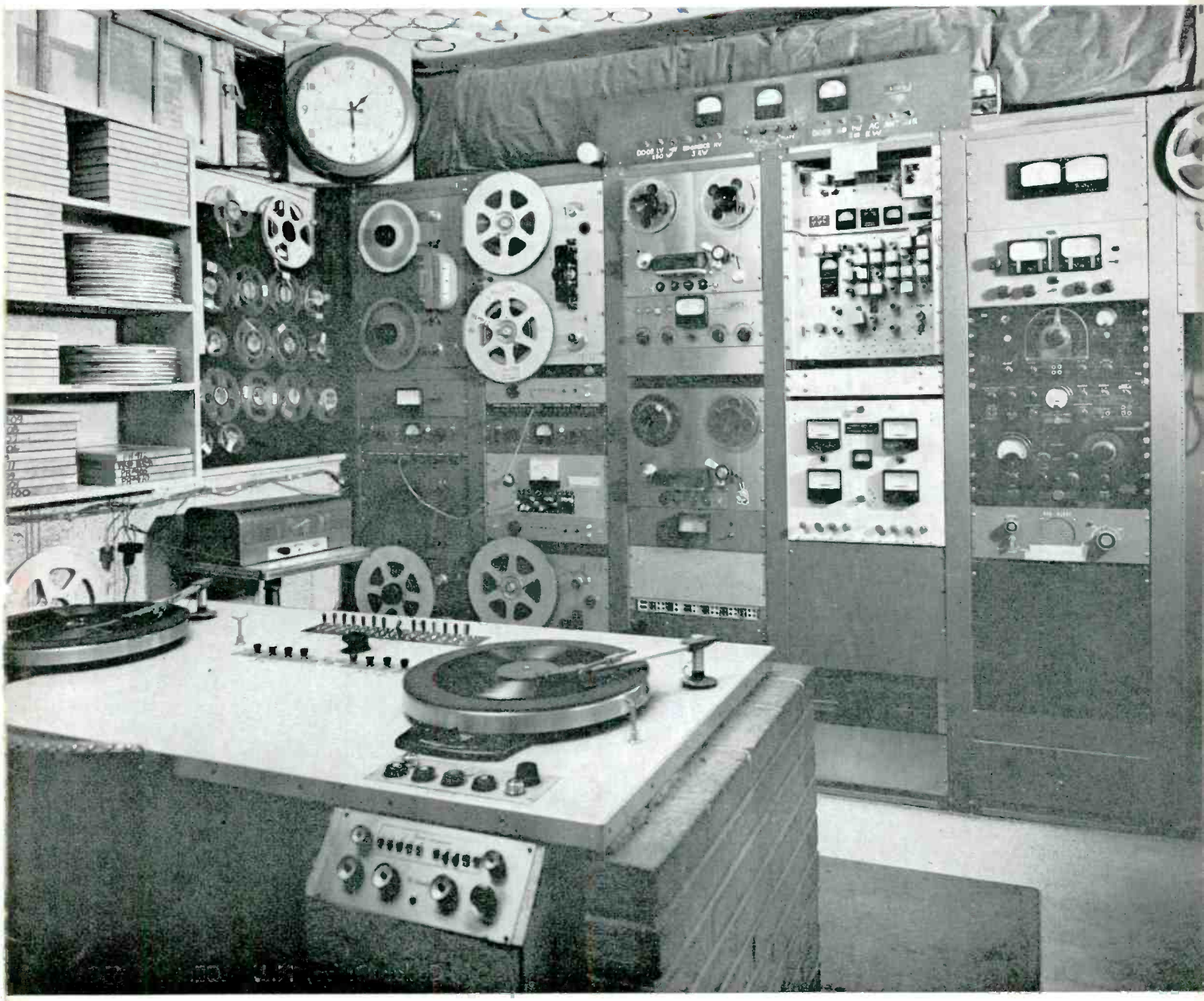
OCTOBER, 1959

Covering all phases of.....

# AM FM TV BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

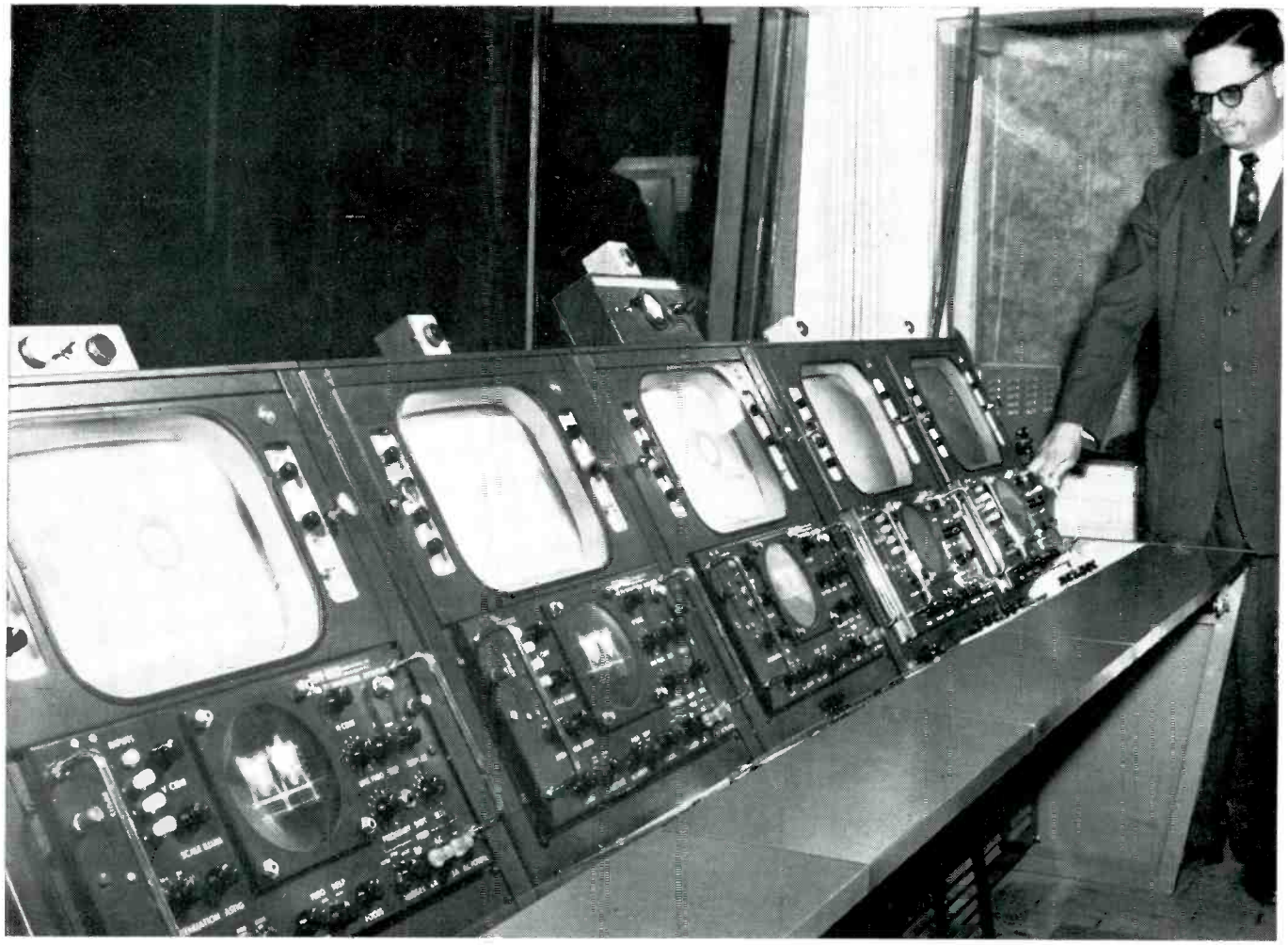


KCMK FULL MULTIPLEXING . . . . . See Page 8

# FOTO-VIDEO® Waveform Monitor Faces Facts

## — "THE FACTS OF CONTINUOUS OPERATION, DAY IN AND DAY OUT"

. . . says Charles Halle of WENH-TV, Durham, N. H. following a year's use of the new **FOTO-VIDEO** V-9B TV Waveform Monitor, the built-in features of which measure up to the precise requirements of this well-known consultant of educational TV stations.



Charles Halle is director of engineering at WENH-TV, the University of New Hampshire station, at Durham. Last December, after searching the field, he chose the rugged Foto-Video—an instrument of near perfection in this exacting phase of TV signal production —as most likely to meet the "operational FACTS of LIFE" in round the clock performance without deviation of characteristics. IT DID!

Mr. Halle was so impressed with the simplicity of design, operational convenience and built-in versatility of the Foto-Video V-9B's —result of years of exacting engineering and production—that he first bought two instruments, then later ordered five more for WENH-TV.

*"Not only was the Foto-Video TV Waveform Monitor less expensive, but it also proved to be of better quality than other comparable units. It is extremely well-engineered, and a lot easier for the operators to handle. It shows that clever design may be accomplished without compromising the essentials needed in such equipment," Mr. Halle said.*

### SOME OF THE FEATURES OF THE FOTO-VIDEO V-9B TV WAVEFORM MONITOR:

1—Four inputs, with push-button selection, affording complete monitoring facilities (both pulse width and level—ITV or broadcast cameras), or quality and level in studio or master control. Any input may be connected either front or rear.
2—Precise time and level calibration: 1-volt Zener reference for video; 4-volt Zener Pulse for sync levels; accurate .025H markers for quick sync and blanking duration settings.
3—Field expansion vertical interval to 4 inches for: counting equalizing and vertical pulses; viewing new test signals at lines 16 to 18; checking vertical pulse duration and delay.
4—Field Shift for interlace checking.
5—Both flat response and new IRE color roll-off: flat (± 0.5 DB) to 6 mc; IRE 6 DB at 1.6 (± .4) mc.
6—Triggering from all sources: internal video; external sync; external H and V drive.
7—Both line and field frequency controls to view: 1, 2 or 3 full lines; 1, 2 or 3 full fields.
8—Electronically regulated power supply.
9—Complete with case and slide-tilt assembly.
10—Continuous production; immediate delivery; low cost.

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# BROADCAST ENGINEERING

THE TECHNICAL JOURNAL OF THE BROADCAST INDUSTRY

VOLUME 1 OCTOBER, 1959 NUMBER 6


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## Cover

KCMK was one of the first stations to transmit two multiplex subcarriers with an FM transmitter. The photo shows the exciter and automatic programming equipment used by KCMK to simultaneously transmit three program services. The story of KCMK's installation begins on page 8.




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# tools of the trade . . .
# MICROPHONES

## C 12 — KING OF THE CONDENSERS

With Remote Control of Directional Characteristics During Program Pick-Up.

The Type C 12 polydirectional condenser microphone, combined with a switch box for the remote control of its directional characteristics during program pick-up, opens many new avenues of pick-up technique.

Frequency response extends beyond the limits of audibility. Without causing clicks or other disturbing noises, the sound engineer can change directional characteristics during program pick-up, select the best pattern for each phase of the program, adjust the microphone to the individual studio, and so on.

### TECHNICAL DATA

Frequency range: 30 - 15000 cps

Frequency response: enclosed 4 original frequency response curves. 0° omnidirectional, cardioid, bidirectional, 180° cardioid.

Discrimination between 0° and 180° angle of sound incidence (for cardioid pattern): 15 db.

Output level: 33 db re 1 milliwatt for a sound field of over 10 dynes/sq. cm.

Sensitivity (for 200 ohms): 1 mV/μbar ±1.5 db.

Output impedance: 50 and 200 ohms.

## D 30 B
## DYNAMIC DIRECTIONAL MICROPHONE

A universal microphone for recording studios, this microphone virtually replaces three different types with different response characteristics:

1. In normal position as an omni-directional;
2. A ribbon microphone with figure 8;
3. A cardioid microphone.

Simple pattern switching. A built-in bass cut permits the reduction of low frequency response in steps of 7 and 12 db on close talk.

### TECHNICAL DATA

Frequency range: 30 - 15000 cps.

Frequency response: ± 2.5 db with reference to standard curve.

Sensitivity: 0.12 mV/μbar.

Impedance: 150 ohms

Directional characteristics: Cardioid and omni-directional.

## D 15
## DYNAMIC DIRECTIONAL MICROPHONE

Close talking hand microphones with cardioid characteristic. Can also be supplied with harness for reporters. Especially suitable for radio and television reporting on portable tape recording equipment under conditions where the background noise ratio is high.

### TECHNICAL DATA

Frequency range: 50 - 15000 cps.

Frequency response: ± 3.5 db with reference to standard curve.

Sensitivity: 0.18 mV/μbar.

Impedance: 200 ohms.

Directional characteristic: Cardioid.

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# for T.V., Film, & Radio

## D 45 B
## DYNAMIC DIRECTIONAL MICROPHONE SHOCK MOUNTED

With Remote Control of Directional Characteristics.

This studio microphone provides a choice of eight patterns, any of which can be selected by a remote control unit, as follows:

2 cardioids with opposite directions of max. response
1 omnidirectional
1 figure 8
4 intermediates, 2 of which are hypercardioids.

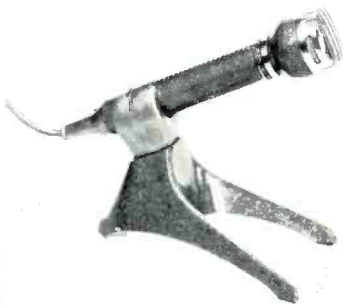
All patterns may be brought into operation during program pick-up without clicking or other disturbances. In addition, a bass switch allows the response curve to be dropped by 7 or 12 db at 50 cps, to increase shock resistance of the microphone and prevent over-emphasis of the bass at very short range.

The low shock sensibility of the D 45 B makes it particularly suitable for TV and film studios, or any other application entailing quick and abrupt movement.

### TECHNICAL DATA

Frequency range: 30 - 15000 cps.
Frequency response: ± 2.5 db with reference to standard curve.
Sensitivity: 0.12 mV/μbar at 1000 cps.
Impedance: 150 ohms

Directional characteristics: Omni-directional, figure 8, and cardioid.



## D 19 B
## DYNAMIC DIRECTIONAL MICROPHONE FOR TAPE RECORDERS

With cardioid characteristic and bass cut switch, this microphone covers the entire frequency range from 40 - 16000 cps. Rising characteristic. The pronounced directional characteristic, especially in the lower frequencies means freedom from background noises.

### TECHNICAL DATA

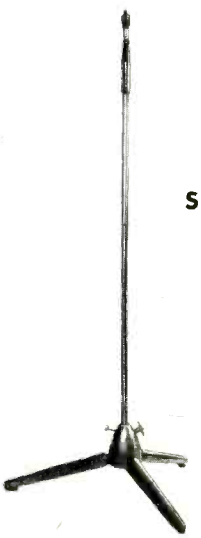
Frequency range: 40 - 16000 cps.

Frequency response: ± 3 db. with reference to standard curve.

Sensitivity: 0.18 mV/μbar (2.5 mV/μbar at high impedance).

Impedance: 200 ohms (high impedance 50K ohms).

Directional characteristic: Cardioid.



## ST 200
## SHOCK-PROOF FLOOR STAND

This stand is not only insensitive to shock and vibration but is also very stable, because of the unique design of its shock-dampening elements. These consist of an arrangement of iron struts embedded in live rubber blocks. The ingenious yet simple design provides isolation against vibration and shock without having to increase the size and weight of the floor stand and affords the necessary restoring force and attenuation against torsion.

## FOR MORE INFORMATION

Southwest: Audio Acoustics Company, 130 Fairview Drive, Arlington, Texas

West Coast: Ralph Auf Der Heide, P.O. Box 201, Altadena, Calif.

East: Harvey Radio Company, 103 West 43rd Street, New York 36, N. Y.

Harry Reizes (Rep.), 1473 Sylvia Lane, Eastmeadow, L. I., N. Y.

