Price 25 Cents Nov. '49

FM-TV

★ Edited by ★
Milton B. Sleeper

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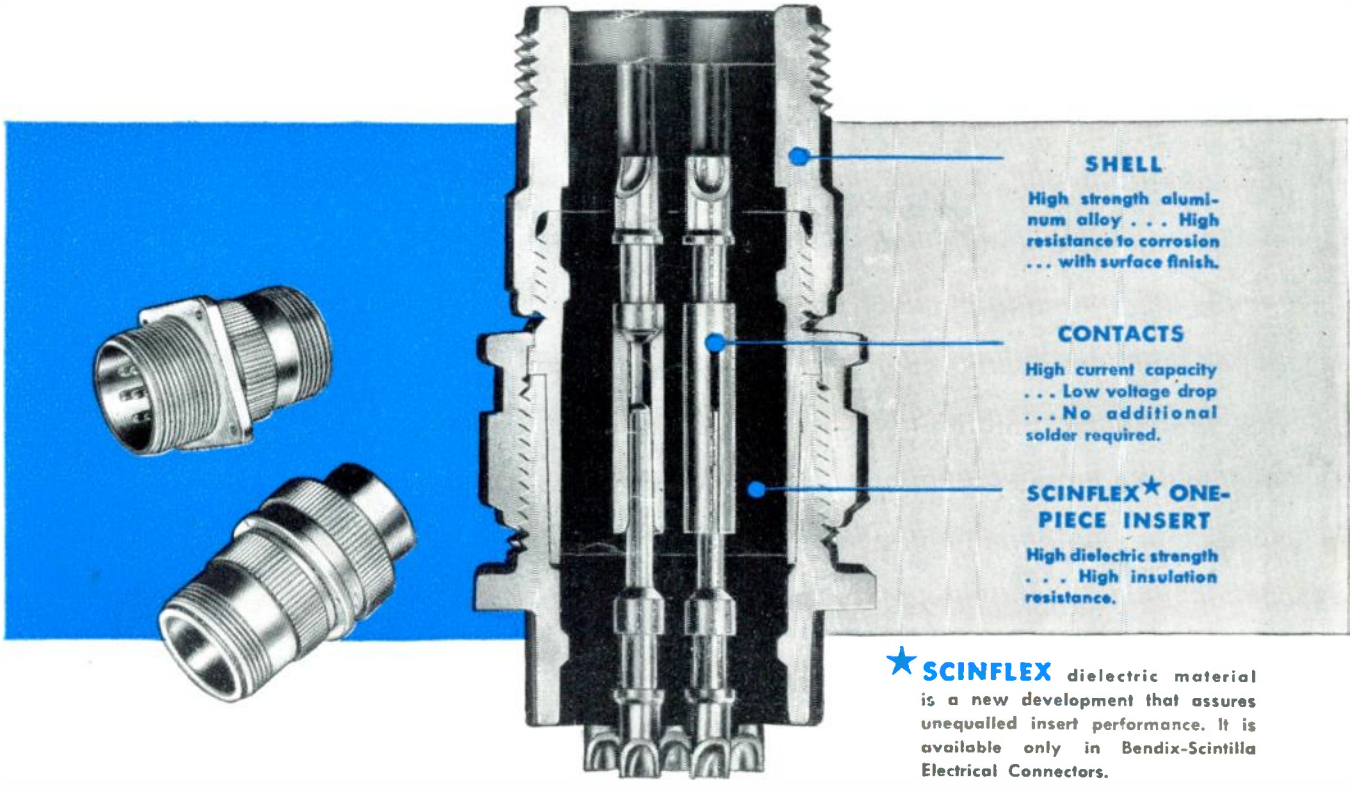

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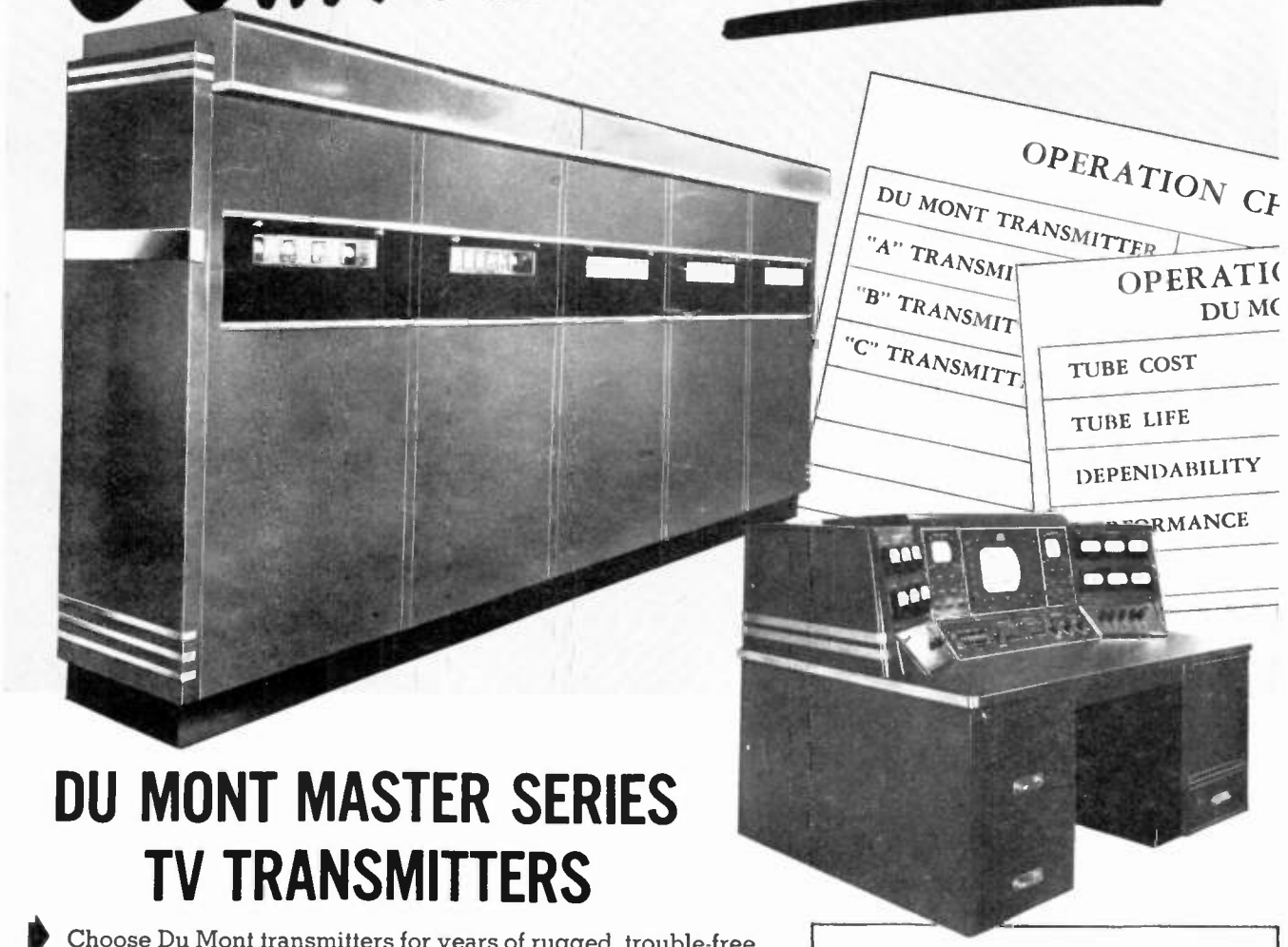

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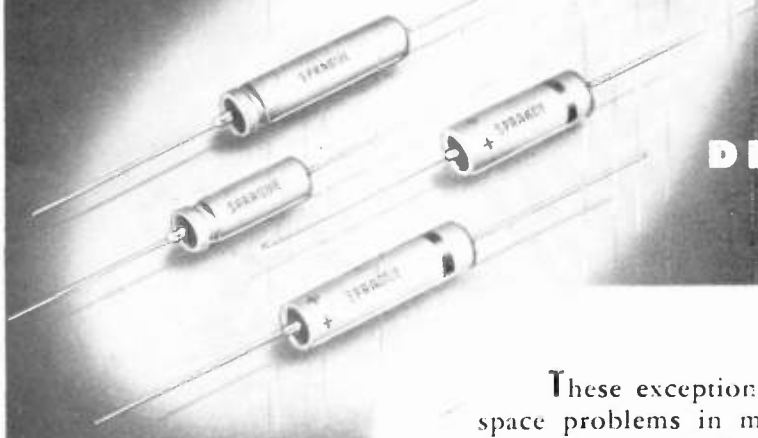

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FM-TV

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

VOL. 9 NOVEMBER, 1949 NO. 11

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CONTENTS

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25-50 Megacycle FM 2-Way Radio Communication Systems

RAYTHEON

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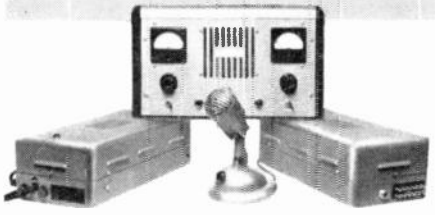
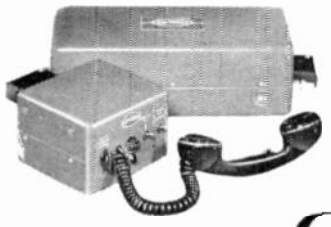


(above)
VS 50-1—50 watt Fixed Station. Operates on 117v 60 cycles A.C. (25-50 megacycles). Remote control optional.



(below)
VM 30-1 (25-50 megacycles)—30 watt. Compact Mobile Station.

(not illustrated)
UM 15-1 (152-162 megacycles)—15 watt (local reception). Compact Mobile Station.

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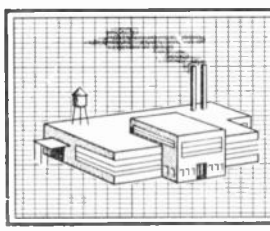


Set Production

SET production figures for August, released by RMA, follow the postwar pattern of being higher than those for July. Only surprise was that TV unexpectedly leaped up to an all-time record, indicating that the trade has pretty well discounted the current FCC hearings and all the talk about color. Actually, the Commissioners seem much more excited about color television than the general public.

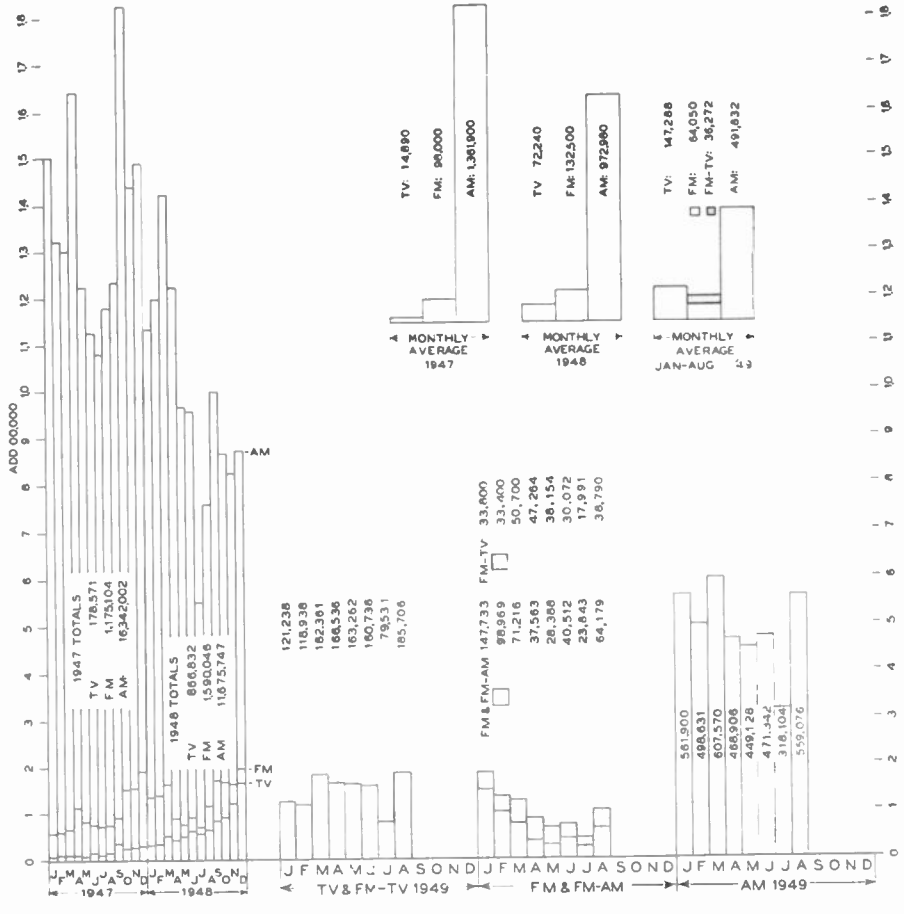
Figures for monthly averages, given on the Production Barometer chart, show that TV set production this year is running 104% above the 1948 average. FM is down 53% below the monthly average for '48, and AM is down 50%.

During the balance of the year, TV should show further, substantial gains, even though the number of broadcast stations will not increase appreciably. Nothing that may happen at the FCC hearings should affect TV adversely, and there is no likelihood of any final action on allocations before 1950.

FM will gain, too, both from normal expansion and because, in areas outside TV service, the dealers and the public are becoming resigned to the fact that they are only going to get audio broadcasting, and that they must make the most of it.

If AM sets follow the '48 production pattern, about 950,000 will be built in the last four months of this year.

Many dealers in the TV fringe areas, indignant over losses sustained from unprotected price drops and discount competition from city stores, are putting their sales efforts on other types of merchandise. Nevertheless, metropolitan dealers are making up for those defections. New York, always the hot spot for standard merchandise at discount prices, has settled down to a general 15% to 20% discount off list, with a few fancy deals thrown in. Only exceptions are department stores which must stand the cost of guaranteeing customer satisfaction, even on unreasonable complaints.



TV, FM, and AM Set Production Barometer, prepared from RMA figures

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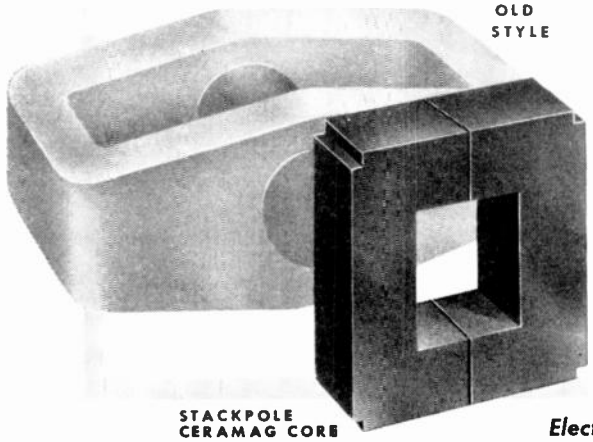

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THIS MONTH'S COVER

Our hat is off to police Lieut. Louis Raub and the city officials of Erie, Pa., for their mobile radio system. The thoroughness of the planning, the completeness of the equipment, and the care with which this installation is maintained is an example of public radio service at its best. In this month's cover you see His Honor, Mayor Joseph C. Martin, Commissioner of Public Safety Raymond J. Wagner, Fire Chief Lawrence P. Scully, and County Sheriff Paul Babbitt. Next month, we shall describe the Erie system in detail.

WHAT'S NEW THIS MONTH

1. How to Write Articles for *FM-TV* 2. Report on *TV* in England

1. We'd like to offer a few very simple basic suggestions to engineers who write articles for *FM-TV* Magazine. No time-consuming study of literary style or construction is involved. In fact, once read they seem obvious. They can be reduced to a mere one-two-three plan that will save any author considerable time and, likely, much mental anguish. Here they are:

1. Before you start to write your text, collect your photographs and drawings. The photographs must be planned to convey as much information as possible. They must be clear, sharp, free from distortion, and printed on glossy paper to afford maximum contrast. If the vertical lines are not parallel, your photographer can tip the easel of his enlarger to make them so. Do not paste captions on the photographs. Instead, number each picture on the margin, and list all the captions on a separate sheet.

Diagrams and curves need not be finished drawings, as we redraw all illustrations to maintain uniform style. We can use free-hand drawings, shop drawings, blueprints, or photostats, but they must be clear, accurate, and complete. Use only reference numbers and notes on the drawings that are referred to in your text.

2. Do not start your text until you have all the drawings before you.

3. At the top of your first sheet, put your name, spelling out your first name, then your company name and address, and your official title.

4. In your first paragraph, give a brief resumé of the information you are going to present. Perhaps, for example, you are going to describe an amplifier. Then, in your first paragraph, state briefly the type of amplifier you are going to describe, the use for which it is intended, the particular need it meets, and the nature of its special advantages. Make this very short, for this introduction must be contained in a single paragraph.

5. Then make a list of subsections such as are generally used in articles published in FM-TV. As a suggestion, they might be:

A discussion of the limited output of conventional amplifiers.
Output required for full dynamic range of reproduction.
Theory of design of the XYZ amplifier.
Discussion of problems encountered in developing the XYZ design.
Electrical and mechanical features and circuit of the final production design.
Experience in the application and use of this design.
Detailed characteristics of production model.
Possibilities of further development or additional applications.

6. Thus equipped, your work is half finished. As you start to write, keep these thoughts in mind: The purpose of your article is to convey information. Make it as easy as possible for your readers to accept the information you want to convey to them. Like yourself, they are very busy. Their reading time is limited. Therefore, if you would instruct them, you must gain and hold their attention.

The surest way to accomplish this end is to present as much information as you can in illustrations. Then, write your text around the illustrations, using words to explain the photographs and drawings, and to give details which cannot be shown or are not made entirely clear by the illustrations.

7. Number each illustration in the order that it is referred to in your text, and write a one-line caption on it. Do not put long, descriptive titles on the

(Continued on page 8)

MOBILE RADIO HANDBOOK FIRST EDITION

Of all the radio books that have been published, here is the first complete handbook on mobile and point-to-point communications. Based on the new rules and allocations made effective by the FCC last July, the Mobile Radio Handbook covers this field from cost figures, system planning, and license applications, to maintenance, operation, and theory. Complete information is given for common carrier, public safety, industrial, and transportation services.

It is a big book, 8¾ by 11½ inches, of more than 200 pages, profusely illustrated with diagrams and detailed photographs of the latest types of equipment and installations.

This book has been planned to present practical, working information for company executives and public officials responsible for communication systems, as well as for radio engineers, supervisors, and operators. The chapters were written by men who are recognized authorities on the subjects treated. Milton B. Sleeper, publisher of *FM-TV* Magazine and one of the pioneers in mobile radio, is the Editor. Jeremiah Courtney, former FCC assistant general counsel and now a specialist in the mobile radio field, is Assistant Editor. Following is a list of the chapters, and a resume of the subjects covered:

1. PLANNING MOBILE SYSTEMS

General information for company executives, public officials and communications engineers on the layout of equipment and facilities for various types of systems, including data on the cost of equipment and towers.

2. FCC RULES AND ALLOCATIONS

Resumé of the rules, frequencies, and qualifications for each class of service, and a complete allocations table for the band from 30 to 30,000 mc.

3. HOW TO APPLY FOR A LICENSE

General instructions are given for selecting the proper FCC form, with step-by-step instructions for filling out a license application. There is also a list of FCC field offices, and the area served by each one.

4. FIXED AND MOBILE EQUIPMENT

Details of standard equipment for various service applications, and a complete table of specifications for all current types of fixed and mobile transmitters and receivers, including tube lists and current consumption data.

5. ADJACENT-CHANNEL OPERATION

A discussion of the engineering problems of adjacent-channel operation, and a description of equipment now available. This is a most important subject, in view of the new FCC rules applying to all transmitters which are installed after July 1, 1950.

6. SELECTIVE CALLING

Details of instantaneous and dial system, and their application to various types of mobile systems. This equipment deserves special attention, as the wide application of selective calling is expected to be the next big advance in mobile radio service.

7. TYPES OF ANTENNAS

Purposes and characteristics of various designs for specific types of communications systems.

8. ERECTION OF A GUYED TOWER

Detailed instructions for erecting a typical 105-ft. steel tower, with photographs showing progressive steps from start to finish.

9. POINT-TO-POINT SYSTEMS

Relays for remote transmitters, two-way communication for rural telephones, and multiplex systems, including cost-per-mile figures.

10. SYSTEM MAINTENANCE

Methods and records for routine maintenance of equipment, use of monitors, frequency meters and WWV calibrators, and FCC rules. Maintenance men will be particularly interested in the illustrations of typical service shops.

11. OPERATOR REQUIREMENTS

Training of operators, taking license examinations, FCC regulations concerning operators. Information presented on examinations for operators will be found particularly helpful.

12. FM THEORY

A thorough, non-mathematical explanation of frequency modulation transmission and reception, and the advantages of FM over AM for mobile systems.

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WHAT'S NEW THIS MONTH

(Continued from page 6)

illustrations. As you can see, *FM-TV* Magazine uses very short captions. All the description belongs in the text of your article.

8. Use mathematical formulas sparingly. They make dull reading. Rather, use curves to show the formulas in action.

9. Technical articles may not be literature, but their presentation in text and illustrations must make interesting reading. It's part of the Editor's job to help the author, but the Editor's work should be only a minor contribution, not a major undertaking.

10. To summarize: Treat your illustrations and text as a unit, like the wires and parts in a piece of radio equipment. Don't write your text as you would construct a wiring harness, and then toss in the illustrations as you might tag a few assorted components and send them along in a box. An author is supposed to present a finished job, leaving the least possible amount of work for his readers to do.

2. Following is an interesting report on the expansion of TV service in England, written by L. Marshall Gander, radio correspondent for the London *Daily Telegraph:*

Television in Britain began as a public service in 1936, and continued until the outbreak of war, in 1939. When it was resumed ten years later, re-establishment was hampered by post-war difficulties, but now British television has not merely recovered but has made great strides in popularity. Plans for country-wide coverage are progressing as fast as economic circumstances will permit.

In 1939 there were, at most, 10,000 set-owners in the London area. Today, the number of licensed sets increases by almost that figure every month and, by the end of 1949, should reach 250,000. The first provincial station, supplementing the transmission from Alexandra Palace, has been built at Sutton Coldfield, near Birmingham, with alternative connections to London by a radio link and a Post Office cable. This will serve another 6,650,000 people. A third station is projected for the North country, situated on the 1,800-ft. peak Holme Moss, near Huddersfield, in Yorkshire, from which transmission will reach another 12,000,000 people. A fourth will be in Scotland, and there are plans for extending television to South Wales, South West and North East England, Southampton, Belfast, Aberdeen, and Plymouth.

