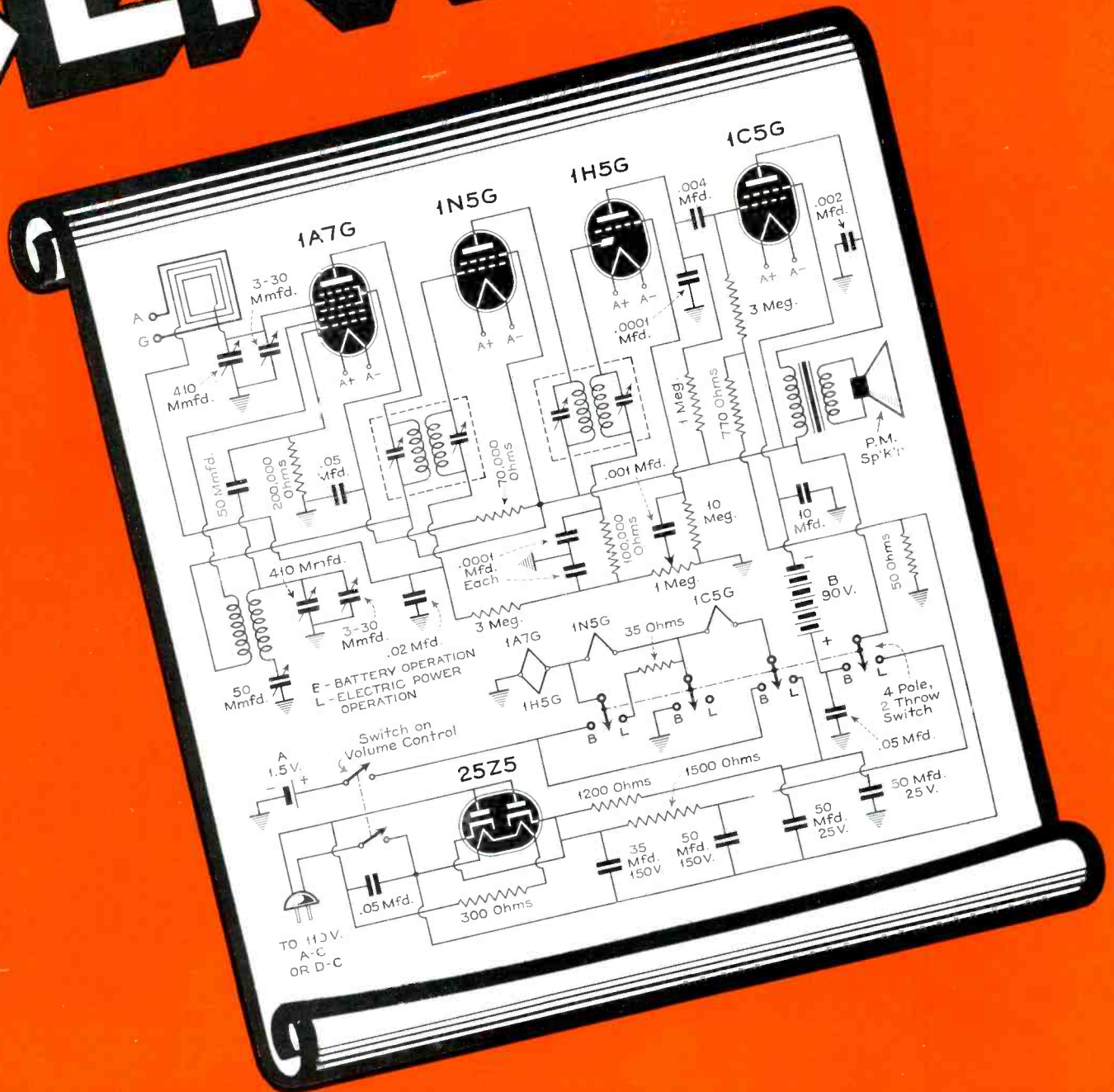


SERVICE



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SERVICE

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Advertising Manager

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Circulation Manager

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A N T E N N A

• • • television has arrived!

