FM AND TELEVISION

Price 25 Cents

Aug. 1948

★ ★ Edited by Milton B. Sleeper ★ ★

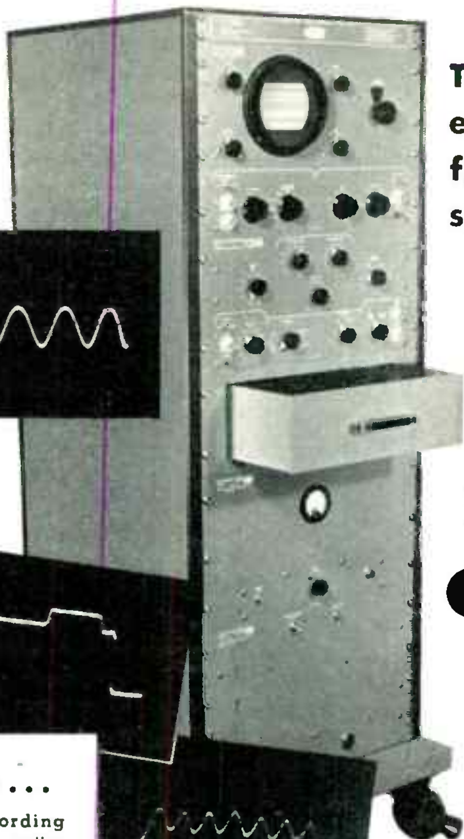
STRATOVISION BROADCAST STATION

(See Pages 3 and 15)

8th Year of Service to Management and Engineering

Television waveforms selected even to the scanning line and fraction of that line, for critical study or recording, with the new

DU MONT
Type 280
Cathode-ray
OSCILLOGRAPH

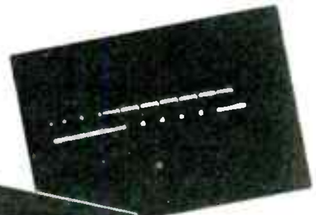


Output of one of the marker oscillators used in setting sweep speeds to known values. This case represents 0.2 microsecond/inch.

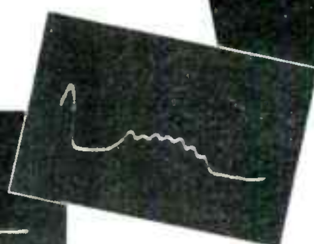
1.2 lines of television signal. Horizontal synchronizing and blanking pulses at each end. Video modulation in center.

Fractional part of a line. Horizontal synchronizing and blanking are shown.

Fractional part of line near center of line. Video modulation produced by wedge, is shown.



Vertical synchronizing and equalizer pulses as seen with 60-cycle-sweep repetition rate; used for checking interlace.



Fractional part of line near center of a test pattern where wedge elements are more closely spaced. Note loss in amplitude of modulation.

Trailing edge of horizontal synchronizing pulse.

OTHER FEATURES . . .

Provisions for attaching recording camera. Fine, clear focus over entire length of trace.

Y-axis: Any degree of attenuation between 1:1 and 1000:1; great expansion of negative polarity signal; undistorted deflection of at least 2"; frequency response within 3 db. from 10 cps. to 10 mc.

X-axis: Time-base duration variable from 1 to 15,000 microseconds. Horizontal deflection of at least 4".
5RP-A Cathode ray Tube. 12,000 volt accelerating potential.

Time-base can correspond with any horizontal line in either or both interlaced fields. Calibrating generator for calibration of sweep-writing speeds by signals of 10, 1, and 0.2 microsecond/cycle.

Wide range of sweep-writing speeds; continuous variation between 0.25 and 3000 microseconds/in.

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Indication as to exact occurrence of time-base with respect to overall television picture.

Interval of 0.25 microsecond may be measured to plus/minus 0.01 microsecond.

DU MONT proudly announces the new Type 280 Cathode-Ray Oscillograph especially designed for television studio and transmitter installations. Here at last is a means for accurately determining the duration and shape of the waveform contained in the composite television signal, as well as the character of the picture-signal video in conjunction with transmitter operation, according to FCC standards and practices.

Excellent for research on all television equipment. Also for study of wide-band amplifiers. Well suited for industrial use wherever high-speed single transients are studied. Consists of four units mounted on standard relay-rack type panels and chasses, and installed on mobile rack. Removable side and rear panels. Grouped controls for easy operation.

By virtue of its great range of applications, Type 280 becomes a "must" for television studio and research laboratory.

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CABLE ADDRESS: ALBEEDU, NEW YORK, N. Y., U.S.A.

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FM AND TELEVISION

★ ★ Edited by Milton B. Sleeper ★ ★

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

VOL. 8 AUGUST, 1948 NO. 8

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THIS MONTH'S COVER

Here, indeed, is an example of conversion from war to peace. This month's cover shows a B-29 bomber now used for television broadcasting. This is the Westinghouse-Martin Stratovision project, recently demonstrated to the press for the first time.

The specific advantage of broadcasting from a plane at 25,000 feet is that an enormous area can be covered, as compared to conventional ground installations. Also, shadow effects, caused by high ground between the transmitter and receiver, are eliminated.

As to coverage, one Stratovision transmitter is equivalent to 12 or more ground stations. Also, coast-to-coast networking can be accomplished without cables or ground relays.

Entered as second-class matter, August 22, 1945, at the Post Office, Great Barrington, Mass., under the Act of March 3, 1879. Additional entry at the Post Office, Concord, N. H. Printed in the U. S. A.

MEMBER, AUDIT BUREAU OF CIRCULATIONS

WHAT'S NEW THIS MONTH

1. Radio Set Production
2. Armstrong FM Suit
3. Sales Technique
4. Second Rate Designs
5. In Case of War

1. The Production Barometer now registers the half-year mark for 1948. AM sets are 1,301,379 below the first six months of '47, but TV figures are up 230,517, and FM up 249,741.

Taking $30 as the average retail price for AM sets, and $400 as the average for FM and TV sets, such an estimate indicates a retail volume for the first half of 1948 of more than $½-billion, with AM accounting for about 40% and FM-TV 60%.

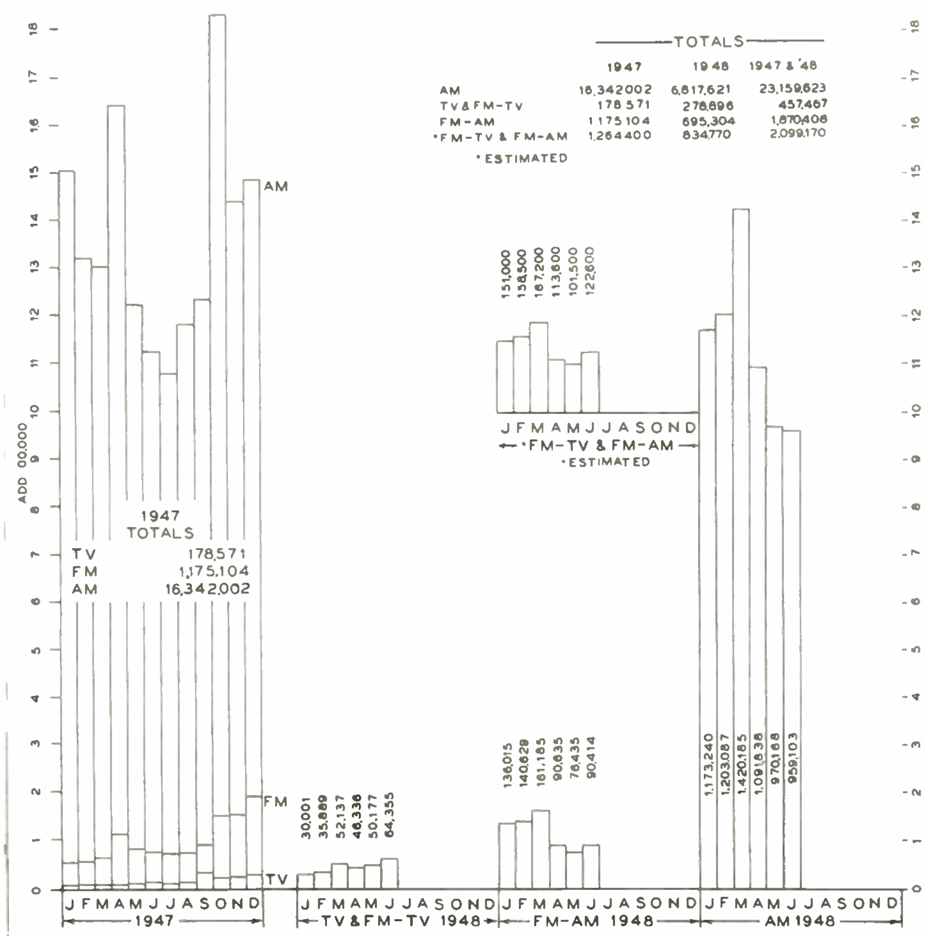
Still, we hear complaints that business is off. The RMA figures don't confirm that. More likely, complaints are coming from set and components manufacturers and dealers who haven't adjusted themselves to the passing of AM, and the advent of FM and TV.

We say that because, while low-priced AM sets are off 19%, expensive TV sets are up 49%, and FM sets up 56% at the half-year mark over 1947.

Although sales volume has varied widely in different areas, the figures indicate that set manufacturers' net sales should exceed $1-billion this year.

Production of cathode-ray tubes is still the limiting factor of TV set output. The bottleneck there is the glass envelopes. Corning Glass is the sole source of quantity supply. No doubt, they could be produced by other companies, but it appears that Corning is the only concern set up for this particular item. Deliveries of envelopes in the different sizes has been allotted to RCA, Du Mont, North American Philips, and Sylvania. They, in turn, have made their allotments of tubes to the various set manufacturers. Therefore, as long as TV sets can be sold as fast as they are turned out, the production of envelopes will set the pace for receivers. It is hard to tell how long this situation will continue since

(Continued on page 10)



FM-AM-TV Set Prodution Barometer, based on monthly figures released by the RMA

FIG. 10. *Lawrence Smith handles the FM and TV transmitters.* **FIG. 11.** *W. C. Cryer at the antenna control, outside forward tunnel*

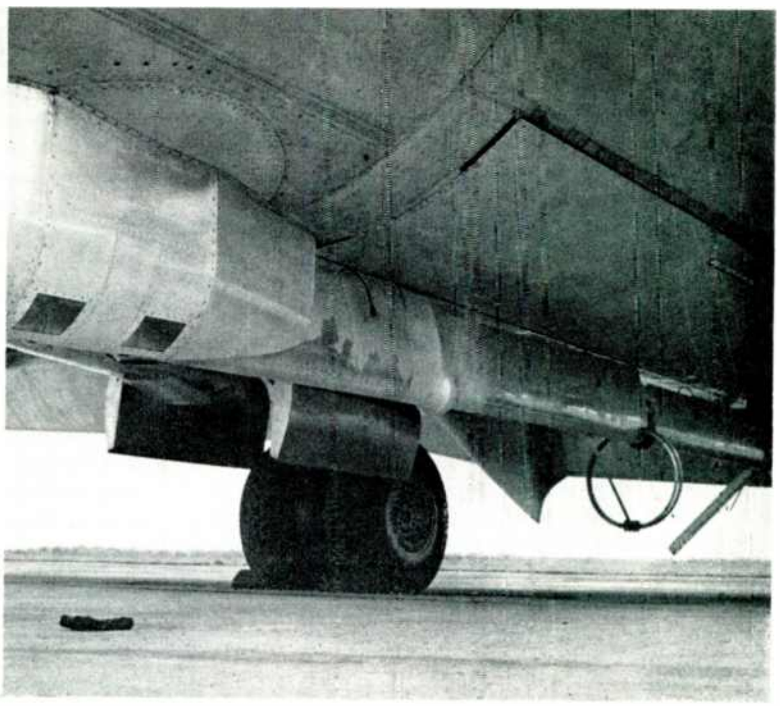


FIG. 3. *This view shows receiving antennas in detail.* FIG. 4. *Mounting of the transmitter antenna mast. Ring antenna is for audio*

THE SHIFT TO HIGH FREQUENCIES

DR. C. B. JOLLIFFE AND H. H. BEVERAGE REPLY TO MAJOR E. H. ARMSTRONG'S LETTER ON THE DISCOVERY OF LONG-DISTANCE, SHORT-WAVE DAYLIGHT PROPAGATION

FOLLOWING the publication of testimony before the House Committee on Interstate and Foreign Commerce given by Dr. C. B. Jolliffe, executive vice president in charge of RCA Laboratories, Major Armstrong discussed this testimony at some length in a letter which appeared in our July issue.

In response to an invitation to comment on Major Armstrong's letter, we received a communication from Dr. Jolliffe, accompanied by a more detailed statement from Mr. H. H. Beverage. The complete texts were as follows:

RADIO CORPORATION OF AMERICA
RCA LABORATORIES DIVISION
PRINCETON, N. J.

July 23, 1948

Dear Mr. Sleeper:

You were kind enough to invite my attention to the letter of Major E. H. Armstrong which appears in the July issue of *FM* AND TELEVISION. In his letter Armstrong refers to testimony I gave before the House Committee on Interstate and Foreign Commerce in March and endeavors to leave the impression that I claimed RCA was entirely responsible for the advance in communications brought about by the use of the higher frequencies.

Armstrong quotes two paragraphs of my statement, and says that Marconi and his associate, C. S. Franklin, are due the principal credit in this field.

Before the House Committee Armstrong talked about the contributions of Armstrong and I talked about the contributions of RCA. In the first sentence of my first point I made it clear that I was dealing with the work of RCA engineers. To avoid any possibility of misunderstanding, I added this paragraph (which appears in my statement immediately preceding the two paragraphs Armstrong quoted):

"It is not meant to imply that RCA was the only one to pioneer in the higher frequencies. In addition to RCA, Marconi worked there, AT & T, Westinghouse and GE did, the Government did, the amateurs did, and many others."

Armstrong also mentioned the views of Beverage. I enclose a copy of a letter by Beverage to me, which includes these sentences:

"I cannot agree with Major Armstrong's statement that 'it is not true that the world-wide revolution in communication which brought about the obsolescence of the alternator was an ultimate result of anything that the Radio Corporation did.' I feel that the RCA played a leading role in this revolution and I am proud to have been privileged to have worked with RCA during this period. At the same time, I also appreciate the very great and outstanding contributions made by my old friends and co-workers, Senatore Marconi and C. S. Franklin."

Sincerely Yours,
C. B. JOLLIFFE

More detailed discussion is given in Mr. Beverage's letter to Dr. Jolliffe:

RADIO CORPORATION OF AMERICA
RCA LABORATORIES DIVISION
66 BROAD STREET
NEW YORK 4, N. Y.

July 21, 1948

Dear Dr. Jolliffe:

I have read with great interest Major Armstrong's letter of June 28, 1948 to the Editor of *FM* AND TELEVISION. Most of the statements upon which he bases his conclusions agree, in general, with my recollection. However, I believe that Major Armstrong might have arrived at somewhat different conclusions if he had been acquainted with all of the background leading up to his observations.

It will be recalled that Dr. Frank Conrad of the Westinghouse Company started experimenting with transmission on wavelengths of about 100 meters in 1921 and obtained results which were quite interesting. Others became interested in this work, including the amateurs. According to Senatore Marconi's paper, "Radio Communication", published in the *Proceedings of the IRE* for January, 1928, he undertook a series of systematic tests with long distance transmission on 97 meters in the spring of 1923, from which he concluded that the strength of the signals which could be received varied definitely and regularly in accordance with the mean altitude of the sun over the space intervening between the transmitter and the receiver. Strong signals were received at night up to distances exceeding 2,300 nautical miles from the transmitter at Poldhu, Wales. The RCA participated in some of these tests and made measurements of field strength at Riverhead, confirming the good reception at night.

During 1923, the RCA constructed and installed a short wave transmitter at its station in Belfast, Maine for propagation tests to determine the feasibility of using the short waves for relaying longwave signals picked up at Belfast to the Central Office in New York. This transmitter was designed to operate on wavelengths of 120, 90, 60 and 40 meters. During 1924, quantitative simultaneous field strength measurements of the radiations from the transmitter were made at the RCA receiving stations at Chatham, Mass. and Riverhead, L. I. at distances of about 200 miles and 310 miles, respectively. The conclusions from these tests were quite significant since it was found that the night signals on 120 meters and the day signals on 40 meters were stronger at Riverhead than for the shorter oversea path to Chatham. The following is quoted from a report on these tests, —

"There is strong evidence that for moderate distances short-wave signals, particularly on wavelengths below 60 meters, have transmission characteristics far below that predicted by the Austin formula, but as the distance is increased, the signal is fed down from above and may remain at constant intensity over a considerable increase in distance, and may actually increase with increase in distance for a certain critical distance."

Before this unusual and interesting observation could be further checked, RCA was notified by Mr. Marconi that he was planning to transmit from Poldhu on a wavelength of 32 meters and requested the RCA to make observations and measurements. These transmissions resulted in the epoch-making discovery that if the wavelength is short enough, good transmission can be obtained during the daylight hours, contrary to previous experience and teachings. This is the great discovery referred to by Major Armstrong. These 32-meter test signals were received at Montreal, Buenos Aires and Sydney, Australia during the October, 1924 tests. Great credit is due to Marconi and his assistants for this remarkable discovery. It was something that no one had predicted, and I have been informed by one of Mr. Marconi's assistants that Mr. Marconi himself was as surprised as the rest of us at the results of the 32-meter tests.

Another indication that this discovery was a surprise to the Marconi people was the following incident: In the autumn of 1921, I was in England. Mr. C. S. Franklin showed me his experimental 15-meter telephone station at Hendon, just outside of London, which communicated with Birmingham some 97 miles distant. A peculiar type of distortion was encountered on this circuit at times for which there was no reasonable explanation. We know now that this distortion was probably caused by transmission of the 15-meter signal completely around the earth, so that it came in on the directive antenna and interfered with the direct signal. Certainly, such an explanation in 1921 would have been considered completely fantastic.

(*Continued on page 42*)

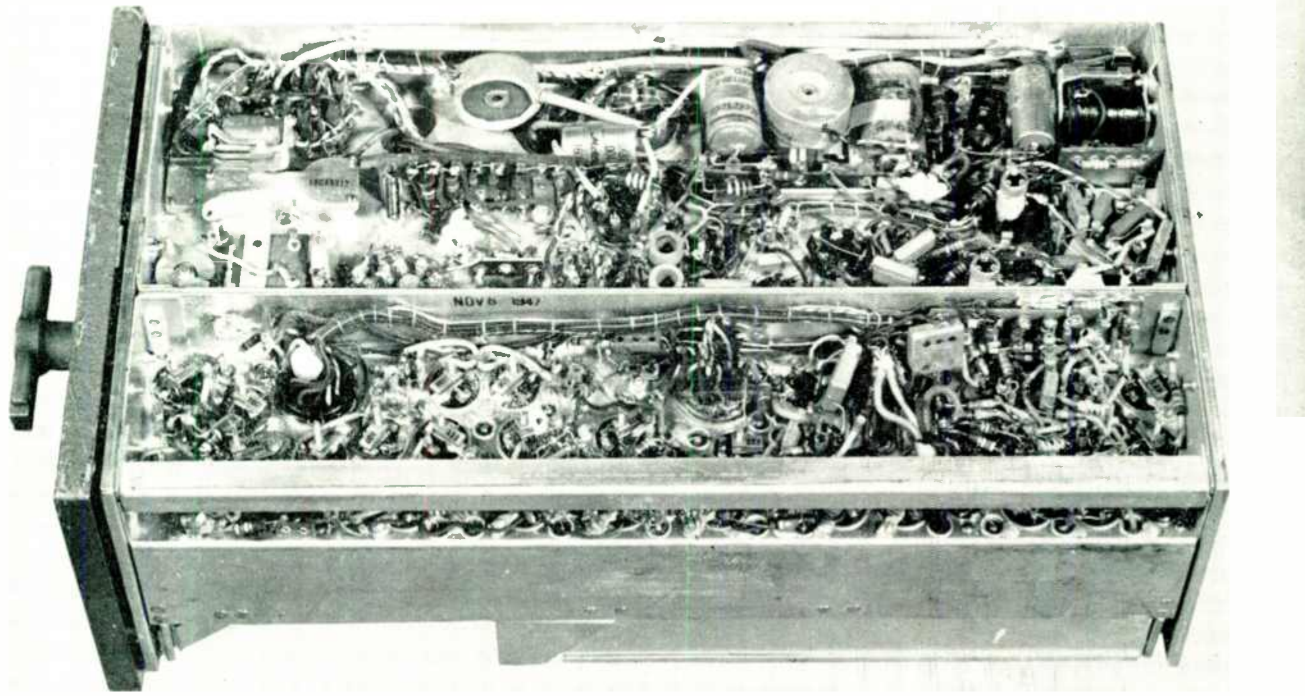


FIG. 7. *Bottom view of the complete Dispatcher transmitter-receiver shows how compactly the circuit components are arranged*

COMPACT UNIVERSAL MOBILE UNIT

CIRCUIT DETAILS OF MOTOROLA'S DISPATCHER EQUIPMENT, FOR SINGLE- OR DUAL-FREQUENCY USE, WITH OPTIONAL SELECTIVE CALLING: PART 2 — *By* L. P. MORRIS*

4. Receiver Section:

The circuit diagram for the receiver section is shown in Fig. 7. This is a double super-heterodyne, producing a high degree of stability, with sensitivity requiring less than 1 microvolt to produce 20 db quieting of inherent noise. Crystal controlled with temperature regulation maintains the frequency within limits better than one-half the conventional standards.