These new stations will all work on

(Concluded on page 9)

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WHAT'S NEW THIS MONTH

(Continued from page 8)

the London definition of 405 lines and, according to present proposals, will carry London studio programs.

The Sutton Coldfield transmitter has unique features. It is understood to be the most powerful in the world, with double the peak power of Alexandra Palace in its vision transmitter, and four times the carrier power for sound. Its 750-ft. mast, built on ground 550 ft. above sea level, is the loftiest in Britain. The height of the aerial and the increased power mean that the station will have a much wider range than Alexandra Palace. Most experts consider that the BBC's estimate of 50 miles as far too conservative, and that its reliable range will be considerably wider.

Emitron Television of Hayes, Middlesex, England, which built the vision transmitter used the vestigial sideband system, to reduce the channel width to be occupied on its 4.8-meter wavelength, thus making room for more stations. This system, using a special filter, occupies only two-thirds the frequency band required by the older method used at Alexandra Palace.

The radio link, designed and constructed by the General Electric Company, London, for Britain's General Post Office, is also something completely new. Six 80-ft. towers are being built along the 100-mile route between London and Birmingham, and the London transmission will be beamed from one to another on a wavelength of 33 centimeters. Signals will be directed by means of bowl shaped paraboloids. Operation will be automatic throughout, and any failure will cause an alarm to be sounded at the London or Birmingham control point. The cause of the failure and automatic changeover to duplicate apparatus will be shown on an illuminated indicator board. All the intermediate stations will be unmanned, and need be visited only once a month for routine checks. Eventually, this system will permit two-way television between London and Birmingham. But, in order to get it working as soon as possible, a single reversible channel, using temporary masts, has been built first.

Assurance that the 405-line system will continue indefinitely has made it possible for Britain's 24 television manufacturers to concentrate on mass production of cheap, reliable, and simple receivers. The United States is the only other country producing receivers in any numbers, but comparison of prices is difficult because the U. S. receivers must receive more than one station. Britain's sets have a 33 1/3% purchase tax added to the cost. However, at least four models are selling, with tax, for less than £50.

Proportionately, it appears that there are more 12-in. screens in British sets than in American. Flat-ended screens are also helping to produce slightly bigger pictures. Though direct or mirror viewing is still the most general method, progress is being made with projection models, providing a large picture from a tiny screen.

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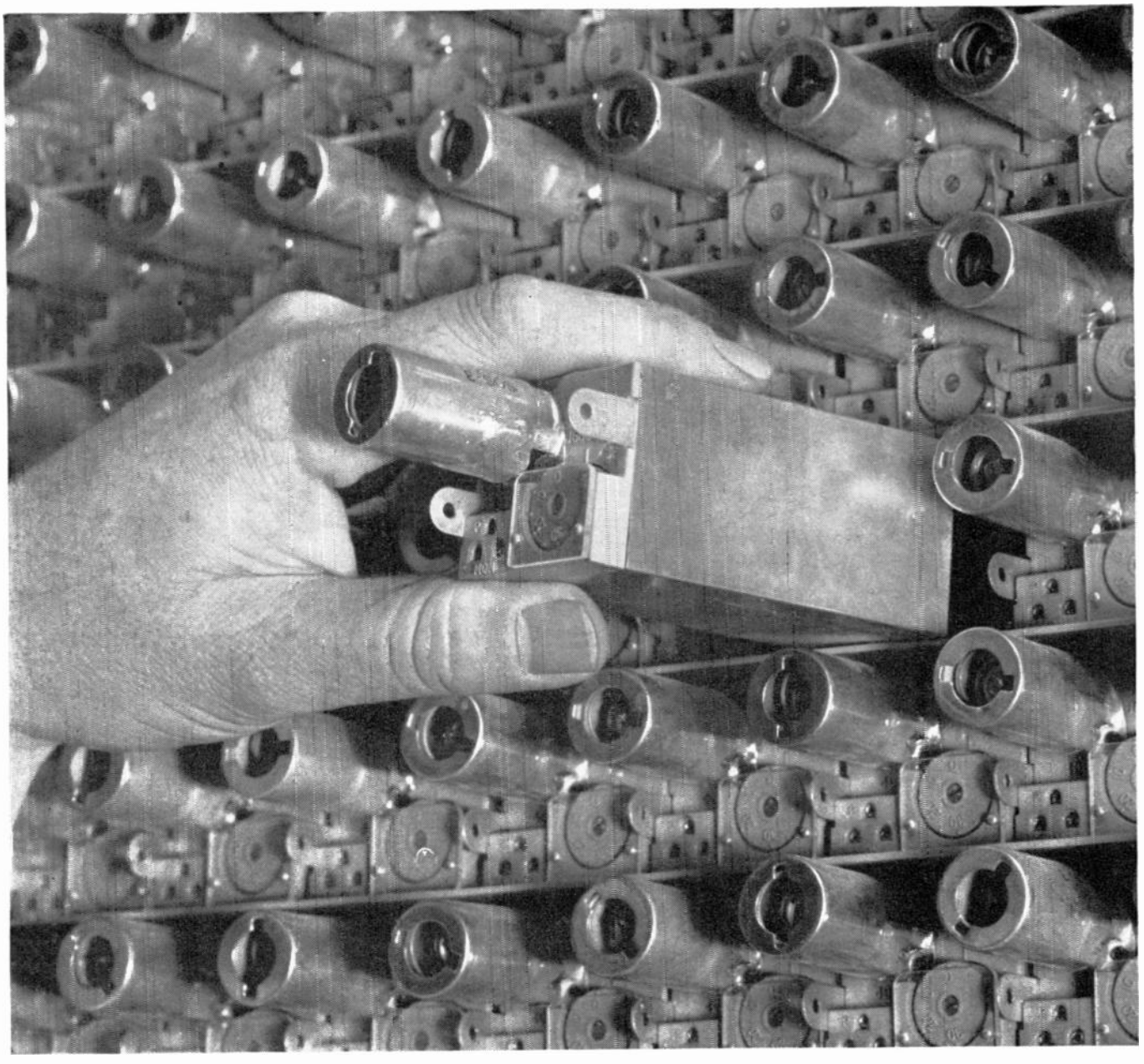
Specialists in the Design & Development of Electronic Test Instruments
BOONTON, N. J.



ANOTHER SCORE IN THE

battle of the inches

It takes many costly buildings to house your telephone system. Every inch saved helps keep down the cost of telephone service. So at Bell Telephone Laboratories engineers work constantly to squeeze the *size* out of telephone equipment.

In the picture a new voice frequency amplifier is being slipped into position. Featuring a Western Electric miniature vacuum tube, tiny permalloy transformers, and special assembly techniques, it is scarcely larger than a single vacuum tube used to be. Yet it is able to boost a voice by 35 decibels. Mounted in a bay only two feet wide and 11½ feet high, 600 of the new amplifiers do work which once required a *room* full of equipment.

This kind of size reduction throughout the System means that more parts can be housed in a given space. Telephone buildings and other installations keep on giving more service for their size — and keep down costs.

The new amplifiers, which will soon be used by the thousands throughout the Bell System to keep telephone voices up to strength, are but one example of this important phase of Laboratories' work.

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

ADJACENT-CHANNEL EQUIPMENT

HOW THE PROBLEMS OF MOBILE RADIO OPERATION ON ADJACENT CHANNELS ARE BEING SOLVED IN NEWLY-DEVELOPED EQUIPMENT, PART 1—*By* HAROLD A. JONES*

TO the far-sighted individuals interested in the future of mobile radio communications, today's need for space in the radio spectrum, coupled with the inevitable future demands, add up to one obvious fact. Methods for increasing channel utilization, both technical and administrative, must be developed and put to use immediately. Propagation limitations known to the art, along with the myriad demands of all the other radio services, practically eliminate the possibility of assigning more spectrum space to the mobile services. It is imperative, therefore, that every last kilocycle now allocated be dedicated to useful service.

Channel congestion is an affliction most prevalent in the metropolitan areas. Here, particularly, is demonstrated the need for decreasing the waste of spectrum space. Here it is most imperative that guardbands be cut to the irreducible minimum, and adjacent-channel operations initiated.

The problem of adjacent-channel operations within a given area is not a simple one to solve. However, in light of recent developments, now proved by actual field tests, there is reason to believe that an entire new approach to channel-utilization can be evolved.

Any long-term scheme to improve spectrum conservation must, obviously, be directly related to equipment design. The time span involved in the transition from an extravagent era of alternate channel operations to the desired period of 100% adjacent-channel operations will necessarily be lengthened in part by technological obstacles, but to a greater extent by the economic considerations involved in clearing out existing, soon-to-be-obsolete equipment.

Representative of new equipment designed to meet the tightened FCC requirements which go into effect July 1, 1950 is the Motorola receiver-transmitter unit for 152 to 174 mc. shown in Fig. 1. The transmitter is furnished with either a 30-watt or 60-watt RF output deck. Individual component assemblies and the basic chassis of the receiver and transmitter are illustrated in Fig. 2.

Problems of Receiver Design:

It is quite universally agreed that the overall receiver selectivity characteristic is one of the major factors in effecting adjacent-channel operations. According to the current minimum-performance standards established by the Radio Manufacturers Association, the desired degree of selectivity for successful adjacent-channel reception on 152 to 174 mc. is at least 85 db down at ± 60 kc., which extends to the centers of the adjacent channels, as indicated in Fig. 3. The results of recent field tests have determined conclusively that a level of -85 db to -100 db at ± 30 kc., the edges of the adjacent channels, is highly desirable.

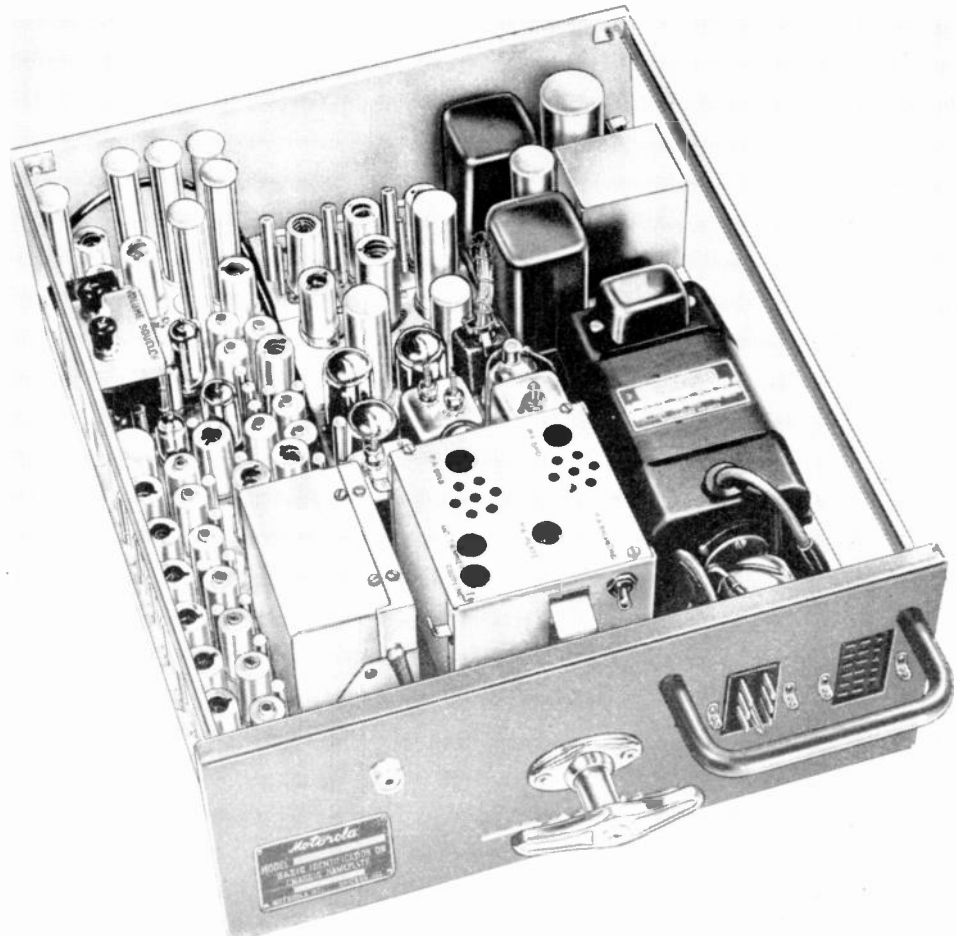
Were it possible to achieve this degree of frequency discrimination in the radio frequency stages of the receiver, selectivity would, indeed, become the dominant element in equipment design. Instead, it is only one of many factors. Even in this day and age of advanced equipment design, RF selectivity of the desired magnitude is unattainable, as indicated in Fig. 4. Conventional permeability-tuned RF preselection stages contribute only a few negligible decibels attenuation to adjacent- and alternate-channel frequencies. Even the bulky, temperature-stabilized cavities designed for base-station installation contribute no more than 20 or 30 db at frequency departures ± 200 kc. from the desired frequency.

Since immediate perfection of specialized parameters capable of providing the desired degree of selectivity at RF levels is beyond the state of the art, appropriate systems design must be adopted which employ certain other advanced techniques of adjacent-channel utilization now known to research specialists. The methods employed in perfecting the equipment to be discussed here involved long-range development not merely of the selectivity-determining components, but of the overall system design.

The new units, Figs. 1 and 2, coupled with a plan for controlled geographical assignment of channels will, undoubtedly, result in well-defined boundaries to the problem of close channel-occupancy.

Each of the operational obstacles was considered as a separate, major problem. Emphasis was given to the fact that a completely satisfactory solution is impossible unless all disturbing elements are controlled. For example, the simple expedient of providing an extraordinary degree of selectivity in the receiver is not the complete answer, since the pre-

Fig. 1. A 30-watt transmitter-receiver unit for adjacent-channel use on 152 to 174 mc.



*Systems Engineering Dept., Communications & Electronics Division, Motorola, Inc., 4545 August a Blvd., Chicago, Ill.

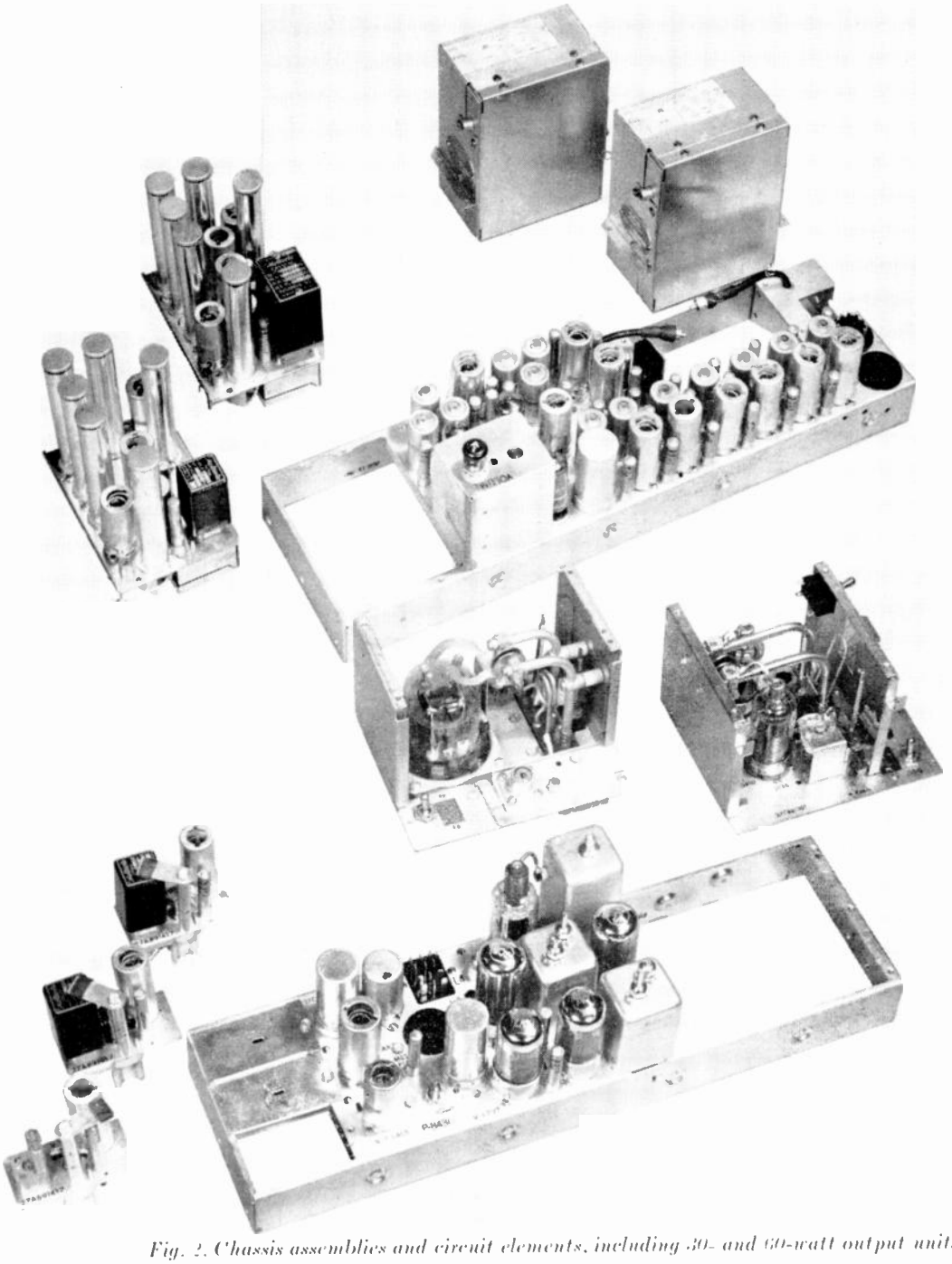


Fig. 2. Chassis assemblies and circuit elements, including 30- and 60-watt output units

selection cannot be made at the antenna or other RF levels. Extreme IF selectivity is required, together with absolute control of frequency stability, intermodulation interference; de-sensitizing, spurious and image response, temperature drift, nuisance noise, and audio quality. In addition, the associated transmitter must exhibit markedly improved characteristics over and above those of conventional units with respect to spurious and harmonic radiation, frequency stability, and deviation control.

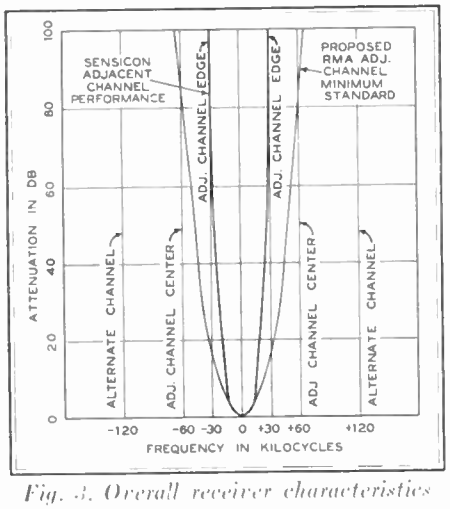


Fig. 3. Overall receiver characteristics

Advances in Receiver Design:

From the design principles employed in the new Motorola narrow-band receiver came several outstanding engineering achievements. To obtain high effectiveness in the RF selectivity circuits, rigid, tunable coaxial lines are employed, as shown at the right in Fig. 5. A total of five such elements precede the first mixer stage, with a sixth serving to resonate the local oscillator plate circuit. Each resonant circuit is effectively a midget cavity, silver-plated to improve efficiency, and temperature-compensated with negative-coefficient ceramic capacitors to insure highly stable RF characteristics. Spring-loaded wiping contacts in the tuning elements aid to minimize contact resistance. As a measure of improved performance, the midget cavities demonstrate loaded Q's in the order of 250 as compared to Q's of 50 to 70 in ordinary transmission-line tuners or 10 to 30 in conventional permeability-tuned circuits.

This increased degree of RF selectivity, together with improved interference charcteristics realized from design refinements in the radio frequency amplifier and first mixer stages, provide excellent control of out-of-band desensitizing, intermodulation, and spurious response.

Spurious responses can be reckoned with and attenuated to a level of insignificance, but the elements of desensitizing and, more prominently, intermodulation interference have been steadily growing in importance until today they rate separate consideration.

By definition, the intermodulation spurious response attenuation characteristic of a receiver is the measured amount of its ability to receive a desired signal to which it is resonant, in the presence of two interfering signals so separated from the desired signal and from each other that nth-order mixing of the two undesired signals can occur in the nonlinear elements of the receiver, producing a third signal whose frequency is equal to that of the desired signal. Fig 6 illustrates this. For example, let

A = desired channel,
B = adjacent channel, and
C = alternate channel.

f_I = intermodulation interference signal
f_A = desired signal
$f_B = f_A + \Delta f$ = adjacent channel signal
$f_C = f_A + 2\Delta f$ = alternate channel signal

EXAMPLE 1: Assume that the difference frequency generated by mixing of the alternate and adjacent-channel signals beats back with the adjacent-channel signal to form another set of sum and difference products. It can be shown that the sum-product will cause interference on the desired channel as follows:

$$f_I = (f_B - f_C) + f_B$$
$$= 2f_B - f_C$$

By substitution:

$$f_I = 2f_A + 2\Delta f - f_A - 2\Delta f$$

Therefore, $f_I = f_A$

EXAMPLE 2: Assume mixing of the adjacent channel second harmonic with the alternate-channel signal. It can be shown that the difference product will cause interference on the desired channel as follows:

$$f_I = 2f_B - f_C$$

By substitution:

$$f_I = 2(f_A + \Delta f) - (f_A + 2\Delta f)$$

Therefore, $f_I = f_A$

Unfortunately, as illustrated by these

two simple examples, there are numerous signal combinations which can produce serious degradation in performance.

As yet there are no established industry-wide tests or minimum performance standards. Tentatively, the following standards and tests have been proposed to furnish the sorely needed basis of comparison and measures of merit for adjacent-channel units:

All receivers designed to provide adjacent-channel service should be capable of satisfying the following minimum performance requirements:

1. Nuisance Intermodulation Spurious Interference: Two equal signal ratios of not less than 64 db above the on-channel effective 20 db quieting signal level, impressed simultaneously across the receiver antenna terminals at frequencies displaced plus 60 kc. and plus 120 kc. from the desired frequency shall produce a nuisance interference signal which quiets the receiver not more than 20 db.

2. Reception Intermodulation Spurious Interference: Two equal signal ratios of not less than 80 db above the on-channel effective 20 db quieting signal level, impressed simultaneously across the receiver antenna terminals at frequencies displaced plus 60 kc. and plus 120 kc. from the desired frequency, shall produce a reception interference signal resulting in an IF meter reading equal to that normally experienced from a 10-microvolt or 20 times 20 db quieting-level on-channel signal (whichever is the greater). The reception interference shall be measured by IF grid metering.