THE position of a prophet is precarious, indeed. Those who agree with him say they know it anyway. Those who disagree, throw stones. We do not feel that we are taking any chances, however, in stating that we definitely look for an immediately *successful* and rapidly-growing television industry.

In our travels around the field during the past few months we have been amazed at the breadth of the research and engineering development—now commercially available in the form of television transmitters and receivers. We have been pleased at the sound and far-sighted plans which have been laid for the merchandising of television and at the precautions which have been taken to prevent either the trade, the broadcaster or the public from being used as a trial horse (remember the first few years of radio?)

The public wants television. News of successful European programs—continual flow of television publicity in the press for the past two years—and granting of television licenses—all have combined to create this public interest.

The Radio Industry needs television to bring it out of the bargain basement, to restore price levels and to increase employment. After all, the radio industry led the way up the economic ladder once before. History may repeat. Of course, it's going to take time to get programs on the air in all localities. Nobody expects this to be achieved in a day or even a year. Television is logically starting in the centers of population, and the rapidity of its spread will be predicated upon the success attained in the serving of this first audience of approximately twenty million. It behooves us all to put our shoulders to the television wheel to help speed this success.

Don't you forget for a minute that television is of extreme importance to the service field. Radio sets that need practically no installation and are not worth a decent service charge don't make a living for any Service Man or service organization.

The public will not buy a large number of console receivers until they can get television with them. The common reaction during the past year or two was "Why spend \$100. more or less for a radio *now* when any minute we will be able to get a television receiver for both sound and sight programs at \$200. more or less?"

Study television—even if you are not in a locality that will have programs immediately. It will reach *you* sooner or later and you want to be ready. In the meantime, a

boost for television is a boost for better times for the trade and for the service field.

• • • looking ahead

THIS month SERVICE runs the gamut of predictions. In our feature article, on pages 159, 160, 161 and 162, Arthur Van Dyck discusses possibilities which should be the realities of tomorrow's receivers. He feels that the time has come when the broadcaster will cooperate with the set manufacturer to make the sound receiver perform new services for the eager listener.

Up to the present receivers, in general, have been manufactured on a mass production basis to deliver average performance for any locality in this great country. Perhaps a large percentage of the people could enjoy better reception with receivers designed specially for the locality in which they reside.

What does television and facsimile promise to a patient public? Will the manufacturers and broadcasters cooperate to provide the utmost possible?

• • • auto-radio data

ON pages 172, 174, 176, etc., and continuing in a subsequent issue, we are presenting, in so far as such information is available, the control data and i-f peaks for practically every auto-radio receiver ever manufactured.

• • • your oscilloscope

IT HAS often been our hope to present a few concise articles on everyday servicing with the cathode-ray oscilloscope. These articles, we thought, should be very brief and to the point. They should, however, cover the complete subject in simple words with nothing left to the imagination. Our search extended far and wide . . . finally we have obtained two short articles which exactly fit the requirements.

J. H. Reyner, an English engineer, has prepared them especially for SERVICE. They will cover all you need know about the cathode-ray oscilloscope to become adept in its use in your everyday service work.

The first of these will appear in the next issue of SERVICE. DON'T MISS IT!

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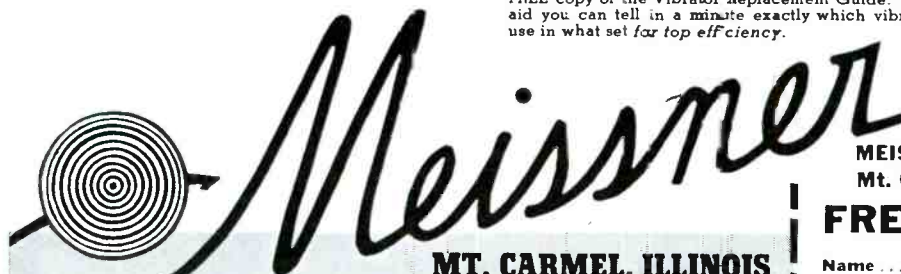


FOR twenty years, the name "Meissner" on a radio part has meant "tops" in quality!

