JANUARY, 1961

BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

AN ELECTRONIC CHIME GENERATOR

FIELD INTENSITY MEASUREMENTS

VIDEO TAPE TIPS

A REVIEW OF MULTIPLEXING

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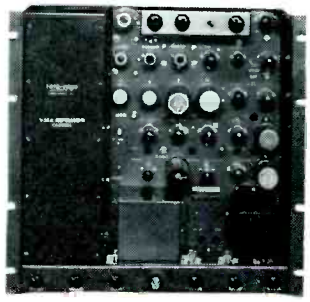

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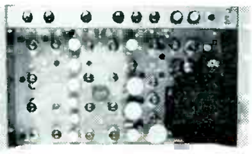

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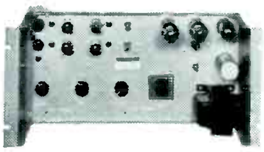

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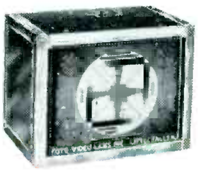

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BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

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Contents

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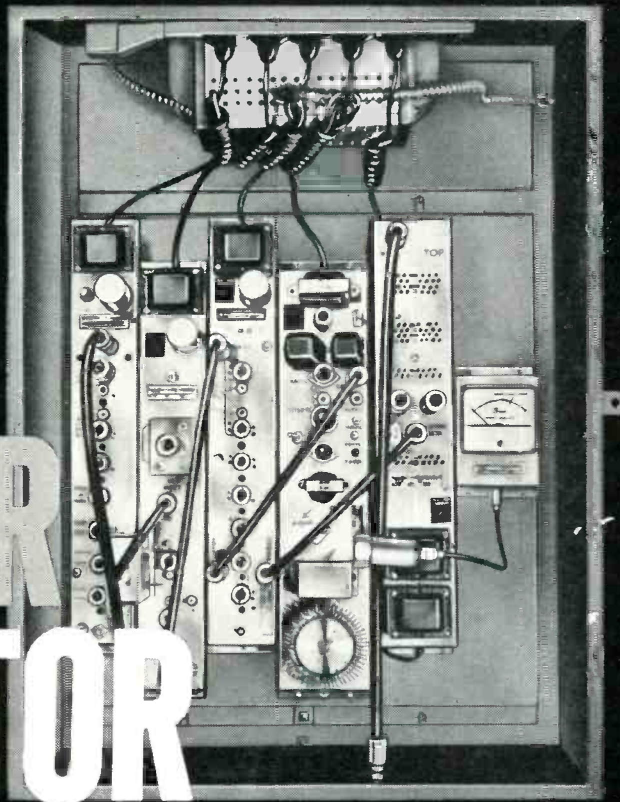

MODEL T-1

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Recommended Input	50-2000 microvolts
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Overall Noise Figure:	
Low Band	4 db ±1 db
High Band	6 db ±1 db
Frequency Stability	.02%
Gain:	
50 microvolts input to one (1) watt output	105 db
2000 microvolts input to one (1) watt output	73 db
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An Electronic Chime Generator

A description of a method of generating tones similar to network identification chimes.

FOR MANY years, the National Broadcasting Co. has identified itself with the now famous three-tone chime. These familiar notes are heard following practically every network program and generally precede the identification of the local network station.

The writer was recently put to the task of creating a set of "NBC Chimes" to be used as a "gimmick" whenever the telephone was answered at the station. Specifications called for a chime system that was electronic rather than mechanical or electro-mechanical in nature. Construction was to be such that, if desired, the unit could be located in some out-of-the-way niche in the offices and forgotten about. The latter requirement dictated the necessity of providing some means of keying the chimes from a remote position. After much thought and

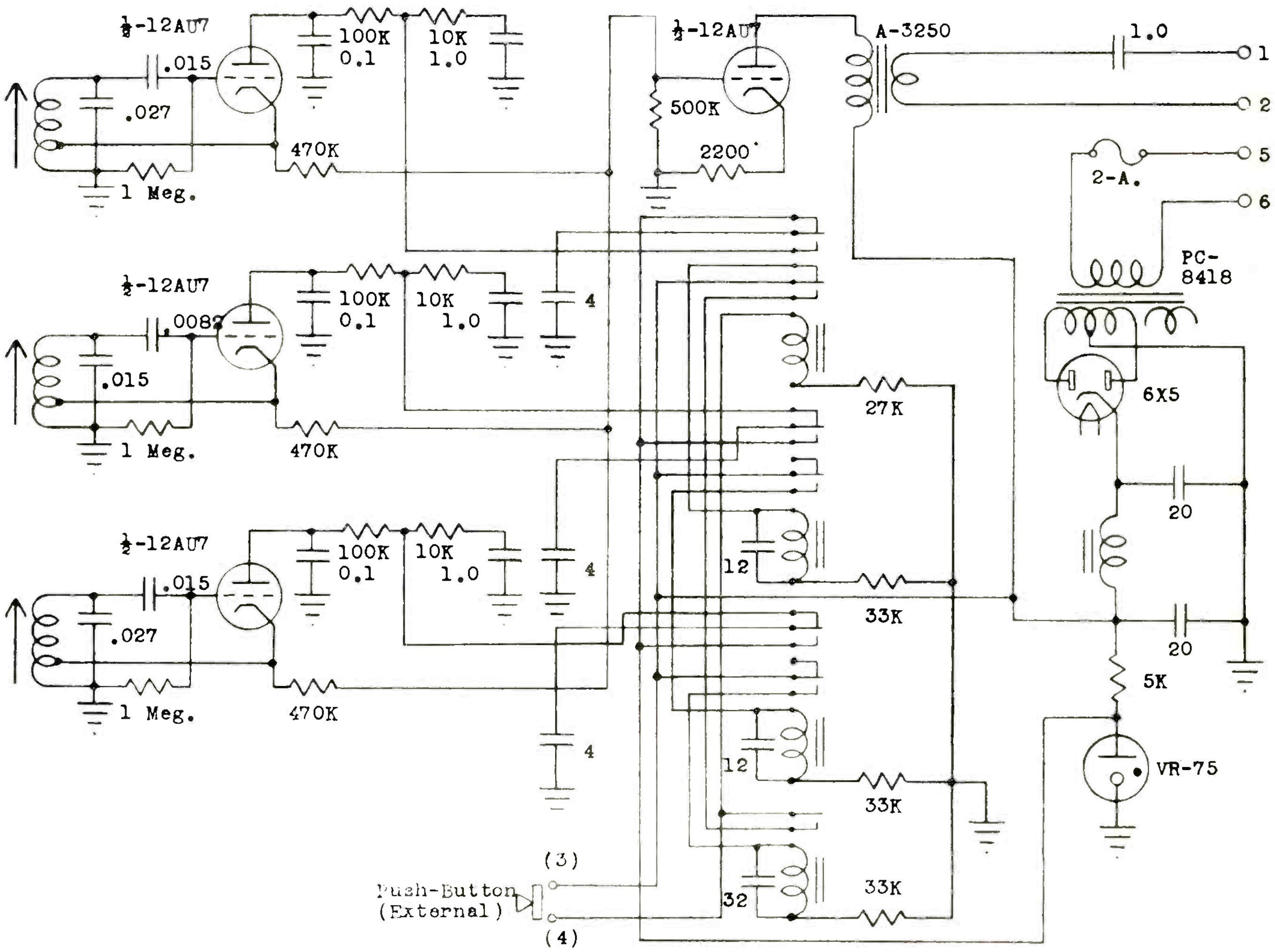

Figure 1. Over-all schematic of chime generator.

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By ROBERT F. TILTON*

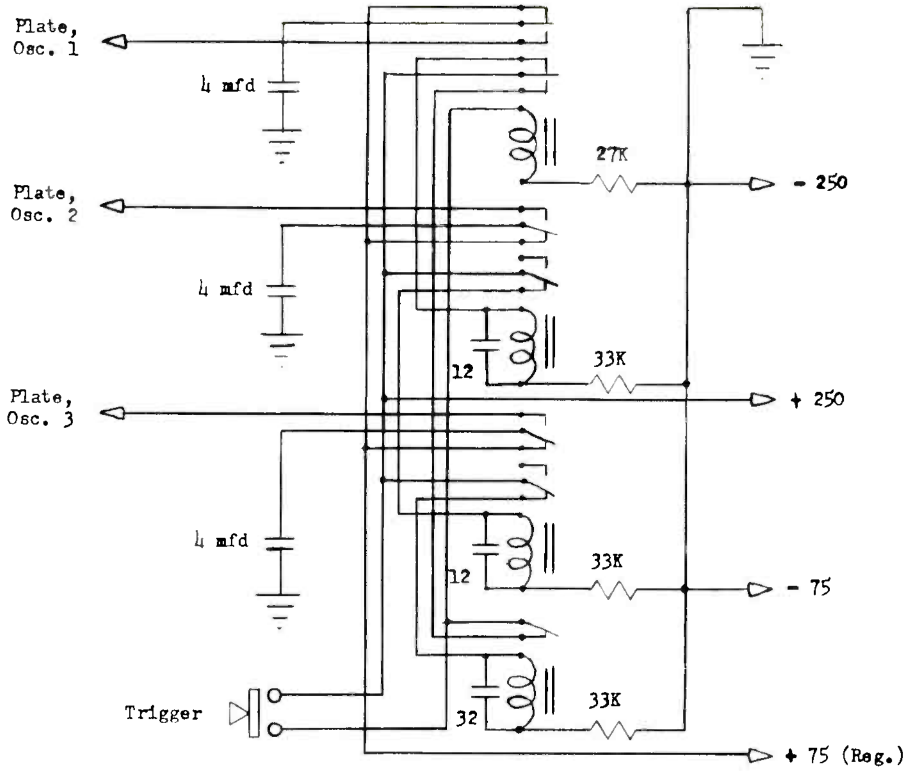

Figure 2. Relay circuitry and oscillator plate voltage control. Relays are shown in the standby position.

experimenting, the following described unit was constructed. The chimes have been compared with those transmitted by the network and the similarity between the two is most amazing.

A complete schematic diagram of the unit is shown in Figure 1. It can be seen that the system is composed of three tone generators, amplifier, keying relays and power supply. The generators are the old familiar Hartley oscillator, using the tapped-inductor method for providing the feedback necessary to produce oscillation. The inductors are special components and are not readily available from radio supply houses. These coils were purchased from Conn Organ Co. and are the same as those used in their various models of electronic organs. Most Conn service representatives carry a small number of these coils in stock for repair work. Any reader interested in reproducing this unit should be able to obtain a set of coils from his local Conn serviceman.

In the prototype, the coils are designated as types 59090-3R, 59090-2R and 59090-3R, reading from top to bottom on the schematic diagram. The tuning capacitors are also available from Conn Organ Co. and designated types 57016, 56302 and 57016, respectively. I would strongly suggest that the builder order the condensers along with the coils since they seem to age at a much slower rate than most paper or plastic condensers. Alternatively, a set of good mica condensers could be used here, but the cost would not be much if any lower than the condensers specified.

Signal from each of the tone generators is taken from the cathode through a 470,000-ohm isolating resistor. The three signal leads are tied to a common bus and fed to the grid of the amplifier. The 500,000-ohm resistor between grid and ground of the amplifier stage completes a voltage-dividing network which prevents driving this stage excessively. Some overdriving is in evidence here and is desired. This is explained in a subsequent paragraph.

A plate-to-line transformer (Stancor type A-3250) couples the output of the amplifier to a 500/600 ohm load. The 1.0 mfd. condenser shown in the secondary lead of the output transformer was used to connect the unit to a telephone circuit while providing dc isolation between the two. When the telephone was answered, the NBC chimes were imposed on the telephone line before the incoming call was answered. After connecting the chime unit in this manner, however, it was found that the single triode amplifier lacked sufficient gain to produce an audible signal level at the far end of the line and it was necessary to add an additional stage of amplification to bring the level up to a satisfactory point. The "final amplifier" used a 6AQ5 in conventional circuitry with the exception of the gain control which is located between the triode voltage amplifier and the grid of the 6AQ5. The reason for this method of gain control is that the triode amplifier stage is slightly overdriven to the point where harmonics are developed and the resultant amplified signal more resembles a true chime than would a pure sine wave.

At the risk of being taken for a punster, I will state here that the relay system is the key to the operation of the generator unit. At first glance, the wiring associated with the relays might seem somewhat complicated. However, this is purely illusionary and the simplicity of the circuitry is evidenced in Figure 2. This shows the condition of the relays with power on the unit, in standby condition. While not so indicated in the overall schematic of

(Continued on page 22)

*Technical Director, the Storz Stations, 222 South 15th St., Omaha, Neb.

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Notes on Standard Broadcast Field Intensity Measurements

Practical suggestions for the procedure to follow in planning and carrying out field intensity measurements are described.

By ELTON B. CHICK*

FIGURE I

A TABULATION OF FIELD INTENSITY MEASUREMENTS

STATION . . . . **WQQQ** **POWER** . . . . **5 KW**

RADIAL . . . . **N 30° E** **ANTENNA** . . . . . **DA DAY**

DATE . . . . . . **OCT. 3, 1960** *Measurements Made by:* CHICK & DAWSON

FREQUENCY **1000**

POINT No.	MV/M	DISTANCE	DESCRIPTION
1	1050	.28	Clear—on creek bank.
2	690	.40	Clear—10′ off expressway.
3	450	.58	Wires near—3 way intersection.
4	240	.97	Clear—intersection.
5	180	1.15	Clear—50′ off end of pavement.
6	130	1.49	Wires—south side of highway.
7	100	1.59	Wires—poor null.
8	108	1.72	Wires—good null.
9	85	1.96	Clear—at end of st.
10	73	2.13	Clear—wires 300 ft. west.
11	69	2.35	Wires—point on east side.
12	56	2.56	Wires—point on sewer drain.
13	50	2.87	Clear—good point good null.
14	41	3.07	Wires— Hi line near.
15	36	3.25	Clear—in drive way No. 3220.
16	30	3.50	Wires—poor null.
17	27	3.95	Wires—point at intersection.

With the continued expansion of the broadcast industry more and more stations are employing directional antenna systems. Of the more than 3,000 stations currently in operation approximately one-third use a directional. Many new stations can be put into operation only by the use of an array, other stations find the directional necessary for improvement of facilities. Invariably the use of directional systems requires field intensity surveys, and many non-directional stations are granted construction permits only after the completion of a survey. With the crowded conditions of the broadcast band these surveys have taken on new importance to the broadcast engineer.

While much information is available on the use of the data derived from the field survey only one article was found that gave adequate coverage of the methods of making the field measurements.[1] Many broadcast engineers are not experienced in this work and although it is not complicated, like other jobs, it may be difficult the first time. These few pointers and a little planning should go a long way in making the job easier and the results more accurate. Then the main purpose of this article is to describe techniques that have been used in numerous surveys; techniques that have resulted in accurate and reliable data.

First, it will be an advantage to understand the use made of the measurements collected on a field

*Assistant Director of Engineeering, Rounsaville Radio Stations, Atlanta, Ga.

[1] NAB Engineering Handbook, Fifth Edition, 1960

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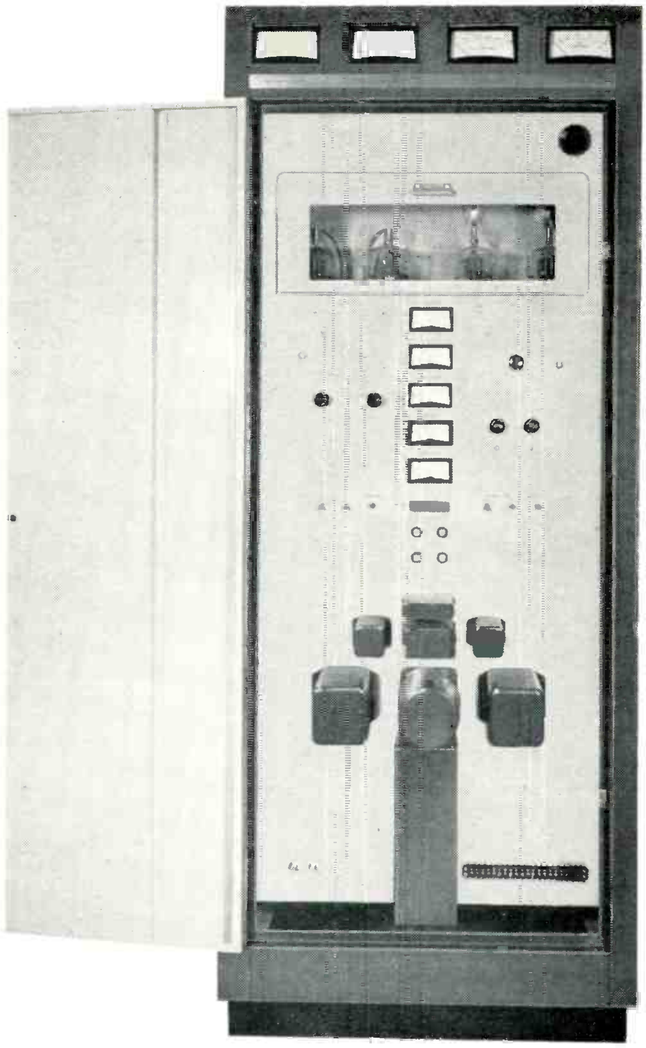