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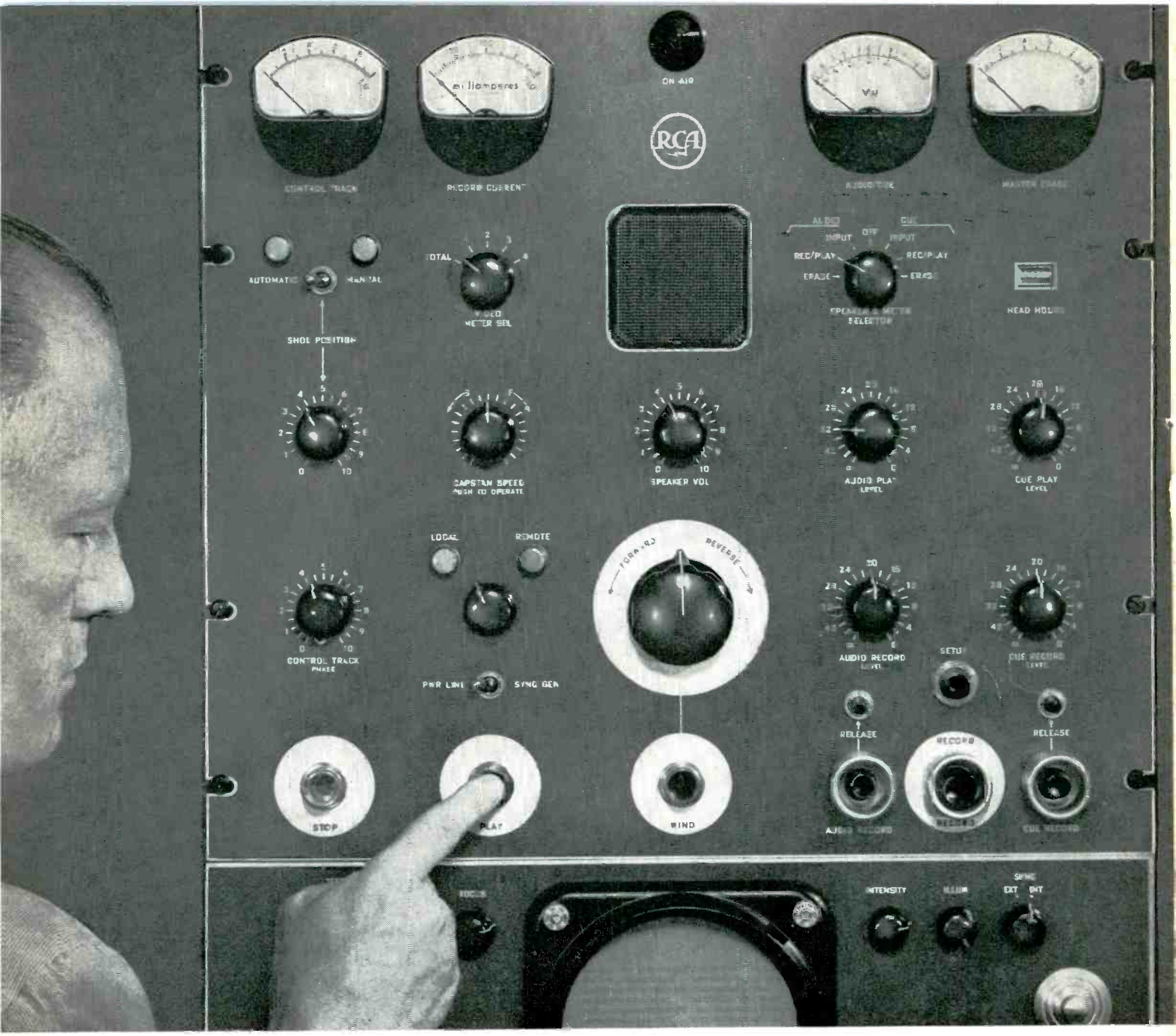
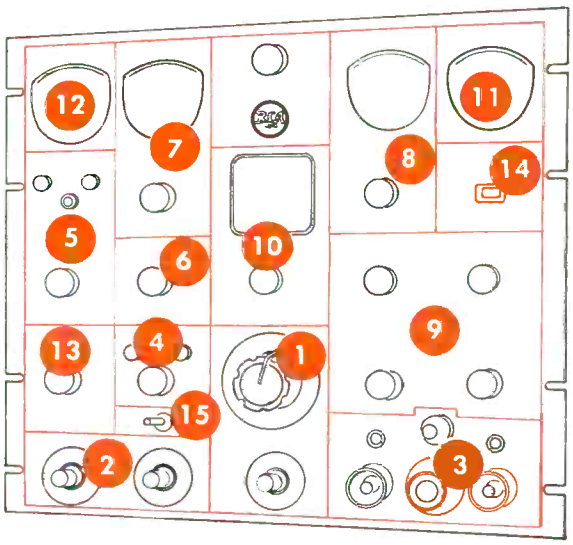



The central control panel of the RCA TV Tape Recorder puts all operating controls at your fingertips. Major control features are illustrated on the panel, zoned in 15 areas as follows: (1) Variable Speed Rewind; (2) Single Control Playback; (3) Independent Control of Video, Audio and Cue Record; (4) Local-Remote Operation; (5) Automatic Shoe Position Control; (6) Capstan Speed Control; (7) Video Head Current Indication; (8) Multi-Purpose Meter/Speaker Selector; (9) Independent Audio/Cue Record and Playback Level Controls; (10) Built-In Monitoring Speaker, and Speaker Volume Control; (11) Master Erase Current Meter; (12) Control Track Current Meter; (13) Control Track Phase Adjustment; (14) Head Hour Meter; (15) Sync Selector.

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THROUGH
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# 15 features at your fingertips... with RCA TV TAPE CONTROL CENTRAL

*All operating controls on a single 19" x 17" panel!*

**1 Variable Speed Rewind**
Fast forward, fast reverse. Rewinds 90 minute reel in 4½ minutes. Rapid cue any point on tape. Tape speed can be varied until audio or cue channel becomes intelligible.

**2 Single Control Playback**
A single push button activates playback functions. Automatically stops at the end of the tape. A stop button is provided for manual operation.

**3 Independent Control of Video, Audio and Cue Recording**
A set-up switch activates all electronics, placing the recorder in operation without running tape through. This enables operators to checkout circuitry prior to recording or playback.

**4 Local-Remote Operation**
Selector switch delegates basic record/playback functions for local or remotely controlled operation.

**5 Automatic Shoe Positioning**
The tape shoe position is automatically controlled during playback to prevent skewing effects. In the record mode, operation is electrically switched to *manual*—head-to-tape pressure can be adjusted using calibrated dial.

**6 Capstan Speed Control**
Manual override of normal operating speed to permit synchronization of two machines.

**7 Video Head Current Indication**
Switchable to indicate recording current in each of the four heads or total current in the head assembly. Permits quick diagnosis of performance during recording.

**8 Multi-Purpose Meter/Speaker Selector**
Provides instantaneous check of input, record and play functions, and erase in either audio or cue channels.

**9 Independent Audio/Cue Record and Playback Level Controls**
Standard RCA broadcast audio amplifiers associated with these controls are interchangeable.

**10 Built-In Monitoring Speaker, and Speaker Volume Control**
For monitoring audio or cue channel input, record or playback output. Built-in RCA BA-24 Broadcast Monitoring Amplifier will also drive external speaker.

**11 Master Erase Current Meter**
Shows master erase circuit is operating by indicating current in master erase head.

**12 Control Track Current Meter**
Provides continuous indication of current in servo-control track head.

**13 Control Track Phase Adjustment**
Dual control provides coarse and vernier adjustments. Coarse adjustment is for slipping any of the four heads on to any given recorded track. Vernier adjustment is for centering the heads precisely on that track.

**14 Head Hour Meter**
Indicates number of hours on video heads during *actual* recording and playback.

**15 Sync Selector**
For locking equipment to power line or local sync generator.

*Such outstanding operating features assure the most efficient utilization of television tape equipment, reducing operating and maintenance costs. And there are many other reasons why RCA TV Tape Equipment will prove right for your requirements. So don't settle for less than the best. See your RCA Representative, or write to RCA, Dept. Z-367 Building 15-1, Camden, N. J. In Canada: RCA VICTOR Company Limited, Montreal.*

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- *Wow and flutter:* 0.4%
- *Loudspeaker:* built in for monitoring and transcribing
- *Transistors:* 8
- *Microphone:* dynamic, low impedance. with remote stop/start switch
- *Dimensions:* 9⅝" x 5" x 2⅝"
- *Weight:* 4½ lbs.
- *Speeds:* 7½" and 1⅞" per second
- *Power:* Four 2-volt rechargeable batteries
- *Output Socket:* for connecting FI-CORD to hi-fi system or studio console
- Separate Earphone Output
- High Signal to noise ratio

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Please send me complete details and specifications on the all-new FI-CORD Model 1A Portable Tape Recorder.

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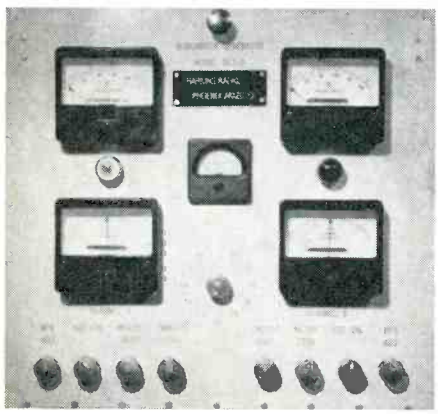
# KCMK FULL MULTIPLEXING

**A description of the KCMK FM facilities which provide two channel multiplex service in addition to high fidelity main channel broadcasting.**

By DWIGHT "RED" HARKINS*



Two channel generator used at KCMK. Each channel is crystal controlled and includes full monitoring of center frequency and percentage of modulation.

When KCMK (FM) began operation March 3, 1958, it marked the beginning of one of the most unique operations in the United States. Not only did it provide the Kansas City area with a high fidelity main channel FM program source, but it also installed facilities to transmit two multiplex subcarriers.

The whole plant was engineered and designed to accommodate this versatile operation. KCMK is owned by FM Broadcasting, Inc., of which Archie Mesch is the president, chief engineer and part owner.

Arrangements were made with the LaSalle Hotel to locate the transmitter in the top floor penthouse, while 12 stories below the studios were built and the exciter portion of the transmitter installed in the studios. Operating on 93.3 Mc. with an effective radiated power of 35 KW, the main transmitter, located on the top floor of the LaSalle Hotel, is a General Electric 10-KW model.

Twelve stories below, the Harkins FME-2 Exciter is used to drive the General Electric transmitter located on the top floor. This is accomplished through a long length of RG8U transmission line connecting the exciter to the main transmitter. RF samples from the transmission line are fed back to the lower floor to operate the station monitors.

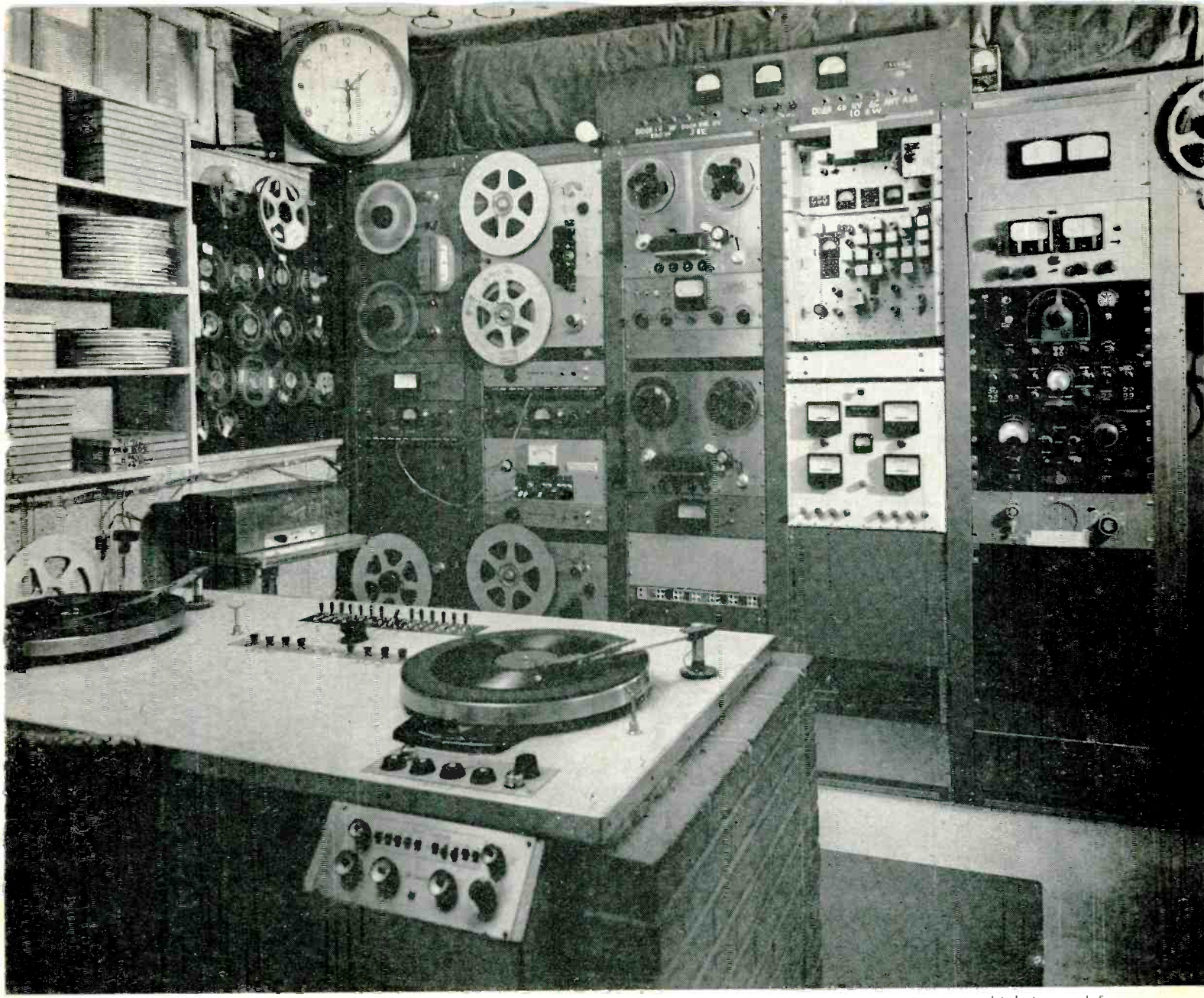
Also located in the special studio that has been designed for subsidiary services is the Harkins Two-Channel Generator which provides subcarriers of 26 Kc. and 65 Kc.

In order to keep separate the subsidiary functions, a completely separate studio is provided for programming of the main channel.

The purpose of the subcarriers was to provide a functional music service on the 65 Kc. channel and a storecasting service on the 26 Kc. channel. In order to do this, a considerable amount of tape reproducing equipment was required together with specially designed automatic equipment that would enable commercials to be interspersed with the music that was transmitted on the 26 Kc. channel.

From the photograph it can be seen that sufficient recorders and

*Harkins Radio Co., 4444 E. Washington St., Phoenix, Arizona.



View of the KCMK control room showing the multiplex exciter and automatic programming equipment which is used for the two multiplex channels and the main program service.

reproducers are available to allow full production of pre-recorded tapes to take place without interfering with the normal operation of the station.

Under normal operation a silent sensing device is used to select the commercial which will appear at the end of each musical selection. It can be arranged so that a commercial will appear either after each selection or after each second or third selection depending upon the day to day requirements.

The subsidiary control room contains an announcing booth and complete facilities for producing pre-recorded tapes that are used in connection with the storecasting service.

The main channel is programmed live from 6:00 a.m. to 2:00 a.m. with diversified programming aimed mainly for the listeners with High-Fi FM receivers.

Over 100 supermarkets in a 40-mile radius are equipped with 26 Kc. receivers for receiving the storecasting service. Another large group of receivers serve the functional music accounts pure background music.

The station has now completed 18 months of continuous operation for 20 hours per day and has proved the practical application of transmitting three separate programs over the same FM transmitter. It has also proved the operational feasibility of locating the main transmitter at a considerable distance from the exciter which is driving it. Only one service man has been necessary to provide maintenance to the many accounts being served by both subchannels.

Mr. Mesch, who formerly was an RCA Transmitter Division engineer, spent considerable time in engineering the complete installation in order to make it the most economical to operate.

# TRANSISTORIZED REMOTE

One of the first invasions of transistors into the broadcasting field was in the form of a four channel remote amplifier. Features include long battery life, absence of microphonics, high level mixing, A-C or battery operation with automatic cutover, built-in test oscillator. General performance and noise figures of transistors are discussed together with possible applications of transistors to other broadcast equipment.

THIS paper is presented as a running account of the planning and development of a new transistorized remote amplifier. The first step in planning the remote amplifier consisted of analyzing our ideas of what we thought the customer would like to have.

In order to get a better idea of what the customer wanted in the remote amplifier, a questionnaire was mailed to a representative sample of broadcasting stations across the country. The features on which favorable sentiments were received are as follows:

1. Power Source to be both 115 V AC and batteries.
2. Automatic power changeover.
3. Battery life of approximately 50 hours, 25 hours considered minimum figure.
4. Batteries to be self-contained.
5. Performance equal to that obtainable from high level mixing.
6. Step by step rather than composition type faders.
7. Maximum gain 90 to 100 db.
8. Four microphones to be accommodated.
9. Switching not desired if four channels provided.
10. All connections at rear of unit.
11. Sloping mixing panel.
12. Compact design with low height.
13. Binding post terminals.
14. Bridging volume control for public address feed.
15. Tone oscillator for line level setup.

Other features of obviously known value include:

1. Compact single unit design.
2. Light weight.
3. Rugged construction.
4. Low distortion.
5. Full frequency response.
6. Line switching.
7. Low cost.
8. Designed for maximum operating ease and convenience.

### Problems Considered

After carefully adding up all the features previously enumerated, it became obvious that the list was long and some features were not too compatible with others. For example, low cost and long battery life don't go together very well with high level mixing and light weight.

Then came the question: "Can transistors help in any way?" It was believed at the start of the project

*Collins Radio Co., Cedar Rapids, Iowa.

# AMPLIFIER

By PAUL G. WULFSBERG*

that some of the later stages could use transistors but their benefit was not too great at this point since in the higher levels transistors are not any more efficient than tubes except for heater power.

Next came the thought that if the whole amplifier was transistorized it might not draw any more battery power than perhaps one vacuum tube filament. However, since transistors were said to be quite noisy, it seemed doubtful that they could fill the bill. After careful scrutiny of the noise figure curves and some hard work in the laboratory, including testing a large number of types and makes of transistors, it was found that a preamplifier could be built which has performance comparable to that

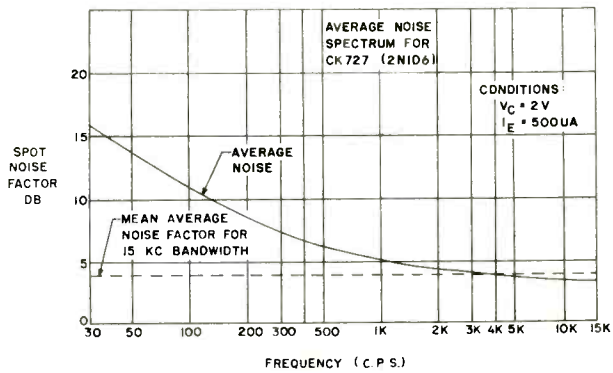



Figure 1—Average noise spectrum for CK-727 (2N106) (selected samples).

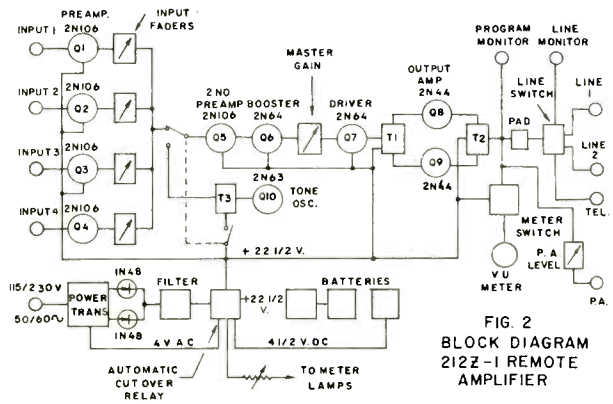



FIG. 2
BLOCK DIAGRAM
212Z-1 REMOTE
AMPLIFIER

Figure 2—Block diagram 212Z-1 remote amplifier.

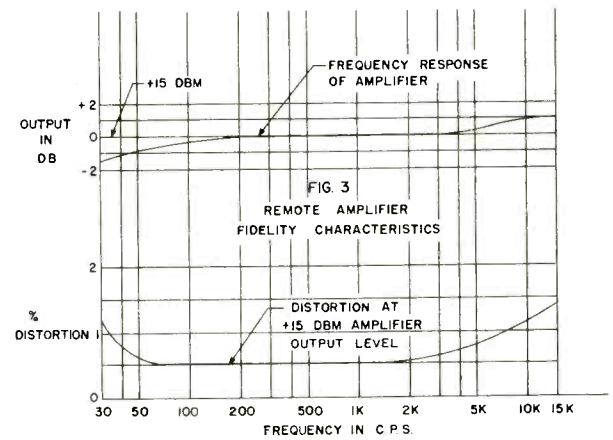



Figure 3—Remote amplifier fidelity characteristics.

