANSMITTER CONTROL: Requires a pair of normally open or normally closed contacts rated at 1/4 ampere d.c.

TRANSMITTER OUTPUT: Adjustable from —25 to +5 dbm into a 600 ohm line.

TRANSMITTER HARMONIC OUTPUT: Less than —40 db total from rated output.

RECEIVER INPUT: 600 ohm input adjustable from —25 to +5 dbm. Variation of ±3 db from normal level is permissible.

RECEIVER OUTPUT: SPDT relay contacts rated for 2 ampere, 115 volt a.c. non-inductive load.

POWER REQUIREMENT: 105-125 volts, 50-60 cycles, single phase, 35 watts.

MOUNTING: Mounted on standard 3½ x 19 inch rack panel.

THE SIGN OF QUALITY

ESTABLISHED 1910

HAMMARLUND

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., NEW YORK 1, N.Y.

Write for Detailed Engineering Information

THIS MONTH'S COVER

Mobile and fixed communication equipment operating on frequencies up to 960 mc. has now reached a high level of performance and dependability. But only a start has been made in special applications of standard equipment. The big area of further progress in the communication field lies, therefore, in system engineering. One outstanding example is the system operated by the Pennsylvania Turnpike Commission, a description of which starts in this issue. One of the PTC relay stations, located on Tussey Mountain, is shown in this month's cover picture.

SPOT NEWS NOTES

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

TeleVision Engineering:

Effective with this issue, TeleVision Engineering is combined with RADIO COMMUNICATION. The purchase of TVE was one of our first steps in expanding our coverage of television, timed with the ending of the freeze. You will see this plan carried forward in succeeding issues. If you have a subscription to TVE, you will receive a corresponding number of RADIO COMMUNICATION issues. If you subscribe to both magazines, your subscription to RADIO COMMUNICATION will be extended by the number of TVE issues still due you. To advertisers, this move is important because it increases the total circulation to 14,000 copies, with no increase in rates.

Mike Muggers:

It's apparent that most FM-AM stations monitor their AM signals, and not FM. Also that announcers and disk jockeys do not know what strange and awful sounds result on FM reception from talking into a microphone and chewing the paint off it at the same time. We've been hearing some very fine shows from discs over FM, but the announcing is simply awful. Particularly, announcers who laugh, click their tongues, and go in for vocal effects should have tapes made of their programs from FM receivers. Some of them would be very much embarrassed!

Transmission Lines & Wave Guides:

A very complete paper on RF transmission lines and wave guides, prepared by E. S. Winlund of Westinghouse, has been published by the Radio Club of America, 11 W. 42nd Street, New York 18. Both theoretical and application aspects are covered fully. In addition, there is a bibliography of 684 references. Copies are available at $1.50.

Low to High TV Power:

A booklet just issued by Du Mont Laboratories, Clifton, N. J., shows how, in successive steps, a 500-watt TV transmitter can be stepped up in power to 20 kw. VHF, or 40 kw. UHF, without discarding any of the initial equipment.

A. H. Jackson:

Appointed manager of the Blaw-Knox tower department. Mr. Jackson joined the company in 1927, even before he was graduated from Cornell University. He succeeds E. J. Staubitz, who has retired, although he will continue as a consultant.

Transistors:

Although developments in transistors have opened up many applications in which they can be used to replace tubes, their use is considerably restricted by their relatively low operating frequencies. No doubt that limitation will be overcome in time.

Quartz Crystals:

A very useful bulletin on quartz crystals has been issued by Bliley Electric Company, Erie, Pa. Electrical specifications and dimension drawings are given for a wide variety of commercial types, operating at 70 kc. to .1 mc., as well as data on military types operating at frequencies up to 75 mc.

New Publication:

The *Demodulator* is a technical house organ just brought out by Lenkurt Electric Company, San Carlos, Calif. If you are interested in developments in carrier equipment, send your name, address, and

(Continued on page 7)

SPOT NEWS NOTES

(Continued from page 6)

company connection to the Publication Department, and ask to have your name put on the mailing list.

Communication Market:

This month, we present the first detailed market data compiled on 2-way radio communication equipment. You'll find it in Mobile Radio News. Sales for the first quarter of this year totalled nearly $10 million, much higher than the current guesstimates. From the information given, sales of towers, antennas, microphones, relays, and other components for new installations and replacements can be determined with considerable accuracy. Since this data is so useful, and is not available elsewhere, similar summaries will be published each quarter.

VHF Vs. UHF Television:

Commissioner Robert F. Jones apears to be on solid ground in some of his objections ot the FCC"s final plan for nationwide television. However, it is difficult to agree with all his statements concerning the advantages of VHF licensees over those who will eventually get UHF channels. It is dangerous to prejudge UHF service at a time when current research and development work is disclosing more and more factors which may make it possible to give the public better service on UHF than on VHF.

Marine Alarm:

Efforts are being made to finalize international standards for automatic alarm signaling equipment on 2,182 kc., to be used on ships at sea. Individuals or companies interested in this project can obtain detailed information from R. T. Brown, Executive Secretary, Radio Technical Commission for Marine Services, Federal Communications Commission, Washington, D. C.

Relays of All Types:

An amazing variety of relays, ranging from standard telephone and midget to differential and stepping types, are listed in a 16-page illustrated catalog from Relay Sales, 47121 W. Madison Avenue, Chicago 44. Specifications are given for nearly 700 types.

Anthony G. Schifino:

Appointed general manager of Stromberg-Carlson's sound equipment division. This appointment coincides with the introduction of a new line of audio units comprising FM-AM tuners, amplifiers, speakers, changers, and speaker labyrinths, together with a TV chassis.

(Continued on page 8)

SPOT NEWS NOTES

(Continued from page 7)

R. B. Barnhill:

Appointed commercial sales manager of the radio communication division at Bendix Aviation Corporation, Towson, Md. He will have charge of sales of the entire communication line, including aircraft, railroad, and mobile equipment.

Historical Records:

The RCA-Clark Collection of Radioana has been presented to the M. I. T. Library at Cambridge, Mass. This collection, made by George H. Clark while he was historian for RCA, includes correspondence files, photographs, blueprints, and records from 1900 to 1935.

Hi-Fi Sales & Service:

That's the name of a new publication from Radiocom, Inc., Great Barrington, Mass. With more and more parts jobbers and dealers taking up the sale of high-fidelity equipment, and new custom-builders entering the field, HI-FI SALES & SERVICE is planned as a trade paper to provide news and information for everyone concerned with this fast-growing business. If you are connected with the manufacture, sale, installation, or servicing of hi-fi equipment, you can get HI-FI SALES & SERVICE without charge by sending in your name and address, together with the name of your company and your official title.

Data on Coaxial Cables:

Much valuable information is contained in Bulletin 81A, just released by Andrew Corporation, 363 E. 75th Street, Chicago 19. Nomographs and tables show complete characteristics for 17 types of coaxial cables intended for use at frequencies up to 3,000 mc.

Ernest A. Marx:

Appointed director of Du Mont's international division. After joining the company in 1945, he organized the TV receiver sales, and built up distribution through more than 2,000 dealers. Now, he will direct export sales from the headquarters offices at Clifton, N. J.

Microwaves Save Copper:

According to Walter Sutter, GE microwave engineer, a 1,000-mile open line strung on poles, capable of handling 6 communication channels, would require more than 1,500 tons of copper. For an equivalent microwave relay system, only 15 to 20 tons of copper are needed.

Television Equipment:

TV transmitters and studio equipment manufactured by Federal Telecommuni-

(Continued on page 9)

SPOT NEWS NOTES

(Continued from page 8)

cation Laboratories will be sold by Graybar Electric Company as well as microwave, railroad, and mobile radio equipment manufactured by Federal Telephone & Radio Corporation. James W. LaMarque, general communication sales manager for Graybar, will direct this new activity. Graybar has offices and warehouses in 105 cities, with headquarters at 420 Lexington Avenue, New York.

Fifteen Years Later:

In point of time, it's a short distance from the Sinclair Lewis book "It Can't Happen Here," to the publication of "Witness," by Whittaker Chambers. Less publicized but equally significant was a pamphlet which James Carey and Julius Emspack distributed during the bitter RCA strike in 1936. It proposed that if all the workers in Camden banded together, they could elect the city officials, and then appoint the chief of police. That, according to the plan they outlined, would be the first step in taking over the industries of Camden. It seemed silly to think of such things. then. But there's grim reality in the siezure of the steel industry under the dictation of Philip Murray.

Airport Radio:

Fixed and mobile AM units operating on 60 to 185 mc. for airport service have been announced by Pye Canada, Limited, of Ajax, Ontario. I. H. Nixon is manager of Pye's telecommunications division.

Russell C. C. Dubois, Jr.:

Appointed sales manager of RCA's mobile and microwave communication equipment, with headquarters at Camden.

MEETINGS and EVENTS

MAY 5-7, QUALITY ELECTRONICS CONFERENCE
Bureau of Standards, Washington, D. C.

MAY 8-10, RTCM SPRING MEETING
U. S. Merchant Marine Academy, Kings Point, Long Island, New York

MAY 12-14,
AIRBORNE ELECTRONICS CONFERENCE
Hotel Biltmore, Dayton, Ohio

MAY 13, RADIO CLUB OF AMERICA
Engng. Societies Bldg., New York City

MAY 16-17,
SOUTHWESTERN IRE CONFERENCE & SHOW
Rice Hotel, Houston, Texas

MAY 19-22, RADIO PARTS SHOW
Hotel Conrad Hilton, Chicago

MAY 23-24, AUDIO SHOW
Hotel Conrad Hilton, Chicago

JUNE 23-27, AIEE SUMMER GENERAL MEETING
Hotel Nicole, Minneapolis, Minn.

AUGUST 12-15, APCO CONFERENCE
Hotel Whitcomb, San Francisco, Calif.

AUGUST 27-29,
WESTERN ELECTRONIC SHOW & CONVENTION
Municipal Auditorium, Long Beach, Calif.

OCTOBER 20-22, IRE-RTMA FALL MEETING
Syracuse, New York

Achievement!

a NEW Eimac tube

4PR60A

Pulse Modulator Tetrode

ACTUAL SIZE

THIS IS THE EIMAC 4PR60A!

Powerful . . . rugged . . . compact . . .

designed and built for outstanding performance in pulse-modulators, including airborne and marine radar. The 4PR60A is a power tube in every respect. It will handle up to 360 kilowatts and withstand 200G shock and strong vibration . . . physically no larger but more powerful than the 715C and 5D21 which it unilaterally replaces.

NEW concepts in tube design and manufacture have made the 4PR60A another Eimac achievement in the field of electronics. Cylindrical electrodes integrally mounted on a rugged moulded-glass header provide mechanical stability never equalled in older designs. The unique cathode with its reserve emission capabilities, the Pyrovac plate, freedom from gas . . . all these features make this new Eimac tube outstanding among pulse-modulator types.

Remember . . . Characteristics of Eimac tubes are firmly established by exhaustive testing under rigorous conditions in our laboratory.

- *Maximum ratings and other operational characteristics for this new tetrode are available from the Eimac Field Engineering Department.*

Follow the Leaders to Eimac TUBES

311

EITEL-McCULLOUGH, INC.

SAN BRUNO, CALIFORNIA

Expart Agents: Frazar & Hansen, 301 Clay Street • San Francisco, California

FCC PLAN FOR NATION-WIDE TV

IMMEDIATE IMPORTANCE OF UHF IS INDICATED BY THE FACT THAT 1,432 UHF ASSIGNMENTS ARE PROVIDED, COMPARED TO 511 NEW VHF ASSIGNMENTS

ON April 14, 1952, the FCC released its Sixth Report and Order, ending the freeze on new TV station construction which had been in effect since September 30, 1948. Commissioner Webster concurred with the report; Commissioner Hennock concurred in part and dissented in part, and Commissioner Jones dissented.

A complete Table of Assignments was released, which utilizes most of the UHF television band and the present 12 VHF channels. A total of 83 six-megacycle channels is now available for Country-wide TV service, providing for 2,051 stations in 1,275 communities. Of these, 619 assignments are made in the VHF band, and 1,432 in the UHF band. UHF channels 66 to 83 are very little used in the present Table, and some possible assignments of channels 2 to 65 have not been made. These "flexibility" channels are intended primarily for future assignments to communities that do not have assignments in the present Table, or do not have both commercial and educational assignments, and for experimental work on television systems. However, if it can be "clearly and affirmatively" demonstrated that an additional assignment is needed in a city that already has Table assignments, a flexibility channel may be assigned for that purpose.

Educational Television:

Specific assignments have been made in the Table for non-commercial educational stations. These are indicated by star prefixes. Authorizations will be made only to non-profit educational institutions or boards of education for utilization of these channel assignments. Municipal authorities may *not* apply for licenses to operate stations on these channels unless they themselves manage the educational systems in the communities concerned, and do not delegate this responsibility to boards of education.

It has been decided not to permit commercial or partly-commercial operation by educational TV licensees. If an educational organization desires to operate a commercial station, it must compete with others for channels assigned for commercial stations, on the same basis. Alternatively, it may file a petition to have an educational channel assignment changed to a commercial assignment. If the change is effected, it must subsequently compete with other interested parties for the channel.

In general, the principles of assignment for educational TV channels are as follows: Where 3 or more channels are assigned to a community, one is reserved for educational TV use. Where less than 3 channels are assigned, none is reserved except in 46 areas designated as primary educational centers, where an educational assignment was made even if a total of only 1 or 2 channel assignments is indicated in the Table. Where a community is assigned a total of 3 or more VHF channels, one is reserved for educational TV unless all the VHF channels are already in use, in which case the educational TV channel assignment is in the UHF band. In communities having less than 3 VHF assignments, the educational TV assignments are all UHF except in the 46 primary educational areas. VHF channels are reserved for educational TV in 26 of the educational centers; in 23 of these, only 1 VHF channel is assigned to the community.

Station Separation:

In order to assure that adequate service will be provided, it is required that transmitter locations be chosen so that the following minimum median field intensities, in db above 1 microvolt per meter, are obtained over the entire principal area to be served:

Channels 2 to 6: 74 db
Channels 7 to 13: 77 db
Channels 14 to 83: 80 db

Minimum permissible operating power is determined by the population of the community served and by antenna height above average terrain. These are listed below:

Population	Minimum ERP
1 million or more	50 kw. at 500 ft.
250,000 to 1 million	10 kw. at 500 ft.
50,000 to 250,000	2 kw. at 500 ft.
Less than 50,000	1 kw. at 300 ft.

Equivalent minimum ERP's for other antenna heights are given in the chart, Fig. 1. It can be seen that in all cases, the absolute minimum permissible ERP is 1 kw. regardless of antenna height.

Insofar as maximum power is concerned, only one class of station is considered, without regard to population. The maximum ERP permitted is given below:

Channels 2 to 6: 100 kw.
Channels 7 to 13: 316 kw.
Channels 14 to 83: 1,000 kw.

For purposes of assignment, the Country was divided into 3 zones. Zone 1 consists of an area in the northeastern part of the Country, extending from Maine to Virginia and west to Ohio, Illinois, and Wisconsin. Zone 3 is a strip approximately 190 miles wide along the Gulf of Mexico, from Florida to Texas. Zone 2 includes the rest of the Country and Alaska, Hawaii, Puerto Rico, and the Virgin Islands.

In zones 2 and 3, the maximum ERP's listed above can be employed in the VHF band with antenna heights up to 2,000 ft. above average terrain; and in zone 1, up to 1,000 ft. Maximum ERP can be utilized in the UHF band with antenna heights up to 2,000 ft. in all zones. Fig. 2 shows maximum ERP's for antenna heights above those indicated.

Co-channel assignments in the Table are based on the following minimum separations:

	VHF	UHF
Zone 1	170 miles	155 miles
Zone 2	190 miles	175 miles
Zone 3	220 miles	205 miles

These co-channel station separations were predicated on the ultimate utilization of offset-carrier operation. It is planned that the offset frequencies will be ± 10 kc. with a 1-kc. tolerance, which provides about 17 db improvement in interference-reduction. No specific offset assignments are indicated at this time. When they are announced, a reasonable transition period will be provided for on-the-air stations.

Minimum spacing for adjacent-channel VHF stations is 60 miles; for adjacent-channel UHF stations, 55 miles.

With the RTMA standard intermediate frequency of 41.25 mc., receiver oscillator radiation will fall within the seventh channel above or below the tuned channel. For this reason, UHF stations 7 channels apart are separated by at least 60 miles.

For image-interference protection, UHF stations 15 channels apart are separated by at least 75 miles. This is for the picture image. Sound images fall on the 14th channel; therefore, a minimum separation of 60 miles is maintained for stations 14 channels apart.

To maintain protection against IF beat reception, UHF stations 8 channels apart must be separated physically by at least 20 miles. Also, for intermodulation reduction, UHF stations less than 6 channels apart are not assigned at intervals of less than 20 miles.

(Continued on page 14)

FCC ASSIGNMENT TABLE FOR TV

ALABAMA
Andulasia 29
Anniston 37
Auburn *56
Bessemer 54
Birmingham 6 *10
13 42 48
Brewton 23
Clanton 14
Cullman 60
Decatur 23
Demopolis 18
Dothan 9 14
Enterprise 40
Eufaula 44
Florence 41
Fort Payne 19
Gadsden 15 21
Greenville 49
Guntersville 40
Huntsville 31
Jasper 17
Mobile 5 8 *42 48
Montgomery 12 20
*26 32
Opelika 22
Selma 58
Sheffield 47
Sylacauga 24
Talladega 64
Thomasville 27
Troy 38
Tuscaloosa 45 51
Tuskegee 16
University *7

ARIZONA
Ajo 14
Bisbee 15
Casa Grande 18
Clifton 25
Coolidge 30
Douglas 3
Eloy 24
Flagstaff 9 13
Globe 34
Holbrook 14
Kingman 6
Mesa 12
Miami 28
Morenci 31
Nogales 17
Phoenix 3 5 *8 10
Prescott 15
Safford 21
Tucson 4 *6 9 13
Williams 25
Winslow 16
Yuma 11 13

ARKANSAS
Arkadelphia 34
Batesville 30
Benton 40
Blytheville 64 74
Camden 50
Conway 49
El Dorado 10 26
Fayetteville *13 41
Forrest City 22
Fort Smith 5 *16 22
Harrison 24
Helena 54
Hope 15
Hot Springs 9 52
Jonesboro 8 39
Little Rock *2 4 11
17 23
Magnolia 28
Malvern 46
Morrilton 43
Newport 28
Paragould 44
Pine Bluff 7 36
Russellville 19
Searcy 33
Springdale 35
Stuttgart 14

CALIFORNIA
Alturas 9
Bakersfield 10 29
Brawley 25
Chico 12
Corona 52
Delano 33
El Centro 16
Eureka 3 13
Fresno 12 *18 24 47 53
Hanford 21
Los Angeles 2 4 5 7
9 11 13 22 *28 34
Madera 30
Merced 34
Modesto 14
Monterey (Salinas)
Napa 62
Oakland
(San Francisco)
Oxnard 32
Petaluma 56
Port Chicago 15
Red Bluff 16
Redding 7
Riverside 40 46
Sacramento 3 *6
10 40 46
Salinas-Monterey 8 28
San Bernardino 18
*24 30
San Buenaventura 38
San Diego 8 10 *15
21 27 33 39
San Francisco-
Oakland 2 4 5 7 *9
20 26 32 38 44
San Jose 11 48
*54 60
San Luis Obispo 6
Santa Barbara 3 20 26
Santa Cruz 16
Santa Maria 44
Santa Paula 16
Santa Rosa 50
Stockton 13 36 *42
Tulare 27
Ukiah 18
Visalia 43 49
Watsonville 22
Yreka City 11
Yuba City 52

COLORADO
Alamosa 19
Boulder *12 22
Canon City 36
Colorado Springs 11
13 *17 23
Craig 19
Delta 24
Denver 2 4 *6 7 9
20 26
Durango 6 15
Fort Collins 44
Fort Morgan 15
Grand Junction 5 21
Greeley 50
La Junta 24
Lamar 18
Leadville 14
Longmont 32
Loveland 38
Montrose 10 18
Pueblo 3 5 *8 28 34
Salida 25
Sterling 25
Trinidad 21
Walsenburg 30

CONNECTICUT
Bridgeport 43 49 *71
Hartford 3 18 *24
Meriden 65
New Britain 30
New Haven 8 59
New London 26 81
Norwalk (Stamford)
Norwich 57 *63
Stamford-Norwalk 27
Waterbury 53

DELAWARE
Dover 40
Wilmington 12 53 *59

DIST. OF COLUMBIA
Washington 4 5 7 9
*20 *26

FLORIDA
Belle Glade 25
Bradenton 28
Clearwater 32
Daytona Beach 2
De Land 44
Ft. Lauderdale 17 23
Ft. Myers 11
Ft. Pierce 19
Gainesville *5 20
Jacksonville 4 *7 12
30 36
Key West 14 20
Lake City 33
Lakeland 16 22
Lake Wales 14
Leesburg 26
Marianna 17
Miami *2 4 7 10
27 33
Ocala 15
Orlando 6 9 18 *24
Palatka 17
Panama City 7 *30 36
Pensacola 3 15 *21 46
Quincy 54
St. Augustine 25
St. Petersburg
(Tampa)
Sanford 35
Sarasota 34
Tallahassee *11 24 51
Tampa-St. Petersburg
*3 8 13 38
West Palm Beach 5 12
*15 21

GEORGIA
Albany. 10 25
Americus 31
Athens *8 60
Atlanta 2 5 11 *30 36
Augusta 6 12
Bainbridge 35
Brunswick 28 34
Cairo 45
Carrollton 33
Cartersville 63
Cedartown 53
Columbus 4 28 *34
Cordele 43
Dalton 25
Douglas 32
Dublin 15
Elberton 16
Fitzgerald 23
Fort Valley 18
Gainesville 52
Griffin 39
La Grange 50
Macon 13 *41 47
Marietta 57
Milledgeville 51
Moultrie 48
Newnan 61
Rome 9 59
Savannah 3 *9 11
Statesboro 22
Swainsboro 20
Thomasville 6 27
Tifton 14
Toccoa 35
Valdosta 37
Vidalia 26
Waycross 16

IDAHO
Blackfoot 33
Boise *4 7 9
Burley 15
Caldwell 2
Cour d'Alene 12
Emmett 26
Gooding 23
Idaho Falls 3 8
Jerome 17
Kellogg 33
Lewiston 3
Moscow *15
Nampa 6 12
Payette 14
Pocatello 6 10
Preston 41
Rexburg 27
Rupert 21
Sandpoint 9
Twin Falls 11 13
Wallace 27
Weiser 20

ILLINOIS
Alton 48
Aurora 16
Belleville 54
Bloomington 15
Cairo 24
Carbondale 34 *61
Centralia 32 59
Champaign-Urbana 3
*12 21 27 33
Chicago 2 5 7 9 *11
20 26 32 38 44
Danville 24
Decatur 17 23
De Kalb *67
Dixon 47
Elgin 28
Freeport 23
Galesburg 40
Harrisburg 22
Jacksonville 29
Joliet 48
Kankakee 14
Kewanee 60
La Salle 35
Lincoln 53
Macomb 61
Marion 40
Mattoon 46
Moline
(Davenport, Ia.)
Mt. Vernon 38
Olney 16
Pekin 49
Peoria 8 19 *37 43
Quincy 10 21
Rockford 13 39 *45
Rock Island
(Davenport, Ia.)
Springfield. 2 20 *26
Streator 65
Urbana (Champaign)
Vandalia 28
Waukegan 22

INDIANA
Anderson 61
Angola 15
Bedford 39
Bloomington 4 *30 36
Columbus 42
Connersville 38
Elkhart 52
Evansville 7 50 *56 62
Ft. Wayne 21 *27 33
Gary 50 *66
Hammond 56
Indianapolis 6 8 13
*20 26 67
Jasper 19
Kokomo 31
Lafayette *47 59
Lebanon 18
Logansport 51
Madison 25
Marion 29
Michigan City 62
Muncie 49 55 *71
Richmond 32
Shelbyville 58
So. Bend 34 *40 46
Terl City 31
Terre Haute 10 *57 63
Vincennes 44
Washington 60

IOWA
Algona 37
Ames 5 25
Atlantic 45
Boone 19
Burlington 32 38
Carroll 39
Cedar Rapids 2 9 20
*26
Centerville 31
Charles City 18
Cherokee 14
Clinton 64
Creston 43
Davenport-Rock
Island & Moline, Ill. 4
6 *30 36 42
Decorah 44
Des Moines 8 *11 13
17 23
Dubuque 56 62
Estherville 24
Fairfield 54
Fort Dodge 21
Fort Madison 50
Grinnell 46
Iowa City *12 24
Keokuk 44
Knoxville 33
Marshalltown 49
Mason City 3 35
Muscatine 58
Newton 29
Oelwein 28
Oskaloosa 52
Ottumwa 15
Red Oak 32
Shenandoah 20
Sioux City 4 9 *30 36
Spencer 42
Storm Lake 34
Waterloo 7 16 *22
Webster City 27

KANSAS
Abilene 31
Arkansas City 49
Atchison 60
Chanute 50
Coffeyville 33
Colby 22
Concordia 47
Dodge City 6 23
El Dorado 55
Emporia 39
Fort Scott 27
Garden City 9 11
Goodland 31
Great Bend 2 28
Hays 7 20
Hutchinson 12 18
Independence 20
Iola 44
Junction City 29
Larned 15
Lawrence *11 17
Leavenworth 54
Liberal 14
McPherson 26
Manhattan *8 23
Newton 14
Olathe 52
Ottawa 21
Parsons 46
Pittsburg 7 38
Pratt 36
Salina 34
Topeka 13 42 *48
Wellington 24
Wichita 3 10 16 *22
Winfield 43

KENTUCKY
Ashland 59
Bowling Green 13 17
Campbellsville 40
Corbin 16
Danville 35
Elizabethtown 23
Frankfort 43
Glasgow 28
Harlan 36
Hazard 19
Hopkinsville 20
Lexington 27 33
Louisville 3 11 *15
21 41 51
Madisonville 26
Mayfield 49
Maysville 24
Middlesborough 57 63
Murray 33
Owensboro 14
Paducah 6 43
Pikeville 14
Princeton 45
Richmond 60
Somerset 22
Winchester 37

LOUISIANA
Abbeville 42
Alexandria 5 62
Bastrop 53
Baton Rouge 10 28 *34 40
Bogalusa 39
Crowley 21
De Ridder 14
Eunice 64
Franklin 46
Hammond 51
Houma 30
Jackson 18
Jennings 48
Lafayette 38 67
Lake Charles 7 *19 25
Minden 30
Monroe 8 43
Morgan City 36
Natchitoches 17
New Iberia 15
New Orleans *2 4 6
20 26 32 61
Oakdale 54
Opelousas 58
Ruston 20
Shreveport 3 12
Thibodaux 24
Winnfield 22

MAINE
Auburn 23
Augusta 10 29
Bangor 2 5 *16
Bar Harbor 22
Bath 65
Belfast 41
Biddeford 59
Calais 7 20
Dover-Foxcroft 18
Fort Kent 17
Houlton 24
Lewiston 8 17
Millinocket 14
Orono *12
Portland 6 13 *47 53
Presque Isle 8 19
Rockland 25
Rumford 55
Van Buren 15
Waterville 35

MARYLAND
Annapolis 14
Baltimore 2 11 13 18
*24 30
Cambridge 22
Cumberland 17
Frederick 62
Hagerstown 52
Salisbury 16

MASSACHUSETTS
Barnstable 52
Boston *2 4 5 7 44
50 56
Brockton 62
Fall River 40 46
Greenfield 42
Holyoke (Springfield)
Lawrence 38
Lowell 32
New Bedford 28 34
North Adams 15
Northampton 36
Pittsfield 64
Springfield-Holyoke 55 61
Worcester 14 20