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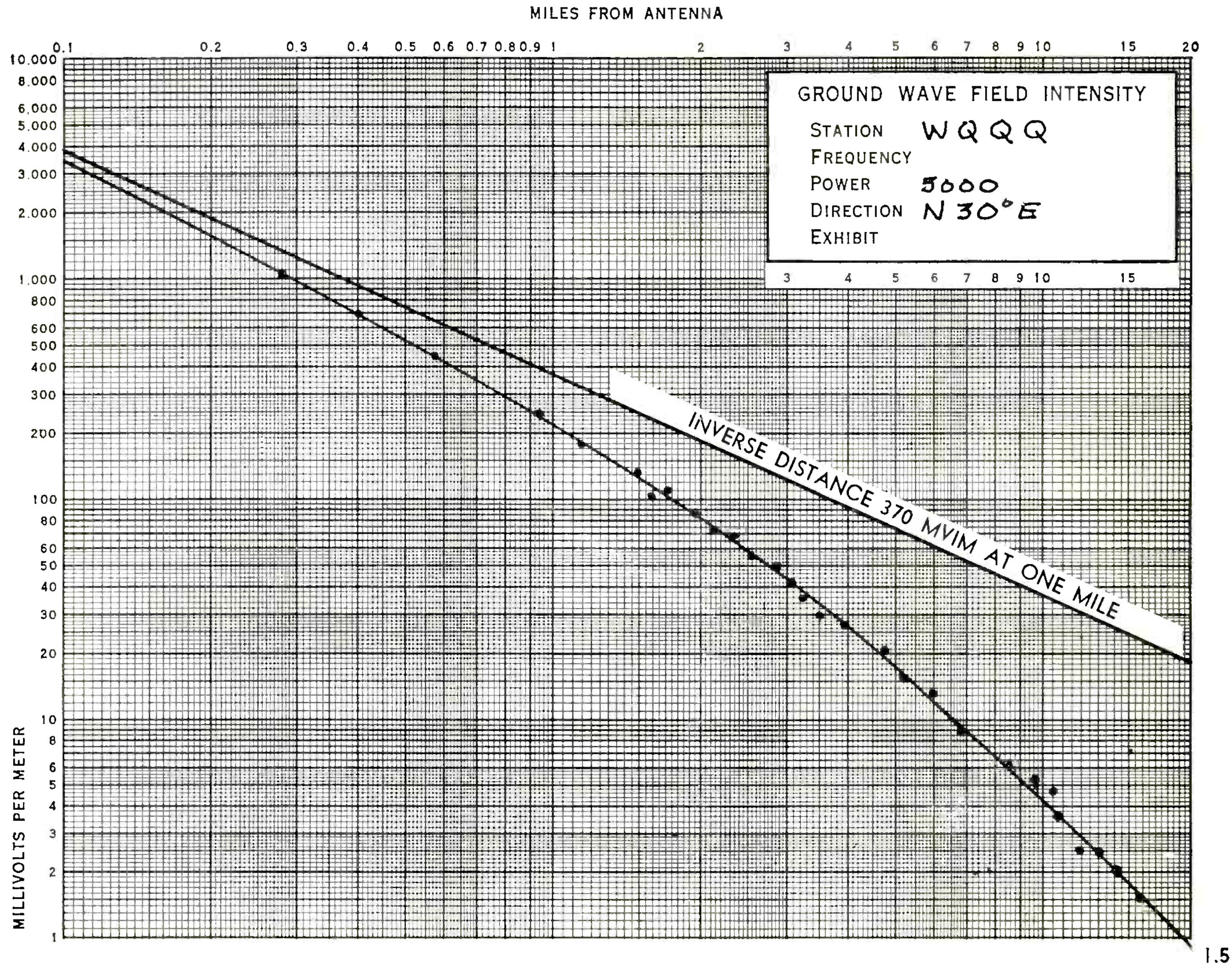

Figure 2.

intensity survey. Usually, the survey produces data giving a field intensity value, measured in millivolts per meter, a distance and a direction. This data is analyzed graphically to evaluate the station's performance in terms of inverse distance fields or to determine the conductivity of the earth over a certain path.

The need for establishing the degree of conductivity, hence the amount of signal attenuation, is brought about by the desire for more accurate prediction of a station's coverage, *i.e.*, the distance to certain contours of uniform field intensity. This data is a great aid in designing directional antenna systems and in calculating interference free coverage. Figure 1 shows a tabulation of field intensity measurements, with distances and point descriptions; and Figure 2 shows how they are plotted to form the curve. This curve represents the attenuated field strength along a line from the station and may be used with the appropriate F.C.C. chart (see Figure 3) to determine the inverse distance field at one mile. Inverse distance fields are standards of comparison and are used to determine a station's RMS field value, which itself is the final measure of the antenna's performance.

The analysis of field strength data requires several special considerations and is not covered here since this work is usually done by the station's consultant. However, if the station engineer has an idea of the way in which the signals are attenuated he will be better equipped to choose sites and make accurate measurements. A review of the F.C.C. Rules will aid in understanding the applications of the field survey.

Once the purpose of a survey is known, certain requirements can be established. Among these are the direction in which the measurements are to be made, to what distance they will be made (to a specified signal value) and the number of measurements desired. The direction, usually referred to as the azimuth, is simply a straight line drawn from the antenna, leading in some geographic direction, such as North 65 degrees East, that is, a line drawn at an angle from the station of 65 degrees east of geographic north. The distance and number of points will depend on the type of survey and the terrain crossed by the radial as well as the existing conductivity. For certain measurements

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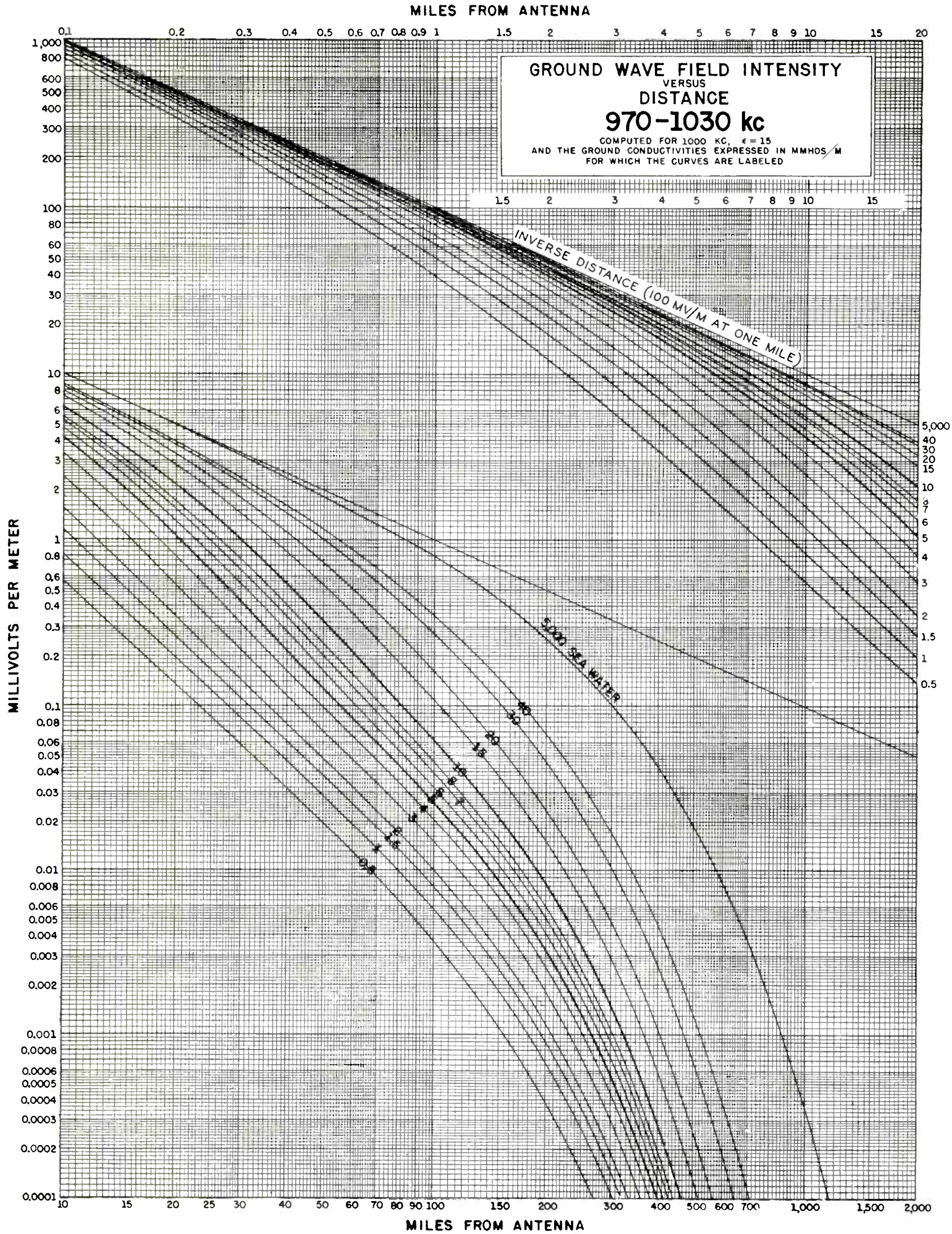

Figure 3.

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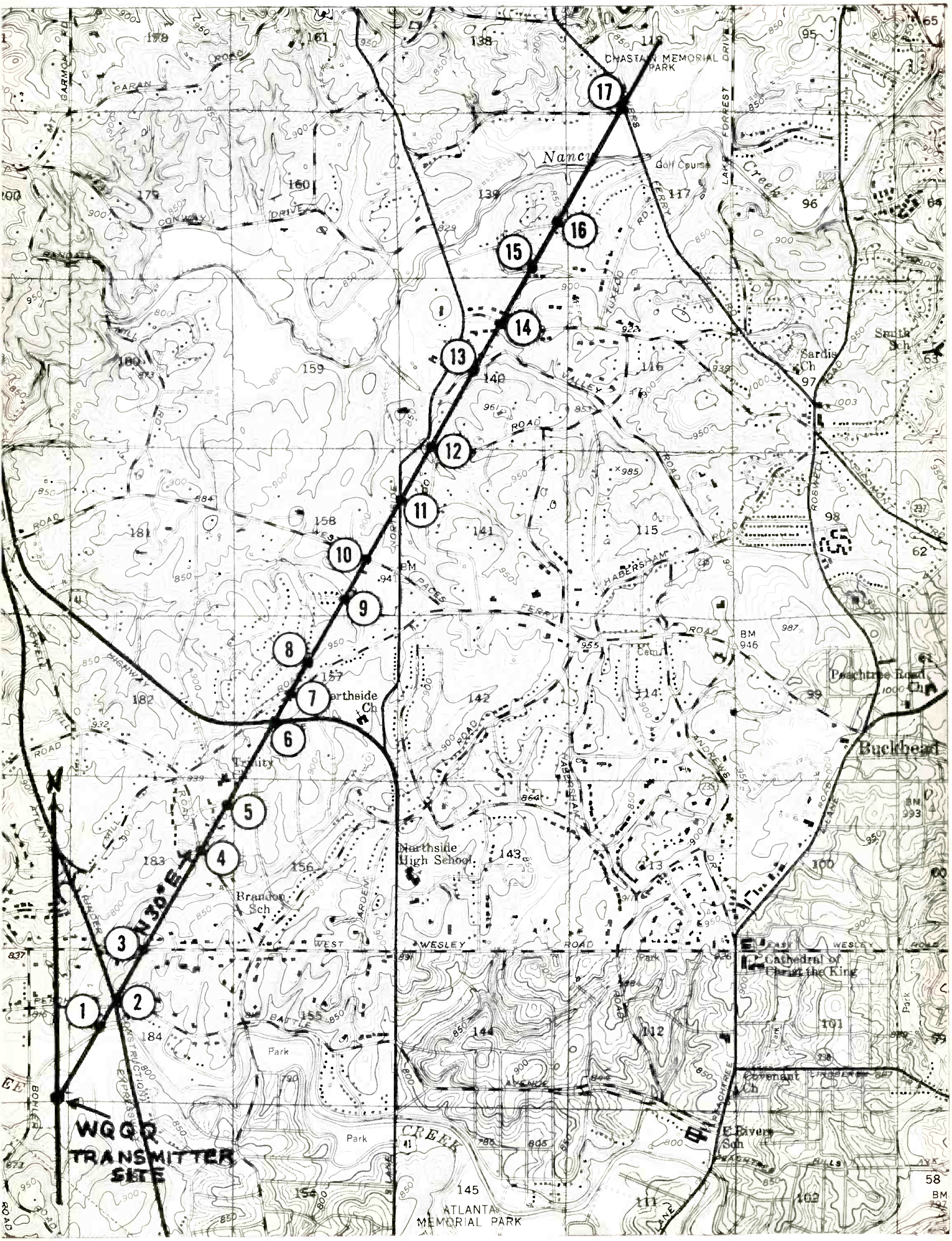

Figure 4. The measurement radial laid out with measuring points.

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required by the F.C.C. recommended spacings are given in the Rules, see Part 3, Section 3.186b. This requirement looks to ideal conditions which seldom exist. Often the close-in points are difficult to space correctly but after two or three miles the spacing need not be so close and can often be more easily arranged. A field survey to determine conductivity in some direction may consist of measurements along one or two radials, whereas the directional antenna proof may require a dozen or more radials. Other purposes may establish other requirements but whatever the purpose, the measurements are made in the same manner at suitable points along the radial, marked on the map and tabulated.

If measurements are to be made for a considerable distance, say more than 35 miles, they will often pass through rural areas where the roads are not the best and where landmarks are sometimes hard to locate. This problem in navigation along with the selection of a spot suitable for the measurement are two of the main considerations in the field. The method of operating the field meter is very important and deserves much attention; this, however, can be learned with a little practice and the aid of the instrument instruction book.

A station engineer asked to make a field survey will often be supplied with maps that have the radials drawn. This is usually done by the station's consulting engineer. If this is not the case the engineer must procure his own maps and draw the necessary radial lines. This is easily done with a good protractor once the station location is pinpointed and a meridian drawn through its location. The station's exact location can be found by geographic coordinates taken from the station's license or construction permit. The meridian is simply a north-south line through the station's antenna location, this line is geographic and not magnetic north or south as indicated by a compass. Once the meridian is drawn it is an easy mat-

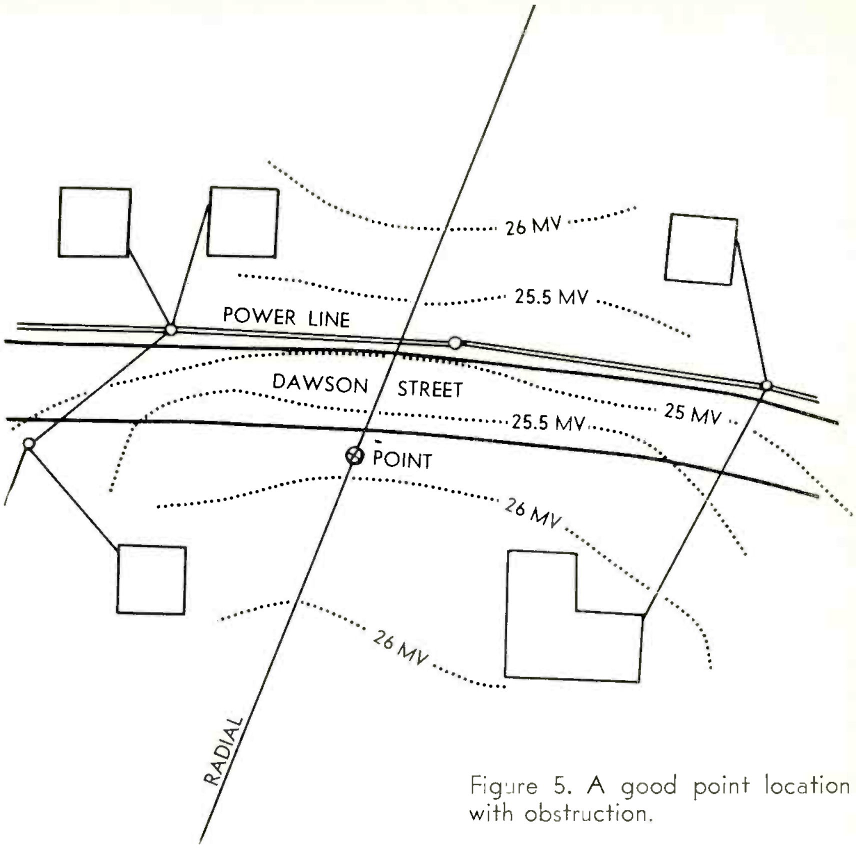

Figure 5. A good point location with obstruction.

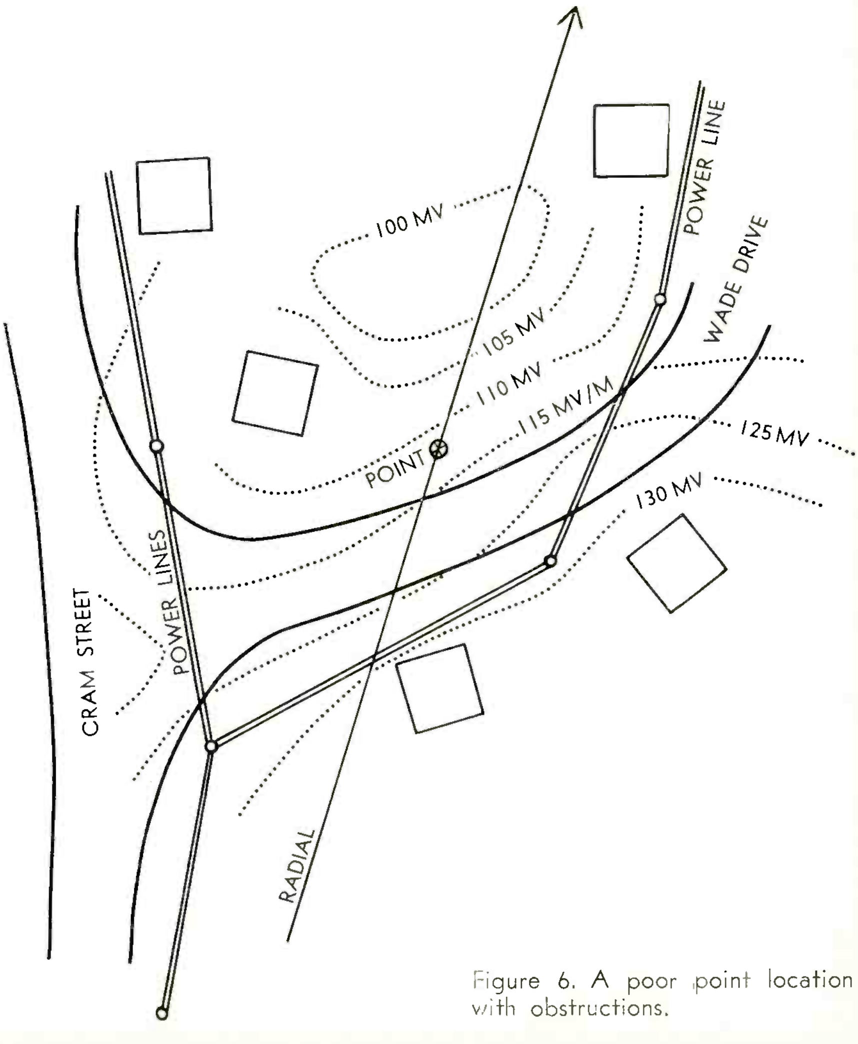

Figure 6. A poor point location with obstructions.

