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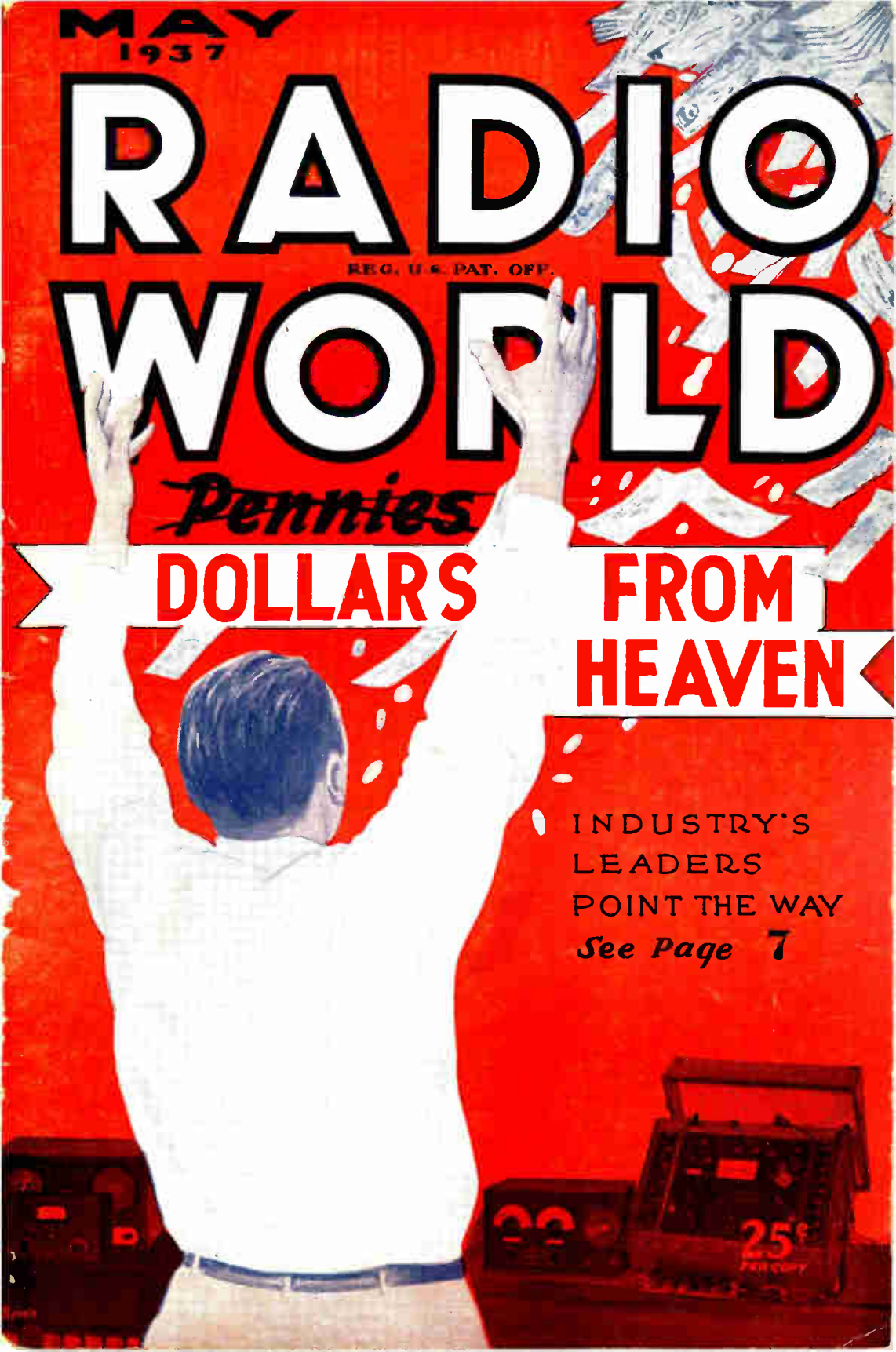

INDUSTRY'S LEADERS POINT THE WAY

See Page 7

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Sixteenth Year

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Table of Contents for May, 1937

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DOLLARS from HEAVEN

Tests Must Follow Sets

By Kendall Clough

President and Chief Engineer, The Clough-Brengle Company

WITH the ever-increasing number and complexity of instruments which are being offered to the service industry, it may be well to stop and take stock of the trend of the design of such instruments and the reasons for their introduction to the market, as well as to make some sort of a guess as to how far the more progressive service laboratory of the future will go into fields which are now considered strictly within the scope of instrumentation or radio engineering. Possibly one of the best ways to evaluate future trends is by examination of past history of the instrument field and its connection with the radio service industry.

Looking back to the early days of radio broadcasting, we see in the radio service field as the contemporary of the tuned-radio-frequency receiver the rather crude radio test oscillator, probably home made a la breadboard and modulated by means of the blocking action caused in the grid of the oscillator tube by an oversized grid condenser and leak. In addition, the voltmeter was an instrument of probably one to three hundred ohms per volt, combined with a socket analyzer, only d-c ranges being provided and not too many of those.

TESTS KEEP APACE OF SETS

The tube checker, if there was one in this early service shop, included from two to five meters, all of which had to be carefully read and the actual worth of the tube determined by pencil and paper, after making current and voltage determinations.

The above items are mentioned as being service shop contemporaries of the tuned-radio-frequency receiver, and they were in most cases adequate to the job because the circuits were simple, broadly tuned by modern standards, and practically the only voltage checks necessary were those of the A, B and C batteries required to operate the receiver. As radio receiver design progressed it was, of course, necessary that test equipment design progress along with it in order that adequate service might be economically rendered.

Thus if we look at the evolution of the test oscillator we see the old condenser and leak modulation scheme with its attendant broad signal due to frequency modulation give way to Heising amplitude modulation with a sharper, more selective signal. With the general introduction of the superheterodyne receiver to the radio market, we find the generator designed not only to supply test signals in the broadcast band, but also signals of lower frequency for alignment of the intermediate transformer system as well.

Along with the march of progress in radio receiver design, sensitivity or ability to tune in distant stations of weak magnitude became a feature and it was consequently necessary for the service engineer to have some means of assuring himself that the receiver had been brought up to its original high state of sensitivity after realignment or the installation of some new part. This called for more complete shielding of oscillators than had hitherto been considered necessary, together with some means of attenuation at the output signal, so that test signals could be attenuated to a level comparable to a weak broadcast or i-f signal.

(Continued on following page)

LEADERS POINT WAY TO SUCCESS IN SERVICING

(Continued from preceding page)

The advent of the superheterodyne receiver also made the matter of frequency calibration of the test oscillator of paramount importance. With intermediate frequencies being chosen which tried to improve the image ratio of the receiver to the best possible value, as well as taking advantage of every possible technicality in allocation of station frequency and geographical location of such stations, it was and is, of course, necessary that the receiver be aligned to precisely the same frequency contemplated in its design. Other factors which demand the best possible precision in the test oscillator were the introduction of the precalibrated dial, for checking superheterodyne oscillators and dual padding circuits of the receiver oscillator.

BETTER BUSINESS METHODS

The writer has always considered it a fortunate circumstance that the education of the service engineer as a business man took root at about the same time, with the result that it was no longer considered good business to enter the customer's home with a suitcase full of equipment and then proceed to dismantle the entire chassis upon the front room rug to the supposed edification, but actually to the complete disgust, of the customer. I consider this change in service practice important because, as is apparent, it was going to be next to impossible to incorporate really fine and necessarily complex features in service equipment which could be carried in the coat pocket, which size had been the trend up to that time.

FIRST TEST OSCILLATOR

Foreseeing this definite trend in service equipment five years ago, the writer and his company introduced to the market the oscillator illustrated in Fig. 1, which was then unique in several points. In the first place, I like to feel that it is the first test oscillator which had been offered the service industry which stood up on its own feet, and embraced the necessary cubical content to permit real and much-needed features at that time.

In this model were pioneered the all-metal cabinet with tightly-bound joints for suppression of practically all of the radiated energy, which in turn confined the test signal to the attenuator.

In addition, there was introduced a system of automatic coil and condenser switching which permitted the selection of four then much-used intermediate frequencies, together with three frequencies in the broadcast band. Frequency modulation was reduced to a minimum by careful proportioning of the oscillating circuits, together with the use of Heising amplitude modulation, which resulted in a test signal truly amplitude-modulated, as broadcast signals are, and without the broad tuning characteristics which had proved so obnoxious in the earlier condenser and leak modulated oscillator.

ALL-WAVE COVERAGE

A year and a half after the introduction of this oscillator the all-wave receiver made its appearance on the market in sufficiently large quantities to be a factor in radio servicing. When this occurred the selector type oscillator of limited frequency range was, of course, limited in use and it became necessary to enhance the original design to be continuously variable from 100 kc to approximately 30 mc (30,000 kc), this frequency range being accomplished in six bands and each band covered by a dial mechanism which extended the rotation of the condenser to 400 easily read graduations, so that the completed instrument could be precisely calibrated against crystal oscillators and the continuous tuning chart plotted for each band. Only by such a continuously variably system was it possible to meet the numerous differing specifications of the receiver manufacturer for the alignment of their product. (Fig. 2).

Fig. 3 illustrates an even later model of this product, the chief advantage in this model being improved shielding and attenuation, made necessary by the highly-sensitized automobile receivers which grew out of the introduction of the turret top in car design, and improved wave form of modulation made necessary by the advent of cathode-ray equipment for the examination of receiver performance. Increasing standards of accuracy now demand that all precision signal generators be calibrated from a temperature-controlled primary standard, which is periodically checked against the Government standard, instead of against the older-type crystal oscillators.

SELECTIVITY TRACE POPULAR

All of this is pointed out to indicate that in radio service the necessary equipment to perform a given function has always been and will

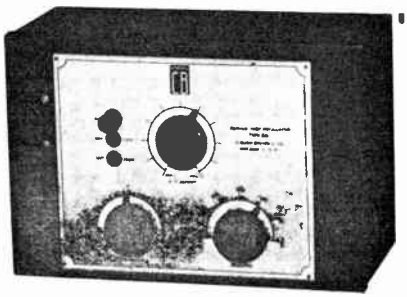

FIG. 1

FIG. 2

always be the outgrowth of the product which is to be serviced. On this principle we can consider numerous other service items which are the outgrowth of product requirements. Thus we see the introduction of a-c ranges in analyzers and multimeters with the introduction of power operated radio receivers. In the same way d-c instruments have been extended in sensitivity first to 1,000 ohms per volt, then to 20,000 ohms per volt, and more recently to meters operating on the vacuum tube principle which have practically infinite input resistance. The introduction of such meters has gone hand in hand with the advent of delicately-balanced high-resistance automatic volume control circuits in modern receivers. More recently the introduction of automatic frequency control has made the more sensitive instruments a matter of paramount importance in the modern service shop.

Viewing the history of test instruments we see frequency-modulated oscillators, together with cathode-ray oscillograph, suitably interconnected for automatic tracing of the r-f selectivity curve introduced concurrently with receiver designs attempting the ultimate in high fidelity of reproduction and consequently containing over-coupled transformers, alignment of which is impossible when attempted by the ordinary oscillator-output-meter method.

CONSOLIDATED EQUIPMENT

Along with block-tuned intermediate frequency systems go extended range audio and speaker systems, which brings the beat-

FIG. 3

frequency oscillator, hitherto a piece of laboratory equipment, into the service field for examination of these broad-band amplifiers for proper operating characteristics, as well as for checking out the speaker systems for any defect which would cause rattles or fuzziness over the extended frequency spectrum for which they are designed.

It was previously mentioned that the service engineer has become a business man, and as such he, of course, insists on neatness of installation of his equipment, conservation of bench space and the best possible impression to the customer who comes to his shop.

This has given rise to the consolidation of separate instruments into rack and panel assemblies such as pictured in Fig. 4. This particular assembly consists of a complete cathode-ray unit, together with amplifiers and both linear and sinusoidal sweep circuits, a beat-frequency oscillator, having a range from 25 cycles to 15,000 cycles, and a test oscillator which may be either amplitude-modulated with a 400-cycle note, or frequency-modulated to plus or minus 20 kc of resonant frequency, con-

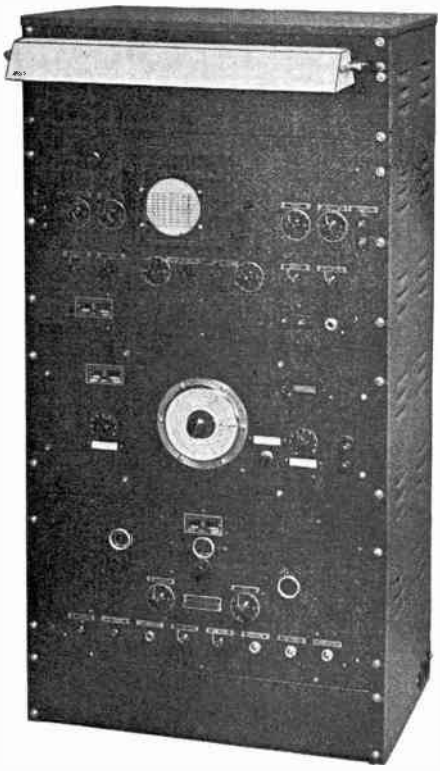

FIG. 4

tinuously variable from 100 kc to 30 mc. The whole unit is effectively illuminated by a long tubular bulb in the top of the unit.

The operation of the individual instruments of such an assembly is no different from that of the separate instruments made in portable form, but the impression left with the customer by such a neat instllation is much better than that caused by an overcrowded bench.

PROSPECTS ON TELEVISION

So many new instruments and new functions have been introduced into the radio service field in the past five years that many servicemen are probably asking themselves where it is going to stop or when the service laboratory can be called complete. Since all developments to date have been premised on the service needs of commercial receivers, it is probably a safe guess that the service engineers' need for knowledge and equipment of new types and forms will continue as long as commercial radio development progresses.

We can only guess what the advent of com-

(*Continued on following page*)

Much Uplift in the Offing

By Alfred M. Ghirardi

Radio and Technical Publishing Company

DURING the past few years, the thought has frequently been expressed that the radio industry has reached its peak of development—at least as far as its technical phases are concerned; in other words, that radio transmitting and receiving equipment has been improved to the point where further radical changes are very unlikely and that the industry is through with important engineering developments. As a matter of fact, innumerable laymen and radio technicians have hailed this with a deep sigh of relief; for, to them, it would mean the end of the frantic rush to keep up to date on the new developments in the field.

An analysis of the true conditions shows that there is absolutely no truth to this idea at all. As a matter of fact, such a condition would lead to stagnation of the worst sort in an industry that has practically lifted itself by its own bootstraps from a position of being a mere hobby for a handful of amateurs, to that of one of the largest industries in this country—all in the short space of about ten years! A little thought will reveal that one of the fundamental reasons for this remarkable growth has been the fact that the radio industry has been steadily progressive. It has continuously had new things to offer—each one an improvement upon the last—each one a new attraction for the public. And because of this consistent ability to retain the public interest and whet its appetite for new things yet to come, it has survived and grown by leaps and bounds.

IDEAS MUST BE UNTRAMMELED

Men intimately connected with the radio industry must not allow this poisonous idea of stagnation to enter their own minds or spread to those in outside circles. They, best of all, are in a position to realize that the radio industry was founded upon scientific discovery and invention—some of which was carried on in

attic and cellar workshops by workers who may have been untrained in scientific research methods, but who had *ideas* and were painstaking and ambitious enough to work them out to successful conclusions. Of course, important discoveries have also been unfolded by carefully-trained and educated engineers in some of the finest and most elaborately-equipped laboratories in the country. Some of them were purely accidental, some were the result of carefully-planned experiments. Regardless of the origin or conditions surrounding the birth and development of these ideas, they represented technological progress; and the growth of the radio industry from year to year has taken place upon an accumulation of ideas. The growth of an industry—especially a scientific one—is a continuous phenomenon of building up upon ideas, discoveries, and inventions—ever progressing—ever widening.

That this has been true of the radio in-

(*Continued on following page*)

(*Continued from preceding page*)

mercial television will bring to the service laboratory. It is already apparent that if one of the basic systems now in the laboratory is permanently adopted the serviceman is going to be concerned with test oscillators capable of being modulated over an enormously wider band of frequencies than is now considered necessary or feasible in a service oscillator. In addition, such a test oscillator is going to have to be modulated by a beat frequency audio oscillator (so-called audio) with a top range which will run into megacycles rather than thousands of cycles as at present, and in addition cathode-ray equipment, with a multiplicity of sweep circuits and amplifiers, which is not even approached by any equipment on the market today.

These matters are not mentioned to frighten service engineers, for when the time comes it means that equipment will naturally be introduced to the market at prices which are commensurate with the prices which can be obtained for service work on receivers of this type and the simplifications necessary for fast and accurate work will be embodied in such designs.

As with all test equipment it will be necessary for the service engineer thoroughly to understand the circuit which he is attempting to service, as well as the functions of the testing equipment itself, and just as at present the man who has this understanding will be the operator of the successful shop.

(*Continued from preceding page*)

dustry will become apparent if we but pause for a moment for a fleeting mental review of some of the outstanding "stepping-stone" developments in radio set construction which have meant progress and have helped keep the public interested.

SKETCH OF RADIO DEVELOPMENT

Starting with the developments of a-c tubes and a-c line operation of radio sets, we have had, in remarkably quick succession, power tubes, single-dial tuning, dynamic speakers, electrolytic condensers, screen-grid and pentode type tubes, radio-phonograph combinations, "single-control" superheterodyne receivers, midget receivers, "universal receivers," automatic volume control, inter-channel noise suppression, small automobile type tubes, remote tuning control arrangements, vibrator-type power supply units, automobile receivers, waveband switching-systems, short-wave and all-wave receivers a.v.c., a.f.c., etc.

After reviewing this list of "key" developments, incomplete as it is, can any radio man truly feel that those keen minds which were responsible for these advances, and the scientifically and broadly trained minds of the hundreds of new young men who are entering the radio field every year, are suddenly going to lie down and become inactive forever—producing nothing new? Sheer nonsense! Even the "depression," violent and drastic as its effects were from a sales point of view, has resulted in very little curtailment of the activities of idea-producing brains; although it has resulted in more careful spending of money for research work and the pruning down of unnecessarily large and cumbersome research development staffs. In fact, many of the most important advances in receiver and tube construction were conceived and developed during the worst years of the depression. At no time has there been as much serious and concentrated research carried out in the scientific and technological laboratories of the radio industry as during the past five years. And, no alert person can help but feel that results—more and more new things—will come of this work, with undreamed-of benefits to both the radio-buying public and those connected with every branch of the radio industry.

PERFECTION STILL FAR OFF

Granted that all this is true, what have we in the radio industry to look forward to? What have designers, employees of radio and tube manufacturing plants, dealers, servicemen, even young men who wish to enter some branch of radio work, to spur them on toward continued effort, with the feeling that everything is secure as long as they continue to be alert and progressive?

Let us first consider radio receiver design as it stands today. Can any radio serviceman or engineer deny the fact that almost every new model and make of radio receiver is put on the market with some weak points in its design, things that can easily be remedied—and, later, often are—by the manufacturer? Will any one deny the fact that, despite the splendid performance of our present-day radio sets, there are still many things regarding their construction, operation and performance, that can be greatly improved?

Has not the popularization of short-wave and all-wave receivers in the home opened up virtually a new and widely-expanding field in the sale and servicing of these more complicated sets, and an entirely new interest in antenna and noise-reducing systems? Has not the automobile radio set opened up new fields and possibilities? Is there any man in the radio profession who thinks that the present-day automobile receiver has reached its peak of perfection—that its design will not undergo radical changes and improvements during the next few years? The same may be said for our present all-wave receivers.

HIGH-FIDELITY TO THE FORE!

Another development, which promises to be the most potent factor in revitalizing the radio industry within the next few years, is the new trend toward real "high-fidelity" in both radio transmission and reception. If the public can be made really "tone-conscious" once again (and some of the best advertising minds in the country are hard at work on plans to make them so), and really satisfactory high-fidelity receiving equipment can be developed and marketed at a reasonable price (trust American engineering and ingenuity to accomplish that), the writer believes that we will experience another expansion of the radio industry that will be more far-reaching than anything we have had in the past—with its usual benefits to all those who are "in the swim." "High-fidelity" reception means more than just extending the range of reproduction further into the low and high frequency regions. It brings with it many difficult problems in noise elimination, set design, construction and servicing; and for once the acoustics of the room in which the set is placed come in for a great deal of careful consideration.

Then there is the field of public address systems. Everyone knows that real strides in this important branch have only been made during the past two years, when really dependable and reasonable-priced equipment has been made available. Most radio technicians are entirely ignorant of this field—many of them do not even realize that the public address man must know all that the radio serviceman must know—and a good deal more—in order to carry on his work successfully. There are countless opportunities in this field alone for every man who knows anything about radio—if he is willing to take the trouble to study this work and learn all about it.

WIDER SCOPE BUILDS BUSINESS

There isn't a reason in the world why radio men should confine their activities strictly to radio. One branch of work which has been almost entirely overlooked by radio men is the photo-electric field, which really has latent possibilities that are undreamed of until we seriously begin to study and investigate it.

(*Continued on following page*)

Ghirardi Noted Editor And Author for 10 Years

Alfred Ghirardi is one of the foremost writers of practical radio text books in the country. His knack of making the most technical phases of radio clear to even the merest beginner has made his books the favorites in radio schools and among servicemen and advanced experts in every English-speaking country in the world.

His knowledge of every phase of radio and his unusual background of experience command respect; for they are undoubtedly responsible for the almost uncanny way he anticipates questions in the reader's mind and clears them up almost before the reader is conscious of them himself.

ALFRED M. GHIRARDI

He holds degrees in electrical engineering and has been occupied in editorial work with such magazines as "Radio Engineering," "Radio Design" and "Radio News." He has contributed notable technical articles during a productive decade to almost every radio magazine published in this country. He organized what was perhaps the first laboratory and lecture course in radio fundamentals and radio service work, and taught these subjects in New York City for ten years. He has acted as technical consultant to many prominent radio manufacturing firms, and has personally answered over 20,000 technical inquiries from persons interested in building and servicing radio apparatus. All of this experience in disseminating radio knowledge has formed the background for his books, "Radio Physics Course," "Modern Radio Servicing," "Radio Field Service Data," and "Radio Servicing Course."

Mr. Ghirardi has been instrumental in awakening radio men to the need for a more broad electrical and radio training as preparation for their work. He has always taken a "wide-angle" view on the future of the radio industry, and even ten years ago he accurately predicted the spreading of the use of radio technique and apparatus into other fields of work, and the need for radio men with a sound and broader knowledge of both electrical and radio principles to design, manufacture, and service this equipment.

(*Continued from preceding page*)

How many radio men know that most photo-electric installations employ vacuum tube amplifiers, with the very radio tubes and basic circuits that they are accustomed to dealing with every day in radio receivers? How many of them realize the numerous applications that the electric eye is being used for daily in industry—how many hundreds of additional uses it will be put to within the next few years! Doesn't photo-electric work logically belong to the radio man because of his intensive training and first-hand knowledge of some of the most important parts of photo-electric installations and his experience and skill in caring for delicate electrical apparatus? Isn't this a field that eventually will open up to those radio men who are alert enough now to learn all there is to know about it and get in on the "ground floor" of this important new industry? The surface of this vast field has barely been scratched; and its possibilities are really bigger than those of radio.

What about television? Yes, we know what you are going to say. "Is it still around that corner?" But seriously, we all know of the difficult problems which must be overcome before commercial television will become a reality. However, would you be willing to bet every nickel you own that within two or three years television will not be with us? Don't you feel that almost any day something may "break" and things really get started?

NOT OVERCROWDED FOR COMPETENT

Any man who really takes the time to think about this question in a broad way cannot help but come to the conclusion that men in the radio industry have plenty to look forward, and upward, to. They have not yet reached the horizon, but will go ever on toward it. Stagnation will not step in; for ideas are created by the mind, and the minds that have created and developed our industry are the type that are going to produce bigger and better things—even if only for the very love of creation itself. But the new things they develop will be quickly taken up by the public—just as they always have been—and will shortly be considered some of the "necessities" of modern life.

Don't worry about the field being overcrowded. It will always be over-crowded for the many men in it whose inadequate training and sheer laziness have resulted in their being left by the wayside—out-distanced by the wide-awake, alert army of radio men who take a real delight in their work, are fascinated and thrilled by its ever-changing newness, and are always alert and on the job to learn the new things quickly and turn them to their own advantage.