MICHIGAN
Alma 41
Alpena 9 30
Ann Arbor 20 *26
Bad Axe 46
Battle Creek 58 64
Bay City 5 63 *73
Benton Harbor 42
Big Rapids 39
Cadillac 13 45
Calumet 13
Cheboygan 4 36
Coldwater 24
Detroit 2 4 7 50
*56 62
East Lansing 60
East Tawas 25
Escanaba 3
Flint 12 16 *22 28
Gladstone 40
Grand Rapids 8 *17 23
Hancock 10
Houghton 19
Iron Mountain 9 27
Iron River 12
Ironwood 31
Jackson 48
Kalamazoo 3 36
Lansing 6 54
Ludington 18
Manistee 15
Manistique 14
Marquette 5 17
Midland 19
Mt. Pleasant 47
Muskegon 29 35
Petoskey 31
Pontiac 44
Port Huron 34
Rogers City 24
Saginaw 51 57
Sault Ste Marie 8 10
28 *34
Traverse City 7 20 *26
West Branch 21

MINNESOTA
Albert Lea 57
Alexandria 36
Austin 6 51
Bemidji 24
Brainerd 12
Cloquet 44
Crookston 21
Detroit Lakes 18
Duluth-Superior, Wis. 3 6
*8 32 38
Ely 16
Fairmont 40
Faribault 20
Fergus Falls 16
Grand Rapids 20
Hastings 29
Hibbing 10
Int'l Falls 11
Little Falls 14
Mankato 15
Marshall 22
Minneapolis-St. Paul *2
4 5 9 11 17 23
Montevideo 19
New Ulm 43
Northfield 26
Owatonna 45
Red Wing 63
Rochester 10 55
St. Cloud 7 33
St. Paul (Minneapolis)
Stillwater 39
Thief River Falls 15
Virginia 26
Wadena 27
Willmar 31
Winona 61
Worthington 32

MISSISSIPPI
Biloxi 13 *44 50
Brookhaven 37
Canton 16
Clarksdale 6 32
Columbia 35
Columbus 28
Corinth 29
Greenville 21 27
Greenwood 24
Grenada 15
Gulfport 56
Hattiesburg 9 17
Jackson 12 *19 25 47
Kosciusko 52
Laurel 33
Louisville 46
McComb 31
Meridian 11 30 *36
Natchez 29
Pascagoula 22
Picayune 14
Starkville 34
State College *2
Tupelo 38
University *20
Vicksburg 41
West Point 8 56
Yazoo City 49

MISSOURI
Cape Girardeau 12 18
Carthage 56
Caruthersville 27
Chillicothe 14
Clinton 49
Columbia 8 16 22
Farmington 52
Festus 14
Fulton 24
Hannibal 7 27
Jefferson City 13 33
Joplin 12 30
Kansas City 4 5 9
*19 25 65
Kennett 21
Kirksville 3 18
Lebanon 23
Marshall 40
Maryville 26
Mexico 45
Moberly 35
Monett 14
Nevada 18
Poplar Bluff 15
Rolla 31
St. Joseph 2 30 *36
St. Louis 4 5 *9 11
30 36 42
Sedalia 6 28
Sikeston 37
Springfield 3 10 *26 32
West Plains 20

MONTANA
Anaconda 2
Billings 2 8 *11
Bozeman *9 22
Butte 4 6 *7 15
Cut Bank 20
Deer Lodge 25
Dillon 20
Glasgow 16
Glendive 18
Great Falls 3 5 *23
Hamilton 17
Hardin 4
Havre 9 11
Helena 10 12
Kalispell 8
Laurel 14
Lewiston 13
Livingston 16
Miles City 3 *6 10
Missoula *11 13 21
Polson 18
Red Lodge 18
Shelby 14
Sidney 14
Whitefish 16
Wolf Point 20

NEBRASKA
Alliance 13 21
Beatrice 40
Broken Bow 14
Columbus 49
Fairbury 35
Falls City 38
Fremont 52
Grand Island 11 21
Hastings 5 27
Kearney 13 19
Lexington 23
Lincoln 10 12 *18 24

McCook 8 17
Nebraska City 50
Norfolk 33
North Platte 2 4
Omaha 3 6 7 *16
22 28
Scottsbluff 10 16
York 15

NEVADA

Boulder City 4
Carlin 14
Carson City 37
Elko 10
Ely 3 6
Fallon 29
Goldfield 5
Hawthorne 31
Henderson 2
Las Vegas 8 *10 13
Lovelock 18
McGill 8
Reno 4 8 *21 27
Tonopah 9
Winnemucca 7
Yerington 33

NEW HAMPSHIRE

Berlin 26
Claremont 37
Concord 27
Durham *11
Hanover *21
Keene 45
Laconia 43
Littleton 24
Manchester 9 48
Nashua 54
Portsmouth 19
Rochester 51

NEW JERSEY

Andover *69
Asbury Park 58
Atlantic City 46 52
Bridgeton 64
Camden *80
Freehold *74
Hammonton *70
Montclair *77
Newark 13
New Brunswick *19 47
Paterson 37
Trenton 41
Wildwood 48

NEW MEXICO

Alamagordo 17
Albuquerque 4 *5 7 13
Artesia 21
Atrisco-Five Points 18
Belen 24
Carlsbad 6 23
Clayton 27
Clovis 12 35
Deming 14
Farmington 17
Gallup 3 *8 10
Hobbs 46
Hot Springs 19
Las Cruces 22
Las Vegas 14
Lordsburg 23
Los Alamos 20
Lovington 27
Portales 22
Raton 46 *52
Roswell *3 8 10
Santa Fe 2 *9 11
Silver City *10 12
Socorro 15
Tucumcari 25

NEW YORK

Albany-Schenectady-Troy 6 *17 23 41
Amsterdam 52
Auburn 37
Batavia 33
Binghamton 12 40 *46
Buffalo 17 *23
Buffalo-Niagara Falls 2 4 7 59
Cortland 56
Dunkirk 46
Elmira 18 24
Glens Falls 39
Gloversville 29
Hornell 50
Ithaca *14 20
Jamestown 58
Kingston 66
Malone 20 *66
Massena 14
Middletown 60
New York 2 4 5 7 9
11 *25 31
Niagara Falls (Buffalo) 24
Ogdensburg 54
Olean 62
Oneonta 31
Oswego 28
Plattsburg 21 *83
Poughkeepsie 5 10 15
Rochester *21 27
Rome (Utica) 18
Saranac Lake 35
Schenectady (Albany) 3 8 *43
Syracuse Troy (Albany) 13 19 *25
Utica-Rome 48
Watertown

NORTH CAROLINA

Ahoskie 53
Albemarle 20
Asheville 13 *56 62
Burlington 63
Chapel Hill *4
Charlotte 3 9 36 *42
Durham 11 *40 46
Elizabeth City 31
Fayetteville 18
Gastonia 48
Goldsboro 34
Greensboro 2 *51 57
Greenville 9
Henderson 52
Hendersonville 27
Hickory 30
High Point 15
Jacksonville 16
Kannapolis 59
Kinston 45
Laurinburg 41
Lumberton 21
Mount Airy 55
New Bern 13
Raleigh 5 *22 28
Roanoke Rapids 30
Rocky Mount 50
Salisbury 53
Sanford 38
Shelby 39
Southern Pines 49
Statesville 64
Washington 7
Wilmington 6 29 *35
Wilson 56
Winston-Salem 12 26 *32

NORTH DAKOTA

Bismarck 5 12 18 *24
Bottineau 16
Carrington 26
Devils Lake 8 14
Dickinson 2 4 *17
Fargo 6 13 *34 40
Grafton 17
Grand Forks *2 10
Harvey 22
Jamestown 7 42
Lisbon 23
Minot *6 10 13
New Rockford 20
Rugby 38
Valley City 4 32
Wahpeton 45
Williston 8 11 *34

OHIO

Akron 49 *55 61
Ashtabula 15
Athens 62
Bellefontaine 63
Cambridge 26
Canton 29
Chillicothe 56
Cincinnati 5 9 12
*48 54 74
Cleveland 3 5 8 19
*25 65
Columbus 4 6 10
*34 40
Coshocton 20
Dayton 2 7 *16 22
Defiance 43
Findlay 53
Gallipolis 18
Hamilton-Middletown 65
Lancaster 28
Lima 35 41
Lorain 31
Mansfield 36
Marion 17
Massillon 23
Middletown (Hamilton)
Mount Vernon 58
Newark 60
Oxford *14
Piqua 44
Portsmouth 30
Sandusky 42
Springfield 46 52
Steubenville (Wheeling, W. Va.)
Tiffin 47
Toledo 11 13 *30
Warren 21
Youngstown 27 33 73
Zanesville 50

OKLAHOMA

Ada 50
Altus 36
Alva 30
Anadarko 58
Ardmore 55
Bartlesville 62
Blackwell 51
Chickasha 64
Claremore 15
Clinton 32
Duncan 39
Durant 27
Elk City 13 15
El Reno 56
Enid 5 21 *27
Frederick 44
Guthrie 48
Guymon 20
Hobart 23
Holdenville 14
Hugo 21
Lawton 7 *28 34
McAlester 47
Miami 58
Muskogee 8 *45 66
Norman 31 *37
Oklahoma City 4 9
*13 19 25
Okmulgee 26
Pauls Valley 61
Ponca City 40
Pryor Creek 54
Sapulpa 42
Seminole 59
Shawnee 53
Stillwater 29 *69
Tulsa 2 6 *11 17 23
Vinita 28
Woodward 8

OREGON

Albany 55
Ashland 14
Astoria 30
Baker 37
Bend 15
Burns 16
Corvallis *7 49
Eugene *9 13 20 26
Grants Pass 30
Klamath Falls 2
La Grande 13
Lebanon 43
McMinnville 46
Medford 4 5
North Bend 16
Pendleton 28
Portland 6 8 *10
12 21 27
Roseburg 28
Salem 3 *18 24
Springfield 37
The Dalles 32

PENNSYLVANIA

Allentown 39 45
Altoona 10 19 25
Bethlehem 51
Bradford 48
Butler 43
Chambersburg 46
Du Bois 31
Easton 57
Emporium 42
Erie 12 35 *41 66
Harrisburg 27 33 71
Hazleton 63
Johnstown 6 56
Lancaster 8 21
Lebanon 15
Lewistown 38
Lock Haven 32
Meadville 37
New Castle 45
Oil City 64
Philadelphia 3 6 10
17 23 29 *35
Pittsburgh 2 11 *13
16 47 53
Reading 55 61
Scranton 16 22 73
Sharon 39
State College *44
Sunbury 65
Uniontown 14
Washington 63
Wilkes-Barre 28 34
Williamsport 36
York 43 49

RHODE ISLAND

Providence 10 12 16 *22

SOUTH CAROLINA

Aiken 54
Anderson 58
Camden 14
Charleston 2 5 *13
Clemson *68
Columbia 10 *19 25 67
Conway 23
Florence 8
Georgetown 27
Greenville 4 23 *29
Greenwood 21
Lake City 55
Lancaster 31
Laurens 45
Marion 43
Newberry 37
Orangeburg 44
Rock Hill 61
Spartanburg 7 17
Sumter 47
Union 65

SOUTH DAKOTA

Aberdeen 9 17
Belle Fourche 23
Brookings *8 25
Hot Springs 17
Huron 12 15
Lead 5 26
Madison 46
Mitchell 5 20
Mobridge 27
Pierre 6 10 *22
Rapid City 7 15
Sioux Falls 11 13 38 *44
Sturgin 20
Vermillion *2 41
Watertown 3 35
Winner 18
Yankton 17

TENNESSEE

Athens 14
Bristol-Bristol, Va. 5 46
Chattanooga 3 12 43
49 *55
Clarksville 53
Cleveland 38
Columbia 39
Cookeville 24
Covington 19
Dyersburg 46
Elizabethton 40
Fayetteville 27
Gallatin 48
Harriman 67
Humboldt 25
Jackson 9 16
Johnson City 11 34
Kingsport 28
Knoxville 6 10 *20 26
Lawrenceburg 50
Lebanon 58
McMinnville 46
Maryville 51
Memphis 3 5 *10 13
42 48
Morristown 54
Murfreesboro 18
Nashville *2 4 5 8
30 36
Oak Ridge 32
Paris 51
Pualski 44
Shelbyville 62
Springfield 42
Tullahoma 65
Union City 55

TEXAS

Abilene 9 33
Alice 34
Alpine 12
Amarillo *2 4 7 10
Athens 25
Austin 7 18 24 *30
Ballinger 25
Bay City 33
Beaumont-Port Arthur 4 6 31 *37
Beeville 38
Big Spring 4
Bonham 43
Borger 33
Brady 15
Breckenridge 14
Brenham 52
Brownfield 15
Brownsville 36
Brownsville-Harlingen-Weslaco 4 5
Brownwood 19
Bryan 54
Childress 40
Cleburne 57
Coleman 21
College Station *3 48
Conroe 20
Corpus Christi 6 10
*16 22
Corsicana 47
Crockett 56
Crystal City 28
Cuero 25
Dalhart 16
Dallas 4 8 *13 23
29 73
Del Rio 16
Denison 52
Denton *2 17
Eagle Pass 26
Edinburg 26
El Campo 27
El Paso 4 *7 9 13
20 26
Falfurrias 52
Floydada 45
Fort Stockton 22
Ft. Worth 5 10 20 *26
Gainesville 49
Galveston 11 35 41 *47
Gonzales 64
Greenville 62
Harlingen (Brownsville) 23
Hebbronville 58
Henderson 42
Hereford 19
Hillsboro 63
Houston 2 *8 13 23
29 39
Huntsville 15
Jacksonville 36
Jasper 49
Kermit 14
Kilgore 59
Kingsville 40
Lamesa 28
Lampasas 40
Laredo 8 13 *15
Levelland 38
Littlefield 32
Longview 32 38
Lubbock 5 11 13
*20 26
Lufkin 9 46
McAllen 20
McKinney 65
Marfa 19
Marshall 16
Mercedes 32
Mexia 50
Midland 2 18
Mineral Wells 38
Mission 14
Monahans 9
Mt. Pleasant 35
Nacogdoches 40
New Braunfels 62
Odessa 7 24
Orange 43
Pampa 17
Paris 33
Pearsall 31
Pecos 16
Perryton 22
Plainview 29
Port Arthur (Beaumont) 42
Quanah 42
Raymondville 17
Rosenberg 35
San Angelo 6 8 17 *23
San,Antonio 4 5 *9
12 35 41
San Benito 48
San Marcos 53
Seguin 14
Seymour 24
Sherman 46
Snyder 30
Stephenville 32
Sulphur Springs 41
Sweetwater 12
Taylor 58
Temple 16 22
Terrell 53
Texarkana 6 *18 24
Tyler 7 19
Uvalde 20
Vernon 18
Victoria 19
Waco 11 *28 34
Waxahachie 45
Weatherford 51
Weslaco (Brownsville)
Wichita Falls 3 6 *16 22

UTAH

Brigham 36
Cedar City 5
Logan 12 30 *46
Ogden 9 *18 24
Price 6
Provo 11 22 *28
Richfield 13
St. George 18
Salt Lake City 2 4 5
*7 20 26
Tooele 44
Vernal 3

VERMONT

Bennington 33
Brattleboro 58
Burlington *16 22
Montpelier 3 40
Newport 46
Rutland 49
St. Albans 34
St. Johnsbury 30

VIRGINIA

Blacksburg *60
Bristol (Bristol, Tenn.)
Charlottesville *45 64
Covington 44
Danville 24
Emporia 25
Farmville 19
Fredericksburg 47
Front Royal 39
Harrisonburg 3 34
Lexington 54
Lynchburg 13 16
Marion 50
Martinsville 35
Newport News (Norfolk) 27
Norfolk-Portsmouth 45
Norfolk-Portsmouth-Newport News 3 10
15 *21 33
Norton 52
Petersburg 8 41
Portsmouth (Norfolk) 23
Pulaski 37
Richmond 6 12 *23 29
Roanoke 7 10 27 *33
South Boston 14
Staunton 36
Waynesboro 42
Williamsburg 17
Winchester 28

WASHINGTON

Aberdeen 58
Anacortes 34
Bellingham 12 18 24
Bremerton 44 50
Centralia 17
Ellensburg 49 *65
Ephrata 43
Everett 22 28
Grand Coulee 37
Hoquiam 52
Kelso 39
Kennewick 25
Kennewick-Richland-Pasco *41
Longview 33
Olympia 60
Okanogan-Omak *35
Pasco (Kennewick) 19
Port Angeles 16
Pullman *10 24
Richland (Kennewick) 31
Seattle 4 5 7 *9
20 26
Spokane 2 4 6 *7
Tacoma 11 13 *56 62
Walla Walla 5 8 *22
Wenatchee *45 55
Yakima 23 29 *47

WEST VIRGINIA

Beckley 6 21
Bluefield 41
Charleston 8 *43 49
Clarksburg 12 22
Elkins 40
Fairmont 35
Hinton 31
Huntington 3 13 *53
Logan 23
Martinsburg 58
Morgantown *24
Parkersburg 15
Welch 25
Weston 32
Wheeling 57
Wheeling-Steubenville, Ohio 7 9 51
Williamson 17

WISCONSIN

Adams *58
Appleton 42
Ashland 15
Beaver Dam 37
Beloit 57
Chilton *24
Eau Claire 13 *19 25
Fond du Lac 54
Green Bay 2 6
Janesville 63
Kenosha 61
La Crosse 8 *32 38
Madison 3 *21 27 33
Manitowoc 65
Marinette 11 32 *38
Milwaukee 4 *10 12
19 25 31
Oshkosh 48
Park Falls *18
Portage 17
Prairie du Chien 34
Racine 49 55
Rhinelander 22
Rice Lake 21
Richland Center 15 *66
Sheboygan 59
Shell Lake *30
Sparta 50
Stevens Point 20 26
Sturgeon Bay 44
Superior (Duluth, Minn.)
Wausau 7 16 *46
Wisconsin Rapids 14

WYOMING

Buffalo 29
Casper 2 6
Cheyenne 3 5
Cody 24
Douglas 14
Evanston 14
Gillette 31
Green River 16
Greybull 40
Lander 17
Laramie *8 18
Lovell 36
Lusk 19
Newcastle 28
Powell 30
Rawlins 11
Riverton 10
Rock Springs 13
Sheridan 9 12
Thermopolis 15
Torrington 27
Wheatland 24
Worland 34

ALASKA

Anchorage 2 *7 11 13
Fairbanks 2 4 7 *9
11 13
Juneau *3 8 10
Ketchikan 2 4 *9
Seward 4 9
Sitka 13

HAWAIIAN ISLANDS

Lihue, Kauai 3 *8 10 12
Honolulu,Oahu 2 4 *7
9 11 13
Wailuku, Maui 3 8
*10 12
Hilo, Hawaii 2 *4 7
9 11 13

PUERTO RICO

Arecibo 13
Caguas 11
Mayaguez 3 5
Ponce 7 9
San Juan 2 4 *6

VIRGIN ISLANDS

Christiansted 8
Charlotte Amalie 10 12

NATION-WIDE TV

(Continued from page 11)

Mileage separations for purposes other than co-channel interference protection are independent of zone classifications. However, where one station concerned is in a different zone than another, the larger co-channel separation applies to this combination. The actual transmitter-to-transmitter separation is to be used wherever possible in determining distances between stations. Where no other transmitter is available from which to measure the distance to a proposed transmitter location, the city coordinates as listed in the Dept. of Commerce pamphlet entitled "Air Line Distances Between Cities in the U. S." are to be used or, if the city concerned is not so listed, the co-ordinates of the main Post Office.

Changes in Table:

No changes in the Table of Assignments will be made except by rule-making proceedings, and those desiring to apply for channels from 2 to 65 not specified in the Table must secure amendments by this method. Petitioners for changes in the Table must merely state clearly the reasons for the proposed changes if the specified minimum spacing requirements are met. No showing of protection to Grade A service of existing stations is necessary, because the Table is set up on the basis of minimum separations and not on a basis of protection to specific service contours.

Such changes will be considered only after a year from the effective date of the Sixth Report and Order, with the exceptions of the following 3 types of petitions:

1) a request for the assignment of a channel to a community not assigned any channels, and not eligible for an assignment under the 15-mile rule,[1]

2) a request for the assignment of a non-commercial educational channel in any community to which no such assignment is available under the Table, and

3) a request for the assignment of a commercial channel to any community *listed in the Table* to which no *commercial* assignment has been made.

No petition whatever will be acted upon during the one-year period if a change in any channel assignment is involved, or if the minimum separations specified in the Rules are not met by the proposed assignment.

Directional Antennas:

A directional antenna is defined as one having 3 db or more difference in effective radiated power in the azimuthal directions of maximum and minimum radiation.

Directional antennas may not be employed for the purpose of reducing the minimum mileage separation requirements. However, they may be used in certain cases to improve service from a station in a community with an existing or permissible assignment under the Table. In no case will a directional antenna with more than 10 db variation in maximum to minimum radiated power in the horizontal plane be permitted.

The minimum ERP in all directions must meet the minimum power requirements of the Rules, and the ERP in any horizontal or vertical direction may not exceed the maximum values permitted by the Rules. Also, the maximum ERP in any direction above the horizon must be as low as the state of the art permits, and may not exceed the ERP in the horizontal direction within the same vertical plane.

Processing Procedure:

All non-commercial educational applications will be processed separately in the order in which they are filed, beginning July 1, 1952, except that priorities in effect for other applications will be effective where there is a conflict of transmitter sites with applications in other categories. Commercial applications will be divided into categories and given a processing priority by category. Applications from Puerto Rico, Alaska, Hawaii, and the Virgin Islands will be handled in the same way.

The first applications to be processed, beginning immediately, will be those arising out of *changed* channel assignments for stations on the air now.

Upon completion of those applications, but not before July 1, 1952, two new-application processing lines will be set up. One line will process applications for new stations in all cities not presently receiving service (40 miles or more from the nearest main transmitter.) These applications will be processed according to the population of the cities concerned.

The other line will process 5 groups in succession. These groups will be processed in a manner which gives precedence to UHF applications. Following is the order in which the groups will be handled:

1) Cities where no VHF channels are assigned, excluding educational TV channels.

2) Cities where all VHF channels are already occupied, excluding educational TV channels.

3) Cities with one TV service but no

(Concluded on page 45)

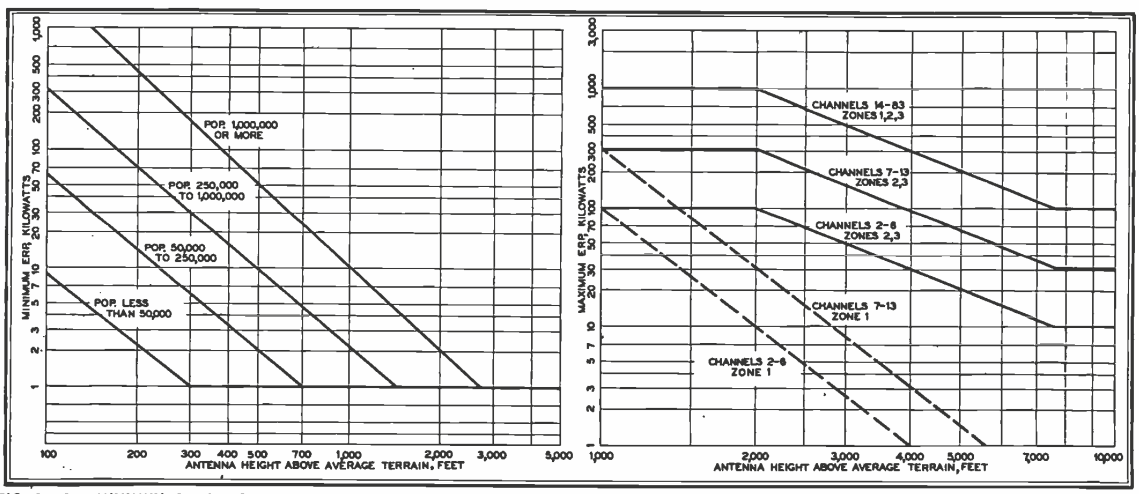


FIG. 1, LEFT: MINIMUM EFFECTIVE RADIATED POWER ACCORDING TO ANTENNA HEIGHT WHICH WILL BE PERMITTED IN COMMUNITIES OF VARIOUS SIZES
FIG. 2, RIGHT: MAXIMUM ERP PERMITTED VARIES ACCORDING TO ZONE, CHANNEL, AND ANTENNA HEIGHT, BUT NOT THE COMMUNITY POPULATION

[1]This states that "A channel assigned to a community . . . . . shall be available, without . . . . . rule-making proceedings, to any other community located within 15 miles of the assigned community and which has no assignment of its own, provided the minimum separations set forth . . . . . are maintained."

SPEECH INPUT UNITS

CONSIDERATIONS IN THE DESIGN OF AMPLIFIERS FOR SPEECH INPUT EQUIPMENT — *By* N. L. JOCHEM*

SPEECH input systems are utilized for many purposes in various applications. Their design is dependent on the purposes of particular systems, and the ideas and desires of the individuals who must use the systems, whether for broadcasting, recording, or sound distribution.

Because of the important parts that audio amplifiers play in any speech input system, the system designer's work would be simplified considerably if a line of versatile amplifier units of high performance were available to him. This article discusses the design considerations and requirements of such amplifier units for present-day high-fidelity input systems, and describes a new line of amplifiers developed to meet these requirements.

Design Considerations:

The design of a new speech-input amplifier is not solely an electrical problem. Rather, the electrical and mechanical aspects of design must be integrated to produce a functionally superior product.

Audio amplifiers have been improved greatly in the last decade. The need still exists, however, for improvements in both electrical and mechanical design to meet the demands of the broadcast and recording industries.

Our analysis of these requirements indicates the following:

1) Three basic types of amplifiers are needed. They fall into the categories of preamplifier, program amplifier, and monitor amplifier.

2) These amplifiers must provide wide latitude in operative adaptability.

3) Tubes that are easily procured and relatively inexpensive should be used. Special or selected tubes should be avoided.

4) Tube types should be held to a minimum. However, tubes should not be misused to accomplish this objective.

5) Electrical characteristics should equal or better those usually considered as standard at the present time.

6) Small, compact design is highly desirable. However, miniaturization should not produce a compromise in electrical performance, nor difficult installation and servicing.

7) Plug-in designs are convenient, but it must be remembered that the plug can easily become the weakest link in the entire system. A rugged, dependable plug is required.

8) The number of chassis sizes should be reduced to a minimum. If possible, larger chassis should be multiples of the smallest.

9) The mechanical design must permit these amplifiers to be used in various ways. They should be adaptable for use in consoles, turntables, various special assemblies, and in standard panel and shelf assemblies.