Figure 4—Amplifier in carrying case.

of the best studio console preamplifiers. Figure 1 shows the curve of noise figure vs. frequency for selected samples of Raytheon type CK-727 (2N106).

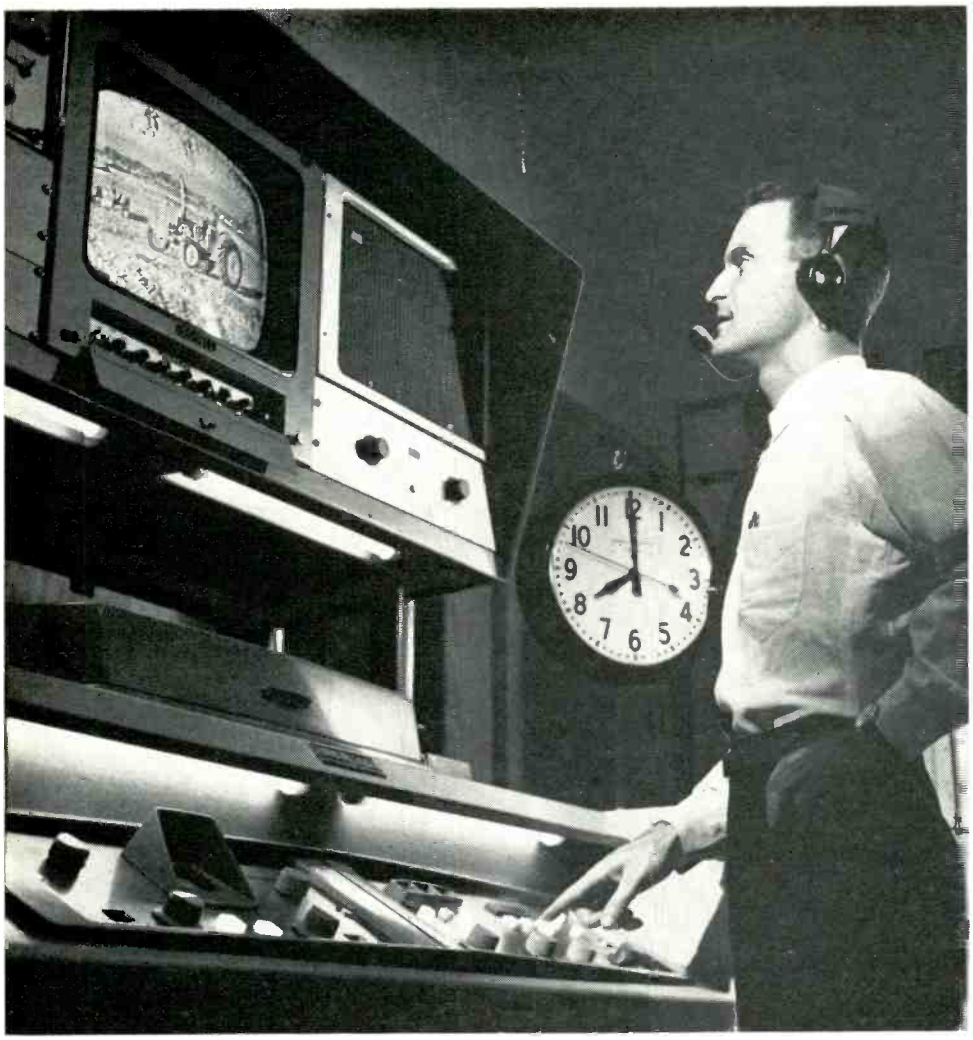
The dotted horizontal line represents the integrated mean average based on a 15 kilocycle bandwidth. Notice that although the noise figure at 1000 cycles and below is not very favorable, the values above 1000 cycles get better and better. Since most of the passband is well above 1000 cycles, the mean average noise output is less than 4 db above thermal. The noise power output from a resistor of any value for a bandwidth of 20 kilocycles is —124.8 dbm at room temperature. Thus, no preamplifier can ever be built having an equivalent noise input of better than —124.8 dbm if its bandwidth is 20 kilocycles. The very best studio console preamplifiers actually run between —116 and —120 dbm. I have never seen one better than —120 dbm. This value corresponds to an operating condition in which the noise is "60 db below a minus 60 dbm input." Actually, preamplifier noise performance should always be specified in reference to either a definite signal input or preferably in terms of equivalent noise input." To illustrate the point let me quote from the advertised specifications for a typical studio console: "Noise: 65 db below +18 dbm with controls at 2 o'clock." Now this statement does not allow one to determine the noise conditions of the microphone end of the equipment, and thus compare it to other console preamplifiers in terms of true performance.

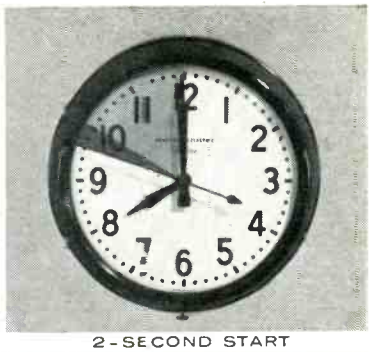
The next question which needed answering was that of how essential the input transformer was, since the input resistance of the transmitter used in a grounded emitter circuit was found to be about 1000 ohms in the circuit used. It was found that only 2 db or thereabouts could be gained by the use of a transformer. Since the absence of an input transformer would mean reduced input hum pickup, eliminating the transformer was obviously a good choice. Lighter weight, smaller space and lower cost were the additional bonanzas attached to this decision. After the use of directly fed transistor preamplifiers was proved to be sound, the decision to use high level mixing circuits was almost automatic since the cost was quite low and no sacrifice in battery life was involved, because the input power for the preamplifier transistor is a matter of a few milliwatts.

There were many more problems to be solved in the use of transistors in the remaining stages. Stabilization of gain, proper frequency response and distortion control were among the problems encountered. Considerable feedback was employed to get the distortion below 1 per cent. Generally speaking, transistors don't seem to be quite as low in distortion characteristics as one would be led to believe. The use of transistors in push-pull such as in the output stage of the amplifier being described also poses a balance problem, especially if the so-called "Class B" operation is employed. Carefully matched units can give efficient fairly low distortion output. However, since matching is rather undesirable for both manufacturer and customer, "Class B" type operation gave way to a modified "Class A" operation condition in this particular amplifier.

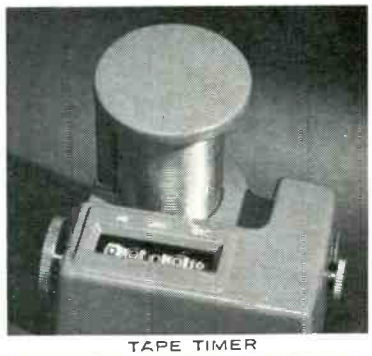
### Amplifier Description

Figure 2 is the block diagram of the amplifier. The four preamplifiers Q1 through Q4 use 2N106's which are hermetically sealed equivalents of the CK727. The input faders feed the second preamplifier Q6, also a 2N106, through the tone oscillator switch. The booster Q6 feeds the master gain control which is fol-

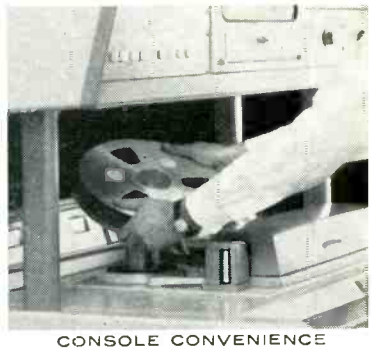




2-SECOND START



TAPE TIMER



CONSOLE CONVENIENCE

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- **2-SECOND START** *Recorder is in full, stable speed fast . . . permits even a 2-second cue with a safety margin.*
- **WAIST HIGH TAPE DECK** *Permits loading of next commercial in seconds . . . reels lie securely without locks. Table top provides extra work space.*
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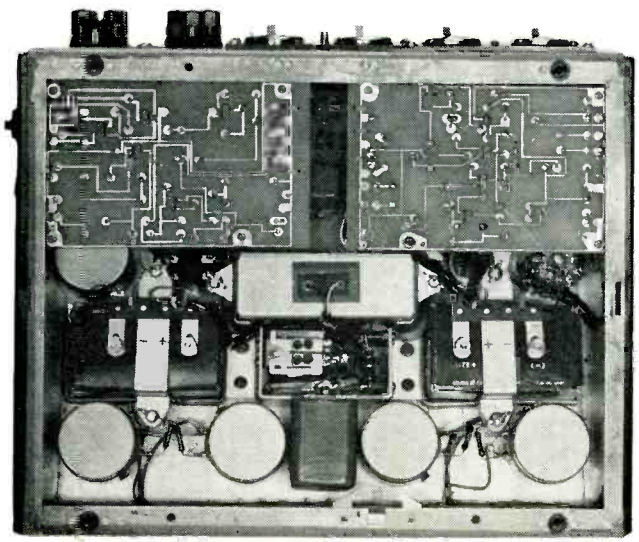
lowed by the driver, Q7. The booster and driver both employ 2N64's. The output amplifier (Q8 and Q9) has push-pull 2N44's with transformer coupling on the input and output sides. Transformer T2 feeds the program monitor, the VU meter, the public address line and the program line switch. Two program lines and telephone are provided for through the line switch.

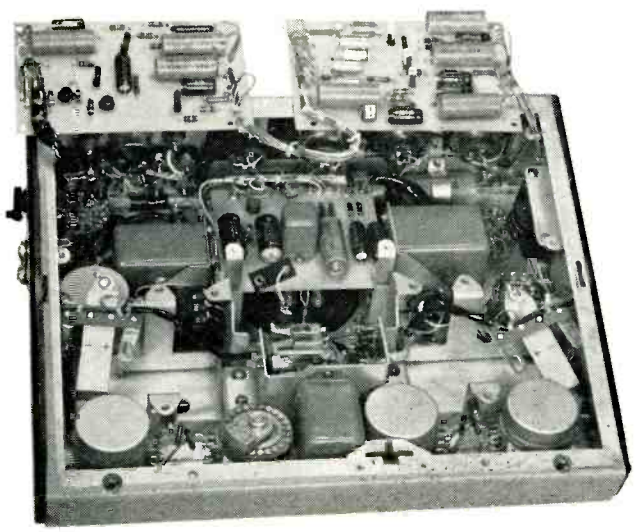
The power supply is a conventional type employing full wave rectification and multi-section filtering. The cutover relay connects the batteries to the amplifier whenever the voltage from the a-c supply fails or the power switch is set for battery operation.

The 400 cycle tone oscillator employs Hartley circuit and feeds a very low level to the second preamplifier through a switch. A power interlock switch is provided to insure that the power is off when the unit is in its carrying case.

The performance of the amplifier in its final form has exceeded expectations considerably. The weight of the complete unit is only 17 pounds. The carrying case is used in the same way as a portable typewriter case and adds five pounds additional weight bringing the total to 22 pounds. The height of the amplifier scarcely exceeds five inches, and the volume of the unit is 50 per cent that of its predecessor. Of the features previously enumerated, all have been realized to a substantial degree through the use of transistors. Figure 3 shows the response and distortion taken at an output level of +15 dbm. The measured equivalent noise input is —116 to —120 dbm and the gain into the line pad is 96 db.

The remaining illustrations show various views of the amplifier.





Figures 5 and 6—Views showing internal construction of remote amplifier.

There are obviously certain areas in electronics where transistors really pay their way in convincing fashion. Portable, battery operated equipment such as hearing aids, personal radios, "walkie-talkie" transmitter-receivers, etc., are just a few of the best applications. Power savings of nearly 100 to 1 are within reach on some of the above types of equipment. In the case of the amplifier described, the battery power required is 0.3 watt as compared to 4.5 watts previously.

Other possible uses for transistors in the broadcasting business might be:

(a) In single channel portable amplifiers of the utility type.

(b) In input stages of studio consoles.

(c) Small built-in microphone preamplifiers for special applications.

(d) Other amplifier applications requiring extremely compact designs.

(e) Wireless microphone.

(f) Prompting receivers for TV use.

In any event, these glamorous little devices, not much bigger in some cases than the head of a match, are here to stay and none of us in our right minds will sell them short.

## DuPont Adds New Facilities For Mylar Production

The Du Pont Co. is building new laboratory and office facilities for its "Mylar" polyester film technical section adjoining its Circleville plant where "Mylar" is manufactured.

Designed to accommodate anticipated future expansion of the section's activities, the building is to be ready for occupancy late this fall by the present research staff of 20 with supporting personnel. Including chemistry, engineering, and physics laboratories, the new building will provide all facilities required for advanced research and development in the polyester film field.

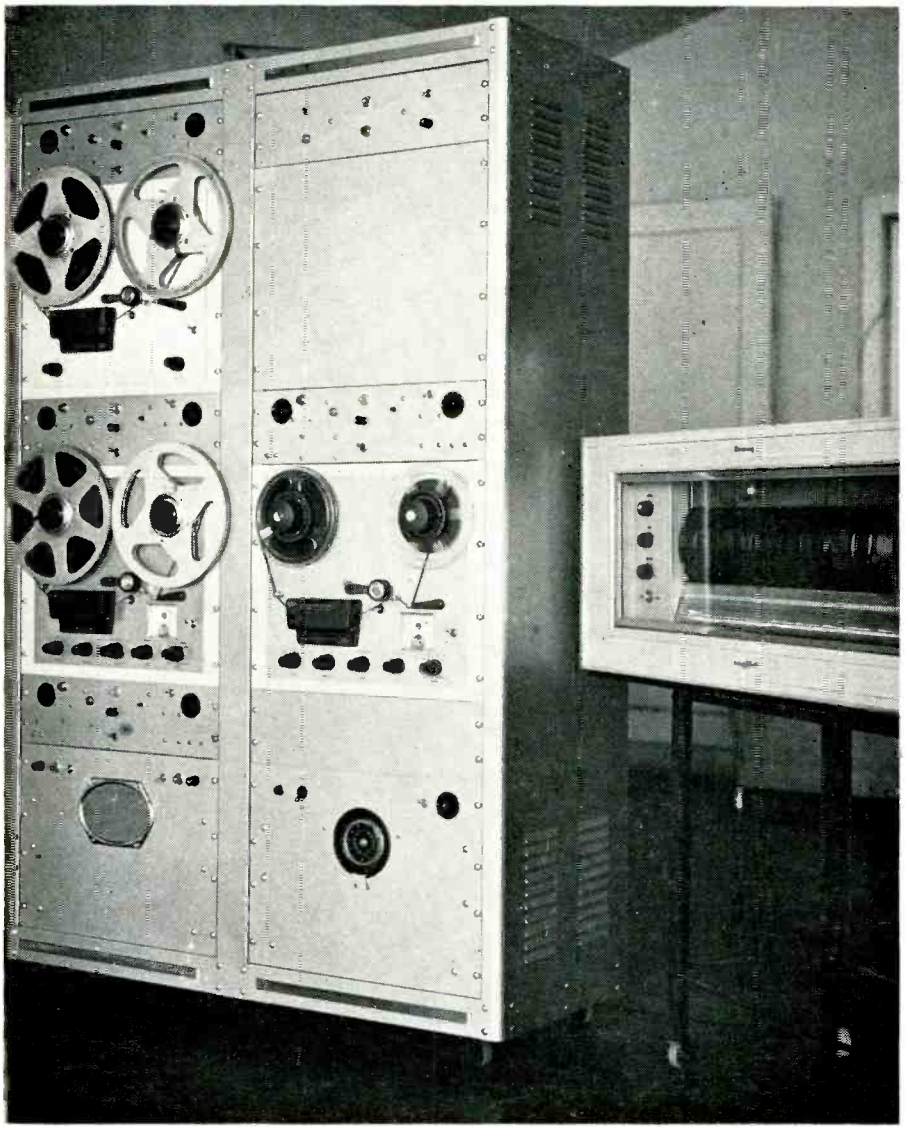
The project reflects the increased technical effort which the company's film department is devoting to new product development, improvements in film quality, and more efficient processes that may make possible further reductions in price to customers.

The "Mylar" polyester film technical section was established two years ago to centralize and co-ordinate research and development programs for polyester films. The section works closely with the company's Yerkes Research Laboratory in Buffalo, N. Y., where "Mylar" was first developed, and with the Circleville plant technical section, whose activity directly supports the manufacturing effort. Since its establishment, the section has used the plant laboratories and offices, but continuing expansion of its activities and those of the plant have led to the need for additional facilities.

Strongest of the plastic films, "Mylar" is a transparent material of sparkling clarity. It has excellent electrical insulating properties, is resistant to attack by most chemicals, and retains its properties under extremes of heat and cold. This combination of properties has led to increasingly wide adoption of the film for such diverse uses as electrical insulation, packaging, magnetic tapes, pressure sensitive tapes, as a base for metallic textile yarn, and in laminations where a tough and durable protective and decorative surface is desired.

# DESIGN CONSIDERATIONS IN AN AUTOMATIC

By KENNETH AITKEN*



The Auto Jockey automatic program unit which features automatic cueing of records and no time lag between end of tape announcement and record.

FIVE YEARS AGO when the need for automatic program equipment for broadcast stations became apparent, the engineering department of Radio Station KTKR in Taft, California began experimenting with various combinations of programming equipment. These experiments led to the development of the Auto Jockey which is described in this article.

Before designing the Auto Jockey, a set of specifications was established and all of the equipment being offered was studied to determine if it met the requirements of these specifications. The specifications were based on five general requirements as follows: versatility, simplicity, dependability, adaptability, and consistency. The most important considerations under each requirements were determined and given precedence over other features in the event of conflict.

The result of this development program is a completely automatic audio system adaptable to the fast paced AM radio of today. The first Auto Jockey was installed in service at KTKR in July of 1958. Engineering continued after installation and many improvements were added. Two important features were developed as a result of demonstra-

# PROGRAM SYSTEM

You should consider these qualities in program automation equipment:
Versatility
Simplicity
Dependability
Adaptability
Consistency

tions at numerous broadcast stations. A system for cueing records within a half turn of the sound and a system for starting the next machine ahead of the ending of the previous machine were added to the Auto Jockey.