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ter to draw the radials with north as zero degrees, east as 90 degrees and south as 180 degrees etc., see figure 4.

F.C.C. Rules provide for the use of certain maps that are published by the U. S. Coast and Geodetic Survey. These maps are very accurate in most areas. However, they are not always revised frequently and often do not show all the roads and other details in an area. In most states the state highway department prepares and publishes county road maps. These maps are much more detailed than the larger Geodetic Survey maps and usually very accurate. A comparison of county road maps in several states shows that these maps are reasonably uniform in accuracy and suitable for field intensity surveys. With even the best maps it is easy to become lost in some rural areas where one intersection looks like another. A wise precaution would be to carry several maps to allow comparison, the Geodetic Survey map, county road maps along with a state highway map would be advantageous. In some areas a compass is often handy and when used with the field meter, which itself is a good radio compass if nulls are used, a reasonably accurate position fix can be obtained.

Once the maps are selected and marked and the transmitter and antenna adjusted, the field survey can get under way. A convenient arrangement for traveling is to use one person as driver who will operate the field meter also and another person to navigate and keep records. Several other arrangements were tried and this one found to work best. In navigating there is seldom a problem in the city or suburban areas as a point can usually be spotted in visual relation to some land mark. The greatest difficulty comes in locating a point in a rural area where landmarks may not be within sight, here, the distance from some landmark to the point must be measured. Using dividers from a drafting set and the scale of miles on the map the radial can be located as so many miles or tenths of a mile from a landmark. Bridges, intersections, church and school buildings, cemeteries, and pipe and power lines offer the most reliable landmarks. A word of caution here, when using an automobile speedometer to measure the distances, beware of large errors. All speedometers are not accurate and a check should be made for any serious error and this error used as a correction factor. Driving a straight course between well established landmarks several times is an easy way to check the speedometer. In one late model automobile an error of .3 mile over a 10 mile course was found. This represents an error of 3 per cent and was considered small enough to ignore for short distances but was used in checking distances over four or five miles.

After consideration is given to maps and navigation problems the only remaining subject is the selection of the exact positions where the field measurements are to be made. On this subject there seems to be a wide variety of opinions as to what constitutes a satisfactory point. Some say an average of the signal values over a small area; others prefer to use only those points that are completely clear of metallic obstructions. Whatever the method used in selecting points the main consideration is to secure an accurate result, one that can be rechecked with very near identical results. Presented here are some suggestions that grew out of experience in making thousands of measurements over a widely varying terrain and in areas where conductivity ranged from 1 to 30.

First, in selecting a point be certain that it is on the radial line or very close. Errors in lateral distance, that is, to the left or right of the radial, are less important than errors in the station-to-point distance since data analysis is a plot or graph of field strength versus distance from the antenna. This is not to say that it is unimportant to stay on the radial, it is very important, and especially so when checking certain parts of a directional pattern. All points off the radial should be marked as such. Once the approximate position is located the next question is in what exact spot to use. Except for deep narrow valleys and densely wooded areas most any spot would be all right if it were not for shielding and reradiation caused by some buildings, power and telephone wires and occasionally a pipe line. A comparison of Figures 5 and 6 will show the effects of shielding and reradiation.

Figure 4 shows a reasonably good location with obstructions; when unobstructed points are not available locations such as this must be used. To determine if shielding or reradiation are present at a point a check can be made by taking several measurements around the area that are separated by 50 feet or more. If there is no abrupt change in signal or any large changes, say more than 5 per cent, then there probably is little reradiation in the area. If on the other hand, there are large differences within just a few feet then the point may be of little value. In making rural measurements more leeway can usually be found in selecting sites, here it is mostly a matter of staying clear of wires, pipe lines, a fence or a metal covered or metal framed building. Buildings and pipes, in rural areas, are not as bothersome as overhead wires unless the pipeline is parallel to the radial. In any case a spot should be selected as far from obstructions as possible while remaining on the radial. As for overhead wires the most reliable points are usually found on the station side of the wires. One power company estimates that their average line height is 37 feet and this is likely a good average throughout the country. Experiments have shown that a line about 35 feet high may upset signal readings for 50 to over 200 feet from the line. This has been checked repeatedly at different distances from the antenna with stations of different power and though by no means a constant it does indicate that a good rule of thumb would be to avoid overhead wires by at least 100 feet, preferably more. With this in mind, each point should be checked for depth-of-null and the direction of arrival of the signal. This data should be logged as it will be of value in analyzing the survey. Also descriptions of the points should be recorded in sufficient detail to allow relocating the point.

One final suggestion, be prepared to travel through rough terrain, take enough accessories to make the expedition safe and reasonably comfortable. Such items as a first aid kit, a full thermos and a little food may be very useful.

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Tape, Tips and Standards

Field experience has provided information which permits the establishment of optimum tip penetration standards. These are proposed in this article. The definitions of reference points used in establishing this standard, the history of tape-head relationships, and a description of the exact operation of video heads are also covered.

By JOHN KING* and
CHARLES E. ANDERSON†

Definitions

Drum Diameter: The design of the Ampex Television Recorder is based upon a nominal video head drum diameter of 2.06405″. *All measurements are referenced to this diameter.* Because of machining tolerances, individual drums may differ slightly from the reference diameter.

Tip Projection: The tips of the four video heads on each drum assembly extend out from the drum a maximum of 3.7 mils (.0037″) past the reference diameter. This yields a maximum tip-to-tip diameter of 2.06405″ + .0074″ or 2.07145″. The common method of using a dial indicator to measure projection of the tips is valid as a standard measurement under two conditions only:

1. If the diameter of the drum is exactly equal to the reference diameter, or

2. If the dial indicator reading is corrected by the amount the drum is above or below the reference diameter.

As an example, suppose that a drum is measured and found to have a diameter 0.2 mil under the reference diameter. Suppose further that the measured tip projections with an indicator are tabulated as follows:

HEAD	MEASURED PROJECTION	CORRECTED PROJECTION
#1	3.2 mils	3.1 mils
#2	3.3 mils	3.2 mils
#3	3.1 mils	3.0 mils
#4	3.1 mils	3.0 mils

FIGURE 2

To find the corrected or actual projection, half the excess diameter or .1 mil must be subtracted from the measured projection.

Tip Penetration: To assure tight contact between the video heads and the tape, there is negative clearance between the head tips and the tape in the guide. The tape guide is relieved in line with the tips so the tape may stretch as the tip travels across it. *The negative clearance is the tip penetration.*

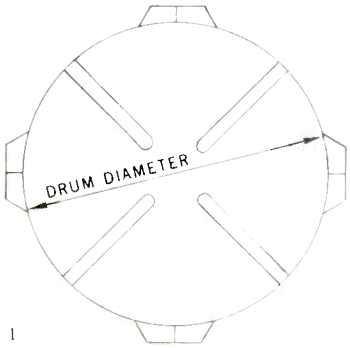

FIGURE 1

*Manager, Video Head Development, Ampex Corp.

†Manager, Video Products Development, Ampex Corp.

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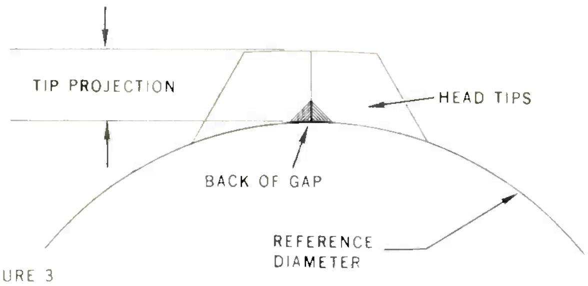

FIGURE 3

Departure Point: As negative clearance is decreased by moving the guide away from the head drum, signal output will remain unchanged until only a small amount of negative clearance (penetration) is left, and intimate contact between head and tape starts to be lost. At this point output will fall and finally reach zero.

Because horizontal movement of the guide away from the drum destroys concentricity between the two, intimate contact will be lost

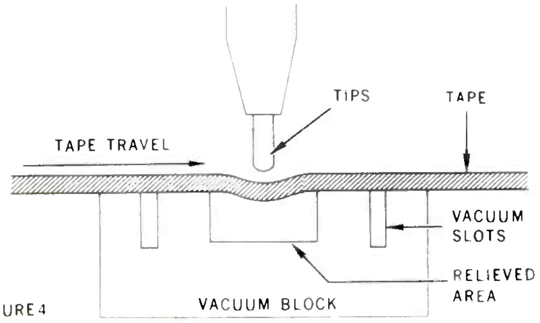

FIGURE 4

CROSS SECTION OF VACUUM GUIDE

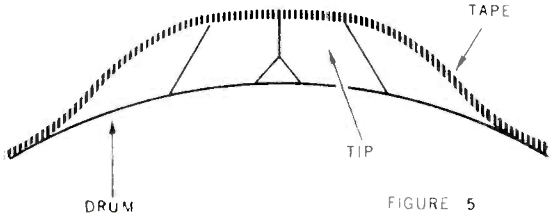

FIGURE 5

first at the mid-point of the head's travel across the tape, and a dip will be introduced at the center of the RF envelope of the head's output, as viewed on a 'scope.

Complete loss of contact between tape and tip is indicated when the envelope dips to zero. This point in the guide's movement is called the "Departure Point" and is the point to which all horizontal guide motion is referenced and to which tip penetration is referenced. To adjust for a given tip penetration it is only necessary to locate the "departure point" and move the guide in the given distance.

Note: In the past the reference point was regarded as the point at which the RF envelope at the output of a preamp just begins to decay, and was referred to as the 'dropout point." The new reference "departure point" is preferable since it can be more accurately reproduced.

Self-compensation: At first glance it would seem that a tape recorded with a given tip penetration must always be played back using the same tip penetration. This is not true. To understand why, let us see what will happen when a tape recorded with a head having 3 mils tip projection is reproduced using a head which has only 2 mils tip projection. We will assume that the recording was made with 3 mils tip penetration. When the tape is played back by the 2 mil head, we find that the tip penetration (when the guide is adjusted to remove skewing) is now only 2 mils! The explanation is this: since the *angular* velocity is held the same during record and reproduce, it follows that the tip velocity must have been greater during the record process due to the larger tip radius; if correct timing is to be maintained, the length of tape traversed by the shorter reproduce tips must be less or, in other words, *less tape stretch* is required; by a happy coincidence, the reduction in tape stretch due to decreased tip penetration is complementary to the reduced velocity due to decreased tip radius.

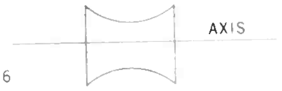

FIGURE 6

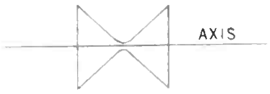

FIGURE 7

The significance of this self-compensation principle can be appreciated if we perform this simple experiment: we record a tape with a head which has a tip projection of 3.5 mils; we use 3 mils of tip penetration; now we simply grind one set of tips down to 1 mil tip projection. If we now reproduce the tape which was recorded when all the tips were equal *we can see no visible defect in the picture!* The reduced velocity of the short tip has been exactly compensated by the reduction in stretch due to reduced tip penetration.

One important idea to be kept in mind is that the stretching will be a localized affair. The effect of stretching is shown in the exaggerated figures that follow. The position of equally spaced recorded pulses on the tape is indicated by black bars on the cross section of the tape.

Facts to Note

1. The head will sweep the same angle in the same time regardless of amount of tip projection.

2. The peripheral speed of the tip is greater with more projection, but the local stretch of the tape bal-

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ances out the increased speed by increasing the separation of the pulses on tape.

3. The horizontal position of the guide relative to the chrome surface of the drum remains essentially constant throughout the life of a head, and tip penetration decreases as the tips wear down.

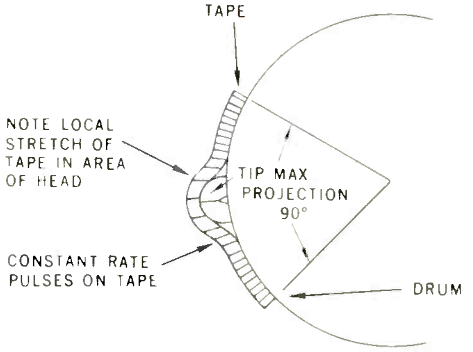

FIGURE 10

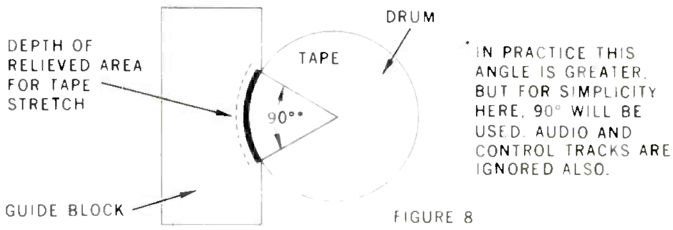

FIGURE 8

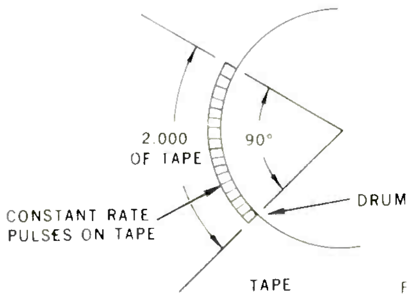

FIGURE 9

Recording Radius: Recording Radius is defined as the distance between two points. One of these is the rotational center of the head drum. The other is the center of the arc occupied by the *unstretched* tape coating in the vacuum guide. Recording Radius is a unique dimension because heads adjusted to common Recording Radii will record and play back tape interchangeably *without resetting*, over a wide variety of conditions of head wear and actual drum diameter. Thus a standard horizontal setting of the vacuum guide may be completely defined by establishing a standard Recording Radius dimension.

To see why this is so, a few examples may be useful. If the vacuum guide is set so the Recording Radius is greater than the radius of the head tips, then the unstretched tape will not touch the revolving heads. If the Recording Radius is exactly equal to the tip radius, then the tips will just graze the center of the tape coating arc in the vacuum guide. But if the Recording Radius is *less* than the tip radius, then the head tips will stretch the tape into the vacuum guide groove in the normal manner. Under this condition, the tape is unstretched at the center of the vacuum guide only in those moments when head tips are well away from this point, but the Recording Radius is still a clearly definable and real dimension.

It may now be seen that we are describing *the same condition* when we call for a Recording Radius of 1.0315 inches as we are when we call for a setting of the vacuum guide "inward from the departure point a distance equal to corrected tip projection plus ½ mil." Corrected tip projection is nothing more than the projection of the tips beyond a reference radius of 1.0320 inches (half the 2.06405 reference diameter, given previously). So if we move the guide toward the drum from the departure point a distance equal to corrected tip projection, and then ½ mil more, we will have moved the unstretched face of the tape coating to a position which is now exactly defined also with respect to the rotational center of the drum, at a radius of 1.0315 inches.

The next question to arise is "what constitutes optimum guide position?" Several factors must be considered in arriving at an answer to this question. Experience has shown that satisfactory operation is possible with tip penetration between 1 and 4.5 mils.

Greater tip penetration accelerate tape wear and may cause permanent distortion of the tape. Tip penetration of less than 1 mil aggravate drop-out activity and may cause clogging of the heads.

The closest relationship between drum and guide must never permit tip penetrations to exceed 4.5 mils. Since the maximum tip projection of new heads is 3.7 mils, the guide must never be closer to the drum than the tip projection plus .8 mil.

Going to the opposite extreme and positioning the guide to provide 1 mil of tip penetration with a new head would result in maximum tape life. But head life would be shortened to an intolerable degree since any head wear would reduce the tip penetration below the 1 mil limit. Somewhere between these two limits a position exists which provides the most favorable balance between tape and head life.

History of Tip Engagement Standards: When the Ampex Videotape Recorder appeared in 1956, tape manufacturers faced a very difficult problem. The new recorder placed demands on the tape that were greater than ever before. Early tape had a habit of shedding its oxide coating, which allowed oxide to collect on the heads and clog them. When sufficient tip penetration was used, the heads could be made to keep themselves clean. On these early tapes at least 3.0 mils penetra-

(Continued on page 24)

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"*More than $3,000 a week in billing* – both announcement and program – dependent on one Ampex tape machine. That's a typical week here at Channel 5," says Fred Fletcher. "We've been in business with *Videotape** for slightly over two years and our *one* machine shows 3,272 hours of use and service . . . Ninety percent of our political business last fall was on tape. I don't say we wouldn't have gotten it on a live basis, but it was easier, less costly, and much more convenient to candidates, having the busy grass roots schedules they do . . . Sure, we see every reason for getting a second machine – and we shall eventually, but we've done a phenomenal job with one for two years. There's no question about our choice of Ampex. They are TV tape recording, no doubt about it." • • • • To get an informative file of reports from your associate TV broadcasters showing how an Ampex VTR fits in as a basic, pay-its-own-way component of any complete TV facility, write to Ampex today. Department EF.