Halldorson Transformer

The Halldorson Company has a new transformer which the serviceman can use at his bench for adjusting his line voltage for any requirement. Besides permitting adjustments in line voltage it will also supply the various ranges of voltages needed for testing radio sets. The Halldorson Vari-Volt Transformer will supply voltages from 0-256 volts in two-volt steps or from 0-128 in one-volt steps. Power output 250 watts maximum.

Complete information can be obtained from The Halldorson Company, Dept. RW, 4500 Ravenswood Avenue, Chicago, Ill.

Standardized System Vital

By John F. Rider

Famous Servicing Authority

THERE is not only a definite trend towards a greater number of equipment units used in the radio service shop, but if we are to judge by radio receiver developments and the evolution of testing methods, there is a very definite need for more elaborate equipment. I am referring to the cathode-ray oscillograph. This unit is not intended solely for alignment work, as many have been led to believe, but also for extensive wave-form checking in audio amplifiers.

The entrance of the servicing industry into the public-address field makes proper checking of an audio-frequency amplifier a very important matter, and what more important test can there be than for distortion? Such distortion tests make it necessary that the serviceman have a cathode-ray oscillograph and, in addition to that, a proper source of audio-frequency voltages, such as an audio-frequency oscillator with sine-wave output. Not only is this type of equipment necessary for public-address work, but it likewise is necessary for proper checking of some of the modern radio receivers and will no doubt become more important in the future.

DUAL-CHANNEL AUDIO

As a matter of fact, some receivers on the market have dual audio channels, each with its frequency range, and proper servicing calls for the checking of these channels so as to establish the performance upon these audio-frequency bands. This is particularly important when we realize that control of these bands is obtained by means of audio frequency filters, which are integral parts of the circuit.

The need for a standardized system of servicing—one which would embrace all parts of receivers and which would eliminate haphazard cut-and-try methods now so widely used—will, in the future, necessitate signal generators with calibrated attenuator systems whereby the well-equipped service station will have available signal voltages covering all of the frequency spectrums used in radio receivers of definite, predetermined and known values.

The vacuum-tube voltmeters, now to be found in very few service shops, will no doubt become a popular piece of equipment because it enables testing of the performance of certain components used in radio receivers and which have hitherto not been checked. One such is the oscillator in superheterodyne receivers. As a matter of fact, I am firm in the belief that as the days pass, more and more interest will be displayed in actual dynamic tests upon radio receivers and kindred equipment. By this I mean tests made in a manner representative of actual operation or during actual operation. My reason for making this statement is that there are to be found a very great number of faults which cannot be located by the normal static operating voltage tests.

NEW OSCILLATOR ENVISAGED

In this connection, I can also conceive of the use of a frequency-modulated audio oscillator, similar to the frequency modulated i-f oscillator used for the alignment of the i-f systems. The frequency-modulated a-f oscillator, which has been heretofore a difficult unit to construct, will, no doubt, be used to give an instantaneous picture of a complete response curve of the audio channel by means of the cathode-ray oscillograph.

I can visualize the development of equipment intended to locate intermittent contacts by having a combination of circuits which could be connected to a finished receiver and which would remain connected and by a system of flashes or other indicators show an interruption of one of the circuits in the receiver. Such a device would, no doubt, be expensive to purchase but would be economical in the long run because it would save a great amount of time.

I can also visualize the development of equipment which would be suitable for the testing of condensers, and possibly inductors, without requiring that the condensers, or inductors, be removed from the receiver chassis, or at least disconnected from other elements in the chassis. At present a great deal of time and money is wasted disconnecting such units for the application of present-day tests.

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As to routine methods of testing, I believe it will become necessary to make tests which have hitherto not been made. I am referring to sensitivity measurements upon receivers so as to establish the final condition of the receiver; also, tests made upon a-f-c systems to make certain that the frequency control circuits lock

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Having made two such notable contributions to progress in the electrical field, it was only natural that he should decide to take up electrical engineering, a course in which was completed at the Sheffield Scientific School of Yale University in 1926.

Having established himself so well as the servicemen's alibi in his home town, he decided to let his local reputation rest on its laurels and started his serious work with the radio industry as a member of the technical staff of the Bell Telephone Laboratories in 1926. At the end of three years of broadcast transmitter development work, field installation supervision and some smattering of television, he decided that the home town might have forgiven. At any rate, he took a chance and made a connection with Harvey Hubbell, Inc., in the capacity of radio engineer.

In about a year he moved from the Hubbell Company back to New York with the firm of T. F. Bludworth, Inc., specialists in sound system installations. Most of his time in this connection was spent on the development of remote control systems for custom-built radio installations. In 1931 at the conclusion of this connection, the writer went into a mild form of consulting engineering for electrical manufacturers, which work was concluded in 1934 when he joined the sales engineering section of the General Electric Company in Bridgeport, Conn.

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A PEEK INTO THE FUTURE

It is interesting to try to picture the radio service situation for, say the next five years. There is no question but that the process of tuning as we know it today will be almost obsolete in a home-type receiver. This means that practically every single home-type receiver sold will be equipped with some type of automatic tuning device. There is also no question automatic frequency control will be developed to the extent that it can be incorporated in even the lowest-priced radio receivers of the future. A perfect example of this is automatic volume control which was considered a luxury on the radio receiver of three or four years ago, but is now considered a necessity on all but the cheapest "cigar box" receivers. There is no escape from the fact that the technical background of the serviceman of tomorrow will of necessity be better than that of the serviceman of today as the public goes on asking for appliances which are easy to operate.

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(Continued on following page)

Rider Blazed Trail In Service Books

Thirty-seven years old—married, John F. Rider prefers golfing to eating. Has been writing for radio magazines and the radio tabloid sections of newspapers—when there were such sections—since 1921. Published the first of the service books in mimeographed form back in 1928. The first Rider Manual appeared in 1929. It was revised and published in enlarged form in 1931. Since then Rider Manuals have appeared annually; at the present time seven such volumes, totalling approximately 8,000 pages, are available. At one time or other, during the past sixteen years, he was connected with practically every radio magazine published in America, as associate or contributing editor. At the present time he is service editor of "Universal Commerce," an export magazine which circulates in foreign countries. He is also the author of the "Hour A Day" series, "Servicing Superheterodyne," "The Cathode-Ray Tube at Work," and other textbooks written for the servicing industry.

JOHN F. RIDER

He was in the service business as an authorized factory service station back in 1924 and 1925 at which time he conceived the need for manuals such as he publishes. Has been intimately connected with the publishing end of the servicing business during the past 10 years.

(*Continued from preceding page*)

in at the proper time; also, testing of a-v-c systems to make sure that proper leveling control exists and that the a-v-c circuit is operative over the proper range and to the proper extent.

With the possibility of automatic selectivity control as a feature of the 1938 receivers, further tests and, no doubt, equipment will be needed so as to make certain that the selectivity of the receiver is correct. As to information which the serviceman will need, there is no doubt that each and every service shop must have in its files a complete collection of servicing data covering the electrical structure and even the mechanical structure of America's radio receivers. I doubt if the most experienced serviceman would attempt to hazard his time by trying to service a modern receiver without first examining the structure of the circuit and without knowing the location of the various parts comprising the chassis and without properly identifying the components.

In line with information, there exists a very great need for a more complete grounding in radio theory and if the information we have received during extensive trips made all over the country can be considered as a barometer, we feel free to state that the conscientious serious-minded serviceman is the one who will do his share of studying so as to augment his technical knowledge.

As to the future of the servicing industry, a great deal depends upon the workers' ability to render proper service—not only from the technical angle but also from the viewpoint of efficiency and economy. Unless proper service is rendered, a great deal of the servicing will gravitate back to where it was many years ago—namely, to the set dealer who originally sold the installation.

In line with this matter of efficient operation and the need for equipment and education, is the necessity for the establishment of profitable prices in the servicing field—which means the application of proper and sound business principles in the administration of a servicing business. Only by recognizing that servicing is a business and must be handled as such can the serviceman acquire the wherewithal needed for proper growth and advancement.

Sound Offers Cash Reward

By S. N. Shure

Shure Brothers

The modern radio service man is an important factor in the distribution of sound amplifying equipment. In his role as technical radio contact man to the public at large he is often consulted on sound problems.

Progressive service men have recognized the profit possibilities in selling, installing and renting sound equipment and are actively going after this type of business. Service men who are not already engaged in this field are urged to investigate the "sound business" and to prepare themselves in order to cash in on the really enormous potential market which it offers.

Readrite Offers Free Trouble-Cure Booklet

A new Ranger-Examiner booklet, "101 Radio Troubles and Their Cures," has been compiled by Ranger-Examiner engineers to assist in speedily solving the more common radio receiving set problems. It is presented to servicemen free of charge by The Readrite Meter Works, oldest company in the service equipment field. Address Dept. RW of the company, Bluffton, Ohio.

Service Today and Tomorrow

By Nathaniel Bishop

Manager, Field Technical Section, Radio Division, General Electric Company

THERE is one thing about human nature which probably is the salvation of the radio service business. Human beings are essentially lazy. If some process which formerly required manual labor can be reduced by engineering to the simple process of pushing a button, the consuming public will pay for it.

There probably is no better example of this than the radio receiver of today as compared with the radio receiver of yesterday. We do not have to go back many years to recall what was then called a wireless set, which consisted of tuning coils, crystal detector, a condenser or two, and a head-set. The contortions that an ordinary human would go through to listen to a faint note that would tell him that Arlington was telling the world that it was 12 o'clock noon, classified anyone who played with a radio set as being somewhat queer.

Of course, this was long before the day that the public began to take an interest. The wireless enthusiast of that day could not even hear Arlington unless he was fortunate enough to know some radio amateur in the vicinity who could straighten him out in the difficulty of tuning amid room noises. Radio service was unknown.

When vacuum tubes first appeared on the market prices were so high as to preclude their use by the general public, and consequently so few receivers were used that the man who tuned one usually knew enough to wire it up and repair it when necessary. With the inception of broadcasting for public consumption and the introduction of complete radio receivers the radio service business was born.

TRAINING AND EQUIPMENT

Even these early receivers required little or no adjustment by servicemen, as practically every control was brought out on the front of the panel; that is, filament rheostats, coupling controls, individual tuning controls for each circuit, etc. Alignment as we know it today in radio servicing was not known because the customer was called upon to align his receiver for every signal received.

It was not long before the public began to tire of the complexity of adjustment of the early type of radio receiver and called for a set requiring less mechanical ingenuity on the part of the operator. About this time radio servicing gots its real start, because as soon as adjustments were taken out of the hands of the operator and put behind the control panel, service began to mean more than just resoldering

a broken connection or replacing a defective component part.

Even a brief review of the modern radio receiver of today with its automatic volume control, automatic frequency control, multiple band reception and all the other various features that go to make up the latest design, indicates the necessity for trained and competent servicemen and well-equipped service shops. In other words, the desire of the purchasing public for simplicity of operation has complicated the construction of the receiver to such an extent that only servicemen with good training and equipment are able to take care of such sets.

REQUIREMENTS OF TODAY

It is interesting to compare the shop equipment considered necessary in 1925 with that required today. In 1925 a serviceman could do a creditable job with a voltmeter, a screw driver, pliers, soldering iron and a roll of tape. Today no radio service shop is considered up to date unless it has at least an all-wave signal generator, frequency-modulated oscillator, a cathode-day oscilloscope, a sensitive and accurate analyzer and a tube checker capable of checking the myriad types of glass, metal and octal base glass tubes now in common use. In 1925 the serviceman himself could do quite a creditable job with only a meager knowledge of the fundamental underlying the design and construction of the relatively simple equipment used in those days. Almost any electrician, if he was equipped with service notes, could "fix" radio receivers. Today, servicemen with a lack of understanding of fundamentals would have considerable difficulty in reading intelligently the service notes on some of the more modern and complicated receivers.

The direct result of this complication of receiver construction and design to satisfy the public's desire for simplicity of operation has been to weed out of the radio service business

(Continued on following page)

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Having made two such notable contributions to progress in the electrical field, it was only natural that he should decide to take up electrical engineering, a course in which was completed at the Sheffield Scientific School of Yale University in 1926.

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One point is self-evident to those who know some of the problems of television. You will recall that with the beginning of short-wave

(*Continued on following page*)

P.A. Takes Up Slack Season

By G. J. Irving

Sales Department,
The Webster Company

WE are definitely of the opinion that there is a place in the public-address industry for the present-day radio serviceman.

Heretofore the serviceman has been living in a world unto himself, and has only recently given any attention whatsoever to this new and lucrative field covered by the ever-expanding public-address industry.

Up to the present most service work covering equipment such as we manufacture or handle has been performed by the dealer and jobber, who in many instances are keyed quite efficiently on the sales angle, but who, in many cases, are weak on installation and trouble-shooting, and here is where the service man who has devoted his years to the principles involved, and who stands recognized as an authority in his own domain, comes in.

The up-and-coming service organization that has already taken on public-address service and installation work has found it to be a very profitable and full-time adjunct to their regular radio business, and to a degree takes up the slack during that portion of the year which is sometimes termed seasonal.

Webster-Chicago has always been in the vanguard as applied to the idea of educating the service man in the use and servicing of public address equipment, and naturally welcomes the advent of that day which brings forth the serviceman and his organization into their proper sphere of operations.

Irving Named Chief of Webster Promotion

G. J. Irving, formerly of Operadio, has been placed in charge of the sales promotion division of Webster-Chicago, making his headquarters at the Chicago office, 3825 West Lake Street, Chicago, Ill.

G. J. IRVING

Mr. Irving has had many years experience in sales promotion work and actual contact with all kinds of "sound" problems.

His appointment creates a new division at Webster-Chicago, with the purpose of providing an increasing amount of dealer sales helps as well as promotion assistance for all kinds of dealer activities.

Mr. Irving predicts a big increase in the already high rate of turnover of Webster-Chicago merchandise.

NEW CORNELL-DUBILIER CATALOG

Cornell-Dubilier has just released an illustrated booklet listing the complete line of replacement electrolytic and paper condensers. The numerous shapes and sizes available, including the latest compact types, makes this catalog invaluable to the serviceman in choosing the proper replacement capacitors. Catalog 137A is obtainable from Dept. RW, Cornell-Dubilier Corporation, South Plainfield, N. J.

(*Continued from preceding page*)

reception for the layman, the problem of installation was and is of utmost importance for satisfactory results. Prior to short-wave reception almost any type antenna system would suffice for satisfactory results on local broadcast programs. Such an antenna, in most instances, was practically useless for effective short-wave reception, due to local noise.

The manufacturers' attack on this problem was to provide well-designed and efficient noise-reducing antennas. This did not relieve the serviceman from the necessity of making a careful and well-planned installation if he was interested in giving his customer the best results possible. This same problem to a much greater degree will be present when television comes to the point that it is ready for public consumption. Noise, as we know it today, in radio broadcast reception, may be classified, depending upon its intensity, as hardly noticeable, annoying, grating on the nerves and so bad as to preclude satisfactory reception. The interesting point is that noise which might be classified as only annoying for radio broadcast reception will blotch a television image to such an extent as to destroy its value. This fact should make it evident that the antenna installation problem for television reception will be an extremely important one and in congested areas will make the difference between acceptable results and complete dissatisfaction on the part of the customer.

The manufacturer will continue to supply the serviceman with all the technical information applicable to service and installation which is available, but the success of television so far as the layman is concerned, will depend to a great extent upon the serviceman and his ability to do a good job. It is therefore only reasonable to assume that as the importance of the serviceman in the whole radio picture increases, so will his profits.

Procedure for Service

By Joseph Kaufman

Director of Education, National Radio Institute, Washington, D. C.

NOT so many years ago, before superheterodyne receivers and special-function vacuum tubes came upon the scene, all radio receivers were very much alike. In those days, consequently, the servicing of radio sets was a simple task; a bright young man needed to learn only how to check tubes, how to look for open connections and shorted parts, and how to use the set analyzer in order to become a full-fledged *radio mechanic*. Naturally, the set analyzer was his more important servicing tool; its rotary switch automatically made the changes required to read volts and milliamperes for each electrode of a triode tube; manipulating a few plugs and repeating the process for each tube in a receiver seldom failed to locate the trouble, so what need was there for a knowledge of the whys and wherefores of radio circuits?

Then came the great march of new developments—superheterodynes, multi-grid tubes, automatic control circuits, all-wave receivers, dozens of different complex circuits for each basic radio function—and each development resulted in new problems, new pitfalls for those who had to repair "them thar new-fangled contraptions."

SOME JUST GETTING BY

By using their old servicing procedure, fortified with a vast amount of practical experience, thousands of these old-time radio mechanics have managed to survive without mastering the fundamental principles of these new developments. Perhaps they are natural-born radio men—perhaps they are lucky at dodging the troublesome modern sets—but more than likely they are just getting by as best they can. Many of these "stone-age-of-radio" mechanics secretly wish that some radio magician would bring forth a modern version of the old set analyzer—a really "hot number," which would almost say: "Buddy, that squeal you hear is caused by an open by-pass condenser in the first i-f stage." Sorry, fellows, but miracles like this just aren't possible even today.

Let me give you just one reason why mechanical "fussing" with an ailing radio receiver won't get by today. Read H. J. Bernard's article, "Full Analysis of Super Squeals," in the April, 1937, issue of RADIO WORLD and you will see why analyzers are useless when supers start acting up. Master the contents of this article, or master a good text-book on the subject, however, and you won't need any analyzer to kill super squeals.

Prompted by fact and not by a desire to pat any one on the back, radio manufacturers are now designating as *radio service engineers* those men in the radio industry who are able to service modern radios intelligently, confidently and dependably. Let us, then, see how a radio service engineer goes about his work of repairing a dead radio receiver.

A PROGRESSIVE METHOD

First of all, there is the confirmation of the complaint by actually trying the receiver in question; after all, one must know what is to be remedied, and the way the set performs is often a direct clue to the trouble.

The next logical step is a check for obvious surface defects, such as power plug out of its wall outlet, top cap of tube off or touching the tube shield, antenna or ground leads disconnected or defective, tubes which do not light or heat up, odors or visible signs of burned and charred parts, etc. An experienced man can check all of these things almost at once.

If this mechanical routine fails to locate the trouble, some brain work is in order. The radio service engineer first proceeds to find the defective section or stage, either by going from stage to stage with a signal generator or by "shocking" each stage in rotation, which he does by shorting one control grid after another to the chassis or simply by touching the grids with his finger; failure to get a click or squeal at a particular tube while working from the loudspeaker back to the antenna indicates a defective stage. Naturally this routine varies with individual cases, for there would be no need to check stages like this if preliminary inspection showed that every stage was "dead," an indication of power supply trouble.

The defective stage being located, either a voltage check-up, a point-to-point resistance check or a set analyzer can be used to trace down the defect itself in the defective stage. Sometimes the isolation test indicates that an entire section of the receiver is at fault; this simply enlarges the region in which the final

search for trouble is made. In practically every case this procedure will lead to the source of trouble in a dead receiver.

NEW PROBLEMS STUMP MANY

A radio mechanic, true enough, would have no difficulty with this procedure if he knew about and used a stage-by-stage trouble-hunting method, but most of these old-time mechanics throw common sense to the wind after the hunt for obvious defects fails; they laboriously test every tube in the set, then test parts and connections in a hit-and-miss manner until they stumble upon the defect. Dead receivers, even though quite modern, are fairly "easy meat" for the radio mechanic.

But what a headache the mechanic runs into when the complaint is a hum, squeal, cut-off, distortion or intermittent reception. Listen to any gathering of old-timers and you'll hear something like this: "Say, Bill, I got a model 82 that distorts like a sick hen at low levels; watcha think is wrong?" If a suitable answer is not forthcoming the troubled radio mechanic will go through files of case histories in the hope that he can find a report on how some one else solved his particular problem.

But time is too valuable to be wasted on such antics, and all too often they lead to naught. And what will the radio mechanic do when he encounters a set having such things as a.f.c., a.v.c., bass and treble compensation, automatic or manual selectivity and sensitivity control, etc.? Well, there is always the manufacturer's service manual, if he can get one, but of what value is this to him if the particular trouble isn't discussed in detail?

KNOW YOUR STUFF

That famous chef, George Rector, never made a salad with a cook book in one hand—no, sir! He knows the fundamentals of cooking—the chemistry of foods and the science of cooking tasty dishes, and he works from these fundamentals, creating rather than following recipes.

Modern radio servicing, like modern cooking, requires a knowledge of fundamentals. The radio service engineer, having mastered the fundamental concepts of radio, is able to reason out the probable causes for a particular complaint and eliminate them one by one until he has found the trouble. This effect-to-cause reasoning is a short-cut that saves hours and hours of time, placing him far ahead in any honest competition with radio mechanics.

As a rule, the actual repair of a defective receiver is quite simple, once the trouble has been located. The job is not really finished, however, until the original pep and action of the receiver have been restored; this, of course, can be done only if the customer will foot the bill. Revitalizing a modern receiver is truly an engineering job, for it requires intelligent use of special testing equipment such as wobbulated signal generaors, cathode-ray oscillographs, vacuum-tube voltmeters, beat-frequency audio oscillators, db meters, etc. The man behind these tools is just as important as the tools themselves in this case.

Each new development in aural and video radio apparatus places a greater burden upon the radio service engineer and pushes the radio mechanic another step back into oblivion. In a field where competition is as great as it today is in the radio service industry, a man must replace his obsolete mental equipment just the same as he replaces obsolete test equipment.

A good training in radio fundamentals is the only difference between a radio mechanic and a radio service engineer, assuming them to be

(*Continued on following page*)

Kaufman Has Taught Servicing to 50,000

A true New Englander hailing from Boston and educated at Massachusetts Institute of Technology, "Radio Joe" Kaufman dates his radio experiences as far back as 1909, when he listened to Nauen, Germany, and other foreign stations regularly on a home-made long-wave crystal set. After S. B. and S. M. degrees in electrical engineering came a position on the teaching staff at M. I. T., where he taught electrical engineering and physics; two years later he entered the manufacturing business as an industrial engineer for the U. S. Rubber Company. The lure of radio became more and more powerful, however, and finally he entered the radio manufacturing business.

JOSEPH KAUFMAN

Old-timers will remember the *El-Kay* parts and receivers—well, the *Kay* in that name stands for designer and partner Kaufman.

Having had his fling at radio manufacturing, "Radio Joe" went to National Radio Institute in 1929 as director of education, and since that time has taught the fundamentals of radio servicing, radio communication and television to more than 50,000 students and servicemen.

He has assisted a number of test equipment manufacturers in designing instruments for modern radio servicing methods, and succeeded in bringing out the importance of stage-by-stage analysis, circuit disturbance tests and effect-to-cause reasoning. There are hundreds of text-books, articles and lectures on various phases of radio to his credit. He's married, and there are two fine lads; Bruce is 7 and has the makings of an artist, while Roger, at 5 "just takes after his daddy." Rejuvenating a 1930 Kolster is Kaufman's hobby; already he has put in high fidelity and automatic frequency control of new design, but still he tinkers with the "antique," testing out new radio engineering ideas and building in novel automatic control features.

All-Wave Set Turned Tide

G. B. Radcliffe

Engineering Dept., Midwest Radio Corporation

THE days when a serviceman could fix almost any radio with just a screwdriver and a pair of pliers has long since past. At that time, which we assume to be ten to fifteen years ago, very little definite information was available as to the proper methods of servicing radios. We had all types of so-called radio men, at that time, which for example included auto mechanics, electricians, machinists and many others with a slight technical knowledge of electricity. Their methods were crude and often purely guesswork. Many of them were quick to realize radio was no plaything, as a dissatisfied customer often made enemies instead of friends and, if the inexperienced man was honest in his dealings, he lost money in trying to satisfy his customer.

This condition existed to a slighter degree up until six years ago, at which time Midwest brought out their all-wave receivers. Many of our most competent servicemen were at odds as to how to service these new short-wave receivers. The all-wave receivers were not just a simple converter, but almost a complete change in the radio itself.

In designing an efficient all-wave receiver it was necessary to incorporate a highly-efficient intermediate-frequency amplifier which had to be changed from the usual 175 kc to 456 kc.

NEEDS TRAINING AND SHOP

The serviceman's problems were increased greatly because his knowledge of only the broadcast band was not sufficient, as he now had five or six bands which incorporated a different r-f amplifier for each band. The two years following showed an increased interest on the part of the customer for short-wave reception. Almost all manufacturers soon realized this and today short-wave reception is a necessity, which brings us up to the present status of radio.