### Versatility

For an automatic program system to be versatile it must be able to handle any type of program material. This includes records of various sizes and tape. At KTKR a large portion of programming was on LP records. These were recorded on tape and were used at various times during the day. Two hours of programming used 45 RPM records. Commercial announcements had to be inserted after every record during portions of the day and after every other record at other times. A system of machine selection was designed around a multiple contact switch which would connect the outgoing activating signal to any one of six busses common to each unit of the Auto Jockey. Each machine was connected to be started from one of the signal lines. Thus, if machine one is connected to the number one line, every time a signal appeared on this line it would start the number one machine. By using a stepping relay the incoming signal could be interrupted and transferred directly to the outgoing terminal, thus by-passing that machine. By proper connection and with a rotary switch it is possible to cause a machine to skip as many as five times before the stepping relay returns to zero and plays that machine. Many combinations can be selected by the skipper arrangement and as many combinations can be set up as desired.

### Simplicity

Since many radio stations now operate with non-technical people, the Auto Jockey was designed with the controls placed close to each machine. The original system was designed with a control panel only 5¼ inches wide. (The new ones are 7 inches to correspond with the width of the new Mark X tape now used.) Only those controls used in the day to day operation were made readily adjustable. A function switch is located at the center of the panel. It has three positions, up for run, center for stop or stand by and the third position is a spring loaded down position used when starting the machine. On the right side is a rotary switch which selects the machine to follow. On the left is a similar switch used to set the skipper. Two adjustments are available from the front. One is a locking type and adjusts the threshold of the Volume Operated Relay. The other is the time delay and is adjustable from 1 to 5 seconds. In the middle of the panel is a panic button. In case the operator starts the wrong machine, it can be stopped with this button. It is also used to neutralize the equipment when setting up for a program.

The controls should be simple and the number of tubes and relays should be held to a minimum. The final design uses only three tubes in the voice control unit along with two relays. A latching type relay transfers the audio and starts and stops the individual machines. Another relay on each panel transfers the signal to the clock controlled machine.

### Dependability

With simplicity comes dependability. The lack of a large number of tubes and relays added to the dependability of the Auto Jockey. A device being used to produce programs in a radio station must be reliable; especially if operated during periods of time when an announcer is not present. Readily available parts must be used for easy replacement.

*Shafer-Aitken Communications, 305 Harrison St., Taft, Calif.

Servicing of the Auto Jockey is extremely easy since each panel has only four mounting screws and all connections to it are made through multiple plugs. The Voice relay is a sub-assembly and also plugs in. Any panel can be removed from the Auto Jockey without disturbing the operation of the remaining units.

**Adaptability**

When the original machine was started it was not known how many program units might be required. For this reason the control cable or control buss system of wiring was decided upon. This system allows more machines to be added without rewiring. The final design permits six complete control panels. Since two Seeburg changers can be operated from a single control panel, this allows up to four tapes and four Seeburgs or five tapes and two Seeburg changers.

**Consistency**

In the first Voice Operated Relay units a straight forward amplifier, detector and relay tube system was used. Soon after the unit was installed, it was noted that if the music or speech ended quietly the switch would take place suddenly. If the ending sound was loud the time delay would be much longer. This condition was corrected in the following manner. First, a limiting circuit was devised to eliminate the longer hold on low level. As the unit now stands, it has two gate circuits. When both are passing energy the limiter functions. To eliminate unusual sound, hum, high frequency energy, etc., the frequency response was limited to the 100 to 3,500 cycle range. It was discovered early that even though there was time between the program segments, if the time interval was constant it was not objectionable. If the time interval was one second during a change then was followed by a three or four second time change it became very apparent. This produced a mechanical effect on the air which was undesirable. With the limiting and gate arrangement the time could be made the same between all segments. This feature made it possible to later eliminate the time interval between program segments.

While the above considerations were of utmost importance, a number of other minor items were also considered and built in. It was felt that with three good tape machines in the control room, some provision should be made to use these machines for regular programs when not being used for automatic programming. It was also discovered that some method of listening to the tape material for cueing was needed. This added feature is used extensively when an operator has been doing something else and wishes to check the point of operation without having to listen to a complete cycle.

A Seeburg record changer supplied with the broadcast attachment was used in the original model of the Auto Jockey. By opening the circuit to one relay it was possible to place the machine in automatic operation. Since this is a mechanical changer, and the pickup simply drops on the record at the same time the machine shuts off; the needle could be left at, near, or far away from sound, depending upon the record. Some records would have only two lead in grooves, while some had as high as ten. While a number of systems seem to be operating successfully by using tones to start the changer ahead of time so that the sound will reach the system by the end of the introduction, it was decided that a better approach should be followed. This brought us to the obvious conclusion that it should be done just as an operator does. That is, run the record into the sound and then back it up. This would always place the sound just a half or quarter turn away.

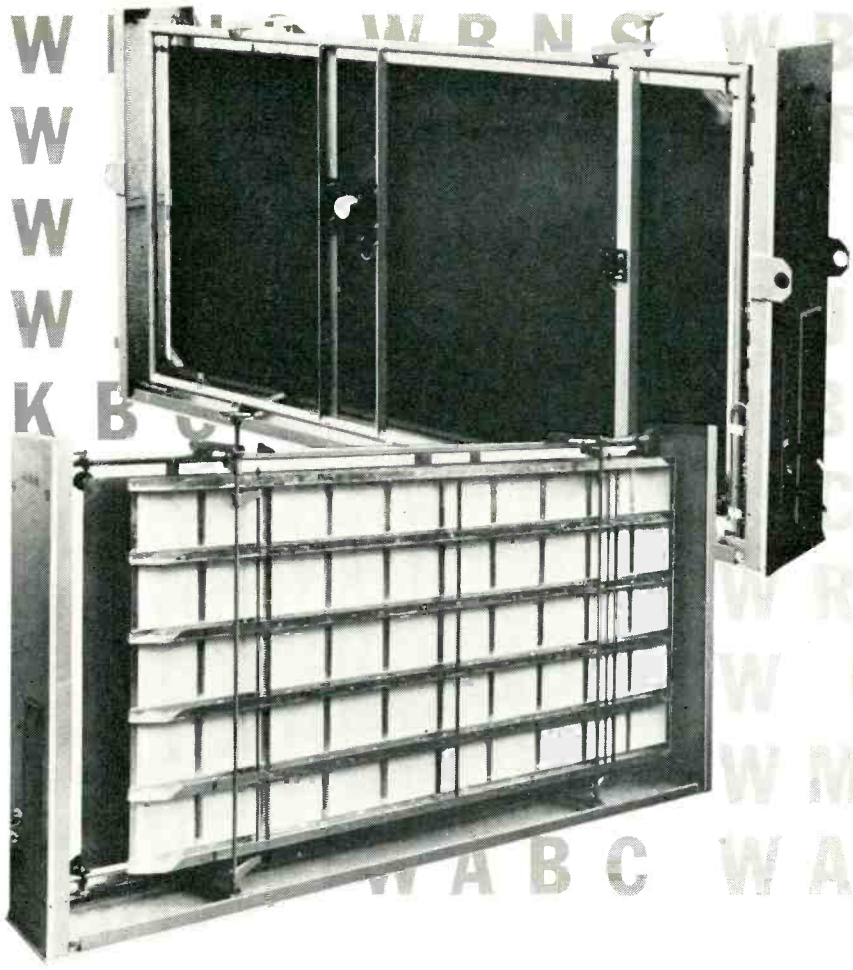
While it sounded simple, many factors were discovered in the first working model. False reversals of the motor had to be eliminated, a system for holding at the instant of reversal and a method of controlling the coasting of the motor were needed. All of these had to be worked out in order to produce a consistent cueing system. The heart of the unit is one of the special Auto Jockey Voice Operated Relays.

A problem existed with the Seeburg when a very low passage was encountered or if there was a long pause in the music. The changer was mechanical in operation and continued to the end of the record. It was possible to have the audio drop out, a tape segment play through and return to the record before it had ended. The results are obvious. You had the first part of a record on the air, then an announcement and the last part of the same record. Consequently, an electrical rejecting system was added to the changer. If a record drops out it will be rejected and the next record cued.

While the cueing system cut the pause time to 1½ seconds, some operators wanted even faster action. We had eliminated the possible use of tone if another system could be made workable. By placing another pickup head on the tape machine prior to the regular playback head it was possible to anticipate the end of an announcement by as much as two seconds. With the cueing system and the anticipator adjusted carefully it is possible to have a fractional overlap of sound. With anticipators on each tape there is no lapse in time between tape machines or between tape and record changer. A slight time interval exists between the end of a record and the beginning of sound from one of the tape units.

In the original unit, no provision was made for producing station breaks on a time basis. These were inserted by careful planning of the program material. Later it was decided necessary to control station identifications on a time basis without interrupting the program material and without changing the operating order of the units. To do this, a relay transfers the activating signal from the next machine in line to the clock control. Here, a memory relay trips at the same time the identification machine is started. When finished, the memory relay sends the activating signal back to the originating panel and thus on to the next machine in the sequence. After several weeks of service, it was discovered that it was possible to have the clock trip during an activating signal. This would split the signal, half going to the next machine in the sequence and the remaining half to the clock controlled machine. This put two machines on the air at the same time. To eliminate this condition, an interlocking system was added to the unit through a set of contacts on the signal producing relay in the voice controlled unit.

K A B C
W B N S
W F I L
W I L
W J J D
K B O X
W C B S
W R C A
W O R
W M P S
W A B C



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# SIGNIFICANT DEVELOPMENTS IN TV STUDIO LIGHTING LAYOUTS

**Certain problems must be overcome to use successfully dimmers of the silicon-controlled rectifier type in TV studios. A specially designed dimmer has been developed and made available economically to allow a greater number of dimmers in a studio installation. This increases the need for more flexible preset systems. A new punch-card type of "automatic infinite preset" system is described. It can be arranged to control position, angle, focus and spectral quality of studio lights in addition to circuit selection and control of lighting intensity. Lighting layouts can use fewer units; and dimmers can be located on, or adjacent to, the lighting fixtures. Backgrounds of luminous color can be accurately controlled for frequent changes of color and brightness.**

By ROLLO GILLESPIE WILLIAMS*

(Reprinted from the Journal of the SMPTE.)

ELECTRONIC dimmer systems using thyratron tubes have been controlling studio lighting loads in this country for many years. These systems very frequently employ a C-I Dimmer, which uses a pair of thyratron tubes back to back, to control lamp loads up to 8 kw per dimmer.

The development of semiconductor devices includes a silicon-controlled rectifier which can be used as a substitute for thyratron tubes with a significant reduction in the size, heat and audible noise of electronic dimmers. Also, tube replacement cost is eliminated and efficiency improved. Consequently, it is not surprising that the silicon-controlled rectifier type of brightness control is heralded as revolutionary in the field of dimmer design and in its promise of low cost.

### Studio-Lighting Dimmer Problems

However, a number of problems, apart from dimmer characteristics, must be overcome before the silicon-controlled rectifier type of dimmer can be considered suitable for TV studio work. Since design, construction and performance characteristics are affected, it is proposed to discuss briefly some of these problems.

"Video hash" and audio interference may take place, lamp filaments may hum, and diode-controlled switches in other equipment may be affected if wavefront "spikes" are not smoothed or eliminated, and current rise-time modified, by suitable circuitry and accessories. Because of the one-half cycle response of the rectifier, ordinary fuse or circuit-breaker protection does not act quickly enough to protect it from damage by short circuit. Equally serious is the heavy surge of current during several cycles, caused by switching a large incandescent filament lamp on at full voltage. For example, the inrush current of a 5000-w lamp is in the order of 500 amp and about 20 cycles are necessary to establish the normal lamp current. The C35B (or C35B X 510) silicon-controlled rectifier (G.E.) used in dimmers has a present peak one-cycle rating of 150 amp. Unless the rectifier response can be delayed from its normal one-half cycle response to the several cycles needed for the inrush to come within the normal rating of the rectifier, it will destroy the junction in the rectifier. Such a time-delay device can be incorporated; for example, it may be placed in each jack of a cross-connect patch panel to prevent "hot" patching of existing lamp loads onto dimmers in the "up" position. However, this affords no protection if a load is already connected to a dimmer but is switched on at a point beyond the dimmer when the latter is "full up," or if lighting units are connected to "hot" pigtails in the studio while the dimmer is "full up." Of course, amp traps, which by burning out first prevent destruction of the rectifiers, can be used. Unfortunately, with the present $I^2T$ rating of the C35B X 510 rectifier,* 20-amp traps are the largest that will afford protection under these conditions (15-amp traps for the C35B rectifier). As far as the author knows, amp traps of this size are not suitable for protecting two back-to-back silicon-controlled rectifiers controlling 4-5 kw of lighting load.

Thus, while it is possible to use a pair of C35B or (C35B X 510) silicon-controlled rectifiers to dim loads of 4-5 kw, it is difficult to protect them from destruction if the load is switched on at a point beyond the dimmer when the dimmer is in the "full up" position, or if the load is connected to the dimmer while it is "full up" without time-delay devices at each possible point of connection, or if there is a short circuit.

*Director of Color Research, Century Lighting, Inc., 521 West 43rd St., New York 36, N. Y.

*This is currently rated at 170 amp$^2$ × sec, compared to 108 for the 20-amp and 169 for the 25-amp amp traps. In view of allowable tolerances the latter rating is too close to that of the rectifier to provide adequate protection.

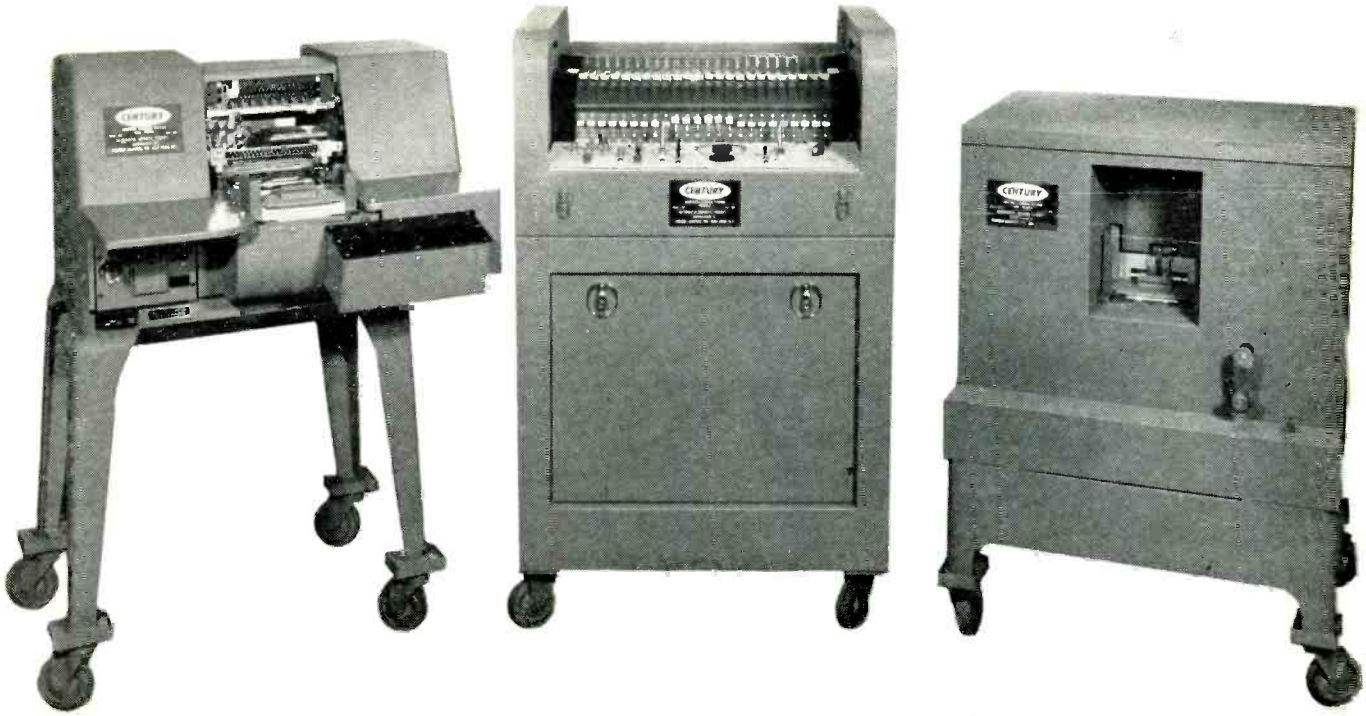


Fig. 1. Three of the control components of the Century "automatic infinite preset" system, from left to right: (a) card-punching machine; (b) operating console with master controls; and (c) card-reading machine. In this instance the matrix is housed in the cabinet under the console.

### Advantages of New Electronic Dimmer

Dimmers must be designed to avoid "drift" so that lighting values are constant for given control settings, and do not vary from hour to hour or from day to day. Especially when cross-connect systems are used, it is desirable that all dimmers of the same size in an installation give approximately the same degree of response to control settings.

Now, having briefly touched on some of the problems, let it be said at once that they can be overcome by means of a new 5-kw C-Core Dimmer. The dimmer is necessarily more complex than the simple setup needed to provide just a good dimming performance, but its size, weight and performance characteristics assure important advances over previous types of remote-control equipment. Voltage drop is small. There is an infinite loading ratio, and the dimming curve is even better than that obtained with thyratron tube dimmers. It is possible to dispense with voltage boosters and certain auxiliary equipment previously needed with electronic dimmer systems. Within the load capacity of the dimmer, the new type is likely to cost less than the previous types of electronic dimmer equipment mentioned.

Another important development is a new application of an old principle of circuitry whereby auxiliary equipment has been developed to handle only one thyratron tube or silicon-controlled rectifier to control the full sinusoidal wave of dimmer output. The embodiment of this method in the C-Core Dimmer provides a further reduction in cost with only a slight increase in size and weight. Performance characteristics are virtually the same, except that the loading ratio is limited to 10:1. In television work, the saving in cost is likely to be much more important than the limitation of loading ratio.

Thus a new electronic dimmer is available that at present will handle loads up to 5 kw (and in the near future loads of larger magnitude) at a cost much lower than has heretofore been possible with electronic dimmer equipment. As a result, a greater number of dimmers may be used in a TV studio and this in turn will advance the art of lighting and create greater opportunities for lighting skill.

### Infinite Preset System

To make full use of such a dimmer system, it is necessary to have preset facilities. At the present time, two-scene, five-scene and ten-scene preset systems are in use. However, even a ten-scene preset imposes limitations on the use of lighting changes, and it is desirable to be able to set up for an unlimited number of lighting changes. This brings up the desirability of an "infinite preset" system which can be set up quickly by the operator. Hitherto it has been necessary to manipulate a preset control for every circuit in each preset scene; this procedure, of course, is time-consuming. Punch-card systems have been made available in which the operator can either mark up or "punch" cards by hand, so that he makes his own punch card, recording all setting in a particular scene. But this method also takes up valuable time and is a limiting factor in the use of a large number of lighting changes in the show.