Selectivity gives 85 to 100 db protection against alternate channels. It is possible to reject a signal of 20 milli-volts or more while receiving a 1-microvolt signal on the desired frequency. With this selectivity, the mobile unit can drive around the block where a 250-watt station is operated on the alternate channel, and experience no interference. This same degree of protection against spurious responses is provided by 85- to 100-db rejection.

4.1 RF and IF Circuits:

Section 7 of Fig. 7 shows the RF section of the receiver. The input circuit of the 6BH6 first RF tube is impedance coupled through condenser C-1. L-101 is a permeability-tuned tank circuit with a 50-ohm input across condenser C-3 of the resonant circuit. The impedance stepup from the 50-ohm transmission line connector to the grid coupling condenser C-1 is provided by the impedance ratios of the two tank condensers C-2 and C-3. The resonant coupling unit L-102 and L-103, between the first and second RF tubes, is double-tuned and coupled for maximum rejection of undesired signals. The coupling between L-102 and L-103 is obtained by capacity inherent in the wiring. This RF coupling unit is impedance coupled to the second RF tube through the condenser C-5. Maximum low-signal sensitivity is obtained by the use of 3.3-megohm resistors R-2 and R-5 in the grid circuits of the 1st and 2nd RF tubes, respectively. Additional RF selectivity and rejection is obtained in the double-tuned circuits, L-104 and L-105, between the second RF tube and the first mixer. Mixing in the first mixer is accomplished by signal injection on the first grid through C-10, and beating frequency injection through C-14.

The high beat-frequency injection to the first mixer is obtained by multiplication from the temperature-controlled crystal shown at the left of Section 9. The crystal oscillator tube also serves as a first quadrupler for the oscillator frequency, delivering 4 times the crystal frequency to the resonant circuit L-109 and condenser C-20.

All the circuits are permeability tuned and the inductances are separated and completely shielded in independent cans to assure high stability and low spurious response. The secondary of this circuit is L-108 and C-19.

To facilitate alignment and to check the operation of the oscillator, the grid current to the second quadrupler is measured across the grid resistor R-11, by-passed by the condenser C-21. Resistor R-10 within this first quadrupler provides isolation, to give the correct meter reading at the terminal of this first quadrupler coupling transformer connected to resistor R-10. The values of the resistors and multipliers have been worked out so that correct readings are obtained when using a 50-microampere test meter, having 2,000 ohms resistance.

Double tuning and the correct coupling between the crystal oscillator and multiplier units are essential for maximum re-

* Communications & Electronics Division, Motorola, Inc., 4545 Augusta Blvd., Chicago, 51.

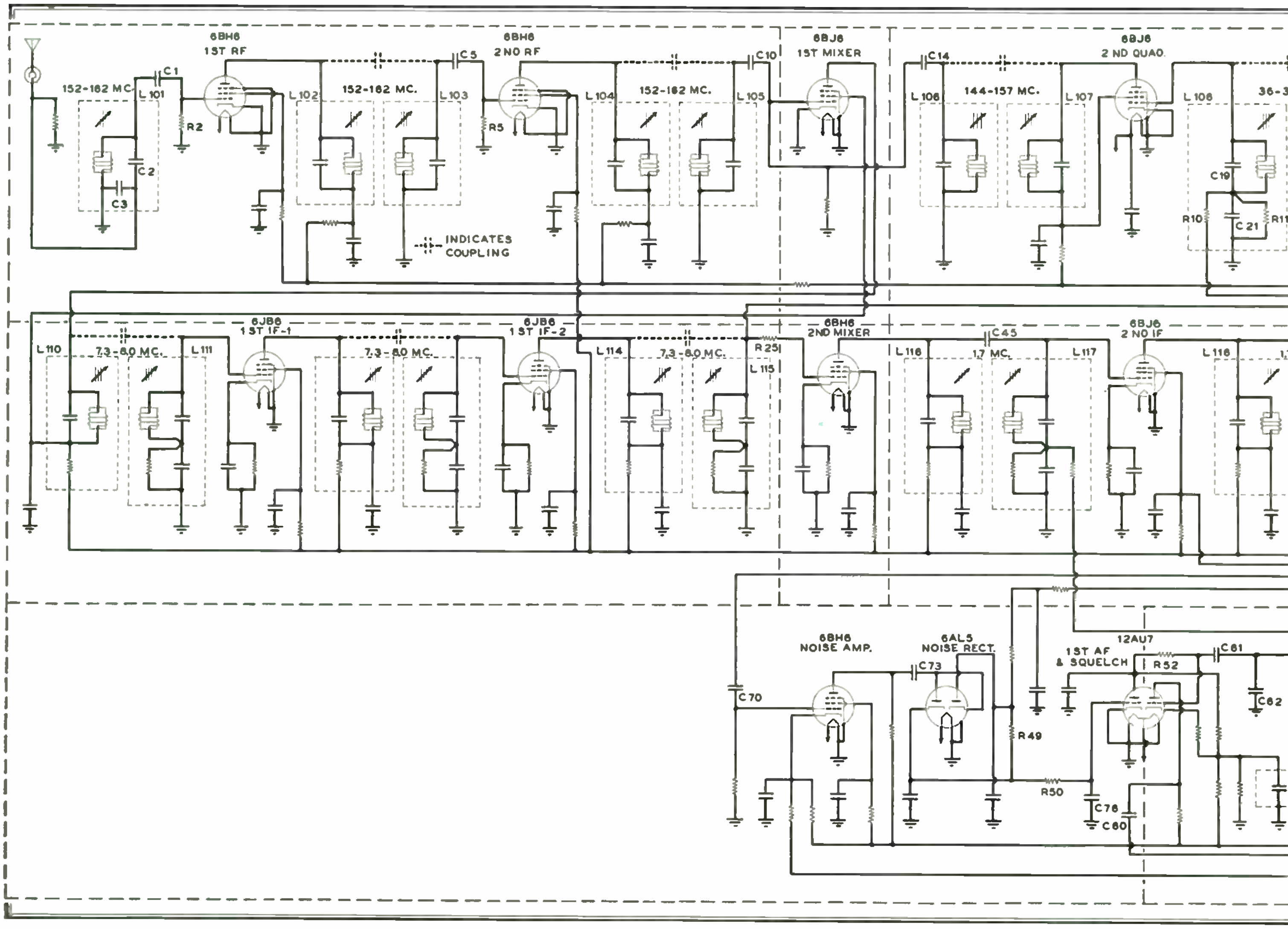


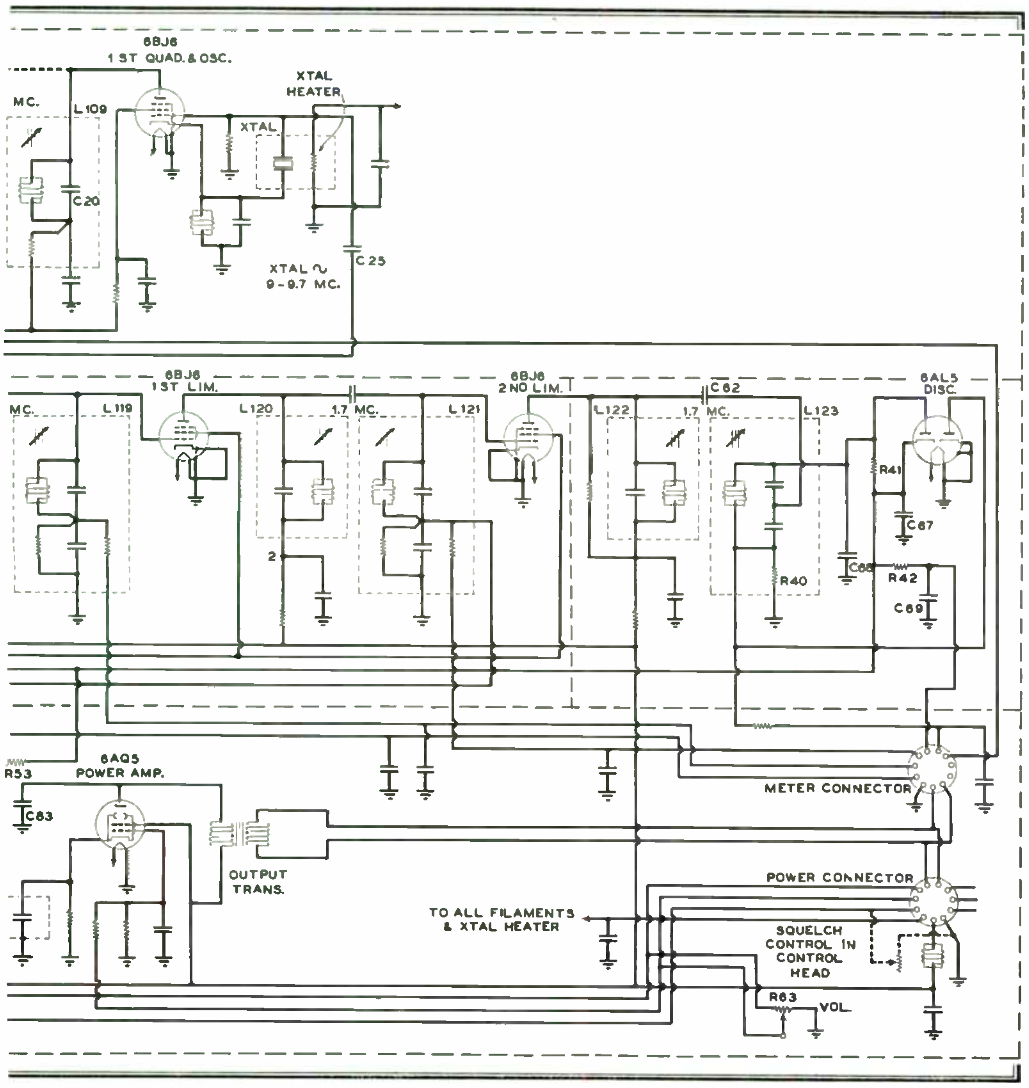
FIG. 8. *Schematic wiring diagram of the Dispatcher receiver section. Note that the remarkably compact design of this 16-tube receiver*

jection of harmonics of the oscillator before the first mixer grid, in order to keep spurious responses of the receiver to a minimum.

Section 10 shows the first IF frequency arrangement, using double-tuned coupled units at all interstage points. The plate of the first mixer tube couples to the grid of the first IF amplifier tube through L-110 and L-111. They are tunable from 7.3 to 8 mc. The second tube of the first IF amplifier is coupled to the second mixer tube grid L-114 and L-115. The injection frequency of the second mixer tube is obtained from condenser C-25, Section 9, to the second mixer tube. The second IF frequency from L-115 and the injection voltage from the crystal oscillator are combined on the first grid of the second mixer through the 330-ohm resistor R-25.

The second IF produced in the plate circuit of the second mixer tube is coupled to the first tube of the second IF amplifier across IF transformer L-116 and L-117. The coupling between the primary and secondary of this permeability-tuned unit is obtained through the small coupling condenser C-45. The second IF amplifier tube feeds the first limiter across another second IF transformer. This unit, L-118 and L-119, operating at approximately 1.7 mc. is coupled in the same manner as the preceding units. The first limiter feeds the second limiter across a double-tuned second IF transformer unit L-120 and L-121. Meter reading points are provided at 3 points in this second IF amplifier: in the grid circuit of the first IF amplifier tube, the grid circuit of the first limiter tube, and the grid circuit of the second limiter tube, through 1-megohm isolation resistors. Second limiter grid potential is fed to the squelch system via L-121. The second limiter tube of this circuit feeds the frequency discriminator diodes through the discriminator transformer L-122 and L-123, also double-tuned. Discriminator voltage for measuring and alignment purposes is taken off through R-42 across condenser C-69 at the meter connector. The parallel discriminator diode voltages are fed to the diode through condenser C-62, direct from the plate of the second limiter.

The phase displacement voltage for the discriminator diodes, normally obtained in the conventional discriminator by inductive coupling between the primary and secondary coils, is obtained in this particular discriminator across the small unbalancing condenser C-68 between the 6AL5 discriminator tube and ground. This method of obtaining the phase displacement voltage permits better control of discriminator characteristics than is generally possible where it is necessary to depend upon the inductive coupling between the primary and secondary coils for the equivalent discriminator components. With the method used here, primary and secondary circuits can be isolated magnetically. The circuit constants can be much better controlled since it is not necessary to depend upon varying degrees of magnetic coupling due to physical irregularity of the circuits. The discriminator metering balance is obtained for the metering connector through the isolation resistor R-42 and by-pass condenser C-69 from the discriminator cathode. For correct alignment and on-frequency signal, the voltage drop across the resistor R-40 and the resistor R-41 are opposed and equal.



chassis is made possible by the use of miniature tubes and components throughout

Great care was exercised to assure the physical and electrical isolation of the components to prevent stray coupling, regeneration, and unsymmetrical selectivity, at the same time maintaining accessibility for servicing despite the small size and compactness of this unit. The chassis is only 3 ins. wide, and for this reason it was necessary to use miniature tubes throughout. Primary and secondary circuits of the IF and RF coupling units have been positioned and shielded carefully to prevent stray coupling and permit the highest LC ratios possible, consistent with the tolerances of the components. LC ratios have been maintained below the points where manufacturing and physical tolerances might cause variations in coupling to the extent that adjacent- and alternate-channel rejection values might not be uniform. The top of the selectivity curve is narrow and AVC is not used, so that out near the fringe areas of operation the signal-to-noise ratio is somewhat improved. As a result of this careful design, component by component, this compact receiver, requiring less than 6 amperes drain from a 6 volt storage battery, has a sensitivity varying between .5 and 1 microvolt for 20 db quieting.

4.2 Squelch and Control Circuits:

The squelch system of the Dispatcher receiver gives very stable and sensitive quieting operation. The circuit can be seen in Section 14 of Fig. 7.

Noise from the grid circuit of the second limiter is applied to the No. 1 grid of the noise amplifier tube through condenser C-70. The noise is applied to the 6AL5 voltage-doubler, noise-rectifier through the condenser C-73. The triode squelch section, the left half of the 12AU7, is controlled by the DC potential on its grid through a resistor filter combination R-50 and C-78. The DC input from this filter to the squelch tube is obtained as a resultant of the DC output of the voltage-doubler, noise-rectifier tube and DC grid voltage from the second limiter. The DC noise voltage is developed across R-49 and its polarity is such that the audio amplifier is turned on or made operative by a drop in noise.

This drop or reduction in noise always accompanies a signal in FM equipment of this type, so that this characteristic alone is in the proper direction. The negative DC bias from the grid of the second limiter increases with a very small amount of signal at the antenna, and the connections are such that this increase in voltage also tends to make the amplifier circuit operative. The ratios of these voltages have been determined so that an increase of noise tends to squelch the receiver audio system a little more than before the noise was introduced, to the extent that noise does not make the audio system operative but instead tends to squelch the set a little tighter. Thus the audio system never becomes operative due to noise. This is an extremely important factor, when combined with the voltage of the second limiter, producing an extremely sensitive, sharp, and positive squelch action. The polarity and values have been determined so as to cause a sort of double-levering operation here, with part of the control coming from the second limiter and part from the noise-amplifier and rectifier combination.

This double leverage operation acts on the grid of the left section of the first audio and squelch tube. The amount of noise and the squelch control is determined by the cathode resistance to ground of the noise amplifier tube. This cathode circuit is connected to the power connector on the receiver unit, and permits external control of squelch, as shown at the lower right hand corner of Fig. 7. The right half of the 12AU7 is the first audio amplifier, controlled by the DC bias and the plate circuit of the squelch tube through resistor R-52. The left half of this tube operates as a DC amplifier of the squelch-controlled DC voltage from resistor R-50 across C-78, explained above.

The audio voltage from the discriminator, appearing across C-67 and cathode pin No. 1 of the 12AU7, is fed to grid pin No. 2 of the audio section through resistor R-53 and condenser C-82, comprising the audio discriminating network. This network reduces the audio response to the higher audio frequencies at a rate of 6 db per octave for a part of the audio spectrum. The audio voltage is fed through C-8 to the grid pin No. 2 of the 12AU7, the grid of the first audio amplifier tube. Audio output from the audio section of the tube, pin No. 1, is fed through coupling condenser C-80 to the volume control R-63 and also to the power connector, where it can be used externally for volume control purposes. Audio to the grid of the audio power amplifier tube, section 15 of Fig. 7, is taken from the center tap to the volume control R-63 and also from the connector socket. This permits volume to be controlled from an external adjustment or from a volume control on the receiver chassis. The plate circuit of the power amplifier tube is bypassed to ground with C-83 to reduce the high frequency response and accompanying noise. This improves the signal-to-noise ratio of the

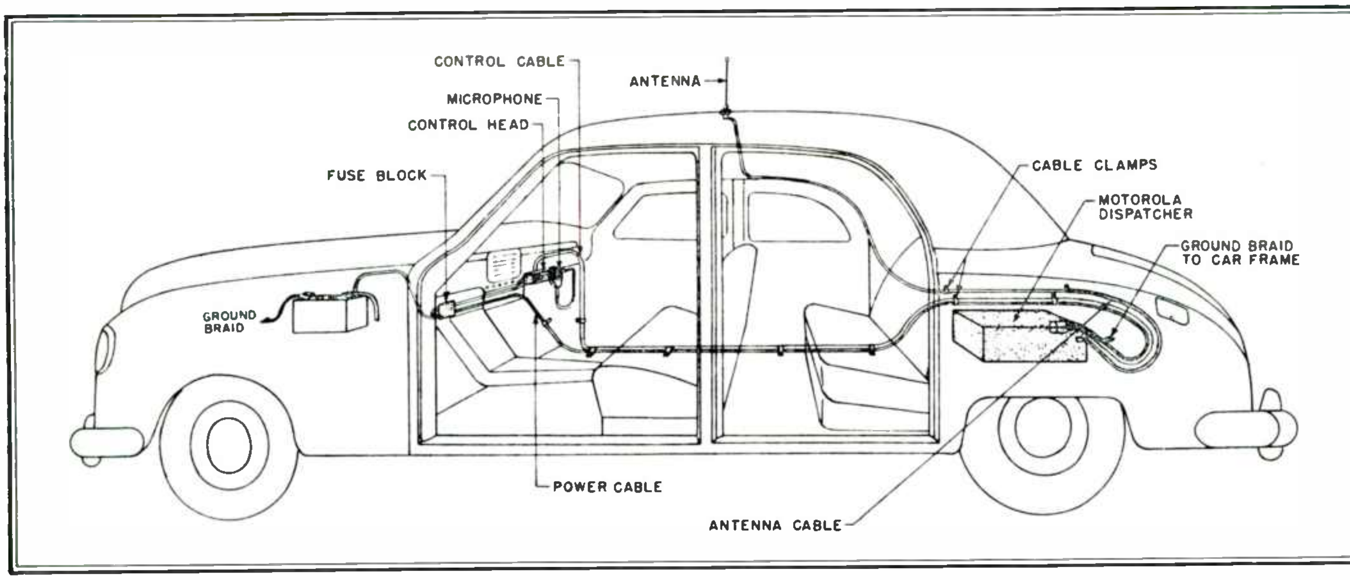


FIG. 10. *Plan of conventional mobile installation. Sometimes the radio unit is put in front of the driver's seat, on the floor*

receiver. The audio fidelity of the receiver is matched to the characteristics of the transmitter in order to deliver the best signal-to-noise ratio at extreme ranges.