Adherence to these design precepts produces problems which are not usually

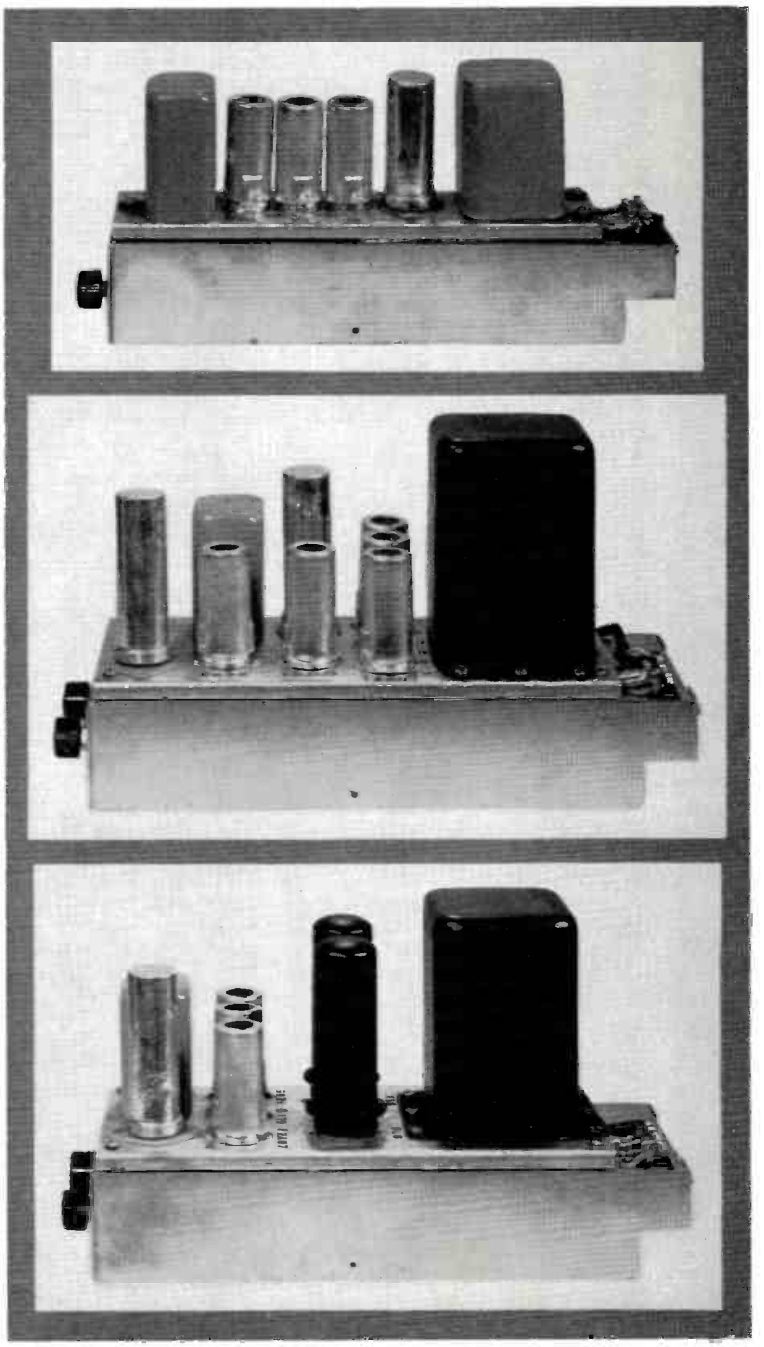


FIG. 1. THE PREAMPLIFIER, PROGRAM AMPLIFIER, AND MONITOR AMPLIFIER, FROM TOP TO BOTTOM

*Chief Audio Frequency Engineer, Gates Radio Company, Quincy, Illinois. This paper was given at the 1952 NARTB Convention, Chicago.

encountered in conventional amplifier design. Solutions to the problems were obtained and incorporated in the three new amplifiers shown on these pages. These amplifiers provide excellent examples for analyses of the engineering procedures required to meet the design objectives.

The three amplifiers to be discussed are the MO-3964 preamplifier, the MO-3977 program amplifier, and the MO-4051 monitor amplifier, manufactured by the Gates Radio Company. They are shown, in the order given, from top to bottom in Fig. 1 and from left to right in Fig. 2.

All the amplifiers are designed to provide generous overlaps in operating limits. For example, the preamplifier can be used as a preamplifier, a turntable booster, a mixing system booster, or a line isolation amplifier. The program amplifier can serve as a line isolation or line booster, a line or program amplifier, or a low-level monitor amplifier. The monitor amplifier can be utilized as an audition or talk-back amplifier because of its high gain, as a low-level monitor amplifier, or as a high-level monitor amplifier with a maximum output of 16 watts.

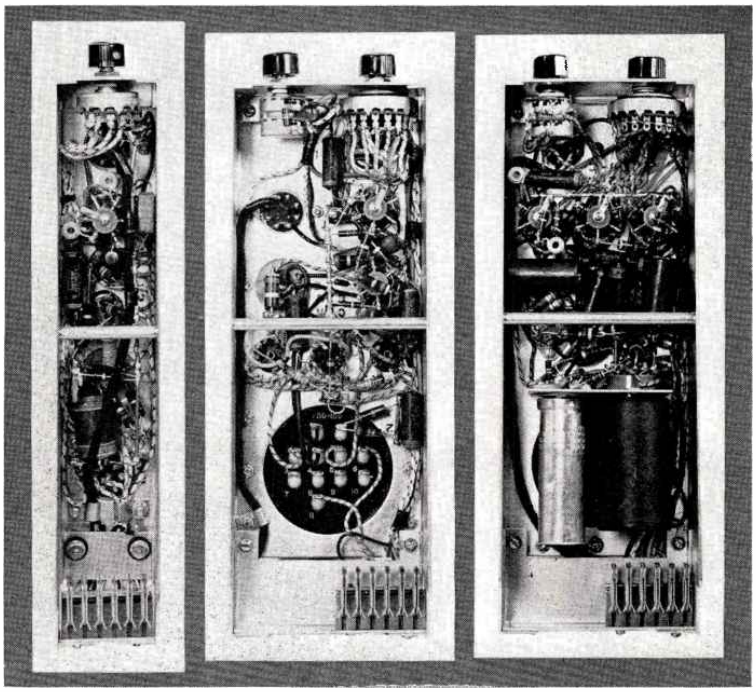


FIG. 2. BOTTOM VIEWS OF THE AMPLIFIER UNITS, SHOWING THE FRAMES AND THE FRAME PLUGS

Because preamplifiers are used in greater quantity than program and monitor amplifiers, the new preamplifier was designed first. Also, it was recognized that the preamplifier would be ideal for experiments with miniature tubes and plug-in devices.

Preamplifier Circuit Analysis:

The basic electrical requirements of a preamplifier are a gain of 40 db; a maximum output of +18 dbm, with less than 1% harmonic distortion at frequencies from 30 to 15,000 cycles; frequency response within 1 db over the entire range; and (possibly the most important), an equivalent input noise of less than −120 dbm.

It was found possible to design the preamplifier around a single tube type. The resulting design is a 3-stage cascade amplifier, Fig. 3, using type 5879's. A pentode-connected first stage feeds a triode-connected second stage. A cathode loaded output stage is triode-connected also.

Feedback, limited to about 17 db, is taken from the cathode of the output stage to the cathode of the first stage. This amount of feedback provides the desired reduction of harmonic distortion and correction of frequency response without detrimental effects to the stability of the amplifier. A frequency-corrective network is included in the feedback loop, by means of which it is possible to produce variations of ±2 db at either extreme of the frequency range.

Metering is provided for the cathodes of each of the three stages and for the B+ supply. The circuit to be metered is selected by a 5-position switch located on the front of the amplifier.

The selection of the proper type of plug is of the utmost importance. The dependability, interchangeability, and the manufacturing tolerances of the amplifier depend to a great extent on the choice of the plug.

The varieties of plugs used in a great many types of electronic equipment were studied thoroughly, and the shortcomings and good features of each were analyzed. Many required extremely precise alignment. Others, although easily aligned and rugged in construction, were difficult to engage and disengage, and thus would require tools for the installation of the amplifier. A number of miniature plugs showed considerable merit, but were discarded because of the close spacing between contacts and the lack of sufficient terminating lug area for wire terminations.

The type of plug finally accepted is not a new development, but one that

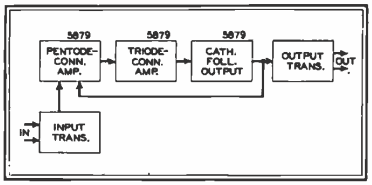


FIG. 3. BLOCK DIAGRAM OF THE PREAMPLIFIER

has been used in the telegraph industry for many years with much success. This plug and its receptacle are known as a base-and-frame jack. Details of the construction can be seen in Figs. 2 and 4.

The base-and-frame jack is extremely non-critical in alignment. It will withstand considerable vertical and lateral movement without injury. The contact design provides excellent wiping action with a large contact area. Because of the spring action of the contacts, little effort is required for engaging or disengaging the plug. A total of 12 contacts takes up less than 2 ins. External wiring to the base is attached easily to large staggered lugs.

The size of the base-and-frame jack, together with the output transformer size, establishes a minimum chassis width — in this case, 2 1/16 ins. The standard rack depth establishes the length of the chassis as 11½ ins.

The chassis proper is of shallow pan-type construction, and is mounted on a frame with an open top and bottom. This frame houses the female section of the base-and-frame jack. The last part of the assembly is a base-plate of such width as to fit on the inside of the frame. The male section of the base and frame jack is attached to the base. Thus, the base serves to align the frame, as can be seen in Fig. 4.

Because of the comparatively non-critical alignment required for the base-and-frame jack, considerable play between the amplifier frame and the base can be tolerated. This makes it possible

to engage and disengage the amplifier without tools, with a minimum of effort, and with considerable speed.

Eight of these preamplifier units can be mounted in a rack space only 7 ins. high by 19 ins. wide. The panel and shelf assembly, Figs. 4 and 5, which can be used for rack-mounting the amplifiers,

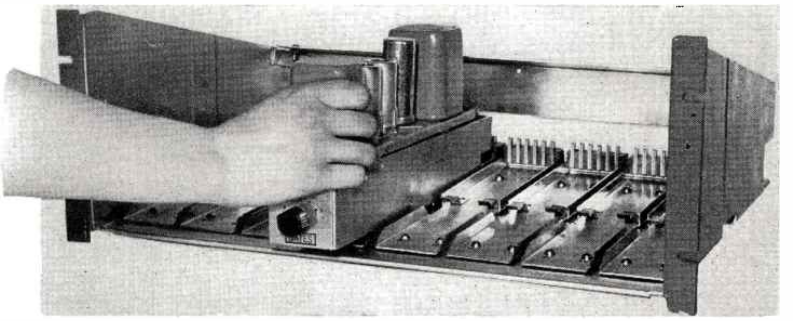


FIG. 4. HOW THE FRAME CHASSIS FITS OVER THE BASE PLATE AND IS SECURED BY BRONZE CLIPS

is equipped with a spring-loaded removable panel to provide access to all the amplifiers.

The electrical characteristics for the final preamplifier design are as follows:

Gain: 40 db.

Frequency Response: ±1 db from 30 to 15,000 cycles.

Harmonic Distortion: Less than 0.5% from 30 to 15,000 cycles, at an output of 18 dbm.

Equivalent Input Noise: −122 to −124 dbm.

Cross Talk Between Adjacent Amplifiers: 90 db below 10 dbm at all frequencies from 30 to 15,000 cycles.

Program Amplifier Circuit:

A successful program amplifier must have a gain of 50 to 65 db. The higher gain is preferable, for it provides more versatility. It must be capable of an output

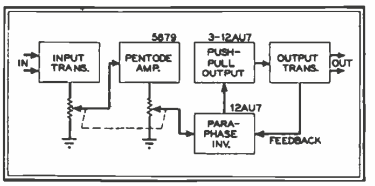


FIG. 6. BASIC PROGRAM AMPLIFIER CIRCUIT

level of at least +24 dbm. If possible, this output level should be extended to +30 dbm (one watt) for an adequate safety margin and, better yet, to a level of +33 dbm so that the amplifier can be used for low-level monitor applications.

The signal-to-noise ratio of this amplifier is of paramount importance, for the program amplifier can determine the final signal-to-noise ratio of the entire system. It has been determined that the equivalent noise should not exceed −115 dbm.

The program amplifier described exceeds these design requirements by means of an unusual circuit design, Fig. 6. Basically, it consists of a 3-stage amplifier. Only 2 tube types are used, however. The first stage is a pentode-connected type 5879. It is resistance-coupled to a type 12AU7 stage, operated as a paraphase phase inverter. This 12AU7 drives an output stage consisting of three 12AU7's connected in push-pull parallel.

Feedback on the order of 19 db is derived from a tertiary winding on the output transformer. It is taken back to the cathode of the first section of the phase inverter. Frequency-equalizing networks are included in this feedback loop, so that the response curve can be altered by ±2 db at either or both extremes of the audio spectrum.

A dual level control is employed in order to permit high input levels with low distortion, and to maintain the excellent signal-to-noise ratio. Although a dual carbon control is supplied as standard equipment, sufficient room is provided for a high-quality step-type attenuator, if it is desired.

All cathodes and the B+ voltage are metered by means of an 8-position switch located at the front.

This program amplifier in its final form has the following characteristics:

Gain: 65 db.

Frequency Response: ±1 db from 30 to 15,000 cycles.

Harmonic Distortion: Less than 0.5% from 30 to 15,000 cycles at an output level of +30 dbm. Less than 0.75% from 30 to 15,000 cycles at an output level of +33 dbm.

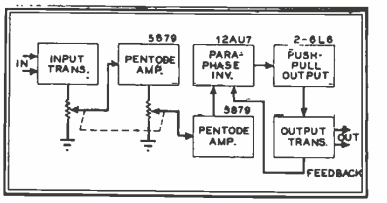


FIG. 7. DIAGRAM OF THE MONITOR AMPLIFIER

Euivalent Input Noise: −117 db.

Size: 4 ⅛ ins. wide by 11½ ins. long.

Mounting Requirements: Four program amplifiers can be mounted in one panel and shelf assembly occupying a rack space 7 ins. high by 19 ins. wide.

Monitor Amplifier Circuit:

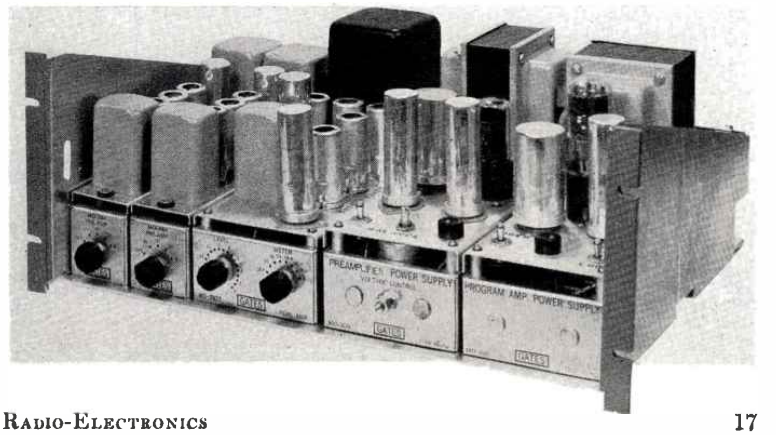
There has been much controversy concerning the necessary gain and the maximum output requirements for an ideal monitor amplifier. The monitor amplifier in broadcast service is used under such varying input and output conditions that the acceptance of one application as standard would probably result in a specialized design which would not be of universal appeal. For this reason, it is necessary to analyze a great many operational situations before design limits can be established.

To be truly practical, the monitor amplifier must offer high gain, high output, low noise, low distortion, and the ability to handle high input levels without overloading the input stages. Translated into more exacting terms, the monitor amplifier must have a gain of at least 100 db, equivalent input noise of −120 dbm, frequency response within ±2 db from 30 to 15,000 cycles, and a maximum output of at least 10 watts. This performance is achieved by the circuit represented in Fig. 7.

The amplifier utilizes 4 stages. Type 5879 tubes, pentode-connected, are employed in the first two stages. The third

(Continued on page 34)

FIG. 5. THESE UNITS FIT SNUGLY IN A STANDARD RACK SHELF. NOTE POWER SUPPLIES AT RIGHT



PATTERN FOR TV PROFIT

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

PART 2 CONCLUDED — STATION AND STUDIO LAYOUTS. DESCRIBING ACTUAL INSTALLATIONS FROM SMALLEST SIZE TO LARGE INDEPENDENT STATIONS

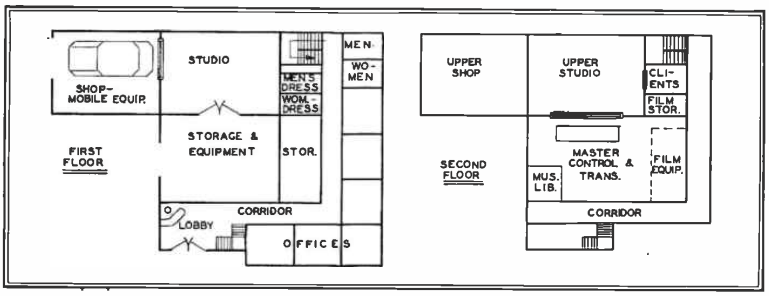


FIG. 4. LAYOUT FOR LOW-COST INITIAL TV FACILITIES SUGGESTED BY CONSULTANT WILLIAM FOSS

IF a mobile unit is planned for a small station, it is possible to use it also at the station for live programs. This can be facilitated by a layout similar to that shown in Fig. 4. With this plan, it is not necessary to remove the control and switching equipment from the truck for studio shows, if it is installed at the rear of the truck and a large windowed area is provided. The truck is backed into the garage and shop area, which adjoins a room set aside for a small studio. This studio is 2 stories high. On the second floor of the building is the master control and transmitter room, situated so that it can be utilized for studio control also upon the installation of permanent camera pickup facilities. Another studio of larger size can be added conveniently in the corner between the garage and the control room. The space now marked STORAGE & EQUIPMENT could be utilized as a control room for at least one of the studios, and new storage space could be provided when the studio is built. Also, present garage and shop could be eliminated to make space for a much larger new studio.

Fig. 5 is a floor plan of the original WDTV installation in Pittsburgh. The station operated for well over a year with film and network programs only, while building up an audience in the area. Later, studio and remote facilities were added to increase the versatility of programming.

It can be seen that this layout encompasses about 1,750 sq. ft., including the large transmitter room. Transmitter power could be increased easily to the maximum permissible, and there would still be ample space in this room. Offices were not required at the location, but the plan can be modified simply to provide for them in other installations of similar size.

The one-floor layout of WDAF-TV. shown in Fig. 6, contains complete facilities for TV operation, including a small live studio. Built in 1949, the Kansas City, Missouri station went on the air with an ERP of 22 kw., provided by a 5-kw. transmitter and a 5-section turnstile antenna atop a 650-ft. tower. With a comparatively modest investment, original program facilities included film, network, remote pickup, and studio live-talent shows.

All switching and control functions are performed in the master control room, including camera switching for the studio. The director has individual camera monitors in the studio control room, but has no direct control of switching.

The insets at either end of the film projection room are for the film cameras. This practice was required by local fire regulations. Only one film camera was used at first, with two 16-mm. projectors and an opaque slide projector. Film editing was done at one end of the projection room.

All cables were run in floor trenches for neatness, accessibility, and protection. These trenches extend to the outside walls in many locations, since it was planned from the beginning to add space for larger TV studios and WDAF radio studios.

WTVJ Miami, Florida, has taken over a motion picture theatre and is converting it to a TV production center. Fig. 7 shows floor plans for this 3-story building, which was connected to an existing studio building by a 25 by 25-ft. addition, shown at the top right corner of the layout.

On the first floor, space is provided for program and sales department offices, dressing rooms, and storage space. Stores at the front of the building were permitted to remain. The stairs at the right of the lobby lead to the studio. Those at the left lead to the balcony audience area, about half of which was removed for studio space. The elevator at the rear services all three floors.

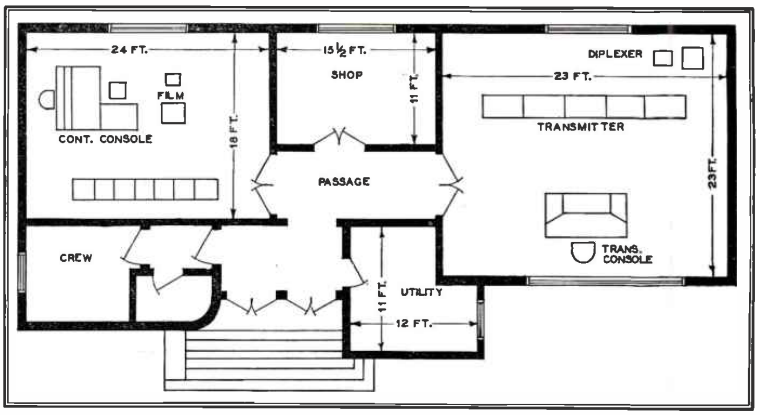


FIG. 5. FLOOR PLAN OF THE ORIGINAL WDTV PLANT, UTILIZED FOR NETWORK AND FILM OPERATION

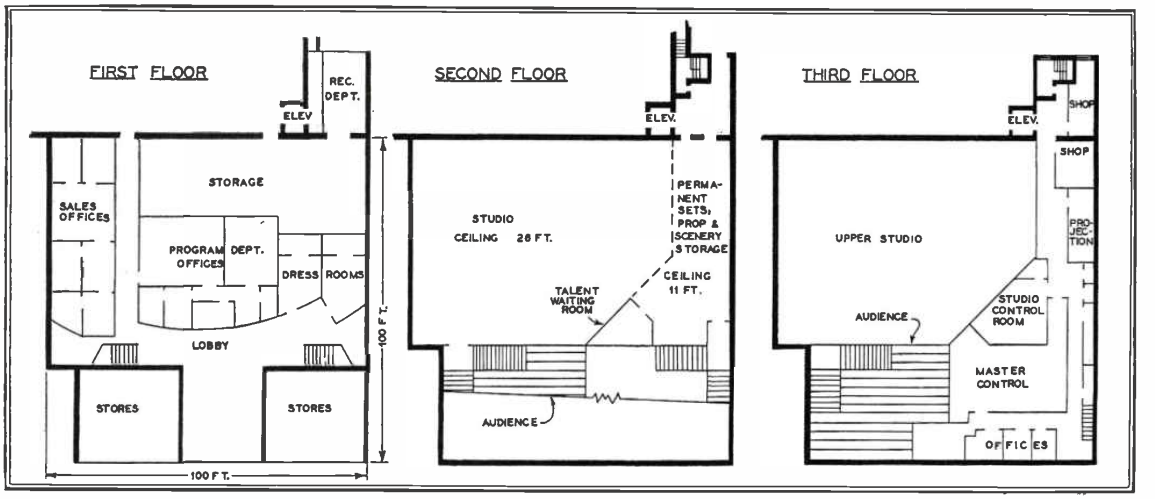


FIG. 7. HOW A MOTION-PICTURE THEATRE WAS CONVERTED BY WTVJ FOR USE AS A TV PRODUCTION CENTER, WITH AN AUDIENCE AREA FOR THE STUDIO

An area about 74 by 68 ft. on the second and third floors is provided for the studio. Ceiling height in this main section of the studio is 26 ft. However, the studio floor continues under the third-floor engineering areas. This part of the studio has a ceiling height of 11 ft., and is used for permanent sets (such as a kitchen and a news room) and for storage of props and scenery. A small room has also been provided in this area for talent briefing and rehearsals. The audience area is separated from the studio by glass partitions.

On the third floor, the control room is placed diagonally across one corner of the studio. Since the studio area is virtually square, this provides an excellent view of any point within the area. An announce booth is located next to the control room, and the master control room practically surrounds the studio control area. Film projection and editing rooms, shops, and offices are also located on this floor level.

In Figs. 8 and 9 are shown the layouts of studios and control areas of

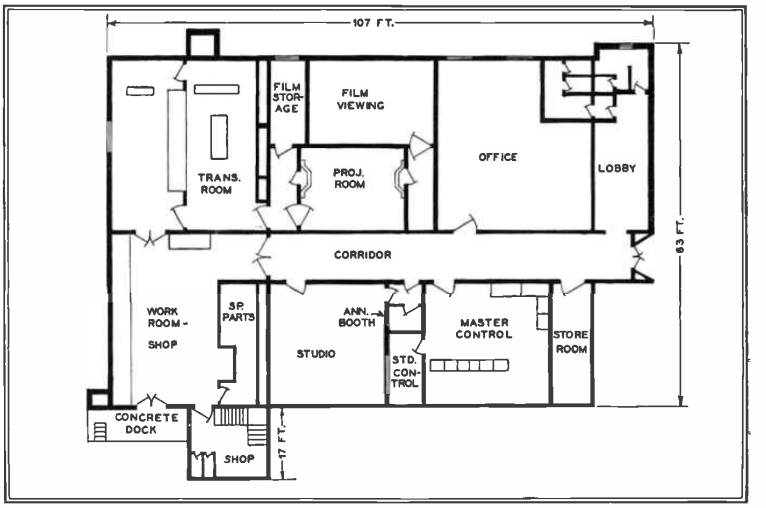


FIG. 6. THIS ONE-FLOOR BUILDING HOUSES ALL WDAF-TV FACILITIES, INCLUDING A LIVE STUDIO

WDSU AM-FM-TV, New Orleans. This new building was erected directly behind the WDSU office building, which is a converted old mansion fronting on famous Royal Street in the heart of the French Quarter.

Fig. 8 is the first-floor plan. The total length of the building is just under

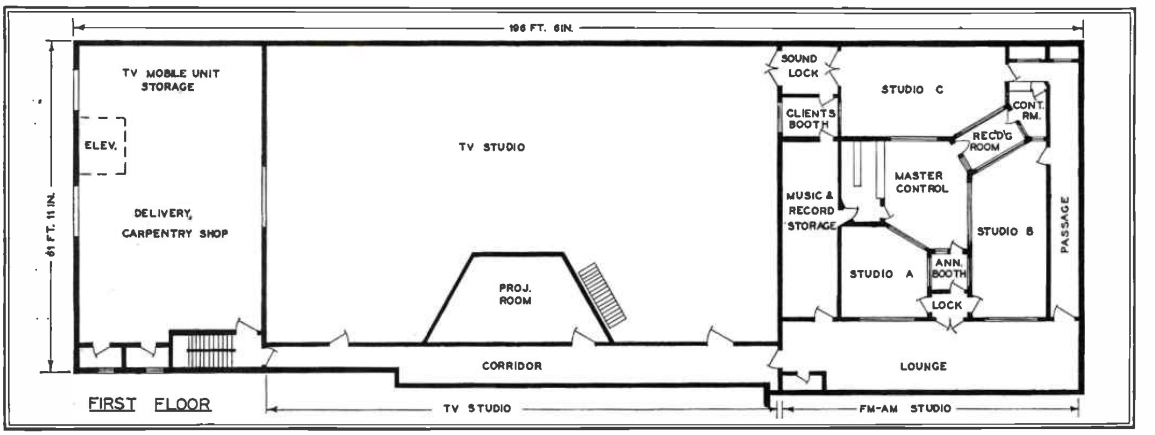


FIG. 8. LAYOUT OF WDSU FM-AM-TV. NOTE VERY LARGE TV STUDIO, NECESSITATING CONTROL-ROOM PLACEMENT AT THE CENTER OF THE LONG DIMENSION

200 ft., of which 100 ft. is taken up by the TV studio. At the left of the TV studio is space for the remote-pickup unit and delivery and carpentry shops. Access to the studio from the shop area is by means of a wide doorway, through which automobiles and other large objects can pass easily. As many as 8 sets can be accommodated in the studio, which is 55 ft. wide.

In order to provide good visibility to all parts of the studio, the control room is located in a wedge-shaped projection at the center of one long wall, directly over the film room. A combined studio control and master control is used for TV.

A second-floor level is provided only over the television section of the building, as shown in Fig. 9. Over the carpentry shop are located the electrical shop, a storage area serviced by a large elevator, dressing rooms, and an engineering office.

The radio studios are arranged ingeniously also, as Fig. 8 shows. Three studios are provided. A separate control room is provided for the two larger studios. In the center of the studio layout are the radio master control rooms and a recording room. A client's observation room is located so that it can be used for the TV studio and the largest radio studio.

Facilities for WHAS-TV, Louisville, Kentucky, are constructed on the seventh floor and mezzanine of a downtown building. The floor plan is given in Fig. 10. A space approximately 63 by 41 ft. in the center of the layout is devoted to the main TV studio, with 2 small areas separated by folding doors from the studio set up permanently as kitchen and dining room sets. The remaining areas on the seventh floor level are generously self-explanatory. It can be seen that a good deal of space has been devoted to film areas, with developing and editing areas for both still and motion picture films. Rear-projection equipment is installed in the film editing area (left center) for backdrop scenes in the studio.

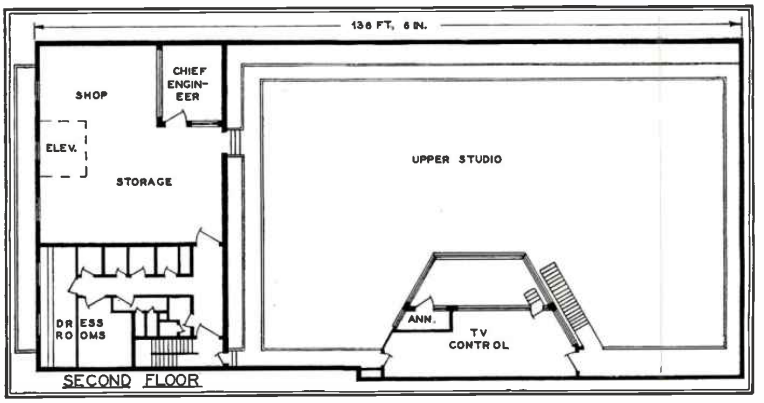


FIG. 9. UPPER PART OF WDSU STUDIO BUILDING DOES NOT EXTEND OVER FM-AM STUDIO SECTION

Basic technical equipment occupies a mezzanine, Fig. 11, over the areas designated in Fig. 10 as the paint and carpentry shops, film editing and supply rooms, and dressing rooms. A circular staircase was installed between the film editing room and the control area in order to provide fast access between the control room and the studio. These areas in Fig. 10 are shaded.