An *automatic* "infinite preset" system has now been developed by Century Lighting, Inc., which overcomes these limitations and reproduces all circuit and brightness selections with an accuracy and speed heretofore impossible. The conventional preset equipment and scene selectors are replaced by electrically operated card-punching and card-reading machines.

When the required brightness values for the various lighting circuits have been determined at re-

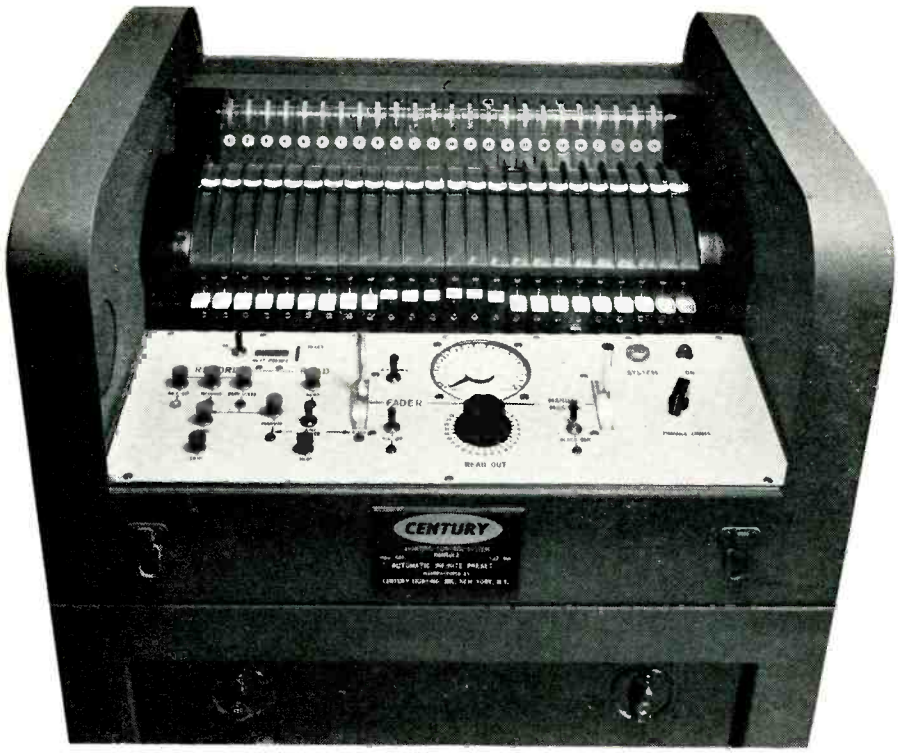



Fig. 2. Close-up of the manually operated console for 24 dimmers, showing the various control buttons, switches and fader for the punch-card "automatic infinite preset" system.

hearsal by manipulation of the manual control console, all that is necessary to record the whole arrangement is for the operator to press a single pushbutton. If the card-punching mechanism is already switched on, it then "reads" all the manual settings on the console and translates them into a digit code on a punch card. The entire operation for a 90-circuit system requires less than 15 sec.

After all the light cues and scenes have been translated into punch cards, these are stacked in the card reader. The first card is "read" into the "upper" memory, the second into the "lower" memory, thereby producing a two-scene preset arrangement — one for the control of the lights and one into which the fader will shift control. As soon as control has been transferred to scene 2, the card reader "reads" scene 3 into the "upper" memory, replacing scene 1. This can be done in approximately ¾ sec, enabling lighting cues to be operated in sequence at the rate of 100/min with complete accuracy.

When the punching of a card is completed, a new card is automatically placed in readiness for the next recording. The code which is punched into a card corresponds to digital translations of the circuit intensities.

If a lighting change is required after the lighting has been set up by the card-reading mechanism, any circuit can be manually changed to a new value by transferring circuit control to the manual controller in the console. Additional means are provided whereby the manual means may first be set at an intensity corresponding to the one provided by the card reader, so that in changing over control from card reader to manual, there is no alteration in the lighting intensity of the circuit.

During a rehearsal period, it may be that after the intensity readings are reproduced by the card-reading machine, it is desired to make a lighting change, so means are provided for corrections. Alternately, if a lighting change is required after the card is punched and certain manual controls have been reset, it is not necessary to reset all other controls in order to punch a new card. Instead, the old card is fed into the reading machine and the lighting setup is corrected as desired on the console, after which a new card is made by pushing a single button.

The automatic preset system will perform any function required and reproduce any setup which has been made for it. However, the time allowance for changing from setting to setting is left in the control of the operator who is provided with the means of having either a ¾-sec. interval between changes or as long a period as he may require. The lighting from one setting can be merged into the following arrangement at any desired speed.

### Control Apparatus of System

This new "infinite preset" system normally comprises four pieces of control apparatus, in addition to the dimmer banks. These are (a) the card-punching machine, (b) the manually operated console with master console, (c) the card-reading machine, and (d) the switching and translating matrix. Three of these pieces of apparatus are illustrated in Fig. 1, in which the console is seen in the center and the card-punching machine on the left. The matrix equipment in this instance is housed in the cabinet under the console.

Figure 2 is a close-up view of the console for a 24-day dimmer installation. The various control pushbuttons, switches and faders are shown. The circular dial seen in the center of the control desk, operated in conjunction with a rotary switch, is calibrated to match values on the scales operated in conjunction with the manual circuit brightness controls. It enables the lighting value of any dimmer circuit to be read at any time while the lighting is in operation, even when under the control of the card-reading machine. Thus to find the intensity for use, say, on Dimmer 20, the rotary switch is turned to position 20, and the value of the lighting intensity on that particular circuit can be read on the dial. This arrangement enables any particular control to be set in advance to give the same value as the lighting before transferring to manual operation; thus transfers can be made without any visual change in lighting intensities.

Figure 3 shows the card-punching machine with a stack of punch

cards in position, ready for transmission into the machine for punching.

Both the card-punching and card-reading machines are less than 30 inches in width and remain this size, regardless of the number of dimmers controlled by an installation. A single punch card will record all necessary information concerning 90 dimmer circuits. When the installation has more than 90 dimmers, then two or more cards are employed. Thus, if the "infinite preset" system is used for 150 dimmers, two cards will be used and the time to punch both of them would be about 30 sec. The time required to "read" both cards would be approximately 1½ sec.

The "infinite preset" system can also be utilized to control the movements of electrically operated mechanisms such as spotlights which can be panned, tilted, focused, raised and lowered, etc., by means of remote-controlled operation. Thus height, angle and focus of spotlights can all be recorded on the punch mechanism and read back from cards.

It might in fact be said that any form of electrical mechanism can be arranged for control by this system. Hence color filter changes, spotlight positioning, circuit selection and brightness control can all be recorded on the same punch cards and reproduced in sequence.

This will have a far-reaching effect on lighting unit layouts. When a single unit can be changed in position, angle and focus by remote control, fewer units normally will be required. This, in turn, will affect the electrical layout, and it may be found better to locate the dimmers on, or adjacent to, the lighting units rather than in a dimmer bank at a distance.

### Application of System To Color Changes

A paper by the author in the July 1957 *SPMTE Journal* described "A New Variable Luminous Studio Wall." This wall has been found very useful for Chroma-Key work, as well as for background effects. The control for a full-color system of this nature by the "infinite preset" system will greatly expand the opportunities for using the color wall. Since very carefully determined combinations of colors can be accurately recorded, and reproduced in ¾ sec., any number of color changes can follow each other at any desired speed. When dealing with four-color lighting systems there are four, instead of one, brightness controls to operate for each piece of four-color equipment, and the need for preset facilities is therefore increased. When using color-change lighting, a great number of presets are required to record every desired variation, and here the "infinite preset" system will be of very great value. Also, when the color lighting sequence is being set up at rehearsal, each desired effect can be accurately recorded in a few seconds on a punch card, providing for more extensive use of color-changing effects.

In another paper the author referred to the desirability, in his opinion, of "modifiable white light" for color work. Such light would be obtained from lighting units, each of which contained a primary source of white light and three secondary sources of colored light (e.g., red, green and blue). The four sources would be blended by means of dimmer controls and would provide any desired spectral quality of light at any required intensity. Among other things, this method would overcome the drawback of changed color quality, which is experienced with dimming incandescent filament lamps.

The "infinite preset" system would overcome the operational difficulties involved with frequent adjustments of lighting quality, and when picture color rendition requires an immediate and unrehearsed adjustment, it can be made with the "over-ride" means, which allows manual operation of any controls without disturbing the rest of the setting.

The end result of the "infinite preset" system is to widen the art of lighting and to enhance the capabilities of people responsible for lighting. It does not tend toward mechanization of the art, but removes many shackles that limit full expression by the individual.

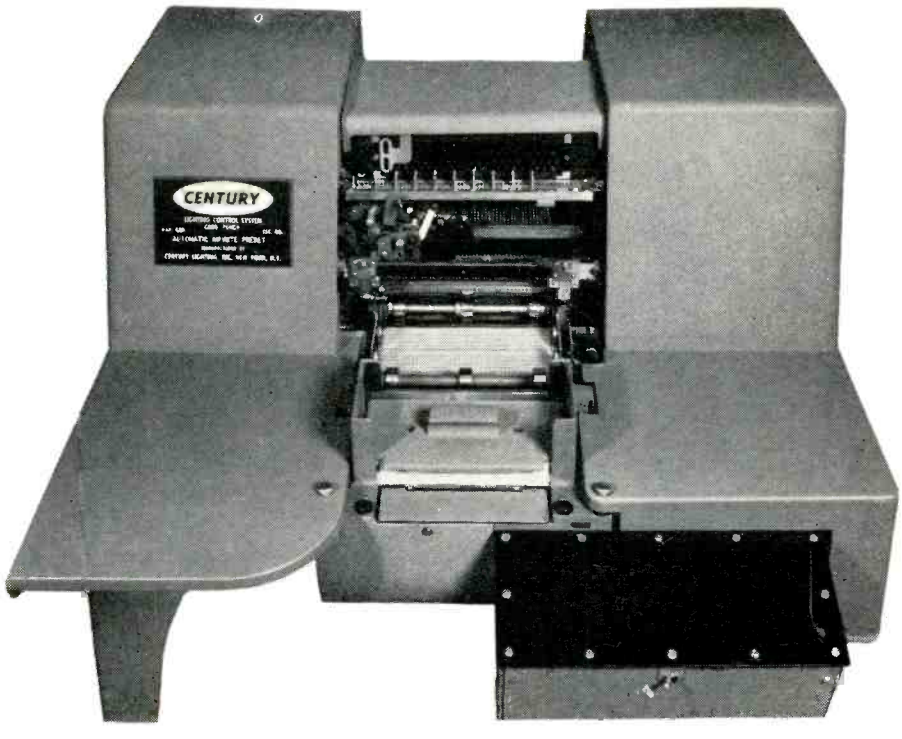
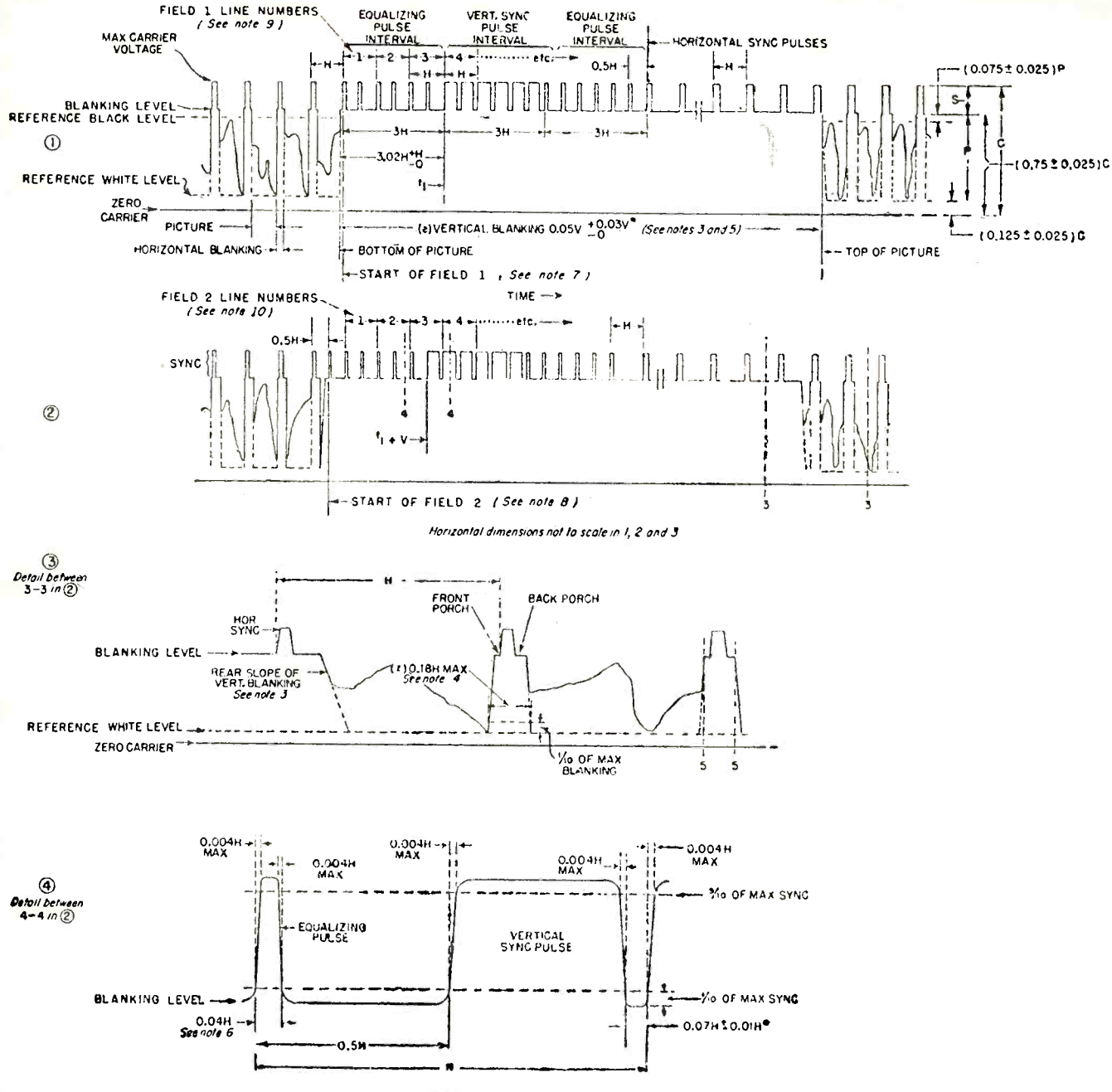



Fig. 3. The card-punching component of the "automatic infinite preset" system. A stack of cards is in position ready for transmission into machine for punching.



October, 1959




NOTES

1. H = Time from start of one line to start of next line.
2. V = Time from start of one field to start of next field.
3. Leading and trailing edges of vertical blanking should be complete in less than 0.1H.
4. Leading and trailing slopes of horizontal blanking must be steep enough to preserve minimum and maximum value of (x + y) and (z) under all conditions of picture content.
5. Dimensions marked with asterisk indicate that tolerances given are permitted only for long time variations and not for successive cycles.
6. Equalizing pulse area shall be beween 0.45 and 0.5 of area of a horizontal sync pulse.
7. Color burst follows each horizontal pulse, but is omitted following the equalizing pulses and during the broad vertical pulses.
8. Color bursts to be omitted during monochrome transmission.
9. The burst frequency shall be 3.579545 mc. The tolerance on the frequency shall be ±10 cycles with a maximum rate of change of frequency not to exceed 1/10 cycle per second per second.
10. The horizontal scanning frequency shall be 2/455 times the burst frequency.
11. The dimensions specified for the burst determine the times of starting and stopping the burst, but not its phase. The color burst consists of amplitude modulation of a continuous sine wave.
12. Dimension "P" represents the peak excursion of the luminance signal from blanking level, but does not include the chrominance signal.
    Dimension "S" is the sync amplitude above blanking level.
    Dimension "C" is the peak carrier amplitude.
13. Start of Field 1 is defined by a whole line between first equalizing pulse and preceding H sync pulses.
14. Start of Field 2 is defined by a half line between first equalizing pulse and preceding H sync pulses.
15. Field 1 line numbers start with first equalizing pulse in Field 1.
16. Field 2 line numbers start with second equalizing pulse in Field 2.
17. Refer to text for further explanations and tolerances.

Figure 7—Television synchronizing waveform for monochrome transmission only.

I. The Commission should extend indefinitely the temporary authorization for broadcast transmission of reference and test signals during the vertical blanking interval on a permissive basis, subject to restrictions outlined in Item II. It is understood that reference signals are intended primarily for operational monitoring and control of program transmission, and normally include a pulse at reference white level. Test signals may employ any waveform and are intended for detailed analysis of specific system performance characteristics.

II. Reference or test signals may be transmitted during the period commencing with the last 12 microseconds of line 17 and extending through line 20, subject to the following conditions:

a. No portion of the reference or test signals should extend beyond the amplitude range bounded by reference white and blanking levels, with the exception that negative excursions of color sub-carrier signals may extend into the synchronizing region but in no case beyond peak of sync level.

b. No portion of the reference or test signals should encroach upon that portion of any horizontal period normally devoted to blanking.

c. A guard interval of at least ½ line duration at blanking level shall separate reference or test signals from the start of the picture signal.

d. The picture signal must commence not later than line 22.

The American Broadcasting Co. in support of the proposed rule reported that it conducted extensive tests and transmissions of vertical interval reference and test signals and believes that results indicate the technique is a valuable aid in maintaining video levels and quality, especially in connection with network transmission. The Columbia Broadcasting System found that the signals were particularly useful for maintaining transmission levels at those stations that receive programs from remote locations by means of cable or microwave relay. WKNX-TV of Saginaw, Michigan reported that experiments have demonstrated reference and test signals can be very beneficial as a continuous reference in adjusting video equipment and says that it has found test signals transmitted by CBS especially helpful in setting up frequency and linearity correction on its three station microwave link. The National Broadcasting Co. has indicated that it has received many favorable comments pertaining to the desirability of a reference test signal for equipment adjustment from its network affiliated stations. NBC, as a result of its experiences, believes that the test signals provide an important operational tool.

The data and comments filed as a result of the tests and experiments show that the test and reference signals can provide a valuable tool for use by television broadcast stations in aligning and adjusting various components of the transmission system so as to more faithfully transmit the scenes viewed by the TV camera and will facilitate evaluation of the performance of the overall transmission system. Although there was no showing that the signals were intended for use by the general public or that any such use would be made, it was shown that the test signals could be transmitted simultaneously with the regular program transmissions without significantly degrading the quality of the program transmission. Since deletion of the signals after they have passed through the entire transmission system might pose difficult technical problems, no reason was found to require such deletion. Future developments may lead to the use of test signals as well as cue and control signals which require transmission to perform their functions.