4.3 Receiver Crystal Frequency:

Knowing the assigned frequency at which a radio system is to operate, the crystal and first IF frequencies of the Dispatcher receiver can be determined readily.

A. The carrier frequency f_c, plus the second IF frequency f_2 (1.7 mc. in this case), divided by 17, equals the crystal frequency f. That is,

$$\frac{f_c + f_2}{17} = f$$

If the assigned carrier frequency is 155.0 mc., then

$$\frac{155.0 + 1.7}{17} = f$$

$$\text{or } \frac{156.7}{17} = f = 9.217 \text{ mc.}$$

B. Having found the frequency required for the crystal, the proper frequency for the first IF amplifiers can be determined. The crystal frequency f, minus the second IF frequency f_2, equals the first IF frequency f_1. That is,

$$f - f_2 = f_1$$

In the case above 9.217 − 1.7 = 7.517 mc.

Test and Operating Data:

The transmitter and receiver can be completely checked by a meter test kit which plugs into the metering sockets. The meter test kit contains a loudspeaker, a 50-microampere meter, a transmitter start button that can be used independently from the microphone, a socket to plug in a standard microphone so that the transmitter can be operated from the rear of the car, and test circuit switches. There are provisions for housing a Simpson Model 260 volt-ohmeter, either the old or new type, and additional space for a small, battery-operated test oscillator. A remote RF test probe is available for testing the system through the antenna. The meter multipliers within the receiver and transmitter unit have been determined to give useable readings on a 50-microampere meter having 2,000 ohms resistance. A simple antenna load can be made from a 32-volt, 15-watt lamp, with the connections soldered to a coaxial connector. A 3-mmf. Erie Ceramicon should be connected in series with the center contact.

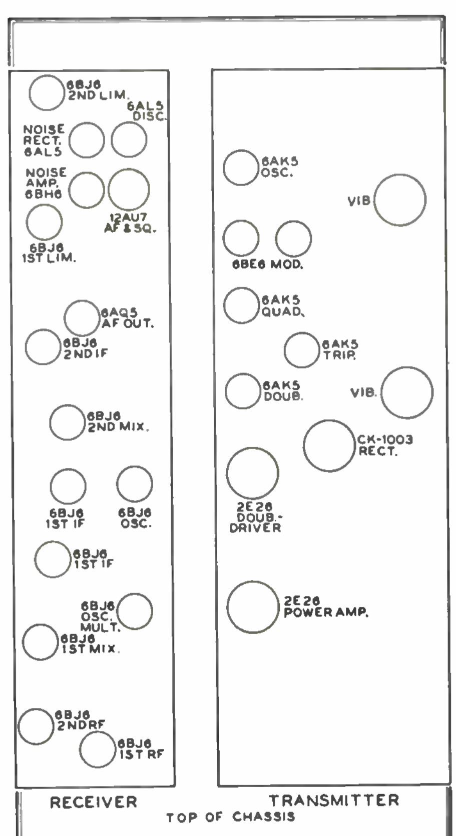


FIG. 9. *Layout of the tubes as seen from the top of the transmitter and receiver*

The frequency stability of the transmitter is ±.0025% with ambient temperatures of −30 to +60°C., or ±.005% at −20 to +80°C. Stability of the receiver is better than ±.002% over an ambient temperature range of − 25° to +125°F.

Power output to the antenna is 7 to 10 watts. Battery consumption of the receiver is 6 amperes at 6 volts. The total transmitter-receiver drain is 9½ amperes at standby, and 19 amperes during transmission. The low-voltage synchronous vibrator B supply for the receiver and part of the transmitter delivers 175 volts at 45 milliamperes, while the high-voltage non-synchronous vibrator delivers 280 volts at 135 milliamperes for the transmitter output tubes.

Fig. 9 shows the arrangement of the tubes as they appear on the top of the transmitter and receiver chassis.

Notes on Installation:

The case for the combined transmitter and receiver sections measures 17½ ins. deep, 5⅝ ins. high, and 8½ ins. wide. The complete unit weighs 27 lbs.

Fig. 10 illustrates a typical car installation. The cables and connections have been so simplified that the equipment can be installed quickly.

It is customary to use a fixed mounting for the transmitter-receiver unit. However, shock mountings are available, so designed as to suit a variety of mounting methods. If necessary, to save space, the case can be fastened without the use of the regular feet. Bosses are supplied on the bottom of the case, just high enough to permit the front panel to be withdrawn.

Under some circumstances, there are advantages in having the volume and squelch controls accessible at the front panel. These controls can be fitted with shaft extensions for external adjustment.

FCC PREPARES FOR UPPER-BAND TV

FCC LISTS ISSUES TO BE CONSIDERED AT HEARING WHICH STARTS SEPTEMBER 20, TO INITIATE PLANS AND STANDARDS FOR TV BROADCASTING ON 475 TO 890 MC.

ON September 20, the FCC will start a hearing in preparation for opening the upper television band to commercial broadcasting. This is not a new idea. However, it seems to be news to a great many members of the industry, probably because the ground work was laid during the war period.

Origin of Upper-Band Plans:

In the FCC's *Report of Proposed Allocations from 25,000 Kilocycles to 30,000,000 Kilocycles*, dated January 16, 1945, it was stated: "The Commission is fully convinced that by virtue of the recent developments in the electronic art, a wide-channel television broadcasting system, utilizing frequencies above 400 mc., can be developed, and the transmission of higher-definition monochrome pictures and high-definition color pictures achieved.

"The Commission is also convinced that all of the improvements that have been made possible in the transmission and reception of monochrome pictures by recent developments in the electronic art cannot be utilized in the 6-mc. television channel. However, the Commission does not believe that broadcast service to the public through the use of a 6-mc. channel, with the improvements presently available over pre-war developments, should be abandoned and commercial television held in abeyance until a wide-channel system in the ultra-high frequencies can be developed and proven. Therefore, we have endeavored to assign to television broadcast as many 6-mc. channels below 300 mc. as possible in the light of the needs of other services for frequency space in the same part of the spectrum. . . . The importance of an adequate program of experimentation in this portion of the spectrum cannot be over-emphasized, for it is obvious from the allocations which the Commission is making for television below 300 mc. that in the present state of the art the development of the upper portion of the spectrum is necessary for the establishment of a truly nationwide and competitive television system."

This proposal was confirmed in the final FCC report on allocations, dated May 25, 1945.

On January 15, 1945, at a press conference the day before the January 16 proposal was made public, then-Commissioner E. K. Jett explained FCC thinking on the new FM and TV frequency assignments in these words: "However, FM is to be started [postwar] and developed as a permanent broadcasting service for the future. Television may or may not be a permanent service in the bands below 225 mc. because we are encouraging the development of television above 480 mc. We fully expect after a number of years that the truly competitive operations in this Country will be in the bands above 480 mc. Therefore, of the two services, when you consider that we must select between one and the other, the 6-mc. television service will be of a temporary character. I admit, of course, that the temporary character may extend for some years. Therefore, the service that is temporary in character should take the interference, not the one that will be with the public throughout the entire future."

The Present Situation

Considerable experimental work has been done in the upper TV band, but no plans for scheduled broadcasting and receiver production can be initiated until transmission standards have been agreed upon by the manufacturers and approved by the Commission. One of the first and most interesting reports on propagation at upper-band TV frequencies appeared recently in the *RCA Review*.[1] This paper describes tests of reception at Denville and Princeton, N. J., from transmitters set up on the Empire State Building, New York City.

Since 1945, the FCC has not put any real pressure on the industry to prepare for upper-band operation. Meanwhile, with the postwar availability of 2-way FM phone equipment and the provision of additional channels, mobile communications has expanded at a rate undreamed of when the present allocations were set up. Even the latest changes proposed, which the FCC will probably confirm shortly, amount to nothing more than stop-gap measures.

But with television a demonstrated success as a public service, the FCC cannot formulate plans for giving any more TV channels to mobile communications until the stage can be set for upper-band operation. Also necessary is a long-range timetable, acceptable to the industry, for moving into the upper band. That is required to protect the public and the manufacturers against a condition of chaos which could throw a monkey-wrench into the wheels of current TV progress.

JTAC Will Advise FCC:

In appraising the status of present upper-band TV, establishing new standards, and making effective plans for the future, the FCC will have the assistance of the new Joint Technical Advisory Committee. JTAC was organized recently, at the suggestion of FCC Chairman Coy, by the Institute of Radio Engineers and the Radio Manufacturers Association. This group succeeds the Radio Technical Planning Board and, it is expected, will function in a more objective manner than did RTPB. The members are: Dr. Ralph Bown, Melville Eastham, D. G. Fink, John Hogan, E. K. Jett, Haraden Pratt and D. B. Smith, with P. F. Siling as chairman and L. G. Cummings, secretary.

JTAC is already gathering data for consideration at the upper-band hearing. Accordingly we have been asked to publish the following list of issues involved, and the list of detailed questions prepared by the FCC staff. JTAC requests that our readers send any information related to these questions to L. G. Cummings, Secretary, Joint Technical Advisory Committee, 1 East 79th Street, New York 21.

Upper Band Considerations:

The purpose of the FCC's upper-band hearing, which opens September 20, is:

1. To obtain full information concerning interference to the reception of television stations operating on channels 2 through 13 resulting from adjacent channel operation of other services, from harmonic radiations, and from man-made noise.
2. To receive such additional data as may be available since the close of previous hearings (Dockets 6651 and 7896) concerning the propagation characteristics of the band 475 to 890 mc.
3. To obtain full information concerning the state of development of transmitting and receiving equipment for either monochrome or color television broadcasting, or both, capable of operating in the band 475 to 890 mc.
4. To obtain full information concerning any proposals for the utilization of the band 475 to 890 mc. or any part thereof, for television broadcasting and the standards to be proposed therefor.

The specific questions prepared by the FCC at the request of JTAC are:

1. What is the present state of development of equipment in the band 470 to 890 mc., in regard to
   A. transmitters, tubes and components
   B. receivers and components
   C. antennas, transmission lines and related equipment for transmission and reception?

(*Concluded on page 45*)

[1] "Comparative Propagation Measurements; Television Transmitters at 67.25, 288, 510, and 910 Megacycles" by G. H. Brown, J. Epstein, and D. W. Peterson, *RCA Review*, June, 1948. Obtainable from RCA Laboratories Division, Princeton, N. J. Price 75¢.

Everything for TV

You see here the transmitter room that is *being delivered to more than thirty television stations* . . . complete, and RCA throughout.

As practical, we believe, as an AM station transmitter room, this layout has the proper equipment you need to put high-quality picture-and-sound signals on the air—reliably, and with surprisingly little supervision. It includes: a combined 5-kw picture and 2.5-kw FM sound transmitter; a complete transmitter control console; a vestigial side-band filter; a dummy load; an antenna coupling network; sound-and-picture input antenna coupling network; sound-and-picture input amplifiers; and frequency and modulation monitors.

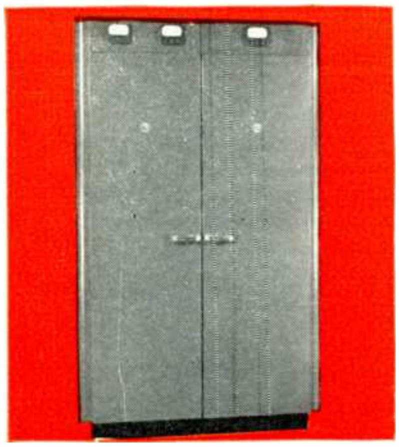
Why the overwhelming acceptance for this transmitter room . . . and all other RCA television equipment?

It's the *thoroughness* with which RCA TV equipment is designed. It's the *practical engineering* experience behind it—more of it than any other television equipment manufacturer. It's the *completeness of the line* . . . with one equipment source for everything you need in your station. It's the undivided *responsibility* RCA assumes for all equipment you buy. It's the unbroken *record of past performance and service* to the industry.

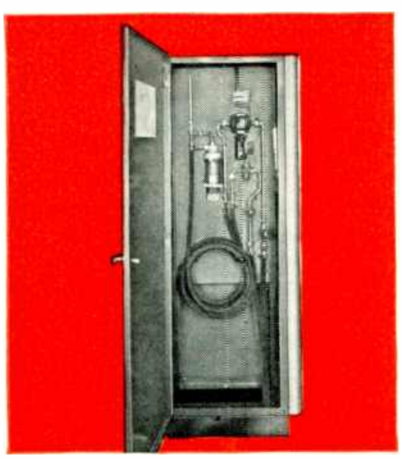
Nothing to planning a television station—when you let an RCA Television Specialist help you. Call him in. Or write Dept. 38-H, RCA Engineering Products Division, Camden, N. J.

The One Source for Everything in TV—is RCA

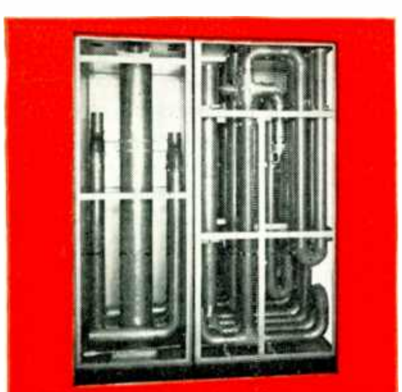
RCA EQUIPMENT CABINETS for small rack-mounting units, such as monoscope camera, studio line amplifiers for sound and picture, microwave relay receiver, test equipment, power supplies, etc.



RCA DUMMY LOAD. For testing and measuring power output. This unit consists of a coaxial line, the inner conductor of which is a water-cooled resistor.

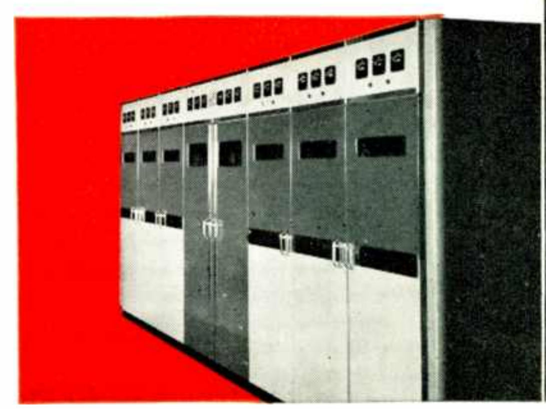


L-F ANTENNA DIPLEXER (left) **AND THE VESTIGIAL SIDE-BAND FILTER** (right). Diplexer makes it practical to use one antenna for picture-and-sound signals. Side-band filter partially suppresses one sideband. No adjustments required.



RCA CONTROL CONSOLE for "push-button" control of your transmitter room. Handles both picture and sound transmitters, a turntable, and an announce microphone. Includes power switches, picture and sound monitors, switching circuits, antenna current meters—and an oscilloscope.

THE RCA 5-KW TV TRANSMITTER (plus 2.5 kw for FM sound). Full picture-and-sound power on your channel. High-level modulation. Meter-tuned, narrow-band drivers. Only one class B stage to adjust. No neutralizing of PA. Built for "walk-in." Delivery being made to more than 30 stations.




...entire transmitter rooms,
for instance—
COMPLETE TRANSMITTER ROOM — by RCA
More than 30 rooms like this one are going to television stations. The entire layout is designed to be used adjacent to your TV studio control room...or at a remote control location.
RCA
TELEVISION BROADCAST EQUIPMENT
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.
In Canada: RCA VICTOR Company Limited, Montreal

SPOT NEWS NOTES

ITEMS AND COMMENTS, PERSONAL AND OTHERWISE, ABOUT MANUFACTURING, BROADCASTING, COMMUNICATIONS, AND TELEVISION ACTIVITIES

FM Transit Radio:

Although several test installations of FM receivers in street cars and buses are now in operation, the first wide-scale service has just been completed in Covington, Ky. Cooperating in this project are Transit Radio, Inc., Union Trust Bldg., Cincinnati, the Cincinnati, Newport & Covington Railway, Dixie Traction Company and station WCTS. Already 100 receivers are in operation, and 300 more will be in service by the end of August. This will add 380,000 to the audience of WCTS.

Easy Money:

Financing of new TV set manufacturers reminds us of similar promotions of radio concerns back in the early 20's. Only trouble is that we can't remember a single radio company financed by brokers in the old days that is still in business.

TV in France:

The Eiffel Tower station is on the air again. Their standards are set at 840 lines per inch. Program schedules is one hour on week days, three on Sunday.

Servicemen's Meetings:

Series of Town Meetings of Radio Technicians, initiated in Philadelphia last January, has been set up by the Radio Parts Industry Coordinating Committee. New York meetings will be at Hotel Astor, September 27–29. The next will be at Hotel Bradford, Boston, November 15–17, followed by others at Atlanta in January, Los Angeles in March, and Chicago in April. Chairman Harry A. Ehle has appointed Walter W. Jablon to assist in preparations for the New York meetings, and W. A. Ready to serve in connection with the Boston meetings.

TV Studios Remodeled:

WABD New York is spending over $125,000 on studio improvements which include redecorating and the addition of new equipment. The latter includes a Fearless hydraulic camera dolly and a dual Iconoscope film pickup chain.

Max H. Bice:

Former chief engineer of KMO Tacoma has been appointed to similar post at FM station KTNT, now under construction by the *Tacoma News Tribune*.

FM-TV Score:

At the end of August, FM stations on the air passed the 600 mark. In 1949, the number will equal the AM stations at the end of the war. The FM-TV score is now:

	TV	FM
On the air	30	601
Authorized	81	441
Pending	299	95
Total	410	1137

The FM figure includes 22 educational stations.

Indiana FM Net:

Comprised of WSRK Shelbyville, WCTW New Castle, WCNB Connersville, and WFML Washington, is now in regular operation. Stations WFMU Crawfordsville, WMRI Marion, and WBCR Warsaw will join the net as soon as their facilities are completed.

Armstrong Medal Award:

Formal presentation, in recognition of contributions to the radio art by the late Stuart Ballantine, was made to Mrs. Ballantine at her home in Boonton, N. J., on June 26. Prof. Hazeltine, Lawrence Horle and Harry Houck represented the Radio Club of America. On this occasion, Major Armstrong recalled that Stuart Ballantine's work included the development of the direction-finder for anti-submarine work in World War I and, later, the principles of negative feedback and AVC, mathematical theory of the vertical antenna, and inventions in acoustics which included the throat microphone.

Important IRE Publications:

Just issued are: "Standards on Television: Methods of testing receivers for monochrome, 6-mc. channel service," price $1.00, and "Standards on Antennas, Modulation Systems, Transmitters: Definitions of terms," price 75¢. Copies can be obtained from the Institute of Radio Engineers, 11 E. 79th St., New York 21.