A separate studio control room is provided, located at the top and at the left in Fig. 11. Directly behind this area are a client's viewing room and an announce booth. The client's room is elevated slightly, and the announce booth is situated so that the announcer can receive cues from the studio control room or from the operator of the combined film control, master control, and transmitter control console.

A 16-mm. projector and an opaque projector feed each film camera. The projectors are of the shutterless type, which make very little noise, and are therefore installed in the control area without dividing partitions. The transmitter is built into the wall at the end of the room. Another wall separates the back of the transmitter from the fan room. The fan room is actually an air plenum chamber, receiving an air supply from the outdoors and combining this with recirculated air, as re-

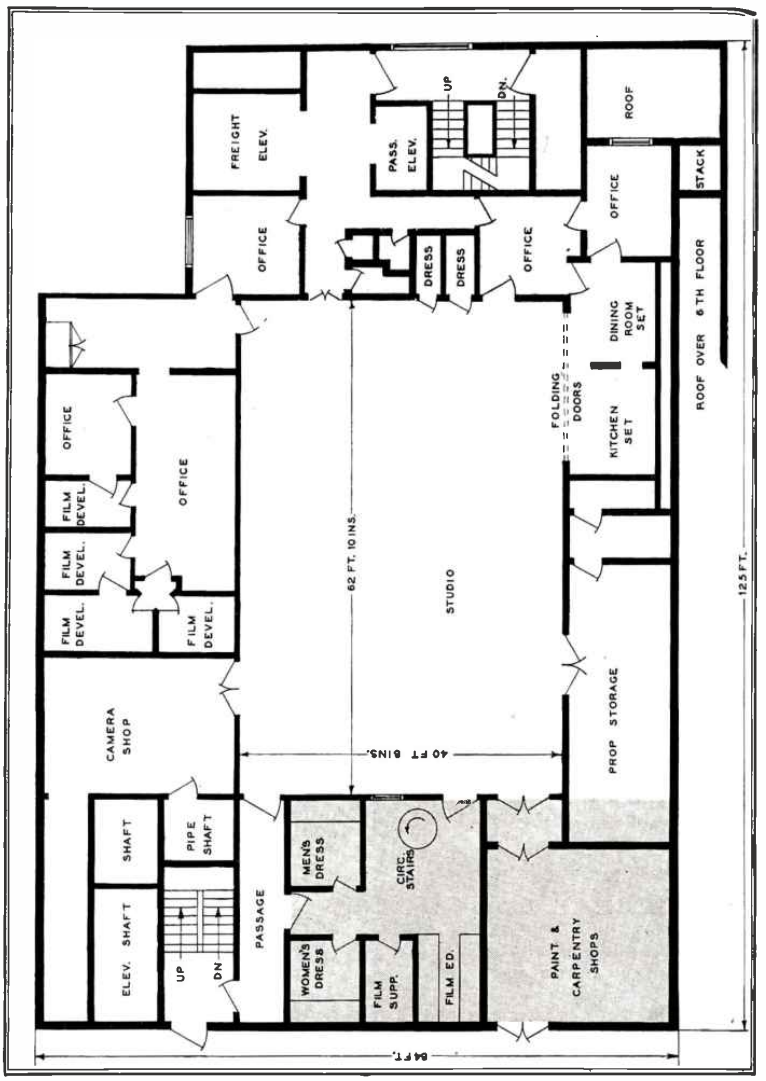


FIG. 10. WHAS STUDIOS, OFFICES ON 7TH FLOOR OF DOWNTOWN BUILDING. TECHNICAL AREAS ARE ON MEZZANINE OVER SHADED SECTION

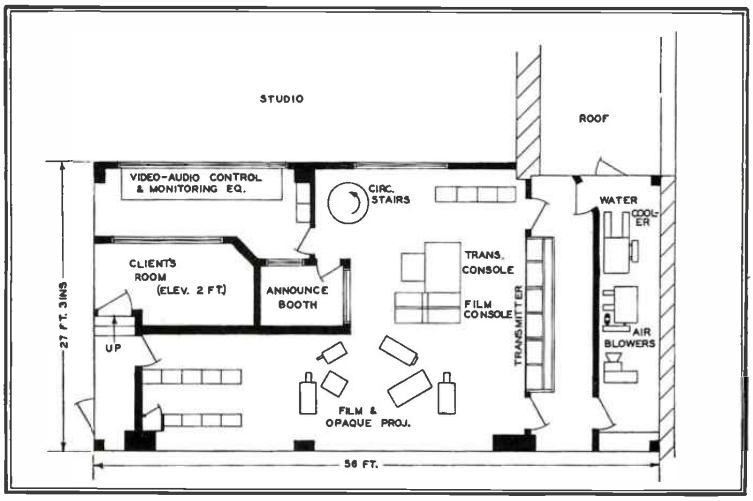


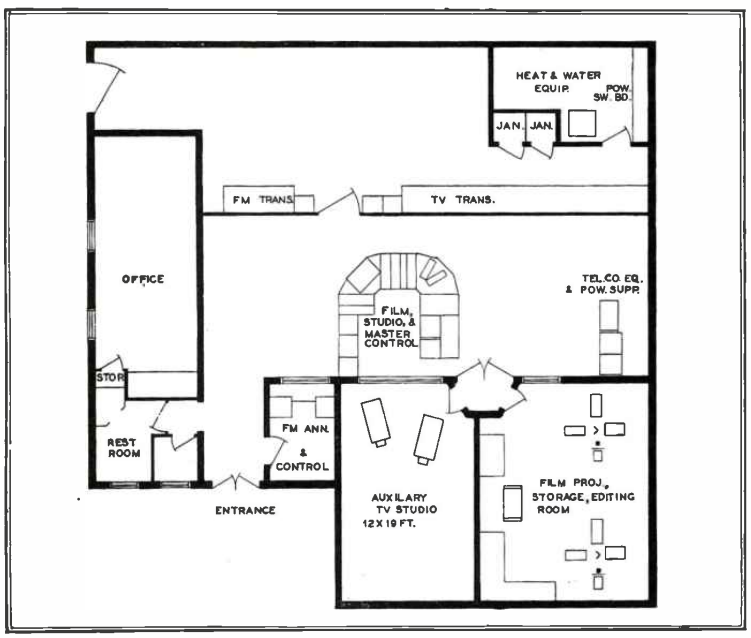
FIG. 11, ABOVE: CONTROL AND TECHNICAL SECTION OF THE WHAS-TV PLANT. FIG. 12, BELOW: THE TRANSMITTER CONTROL AND FILM CONTROL CONSOLES

quired to maintain proper temperature, by means of thermostatically-controlled dampers in the inlet and exhaust ducts. Fig. 12 shows the transmitter console, audio and measuring equipment racks, and the transmitter in the far right background.

KRON TV-FM San Francisco shares a transmitter building atop San Bruno mountain with KNBC-FM. The antennas are over 1,300 ft. above average terrain within a 10-mile radius. A layout of KRON's section of the building is given in Fig. 13.

TV master control equipment is arranged in a U, Fig. 14, so that the station operation can be handled by two technicians. This includes operation of the transmitter, which is built into a wall opposite the apex of the U; two film cameras, fed by two 16-mm. motion-picture projectors, three slide projectors (two of which are automatic), and an opaque projector; a live studio with two

FIG. 13, BELOW: KRON-TV HAS MASTER CONTROL AT TV AND FM TRANSMITTER SITE. FILM AND LIVE STUDIO MAKE IT INDEPENDENT OF URBAN STUDIOS



field cameras: two microwave links, one an ST link: and a 2-channel audio system with a tape recorder. The technicians are capable of operating all the controls and, since the controls are all within easy reach of an operator at the console, one technician can man the console while the other changes film, takes meter readings, or sets up the studio cameras. Also, one man can handle the station during periods of test-pattern transmission.

A 12 by 19 ft. studio in back of the operating console is used primarily as a news room and for live commercials. The studio actually reduces the operating cost of the station considerably, since it is not necessary to keep the downtown studio manned on weekends, holidays, or late at night.

For many shows originating at this studio, the two cameras can be set up permanently and left in fixed positions. When the cameras must be moved and refocussed during the show, however, one extra technician can handle both cameras since the studio is so small. The producer stands in the control area, Fig. 15, where he can see into the studio and, by turning his head, see the camera and air monitors. He also serves as the announcer. Thus, for simple live talent shows, the complete station operation can be carried on by 4 men, in addition to whatever talent is required!

Offices and more elaborate studio facilities are located in the Chronicle Building in urban San Francisco. Fig. 16 shows the ground-floor plan. Efficient use was made of the available space, with the studio and control room located

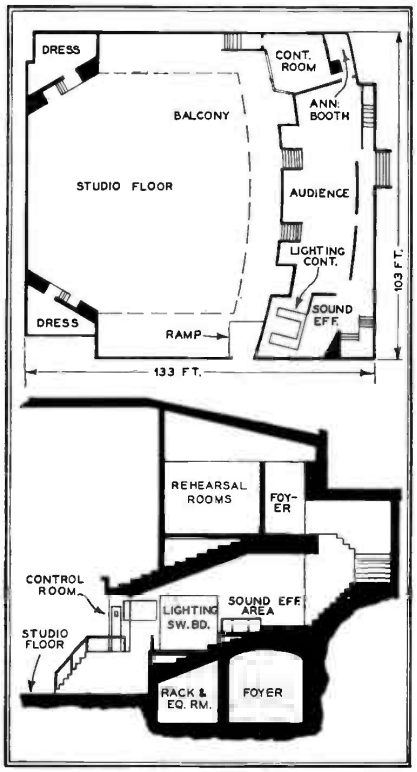


FIG. 17. AUDIENCE STUDIO MADE FROM THEATRE

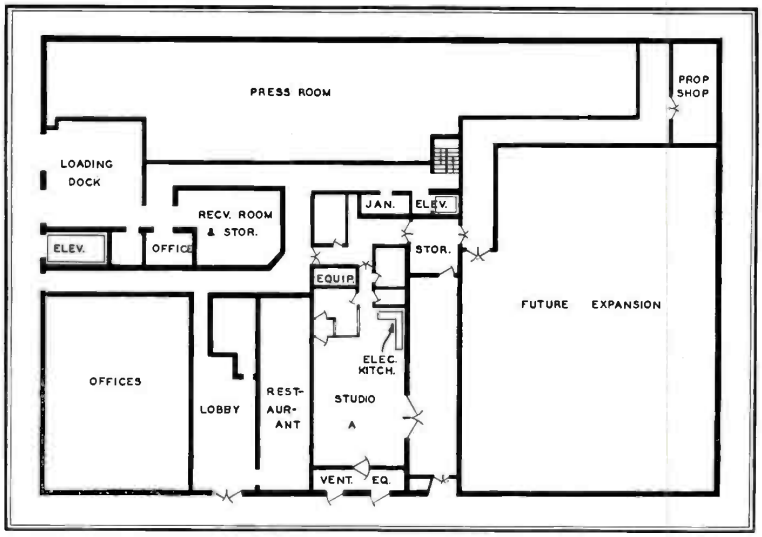


FIG. 16. DOWNTOWN STUDIOS AND OFFICES OF KRON-TV ARE IN NEWSPAPER BUILDING WITH PRESSES

as far as possible from the press room. In this case, special floor suspension was not required, since the presses are individually mounted on vibration-isolation bases.

In large cities, stations sometimes require auditorium studio space of such size that conversion of existing theatres is practical. CBS-TV converted the Monroe Theatre in New York City for TV production purposes. Formerly seating an audience of 2,400, studio 61 now has a capacity of 247, since the entire former orchestra area was leveled off for use as a staging area. This area is approximately 100 by 100 ft., with an overhead height of 30 ft., as shown in Fig. 17. Part of the first balcony is used for the control room, announce booth, lighting switchboard area, and sound effects area, with the rest retained as an audience area. Most of the second balcony was used to provide two large combination rehearsal and dressing rooms, with additional space allotted to scenery and prop storage.

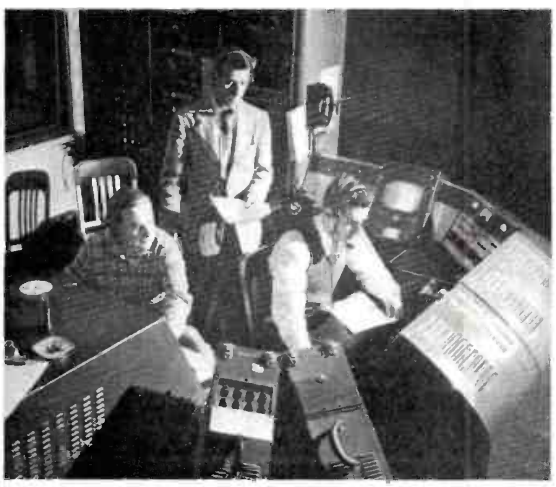
An equipment room and maintenance shop are directly under the control room. Under the audience area, other dressing rooms and an air-conditioning unit are located. Service areas are off the lobby.

Fig. 18 shows the main floor plan of WHAM AM-FM-TV in Rochester, N. Y. This installation is unique in that it has no TV master control *per se*. Network switching is done in the film control room. Programs are microwaved to the remote transmitter building.

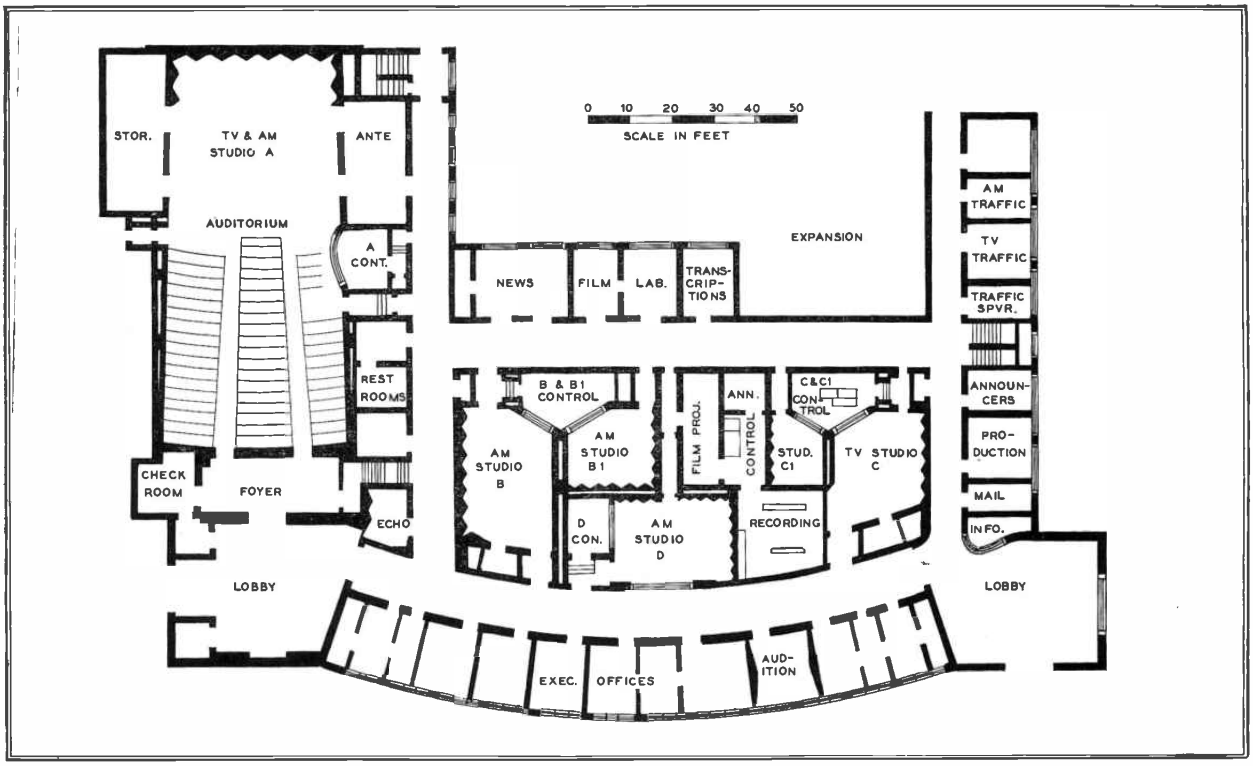
The TV control setup for the auditorium studio is also unusual. Camera control units are at the front of the studio A control room. However, the producer, audio operator, and technical director have monitors and switching equipment in a room directly above the foyer at the rear of the auditorium.

The room identified by RECORDING is used for disc and tape recording and other audio equipment. Paint and carpentry shops are in the basement. Because additional storage space for television appurtenances is contemplated but not yet provided, stage sets and props are now stored in studio B, and many must be taken to the basement.

Admittedly, some of these arrangements are not so convenient as they could be. But WHAM added TV production in a building designed primarily for radio broadcasting, without undertaking extensive alterations, and made it work. This description may, therefore,



FIGS. 14, 15. MASTER-CONTROL AREA OF KRON-TV IS U-SHAPED FOR MAXIMUM OPERATING CONVENIENCE. DIRECTOR FOR LIVE SHOW STANDS IN THE U



FIGS. 18, ABOVE, AND 19, BELOW: WHAM AND WTMJ ARE EXAMPLES OF INDEPENDENT STATIONS COMBINING RADIO AND TV PRODUCTION IN ONE BUILDING

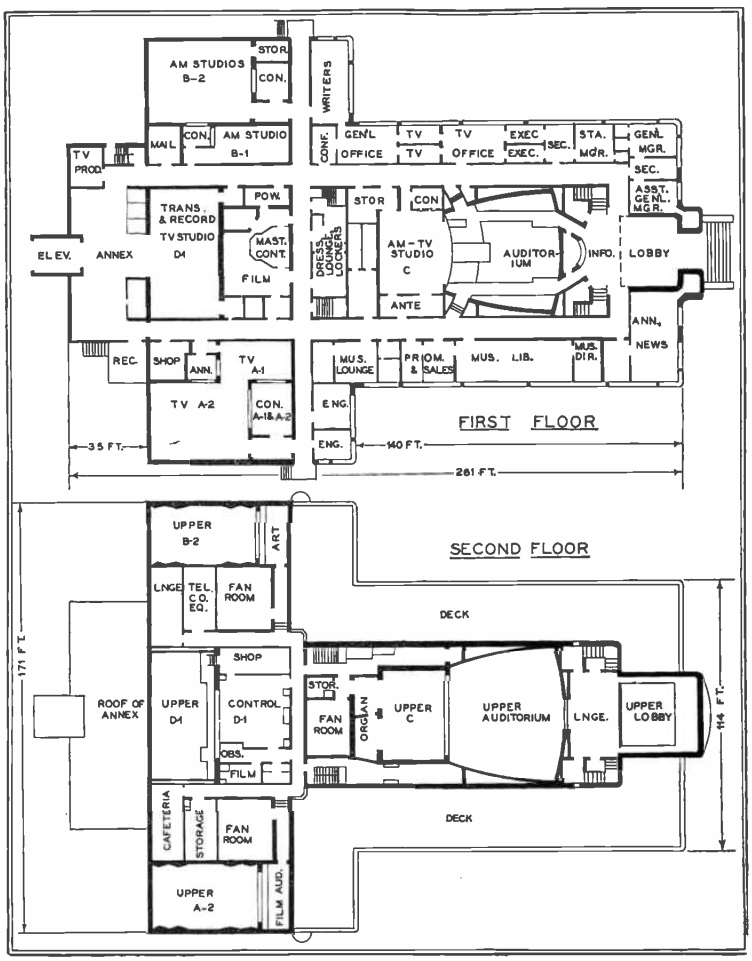
provide some workable ideas for others in the same situation.

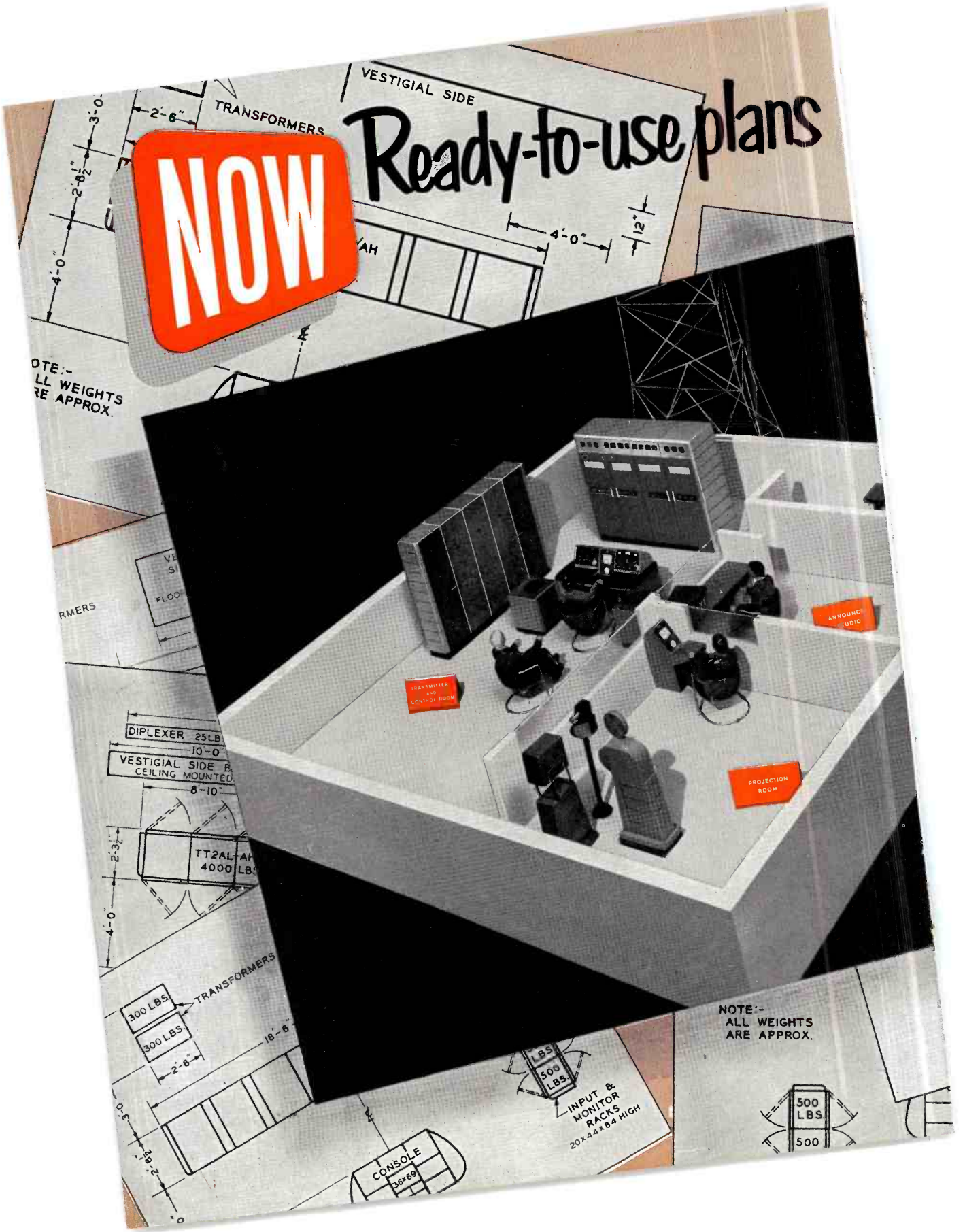
WTMJ AM-TV Milwaukee, Wisconsin, occupies a building approximately 260 by 170 ft. overall, which was planned specifically as a broadcasting production center. Plan views of the well-designed first and second-floor layouts are shown in Fig. 19. The diagrams are generally self-explanatory, and a study of them will provide many ideas that can be carried over to other designs.

The auditorium studio is situated so that a direct route is provided for the public from the front entrance of the building to the auditorium seats. All executive offices are off one of the main corridors, while production and sales of fices are off the other. Engineering offices, lockers, and dressing room are close to the studios and control areas, and are accessible by side entrances. The integrated AM and TV master control room is centrally located, convenient to all studios and control areas.

Power supplies for the master control are in a separate room, providing ease of ventilation and convenience in patching of spare units. The TV transmitter, heating unit, and air-conditioning equipment are located in a separate 2-story building, which is connected to the main building by means of a tunnel passage. The hydraulic lift is 10 by 20 ft. in size.

(Next month: Details of TV studio construction and lighting).





...for any TV power up to 200 kw!*

Typical 2-kw TV station layout for VHF (ERP range, 2 to 20 kw)

A low-cost arrangement for getting up to 20 kw ERP with an RCA high-gain antenna. The installation includes: an RCA 2-kw transmitter, control console, transmitter monitoring equipment, audio equipment, sync generator, video equipment, and power supplies.

THE drawings spread across these pages are layouts of typical TV transmitter rooms using RCA equipment. They are prepared expressly for TV station planners in accordance with the best engineering practice known today. Each plan represents the basic or minimum TV transmitter room equipment needed to get "on the air" for a specific power. Each indicates the approximate space needed for the equipment—including approximate weights of individual units. Each provides wide flexibility for equipment rearrangements to meet the special or future requirements of individual stations.

"Ready-to-use" plans like these are just one of RCA's many television services now available to you—through your RCA Sales Representative. For a complete engineering analysis of your station requirements, call this expert. He can show you exactly what you will need to get "on the air" for a minimum investment.

*Effective radiated power

MOBILE RADIO

NEWS AND FORECASTS

THE analysis of applications in the public safety, industrial and transportation services contained on this page presents, for the first time, an accurate, up-to-date picture of the growth of 2-way radiophone communication. The data covers the first three months of 1952, and was compiled painstakingly from the listings of new applications as published monthly in this Magazine.

Taking the average cost of a mobile unit at $500, a base transmitter installation at $1250, and a relay station at $5,000, equipment purchases for the first quarter of 1952 must have totalled nearly $10 million. Here are the details:

Public Safety:

Of the 76 applications filed by municipalities in the public safety group, 4 were for 9 Speedmeter installations; 56 were for base and mobile units, and 16 were for mobile units only. Among the total applications, a few were for the replacement of old installations, but the majority covered completely new systems. Applications for mobile units only were additions or replacements. Frequencies were about evenly divided between the 30 to 50 and 152 to 160-bands.

Applications from county sheriffs totalled 61, covering 49 base stations and 739 mobile units. Of these, 51 were for frequencies in the 30 to 40-mc. band, and 10 in the 152 to 162-mc. band.

Activity in state police departments was limited to 19 applications for 31 base stations, 30 mobile units, 17 temporary bases, 1 relay, and 1 Speedmeter.

This gives a total in the municipal, county, and state police group of 156 applications, 145 base stations, 1,282 mobile units, and 10 speedmeters.

Forestry:

Practically all installations in this group are licensed to state departments of conservation. Those used in connection with lumbering operations are listed separately under Forest Products. The 121 applications were for 120 base stations and 14 mobile units. The former are used in observation towers manned by the Forest rangers.

Fire Department:

Municipal fire departments filed 43 applications for 41 base stations and 416 mobile units, indicating a substantial interest in a field which, for so long, looked rather disdainfully on the use of radio equipment. In a number of cities, one system serves both police and fire. Applications listed here, however, are from fire departments. Frequencies requested were evenly divided between the 30 to 50 and 152 to 162-mc. bands.

Highway Maintenance:

Of the 27 applications filed for highway maintenance service, 8 were for 950-mc. relay and control stations, 12 were for base stations only, and 7 for single base stations and a total of 251 mobile units.

Special Emergency:

Veterinarians accounted for the largest number of special emergency applications. Radio is important to these men because, for the most part, patients cannot be taken to them. They must go to their patients, and they must cover considerable distances between calls. Second in number were the medical doctors, with the undertakers in third place. There were 83 applications, covering 83 fixed stations and 206 mobile units. Only two were in the 152 to 162-mc. band. The remainder were for 47 to 48 mc.