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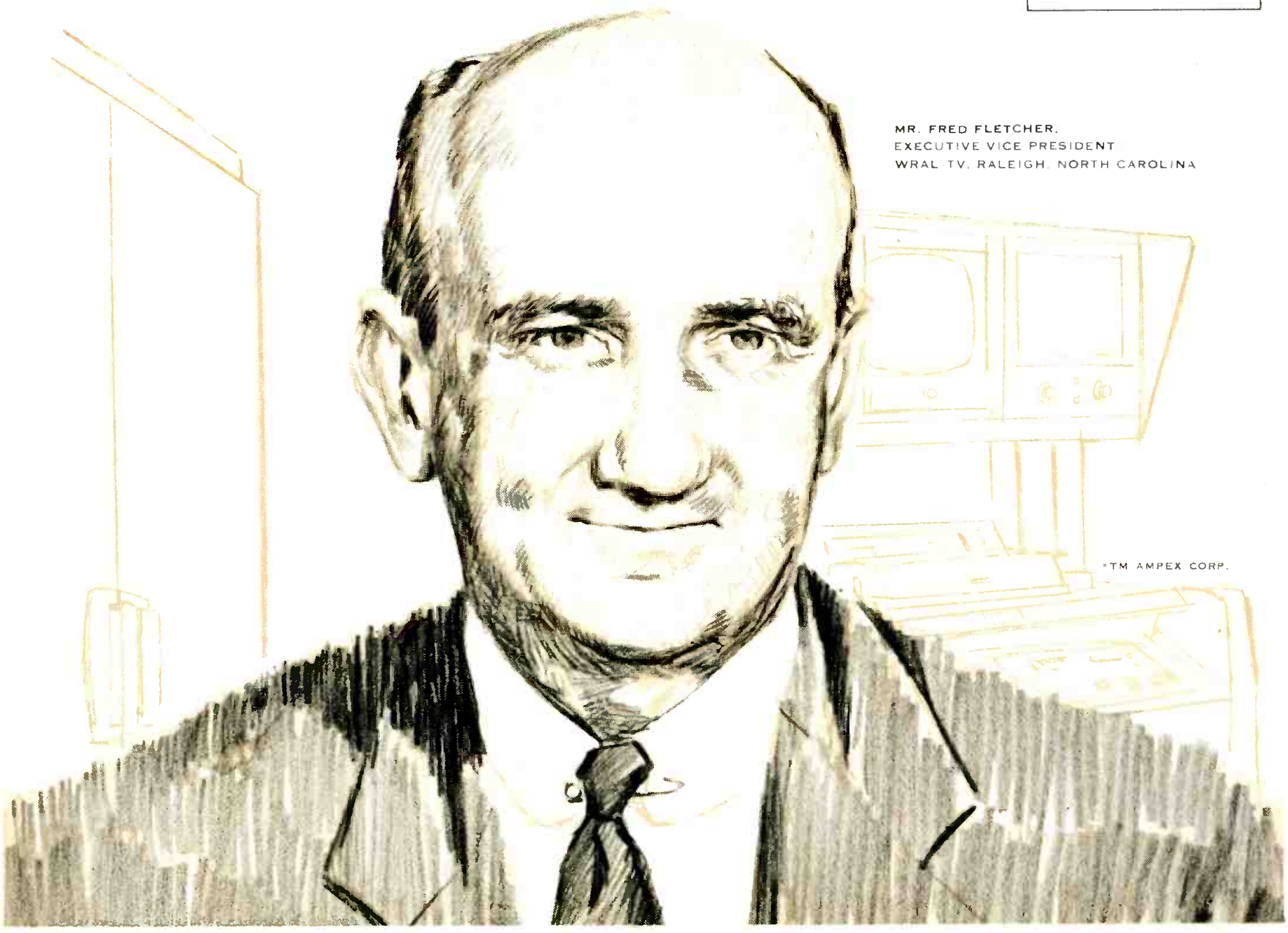

MR. FRED FLETCHER,
EXECUTIVE VICE PRESIDENT
WRAL TV, RALEIGH, NORTH CAROLINA

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MULTIPLEXING / 1961

A review of the principles of FM multiplexing together with an outline of the advancements made during recent years.

By DWIGHT HARKINS*

IN THE SPRING of 1955, the Federal Communications Commission issued rules and regulations that permitted FM broadcast stations to transmit supersonic subcarriers in addition to the regular modulation components intended for the general public. In the original rule making, usage of the subcarriers was limited to functional music or storecasting type of service. A Subsidiary Communication Authorization (SCA) was issued to those stations desiring to enter this service.

The Commission's ruling was based upon the technical fact that the transmission of supersonic tones between 20,000 cps and 75,000 cps did not in any way interfere with the normal function of the FM station nor did it cause the transmitted signal to occupy more than its allocated bandwidth of the spectrum. In addition, the Commission specifically indicated its desire to provide an economic "shot in the arm" to the FM phase of the broadcast industry.

This new "art" got off to a bad start, however. In early 1955, when the F.C.C. first made it available to the broadcasters, little was known about the practical application of multiplex. Transmitters and receivers were not generally available nor properly field tested. In fact, the only way a station could multiplex was by making a conversion to the existing transmitting equipment.

Although the unique characteristics of frequency modulation permitted the transmission of tones well beyond the range of hearing, the existing transmitting equipment was not designed for this type of service. At first, it appeared that the "bottle neck" was in the exciter portion of the transmitter. The modulation and frequency multiplication processes of the original transmitters were incapable of accommodating the supersonic subcarrier without intermodulating it with the regular main channel products. In other words, reception of the subcarrier carried with it undesirable interference from the main channel.

After an exciter was developed that overcame these "crosstalk" difficulties, early installations revealed that other portions of the system also contributed to the problem. Such things as poor neutralization and improper loading between power stages together with mistuned transmitting antennas became critical. And to add insult to injury, the receiver was found guilty of serious "crosstalk" and noise problems.

In spite of these shortcomings, commercial multiplexing became a reality. To a degree of success closely related to the engineering perspicuity of the individual station, multiplexing can now boast thousands of locations receiving service throughout the United States. The recent improvements in transmitting

(Continued on page 25)

Articles Carried in Broadcast Engineering in 1960 on FM and Multiplexing

Subcarrier Generation in Multiplex Exciters	January
Multiplex Monitor Design	February
Multiplex Monitor Design	March
Multiplex Reception-Heterodyning vs Selective Filtering	March
FM Transmitter Measurements	April
FM Antenna Design Considerations for Multiplexing	May
FM Multipath Transmission Vagaries	June
FM Multiplexing Regulations Finalized	June
Planning an FM Station	July
A Modern FM Transmitter Design	August
A Multiplex Subcarrier Generator	September
The 99th Cause of Crosstalk	September
More Multiplex Profits from Selective Muting	November
Multiplex Receiver Installation	December

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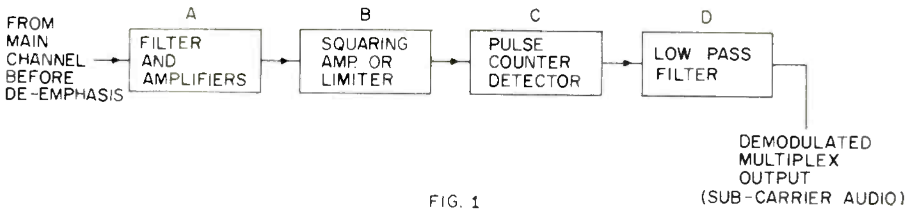

FIG. 1

Modulator Demodulator Circuitry

A discussion of the various methods of subcarrier recovery in FM multiplex reception.

By J. BRUCE GLABB*

In recent months since multiplex transmission has been accepted as a commercial part of an FM system, receiver design engineers have been exerting efforts toward producing the highest quality sound reproduction possible from existing sub-carrier circuit techniques.

Closely associated with this has been the specialized control circuitry required in selective muting, automatic muting and other adaptations to fit particular needs in the field. Since basic multiplex demodulator circuits can be used without the foregoing elaborations, they will be discussed first.

Initial attempts at demodulation of the sub-carrier embodied a simplified approach, and were as straight-forward as possible. The elements involved were amplifier stages, filters, limiters, and various detection systems applied in a variety of ways.

Since the multiplex modulating frequency is a carrier frequency modulated by audio, it would appear that an amplifier of the required bandwidth at the carrier frequency, a limiter and a discriminator would do the job adequately.

This did not satisfy the problem, however, because of the wide relative bandwidth required at the low frequencies involved. 32.5 KC was the original sub-carrier frequency and a ±7.5 KC swing was accepted as 100 per cent modulation. In 1956 two other approaches came to light. Heterodyning of the sub-carrier to a higher frequency (particularly 455 KC where IF transformers and discriminators were available) was dropped due to complicated alignment procedures and lack of reliability, in favor of pulse counting detectors and computer circuitry in general.

Unfortunately, the information published on pulse type detectors and their operation is sparse, and generally on a highly technical level. On the lighter side, however, is the fact that once properly designed, circuits work with very little trouble and require no adjusting. The latter advantage is more than casual when it is realized that carrier conversion at multiplex frequencies requires oscillators working very close to the carrier frequency, and a slight "miss" in adjusting may mean peaking the IF amplifier at the oscillator frequency.

There are also a multitude of adjustments on the extra IF strip along with the difficulty of truly tuning an over-coupled transformer as such, and not converting the whole amplifier to a stagger-tuned arrangement with phase non-linearity worse than encountered in the main channel IFs; a problem that encourages cross-talk. Then there is also another discriminator capable of drifting off tune.

Conventional IF amplifiers and discriminators are commonplace and they cannot be treated as specialized circuits. However, pulse counting detectors are a different story

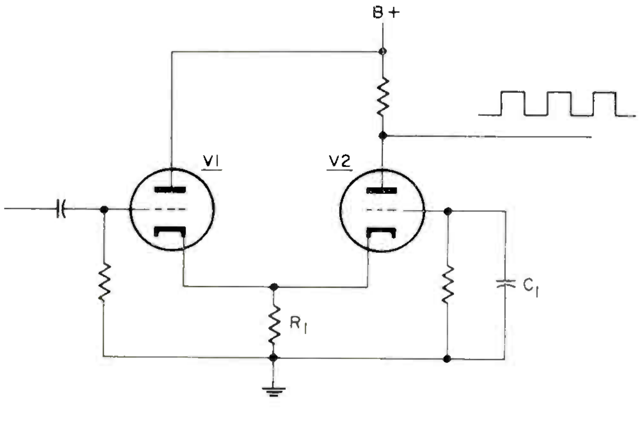

FIG. 2
CATHODE COUPLED CLIPPER

*Project Engineer, Electro-Plex Division, Nuclear Electronics Corp., Philadelphia, Pa.

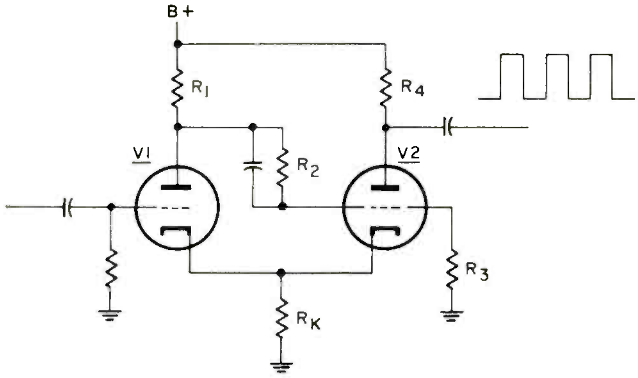

FIG. 3
TYPICAL TRIGGER CKT

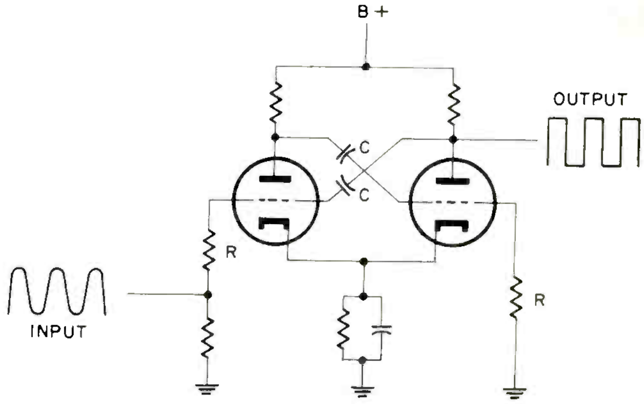

FIG. 4

and considerably more expression is possible in varied circuit approach.

In Fig. 1 we have a general arrangement of a typical multiplex demodulator. The input to A is the main channel program, subcarrier(s) and selective muting tones, if used. All but the desired sub-carrier band is rejected by the filters and amplifiers.

The amplifiers are conventional audio frequency types and the filters are band pass types designed to the center frequencies of the carriers involved. All that appears at B will be an amplified level of subcarrier. Section B may contain anything from conventional grid limiters to multivibrators. The three most common circuits will be described. They are:

The cathode coupled clipper: This circuit performs the function of creating from the sine waves of the previous amplifier stage, square wave pulses of given amplitude regulated by the circuit components. In Fig. 2 it will be noted that as the grid of V1 goes more positive, more current flows in that section. This will cause the voltage across the cathode resistor R1 to increase, ultimately to the point that the voltage, acting as bias on V2, will cut V2 off. Likewise, a negative voltage applied to V1 will cut V1 off and no signal will pass. Actually the tube acts like a voltage window, above and below which the tube will pass no signal. It will be noted that C1 is used to by-pass audio on the grid of V2 to keep it at ac ground.

The trigger: This device is actually a voltage sensitive multivibrator which will remain in one state until its voltages are changed to a certain extent and then it will flip to its other state until the voltages return to their original values. By referring to Fig. 3 it will be seen that the current normally flowing through V1's plate load resistor R1 will cause a plate voltage which will divide and appear on the grid of V2. This positive voltage will cause a current flow in V2 and Rk. The voltage across Rk appears as bias to both sections but in tending to further cut off V1, it raises its plate voltage and this further causes V2's grid to go more positive. This leads to the condition of saturation in V2 and cut-off in V1. If then the voltage on V1 was to be made positive, current would start to flow through it and its plate voltage would start to drop. This would cause the stage to finally flip over to V1 conducting and V2 cut-off. Of course as soon as the voltage on the grid of V1 was to be removed, the circuit will flop back to its original state. As a sine wave or other voltage approaches the point that V1 conducts, the stage will rapidly flip over to its other state and as the voltage decreases to the point at which the stage will not be held on, the stage rapidly flops back and therefore the voltage out is a square wave varying in width with frequency.

Synchronized multivibrators: These circuits are often used as limiters and are on the free running multivibrator which will flip and flop at a rate set by the R-C time constants in the grids of the tubes involved.

Actually the waveshape need not be square and often is a triangular pulse. Basically, this type of multivibrator is made to free run (oscillate) at a lower rate than the lowest instantaneous frequency to be encountered. A small amount of sub-carrier frequency is fed into the grid of the multivibrator and the stage flips at that rate rather than wait for the full time constant of the grid circuits. This type of forcing circuit is common in almost all TV set sync circuits. Refer to Fig. 4 which shows a typical free-running multivibrator circuit, the output at B is virtually always square wave. Referring again to Fig. 1, C will almost always contain a differential pulse type counter circuit or another multivibrator.

The differential pulse counter is relatively easy to understand and the reason for its inherent low distortion will become evident with an understanding of its operation. If, in

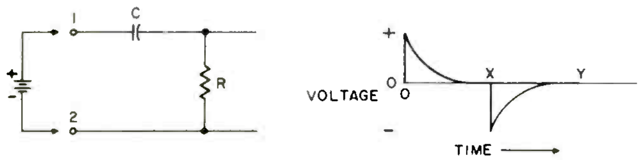

FIG. 5

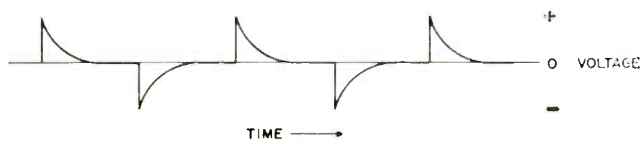

FIG. 6

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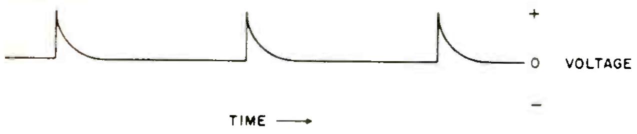

FIG. 7

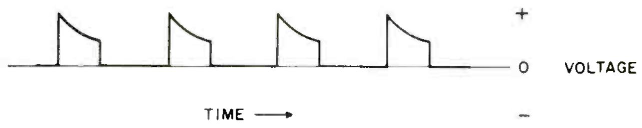

FIG. 8

Fig. 5, we were to connect a battery across terminals 1 and 2, at time zero, a high current would flow through the network and the voltage would be a maximum across the reisstor because of the current flow through it. At a predetermined rate, the capacitor will become fully charged and no further current will flow. The voltage across the resistor is therefore zero. Removal of the battery at this time will have no effect on the circuit. If we now reverse the battery polarity, maximum current will flow again to discharge the capacitor and charge it to its new polarity. This action is shown from time x to y on the curve. The battery is connected at time x and the capacitor becomes charged by time y. Relative times are determined by the sizes of capacitor and resistor and will always have the same relative rate of decay. Now if we were to switch the battery at a rapid rate and use a time constant R times C which is short compared to the time between switches, we would get a train of positive and negative pulses as shown in Fig. 6. The average of all the pulses is zero since the minus pulses are cancelled out by the plus pulses. If we now get rid of the minus pulses we would have a pulse train similar to Fig. 7. (We could have gotten rid of the plus pulses just as easily and not affected the operation of the circuit.)