Last Word in AM Receivers:

New York manufacturer offers the tops in functional design. It's a statue of a horse, presumably in bronze, mounted on what looks like a marble base. But it's described as a 4-tube AC-DC set, with built-in antenna. From the picture we judge that: the set is tuned by twisting the horse's tail; the music comes out of his mouth; he hangs his head for commercials; and static makes him buck.

AES Elections:

San Francisco chapter of the Audio Engineering Society has elected I. R. Ganic, chairman; Walter Selsted, vice chairman; Don Lincoln, secretary, and Frank Lennert, treasurer.

WSB-FM Atlanta:

Atlanta Journal will soon have a 10-kw. Westinghouse FM transmitter on the air, replacing the present low-power installation. A 600-ft. tower for the FM antenna is designed to take a TV antenna later. Chief engineer of WSB is C. F. Dougherty.

Ignition Interference:

Tests made by RMA and the Society of Automotive Engineers, under the chairmanship of K. A. Chittick, show that recommended changes in ignition systems reduced tolerable interference with TV reception from a distance of 200 ft. from the antenna to a distance of 70 ft. Average tolerable interference was found to be approximately 33 microvolts. The sound channel was immune to impulses that interfered with picture reception.

WMBI-FM Chicago:

New call letters for Moody Bible Institute station, formerly identified as WDLM. Present power of 5 kw. will be increased to 50 kw. early this fall.

ABC's TV Center:

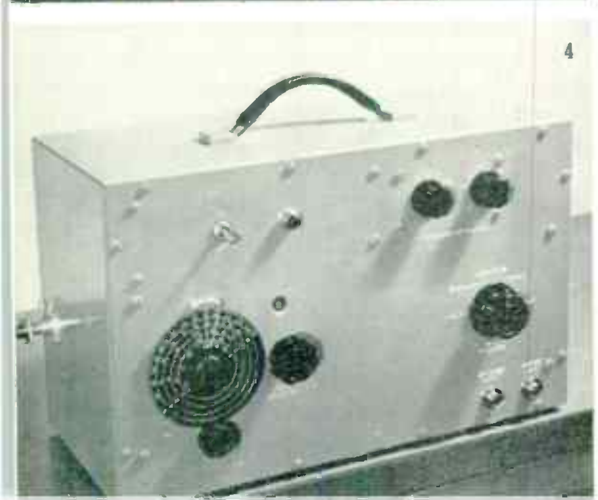
American Broadcasting Company has taken over a building which runs from 66th to 67th Streets, New York City. The structure, just west of Central Park, was formerly used as an arena for the N. Y. Riding Club. This will be ABC's TV studios when alterations are completed early next year. WJZ-TV New York is already transmitting test patterns on channel 7.

New Company:

Raymond Rosen Engineering Products, Inc., 32nd and Walnut Streets, Philadelphia, has been formed to handle what was the commercial sound, communications, and development department of Raymond Rosen & Company. One of the big jobs done by the new concern was the installation of the sound systems for the recent political conventions. Vice president and general manager is Louis P. Clark.

Straight FM Table Model:

Emerson Radio has announced a table model, priced at $30, with FM tuning only. If it has good sensitivity and limiting action, it's big news to dealers and broadcasters. Today, in all important trading areas, a good FM set can bring in *enjoyable reception* from more FM stations than AM stations. So the advent of a straight FM set is amply justified. However, to be successful, the Emerson model must equal the FM performance of Zenith's new $49.95 FM-AM receiver.



NEWS PICTURES

1. To protect the WWJ-TV cameras which televise baseball games at Briggs Stadium, home of the Detroit Tigers, Rohm & Haas produced a $\frac{1}{2}$-in. sheet of Plexiglas 7 by 8 ft. The material does not interfere with the cameras, and affords ample protection against a 9-oz. ball.

2. RCA recently staged another week-long course in television for sixty-four broadcast engineers at Camden. The group included a Canadian contingent. In this photograph are, from left to right: Walter J. Blackburn, president of CFPL, CFPL-FM London, Ont.; Aurele Boisvert, chief engineer of CHUM Toronto; Frank M. Folson, executive V.P. of RCA; W. W. Watts, V.P. in charge of RCA engineering products department; Percy Fields, chief engineer of CFPL, CFPL-FM; and RCA representative Ken Chisholm.

3. A tape recorder, designed to meet the requirements of FM broadcast studios, has been developed by Ampex Electric Corporation, 129 Howard Avenue, San Carlos, Cal. Response is rated at ± 1 db from 30 to 15,000 cycles; overall distortion is 4% intermodulation at peak meter reading.

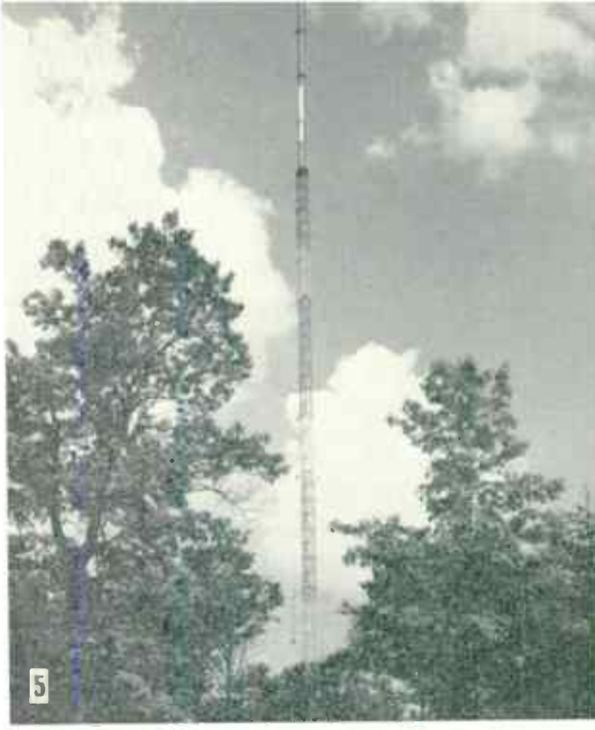
4. Latest addition to FM and TV test instruments is the Raytheon-Belmont signal generator for RF alignment. Used in conjunction with an oscilloscope FM sets can be checked accurately and quickly. For TV, a video generator is needed.

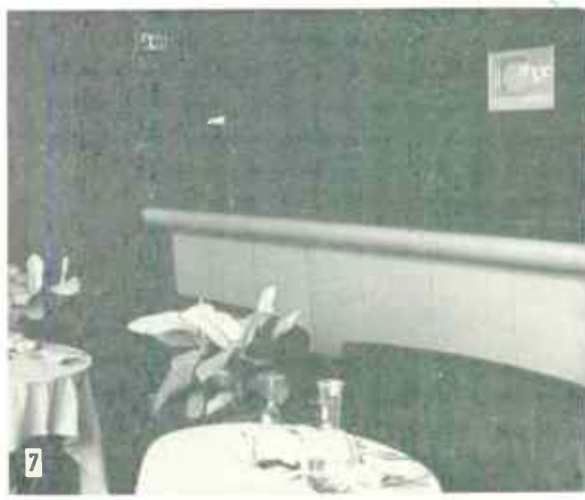
5. York, Pa., Fred Link's home town, is also distinguished by having a unique broadcast antenna installed for WNOW and WNOW-FM. The top 54-ft. section is a 4-bay Pylon antenna, mounted on a 154-ft. Wind Turbine tower. The entire structure serves as an AM radiator.

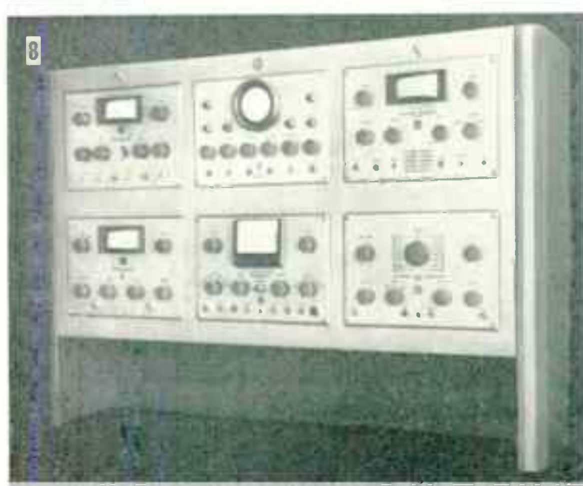
6. FM transit radio service from WCTS Cincinnati was formally inaugurated on July 10. Taking part were, left to right, Guy C. Hecker, manager of the American Transit Association and Harry Reid, president; P. G. Vondersmith, president of the Green Line; Richard C. Crisler, vice president of Transit Radio and Hulbert Taft, Jr., president.

7. At the new Terrace Plaza Hotel in Cincinnati, a Crosley television receiver is fitted permanently into one wall of the garden restaurant, and connections are provided for three more sets to be used on special occasions.

8. To facilitate the use of test equipment, and to protect the instruments from damage on the service bench, RCA is providing this rack mounting. Of aluminum trimmed in blue-gray, it holds six standard-size RCA instruments. Size is 4 ft. wide, 3 ft. high, and 1 ft. deep.







MERCHANDISING TV RECEIVERS

RECOMMENDATIONS BASED ON THE RESULTS OF A SURVEY OF TV OWNERS AND NON-OWNERS IN NEW YORK AND PHILADELPHIA AREAS—*By* STANLEY H. MANSON*

TELEVISION is a rapidly growing industry. It has moved ahead so fast during recent months that manufacturers, broadcasters, distributors, and dealers have all made serious blunders in selling this new and exciting form of home entertainment. This confusion in the ranks is a natural outcome when everyone tries to get into the business in a hurry. However, progress in the right direction has been made since the first of this year by broadcasters who are now offering better programs, manufacturers who are producing better receivers at more attractive prices, and by dealers who have improved their demonstration facilities and selling techniques. The public has been given a better understanding of what it can and cannot expect from television by more informative advertising sponsored by manufacturers and dealers, plus a wide distribution of literature and booklets on the subject which have recently been made available.

In markets where television has been a factor for many months, the fans and those individuals who always are among the first to buy something new have made their purchases, and business for the dealers is settling down to the application of merchandising techniques that have proved successful in the past. In other words, television, like any other product, must be thoroughly sold in order to guarantee the dealer a satisfied owner list. The radio business is now entering a tremendous era of expansion with the advent of television, and competition will be greater than ever between manufacturers and within the ranks of the retailers. Therefore, it is only logical that those who are adequately prepared in every way to enter this new field will gain the greatest amount of volume and profit from it during the years ahead. There has been confusion in the ranks as individual manufacturers attempt to approach the problem of merchandising and promoting their television products in a manner which differs from their competitors, but this is a healthy condition and probably one of the main reasons why the radio industry is fast reaching a billion-dollar annual sales peak. Sales methods employed by individual dealers in any given community also differ, but these varying approaches to the problem of moving merchandise usually result in profitable operations for the majority.

There are, however, certain fundamental merchandising techniques which have been exploited already and proved successful in the promotion and sale of television instruments. In these cases, the progressive dealer usually knows what the prospect wants in his new television receiver, what he is willing to pay, why he will make his purchase at a particular store, and what he can say in his local advertising which will make the prospect want to buy *now*. This same knowledge must be obtained by the manufacturer and applied to his planning of future products and merchandising campaigns.

THE CHANGING SCENE

IN the days before FM and TV, most radio displays were cubby-hole affairs, with little table models (top price $29.95) set in each opening. Consoles, if shown, were pathetic affairs, with a miniature chassis reposing in an almost-empty shell of borax woodwork.

The display of 1948 FM and TV models on the page opposite, in amazing contrast, emphasize the new merchandising problems which now confront manufacturers and dealers. From left to right, and by rows from top to bottom are models produced by Westinghouse, Magnavox, Freed-Eisemann, Hoffman, RCA, Du Mont, Pilot, Philco, TCA, Farnsworth, Zenith, and Crosley.

New sets and added services are multiplying the profit-possibilities of radio sales, but they call for a more profound technical knowledge and a broader understanding of markets and merchandising methods. Over-the-counter, cash-and-carry sales are becoming fewer and farther between for the simple reason that while production of shelf merchandise is dropping off, there is an enormous increase in sets too heavy to pass over the counter, or to carry out under one's arm.

Early this year, our Company delegated its advertising agency to make a pilot survey among owners of *all* makes of television receivers and also non-owners, or prospects, in the New York City and Philadelphia areas. This form of market research will be continued in other cities during the fall months, for we anticipate many changes in the buying habits and desires of the public as television becomes more and more an essential part of home entertainment.

From both groups, owners and non-owners, we took a complete history of their exposure to television, what influence this exposure had on their enthusiasm for television, and what considerations would be regarded as the most important if they were investing in television today. In allocating both owner and non-owner interviews, representation was secured from all important sections, both city and suburban, as well as a cross section by income and age groups in the New York and Philadelphia areas. Here are the highlights of the survey:

1. We found that the man of the house made the purchase decision in 75% of the cases. This is a high percentage compared to the sale of radio and radio-phonograph combinations, for in the past women have had great influence in the selection.

2. 30% of the owners made a decision to buy and bought immediately. 24% took 2 to 4 weeks to shop around. Another 24% took 2 to 6 months before placing their order.

3. 73% of the owners purchased table models, against 27% who selected consoles or combinations. Price or availability were the chief factors in table model sales, although many indicated that because of the television programming available at the time of purchase, it was desirable for them to retain their radio-phonograph combination in the living room for the entertainment of members of their family and friends who were not interested in television programs. In such cases, the television table model was placed in a den or game room for the entertainment of Dad and the boys.

4. In the homes visited by interviewers, 75% of the receivers contained 10-in. tubes and 11%, 7-in. tubes. The remainder were using larger tubes. When asked for preference in considering the next purchase, the majority indicated that they would buy a receiver with a larger tube, with the 12 and 15-in. sizes most popular.

5. In considering the extent of shopping comparisons before purchase, it must be remembered that the limited availability of television during 1947, and even in early 1948, undoubtedly upset the normal shopping habits of buyers. It is noteworthy that almost half of the owners (49%) did not consider any makes other than the particular one purchased. The present shopping habits are becoming more normal, as many more makes and models are being introduced and effectively advertised, resulting in the prospect's desire to see and compare before making his choice.

6. Here is an interesting observation which must be given consideration in planning your merchandising program. Although the man of the house made the selection of the television receiver (in 75% of the cases), a tremendous amount of influence on him to buy was exerted by other members of the family, especially the children. In fact, children are the most enthusiastic audience for television programs, and it is common for youngsters in the neighborhood to gather as a group in a television home and quietly watch afternoon and evening programs by the hour, no matter what type of entertainment is being broadcast. This may be a good thing for those of us who occasionally look for a little peace and quiet at home.

* Manager of Advertising and Public Relations, Stromberg-Carlson Co., Rochester, N. Y. Complete text of an address before the National Association of Music Merchants, Chicago, June 17, 1948.












Nearly three-fourths of the respondents claim that members of their families had developed new interests as a result of television ownership. This pertains particularly to sporting events.

7. Although many owners took several months to make up their minds regarding their television purchase, they were upset because of the period of time which elapsed between purchase and installation. No doubt many of these complaints could be eliminated if the dealers' salesmen would explain the delivery and installation problems at the time of purchase.

8. Under the heading of service, we were pleased to find that 84% of the owners reported that their installation was completely satisfactory. This indicates that dealer and special installation service organizations are well trained and are doing a thorough job.

9. Another encouraging report is that the large majority found their television receivers easy to operate. Wives receive more instruction on operation than husbands, probably because more women than men are home at the time of installation. Generally speaking, buyers have learned to operate their sets quickly and easily, with only 6% admitting difficulty.

10. More than two-thirds of the receivers (68%) required service of one form or another. As to the nature of the trouble, the majority of complaints were not serious and necessary service calls were reported to be satisfactory with little time involved in making adjustments. It should be pointed out that poor signals from the broadcast transmitter or inferior programs have resulted in many calls to the dealer's service department. Stations are overcoming this by announcing during the broadcast that their difficulties are temporary. Dealers should also be alert to any period of unsatisfactory broadcasting service in order to explain to the customer that the fault does not lie in the receiver.

11. Viewed in relation to standards of reception anticipated prior to purchase, set owners evidenced a high degree of satisfaction with their television receivers. 82% judged the pictures "very good"; 16% regarded them "fairly good"; and only 2% had experienced real disappointment and considered the images "poor." Evaluation of sound or tone quality was identical with the evaluation of the image. Difficulty in picking up channels or stations was reported by 22%. This will naturally vary by cities because of signal strength and location of transmitter.

12. Important to all of us in the television business is the influence of this new communication service on the family life and interests. The greatest source of satisfaction, cited by 45% of the owners, was that for the first time they were able to enjoy a variety of entertainment visually in their own homes. As natural corollaries, such responses were received as "brings family closer together" and "provides means of entertaining friends." The educational advantages of television, particularly for children, were mentioned by nearly 25% of the respondents.

13. 60% of the owners experienced some disappointment in their television set ownership. The entertainment now offered on television was the principal ground for criticism, 19% citing poor programming and an additional 15% specifically naming old, poor movies. Lack of variety was also pointed out by 9%, and 6% expressed this same thought "no good programs except sports." This problem is fast being overcome by stations and networks broadcasting better programs, including musical shows, now that the ban has been lifted.

14. In regard to the weekly viewing time spent by individuals and families before their television receiver, 31% reported 25 hours or more per week, while 22% use their set 20 to 25 hours. This means that more than one-half of the television owners interviewed were actually viewing on an average of 3 hours per night. Only 11% limited the use of their sets to less than 10 hours per week. Another interesting observation is that 69% of the leisure time now given to viewing television was previously spent listening to radio. When owners were asked to indicate their favorite radio program and their favorite television show and then decide which they would tune in if both were on the air simultaneously, 89% favored the television broadcast. This is something for all of us to think about, especially those who are in the broadcasting business.

15. A strikingly strong endorsement of television was evidenced when 99% of the owners answered that they would buy a television set if they had the decision to make again. As further testimony of satisfaction, 35% are interested in acquiring a second television receiver.

16. With a background of experience with their present television receivers, owners in entering the market today would look first for a larger screen, as indicated by 48% of the respondents. Somewhat related, and of almost equal importance, would be clarity of image, 40%. Better cabinet designs and finishes would be expected by 24%. 18% would require improved sound or tone quality. Simplification of controls and fewer knobs would be an advantage in reselling 15% of the owners. The hope for color television was expressed by 17%. With the exception of the last mentioned requirement, the radio manufacturers are meeting the future wants and specifications of those who have television sets in their homes today.

17. 51% of these owners would want a console type receiver with all services — television, AM, FM, short wave, and automatic record player. In contrasting preference with the present ownership (27% console and 73% table model) the apparent shift must be considered in the light of the limited availability of television during the period in which many of the present sets in operation were purchased. Also, the respondents have had both an introduction to television and gratifying experience with it, which makes them less resistant to higher-priced console models. Interesting information regarding furniture styling, finishes, desired height of screen from the floor (which happened to be 38 ins. as indicated by the majority), improvement of controls, and size of screen was also secured from this survey.

18. Our survey among non-owners showed that 96% had been exposed to television programs. 84% desired to own television sets, representing all income groups. It is interesting to note that the non-owners' requirements are almost identical to owners' specifications, 51% desiring a console model and 49% a table model for the same reasons expressed by owners. Large picture, clarity, fine cabinetry are also expected by non-owners. The general level of prices which non-owners would be willing to pay for television receivers was considerably lower than the prices the owners would expect to pay. 35% indicated that they would invest up to $400 for a television set. Another 35% of non-owners would be willing to pay $400 to $600 and 30% over $600. In the majority of cases, these prospects were not fully informed on the costs involved in producing receivers to meet their requirements.

These are the high lights of our survey as they pertain to the problems faced by manufacturers and dealers in merchandising television effectively during the months ahead. Our contacts with dealers in television areas indicate that they are genuinely enthusiastic about this new and wonderful broadcasting service, many realizing that television is the answer to a much needed impetus to greater volume and profits in the radio business. Sales in television territories have been made to all income classes, although it was not many months ago that television was looked upon as a rich man's toy.