There is general agreement that the transmission of test signals should be permissive and not mandatory. The kinds of test and reference signals which might be used should not be specified nor should test signal standards be established at present. The new rules which have been adopted prescribe the area within the vertical interval during which test signals may be transmitted and sets forth certain conditions designed to prevent degradation of the program content and minimize potential interference to other stations.

The new rules read as follows:

§ 3.682 *Traansmission standards and changes.*

(a) Transmission standards.

(21) The interval beginning with the last 12 microseconds of line 17 and continuing through line 20 of the vertical blanking interval of each field may be used for the transmission of test signals subject to the conditions set forth below. Test signals may include signals used to supply reference modulation levels so that variations in light intensity of the scene viewed by the camera will be faithfully transmitted; signals designed to check the performance of the overall transmission system or its individual components; and, cue and control signals related to the operation of the television broadcast station. Figures 6 and 7 of § 3.699 identify the numbered lines referred to in this subparagraph.

(i) Modulation of the television transmitter by such test signals shall be confined to the area between the reference white level and the blanking level except where such test signals are composed of chrominance subcarrier frequencies, in which case their negative excursions may extend into the synchronizing peak amplitude. In no case may the modulation excursions produced by test signals extend beyond peak-of-sync level.

(ii) The use of test signals shall not result in significant degradation of the program transmissions of the television broadcast station nor create emission components in excess of those permitted for normal program transmissions.

(iii) Test signals may not be transmitted during that portion of each line devoted to horizontal blanking.

(iv) A guard interval of no less than one-half line shall be maintained at all times between the last test signal and the beginning of the first picture scanning line.

§ 3.699. [*Amendment*]

2. Delete present Figures 6 and 7 and substitute the new Figures 6 and 7.

# A STUDY OF TELEVISION AURAL

Results of engineering and field tests conducted by the Television Allocations Study Organization concerning the reduction of Aural to Visual power ratio.

*The following article consists of excerpts from the TASO Reports "Engineering Aspects of Television Allocations."*

THE RATIO of sound-to-picture power to be employed in television transmission to provide best television service to the public is a matter upon which there are a variety of opinions. The differing points of view were represented on the several TASO panels and were presented effectively by their proponents. It is not the function of TASO to resolve these differences and make specific recommendations, but rather to gather and present the engineering information upon which decisions can be based.

The present standard of television broadcasting calls for a ratio of FM sound power to peak picture power of 1:2. (With permitted tolerance this ratio may vary from 0.5 to 0.7). There have been suggestions to decrease this ratio. The figure usually mentioned is 1:10, the purpose being primarily to improve the lower adjacent-channel interference. This was felt to be an aid to allocation. Though there would be some savings possible to broadcasters through equipment simplifications and some reduction in power cost, it has been agreed in TASO that this is not significant to allocations and is therefore not a consideration.

The problem of the proper choice of sound-to-picture power ratio was

# TO VISUAL POWER RATIO AT VHF

brought to the attention of TASO largely because of two factors. First, a consideration of the permitted power per kilocycle of bandwidth of the standard sound and picture channels would seem to indicate a considerable disparity in favor of the sound channel. This disparity would appear to be increased when it is remembered that frequency modulation is used for the sound channel and amplitude modulation for the picture channel; and when it is noted that the picture transmitter is rated in terms of the power during synchronizing peaks (with a resulting rather low average power) while the sound transmitter is rated in terms of its constant average power. Second, many stations have reported that because of emergency conditions, they have occasionally operated with very low audio power, sometimes for periods of weeks or months, with no adverse reaction on the part of the public. Even with normal operation of transmitters, the received ratio of sound-to-picture signal strength may vary greatly because of vagaries in transmission. It was therefore apparent that this matter should be considered by TASO since, if the sound power were to be reduced, allocation practices might be affected.

Both Panel 1 — Transmitting Equipment, and Panel 2 — Receiving Equipment, obviously have direct interests in the sound-to-picture power ratio. Panel 3 was also involved through a series of field tests. Also, Panel 6 made tests of the subjective effects of lower adjacent channel interference with normal and with reduced sound-to-picture power ratios. Panel 5 studied the problem from the viewpoint of the overall television system. Finally, the Panel Coordinating Committee worked to keep the activities of the various groups coordinated. Actually, some TASO groups may have devoted more attention to this problem than might be thought justifiable in terms of the ultimate effect of this item on television allocations.

The general nature of the sound-to-picture power ratio problem is stated in a memorandum written by the Panel Coordinating Committee for the guidance of Panel 2 and from which the following is quoted.

"The reason that TASO is interested in the ratio of sound-to-picture power which is used in television broadcasting is that the choice of this ratio has an effect on the extent of the service provided by television stations and therefore might have an effect upon the television allocation problem. It should be noted that this significance extends to the general problem of television allocations and is by no means limited to considerations regarding 'drop-ins'.

"If the ratio of sound-to-picture power were to be reduced, two contrary effects would be produced. (1) In areas where television service is limited by decreasing signal strength at increasing distance from the transmitter (fringe areas), the area receiving a usable sound signal would be reduced. This would be the predominant effect in areas of low population density. (2) In areas where television service is limited by interference from the lower adjacent sound channel, the area receiving a usable picture signal would be increased. This would be the predominant effect in areas of high population density.

"The proponents of a lower sound-to-picture power ratio believe that in the fringe areas where the sound service would suffer, the picture is already unusable and therefore the effective service area of the television broadcasting station would be unaffected. Those who are opposed to a reduction in the ratio point out that, even in these marginal areas, 'viewers' still watch a poor picture and maintain continuity of the program via the sound channel.

"Other matters have been raised in TASO panels. These are not pertinent to the allocations problem. Among these are the following: (1) The initial and operating costs of a television transmitter would be less if the sound-to-picture power ratio were reduced. (2) The cost of a television receiver would be increased if the sound-to-picture ratio were reduced. Any effect on the relative costs of transmitting equipment or of receiving equipment due to a change in the sound-to-picture power ratio is outside the purview of TASO except as such changes in cost may be related to the relative economies of UHF and VHF operation. Adequate performance within the service area should, however, be maintained.

"The question which is of real concern to TASO is the extent to which the service area of a television transmitter would be changed (increased or decreased) by a change in sound-to-picture power ratio. The answer can be determined for typical locations if certain factors are known. Some of these factors relate to the propagation of signals from the desired transmitter within its service range and to the propagation of signals from an undesired transmitter within its interfering range. Other factors relate to subjective-objective relationships in judging picture quality — to the necessary signal-to-thermal-noise and desired-signal-to-lower-adjacent-channel-signal ratios necessary to produce a satisfactory picture. Still other factors relate to the performance characteristics of typical television receivers — lower adjacent channel sound rejection, and sound and picture sensitivities (at normal and at reduced but still adequate receiver outputs)."

It should be noted that the items mentioned in the last paragraph fall within the purviews of several TASO panels.

Before considering this problem in detail, it should be emphasized that no TASO panel suggested a large reduction in sound power. This was stated specifically in the same memorandum quoted above, as follows:

"Only the following values of sound-to-picture power ratio need be considered. In every case, the ratio is of picture power in sync peaks to sound power.

| Ratio in db | Ratio of Powers | Ratio of Field Strengths |
|---|---|---|
| 3 | 2:1 | 1.4:1 |
| 6 or 7 | 4:1 or 5:1 | 2:1 or 2.2:1 |
| 10 | 10:1 | 3.2:1 |

No TASO group is suggesting a reduction of more than 7 db below the present standard of 3 db (making a total of 10 db) which is a power ratio of 10:1 or a field strength (or voltage) ratio of 3.2:1.

The findings of the various panels are found in their reports. The information gathered by Panel 1 on the savings in original and in operating costs of transmitters is presented in such a way as to show the effects on these costs of reducing sound power. In general, it is felt by Committee 1.4 that a moderate reduction in the sound-to-picture power ratio would be advantageous from the equipment standpoint (which is not particularly important in the allocations problem) and that field experience indicates that television service would not thereby be adversely affected to a significant extent. In general, the receiver engineers feel that a reduction in the sound-to-picture power ratio would result in significantly poorer receiver performance and a deterioration of television service provided to the public. It is shown that a reduction in sound-to-picture power ratio would not affect the sound-to-thermal-noise ratio greatly at moderate levels of picture signal strength but that sound deterioration would set in at the low picture signal levels found in fringe areas. On the other hand, susceptibility to ignition noise is shown to increase at the same rate as the decrease in sound power at all levels. The practical significance of the response of a receiver to impulse noise depends upon the operating frequency. Impulse noise is most bothersome at low VHF, is of a little less significance at high VHF and is of no importance at UHF. The subjective tests made by Panel 6 indicate that the decrease in lower adjacent channel interference as the sound power is lowered is somewhat less than the decrease in sound power.

The effect of a reduced sound-to-picture power ratio on the performance of color television receivers is a question regarding which there is some difference of opinion. There would appear to be no question but that a reduced sound power would reduce the (approximately) 900 kilocycle beat between the sound carrier and the color sub-carrier. This beat is annoying in many current receivers, both color and monochrome, during the reception of color transmissions. In the opinion of Panel 2, however, the possible easing of receiver design in this respect would be more than offset by the increased difficulties noted in their report, particularly with respect to the design of traps (or filters).

### Report on Iowa Field Tests

Since the beginning of commercial television in the United States, it has been accepted practice for television stations to run a ratio of FM sound-to-peak picture transmitter powers of approximately 1:2. This ratio of powers has been the subject of considerable debate in recent years. It is contended by some that the coverage of sound far exceeds that of a useable picture. Therefore, it is argued, reduction of sound power is in order since considerable savings would be made at the transmitter, both in initial investment and operating expenses. Moreover, such a reduction might result in substantially less lower adjacent channel interference. Therefore, the question is pertinent to the allocations problem. On the other hand, it is contended by others that a reduction in sound power would adversely affect the service now provided by television broadcasting stations, especially in the fringe areas.

It was the purpose of this study to make a survey of television sound and picture reception in an area where sound power was occasionally reduced but picture power was kept at normal values. In this way, it was

hoped to determine if reductions in sound power were feasible.

The tests were conducted as follows: Three television stations, all VHF, in the Des Moines-Ames, Iowa, area made occasional changes in their sound power during the entire month of November, 1957. These changes were made independently by each station and no station had any knowledge of when the others were making power changes. Those stations participating were WHO-TV, KRNT-TV, and WOI-TV. All three stations are normally maximum power. WHO-TV is on channel 13, KRNT-TV is on channel 8, and WOI-TV is on channel 5. The first two have peak video powers of 316 kw and the latter has a peak video power of 100 kw. The peak video powers were kept constant during the entire month at their normal values, but the sound carriers were varied such that the power ratios were either approximately 1:2, 1:5, or 1:10.

Simultaneously with these power variations, about 1600 post cards were distributed to about 40 television servicemen and dealers throughout the State of Iowa. Most of these men were contacted personally through the efforts of the Engineering Extension Service of Iowa State College. A supply of post cards and a set of instructions were left with each man. The individual was instructed to send in two post cards during each weekday, one in the morning and one in the afternoon. Each post card called for information on the acceptability of picture and sound for each of the three stations according to the NTSC six point scale. It will be noted that the instructions say nothing about the changes in sound power. They merely mention a study of "reception conditions." Those people who contacted the observers were specifically instructed to give no hint that anything abnormal was going on. This was done to avoid the well-known ability of the human being to observe an effect subjectively whether it is present or not. There was a space for the time

**TABLE I: Tabulations for 1:2 Power Ratio**

| Distance Range | Excellent | Good | Passable | Not Quite Passable | Lousy | Not Useable |
|---|---|---|---|---|---|---|
| 0-25 | | | | | | |
| aural | 34 | 2 | 0 | 0 | 0 | 0 |
| visual | 32 | 3 | 1 | 0 | 0 | 0 |
| 26-50 | | | | | | |
| aural | 140 | 126 | 0 | 0 | 1 | 0 |
| visual | 94 | 128 | 42 | 0 | 3 | 0 |
| 51-75 | | | | | | |
| aural | 104 | 313 | 56 | 10 | 8 | 5 |
| visual | 55 | 206 | 147 | 46 | 37 | 15 |
| 76-100 | | | | | | |
| aural | 45 | 194 | 96 | 27 | 31 | 57 |
| visual | 0 | 44 | 125 | 101 | 70 | 110 |
| 101-125 | | | | | | |
| aural | 17 | 18 | 20 | 7 | 16 | 12 |
| visual | 6 | 8 | 19 | 16 | 15 | 26 |

**TABLE II: Tabulations for 1:5 Power Ratio**

| Distance Range | Excellent | Good | Passable | Not Quite Passable | Lousy | Not Useable |
|---|---|---|---|---|---|---|
| 0-25 | | | | | | |
| aural | 2 | 0 | 0 | 0 | 0 | 0 |
| visual | 2 | 0 | 0 | 0 | 0 | 0 |
| 26-50 | | | | | | |
| aural | 44 | 28 | 0 | 0 | 0 | 0 |
| visual | 24 | 41 | 6 | 0 | 1 | 0 |
| 51-75 | | | | | | |
| aural | 48 | 104 | 14 | 4 | 5 | 5 |
| visual | 18 | 84 | 45 | 18 | 11 | 4 |
| 76-100 | | | | | | |
| aural | 8 | 57 | 31 | 7 | 7 | 31 |
| visual | 0 | 10 | 29 | 33 | 23 | 46 |
| 101-125 | | | | | | |
| aural | 1 | 2 | 4 | 1 | 3 | 3 |
| visual | 0 | 0 | 3 | 0 | 4 | 7 |

**TABLE III: Tabulations for 1:10 Power Ratio**

| Distance Range | Excellent | Good | Passable | Not Quite Passable | Lousy | Not Useable |
|---|---|---|---|---|---|---|
| 0-25 | | | | | | |
| aural | 1 | 0 | 0 | 0 | 0 | 0 |
| visual | 1 | 0 | 0 | 0 | 0 | 0 |
| 26-50 | | | | | | |
| aural | 22 | 10 | 0 | 0 | 0 | 0 |
| visual | 13 | 11 | 7 | 0 | 1 | 0 |
| 51-75 | | | | | | |
| aural | 25 | 50 | 8 | 2 | 1 | 3 |
| visual | 11 | 48 | 15 | 7 | 4 | 4 |
| 76-100 | | | | | | |
| aural | 3 | 30 | 15 | 3 | 4 | 9 |
| visual | 1 | 9 | 14 | 13 | 12 | 15 |
| 101-125 | | | | | | |
| aural | 0 | 2 | 2 | 0 | 2 | 4 |
| visual | 0 | 1 | 3 | 0 | 3 | 3 |

and date of observation on each post card, although the necessity of marking the time on the card was not specifically stressed for obvious subjective reasons. On later tabulation, a significant number of post cards were thrown out because the time was not determined accurately enough to be absolutely certain of correlation requirements.

The observers were scattered from 10 to 125 miles from one or more of the transmitters. After the post cards were received, they were marked with the distance to each transmitter and the power ratio of each transmitter. The distances from observer to transmitter were then broken into five ranges. They are 0-25 miles, 26-50 miles, 51-75 miles, 76-100 miles, and 101-125 miles. For each distance range, tabulations were made for each of the six points on the rating scale for each power ratio. Tables I, II, and III give these results for power ratios of 1:2, 1:5, and 1:10, respectively.

**TABLE IV: Relative Sound and Picture Tabulations**

| Distance Range | No. of Persons Reporting Sound Better than Picture | No. of Persons Reporting Sound and Picture Equivalent | No. of Persons Reporting Picture Better than Sound |
|---|---|---|---|
| POWER RATIO 1:2 | | | |
| 0-25 | 3 | 33 | 0 |
| 26-50 | 74 | 193 | 1 |
| 51-75 | 260 | 236 | 6 |
| 76-100 | 317 | 127 | 3 |
| 101-125 | 46 | 42 | 0 |
| POWER RATIO 1:5 | | | |
| 0-25 | 0 | 0 | 0 |
| 26-50 | 26 | 47 | 1 |
| 51-75 | 86 | 89 | 4 |
| 76-100 | 95 | 45 | 1 |
| 101-125 | 6 | 9 | 0 |
| POWER RATIO 1:10 | | | |
| 0-25 | 0 | 1 | 0 |
| 26-50 | 15 | 17 | 0 |
| 51-75 | 36 | 52 | 1 |
| 76-100 | 42 | 21 | 1 |
| 101-125 | 2 | 7 | 0 |

For discussion purposes, let us consider each distance range in sequence. For the distance range from 0-25 miles, there is no observable trend from Tables I through III. It could hardly be expected that significant differences would occur in this range, of course. From 26-50 miles, no hard statistical conclusions can be drawn. For the Good rating at a power ratio of 5:1, it might seem that the status of the sound carrier has slipped somewhat from the power ratio of 2:1, but the trend is not supported by the data on the power ratio of 10:1. More observations at a power ratio of 10:1 would clearly have been desirable here. At a range of 51-75 miles, the predominant number of reports do not indicate any serious degradation of sound quality. In the range from 76-100 miles, the sound quality seems to be holding for all power ratios, but the picture slips quite badly, and approximately uniformly, for all power ratios. In the range from 101-125 miles picture and sound are obviously slipping and it may be possible to notice a little degradation in sound coverage, although the main problem is again too little data at the low sound powers.

There is another interesting tabulation of this information which may indicate any trends, or lack of them, somewhat more efficiently. The reported observations are broken into three categories; the number of persons rating sound higher than picture; the number rating sound and picture the same, and the number rating sound worse than picture. This information is tabulated for all distance ranges and for all power ratios in Table IV.

Table IV shows no significant degradation in sound with respect to picture quality at any of the power ratios for any distance out to 125 miles at least.

One other effect was noted on the post cards which is not easily tabulated but nevertheless may be quite important. In a significant number of cases, it was noted that certain observers rated sound and picture in a similar manner consistently irrespective of the power ratio. This would probably be an additional indication that neither sound nor picture changed a significant amount from the subjective viewpoint at least.

It is not the purpose of this report to make recommendations as to specific changes in the standards of sound-to-picture power ratios. It appears, however, that adequate service can be obtained with power ratios considerably less than those currently used.