The paragraphs above outline absolute minimum performance standards considered adequate for satisfactory adjacent-channel operations. The curves in Fig. 3, for example, illustrate the actual performance characteristic of the Motorola Sensicon unit.

Adequate suppression of both desensitizing and intermodulation interferences have been slighted in many receivers now commercially available. Practicably, both types of interference have been dominant obstacles in the road toward successful adjacent-channel operations, particularly in same-area operation.

The overall selectivity of this special mobile service receiver is determined predominantly by the separately-packaged IF wave filter illustrated in Fig. 5. Permeability tuned coils and compensating capacitors assembled in a modified constant-K and *m*-derived network comprise a total of 15 tuned circuits which are permanently fixed electrically and mechanically by casting the entire filter structure in a solid block of polymerized resin. Thus, those circuits which regulate to a controlling degree the frequency-rejection capabilities of the unit are rendered impervious to the extreme heat, humidity, and vibration conditions common in the mobile services. This technique not only prevents degradation of performance through shock or exposure to the elements, but also removes the possibility of tampering or misalignment as a result of field service without proper test equipment.

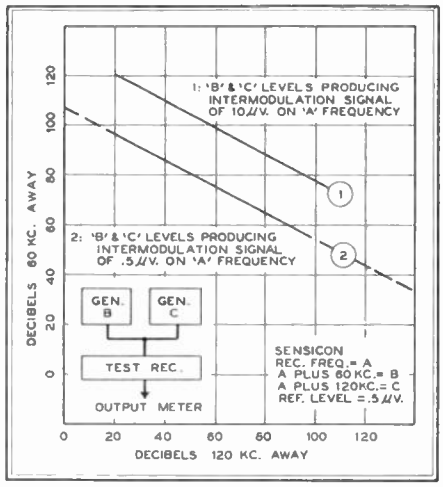


Fig. 6. RF intermodulation characteristics

Electrically, the cast filter provides at least 100 db. attenuation at ± 30 kc., the edges of the adjacent channels for the 152- to 174-mc. band, as indicated in Fig. 4. Recent investigations indicate that the characteristics exhibited by this unit are suitable for same-area, adjacent-channel operations in the 152- to 174-mc. band (60-kc. channels), and for adjacent-area, adjacent-channel operations in the 25- to 50-mc. band (40 kc. channels).

A similar filter has been designed, tested, and put in production to provide 100-db attenuation at ± 20 kc., the edges of the adjacent channels for the 25- to 50-mc. band.

Since the band-acceptance limits of the receiver IF stages are now immovably fixed, a special local oscillator has been introduced. This innovation in manually-tuned, crystal-controlled local oscillators results in a receiver which is easy to tune and maintain. Precision tuning is made possible through the use of a unique series-mode, permeability-adjusted oscillator circuit. Thermal compensation has been incorporated to insure stable performance through broad ambient temperature variations. The circuit, employing a temperature-controlled, oven-type crystal assembly is guaranteed to maintain frequency stability to better than ± .00066% over an ambient temperature range of − 30° C. to + 60° C. when operating on any assigned frequency in the band of 152 to 174 mc. A comparable unit is available for operation on 25 to 50 mc.

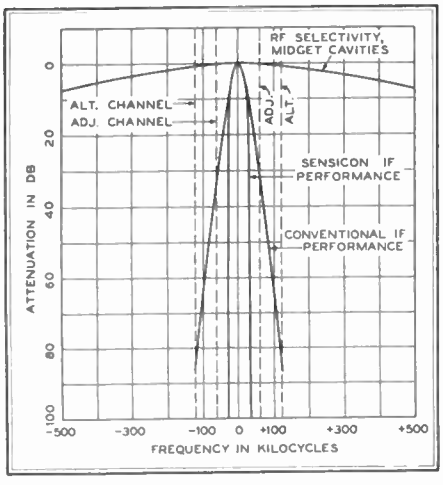


Fig. 4. RF and IF receiver selectivity

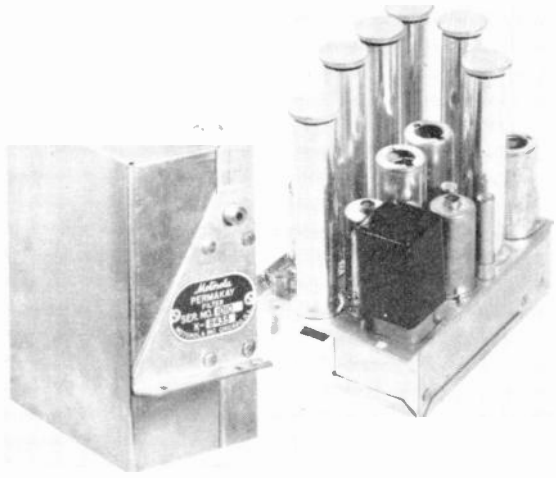


Fig. 5. An IF filter and RF tuner deck

Transmitter Improvements:

The attainment of extraordinary receiver characteristics will not solve the problem of adjacent-channel or even alternate-channel operations unless the radiated energy of stations occupying these nearby channels is also controlled adequately. Effective steps must be taken to eliminate the possibility of any appreciable on-channel radiation appearing in the neighboring channels. It is impossible to design a receiver which will reject an undesired signal when that signal contains frequencies within the band-acceptance limits of the receiver.

Spurious and harmonic radiation must be eliminated or at least attenuated to safe levels of 70 to 100 db. below the desired carrier level. In addition, carrier deviation due to modulation must be limited to insure operation only out to, and not exceeding, the authorized channel limits.

It is well known that in phase modulation the instantaneous deviation excursion is determined by both the amplitude of the modulating wave and the steepness of the wave front, or slope of the modulating wave. This means that an ordinary amplitude limiter will not control the instantaneous deviation maxi-

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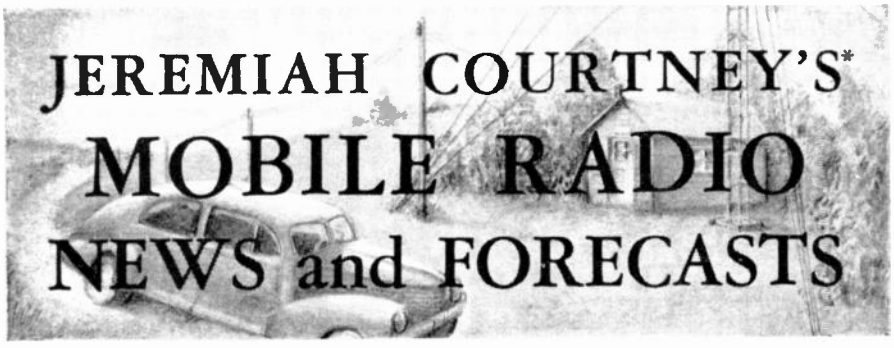


JEREMIAH COURTNEY'S* MOBILE RADIO NEWS and FORECASTS

ALTHOUGH the Federal Communications Commission last month accorded priority to processing of all applications seeking reclassification of existing facilities in the recently-established regular services, there was considerable doubt whether all the taxi applications could be processed by November 1, when their experimental licenses expire. Priority accorded reclassification applications is badly delaying the processing of applications for new facilities which, in several services, is now about 90 days.

No Interruption of Taxi Service:

Flood of reclassification applications in the taxi service was so heavy that Commissioner George E. Sterling mentioned situation in speech before the National Association of Taxi Operators in Buffalo.

Laying at rest any fears of interruption in radio use pending FCC review of reclassification applications, Commissioner Sterling said:

"One of your most pressing problems right now is shifting from the frequencies you have occupied on an experimental basis to the new frequencies. The abnormally large number of applications for modification of licenses has swamped our Commercial Licensing Section and we must ask you to be understanding.

"It is true that your present experimental licenses expire on November 1. However, if you have your application on file before that date, you will be permitted to continue operating until action is taken on the application. We will process these applications as diligently as we can, but if it is some time before your new license comes through, don't lose too much sleep over it. And don't think the Commission has gone off fishing. The load is simply too big."

Area Coordination for Taxis:

Commissioner Sterling also outlined conditions under which frequency recommendations of area coordinating committees would be considered by FCC in taxi field: Committee formation must be entirely voluntary, fully representative in character, and recommendations must be impartial. Under such circumstances, the Commissioner indicated that the FCC would try to follow area committee recommendations although, he stated, the FCC "cannot delegate its duty of assigning frequencies to organizations or committees of licensees." His remarks left matters pretty much where they were. Individual taxi operators who come to an agreement on frequency use will likely have their plan respected; those who don't are free to pursue their separate frequency ways before the Commission. What was not made clear was extent to which Commission or staff will study individual area situation to determine best plan of frequency utilization for each area where an agreement on the subject is not reached by the operators, themselves.

Supervisors' Cars:

American Taxicab Association, National Association of Taxicab Operators and a number of individual taxi operators have filed objections to FCC proposed ban of mobile radio use in supervisors' cars, asking for oral argument before Commission on subject. Objections pointed out that the supervisor's car is the enforcing agent of the large company, and the combination maintenance-repair-and-supervisory unit of the small fleet. FCC fears that supervisory vehicle radio use would cause channel saturation were discounted by reference to automatic brake on communications to supervisor's units, involving enforcement of FCC, safety, or cab company regulations, since they would be heard by all passengers.

Field Strength Surveys:

Reversing itself, FCC is now issuing Class I experimental licenses to manufacturers for field strength surveys. Licenses, good for a year, will authorize operation in 30- to 50-mc. or 152- to 162-mc. bands, or both, as requested. Specific frequencies will be assigned, as needed for specific surveys, by the FCC's Chief Engineer.

The complicated procedures adopted for use of the licenses that will be issued appear from the following conditions which will accompany all licenses:

"Your attention is directed to the fact that no specific frequencies have been assigned in this authorization. Specific frequency assignments cannot be made for Class I Experimental authorizations involving field strength surveys since all frequencies above 25 mc. available for this purpose are assigned subject to the condition that no harmful interference will be caused to the services or stations to which such frequencies are allocated in Part 2 of the Commission's Rules. In view of this, the broad geographical frequency assignments which had been made in the past are precluded under the new allocation plan due to interference potentialities. Furthermore, surveys conducted in connection with the improvement or the establishment of a particular communication system should be conducted on frequencies regularly assigned to that particular service. Therefore, for the conduct of such surveys, frequencies will be assigned for each area or location at which a particular survey is to be conducted.

"The licensee, when desiring to conduct a survey at a particular location, will request by mail or telegram a specific frequency assignment for the conduct of the survey. The request for a frequency assignment shall also state for whom the survey is being conducted, purpose of the survey, duration of time the frequency is required, and a statement from the person or organization for whom the survey is being conducted indicating that such a survey has been requested in their behalf. No operation shall be conducted prior to the receipt of a specific frequency authorization."

While these procedures may handicap the salesmen in the field, they should certainly serve to reduce the Western Union deficit, while contributing their mite to keeping intact Washington's reputation as chief paper-work producer of the Country.

LCC Subscribers Increasing:

Limited common carriers furnishing mobile radio service on a charge basis to the general public seem to be adding subscribers as winter months approach, and the importance of radio service to fuel-burner suppliers, garages, and others is sharply increased with cold weather conditions. Further stimulus will shortly be accorded service when regular grants are made, removing the sales resistance to mobile unit subscriber purchases which existed during the initial "experimental" phase.

All operators find satisfied customers the best source of new business. There is no question about the superior service radio permits all types of service organizations. Still lacking, however, and badly needed, are cost studies of fleet operations, with and without radio

(Concluded on page 34)

* Courtney, Krieger, and Jorgensen, Washington, D. C. District of Columbia

EQUIPMENT SPECS

MANUFACTURERS' DATA ON TRANSMITTERS AND RECEIVERS USED IN MOBILE RADIO SYSTEMS — PART 2

MOTOROLA, INC.
Chicago 51, Illinois

Fixed: No. FSTR-80BY(A), 25-50 Mc.

Transmitter: 30 w. to 50-72 ohm line; AC input 225 w. *Tubes:* 6AK6 osc; 7V7 mod; 7V7 doub; 7C5 doub; 2E26 doub-driver; 2)2E26 output; 12AX7 IDC amps; 6AL5 IDC clip-lim; 2)5R4GY rect. *Notes:* Shure mike or W.E. handset; Motorola DO4 temp. cont. crystal; 2 or 3-freq. operation available; case mounting.

Receiver: double superhet.; 2.7 mc. & 455 kc. IF; Motorola temp. cont. crystal; Sensicon circuit; Permakay filter; 2-freq. Sensicon recvr. available. *Tubes:* 6BH6 RF; 6BH6 RF; 6C4 osc; 6BH6 1st mix; 6BH6 IF; 6BH6 2nd osc; 6BH6 2nd mix; 6BH6 IF; 6BH6 IF; 6BH6 IF; 6BH6 IF; 6BH6 lim; 6BJ6 lim; 6AL5 disc; 6BH6 noise amp; 6AL5 noise rect; 12AX7 1st AF & sq; 6AQ5 output.

Fixed: No. FSTR-80BY(B), 25-50 Mc.

Transmitter: 30 w. to 50-72 ohm line; AC input 225 w. *Tubes:* same as No. FSTR-80BY(A); case mounting.

Receiver: double superhet.; 2.7 & 1.7 mc. IF; Motorola temp. cont. crystal. *Tubes:* 6BH6 RF; 6BH6 RF; 6BH6 1st mix; 6BH6 1st osc; 6BJ6 IF; 6BJ6 IF; 6BH6 2nd mix; 6BH6 2nd osc; 6BJ6 IF; 6BJ6 lim; 6BJ6 lim; 6AL5 disc; 6BH6 noise amp; 6AL5 noise rect; 12AU7 1st AF & sq; 6AQ5 output.

Fixed: No. FSTR-80BR(A), 25-50 Mc.

Transmitter and receiver same as No. FSTR-80BY(A) except in cabinet.

Fixed: No. FSTR-80BR(B), 25-50 Mc.

Transmitter and receiver same as No. FSTR-80BY (B) except cabinet.

Fixed: No. FSTR-140BY (A), 25-50 Mc.

Transmitter: 60 w. to 50-72 ohm line, AC input 375 w. *Tubes:* same as No. FSTR-80BY(A) except 829B output; case mounting.

Receiver: same as No. FSTR-80BY(A).

Fixed: No. FSTR-140BY(B), 25-50 Mc.

Transmitter: 60 w. to 50-72 ohm line, AC input 375 w. *Tubes:* same as No. FSTR-80BY(A) except 829B output; case mounting.

Receiver: same as No. FSTR-80BY(B).

Fixed: No. FSTR-140BR(A), 25-50 Mc.

Transmitter and receiver same as No. FSTR-140BY(A) except cabinet mounting.

Fixed: No. FSTR-140BR(B), 25-50 Mc.

Transmitter and receiver same as No. FSTR-140BY(B) except cabinet mounting

Fixed: No. FSTR-520BR(A) 25-50 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1100 w. *Tubes:* same as No. FSTR-80BY(A) plus 2)100TH output and 2)866A rect. *Notes:* Shure military mike or W.E. handset; Motorola DO4 temp. cont. crystal; 2-freq. operation available.

Receiver: same as No. FSTR-80BY(A).

Fixed: No. FSTR-520BR(B), 25-50 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1100 w. *Tubes:* same as No. FSTR-80BY(A) plus 2)100TH output and 2)866A rect. *Notes:* same as No. FSTR-80BY(A).

Receiver: same as No. FSTR-80BY(B).

Mobile: No. FHTR-1A (Handi-Talkie Unit) 25-50 Mc.

Transmitter: .5 w. output; 0 w. stby.; 5.8 w. trans. *Tubes:* 5672 osc; 2E36 mod; 2E36 buf; 5672 mult; 2)2E36 mult; 1S4 mult; 3B4 output. *Notes:* 3 miniature 67½ v. B bat; W.E. handset.

Receiver: single superhet.; 2.1 mc. IF; Motorola crystal 802; 1.25 w. *Tubes:* CK569AX/5168 RF; 2E32 RF; 2E36 mix; 2E32 IF; 2E32 IF; 2E32 IF; 2E32 lim; 2E32 lim; 2E36 AF; 5672 osc & mult; 5672 mult; 2)1N34 crystal disc.

Mobile: No. FMTR-40V(B), 25-50 Mc.

Transmitter: 10 w. to 50-72 ohm line; 6 v. input, 3.5 a. stby.; 16 a. trans. *Tubes:* 6AK6 osc; 6AU6 mod; 6AK6 buf; 6AK6 doub; 6AK6 doub; 6AK6 doub; 2E26 doub-driver; 2E26 output; OZ4, 6X5, or CK1204 rect. *Notes:* Shure military mike or W.E. handset; Motorola "temp-fixed" crystal; IDC; 2-freq. operation available.

Receiver: double superhet.; 2.7 & 1.7 mc. IF; Oak or Mallory vibrator; Motorola temp. cont. crystal; 5.5 a. *Tubes:* 6BH6 RF; 6BH6 RF; 6BH6 1st mix; 6BH6 1st osc; 6BJ6 IF; 6BJ6 IF; 6BH6 2nd mix; 6BH6 2nd osc; 6BJ6 IF; 6BJ6 lim; 6BJ6 lim; 6AL5 disc; 6BH6 noise amp; 6AL5 noise rect; 12AU7 1st AF & sq; 6AQ5 output.

Mobile: No. FMTR-40V(A), 25-50 Mc.

Transmitter: 10 w. to 50-72 ohm line; 6 v. input, 3.5 a. stby.; 16 a. trans. *Tubes:* same as No. FMTR-40V(B).

Receiver: same as No. FSTR-80BY(A); 7.5 a.

Mobile: No. FMTR-80D(A), 25-50 Mc.

Transmitter: 30 w. to RG8U line; 6 v. input, 7.0 a. stby.; 40 a. trans. *Tubes:* same as No. FSTR-80BY(A) except no rect. *Notes:* Shure military mike or W.E. handset; Motorola DO4 temp. cont. crystal; Carter dynamotor; 2 or 3-freq. operation available.

Receiver: same as No. FSTR-80BY(A); 7.5 a.

Mobile: No. FMTR-80D(B), 25-50 Mc.

Transmitter: 30 w. to RG8U line; 6 v. input, 7.0 a. rec; 40 a. trans. *Tubes:* same as No. FSTR-80BY(A) except no rect.

Receiver: same as No. FSTR-80BY(B); 5.5 a.

Mobile: No. FMTR-140D(A), 25-50 Mc.

Transmitter: 60 w. to RG8U line; 6 v. input; 8.0 a. stby.; 64 a. trans. *Tubes:* same as No. FSTR-80BY(A) except no rect. *Notes:* same as FMTR-80D(A).

Receiver: same as No. FSTR-80BY(A); 7.5 a.

Mobile: No. FMTR-140D(B), 25-50 Mc.

Transmitter: 60 w. to RG8U line; 6 v. input; 8.0 a. stby.; 64 a. trans. *Tubes:* same as No. FSTR-80BY(A) except no rect. *Notes:* same as No. FMTR-80D(A).

Receiver: same as No. FSTR-80BY(B); 5.5 a.

Fixed: No. FSTRU-80BY(A), 152-174 Mc.

Transmitter: 30 w. (152-170 mc.) or 25 w. (170-174 mc.) to 50-72 ohm line; AC input 250 w. *Tubes:* 6AK6 osc; 7V7 mod; 7V7 buf-doub; 7C5 trip; 7C5 doub; 2E26 doub-driver; 2)2E26 output; 6AL5 IDC clip-lim; 12AX7 IDC amp; 2)5R4GY rect. *Notes:* Shure carbon desk mike or W.E. handset; Motorola DO1 temp. cont. crystal; 2- or 3-freq. operation available; case mounting.

Receiver: same as No. FSTR-80BY(A) except high IF is 5.5 mc. and only one RF stage; 7.5 a.

Fixed: No. FSTRU-80BY(B), 152-174 Mc.

Transmitter: 30 w. to 50-72 ohm line; AC input 250 w. *Tubes:* same as No. FSTRU-80BY (A); case mounting.

Receiver: double superhet.; 7.3-8 and 1.7 mc. IF; Motorola temp. cont. crystal. *Tubes:* 6AK5 RF; 6BH6 RF; 6BJ6 1st mix (152-162 mc.) or 6AK5 1st mix (162-174 mc.); 6BJ6 osc & 1st quad; 6BJ6 IF; 6BJ6 IF; 6BH6 2nd mix; 6BJ6 2nd quad; 6BJ6 lim; 6BJ6 lim; 6AL5 disc; 6BH6 noise amp; 6AL5 noise rect; 12AU7 1st AF & sq; 6AQ5 output, 5.5 a.

Fixed: No. FSTRU-80BR(A), 152-174 Mc.

Transmitter & receiver same as No. FSTRU-80BY(A) except in cabinet mounting.

Fixed: No. FSTRU-80BR(B), 152-174 Mc.

Transmitter & receiver same as No. FSTRU-80BY(B) except cabinet mounting.

Fixed: No. FSTRU-140BY(A), 152-174 Mc.

Transmitter: 60 w. to 50-72 ohm line; AC input 445 w. *Tubes:* same as No. FSTRU-80BY(A) except 829B output; case mounting.

Receiver: same as No. FSTR-80BY(A) except high IF is 5.5 mc. and only one RF stage.

Fixed: No. FSTRU-140BY(B), 152-174 Mc.

Transmitter: 60 w. to 50-72 ohm line; AC input 445 w. *Tubes:* same as No. FSTRU-80BY(A) except 829B output; case mounting.

Receiver: same as No. FSTRU-80BY(B).

Fixed: No. FSTRU-140BR(A), 152-174 Mc.

Transmitter & receiver same as No. FSTRU-140BY(A) except cabinet mounting.

Fixed: No. FSTRU-140BR(B), 152-174 Mc.

Transmitter & receiver same as No. FSTRU-140BY(B) except cabinet mounting.

Fixed: No. FSTRU-520BR(A), 152-174 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1300 w. *Tubes:* same as No. FSTRU-80BY(A) plus 2)4-125A output and 2)866A rect.

Receiver: same as No. FSTR-80BY(A) except high IF is 5.5 mc. and only one RF stage.

Fixed: No. FSTRU-520BR(B), 152-174 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1300 w. *Tubes:* same as No. FSTRU-80BY(A) plus 2)4-125A output and 2)866A rect.

Receiver: same as No. FSTRU-80BY(B).

Mobile: No. FHTRU-1A (Handi-Talkie Unit), 152-174 Mc.

Transmitter: .25 w. output; 0 w. stby.; 6 w. trans. *Tubes:* 5672 osc; 5672 mod; 2E36 doub; 5672 doub; 5672 doub; 1AD4 doub; 573AX doub; 573AX output. *Notes:* 3 miniature 67½ v. B bat; W.E. handset.