Power Utility:

The power utility group is now one of the most active in expanding the use of radio communication. Applications added up to 180, for 160 base stations, 49 relay and control transmitters, and 935 mobile units. Frequencies requested were about evenly divided between the 30 to 50 and 152 to 162-mc. bands, except for the relay and control stations. Of the latter, 12 were for 72 to 76 mc., 2 for 158 mc., 6 for 475 mc., 14 for 950 mc., 11 for 1,975 mc., and 4 for 6,600 to 6,800 mc.

Pipeline Petroleum:

Pipeline companies handling petroleum and natural gas accounted for 163 applications. These called for 223 base stations, 648 mobile units, and 25 relay or control stations. Most of the base and mobile transmitters are for operation on 30 to 50 mc., with only a few on 152 to 162 mc. Frequencies specified for relay and control stations were divided between 7 on 72 mc. and 18 on 6,625 mc. There were 31 applications for the 648 mobile units.

Forest Products:

In lumbering operations, radio communication plays a very important part. However, the number of applications was relatively small, amounting to only 31. These were for 26 base stations, 158 mobile units, and 5 relay or control stations. All the latter were for 72 mc., while the frequencies for base and mobile transmitters were mostly 30 to 50 mc.

Low Power Industrial:

There were 39 applications filed for 272 of the low-power portable-type transmitter-receivers. Some were for fixed use, operating on 115 volts AC. Nevertheless, the FCC groups them with the battery-operated, hand-carried types. In addition, about 200 of these models were included in the applications for mobile transmitters.

Relay Press:

It seems as if relay press should be a very active radio service, yet only 4 applications were filed for 4 base and 37 mobile transmitters. Of these, 2 base and 25 mobile transmitters were for use in Alaska.

Special Industrial:

Broadest range of users is represented by the special industrial service. Applicants range from ship-builders to ranchers, and aircraft manufacturers to construction companies. There were 211 applications for 218 bases, 2,519 mobile, and 30 relay and control transmitters. Majority of the base stations and mobile units called for operations on 30 to 50 mc. Of the relay and control applications, 16 specified 72 mc., and 14 specified 6,425 mc.

Railroads:

This seems to have been a quiet period for railroad radio. There were 23 applications for 23 base and 16 mobile transmitters, with 1 mobile relay. All were for 152 to 162 mc. with two or three frequencies specified for each base transmitter.

Transit Utility, Intercity Bus:

Only 8 applications were filed for transit utility and intercity bus lines. They were for 8 base stations and 35 mobile units, all on 44 mc.

Auto Emergency:

Garages planning to use radio for dispatching service trucks and wreckers filed 11 applications for 11 base and 57 mobile transmitters. All were for 35 mc.

(Concluded on page 34)

LEFT: CHAIRMAN THOMAS J. EVANS OF THE PENNSYLVANIA TURNPIKE COMMISSION. HE HAS TAKEN AN ACTIVE INTEREST IN THE RADIO SYSTEM. ABOVE: A TYPICAL INTERCHANGE FROM THE AIR. THIS IS AT READING

VHF-UHF TURNPIKE RADIO SYSTEM

PART 1: HOW VHF-UHF RADIO IS EMPLOYED IN THE OPERATION OF THE PENNSYLVANIA TURNPIKE — *By* DOUGLAS N. LAPP AND ARDEN B. HOPPLE*

THE communication system operated by the Pennsylvania Turnpike Commission, cited by FCC Commissioner E. M. Webster as an outstanding example of system engineering,[1] illustrates in an unusual way the result of implementing technical advances by progressive operational policies. That somewhat complicated statement is explained by the history of the Turnpike system.

Three Stages of Development:

The original Turnpike, 160 miles long, was opened to the public in the fall of 1940, and the initial radio system went into service the following year. Relay stations on 116 and 119 mc. provided end-to-end communication. In addition, receivers and transmitters on the 30 to 40-mc. band, operating in conjunction with the relay system, picked up signals from the mobile units for transmission in both directions on the relay, and for retransmission on the frequency of the mobile and fixed-station receivers. Thus, each car could talk to any other car or to any toll booth along the highway.

This system, built around RCA fixed and mobile equipment, was designed, installed, and maintained by Raymond Rosen Engineering Products, Inc. Performance was remarkably successful, particularly in view of the fact that the combination of mobile and relay circuits was much in advance of communication practices at that time. Such trouble as was experienced was due principally to the fact that, under FCC rules, we could not keep the VHF relay carriers on the air continuously, but only during reception of the carrier of a mobile or fixed station, or reception of the carrier from the preceding relay in the chain. The delay of 1 to 2 seconds at each relay point set up a cumulative delay in activating the system, and the failure of a switching relay to release promptly could impede its normal functioning.

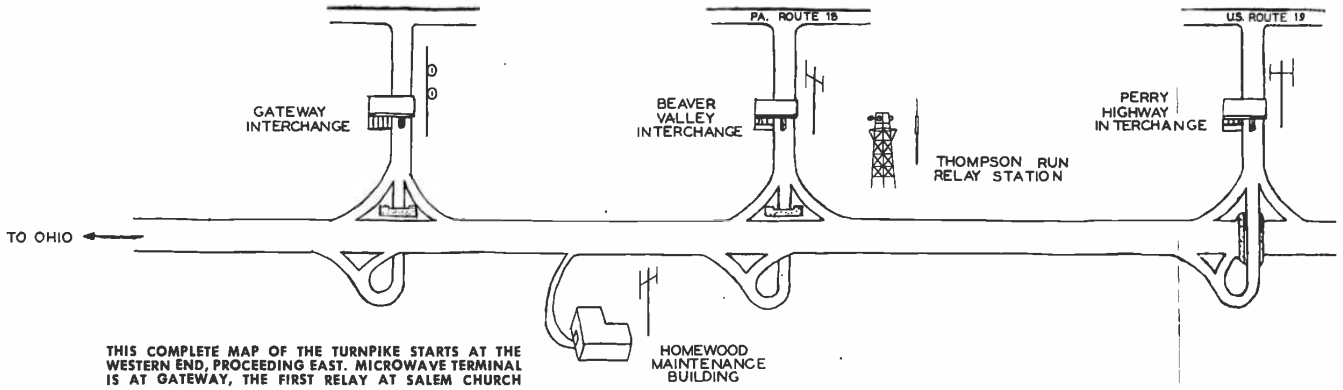
The second phase in the progress of this system was initiated by the postwar revision of frequency allocations, when 116.1 mc. was assigned to aircraft beacon transmitters. As suitable equipment for operation on a higher band could not be obtained within the brief time allowed for shifting the relay operation, the FCC authorized the use of frequencies in the No. 5 TV band of 76 to 82 mc., on a shared basis. Channel-sharing was cancelled by the FCC in June, 1948, and it was again necessary for the Turnpike Commission to vacate frequencies which had been allocated to their relay system.

This brought about the third, and presumably final, development phase.

ARDEN HOPPLE, LEFT, AND DOUGLAS LAPP SHARE RESPONSIBILITY FOR THE TURNPIKE SYSTEM

*Respectively, Chief, Field Operations, Raymond Rosen Engineering Products, Inc., 32nd & Walnut Streets, Philadelphia, and Chief of Communications, Pennsylvania Turnpike Commission, Harrisburg, Pa.

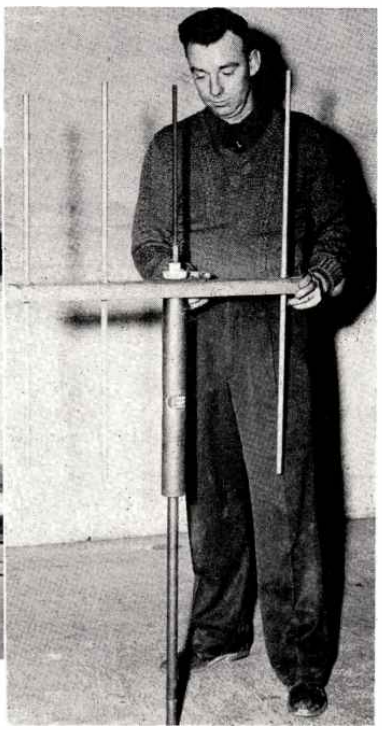
[1]See "The New Era of Communication" by Commissioner E. M. Webster, RADIO COMMUNICATION, Nov. 1951, 3rd column, page 20.



THIS COMPLETE MAP OF THE TURNPIKE STARTS AT THE WESTERN END, PROCEEDING EAST. MICROWAVE TERMINAL IS AT GATEWAY, THE FIRST RELAY AT SALEM CHURCH

Raymond Rosen Engineering Products, Inc. was called upon to design a completely new installation. Thus, under force of necessity, the opportunity was created to modernize the system just at a time when additions were needed to cover the 100-mile Philadelphia Extension of the Turnpike, and the 67-mile Western Extension, running to the Ohio border.

Meanwhile, new transmitters for operation on 950 mc., new multiplex channelizing equipment, and new mobile units for 150 mc. had been developed. These advances opened the way to planning an entirely new system, and designing into it the experience gained from operation of the original installation over a period of years.



ABOVE: AT BEDFORD BARRACKS, A TYPICAL INSTALLATION OF RCA VHF EQUIPMENT. RIGHT: ANDREW VHF ANTENNA USED AT FIXED STATIONS

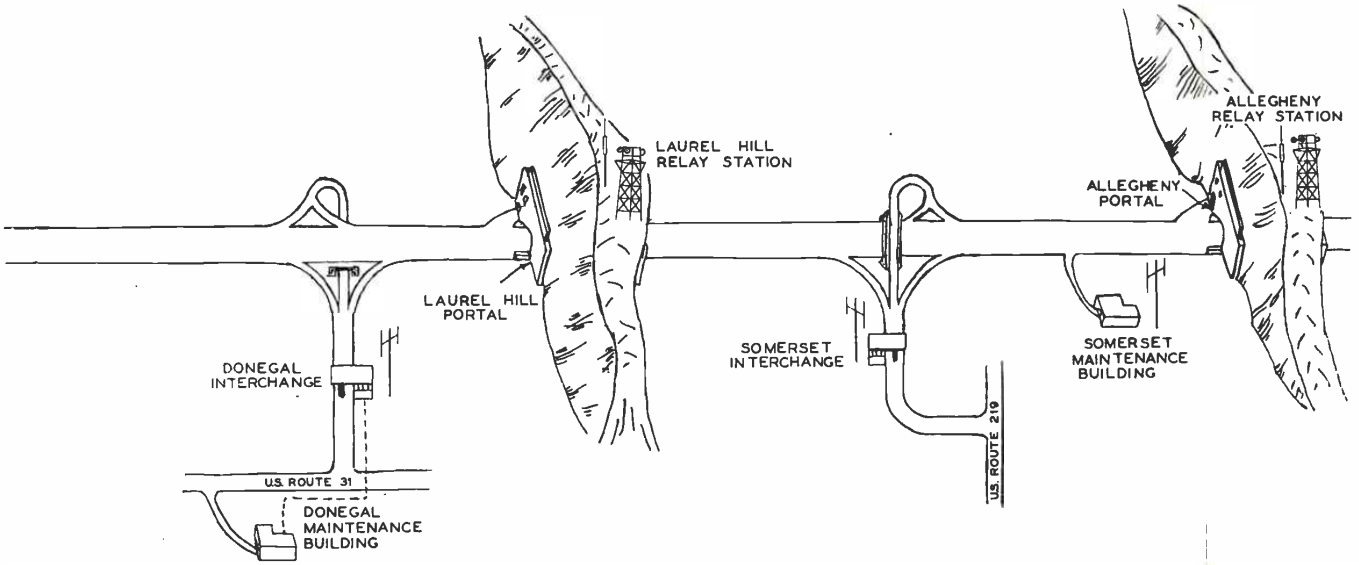
Plan of the New System:

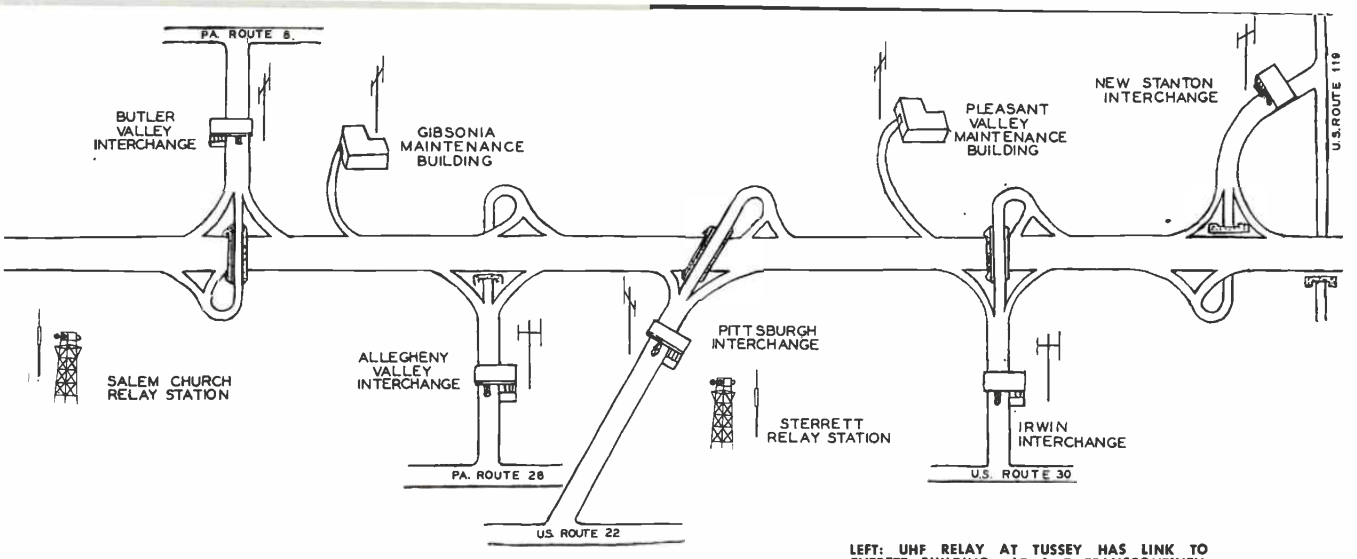
The operation and administration of the Turnpike require three multiplexed radio services. These are:

1. Voice channel for handling mobile communication.
2. Voice channel for handling administrative communication.
3. Teletype communication.

In addition, certain audio-frequency control operations must be performed, as will be explained, and provision is required for north-and-south links at certain points. Experience had indicated the advantages of keeping the microwave carrier of each relay on the air continuously, instead of using the successive on-off switching arrangement employed originally. This was practical to do with multiplexed circuits.

In order to accommodate the maximum volume of mobile traffic, it was decided to divide the end-to-end relay into two parts, isolated by terminal equipment at Everett, near the Bedford interchange, where one of the maintenance buildings is located. This point can be seen on the accompanying map. However, the voice channel for administrative use and the teletype circuit, from the east going west and from the west going east, are demodulated and reinserted in the other half of the system.





The purpose is to eliminate the possibility of cross talk. If a call from a mobile unit must go beyond the Everett station, the message is repeated by the operator, but those occasions are infrequent.

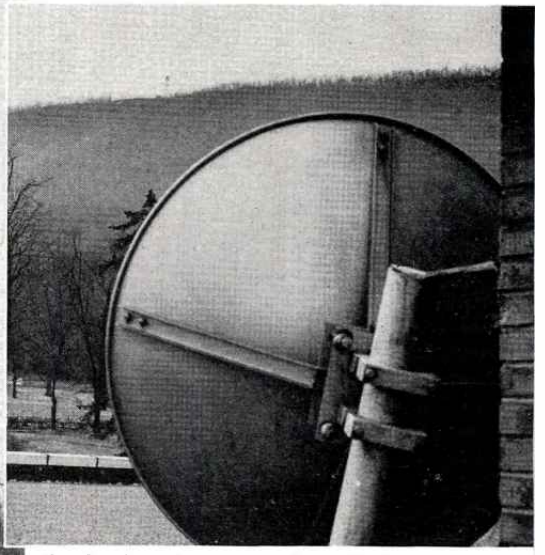
Terminals for the administrative voice channel are located at Valley Forge, Harrisburg, Everett, and Pittsburgh. Teletypewriters are installed at the east and west ends of the Turnpike, at Harrisburgh, Everett, and at five tunnel stations. The latter are important because the four-lane highway narrows down to two lanes through the tunnels, so that roadblocks can be set up readily at those points.

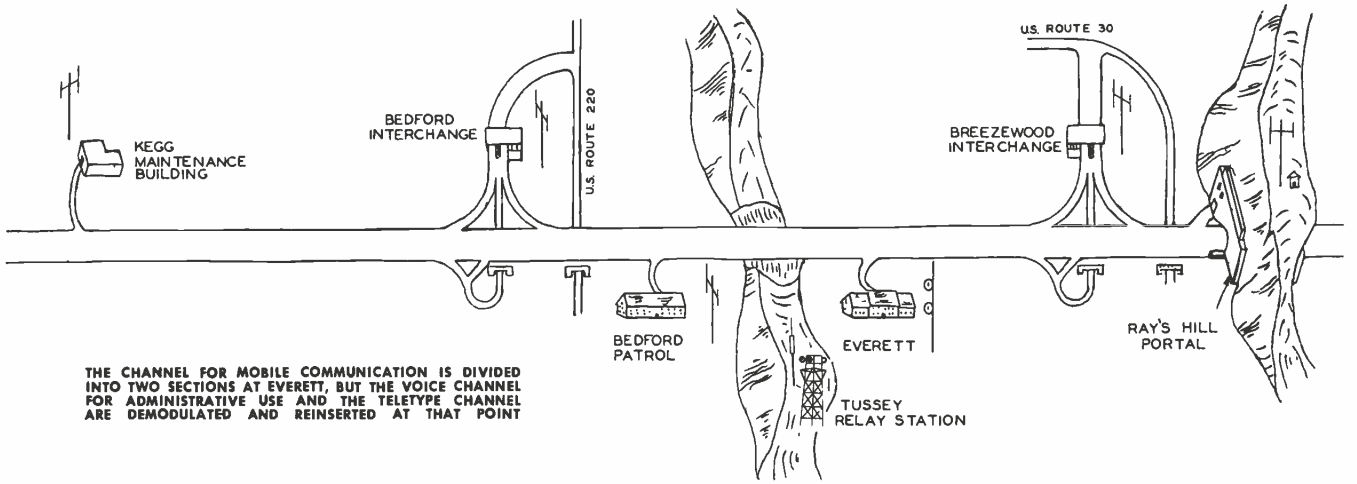
The mobile communication circuit provides important services that can be broken down into six categories:

1. Towing cars and supplying gasoline. Although there are filling stations at frequent intervals along the Turnpike, cars do run out of gas between them. More serious, however, is the plight of the motorist who cannot resist the temptation to see how fast his car will go, unmindful not only of the danger in exceeding the 70 mph. limit, but of the fact that passenger cars, even though they can do 90 or 100 mph., do not have lubricating systems for that speed. So the bearings burn out. Interestingly enough, the least trouble in that respect is experienced with Fords, Plymouths, and Chevrolets!

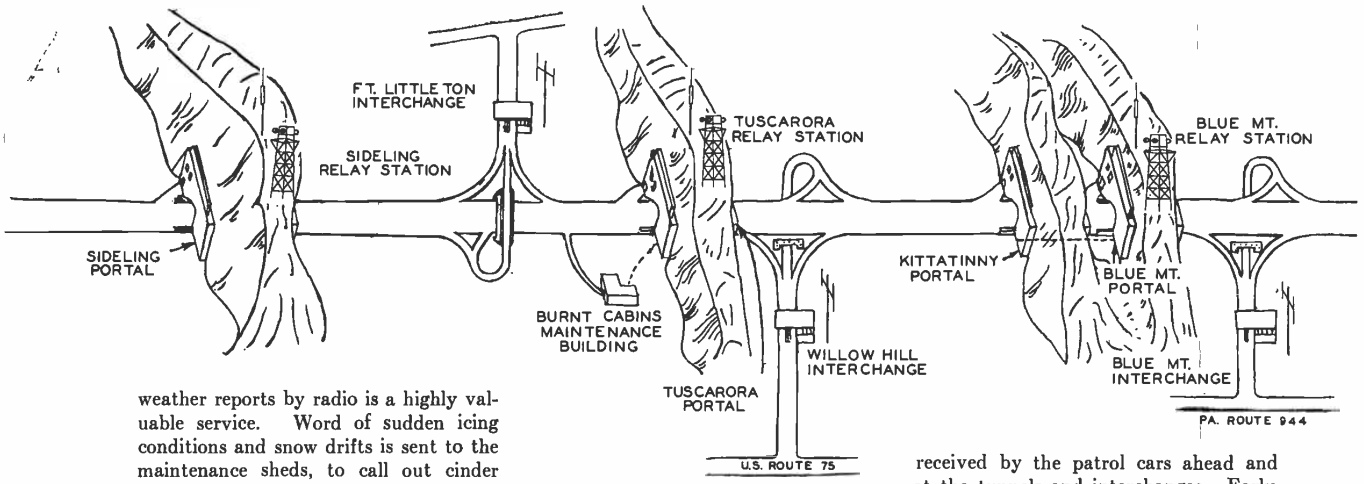
2. In the winter, and during late fall and early spring, the dissemination of

LEFT: UHF RELAY AT TUSSEY HAS LINK TO EVERETT BUILDING. AT & T TRANSCONTINENTAL CABLE CROSSES MOUNTAIN AT THIS POINT. BELOW: LINE-OF-SIGHT TO TUSSEY RELAY

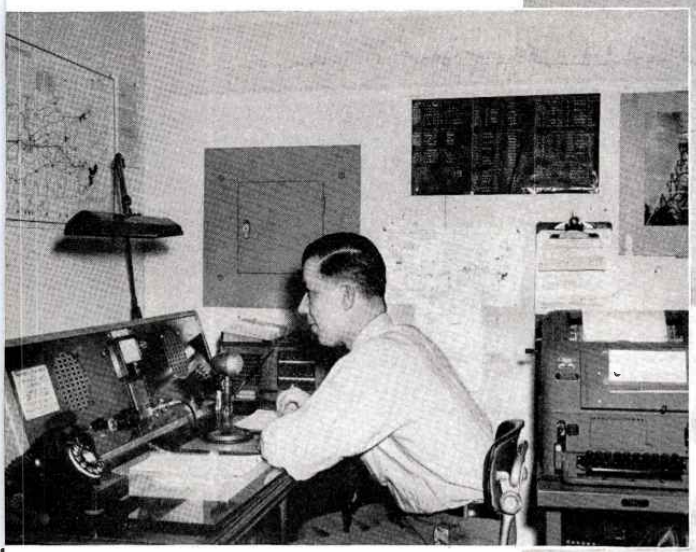


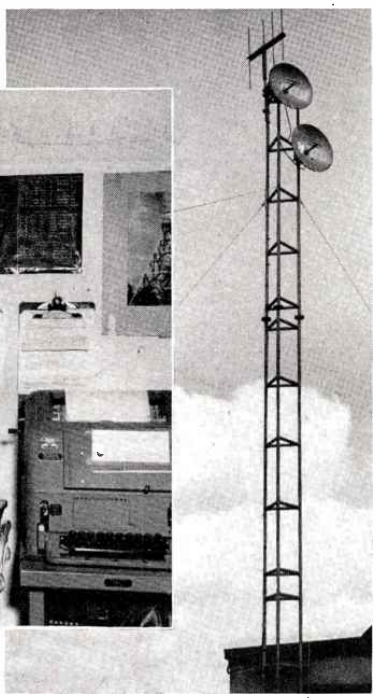


THE CHANNEL FOR MOBILE COMMUNICATION IS DIVIDED INTO TWO SECTIONS AT EVERETT, BUT THE VOICE CHANNEL FOR ADMINISTRATIVE USE AND THE TELETYPE CHANNEL ARE DEMODULATED AND REINSERTED AT THAT POINT



weather reports by radio is a highly valuable service. Word of sudden icing conditions and snow drifts is sent to the maintenance sheds, to call out cinder trucks and snow plows, and to patrol cars and interchanges, so that drivers can be warned in advance.





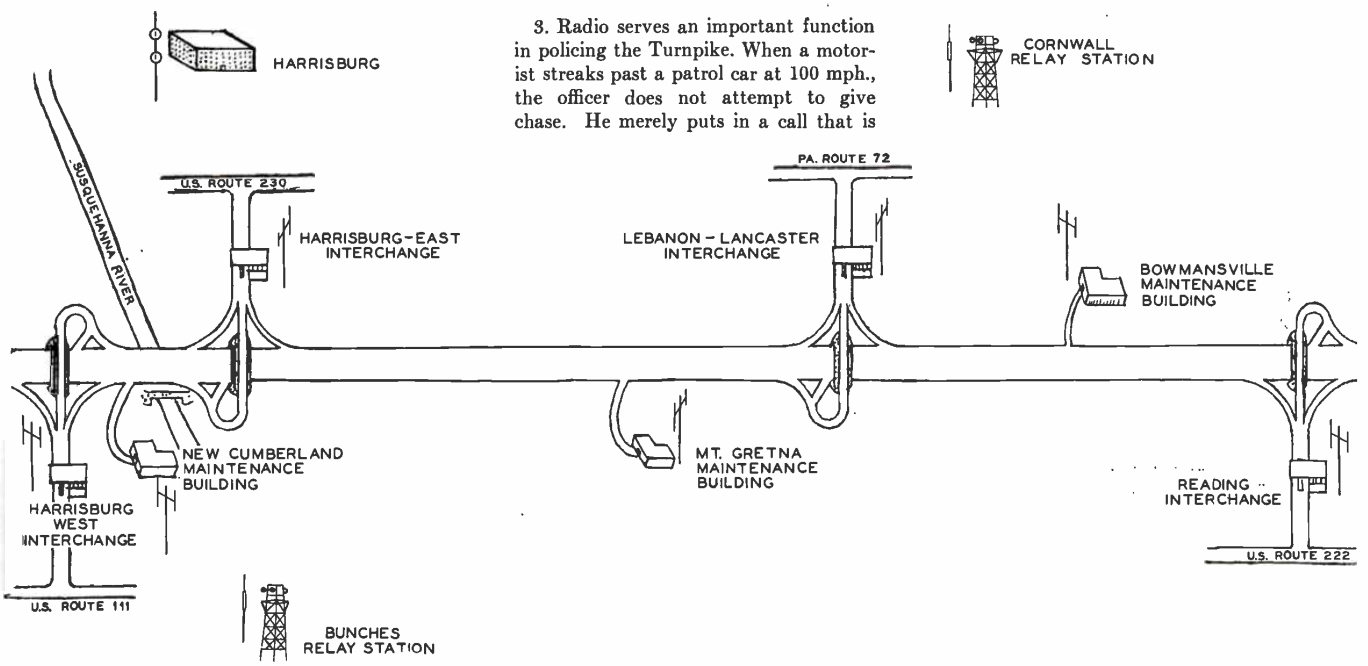
ABOVE: OPERATOR AT HARRISBURG HEADQUARTERS HANDLES 2 VOICE CHANNELS AND TELETYPE. RIGHT: THE ANTENNA AT HEADQUARTERS

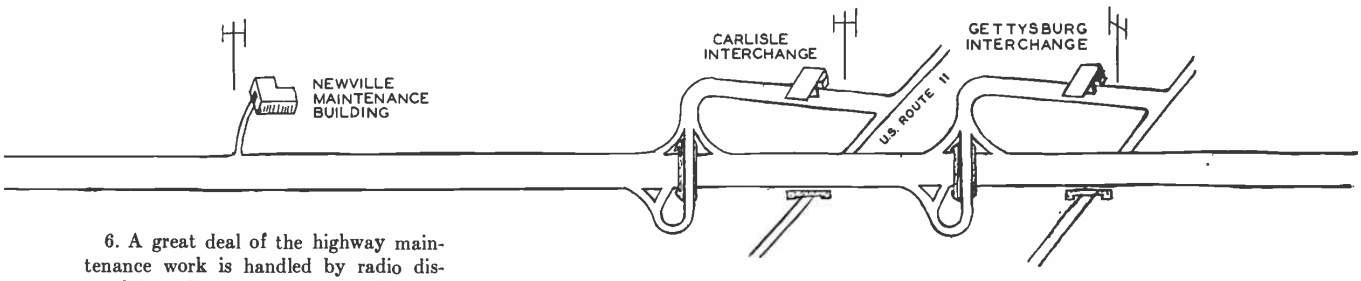
3. Radio serves an important function in policing the Turnpike. When a motorist streaks past a patrol car at 100 mph., the officer does not attempt to give chase. He merely puts in a call that is received by the patrol cars ahead and at the tunnels and interchanges. Early this spring, when word was received that striking drivers would park their trucks on the Turnpike, and would stone other trucks from the overpasses, state troopers, county sheriffs, and the FBI were alerted in a matter of minutes, and trouble was averted before it had time to develop.