In conclusion, it should be noted that the choice of the proper sound-to-picture ratio may become more important in the future than it is now. At present, co-channel interference is probably more of a restrictive factor in some areas than adjacent channel interference in television allocations. However, if co-channel interference is reduced significantly through the use of precise carrier frequency offset, adjacent channel interference could become the limiting factor. Moreover, as a television system (or any other system) matures and becomes more sophisticated and complex, all factors must be considered carefully and brought into proper balance.

# BROADCAST BAND MULTIPLEXED

**Here is the Professor's answer to the crowded broadcast frequencies. He claims that the entire broadcast band can be multiplexed on one FM transmitter.**

By PROF. OSCAR VAN DER SNIKRAH

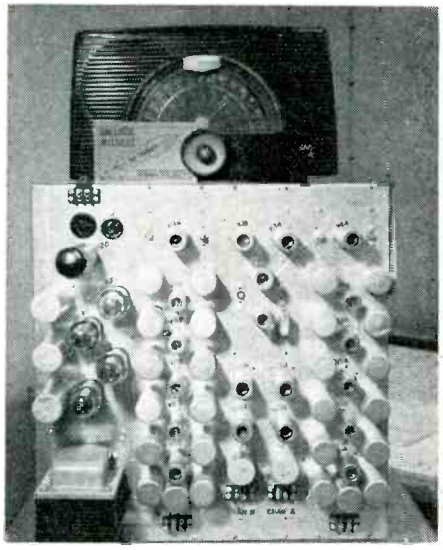


Fig. 1. Adapter for use with existing AM radios. Unit uses 27 tubes but future models are expected to be simpler.

From recent experiments conducted in our laboratory, it has been determined that the present use of multiplexing on the FM transmitters has been completely underdeveloped.

In our laboratory experiments being conducted to determine the maximum number of subcarriers that may be transmitted over a single transmitter, it was discovered that there is practically no limit to the number of subcarriers that can be transmitted; the only problem being that of maintaining complete linearity in the transmitting system and the provision of proper means of separation to be provided at the receiving point.

As a result of these experiments, the multiplexing of frequencies between 550 and 1700 Kc. was proposed.

Using amplitude modulated subcarriers spaced 30 Kc. apart throughout the so-called AM broadcast band from 550 to 1700 Kc., the remarkable results have led to the proposal of a reallocation of the spectrum that will solve many problems.

At this time, it is proposed that the entire broadcast band be turned over to other services and each major community throughout the nation install a super powerful 3 megawatt FM transmitter which would be used to convey the multiplexed AM broadcast carriers.

Each station would pipe its program over phone lines to the main distribution point at the super-powered FM transmitter.

At the receiving end none of the existing AM receivers in the hands of the public would be made obsolete. To each receiver would be added a small front end converter which would pick up the FM signal, demodulate it and make available through a loop coupling, the subcarriers in the range of the broadcast band. These signals would then enter the regular antenna circuit of the existing AM receiver and by tuning the AM dial the listener would have his pick of which subcarrier to receive. From then on, for all normal purposes, the reception would be the same as the regular old-fashioned AM receivers.

The important thing about this system would be that there would be no interference from night signals, or any other of the dozens of faults that constantly cause bad reception on the AM broadcast band.

Since the taxicab services and citizens band radio are in dire need of additional frequencies, to mention a few, the broadcast band could be turned over to them.

Another feature of the system would be that the super-powerful FM transmitter being used to convey all of the subcarriers would have no main channel modulation. This would be very confusing to an enemy in case of a war, because they would not know what was being transmitted since the main channel would appear to be blank when they tuned it in.

Several equipment manufacturers have agreed to pool their efforts in providing the country with the millions of front end converters that will be required. A still further technical advantage of the system would be that no AVC will be needed in the future AM receivers, thus cutting down their production cost and making radio service available to that many more families. There are, of course, many other economic factors that are self evident and beyond the scope of this paper.

If the Commission should switch over to this system, there would be some new problems develop in the disposal of the existing directional arrays and in relocating consulting engineers who would be put out of work. One good plan has been proposed, however. It has been suggested that a large portion of the Indian Territory be allocated as an engineering refuge. In this electronic no man's land, full freedom for experimenting would be permitted without regard to F.C.C. or international agreements. All present consulting engineers would be relocated with their families (if they still have any) at government expense.

This is not to imply that the consulting engineers are sceptical of this AM broadcast band multiplex proposal.

The over-all service to the public would provide such improved advantages, however, that it more than overshadows these disadvantages.

# F.C.C. REGULATIONS

REVISED UP TO PUBLISHING TIME.

## RULES FOR CONELRAD OPERATION

### CONELRAD

#### Scope and Objective

§ 3.901. *Scope of subpart.* This subpart applies to all standard, FM and TV broadcast stations and is for the purpose of providing for operation of certain stations located within the Continental United States during periods of enemy air attack or imminent threat thereof.

§ 3.902. *Object of plan.* The aim of this plan is to minimize the navigational aid that may be obtained from the continued operation of broadcast stations while at the same time providing for transmission of civil defense information to the public. During CONELRAD radio alert periods, when not broadcasting civil defense programs or alert or all-clear notification messages, these stations may, on their own responsibility, broadcast such other programs as they may desire.

#### Definitions

§ 3.910. *CONELRAD.* The word CONELRAD is a contraction of the words Control of Electromagnetic Radiation and is the general name given to required procedures under authority of Executive Order 10312 dated December 10, 1951 (3 CFR, 1951 Supp.)

§ 3.911. *Air Defense Control Center (ADCC).* An air operations center from which an air division (defense) commander supervises and coordinates air defense activities within an air defense sector, including dissemination of warnings, identification and security control of air traffic and utilization of available combat forces in support of the national air defense effort.

§ 3.912. *Basic key station.* A station that receives the radio alert by telephone directly from the ADCC. Basic key stations relay radio alerts to other stations by radio and by telephone.

§ 3.913. *Relay key station.* A station that receives the radio alert by telephone or radio broadcast from a basic key station or other relay key station. Relay key stations pass the radio alert on to other stations by radio broadcast or telephone.

§ 3.914. *Skywave key station.* A station designated to disseminate a radio alert by broadcast primarily during the experimental period as an alternate for local key stations which may not be in operation. It will normally be capable of disseminating the alert over a wide area by means of skywave transmission.

§ 3.915. *Radio alert.* The radio alert is the Department of Defense order to operate stations in accordance with CONELRAD requirements for a period of time, as determined by the Air Division Commander or higher military authority.

§ 3.916. *Radio all clear.* The radio all clear is the Department of Defense order to discontinue CONELRAD requirements, as imposed by an outstanding radio alert, with authorization to return to normal operation. It is initiated by the Air Division Commander or higher military authority.

§ 3.917. *Cluster.* A cluster is a group of broadcast stations serving a single area, all operating on the same CONELRAD system frequency. All stations in a cluster will be inter-connected by wire lines and will carry a common program.

§ 3.918. *Sequential control lines.* Sequential control lines are the wire lines interconnecting the several stations in a cluster. By means of a mechanical, manual or electronic device at a central control point, the stations in a cluster are turned on and off in sequence over the circuits provided by the sequential control lines. In some cases these lines may also carry the cluster program.

§3.919. *CONELRAD manual.* The CONELRAD manual is the document containing the detailed description of how broadcast stations will be alerted and operated in the CONELRAD system. The manual will be subject to modification from time to time as experience indicates a need for such changes.

#### Supervision

§ 3.920. *Zones.* CONELRAD activities under the authority of FCC are under the immediate supervision of three FCC Zone Supervisors whose respective zones are coextensive with the three Air Defense Force Areas. (Each broadcast station will be furnished the name and address of the Zone Supervisor of its Zone.)

§ 3.921. *Divisions.* Each zone is divided into several divisions corresponding to the USAF Air Divisions. An FCC Coordinating Engineer is assigned to each Air Division and has responsibility under the Zone Supervisor for all CONELRAD activities under the authority of FCC in his division.

#### Radio Alerts

§ 3.930. *Notification of a radio alert.* (a) All notifications of radio alerts and all clears shall be issued by the Air Defense Control Center(s) (ADCC) under the authority of the Air Division Commander or his duly authorized representative, to all basic key stations. All relay key stations will, in turn, be notified by the basic key stations or other relay key stations. The remaining stations will then be notified by basic key stations or relay key stations. These notifications will be accomplished either by telephone messages or by radio broadcast.

(b) During the experimental period many of the regular key stations may be off the air. All standard, FM and TV stations will be supplied with the list of skywave key stations at least one of which must be monitored during any period of operation when the regularly used key station is not on the air.

§ 3.931. *Reception of a radio alert.* All standard, FM and TV broadcast stations, including basic key and relay key stations, must install the necessary equipment to receive notifications of radio alerts and radio all clears by means of reception of radio broadcast messages, and must maintain this equipment in a state of readiness for reception, including arrangements for human listening watch or automatic alarm devices or both. Such equipment should have its termination at the transmitter control location.

§ 3.932. *Operation during a radio alert.* (a) Immediately upon receipt of a radio alert, either by radio broadcast or telephone, all standard, FM and TV broadcast stations, including such stations operating under equipment or program test authority, will follow the prescribed procedure and transmit an approved sign-off message as set forth in the CONELRAD Manual For Broadcast Stations, then remove the transmitter from the air.

(b) Those stations which are authorized to participate in the operating system will immediately take necessary steps and begin operations on assigned frequencies in accordance with the terms of their CONELRAD authorizations and current operating instructions. All other broadcast stations will observe radio silence until the radio all clear.

(c) No identification may be broadcast between the time the radio alert is received and the time the radio all clear is announced, unless expressly authorized by the FCC. The transmission of any information which would serve to identify the geographical location of the station is prohibited.

(d) A station operating in the CONELRAD system may transmit in accordance with its CONELRAD authorization during a radio alert beyond its normal hours and nothing in its regular license or other instrument of authorization shall prevent such operation in the CONELRAD system.

(e) Prior to commencing routine operation or originating any emissions under program test, equipment test, experimental or other authorization or for any other purpose, licensees or permittees shall first ascertain whether a state of radio alert exists and if so shall refrain from operation or operate in the CONELRAD system whichever is appropriate.

#### Radio All Clear

§ 3.940. *Notification of a radio all clear.* The radio all clear notification will be transmitted through the same channels as the radio alert. Stations operating in the CONELRAD system will transmit the radio all clear message on the CONELRAD system frequency. Key stations will, as soon as possible thereafter, follow the prescribed procedure and broadcast the radio all clear message on their regular operating frequency. All stations, including FM and TV stations, upon resuming regular operation will follow the prescribed procedure and immediately broadcast the radio all clear message.

#### System Operation

§ 3.950. *Procedure.* Each broadcast station permitted to operate during a radio alert must observe operating procedures for the mode of operation to which it is assigned, as set forth in detail in the CONELRAD Manual For Broadcast Stations.

§ 3.951. *Participation.* (a) Any standard broadcast station desiring to participate in a CONELRAD operating system should contact the Zone Supervisor, indicate the station's willingness to make such technical modification of the station equipment as might be necessary to permit operation on a system

frequency and with such power limitations as might be necessary. The Commission will then issue a CONELRAD authorization to the station specifying the frequency to be used by the station. Stations which have indicated a willingness to participate in CONELRAD on a voluntary basis prior to the effective date of this rule need not take any further steps.

(b) At such time as technical consideration may warrant the inclusion of FM and TV broadcast stations within the operating CONELRAD system, appropriate announcement will be made by the Commission and application for participation made as above set forth.

(c) Any station participating in CONELRAD system operations may withdraw from the system by giving thirty days' notice to the FCC Zone Supervisor in writing and by submitting its CONELRAD authorization for cancellation.

(d) Broadcast stations are specifically exempt from complying with § 3.57 while operating under their CONELRAD authorization.

Tests

§ 3.960. *Alerting system.* Tests of the alerting system will be conducted periodically.

§ 3.961. *Sequential control lines.* Sequential control and program lines must be tested at frequent intervals and results reported in the prescribed manner to the FCC Zone Supervisor.

§ 3.962. *Entire system.* Tests of the entire system will be conducted from time to time. During such tests, all stations which are authorized to operate in the CONELRAD system will operate in accordance with terms of the CONELRAD authorization. Other stations will not be required to go off the air during such tests but will be subject to any interference which might result from the CONELRAD operation. Such tests will be scheduled to take place during the experimental period. Industry representatives will be consulted prior to conducting CONELRAD system tests to obtain views relative to the action and to coordinate the activity.

§ 3.963. *Equipment.* The licensee of each station authorized to participate in CONELRAD system operation shall make such tests of his equipment as may be necessary to assure it is ready for instant use.

§ 3.964. *Log entries.* Appropriate entries of all tests shall be made in the station log.

Drills

§ 3.970. *Notification of a drill.* At some time it may be necessary to conduct an Air Defense Drill under conditions of simulated attack. Industry representatives will be consulted prior to conducting CONELRAD drills to obtain views relative to the action and to coordinate the activity. Such drills will only be called when the Department of Defense, the Office of Defense Mobilization, and the Federal Communications Commission concurrently agree that the drill is necessary. All stations will be notified well in advance of such a drill.

§ 3.971. *Operation during a drill.* During a drill, all standard, FM and TV broadcast stations will take the same steps as such stations would be required to take in the event of an actual radio alert under this part of the rules and current operating instructions as set forth in the CONELRAD Manual For Broadcast Stations, except for special drill messages.

[F. R. Doc. 55-9821; Filed, Dec. 8, 1955; 8:45 a.m.]

# AMENDMENT AND PROPOSED CHANGES OF REGULATIONS

## VHF "BOOSTERS"

### Extension of Status Quo

The Commission is continuing its further study of the problems raised by proposals that it license television repeaters, commonly referred to as "boosters," in the VHF band.

Additional time will be needed to complete consideration of the matter. Meanwhile it appears desirable to maintain the status quo with reference to existing VHF "booster" operations.

Accordingly, the Commission is extending, until December 31, 1959, the general period of grace for such operations. It is hoped that by that date the Commission will have been able to resolve the remaining problems raised by proposals to license VHF "boosters." Every effort is being made to this end.

### Standards of Good Engineering Practice

In the matter of Amendment of Part 3 of the Commission's rules and regulations and the Standards of Good Engineering Practice Concerning Bandwidth and Spurious Emissions of AM and FM Stations:

1. On December 9, 1954 the Commission released a Notice of Proposed Rule Making (FCC 54-1518) in the above-entitled matter. The date for filing comments was specified as March 7, 1955 and was subsequently extended to June 6, 1955. The purpose of the proposed rules is to establish definitions of bandwidth and specifications for suppression of spurious emissions of AM and FM broadcast stations.

2. Comments were received from licensees of AM and FM broadcast stations,[1] the National Association of Radio and Television Broadcasters (NARTB), the Radio-Electronics-Television Manufacturers Association (RETMA) and the General Electric Company. A review of the comments shows that they may be divided into two categories: Those concerning transmitters presently in use, and those applying to transmitters to be installed in the future.

3. The comments generally favored the adoption of the proposed performance standards with certain modifications, but expressed the opinion that existing transmitting equipment should be exempted from the proposed requirements until a further study could be made. Such a survey was conducted by NAB and the results submitted to the Commission on November 16, 1956. These results showed that although many existing stations were achieving suppression in excess of that proposed to be required, it would impose an extreme hardship on some to make the necessary modifications in existing equipment to comply strictly with the proposed standards.

4. Evidence was also submitted indicating that the Commission's original proposal would require an abrupt transition from the amplitude of the emissions required for the proper performance of the broadcasting system and the so-called out-of-band or spurious emissions in the region of the spectrum immediately adjacent to the channel occupied by the broadcast station. Such a transition not only imposes a severe requirement on the equipment design but also may result in other undesirable effects which would lead to other spurious emissions. The comments also point out that the degree of suppression under the formula proposal in the initial Notice would require attenuation of some out-of-band emissions by more than 90 decibels.

5. On the basis of the comments submitted and the record in the proceeding in Docket No. 11654,[2] the Commission has concluded that its rules should be amended as set forth below. It will be noted that the maximum suppression required as a matter of equipment acceptance and normal operation is 80 decibels. Should such suppression in individual cases be insufficient to prevent the interference to the reception of other radio stations, the Commission may require a licensee to take such further steps as may be necessary to eliminate the interference. It may also be noted that although existing stations are not required to adhere strictly to the performance requirements they are expected to achieve the highest degree of compliance within the capabilities of their present equipment. This exemption does not extend to individual cases where actual interference occurs. In such cases the Commission may require licensees to take further steps to eliminate the interference. All transmitting apparatus which is type accepted after January 1, 1960, must meet the new requirements.

6. In view of the foregoing considerations and pursuant to the authority contained in sections 4(i), 301 and 303 of the Communications Act of 1934, as amended: *It is ordered*, That, effective January 1, 1960, Part 3 of the Commission's rules is amended as set forth below.

1. Section 3.40(a) is amended by adding thereto the following new subparagraphs:

§ 3.40. *Transmitter; design, construction, and safety of life requirements.*

(a) * * *

(12) Any emission appearing on a frequency removed from the carrier by between 15 kc and 30 kc, inclusive, shall be attenuated at least 25 db below the level of the unmodulated carrier. Compliance with the specification will be deemed to show the occupied bandwidth to be 30 kc or less.

(13) Any emission appearing on a frequency removed from the carrier by more than 30 kc and up to and including 75 kc, inclusive, shall be attenuated at least 35 db below the level of the unmodulated carrier.

(14) Any emission appearing on a frequency removed from the carrier by more than 75 kc shall be attenuated at least $43+10\ \mathrm{Log}_{10}$ (Power, in watts) decibels below the level of the unmodulated carrier, or 80 decibels, whichever is the lesser attenuation.

2. Section 3.46(c) is amended by deleting the present text and substituting the following:

§ 3.46. *Transmitter.*

* * * * *

(c) The station equipment shall be so operated, tuned, and adjusted that emissions outside of the authorized channel do not cause harmful interference to the reception of other radio stations. Standard broadcast stations employing radio transmitters type accepted after January 1, 1960, shall maintain the bandwidth occupied by their emissions in accordance with the specifications set forth in § 3.40(a). Stations employing transmitters installed or type accepted prior to January 1, 1960, shall achieve the highest degree of compliance practicable with their existing equipment. In either case, should harmful interference to the reception of other radio stations occur, the licensee may be required to take such further steps as may be necessary to eliminate the interference.

3. Section 3.317 is amended by adding new subparagraphs to paragraph (a) and by substituting new text for paragraph (f) (2), as follows:

§ 3.317 *Transmitter and associated equipment.*

(a) * * *

(12) Any emission appearing on a frequency removed from the carrier by between 120 kc and 240 kc inclusive shall be attenuated at least 25 decibels below the level of the unmodulated carrier. Compliance with this specification will be deemed to show the occupied bandwidth to be 240 kc or less.