Each of these pulses contains a little bit of energy, the exact amount depending on the amplitude and width of the pulse. If we were to add all these energies in a capacitor we would get a definite output voltage. If we were to double the number of pulses in a given time (frequency) we would get twice as many bits of energy to add together and therefore twice as much output.

There are limitations to this type of circuit with regard to its output capability. These limits are set by C and R in Fig. 5. Deviation in the time constant value can result in distortion when a new pulse starts before the previous one reaches zero. This condition is shown in Fig. 8. Now if we were to switch the input with a square wave, we could make our time constant much smaller and handle many more cycles in a given time. If the square wave frequency were to vary, the amount of output determined by the number of pulses per second would vary proportionately. This is the way the differential pulse counter operates. A typical circuit is shown in Fig. 9. In operation, a square wave is impresseed on C1. On positive halves of the cycle the crystal diode CR2 conducts and the path of current is from ground through R1, CR2 and charges the capacitor.

On negative halves of the cycle CR1 conducts and capacitor C1 charges to the opposite polarity through CR1. This eliminates any possibility of voltage appearing across R1 on this part of the cycle and satisfies the conditions for Fig. 7. Resistor R2 is high in value compared to R1 and is used as a voltage probe to sense the voltage across R1. C2 stores the pulses that appear across R1 and gives the average. This is actually an integrating network and two or three more of these stages would remove any variations due to the sub-carrier without seriously affecting the audio frequencies present. Low pass audio filters may also be used instead of integrators after this type of detector.

In some applications and certain receivers, the output of the differential pulse counter type of detector was either too small or it was desired to improve the signal to noise ratio and a certain type of multivibrator was used instead of the differential pulse counter. Basically this type of detector generates one pulse of constant shape no matter what the frequency and then the pulse suddenly returns to zero after a predetermined time. In Fig. 10 a circuit and the wave shapes normally encountered are shown. It will be noted that the integrator or filter are the same, but the differentiated pulse, or triggering spike, is applied to the grid which causes the tube to trigger much as in the case of the circuit in Fig. 3 but here there is no resistor from grid to plate and after the time constant of the capacitor C1 decays, the circuit will reset and await the next triggering pulse.

It is hoped that through the foregoing circuit explanations, a better understanding of multiplex detection circuits may result.

The versatility of pulse circuitry lends itself admirably to multiplex work, and every opportunity where it can be used is extremely advantageous as far as performance and maintenance is concerned.

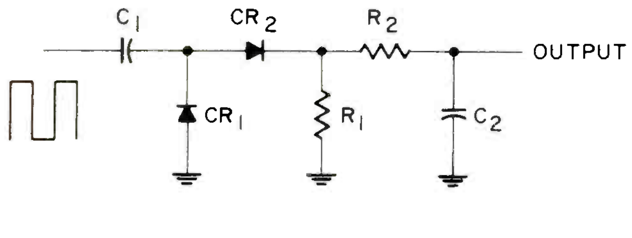

FIG. 9

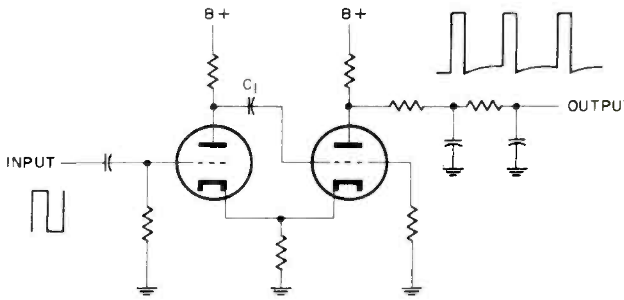

FIG. 10

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". . . condensors supply plate voltage for oscillators . . ."

CHIME GENERATOR starts on page 4

Figure 1, the bottom three relays are engaged or energized during the standby period. The upper of the four relays remains in the normal or deenergized position.

The four-microfard condensers are charged to a potential of plus seventy-five volts during the standby period. These condensers supply plate voltage to the oscillators when the keying system is activated. This is the only source of plate voltage for the oscillators and the capacity value of four microfarads seems to be about optimum for fading of the oscillator output prior to the keying of the next tone burst.

Now, let us follow the sequence of events as the relays go through their motions. Momentarily depressing the trigger switch energizes the upper relay, pulling its contacts to the down or closed position. The "A" contacts (those closest to the armature) lock this relay shut and at the same time remove the holding voltage source from the next relay. However, this relay is held closed by virtue of the 12-microfarad condenser bridged across its coil. This relay releases when the voltage across this condenser is expended through the resistance of the coil. Upon release of this relay, holding voltage is removed from the third relay, and so forth until the bottom relay releases. The contacts on this last relay release the upper relay, reversing its contact arrangement and closing the three lower relays once again.

The relays shown on the diagrams are Potter and Brumfield "L-M" series. The uppermost relay on the schematic has a coil resistance of 5,000 ohms while the remainder of the relays have coils of 10,000 ohms resistance. Using these relays and the values of holding condensers shown on the drawings, very good timing of the tone bursts is achieved. Relays of another manufacture or with different coil resistances will require holding condensers of another value. The resistors in series with each of the relay coils are included to limit the current flow through the coils to a value of around seven milliamperes during stand-by periods.

The power supply is straightforward in design. The gaseous-regulator tube provides a stable source of potential for the plates of the oscillator tubes. This regulated voltage insures that the tones obtained from the generators will not vary in pitch due to variations in supply voltage. The relays do not require this regulated voltage since the relatively high-impedance of the circuit makes it somewhat self-regulating and any excursion of the holding voltage will affect all the relays in an equal manner.

Construction of this unit was made on an aluminum chassis measuring 7 x 9 x 3 inches. This size chassis allows room to mount the transformers, tubes and relays and still affords adequate separation between the audio and power supply components. The audio tubes are mounted in vector-type sockets. Use of this type of socket gives the builder the opportunity to completely wire the audio stages and check them out prior to installing them in the chassis. After mounting the sockets, it is only necessary to run the power and interconnecting leads from the oscillators and amplifiers to their respective points under the chassis. The relays were mounted, in-line, along a top edge of the chassis. Power and control leads are passed from the coils and contacts through rubber grommets to the underside of the chassis.

Power, output and control leads are brought to a six-terminal barrier connector strip on one wall of the chassis. A plug and socket arrangement could be incorporated here if desired, but the screw terminals on the barrier strip provide quick and easy access to the unit if it should be desired to include control of the unit from more than one point.

One word of caution. The switch terminals are roughly 250 volts above ground. Therefore, make sure that these terminals are not exposed or otherwise made accessible to personnel unaware of this potential danger. The remote switch, likewise, should have its terminals concealed to prevent accidental bodily contact with them.

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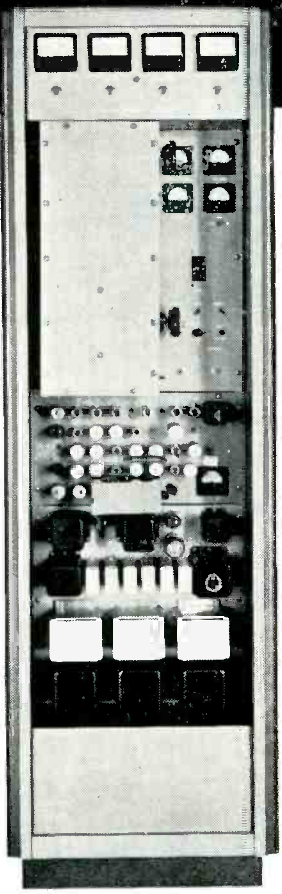

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". . . number of dropouts was now the limiting factor . . . "

TAPE starts on page 14

tion was necessary to ensure that clogging would not occur. As tape improved it soon became feasible to operate with much less tip penetration. Head clogging was no longer the problem; instead the number of dropouts became the limiting factor. A tip penetration equal to corrected tip projection plus .5 mil from the departure point was adopted as standard. As we have seen this is equal to a Recording Radius of 1.0315 inches.

Tape quality has continued to improve and Ampex engineers agreed with many recorder users that the time was appropriate to decrease tip penetration. Several significant advantages result from the decrease. The ability of the video recorder to handle splices is enhanced. Also, head and tape life are extended. There is a slight adverse effect on the dropout count when using well worn heads with low tip projection since below a certain penetration the number of dropouts increases with further decreases in tip penetration. This condition is important, however, only when using new tape. It has been shown that after tape becomes worn in, the dropout count is practically independent of tip penetration, in the range of tape-to-head pressures with which we are concerned.

The new standard guide position is .5 mil further out than the previous one. It is arrived at by moving the guide in from the departure point a distance equal to corrected tip projection. This position is equal to a Recording Radius of 1.0320 inches.

This newly proposed operating position can be obtained with or without a test tape. Without a tape it will be necessary first to measure with a micrometer the diameter of the head drum, establishing exactly the diametric distance from opposite chrome drum surfaces. Then measure the tip projection of the No. 1 head. Divide drum diameter by 2. Add to this the tip projection. Subtract 1.0320 inches from the total of drum radius and tip projection. Adjust the vacuum guide to the departure point. Then move the guide inwards exactly the distance obtained by the above subtraction. Use dial indicator for measurement, since this is more accurate than the remote control calibration.

As the new standard was proposed, Ampex began producing reference tapes accurately made to the new standard. Operationally, guide position may be most easily and accurately set by obtaining one of the new reference tapes. The procedure is as follows:

1. Place auto compensation in the manual mode.

2. Position tip projection control to zero (previous procedure called for positioning this control at the red arrow).

3. Reproduce the reference tape and adjust the Allen head screw in the guide actuating arm to remove skewing in the picture.

After these adjustments have been made, it will be possible to measure tip projection by rotating the tip projection control counterclockwise until the departure point is reached. Approximate tip projection may then be read opposite the index mark on the tip projection control.

Interchangeability

With the old standard, heads could many times be worn down until the tip projection reached 0.5 mil or less. With the new standard it will be advisable to retire heads when their tip projection reaches 1 mil. At this point the tip penetration will be 1 mil which is the practical minimum. Heads which have tip projection below 1 mil may play back tapes made to the old standard satisfactorily but may be unusable on tapes made to the new standard. If tapes made to the two different standards are spliced together, skewing will be visible in the picture for about two or three seconds after the passage of the splice, while the automatic compensator acts.

Summary

The new guide position standard should improve both head and tape life. Even though the amount of permissible wear on the heads is less, the number of head hours is increased because of the lower rate of wear. In addition, the ability of the recorder to handle splices will be improved.

". . . new types of equipment are rapidly appearing . . ."

MULTIPLEXING starts on page 18

and receiving equipment point to even faster growth in the near future.

During the past, this journal has published many technical articles describing the various facets of multiplexing. Those who are planning future multiplex operation can use this material for becoming acquainted with the processes required. Whether it be modification of existing transmitters or a complete new installation, the transmitting system must be capable of accommodating supersonic tones without causing intermodulation. Several methods of generating subcarriers are now available—new type monitoring equipment is rapidly appearing, and receiver improvements are constantly being made.

The Commission does not regulate the operating parameters beyond the extent of requiring the subcarriers to lie between 20 Kc. and 75 Kc. and not to modulate the main channel more than a total of 30 per cent. It is then up to the station to determine how many subcarriers to use and what the center frequency of each should be. The bandwidth requirements of each subcarrier together with harmonic interference problems has limited multiplex to a total of two subcarriers with reasonable frequency response.

During 1960 the Commission issued new rules regarding the use of Subsidiary Communication Authorizations that permitted much wider use of subcarriers rather than limiting them to functional music type applications. Under the new rules, subcarriers may be used for relay of programs, telemetering of transmitters and other usages of a broadcast nature.

The Commission has before it proposals that will permit multiplexing to be used for transmission of stereo broadcasts to the public. Unlike the SCA multiplex signals, the stereo broadcasts must all meet the same standards so that the public may purchase receivers that all operate on the same principle.

In order to evaluate the many different methods proposed, a National Stereophonic Radio Committee was formed to field test systems for transmission and reception of compatible stereophonic sound over a single F.M. channel. Six systems were tested by the NSRC using KDKA-FM at Pittsburg. The engineering data now on file with the Commission reveals thousands of measurements relevant to frequency response, distortion, separation between channels, crosstalk and spectrum utilization.

From all of the complex information it is impossible to draw any conclusions as to what system the Commission will choose. A decision is expected the first part of this year. In one way or another, each proposed system uses a portion of the 20 Kc. to 75 Kc. allocated for multiplex use. Since the amount of "subcarrier spectrum" used varies with the proposed systems, the forthcoming decision of the F.C.C. will also determine whether or not a transmitter can be used for both stereo service and SCA service or for just one or the other by itself.

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AMENDMENTS AND PROPOSED CHANGES OF F.C.C. REGULATIONS

Channels 5 and 6 Are Not Available for TV Translator Use in Alaska and Hawaii

On July 27, 1960, the Commission adopted a Report and Order in Docket No. 12116 amending Part 4 of the rules to provide for the licensing of television broadcast translator stations on VHF television channels. Section 4.702 failed to note that the frequency bands 76-82 Mc and 82-88 Mc (television channels 5 and 6) are allocated for nonbroadcast use in Alaska and Hawaii and, consequently, are not available for use by VHF translators in those states.

The amendment adopted herein is corrective only and therefore may be accomplished and made effective without compliance with the public notice, procedural, and effective date requirements of section 4 of the Administrative Procedure Act.

Authority for the amendment herein is contained in sections 4 (i) and 303 (c), (d) and (f) of the Communications Act of 1934, as amended, and section 0.341 (a) of the Commission's Statement of Organization, Delegations of Authority, and Other Information.

Accordingly, it is ordered, That, effective December 15, 1960, § 4.702 (b) of the Commission's rules and regulations is amended; the paragraph reading as follows:

§ 4.702 *Frequency assignment.*

* * * * *

(b) Any one of the 12 standard VHF channels (2-13 inclusive) may be assigned to a VHF translator on condition that no interference is caused to the direct reception of any television broadcast station operating on the same or an adjacent channel: *Provided, however,* That channels 5 and 6 are allocated for nonbroadcast use in Alaska and Hawaii and will not be assigned to VHF translators in those states.

Requirements for Frequency Monitors

In the matter of amendment of Part 3 of the Commission rules governing TV broadcast stations concerning requirements for frequency monitors. Docket No. 13854.

1. Notice is hereby given of proposed rule making in the above-entitled matter.

2. In November 1955, the Commission adopted a Report and Order in Docket No. 11094, which for the first time required television broadcast stations to have an approved frequency monitor in operation during all periods of operation of the station. Since no approved monitors were available at that time, the time for compliance with the rule was set forward to June 1, 1957. This date has subsequently been extended, the most recent extension having been made by order adopted November 16, 1960 (FCC 60-1379) which extended the time for compliance to February 28, 1961. In the extension Orders the Commission stated that it would review the requirement for frequency monitors to determine whether it was still needed.

3. The development of new and better frequency controls and the crystals used therein for television broadcast stations has improved the stability of transmitters to the point where their short term frequency stability is approaching that of the currently available frequency monitors. There have been relatively few incidents where TV stations were found operating beyond their frequency tolerance and in some of those the off-frequency operation came about because the operator attempted to adjust the transmitter frequency to agree with the frequency monitor indication but the frequency monitor had drifted off-frequency.

4. The lack of long-term frequency stability in currently available monitors makes it necessary to check them with an external frequency source of known accuracy at periodic intervals. In most cases the standard frequency transmissions of WWV, operated by the National Bureau of Standards, are used. One of the most commonly used procedures is to check the operating frequency of the transmitter and then correct the monitor to agree with the known transmitter frequency.

5. In view of the foregoing, we believe that the requirement that a continuously operating frequency monitor be installed at television broadcast stations can be eliminated and licensees permitted to compare the operating frequency of the station with an external frequency source of known accuracy at sufficiently frequent intervals to insure that the operating frequency is main-

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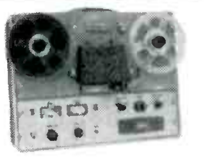

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tained at all times within the prescribed tolerance. This frequency check should be made as often as necessary to insure compliance and, in all cases, at least once each day. The choice of measuring equipment and the method employed is left to the discretion of the licensee but must be technically sound. Stations desiring to maintain continuously operating frequency monitors of suitable design may continue to do so. However, the daily checks against a frequency source of known accuracy must still be made.

6. It is proposed to amend § § 3.663 and 3.690 of the Commission rules as set forth below and to delete § 3.693.

7. Authority for the issuance of the proposed amendments is contained in sections 4 (i), 303 (e), (f) and (r) of the Communications Act of 1934, as amended.

8. Pursuant to applicable procedures set out in § 1.213 of the Commission's rules, interested parties may file comments on or before December 26, 1960, and reply comments on or before January 6, 1961. In reaching its decision on the rules and standards of general applicability which are proposed herein, the Commission will not be limited to consideration of comments of record, but will take into account all relevant information obtained in any manner from informed sources.

9. In accordance with the provisions of § 1.54 of the Commission's rules and regulations, an original and fourteen copies of all statements, briefs, or comments filed shall be furnished the Commission.

1. Delete § 3.690 *Frequency monitor* and substitute the following:

§ 3.690 *Frequency measurements.*

(a) The operating frequencies of the visual and aural transmitters shall be checked at sufficiently frequent intervals to insure that they are within the prescribed tolerance and in any event at least once each day. A frequency monitor or other frequency source of known accuracy, independent of the frequency controlling elements of the transmitter, shall be used for this check. The determination may be a measurement of the actual operating frequency of the station or a multiple or sub-multiple thereof, or in terms of the difference between the actual operating frequency and the assigned frequency without regard as to whether the difference is plus or minus.