A point of information: The entire expense of operating the Turnpike is paid by the toll revenue. Even the salaries of the State troopers who patrol the highway are paid by the Turnpike Commission. No funds are drawn from local or state taxes.

4. Many a motorist has the radio system to thank for prompt recovery of articles left at restaurants and gas stations. Glasses, pocket books, jewelry, and briefcases are among the items left behind, reported to interchanges and patrol cars, and recovered with the least delay and inconvenience.

5. When personal injury results from accidents, the nearest ambulance can be summoned quickly to the scene by a radio call. Ambulances are garaged at each maintenance building along the Turnpike.





6. A great deal of the highway maintenance work is handled by radio dispatching. Crews and trucks can be sent at any time to take care of emergency conditions which might endanger motorists.

All these services add up to heavy message traffic. In addition to very strict rules which limit messages as to their nature and length, all operators are required to use number-code signals, of which there are 67. Locations are not described, but are identified by the mile posts and 1/10-mile markers along the Turnpike, reading from west to east.

Method of Operation:

The accompanying map shows the radio facilities installed along the Turnpike. There are 13 relay stations, plus the terminal stations at Valley Forge and Gateway, and the operational stations at Harrisburg and the Everett Maintenance Shed, all using 953 and 960 mc.

Each relay station has a receiver on 155.67 mc. to pick up VHF signals from the mobile units or the various fixed transmitters along the Turnpike at the interchanges and maintenance shed. All fixed transmitters have directional antennas, aimed at the associated relays, since they are not used for transmission directly to the cars.

In addition, each relay station has a transmitter with an omnidirectional antenna on 159.21 mc. Receivers at the fixed stations and on the cars are tuned to that frequency.

Under this arrangement, messages from the cars and fixed stations are picked up by the VHF receivers at the UHF relays, and all messages to the cars and fixed stations are sent from the VHF transmitters at the UHF relays.

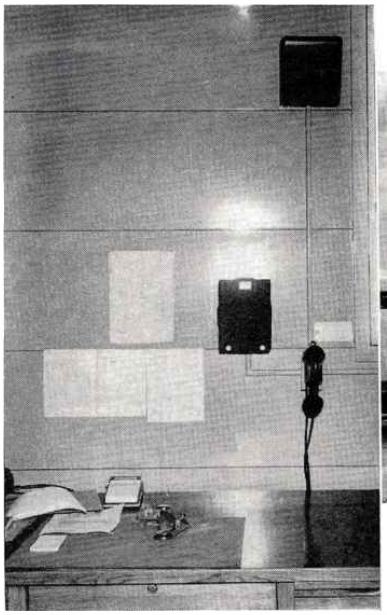
Every message from a car or fixed station is received at a relay station, and is relayed on UHF, both east and west, along that particular half of the Turnpike system. And at each relay station, the message is transmitted simultaneously on VHF.

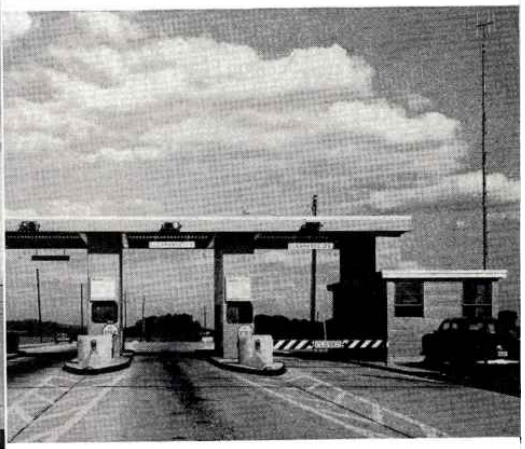
For example, if a car traveling along the eastern half of the Turnpike puts in a call, it is picked up by the VHF receiver at the nearest relay. Then it is carried by the relay system on UHF all the way east to Valley Forge, and west as far as the Everett Maintenance shed. At each relay, the call is put out on the associated VHF transmitter. The same thing happens if a call originates from one of the fixed stations at an interchange. This provides direct communication between mobile units, between fixed stations, and between mobile units and fixed stations. It's a party line, over which everyone hears everything that is said.

Administrative calls, however, go straight through on UHF, and can be heard only at the Valley Forge, Harrisburg, Everett, and Pittsburgh offices. At the Harrisburg office, it should be noted, the control console has two speakers, and the tower has both UHF and VHF antennas. Normally, traffic is handled over the UHF link with the relay system. However, the VHF link can be used in case of emergency.

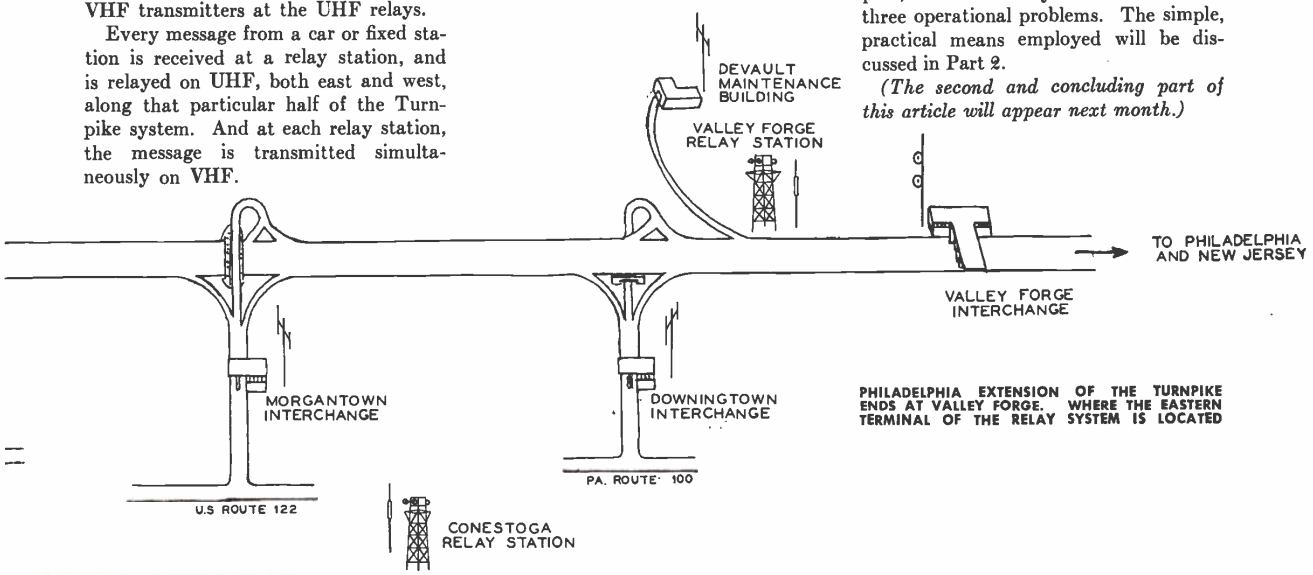
To attain dependable communication between cars, cars and fixed stations, and between fixed stations all along the Turnpike, it was necessary to find solutions to three operational problems. The simple, practical means employed will be discussed in Part 2.

(The second and concluding part of this article will appear next month.)





LEFT: AT TOLL BOOTH, ONLY SPEAKER AND HAND SET ARE IN EVIDENCE. BELOW: TYPICAL INTERCHANGE ANTENNA AIMED AT NEAREST RELAY



PHILADELPHIA EXTENSION OF THE TURNPIKE ENDS AT VALLEY FORGE. WHERE THE EASTERN TERMINAL OF THE RELAY SYSTEM IS LOCATED

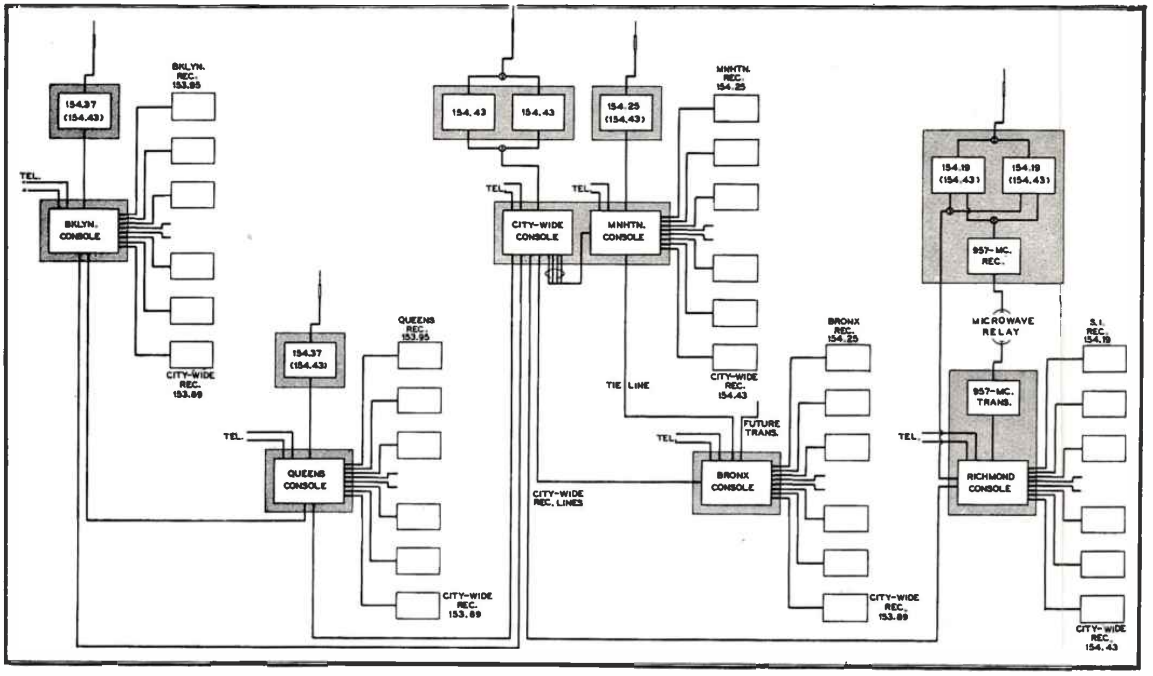


FIG. 5. PLAN OF THE 5-BOROUGH SYSTEM. AT EACH CONTROL CONSOLE, THE ASSOCIATED TRANSMITTER CAN BE SHIFTED TO THE CITY-WIDE CHANNEL

NEW YORK'S FIRE RADIO SYSTEM

PART 2: CONCLUSION OF SPECIFICATIONS; REQUIREMENTS FOR INSTALLATION OF MOBILE UNITS ON FIRE APPARATUS — *By* LIEUT. SAMUEL HARMATUK

Mobile Transmitter Specifications:

Transmitters of 25 watts output are used on all vehicles, and 50 watts output on the fire boats. Specifications called for an FM signal-to-noise ratio of 45 db; spurious emission of −85 db; second and other harmonics −85 db; and ambient operating temperature of −30° to +70° C. Instantaneous deviation limiting was specified, with overall system intelligibility unaffected during periods of less than 100% modulation, and not more than 15% distortion for audio inputs 100% above normal. Further, the permissible variation of the deviation control from its present value at +25° C. was specified as ± 20% (less actual overall mean temperature stability) of the half-channel width over the ambient temperature range of −20° to +60° C. A variable modulation control was also specified, to permit the adjustment of deviation from ± 7.5 to ± 15 kc. This was a hedge against the possibility that channel widths may be reduced by the FCC while the initial equipment is still in service.

Because the entire system plan was premised on the accurate maintenance of assigned frequencies, the carrier-frequency stability was specified as ± 1 kc. Basis of maintaining this extremely close tolerance is our General Radio primary frequency standard. In addition, our maintenance shop has been equipped with the very best laboratory instruments, so that we can maintain our transmitters and receivers at peak performance. These instruments are listed in a subsequent section.

Component Specifications:

The specifications for components in the mobile units were set forth at considerable length, but space does not permit a discussion of them here. Particular attention was devoted to requirements for the various relays, because they are one of the principal potential sources of failure in mobile equipment. Operating limits on mica, ceramic, and oil-filled paper condensers were set at 60% or less of their rated voltage: electrolytic condensers, permissible only where other types cannot serve, at 75% or less of their rated voltage; and resistors at 60% of their nominal ratings.

On the fire apparatus and fire boats, reflex air-column horns were provided. These are Racon type RE-15, of 4 ohms, finished in Fire Department red.

On the mobile transmitters, Carter dynamotors were furnished. Performance requirements included the specification of 40 amperes input at 5.8 volts; minimum of 20,000 starts under test load; starting time 300 milliseconds or less to reach 80% of rated voltage; and a temperature rise for duty cycles of 5 minutes on and 20 minutes off not to exceed 40° C.

Antenna Specifications:

Quarter-wave whips were used for the sedans. For the flexible whips, the use of non-corroding metal was required, capable of being bent in a complete circle without permanent set, with all other exposed metal parts of either stainless steel or chromium-plated brass.

On the fire apparatus, fire boats, and pickup installations, we decided on quarter-wave coaxial dipoles, vertically polarized, of stainless steel polished to match the appearance of chromium on the fire apparatus, with stainless steel or chromium-plated brass or bronze mounting hardware. VSWR was limited to 1.3 to 1 at the resonant frequency. Construc-

tion was required to be such that the antennas could be assembled or disassembled without soldering or unsoldering joints. Teflon was used for insulation. These antennas were made by J. L. White & Son.

For the 350-watt fixed transmitter, 3-element colinear-coaxial antennas with vertical polarization were specified, capable of a gain of not less than 5 db over a standard dipole, with a VSWR not exceeding 1.2 to 1 at the resonant frequency. It was further required that stainless steel be used for all exposed parts, in a design that would prevent the absorption or retention of water, and would be capable of withstanding a wind velocity of 80 MPH when covered with ½ in. of ice.

Mobile Installations:

Our experience indicates definite advantages in having the complete installation work done by the company supplying the equipment, rather than turning it over to members of our own department, or to another contractor. The principal reason is that the final performance of the equipment depends to a large extent on the manner in which it is installed. If the entire responsibility lies with a single contractor, there is no possibility that one company will blame poor performance on the manner of installation, and the other will blame the equipment.

Because of the many special problems involved, the specifications called for making a sample installation on each type of sedan and each type of fire apparatus under the direction of the Engineer in Charge. Then these were used as standards as to method, workmanship and appearance. Figs. 1 to 4, Part 1, illustrate a typical installation.

Fig. 1 shows the quarter-wave coaxial

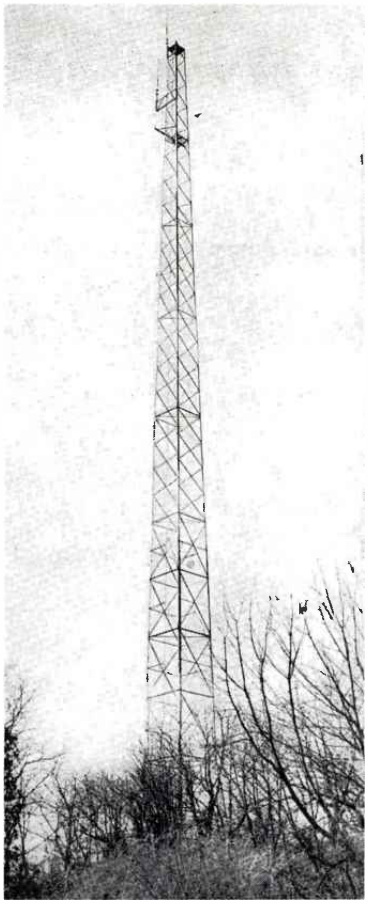


FIG. 7. SPARE ANTENNA IS MOUNTED ON THIS LEHIGH TOWER AT THE QUEENS TRANSMITTER

dipole. This design and method of mounting was chosen in preference to the conventional whip, from considerations of performance as well as adaptability to various types of fire apparatus. Special provisions were made to protect the radio equipment from water and mechanical damage. Fig. 2 shows how a covered compartment was built into a pumper, for example. The handset, control head, and speaker can be seen in Fig. 3. Very thorough tests were made on speaker locations. We came to the conclusion that the best reception, while the apparatus is rolling, can be obtained with the speaker under the dash, rather than in any more exposed position. It should be explained that the coil above the speaker in Fig. 3 is not a part of the wiring!

Following are some of the requirements set forth in the specifications: Where cables or conductors pass through fire walls or partitions, they shall be suitably protected from chafing by means of Chase nipples or cord-grip connectors: these cables shall be fasteneed in position securely by approved clamps. The cables shall be run through Greenfield of sufficient size to permit ready installation and withdrawal. (Note the Greenfield coming through the fire wall at the right of the oil can, Fig. 4.) The coaxial antenna cable shall also be suitably protected by flexible metal sheathing where it is exposed to mechanical injury. All attachment bolts shall be brass with lock washers: self-tapping screws shall be used only where permitted by the engineer.

Wiring shall be such that it is not energized unless the ignition switch of the motor is turned on. If a body ground return is used, the body of the vehicle shall be bonded to the battery supply and to the grounding conductor by means of a flat, tinned copper braid, equivalent to a No. 2 AWG conductor, bolted and soldered where it makes con-

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FIGS. 6, 7. THE 50-WATT MOTOROLA UNIT ABOARD THE "FIRE FIGHTER." RACON SPEAKER, UPPER RIGHT, IS CUT OUT WHEN HANDSET IS PICKED UP

MOBILE RADIO NEWS

(Continued from page 26)

Highway Trucks:

A total of 37 applications were filed by trucking and service companies. These were for 38 base stations and 331 mobile units, all to be operated on 35 mc.

Taxicabs:

In the taxi group, 160 applications were filed for one base and one or more mobile transmitters, in addition to 3 for 4 base stations, and 1 for only 6 mobile units. It is interesting to see how the 160 new systems break down as to the number of mobile units. There were 13 calling for 1 or 2 mobile units, 33 for 3 to 5 mobile units, 75 for 6 to 10 mobile units, 23 for 11 to 20 mobile units, 11 for 21 to 50 mobile units, and 5 for 65, 75, 82, 100, and 500 mobile units each. This puts the taxis in second place for mobile transmitters, with a total of 2,445.

Summary:

Following are the totals of new facilities for which applications were filed in the first three months of 1952, as reviewed above:

Service	Applications	Base Trans.	Relay & Control	Mobile Trans.
Police	156	128	1	1282
Fire	43	41		416
Forestry	121	120		14
Highway	27	19	8	251
Sp. Emer.	83	83		206
Pub. Uti.	180	160	49	925
Pipeline	163	223	25	648
For. Prod.	31	26	5	158
Sp. Ind.	211	218	30	2519
R. R.	23	23	1	16
Trans.-Bus	8	8		35
Auto	11	11		57
Truck	37	38		331
Taxi	160	163		2445
	1,234	1,221	119	8,313

SPEECH INPUT UNITS

(Continued from page 17)

stage employs both sections of a 12AU7 as a phase-inverter. The output stage consists of two 6L6's in push-pull.

Feedback from a tertiary winding on the output transformer is introduced at the cathode circuit of the first section of the phase inverter.

All tubes, the bias supply, and the B+ voltage can be metered by means of a 9-position switch located on the front of the amplifier. The dual level control is also accessible from the front.

In size and mechanical construction, including the base-and-frame jack, the monitor amplifier is identical to the pro-

(Concluded on page 35)

SPEECH INPUT UNITS

(Continued from page 34)

gram amplifier. Four monitor amplifiers without power supplies, or two monitor amplifiers with power supplies, can be mounted in one panel and shelf assembly. Power supplies are identical in size to the program and monitor amplifiers. Two can be seen at the right in Fig. 5.

The monitor amplifier has the following specifications:

Gain: 105 db.

Frequency Response: ±2 db from 30 to 15,000 cycles.

Harmonic Distortion: Less than 1.5% from 50 to 15,000 cycles at an output of 12 watts. Less than 3% from 50 to 15,000 cycles at an output of 16 watts.

Equivalent Input Noise: −122 dbm.

New FCC Applications

This list includes applications for mobile, point-to-point, control, and relay communication facilities filed with the FCC during April, 1952.

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

WEEKLY REPORTS

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

CODE LETTERS

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

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

Make of equipment is indicated by one of these letters:

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

X Miscellaneous

AERONAUTICAL & FIXED

Aeronautical Radio Inc 1523 L St NW Washington DC
Binghamton NY 1b 9.9w 129.7 T
Riggs Aviation Serv Grand Junction Colo
1b 87w 3.290 X
Simplot Mining Camp & Airstrip 1b 87w 3.290X
Wien Alaska Airlines Inc Fairbanks Alaska
Stevens Village Alaska
1b 100w 2.922, 5.652, 5.622 BB
Shungnak Alaska 1b 100w 2.922, 5.652, 5.622 BB
Barrow Alaska 1s 100w 2.922, 5.622, 5.652 BB
Alaska Aeronautics Communications Comm
Box 121 Juneau Alaska
Alitak Alaska 1s 20w 2.632, 2.986, 3.190, 5.207, 5.622, 5.652 X
Robt C Reeve Box 559 Anchorage Alaska
Sand Pt Alaska 2s 25w 2.648, 2.922, 5.310, 5.622 X

FLIGHT TEST

Jack Ellsworth Gretta 729 Holmes Av Ontario Calif
1p 6w 123.3 T

AERO MOBILE UTILITY

Muskegon County Airport Muskegon Mich
1m 10w 121.1, 121.5, 121.9, 122.1, 122.5 SS
Douglas Aircraft Co 3000 Ocean Park Blvd
Santa Monica Calif 6m 4w 121.9 C
J E Greiner 1201 St Paul St Baltimore Md
1b 6w 121.9 SS
State of Conn Brainard Field Hartford Conn
3m 1w 121.9 X
Wm A Sweet Jr 742 Chesterfield Rd Columbus Ohio
1m 6w 121.9 SS

AIRDROME ADVISORY

Walter H Grimes Bethel Pa 1b 4w 122.8 NN
A H Hanzlik Flushing NY 1b 4w 122.8 NN
City of Alma Mich 1b 4w 122.8 NN
County Airport Philadelphia Pa 1b 10w 122.8 X
Scranton Airways Clarks Summit Pa 1b 4w 122.8 NN
Lloyd L Decker Staten Island NY 1b 7w 122.8 T
Hair Flying Serv Baton Rouge La
1b 4w 122.8 NN
Stafford Municipal Airport Stafford Kans
1b 3w 122.8 X
Municipal Airport 419 SW Market St Portland Ore
Troutdale Airport 1b 2w 122.8 X
Kirsch Co Sturgis Mich 1b 4w 122.8 SS
Donegal Aviation Service Marietta Pa
1b 4w 122.8 NN
Red Bank Airport Inc Red Bank N J
1b 2w 122.8 X
Skyways Inc Troutdale Ore 1b 10w 121.7, 122.8 X
K M Guinnip Olean NY 1b 4w 122.8 NN
Downtown Airport Inc Oklahoma City Okla
1b 4w 122.8 NN
F C McNabb Lubbock Tex 1b 2w 122.8 X
Minn-St Paul Met Airports Comm 2429 Univ Av
St Paul Minn
Crystal Village Minn 1b 8w 122.8 X
Shakopee Minn 1b 8w 122.8 X
Church Flying Serv North Platte Neb 1b 4w 122.8 NN
C Stanton Gallup Plainfield Conn 1b 4w 122.8 NN

CIVIL AIR PATROL

CAP Crestview Sqdn Grp IV Florida Wing
c/o R R Swain Johnson Hall Elgin AFB Fla
Fort Walton Fla 1b 8w 148.14 —
Shalimar Fla 1b 8w 148.14 —
CAP Palacios Sqdn Texas Wing Palacios Tex
1b 75w 45.85 X

(Continued on page 36)

NEW APPLICATIONS

(Continued from page 35)

CAP Greenfield Ind 5m 50w 45.85, 4.507 Q
CAP Utah Wing Salt Lake City Utah
2b 400w 4.585, 148.14 X; 14m —w 4.585, 148.14 KT
CAP Waverly Detached Flight Binghamton Grp NY
Wing Waverly NY 1q 30w 4.507; 1m 30w 4.585 X
CAP La Wing Monroe Sqdn Monroe La 1b 75w 4.507, 4.585 O; 1b 1w 5.500 M; 1b 15w 148.14 T
CAP NY Wing Grp 6 Buffalo Airport
Cheektowaga NY 1q 210w 2.374, 4.585 A
CAP Utah Wing Salt Lake City Utah 1b 10w 15m 10w 148.14 X; 1b 100w 4.585, 4.507, 148.14 G; 1b 15w 148.14 X; 6m 7w 4.585, 4.507 R; 6m 15w 148.14 X
CAP Grp 7 Mich Wing E Lansing Mich 5b .75w 30w 50w 150w 2.374, 4.507, 4.585, 5.500, 148.14 X
CAP Mich Wing Charlotte Flight Grp 7
Charlotte Mich 1b 1w 10w
45w 4.507, 4.585, 5.500, 148.14 X
CAP Hdqtrs Kans Wing Lyons Sqdn Lyons Kans 1b 75w 2.374, 4.585, 4.507 X; 1b 15w 148.14 T; 10m 15w 4.585, 4.507 X; 10m 15w 148.14 X
CAP Iowa Wing Clarion Sqdn NW Ia Grp
Clarion Ia 2b 50w 3m 1w 4.507, 5.500 X
CAP Hdqtrs Kans Wing Garden City Sqdn 434 Maple Wichita 12 Kans 1b 150w 2.374, 4.585, 4.507 Q; 1b 15w 148.14 Q; 10m 15w 4.585, 4.507 T;10m 15w 148.14 X
Dodge City Kans 1b 75w 2.374, 4.585, 4.507 A; 1b 15w 148.14 T; 10m 15w 4.585, 4.507 X; 10m 15w 148.14 X
CAP Minn Wing 114 Federal Courts Bldg Minneapolis Granada Minn 1b 75w 4.507, 4.585 X
CAP Grp 11 Md Wing Cent Balt Sqdn Baltimore Md 1b 15w —m 50w 4.325, 4.585 X