(13) Any emission appearing on a frequency removed from the carrier by more than 240 kc and up to and including 600 kc shall be attenuated at least 35 db below the level of the unmodulated carrier.

(14) Any emission appearing on a frequency removed from the carrier by more than 600 kc shall be attenuated at least $43+10\ \mathrm{Log}_{10}$ (Power, in watts) decibels below the level of the unmodulated carrier, or 80 decibels, whichever is the lesser attenuation.

* * * * *

(f) * * *

(2) The station equipment shall be so operated, tuned, and adjusted that emissions outside of the authorized channel do not cause harmful interference to the reception of other radio stations. FM broadcast stations employing transmitters type accepted after January 1, 1960, shall maintain the bandwidth occupied by their emissions in accordance with the specifications set forth in paragraph (a) of this section. Stations employing transmitters installed or type accepted prior to January 1, 1960, shall achieve the highest degree of compliance practicable with their existing equipment. In either case, should harmful interference to the reception of other radio stations occur, the licensee may be required to take such further steps as may be necessary to eliminate the interference.

# INDUSTRY NEWS

## New Appointments at WROC-TV

GEORGE S. DRISCOLL

ALFRED W. BALLING

Announcement was made by Gunnar O. Wiig, station manager of WROC-TV, Rochester, N. Y., of the appointment of George S. Driscoll as engineering manager.

A 30-year veteran, Mr. Driscoll is a member of the Radio Pioneers. He began with WHAM in 1929, after a year as an announcer and engineer at WHEC. In his 30 years of service he has held many jobs including control operator, transmitter operator, remote operator, FM transmitter operator, FM transmitter supervisor, WHFM director of war service, WHFM assistant to the WHAM general manager, AM-FM-TV coordinator and until June of this year supervisor of TV studio engineering. He then became acting assistant director of engineering.

He was corporation secretary of the Empire State FM School of the Air, Inc., and a member of the board of trustees. Mr. Driscoll is also a member of the Rochester Engineering Society.

Simultaneously, announcement was made by Mr. Wiig of the appointment of Alfred W. Balling, as assistant engineering manager.

Mr. Balling is also a 30-year veteran with the station, having started in September of 1929 as a transmitter operator at the old double tower transmitter atop the hill at Victor, N. Y., operated by WHAM Radio. In September of 1940 he became WHAM radio transmitter supervisor. Mr. Balling is known as one of the "old-time" ham radio operators. Prior to World War II his call letters were W8ALY and W8AC. In 1949 he was made transmitter supervisor of WHAM-TV-WHFM and held this position until the station's sale to Transcontinent Television Corp. in 1956 and after 1956 he was transmitter supervisor for WROC-TV.

### Fairchild Recording Appoints Rep

Fairchild Recording Equipment Corp. has appointed Stan Cluphf of Stan Cluphf & Associates of Denver, Colo., as sales representative for the Rocky Mountain territory which includes Montana, Wyoming, Utah, Colorado, southern Idaho, and northwestern Nebraska.

### Visual Electronics Sells Browning Multiplex Equipment

Gardiner Greene, president of Browning Laboratories, Inc., has announced the appointment of Visual Electronics Corp. to handle exclusively all sales of Browning FM Multiplex equipment to the background music and FM broadcasting industry. Visual Electronics specializes in the sale of technical equipment to the communications and broadcast industry through its nation-wide staff of sales engineering personnel.

DON UDEY

### Personnel Changes At Gates

Don Udey, engineering manager of Northeast Radio Corp., Ithaca, N. Y., has joined the Gates Radio Co. as broadcast sales engineer. He has been assigned the territory of Pennsylvania, eastern Ohio and western New York which was formerly assigned to Walton T. Ayer who has been promoted to representative of the Gates government contracts division. In another appointment Franz Cherny, formerly chief engineer of KFNK, Shenandoah, Iowa, has been appointed manager of broadcast transmitter sales.

### Collins Appoints Gebhardt To Sales Office

Frederick C. Gebhardt, Jr., has joined the staff of the Broadcast Product Line office of Collins Radio. He will be in charge of incoming contracts, credit clearances and product information. He was formerly with Solar Aircraft Co.

### UHF TV Rebroadcasting Brochure Offered

An illustrated 12-page brochure containing technical specifications and applications data on UHF TV Translators and associated UHF Antennas is available from Adler Electronics, Inc., 1 Le Fevre Lane, New Rochelle, N. Y.

**RED SKELTON FORMS TV PRODUCTION FIRM**

Comedian Red Skelton signs contract for the world's first mobile color TV tape recording studio. Looking on (left to right) are Charles Luftig, Skelton's business manager; Robert Cochran, Los Angeles district manager for General Electric Broadcast Equipment, and William Wallace, Hollywood sales representative for the professional products division of Ampex Corp. The mobile facilities will include two Ampex color Videotape television recorders and three G-E color TV cameras.

Skelton said that he would begin operations with the new mobile color taping studio within four months. He is now in the process of forming an independent production company.

The fully mobile color Videotape recording facilities will be housed in three vehicles. One will contain the two Ampex recorders, color monitoring equipment and tape storage space. This Videotape Custom Cruiser will have an over-all length of 35 feet.

In the second van will be the three GE color camera chains, switching equipment, sync generator and special effects amplifier. A third truck will carry an auxiliary power unit.

Skelton said that productions to be turned out by his firm would be aimed both at the domestic television market and abroad.

The veteran performer recently returned from Japan where he studied that land's TV programming and studio facilities. Previously he toured Europe on a similar mission. Skelton said that countries now beginning to introduce television to their citizens are concentrating on color.

"It is my belief that the great future for international television lies in color and tape," he said. "This conviction has guided my decision to enter the business of television program production."

## C. C. Davis Joins Stancil Hoffman

C. C. DAVIS

The Stancil-Hoffman Corp. of Hollywood, manufacturer of magnetic recording systems, has announced the addition of C. C. Davis to its engineering staff.

Mr. Davis, formerly employed by Westrex and Western Electric Co., was responsible for the development of many of their recording equipment designs. His most recent invention and one of tremendous impact in the recording field was the 45/45 stereo cutter that has made possible the stereophonic disc. He is also recognized for the design of the "Davis" mechanical filter system used in most modern film recorders. While the filter design is applicable both to optical and magnetic recorder transports, it has proved particularly beneficial in magnetic recorders because of the resultant low flutter rate possible despite the friction of the heads.

Two other developments included among his 15 U. S. patents are the reduction of crosstalk in multi-track heads and balanced magnetic shields for hum reduction. A Fellow member of both the SMPTE and the Audio Engineering Society, Mr. Davis has also received many engineering honors.

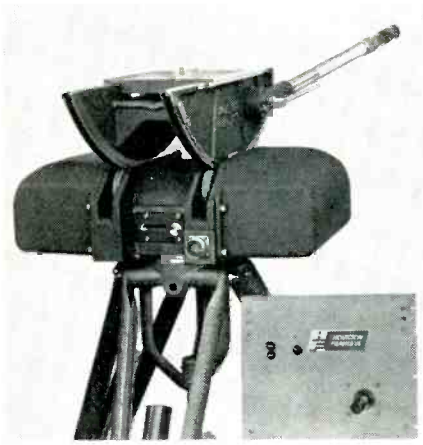
Mr. Davis will be responsible for electro-mechanical designs of the company's magnetic film recorders, subminiature recorders, and special high resolution magnetic heads.

# PRODUCT NEWS

### NEW ADAPTER FOR ZOOMAR LENS

**Television Zoomar Co.**
500 Fifth Ave.
New York, N. Y.

A new special adapter for the Super Universal Zoomar Lenses makes it possible to zoom from a medium waist shot of an announcer with product to an area 3 by 4 inches. The effect is particularly useful in producing videotape and live commercials. The new close-up adapter mounts on the front of the Super Universal in 30 seconds. The camera stays 4 to 6 ft. from the subject.



### REMOTE-CONTROL CRADLE HEAD

**Houston Fearless Corp.**
11851 W. Olympic Blvd.
Los Angeles 64, Calif.

Television cameras can be tilted and panned via remote control with a new power-driven Cradle Head introduced by Houston Fearless. This makes it possible to position the cameras in inaccessible and dangerous locations where manual operation would not be practical. The head is powered by two separate motors which tilt the camera 30 degrees up and 38 degrees down and rotate 370 degrees. They are housed in sound-proof housings for silent operation. Manual operation of the head is possible. Movement of the camera is controlled by a "joy stick," which when moved in any direction causes the head to tilt or pan in that direction. Both actions can be performed simultaneously. Speed movement is governed by the distance the joy stick is moved from vertical. The camera remains in balance around a constant center of gravity as it is panned or tilted.

### V-9B TELEVISION WAVE FORM MONITOR

**Foto-Video Laboratories, Inc.**
36 Commerce Road
Cedar Grove, N. J.

The Foto-Video Model V-9B is a television wave form monitor featuring extremely wide sweep expansion of the vertical interval (up to 40 times). The unit thus provides a clean display of all information in the vertical blanking interval.

Even at 40-to-1 expansion the trace is very bright and easily viewed under normal light conditions. A unique feature of the instrument is a built-in input signal switcher providing for a choice of four signals at the monitor. The built-in switcher may be used to switch input signals to other equipment. For example, when connected to a picture monitor, the built-in switcher may be used to place the same signal on both wave-form and picture units.

The V-9B will trigger on a composite video signal, composite sync pulses, or separate horizontal and vertical drive pulses. An important feature is the inclusion of time markers at intervals of 0.025 H for easy adjustment of EIA pulse widths.

The V-9B also includes a field shift button to hceck interlace, and comes with a flat-face 5-inch Cathode Ray Tube. Standard oscillograph cameras mount on the face of the instrument. The unit includes an electronically-regulated power supply, and has a steel case with built-in chassis tracks. Model V-9B mounts in its own case, and chassis tracks make it possible to service the equipment without removal from the rack.

### TELE-TWIN HEADSET

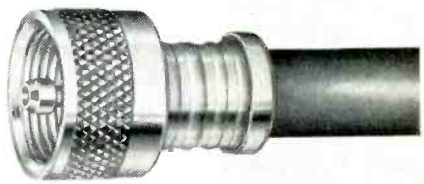
**Telex, Inc.**
1633 Eustis St.
St. Paul, Minn.

The Tele-Twin Headset is a light weight design that provides balanced stereo listening.

### 1 KW DUMMY ANTENNA

**Collins Radio Co.**
Cedar Rapids, Iowa

Now in stock at Collins Radio are the 172G-1 and 172G-2 52 and 73-ohm air-cooled dummy antenna loads. These are made up of eight ferrule type, non-inductive resistors. The resistors clip into metal end brackets which are supplied with standoff insulators.



### NEW SOLDERLESS COAXIAL PLUGS

**Cannon Electric Co.**
Box 3765 Terminal Annex
Los Angeles 54, Calif.

New from Cannon Electric is a completely solderless RF coaxial plug, using a simplified crimping method for high speed assembly. The plug is interchangeable with Military PL-259 plugs and mates with the SO-239. It is available for five cable sizes: RG-8U, 9U, 11U, 58U, and 59U. It is assembled by crimping the cable braid between two concentric ferrules, which are placed over the cable jacket. The operation may be performed with the aid of a crimping tool, especially designed for this plug by Cannon. Once crimped into place the connection will not come loose or pull apart. Laboratory tests show that 101.5 lb. of force were necessary to separate cable from plug.

### NEW LITERATURE OFFER

**General Electric Co.**
Electronics Park, Syracuse, N. Y.

The General Electric Co.'s Communication Products Department has published a new bulletin No. GEA-6842 and ECL-74 which describes the use of closed-circuit television for transmitting high-resolution pictures of opaque or transparent weather charts, maps and drawings from a central point to a number of remote receiving locations.

### NEW STAINLESS STEEL PAINT

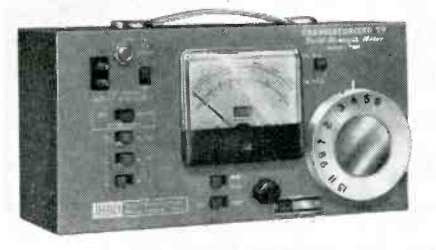
**Vita-Var Corp.**
10 Commerce Court
Newark 2, N. J.

The Vita-Var Corp. announces that their research laboratory has developed a multi-pigment stainless steel paint which represents a significant advance in the durability of maintenance paints for exposed steel and aged galvanized iron. The paint contains mixtures of stainless steel flakes and non-metallic pigments in a long oil alkyd vehicle, has successfully passed eight years of extensive laboratory and field tests in corrosive areas. Extreme durability in corrosive atmosphere with a life expectancy of at least 12 years, ultra smooth surface which readily sheds dirt retaining freshness for years is claimed.

NEW MATCHED TUBES

**CBS Electronics**
Danvers, Mass.

Two new matched pairs of audio output tubes have been added to the line of CBS Electronics. These are the types 7189 and 6L6GC. The critical audio characteristics are matched to help minimize distortion in push-pull amplifiers. It is claimed use of matched tubes reduces distortion even below that attainable by controls for balancing plate currents. Other matched tubes available are the 6BQ5, 6V6GT, 5881, and 6550.



MODEL TMT PORTABLE FIELD STRENGTH METER

**Jerrold Electronics Corp.**
15th and Lehigh Ave.
Philadelphia 32, Pa.

A new portable, direct feeding, transistorized field strength meter has been introduced by Jerrold. The meter weighs four and a half pounds and operates on four small C-cells. Readings are provided from 100 to 2,000,000 microvolts in eight switchable ranges. A battery calibrating control is included to compensate for battery aging. A weather-resistant carrying case complete with neck strap is available.

# TECHNICAL HINTS

### Tower Light Condition Indicator

Determining whether or not all tower lights are lit can be a tedious job, depending on how many towers a particular system uses, tower height, and weather conditions. Our particular antenna system uses two 220-ft. towers with six lights on one and four lights and a beacon on the other. By inserting an AC ammeter in series with our tower light power line we can determine at a glance if all our lights are burning, and a periodic kick of the meter's pointer indicates our beacon is operating. With all lights lit the ammeter reading is marked on the face of the meter. Should the meter indicate a lower value at any time it indicates that one or more lights are out, and a steady reading indicates the beacon is not operating. A meter should be chosen that will read about two-thirds full scale under normal load so that even if one bulb opens a visible drop in meter reading will result. When replacing a defective bulb one of equal wattage should be used in order to retain the original "normal" meter reading.

ALBERT J. KRUKOWSKI
*WSPR Transmitter Engineer*
*West Springfield, Mass.*

**FIVE DOLLARS IS PAID FOR EACH TECHNICAL HINT PUBLISHED**

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### HELP WANTED

Studio Equipment Engineer. Experienced in Cameras, Sync Generators and Power Supplies, for Design, Test and Field Engineering with fastest growing company in TV and Closed Circuit field. **FOTO-VIDEO LABORATORIES, INC.**, CEnter 9-6100, Cedar Grove, N. J.

### EQUIPMENT FOR SALE

VIDEO MONITORS — Closed Circuit and Broadcast see **FOTO-VIDEO** Laboratories advertisement Second Cover This Issue.

FOR SALE — Collins FM Transmitter 250 watts, 250 feet coax cable 1⅞-inch, Four Bay Antenna — Complete package $2000. Futura Music Inc., 5064 Rock Creek Lane, Mission, Kansas.

Evan Maloney
Collins Radio Co.

# Straight talk

## *to broadcast engineers*

"The 26U-1 Limiting Amplifier is designed to provide broadcasters with an easy-to-operate peak limiter which will reduce the possibility of audio distortion."

The Collins 26U-1 Limiting Amplifier provides high fidelity, thump-free performance. It effectively limits loud audio passages to prevent overmodulation, accompanying distortion and adjacent channel interference, but allows low level passages to be broadcast with true dynamic range as originally recorded and produced.

Tube selection and delicate balancing procedures usually associated with peak limiters are eliminated with the 26U-1. Performance, ease of operation, reliability and low maintenance cost make the 26U-1 an outstanding amplifier.

Conventional circuitry, negative feedback, full wave rectification for control voltage and silicon rectifiers in the power supply are incorporated into this unit. Designed for rack mounting, the Collins Limiting Amplifier has a minimum number of controls, tubes and tube types.

An illuminated VU meter with a special scale calibrated in VU and db of compression is provided in the 26U-1. The VU meter attenuator and a rotary switch allow measurement of external gain reduction, db of compression and levels of input, output and external audio circuits. This external meter circuit provides a facility that eliminates the requirement for an additional VU meter panel for measuring audio levels on other program lines.

Silicon diodes and extended life electrolytic capacitors are used in the power supply and provide an efficient, low heat power supply for years of worry-free service. A voltage regulator provides stabilized reference voltages. Input, output and VU meter level controls are Daven step-type attenuators.

The 26U-1 Limiting Amplifier is designed to provide broadcasters with an easy-to-operate peak limiter which will reduce the possibility of audio distortion. Continued success and reliable performance in the field have proven the validity of the Collins 26U-1 design.

Evan J. Maloney

PROJECT ENGINEER
BROADCAST AUDIO EQUIPMENT
COLLINS RADIO COMPANY

COLLINS

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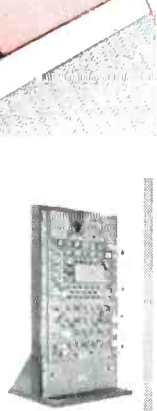
Telechrome brings to TV broadcasters a vastly improved system for producing a wide variety of dramatic wipes, inserts, keying and other special effects. The superb engineering of the Telechrome Special Effects System provides outstanding reliability and technical performance when used for either color or monochrome TV. Simplicity of pattern selection and wipe speed is provided by manual switches on the remote control unit.

- Unusual compactness and portability make possible the creation of special effects even in field locations.
- Simplest to operate. All 72 wipes available at all times.
- Stabilized black balance between pictures. Millimicrosecond transition time eliminates edge effects.
- Additional camera input allows keying from camera signal.
- Its versatility permits use in live, video-tape or film programming.

# TELECHROME
## SPECIAL EFFECTS GENERATOR
### FOR WIPES & MATTING, MODEL 490A

Insert Keying with Super Stability



Rack Mounted

490W1 Waveform generator. Generates keying signals for the 72 different wipes.

490S1 Switching Amplifier. Combines two picture signals in accordance with applied keying waveform.

490R1 Remote Control Unit. Selects and controls desired effect. Designed for console or desk mounting. Easily modified for integration into existing studio facilities. Complete with power supply—512CR.

Designed for 19" rack mounting, or portable cases.
Full specifications and details available on request.

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