Receiver: single superhet.; 2.1 mc. IF; Motorola crystal C02; 1.5 w. *Tubes:* 1AD4 RF; 5678 mix; 5672 osc; 2E32 IF; 2E32 IF; 2E32 IF; 2E32 lim; 2E32 lim; 2E36 AF; 1AD4 mult; 2)1N34 crystals disc.

Mobile: No. FMTRU-40V(A), 152-174 Mc.

Transmitter: 7-10 w. to RG58U line; 6 v. input; 3.5 a. stby; 16 a. trans. *Tubes:* 6AK5 osc; 2)6BE6 mod; 6AK5 quad; 6AK5 doub; 2E26 doub-driver; 2E26 output; 0Z4A, 6X5, or CK-1024 rect. *Notes:* Shure military mike or W.E. handset; Mallory or Oak vibrator; 2-freq. operation available.

Receiver: same as No. FSTR-80BY (A) except high IF is 5.5 mc. and only one RF stage; 7.5 a.

Mobile: No. FMTRU-5V, 152-174 Mc.

Transmitter: 6-10 w. to RG58U line; 6 v input, 3.5 a. stby.; 16 a. trans. *Tubes:* same as No. FMTRU-40V(A).

Receiver: same as No. FSTRU-80BY(B); 5.5 a.

Mobile: No. FMTRU-80D(A), 152-174 Mc.

Transmitter: 30 w. to RG58U line; 6 v.

input; 7 a. stby.; 42 a. trans. *Tubes:* same as No. FSTRU-80BY(A). *Notes:* Shure military mike or W.E. handset; Carter dynamotor; 2 or 3-freq. operation available.
Receiver: same as No. FSTR-80BY(A) except high IF is 5.5 mc. and only one RF stage; 7.5 a.

Mobile: No. FMTRU-80D(B), 152-174 Mc.

Transmitter: 30 w. to RG58U line; 6 v. input; 7 a. stby.; 42 a. trans. *Tubes:* same as No. FSTRU-80BY (A).
Receiver: same as No. FSTRU-80BY(B); 5.5 a.

Mobile: No. FMTRU-140D(A), 152-162 Mc.

Transmitter: 60 w. to RG58U line; 6 v. input; 8 a. stby.; 74 a. trans. *Tubes:* same as No. FSTRU-80BY(A) except 829B output and no rect. *Notes:* same as No. FMTRU-80D(A).
Receiver: same as No. FSTR-80BY(A) except high IF is 5.5 mc. and only one RF stage; 7.5 a.

PHILCO CORP.
Philadelphia 34, Pa.

Fixed: 30-50 Mc.

Transmitter: 30 w. to 50-72 ohm line; AC input 300 w. *Tubes:* 6C4 osc; 9003 mod; 6BJ6 amp; 6BJ6 trip; 6BJ6 trip; 7C5 doub; 807 output; 2)6L7 AF comp; 7F7 volt amp; 7A6 cont; 7A4 amp; 2)5R4GY rect; 2)VR150 reg. *Notes:* Philco crystal 34-8009.

Fixed: 30-50 Mc.

Transmitter: 50 w. to 50-72 ohm line; AC input 405 w. *Tubes:* same as 30 w. transmitter above, except 2)807 output.

Fixed: 30-50 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1000 w. *Tubes:* same as 30 w. transmitter, plus 6X5 rect; 7A6 cont; 2)4D21 output; 2)866A rect. *Notes:* line termination equipment with hybrid transformers available with each trans.
Receiver: double superhet.; 4.3 mc. & 455 kc. IF; Philco crystal 34-8010; 64 watts. *Tubes:* 6AK5 RF; 6C4 osc; 6J6 1st mix; 6BJ6 IF; 7A8 2nd mix; 6AK5 IF; 6AK5 IF; FM1000 det; 7F7 AF & sq; 7F7 noise amp & rect; 7C5 output; 7Z4 rect.

Mobile: 30-50 Mc.

Transmitter: 50 w. to RG58U line; 6 v. input, 2.1 a. stby.; 48 a. trans. *Tubes:* 6C4 osc; 9003 mod; 6BJ6 buf amp; 6BJ6 trip; 6BJ6 trip; 6AQ5 doub; 2)807 output. *Notes:* Military mike or Kellogg handset; dynamotor pwr. supply; 2-freq. operation available.
Receiver: double superhet.; 4.3 mc. & 455 kc. IF; Philco crystal 34-8010; Philco vibrator. *Tubes:* same as above except 7C5 output.

Fixed (Repeater): 72-76 Mc.

Transmitter: 50 w. to 50-72 ohm line; AC input 400 w. *Tubes:* 6C4 osc; 9003 mod; 6BJ6 amp; 6C4 trip; 6C4 trip; 6AQ5 doub; 2E26 buf; 829 output; 2)6L7 AF; 7F7 volt amp; 7A6 cont; 7A4 amp; 2)5R4GY rect; 2)VR-150 reg. *Notes:* Astatic mike; Philco crystal 34-8012.
Receiver: double superhet.; 15 mc. & 1 mc. IF; Philco crystal 34-8017; input 64 watts. *Tubes:* 6AK5 RF; 6BJ6 1st osc; 6AK5 trip; 6C4 1st mix; 6BJ6 IF; 7A8 2nd mix; 6BJ6 IF; 6BJ6 IF; FM1000 det; 7F7 AF & sq; 6AQ6 noise amp; 6AQ5 output; 7Z4 rect.

Fixed: 152-174 Mc.

Transmitter: 50 w. to 50-72 ohm line; AC input 405 w. *Tubes:* 6C4 osc; 9003 mod; 6BJ6 buf amp; 6C4 trip; 6C4 trip; 6AQ5 doub; 2E26 doub; 2)6L7 AF; 829 output; 2)5R4GY rect; 7F7 volt amp; 7A6 cont; 7A4 amp; VR150 reg. *Notes:* Philco crystal 34-8012.

Fixed: 152-174 Mc.

Transmitter: 250 w. to 50-72 ohm line; AC input 1300 w. *Tubes:* same as 50 w. transmitter, plus 2)4D21 output; 6X5 rect; 6AL5; 2)866 rect. *Notes:* Line termination equipment with hybrid transformers available with each trans.
Receiver: double superhet.; 15 & 1 mc. IF; Philco crystal 34-8011; 64 watts. *Tubes:* 6AK5 RF; 6BJ6 1st osc; 6AK5 quad; 6AK5 1st mix; 6BJ6 IF; 7A8 2nd mix; 6BJ6 IF; 6BJ6 IF; FM1000 det; 7F7 AF & sq; 6AQ6 noise amp; 6AQ5 output; 7Z4 rect.

Mobile: 152-174 Mc.

Transmitter: 30 w. to RG58U line; 6 v. input; .6 a. stby.; 35 a. trans. *Tubes:* 6C4 osc; 9003 mod; 6BJ6 buf amp; 3A4 trip; 3A4 trip; 2E30 doub; 2E24 doub; 2)2E24 output. *Notes:* Military mike or Kellogg handset; dynamotor supply; 2-freq. operation available.
Receiver: double superhet.; 15 & 1 mc. IF; Philco crystal 34-8011; Philco vibrator; 7 a. *Tubes:* same as 250 w. receiver above, except no rect.

RAYTHEON MFG. CO.
Newton, Mass.

Fixed: No. VS50-1, 25-50 Mc.

Transmitter: 50 w. to 52-ohm line; AC input 120 w. *Tubes:* 6J6 osc; 2)6AK6 mod; 6BA6 doub; 6AK6 trip; 2)6AQ5 doub; 2)2E26 amp. *Notes:* Shure desk mike 48M-12687; Bliley crystal MC9; 2-freq. operation available.

Mobile: No. VM30-1, 25-50 Mc.

Transmitter: 30 w. to RG58U line; 6.3 v. input, 3 a. stby.; 25 a. trans. *Tubes:* same as VS50-1. *Notes:* vibrator high-voltage supply; Electro-Voice mike or N201-13512 handset; 2-freq. operation available.
Receiver: single superhet.; 2 mc. IF; Bliley crystal MC9; Oak vibrator; 5 a. *Tubes:* 6AK5 RF; 6AK5 RF; 6BE6 conv; 6BA6 inj amp; 6J6 osc; 6BA6 IF; 6BA6 IF; 6AV6 lim; 6AL5 disc; 6AV6 squelch amp; 6AQ6 AF & sq; 6AK6 output.

Fixed: No. US20-1, 152-162 Mc.

Transmitter: 20 w. to 52-ohm line; AC input 120 w. *Tubes:* 6J6 osc; 2)6AK6 mod; 6BA6 trip; 6AK6 trip; 6AQ5 doub; 832A amp. *Notes:* Shure desk mike 48M-16287; Bliley crystal MC9.

Mobile: No. UM15-1, 152-162 Mc.

Transmitter: 15 w. to RG58U line; 6 v. input; 3 a. stby.; 18 a. trans. *Tubes:* same as US20-1. *Notes:* vibrator high-voltage supply; Electro-Voice mike or N201-13512 handset; 2-freq. operation available.
Receiver: single superhet.; 3 mc. IF; Bliley crystal MC9; 2 Oak vibrators; 5 a. *Tubes:* 6AK5 RF; 6AK5 RF; 6BE6 conv; 6AK5 trip; 6J6 osc; 6BA6 IF; 6BA6 IF; 6AU6 lim; 6AL5 disc; 6AU6 sq amp; 6AU6 AF & sq; 6AK6 output.

Fixed: No. US85-1, 152-162 Mc.

Transmitter: 85 w. to 52-ohm line; AC input 440 w. *Tubes:* same as US20-1 plus 829B output; 4)5Y3GT G rect.

Fixed: No. US400-1, 152-162 Mc.

Transmitter: 400 w. to 52-ohm line; AC input 1 kw. *Tubes:* same as US20-1 plus 2)4X150R output; 2)866 rect.

RCA, CAMDEN, N. J.

Fixed: No. CT-2A, 30-44 Mc.

Transmitter: 60 w. to 50-70 ohm line; AC input 880 w. *Tubes:* 6SG7 speech amp; 6SJ7 osc; 6SJ7 mod; 6SL7GT lim; 6SJ7 mult; 6SJ7 mult; 6V6 mult; 2)807 output; 2)5R4GY rect. *Notes:* Desk mike or handset; RCA crystal RC-1.

Fixed: No. CT-4A, 30-44 Mc.

Transmitter: 250 w. to 50-70 ohm line; AC input 880 w. *Tubes:* same as No. CT-2A, except 2)8005 output plus 2)866A rect.

Mobile: No. CMV-2A & 3A, 30-50 Mc.

Transmitter: 30 or 55 w. output; 2.71 a. (30 w.) or 3.63 a. (55 w.) stby.; 39 a. or 60 a. trans. *Tubes:* 6AK5 osc; 6C4 mod; 6BH6 trip; 6BH6 trip; 5763 doub; 807 output (30 w.) or 2)807 output (55 w.); 12AU7 AF; 6AQ6 AF lim. *Notes:* Military mike or handset; dynamotor supply; 2-freq. operation available.
Receiver: double superhet.; Mallory vibrator; RCA crystal HC6; 5.5 a. *Tubes:* 6BH6 RF; 6BH6 osc-mult; 6BH6 1st mix; 6BH6 IF; 6BH6 2nd mix; 6BH6 IF; 6BH6 IF; 6BH6 lim; 6BH6 lim; 6AL5 disc; 6AL5 noise rect; 12AX7 AF; 12AK6 output.

Fixed: No. CT-5A, 152-162 Mc.

Transmitters 45 w. to 50-70 ohm line; AC input 390 w. *Tubes:* 6SG7 speech amp; 6SL7 lim; 6SJ7 osc; 6SJ7 mod; 6SJ7 mult; 6SJ7 mult; 6V6 mult; 1614 mult; 829B mult; 829B output; 2)5R4GY rect. *Notes:* desk mike or handset; RCA crystal TWV-129.

Fixed: No. CT-6A, 152-162 Mc.

Transmitter: 250 w. to 50-70 ohm line; AC input 1000 w. *Tubes:* same as No. CT-5A, but with 2)4D21 output tubes, plus 2)866 rect.

Mobile: No. CMV-1A, 152-174 Mc.

Transmitter: 10-12 w. output; 2.9 a. stby.; 20 a. trans. *Tubes:* 6BH6 osc; 6AQ6 AF; 6BH6 AF lim; 6BH6 mod; 6BH6 amp; 6BH6 trip; 6BH6 trip; 6AQ5 doub; 2E26 doub; 2E26 output; OZ4A rect. *Notes:* Military mike or handset; dynamotor supply; 2-freq. operation available.
Receiver: double superhet.; 24 & 2 mc. IF; Mallory vibrator; RCA crystal HC-6; 5.5 a. *Tubes:* 6BH6 RF; 6BH6 RF; 6BH6 osc; 6BH6 osc mult; 6BH6 1st mix; 6BH6 IF; 6BH6 2nd mix; 6BH6 IF; 6BH6 IF; 6BH6 lim; 6BH6 lim; 6AL5 disc; 6AL5 noise rect; 12AX7 AF; 6AK6 output.

WEST COAST ELECTRONICS CO.
Los Angeles 6, Calif.

Fixed: No. FFM25-150B, 152-162 Mc.

Transmitter: 25 w. to 52-ohm line; AC input 300 w. *Tubes:* 6AK6 osc; 6BJ6 mod; 6BJ6 speech amp; 6J6 quad & trip; 6AK6 doub; 6AK6 doub; 6AK6 doub; 832-A output. *Notes:* Shure dynamic or W.E. carbon mike; Mon. Prod. temp. cont. crystal.
Receiver: double superhet.; 23.5 & 2.1 mc. IF; Mon. Prod. crystal. *Tubes:* 6AK5 RF; 6J6 osc & trip; 6AK6 doub; 6AK5 1st mix; 6AK5 IF; 6BE6 2nd mix; 6BJ6 IF; 6BH6 IF; 6BH6 lim; 6BH6 lim; 12AX7 AF & sq; 6BH6 noise amp; 6AK6 output.

Fixed: No. FFM50-150B, 152-162 Mc.

Transmitter: 50 w. to 52-ohm line; AC input 440 w. *Tubes:* same as No. FFM25-150B plus 829B output.
Receiver: same as No. FFM25-150B.

Mobile: No. MFM 15-150, 152-162 Mc.

Transmitter: 15 w. to RG8U or RG58U line; 6 v. input, 11.5 a. stby.; 23 a. trans. *Tubes:* same as No. FFM25-150B. *Notes:* Shure mike CB-12A; Mon. Prod. temp. cont. crystal; Mallory vibrator 1501.
Receiver: same as No. FFM25-150B.

Mobile: No. MFM25-150B, 152-162 Mc.

Transmitter: 25 w. to RG8U or RG58U line; 6 v. input, 10.5 a. stby.; 34 a. trans. *Tubes:* same as No. FFM25-150B. *Notes:* dynamotor supply, Shure mike CB-12A; Mon. Prod. temp. cont. crystal.
Receiver: same as No. FFM25-150B.

NOTE

Part 1 of these specifications was published in the October issue of *FM-TV*. The equipment manufacturers represented in Part 1 were: Communications Company, Inc., Doolittle Radio, Inc., Federal Telephone & Radio Corporation, General Electric Company, Harvey Radio Laboratories, Inc., Kaar Engineering Company, and Link Radio Corporation.

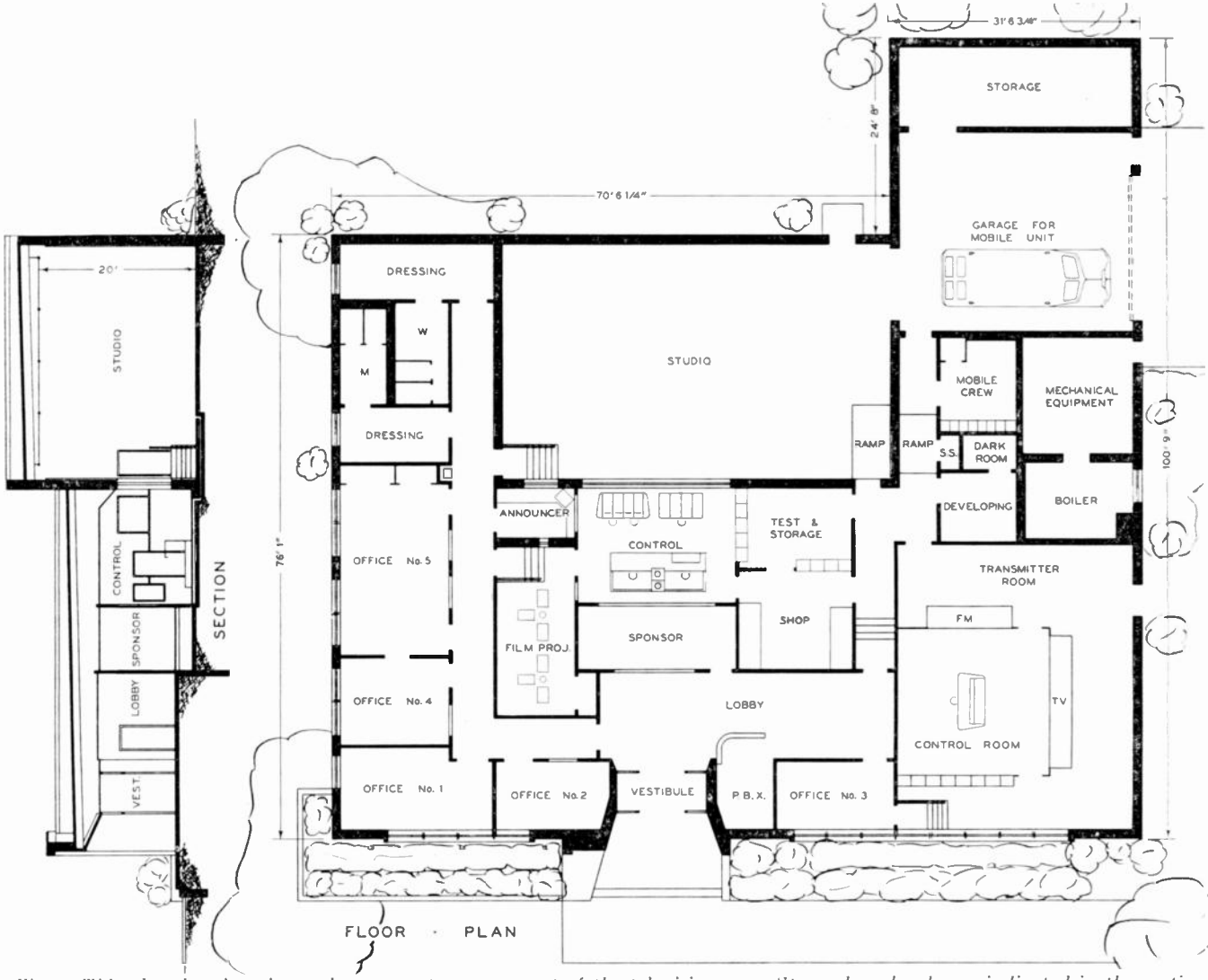


Fig. 1. This plan drawing shows the compact arrangement of the television area. Stepped up levels are indicated in the section

FM-TV STATION AT DAYTON, OHIO

HOW THE AUSTIN COMPANY MET TECHNICAL REQUIREMENTS IN AN ARCHITECTURAL DESIGN ACCEPTABLE IN A RESIDENTIAL AREA—*By* L. M. DRUCKENDROD*

IT is a far cry from the radio shacks that broadcasters once ran up, to the type of construction represented by the building recently completed for the Miami Valley Broadcasting Corporation's FM and TV transmitters. This applies not only to the outward appearance but to the facilities provided. An examination of the floor plan, Fig. 1, indicates such postwar innovations as a garage for a mobile TV transmitter, developing and dark rooms, film projection room, an air-conditioning installation, and as much space for testing and shop equipment as the total area once allocated to an entire broadcast transmitter house.

The WHIO building is also distinguished by its outward appearance. The simple lines, carried out in brick and limestone, were dictated by the fact that the location is a residential area, on Dayton's Wilmington Pike. Still, as the accompanying illustrations show, the functional plan and convenience of the operating personnel were not sacrificed in the least particular.

Studio Section:

Nucleus of the arrangement is the area comprising the studio, studio control, and sponsor's room. The sectional drawing, Fig. 1, indicates the 3-level construction. Figs. 3 and 6 show that the control operators look down into the studio, while observers in the sponsor's room look over the heads of the operators.

Fig. 2. The main entrance of limestone, flanked by back-lighted aluminum letters

*Broadcast Division, The Austin Company, Cleveland, Ohio.

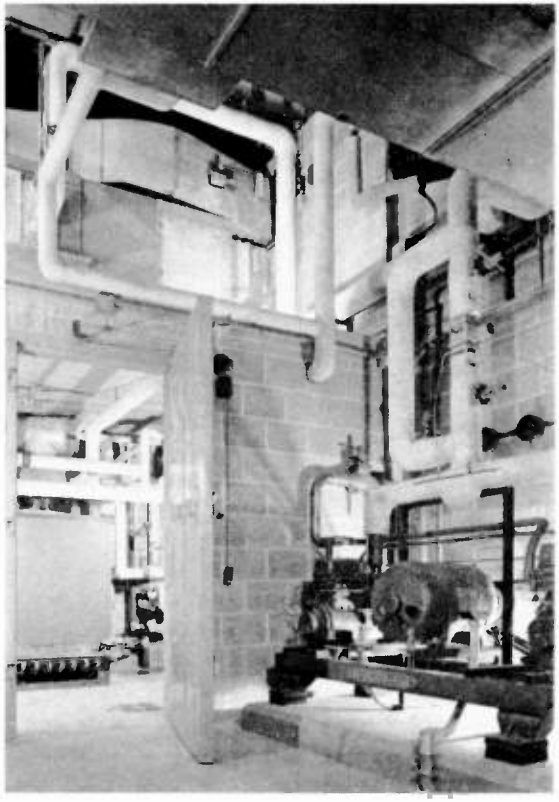


Fig. 3. The studios as seen from the sponsor's room. Note projection room and announcer's booth. Fig. 4. View of the boiler room

Immediately adjacent to this area are the film projection room, Fig. 7, a small announcer's booth, a shop, and space for test equipment and storage. By surrounding the television facilities with corridors, they are isolated effectively from all other activities. At the same time, visitors in the reception lobby can see the television stage by looking through the rear window of the sponsor's room.

The same degree of convenience is provided by putting the property-storage and garage areas adjacent to the studio at the rear. This permits the transfer of cameras and other equipment between the studio and the mobile unit with a minimum of time and effort. If heavy items must be brought into the studio, a truck can be backed right up to the door, and access is provided for programs involving automobiles, as shown in Fig. 8.