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" A FAMOUS NAME FOR TWO DECADES "

LOOKING AHEAD! *

With the industry approaching its twentieth birthday, the author makes a few suggestions for the future

BROADCASTING is approaching its twentieth birthday anniversary, so that we can say no longer, as has been said so often, that it is in its infancy. *New* infants are being added to the broadcasting family, by name facsimile and television, and sound broadcasting, now twenty years old, is past the infant and adolescent stages, has had its growing pains, and has passed through the critical formative years. It has now reached maturity.

• • • receiver development

The first receivers produced for sale to the public were extremely simple. This was not because more complex and more efficient ones were not known to radio engineers, but because they were the best suited to the new purpose. Simplicity was a paramount requirement because operation was to be effected by laymen, not by trained personnel. Radio engineers did not know at that time how to build complex high-performance circuits with simple operating features. Today, home broadcast receivers have circuits which are vastly more complex than those of the commercial receivers of 1920, and yet their controls are simple.

The receiver designer must so utilize new developments as not to add unduly to the operating skill required. As a matter of fact he actually has succeeded in reducing the skill required to a push-the-button stage. However, he not only must supply the push-buttons, but has to arrange them so that if the user pushes all of them at once nothing untoward will happen.

Considered with relation to other appliances in the home, the broadcast receiver has some remarkable characteristics. It is at once the most complex, the most sensitive, and the most precise device, which has entered the home. It operates on inputs measured in millionth parts of one volt, it includes

generation of voltages of hundreds of volts, and it maintains frequency acceptance conditions to one part in many thousand throughout years of use with-



out attention. If we did not today so quickly accept and become accustomed to the marvels of the age, we would find interest and romance in the story of this development by tracing the step-by-step contributions from hundreds of engineers which have made possible the refined product we now have.

• • • tube development

The development of receivers is intimately associated with the development

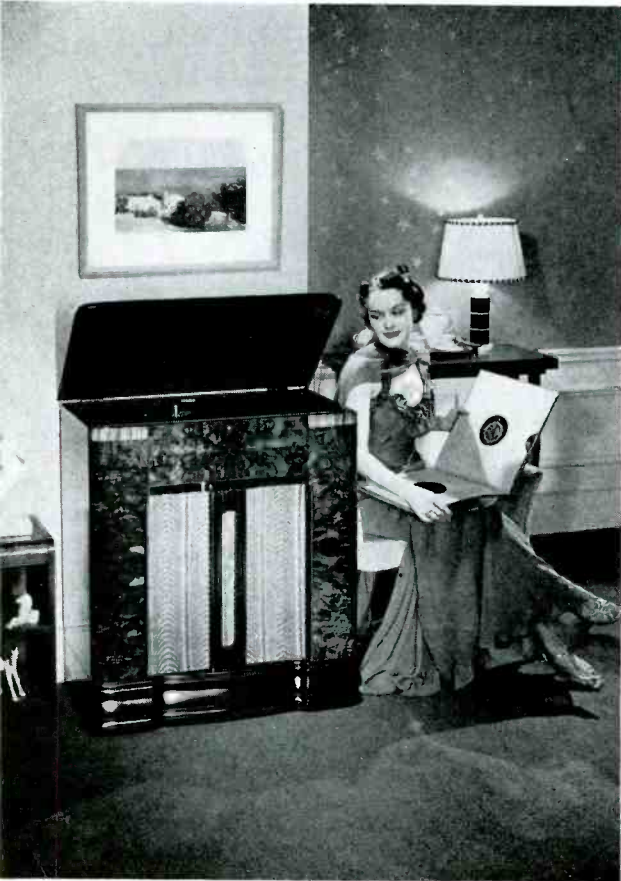
of vacuum tubes. The first tubes were simple triodes having high power consumption, low amplification, poor uniformity, high internal capacitance, poor circuit-matching characteristics. Only two or three types were available at all, to serve all purposes. As development progressed, all of these objections were overcome, until today the receiver designer has several hundred tube types from which to choose. Each major step in tube advance made possible a new receiver service expansion. The low-power cathode tube made possible portable sets, the alternating-current tubes changed broadcast listening from a mechanical hobby to a public service, and the screen-grid tube made possible the utilization of complex, high-amplification circuits having greater efficiency and the necessary stability. Today's tubes are so excellent, in fact, that one is tempted to say that they have reached the ultimate, or at least that no great further improvement is needed. How-

New infants are being added to the radio family. The facsimile receiver-printer prints 8½ by 12-inch pages at the rate of 3 feet an hour on a continuous roll. An automatic clock arrangement turns it on and off in accordance with the predetermined transmission schedule.