The serviceman of today, if he is competent, must have a service shop of his own, whether it

Intermediate-frequency amplifiers are aligned with a cathode-ray oscilloscope, for passing the correct band width and establishing symmetrical attenuation. A frequency modulator is a necessary adjunct. The receiver performs the required detection.

(Continued from preceding page)

of equal intelligence. That training must be secured from a reliable source, a school which understands the relationship between theory and practice, building a foundation training brick by brick into a complete interlocking mastery of radio.

Obviously there are practical considerations which prevent many from attending resident schools in order to obtain this training; for them a good home-study course, taken with a school which has proved in the past that it can train men for success in radio, is the answer. But study must not stop with completion of the course; the radio service engineer must keep in touch with the newest developments through articles in technical magazines such as this—he must keep ahead of the game, not behind it.

is in his home or in a shop. He must be well-trained in knowledge by considerable practical experience and instructions from any of the many courses offered by radio training schools. His equipment today should consist of multi-range voltmeter, a highly efficient cathode-ray oscilloscope, a dependable and accurate r-f signal generator, a tube tester that will test any of the tubes on the market, and service instructions as furnished by the manufacturer of the radio he is repairing.

REASONS STATED

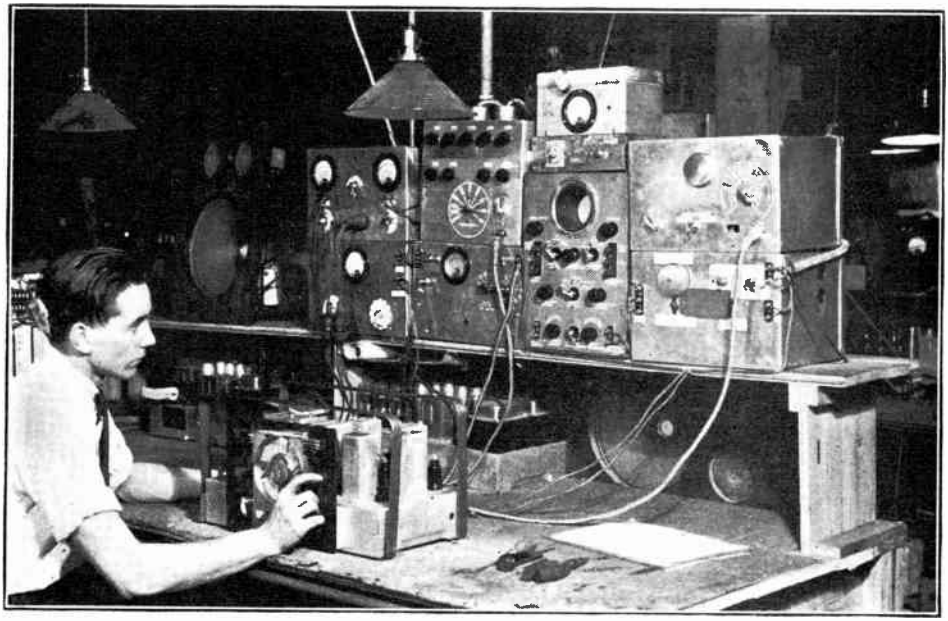
This equipment and knowledge are only a small portion of what the dependable service shops throughout the country now possess and it is also the necessary equipment for a person entering the radio service business, for the following reasons:

Some of the most complicated features of the modern all-wave receiver include automatic frequency control, automatic volume control, efficient intermediate-frequency ampliers of several stages, two stages of r-f amplification and its associated oscillator section, compensated audio amplifiers and heavy-duty, hum-free, rectifier systems.

When all these features are incorporated in one receiver voltages become critical, alignments of every section dependent upon each other and the utmost efficiency must be had from each tube. The advent of automatic frequency control has definitely put the cathode-ray oscilloscope into the serviceman's category as a permanent article and the serviceman who attempts to be without one is handicapped.

The manufacturer's requirements for radio receivers, while fundamentally the same, vary in specifications with parts and alignment procedure and it is not advisable for a serviceman to attempt repairing a receiver without definite instructions as provided by the manufacturer of the set.

Midwest has realized that time spent in training their service and test departments in receiver design will reap rich rewards by producing a well-built receiver by well trained men.



Metered tests are made of all voltages, including output voltage, and power measurements are made, besides. It is the general opinion that service men will have to be equipped to make the same type measurements as do the best set manufacturers.

GROWS MORE COMPLICATED

The radio servicing field is gradually becoming more complicated and the men needed will be better trained and more educated than in the past. They will be required to have closer cooperation with the manufacturers of the radio receivers. They will subscribe for a few of the radio publications now on the market and prepare themselves for new features that are constantly being brought to light by radio laboratories throughout the country.

With the prospect of television playing an important part in our life, the servicemen will avail themselves with all the information they

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can collect from these publications and it is good practice to do some experimenting along the lines as outlined by the various laboratories supplying such information.

As Midwest sees the future of servicing television receivers, the servicemen will be required to have the knowledge of the band-pass tuning type of intermediate-frequency amplifiers, the knowledge of infinite impedance detection and knowledge of audio amplifiers of the degenerative feedback design and operation characteristics of cathode-ray tubes.

The reasons for such an audio amplifier is that a flat frequency response, much greater and better in range of frequencies than anything yet produced, will be necessary if it is to operate in a television set as plans are outlined. The bands allotted to television, without a doubt, will be on the ultra-high frequencies, which means that the serviceman should avail himself of the knowledge as to characteristics and peculiarities of the ultra-high frequency band.

At present the cathode-ray tube seems to be accepted as the medium of viewing and this particular subject cannot be overstudied. Many of the servicemen have already taken the opportunity of utilizing the amateur bands to gain this knowledge and many new ideas are daily being brought to light from their efforts.

Soon We'll All Need Degree

By E. V. Sundt

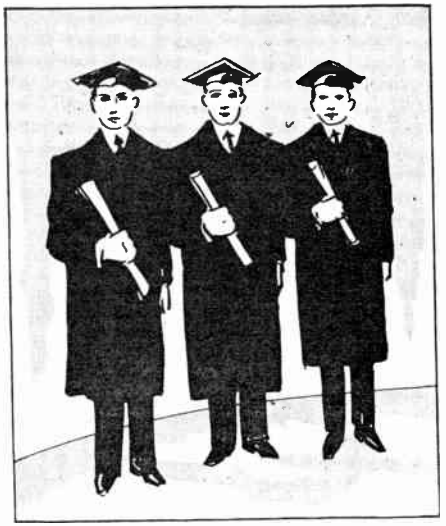
General Manager, Sundt Engineering Company

IF we could predict the future from past events, it would seem that the future trend in radio servicing is going to be along the lines of a more scientific treatment of this subject.

Radio servicing, even ten years ago, received comparatively crude treatment. A typical radio service man was a man who had learned just enough about radio servicing to be dangerous, and because he could not get a job at anything else, he took up radio servicing. With the increased complexity of radio service and design, men of this type could no longer compete with the more technically trained men able to use more highly developed tools of analysis.

The radio service man of the future is go-

Tube voltmeters play an important part in receiver checking and servicing, while checking tubes themselves is one of the basic requirements. The above photograph, and its two predecessors, were taken in Midwest's enormous plant.



ing to be a radio service engineer, and it is our belief that eventually these man will be nothing less than engineers—engineers plus business men. The tools they work with will perhaps not need to be as scientifically accurate as the tools required in radio research, but they will need to be informative; and in order to be a good investment from the economic point of view, will need to be relatively simple and easy to set up and use. It was with this thought in mind that we designed the Neobeam Oscilloscope, making it highly simplified, quick to set up, and with a degree of sensitivity sufficient for any radio servicing; I think we are following the correct trend.

Radio servicing is passing from the field of non-technical trouble shooter to that of a profession.

Best Customers Smart As You

By John W. Million, Jr.

President, Million Radio and Television Laboratories

THE future of the radio serviceman is full of money-making possibilities. The automotive serviceman has already experienced the improved conditions that will come to the radio serviceman in the near future. The amount of back-alley and home garage service work in the automotive field has dwindled in the last year tremendously. Men have gone back to work. The established shop is now benefiting in two ways. Not only is the chiseler forced to go to a regular shop but he is in a position to pay the prices of a regularly-established shop. In addition, many home shops of qualified men are now closed, due to satisfactory earnings in regular employment.

The trend toward regularly established service shops will continue for several years. Now it is a question of what shop or whose shop gets the business. This as always will depend on many factors, such as location, personnel, sales ability, technical ability and last, but far from least, equipment.

CUSTOMERS FAST THINKERS

Customers who enter the shop will not return if old, obsolete equipment is used. Even though the equipment may be very good (seldom true) the fact that it is not *modern* in appearance makes a poor impression. Don't ever kid yourself that the customer is a dummy who doesn't know the difference. Remember that he earns a good enough pay check to pay you and he uses his head in earning that money.

Your best pay comes from the higher-priced repairs and these customers are likely to be salesmen, buyers, or other executives who are fast thinkers. Take them into your confidence and frequently you can get more for the job. This makes the customer remember to send others to you.

In the matter of equipment always look at it from two points of view. For the shop you need impressive appearance and speed in your work. For outside use portability and speed in your work are the two requisites. Too many servicemen have great big impressive panels in the shop but any visitor is immediately impressed with the maze of gadgets and the time and inconvenience in use.

Next let us consider the matter of buying to avoid obsolesence from technical advances Tube testers have, of course, been the worst

(*Continued on following page*)

Servicing Now Is Engineering

By R. M. Coburn

General Sales Manager
National Union Radio Company

LIKE every other industry, radio had to go through it's "horse and buggy era." In radio, however, the era might be well termed, the "Age of Screw-driver Mechanics." This term was applied to the bright boys who could with the flick of a wrist "repair" a radio receiver. All very well, in those days of simple circuits, back in the late 1920's. As the art of radio progressed at a headlong pace, however, receivers soon took on a more complex nature. Circuit refinements developed by thousands of experimenters and hundreds of engineers, toiling far into the night throughout the land, made their way into commercial receivers and the business of fixing sets became more and more a job for highly trained men instead of just "the neighbor's boy" or some radio fan around the corner.

As radio development plunged ahead through the early '30's it became obvious that simple tinkering just wouldn't do. Then started to dawn the realization that testing instruments and a knowledge of how to use them would become important factors.

INSTRUMENTS VITAL

Thousands of smart radio-minded men throughout the country took it upon themselves to study the scientific fundamentals of radio so they would be in position to handle complex work in the repair line as it started to come to them. They went to school, they took correspondence courses, they studied articles in technical magazines, drinking up every ounce of knowledge they could absorb.

Thus, it comes about that radio servicing is no longer a simple screw-twisting game. The men in it have to study continuously and operate from a broad base of knowledge in general radio theory. These men today who know their business are literally engineers of service.

Knowledge and constant study, however, are not the only elements which are important. without scientific instruments, the man is lost. Great strides have been made in the instrument line by manufacturers who have catered chiefly to the needs of the radio service specialist. Of course, this need for scientific instruments has presented a real problem to the service man from the expense viewpoint. He must have the instruments to increase his business, and yet the purchase of adequate equipment indicates the outlay of an amount of money which is a real blow to his pocketbook.

DISTRIBUTION 75,000 PIECES

This financial burden has been and is being eased in large measure by the manufacturers of National Union radio tubes, who were quick to sense the serviceman's need for scientific equipment early in 1930. This tube maker has consistently carried on the selling program which has made it possible for servicemen throughout the United States through their normal purchase of radio tubes to obtain instruments on a premium basis. Recent reports indicate that National Union has supplied more than 75,000 pieces of equipment to date. At present our free equipment offers include every needed implement for the modern service specialist.

CONSTANT STUDY REQUIRED

The screw-driver mechanics are gone. They have been banished from the face of the radio

(*Continued from preceding page*)

complicated modern receiver is available in a highly-perfected state, actually more nearly perfect than modern receivers really require; in other words, suitable for the most exacting requirements of present and immediate future designs. These same instruments will analyze every circuit component in the latest known types of television equipment. This may not be true two, three or five years hence, but in the meantime there are 25,000,000 radio receivers which will require more or less than 50,000 servicemen to look after this business. Of these not more than 2,500 are adequately equipped. The men who have modern equipment will reap a harvest in the prosperous years immediately to come. Before special equipment is necessary for television, the cost of present instrument requirements will be more than paid for by the profits from the business available today.

To be successful, be modern!

ing to be a radio service engineer, and it is our belief that eventually these man will be nothing less than engineers—engineers plus business men. The tools they work with will perhaps not need to be as scientifically accurate as the tools required in radio research, but they will need to be informative; and in order to be a good investment from the economic point of view, will need to be relatively simple and easy to set up and use. It was with this thought in mind that we designed the Neobeam Oscilloscope, making it highly simplified, quick to set up, and with a degree of sensitivity sufficient for any radio servicing; I think we are following the correct trend.

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Million Known for Research, Engineering

John W. Million, Jr., has been president of Million Radio and Television Laboratories, 361 West Superior Street, Chicago, since 1934. The service instrument branch of the business has been greatly enlarged recently.

JOHN W. MILLION

Mr. Million was born September 25, 1902, at Mexico, Mo. He was graduated from the University of Michigan in 1920. Positions he held since then are: research assistant, L. D. Caulk Co., Milford, Del.; instructor, mathematics and physics, Des Moines University. Million was research assistant to Dr. A. H. Compton, at Washington University, St. Louis. During this time the Compton effect was verified and a few years later, in 1927, Dr. Compton received a share in the Nobel prize for physics. Research engineer, Bell Telephone Laboratories (vacuum tubes, receiving sets, field strength measurements).

Chief engineer of King-Hinners Mfg. Co., Buffalo, N. Y.; Brunswicke, Balke, Collender Co., Chicago; Bremer-Tully Mfg. Co., Audiola Co., Fairbanks-Morse (home appliance), Chicago.

Also he was research director, Utah Radio Co., Chicago. He is a member of the Acoustical Society, American Physical Society, Institute of Radio Engineers, Radio Engineering Club (Chicago) and the American Association for the Advance of Science.

(*Continued from preceding page*)

and will continue to be. The early voltmeters of a few hundred ohms per volt were shortly replaced by the 1,000 ohms-per-volt units. These have lasted for some time but may become obsolete. The minimum for any but a cheap knockabout meter is 5,000 ohms per volt. These are technical changes and all the buyer can do is to buy the most advanced available even if it does cost a little more. For example, our 5,000-ohm-per-volt unit has a-c and d-c voltage scales from 3 to 900 volts. Current scales are from 200 microamperes up to 600 ma. Low ohms and high ohms from one ohm to 10 megohms, db power level scale besides, and sells for only $19.95. The point is that a similar meter of 1,000-ohms-per-volt would be only a few dollars cheaper and of no use for a.v.c. or a.f.c. tests.

In our larger model the sensitivity is 20,000 ohms per volt and reads resistance to 30 megohms. In both testers separate batteries and zero adjusters are used for both ohms scales, and all connections are on two high-speed switches. The leads are permanently anchored in the tester. Both units use modern square meters.

A GLIMPSE OF TELEVISION

The same difficulty is experienced in tube testers. Many do not provide any method of testing for leaks above 100,000 to 200,000 ohms or even if release of the neon is provided no calibration is available to tell the amount of the leakage. Again the matter of the circuit is important. Many have fixed circuit arrangements. In our units the selector is based on a principle that permits the testing of any tube that keeps one of the filament leads fixed. No combination of elements can prevent the testing of each section individually. These features are included even in the small portable tester that sells to the service man at $9.95. In all but this cheapest unit an extra socket is provided in case of a new base for tubes.

Now let's talk about television. Many people consider television as too far in the future to concern the serviceman. Many prospectuses on what will be needed to service a television receiver have been prepared and are enough to scare any serviceman out of his wits. These have assumed that the serviceman was going to do the same things that the laboratory engineer does when he designs the receiver. Fundamentally the serviceman's problem in television will be just an extension of the work he is now doing. The smart serviceman spends little time trying to redesign the set. He finds out what isn't working and replaces it or resolders it or what have you. In television servicing he will do the same thing in a little more complicated collection of amplifiers at a few more and different frequencies.

AVOIDING LOSS IN SHUFFLE

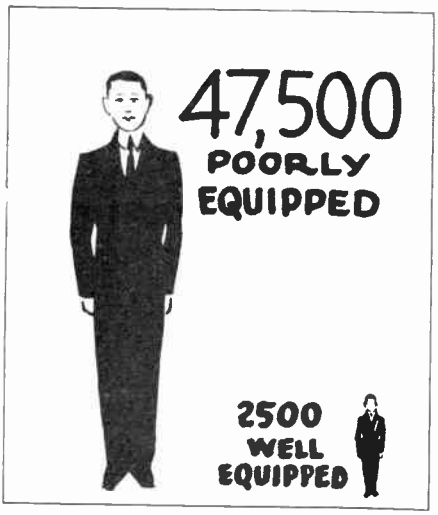
Now what does this mean in equipment? First it means checking a lot of megohms, for they run loose all over the television receiver. It, of course, will mean checking a-f-c and a-v-c circuits in the presence of these self-same megohms. That means that a 1,000-ohms-per-volt meter won't be much use. The 5,000 will get by and the well-equipped shop will use the 20,000-ohms-per-volt. At the same time the tubes used with all these megohms will have to have very low leakage and some test such as is used in all our tube testers must be provided. This test tells you whether the leakage is of the order of 100,000 ohms, 1,000,000 ohms, or several megohms. Amplifiers with megohm grid resistors will not work right with grid to cathode leakage of one or two megohms in the tube itself. The 20 to 50% loss in gain due to such causes will be one of the hard things to find in television service.

The buyer of test instruments and the designer of them must take these things into account if he is not to be lost in the shuffle without knowing why. Television will soon be here, amateur if not commercial.

50,000 Servicers; 2,500 Equipped

By J. P. Kennedy

Sales Manager, Triumph Mfg. Co.



WILL my test equipment meet the changing conditions of the radio and television designs? Should I forego new equipment to see what will develop?

Let's get down to earth.

How many television service calls have you had? Do you know of any of your customers who own television equipment? Last year more than 8,000,000 radio sets were sold and fewer than 1,000 devices which are alleged to be television instruments were sold.

Your immediate concern is not television but good substantial superheterodynes with delayed a.v.c. and automatic frequency controls, which can be thoroughly analyzed with standard equipment available today!

For once in the progress of radio, test equipment has caught up with and passed current receiver requirements.

SERVICEMEN LEAD WITH 'SCOPES

Speaking from the experience of the Triumph Mfg. Co., there are more oscillographs in the hands of radio servicemen today than in all the factories and broadcast stations in the world. In fact, radio manufacturers are just starting to consider oscillograph equipment in their production lines due to the complaints of their dealers who check their receivers with oscillographs!

Even in oscillograph equipment changes in design have kept ahead of the industry but the first oscillographs designed are still good and applicable to service needs. Now midget oscillographs are combined with wobbulators, permitting the one instrument to perform all the functions of receiver analysis. We make one called the Triumph Model 77. The flexibility of this fundamental unit is such that every component part in a receiver can be individually or collectively analyzed.

STILL HIGHER FREQUENCIES SOUGHT

Development of good oscillographs disclosed glaring faults in ordinary oscillators; faults of poor wave form, improper percentage of modulation and queer harmonic frequencies. Today, oscillators have developed into signal generators and servicemen often check these instruments on an oscillograph before buying. Instrument manufacturers such as we have been forced to perfect our equipment by the disclosures of cross-checking one device against another. We were compelled to develop a signal generator with a pure sine wave output because our oscillographs were a means of immediately checking our wave form and percentage of modulation.

A good sine-wave signal generator will not be obsolete for a long time. Our equipment is now calibrated within ½ of 1% from 100 kc to 75mc, and harmonics may be used satisfactorily at still higher frequencies. A modern signal generator, such as the Triumph Model 120, is a fundamental unit and as sound an investment as an ohmmeter.

The signal generator and the oscillograph-wobbulator are fundamental units dealing with the fundamental characteristics of audio and high-frequency currents. Perhaps we will have improvements in this equipment. A better thyraton tube which will operate at ultra-high frequencies would be a help but its development will not limit the use of present thyratrons, rather if it is interchangeable it will extend the usefulness of linear sweep circuits in cathode ray oscillographs.

D-c. and power-frequency a-c. voltage indicating devices have not changed appreciably in several years, save for the perfection of more sensitive units but even these came out too late because the oscillograph is already performing most of the measurements on circuits for which high sensitivity meters were intended. A good 1,000 ohm per volt multi-range meter, such as the Triumph Model 300, will still handle 99% of a serviceman's requirements.

Tube testers have now practically all standardized on the emission method of testing, recommended by the Radio Manufacturers Association, Inc., technical committee, and this is supplemented by inter-element short checks. This test is satisfactory for detecting all ordinary causes of trouble except microphonics, which are now a rare complaint. Our Triumph Model 420L also detects open circuits within a tube.

All right, let's summarize the service instrument situation.

Every instrument required for even the most

(*Continued on following page*)

Servicing Now Is Engineering

By R. M. Coburn

General Sales Manager
National Union Radio Company

LIKE every other industry, radio had to go through it's "horse and buggy era." In radio, however, the era might be well termed, the "Age of Screw-driver Mechanics." This term was applied to the bright boys who could with the flick of a wrist "repair" a radio receiver. All very well, in those days of simple circuits, back in the late 1920's. As the art of radio progressed at a headlong pace, however, receivers soon took on a more complex nature. Circuit refinements developed by thousands of experimenters and hundreds of engineers, toiling far into the night throughout the land, made their way into commercial receivers and the business of fixing sets became more and more a job for highly trained men instead of just "the neighbor's boy" or some radio fan around the corner.

As radio development plunged ahead through the early '30's it became obvious that simple tinkering just wouldn't do. Then started to dawn the realization that testing instruments and a knowledge of how to use them would become important factors.

INSTRUMENTS VITAL

Thousands of smart radio-minded men throughout the country took it upon themselves to study the scientific fundamentals of radio so they would be in position to handle complex work in the repair line as it started to come to them. They went to school, they took correspondence courses, they studied articles in technical magazines, drinking up every ounce of knowledge they could absorb.

Thus, it comes about that radio servicing is no longer a simple screw-twisting game. The men in it have to study continuously and operate from a broad base of knowledge in general radio theory. These men today who know their business are literally engineers of service.

Knowledge and constant study, however, are not the only elements which are important. without scientific instruments, the man is lost. Great strides have been made in the instrument line by manufacturers who have catered chiefly to the needs of the radio service specialist. Of course, this need for scientific instruments has presented a real problem to the service man from the expense viewpoint. He must have the instruments to increase his business, and yet the purchase of adequate equipment indicates the outlay of an amount of money which is a real blow to his pocketbook.

DISTRIBUTION 75,000 PIECES

This financial burden has been and is being eased in large measure by the manufacturers of National Union radio tubes, who were quick to sense the serviceman's need for scientific equipment early in 1930. This tube maker has consistently carried on the selling program which has made it possible for servicemen throughout the United States through their normal purchase of radio tubes to obtain instruments on a premium basis. Recent reports indicate that National Union has supplied more than 75,000 pieces of equipment to date. At present our free equipment offers include every needed implement for the modern service specialist.

CONSTANT STUDY REQUIRED

The screw-driver mechanics are gone. They have been banished from the face of the radio

(*Continued from preceding page*)

complicated modern receiver is available in a highly-perfected state, actually more nearly perfect than modern receivers really require; in other words, suitable for the most exacting requirements of present and immediate future designs. These same instruments will analyze every circuit component in the latest known types of television equipment. This may not be true two, three or five years hence, but in the meantime there are 25,000,000 radio receivers which will require more or less than 50,000 servicemen to look after this business. Of these not more than 2,500 are adequately equipped. The men who have modern equipment will reap a harvest in the prosperous years immediately to come. Before special equipment is necessary for television, the cost of present instrument requirements will be more than paid for by the profits from the business available today.

To be successful, be modern!

Coburn Has Brilliant Record as Executive

R. M. Coburn, general sales manager of National Union Radio Corporation, is a veteran of the radio industry. He has been actively engaged in all angles of the business since his graduation from Cornell University, just prior to the entry of the United States into the World War.

R. M. COBURN

Immediately after his graduation, he enlisted in the United States Navy as a radio operator and was assigned to duty in the Naval Aviation Branch. He served for the duration of the war as a radio operator in one of the flying boats which patrolled the Atlantic seaboard. Immediately after he was mustered out of the service, he engaged in retail radio store operation and the production of custom-built sets.