Program production experience indicates that the studio space provided is adequate for such shows as will be originated locally. As is shown in Fig. 1, the room is 30 by 49 ft., with a ceiling height of 20 ft. Floor and lower walls are concrete, the former painted a soft gray, and the latter blue-gray. The upper walls have acoustic treatment on three sides, comprising alternate bands of perforated and flat asbestos cement board.

The announcer's room has large windows opening into the studio and control room, and a narrow window, visible in Fig. 7, into the projection room. Under this arrangement, the announcer and the program director have complete visual as well as voice communication.

Transmitter Installation:

Figs. 9 and 10 show opposite sides of the transmitter control room. On the left in Fig. 9 is the Western Electric FM transmitter, with the RCA television transmitter on the right. Additional TV units can be seen in Fig. 10. The control console is also an RCA installation. Removable floor plates cover the ducts which carry power, video, audio, and

Fig. 7. RCA film and slide projection equipment. Fig. 8. Mobile TV unit, and view of the studio through the service entrance

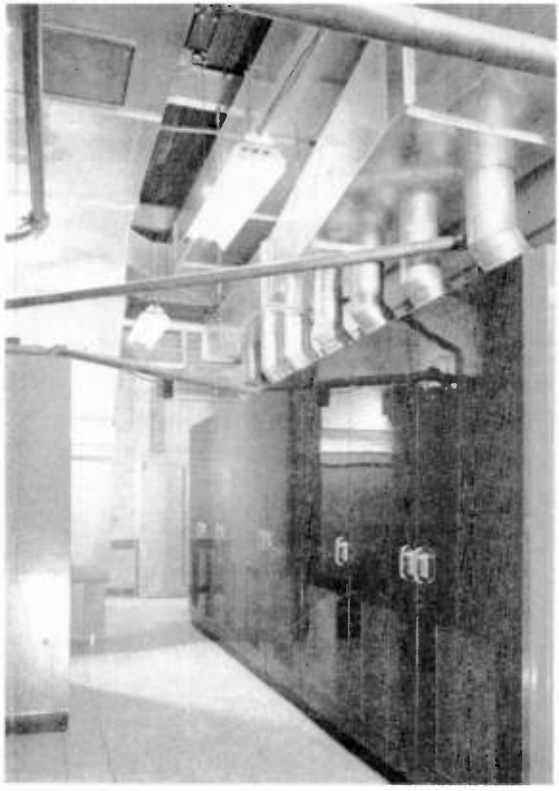


Fig. 5. Heat from FM transmitter is exhausted outdoors, or used to heat the building. Fig. 6. TV studio, looking toward sponsor's room

control wires. Acoustic wall tile painted pastel blue combines with the red asphalt tiling to create a very agreeable effect.

Fig. 5 shows the rear of the FM transmitter, and the manner in which heat produced by the tubes is vented to the outside, during warm weather, or returned for use in heating the studio during cold weather. The sideband filter is located at the extreme left, with the transmission line in the foreground, above. In the background at the left is a ventilating unit with a capacity of 7,850 cubic feet per minute.

Heating and Ventilating:

The principal heating and air-conditioning equipment for the building is located in the boiler room, Fig. 4. Heat is provided by a Bryant gas-fired boiler, which can be seen through the doorway. A pair of Frigidaire compressors, operating in tandem, furnish 25 tons of refrigeration for the McQuay air-conditioning unit.

This has been mounted on a concrete floor slab directly above the boiler room. The system handles approximately 7,000 cubic feet per minute, regulated by economizer controls. It serves the television control room, announcer's booth, transmitter control room, film-processing area, and the mechanical shop. A corner of the water-cooling tank for the television transmitter can be seen on the left, and a portion of the studio-return air duct in the foreground above.

Future Expansion:

Although the facilities provided in the WHIO building are complete in every detail, a study of the plan will reveal that it was laid out with an eye to the possibility of future expansion. This is an important consideration in all new station construction, for broadcasting is a dynamic business, and experience has proven again and again that what may seem more than adequate at the beginning may be outgrown within a few years.

Fig. 9. W. E. transmitter and RCA transmitter and operator's console in control room. Fig. 10. Opposite view of control room

SPOT NEWS NOTES

NOTES AND COMMENTS ABOUT SIGNIFICANT ACTIVITIES OF PEOPLE & COMPANIES

FCC Commissioner Sterling:

Addressing the 33rd annual convention of the National Association of Taxicab Owners, at Buffalo: "Within 5 years, a taxi without a radio will be as rare as a surrey with the fringe on top. . . . Two-way radio eliminates great economic waste, since 40% of all taxi mileage, running into millions of miles, has been dead mileage."

Audible Warnings for Pilots:

The Royal Aircraft Establishment at Farnborough, England, has developed a warning system, based on the use of phrases recorded on plastic tape, to tell pilots what has gone wrong when equipment failures occur in the air. Operation of the system was demonstrated at the recent Radiolympia show in London.

Broadcast Equipment Sales:

Shipments billed by RMA members in the first 6 months of '49 show AM transmitters $552,000; FM transmitters $548,000; studio equipment $1,204,000; and antennas and towers $293,000. The RMA report lumps TV transmitters, antennas, and associated items in a single figure of $531,000.

300 Phonevision Sets in Chicago:

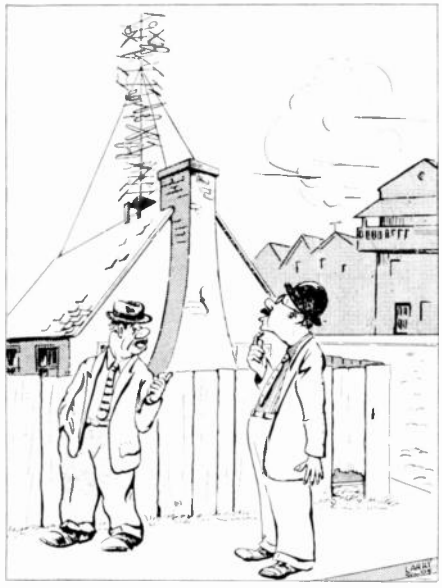
Early next year, 300 Zenith Phonevision TV sets will be hooked up to telephone lines, according to an announcement in the *Chicago Daily News*. Set owners who ask Central for a connection to receive a feature movie will be charged $1 on their telephone bills. During the Phonevision reception, incoming and outgoing calls can be handled without interruption.

Jim Lansing, 1902-1949:

President of James B. Lansing Sound, Inc., passed away suddenly at his ranch in San Marcos, Calif., on September 29. In 1927, he founded the Lansing Manufacturing Company which, through consolidation, became the Altec Lansing Corporation in 1941. He served as vice president until resigning in '46. Two years ago, he formed the new company which bears his name. Now, Jim Lansing has been succeeded by William H. Thomas, formerly secretary-treasurer. Leonard Larson will continue as vice-president and sales manager.

FCC Television Hearing:

In case you have wondered why we haven't undertaken to report on the TV hearing in detail: The only thing about the proceedings that has impressed us is its tremendous cost to the industry. As for the testimony, it seems to be important only as a record for the FCC files. We still do not expect that color will be authorized on VHF. Privately, we'd put a little money on that opinion. Publicly, we admit frankly that it's only an opinion, and one which may prove to be 180° out of phase!



"Eager beaver ain't he?"

FM for Guided Missiles:

It seems as if practically every new radio development is being built around the use of FM. Latest to come to our attention is the application of FM to guided missiles. Reason is that this system is less subject to interference.

Further Progress:

Robert Olds, TV film production manager for BBDO, recently told members of the National Television Film Council that the agency men are completely baffled over the poor home reception of some spot commercials that look simply beautiful in the studio picture monitors. Well, well! Those agency men are really alert. Next thing you know, one of them will discover just how interference and fading on AM louse up some of the audio shows that sound so delightful in the studio speakers!

A. E. Bennett:

Former electronics consultant with the Air Force, and recently chief engineer of Hoffman Radio, has joined Audiograph Company, San Carlos, Calif., as chief engineer and general manager.

August Receiver Tube Sales:

Above July by 3.4 million, to a total of 13,505,940, according to RMA figures. This was 3.1 million below August '48. The breakdown shows 9,659,033 sold for new sets, 2,788,824 for replacements, 779,811 for export, and 278,272 to Government agencies.

Mobile Radio for Nebraska:

Consumers Public Power District, with headquarters in Columbus, Neb., will install fixed stations at 28 offices throughout the state, and mobile units on 155 service trucks and passenger cars. Motorola equipment will be used.

Logging FM Stations:

With so many FM stations coming in on our Zenith Major set, the distaff side of our house has had trouble keeping up with them. We've solved that problem. Using some fine sandpaper, we removed the lacquer from the metal scale. Now the surface takes and holds pencil marks which indicate the points at which the important stations come in. This has proved to be a very practical idea.

TV Set Production:

According to vice-president R. A. Graver, Admiral produced 57% of all TV phono combinations built during the first 6 months of this year, and 23% of all TV sets.

Microwave Relay for KNBC-FM:

An REL link, operating on 946 mc., has been installed to carry programs from the San Francisco studios to the transmitter on San Bruno Mountain. Airline distance is 6.9 miles.

Change of Address

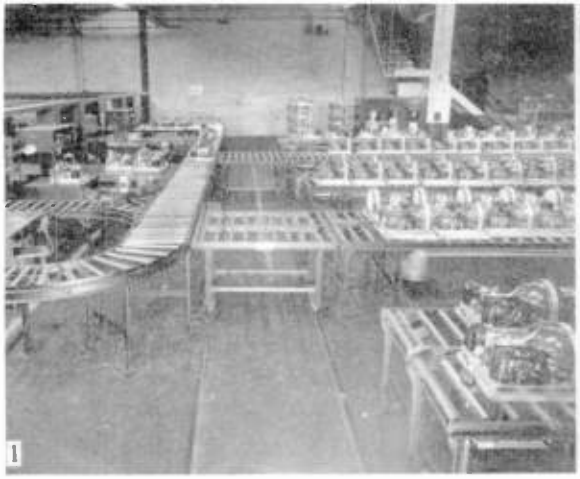
Executive offices of the Du Mont receiver sales division have been moved from 515 Madison Avenue, New York City, to the new plant at 35 Market Street, East Paterson, N. J. The phone is Sherwood 2-7400.

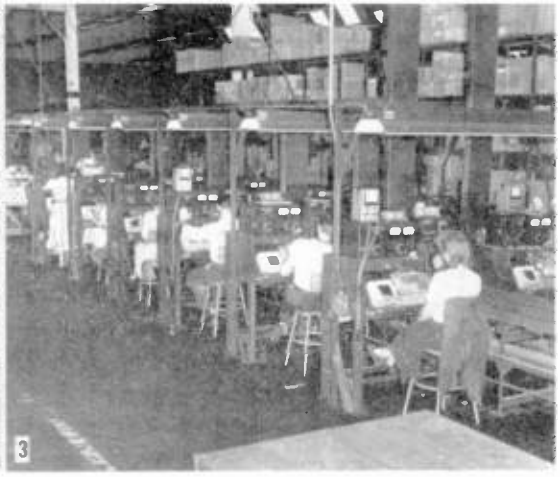
Mobile Radio Production Moved:

Raytheon mobile radio equipment, previously manufactured at the Belmont, Chicago plant, will soon be produced at Raytheon's main factory in Waltham, a suburb of Boston. The entire operation will be under Ray Ellis, vice-president in charge of the equipment sales division.

Audio Equipment Shift:

Western Electric has withdrawn from commercial activities in microphones, speakers, and disc reproducing equipment. Under an agreement effective last October 1, Altec Lansing has acquired all the rights, designs, and tools for manufacturing those W. E. items, so that they will still be available to the trade. Sales and service will be handled by Graybar Electric, as in the past.





NEWS PICTURES

1. In the new DuMont plant at East Paterson, N. J., formally dedicated on September 26, there are 1¾ miles of conveyors to move TV sets.

2. Two of the 475-ft. assembly lines at the DuMont plant. This building occupies 480,000 square feet, employs 2,700 workers, has no time clocks. Since the company started 19 years ago with four employees, there has never been a work-stoppage due to a labor dispute.

3. In this section of the DuMont plant, Inputuner head-end assemblies are carried on conveyors past a double line of test positions.

4. Don Lee station KTSL is using this Electra-Zoom TV lens invented by Joseph B. Walker, who appears in this picture, and H. L. Smith, the station's chief cameraman. This lens has an *f*3.1 aperture, with a focal length variable from 3 to 8 ins.

5. A new console-type tape recorder, manufactured by the Audiograph Company, San Carlos, Calif., for studio use. Mechanical and electrical design features are intended to meet all requirements of professional tape recording at tape speeds of either 7½ or 15 inches per second.

6. When officials of the Providence Journal station WPJB were unable to buy FM automobile receivers to check and demonstrate their wide coverage, they engaged Barber & Howard, of Westerly, R. I., to develop this 11-tube car set. It tunes over the entire FM band without any interference from the ignition system. In this photograph, left to right, are: receiver engineer Charles Snell, station manager H. William Koster, and WPJB engineer George Sharpe.

7. Part of the color television equipment set up by RCA at the Wardman Park Hotel, Washington, for demonstrations during the current FCC hearings on TV. The installation includes two color cameras for live studio productions, another for color film, and a fourth for color slides.

8. A general view of RCA's color television demonstration equipment at Washington. Ray D. Kell, head of the TV section at the RCA Princeton Laboratories, stands before the monitor.

9. This picture shows the interior of the RCA color television camera. It has two dichroic mirrors which allow green rays to pass through to the lens of the center orthicon tube, while reflecting red rays, via a silvered mirror, to the right hand tube. The blue rays are reflected by another mirror to the tube at the left. R. C. Webb is at the camera.

BUILDING CUSTOM-RADIO BUSINESS

MORE PEOPLE ARE SEEKING BETTER PERFORMANCE AND GREATER VALUE THAN ARE AVAILABLE IN FACTORY-BUILT CABINET MODELS—*By* ULRIC J. CHILDS*

LAST February, in the Audio Section of *FM-TV*, John Van Buren sold forth at some length on the superior performance and lower cost of custom-built radio phonograph installations as compared with commercial designs.[1] I must say that I concur with him. In fact, during the years that I have been handling custom radio equipment, I have built my business by demonstrating substantially finer reproduction quality than is delivered by much more expensive factory-built, cabinet-type instruments.

And when I say "substantially finer reproduction" I don't mean some slight improvement that different listeners might argue about. I am referring to a degree of difference that is obvious to all listeners.

Basic Requirements:

Such installations, of course, call for top quality circuits and components. In my installations, I use Browning RJ-12A FM-AM turners, all-triode 15- or 30-watt amplifier of my own design, and magnetic pickups. I don't use the ultra-expensive types of speakers for a very practical reason. Given a really fine amplifier, the extra cost of such speakers simply isn't justified by the results.

I often demonstrate this in a way that amazes my clients. I put my arm tightly around a cheap 8-in. speaker, and let them hear it on phonograph music. Driven by an ordinary amplifier, such a speaker with practically no baffle would have no bass at all, but with a really adequate amplifier the quality from even an inexpensive speaker is remarkably good. This is one way of showing the capabilities of the amplifier design I use.

Amplifier Design:

Both radio and record reproduction are specified for most installations. This calls for a pre-amplifier and equalizer ahead of the main amplifier. The equalizer is used only to provide the adjustment made necessary by the various recording techniques. It is not used in conjunction with radio reception because the transmitted quality of radio programs cannot be improved upon. This is particularly true of FM, where noise is completely limited by the Browning tuner.

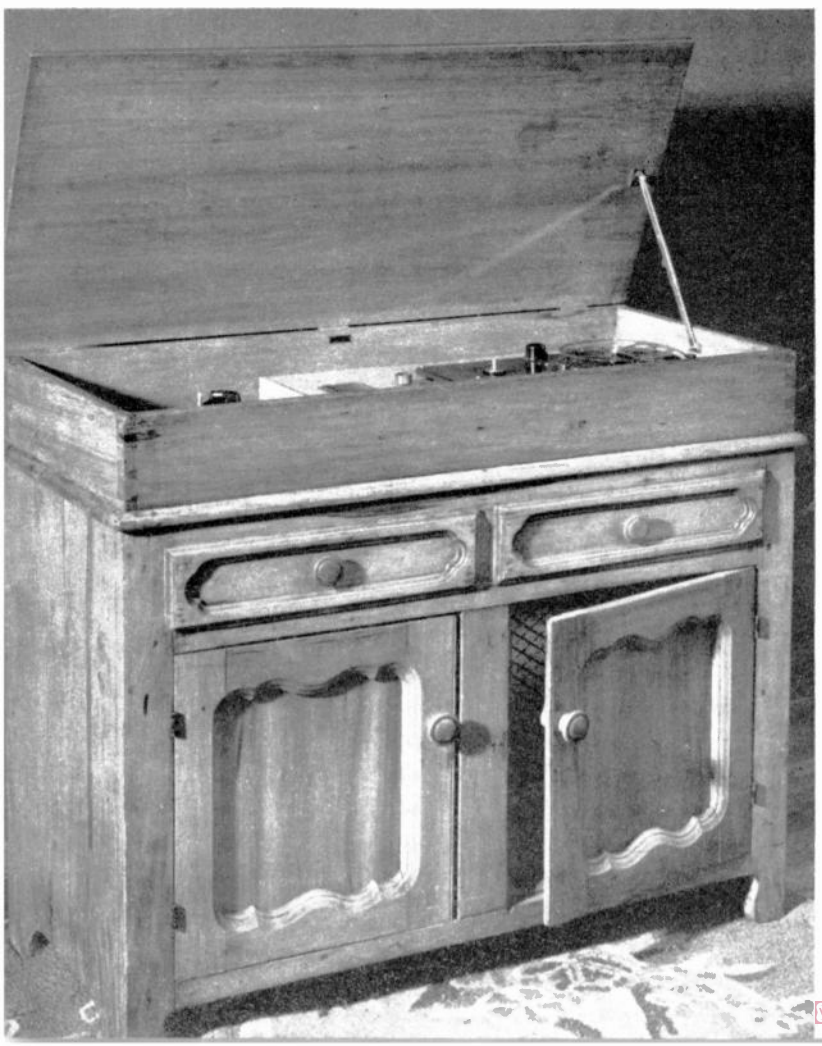
Usually, the pre-amplifier unit serves as a remote control. It has two equalizer controls with 20 positions, an on-off and radio phonograph switch, and fully-compensated volume control to maintain proper balance between treble and bass, regardless of reproduction level. The effect of completely eliminating bass response, characteristic of conventional volume controls at low-level settings, is thus avoided successfully. Hence, there is no need to run up the volume to get the best reproduction. This compensation is so perfect that, when the volume is reduced, it creates the impression that the speaker is actually being moved away from the listener. Two or three tubes are used in the pre-amplifier, in a circuit that provides cathode-follower output.

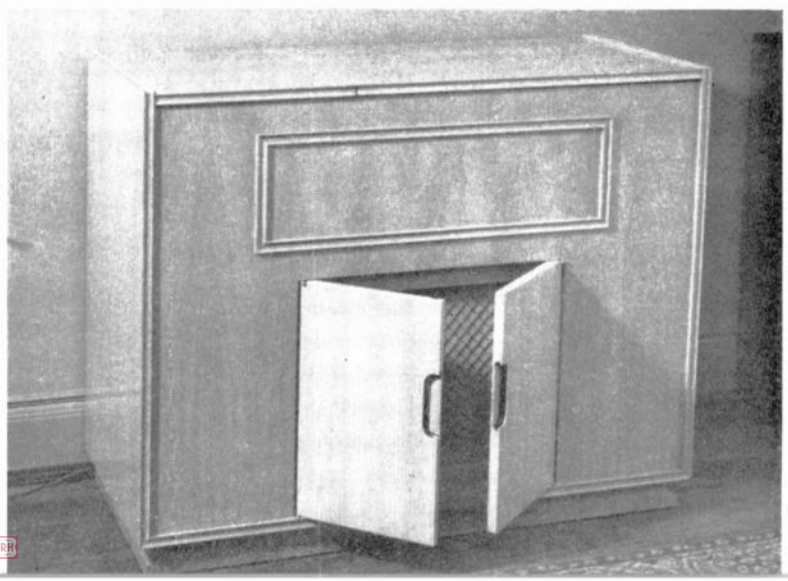
The amplifier is an all-triode design,

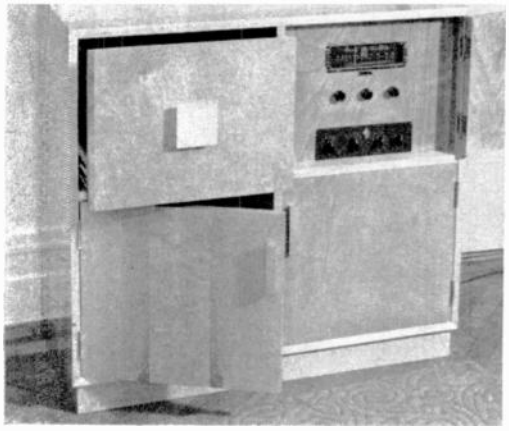
*1601 First Avenue, New York City.

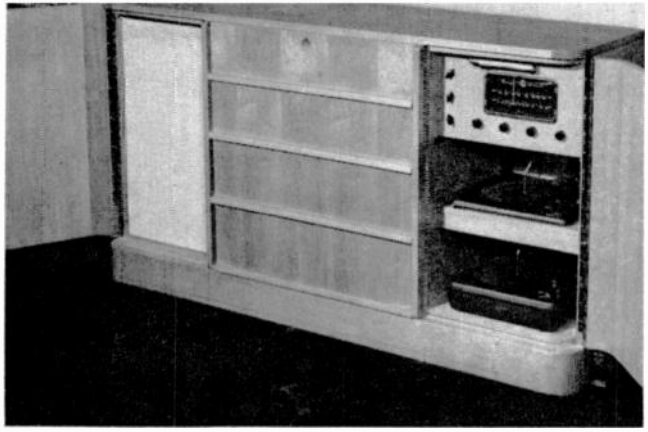
[1] "Cost vs. Quality in AF Circuits" by John M. Van Buren, *FM-TV*, February, 1949.