(b) The frequency monitor or other frequency source employed for the above check shall be capable of supplying a reference signal at the time the check is made, that when compared with the standard frequency transmissions of the National Bureau of Standards, is accurate to within 10 per cent of the allowable frequency tolerance at the operating frequency of the station and shall maintain this accuracy during the period required for the frequency check.

(c) The frequency monitor or other frequency source employed for the above frequency determination shall be checked against the standard frequency transmissions of the National Bureau of Standards at sufficiently frequent intervals to insure that the required accuracy is maintained and in any event at intervals no longer than one month.

(d) If a commercial frequency measuring service is employed for the periodic checks of the operating frequency, the licensee of the station shall secure a written statement from the organization performing the frequency measurements giving the guaranteed accuracy of their measurements and the frequency with which their equipment is checked against the standard frequency transmissions of the National Bureau of Standards. This statement shall be posted or filed at the operating position of the station.

§ 3.692 [*Amendment*]

2. Delete the words "frequency" and "and" from the heading of § 3.692.

3. Delete § 3.693 *Requirements for type approval of frequency monitors* and substitute the following:

§ 3.693 [*Reserved*]

§ 3.663 [*Amendment*]

4. Delete subparagraph (iii) of § 3.663 (b) (4).

5. Add the following subparagraphs to § 3.663 (b):

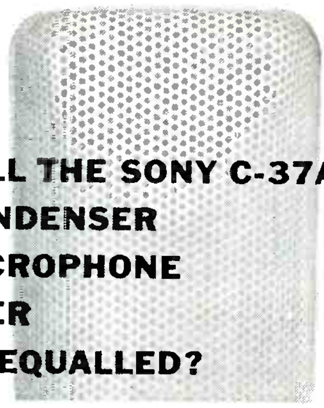
6) An entry showing the time and date of each check of the operating frequency against a frequency source of known accuracy, giving the method used, the deviation noted, and any correction made in the operating frequency. If a fixed routine is employed for such checks, the detailed description of the method may be posted or filed at the operating position and the log entry merely refer to the posted or filed description.

(7) An entry showing the time and date of each check against the standard frequency transmissions of the National Bureau of Standards, of the equipment used to check the operating frequency of the transmitter, giving the method used, the deviation noted, and any correction made. If a fixed routine is employed for these checks, the detailed description of the method may be posted or filed at the operating position and the log entry merely refer to the posted or filed description.

§ 3.694 [*Amendment*]

6. Delete paragraph (a) of § 3.694 *Requirements for type approval of aural modulation monitors*, and redesignate paragraphs (b) through (e) as (a) through (d) respectively.

(Continued on page 38)



Probably. Within the next 5 to 6 years other manufacturers may learn the Sony technique of producing the remarkable gold membrane used in the C-37A diaphragm capsule.

Until then, the Sony must be considered the only perfect microphone in the industry. $295
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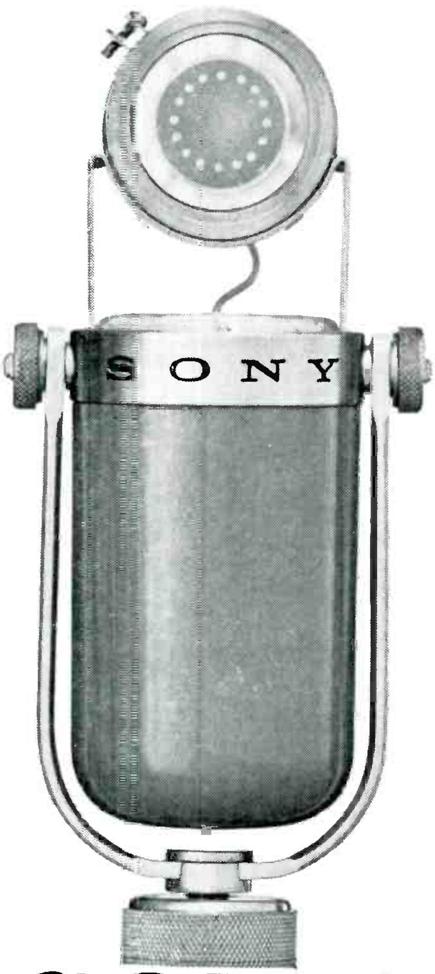

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Miniature Audio Input Transformer, low-level input
Miniature Hermetically-Sealed Output Transformer, 400 cps, high level

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Single-phase, oil-immersed unit rated at power level of 26KVA. Frequency response of ±.5 db from 20 cps to 5 KC. Above resonant frequency, at 28 KC, attenuation slope and phase shift are smooth and without irregularity. Suited to such applications as driving high-power shaker tables.

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Industry News

Named Broadcast Consultant Coordinator

George C. Wetmore has been appointed broadcast consultant coordinator of Collins Radio Co. with offices in Washington, D. C. Wetmore, formerly a staff engineer with Page, Creutz, Steel & Waldschmitt consulting firm, will hold a full-time position for the purpose of supplying to consulting engineers and attorneys practicing before the F.C.C. all information and materials connected with Collins broadcast equipment and services. His new office will be located at 1832 M St., N. W., Washington, D. C.

NAB Committe Approves Specifications for Tape Leader

The TV Advisory Committee on Video Tape Usage of the National Assn. of Broadcasters has endorsed for operational use the technical specifications for monochrome video magnetic tape leader submitted by the Society of Motion Picture and Television Engineers to the American Standards Assn. in July.

The standards for tape leader were drawn up by the SMPTE Video Tape Committee for the purpose of insuring interchangeability among tape users. The standards specify the audio and video information that precedes and follows the recorded program material, provide the necessary identification "cue up" and "run out" information, and specify the minimum lengths of tape required to insure proper "threading" and "wrap around" for monochrome video tape recordings.

The NAB Video Tape Usage Committee is responsible for the development of operational standards for tape usage—as compared to the purely technical standards developed by the parallel SMPTE Committee.

Other topics discussed and still under active consideration by the NAB Video Tape Usage Committee are: Standard terminology in tape operations; physical marking and identification of tape; a recommended form for the identifying slate which precedes program material; specifications for exact timing for taped commercials and the use of operable reels in transshipping.

Good Results in Field Tests Of Stereo Broadcasting

A. Prose Walker, manager of engineering for the National Assn. of Broadcasters, has reported good results with all five stereophonic broadcast systems tested in field trials at Uniontown, Pa., in July.

The Federal Communications Commission is expected to establish FM stereo standards early next year, and may adopt any one of the five systems tested, a composite of several, or a completely different "dark horse" entry.

Mr. Walker said the future of FM stereo depends on the system adopted by the FCC, the quality of equipment, and the best use and promotion of stereo by FM broadcasters.

The field trials were conducted by the National Stereophonic Radio Committee to help the FCC decide whether to authorize and establish standards for a stereo broadcast system.

Mr. Walker was chairman of a special panel that conducted the tests. About 40 broadcast engineers, using facilities of station KDKA-FM at Uniontown, put in 1,300 manhours of work on the field trials. The systems tested generally are known as Crosby, Calbest, Halstead, Percival, General Electric and Zenith.

KHQ Readies New Facilities

Richard O. Dunning, in his regular report to the KHQ Sidewalk Superintendents' Club, reports that the foundations for the new 904-ft. tower have been poured and that the erection crew is proceeding with the erection. KHQ hopes to be operating from the 4,549-ft. tower height on Tower Mountain this month. Construction of the new studio and office building will be finished late in the fall. The new facilities will expand KHQ's coverage by 16 per cent as well as improve its signal strength in its present coverage areas.

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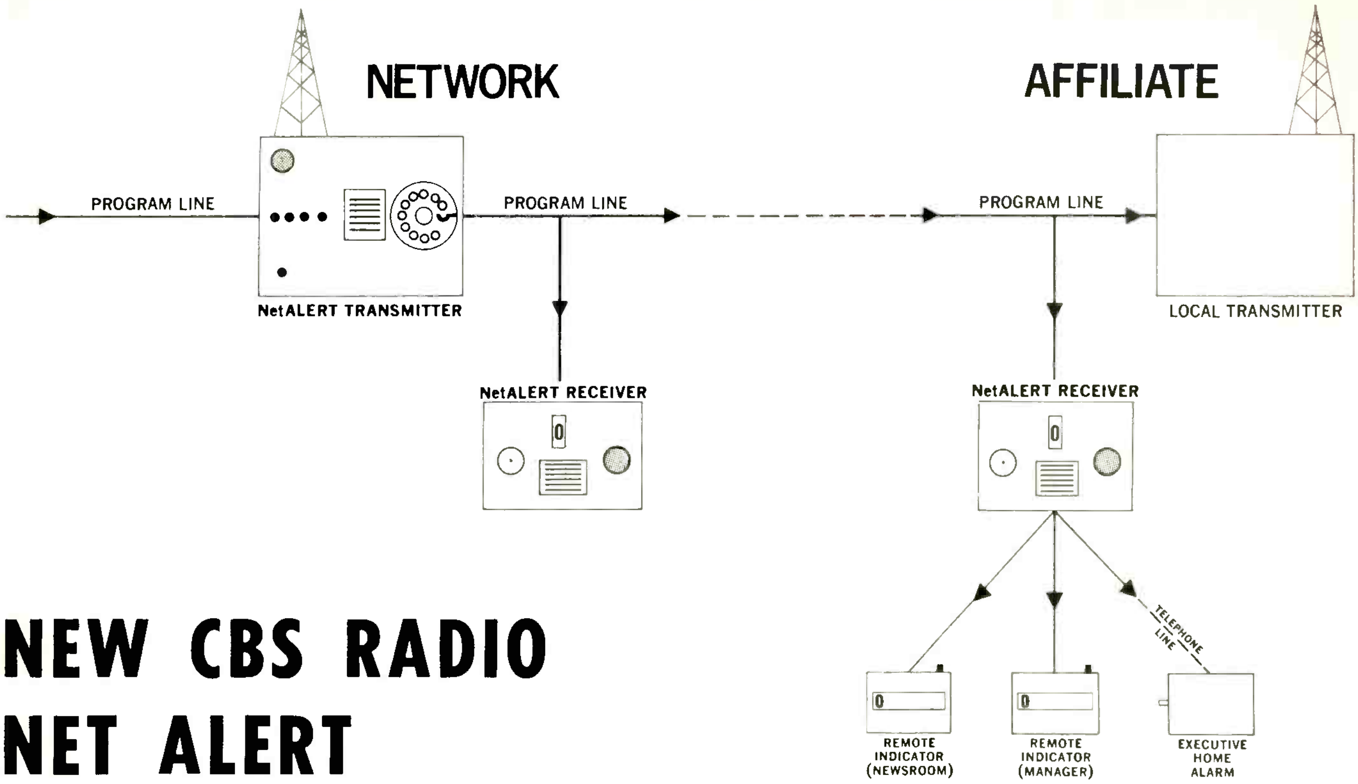

NEW CBS RADIO NET ALERT

Six different alert signals transmitted by pulses over the CBS program line will notify affiliates of urgent news.

A REVOLUTIONARY round-the-clock network radio signaling system, which for the first time will make it possible for local radio stations from coast to coast, whether on or off the air, to be alerted to receive urgent news bulletins, on-the-spot news coverage or national emergency announcements, has been demonstrated by the CBS Radio Network.

Known as the CBS Radio NetALERT, the new system was shown publicly for the first time at New York's Waldorf-Astoria Hotel, during the opening day program of the Seventh Annual CBS Radio Affiliates Convention. More than 200 CBS Radio affiliate station managers and executives were in attendance.

The CBS Radio NetALERT system provides six different alert signals, each composed of from one to six virtually inaudible pulses of less than one-thirtieth of a second's duration. Transmitted at a fraction of the normal program sound level, these signals are completely unobtrusive during program periods and equip the network with a new and remarkably flexible channel for internal communication.

In describing NetALERT, Arthur Hull Hayes, president of CBS Radio, said, "Now, for the first time in broadcasting history it will be possible for a network to protect its affiliated stations with twenty-four-hour-a-day coverage so that no matter when news of major significance occurs—or a national emergency is declared—the stations and their executives can be alerted instantaneously.

"The stations can thus interrupt local programming to receive important bulletins or major on-the-spot special events coverage, for instance, of the type we provided at the time of the Khrushchev press conference in Paris. Even if the station is off the air for the night, a special executive alarm installed in the station manager's home will warn him of a major news break or national emergency situation."

According to Mr. Hayes, "NetALERT opens the door to eventual automation of certain phases of station operation. For example, with the installation of attachments developed by the stations, NetALERT could be triggered to activate tape machines for the purpose of recording a special network transmission for broadcast at a later hour; it might also trigger tape machines to play previously prepared materials."

NetALERT was developed and built by CBS Laboratories, Stamford, Conn., the research and development division of Columbia Broadcasting System, Inc. Most prominently involved in the NetALERT project were Dr. Peter C. Goldmark, president and director of research, CBS Laboratories; Benjamin B. Bauer, vice-president, acoustics and magnetics; and project engineers Abraham Goldberg, George Pollock and Arthur Kaiser.

The NetALERT transmitter, which is installed across outgoing program lines at major network points, is equipped to send the various NetALERT signals to the entire network, to any single time zone, or to any combination of time zones, as the situation may require.

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When the NetALERT receivers, installed across the incoming program lines in the control rooms of affiliate stations throughout the country, receive the NetALERT signals, a signal light flashes and a number, designating the nature of the alert, is illuminated on the receiver panel. In addition, a buzzer sounds and will continue to sound its warning until de-activated by a member of the control room crew.

Alert Number One is for station cueing and will provide information for the affiliates as to when to cut from network program material to local announcements or commercials and then back again to the network line. Alert Number Two is for network cueing. Alert Number Three indicates that a closed circuit announcement is coming up on the program line. This is particularly important in cases in which stations are not, at the moment, taking network program material. At present, it is impossible to contact the affiliates if they are off the network line, except by telephone, unless the station has someone continuously monitoring the network line. This is a prohibitively costly operation.

Alert Number Four indicates that a special exclusive news bulletin is coming up and Alert Number Five indicates that a very special, unscheduled news program or special on-the-spot news coverage is coming up. Alert Number Six is only to be used in case of a national emergency.

To make certain that vital information is made available immediately to key station personnel, such as the station manager, the chief engineer and the news director, tiny, desk model remote indicators can be installed to connect individual executive offices to the main receiver in the control room. Each remote unit is equipped with a flashing light, a back - illuminated number panel which designates the individual signals, and an optional buzzer.

Finally, a special executive alarm unit will be installed at the home of the local station manager or his chief engineer. This unit will only be activated by a Number Five or Number Six alert.

Installation of the executive alarm in the station manager's home will make it possible for him to be aware of news events of utmost national significance even if they occur during the night. During World War II, for example, many station managers did not learn of the invasion of Normandy, which took place during the night, until they awoke the next day. They had missed special all-night programming of great importance, transmitted by the network.

The Number Six Alert—an alternate buzzing sound which will continue until de-activated at the station receiver—is only to be used in case of national emergency. A special locking pin is installed over the Number Six on the transmitter dial so that it will be impossible for the engineer or network executive sending the alert signals to dial the national emergency alert number accidentally.

Mr. Hayes reported that CBS Radio Network plans to install the NetALERT equipment at the individual affiliate stations for a nominal service charge. It is expected that the initial units will be installed before June, 1961.

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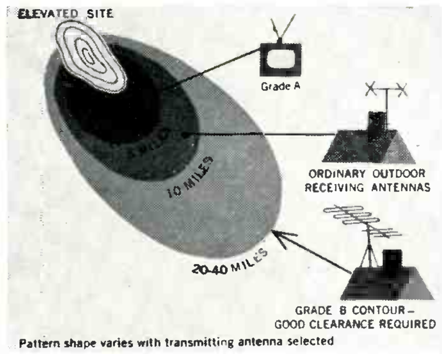

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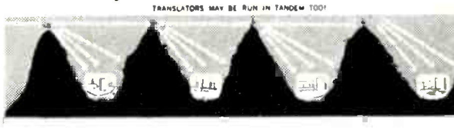

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Industry News

SMPTE Names Fellow

Richard E. Putman of the General Electric Co. has been named to a fellow membership in the Society of Motion Picture and Television Engineers in recognition of his contributions and achievements in the engineering field.

Putman is manager of studio and industrial television engineering at GE's Technical Products Operation. He has been with General Electric for 19 years and has held engineering posts at WGY radio and WRGB television. He has been engaged in the design and development of studio film and camera equipment. He has been manager of studio and industrial television engineering since 1955.

New Officials at Collins

Election by Collins Radio Co. board of directors of John B. Tuthill to vice-president, finance, and W. W. Roodhouse, vice-president, administration, has been announced by Arthur A. Collins, company president.

Tuthill joined the Collins organization in 1951 as assistant to the general manager. He was elected assistant vice-president, finance, in 1955. Prior to joining Collins, Tuthill was an assistant vice-president of the American Fletcher National Bank at Indianapolis, Ind. In addition to his commercial banking experience, he spent several years as a Field Examiner with the Federal Home Loan Bank Administration.

Roodhouse, who joined Collins in March, 1953, as manager of field service engineering in Dallas, has also served as aviation sales manager, assistant general sales manager and general sales manager, and until his present appointment was serving as director of marketing. He will continue to act as director of marketing for the Cedar Rapids Division until an appointment is made to this post. In his new position as vice-president, administration, Roodhouse will participate in Collins central management.

Prior to joining Collins, Roodhouse was director of communication for Chicago and Southern Airlines, now Delta Airlines.

New Chief Engineer at Fairchild

Fairchild Recording Equipment Corp. has appointed George Alexandrovich as chief engineer of its professional and consumer product lines. Mr. Alexandrovich has been with Fairchild for a number of years, his latest developments including the new single-belt driven two-speed 440 turntable and the new anti-skating 500 arm-transport with linear separation stereo cartridge.