Dealers are now beginning to report that all prospects interested in television are not buying. Objections to price, character, and quality of programs being broadcast, and the desire to hold off for revolutionary developments and improvements are influencing factors. As stated above, manufacturers, broadcasters, and dealers are now finding the way to satisfy the millions of television prospects who will buy during the next few years.

With a thorough knowledge of what television is and how it is playing so important a part in offering complete home entertainment to owners, those of you who are already selling television receivers, and others who may soon be, must enter

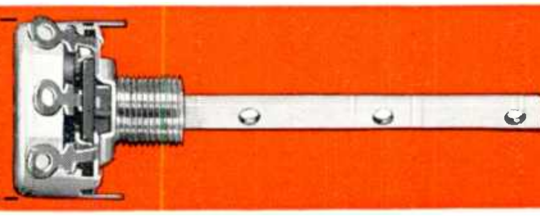
(*Continued on page 46*)

All New!

Mallory Midgetrol

Revolutionary

The First 15/16" Replacement Control Line



Quietest and Smoothest . . . by Test!

THE SIZE IS . . . . NEW

Only 15/16" in diameter, it easily services the increasingly popular small sets where ordinary controls will not fit.

THE DESIGN IS . . . . . . NEW

Brand new shaft style saves valuable time in installation—reduces inventory since one shaft fits all knobs.

THE CONSTRUCTION IS . . NEW

Extra quiet—no metal-to-metal contact between shaft and cover or bushing. Special Mallory contact material.

THE SHAFT IS . . . . NEW

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THE EXTENSION IS . . . . NEW

Easy to apply with self-tapping screws. Supplementary shafts available for installations which require them.

THE SWITCH IS . . . . . . NEW

No chance of failure—it's Mallory engineered and Mallory manufactured. Pushes on—stays on—and *works.*

THE ELEMENT IS . . . . . . NEW

More accurate over-all resistance, smoother tapers, ample power dissipation.

THE CONTACT IS . . . . . NEW

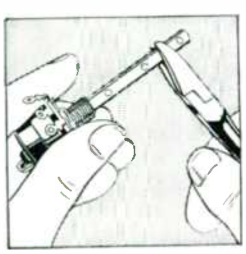
Laboratory tests prove that the Mallory Midgetrol is the quietest control on the market.

THE TERMINAL IS . . . . . NEW

Won't break—twist 'em all you want in close working space. Away from panel to avoid shorting.

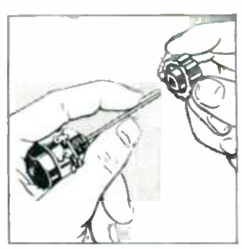
THE SUSPENSION IS . . . NEW

Two-point—insures even contact pressure at all points of rotation. Larger bushing area—added support—no wobble.

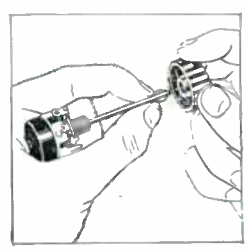


Side snips neatly cut shaft to length desired.

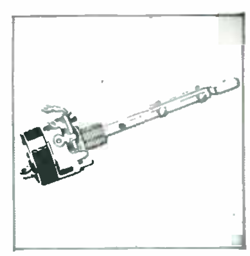
U-clip furnished to slide over end of shaft—holds set-screw knobs.



Use half the U-clip to hold push-on type knobs.



Spring steel clip included for use with knurled knobs.



Extension shafts with two self-tapping screws available when needed.

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Bendix radio installations on the tugs can be identified by the cartwheel antenna

HOW N. Y. TUGS USE FM

LACKAWANNA RAILROAD SAYS: "DON'T SHOUT! OUR TUGS HAVE HEARING AIDS." — *By* JOHN M. SITTON *

FEW people, not connected with the railroads, realize that their marine extensions in harbors and on waterways perform an important function in moving freight between inland areas and coastwise and foreign vessels. Also, transit time is saved by moving freight cars on floats.

Motive power for these operations is supplied by tug boats. Their movements are necessarily slow because the loads are heavy and ponderous, and their speed is limited by harbor traffic, tides, winds, and weather. There has been a further limitation to tug boat operations, namely, the lack of communications between the captains and their respective dispatchers. Until the advent of the 2-way FM telephone, orders and changes could be delivered to a tug over a distance limited by the carrying power of the human voice, augmented by the use of a megaphone!

It is easy to see that, under such circumstances, considerable time is lost 1) when conditions change and a tug continues unnecessarily to a destination because it was impossible to countermand the original order, or 2) when a tug, returning to its pier, passes an assignment because new orders cannot be transmitted to the captain en route.

In contrast, Captain Doran, assistant superintendent of the Lackawanna Railroad's marine department, described the effect of equipping ten of their fourteen tugs with radio in these words: "Two-way radio has made it possible for us to coordinate our whole New York Harbor operation of moving freight into a cohesive, efficient organization."

Two-Way FM Performance:

To get first-hand information on the use of radio in tug boat service, the author spent a day with Capt. Torcic on the *Fulton*, one of the Lackawanna's New York Harbor tugs now equipped with 2-way FM.

The headquarters antenna, 250 ft. above the water, is mounted on the Lackawanna tower, Hoboken. The transmitter, a Bendix installation operating on 160.29 mc., is about 75 ft. down the tower, remotely controlled from the dispatcher's office on Pier 6.

Similar Bendix equipment is used on each tug, with the addition of a dynamotor power supply. The remote control unit and hangup for the handset are mounted directly forward of the wheel, as shown in one of the accompanying illustrations.

The loudspeaker is normally connected to the radio receiver, but when the handset is removed from its hook, the speaker is silenced, and the incoming voice is heard on the receiver in the handset. This is the same arrangement as is used on land mobile installations.

According to John de Silva, who handles the maintenance of all the radio equipment, radio coverage of New York Harbor is virtually solid except at a few spots in the East River, close to the Manhattan shore. That is due to strong shadow effects from certain groups of tall buildings, since the main transmitter is across the Hudson River on the opposite side of Manhattan. In the middle of the East River, and on to the Brooklyn side, no trouble is experienced at all, as would be expected.

The noise level in New York Harbor is

Use of the 2-way radio does not interrupt tugboat Capt. Torcic's trick at the wheel

* Bendix Radio Division, Bendix Aviation Corporation, Towson, Md.

very high, with the source apparently in the direction of Manhattan Island. Initial trouble caused by the high level of interference was overcome, however, by changing the squelch from carrier operation to noise operation.

Typical Daily Schedule:

Normally, each crew on the Lackawanna tugs stands an 8-hour watch. Each tug is out of service for 1½ hours in 24, when the ashes are blown out by a steam injector into a gondola car at the pier. Then new fuel is taken on.

The day starts at 5:00 a.m. when the Captain and his crew go aboard. By radio, the Captain reports to the dispatcher that he is ready for orders. Up to this point, there is no change in routine over pre-radio procedure. But when the tug leaves its pier, there are radical departures. On the occasion of the writer's trip with Capt. Toreic of the *Fulton*, we had just pulled in at Emigrant Slip, Hoboken, when a call came with instructions to tow the tug *Madison* to the ash car. Before that assignment was completed, the next order came:

"Pier No. 6 to Fulton, over." Capt. Toreic replied:

"Fulton to Pier No. 6, OK."

"Take barge 507 from Pier 4, D.L. & W. Terminal to 7th Street, Hoboken. Also, shift lighter 448, Pier No. 1 Army Hoboken to Pier No. 60, North River."

A few minutes later there was another call, the routine acknowledgment, and then:

"Pick up barge 571 from Hoboken Pier No. 3 Army and take it along with 507, over."

"Fulton to Pier No. 6, OK, over and out."

Capt. Doran explained: "The old method was to send a deck hand ashore whenever a tug docked so he could telephone the dispatcher for orders. It took about 15 minutes for each call. If 10 calls were made during a watch, that meant tying up the tug for 2½ hours! If the dispatcher wanted to reach the tug, he had to wait until it showed up, and hove to within hailing distance. He couldn't catch it en route. Now he can give a tug a string of change orders, no matter where it's working. Radio has done that."

By 1:00 p.m. the *Fulton* had completed six jobs. On our way to the next one, we heard:

"Tug Newark to Pier 6, over."

"OK, Newark, go ahead."

"Tug Newark reporting a fire ashore at Roosevelt Street, East River. Fire boats are on the way. No need for us to stand by. Over and out."

"Pier 6 to Newark, OK, out."

The Captain explained that the fire was under Brooklyn Bridge. "If it had been necessary, the *Newark* would have helped fight the fire. Each tug has a fire tower and extra hose. It can throw a stream about 60 ft. to fight a fire aboard a vessel

To dispatcher Joseph Strohscheim, the old megaphone is now a relic of pre-radio days

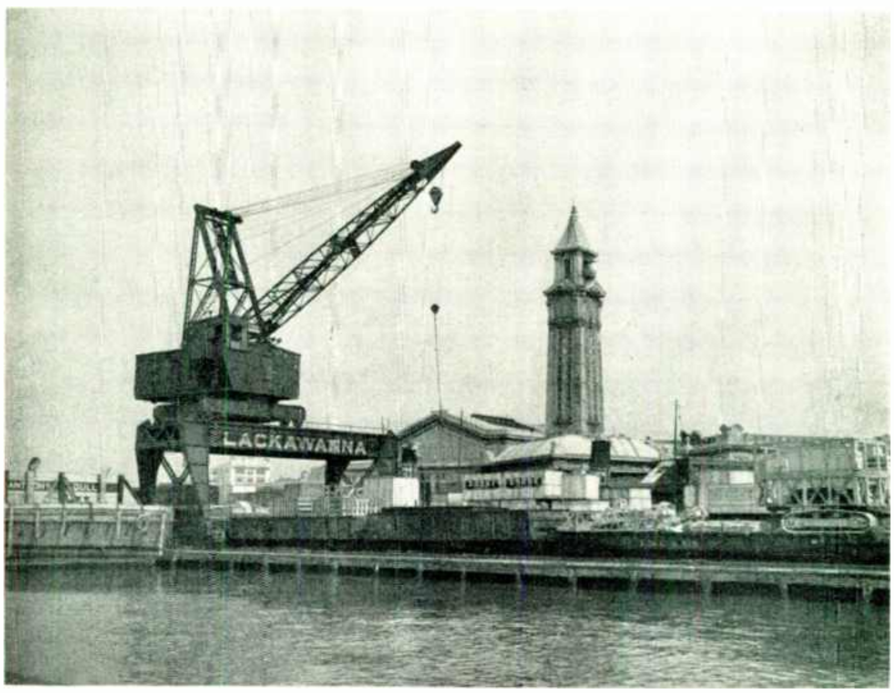
or ashore. During the famous Weekauken fire, the tug *Bath* operating as a central station, transmitted messages to two Lackawanna tugs which passed them to non-radio tugs working in the area."

As we plowed along, Capt. Doran described events on that day-after-last-Christmas, when winds of hurricane force lashed harbor traffic with blinding snow. "With radio aboard," he said, "our tugs never lost a minute's time, for they were in constant contact with the dispatcher. At one time, damage was threatened to equipment at the Bush Docks in lower Brooklyn, where it was exposed to the full sweep of the wind from the upper bay. But it was saved by the crew from one of our tugs. The dispatcher knew the location of each tug, and sent the nearest one to do the job. Not a minute's time was wasted.

"Some carfloats were being towed around the Erie Basin breakwater that day. The wind was so strong that a second tug was needed. As soon as the difficulty was reported by radio, the dispatcher called another tug and rerouted it."

Capt. Toreic, the *Fulton's* skipper, recalled that the snow on that day was the heaviest he had ever seen, and he has been on the Harbor for nearly fifty years.

(*Concluded on page 40*)



Main transmitter installation at Lackawanna tower is remotely controlled from Pier 6

TELEVISION HANDBOOK

CHAPTER 3: PRIMARY COMPONENTS OF EQUIPMENT—PART 5: DISCUSSION OF THE THEORY & OPERATION OF RELAXATION OSCILLATORS—*By* MADISON CAWEIN

(5.2) Current Relaxations:

The type of relaxation oscillator which was discussed in the last section is used to generate sawtooth potential waves. This type is generally referred to as the capacitance-resistance (CR) type of relaxation oscillator, of which the multivibrator, the van der Pol, the blocking oscillator, and the Potter oscillator are examples. Figs. 62 and 63 illustrate the two latter circuits. The time-determining circuits are defined by the magnitude of C and R, and the output waveform is defined by the magnitude of C′ and R′. R″ may be introduced to include a pulse component in the output sawtooth wave.

Another type of relaxation oscillator can be used to generate sawtooth-current waves, in which the time-determining circuit may consist of L and R. Then the oscillation is referred to as an L/R relaxation.

(5.21) The Beam Relaxor:

One form of sawtooth-current relaxation oscillator which has been referred to as the Beam Relaxor will supply 2,500 volts DC for excitation of the 2nd anode of magnetic-focus camera tubes, in addition to supplying the deflection current. The circuit shown in Fig. 63. The theory of this circuit will be described in some detail from a physical standpoint, to help the student to visualize the operation of the circuit.

This circuit is known as an L/R type of relaxation oscillator, in which the frequency and waveform control are dependent entirely on the ratio of plate-circuit inductance to dynamic plate-circuit resistance, as opposed to the capacitance and resistance in the more generally used CR-type relaxation oscillators.

The effective load of the plate circuit is the determining L, and the effective plate resistance of the tube is the determining R of the circuit. The actual impedances of the primary and secondary are non-critical. The impedance and potential of the screen electrode is the most critical element in the circuit, there being an optimum value of screen resistor for every design, which optimum controls the amount of high-voltage obtained, the synchronizing susceptibility, the speed of the wave, and the tendency to parasitic oscillations.

The equivalent circuit is shown in Fig. 64. The potential waveforms at various points of the circuit are shown in Fig. 65. The following physical description of a single cycle is suggested:

Consider that a linear, sawtooth electron-current flows into the plate of the beam-power tube from the cathode, during the trace portion of the sawtooth cycle. The load is purely inductive. The electrons leave the plate, flowing into the load inductance at a lower rate than that

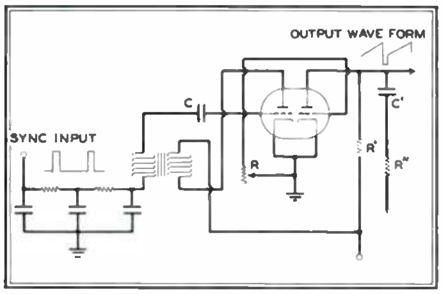


FIG. 61. *CR relaxation oscillator, in which the low-frequency blocking-osillator type of circuit is employed*

at which they arrive from the cathode, due to the inertia effect of the inductive circuit. There is a linear, negative potential-gradient along the plate inductance, the plate being the most negative point, due to the steady difference between the number of arriving and departing electrons at any point of the circuit. This difference exists even though the number of electrons arriving from the cathode is steadily increasing with time, as the cycle progresses, because the num-

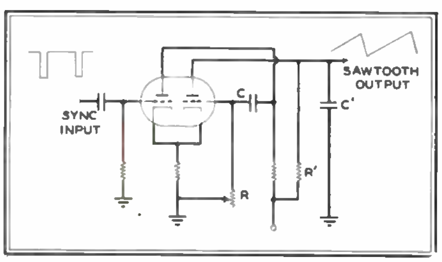


FIG. 62. *Another CR relaxation oscillator, employing the high-frequency Potter oscillator type of circuit*

ber which leaves the plate and flows away through the inductance is also steadily increasing with time. It may also be considered that the uniform potential induced across the inductance due to this steady change in current keeps the plate potential at a lower-than-normal value during this part of the cycle.

Suppose now that the steadily increasing electron stream from cathode to plate slows down, or is cut off. If the current change through the inductance is interrupted slightly, for any reason, then electrons pile up at ground due to inertia, which keeps them flowing through the inductive load away from the plate. This leaves a great deficiency of electrons at the plate, and a consequent high value of positive potential on this element. The positive potential at the plate slows down the rate-of-flow of electrons away from the plate until this rate becomes less than the decreased rate-of-flow from the cathode. The two rates become equal at a point midway along the retrace, or flyback of the sawtooth cycle, indicated by dots in the diagrams of Fig. 65. The plate potential reaches its maximum negative level again as current-flow from the cathode starts in again. The starting current represents at least the maximum rate-of-rise at any point of the cycle.

In this type of relaxation, as the cathode-current interruption starts, there is an instantaneous pile-up of electrons at the grid due to the transfer of kinetic energy of motion from electrons in the plate circuit to those in the grid circuit, by way of the radiation field of the coupling transformer. This is perhaps another manner of saying that the mechanics of any physical process is not completely understood or explainable in the final analysis. A negative, impulsive potential is produced at the grid, and this accelerates the interruption of the cathode current. We say that the circuit is regenerative, any small change becoming greatly augmented to its physical limit in a small interval of time, limited by the transit time of electrons and the time constants of the circuit elements.

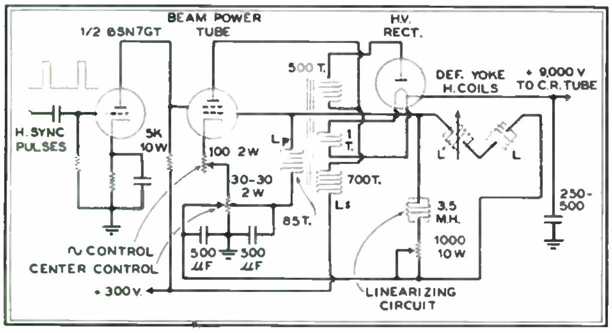
The screen potential, as the cathode current starts to rise, is at its lowest value, because a large number of electrons are deflected toward the screen just at the inception of the cathode current. This can be seen by reference to the potential waveform of the screen, Fig. 65. The potential waveform of the cathode is such that absolute current cut-off occurs during the retrace. The beam-forming electrode, which is connected to the cathode internally, must follow the cathode potential. One explanation of the performance of this oscillator is that, as the beam-forming electrode potential increases linearly with the cathode potential, the screen is robbed of electrons at a linearly increasing rate until the screen potential reaches a value where part of the beam strikes the beam-forming electrode, and current interruption starts.

(5.22) Magnetic Deflection Circuit:

The analysis of the output circuit in Fig. 63 is typical of magnetic deflection circuits in general, whether of the current-relaxation type under discussion in the previous section, or whether the grid of the power tube (utilized as an amplifier) is driven by a waveform similar to either of the output waves shown in Fig. 62 as generated by a CR-type of relaxation oscillator.

oscillations. With deflection coils having an inductance equal to 2.0 mh., the turns ratio of the transformer should be approximately 6:1.

The optimum value of screen resistor increases with the turns ratio, having a value of approximately 5,000 ohms for n = 6, and for a 300-volt B supply. Departure from this optimum value will result in some loss of deflection-current amplitude, and may decrease the impulsive high-voltage at the plate.