Fig. 1. Changer, Browning FM-AM tuner, and Magnecord recorder in an antique cabinet. Fig. 2. Similar units in a custom-built cabinet









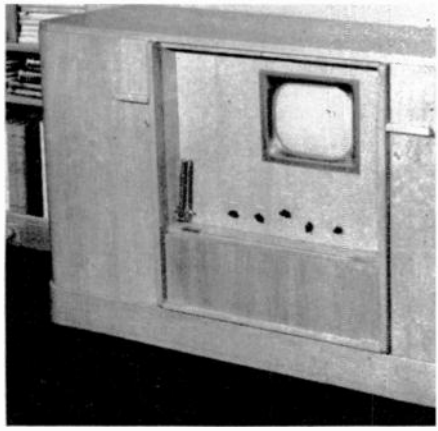


Fig. 3. In this instrument, the equalizer is below the Browning FM-AM tuner. Figs. 4, 5. The doors make this an audio or video set

with 7 tubes in the 15-watt and 11 tubes in the 30-watt model. Cross-coupled, cathode-follower input insures perfect balance between the two sides of the push-pull circuits. Cathode-follower output circuits are used to attain output regulation of 1 db. With such an amplifier, it is not necessary to use a reflex baffle for the speaker mounting. All hangover effects are completely avoided, and the resulting lifelike crispness throughout the audio spectrum is truly amazing.

Tape Recorders:

Frequently, my customers want recorders. In such cases, I supply Magnecord units. Sometimes they are only used to record off-the-air programs. In other instances, the owners want microphones, so they can record their own material. Even in case the improved audio quality of tape is not specified, I recommend it in preference to wire because the former is easier for non-professional people to handle.

Types of Installations:

The different types of custom installations fall into three general categories. These are:

1. Equipment installed in special pieces of furniture already owned by customers: A typical example is the antique chest shown in Fig. 1. The record changer, FM-AM tuner, and tape recorder are all accessible from the top, with the amplifier mounted below, and the speaker behind one of the doors.

2. Equipment installed in made-to-order cabinets: Jobs of this sort are illustrated in Figs. 2 to 5. This, of course, is a practical way for a client to meet the problem of furniture design, although it adds substantially to the price. Like most producers of custom installations, I am not equipped to build cabinets, nor would it be economical, in the long run, to set up for this work. Another consideration in a high-rent area of New York is the expense of the extra space required for woodworking machinery. Therefore, I have this work done by a cabinetmaker[2] who is very well aware of the absolute need of stout construction and the elimination of all loose joints that might rattle in response to speaker vibrations.

Such installations range over a wide variety of designs, both as to cabinets and the facilities provided. Figs. 4 and 5, for example, show a combination of audio and video equipment. Sometimes the speakers are mounted in the cabinets, sometimes the equipment and the speakers are at opposite ends of the room.

3. Equipment built into permanent cabinets or storage walls: Very often, clients do not want to use furniture pieces at all. Then the speakers must be mounted in wall-openings or in unobtrusive cases with the openings disguised by overall cloth covering. Careful planning and considerable ingenuity is called for, in order to fit the radio and audio units into existing shelves or closet space where it will be accessible and sufficiently ventilated. However, there seems to be a way out every time.

It is my practice, wherever practical, to recommend that the speaker be located at some distance from the receiver and record-player. Thus the controls can be at the most convenient point of access, and the speaker where it can be heard to best advantage. Also, and this should not be overlooked, the separation of set and speaker provide a degree of flexibility which women appreciate when they change the arrangement of their living room furniture.

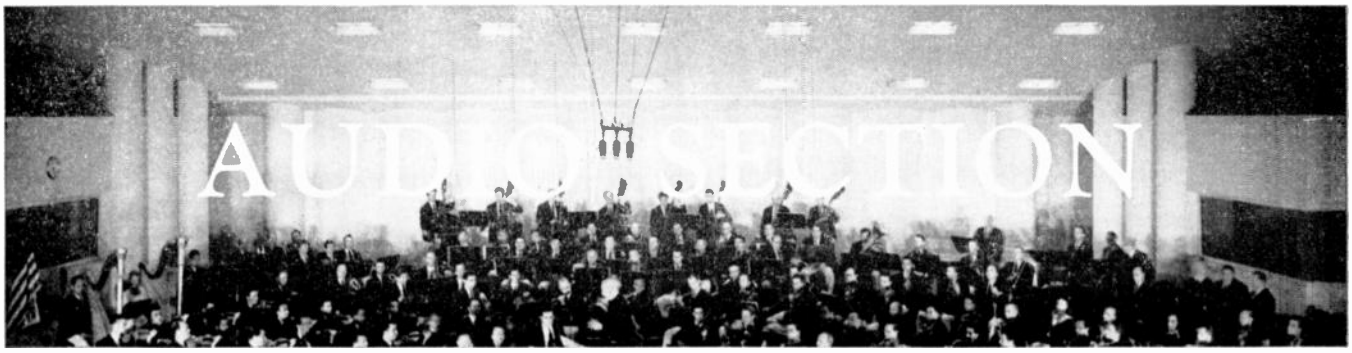
Building Custom Business:

Occasionally I am asked: "How do you get orders for this kind of radio work? Where do you find your customers?" The truth is that I seldom seek clients. For

(Continued on page 32)

[2]Bates & Bates Company, 152 E. 129th St., N. Y.

Fig. 6. Individual sound installations at Doubleday Book Shop's record department. Fig. 7. Buttons cut in any one of eight records



PORTABLE TAPE UNITS

THE DESIGN OF THESE PRESTO UNITS IS DICTATED BY FIELD OPERATING EXPERIENCE—*By* ALFRED JORYSZ*

IN any completely new equipment, the first models reflect the designers' idea as to the manner in which he expects them to be used, and such special requirements of service as can be anticipated. However, when new equipment is widely adopted by an industry, the users develop their own operating techniques, and their own ideas as to modifications that will best suit their needs.

This has been specifically true of tape recorders since they have been so widely used by broadcast engineers, and to the virtual exclusion of wire types. Thus it has been possible to survey the established requirements for the performance and application of portable tape recorders, and to produce a new design which includes all the features indicated by experience, and omits those found unnecessary. That, briefly, is the background story of the Presto PT-900 equipment.

Fig. 1 shows the recorder, which is contained in one case, while the power supply, Fig. 2, and the amplifier section, Fig. 3, lock together to form the second case. Each weighs less than 40 lbs., making the total weight under 80 lbs.

Design of the Recorder:

The recorder unit contains the reels and motor drive, separate heads to erase, play, and record, a movable tape guide to save wear on the heads during fast rewind, a switch to select either 7½ or 15 inch-seconds drive, a control lever which can be set to rewind, stop, play, or record, and circuits for erase and bias supplies. It is not necessary to use the unit in a vertical position, as it is designed to operate at any angle.

Both the reels and the main capstan are driven through a system of idlers by a single two-speed hysteresis-type synchronous motor, operating at 900 or 1,800 RPM. This has proved entirely satisfactory for reels up to 7 ins. in diameter, which this equipment accommodates. Rewind speed is about 15 times the normal operating speed, and the fast forward speed is about 5 times normal. Of course, there is much to be said for the use of three separate motors, but the resulting space and weight requirements prohibit such a drive in a machine that operators will consider as being actually portable.

The use of three separate heads for erase, record, and playback, offers advantages in both audio performance and flexibility of operation. The best recording and playback heads are of dissimilar designs. Any combination head, therefore, must be a compromise between the optimum characteristics available in separate heads. Another advantage is that, with a separate playback head, an azimuth adjustment is provided.

Operationwise, with the playback head following the recording head, it is possible to monitor the tape, rather than the amplifier driving the recorder. In the latter case there is the disadvantage that the operator always hears the program, even though the recording head is putting nothing on the tape!

Power Supply and Amplifier:

Voltage regulation in the power supply, Fig. 2, delivers a constant output at line voltages of 100 to 130 volts. DC is provided for the filaments of the first-stage tubes of the amplifiers. All connecting cords can be stowed away in the lower section of the power supply case.

The amplifier unit contains the separate record and playback amplifiers, with input channels for three microphones and one line, and a built-in high-impedance bridge for the line. The upper knob at the left is the equalizer control for remote, 7½-in., or 15-in. tape operation. At the right is the switch for the VU meter which indicates the level at remote, record, and playback operation, and the bias and erase current.

Across the lower part of the panel are

(Concluded on page 30)

*Development Engineer, Presto Recording Corporation, Box 500, Hackensack, N. J.

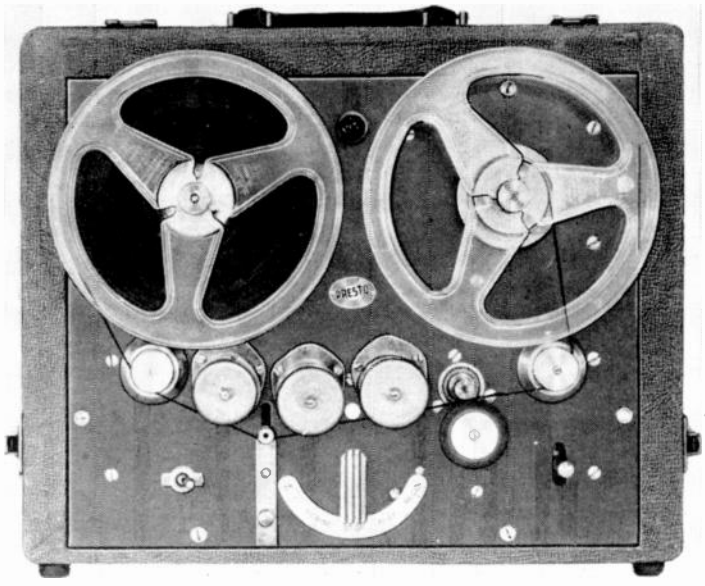


Fig. 1. Important feature of this tape recorder is the use of three separate heads

DESIGN OF RECORDING SYSTEMS

PART 2: THIS DETAILED DESCRIPTION OF A COMMERCIAL RECORDING STUDIO SHOWS THE VERSATILITY OF UNITIZED EQUIPMENT—*By* LEON A. WORTMAN*

LAST month, the author discussed the 14 basic elements of professional recording installations. Part 2 undertakes to show how these 14 units, represented in Fairchild recording equipment, can be arranged in a typical commercial studio. The installation shown in the accompanying illustrations called for complete equipment for cutting original and master disks, instantaneous audition disks, and dubbings to afford a program service for commercial broadcasters. Extremely versatile facilities were necessary, since the programs were to include dramatic presentations, comedy, musical variety, disk jockey, and personality interviews, ranging from 5 minutes to 1 hour in length.

In such an installation, program material must be recorded on both tape and disks: tape, so that the program material can be edited for time and context; disks for cutting masters of the program material originally recorded on tape. The character and variety of the programs require multiple-channel mixing of sound effects, voices, and music. This installation, therefore, represents an excellent example of unitized design application because of the extreme degree of flexibility required.

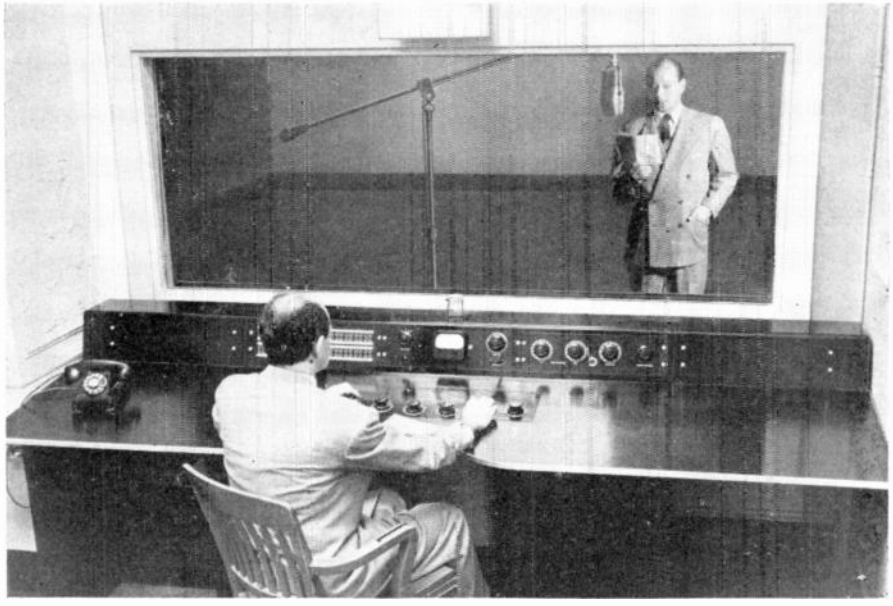


Fig. 1. Arrangement of the control room and studio A. The author is at the mike

*Technical Data Division, Fairchild Recording Equipment Corp., Whitestone, N. Y.

Fig. 2. Cutting-room equipment, in the form of a U, facilitates one-man operation

Plan of the Installation:

Floor space was acquired for the construction of 2 studios, a control room, cutting room, echo chamber, library, offices, and storage space. Studio A, 26 by 30 ft., is used for musical and dramatic shows. Utility studio B, for interviews and disk jockey shows, is 15 by 12 ft. Ceilings are 15 ft. high. Wall and ceiling panels of 3-in. Fiberglas are covered with Monk's cloth. Doors are felt lined and sound-trapped.

The control room, 11 by 11 ft., is shown in Fig. 1. This is adequate for a combination operator's console and producer's desk, with seating facilities for observers. The window separating the control room and studio A is constructed of 2 panes of glass at non-parallel angles, to break up sound reflections and increase the effective acoustic isolation between the two rooms. The felt strips on which the thick glass panes are mounted practically eliminate sound conduction.

The cutting room, Fig. 2, is adjacent to the left wall of the control room. A small 2-pane glass window provides visual communication between control and recording engineers.

Fig. 3 is a block diagram of the complete installation. It should be noted that the entire facilities are made up from the basic equipment units previously described. All preamplifiers, booster and power amplifiers, and power supplies are stock items. The mounting trays and panels for the basic plug-in units require no more than inter-wiring. The only deviations from standard Fairchild production equipment are the control room console and the small consolette between the turntables in the cutting room.

Control Room Equipment:

The control room is equipped to mix audio from five separate signal sources simultaneously. The operator, seated at the console, has all controls and the patch board within arm's length. The table surface is at a slight incline, with the mixing controls mounted on a steel panel at the center. The operator, by pivoting his forearm, can easily handle the 5 mixing controls and master atten-

uator. The VU meter panel carries the master AC switch for the audio equipment. On the same panel is a lever type switch for actuating the talkback circuit. This switch energizes two relays. One transfers the input of the control room monitor amplifier to the output of the talkback microphone preamplifier. The other relay transfers the output of the control room monitor amplifier to the cutting room talkback speaker and to a talkback speaker in studio A.

The VU meter can be transferred, through the patch board, and inserted across three audio lines. A 3-position switch immediately to the left of the meter enables instantaneous VU readings of the three audio channels. The panel to the right of the meter panel carries the gain controls for the input and output audio channels of the echo chamber, control room, and studio monitor loudspeakers. The panel to the left of the meter panel carries the patch board jack strips.

Fig. 4 shows a section of the cabinet space of the console table with the front access door removed. All units plug into the mounting trays, which, in this installation, are mounted on three levels. Details of the trays and plug-in units are shown in Fig. 5. The top level contains the line or output amplifier for the

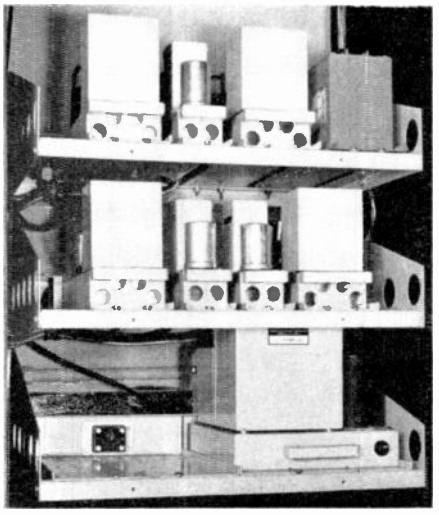


Fig. 4. Plug-in units under control desk

console, which feeds the cutting room. Beside this is the talkback microphone preamplifier and another output amplifier which doubles as the talkback power amplifier and the control room monitor amplifier. The two talkback relays and a loudspeaker matching transformer are also located on the top tray.

The middle tray contains the echo chamber audio channel, comprising two preamplifiers and two line amplifiers. The bottom level carries the power supplies, illustrated in Fig. 5, for the audio equipment in the control room. Fig. 4 shows one of the units removed to demonstrate the plug-in method. The 5 microphone preamplifiers for studio A and the talkback microphone preamplifier are all of the type illustrated in Fig. 5. They plug into one mounting tray in the console cabinet. Fig. 3 indicates the extensive patch system provided for the control room.

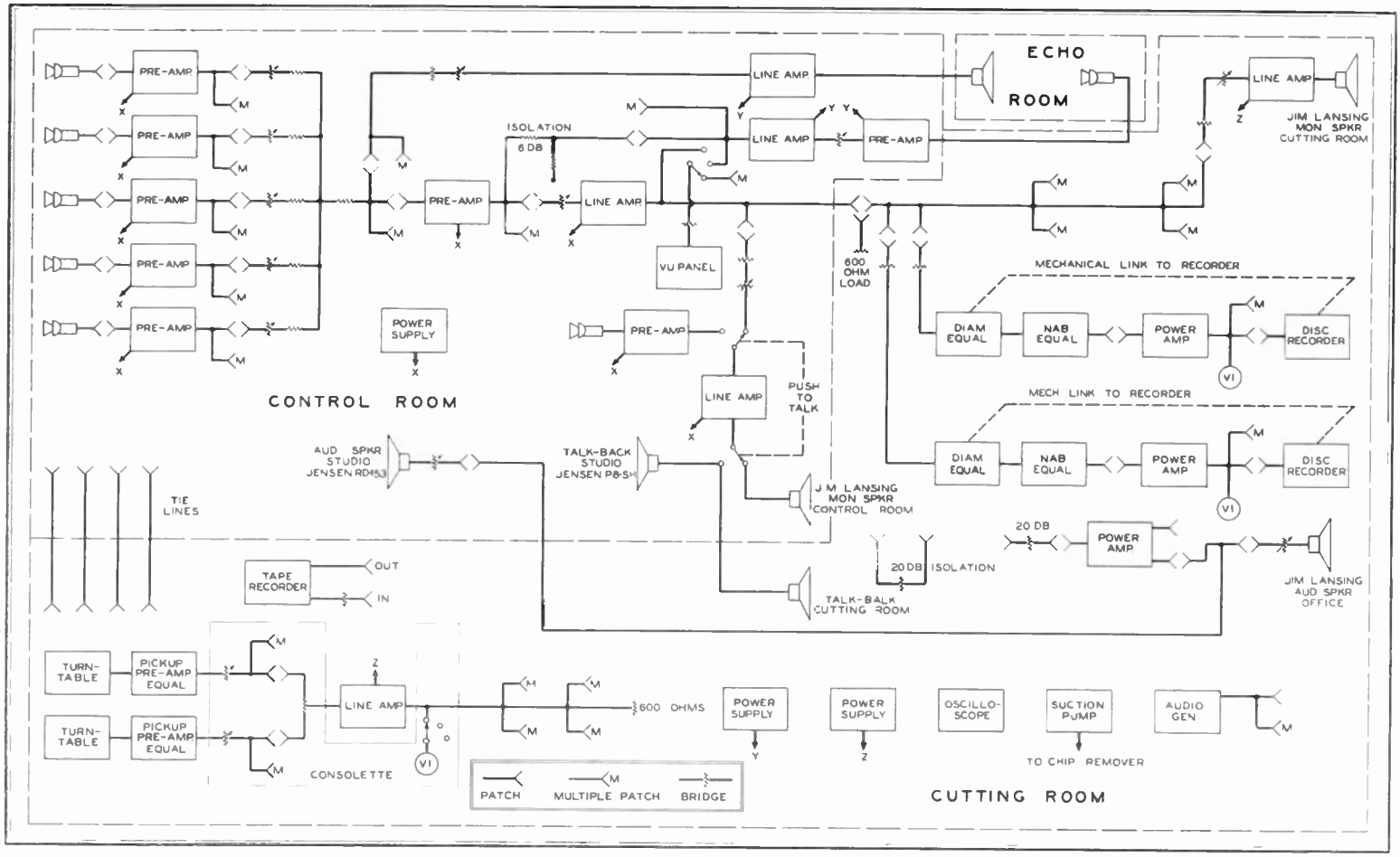
On the wall above the observation window are signal lights for standby and go-ahead cues. In addition, telephone communication is provided between the cutting room, control room, and offices.

Cutting Room Installation:

Four tie lines connect the control room with the cutting room, Fig. 2. However, as Fig. 3 indicates, the audio rack in the recording room can be operated for cutting purposes independently of the control room audio equipment. The advantage of this plan is the realization of the most efficient use of studio and electrical equipment from the time standpoint. For example, a program cast can be rehearsed under the ideal conditions of production from the control room monitor, while the cutting room is being used for editing, dubbing, and cutting program material previously recorded.

The equipment is arranged in a U, to

Fig. 3. This block diagram shows the distribution of equipment employed in the control room, cutting room, and echo chamber



New Higher Power Electron Tube with All-Ring Seals

Now Available for Full Power Operation Up to 110 mcs/sec.

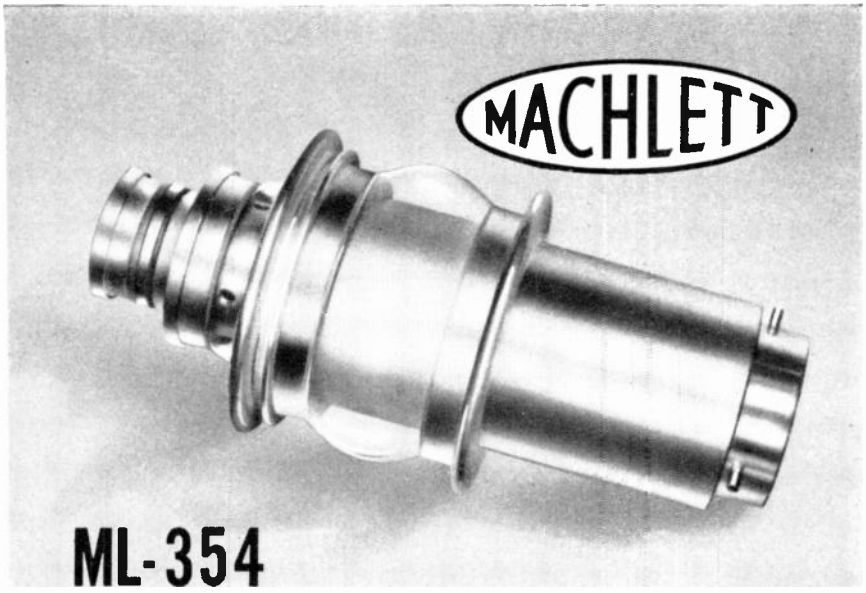
The availability of the Machlett ML-354, a compact, super-power water and forced-air cooled triode for operation up to 110 mcs/sec. in FM, AM, TV and industrial service is a contribution of significant proportion to progress in all fields of electronic development. The tube is provided with coaxial filament, grid, and plate seals, making it ideally suited to cavity-type circuits.