POLICE

New Jersey Turnpike Auth 65 Prospect Trenton NJ
1m .2w 2455 speedmeter
N C State Highway Patrol Raleigh NC
20m .2w 2455 speedmeter.
City of New Haven Conn 1b 60w 158.79; 5m 30w 158.79 M
Buena Vista County Sheriff Storm Lake Ia
1b 120w 37.1; 5m 60w 37.1 M
Town of Colonial Beach Va 1b 114w 39.5; 6m —R
City of St Petersburg Fla 1b 500w 155.73 F
Town of Newington Conn 1b 120w 155.49; 10m 30w 155.49 R
Traffic & Planning Div Dover Del .2w 2455 speedmeter
City of Donley Clarendon Tex 1b 120w 37.18; 10m 60w 37.18 M
Haskell County Sheriff Haskell Tex
1b 120w 37.18; 5m 120w 37.18 M
Texas State Police N Austin Station Austin Tex
Lufkin Tex 1b 500w 42.9 M
Wallace County Sheriff Sharon Springs Kans
1m 120w 44.82, 44.98 L
State of Colo Police Patrol 1950 31st St
Denver Colo 1b 150w 42.46 P
Cortez Colo 1b 150w 42.46 P
Atop Wilson Creek Hill 1r 120w 154.77 P
Meeker Colo 1q 120w 156.69 P
Glenwood Springs Colo 1q 120w 156.69 P
Atop Sunlight Creek Hill 1b 150w 42.46; 1r 120w 154.77 P
Jo Daviess County Sheriff Galena Ill
1b 140w 39.5; 5m 140w 39.5 M
Boro of Westville Boro Hall Westville NJ
5m 60w 4m 30w 4m 3w 155.37 M
Kennebec County Sheriff Augusta Me
1b 120w 39.62 M
Va Dept of Highways 12th & Broad Richmond Va
1m .2w 2455 speedmeter
Town of Galveston Ind Town Marshalls Office
2m 80w 155.13, 154.89 M
Town of Flora Ind Town Hall
2m 80w 140.89, 155.13 M
Tenn State Police Nashville 3 Tenn
Lawrenceburg Tenn 1b 1000w 42.42 L
Cookville Tenn 1b 1000w 42.42 L
Kans State Police Topeka Kans 1b 120w 44.98 M
Marathon County Sheriff Wausau Wis
1b 500w 159.21; 1b 8w 456.65; 30m 80w 159.29 M
Dewitt County Sheriff Cuero Tex
1b 200w 190w 39.18; 10m 120w 37.18 G
Town of Griffing Park 4645 Woodlawn Dr
Port Arthur Tex 1m 50w 37.22 M
Grant County Sheriff Sheridan Ark
1b 120w 37.10; 5m 120w 3m 25w 37.10 M
Knox County Sheriff Benjamin Tex
1b 10m 124w 37.18 G
Town of Storr Mass 1m 60w 44.74 M
N Hampton County Sheriff Jackson NC
2m 48w 39.1 L
Jefferson County Sheriff Boulder Mont
1b 5m 120w 39.82 M
Inc City of Milwaukee City Hall 200 E Wells Milwaukee Wis 3tb .2w 2455 speedmeter
Towns of Dagsboro & Frankford Del
1m 48w 39.5, 39.78 L
Police Dept Union Gap Wash 5m 60w 39.82 R
Colo State Police Patrol 1950 31 St Denver Colo
Burlington Colo 1b 150w 42.46 P
Pueblo Colo 1b 50w 42.46 P
City of Akron 166 W High Akron Ohio
4p .2w 2455 speedmeter
Utah State Police Patrol 121 Capitol Bldg
Salt Lake City Utah

(Continued on page 38)

NEW APPLICATIONS

(Continued from page 36)

Kanab Utah 1b 125w 42.94 M
Wendover Utah 1b 125w 42.94 M
Moab Utah 1b 500w 42.94 M
City of Shelbyville Ky 1b 120w; 4m 30-120w 155.49 M
Boro of Oakland NJ 1b 30w; 3m 120w 37.1 M
Calif State Highway Patrol Sacramento Calif
Los Angeles Calif 1b 150w 42.34 G
Whitewater Calif 1b 150w 42.34; 1r 120w 72.26 G
Indio Calif 1b 150w 42.34; 1q 120w 73.42 G
Big Horn County Sheriff Basin Wyo
Lovell Wyo 1b 150w 45.1 G
City of Texarkana Tex 1b 50w 37.26; 36m 120w 60w 100w 25w 37.26 M
Village of Peninsula Ohio 8m 40w 39.58, 39.66 M
Greensville County Sheriff Emporia Va
1b 60w 10m 60w 39.5 M
Williamsburg County Sheriff Kingstree SC
1b 60w; 15m 60w 48.18 M
Town of Uxbridge Mass 1b 60w; 7m 60w 39.98 L
Leake County Sheriff Carthage Miss
5m 120w 42.02, 42.18 L
Sharkey County Sheriff Rolling Fork Miss
5m 120w 42.02, 42.18 L
Grenada County Sheriff Grenada Miss
5m 120w 42.02, 42.18 L
City of Jacksonville Beach Fla 1b 120w; 15m 22w 159.21 M
Crawford County Sheriff Meadville Pa
Geneva Pa 1b 60w 33.98 M
Boro of Princeton NJ 1m .2w 2455 speedmeter
Minn State Police Patrol 2179 Univ St Paul Minn
Virginia Minn 1b 1,000w 42.82 M
Pike County Comm Waverly Ohio
3m 120w 39.58, 39.66 M
Police Dept City Hall Chicago 1b 140w 155.37 M
Ill State Police Patrol 601 Sangamon Ave
Springfield Ill
Chicago Heights Ill 1b 150w 42.5 L
Dixon Ill 1b 150w 42.5 L
Ottawa Ill 1b 150w 42.5 L
Town of Amherst Mass 1b 120w; 3m 60w; 7m 30w; 3m 2w 158.79 M
Town of Smithfield Va 1b 120w; 10m 60w; 2m 20w 6m .5w 155.13 M
Culpepper County Sheriff Culpepper Va
1b 120w; 15m 60w; 3m 24w; 6m 500w 39.5 M
City of El Centro Calif 1q 120w 155.43 M
City of Oceanside Calif 1q 60w 155.43 M
City of Ft Wayne Ind 2m 10w 2455 speedmeter
City of Aurora Mo 2b 30w 155.37, 155.73; 5m 30w 155.73 M
City of Yonkers NY 2m .2w 2455 speedmeter
Govt of PR Box 3826 San Juan PR
Hato Rey PR 1b 30w 155.13, 154.89 M
Tallahatchie County Sheriff Charleston Miss
5m 120w 42.02, 42.18 L
Clark County Sheriff Quitman Miss
5m 120w 42.02, 42.18 L
St Charles Parish Paradis La 1b 124w 39.5 G
NY New Haven & Hartford RR 54 Meadow St New Haven Conn 1m 150w 39.22 G
Ga State Police Patrol Marietta Ga 1b 2.25w 42.2 M

FIRE

City of Evanston Ill 4b 60w 154.19; 20m 30w .5w 154.19 M
Sacramento County Sheriff Elk Grove Calif 1b 150w 154.19 R
City of Conroe Tex 1b 60w; 5m 60w 154.19 M
City of Mobile Ala 3b 600w 154.43 G
Town of Braintree Mass 1b 120w; 12m 75w 46.14 G
Northbrook Vol Fire Dept Northbrook Ill 1b 10w 154.13 M
Incorporated Village of Webster NY 1b 30w; 5m 30w 154.31 M
Town of So Berwich Me 1b 30w; 3m 30w 33.7 X
City of N Adams Mass 1b 30w; 6m 30w; 3m 3w 154.31 M
Town of Falmouth Me 1b 120w; 15m 80w 154.31 G
Silver Lake Fire Dept Silver Lake Wis
Kenosha County Wis 1b 120w; 20m 60w 154.25 M
City of Abilene Tex 1b 75w 46.1 R
Phantom Hill Lake Tex 1b 75w 46.1 R
Ogantz Fire Co Elkins Park Pa 10m 60w 154.13 P
City of Birmingham Mich 1b 60w; 7m ¼w 154.43 M
Upper Montgomery County Vol Fire Dept Beallsville Md 3m 124w 37.1 G
Village of Spring Valley NY 1b 120w 46.18 M
City of Salem Fire Dept Salem Ill 5m 6w 39.5 G
Glenbrook Fire Dept Glenbrook Conn
1b 120w; 5m 30w 154.13 M
Adams Twp Fire Dept Toledo Ohio
1b 120w; 5m 60w; 3m 21w; 3m 3w 33.74 MG
Menlo Pk Fire Prot Dist 1077 Merrill St Menlo Park Calif
Atherton Calif 1b 30w 154.37 K
Los Angeles County 524 N Spring Los Angeles Cal
Oat Mtn Calif 1b 600w 154.43 R
Portal Ridge Calif 1b 600w 154.43 R
Windber Fire Co #1 Windber Pa 1b 115w; 10m 25w; 3m 80w; 5m 3w 154.37 GD
Cranbury Fire Co Cranbury NJ 1b 114w; 6m 57.8, 33.82 R

FORESTRY

Jefferson Chemical Co Inc 711 5th Ave New York 22
Port Neches Tex 1b 20w 154.19 M
Tenn State Dept of Conservation Div of Forestry State Off Bldg Nashville Tenn 1b 124w 46.62, 46.70; 40m 124w 46.70 G; 100m — — D
Lexington Tenn 2b 124w 46.62, 46.70, 35m 124w 46.70 G
Camden Tenn 1b 124w 46.62, 46.70; 25m 124w 46.70 G
La State Forestry Dept Box 1269 Baton Rouge La
1b 120w 31.18, 31.38, 31.50 M
Town of Erving Forest Fire Dept Erving Mass
1b 10w; 5m 10w 31.39 LM
State of Oregon Dept of Forestry 2600 State St Salem Ore
Owl Camp Ore 1b 60w 2.236, 31.58 X
Prineville Ore 1b 100w 2.236, 31.58 X
La State Dept of Forestry 126 Civil Courts Bldg New Orleans La
Belwood La 1b 80w 31.06 L
Natchitoches La 1b 80w 31.06 L
Mich State Dept of Conservation Roscommon Mich
Plainwell Mich 1b 120w 159.39 M
Paw Paw Mich 1b 120w 46.58, 46.66; 1b 120w 171.57 M
Fla State Game & Fresh Wtr Fish Comm Tallahassee Fla
Immokalee Fla 1b 140w 46.82 M
Comm of Va Conservation Dept 7 N 2nd St Richmond Va
Oyster Va 1b 120w 46.54 M
N C State Forestry Dept 211 Education Bldg Raleigh NC
New Bern NC 1b 150w 31.34, 31.46 M
Nr Edward NC 1b 150w 31.34, 31.46 M
Nr Southern Pines 1b 150w 31.34, 31.46 M
Nr Chadburn NC 1b 150w 31.34, 31.46 M

HIGHWAY MAINTENANCE

Calif State Dept of Highways Sacramento Calif
1q 150w 75.78 R
Salinas Calif 1q 150w 75.78 R
Nr Chualar Calif 1b 500w 47.02, 47.01; 1sr 150w 72.1 R
Nr Santa Ynez Calif 1b 150w 47.02, 47.1; 1sr 150w 73.30 R
Santa Maria Calif 1q 150w 73.30 R
Buellton Calif 1q 150w 73.30 R
Nr Descanso Calif 1b 150w 47.02, 47.1; 2qr 110w 957 R
Escondido Calif 1q 110w 959 R
San Diego Calif 1q 110w 959 R
Idaho State Dept of Highways Boise Idaho
1b 120w 156.99 G
Rigby Idaho 1b 120w 156.99 L
Teton County Idaho 1b 120w 161.73 L
Chautauqua County Dept of Highways 454 N Work St Falconer NY 1b 60w 455.95 M
Romeo Mich 1b 120w 47.06 M
Macomb County Road Comm Mt Clemens Mich
1b 500w; 25m 60w 47.06 M
City of Beaumont Dept of Highways Beaumont Tex
1b 6w; 10m 30w 47.06 L
State of Me Dept of Highways Augusta Me
Madawaska Me 1b 500w 47.34; 1r 60w 75.82 M
Island Falls Me 1b 500w 47.34; 1r 60w 75.82 M
Presque Isle Me 1q 60w 72.02 M

Essex County Road Dept Newark NJ 1b 120w; 30m 60w 33.02 M
Orange NJ 1b 12w 33.02 M
Livingston NJ 1b 12w 33.02 M

SPECIAL EMERGENCY

Francis N Schwarm DVM St Paris Ohio
1b 60w; 1m 30w 47.66 M
Lopez Funeral Home Hialeah Fla 1b 50w 161.85 G
D E LaDore DVM Cynthiana Ky
1b 120w; 3m 120w 47.54 M
G W Neikirk Bucyrus Ohio 1b 20w; 2m 20w 47.58 M
Acme Ambulance Serv Oakland Calif
1b 120w 33.47; 1m 120w 33.47 G
Dr E K Bicek Tracey Minn 1b 60w; 1m 60w 47.62 M
Dr Leslie T Jacobson Winthrop Minn
1b 120w; 3m 60w 157.47 M
Dr R L Erkel St Cloud Minn
1b 120w; 2m 60w 47.58 M
Drs B A Zupp & A B Magnusson Blooming Prairie Minn 1b 120w; 2m 60w 47.58 M
Frederick W Baker Blanchardsville Wis
1b 120w; 1m 80w 47.66 M
W E Welbourn Winchester Ind
1b 12w; 3m 12w 47.58 M
R S Ensign New Castle Ind
1b 30w; 2m 30w 33.02 M
Wayne E Sharp DVM Union City Ind
1b 12w; 2m 12w 47.54 M
J Arnier Porter Jr Fredonia Kans
1b 124w; 5m 62w 47.5 G
Dr C C Moore Springfield Mo
1b 30w; 5m 30w 47.54 M
Dr G L Shultz Carlisle Pa 1b 120w; 1m 60w 47.50 M
G C Ross DVM Ionia Mich 1b 60w; 2m 30w 47.58 M
Roberts Vet Clinic Osborne Kans
1b 140w; 2m 8w 47.58 M
Dr E C Eickhoff Land O'Lakes Wis
1b 60w; 2m —w 47.46 M
Dr T A Hayes Clanton Ala 1b 60w; 1m 3w 47.62 M
Stark Animal Hosp Canton Ohio
1b 30w; 3m 30w 47.58 M
E R Rodabaugh Ada Ohio 1b 20w; 2m 20w 47.66 M
Dr A J Shull Almont Mich 1b 30w; 3m 30w 47.5 M
Dr J J Kelly Marshall Minn 1b 120w; 2m 60w 157.47 M
Dr K Knocke Austin Minn 1b 12w; 2m 60w 157.47 M
Dr R G Fleming & Dr C W Riley Alexandria Minn
1b 120w; 3m 60w 47.62 M
Dr C C Krouse Armada Mich 1b 30w; 3m 30w 47.46 M
Dr L R Newlin Romeo Mich 1b 10w; 3m 10w 47.66 M
R H Folsom DVM Danville Ky
1b 120w; 1m 120w 47.42 M
D F Armstrong DVM Hoosick Falls NY
1b 120w; 1m 30w 47.54 M
Jack Leamon Lena Ill 1b 60w 47.46 M
J C Sharp Van Wert Ohio 1b 20w; 2m 20w 47.46 M
Dr A Leech Jackson Tenn 1b 60w; 3m 60w 47.62 M
West Funeral Home Casselton ND
—m 60w 42.26, 42.38 M
F G Schell DVM Franklin Tenn
1b 60w; 3m 60w 47.46 M
Medical Oxygen Therapy Co Phoenix Ariz
1b 115w; 15m 115w 154.47 G
Dr J M Higbee Albert Lea Minn
1b 120w; 1m 3w; 1m 60w 47.58 M

STATE GUARD

Texas State Guard Box 613 Refugio Tex
1tb 150w 2.726 Q

POWER UTILITY

West Penn Power Co Box 1736 Pittsburgh 30 Pa
1q 5w 957 W
Lake Lynn Pa 1q 5w 956 W
Connellsville Pa 1r 5w 955, 956 W
New Hampshire Elec Co 727 Mass Av Cambridge Mass
New Market N H 1b 60w; 10m 60w 47.74 L
Jaffrey N H 1b 60w; 10m 60w 47.74 L
Northern Elec Coop Assn 704 7th Av Virginia Minn
Cook Minn 1b 120w 158.25 M
Southwestern Elec Serv Co Jacksonville Tex
Alto Tex 1b 40w 47.9 M
Ohio Fuel Gas Co 99 N Front Columbus 15 Ohio
Springfield Ohio 1b 30w 153.65 L
Mountain States Power Co Albany Ore
1b 120w 158.13 M
Corvallis Ore 1b 60w 158.13 M
Springfield Ore 1b 120w 158.13 M
Tillamook Ore 1b 120w 158.13 M
Lebanon Ore 1b 60w 158.13 M
Atlantic City Elec Co 1600 Pacific Ave Atlantic City NJ
Tuckerton NJ 1b 30w 47.98 M
Northern States Power Co Eau Claire Wisc
Sparta Wis 1b 30w 48.14 M
Stanley Wis 1b 30w 48.14 M
Viroqua Wis 1b 30w 48.14 M
Elmwood Wis 1b 30w 48.14 M
Hudson Wis 1b 30w 48.14 M
Menominee Wis 1b 30w 48.14 M
Neillsville Wis 1b 30w 48.14 M
Wabasha Wis 1b 60w 48.14 M
Abbotsford Wis 1b 30w 48.14 M
Augusta Wis 1b 30w 48.14 M
Blair 1b 30w 48.14 M
Chippewa Falls Wis 1b 30w 48.14 M
Alabama Gas Corp 1918 1st Av N Birmingham Ala
Opelika Ala 1b 120w 158.25 G
Municipal Lt & Pr Co North Platte Neb
1b 60w; 20m 10w 153.53 M
Indiana Gas & Water Co Mays Ind
1b 30w 48.26 M

Bridgeport Gas Light Co Bridgeport Conn
1b 120w; 50m 120w 153.53 GM
Carlton County Coop Pr Assn Kettle River Minn
1suq 50w 74.42; 1suq 50w 73.30 G
E Ohio Gas Co 1405 E 6th St Cleveland Ohio
Canton Ohio 1b 120w 158.25 L
Pacific Gas & Elec Co 245 Market San Francisco
Madera Calif 1b 120w 153.71 L
Consumer Pub Pr Dist 14th & 25th Av Columbus Neb
Elm Creek Neb 1b 40w 48.18 M
Humphrey Neb 1b 40w 48.18 M
Ravenna Neb 1b 40w 48.18 M
Creighton Neb 1b 40w 48.18 M
Pawnee City Neb 1b 40w 48.18 M
Exeter Neb 1b 40w 48.18 M
Boelus Neb 1b 40w 48.18 M
Aurora Neb 1b 40w 48.18 M
Ainsworth Neb 1b 40w 48.18 M
Adams Rural Elec Co West Union Ohio
Nr Peebles Ohio 1b 25w 37.54 M
So Ogden Conservation Dist Ogden Utah
1b 40w; 6m 40w 153.59 M
City of Los Angeles Box 3669 Term Annex
Los Angeles Calif 3b 120w 48.42 G
Wilmington Calif 1b 120w 48.42 G
N Hollywood Calif 1b 120w 48.42 G
City of Dayton Ohio 1b 60w; 30m 60w 153.47 X
Dairyland EC Inc Grand Rapids Minn
Bay River Minn 1b 120w; 5m 120w 153.71 M
Gulf States Utilities Co Beaumont Tex
Denham Springs La 1b 150w 48.50 G
Port Allen La 1b 150w 48.50 G
Clinton La 1b 150w 48.50 G
City of Centralia Wash
Chehalis Substa Lewis County 1b 50w 158.19 G
City Light Dam Thurston County 1b 50w 158.19 G
SW Elec Coop Bolivar Mo
Knobby Mo 1b 72.1 M
Se-Ma-No Elec Coop Mansfield Mo
Seymour Mo 1b 30w 48.46 M
Mountain Grove Mo 1b 30w 48.46 M
Penna Pr & Lt Co 19th & Hamilton Allentown Pa
1b 120w 5p 120w 37.86 L
Nr Pittstown Pa 1b 120w 37.86 L
Nr Northampton Pa 1b 120w 37.86 L
Williamsport Pa 1b 120w 37.86 L
Shamokin Dam Pa 1b 120w 37.86 L
Harrisburg Pa 2b 120w 37.86 L
Nr Pine Grove Pa 1b 120w 37.86 L
Nr Lansford Pa 1b 120w 37.86 L
Nr Hazleton Pa 1b 120w 37.86 L
County Gas Co Atlantic Highlands NJ
1b 550w; 50m 120w 153.53 G
First Elec Coop Corp Jacksonville Ark
Benton Ark 1b 60w 153.71 M
Cent La Elec Co 528 Monroe St Alexandria La

(Continued on page 40)

NEW APPLICATIONS

(Continued from page 39)

Mansfield La 1b 120w 47.98 M
Many La 1b 120w 47.98 M
Pub Serv Co of NH 1087 Elm St Manchester NH
Meredith NH 1b 250w; 16m 3w; 5m 60w 158.25 M
Panola-Harrison EC Inc Marshall Tex
Keatchie La 1b 100w 48.38 M
S Jersey Gas Co 20 N Mich Av Atlantic City NJ
Pleasantville NJ 1b 60w 153.65 M
Dyke Water Co 3600 Emory Los Angeles Calif
Downey Calif 1b 110w; 2m 50w 110w 48.1 G
Joe Wheeler Elec Memb Corp Hartselle Ala.
Nr Courtland Ala 1b 60w 47.74; 1b 15w 457.95 M
Moulton Ala 1b 15w 457.95 M

PIPELINE PETROLEUM

Mid-Valley Pipeline Brandette Bldg Longview Tex
Woodlawn Tex 1b 10w 153.05 M
Service Pipeline Co Box 1979 Tulsa 2 Okla
Nr Lovington N Mex 1b 60w 49.14 R
Lovington N Mex 1b 60w 49.14 R
Nr Tatum N Mex 1b 60w 49.14 R
Cent Ky Nat Gas Co 1035 Quarrier Charleston W Va
Winchester Ky 1b 150w 33.38 G
Mt Sterling Ky 1b 150w 33.38 G
Gulf Oil Corp Box 7408 Philadelphia Pa
2b 15w; 20m 15w 153.31 R
Tinicum Twp Pa 1b 15w 153.31 R
Sharon Hill Pa 1b 15w 153.31 R
Texas Co 135 E 42nd St New York N Y
6tb 120w 48.94 M
Standard Oil Co of Calif 225 Bush San Francisco
El Segunda Calif 1b 30w 158.37 M
B L McFarland Inc Midland Tex
10tb 120w 153.17 M
Plains Pipeline Newcastle Wyo 1b 124w 49.1 G
Sohio Petroleum Co Covington Ky 10m 1w 153.17 M
Phillips Petroleum Co Bartlesville Okla
1tb 60w 33.38 M
Geological Survey & Wtr Res of State of Mo
9th & Rolla Sts Rolla Mo 20m 10w 17 channels
1.614-4.6375; 25.02-30.74; 153.05-153.17 X
Standard Oil & Gas Co 910 17th St NW Wash DC
Rangely Colo 1b 120w; 25m 60w 48.62 M
Interstate Oil Pipeline Box 1107 Shreveport La
1b 150w 49.10 G
Brookhaven Miss 1b 150w 49.10 G
Liberty Miss 1b 150w 49.10 G
Port Allen La 1b 150w 49.10 G
Kans-Colo Utilities Inc Lamar Colo
1b 120w; 15m 60w 48.9 M
Mountain Fuel & Supply 625 Conn Av
Rock Springs Wyo
Nr Rock Springs Wyo 2b 500w 48.82; 3b 125w 48.82; 1us 75k 72.58; 1r 75w 75.58 M
Nr Altamont Wyo 1r 500w 48.82 1r 75w 75.58 M
Nr Coalville Wyo 1us 75w 72.58; 1b 125w 48.82 M
Nr Lyman 1b 125w 48.82 M
Richfield Oil Corp 555 S Flower Av Los Angeles
Wilmington Cal 1b 60w; 23m 12w; 2m ¾w 49.14 M
Panhandle Eastern Pipeline Co Kansas City Mo
Inka Kans 1b 150w 48.7 M
Sun Oil Co Box 2831 Beaumont Tex
Nr Delhi La 1b 150w; 1m 120w 153.23 —
S W Richardson 2105 Continental Bldg Ft Worth Tex
Cox Bay La 1b 150w 48.90 G
Dow Chemical Co Freeport Tex
3s 15w 67.25 67.45 68.05; 1s 15w 66.05 M
Lake Creek Tex 1s 15w 66.85 M
Texas City 1b 120w 153.17; 1s 15w 67.25 M
Powderhorn Tex 1s 15w 66.85 M
Nr Powderhorn Tex 1b 120w 153.17 M
Houston Tex 2b 120w 66.25 66.85; 1b 120w 153.17; 75m 120w; 12m 3w 158.31 M
Bay City Tex 2b 120w 66.25 66.85; 1b 120w 153.17 M
Chenango Tex 2s 15w 66.25 68.05 M
Katy Tex 2s 15w 67.45 68.05 M
Nr Katy Tex 1b 120w 153.17 M
Collegeport Tex 2s 15w 67.45 68.05; 1b 120w 153.17 M
Sweeney Tex 3s 15w 67.25 67.45 68.05 M
Rosharon Tex 3s 15w 66.05 66.25 68.05 M
Magnet 2s 15w 66.05 66.25 M
Lakeview 1s 15w 67.45 M
Harris Reservoir Tex 1b 120w 153.17 M
Nr El Campo Tex 1b 120w 153.17 M
Nr Pinehurst Tex 1b 120w 153.17 M
Nr Velasco Tex 1b 120w 153.17 M

FOREST PRODUCTS

L H L Lumber Corp Carlton Ore
1b 124w; 24m 124w; 15m 15w 49.5 GX
Pack River Lumber Co Sandpoint Idaho
1b 30w 72.3 C
Nr Bonner Ferry Idaho 1b 30w 74.1; 1b 30w 49.58; 4m 3w 49.58 A
S of Porthill Idaho 1b 30w 49.58 C
McCracken & McCall Inc Lexington Ky
Nr Pineville Ky 1b 7m 120w 49.26 M
M & M Woodworking Co 2301 N Columbia Blvd
Portland Ore
Sweet Home Ore 1b 150w; 49.58 G
Idanha Ore 1b 90w; 1tb 90w; 25m 90w; 10m 15w X; 1tb 150w; 25m 124w G; 10m 3w M

SPECIAL INDUSTRIAL

Balcom & Moe Grandview Wash
1b 55w; 12m 30w 154.49 K
Clarence Le Bus Lexington Ky
1b 120w; 1m 120w 43.06 G
Loraine E Gum Rte 4 Box 395 Amarillo Tex
Canyon Tex 1b 120w; 10m 120w 43.02