He left the retail field to join the sales force of a national manufacturer of radio receivers where he served in the capacity of salesman and district sales manager. Later, another national manufacturer called him into service as general sales manager. Some years ago he left the set-manufacturer field to serve with the executive sales force of National Union Radio Corporation, makers of National Union radio tubes. With this company he has served as sales statistician, office manager, and assistant general sales manager. In 1936 Mr. Coburn was advanced by National Union to the post of general sales manager, which he holds today.

(*Continued from preceding page*)

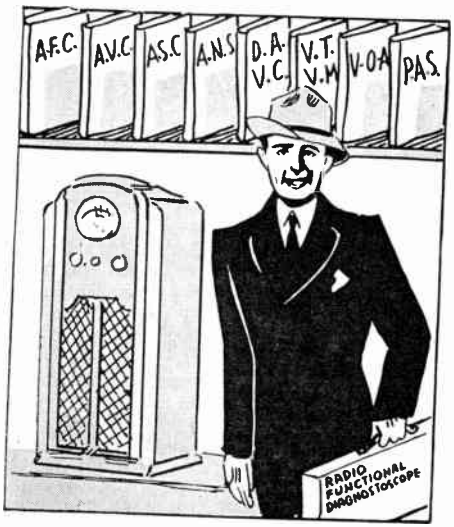
industry just as surely as if a tornado had lifted them to another planet. In their places are men who have a complete sense of the need for knowledge and constant study, combined with the ownership of scientific instruments which will enable them to carry on their all important work. These men know that progress in radio goes on and on and they are facing the future with an understanding of the fact that their work will be increasingly complex. Radio and radio service work have a limitless horizon, with television looming in the distance and no man knows what more.

Let the man who will play the game of radio maintenance, then, keep himself alert to drink at the fountain of radio knowledge and equip himself with the scientific tools he must have to win success.

Be Modern as Latest Sets

By James L. Fouch

Test Technician, Universal Microphone Co., Ltd.



HOW many of you started your first radio servicing by adjusting the cat's whisker on a crystal set that brought a thousand-watt station just "pounding in" on a pair of ten-dollar 'phones? Now it is possible to buy a radio for what those 'phones cost. But, is the new set complicated as compared with the crystal set? It may be even harder to service than a much larger radio. Using the new modern test equipment to diagnose the trouble, all ailments are quickly indicated, and easily repaired by the up-to-minute radio service man.

Since the radio listener wishes to put forth as little effort as possible, many trick gadgets have been invented that sell radios. The service man must know how to adjust and align this new equipment and necessarily his test apparatus must be as modern as the radio he expects to service. The old tube tester that indicated only when a tube was good, bad, or indifferent is O. K. for use in the store, but not for checking circuits as complicated as those in use today. Set analyzers and multi-meter units usually catch the trouble and they will find use for many years to come.

TWO HANDY COMPANIONS

But not always does the trouble appear on the surface and these units may not delve deep-

(*Continued on following page*)

Fouch is a Physicist and an Inventor

James L. Fouch, after an extensive education in physics and chemistry, was engaged by the Universal Microphone Co. in 1930. In the assembly department he received much first-hand knowledge of microphone construction. After a year in this department Mr. Fouch was transferred to the technical staff, engaging in routine testing of microphones and their amplifiers. In the past six years he has made a comprehensive study of radio and television problems as related to electro - acoustic products. He has developed and designed various pieces of apparatus for production testing of electro-acoustic devices. These embodied several innovations in procedure. In 1936 Mr. Fouch was concerned in the research, development and design of the Universal velocity microphone. Here he also worked on new microphone production methods.

JAMES L. FOUCH

Since then he has been greatly interested in communication problems such as police and amateur radio and inter-communication systems. After these studies, several special service microphones were brought forth for these applications. Mr. Fouch is now in charge of the testing of the Universal high-fidelity recording amplifiers and radio tuners, which require special analyzers for a perfect check. Together with this work he supervises microphone and amplifier testing. His work at the Universal Microphone Company plant at Inglewood, Calif., has continued over seven years.

(*Continued from preceding page*)

ly enough. An example is seen in the case where the i-f stages are out of line. "Blind" cut-and-try methods have been eliminated by the present-day adoption of the oscillator and oscilloscope, two handy companions. Here, the radio service man has been given instruments that afford an X-ray picture of what is happening in those circuits that cause unseen trouble. Not just a still picture but one that indicates immediately any change you have made to better the condition in the circuit.

Higher standards have been set up for selectivity, quality and performance of today's radio. So, the radio service man must follow through. The range of radio is being greatly increased into the shorter wavelengths. Again there is the call for apparatus that will test these new circuits without introducing a loss, hence falsity of reading. The vacuum-tube volt meter is a fine example of such equipment for the alignment and check of the efficiency of ultra-high frequency circuits.

But is the radio service man always being concerned with receivers? No, you have other means of deriving income, such as public-address systems, either sale or rental. Periodic inspection of public-address equipment sold, not only keeps the customer happy, but also paves the way for additional sales and service.

New dynamic, velocity, condenser and crystal microphones may be checked over occasionally, using an oscilloscope to see any distortion of tone. Carbon, velocity and crystal microphones are being used in the new call and inter-communication systems that are finding such popularity today. Maintenance or periodic check of systems using carbon microphones, considering the button currents which indicate what quality to expect, is the way to satisfy customers. Extreme variations from normal button current indicates trouble in the microphone. The oscillator and oscilloscope are a pair that may be used for a quality check of these systems, remembering of course that the audio range is restricted, since voice frequencies alone need be clear and distinct.

WHAT TELEVISION REQUIRES

Another field into which the radio service man has entered is the recording business. Maybe first as a side line, but many are doing a very interesting trade. The equipment runs in price from about $75 up. Many forward-looking fellows are already making noiseless recordings on professional machines for local radio stations. These fellows knew radio and had even a slight knowledge of mechanics mastered the simple technic of recording. The test apparatus for checking this equipment amounts to a strohoscope, protractor, micrometer and microscope. All these are furnished with the Universal Professional Recording machine. A good audio amplifier is required, having a rising characteristic. The oscillator and oscilloscope will tell you if the output is undistorted and without hum, along with the rising characteristic. Inexpensive aluminum discs are used on work that is not so critical, and acetate-coated discs for the highest quality.

Now looking ahead we gaze into the oscilloscope and see television coming up over the green horizon for the consideration of the radio service man in the very near future. Your job will then be one of servicing two radios instead of one—the audio channel and the television channel. Along this line, who has seen the fellow who wasn't a little bit curious about the workings of his oscilloscope? It looks as if when the fundamentals of this instrument were grasped a foundation is made for the approach of television.

The television channel itself is what might be called a "glorified" audio channel. Again new higher and lower frequency oscillators will be in demand for checking and aligning. Other apparatus will be necessary for testing of inductances and capacitances, with a larger oscilloscope for television purposes.

Better Parts, Better Service

By Charles Golenpaul

Aerovox Corporation

AS one who has been somewhat instrumental in raising the radio parts trade from the status of a junk shop to a real jobbing business, the Aerovox organization is most impressed today by the growing demand for good radio parts. To our way of thinking this is indeed the keynote of the conscientious servicing now demanded by the radio public and rendered by servicemen worthy of their title.

There is, after all, a definite parallel between the automobile and the radio industries. We in radio are following in the footsteps of the older automobile industry. We are probably about ten years behind in point of development. Therefore, when we note that the automobile servicing business came of age with the availability of essential equipment and good parts, particularly exact duplicate parts, we can naturally assume that radio servicing with the same demands has now attained its majority.

RIGID REQUIREMENTS NOW

Time was, not so long ago, when radio parts were mainly a salvage proposition. The surplus parts of some set manufacturers, left over after the production activities of the year, were simply dumped on the market. Much of this business was of the most violent price-slashing category. Those who did servicing had to take pot luck when it came to finding needed parts. Maybe yes, maybe no. Anything could be pressed into service in patching up a broken down set.

With the advent of the socket-power set, however, the radio industry got away from the home-made idea. Sets were now produced in tremendous factories, on a mass production scale, with critical circuits calling for components built to rigid specifications. The neighborhood handyman soon found himself at a loss to figure out the ailments of these socket power sets. And the junk pile of dumped nondescript parts, heretofore the "gold in them thar hills," proved of little or no use for the necessary replacements.

Thus we have evolved into the highly-organized parts jobbing business of today. And the climax of good servicing is attained in exact duplicate replacements.

PSYCHOLOGY OF OWNERSHIP

Why exact duplicate parts? The question would be utterly foolish except for the tremendous amount of trouble, time and expense which exact duplicate replacements cause parts manufacturers.

Quite naturally, no one wants to tackle a cross-word puzzle business if there is any simpler way out. But fortunately or unfortunately, depending on which side of the radio-trade fence you happen to be on, there is no substitute for an exact replacement when it comes to first-class servicing.

You see, it's this way: There is a pride of ownership inherent in most folk. The new car receives undue care for the first few months. It is washed and polished and coddled. The family enjoys its rides to the utmost. But let there be a dent in the fender, or a broken bumper, or a bad tire bruise, and the average family no longer feels quite right about the car. Something has happened to the mental attitude. The only way to restore the normal pride of ownership, is to put that car back to its original status. That means exact duplicate parts, with most careful car owners.

Radio is much the same. True, the radio chassis is concealed in a cabinet. But folks will take a look at that chassis when it is returned by the service man. People want to know what they are paying for. And if the chassis has a messy appearance—a batch of condensers taped together and jammed in place of the former condenser block; a volume control that obivously doesn't fit; a transformer that is so out of place—the pride of ownership is likely to suffer a severe blow. The mental attitude may be soured, in which case the set owner will be looking for something wrong in the set's performance. And it isn't difficult to find fault when you are looking for it.

An exact duplicate replacement restores any set to its original condition. Such a replacement unit fits right, works right, looks right. The set owner is fully satisfied that his set is as good as new.

If exact duplicate replacements were not the logical thing for good servicing, manufacturers would not be making them. It would be so

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much simpler to insist that standard units can be pressed into service for any sort of replacement. Of course they can, but the job is simply an improvision. For that matter, you could use an ox-cart wheel on your automobile, and you could roll into the nearest town. But needless to say, you wouldn't have the right mental attitude until an exact duplicate wheel was installed.

INFORMATION MUST BE EXACT, TOO

Exact duplicates call for a tremendous amount of work on our part. Servicemen and jobbers send us specifications or, better still, actual parts to be duplicated. These are measured, analyzed, torn apart and copied. Production orders are put through for sufficient lots to bring costs down within reach. Jobbers stock replacement units largely based on the prevalent sets in use in their territories. But the manufacturers and jobbers alike must take a big gamble in making available the wide array of exact duplicates that may be called for—and perhaps not.

The matter of providing helpful data also presents a serious undertaking. Exact replacements are of little or no use unless the serviceman can be properly guided in making the right selection. We have spent months and years, evolving reasonably complete listings of all the sets on the market, together with their replacement needs. In every case we are recommending a part that matches the initial equipment.

There's no substitute for an exact duplicate. Of course, an improvised or makeshift repair is always possible—like the ox-cart wheel on your car. But good servicing calls for the restoration of any set to its original condition, and that means exact duplicate parts. And this development, to our way of thinking, means the attainment of its majority by the radio industry.

Knowledge is Primary, Instruments Secondary

When faults develop in radio receivers it is necessary to make tests, to disclose what is wrong. One must know what to do to correct the discovered fault. The tests themselves, intended to disclose the trouble, require some knowledge of electrical fundamentals. Curing the trouble requires still further knowledge.

Though all the possible devices for making tests and measurements may be at hand, they by themselves are of practically no value, but are made highly valuable by knowledge of how to use them. This requires information on the purpose of the instrument, the significance of its disclosures and its limitations. Then, when the circuit is properly repaired, requiring additional knowledge, the instruments again come into play, to check the finished result.

Therefore knowledge is the prime possession. The instruments themselves are secondary. Only by combining the two should one expect to service radio receivers.

Tinkerers On Last Lap

By H. W. Fritz

Sales Department, Centralab

"I'D like to see one of your superhydrophones," was a customer's request heard in the days when storage-battery receivers were the vogue. This customer had probably heard rumors that there was a super-heterodyne circuit in existence and his curiosity got the best of him—but he was a little confused in his terminology. Those were halcyon days for the serviceman. A d-c voltmeter, a hydrometer and a simple tool kit were his complete service equipment; and customers requiring service were accustomed to pay $5 for a tube and other parts in proportion.

This era was responsible for the "screwdriver mechanic," a definite class of individual who has clung tenaciously to the service profession through the years, but who is gradually being weeded out because of the demands put on his limited knowledge by modern receiver circuits. This individual is familiar to legitimate servicemen everywhere. He cuts prices, does poor work and is largely responsible for the distrust with which the average layman views most servicemen.

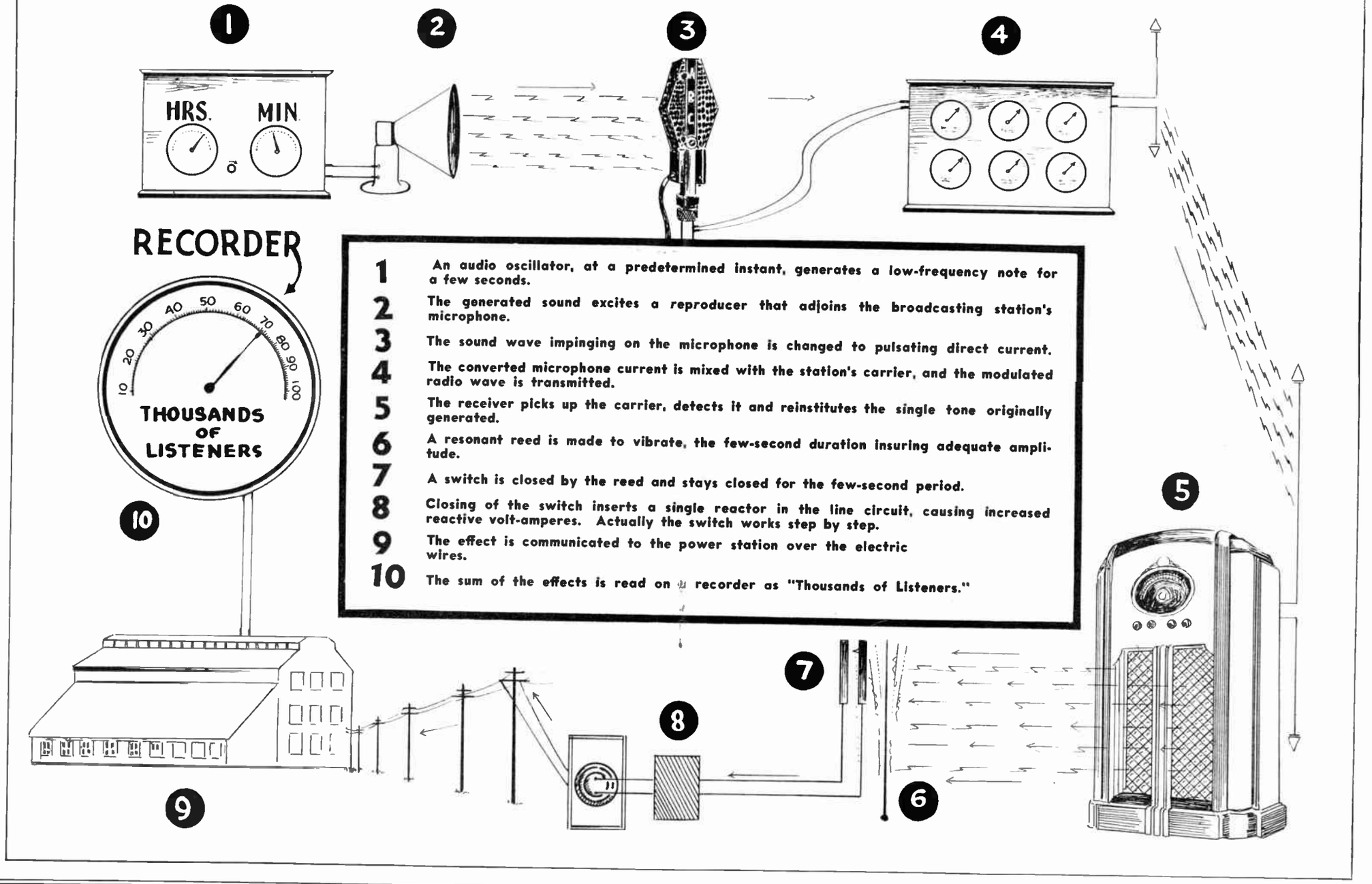
RADIO'S ADVANCE

A brief review of developments in the design of radio receivers will show what a rapid evolution has occurred in the service profession. The screen-grid tube was a major step. Gain and sensitivity were increased many times over and some servicing complications were introduced. The general use of the superheterodyne circuit made sudden demands on the serviceman's knowledge and equipment. Service oscillators changed from the luxury to the necessity class. At this point the "screwdriver" mechanic began losing his grip. With the superheterodyne came automatic volume control —a further complication requiring a vacuum-tube volt-meter for quantitative voltage measurement.

The next step was the all-wave receiver. New service oscillators were required to line up high-frequency bands—new problems taxed the serviceman's knowledge. Another change was the inclusion of i-f band-width controls in "high-fidelity" receivers. An oscilloscope is a necessity to accurate alignment of receivers with this type of "high-fidelity" control. What chance has our friend with an obsolete meter or two and his "screwdriver" methods when he bumps into one of these modern sets that requires repairs?

Content, for the time being, with the radio-frequency amplifier, development engineers

Improved Device Counts Listeners



1 An audio oscillator, at a predetermined instant, generates a low-frequency note for a few seconds.

2 The generated sound excites a reproducer that adjoins the broadcasting station's microphone.

3 The sound wave impinging on the microphone is changed to pulsating direct current.

4 The converted microphone current is mixed with the station's carrier, and the modulated radio wave is transmitted.

5 The receiver picks up the carrier, detects it and reinstitutes the single tone originally generated.

6 A resonant reed is made to vibrate, the few-second duration insuring adequate amplitude.

7 A switch is closed by the reed and stays closed for the few-second period.

8 Closing of the switch inserts a single reactor in the line circuit, causing increased reactive volt-amperes. Actually the switch works step by step.

9 The effect is communicated to the power station over the electric wires.

10 The sum of the effects is read on a recorder as "Thousands of Listeners."

Two developments of importance to service men are improving rapidly: television, which has attained technical value, and very much improved radio electric voting. The serviceman will have a great deal more to do when both developments are fully commercialized. As to television, he will extend his present technique into the more complicated and exacting requirements of special amplifiers, ray tubes, and high voltages. As to radio voting, he will finally install devices in a-c sets that will franchise the listener. Thus the radio set user will become endowed for the first time with the ability automatically to register the fact he is listening to a certain program, and by volition may vote in favor of or against particular programs, plans or projects, at the invitation of the sponsor or station. Thus as the voter values his civic ballot franchise he will attach importance to his electric franchise, and become articulate in the choice of programs, even without effort, in fact, even against his will, in a sense. As such an electric franchise would be obtainable cheaply—say, for $2.50 or $3—and as an stallation would be required for equipment of old sets, though all new sets could include the invention, the service man's sphere of activities would be considerably augmented. Practically no addition to his present knowledge or instrumentation would be required for radio voting installation.

In last month's issue was an article that discussed theoretical aspects of radio voting methods, based primarily on inclusion of condensers, so that the power factor of the line would be altered and this alteration measured. There would be quite naturally numerous obstacles to the success of such a method, and some of these were pointed out, in the interest of the understanding of the theory of the general idea of radio voting. In brief, this is to influence an indicator by a means that does not substantially affect the power load on the line, but does affect the wattless power. In last month's article, which was theoretical, the power factor was used as the basis of indication.

This month the practical application of radio voting is disclosed, being an authentic account of the inventions of Dr. Nevil Monroe Hopkins, formerly a member of the faculty of New York University, and a distinguished practical engineer who is consultant on power and mechanical research for various large corporations, besides having been in charge of all power plant design and construction at all U. S. Navy Yards and Naval stations. He is a John Scott medalist, Franklin Institute (1900).

—EDITOR.

(Continued from page 33)

as a deterrent to the count, unless there is some extremely heavy load unexpectedly put on the system, for instance a blast furnace set in operation in a large plant which would immediately show up upon the voltmeter of the station and be allowed for. However, for the present the industrial centers are not to be covered, but only the residential ones, and where there is any considerable commercial consumption of electricity, the schedule of such operation would be obtained in advance, and allowance made for effect on the registration, by discounting the indexing by that amount. Besides, the radio voting would usually be done at night, when the listeners are much more numerous, and when the contrary is true of industrial loads on the power line.

The number of sets tuned to the station is gauged on the basis of the known effect of a single receiver of average wattage.

THE EFFECT IS AUTOMATIC

Therefore the effect of listening is automatically registered by the very fact that the set is connected to the line, is tuned to the station, and has an automatic switching device. The reactor controlled by a sustained tone from the reproducer influences the resonant relay. The note is sustained for a few seconds so that there will be a sufficient amplitude attained in the resonant vibrating device, which may be a metal reed, to close the contact of the little switch-operating motor.

As for voting "yes" or "no" on any program, or on any proposition in general, that naturally requires volition on the user's part. But all he has to do is to press a button. The yes-man will press the button when told to do so and the no-man will press the same button when told to do so. We therefore secure two separate graphs upon the strip-chart, one "yes" and one "no." This button service may be located anywhere in the home, even on the arm of a reclining chair, for those listeners from whom home is the asylum of extravagant comfort, but preferably would be on the receiver, even though the listener possibly would have to get up to vote. The voting operation is more simple than tuning in a station.

The general method by which Dr. Hopkins' inventions are applied is familiar to all versed in radio and electrical technique. There is some form of audio oscillator at the broadcasting station that not only generates a given frequency for a specified duration, but also automatically or manually is made operative at a predetermined instant. The automatic feature is easily included, on the same basis as timed switching of synchronous electric clocks.

THE FINAL EFFECT

The note is picked up by the microphone, which changes the form from sound wave to equivalent frequency of electric pulses, and these are wired to the transmitter, where the note is made to vary the amplitude of the radio-frequency carrier. The radiated modulated wave is transferred to the antenna through feeders and thus into the ether and is picked up by the receiving antenna of a home set.

RADIOVOTING Test Soon

Dr. Hopkins' Improved Device and System, Applicable to All A-C Sets, to Check One-Third of Jersey Listeners—Counts Sets Tuned in, Also Enables Yes and No Votes, by Indicating and Recording Reactive Volt-Amperes

A NOTEWORTHY test of radio voting, in its improved form, will be conducted this Fall in New Jersey, by National Electric Ballots, Inc., in co-operation with WOR and the Public Service Corporation, which supplies power to New Jersey consumers. The N.E.B., which has offices at 60 East Forty-second Street, New York City, is sole licensee under the patents of Radiovoter, the system invented by Dr. Nevil Monroe Hopkins, diplomat, author, engineer and scholar of international attainment.

About 5,000 devices will be installed in Jersey homes, so that the users of sets operating from the alternating-current main will become the proving ground for the first advanced effort to enable the listener to register either the fact that he is tuned to a particular station at a particular time, or that he likes or dislikes the program he is hearing.

Registration of the fact of listening, or at least being tuned to a particular station, is made automatic by Dr. Hopkins' method, because at a selected moment a low frequency audio tone is generated, is permitted to endure for a few seconds, and this sound energy actuates a resonant relay, which operates a step-by-step switch and keeps it closed until the period is up.

NEW SENSITIVITY ATTAINED

When the switch is closed a reactor is cut into the line and a tiny motor is made to turn the contact-making sector of the switch in the radio voter. The brushes on these sectors are staggered, for four different steps of wattless power application on the line, so that for a given installation a reactive load is gradually applied to the distribution system of a sub-station or switching station of a power company.

Converse Studios, Inc.

NEVIL MONROE HOPKINS, Ph.D.
Inventor of the radio tally and voting systems.

The incremental wattless load on the line shows up at the power substation, and is read by an engineer, who watches the indicator, as well as recorded on a strip-chart meter. There is a temporary power factor alteration, or change in the line condition practically independent of power loading. Dr. Hopkins' indicator measures not the power factor but the reactive volt-amperes. In this way it is possible to record a full-scale deflection on the strip-chart with as little as a 10 per cent. change of reactive load.