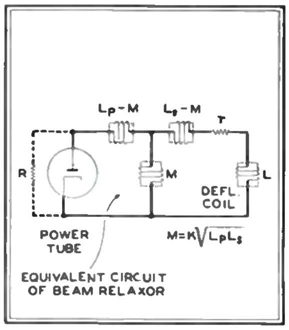


FIG. 63. *L/R Beam Relaxor, in which frequency and waveform depend on the ratio of plate-circuit inductance to dynamic plate-circuit resistance.* FIG. 64. *Equivalent diagram of the Beam Relaxor, showing the circuit elements*

The effective impedance of the equivalent plate circuit in Fig. 64 is:

$$Z = \frac{L_pL_s(1 - k^2) + L_pL}{L + L_s} \text{ (neglecting r) (10)}$$

which reduces, at substantially unity coupling (k = 1), to:

$$Z \doteq \frac{L_pL}{L_s + L} \quad (10.1)$$

The ratio of L_p:L_s is approximately equal to n^2, where n is the turns ratio of the transformer, so that when L_s is large with respect to L

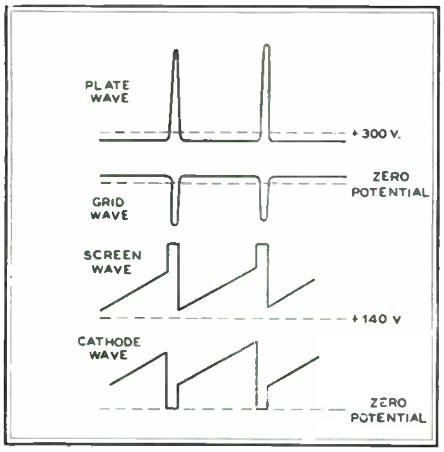


FIG. 65. *Potential waveforms as they appear at various points of the Beam Relaxor circuit shown in Fig. 63*

$$Z \doteq n^2L$$

This impedance is the frequency-determining inductance. It should be of the order of 80 mh. for tubes of the 6L6 type, which have a plate resistance of the order of 500 to 1,000 ohms during the positive-grid portion of the cycle. This gives an L:R ratio between 1/6,000 and 1/12,000 second, and is approximately the correct time-constant for 16,000-cycle

As might be expected, the linearity of current rise can be controlled by the use of an L + R damping circuit across the coils, instead of a C + R circuit, or a damping diode. The damping circuit absorbs a considerable amount of power, which loss can be avoided by the use of a damping tube when reduction in the number of tubes is not important. A correction of the curvature of the power-tube characteristics would eliminate the necessity for this non-useful power drain. Almost any efficient horizontal deflection transformer will give satisfactory operation in this circuit.

Control of deflection amplitude can be obtained in several ways. The easiest and cheapest method is to vary the 2nd-anode potential of the camera tube or cathode-ray tube. This method has the disadvantage that brilliance and focus must be adjusted as the size is changed.

Small universal coils with iron plungers and screw adjustments make satisfactory variable inductances for size control. This variable inductance can be placed in series (coil L' in Fig. 63) or parallel with the deflection coils, so that its adjustment changes the current flowing therethrough. When the deflection frequency is in proper step with the synchronizing signal, approximately 1 in. of deflection-amplitude variation can be obtained before the sync control needs readjustment.

(5.23) Kick-Back High-Voltage:

The high-voltage AC pulse, Fig. 65, existing at the plate of the horizontal-deflection tube (6L6, 807, or 6BG6G) can be rectified as shown, and used to supply the high voltage for the camera tube. This is usually of the order of 1,500 to 2,000 volts. This is usually not considered good practice for studio equipment, however, in spite of the fact that it is common usage to employ 8,000 to 10,000 volts for television receivers. It is more usual at the camera to use an RF high-voltage supply, or to use a brute-force supply by the rectification of high-voltage, 60-cycle power in the conventional manner.

Generally, it may be said that in the kick-back or fly-back type of high-voltage transformer, the magnitude of the high voltage pulse is directly proportional to the effective plate-circuit inductive impedance Z, and inversely proportional to the effective capacitance across the plate winding. It is necessary to keep this capacitance at a low value in order to obtain high-voltage pulses, and fast return of the sawtooth wave.

(5.24) The Deflection Transformer:

In Fig. 66 there is shown the essential output circuit of a deflection amplifier, together with the equivalent circuit, for purposes of analysis. Referring to the figure, the driving EMF in the secondary, for each component of the deflection wave having an angular velocity ω is:

$$e_s = -j\omega Mi \quad (10.3)$$

which, by Kirchoff's Law is also:

$$e_s = j\omega(L_s + L)I + rI \quad (10.4)$$

Let $L' = L_s + L$. The power factor (which is the reciprocal of Q) in the secondary circuit is

$$p = r\ L'\omega \quad (10.5)$$

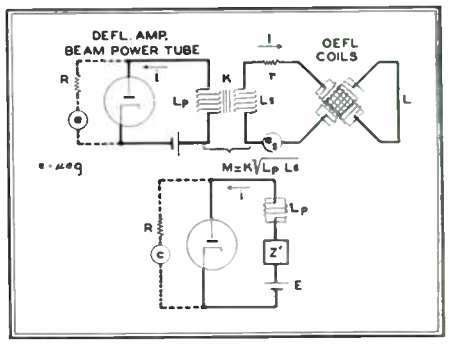


FIG. 66. *Essential output circuit of a deflection amplifier, together with the equivalent circuit elements*

and therefore the driving electro-motive force for each component of the sawtooth wave in the secondary circuit is

$$e_s = L'\omega I(j + p) \quad (10.6)$$

From (10.3) and (10.6) the magnitude of the secondary deflection current can be obtained:

$$I = \frac{-jMi}{L'(j + p)} \quad (10.7)$$

From this equation it is clear that the magnitude of the deflection current is dependent upon the ratio of mutual inductance to total secondary-circuit in-

(*Continued on page 40*)

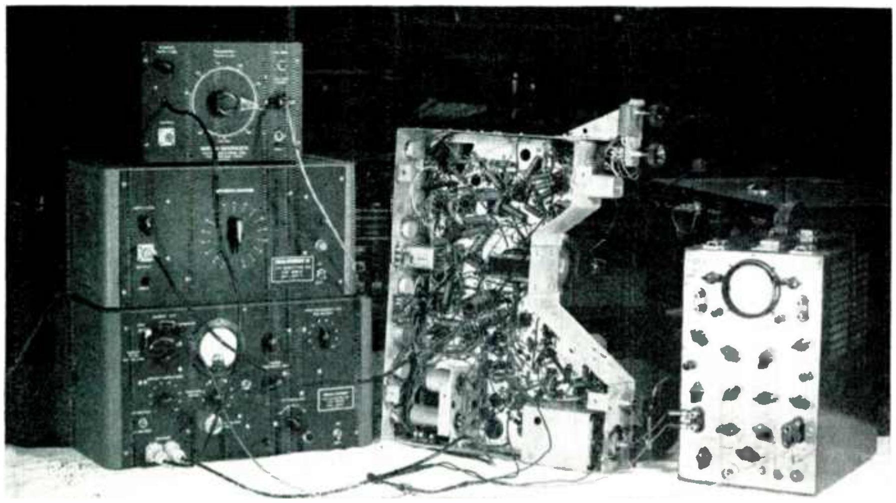


FIG. 1. *Visual TV alignment calls for Mega-Marker, Mega-Marker Sr., and Mega-Sweep*

TV TEST TECHNIQUES

HOW AND WHY FAST VISUAL METHODS HAVE REPLACED SLOW POINT-BY-POINT TESTING—*By* FRANK G. MARBLE*

TELEVISION receivers are, in many respects, similar to conventional audio receivers. For instance, they have RF sections, local oscillators, mixers, IF amplifiers, second detectors, low-frequency amplifiers, and energy converters. There are many differences in the specifications of these sections, but their primary functions are the same.

Testing Audio Receivers:

In the earlier days of audio receiver manufacturing, much of the testing was done simply by tuning receivers to the local transmitters that happened to be on the air. Adjustments were then made for satisfactory tone and volume. As long as the number of sets to be tested was small, and signals from these transmitters were available, this was a satisfactory method. But the transmitting schedules were limited in those days, and it was necessary to make adjustments for stations other than those available. So, as set production increased, that method of testing receivers was soon abandoned.

It became necessary to devise equipment and techniques that would make it possible to test both components and assembled receivers on signals generated in the factory. Signal generators and oscillators tuned to different single frequencies were devised for use with output meters. Techniques which came into use then included tests which, when completed satisfactorily, showed that the receivers would operate perfectly on all channels.

Television Receiver Testing:

The passbands of RF and IF amplifiers in a television set are very much broader than those in an audio receiver. In addition, the shapes of these passbands are more critical, and must be maintained within narrow limits. Response of a television receiver can be determined by the same point-by-point methods used in audio sets. However, since the band is so broad, the mechanical operations involved require more man-hours than can be spared in these busy days. Also, the job is complicated by the fact that an adjustment at one point in the band is liable to have considerable effect at other parts of the response curve. For these reasons, the adjustment of an IF amplifier by the point-by-point method becomes a tedious, cut-and-try process.

In the initial stages of television receiver development, that method was employed because there was no equipment to accomplish the work more rapidly. Under pressure of necessity, however, a new technique was evolved for checking sets both in the laboratory and in the factory test cages. Now, a constant-amplitude, frequency-modulated signal is used in place of the adjustable, single-frequency signal generator and, instead of measuring the receiver output on a meter, the output amplitude is observed on an oscilloscope deflected horizontally by a voltage related to the sweep-signal voltage. This allows a continuous view of the shape and width of the response while adjustments are being made.

Since television receivers operate at higher frequencies and over broader bandwidths than audio receivers, the need of matching the antenna, transmission line, and RF section input is more critical. To take care of this requirement, it is necessary to test the input impedance of these three elements over the frequency range in which they are to be used. Again, frequency-sweeping equipment can be used to display the impedance match over a wide frequency-band on the screen of an oscilloscope. This method takes minutes, compared to the hours spent on point-by-point measurements.

In order to indicate specific frequency points on the oscilloscope when using the frequency-sweeping technique for amplitude response and impedance-matching observations, instruments have been designed to put marker birdies or pips at corresponding points on the trace.

Also required for television work is the observation of the sideband and carrier energy propagated by the transmitters, and the measurement of field strength. This need has been met by the development of spectrum analyzers and field strength devices for the new frequency range.

Newly-Developed Instruments:

Some of the new instruments developed for these purposes by Kay Electric are shown in the accompanying illustrations. The three setups are arranged for typical TV measurements.

Fig. 1 shows the equipment used for RF and IF alignment. At the top left is the Mega-Marker, then the Mega-Marker Sr., and the Mega-Sweep, with a DuMont oscilloscope at the right.

Instruments for measuring the input of a TV tuner are illustrated in Fig. 2. A Mega-Pipper is set on a Mega-Match at the left.

In Fig. 3, a Mega-Pulser is pulsing a Mega-Sweep, at the left. Thus the transient response of the TV set can be determined on the Magalyzer, at the right. These three typical arrangements will be described in detail.

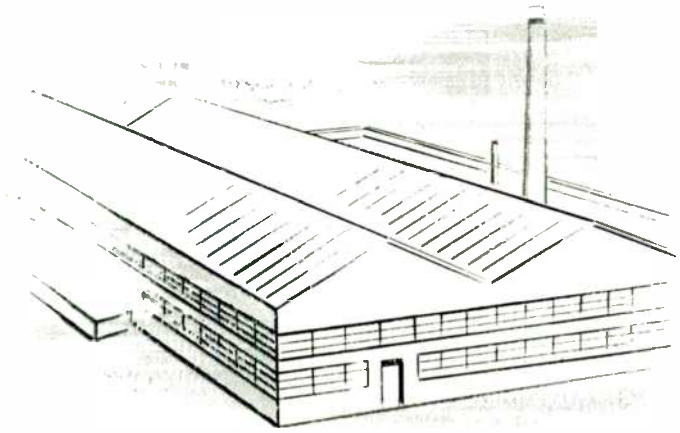
Visual Alignment:

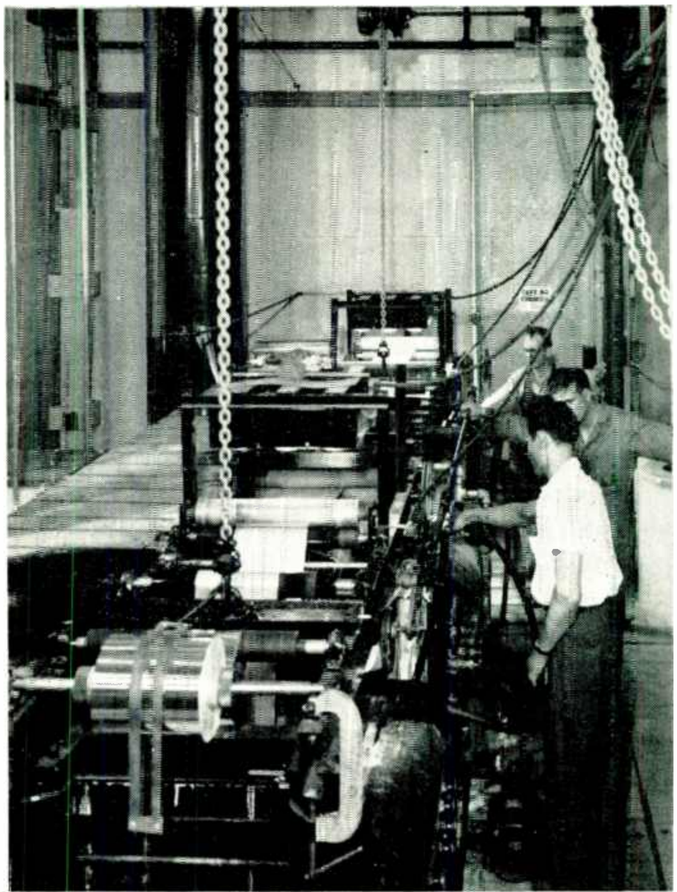
In Fig. 1, a frequency-modulated oscillator, the Mega-Sweep, is used to provide a constant-amplitude, variable-frequency signal. The output of the sweeping oscillator produces up to approximately 100 millivolts at a 50-ohm impedance level. The signal is swept by a linear, sawtooth waveform at rates between 50 and 100 cycles per second over a bandwidth up to 30 kc. The amplitude modulation is very small, and the sweeping signal can be used anywhere between 50 kc. and 500 mc. Thus, in conjunction with any standard oscilloscope, the shape and bandwidth of video, RF, and IF response can be observed, except for the very low frequencies in the video amplifier. The sawtooth voltage which sweeps the frequency is also made available for deflecting the oscilloscope trace in a horizontal direction. The frequency range of the Mega-Sweep can be extended, by a simple internal adjustment, to 1,000 mc. This feature makes it applicable to work in the upper television band, between 400 and 900 mc.

In order to determine the frequency in the horizontal direction on the oscilloscope, a wavemeter is included in the

* Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Electrolytics by Sangamo





a *New* plant for Electrolytic Capacitors

Sangamo is manufacturing electrolytic capacitors in a completely new plant, with the latest equipment, and with the most modern techniques. The plant is completely conditioned with filtered air to conform with Sangamo standards of cleanliness. Humidity is carefully regulated to accurately control moisture absorption. Stainless steel or aluminum is used on all surfaces which may be touched by the capacitors, and all operators wear rubber gloves in order to avoid contamination of foil.

The fine aluminum foil used in Sangamo Electrolytics is given particular attention. The equipment pictured above washes the foil in hot chemicals to remove any trace of surface impurity and etches the foil in one continuous operation.

Every capacitor is aged and tested at voltages in excess of the working voltage, and is heat-treated in temperature-controlled ovens. Only after these tests and repeated individual inspections, are Sangamo Electrolytics ready for you.

CAPACITORS:
PAPER • MICA • SILVER • ELECTROLYTIC

SANGAMO

A complete line of capacitors for every electronic application—write for information today.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD • ILLINOIS

SC487

Mega-Sweep, accurate to about 1 mc. To tune the various traps in a receiver, and to determine accurately the shape of a curve, more precise frequency indications are necessary. The Mega-Marker and the Mega-Pipper were developed for this purpose. The Mega-Marker, Fig. 1, is a precise variable oscillator which can be tuned to any frequency in the IF band. When used in conjunction with the Mega-Sweep, it produces a narrow birdie on the response curve at a point corresponding to the frequency indicated on the dial of the Mega-Marker. It is accurate to ±.25%. Provisions are included for adjusting the amplitude of the birdie, and for mixing the output of the Mega-Marker with that of the Mega-Sweep. A crystal-controlled oscillator, included for periodic calibration of the variable oscillator, produces an accurate birdie in the center of the FM IF characteristic.

The Mega-Pipper, Fig. 2, when used with the Mega-Sweep, provides four accurate, crystal-positioned pips which are introduced directly at the oscilloscope, rather than going through the television receiver. These pips occur simultaneously at the audio and video IF carriers and at the adjacent-channel IF carriers. Because they do not go through the television receiver, their amplitude is not diminished when they are tuned into the center of the traps. This allows more accurate trap adjustments. Provisions are made for inter-connecting the sweep output and the Mega-Pipper and receiver inputs. By changing one plug-in crystal, the four pips can be positioned properly for any IF frequency within the standard RMA band.

To adjust a TV receiver, it is necessary to trim the local oscillator for each channel, so that it can then be tuned for maximum audio output by a vernier control on the front panel. The Mega-Marker Sr., Fig. 1, provides 12 sound IF carriers — one for each channel — for this operation. The signal for each channel is controlled by a separate quartz crystal to an accuracy of .01%. Internal provisions are made for tone modulation, so that adjustments can be made aurally. The tone amplitude modulates the crystal oscillator stage, and can be switched on or off by a front-panel control. When the local oscillator of the receiver is correctly tuned, the level of the tone is at a minimum. At this adjustment, the signal is at the center of the IF discriminator characteristic.

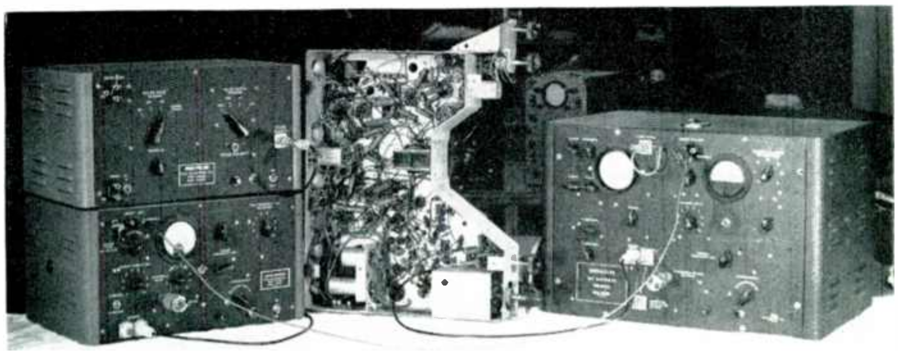


FIG. 3. *Measuring transient response visually with a Mega-Pulser and Mega-Sweep*

Visual Impedance Measurements:

A mismatch between the transmission line from the antenna and the input to the RF section results in overall loss of sensitivity, since energy is reflected away from the input. The television spectrum covers a wide range of frequencies, and determination in the laboratory of the correctness of the impedance match over this range by point-by-point methods is not only tedious but wasteful. However, the Mega-Match, Fig. 2, provides a means for observing the correctness of the impedance match. This instrument, used with a standard oscilloscope, indicates the amount of reflected energy from a transmission-line termination over a band-width up to 30 mc. The center of the swept frequency band can be set anywhere between 10 and 250 mc. Standing-wave ratios as low as 1.02 can be observed.

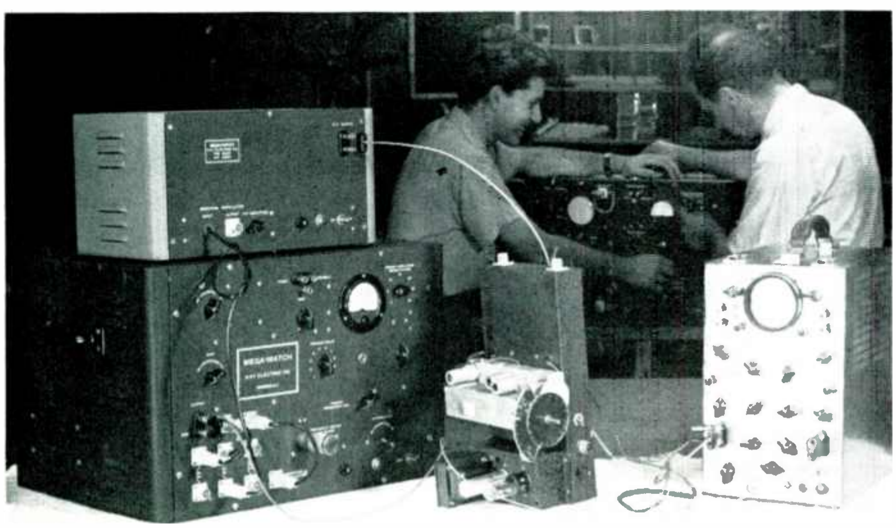


FIG. 2. *TV tuner input impedance measurements employ Mega-Pipper and Mega-Match*

This new technique allows very rapid adjustment of antennas or RF input impedances, and indicates all the changes which occur over a wide frequency-band as a result of the adjustments.