Horseshoe Ranch Inc Beowawe Nev 1b 120w 154.49 G
Red House Nev 1b 120w 154.49 G
Carlin Nev 1b 120w; 10m 120w 154.49 G
Green Giant Co Le Sueur Minn
Winsted Minn 1b 60w; 15m 60w 43.10 M
Winthrop Minn 1b 60w; 5m 60w 43.10 M
Cokato Minn 1b 60w; 10m 60w 43.10 M
Blue Earth Minn 1b 120w; 15m 60w 43.10 M
Watertown 1b 60w; 15m 60w 43.10 M
Inspiration Cons Copper Co Miami Ariz
3b 30w 154.49 M
Pringle Ariz 1b 30w 154.49 M
Butler Constr Co Grand Forks ND
1b 120w; 20m 60w 154.49 M
J W McCart & Co & I J Higginbotham Rte 2 Hwy 31 S Decatur Ala
Nr Decatur Ala 1b 60w; 6m 15w 43.1 M
H W Goodman M S Openshaw & O Production Serv
Santa Maria Calif 1b 60w; 4m 30w 43.14 M
Oceano Packing Co Box 132 Oceano Calif
Santa Maria Calif 1b 60w 43.1 M
Marshall Womack Rte 6 Paris Tex
Nr Faulkner Tex 1b 70w; 10m 70w 43.20 G
Hettner Constr Co 222 Fulton St Celina Ohio
Nr W Mansfield Ohio 1b 27.7w; 10m 24.8w 154.49 R
Gentry & Lyles Midland Tex
1b 500w; 10m 95w 30.58 M
Ann Arbor Constr Co Inc Ann Arbor Mich
1b 60w; 10m 30w 3m 10w 49.98 M
Midland Contracting Co Bay City Mich
1b 60w; 10m 60w 49.94 M
Harold Barnett 103 NE Ellis St Pendleton Ore
1b 120w; 20m 120w 49.86 M
Boeing Airplane Co Wichita Kans
1b 106w; 18m 60w 43.02 MG
Sondgrath Bros Mt View Calif
1b 120w; 10m 120w 49.94 G
Desert Grain & Milling Co Westmoreland Calif
1b 60w; 6m 30w 49.86 M
Allender & Lachenmyer El Centro Calif
1b 60w; 6m 30w 49.86 M
Imperial Cattle Co Imperial Calif
1b 60w; 6m 30w 49.86 M
Calipatria Calif 1b 60w; 6m 30w 49.86 M
Arthur B Siri Inc 1357 Cleveland Av
Santa Rosa Calif
Nr Willits Calif 1b 60w 43.14; 1r 30w 72-76 M
Lucas Engineering Co Desoto Mo
1b 120w; 10m 60w 43.1 M
M M Green 912 N Main Carrollton Mo
1b 41w 43.18 M
Richmond Mo 1b 41w 43.18 M
Blue Mound Mo 1b 41w 43.18 M
General Motors Research Corp 3044 W Grand Blvd Detroit Mich
Flint Mich 1b 60w 152.93; 1b 10w; 35m 10w 154.49 M
Greenfield Plantations Albany Ga
1b 50w; 5m 15w 43.18 M
Jack Richtman Custer SD 8m 100w 154.49 G
Campanella & Cardi Constr Co 780 Jefferson Blvd Hillsgrove R I
Providence R I 1b 60w 43.02 R
E G Sheet Metal Works Box 117 Augusta Ga
Savannah River Plt Atomic Energy Comm SC
1b 30w; 5m 30w 5m 15w 43.18 M
Paradise Collieries Inc Greenville Ky
1b 120w; 20m 24.8 154.49 G
Southern Plant Co Omega Ga
1b 70w; 5m 70w 43.18 G
Nicholas Ga 1b 70w; 5m 70w 43.18 G
Sam Carline Inc Berwick La 1b 240w; 2tb 120w; 10m 120w 2.292 X
Brown Lone Co Port Arthur Tex
1b 120w 45m 25w 60w 154.49 M
Condor Radio Mfg 116 N Montequma Prescott Ariz
3m 3w 30.58 X
Shute Concrete Prods Inc E of Richmond Ind
1b 60w; 10m 30w 49.90 L
Republic Steel Corp Republic Bldg Cleveland Ohio
1b 50w; 100m 10w 154.49 G
Myrtle Beach Farms Myrtle Beach SC
2b 20w; 20m 20w 154.49 M
The Bullard Co 286 Canfield Av Bridgeport Conn
Fairfield Conn 1b 120w; 5m 30w; 15m 1w 154.49 M
Hodgkiss & Douma Petosky Mich
1b 60w; 12m 30w; 2tb 60w 43.18 M
Merchants Del Serv Garden City Kans
1b 23w; 3m 23w 154.49 M
R J Kern Schnecksville Pa 1b 120w; 6m 120w 43.10 G
Ole Hansen & Sons 22 N Franklin Pleasantville NJ
1tb 120w 30.62 G
C H Trask Rocky Point NC 1b 120w; 6m 20w 49.9 M
G W Talman Wilmington NC
1b 120w; 10m 20w 49.86 M
Don Wells Inc Detroit Mich
1b 60w; 4m 30w; 4m 12w 43.14 M
A & A Asphalt Paving Co 1045 Haynes St Birmingham Mich
Nr Pontiac Mich 1b 12w 49.98 M
Nr Livonia Mich 1b 12w 49.98 M
Tri-City Constr Co Flushing NY
1b 120w; 15m 60w 49.9 R
Quality Concrete Prods Co Tifton Ga
1b 30w; 5m 15w 49.86 M
Moultrie Ga 1b 15w; 3m 15w 49.86 M
R A Parsons Cape Charles Va
1b 120w; 6m 24-8w 154.57 G
H F Stuckey Co Coldwater Mich
1b 60w; 5m 30w 12w 43.14 M
Boaz Well Serv Co Graham Tex 3tb 70w 49.7 G
Gen Foods Corp 250 Park Av New York NY
Pocomoke City Md 1b 60w; 10m 30w 152.99 M
Penker Constr Co Richmond Ky
2tb 30w; 4m 30w 43.06 M

(Continued on page 43)

NEW APPLICATIONS

(Continued from page 41)

Brooks Inc Box 36 Homestead Fla
Nr Homestead Fla 1b 30w; 4m 30w 152.99 M
Alexander Constr Co 4641 Hiawatha Av Minneapolis
2b 120w; 12m 60w; 4m 3w 152.87 M
Claussen Lawrence Constr Co 1395 Gwinnett St
Augusta Ga 1tv 70w 43.06 G
Pennington Winter Constr Co Farley St
Oklahoma City Okla 1tb 60w; 15m 60w 43.02 M
Chrysler Corp 341 Mass Av Detroit Mich
Nr Detroit Mich 1b 60w; 25m 30w; 25m 10w 152.87 M
Dow Chemical Co Dow Plt B Velasco Tex
1b 120w; 1b 500w 49.98; 1b 120w; 25m 120w; 75m 60w 152.99; 50m 120w; 6m 3w 49.98 M
Kenton Meadows Contractor Gassaway W Va
1tb 150w 20m 150w 30.62 G
A D Powell Luling Tex 1b 150w; 10m 150w 43.18 R
Douglas Aircraft Co 3000 Ocean Pk Blvd
Santa Monica Calif
Tulsa Okla 1b 30w; 12m 10w 150mc band M
Paul Niemann Constr Co Sumner Ia
1b 60w; 10m 60w 30-50mc band M
H D Roddenberry Co Yuma Ariz
1b 120w; 10m 60w 154.49 M
A L Luckett Marana Ariz
1b 115w; 15m 24.8w 152.93 G
Patterson Mud & Chemical Co 600 Roosevelt Av
Houma La 1b 500w; 20m 124w 27.39 G
Berwick La 1b 124w 27.39 G
Al-Fa Meal Co Columbus Neb
1b 60w; 12m 10w 154.59 M
Central Ohio Coal Co Fultonham Ohio
Nr Cannon Sta Ohio 1b 150w 43.06 G
Nr Unionville Ohio 1b 150w; 20m 75w 43.06 G
N American Cement Corp Alsen NY
1b 30w; 5m 30w 10m 3w 154.49 M
G W Trask & Sons Myrtle Beach SC
1b 60w; 10m 30w 43.14 M
G L Wilson Building Co Statesville NC
1b 120w; 5m 60w; 10m 20w 43.06 M
L L Fitinghoff Los Gatos Calif
1b 500w; 25m 150w 30-58mc band K
Edmund C Ginsti Fresno Calif
1b 150w; 9b 150w; 75w 43.06 G
H C Draper Mankato Minn
1b 120w; 12m 60w 3m 3w 43.06 M
C L Nelson & Co Brainerd Minn 15m 120w 43.1 M
D E Winebrenner Co Hanover Pa
1b 120w; 10m 50w 43.1 L
McLaughlin Inc Great Falls Mont
5tb 120w; 6m 75w; 25m 3w 43.06 M

LOW POWER INDUSTRIAL

G B Downer 327 Central Block Pueblo Colo
6p 2w 42.98 M
Vermont Hardware Co 180 Flynn Burlington Vt
1p 1w 154.49 A
Willis Rose Corp New York Intl Airport
Jamaica 20 NY 15m 3w 33.14 M
Hal F Corry Sr Dallas Tex 1— 6w 27.30 SS
Harvey Radio Co 103 W 43rd St New York 36 NY
2m 1w 154.57 A
F C Huggman Box 315 Rockport Tex 4p 3w 154.57 M
Tropical Radio Telegraph Co 80 Federal St
Boston Mass 20m 3w 154.47 M
Scintilla Magneto Div Bendix Aviation Corp
Sidney NY 20m 3w 154.57 M
Evans Radio Box 312 Concord NH
2m 1w 154.57 3w 42.98 35.02 33.14 27.51 A
Mosque Sound Engr Co 331 W 51st St, New York NY
1m 1w — X
New Rochelle Tool Co 162 E Main New Rochelle NY
4m 3w 4m 2w 35.02 M
Bulova Watch Co 630 5th Av New York NY
6m 3w 4m 2w 35.02 M
Northwestern Bell Tel Co 118 S 19th St
Omaha Neb 100m .5w, 1w — MD
Carson & Hart Spraying Serv Wray Colo
4m 1.5w 27.51 X
Norris Thermador Corp Vernon Branch Box 15384
Los Angeles Calif
Riverbank Calif 26m 3w 154.57 M
Southwest Kans Aircraft Sales Greenburg Kans
4p 3w 42.98 M
Frisch's Enterprise Inc 2951 Duck Creek Rd
Cincinnati Ohio 35m .5w 154.57 M
Fairmac Corp 3811 Porter St NW Washington DC
10m 3w 154.47 M

RELAY PRESS

The Hearst Corp NY Mirror Div 235 E 45th St
New York NY 10m 10w — M

COASTAL & MARINE RELAY

Great Lakes Dredge & Dock Co 122 S Michigan Av
Chicago Ill 2b 50w 156.5 G
Curtis Bay Towing Co of Va Norfolk Va
1b 120w; 25m 60w 156.6 M

ALASKAN CONTROL

Alaska Steamship Co c/o Northern Elec Co
314 Bell St Seattle Wash
Cordova Alaska 1b 100w 14 channels from 2.382 to 3.190 BB
Sitka Alaska 1b 100w 14 channels from 2.382 to 3.190 BB
Pacific Amer Fisheries Inc c/o Northern Elec Co
314 Bell St Seattle Wash
Swedonia Trap #3 Alaska 1b 40w 13 channels from 1.646 to 5.167 BB

(Continued on page 44)

NEW APPLICATIONS

(Continued from page 43)

Tolstoi Trap #4 Alaska 1b 40w 13 channels from 1.646 to 5.167 BB
Alaska Packers Assn c/o Northern Elec 314 Bell St Seattle Wash 3tb 5w 20w 9 channels from 2.382 to 3.190 BB
Packers Ekuk Alaska 1b 20w 15 channels from 1.622 to 3.190 BB
Ivanof Bay Packing Co c/o Northern Elec 314 Bell St Seattle Wash
Ivanof Bay Alaska 1b 100w 12 channels from 2.382 to 5.167 BB
Whiz Fish Products Co c/o Northern Elec Co 314 Bell St Seattle Wash
Tyee Alaska 1b 100w 20 channels from 1.622 to 5.652 BB

COASTAL & FIXED

Alaska Aeronautics & Communications Comm Box 121 Juneau Alaska
Alitak Alaska 1b 20w 6 channels from 2.632 to 5.622 X
Nakat Packing Corp c/o Northern Elec 314 Bell St Seattle Wash
Brownson Bay Trap Alaska 1s 40w 11 channels from 2.382 to 3.190 BB
Rip Point Trap Alaska 1s 11 channels from 2.382 to 3.190 BB
Columbia Riv Packers Assoc c/o Northern Elec Co 314 Bell St Seattle Wash
Combine Alaska 1b 40w 10 channels from 1.622 to 3.190 BB
Peninsula Packers c/o Northern Elec Co 314 Bell St Seattle Wash
Naknek Alaska 1b 100w 13 channels from 1.622 to 5.167 BB
Libby McNeill & Libby Box 1902 Seattle Wash
Nr Kenai Alaska 1b 65w — X

MARITIME FIXED

Brewster Bartle Drilling Co 1912 Esperson Bldg Houston Tex 1tb 100w 2.134 2.206 X

RAILROADS

Gulf Mobile & Ohio RR 104 St Francis Mobile Ala Tusceloosa Ala 1b 60w 161.73 M
Chicago Great Western RR 309 W Jackson Blvd Chicago 6 Ill
Lorimor Iowa 1b 60w 159.57 160.17 X
NY New Haven & Hartford 54 Meadow St New Haven Conn 1b 100w 161.55 N
North New Haven Conn 1b 100w 161.13; 1b 100w 160.83; 23m 50w 160.83 161.13 161.55 N
Southern Pacific Co 65 Market St San Francisco Los Angeles Calif 1b 30w 159.51 159.57 159.63 159.69 161.55; 2b 30w 159.51 159.57 159.63 159.69 161.55 161.79; 1b 30w 160.89 161.55 T
New Orleans & Lower Coast RR Co Algiers La 1b 60w 161.07 M
Erie RR Co 101 Prospect Av Cleveland Ohio Ferrona Pa 1b 30-120w 159.75 159.87 160.05 O
Union Pacific RR 1416 Dodge St Omaha Neb Salt Lake City Utah 1b 30w 160.23 M

TAXICABS

Lebanon Cab Co Lebanon Mo
1b 30w 152.39; 10m 30w 157.65 M
Springdale Taxi Serv Springdale Ark
1b — 152.33; 5m 10w 157.59 M
Red Top Cab Clear Lake Ia
1b 60w 152.45; 5m 12w 157.71 M
Union Cab Co Sault Ste Marie Mich
1b 60w 152.33; 5m 10w 157.59 M
City Taxi Co Hawthorne Calif
1b 60w 152.39; 3m 30w 157.65 L
Checker Cab Co New Castle Ind
1b 60w 152.33; 4m 10w 157.59 M
Robert S Mace Liberty Mo
1b 140w 152.39; 10m 41w 157.65 M
Upland Cab Co Upland Calif
1b 10w 152.39; 3m 10w 157.65 L
Charles Taxi Serv Mountain View NJ
1b 30w 152.45; 2m 30w 157.71 M
Yellow Top Cab Co Houma La
1b 30w 152.45; 9m 30w 157.53 BML
Freddies Taxi Ashland Mass
1b 30w 152.45; 3m 30w 157.71 M
Wayne C Johnson Ft Madison Ia
1b 30w 157.65; 5m 30w 157.65 M
Lexington Cab Co Inc Lexington Mass
1b 30w 152.33; 5m 157.59 M
Galuffs Taxi Winchester Mass
1b 30w 152.45; 3m 30w 157.71 M
Whitehall & Central Cab Co Providence RI
1b 30w 152.45; 3m 30w 157.71 M
Veterans Cab Serv Alexandria Ind
1b 12w 152.33; 4m 12w 157.59 G
Karl J Swanson Mary Esther Fla
1b 60w 35.9; 10m 70w 35.9 G
L C Roy Guthrie Morehead City N C
1b 100w; 5m 100w 152.39 K
Birmingham Cab Co Birmingham Mich
1b 120w 152.33; 10m 20w 157.59 M
Varsity Cab — Campus Cab Co E Lansing Mich
1b 10w 152.39; 5m 10w 157.65 M
D B Borbore Ann Cab Co New Orleans La
1b 115w 152.33; 1m 25w 157.59 G
Rosies Taxi Gloucester Mass
1b 30w 152.33; 6m 30w 157.59 M
Dougs Cab Anacortes Wash 1b 30w 152.27 F
Mann's Taxi Co Maynard Mass
1b 60w 152.33; 5m 12w 157.59 M

(Concluded on page 46)

FIRE RADIO SYSTEM

(Continued from page 33)

tact with the body of the vehicle.

At this time of writing, Leece-Neville alternators have been installed on some of our vehicles for battery-charging purposes, and others are scheduled to be installed. This program will be continued as Department funds become available.

From the foregoing, it will be seen that requirements for fire department radio communication must be far more rigid than for conventional mobile installations because the use to which the equipment is put differs greatly from other types of systems.

NEXT MONTH: In the concluding part of this article, Lieut. Harmatuk will describe the base transmitters, microwave relay, control consoles, and the special tape recorders which have been built by Magnecord for the Fire Department's five-borough FM system.

NATION-WIDE TV

(Continued from page 14)

local TV station.

4) Cities with one local station but no other TV service.

5) All others.

Priorities within the groups in the second category are dependent on the number of operating stations in the city, where a distinction can be made on that basis, or on a population basis where it cannot. An exception is the group of cities presently receiving service but which have themselves only UHF assignments. These will be processed according to the number of services now being received.

A separate processing line will be set up to handle applications for modifications to CP's granted after July 1, 1952; petitions for reconsideration of actions taken with respect to applications for new TV stations; and petitions for waiver of hearings of these applications. These will be processed as filed. Applications for changes in existing facilities, other than those required by the new Table, and license applications will be processed at some later date.

Revised Application Form:

Page 1 of Section 1, pages 1, 2, and 3 of Section V-C, and Section V-G of FCC form 301 for CP applications have been revised as of March 21, 1952, and the revised pages must be used in all applications filed with the Commission in April, May, and June, 1952. The new pages are identified by the date 6-30-52 in the lower right-hand corner. A complete reprinting of Form 301, incorporating these revisions, is in progress; when it is made available, the pages identified by 6-30-52 will no longer be used.

NEW APPLICATIONS

(Continued from page 44)

K Cab Co Inc Bloomsbury Pa 1b 24.8w 152.27 G; 9m 24.8; 1m 50w; 2m 40w 157.53 GLB
Veterans Cab Co Lodi Calif
1b 20w 152.33; 5m 20w 157.59 M
Evanston Cab Co Evanston Ill
1b 120w 152.44; 74m 30w 157.71 G
Holley Taxi Shelbyville Ill
1b 15w 152.45; 6m 15w 157.71 M
Crescent City Cab Co Crescent City Calif
1b 15w 152.39; 6m 12w 157.65 K
Safety Cab New Castle Ind
1b 30w 152.45; 5m 10w 157.71 L
Mercury Cab Co Nashville Tenn
1b 119w 152.45; 15m 24.8w 157.71 R
Veterans Cab Co Memphis Tenn
1b 60w 152.27; 100m 10w 157.53 M
Courtesy Cab Conway NH
1b 25w 152.27; 1m 10w 157.53 F
Courtesy Cab Co Angola Ind
1b 30w 152.27; 6m 10w 157.53 M
Frontier Taxi Serv Tonawanda NY
1b 15w 152.33; 6m 15w 157.59 R
Robbinsdale Yellow Cab Co Robbinsdale Minn
1b 120w 152.39; 10m 30w 157.65 M
Union Cab Co Sunnyside Wash
1b 115w 152.39; 10m 24.8w 157.65 G
Pritchards Taxi Hancock NY
1b 120w 152.33; 5m 20w 157.59 M
Zentmeyer Taxi Zentmeyer Pa
1b 120w 152.33; 6m 24.8w 157.9 G
Wing Cab Assoc Evanston Ill
1b 140w 152.45; —m 30w 157.71 M
Lewis Taxi Hudson Falls NY
1b 120w 152.33; 10m 30w 157.59 M
Holbrook Taxi Holbrook Mass
1b 30w 152.33; 3m 30w 157.59 M
O'Kees Taxi Madison Ind
1b 120w 152.39; 5m 40w 157.65 M
Vet Cab Trenton NJ
1b 120w 152.39; 10m 30w 157.65 M
Black & White Cab Co Berwyn Ill
1b 140w 152.33; 20m 30w 157.59 M
Red Top Cab Co Killeen Tex
1b 120w 152.33; 20m 30w 157.59 M
Comer's Taxi Serv Elkton Va
1b 35w 152.27; 3m 25w 157.53 B
Jacobsen's Taxi Ogunquit Me
1b 30w 152.33; —m 30w 157.59 —
Ducks Cab Indian Head Md
1b 10w 152.33; 6m 10w 157.59 G
Yellow Cab Co 611 6th St Rapid City SD
Weaver SD 1b 20w 152.27 G
Yellow Cab Co Las Vegas Nev
1b 115w 152.45; 30m 25w, 20w, 105w 157.71 GM
Red Bird Taxi Co Cushing Okla
1b 60w 152.45; 6m 30w 157.71 M
Dewey R Urie Buffalo Mo
1b 41w 152.39; 5m 41w 157.65 M
Yellow Top Cab High Point NC
1b 120w 152.45; 15m 20w 157.71 M
H & O Taxi Rockland Me
1b 120w 152.27 T; —m 30w 257.53 L
Yellow Cab Co Walnut Creek Calif
1b 30w; 5m 30w 157.65 M

AUTO EMERGENCY

Georges Garage Inc Jamaica LI NY
1b 120w; 5m 80w 35.7 M
Matt's Service Station Waukesha Wis
1b 12w; 2m 12w 35.7 M
Milliron's Garage E Point Ga
1b 70w; 10m 40w 35.70 G
Fox Auto Rebuilders Evergreen Park Ill
1b 60w; 4m 60w 35.7 M
Casa Cameo Garage Inc Brooklyn NY
1b 120w; 6m 80w 35.7 M
Clyde Downer Downey Calif
1b 124w; 12m 124w 35.7 G

HIGHWAY TRUCKS

Fredericktown Farm Supply Co Inc So Main St
Frederickton Ohio 1b 25w 35.94; 7m 60w 35.94 M
Belleville Ohio 1b 25w 35.94 M
Central Truck Lines Inc Ft Lauderdale Fla
1b 85w 35.86; 10m 50w 35.86 L
T M Miles Oil Co Milton Pa 1b 120w 35.82 G
McKeon Gas & Elec Co Kennebunk Me
1b 60w 35.82; 5m 30w 35.82 R
Mueller Transportation Co St Paul Minn
1b 60w; 40m 20-30w, 20-15w 35.82 M
Butane Gas Woodworth La
1b 150w; 10m 150w 35.78 R
Fred Crowder Sales Inc Goodland Ind
1b 30w; 5m 30w 35.86 L
New Jersey Cleaners & Dyers Inc Camden NJ
1b 120w; 20m 40w 35.82 M
Milford Oil Co Inc Milford Conn
1b 150w; 12m 60w 35.74 M
Baker Oil Co Williamston NC
1b 120w; 8m 20w 35.82 M
Sam E Wood Inc Box 198G Rte 1
Midland Tex 1b 95w 35.82 M
Hadacal Corners Tex 1b 95w 35.82 M
Butler Oil Serv Hamilton Ohio
1b 60w; 10m 12w, 30w 35.94 M
Elmhurst Trucking Corp Hialeah Fla
1b 100w; 100m 30w 45m 100w 35.94 C
Anderson Trans Co Anchorage Alaska
1b 120w; 10m 40w 35.9 M
Alaska Sales & Serv Inc Box 2280 Anchorage Alaska
Portage Alaska 1b 120w 35.78 M
Eddie Herr York Pa 1b 70w; 8m 50w 35.78 L

INDEX OF ADVERTISERS

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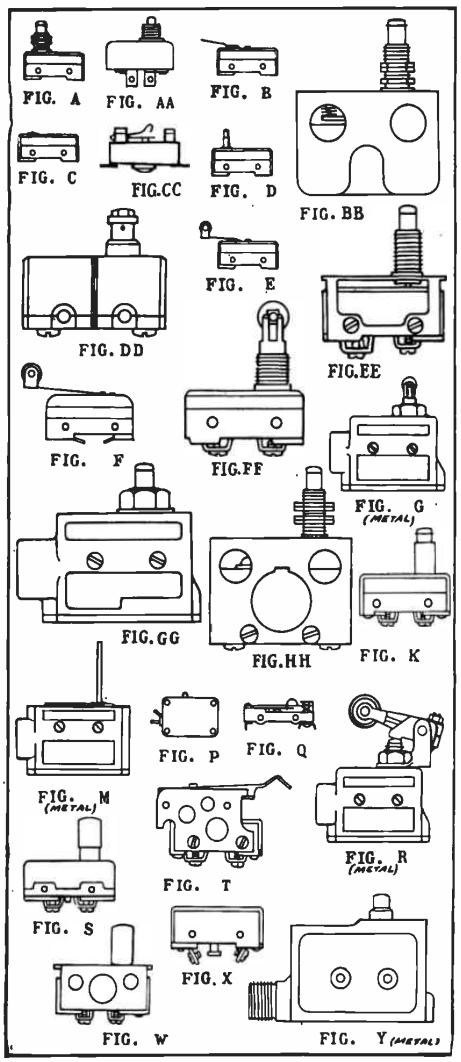

This list of brand new standard brand miniature switches represents only a few of many types in stock at Wells. Large quantities of most types are on hand for your immediate requirements. Write or wire for quotations on switches not listed.

Stock #	Mfr.	Type #	Contact	Fig.	Price	Stock #	Mfr.	Type #	Contact	Fig.	Price
4MC2	ACRO	2MD3.1A	NO	P	.50	4MC27	MICRO	WZ2RST	NC	D	.55
4MM2	MU	ACZ101BB	SPDT	W	.85	4MD16	MICRO	WZ7R	NC	C	.55
4MC17	MICRO	B-1	NC	Y	1.45	4MC15	MICRO	WZ7RQT2	NC	A	.70
4MC16	MICRO	B-1T	NC	DD	.90	4MD36	MICRO	WZ7RST	NC	D	.55
4MC7	MICRO	B-14	NO	HH	1.70	4MC23	MICRO	WZE7RQTN	NC	R	3.75
4MD62	MICRO	B-R	SPDT	C	.70	4MD54	MICRO	WZR8X	NC	X	.80
4MD63	MICRO	B-RS36	SPDT	D	.80	4MC9	MICRO	WZR31	NC	C	.65
4MD23	MICRO	BD-RL32	SPDT	B	.95	4MD57	MICRO	WZR31	NC	T	.70
4C51	MICRO	BZ2FTC1	SPDT	C	.75	4MD31	MICRO	WZRD	NC	C	.55
4ML4	MICRO	BZRQ41	SPDT	W	.85	4MD19	MICRO	WZRL8	NC	B	.70
4MD51	MICRO	BZ-R37	SPDT	C	.70	4ML3	MICRO	WZRQ41	NC	W	.65
4MD2	MICRO	BZE7RQT2	SPDT	GG	1.70	4ML2	MICRO	WZV7RQ9T1	NC	G	2.25
4MD21	MICRO	BZ-7RST	SPDT	D	.80	4MC21	MICRO	X757	NC	C	.55
4MD38	MICRO	BZE2RQ9TN1	SPDT	G	2.65	4MD37	ACRO	XC1A	NC	C	.55
4MD6	MU	CUM 24155	NO	E	.80	4MC5	ACRO	XD45L	SPDT	B	.95
4ML1	MU	D	NO	BB	1.50	4MD4	MICRO	YZ	NO	C	.75
4MC12	MICRO	D in case	NC	Y	1.45	4MD40	MICRO	YA2RLE4D13	NO	B	.70
4MD60	MICRO	G-RL	NO	B	.80	4MD24	MICRO	YZ2YLTC1	SPDT	B	.95
4MC11	MICRO	G-RL 5	NO	B	.80	4MC1	MICRO	YZ2YST	SPDT	D	.60
4MD61	MICRO	G-RL35	NO	B	.80	4MD13	MICRO	YZ3R3	NO	C	.60
4MC32	ACRO	HRO 7.1P2TSP1	NO	K	.65	4MD56	MICRO	YZ3RLTC2	NO	B	.80
4MC19	ACRO	HRO7.4P2T	NO	S	.60	4D79	MICRO	YZ3RT	NC	C	.60
4MD8	ACRO	HRRC 7.1A	NC	C	.55	4D127	MICRO	YZ3RW2	NC	F	.80
4MD27	ACRO	HRRO 7.1A	NO	C	.60	4MC14	MICRO	YZ3RW2T	NO	F	.90
4MC31	MICRO	LN-11 HO3	SPDT	M	1.70	4MD49	MICRO	YZ7RQ9T6	NO	FF	.85
4MC18	MU	MLB 321	SPDT	B	.95	4MD32	MICRO	YZ7RST	NO	D	.60
4MD1	MU	MLR 643	NC	B	.70	4MC13	MICRO	YZ7RA6	NO	EE	1.00
4MD55	PHAO	PS 2000	SPDT	C	.85	4C116	MICRO	YZRE4	NO	C	.65
4MC28	ACRO	RC71P2T	NC	A	.70	4MC20	MICRO	YZRQ4	NO	S	.60
4D129	ACRO	RD71AT2	SPDT	C	.75	4MC22	MU	Z	NC	Y	1.45
4MD22	ACRO	RO2M	NO	E	.80	4MD52	MU	Blue Dot	SPDT	E	.90
4MC28	ACRO	RO2M12T	NO	E	.80	4C73	MU	Blue Dot	SPDT	D	.80
4D87	ACRO	RO7 8586	NO	K	.70	4MC8	MU	Red Dot	NC	C	.65
4MC25	MICRO	R-RS	NC	D	.50	4MD18	MICRO	Open Type	SPDT	Q	.50
4MD9	MICRO	SW-186	NC	D	.50	4MD39	MU	Green Dot	NO	B	.80
4MC10	MICRO	WP3M5	NC	AA	.50	4MC29	MU	Green Dot	NO	O	.55
4MC4	MICRO	WP5M3	NC	AA	.50	4D84	MU	Green Dot	NO	B	.80
4MD53	MICRO	WP5M5	NC	AA	.50	4MD26	MAXSON	Precision	SPDT	B	.95

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