The new and practical method is not completely wattless, when a coil is cut in, but the power load is negligible, and does not enter

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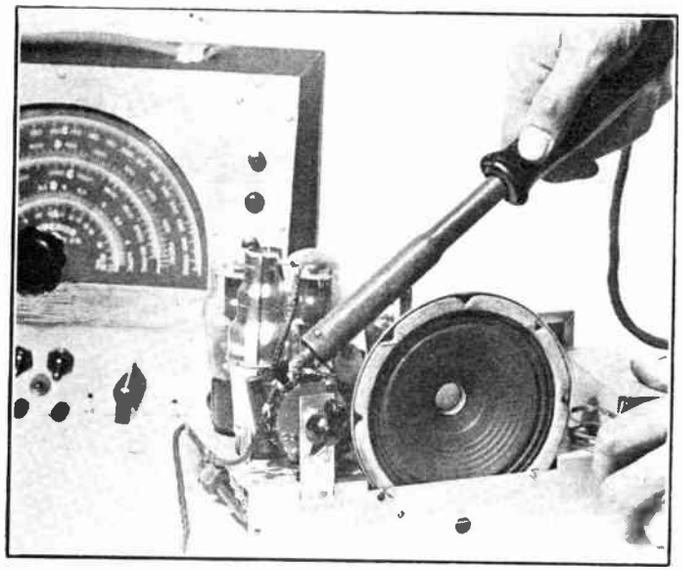
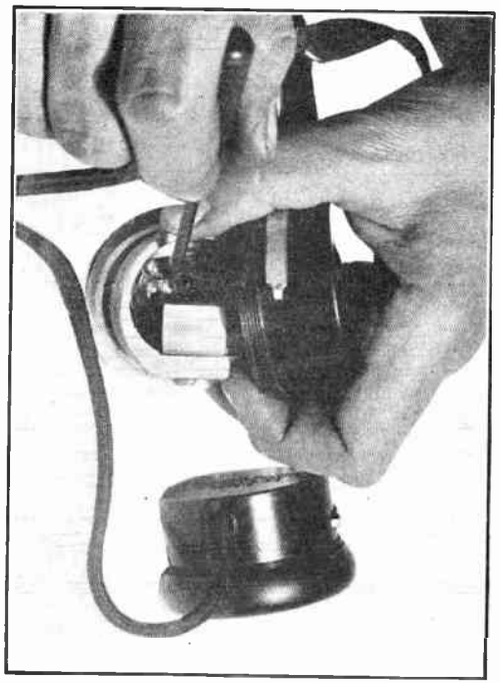
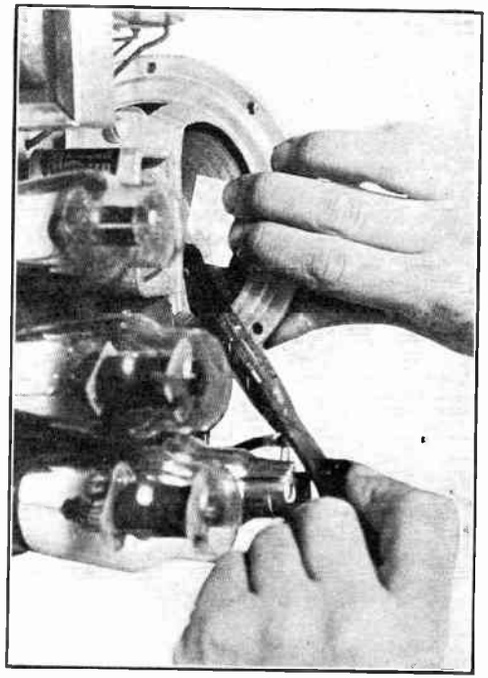
By H. J. Bernard

Inter-Office Devices Popular



Inter-office communication devices have brought vast business, some plants working three shifts. Two methods are used, the carrier call, which includes an oscillator, and may cause interference to receivers unless carefully filtered, and the other an audio amplifier. In both instances speaker serves also as microphone. Switching from "send" to "receive" is done so often that the switch contacts must be suspected when there's trouble. Photo illustrates resoldering the tabs.





Earphones may have unequal sensitivity, so adjust the diaphragms while the 'phones are playing. Listening with the same ear enables practical equalization of sensitivity, or, if one's ears are of dissimilar sensitivity, the 'phones may be adjusted in compensation. At right, Scotch tape mends crack in speaker cone, reinforced by acetate or other cement.

There the receiver, which has been used for selecting the station, amplifies the radio wave, detects it, by eliminating the carrier and leaving a pulsating direct current of the same general nature as existed in the microphone, amplifies the voltage of this frequency, and finally through a power tube actuates the reproducer or loudspeaker. Then the reactive relay responds to the reproducer's excitation for switching and final indexing effect.

Voting aye and nay done under circumstances which manually trip the relay, is a simple matter of pressing the button, and then at a given signal from the station, which could be an aural announcement, at a particular moment the ayes would vote, and at some other announced moment the nays.

During the past decade the doctor has been carefully developing his system, and has actually applied it in earlier form to given localities, where it worked out to his general satisfaction, although the field experience was very valuable as a means of disclosing improvements, which were introduced gradually.

TECHNICAL GOAL ATTAINED

The whole system comes to the fore anew, not only because of the improvements, for instance practical freedom from mischievous "ballot-box stuffing," or tampering, but because the patents have been fully validated by the Patent Office, and the corporation is now ready to drive steadily on to commercial success. The technical aspects are regarded as having reached the desired goal.

There were many refinements, as well as basic improvements, for instance, the elimina-

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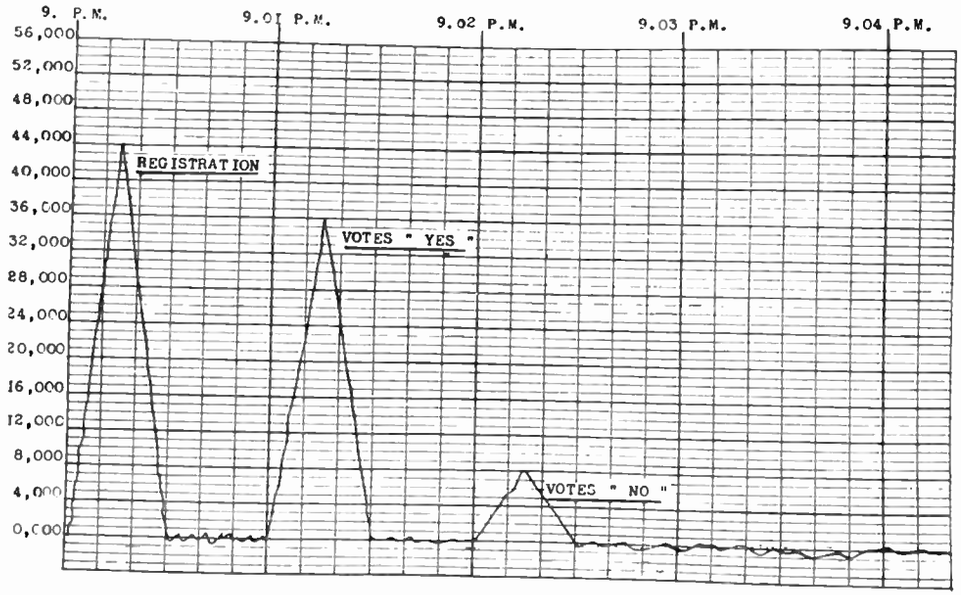


Pictorial chart of the result of a "registration" and a "Yes" and a "No" vote when the dial knobs of home-voting stations connected with a public utility power and light company sub-station, were simultaneously turned upon a pre-published newspaper announcement, or broadcast request signal, or both. Within 2 minutes and 20 seconds, 44,000 persons were "registered" present, with 36,000 shown to be in favor of the question asked, and 8,000 opposed.

How Voting Is Charted

The above chart represents a large station supplying a community of 500,000 persons with light and power, and 44,000 persons shown here as registering, therefore, is less than 10 per cent.

This "registration" in any well-chosen community could easily grow to 100,000 persons, or 20 per cent of the total, provided an adequate distribution of Home Voting Stations was secured, and a well-advertised popular forum was staged weekly. This greater number of persons could likewise have been "registered" and the "yes" and "no" votes taken in the same period of time.

(*Continued from preceding page*)

tion of all flicker effect on the house lights when Radiovoter comes into play, accomplished by the step-by-step gradual application of load. Also, the indicating wattmeter, besides the reactive volt-ampere meter, is such that it would show at once whether some untoward load were suddenly put on the line, such as a big motor or smelter, and so for all such loads, furnaces, locomotives, etc., the known effect would be deducted from the reading. Tampering by repeaters and multipliers is deemed impossible because of operation at 110 volts, 60 cycles, at which voltage and frequency the tampering devices would have to be of gigantic physical proportions to attain sensible electric values.

WIDESPREAD INTEREST

Many organizations have subjected the device to tests and all have shown great interest in its possibilities or voiced approval of the general method. These tests were made for experimental purposes, as the improved technique was not yet in existence. In fact, in some of them the general method was tried out by simply having the listeners turn on a 40-watt lamp apiece, producing a watt load registration. It was estimated from such a test, made in Jersey, that 60,000 out of a possible 600,000 were listening. Newspapers aided in the promotion of listener interest. One such test was made in Hackensack, another in West Orange. Such question were decided as this one: Do you prefer an organ recital to a crooner?

In the absence of actual field experience with the improved method, the automatic recording by the mere fact of having the set tuned to the station, and the button-pressing for reactive line loading in voting on questions, just what the relative importance must be attached to the future applications remains naturally to be seen. The sponsors of Radiovoter feel that the chief interest in the device is in the fact that the big advertisers, some of whom spend millions of dollars a year on radio programs, as yet have no method of close reckoning of listener interest in the programs offered. An unpopular program can easily be kept from demise at least $100,000 too long.

QUICK CHECKUP

So Radiovoter would afford these big advertisers a quick and reliable checkup on listeners' preferences. At present there are numerous surveys that offer the best information they can obtain, and many are based on sampling, which may mean that the taste of an audience may be reported on the basis of interviewing less than 1 per cent, of the listeners in a given area. Waiting for the effect the program has on sales is another method, excellent for its finality, but possibly ruinous, as before the answer is known the whole radio budget may be wasted. Immediacy is an important consideration.

However, the listening audience is itself the biggest asset that radio has, the most important consideration, and if greatest service to the greatest number of listeners is taken as the guiding principle, some hold that all other effects will be incurred in their natural order: the stations and sponsors will obtain quick and reliable audience reaction, radio voting will become as much an attraction as general listening to programs, eradication of the undesired programs will tend to improve the offerings to the public taste, sales results will be increased and therefore greater consumption of advertised products will increase purchasing power by creating greater need for labor, and incidentally the work attending Radiovoter, from manufacture, installation and servicing, to recording, will call for ratable enlargement of personnel.

SET MAKERS INTERESTED

For instance, installations at the sub-stations and switching stations of the power plants in some cases would be special ones to enable the recording to be made, hence the power companies would have to find an economic basis for their activities. This might well arise from the fact that an added incentive to the possession of a radio receiver increases the number of receivers used, and the more numerous the receivers, the greater the amount of electricity consumed. Besides, power companies are exceedingly attentive to consumer service, and often engage in costly outlays where no immediate or even possible increase in revenue is in sight, but merely some more accurate or more extensive service to the user.

Radio set manufacturers have been broached in informal discussion, and some showed great interest. One made an offer for exclusive rights to Radiovoter, but it was felt this would restrict the application to fewer users than desired. If radio voting is a subject in which the public has a keen interest, as many believe, then it was assumed that some method of catering to the public more abundantly, and less monopolistically, would be conducive to broader service to the public and more immediate success.

WHAT THE TEST IMPLIES

Therefore the trial to be undertaken with the improved method in an area comprising almost one-third of New Jersey's radio listeners, and at an initial cost of about $25,000 for installation alone, to be borne exclusively by National Electric Ballots, Inc., is considered of two-fold importance: first, as a test of the system itself, for its effect on listener interest, on stations and clients who sponsor programs; second, as an indication of the distribution method that should best be applied for quickest and widest application of Radiovoter, should the demonstration meet with public and private acclaim.

Dr. Hopkins is president of National Electric Ballots, Inc., Arthur M. Acheson, vice-president; and the directors, besides the officers, are Raymonde B. Hopkins, Thomas N. Tracy and George L. Edmunds. General counsel is Conrad Milliken.

MODULATION SAFEGUARDED

A new device has been perfected for preventing a station from modulating its carrier more than 100%.

6A8G, New Double Triode, Has Separate Cathodes

A distinctive addition has been made to the tube line, the 6C8G, the first duo-triode with independent heaters. This independence permits the same flexibility as would attend the use of two separate triodes and permits use of a single envelope for special circuits, preserving compactness and economy.

Previously the independent cathode idea in dual tubes was restricted to the 6H6 in metal and glass forms, and the combination B-rectifier and power output tube. The third and new form is highly valuable.

The Ken-Rad Tube & Lamp Corporation of Owensboro, Kentucky, supplied the following data on the 6C8G:

GENERAL DESCRIPTION

Application: The 6C8G is a cathode type douhle-triode designed for use as a voltage amplifier and output tube. The cathode, grid, and plate of each triode are brought out to individual connections so that a number of specialized functions are possible. It is especially recommended for phase inverter service in automobile receivers and other applications where heater current consumption must be held at a minimum. The 6C8G is a glass tube equipped with an octal base.

RATING AND CHARACTERISTICS

Heater:	
Voltage	6.3 Volts AC or DC
Current	.3 Ampere

Note: Voltage between heater and cathode should be kept at a minimum if direct connection is not possible.

CLASS A AMPLIFIER—ONE TRIODE

Plate Voltage	250	Volts Max.
Grid Voltage	—4.5	Volts
Plate Current	3.1	Milliamperes
Plate Resistance	26,000	Ohms
Mutual Conductance	1,450	Micromhos
Amplification Factor	38	

TYPICAL CLASS "B" OPERATION

*6L5G Driver			
Plate Supply Voltage..	—4.0	—5.0	Volts
Grid Voltage			
**Plate Current (No signal)	135 0.6	180 1.2	Volts Milliamperes
**Plate Current (Full Signal)	15.2	22.0	Milliamperes
Plate to Plate Load Resistance	18,000	18,000	Ohms
Power Output	1.1	2.6	Watts
Total Distortion	8.5	9.0	Per Cent
Second Harmonic	5.9	5.8	Per Cent
Third Harmonic	5.7	6.8	Per Cent

*Driver Conditions given on following page.
**Values are total for both triodes.

started to work on audio amplifiers in receivers. Tone compensation, manual and automatic bass compensation, double channel amplifiers, volume expansion, and feedback amplifiers were some of the results. Here is need for an audio frequency amplifier if definite results are expected.

The latest development in receiver design is automatic frequency control. We hear that automatic selectivity is on its way. With all of these factors to consider, a modern serviceman needs a modern tube tester, analyzer, all-wave oscillator, audio frequency oscillator, oscilloscope, wobbler, and capacity indicator in addition to a complete set of tools before he can cope with all the problems that develop. The last chapter in the life of the "screwdriver" mechanic is being written.

This development is traceable in the production of Centralab volume controls, fixed resistors, and wave change switches, for Centralab has been manufacturing radio parts since 1922. The first volume controls were bulky and simple in design. The modern control is small and frequently has one or more taps on a resistance strip of critical taper. The trend in resistors is to the small types—for two reasons. Conservation of space and reduction of capacity effect between components. Now over 95 per cent of resistors used in original equipment are rated at one-half watt or less.

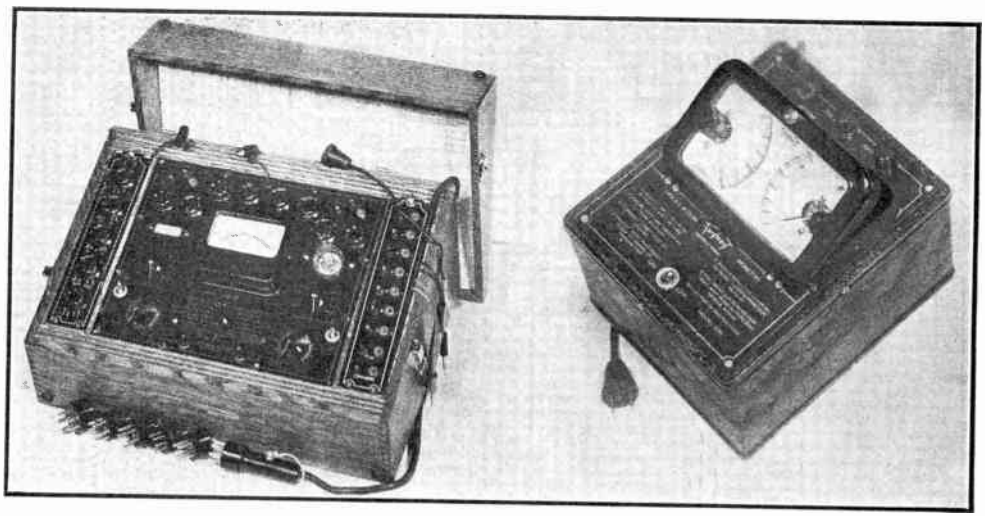
Wave change switches are complicated in design—many require ceramic insulation for high-frequency applications. In some receivers switch sections must be removed to replace r-f coils. This means that the serviceman has to analyze the trouble before taking a set apart. The opposite used to be the rule—take the set apart to find out what is wrong with it.

Television, which is certainly on its way, will require all that servicemen already know plus new knowledge and instruments.

The progress has been slow, but the radio service business is surely developing into a profession. The future need for specialized knowledge will demand that servicemen go to school to learn theory. Practice alone will not enable him to "get by." The part-time serviceman and the "fly-by-night" operator will be eliminated. The radio service business will require too much investment to make it worthwhile for anyone but a reliable and well-trained individual to enter the field.

[*Next month, servicing articles by engineers of RCA Manufacturing Co., Inc., Weston and others.*]

Triplett New Tester and Modulation Meter



The multi-purpose tester.

The modulation meter.

The Triplett Multi-Purpose Tester, Model 1504, combines in one instrument the equivalent of eleven separate units.

It checks any type tube for worth and has a neon short test (for shorts and opens), separate diode test, metered paper condenser test, electrolytic condenser leakage test, is a d-c voltmeter, d-c milliammeter, a-c voltmeter, ohmmeter, decibel meter and free point tester.

Tube testing is done by the power output emission method, providing complete tests for any type tube. The device is furnished in an attractive quartered oak case wth sloping silver and plack panel. For portable and counter use. Case measures 15¾" x 11⅛" x 7½". Model 1504. U. S. A. Dealer net $56.67. The manufacturer, Triplett Electrical Instrument Co., Bluffton, O., Dept. RW, has a circular on this instrument.

Model 1295 Triplett Master Modulation Monitor eliminates the uncertainty of depending on the ear, variation of the antenna ammeter, or the loop and light to determine carrier shift and modulation percentage of voice transmitting radio stations.

Actual modulation of transmitters is shown on the direct reading dial of this instrument, which has ranges from 40 to 120 per cent, all readings in peaks. Visual information is provided on a second scale for carrier reference level for the modulation test and also to check carrier shift during modulation.

With the Model 1295, adjustment of the transmitter can be regulated to prevent monkey chatter, cross talk and B. C. L. interference. The instrument is factory calibrated and no further calibration is needed.

Case is metal with black wrinkle finish, 7⅞" x 6⅝" x 4⅝". Panel is silver and black. U. S. A. dealer net price $24.83. There is a circular on this, too, obtainable by addressing the company, Dept. RW.

Adelman On Long Airplane Sales Trip

Leon L. Adelman, sales manager of the Cornell-Dubilier Corporation, expects to cover 15,000 miles of his territory in seven weeks. He is now on the road. By May 16th, Mr. Adelman will have visited C-D jobbers and distributors in practically every state in the Union.

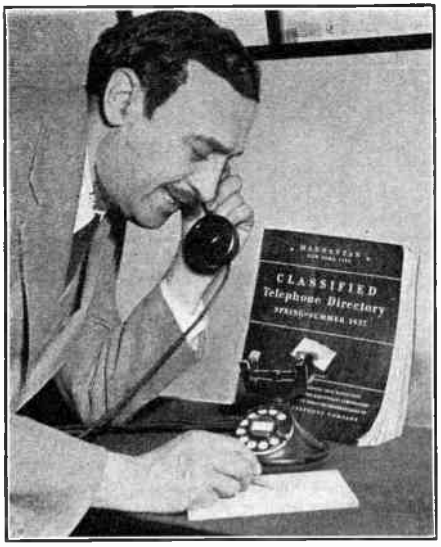
So comprehensive is his itinerary, that to cover the more than thirty-five principal trade centers of the country, more than 12,000 miles will have to be travelled by air. After a week's vacationing at "The Breakers" in Atlantic City, Mr. Adelman wings his way through New England and west to the Pacific, covering the northern jobbers and dealers in the Great Lakes section and the Northwestern states.

Thence Mr. Adelman heads on to the Pacific Coast, and down from Seattle to Los Angeles, and completing the swing South to return through Texas, the Gulf Cities, Florida, and the main South Atlantic cities, including the Capital. Mr. Adelman expects to bring back with him substantial orders plus an optimistic selling viewpoint from jobbers and dealers he interviewed.

GETTING More Business

By M. N. Beitman
The Radolek Company

By Printed and Spoken Word and Use of Display



"These new aerial systems bring in short-wave stations louder and also reduce noise on all stations."

SERVICEMEN forget that they live in a highly-competitive society. They expect Mr. Radio Owner to come to them when he has radio difficulties, to beat a path to their door, and to search high and low for their addresses if necessary. Of course, this does not happen and the fellow down the street gets the job. If *you* want more business, if you want the business of people who never heard of you, you must let them know of your existence, your good points, your special abilities to serve them. You must approach them many times in many different ways. Advertising does this and advertising pays!

ATTENTION TO ADVERTISING

Money invested in advertising is far from being foolishly spent. Not only do you expect to receive back every dollar spent on advertising, but on every dollar you expect a certain definite return in the form of increased business and greater profits. You will get these successful results if you plan your advertising wisely and correctly.

Among the various forms of advertising suitable for radio service business, advertising in publications such as local newspapers and telephone books is most common. When advertising is sent directly to the prospect, either by mail or messenger, this method of advertising is called direct mail.

Posters, window displays, and signs are very effective ways of obtaining additional business. There are also certain unique methods of advertising salesmanship that get business.

Advertising in any form must get attention. Unless an advertisement or a sign attracts attention it is not present as far as the prospective reader is concerned and it is useless. Attention is obtained in various ways. Sheer size, black type, white space, color, novelty, illustration, and catch-phrases serve to get attention.

Once attention is arrested in any suitable manner the interest of the reader must be held. The story, the picture, the idea must "get the reader," compel him to read on. In other words, it is not merely enough to notice an advertisement, but the advertisement must actually prove interesting. With the reader expressing a not personally realized interest in your advertisement, the next step is to create a *desire*. A desire for a better set, a new set of tubes, or better reception.

GET HIM TO ACT

Once the desire is aroused, the reader must be impressed with conviction that your tubes, your service, or your appliances are what he wants. Your items and service must appear to him as the logical solution of his desires.

At this stage, the reader is convinced that your service or products are what he wants and needs, but you must make him act. Action will make him pick up the 'phone and call you up or stop in to have his tubes tested. Do not merely tell your story in your advertisements. Finish up with action that will make the reader exclaim: "I'll phone that service man right now," and not "Well, my radio hasn't been playing right, I'll get is fixed one of these days."

In larger cities, a small advertisement in the want-ad section of the daily newspaper brings excellent results. Some outstanding points about your service must be featured. Note the few examples shown. The feature of the first ad. is the fact that no set is too complicated and the work is guaranteed. Price is stressed in

the second, and terms are brought out in the third. In smaller city papers and in weeklies it is best to take display space, two or three inches.

CAREFUL WITH EVERYTHING

The principles in the preparation of the advertising copy are therefore well defined, and of course the main objective is sales. It may seem a far cry from a two-line classified advertisement to a well-considered plan of copy preparation. Perhaps it is. The name, nature of business, solicitation, address and telephone number may take up half the space. Not much theory need be applied to creation of the seven words constituting the extra line of type. But there are at least two factors that justify exercise of skill and care, even under the extremely resitricted condition outlined. First, the habit of doing things right is just as important to your smallest effort as to your grandest one, and large advertising agency businesses have been developed for handling only classified advertisements because of specialized skill; second, your advertising space will grow with you, and the principles applicable to copy and art creation are in general the same for all sizes of advertising space. So address yourself to these purposes:

1. Arouse interest.
2. Create desire.
3. Impress conviction.
4. Induce action.

USING THE TELEPHONE

Telephone book advertisements offer excellent possibilities. A large number of people turn to the 'phone book when they are in need of some special commodity or service. The two examples shown demonstrate the two possibilities of such advertisements. Notice that the upper ad, has much copy or reading matter. On the other hand, the second ad. has white space and but a few words. Both methods have their advantages, but a happy medium will be best.