Foto-Video Breaks Ground For New Plant

Ground-breaking ceremonies were recently held for a new, efficient plant to be occupied soon by Foto-Video Electronics, Inc.

The building will be a modern, fireproof, completely air-conditioned, one-story, steel and brick structure of 30,000 sq. ft. area, with an off-the-street parking area of 25,000 sq. yds.

The new plant is expected to be ready for occupancy on or about Jan. 15. It will contain all of the present manufacturing facilities of the present plant at 36 Commerce Road, plus additional facilities and equipment to expand the production of the company's extensive line of electronic equipment in the TV Broadcast-Closed Circuit Fields and Current-Voltage Regulated Power Supplies.

Foto-Video is only six years old but in that time has outgrown three plant locations. Its current backlog of orders exceeds one-half million, with forecast for 1961 approximately twice 1960 sales volume.

West Coast Office for Gotham

Gotham Audio Corp., New York, exclusive importers and representatives of Neumann condenser microphones and disk recording equipment, Beyer dynamic headphones and dynamic microphones and other professional recording and broadcast equipment, announces the opening of its West Coast office at 1710 No. LaBrea, Hollywood 28 (HOllywood 2-1250). The new office is under the supervision of Hal Michael.

National Sales Manager at Ampex

Frederick G. Ramback has been appointed national sales manager of Ampex Professional Products Co., according to Harold S. Salzman, marketing manager. Rambeck will direct sales activities for all professional audio and video equipment manufactured and distributed by the company. He formerly was with Pacific Telephone & Telegraph Co. and American Telephone & Telegraph Co.

Teleprompter Names George McElrath to New Post

George McElrath, formerly director of radio and television technical operations for the National Broadcasting Co., was named by TelePrompTer Corp. to the newly created position of manager, engineering planning and product control.

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H. J. Schlafly, Jr., TelePrompTer Corp. vice-president in charge of engineering, said the new post was made necessary by the company's expanding activities as a producer of group communications systems and equipment. "Mr. McElrath is known and respected in the broadcasting industry," Schlafly said.

McElrath was appointed to head technical operations for the NBC radio network in 1928 and, after the advent of television, was responsible for both TV and radio technical operations for seven years. He is a fellow in the Institute of Radio Engineers and the author of numerous articles and papers on technical operations. He is a resident of Darien, Conn.

TelePrompTer Corp. was organized ten years ago as supplier of the well known electro-mechanical studio and public speaking cueing device. It now specializes in communications products and systems for industry, government and education and also is the developer of a subscription and participation television system, Key TV.

Danish Science Medal to Ampex Official

Charles P. Ginsburg of Ampex Corp., who led the development of the Videotape television recorder, has received the coveted "Valdemar Poulsen Gold Medal" from the Danish Academy of Technical Sciences.

Ginsburg is the first native-born American to receive the award, which has been given only six times since its inception in 1939. The Gold Medal was presented to Ginsburg by Carl Schroder of Copenhagen, vice-president of the Danish Academy of Technical Sciences, in special ceremonies Nov. 23 in San Francisco.

Ginsburg was cited by the academy for his "guiding spirit and principal participation in the development of the 'video tape' recorder by Ampex Corp. — an outstanding achievement . . . which is well known to magnetic recording and television engineers all over the world." The academy, which administers the "Valdemar Poulsen Gold Medal Foundation," noted that its decision is supported by the Institute of Radio Engineers and the Society of Motion Picture and Television Engineers.

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Industry News

NAB Holds FCC Is Final Authority on Air Hazard

The National Assn. of Broadcasters said recently that final authority in determining whether construction of a radio or television tower would constitute a hazard to air navigation rests with the Federal Communications Commission.

Its position was taken in comments filed with the FCC in answer to a statement by the Federal Aviation Agency seeking final approval by the aviation agency before such a tower could be built.

The NAB answer said the intent of Congress to place final jurisdiction in the FCC was "clearly manifested" in the Communications Act of 1934 and has been "sustained in clear and unequivocal terms by the courts."

Furthermore, it said, an examination of the Federal Aviation Act setting up the aviation agency discloses "no authority, expressed or implied, to exercise final jurisdiction over broadcast transmission towers is vested in the FAA."

GEC Names New Manufacturer's Representatives

General Electrodynamics Corp., Garland, Tex., has appointed three new manufacturer's representatives to help market the GEC lines of broadcast, industrial, and military television pickup scan conversion and image conversion tubes.

Representatives named are Nelson Thomas & Associates of New Orleans; Videonics of Cambridge Mass., and Pelco Sales, Inc., of Gardena, Calif.

The Thomas organization will handle GEC products in the southern and southwestern states of Arkansas, Alabama, Mississippi, Florida, Georgia, Tennessee, Oklahoma, Louisiana and Texas.

The Videonics area in the east will cover Pennsylvania, New York, Vermont, New Hampshire, Maine, Massachusetts, Connecticut, Rhode Island and New Jersey.

Pelco, the western representative, will handle the states of California, Oregon, Washington, Idaho, Nevada, New Mexico, Arizona, Utah, Colorado, Wyoming and Montana.

Information concerning local dealers may be obtained from the representatives, or by writing direct to General Electrodynamics Corp., 4430 Forest Lane, Garland, Tex.

Full-Scale Multiplexing Used by Los Angeles Station

KMLA in Los Angeles is now transmitting background music to more than 1,200 commercial accounts by means of multiplexing. According to Bill Tomberlin, executive vice-president of KMLA and Musicast, Inc., this represents the largest number of multiplexed background music accounts being served by any single FM station in the world.

Musicast, Inc., owner and operator of KMLA, pioneered FM background music in Los Angeles on a simplex basis (main carrier with beep) more than a decade ago. In 1955, when the Federal Communications Commission originally outlawed the simplex method of transmitting background music and replaced it with multiplexing, Musicast started an intensive research and development program in an effort to find suitable equipment to use in its massive conversion to multiplexing.

In mid-1957, a Harkins subcarrier generator and exciter was installed in the KMLA transmitter at which time a controlled system of checking multiplex receivers was undertaken. A year and a half of testing finally brought fruit in the form of a completely newly designed multiplex receiver produced in conjunction with Calbest Electronics of Los Angeles. Another six months of field testing and modifications led to an order for Calbest to manufacture all of the Musicast multiplex receiver requirements in late 1959, as well as the appointment of Musicast, Inc., as national sales representative for Calbest multiplex receivers.

Now, one year later, all of the background music accounts in Southern California who receive their music through KMLA, do so by means of multiplexing, making it the world's number one multiplex station. It is estimated that more than one million people hear KMLA transmitted music each day, including every person that arrives or departs from Los Angeles by commercial airline.

This remarkable achievement provides ample proof that multiplexing is here to stay, thus giving FM broadcasting another "shot in the arm" since it permits economic security through the use of a multiplex sub-carrier, yet allows for the orderly development of main channel FM broadcasting in the public inteerest, according to Mr. Tomberlin.

Ellis Expands Territory

Tom Ellis, Continental Mfg. Inc., field representative residing in Kansas City, Mo., has been assigned additional territory, Ray McMartin, Continental president, has announced.

Ellis, who has represented the electronics firm in the states of Nebraska, Kansas, Missouri and Iowa, will now cover, in addition, North and South Dakota, Minnesota, Wisconsin, Illinois, Indiana and Kentucky.

Continental Mfg. is one of the nation's leading producers of receiving and amplifying equipment for background music operations. The firm produces full lines of multiplex receivers, relay receivers, monitor receivers and custom amplifiers.

Continental also manufactures intercom equipment and a limited number of transmitter items.

Roberts Builds New Plant

Roberts Electronics, Inc., 829 N. Highland Ave., Los Angeles, is building a new plant at 5918 Bowcroft Ave., Los Angeles. Building will be completed around the first of March, according to Eugene John Freeman, vice-president and general manager of Roberts.

The new Roberts plant, which is near the intersections of Rodeo and

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La Cienega Boulevards, will house the administrative offices, engineering and warehousing facilities. The 50,000-sq.-ft. building is being built at a cost of $1 million by John A. Alexander.

A. Prose Walker Addresses Collins Group

Automatic logging equipment will present a market potential of $10-$15 million for broadcast equipment manufacturers, A. Prose Walker predicted recently at Cedar Rapids, Iowa. Walker, manager of engineering of the NAB, spoke at a Collins Radio Co. broadcast sales meeting.

The NAB recently proposed the use of automatic logging equipment to the FCC, he said. "The NAB is convinced automatic logging equipment will be approved by the FCC in spite of objections by some groups," Walker said.

Walker told the Collins broadcast salesmen that the proposed equipment is "one way broadcasters can convince the FCC they are doing the right thing."

The most numerous FCC citations involve transmitter and programming logs, he said. An automatic logging system would eliminate this difficulty.

Transmitter conditions would be recorded continuously and accurately. In addition, the equipment would be more economical than the personnel it requires to log transmitter operation manually each half hour, he said.

The NAB proposal to the FCC will be based on automatic log tests performed at WTOP, Washington, D. C.; KFI, Los Angeles; WIP, Philadelphia; and WSJS, Winston-Salem, N. C.

Ampex Reassigns Territory

Donald Creswell, Ampex Professional Products Co. sales representative, has been transferred to the firm's midwest district, with headquarters in Chicago, according to Frederick G. Ramback, national sales manager.

Succeeding Creswell as sales representative in the territory comprising Pennsylvania, Delaware, Virginia, West Virginia, North Carolina and Maryland is Richard Sirinsky, formerly a field service engineer for Ampex.

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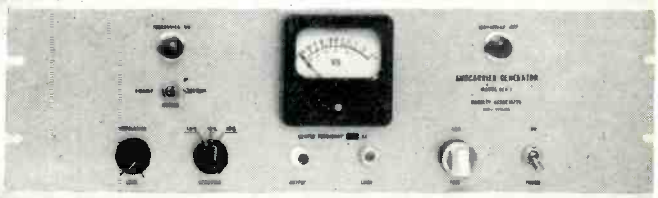

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Product News

SSB RECEIVER FOR AM BROADCAST RECEPTION

Kahn Research Laboratories, Freeport, N. Y. has announced the new fixed tuned Model RSSB-59-1A Single-Sideband Receiver for AM broadcast use. Applications include off-the-air relay broadcasts, high quality monitoring in difficult reception areas and Conelrad. Optimum reception of the AM signal is achieved by utilizing advanced SSB communications techniques. Thus, minimum selective fading distortion, improved signal-to-noise and greatly reduced adjacent channel interference are major advantages offered over conventional AM reception. Choice of product detection, utilizing local or reconditioned carrier insertion for minimum selective fading distortion or standard diode detection is provided to suit local conditions. Completely transistorized, the Model RSSB-59-1A permits upper or lower sideband reception and operates on 110 volts ac or self-contained automatic emergency dc supply.

AC CURRENT PROBE

A unique instrument which converts ac current to ac voltage for direct reading on a conventional oscilloscope or ac voltmeter is now available from Hewlett-Packard Co., 275 Page Mill Road, Palo Alto, Calif.

The instrument, Model 456A AC Current Probe, has a probe which simply clamps around the current-carrying wire, providing a voltage output which is quickly and easily read on a VTVM or oscilloscope. The instrument's 1 mv to 1 ma unity conversion permits direct readings in milliamperes on voltmeters or oscilloscopes.

The Model 456A measures current without direct connection to the test circuit and with no appreciable circuit loading. Typical applications include measurements on transistors, vacuum tubes and logic circuits.

NEW WIRELESS MIKE

A new development in the field of wireless communications was recently revealed with the introduction of the Vega-Mike by Vega Electronics Corp., 10781 N. Highway 9, Cupertino, Calif.

Vega-Mike is a wireless microphone 1 inch in diameter by 6 inches long, weighing 8 oz., which can deliver broadcast quality transmission over ranges from 25 ft. to more than half a mile. It operates for more than 20 hours on a single mercury cell battery carried in the cigar-sized case of the miniaturized, all-transistor broadcasting station.

The microphone is available in three different models: a hand-held model with a 3-ft. whip antenna attached to a ball socket on one end of the case; a hand-held model with the antenna affixed to a helmet and a lavalier model which can be worn around the neck of the user with the suspending cord acting as the antenna.

It operates on FM frequencies of 33.14, 35.02 and 42.98 megacycles or others as assigned on special order, on amplified power up to 40 milliwatts and radiated power up to 20 milliwatts. Other frequencies in the 25-45 mc band specifically assigned by FCC for other radio services are available.

Vega-Mike's receiver can be either portable or rack mounted with the speaker either included in the receiver case or externally and operates over an FM audio response of from 20 cycles to 20 kc.

CARTRIDGE TAPE RECORDER

A completely automatic compact magnetic recorder has been introduced by the Amplifier Corp. of America, 398 Broadway, New York 13, N. Y. The Magnematic Recorder is available in rack panel form for professional use. It fits a standard 3½-inch rack panel.

Tape handling is entirely eliminated. The 3M specially lubricated tape is contained in a Fidelipac plastic cartridge (sizes are available to handle 300, 600, or 1200 ft. lengths). The cartridge is inserted into the player and the "Start" button pressed. Cartridges are of the continuous self-contained, single-reel type which operate on an endless-loop principle.

This new compact unit provides instantaneous start-stop by utilizing a push-button operated solenoid with a fool-proof mechanism designed for continuous duty operation. It can be remote controlled for automatic start and stop.

NEW WIRED PORTABLE COMMUNICATIONS SYSTEM

A new industrial wired communications system has been announced by the Seiscor Division, Seismograph Service Corp., Tulsa, Okla.

This new system provides intelligible communications under any noise conditions, including jet-engine type noise. It utilizes transistorized amplifiers in combination with a variety of earphone/microphone headsets to form "wearable" units for almost any type of operation requiring wired person-to-person communications.

Two amplifiers are available in the system. One is for low to medium background noise conditions and the other is for medium to high background noise conditions. Both are lightweight, belt-clip units in attractive gold and black cases, with self-contained batteries and controls. Either Telepath amplifier may be used with four different headsets offered, with all units providing complete, hands-free operation. A unique feature is the volume control, which permits the user to choose the most comfortable voice level.

For most applications, the distance between separate units is unlimited, and party-line operations with three or more units working together is possible.

More information is available from the Communications Section, Seiscor Division, Box 1590, Tulsa, Okla.

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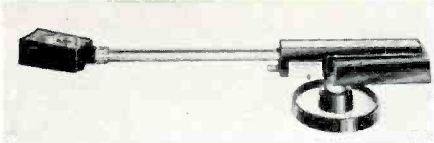
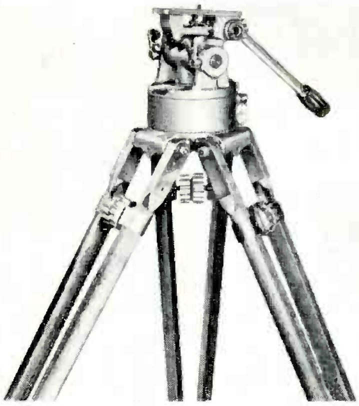


PROFESSIONAL UNIVERSAL TONE ARM

A new professional tone arm, introduced by Shure Brothers, Inc., 222 Hartrey Ave., Evanston, Ill., has design and adjustment features that keep record wear to a minimum. It accepts practically all cartridges now available. A micrometer counterweight and direct-reading stylus force gauge maintain perfect balance and accurate tracking on monophonic and stereophonic records. No soldering is required to install the arm.



NEW TRIPOD LEG DESIGN

Camera Equipment Co., Inc. of New York announces the use of totally different tripod legs on all its CECO Professional Junior Tripods. Called CECO heavy-duty tripod legs, these new legs assure greater rigidity no matter how far the legs are extended. The CECO heavy-duty groove design has increased gripping power because there is almost twice the gripping surface of wood to wood. The outside of the leg has a modern, rounded shape which adds strength and durability to the wood.

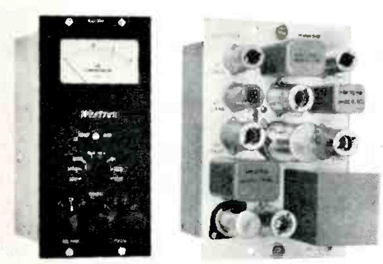
The grooved leg is now standard equipment for all the company's Professional Junior Tripod Heads, including the fluid head and the Pro Jr friction head.

IMPROVED STEREO HEADPHONES

The AKG (Austria) featherweight K-50 stereo headphones are now available with improved low-frequency response down to 30 cps and high frequency response to 20,000 cps. Distortion is also lower in the new model. Coupled with its light weight of only three ounces, including the cable, the clarity and fidelity of reproduction help further in reducing fatigue during long hours of quality-monitoring in broadcast, recording and communications work.

Requiring less than one milliwatt input, the K-50 has a high output when used with line and cathode-follower circuits with the U-50 transformer, and thus can be used without a power amplifier. It is easily disassembled for cleaning, and converts between binaural and monaural without soldering.

Additional information on the headphones is available from Mr. Vince Shaw of Electronic Applications, Inc., Stamford, Connecticut.



COMPRESSOR-LIMITER

A new general purpose audio compressor-limiter for use where the amplitude of the original sound is greater than the useful range of the recording or broadcasting equipment has been introduced by the Westrex Corp., 6601 Romaine St., Hollywood 38, Calif., a division of Litton Industries.

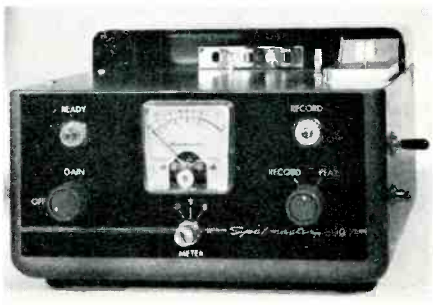
The system consists of an RA-1593-A Amplifier and RA-1594-A Control Unit. After initial settings are made on the control unit from a preliminary audio level test, the amplifier automatically compresses its output or chops peaks to keep the volume to within limits of the system.