Voltmeter & Spectrum Analyzer:

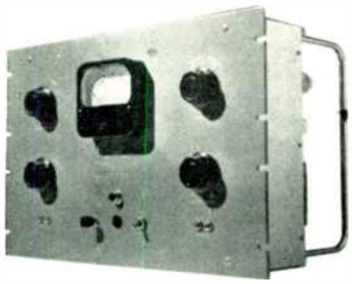
The Megalyzer, Fig. 3, has a built-in oscilloscope to indicate the frequency and relative amplitude of the signals present over a band up to 30 mc. wide. This swept-frequency band can be set anywhere between 30 and 300 mc. by tuning the Mega-Sweep, which forms part of the equipment. By adjusting the sweep to a suitable band width, the relative energy in the side bands and the carrier can be observed. Using a calibrated, single-frequency signal generator as an accessory, the microvolts present at the antenna from each of the signals displayed can be measured by comparison methods. The CW sensitivity of the instrument is approximately 200 microvolts for a ⅛-in. deflection at full gain, and the resolution is approximately 100 kc. The instrument will, therefore, display signals separated by about 100 kc. anywhere in the frequency band defined.

Pulse Equipment:

In testing video amplifiers, one technique which has been employed is to introduce at the input of the amplifier a test signal consisting of very narrow pulses, repeated at audio rates. The quality of the reproduction of the pulses on an oscilloscope at the output of the amplifier is a direct indication of the bandwidth, phase characteristic, and transient response of the circuit. Broader bandwidths will correctly reproduce narrower pulses. For these tests, the Mega-Pulser has been developed. This instrument, Fig. 3, produces pulses of .025 to .25 microsecond in width, at repetition rates between 100 and 2,000 per second. This range covers video amplifiers up to bandwidths of 50 mc.

The Mega-Pulser has been used successfully to pulse the Mega-Sweep. By this method, a pulse-modulated, high-frequency carrier is made available for testing the transient response of wide-band RF and IF systems. The frequency of the carrier can be adjusted by simply changing the frequency of the Mega-Sweep.

Better Programs from . . . Better Broadcasting



Type 910-C Dynamic Noise Suppressor the only noise suppressor suitable for use with broadcast stations.

No. 2 of a series on the reproduction of music from FM and phonograph records

Hermon Hosmer Scott, Inc.
385 Putnam Ave., Cambridge 39, Mass.

Representatives and distributors in all principal cities

BROADCASTING can be no better than its programs. In earlier days, the microphone was often merely placed in front of a mechanical phonograph. Because of limitations in the primitive radio equipment, the listener could notice little quality difference between live and recorded programs.

Radio improvements soon eclipsed recorded music until, first, electrical recordings, and, later, transcriptions (which are merely high-grade records) provided sufficient improvement in quality to make recordings compare favorably with contemporary live AM programs. Then came FM.

Now, recorded music spans the entire audible frequency range, and the only remaining disadvantage of records as program material is the surface noise which seems inherent in all types of recordings.

Manufacturing refinements can reduce record noise, but always at a higher price for the finished product. Furthermore, even the finest records become more noisy with wear or as a result of dust or handling. With the present demand for high-fidelity programs, the earlier method of filtering out the high frequencies to minimize noise is inacceptable.

In the past two years, a new technical development has made recorded programs again comparable with live talent. When the Dynamic Noise Suppressor * was first announced, it met with considerable understandable skepticism on the part of many broadcast station owners. The continuous and profitable use of even the earliest models for over two years has completely reversed this attitude. Instead of a scientific mystery bordering on perpetual motion, it is now regarded as an indispensable part of any up-to-date broadcast station. Those stations and networks most famous for their recorded programs are continuous and enthusiastic users of the Dynamic Noise Suppressor.*

The Dynamic Noise Suppressor * more than pays for itself by allowing wider use of recorded programs. By opening to the broadcast station the vast library of standard phonograph records, it greatly increases, at low cost, the available program material. In FM and AM broadcasting, it is indispensable since only the Dynamic Noise Suppressor * provides the same combination of wide effective frequency range and low noise level.

The newest broadcast station model is priced at $565.00, direct from our laboratory. For home use, lower priced but highly efficient units have been developed. These are available from leading distributors and dealers. Special versions of the Dynamic Noise Suppressor * are standard equipment in the world's finest radio-phonographs.

** Licensed under United States and foreign patents, pending and issued.*

TELEVISION HANDBOOK

(*Continued from page 35*)

ductance, and upon the primary current, as is to be expected. It is apparent, also, that the power factor of the deflection yoke and transformer should be minimized. For practical purposes, the primary current will be optimum if the primary impedance matches the output impedance of the deflection amplifier.

The secondary reactance which is reflected into the primary (labeled Z′ in the figure) adds to the primary reactance to produce a total primary impedance of

$$Z = j\omega Lp + \frac{M^2\omega^2}{L\omega(j+p)} \qquad (10.8)$$

The primary current, then, is

$$i = E/(Z + R) \qquad (10.9)$$

To summarize the theory, briefly, let:

- M' = magnetomotive deflection force
- n = number of turns in the deflection yoke
- L'' = effective load inductance
- L = deflection yoke inductance
- φ^2 = transformer impedance ratio
- i = primary current
- ω = angular velocity of deflection
- E = B + potential

Then: (a) L is proportional to n^2
(b) M' is proportional to nI
(c) L'' is proportional to $\varphi^2 L$

from which the defining proportionalities for any unknown parameter can be determined from the known. For Beam-Relaxor operation:

(d) ω is proportional to $E/\varphi^2 Li$
or L is proportional to $E/\varphi^2 i\omega$

The ways in which the various parameters affect deflection are determined from these relationships:

(1) The DC power requirement is proportional to the product of frequency and the square of the deflection force.

(2) The power requirement is independent of the impedance ratio (neglecting transformer losses).

(3) The current requirement is proportional to the product of frequency and the square of the deflection force for a given B supply.

(4) Independently of other parameters, the turns ratio is inversely proportional to the inductance of the deflection yoke. This ratio should be chosen to reflect as low a capacitance as possible from the cable connecting the yoke to the transformer.

From experiment the following facts have been ascertained:

(1) The number of oscillating tubes in parallel which supply the current is immaterial to the design except as it affects capacitance across the primary. Too many tubes will increase the return time. Adding tubes in parallel merely divides the total load per tube.

(2) A value of $L' = 60$ mh. is approximately optimum for horizontal deflection.

(3) A magnetomotive force of approximately 50 RMS ampere-turns is sufficient for deflection of the dissesector under average conditions.

(*To be continued*)

HOW N. Y. TUGS USE FM

(*Continued from page 33*)

"Visibility," he said, "was cut down to 150 ft. What a comfort it was to have the radio to keep us in constant contact with the dispatcher. Did you ever try to holler through a megaphone against a gale?"

While we were talking, another call came in: "Get that long spile out of the ferry slip at Barclay Street, New York, before one of the ferry boats breaks a wheel on it."

It's All Different Now:

Finally, we got back to Pier 6 just as dispatcher Joe Strohscheim was coming on duty for the night watch. He has been in the employ of the Lackawanna for forty-two years, and has dispatched tugs for thirty-one. He knows his business! Answering the $64 question, he explained:

"Sure I like to use the radio. It's a great time-saver for the shippers, and makes my job easier, too. I used to holler into a megaphone all day long." — he produced it from under the table. "The tugs had to come right up here under the office window so we could yell to each other. Now I just talk natural-like, and they can hear me past Governor's Island!" He continued: "I had a hard time to keep from hollerin' in the radio at first. They say I'm pretty good at it now, though. You know, I was thinking of retiring, but this radio gave me a new lease on life."

The conversation shifted to special uses of radio on the tugs. For example, there are inquiries made by steamship operators concerning the arrival time of floats with cars bearing freight consigned to their vessels. Before radio was installed, the tug boat dispatcher's answers were pure guesswork. Without knowledge as to the whereabouts of the tug and the floats, or conditions prevailing at their location, he was often wide of the mark by hours. Such errors are costly when they affect the departure-time of a big ship.

Now, when such an inquiry is received, the dispatcher simply says: "Hold the wire!" Then he calls the tug in question by radio, asks the Captain where he is and when he expects to dock, and relays the information over the land telephone to the steamship company. The dispatcher's answer is exact, and it takes him less than a minute to give it. That is an extremely valuable by-product service of the Lackawanna's 2-way communications system.

Capt. Doran summed up the value of the radio system in this way: "We don't think about the time we save with radio any more. It's a standard facility for us. We could figure out how much time we'd lose in a week's operations if they took the radio away. But there's no danger of that. The radio is much too valuable!"

NEXT MONTH, READ:

Pattern for FM Profits

NEXT MONTH, *FM* and TELEVISION will carry what we believe to be the greatest scoop published by any radio magazine in recent years.

Under the title "Pattern for FM Profits", we shall present a complete, one-package plan that will have a profound influence on the entire radio industry, from broadcasters and manufacturers to dealers and servicemen.

You say you've been hearing enough fancy theories lately? You're only interested in down-to-earth ideas that have already paid off in hard cash?

Brother, you are going to get *exactly what you've asked for* in the September issue of *FM* and TELEVISION.

"Pattern for FM Profits" is a detailed account of the most comprehensive FM setup in the United States, one that is unique, complete, and successful. This is not a special case, however, built around unusual circumstances. On the contrary, you can set this pattern down in any area of the Country and put it to work without changes other than minor modifications.

Who conceived the idea? Who's behind it? Well, this job was planned and executed by a group of practical businessmen, assisted by smart engineering brains. Working with them was an old-time broadcaster whom many people consider the outstanding genius among broadcast executives. He, by the way, has written the introduction to the special section devoted to "Pattern for FM Profits" in our September issue.

If it's so important, why haven't you heard about this project before? You'll find the explanation of that, too, in the five parts of the special section. Each part, profusely illustrated with actual photographs, is written by the executive or engineer responsible for the accomplishments described. The subjects range from organization and financing, programs, and technical facilities to audience-building, receiver sales, and details of the sets recommended to the public.

"Pattern for FM Profits" contains profit-information for everyone in the radio industry. Whatever your particular field, you'll find a wealth of practical ideas that will make you exclaim: "*This is just what I've been looking for!*" That's why you must get and read the September issue of *FM* and TELEVISION.

HIGH FREQUENCIES

(*Continued from page 18*)

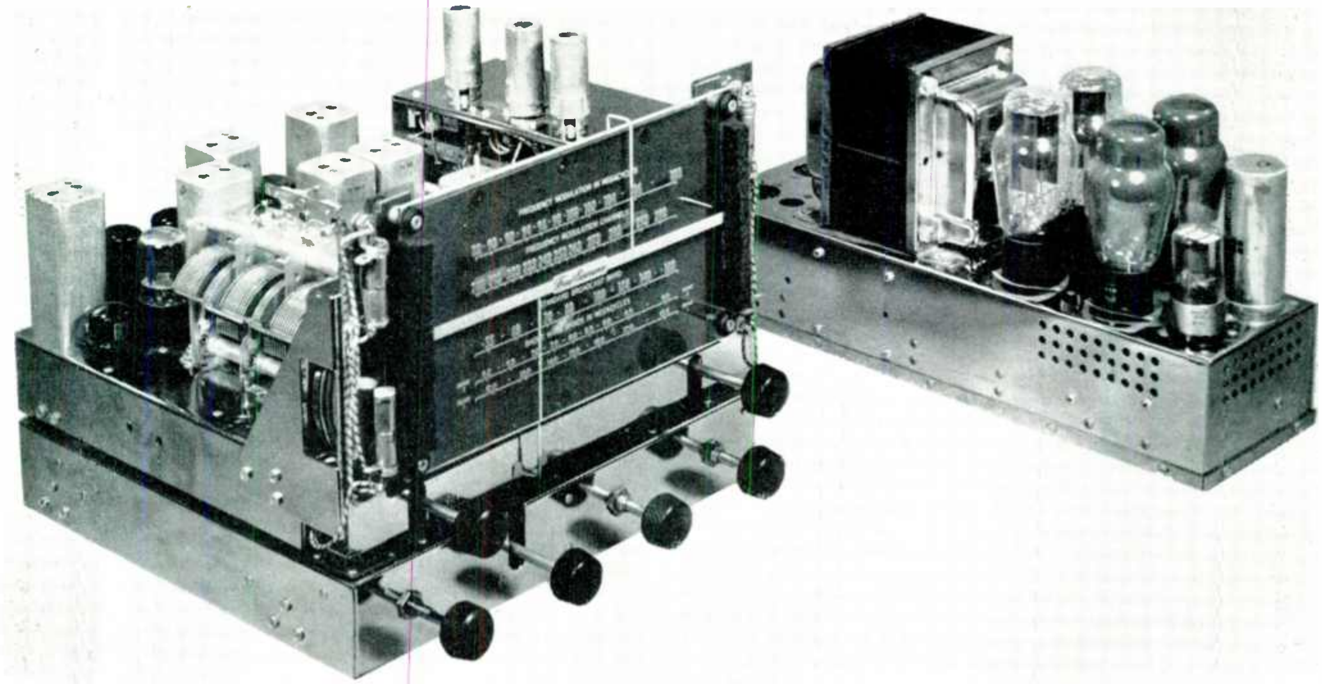
The Belfast tests were headed in the right direction to lead to the discovery that the short waves were effective during the daylight hours, but were quite overshadowed by the results of the Poldhu tests. However, since RCA was privileged to cooperate with Mr. Marconi in the 32-meter Poldhu tests, they were made aware of the possibilities of the short waves at the same time as was Mr. Marconi, and were greatly stimulated by this discovery to speed the development of equipment for making use of this discovery, and to make propagation studies of the entire shortwave spectrum.

At the time these tests were made in 1924, RCA was already on the air with a 10-kw., 103-meter transmitter at Tuckerton, N. J., which was successfully handling traffic to South America under conditions which were impossible on the long waves because of the heavy static. In January, 1926 the world's first high power 15-meter transmitter went into regular commercial service at Rocky Point, and was used with great success in handling traffic to Buenos Aires during the daylight hours.

In the early autumn of 1926, the period mentioned by Major Armstrong, RCA was operating a considerable number of shortwave circuits to various parts of the world with reasonable success. Early in October, 1926 I accompanied Mr. W. A. Winterbottom and Mr. C. W. Hansell to Montreal to witness the Marconi beam tests to which Major Armstrong refers. I was greatly impressed by the results they were getting, which were brought about by the high gain of the beam antenna arrays supported by rows of 300-foot towers spaced 650 feet apart. I know that Mr. Winterbottom was impressed and have no reason to doubt Major Armstrong's statement that Mr. Winterbottom was instrumental in having the Marconi beam system installed at Riverhead and Rocky Point during 1927 for communicating with London. I was in favor of this too because I felt that if we could equal or excel the Marconi beam system we were getting somewhere. An engineer always likes to have a standard with which to measure his results. As of the autumn of 1926, I think there is no doubt but what the Marconi beam system out-performed to a considerable degree anything that the RCA or, for that matter, any other organization had in operation. However, this situation did not last long. The RCA engineers felt that the Marconi beam system was too expensive for duplication to the extent necessary to serve the large number of worldwide circuits they were operating. They had very early recognized the principle of diversity reception and were working on the problem of optimum spacing for the antennas, best methods for combining the outputs from the antennas, and developing the receivers, antennas, transmission lines, and associated equipment and components. At the Transmission Laboratory, development was proceeding on transmitters and directive antennas, including the first directive antenna of the long-wire type. These developments made it possible for the RCA to outperform the Marconi beam system at a fraction of the cost. During 1928, or a little over a year after the period discussed by Major Armstrong, RCA installed diversity receivers and its own directive antennas on all of its major circuits. Shortly thereafter, the Marconi beam system at Riverhead and Rocky Point was dismantled, since the RCA developments outperformed it.

I cannot agree with Major Armstrong's statement that "it is not true that the worldwide revolution in communication which brought about the obsolescence of the alternator was an ultimate result of anything that the Radio Corporation did." I feel that the RCA played a leading role in this revolution and I am proud to have been privileged to have worked with RCA during this period. At the same time, I also appreciate the very great and outstanding contributions made by my old friends and co-workers, Senatore Marconi and C. S. Franklin. In addition, I would also like to mention Mr. G. A. Matthieu, who, as Marconi's assistant on

(*Continued on page 44*)



Today's Outstanding Chassis Value For Custom Set-Builders

HERE IS IMPORTANT NEWS if you build or sell custom radio-phonograph installations where precise reproduction of musical values and absolute perfection of engineering detail is required: *You can now obtain Freed-Eisemann chassis equipment for your custom-built jobs . . . at prices that represent today's outstanding value by every valid standard of good engineering, sturdy construction, superb performance.*

Here is the identical tuner and amplifier (plus high-fidelity co-axial speaker and Webster or Garrard intermixer record changers, if desired) which have given Freed-Eisemann Radio-Phonographs an acknowledged reputation among radio engineers, musical authorities, broadcasters and dealers as the finest instrument available *any*-where at *any* price. Now they can be built into special, personalized installations for those who demand something finer in radio-phonograph reproduction.

Furnished complete with 21 tubes*, the Freed-Eisemann No. 100 Tuner is a compact unit suitable for the most diverse cabinet applications. Connected by plug-in cable to the P.S. 1 Amplifier and any record changer and speaker system in your design, the actual installation of the equipment becomes simplicity itself.

Spanning the complete AM and FM tuning range, and with band-spread shortwave from 6.2 to 17.5 megacycles, the Freed-Eisemann No. 100 Tuner provides separate RF and IF circuits for both AM and FM sections. The FM section incorporates the Armstrong receiving system and employs a double superheterodyne to provide excellent stability and sensitivity, and dual limiters to give full limiting on 5 microvolts. Broadband IF circuits in the AM section offer maximum fidelity. Separate bass and treble controls, of course.

The Freed-Eisemann No. 1 Amplifier delivers an undistorted output of 20 watts, with flat audio response from 30 to 15,000 cycles. All laboratory readings are carefully made . . . *and carefully maintained in production testing procedures.*

For further information and for prices on this magnificent chassis equipment, write today to Freed Radio Corporation, 200 Hudson Street, New York 13, New York.

Freed-Eisemann

ONE OF THE WORLD'S GREAT RADIO-PHONOGRAPHS

*Two 6SK7, two 6SA7, two 6J5, three 6AG5, two 6L6-G, two 5U4-G, two 6SG7, two 6SH7, one 6SL7-GT, one 6H6, one 6J5-GT, one 6U5.

HIGH FREQUENCIES

(*Continued from page 42*)

his yacht "*Electra*", did much of the pioneering propagation studies and, also, I believe, had a hand in the design of the early beam receivers.

Perhaps the best proof that RCA made substantial contributions to the "short wave revolution" is the fact that RCA's diversity reception system, long-wire types of antennas, crystal-controlled and amplifier-multiplier transmitter arrangements and other developments, too numerous to mention, are now widely used all over the world by many radio communication organizations.

Very truly yours,

H. H. Beverage

CLASSIFIED ADVERTISEMENTS

Positions Wanted: No charge. Use either your own name and address or FM and TELEVISION box number.