Every serviceman should have a complete mailing list of the people he has served. Occasional mailings should be made, suggesting free check-up service on tubes, or other offer. New names may also be used for this publicity.

Publicity via the telephone is also adaptable for selling service. If Mr. Brown had his radio repaired ten months ago, a telephone call some evening should be made. Here is a typical conversation:

"Good evening, Mr. Brown. I repaired your radio sets ten months ago. How does it work now?"

"Fine. We haven't had a bit of trouble with it since."

"I'm glad to hear that. I was wondering if you'd be interested in improving your reception by using a high-efficiency antenna system. You've probably heard about these new aerial systems that bring in short-wave stations louder and also reduce noise on all stations?"

IT'S A PLEASURE

"To tell the truth, I didn't hear about them. I'm in the sugar business and we don't hear of such things in our line."

"Well, Mr. Brown, sugar is your business but radio is your pleasure. And you do want to improve the pleasure you and your family get from the radio set, don't you? The United States Government recognizes the worth of the high-efficiency antenna, and mentions it in its book, 'A Guide to Reception of Short-Wave Broadcasting Stations'. I'd be glad to install one of these systems and your whole family will be delighted with the result."

"How much would it cost?"

The sale is practically closed. When it is, the "guide" may be offered, too. It is in simple language and costs a quarter. But a sale will be the exception rather than the rule. If no immediate results are obtained at least goodwill is established. It is vital to be good-natured even when no is the answer to your sales talk.

CHECK UP RESULTS

Antennas are not the only topic. Nor is the report of fine reception the only answer. If the set is working satisfactorily it is of small value to discuss tube testing or set checking. But you might inquire whether the customer plays phonograph records, and if electrical reproduction is not used, explain the better tone possible by use of a phonograph adapter. Various accessories are best plugged hard as soon as they come out, and telephone calls based on new products of that type are very helpful in extending your prestige and convincing your customer you are a live wire. It is just as vital to hold old customers as to get new ones.

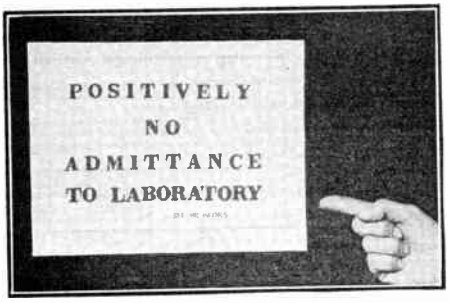
(Continued on following page)

"To tell the truth, I didn't hear about them. How much —". The sale is practically closed.

(*Continued from preceding page*)

And the old one is a new one in a sense, when you make a sale you otherwise would not have made.

The results of different types of telephone solicitations should be checked. Perhaps some particular approach is the one you're best at,



When the servicing business grows to considerable importance it is necessary to segregate the laboratory from the store front or reception quarters.

as results will prove, so largely follow that, but keep trying others also, to avoid possibility of operating in a restricted groove.

Window display advertising can be very effective. It is of prime importance, where you have a street front, to have the window dressing not only neat and orderly, but interesting. This is an art in itself and large outfits either have professional window dressers on their payroll or hire them as needed. A small operator has to do his own work, probably. So the fellow who started out as a service man finds he has to be an advertising writer of sorts, a window dresser, a bookkeeper, a buyer, a clerk, and finally a service man.

Help in a plan of window display may be

obtained from the women folk. Mother, sister or wife can suggest that "touch" a man handy with soldering iron is not likely to have.

The usual displays as received from manufacturers may serve well on counters and in windows, but the most effective method is one invoking originality. Then one's window becomes distinctive. Services that incur movement are impelling. Anything that evokes an interesting contrast is valuable for its attention value. All ideas should be definitely associated with a sales appeal. The object is to sell. Everything else is only the means.

A TUBE SPECTACLE

One fellow got six dead transmitting tubes from a station and put these giants next to six receiver tubes. He cited the fact the station

SAMPLES OF DISPLAY ADS

RADIO SERVICE CENTER

Calls Made Day and Night
HONEST - RELIABLE SERVICE
Any Make Set—10 Years in Business
Accurate Tube Test in Home
Most Modern Test Equipment
Member, Radio Service Institution
FREE ESTIMATE IN SHOP
Parts in Stock for All Sets
19 Yes St. BRyant 9-0558

SOMEONE'S RADIO SHOP

Prompt
EXPERT REPAIRS
On
ALL MAKES
Free Estimates — Work Guaranteed
19 Yes St. BRyant 9-0558

SAMPLES OF CLASSIFIED ADS

Service, Repair, Etc.

$1 RADIO SERVICE—WORK GUARANteed. No set too complicated. Experienced men, Radio Center, 19 Yes St. BRyant 9-0558.

50c—RADIO SERVICE—
Any place; work guaranteed. BRyant 9-0558.

E-Z TERMS ON ALL RADIO REPAIR, wash. mach. vacuum cleaners. BRyant 9-0558.

50c RADIO SERVICE. ALL WORK GUARanteed. Anywhere, any set. BRyant 9-0558.

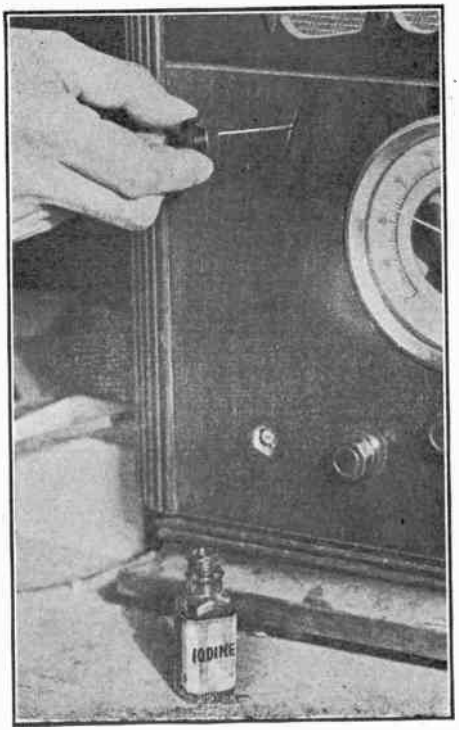
checked tubes hourly. Why should not the listener have his tubes checked twice a year, also for the same reason—best quality performance? The transmitting tubes cost $1,500. The six receiver tubes could be bought for less than $5.

"Let us check your tubes" is the sales appeal, because if any tubes are bad or weak a tube sale is made, and if the tubes are in good condition, the set may not be. Or, if everything is all right, some accessory may be sold to make reception better than just "all right," or to introduce a new service from the receiver, as in the case of the phonograph pickup attachment.

Another dealer attracted large crowds of real radio prospects by offering $10 prize for the owner of the oldest radio set. Certainly the person who thinks he has the oldest radio in a community is a good prospect for a new set.

Besides the problem of getting and holding business through publicity of various sorts, the main consideration must be that everything you do, you do well. Therefore no set must leave your bench unless it is in excellent condition, and this may even require devoting more time to it than the customer will pay for, but you must act so in your own protection.

DOCTORING UP CABINET

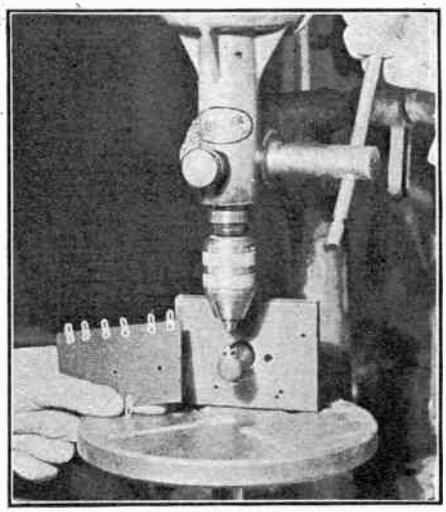


Iodine is fine for cuts, all know. But did you know that scratches on a radio cabinet are included among the beneficiaries? The iodine blends with the color of the cabinet finish and disguises the presence of the cut or scratch.

Drill Press for Eyeletting

By Edward M. Shiepe

Manager, Delta Radio Co.



Drill press with improvised eyeletting device, and a sample of eyeletted fibre used by service men for mounting coil assemblies and grouped resistors, condensers, etc.

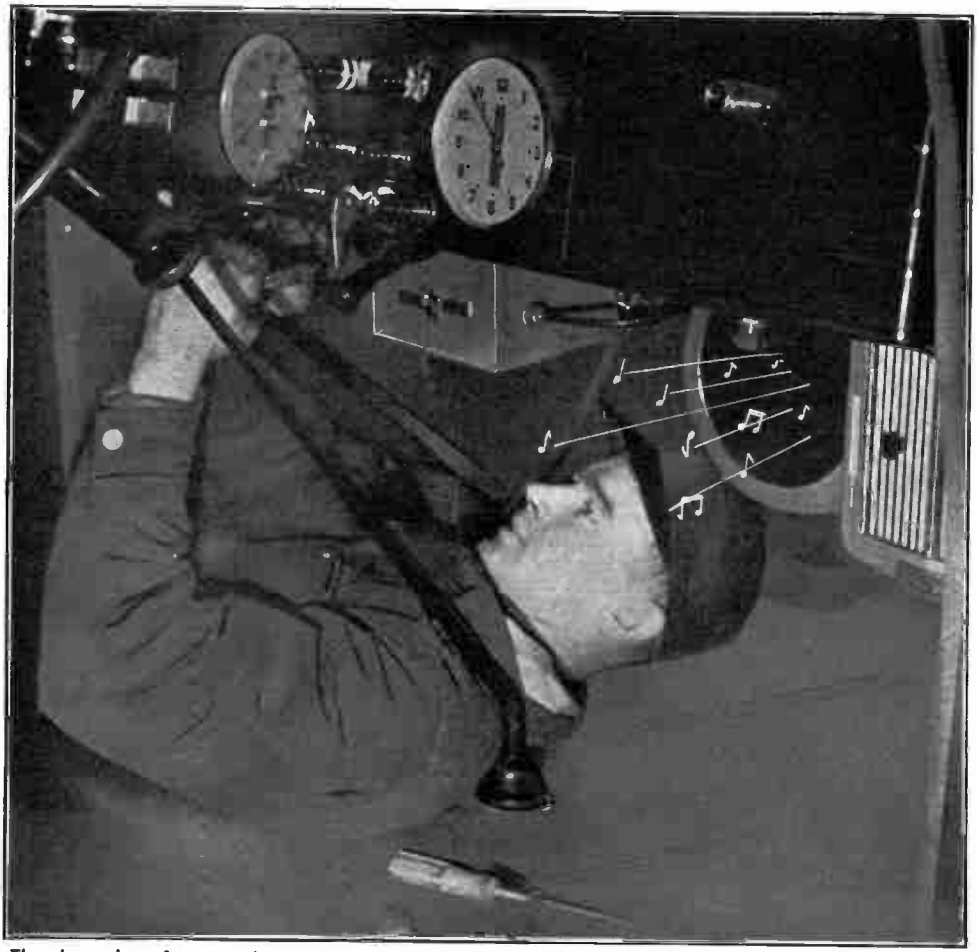
To use a drill-press for eyeletting, it is necessary to obtain a pair of dies for forming the eyelet. These dies consist of male and female parts, the latter preferably being held in the drill-press while the male piece is supported by a projecting arm resting on the drill-press table. The male portion forms the end of the eyelet or eyelet lug when the drill-press handle is pushed down with the lug in between.

The forming die has a point for guiding the eyelet to its base which spreads it out and curls it back. The female die requires a recess axially to permit the dies to come together. The dies must be pack-hardened or tempered to prevent wear. As many service men have drill presses and occasionally would like to resort to eyeletting, the method described offers a simple solution.

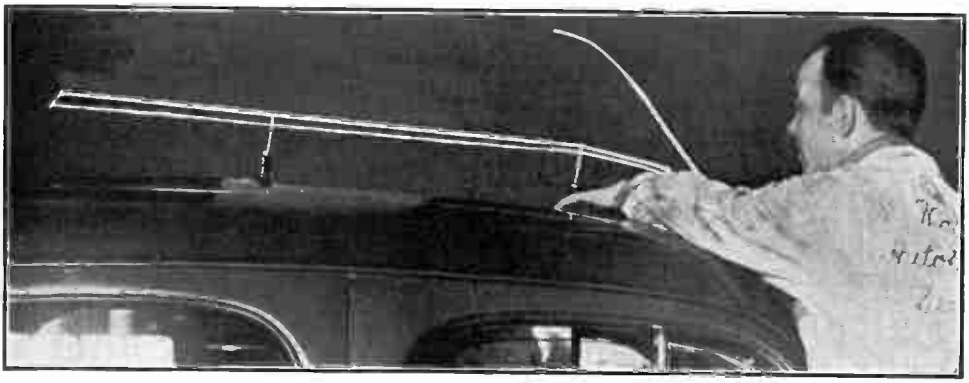
HERTZBERG IN NEW POST

Robert Hertzberg, formerly a technical radio editor, writer and advertising manager, has been appointed editor of "Modern Mechanix."

Car Sets Are Big Time Now

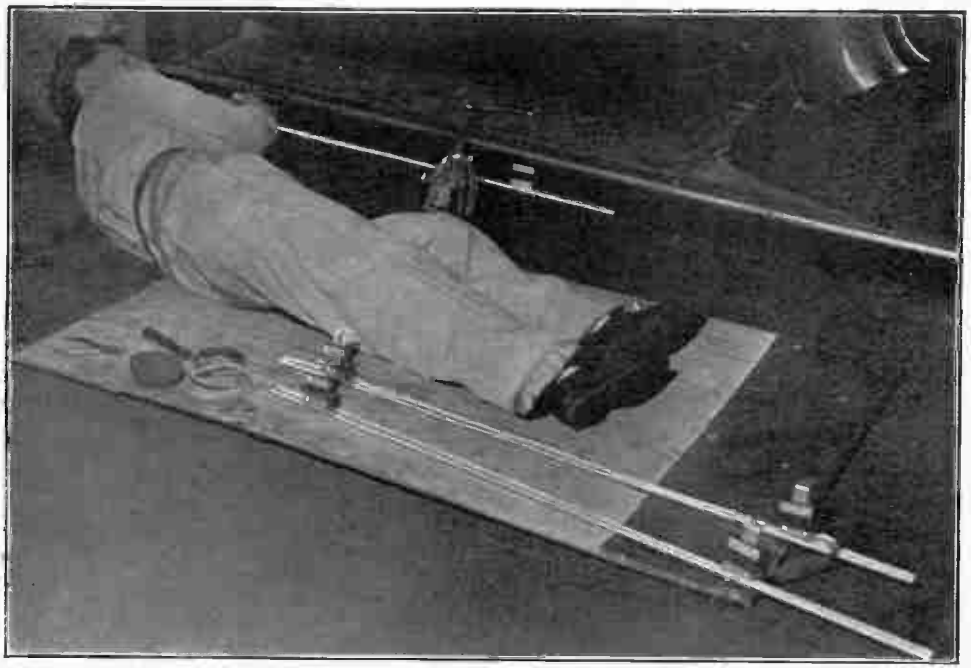


There's a place for everything, and under the cowl is a good one for the receiver, but you may not have to be strap-supported to attend to some of the instrument board rewiring.



Radio antenna goes over the top in all-steel-body car, as demonstrated at Wally's on Dey Street, New York City.

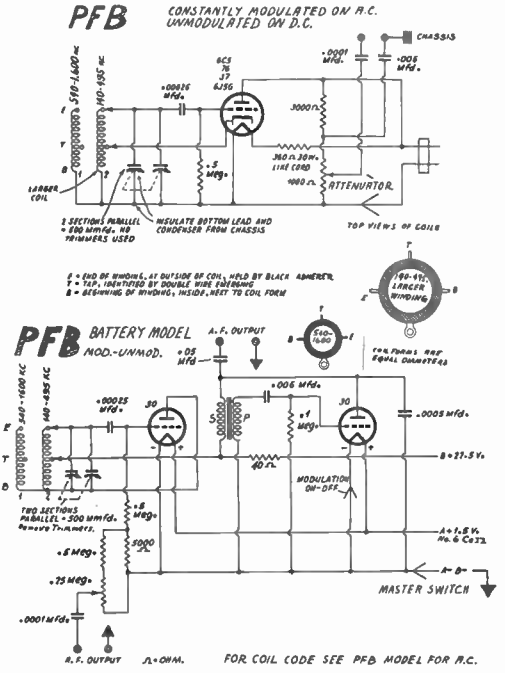
Right Antenna a Vital Factor



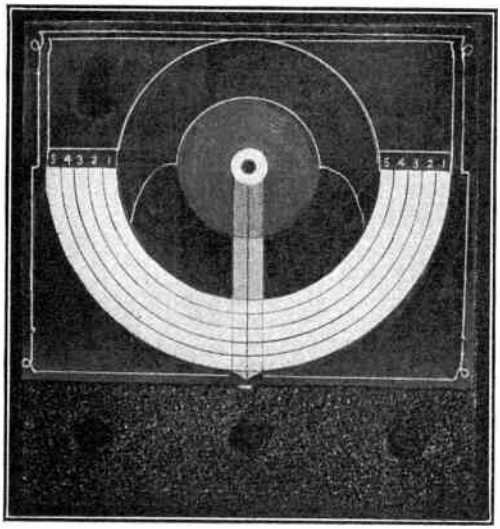
Under the running board is a favorite antenna location. Two special antennas are seen in the foreground, and an expert is shown actually installing a third one. The antenna should be insulated from the board and be several inches away.

Pole type antennas are becoming more and more popular for automobiles. Tests are made for best location. In the illustrated example this was at right rear. At right, checking ignition and high-frequency cable leading to spark plugs, for corroded or loose connections that produce noisy reception.

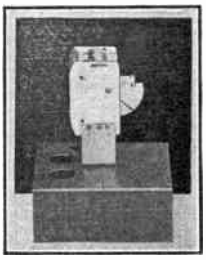
Signal Generator Circuits



FRONT PANEL ASSEMBLY



The condenser hub protrudes 1/4 inch through the front panel. The pointer is line-scratched, for indexing, then cemented to roughened surface of a setscrew bushing. When the bushing is tightened to the condenser shaft the pointer travels at 4-1 vernier ratio, due to planetary drive.



Diagrams for two-band operation, covering 140-495 kc and 540-1,600 kc, with coil connection data. At right is the rear view of the panel and chassis for two-band operation, or for all-wave, five-band operation, covered by diagrams on the next page.

THE circuit diagrams of signal generators for battery and a.c.-d.c. operation on this page and the next use commercial coils for which direct-frequency-reading dials are obtainable. The diagrams on this page afford two-band operation, 140-495 kc and 540-1,600 kc, for the intermediate frequencies and standard broadcast band. The top diagram is for a-c operation, with hum as the constant modulation. If the circuit is used on line d.c. there is oscillation, when the plug polarity is correctly observed, but no modulation. Sets may be aligned by the unmodulated method by noting maximum or minimum deflection of the needle of a meter in series with the detector anode. The second diagram on this page is for battery operation, using separate r-f and a-f tubes. The same type coils, condenser and dial are used. Calibrations are always for a particular condenser. No substitution is permissible, unless one is to calibrate his own generator.

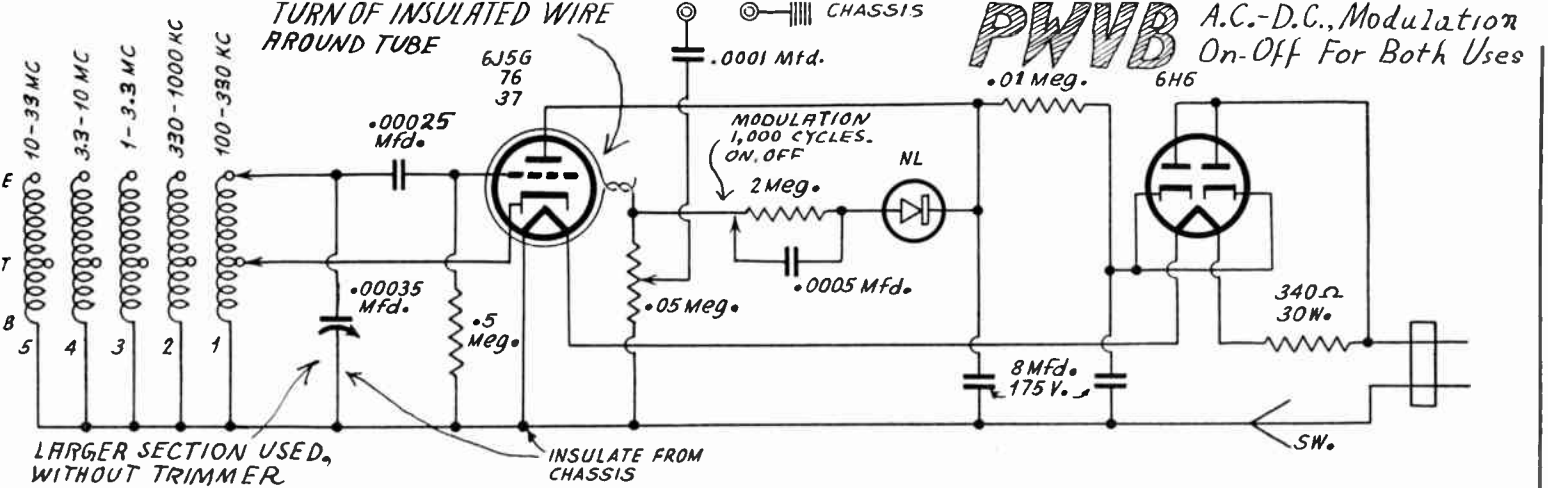
The diagrams on the next page differ principally from those on this page because all-wave coverage is afforded, 103 kc to 33 mc, in five bands. The 100 kc appearing on these diagrams should read 103 kc. The top diagram is for a.c.-d.c. operation, with modulation on-off privileges. The neon tube NL is the modulator. It also tests condenser and other leakages. The 6H6 rectifier is used because it fits the chassis. The second diagram is for a-c operation, hum as modulation, or for use on line d.c. without modulation.

The coil connections are given on the diagrams, all coils viewed from the top.

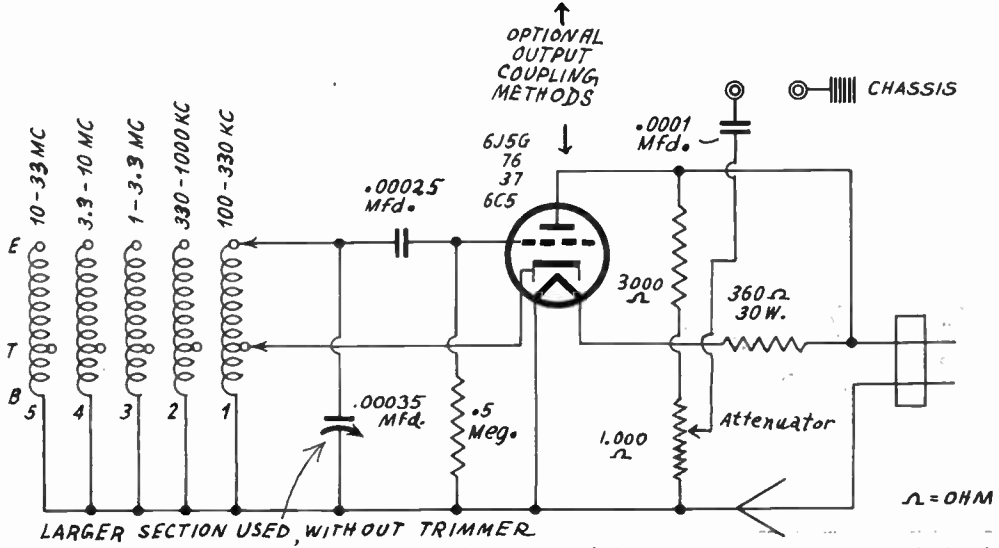
The front and rear views are of panel and chassis for the all-wave circuits particularly, although may be followed for the two-band instruments, the dial being smaller. It should be noted the pointer covers the lower segment, due to convenience in connection with mounting.