Superior Design Features

Developed to satisfy the need for higher-power electron tubes in broadcast, communications, research, and industrial services, this all-ring-seal triode is of a balanced electrical and mechanical design. Its low plate impedance makes it ideally suitable for broad band applications. All electrodes mount directly from heavy copper cylinders, resulting in a structure which is far superior, electrically and mechanically, to conventional water-cooled electron tube design; all glass-to-metal seals are of Kovar, and the large diameter seals give increased strength and freedom from excessive heating at electrode contacts. The tube incorporates a high-conductivity, heavy-wall copper anode. The integral anode water jacket and quick change water-coupling, contribute to easy and rapid tube replacement. The cathode is a 16 strand self-supporting thoriated-tungsten filament, completely balanced and stress-free throughout life. The rigidly supported grid and cathode are designed to give uniform anode heating. The grid is capable of unusually high heat dissipation contributing to maximum stability of tube performance and circuit operation.

Wide Application

The foregoing design features and characteristics are incorporated in the ML-354 triode, developed by Machlett Laboratories, Inc., Springdale, Conn. The ML-354, having basic design features usable over a wider range of power and frequencies than has been heretofore available in triodes, finds applications, among others, in high-power AM, FM and TV broadcasting, cyclotron and synchrotron oscillators and in induction and dielectric heating.



DESCRIPTION

The **ML-354** is a compact, general purpose, high power electron tube designed for operation at full power up to 110 mcs/sec. It is an all-ring-seal water and forced-air-cooled triode capable of giving in excess of 50 kilowatts output power at 108 mcs/sec. in grounded grid circuits with 10 kilowatts driving power. Considerably higher power is available at lower frequencies. This tube is ideally suited for cavity operation, and its low plate impedance is advantageous for broad band applications. Features include Kovar glass-to-metal seals, sturdy electrode structures, integral anode water jacket, and quick change water coupling. The cathode is a stress-free self-supporting thoriated-tungsten filament.

GENERAL CHARACTERISTICS

Electrical		Mechanical	
Filament Voltage	12.5 volts	Mounting	Vertical, Anode Down
Filament Current	220 amps	Water-flow on Anode	
Amplification Factor	25	for 75 KW Dissipation	45 gpm
Interelectrode Capacitances		for 50 KW Dissipation	30 gpm
Grid-Plate	65 uuf	Air Flow on Seals	
Grid-Filament	83 uuf	to limit glass to 165°C.	220 cfm
Plate-Filament	2.4 uuf	Net Weight, approximate	40 lbs

MAXIMUM RATINGS: Radio-Frequency CW Oscillator

	Max. Freq. 50 mcs/sec.	*Max. Freq. 110 mcs/sec.*	
DC Plate Voltage	15	9	kVdc
DC Plate Current	13	13	Adc
DC Grid Voltage	−1.6	−1.6	kVdc
DC Grid Current	2.5	2.5	Adc
Plate Input	195	100	kW
Plate Dissipation	75	50	kW

For complete technical data on the ML-354 high power, all-ring-seal triode, write to Engineering Department.

MACHLETT LABORATORIES, INC.
Springdale, Conn.

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MACHLETT OVER 50 YEARS OF ELECTRON TUBE EXPERIENCE

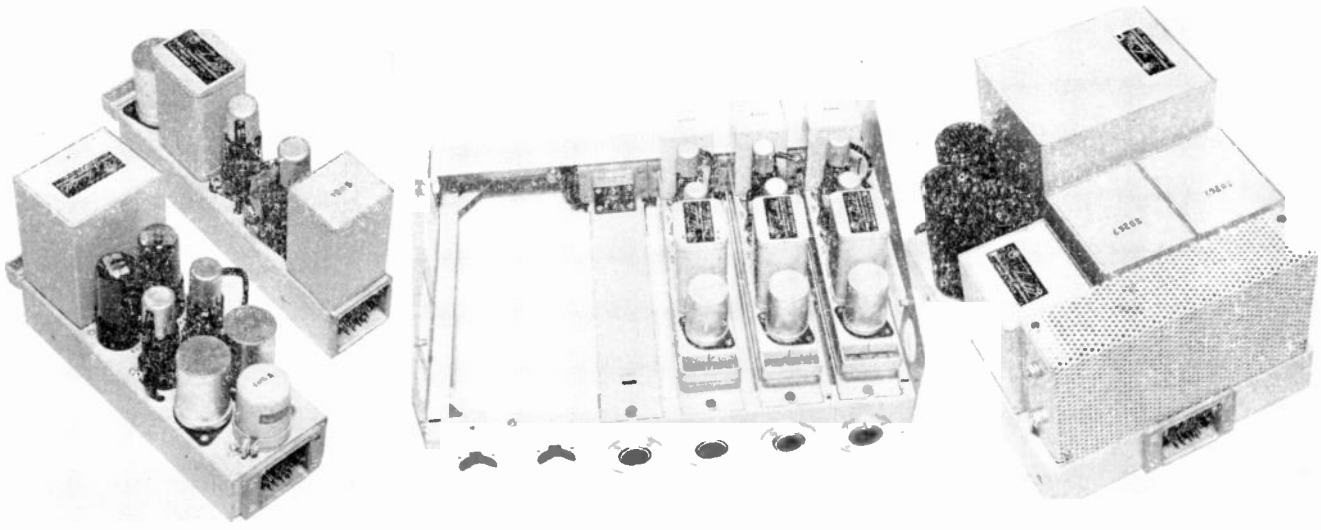

Fig. 5. Fairchild plug-in units, left to right, model 623 line amplifier, 621 preamplifier, plug-in mounting, and 632 power supply

facilitate one-man operation. Along the right wall are two disk recorders, shown in detail in Fig. 6. These units operate at 78 or 33 1/3 RPM. The feed-screw drive mechanism is unusual, in that it affords continuous and instantaneous variation of cutting pitch from 80 to over 500 lines per inch. Thus, standard and microgroove disks can be cut on one machine, and inordinately high average audio levels can be handled by varying the cutting pitch with relation to the modulation level, decreasing the number of lines per inch as the audio level increases, thereby avoiding overcutting. This method, rather than closely riding the gain control and destroying the natural dynamic range, results in transcribed programs that delight the critical listener, and gain much in signal-to-noise ratio.

The tape recorder, at the left side of the room, has input and output gain controls and a VU meter conveniently mounted on the sloping front panel. Along the back wall are two transcription turntables. Pickups with 1-, 2.2- and 3-mil stylii are provided for the continuous dubbing of transcribed programs in two or more parts. Mounted on the top of each cabinet is a preamplifier-equalizer. The arrangement can be seen in Fig. 7. Fig 8 shows the complete unit.

The line level output from the playback tables is used to an interesting advantage. A mixing consolette was constructed and placed between the two turntables. Each output is brought up to this consolette and fed to a variable attenuator. The variable attenuators feed a line amplifier, the output of which can be patched to disk recorders, tape recorder, or monitor channels, singly or simultaneously. A volume indicator meter, calibrated in VU and mounted on the consolette, permits the precise adjustment and equalization of audio levels from the output of the pickup preamplifier-equalizers. The method of interconnecting can be seen in Fig. 3.

Two power amplifiers, Fig. 9, are mounted in the audio rack. They feed the cutterheads of the two disk recorders. A third power amplifier, mounted in the same rack, can be patched as a spare recording or monitoring amplifier channel in any emergency. An isolation pad is normalled through the input of this utility amplifier so that it can be inserted across any channel without upsetting impedances or levels.

Automatic diameter equalizers and NAB equalizers are incorporated in the system, with in-out switching brought to a convenient panel on the cutting room rack. The block diagram, Fig. 3, shows that recording channels for the disk and tape recorders have bridging inputs. Each input and output channel normals

Fig. 6. The Fairchild model 523 recorder provides instantaneous and continuous variation of the cutting pitch. Fig. 7. Transcription turntable has a preamplifier-equalizer at the front right corner of the cabinet

TAP A GREAT NEW MARKET

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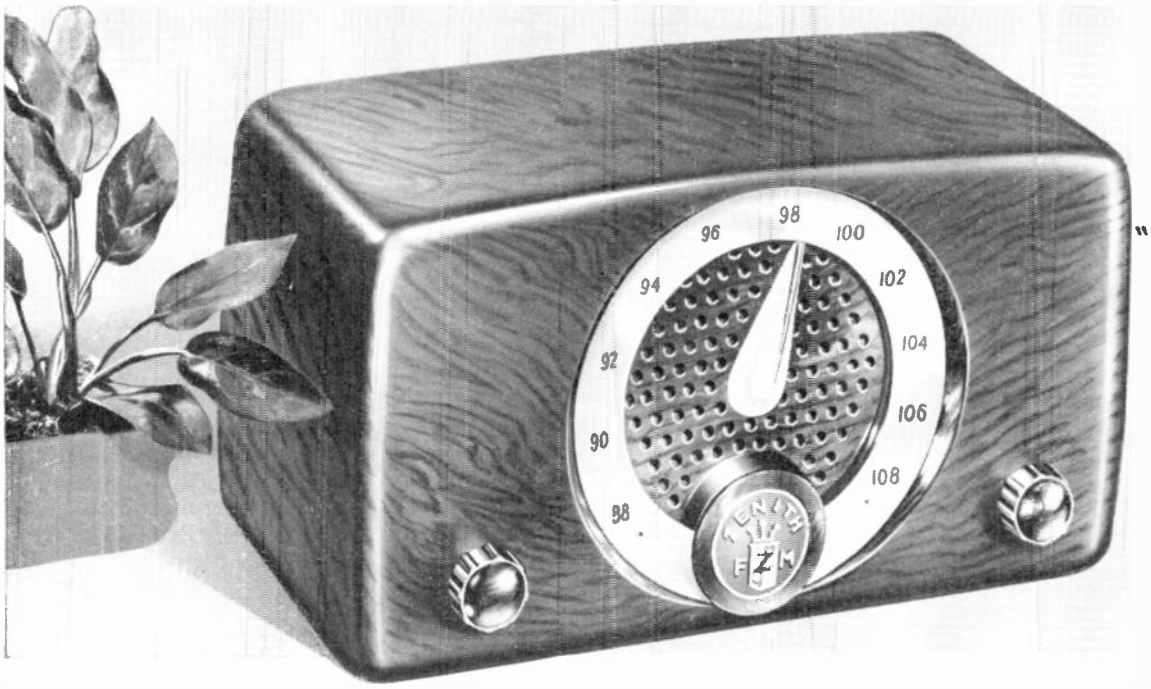
Most Sensitive FM Radio Ever Built

FOR THE PUBLIC!



NEW ZENITH "MAJOR" ONLY $39.95*

It's actually 10 times more sensitive than the average of 16 other FM radios tested. So this all-new Zenith "Major" greatly extends the range of FM reception . . . creates thousands of new prospects for you . . . opens up a rich new market that's just waiting to be tapped!

The "Major" gives superb performance even in remote "fringe" areas where static and interference make ordinary radios useless. *Yet it's priced so low anyone can afford it.* Feature the Zenith "Major"—and cash in on the most terrific profit opportunity in radio today!

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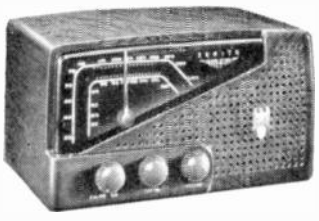
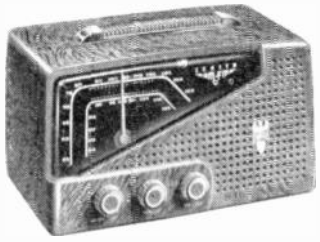


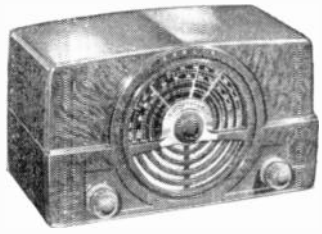
New "Medallion"

Big value at low cost! Genuine Zenith-Armstrong FM with exclusive "Power-Line" Antenna, just plug in and play . . . sensational Zenith Long Distance AM . . . new "Cut-Away" Dial for easier tuning . . . Zenith Wavemagnet . . . Alnico 5 Speaker . . . smart swirl plastic cabinet. AC, DC. **$49.95***



New "Super-Triumph"

Terrific FM-AM "buy"! Has *new super-sensitive* Zenith-Armstrong FM with "Power-Line" Antenna, and Zenith's famous Long Range AM. Exclusive Wavemagnet† . . . big Alnico 5 Speaker . . . improved tone control . . . 'Cut-Away" Dial, so easy to see and tune . . . on/off indicator. Swirl walnut or white plastic cabinet, Flexo-Grip handle. AC, DC. **$59.95*** (White plastic $62.95*)



New "Symphony"

Famous for rich, big-console tone! *New, super-sensitive* Zenith-Armstrong FM with patented "Power-Line" Antenna, plus Long Distance Zenith AM. Giant speaker, thanks to Zenith's exclusive DialSpeaker design. Zenith Wavemagnet. Rich swirl plastic cabinet. **$79.95*** AC, DC.

(White plastic $82.50*)

†® ZENITH •LONG DISTANCE• RADIO and TELEVISION

ZENITH HAS THE GREAT VALUES

**Suggested retail price. West Coast prices slightly higher on Medallion, Super-Triumph and Symphony. Prices subject to change without notice.*

ZENITH RADIO CORPORATION • 6001 WEST DICKENS AVENUE, CHICAGO 39, ILLINOIS

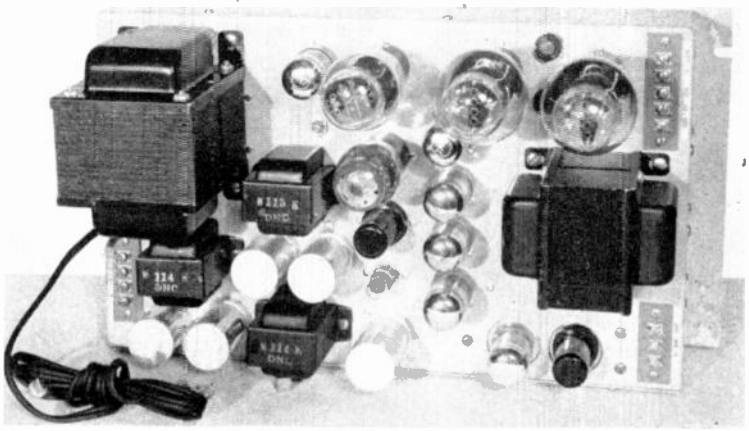


Fig. 8. A preamplifier-equalizer is mounted on each turntable cabinet. Fig. 9. Power amplifier used to feed the cutter head

through patch terminations. Thus the input of any channel can be lifted, transferred to, and inserted across another circuit without upsetting levels or impedances. Multiple, or paralleling jacks are used extensively.

The cutting room monitor amplifier is the same type of unit used as a booster amplifier for the playback turntable pickups and control room line, monitor, and talkback circuits. With an overall gain of 50 db, an output capability of 8 watts, and response of 30 to 15,000 cycles ± 1 db, this unit proves its versatility in an installation such as this one.

An auxiliary power supply, Fig. 5, for the cutting room monitor and pickup line amplifiers mounts in the audio rack. A rack-mounted audio generator, with its output terminating at the patch board, provides an ideal means for audio-level reference adjustments. Four pairs of shielded cables, terminating at the cutting room patch board, and at the control room patch board, are provided as utility and spare interconnections. The cutting room monitor loudspeaker is a Jim Lansing D-1001 woofer-tweeter, while the talkback monitor loudspeaker for aural communication and cueing from control room to cutting room, is a Jensen P8SH in an H-81 enclosure.

It seldom happens that any two installations for recording studios are just alike. However, the foregoing description indicates the unlimited possibilities of adapting the same basic units of equipment to any specific requirements.

Editor's Note: The third and concluding part will describe another installation of an entirely different sort, in which the same equipment is employed.

PORTABLE TAPE UNITS

(Continued from page 24)

faders for the 3 microphones, master gain control for recording, and another gain control for playback.

Since there are two separate amplifiers, it is possible, when required, to make a recording in the field and, with the monitor amplifier, feed the program back to the station at the same time. The power supply and amplifier units also constitute excellent emergency remote equipment, when recording is not required. When the equalizer and meter switches are in the REMOTE positions, the amplifier is automatically set for flat response, and the meter reading is brought to the reference point for 8 vu at 500 ohms.

If continuous recording is required, two recording units can be used with one power supply and amplifier section. An external switch box and the necessary cable receptacles are furnished for switching from one recorder to the other.

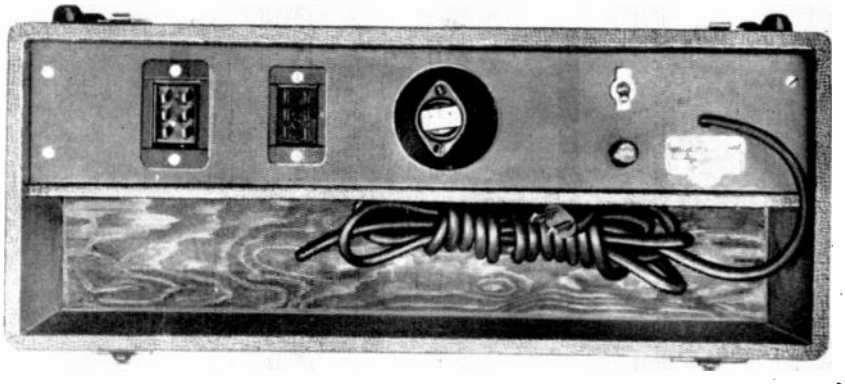
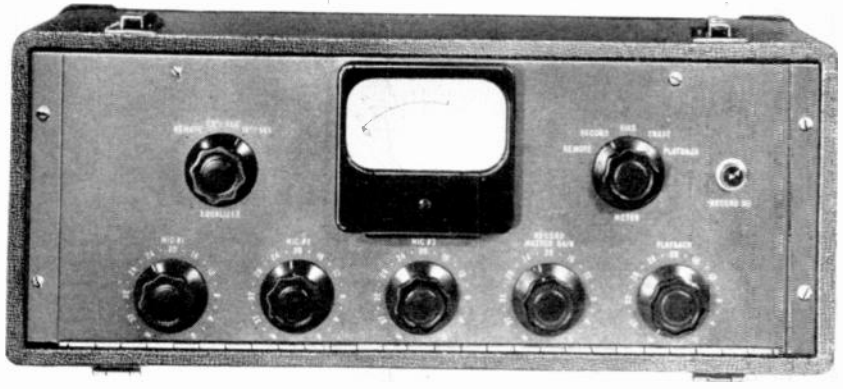
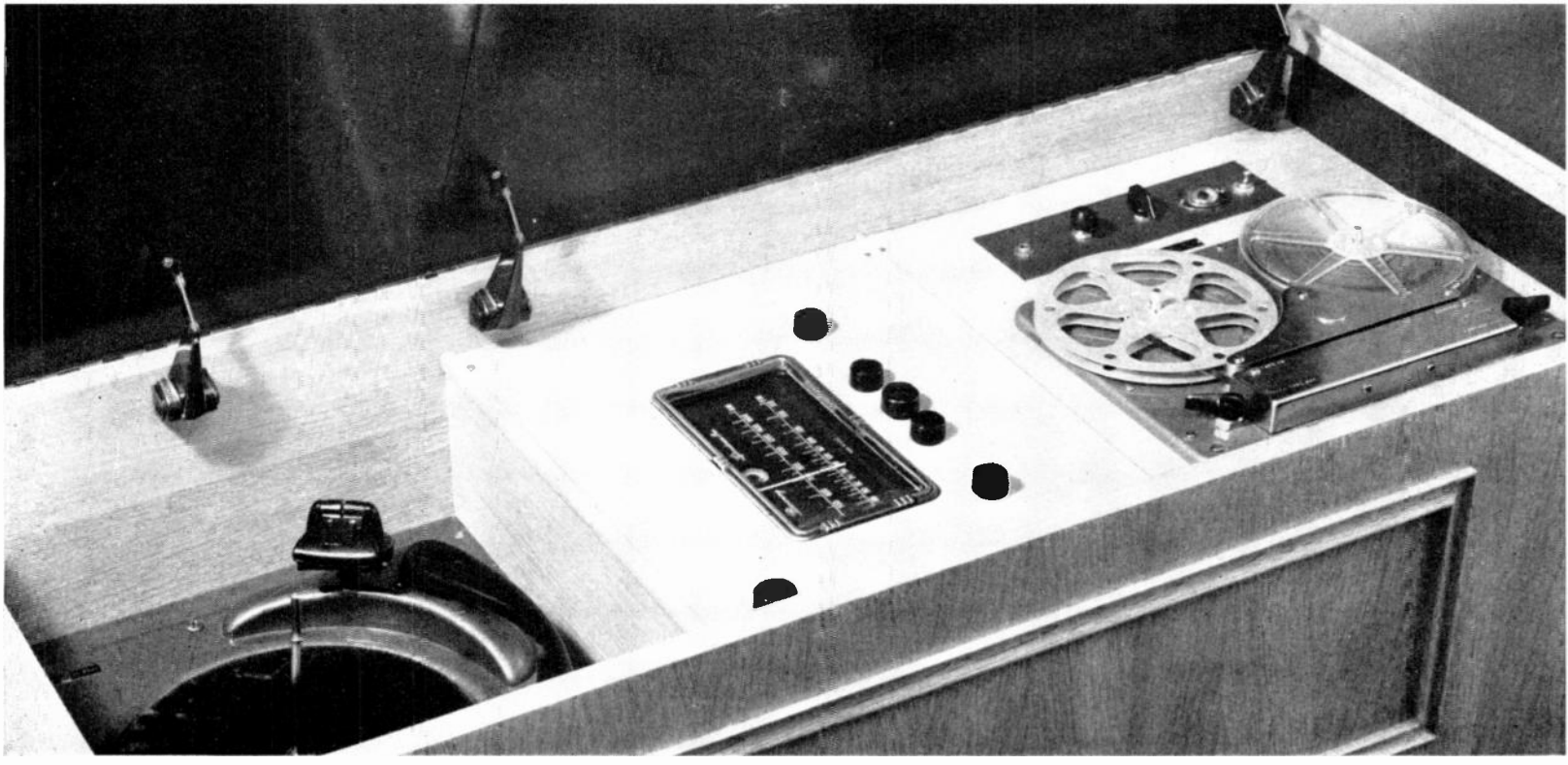


Fig. 2. Power supply unit. Fig. 3. Amplifier section. The cases fasten together



Both the power supply and amplifier are carried on 19-in. panels, suitable for rack mounting. The recorder panel as mounted in the portable case, is less than 19-ins. wide, but a standard rack panel can be furnished if it is specified.