Other Advertisements: 20c per word, minimum $2.00. One-inch advertisements in ruled box, $10.

Copy received up to the 20th of the month will be published on the 15th of the month following.

Address replies to box numbers: FM and TELEVISION, Savings Bank Building, Great Barrington, Mass.

Program Director, announcer, newscaster, disc jockey. Ten years radio background (AM & FM) also includes production (drama and symphony), writing, acting, directing. Extensive theatrical experience as actor-director. Minimum $75. Veteran, single. Jack Steinhardt, 390 Bergen Ave., Jersey City 4, N. J.

Television Director, 15 years experience producing, directing, photographing motion pictures. Have thorough knowledge of stagecraft, television techniques and related arts. Salary open. Box 811, *FM* and Television

Chief Engineer AM, FM, TV installation, maintenance, operation experience. At present head of radio school. 1st class telephone, telegraph, amateur. College graduate, degree. Field strength measurements and FCC applications experience. 2 years Bureau of Standards. Will also manage station, small city. Age 31, married, family. Prefer West Coast or New England. Salary $5000. Box 815, *FM* and Television

Engineer, single, specialization transmitter installation, operation, maintenance. Broadcast experience includes network nemos and control room operations. Also Navy electronics and amateur experience. Will travel anywhere in U. S. Available on two weeks notice. Excellent references. Box 830, *FM* and Television

Wanted, by manufacturer entering mobile radio field, experienced engineer to head this new division. Excellent opportunity for a capable man seeking recognition of his ability. Knowledge of military communications desirable. Give resume of experience and state salary expected. Box 858, *FM* and Television

Wanted, junior engineers experienced in the development of home television receivers. Previous knowledge of this field is required. Immediate employment by one of the oldest receiver manufacturers in the New York area. Give full details in your first letter. Box 875, *FM* and Television

UPPER-BAND TV

(Continued from page 23)

2. How much experimental work has been undertaken in television systems in this band, with respect to field operation?

3. What consideration has been given to the costs of television systems for this band, particularly to the reduction of receiver costs, and the transfer of cost burdens to the transmitter?

4. What areas of service might be expected in this band, based on the following assumptions:

A. a particular system, using one of the following typical bandwidths: 6 mc., 13 mc., 20 mc.

B. radiated power, available now and expected to be available, say, 10 years in the future

C. receiver sensitivity

D. at each of the following typical frequencies: 475 mc., 600 mc., and 890 mc.?

5. What co-channel and adjacent-channel separations would be appropriate under the assumptions made in item 4, above?

6. How many channels would be available in the band 475-890 mc. on the assumptions of item 4, above, and how might they be allocated among the 140 metropolitan districts of the United States?

STRATOVISION

(Continued from page 17)

ment, not only as a means of broadcasting, but of network operation by relaying programs from plane to plane, thus doing away with short-hop relay systems on the ground.

Statistics on Plane Operation:

Since the Stratovision plan is built around airborne equipment, statistics on the Martin 202 are of interest. This is the type which is intended as the eventual carrier. The 202 can carry radio equipment and a 4-man crew totaling 7,000 lbs., plus 1,250 gallons of fuel. That is enough for climbing, 3 hours on station, descent, and, in case of bad weather, flying 200 miles to another field and circling for 1 hour. This plane can reach transmitting altitude in 32 minutes. During transmission, it would circle at 180 MPH in a radius of 3½ miles, with a maximum bank of 10 to 20°.

Summary:

From observation of Stratovision in operation on the low band, and such data as has been released by Westinghouse and Martin, it appears that the system has been developed to the point of being technically practical, except for the fact that frequencies required for cross-country operation are not available. However, it may well be that, on the upper band, Stratovision can render such an important service that there will be justification for providing the number of channels required for its operation.

MERCHANDISING TV

(Continued from page 30)

this great, new business with enthusiasm, knowledge, and proper facilities.

Many dealers have done very little advertising and merchandising of their television lines to date. They have been depending wholly on store traffic, leaving the promotion of their products up to the manufacturers. The exceptions to the rule have gone all out in their advertising and direct mail campaigns.

There is an old saying "You have to spend money to make money." I sincerely believe that there is no better time for you to invest in a business that is bound to succeed and pay real dividends than at the time television service comes to your city. Here are a few suggestions which may prove helpful in preparing for your future in television:

1. Enlarge your service department to handle installation of television receivers promptly, or arrange for this service to be provided by an experienced outside television service organization.

2. Construct comfortable, well-decorated demonstration rooms and invite the public to television shows whenever there are programs on the air.

3. Feature leading makes in attractive floor and window displays at all times.

4. Advertise your store regularly as headquarters for these leading nationally advertised brands.

5. Take advantage of the manufacturers' literature and booklets on the subject of television by mailing this material out each month to your prospect list.

6. Let the prospects know that television provides entertainment for the entire family, that television receivers are available in many price classes, that they make the reception of a variety of programs possible, and that your store offers the best in television service.

7. Invite manufacturers and distributors to thoroughly train your sales and service personnel, not at just one meeting, but on a regular schedule.

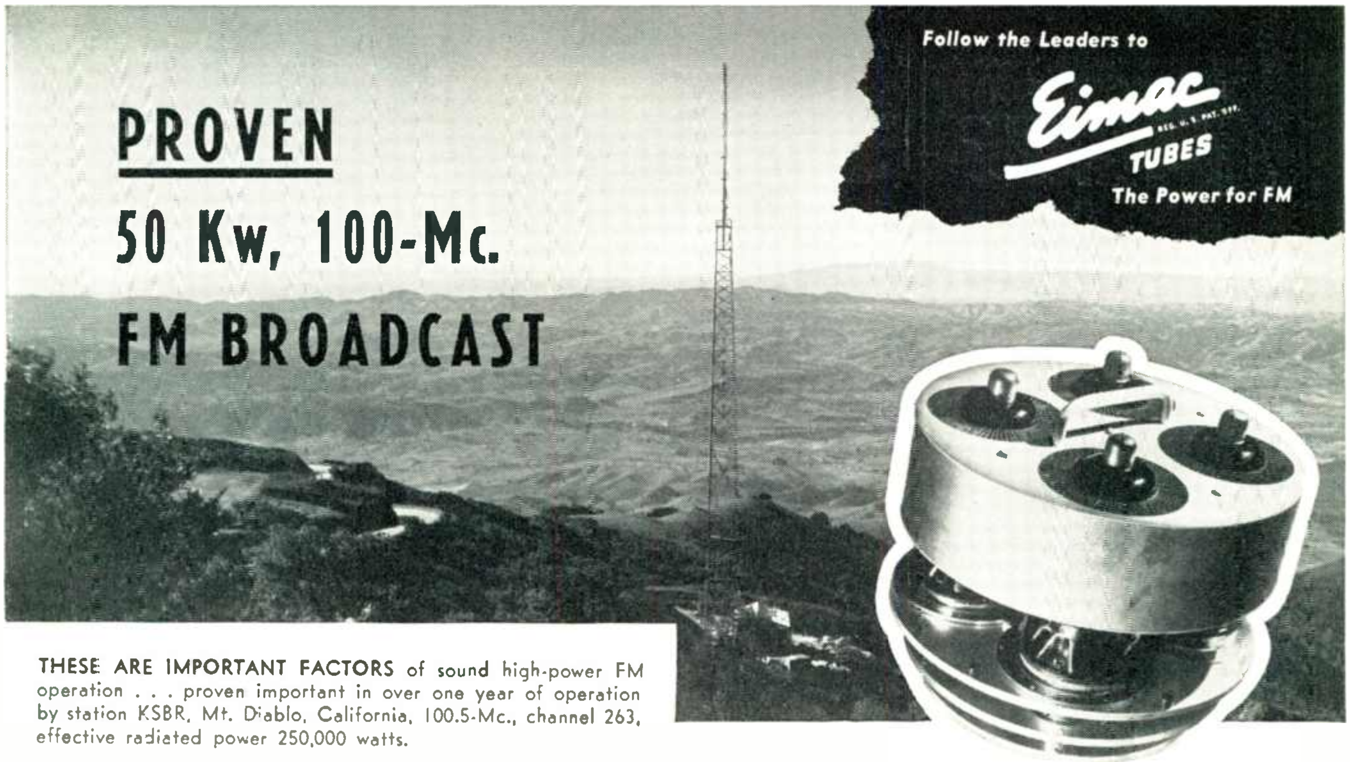
8. The prewar success enjoyed by so many dealers in selling radios involved home demonstrations. Today radio-phonograph combinations and television receivers can be sold in the homes when store demonstrations have failed.

9. Attractive time-payment plans will also influence many television prospects to visit your store and make their purchases.

10. Enter the television business with enthusiasm and knowledge. This spirit will penetrate throughout your organization and be contagious as far as your customers are concerned.

You have a bright and prosperous future in television, and television itself will prosper as a result of the effective merchandising support the dealers can and will give it.

ADVERTISERS INDEX



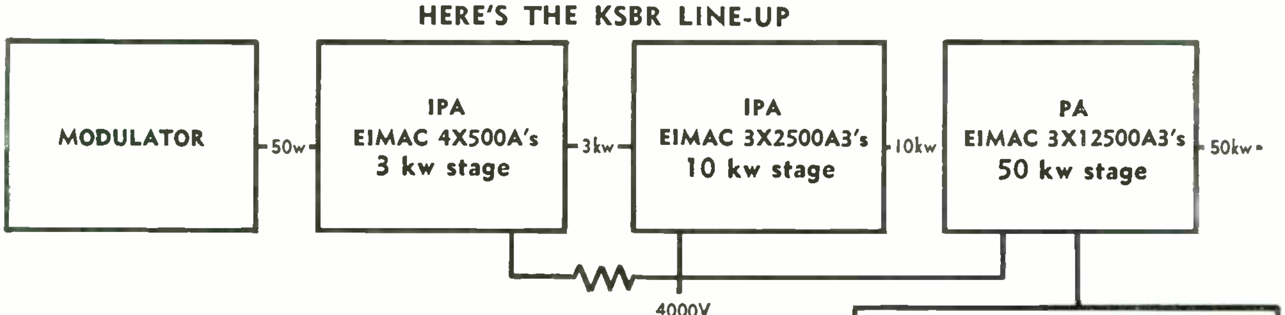
THESE ARE IMPORTANT FACTORS of sound high-power FM operation . . . proven important in over one year of operation by station KSBR, Mt. Diablo, California, 100.5-Mc., channel 263, effective radiated power 250,000 watts.

1) Overall power consumption is under 90 kw.
2) Equipment is of compact design.
3) Power tubes have highly efficient thoriated tungsten filaments.
4) Tube servicing is possible without special tools, equipment, and training.
5) Vacuum tube components are capable of supplying sufficient output without being run at maximum ratings.
6) 50 kw. final is driven directly by the 10 kw. stage.
7) Air cooled. 3, 10, and 50 kw. stages only require the output of a single blower driven by a 1 h. p. motor.

And they are made possible because of one component . . . the Eimac multiunit triode, type 3X12500A3. A pair of these tubes (as grounded grid amplifiers) are capable of providing over 50 kw. of useful output power with but 10 kw. watts of drive. The lineup of KSBR equipment and operational data, below, further illustrates advantages inherent to equipment designed around the 3X12500A3.

Analyze the vacuum-tube components in the equipment you consider . . . be sure their design presents the highest advantage to you. The Eimac sales department will gladly furnish names of equipment manufacturers and engineers using Eimac tubes. **Phone, write or wire direct.**

HERE'S THE KSBR LINE-UP



OVERALL EFFICIENCY: input from 50 watts to 50KW - - - - - - - 65%
OVERALL POWER CONSUMPTION - 85KW
TOTAL FLOOR SPACE USED BY EQUIPMENT - - - - - - - 22 sq. ft.
TUBE REPLACEMENT COST
4X500A $97.50, 3X2500A3 $180.00, 3X12500A3 $875.00*

*$115 credit for return of radiator and mechanical assembly in good condition. $35.00 credit for return of crate in good condition.

OPERATING CONDITIONS
(Two Tubes)

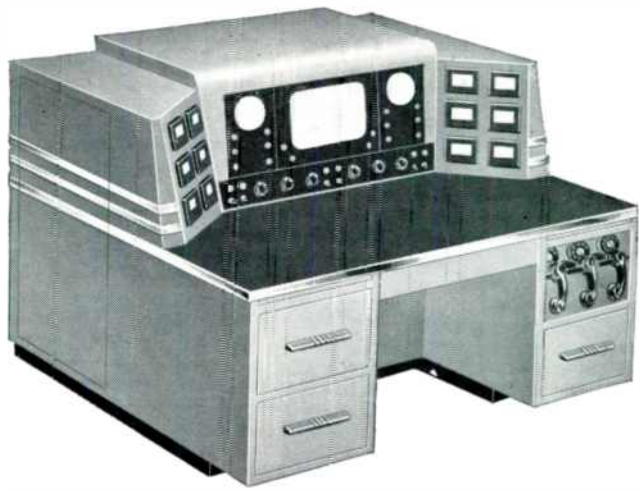
D-C Plate Voltage	4000 volts
D-C Plate Current	14.4 amperes
D-C Grid Voltage	-620 volts
D-C Grid Current	1.9 amperes
Driving Power (Approx.)	12 kilowatts
Plate Dissipation (total)	15.4 kilowatts
Plate Power Input	57.6 kilowatts
Useful Power Output	54.4 kilowatts[f]
Apparent Efficiency	94 per cent

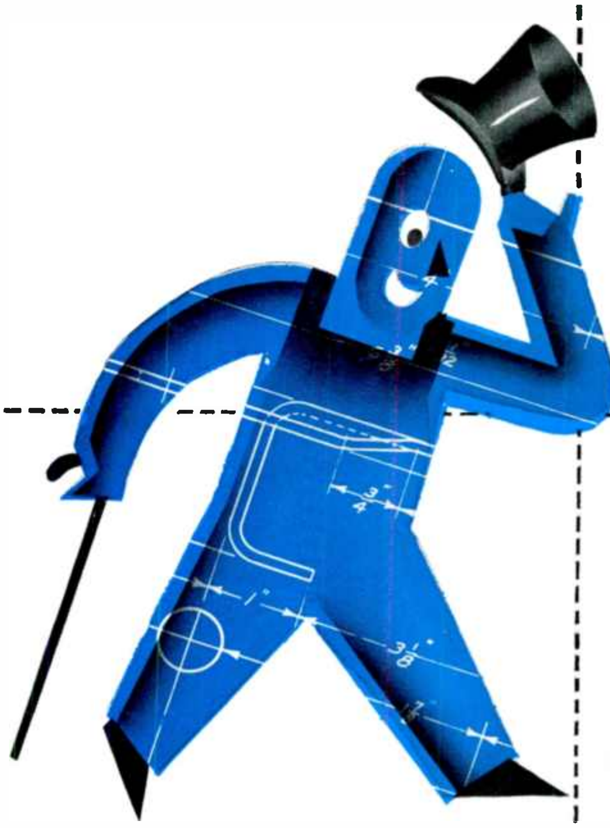
[f]Actual power delivered to water-cooled load. Amplifier output estimated to be 3 kw higher, due to resistance and radiation losses between amplifier and load.

EITEL-McCULLOUGH, INC.
201 San Mateo Avenue, San Bruno, California

MULTI UNIT DESIGN IS ANOTHER EIMAC FIRST

Our Hat Is Off to Television Engineers





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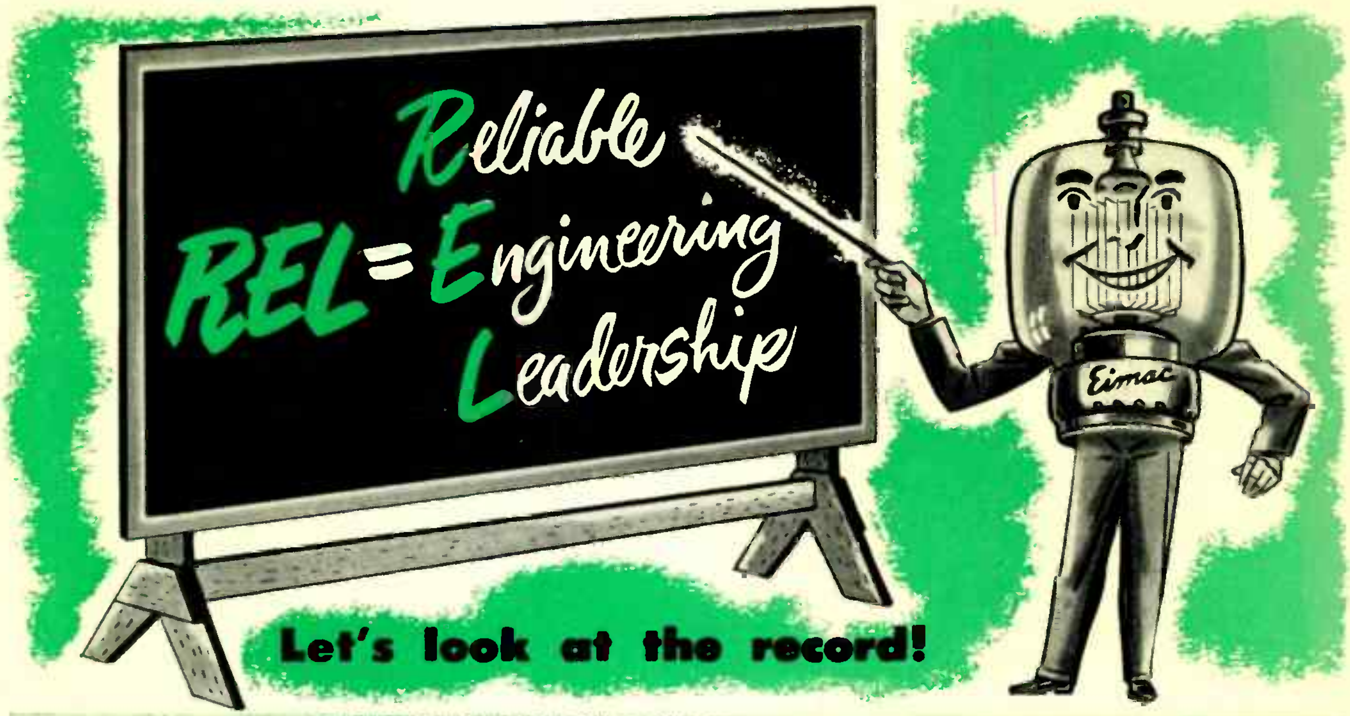

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1939	**FIRST WITH COMMERCIAL FM!**	REL was the first manufacturer to produce and install commercial transmitter equipment for FM broadcasting.
1939	**FIRST WITH AN FM RELAY!**	REL established the first studio to transmitter FM relay ever installed. This equipment is still functioning between Boston and Paxton, Mass., 43 miles airline over two ranges of hills.
1940	**FIRST WITH 50 KW FM!**	REL engineered and built the first commercial FM transmitter rated at 50 KW output.
1947	**FIRST WITH THE "QUADRILINE"!**	The *"Quadriline"* circuit structure, at one stroke, eliminated a host of expensive RF and mechanical construction problems at the 10 KW level.
1947	**FIRST WITH AN FM NETWORK!**	REL transmitting and receiving equipment was used exclusively to establish the first FM-all-radio-linked network. This net covered a total distance of 445 miles with total radiated power of approximately 450 KW.
1948	**FIRST WITH UHF STL!**	With the introduction of REL Model 694 STL equipment, the art and practice of FM broadcasting took another great stride forward free from the handicap of inadequate wire line facilities.
1948	**FIRST WITH THE "SERRASOID" MODULATOR!**	Simultaneously with the introduction of high performance STL equipment REL announced the amazingly efficient and economical *"Serrasoid Modulator."*
1948	**CONTINUOUS ENGINEERING LEADERSHIP!**	Another REL first is in the making. We can't release information now but you'll hear about it soon. Just remember the *"80-80"*—it's going to be big news for FM broadcasting.

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