NEW C-D DISPLAY ISSUED

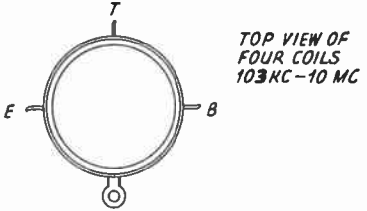
While jobbers and distributors are still reporting their increased sales, the Cornell-Dubilier Corporation announces the release of its sixth of a series of "point of sale" promotional displays. Three eye-attracting colors are processed by the silk-screen method onto counter-size placards. They are available to all C-D jobbers and distributors. Address requests to the Dept. RW, Cornell-Dubilier Corporation, South Plainfield, N. J.



PWVB A.C.-D.C., Modulation On-Off For Both Uses

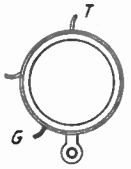


All PWVB Coil Connections



TOP VIEW OF FOUR COILS 103 KC – 10 MC

E = GRID; T = TAP; B = GRID RETURN



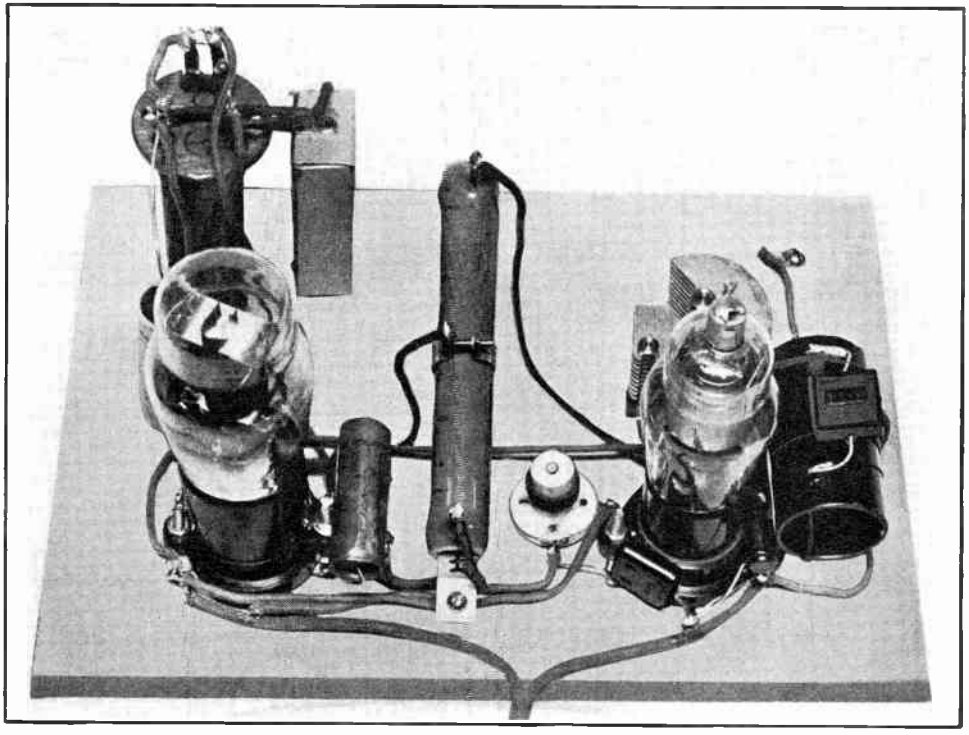
TOP VIEW OF SMALLEST COIL 10-33 MC

FOR PWVB, BATTERY OPERATION, FOLLOW PFB BATTERY DIAGRAM, ADDING THREE S-W COILS

CAPACITY RELAY

Replaces Photo Cell in Many Uses

By Roscoe Ammon and Harold Kent
Douglas Radio Co.



Sensibly arranged, the parts of the capacity relay present an utterly simple and convincing appearance.

A LOW-COST protective device of unlimited possibilities can be constructed using as a basis the capacity relay. This unit operates when any change in capacity take place in its aerial. The aerial may be of any length from one to twenty feet and longer if necessary, provided a small variable condenser is placed in series with the aerial.

The capacity relay is more flexible and cheaper to construct than a photo-electric cell and may be used in many of applications common to both.

As a burglar alarm, the object for protection may be surrounded with a fine concealed wire and any person coming within a radius of three or four feet will cause the relay to operate, which in turn will ring an alarm bell or flash a signal lamp.

Many parents will find the capacity relay invaluable to notify them of any disturbance in the nursery, whether it be the removal of the child from its bed by an intruder, or the child himself getting up.

As a window display the capacity relay can be made to stop and start any object which requires the turning of a switch. When it is desired to operate equipment drawing heavy current the relay may be used to excite another heavy-duty relay.

The rules of construction that apply to an oscillator apply to a capacity relay. The relay used should operate on 10 milliamperes of current. When tuning you are close to the oscillator, therefore tune it so that the relay opens when you remove your hand from the tuning dial. Tuning is a matter of experiment, especially where it is desired to operate the relay at a greater distance than four feet.

The principle of its operation has been observed by almost everyone who has operated regenerative receivers of the old days which could be tuned and detuned with a wave of

the hand. The variation in the output of the 77 oscillator tube caused by a change in the capacity across coil 2, varies the bias of the 43 tube and in turn sharply varies the plate current of the 43.

The constants have been selected to give a plate current change of from 1 to 20 milliamperes of current. This change is sharp because changing the capacity throws the oscillator in and out of resonance sufficiently to open and close the relay.

We have been using the relay as shown, for several months in our store, and have attracted many customers on that account. Also persons entering the store are unwittingly made to turn on lights or ring bells. It fascinates them.

Servicemen can use the inexpensive capacity relay as a business-getter.

LIST OF PARTS

Coils

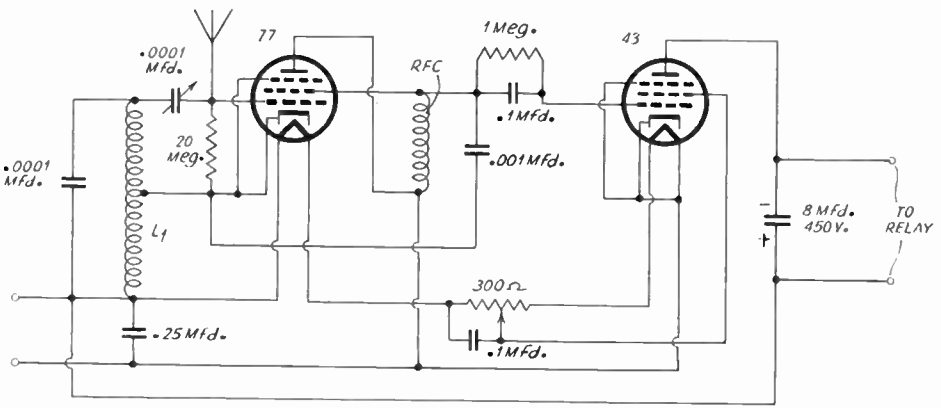
One r-f choke (2.5 millihenries up)
One 50-turn center-tapped coil on 1" form, No 32 enamel wire

Condensers

One .25 mfd. One .0001 mfd.
One .0001 mfd. variable.
One .001 mfd.
Two .1 mfd.
One 8 mfd. electrolytic

Resistors

One 20 meg. 1 watt
One 1 meg. ½ watt
One Variohm, 300-ohm 50 watt



Circuit diagram of the sensitive capacity relay.

BEST NONE TOO GOOD

I am a serviceman, amateur and experimenter, and read RADIO WORLD regularly. I think it's the best of its kind.

DALE NESTLERODE,
12 Washington St., West Pittston, Pa.

* * *

THE JEWEL OF CONSISTENCY

I am a consistent reader of RADIO WORLD and receive many valuable ideas from your diagrams and articles.

TONY VENTURINI,
Cliff Hotel, 204 East Jefferson Ave.,
Dallas, Tex.

* * *

HE'S REGULAR

I read your publication regularly, and I find it most interesting.

GEO. MCLAUGHLIN,
Cayuga, Ont., Canada.

NOT REALLY O'ER YOUR HEAD

I have bought your magazine almost every month and enjoy it even though some of its contents are over my head, nevertheless it contains very interesting and educational articles on just what is happening in radio.

EDWARD J. WHITE,
34 Gould St., Wakefield, Mass.

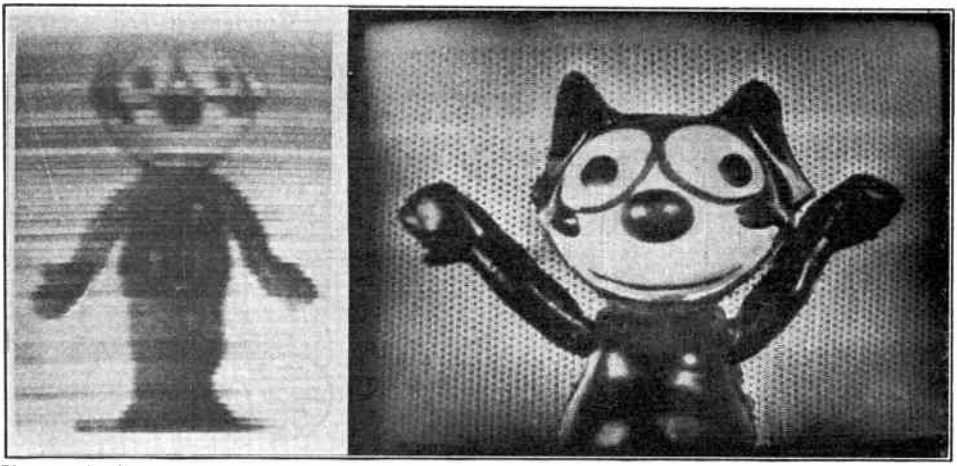
* * *

PUTS IN HIS THIRTY CENTS

I have all the issues since they were published monthly and several weekly issues. Sometimes I loan them to friends and have a great time getting them back. Your valuable book costs me 30 cents each month, but I would not want to do without it.

LESLIE THIRLWALL,
1205 15 Ave. West,
Calgary, Alberta, Canada.

Television Servicing Is



Photographs from National Broadcasting Company

It is all right now to laugh at the picture at left as something poor and imperfect, because it represents the 60-line result of the mechanical scanning system of the early days. At right the same character, Felix the Cat of the newspaper comic strips, is sho wn in 343-line electronic result, late 1936. Since the better picture was shown a still better one obtains, due to use of 98 more lines in scanning. The reproduction herewith are greatly reduced, and a 25 per cent. loss of definition must be ascribed to the engraving.

Serious Problem Affects All Branches of the Art—New Instrumentation Necessary—Training is One of the Difficulties—Engineering Capabilities Required

WHEN commercial television receivers are introduced a very serious servicing problem will be introduced simultaneously. Because television will represent an unparalleled technical attainment, far eclipsing sound broadcasting both in magnitude of problems solved and in the complexity of the means necessary to solution, an engineering background, plus practical experience in television itself, will be absolutely required.

NEW PAPERS TO BE PRESENTED

It is the present policy of RCA, Farnsworth and Don Lee to give full detail of television circuits and methods, although the fourth of the television quartet, Philco, has not yet fallen in line on this, but is expected to do so. By familiarizing themselves with announced methods service men will be able to grasp some of the facts necessary to proper servicing. But the transmitters and receivers are being changed so fast that there can be no commercial television until there is at least tentative fixation on the sets.

In its own periodicals and otherwise RCA has given much data on its television methods and circuits, but much of the published data is outmoded except as to principles, and the latest facts require a new technical series. This will be presented in papers before the convention of the Institute of Radio Engineers, to be held May 10, 11 and 12, at the Hotel Pennsylvania, N. Y. City. The RCA papers will be read mostly on the afternoon of Wednesday, the 12th.

It will be found that for a good understanding of the circuits and methods a mathematical background is necessary. There will, of course, be efforts published in the press to restate the contents of the papers without the use of mathematics, but with consequent loss of accuracy.

CATHODE-RAY SERVICING

However, when television is established, and a servicing group has to be supplied, or to supply itself, instrumentation will enable servicing of television receivers without any knowledge of mathematics, just as is true today in sound receiver and public-address servicing. Instruments that measure the effects and disclose the causes are either self-calibrated or require no calibration. So what at first may appear as entirely too much for the service man to cope with, finally will turn out to be something he can handle on the basis of a rhetorical explanation, plus minute details of the application of instrumentation.

The fundamental principles of television of

-What and When?

A carrier wave of about 6 meters brought to an RCA receiver a few miles away the video or television modulation which, when extracted from the carrier, amplified and scanned produced the picture shown above, of Betty Goodwin, television announcer. She was standing before the studio pickup camera at the time, so this is a reproduction of what was seen when observers looked at the cathode-ray tube of the receiver. If all pictures were as good as this there would be little technical improvement required for commercialization of television, but the trouble is the pictures don't stay put.

Photograph from National Broadcasting Company

course will be constantly applicable to the servicing problems, even though the technique and the applications will change rapidly. Ultra-frequency operations, high-fidelity amplification of a new criterion far higher than any now familiar, critical antenna installations, scanning and other new aspects will have to come within the service man's scope of intimate knowledge. Instruments not even in existence will have to be developed and in them the cathode-ray tube as a servicing adjunct will assume new and preponderating importance, as all the worth-while television developments in this country is now on the basis of electronic, and not mechanical, television.

As to when commercial television will be introduced, nobody knows the answer. The guess of the president of a television company is no better than your guess. The engineers are not satisfied with the present state of television's development. The pictures are good when they are good, but change from good to bad to worse and back again. Not until the vagaries are eliminated will any of the substantial corporations even attempt commercial television, although there is some apprehension that some concern will go off half-cocked and force a premature start. There has been prematurity in the past and it has always been disastrous.

MASSIVE PROBLEMS

Though the pictures today are far better than those shown in the mechanical systems of a decade ago, looking at any of the pictures for more than half an hour becomes tiresome, due both to programless programs and picture instability. The technical quality should be improved so that this tax on patience is reduced. Both transmitter and receiver are still full of "bugs." Moreover, the technical aspects, even if and when improved to a state deemed satisfactory, are only a small part of the problem. Compelling programs are another stumbling block, due to their cost and evaporation. Methods of dissemination also have to be solved.

Present Pictures Unstable, Soon Get Tiresome—Commercial Exploitation Awaits Solution of Technical, Program, Dissemination and Financial Problems

The policy of Radio Corporation of America is to give full publicity to their engineering and program developments for television, and when the time arrives that a receiver is developed that gives some promise of life expectancy, the circuit will be released for experimental work by amateurs, according to Frank E. Mullen, in charge of the department of information.

Mr. Mullen pointed out that RCA has expended vast amounts of money on television development, and in fact has assumed the leadership of such development in this country, so that when commercial television arrives

(Continued on following page)

Sponsors to Be Invited to Back Television Programs

By David Sarnoff

President, Radio Corporation of America

Many improvements have resulted from the field tests of the RCA television system which are being continued. The definition of the picture has been increased from 343 to 441 lines per frame. This improvement provides greater detail and clarity. It has also made it possible to double the size of the picture from approximately 5½ x 7 inches to 7½ x 10 inches.

PROBLEM IS ENORMOUS

The requirements of a nationwide television service must be viewed from the standpoint of eventual coverage of more than 3,000,000 square miles of territory with approximately 130,000,000 inhabitants. The size of this problem is much more formidable here than is the case, for example, in England, where the area is small and the population is concentrated. There the government subsidizes the television experiments and the broadcasting of television programs, but the owner of a home receiving set must pay an annual license fee to the government. In the United States, as you know, home radio reception is free and we hope, through the development of private enterprise, also to maintain television reception free.

Technically, the art of television needs still further improvement in transmission as well as reception. As these improvements are made, the cost should decrease and thereby reduce the magnitude of the financial problems of establishing a nationwide television service.

GOOD PROGRAMS COSTLY

In addition to these practical considerations, there is the further problem of developing studio and program technique to meet the requirements of such a revolutionary form of public entertainment, information and education. The program service will be costly, and its support will devolve primarily upon the sponsors of television programs, as is the case today with the sponsors of sound broadcasting programs.

Before sponsors can be interested in supporting television programs, it is necessary to provide a seeing as well as a hearing audience; and here we have the age-old question of what comes first, the chicken or the egg.

Nevertheless, it is my firm conviction that one day we shall have both the chicken and the egg, and that television ultimately will be established in the United States by private enterprise on a practical basis of free service to the home. The potentialities of television are such as will bring new meaning to the service and business of radio.

GETS ORDER FROM CBS

Developments here and abroad have demonstrated the fact that RCA is in the forefront of technical development in this new and promising field. Recently the authorities responsible for television in England adopted the Marconi-EMI system of television in preference to the other systems which they tested. The system thus adopted as the English standard is based on RCA inventions.

In our own country, the Columbia Broadcasting System has just announced its plans to enter the field of experimental high-definition television. That company has placed with us an order for the manufacture of a modern RCA television transmitter to be installed on the Chrysler Building in New York City.

(Continued from preceding page)

the corporation will be not only ready but showing the way.

The cathode-ray experimentation, it has been learned, is running into the third million of dollars, and all told RCA has invested in television about $10,000,000. The start was made with mechanical systems about a decade ago. The present cost of experimental operations is so large due to th eexpense of the apparatus used, the large personnel required and the rapid obsolescence.

Recently RCA changed from 343 lines to 441 lines and enlarged the picture to about 7½x10 inches. The reason for the 441 lines was to afford better definition and subscribe to the RMA standards, so a given receiver would be able to bring in the telecasts from competing stations.

"Not only are we making full disclosure of our technical developments in television," said Mr. Mullen, "but we are also licensing companies under our television patents."

(Continued on following page)

Sarnoff's Noted Rise An American Saga

David Sarnoff, president of the Radio Corporation of America, and chairman of the board; president, or director in various other companies in the the field of radio communication and the electrical entertainment arts, was born in Uzlian, Minsk, Russia, February 27th, 1891. At the age of 9 he was brought by his parents to America. The death of his father when David was still in his 'teens placed the burden of family support upon the boy's shoulders. He was in turn delivery boy, newsboy and messenger boy.

DAVID SARNOFF

As a messenger he worked in the old New York Herald telegraph office at Thirty-Fifth Street and Broadway, where he built up an income of $5 a week in addition to what he made from his paper routes. Saving money, he bought a telegraph instrument and in six months learned the Morse code. He next got a job as office boy with Marconi-Wireless.

At Siasconset, on Nantucket Island, Mass., there was a lonely wireless station of the Marconi Company. Sarnoff at 17 became an operator there at $60 a month. He remained for two years and read all the books in the company's library, becoming a full-fledged operator with a $10 a month raise.

When he wanted to take a special electrical engineering course at Pratt Institute in Brooklyn he asked for a transfer to the company's wireless station at Sea Gate, Coney Island, N. Y. At about that time John Wanamaker decided to equip his New York and Philadelphia stores with the most powerful radio stations that could then be designed. Sarnoff asked for the New York job. On April 14, 1912, he was sitting at his instrument in the Wanamaker store in New York, when he heard on earphones:

"S. S. Titanic ran into iceberg. Sinking fast."

For the next seventy-two hours Sarnoff sat at his post, straining to catch every signal that migh come through the air. By order of the President of the United States every other wireless station in the country was closed to stop interference. Of those persons on the Titanic, 1,517 went down. Huddled in boats and clinging to driftwood were 706 survivors. The drama of this struggle against the sea caused millions throughout the world to grasp at every word that came through the Wanamaker station. Not until he had given the world the name of the last survivor, three day and three nights after that first message came did Sarnoff call his job done.

The loss of the Titanic and the great service of radio aroused public consciousness to the importance of this new service. Sarnoff became successively chief inspector, assistant chief engineer, assistant traffic manager and in 1917, commercial manager of the Marconi company. In 1919, when the Radio Corporation of America was formed, it acquired the American Marconi Company and appointed Sarnoff commercial manager of the RCA.

In the following eleven years Mr. Sarnoff progressed steadily from commercial manager to general manager, vice-president, executive vice-president, and, in 1930 at the age of 39, to president of RCA.

Mr. Sarnoff gained his understanding of the job of marine radio operator first hand, by serving on shipboard as well as on shore.

As president of the Radio Corporation of America, Mr. Sarnoff is head of a company engaged in activities in virtually every field of radio development. He exercises general supervision over the financial and policy matters affecting the operations of the Radio Corporation and all its subsidiary companies. He is president and a director of RCA Communications, Inc.; a director and chairman of the board of the National Broadcasting Company, Inc., RCA Manufacturing Company, Inc., and Radio-Keith-Orpheum Corporation. He is a director of the Electric and Musical Industries Company, Ltd., of England.

His interests have taken him into close association with the motion picture industry.

Besides his notable achievements as an executive, Mr. Sarnoff is a good mixer and regular fellow, and is just as approachable today as he was when a newsboy. He is especially highly esteemed by his co-workers.

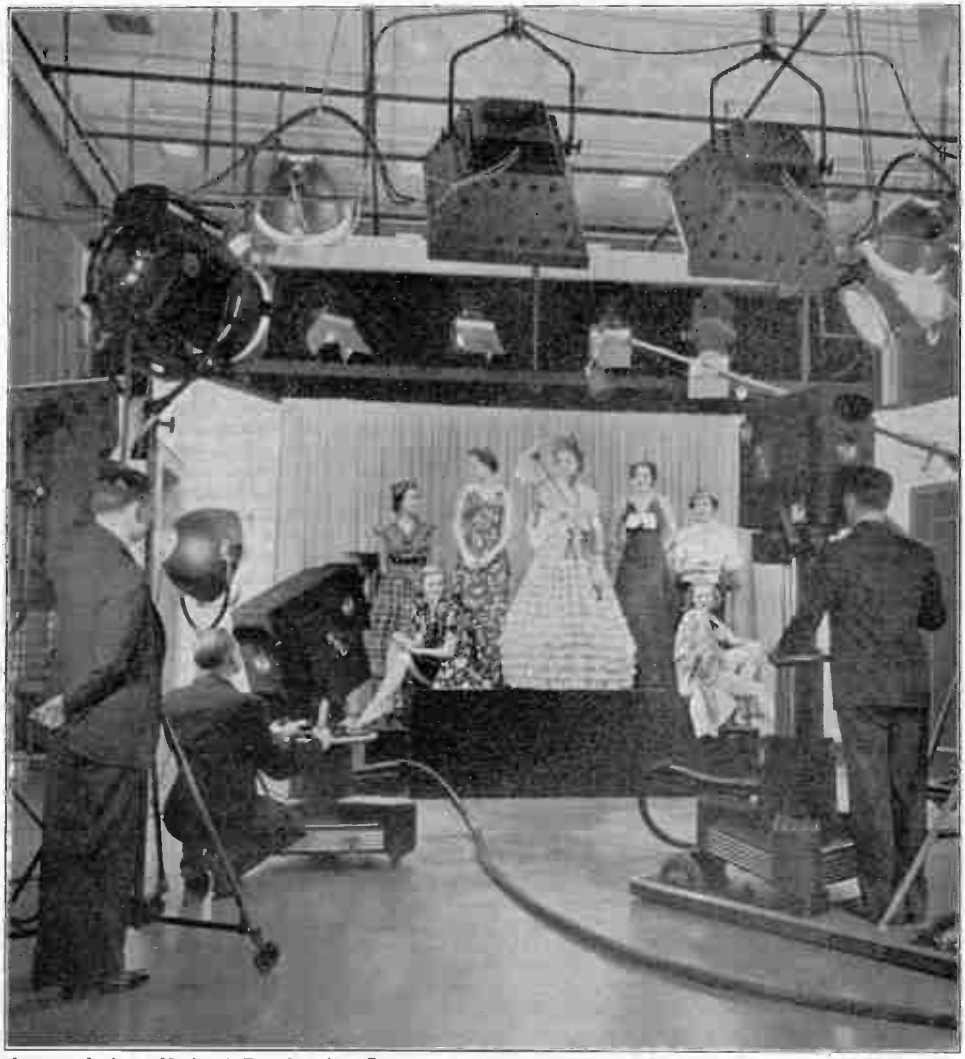
(*Continued from preceding page*)

The situation regarding television patents is therefore much the same at RCA as with patents applicable to sound receivers, and royalties will be paid by the licensees, who will in the main be television set manufacturers and station owners. The patents cover both transmission and reception.

It is said that RCA has never gotten out of its patents the amount of money spent for experimentation in connection with them, and the extreme cost of television development is expected to produce the same effect, only on a still larger scale. RCA must therefore be interested in some way of making television remunerative to itself.