Frequency response is 50 to 8,000 cycles ± 2 db at 7½ inch-seconds, or 50 to 15,000 cycles ± 2 db at 15 inch-seconds tape speed. Signal-to-noise ratio is more than 50 db below maximum signal. Maximum signal is the level at which 400 cycles input produces 2% RMS distortion. Playing time is 16 or 32 minutes.



THIS CUSTOM-BUILT INSTALLATION, BY ULRIC J. CHILDS, HAS A BROWNING RJ-12A FM-AM TUNER USING THE GENUINE ARMSTRONG FM CIRCUIT

IT TAKES A BROWNING FM-AM TUNER TO SATISFY CRITICAL LISTENERS

NO doubt about it, the BROWNING RJ-12A FM-AM tuner is custom-built to meet the requirements of custom builders! Whatever type of installation you want to make, from the simplest to the most elaborate, the RJ-12A can be coordinated most readily and economically with the other equipment you plan to use.

Circuit-wise, there are few cabinet-model sets that equal the performance of the AM end. As for FM, well, many listeners insist that the only thing that can equal this BROWNING is another BROWNING.

That is because the extreme sensitivity and the noise-limiting capabilities of the Armstrong FM circuit have been so highly perfected in the RJ-12A. The long-distance range of this tuner is really amazing. The freedom from all background noise, due to the effectiveness of the dual limiter, adds new joy to listening.

It is not unusual for us to get reports that run like this: "A week after I install a BROWNING tuner with a high-quality amplifier and speaker, the whole family is won over to FM reception. I've never known it to fail."

Behind this consistently fine performance is an important fact well worth remembering: The same continuous program of refinement, the same highly-skilled workmanship, and the same precision quality control go into BROWNING tuners that are represented in this Company's line of laboratory measuring instruments for commercial and Government use.

Thanks to the enormous demand for these tuners, continuous production holds down manufacturing costs. In this way, premium performance is made available without any premium on the price.

This applies to the RJ-12A and RJ-20 FM-AM tuners, and the RV-10 FM-only model. We shall be glad to send you complete working data and prices. *Address your request to:*

BROWNING
LABORATORIES, INC.
WINCHESTER, MASS.
ENGINEERED FOR ENGINEERS

IN CANADA, ADDRESS:
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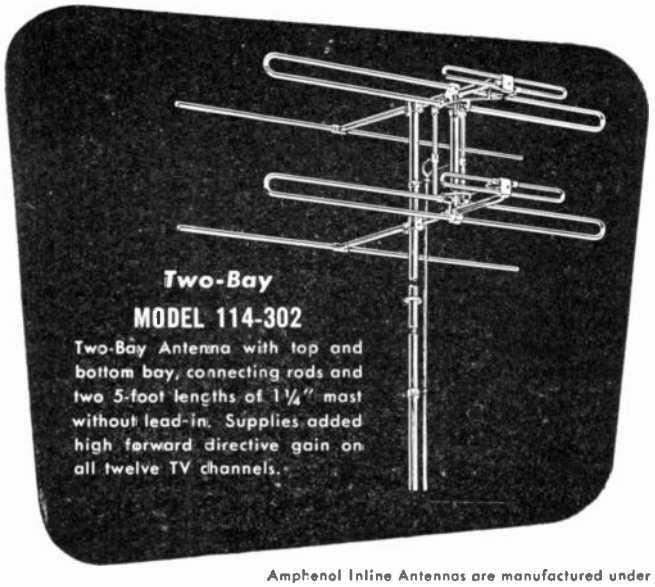
INLINE TV ANTENNAS



Amphenol Inline Antennas are manufactured under Patent No. 2,474,480.

The best reception of picture and sound on ALL TV CHANNELS is directly dependent upon the mechanical and electrical construction of the antenna.

Amphenol has designed the Model 114-005 IN-LINE TV ANTENNA after years of study and research to meet the strict demands for optimum antenna performance . . . this antenna provides the best in high, uniform gain with clear, brilliant reception on all channels. The Model 114-302 TWO-BAY INLINE TV ANTENNA provides added high forward gain for TV sets in fringe areas.

Costly service calls due to antenna maintenance problems are eliminated with an Amphenol installation. The faithful, steady performance of Amphenol antennas is the solution for excellent picture reception through many years.

AMERICAN PHENOLIC CORPORATION

AMPHENOL

1830 SO. 54TH AVENUE
CHICAGO 50, ILLINOIS

CH ANNEL UNITS

(Continued from page 13)

mums, and in order to gain control it becomes necessary to add a slope limiter to the control circuit. One way to achieve such a control is to use an ordinary amplifier modified by differentiating circuits so that the control voltage increases with an increase in frequency of the modulating wave. Such a system has the disadvantage of slow attack and release time, and is obviously too cumbersome to include in compact mobile and portable equipment.

To comply with the requirements of adjacent-channel operations and, more recently, with the FCC ruling effective July, 1950 governing deviation control, an instantaneous deviation control has been designed and developed to provide amplitude limiting and positive slope limiting without introducing time constants for the attack and release of the limiter. The circuit is simple enough to include in the usual types of base station and mobile communications equipment.

Editor's Note: The second and concluding part of this paper will appear in December.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933

Of *FM* AND TELEVISION, published monthly at Great Barrington, Massachusetts, for October 17, 1949

State of Massachusetts
County of Berkshire
ss.

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

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

2. That the owner is: Milton B. Sleeper, d/b/a FM Company, Great Barrington, Massachusetts.

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

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

(Signed) MILTON B. SLEEPER, *Owner*

Sworn to and subscribed before me this Seventeenth day of October, 1949.

[Seal] LILLIAN BENDROSS, *Notary Public*

Commission expires July 1, 1954.

CUSTOM BUSINESS

(Continued from page 23)

the most part, they come to me. They see and hear installations I have made in homes of their friends. They ask questions, and eventually come to my workshop. Needless to say, an important part of my responsibility is the complete satisfaction of each client, for I must depend on the enthusiasm of each one to bring me new business. In all modesty, I can say that I have been successful to the point where, recently, I was ready to solicit business over WABF, the New York FM station which is specifically programmed for music lovers. For the benefit of other custom specialists who may want to do something similar, here is the text of one of my spot announcements:

"Music lovers who want the finest listening quality available — this announcement is for you. Ulric J. Childs offers just such listening from his custom-built radios and phonographs. He designs and constructs his own amplifiers in order to provide many features unobtainable elsewhere, regardless of price. Really fine music needs and deserves the true reproduction that can be had only through the finest equipment. To produce such radios and phonographs, the builder must be not only an able engineer but also an understanding music lover. You will find such a person in Mr. Childs. His custom-built installations can bring into your home the kind of entertainment you can duplicate only by being present at the original performance. What's more, these instruments are surprisingly moderate in price for the quality of enjoyment they offer. Call Ulric J. Childs at Trafalgar 9-8290, and discuss with him your needs for fine musical reproduction, or visit him at his workshop, 1601 First Avenue."

Sound Installations:

An important, related source of business is the installation of special audio systems, such as shown in Figs. 6 and 7. These were made for the Doubleday Book Shop at Fifth Avenue and 53rd Street. The arrangement illustrated in Fig. 7 permits a customer to select and listen to any one of eight popular records, set up on remote, repeating turntables. The separate booths, Fig. 7, are arranged in the conventional manner, with individual turntables.

Here, again, high-quality audio equipment was used. And, it might be added, the extra cost has been amply justified by selling records in greater volume.

It's Dangerous to Compromise:

Selling custom-built equipment is very different from selling regular, commercial radios and phono combinations. The

(Concluded on page 34)

ACKNOWLEDGED STANDARD OF FM PERFORMANCE

You'll Never Want to hear AM If You Have an REL Receiver!

THE REL 646-B has many features not found in other FM receivers. The reason is that it was designed specifically for the use of broadcasters, as an FM monitor or network relay receiver.

Consider the matter of sensitivity, for example. High sensitivity is required not only for long-distance reception, but for eliminating noise and fading on weak signals. In order to meet the requirements of commercial broadcasters, the 646-B is designed to limit on input circuit noise at any frequency from 88 to 108 mc.

To be more specific, on any signal of 4 microvolts or more applied to the receiver input, the output signal-to-noise ratio from 50 to 15,000 cycles is within 3 db of the optimum obtainable at the present state of the art, where the limiting noise is random. The receiver noise is 70 db or more below output of 10 watts for any quieting carrier.

No receiver designed for use in the home approaches the REL 646-B in ability to bring in noise-free reception of distant stations. Because of this extreme sensitivity, a 4-point RF gain control is provided by the right-hand knob. This is necessary so that the signal meter will register on weak stations, and not be driven off-scale by those nearby.

For those interested in the tube complement, here is the list: A 7F8 is used as a dual, high-gain RF stage, with a 7F8 mixer-oscillator and a 7AG7 first detector. Two IF stages with 7AG7's are followed by two limiters, also using 7AG7's. The 7A6 discriminator feeds a 7F7 audio stage and phase inverter, with two 7C5's in push-pull for the output. A 5U4G is used as a power supply.

Audio output is flat within 1 db from 30 to 15,000 cycles, including de-emphasis. Receiver distortion up through the detector is less than 1% for 100% modulation, and the 10-watt audio amplifier has less than 1.5% distortion at full output for any fundamental from 50 to 7,500 cycles.

You may say: "It's all very well to talk about laboratory measurements, but what people pay their money for is reproduction from the loudspeaker. Do those extreme circuit refinements make a difference that can be heard?"

We can answer that with a very emphatic "Yes!" These refinements add up to such a startling difference in performance that you, too, will say when you listen to the model 646-B: "I had no idea that radio reception could sound like *that!*"

If you are handling equipment of this quality, either as a dealer or a professional custom set-builder, we invite you to write for information as to the trade discount and deliveries.

$345 WITH 19-IN. RACK PANEL, OR IN METAL CABINET, AS ILLUSTRATED

FM THE ARMSTRONG SYSTEM
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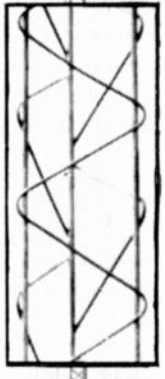
with the TRYLON ANTENNA MAST #650



At a surprisingly low cost per lineal foot, you can raise your present antenna height to 60 ft. with the new TRYLON #650 Antenna Mast. It weighs only 2 lbs. per foot, comes in handy 10 ft. sections and is easy to erect and climb. It is *double*-welded for added safety and hot dip galvanized *after* fabrication.

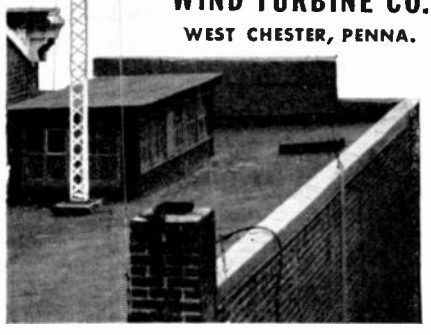
All sections are standard. Base plates and top fittings for mounting antenna support tube are available from stock.

Write for complete details and specifications.

Tower and Antenna Division

WIND TURBINE CO.

WEST CHESTER, PENNA.



CUSTOM BUSINESS

(Continued from page 32)

latter are bought on the strength of advertised trade names. If a man or woman asked for a set made by the XYZ Corporation, he will generally accept the performance for better or worse.

The custom builder, however, is both manufacturer and dealer. He can't cheat or cut corners and stay in business. His equipment must be so high in quality that his customers have no reason to complain. And if, as sometimes happens, he gets an unreasonable complaint, he must be in a position to say: "Anything else I might give you would be inferior to what you have now, for the components of your installation are the finest obtainable, regardless of price."

Actually, the custom builder can use the best equipment exclusively, and still charge substantially less than the price of commercial models of inferior performance and cabinet design. What he cannot afford, however, is to compromise on performance for, since his trade-mark is not an advertised name, his reputation depends entirely on the quality of entertainment that comes out of the loudspeaker.

MOBILE RADIO NEWS

(Continued from page 14)

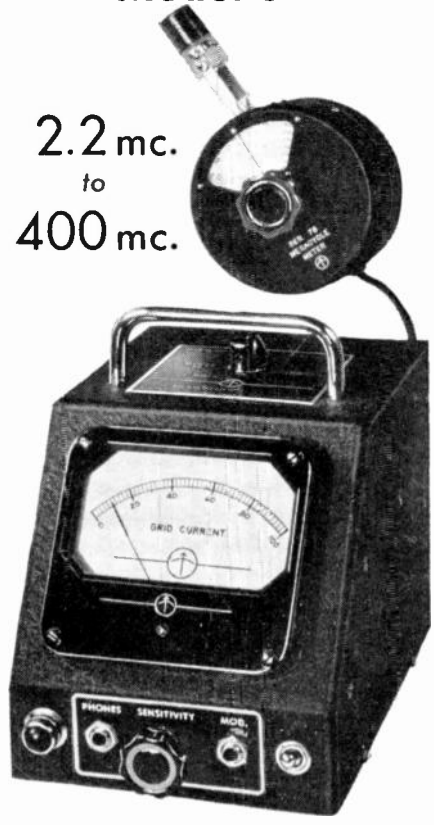
service, to demonstrate the dollars-and-cents savings radio permits.

Cooperation Among Taxi Owners:

Taxi operators of Madison, Wisc., have come up with a unique agreement to govern frequency changing. The four operators involved, each operating about 25 mobile units, have set up a trust fund of $2,500 to be administered by trustees for the purpose of meeting the expenses involved in carrying out the frequency changes agreed upon by the four operators. These changes call for two of the companies to use the end taxi channels. The two center taxi channels they hope to leave vacant until the present equipment has been worn out. Successful accomplishment of the plan, however depends on temporary use of two unused railroad frequencies in the area, which is served by only three railroads. As the worn out equipment is replaced with equipment capable of operating on adjacent channels, the center taxi channels will be utilized by these companies. The four Madison operators have filed a petition with the Commission requesting a waiver of the taxi rules to permit temporary use of unused railroad frequencies during this transitional period while the useful life of present equipment is being exhausted. Petition was supported by detailed agreement entered into by all four Madison operators.

MEASUREMENTS CORPORATION
Model 59

2.2 mc. to 400 mc.



MEGACYCLE METER

Radio's newest, multi-purpose instrument consisting of a grid-dip oscillator connected to its power supply by a flexible cord.

Check these applications:

- For determining the resonant frequency of tuned circuits, antennas, transmission lines, by-pass condensers, chokes, coils.
- For measuring capacitance, inductance, Q, mutual inductance.
- For preliminary tracking and alignment of receivers.
- As an auxiliary signal generator; modulated or unmodulated.
- For antenna tuning and transmitter neutralizing, power off.
- For locating parasitic circuits and spurious resonances.
- As a low sensitivity receiver for signal tracing.

TELEVISION INTERFERENCE

The Model 59 will enable you to make efficient traps and filters for the elimination of most TV interference.

Write for Special Data Sheet, 59TV1

SPECIFICATIONS:

Power Unit: 5⅛" wide, 6⅛" high; 7½" deep. Oscillator Unit: 3¾" diameter; 2" deep.

FREQUENCY: 2.2 mc. to 400 mc.; seven plug-in coils.

MODULATION: CW or 120 cycles; or external.

POWER SUPPLY: 110-120 volts, 50-60 cycles, 20 watts.

MEASUREMENTS CORPORATION
BOONTON NEW JERSEY

Advertisers' Index

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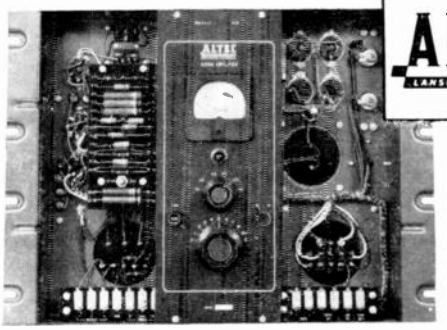
the Altec Lansing A-256A amplifier



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WILL MEET YOUR REQUIREMENTS FOR AUDIO POWER

Your need for high quality audio frequency power can be handled better, with greater dependability and with better quality by the Altec A-256A Beam Power Amplifier. Rated conservatively at 65 watts, the A-256A Amplifier will deliver 75 watts with less than 2% total harmonic distortion. At 65 watts the intermodulation is only 8%. Never before has there been a high quality amplifier which will deliver you as many watts per dollar as you receive from the A-256A Amplifier. Full power available within 1 db at 40 cycles and 15,000 cycles.

The A-256A Amplifier is assembled on a relay rack of recess pan construction, making it adaptable to either rack or cabinet mounting. Sound design and the use of conservatively rated quality components insure the user of long trouble-free life without deterioration in performance characteristics.

SPECIFICATIONS

GAIN: 50 DB, 500 ohm input.

FREQUENCY RANGE: 20-20,000 cycles within ½ DB.

NOISE LEVEL: —45 dbm (.001 watt reference).

OUTPUT IMPEDANCE: Taps for 8 & 16 ohm loads.

INPUT IMPEDANCE: 30, 250 & 500 ohms. 5,000 ohm bridging input.

For technical bulletin, write

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161 Sixth Avenue, New York 13, New York

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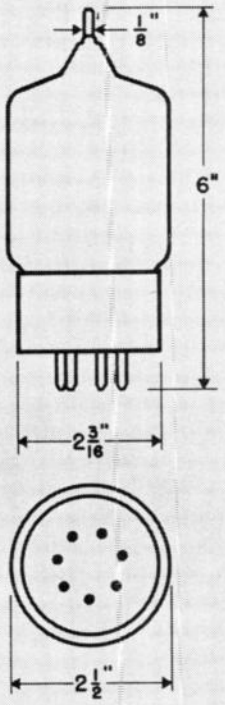

EIMAC PENTODE TYPE 4E27A/5-75A

Encompassed in the structure of this new version of the 4E27 are many outstanding improvements that now will guarantee performance-dependability to users of this tube type.

The plate-lead of this new Eimac 4E27A/5-75A pentode is of larger diameter than the protype* providing a low-loss, low inductance, more rugged lead. The plate itself is larger assuring a good reserve dissipation capacity above its 75 watt rating. It is made of Eimac Pyrovac plate material, which lengthens the life of the tube and enables it to withstand high momentary overloads.

Primary grid emission has been eliminated and secondary characteristics stabilized through the use of Eimac processed grids. Perfected beam-action and permanent alignment are assured through well engineered internal-element mounts.

The unique moulded-glass header eliminates a base on the 4E27A/5-75A. This simplifies lead cooling, minimizes lead losses, and provides precision alignment of base-pins.

The stability and high power-gain characteristics of this new Eimac pentode make it an excellent VHF or video power amplifier. It is equally well suited for conventional power amplifier service.

Further information and detailed characteristics concerning this latest product of Eimac engineering research may be had by writing the Application Engineering Department of Eitel-McCullough, Inc.

* Lead connector is supplied to make this new tube directly interchangeable with 4E27.

236

EITEL-McCULLOUGH, INC.
San Bruno, California

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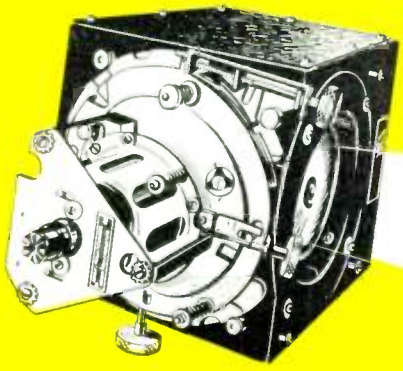

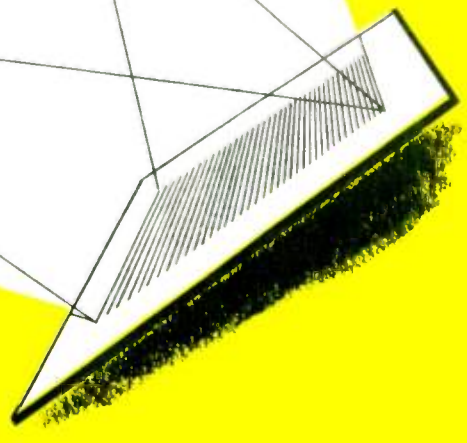

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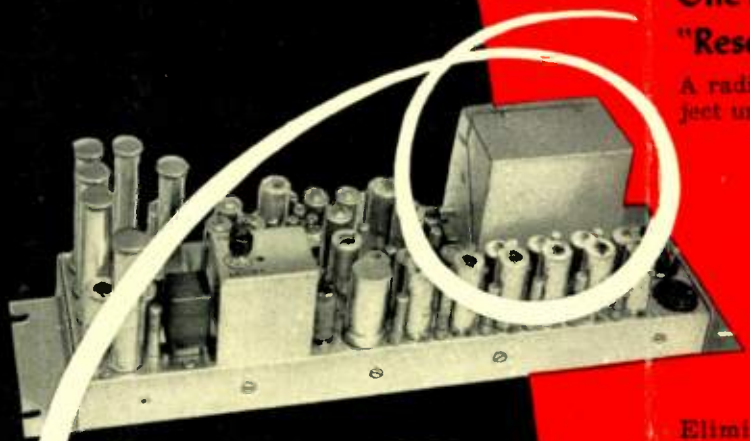
Motorola "RESEARCH" LINE with the Sensicon Communications receiver and the new

PERMAKAY I.F. wave filter

Reduced Maintenance Costs... Increased Serviceability... Guaranteed Selectivity...



One more reason *why* the Motorola "Research" Line is the best

A radically new type of band pass filter to reject unwanted signals.

Check these features of the "PERMAKAY" Filter!

- *Super-precision selectivity*
- *15 factory tuned circuits*
- *Circuit sealed in polyester-styrene resin*
- *Absolutely maintenance free*
- *Unconditionally guaranteed*

Eliminate adjacent channel interference, lighten the service technician's load and reduce operating expenses.

Selectivity determining circuits of the new Sensicon unit are tuned at the factory and completely sealed in a solid casting of polyester-styrene — protecting components forever from the effects of heat, humidity and vibration. 100 db. edge of adjacent channel selectivity, unconditionally guaranteed for the life of the receiver.

A product of the Motorola Research Laboratories, the world's largest laboratories devoted exclusively to the development of F.M. 2-way radio equipment. Specialists in the field of mobile radio for 20 years.

Precision equipment and precision systems that will be years ahead for years to come.

the best is now BETTER than ever before

Motorola

"RESEARCH" LINE

FM 2-WAY RADIO

Compare feature for feature with any other equipment on the market, get the complete story. . . . Write today!

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