The RA-1593-A Amplifier consists of a three-stage push-pull program amplifier and a control amplifier. Various types of compression and limiting are obtained by varying the d-c grid bias of two remote-cutoff pentodes in the first stage of the program circuit. Distortion is less than 1 per cent under all conditions below peak chopping.

Peak chopping is provided by diode limiting in the output stage, and occurs at an output level of approximately +29 dbm.

CARTRIDGE TAPE RECORDER

Broadcast Electronics, Inc., 8800 Brookeville Road, Silver Spring, Md., is now producing the Model 500 Spotmaster combination recorder-playback unit using automatic pulse cueing. The unit makes use of Fidelipac continuous loop tape cartridges. The size of the recorder is 10¼ x 12½ x 7 inches. It weighs 17 pounds and operates at 7½ inches per second. Frequency response is 70 to 12,000 cps. Seven transistors and four tubes are used.



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F.C.C. Regulations

(Continued from page 27)

Class IV Broadcast Stations Power Increase to More Than 250 Watts

1. The Commission has under consideration its notice of proposed rule making (FCC 60-968), adopted July 27, 1960, and released in this proceeding on August 2, 1960. The Commission proposed therein to amend § 3.28 (c) of the rules which presently provides that a Class II, III or IV standard broadcast station may be assigned to a channel, even though it receives interference, if (1) no objectionable interference is caused to existing stations, or, if so, the need for the new service outweighs the need for the service lost; (2) primary service will be provided to the community in which the station is located; and (3) the interference received does not affect more than 10 per cent of the population in the proposed station's normally protected primary service area. The amendment proposed would exempt existing Class IV stations applying for daytime power increases in excess of 250 watts from the 10 per cent limitation on interference specified in subparagraph (3) of § 3.28 (c). It was not proposed to extend the exemption to any proposals for new Class IV stations.

2. Over 100 comments were received on this proposal, and all, except three, urged its adoption. The supporting comments were from the Community Broadcasters Association, Inc., whose membership consists of Class IV standard broadcast stations (currently numbering 90), and from approximately 180 licensees of Class IV standard broadcast stations. Silliman, Moffet and Rohrer, a consulting engineering firm at Washington, D. C., also filed individual comments supporting the proposed amendment. The opposing comments were filed by J. G. Rountree, a consulting engineer at Austin, Texas, Ward Broadcasting Co., an applicant for a Class IV 250 watt standard broadcast station at Sonora, Texas (File No. BP-13026), and William G. Ball of Mansfield, Ohio. Joint reply comments were filed by Southeastern Ohio Broadcasting System, Inc., licensee of Class IV standard broadcast Station WHIZ at Zanesville, Ohio, and by The Zanesville Publishing Company, licensee of Class IV standard broadcast Station WTAP at Parkersburg, West Virginia. Their reply comments, while favoring the proposed amendment to § 3.28 (c) (3) of the rules, also request rule making looking toward another change in Class IV allocation policy. The proposal is discussed in paragraph 12 herein.

3. The Commission raised the daytime power ceiling for Class IV standard broadcast stations, with certain restrictions, in May of 1958 in Docket No. 12064 from the then 250 watts maximum to 1 kilowatt (17 RR 1541). The objective was to improve opportunities for such stations to provide an effective local daytime service in the face of hindrances occasioned by the increasingly higher degrees of local man-made noise levels from population and industrial growth, the expansion in the size of communities, and increased competition resulting from the growth of the standard broadcast service and the advent of television. We concluded at that time that this new 1 kilowatt daytime power ceiling, administered on a selective case-by-case basis, and utilizing directional antennas, if necessary, to protect the normally protected contours of other stations, represented the maximum, although not the absolute, solution practicable in light of all domestic and foreign considerations to the problems of the Class IV local radio service. It was our opinion that relaxation of the power ceiling on local channel stations to this extent would bring more effective and new daytime radio service to sizeable segments of the public and benefit Class IV stations to the maximum practicable degree. On April 13, 1959, we took further action in Docket No. 12064 to permit processing and final action on applications of Class IV AM stations for power increases in excess of 250 watts daytime in all areas except within 62 miles of the common U. S./Mexican border or within an area south of 28 degrees north latitude and between 80 and 82 degrees west longitude in the State of Florida.

4. In administering this new policy with respect to Class IV stations, we have become convinced that an additional change in allocation policy with respect to them is desirable to enable and encourage a greater number of Class IV stations to increase daytime power to 1 kilowatt and thereby make possible a fuller realization of the benefits to the nationwide Class IV local radio service and the public from the raise in the daytime power ceiling. That change, under consideration in this proceeding, would amend § 3.28 (c) (3) to obviate the necessity of considering whether the amount of interference received by existing Class IV stations proposing daytime power in excess of 250 watts would violate the 10 per cent population criterion of the rule.

5. As of August 22, 1960, only 76 of the 987 existing Class IV stations had obtained authorization to operate with daytime power of 1 kilowatt, and 4 had obtained authorizations to operate with daytime power of 500 watts. A total of 439 applications were pending for daytime power increases in excess of 250 watts by existing Class IV stations and 4 for like daytime power by applicants for new Class IV stations. Most of the pending applications are now in hearing or will require designation for hearing in groups ranging from a few to many applications because of interlocking co-channel and adjacent channel interference problems. The great majority of these applications present conflicts with § 3.28 (c) (3) of the rules because of interference in excess of the 10 per cent contemplated by the rule within their proposed normally protected contours, due primarily to the impact of other Class IV applications for power increases. For example, in one large multi-party Class IV proceeding noted in the comments, there were originally 60 applications consolidated for hearing, and all but three of the 60 involved § 3.28 (c) (3) question.

6. Section 3.28 (c) of the Commission's rules now provides a condition under which the Commission may grant an application notwithstanding interference to the proposed operation in excess of that otherwise permitted. Under this condition the Commission may grant if the otherwise prohibited interference does not exceed 10 per cent of the population included within the normally protected contour. We believe that this condition should be extended with respect to the daytime operation of Class IV stations with power in excess of 250 watts so as to not preclude operation with power over 250 watts even though substantially more than 10 per cent of the population within the normally protected contour may be subject to interference.

7. It is clear, in any group of 250 watt Class IV stations, that a uniform mutual power increase of any nature will not create interference to any station in any area served with the lower power but may and probably will result in mutual interference within the new service areas. Generally the population within the interference area of the new service area will exceed the 10 per cent figure now permitted under § 3.28 (c). The net result of the uniform mutual increase in power will be, however, to increase the population within the service area of each station, and to increase the signal intensity over the area previously served with the lower power without resulting in interference to any area previously served with the lower power.

8. These considerations, stressed in the supporting comments convince us that it is sound allocation policy and in the public interest to extend the conditions under which interference to a proposed Class IV operation involving power in excess of 250 watts may be permitted. An additional consideration, also consonant with the public interest, and urged by those supporting the proposal, is that removing this factor in the con-

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sideration of applications of existing Class IV stations for power increases above 250 watts will eliminate one of the obstacles to expeditious action on such applications both at the processing and hearing stage and result in significant savings in time and expense to both the Commission and applicants.

9. The opposing comments of J. G. Rountree and Ward Broadcasting Company regard it unfair to applicants for new Class IV stations to hold them to the requirements of the 10 per cent rule if existing Class IV stations seeking daytime power in excess of 250 watts, with which they may have interference conflicts, would not be bound. A number of the comments supporting the proposal urge, however, that there is no unfairness since the 10 per cent population criterion for interference received controlled the assignment of all existing stations when originally authorized at a 250 watt maximum daytime power. On consideration, we deem it desirable that all Class IV proposals be considered by the same criterion for interference received, whether they are for new stations or for changes in existing stations. The amendment adopted herein provides that compliance with § 3.28 (c) by new Class IV stations proposing power in excess of 250 watts shall concern only that area which exists within the equivalent 250 watt, 0.5 mv/m contour of the proposed station.

10. In opposing the subject proposal, Mr. Ball of Mansfield, Ohio, assumes that it would enable Class IV stations to increase daytime power up to 1 kw regardless of the interference caused by the increase. This is not the case, since the change in § 3.28 (c) (3) under consideration and which we are adopting applies only to interference received by Class IV stations.

11. Mr. Rountree also contends that if the 10 per cent rule is a good allocation tool, a large category of standard broadcast stations should not be exempted therefrom. On the other hand, he urges that if it is not a good rule, and he claims that it is not, the rule should be deleted in its entirety and each case considered on its individual merits. Even though the 10 per cent rule may have operated to preclude new stations in outlying areas in some instances, as Mr. Rountree claims, we are of the view that it has been for many years and still is a desirable allocation tool to delineate an effective utilization of an available frequency and to give both the Commission and interested parties a reasonable standard to rely upon. There are factors, however, which apply peculiarly to Class IV stations seeking power in excess of 250 watts which, in our opinion, justify excepting them as a group from the 10 per cent population criterion. Unlike other classes of standard broadcast stations, Class IV stations are almost universally non-directional, nearly all operate with the same power and are applying for equal power increases. Under such conditions, neighboring Class IV stations on local channels may generally increase power beyond 250 watts without interference resulting within their existing primary service areas, and obtain the substantial benefits of increased signal strength within existing areas, and a net expansion of primary service, even though population in the new service areas may be subject to interference in excess of that which may be permitted under § 3.28 (c) (3). Conditions conducive to a comparable general result do not exist on other than the local channels, and we adhere to the view that it is necessary to retain the 10 per cent population criterion for delineating the requisite minimum of interference-free service to be provided within the normally protected contours of stations of other classes to insure efficient use of broadcast frequencies.

12. The reply comments of Southeastern Ohio Broadcasting System, Inc., and The Zanesville Publishing Company urge rule making on another proposal affecting Class IV stations and assignments. The proposal looks toward an amendment to the rules which would require that the normally protected daytime service area contour (0.5 mv/m) of Class IV stations be determined on the basis of 250 watts with regard to other Class IV stations regardless of whether greater power is utilized. Also, these parties propose that the interfering daytime signal of Class IV stations be calculated with respect to each other on the basis of 250 watts regardless of whether greater power is utilized. We are not prepared at this point to act upon additional revisions of the rules governing Class IV stations but are continuing to study other possible improvements. Consideration will be given to the foregoing proposal in the course of that study.

13. Authority for the adoption of the amendment herein is contained in sections 4 (i) and 303 (f), (h), and (r) and 307 (b) of the Communications Act of 1934, as amended.

14. In view of the foregoing: *It is ordered*, That, effective January 23, 1961, § 3.28 (c) of the Commission's rules and regulations is amended as set forth below.

Subparagraph (3) of § 3.28 (c) is amended; as amended, paragraph (c) reads as follows:

§ 3.28 Assignment of stations to channels.

* * * * *

(c) Upon showing that a need exists, a Class II, III, or IV station may be assigned to a channel available for such class, even though interference will be received within its normally protected contour; *Provided:* (1) no objectionable interference will be caused by the proposed station to existing stations or that if interference will be caused, the need for the proposed service outweighs the need for the service which will be lost by reason of such interference; and (2) primary service will be provided to the community in which the proposed station is to be located; and (3) the interference received does not affect more than 10 per cent of the population in the proposed station's normally protected primary service area; however, in the event that the nighttime interference received by a proposed Class II or III station would exceed this amount, then an assignment may be made if the proposed station would provide either a standard broadcast nighttime facility to a community not having such a facility or if 25 per cent or more of the nighttime primary service area of the proposed station is without primary nighttime service. Further, proviso (3) of this paragraph shall not apply to existing Class IV stations on local channels applying for an increase in power above 250 watts, nor to new Class IV stations proposing power in excess of 250 watts with respect to population in the primary service area outside the equivalent 250 watt, 0.5 mv/m contour.

MULTIPLE OWNERSHIP OF AM, FM, AND TV BROADCAST STATIONS

Notice of Proposed Rule Making

1. Notice is hereby given of proposed rule making in the above-entitled matter.

2. On November 25, 1953, the Commission adopted a Report and Order making certain changes in §§ 3.35, 3.240, and 3.636 of our rules, which relate to the multiple ownership of AM, FM, and television stations, respectively (Docket No. 8967, Report and Order released November 27, 1953, FCC 53-1570, 9 Pike & Fischer R.R. 1563). Up until that time, our multiple ownership rules had referred to stations "directly or indirectly owned, operated or controlled" by the same person (including persons under common control); the word "control" being defined in the rules as "not limited to majority stock ownership but including actual working control in whatever manner exercised."

3. Under the provisions of the 1953 revision, for the first time "interests" as such, whether majority or minority and whether or not amounting to actual control, were taken into account, so that one person (or persons under common control) cannot hold directly or indirectly interests in more than 7 AM, 7 FM, and 5 television stations (in 1954 the limit on TV stations was changed to 5 VHF and 2 UHF). In our Report and Order (par.

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TV VIDEO MONITORS — Metal cabinets, Rack, Portable Remote Kine, Educational, Broadcast, starting at $199.00. 50 different models, 8" through 24". Miratel, Inc., 1st St. S. E., and Richardson, New Brighton, St. Paul 12, Minn. 1-61 1t

GE FM transmitter conversion—all parts, hardware and instructions for converting 10 KW amplifier to use 3X2500 tubes. Installation time approximately 3 hours. Price $335 less tubes or $780 with 3 Eimac tubes. Teletronix Engineering Company, 4688 Eagle Rock Blvd., Los Angeles, Calif. 1-61 1t

AMPEX 400 TAPE RECORDER. Single case portable. Manual controls. $400. Jon Monsen, 1350 N. Harding, Pasadena, Calif. 12-60 2t

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Will buy or trade used tape and disc recording equipment — Ampex, Concertone, Magnecord, Presto, etc. Audio equipment for sale. Boynton Studio, 10-BE Pennsylvania, Tuckahoe, N. Y. 11-60 4t

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12) we concluded that minority interests should be included because the holder of only a small minority of stock (especially where he has numerous broadcast interests and therefore is active in the field) may often exercise a significant influence on the affairs of the licensee. However, it was recognized that in the case of large corporations with a great many holders of small percentages of outstanding voting stock, the influence of very small stockholders (who are not officers or directors) would normally be so small as not to be of significance in this area. Therefore, footnotes to each of the rules provide that in applying the provisions thereof "to the stockholders of a corporation which has more than 50 voting stockholders, only those stockholders need be considered who are officers or directors or who directly or indirectly own 1% or more of the outstanding voting stock." (Note 2 to §§ 3.35, 3.240, and 3.636.)

7. Accordingly we propose to amend the multiple ownership rules, §§ 3.35, 3.240, and 3.636, by changing the pertinent notes thereto in these respects. Note 2 to §§ 3.35, 3.240, and 3.636 would read as follows:

In applying the foregoing provisions, a person who is not an officer or director of a corporation shall not be deemed to have an interest in or to be a stockholder of that corporation unless he: (1) Directly or indirectly owns 1 per cent or more of the outstanding voting stock thereof if the corporation has more than 50 holders of voting stock; or (2) directly or indirectly owns 5 per cent or more of the outstanding voting stock if the corporation has 50 or fewer holders of voting stock; or (3) owns any of the stock of the corporation whatsoever and in fact controls or has a substantial voice in the control or management of the corporation or its affairs.

8. The Commission is of the view that rule making proceedings should be instituted in this matter in order that all interested parties may submit their views.

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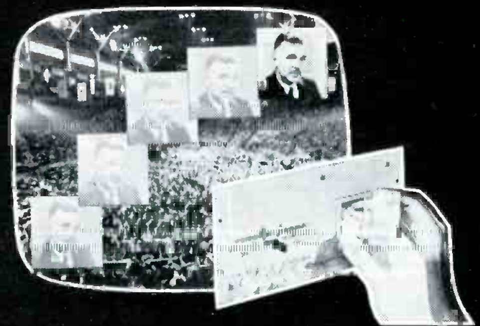

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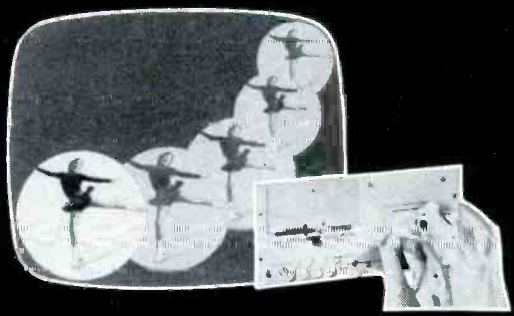

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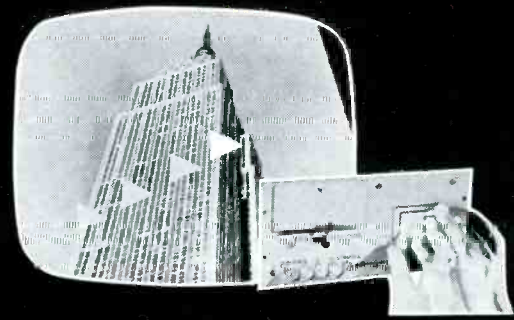

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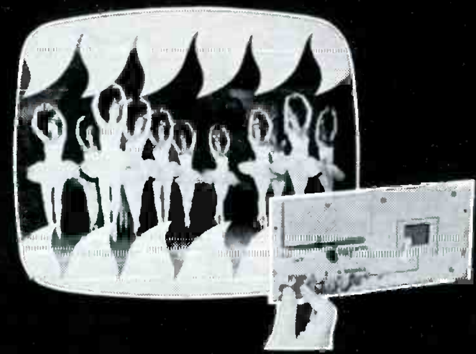

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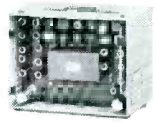
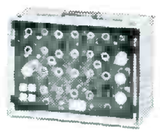


490WA1 Waveform generator. Generates keying signals for the 72 different wipes.



490SA1 Switching Amplifier. Combines two picture signals in accordance with applied keying waveform.

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