The recent sale of an experimental television

(*Continued on following page*)



Photograph from National Broadcasting Company

Still pictures become rather fatiguing, so some animation is introduced by putting on a fashion show. For the present only engineers view the reception results when this "program" is telecast. The immediate future holds forth fully acted-out continuities, with stage settings, costuming and a measure of other embryos of television program technique. A television studio scene is shown.

(*Continued from preceding page*)

transmitter by RCA to the Columbia Broadcasting System, for use in the tower of the Chrysler Building in New York City, was one of the few examples of any revenue whatever. The price was $500,000. If any serious part of the experimentation cost is charged, even that sale was without financial profit. Moreover, Columbia is the biggest rival of the National Broadcasting Company in sound network broadcasting, and NBC is owned by RCA.

The comparison between television of the early days, and of 1936, is shown in two illustrations of Felix the Cat, a popular character in newspaper comic strips. The 60-line old-type result at left is contrasted with the 343-line reproduction at right. The cat is in the form of a studio doll and has been the obliging subject of many a television demonstration.

REAL PROGRAMS SOON

Another picture shows Betty H. Goodwin, NBC's first television announcer. It is NBC that is transmitting the television as developed by RCA, the studios being in the RCA Building, Radio City, and the antenna atop the Empire State Building, at 34th Street and Fifth Avenue. Miss Goodwin stood before the television pickup device, known as the Icono-

Nutshell Facts On Television

The following facts and opinions about television sum up the situation as it exists today:

1—Television is not good enough yet for public offering. Though splendid pictures are shown, they do not remain so. Looking at the pictures grows tiresome in half an hour—or less.

2—Money matters are beginning to worry television developers, as millions and more millions are spent on experimentation, with no income, much less profit, in sight.

3—All problems gravitate about money, and money alone can buy anything except the technical developments, which cover unexplored fields. The sum of problems is so staggering that those closest to the scenes of operations are as much in the dark as to television's future as any one else.

scope, invented by Dr. Vladimir K. Zworykin, at RCA Victor.

The dissected picture was made to modulate the carrier and sent by radio to the Empire State Building and picked up some miles away by an RCA television receiver, so that the reproduction shows what was seen when one looked on the reflected screen of the cathode-ray tube in the receiver.

Still subjects soon become tiresome to see, even pretty ones like Miss Goodwin. A little more variety results when a fashion show is staged, and the mannikins turn around and walk to and from to exhibit the graces of the latest-style dresses and bathing suits. You can call quits early on that too, and offend no one.

Along with 441 lines as an advance in television technique, closer attention is being given to experimental programs, and soon there will be something more interesting as a program for the RCA engineers to look at in the receivers in their homes. About 75 such sets are distributed in the normal service area.

Intimate scenes are favored, naturally, because head-and-shoulder views seem to give the best results, while pictures composed of many objects, where some or all must be comparatively small, do not possess sufficient detail.

While the accomplishments to date have been notable, the fact may be plainly stated that television is not yet ready, nobody of any responsibility says it is, the developers admit it is not, and the Federal Communications Commission is fully in accord. The engineers in charge of the developmental work are, if anything, the most desirous of postponing any attempt to commercialize television until the technical results are better, while the sales departments are eager to get going on a public demand that for the first time in our history is utterly tremendous for a supply that does not even exist.

KEEP IN TOUCH WITH ALL
TELEVISION DEVELOPMENTS
By Reading
Radio World Each Month

Series of Successes Put Mullen on Top

Frank E. Mullen, manager of RCA's Department of Information, is a Kansan by birth, but spent his boyhood and high-school days in South Dakota. He was a journalism student at Iowa State College when the United States entered the World War, and enlisted in the U. S. Army in May, 1917. After serving overseas with the Tenth Engineers from September, 1917, to February, 1919, he returned to this country, and completed his course at Ames. After he was graduated he started work as a newspaper man. This soon led into the radio industry, when he was assigned in March, 1923, by the National Stockman and Farmer, a weekly paper published in Pittsburgh, Pa., to organize the first radio broadcasting service to farmers ever undertaken in the United States. In his programs for this newspaper, broadcast over KDKA in Pittsburgh, he was the first announcer to give a market report over the air, and was also the first to broadcast a "barn dance."

FRANK E. MULLEN

When the National Broadcasting Company was formed, in 1926, Mr. Mullen joined its forces. His first NBC assignment was the organization of an agricultural service, which he started at station KFKX, at Hastings, Nebraska. He soon was transferred to Chicago, and opened the offices and studios of NBC there.

The National Farm and Home Hour, the noon broadcasting program that numbers a host of farmers and city dwellers interested in agriculture among its followers, was organized by Mr. Mullen in 1930. His work in directing that program has given him an exceptionally wire acquaintance throughout the country.

In December, 1934, he was appointed manager of the newly-created Department of Information for the Radio Corporation, with headquarters at Radio City, New York.

Beal Cites Wide Experience as Backing RMA Vision Band

The recommendation of the committee of Radio Manufacturers Association, Inc., that studied the frequency bands for intended television use, that 42-90 megacycles be reserved, except that the amateurs retain their present 56-60 mc band, is in line with a great wealth of factual data assembled by Radio Corporation of America, according to Ralph R. Beal, RCA engineer in charge of television research.

The proposal to have the 42-90 mc band assigned to television, with the stated gap, is now before the Federal Communications Commission.

BEAL TELLS OF RESEARCH

Against the proposal the technical argument has been made that the service area is not steady for this band, but that variations in distance-coverage take place, sometimes from hour to hour, or moment to moment, and there are authenticated instances of some sort of reception even over thousands of miles. Ordinarily the range may be considered as 25 miles. Amateur reception often has been verified between Chicago and New York, 56-60 mc, and there have been some reported instances of reception in the United States of signals from abroad.

Since the television carrier is modulated with frequencies that themselves run into megacycles, and there would be room for only a dozen or so stations in the 44 mc spread, 42-56 and 60-90 mc, fear of interference prompted the technical opposition.

"We have assembled very careful and comprehensive data on the subject of operation within the spectrum recommended by RMA," said Mr. Beal, "and would not have joined in the recommendation had we felt that there was any peril of interference due to the operation on these frequencies.

NO INTERFERENCE EXPERIENCED

"We went into this subject very thoroughly. Our records include every instance of verified reception over unusual distances on these frequencies that we could obtain, not only as the the result of activities of amateurs, but of commercial companies as well.

"Have you ever considered the large power necessary to deliver a television signal, and compared it with any signal in the same spectrum that arrived from outside the normal service area? Have you ever known of a signal having been received intelligibly in this frequency span over great distances?"

OPPOSITION IS DECLINING

Those who do think there might be some interference usually recommend that higher frequencies be used, where it is said that the chance reception over long distances is not known to exist.

The remote penetration is due to reflections, involving the skip distance effect of the same general nature as experienced on the short waves to which all-wave receivers now tune. There has not been much recognition of this reflected wave in scientific discussions of the ultra frequencies, because of the smallness of the effect, although there has been do denial of the occasional existence.

Before the Federal Communications Commission arguments against the recommendation have not been based much on the idea of interference due to reflections, but to competition with Government activities. The Army and Navy, also the Department of Agriculture and the Department of Commerce, have opposed the idea of relinquishing waves they use in this spectrum. Only very recently the Army and Navy authorities have shown signs of withdrawing their opposition, the Department of Agriculture is expected to do likewise, but there still remains the insistence of the Department of Commerce, which at present desires no molestation of communications in this band by its Bureau of Air Commerce.

Beal Brilliant Top Man in Radio Engineering

Ralph R. Beal is an alumnus of Leland Stanford University and has been continuously identified in radio engineering since 1912. His career began with the early development of the arc converter as a generator of continuous waves for long-distance radio communication.

RALPH R. BEAL

During the war he was resident engineer in Washington, D. C., for the Federal Telegraph Company. He later served for five years as Chief Engineer and was in charge of the installation of high-power radio transmitting equipments in stations of the United States Navy.

In 1926 he joined RCA as Pacific Division Engineer and four years later became Manager, Pacific Division, R.C.A. Communications, Inc. In 1934 he was appointed to his present position of Research Supervisor of RCA.

TUBE UNIVERSITY

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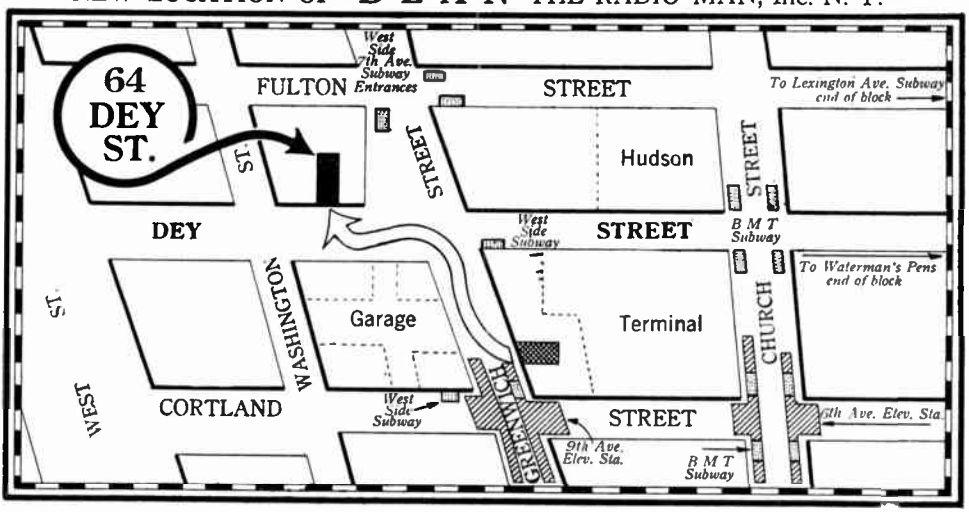

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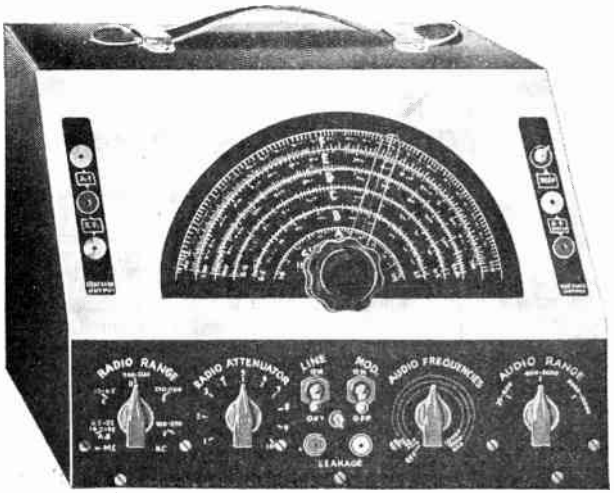

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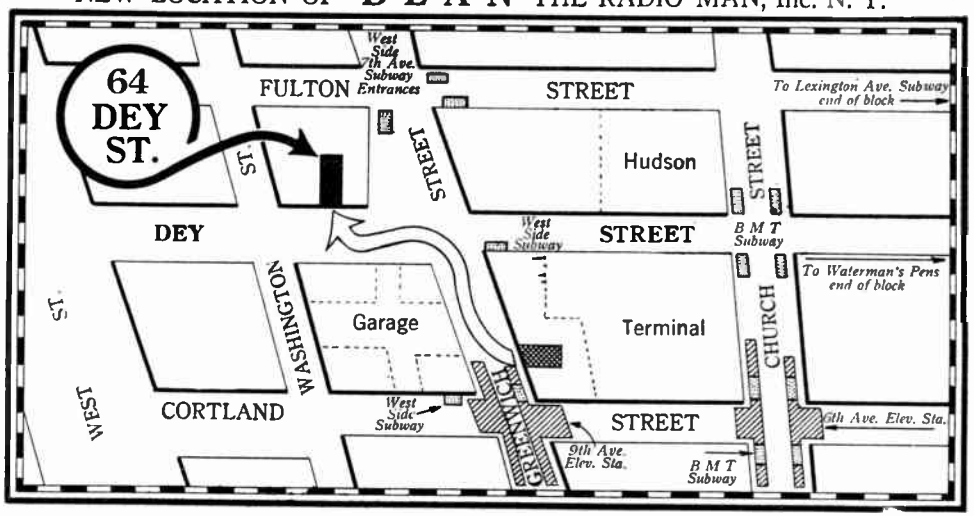

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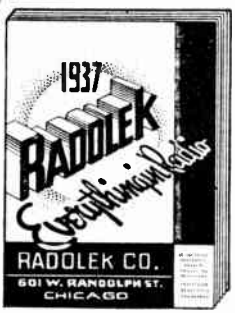

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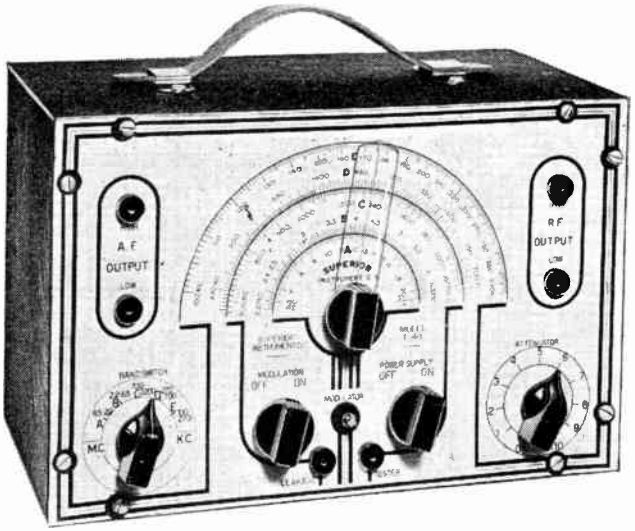

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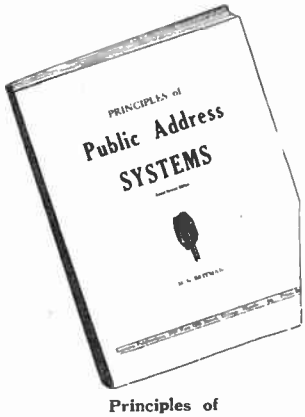

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Send for the new Spring 1937 ALLIED Radio Catalog! 156 pages packed with Everything in Radio at lowest prices; more than 10,000 exact duplicate and replacement parts; latest Amateur transmitters, receivers and transceivers; dozens of set-builders' kits; 53 new Knight Radios; test instruments; P. A.; books, tools, etc.—Radio's Complete Supply Guide!

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Lewis Winner's Genius in Hammarlund Catalogue

The most beautifully artistic catalogue ever produced by Hammarlund Manufacturing Company, and outstanding in the radio field, is the latest one, No. 37, prepared under the personal direction of Mr. Lewis Winner, director-general of all Hammarlund advertising.

Mr. Winner, whose artistic genius has made itself felt in the Hammarlund executive office modernization, and in the strikingly compelling Hammarlund advertising in all the radio publications, has combined highly artistic taste with fine detail of textual description, adding his gift for literature to his mastery of the pictorial art.

Hammarlund's condensers are presented in an original advertising manner, every one with "blackboard diagrams" of their use. All the other products are expositioned with equal skill, thus adding fresh laurels to Mr. Winner's already great crop. Personal congratulations have rained upon Mr. Winner from all parts of the country for his masterly achievement.

The catalogue may be obtained by addressing the company. 424 West 33rd Street, New York City, Dept. RW.

The Remedy for... ANNOYING COIL PROBLEMS!

WINDING solenoid coils for radio frequencies requires knowledge of the number of turns of any selected type of wire on any sensible diameter to attain an inductance suitable for the tuning condenser and lowest frequency. Hence, with capacity and frequency known, there are two unknowns: (1), the required inductance; (2), the number of turns to establish that inductance. The answers are obtained without computation by use of "The Inductance Authority," by Edward M. Shiepe, and an 18 x 20" supplement. On the large supplement are plotted the "curves" of frequency, capacity and inductance in straight lines, so for a desired low frequency and known capacity the unknown inductance is solved by mere inspection. The number of turns for attainment of that inductance, for all popular tubing diameters and all generally used wire diameters and wire insulations, is read from the inductance-turns charts which are in the bound volume. Coil and set manufacturers, as well as home and shop experimenters, students and teachers freely use this book. Accuracy is 1%. The only book of its kind in the world.

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RADIO WORLD

145 West 45th Street, New York City

Superior Oscilloscope Complete *with* Amplifiers $24.60

HERE is real news, hot news, spot news! A genuine cathode-ray oscilloscope, with built-in amplifiers, complete with five tubes, at only $24.60. You've always wanted one, but it had to be good and it had to be inexpensive. The engineering staff of Superior Instruments Co. spent three months designing and perfecting this instrument, and now it is ready. And not only ready but *right!* And because of our adjustable insulating hood for the 913 the device may be used in broad daylight.

CONTROLS

1—Focus, to get a sharp spot.
2—Intensity, to govern brilliance (line switch attached).
3—Saw-tooth range switch, five positions, for rough frequency selection.
4—Saw-tooth frequency vernier, for fine frequency selection.
5—Saw-tooth on-off switch.
6—Internal 60-cycle and external "any frequency" synchronization.
7—Vertical amplifier gain.
8—Horizontal amplifier gain.

INPUTS

1—For vertical deflection (red insulation for "high" side).
2—For independent horizontal input, when saw sweep is "off." Same color scheme.
3—For external synchronization.

GROUND POST

1—Connected to the totally shielding cabinet.

A fetching appearance marks the front view of the Superior Oscilloscope that sets the all-time record for lowest price of a complete oscilloscope with amplifiers. Cabinet is 7½" wide, 10" high, 10¾" front to back. Front panel is sloping. The 913 has an adjustable insulating hood enabling viewing in broad daylight.

Significant Results at Insignificant Cost

DESIGNED and manufactured with great care, the Model S-10 Superior Oscilloscope gives you the biggest break of your life! My, how service men and experimenters do need an oscilloscope! Flat-top peaking, distortion location and remedy, push-pull balancing, frequency, amplitude and modulation measurements—these and thousands of other uses establish the oscilloscope first among your new-equipment needs.

One of the simple tests of oscilloscope design is how finely the spot can be adjusted. Our focus control permits pin-point spotting! This is particularly important when using a tube like the 913.

The circuit permits grounding of the total-shielding cabinet at the zero d.c. potential and therefore insures 100 per cent safety in the device itself and to external circuits being analyzed.

Built-in is our special saw-tooth oscillator, feeding the horizontal amplifier. The saw-tooth oscillator's return trace is either invisible or negligible. And our own LC interlock makes correctly adjusted patterns stand still!

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Order Direct From

SUPERIOR INSTRUMENTS CO. 136 Liberty Street, New York, N. Y. Dept. RW-5

Blan Grows Some More, Moves to Vaster Quarters

Michael Blan, with his wife and three children, Eugene, Shirley (standing) and "Baby" Lucille.

Back in 1922 the chief engineer of the Waldorf-Astoria suggested lightly to his able electrical assistant, a man named Blan, that if he wanted to remain the hostlery's electrical wizard and general fixer-upper, he would have to give up a second job that he was holding down nightly as radio repairman.

The Marconi urge was too great for Michael Blan, so he up and left in 1923, getting a position with the Liberty Radio Co. After a month's association he was appointed manager of the branch at Sixth Ave. and Forty-second Street, N. Y. C., where he remained for a year. He had made so many friends meantime that it seemed the most natural next step that he go in business for himself. He opened his place at 145 East Forty-second Street, next to the famous Chrysler Bldg. He coined the trade name, "Blan the Radio Man," and after four successful years moved to 89 Cortlandt Street.

Blan the Radio Man's customers were interested also in automobiles, photography, experimented with things generally, and many had a flair for inventing. Blan started selling condensing lenses, air-conditioning service parts, photographers' supplies etc., always featuring radio.

Recently he moved to 64 Dey Street taking over three floors, each 25 x 66 feet, and will have "everything electrical."

GREATEST ACTIVITY SINCE '29

The greatest activity in radio developmental and field work since 1929 took place between March 15 and April 15, 1937.

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Readers whose names and addresses are printed herewith desire trade literature on parts and apparatus for use in radio construction. Readers desiring their names and addresses listed should send their request on postcard or in letter to Literature Editor, Radio World, 145 West Forty-fifth Street, New York, N. Y.

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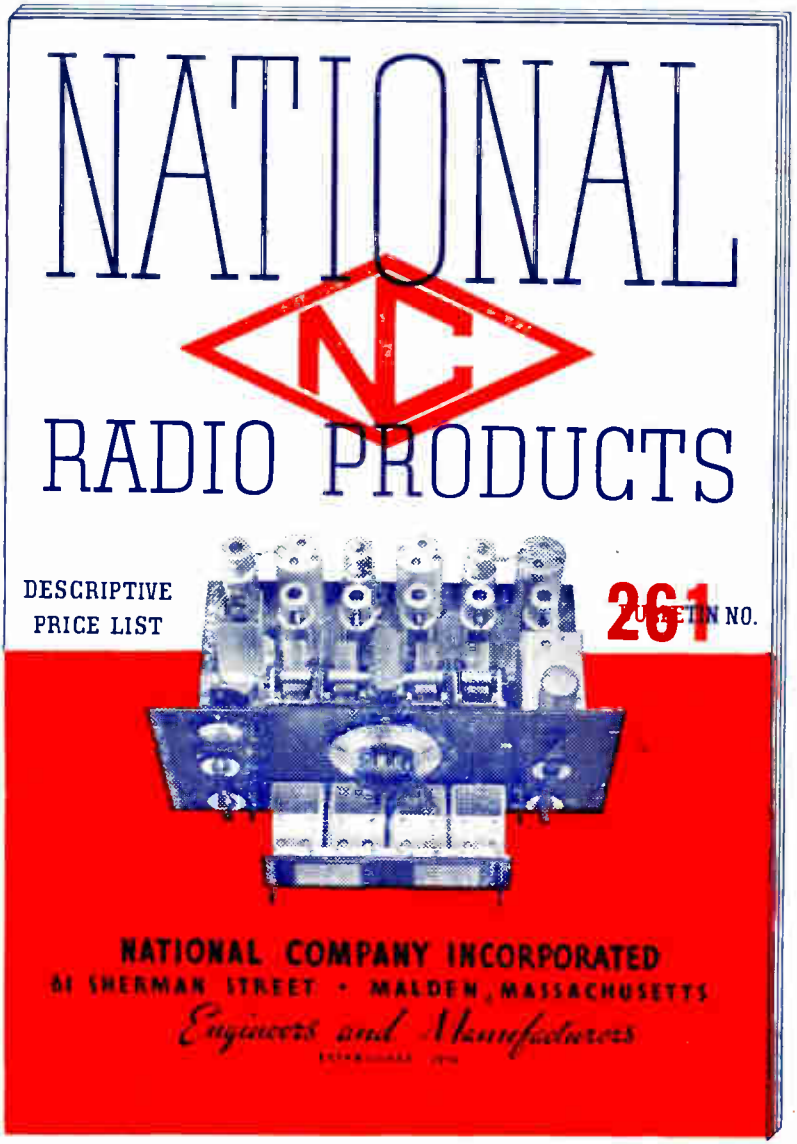
Allied Radio Corporation announces the release of an attractive new 156-page Spring 1937 Catalogue. Of interest to servicemen, dealers, amateurs, experimenters and sound specialists, it includes more than 10,000 exact duplicate and replacement parts; 53 new Knight radios, featuring automatic dialing, AFC, Touch-o-matic tuning, etc., new plastic, portable, phono-radio and auto models; complete lines of amateur transmitting and receiving gear; matched unit Public Address systems from 8 to 60 watts; test instruments; build-your-own kits; Rurlpower windchargers and generators; books, tools, etc. A free copy may be obtained by writing to Dept. RW, Allied Radio, 833 West Jackson Blvd., Chicago, Ill.

The new edition



If you are without a copy of the new National General Catalog, write us and we will gladly send you one. Or better, visit your dealer. He will welcome the opportunity to give you a copy of this new catalog and to demonstrate the latest National products.

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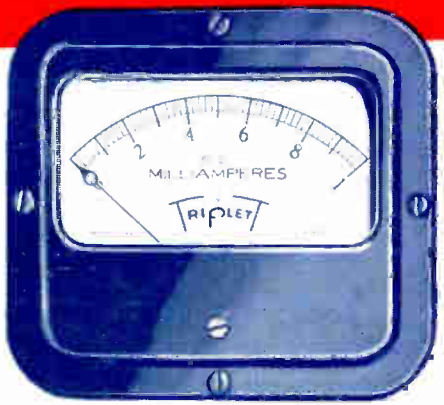

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