Illustrations courtesy RCA Mfg. Co., Inc.



*Abstracted from "The Radio Receiver as a Part of the Broadcast System," by Arthur Van Dyck, COMMUNICATIONS, March and April, 1939.



ever, it will be well to resist the temptation, because there is little doubt that some new development of tomorrow will open up additional possibilities.

• • • **circuits**

After the first simple receivers had done their duty in the initial stages, and after broadcast stations had increased to be very considerable in number, it became apparent that two certain receiver improvements were needed vitally. These were more selectivity and less radiation. It was an unfortunate characteristic of the simple, early receivers that they radiated and caused interference. Two circuits having the needed characteristics were available, both having been invented before the advent of broadcasting. One was the tuned-radio-frequency circuit, and the other the super-heterodyne. The latter was considerably more complex, and although in commercial use, not enough was yet known about it to permit its use in large quantity production. The t-r-f circuit was considerably simpler, and considerably easier to reduce to the new practice of large production and layman operation. Therefore it became popular, rapidly displaced the early sets and for several years met the need for more receiver selectivity, which was growing as the number of broadcast stations increased. But the limit of its capabilities was finally reached, however, and the superheterodyne circuit

was introduced. By this time, the complexities of this circuit had been brought under control and it could be built with economy and reliability under mass-production methods. Today, this circuit is used universally.

• • • **fidelity**

At about this time another factor entered, that of fidelity of transmission and reception. Up to this time, receivers had been very seriously deficient in this respect. Even the best receivers had a tone frequency range of only about 300 cycles to about 3000 cycles, and the deficiency was due primarily to the loudspeakers used. Introduction of the electro-dynamic speaker brought enormous improvement, and caused more attention to be paid to the matter of fidelity, in transmitters as well as receivers. For example, it was found that improvement of transmitter frequency stability gave improvement in fidelity of reproduction. As a further consequence of the dynamic loudspeaker,

Receiver appearance is a serious problem. As new features and services are added it will be increasingly difficult to maintain the aesthetic aspects of home instruments and at the same time meet technical requirements satisfactorily.

and the improved tone frequency range, it became feasible to utilize larger reproduced volume. Receiver output increased from small fractions of one watt to several watts, and the receiver became a qualified musical instrument for the first time. Another result of this improvement in receivers was that they were then capable of revealing transmitter imperfections. Transmitter engineering and operation were then forced to pay full attention to tone frequency range, frequency stability, hum modulation, over-modulation, and all matters affecting fidelity of transmission, and transmission improvement resulted.

• • • **refinements**

Satisfactory basic components of the receiver having been obtained, later development began to turn in the direction of circuit refinements. Such additions as single-knob tuning, higher sensitivity, automatic volume control, hum and noise reduction, tone control, selectivity control were provided. These refinements might be called internal in nature, and as they grew into standard practice, the attention of designers began to be directed externally, that is toward operating characteristics. This resulted in changes such as better knobs and dials, smaller and more convenient cabinets, better antenna design, and has finally culminated in automatic or push-button tuning and remote control.

• • • **short waves**

A development having large effect upon both receivers and transmitters, as well as upon broadcasting service as a whole, was that of the extension of broadcasting to short waves. This involved very considerable expansion of broadcasting, but was carried out with little coordination between transmitter and receiver interests. This was due largely to the fact that the receivers were intended for reception from foreign stations, rather than our own, while our transmitters were to supply foreign receivers rather than domestic ones. Even so, the number of receivers built here for sale abroad was large, and it is remarkable that the innovation was accomplished with so little coordination between broadcasters and receiver manufacturers. It seems to prove that the democratic way of operation can be depended upon for good results in the public interest without resort to centralized, planned, and dictatorial methods, even in a matter such as this, where the project is new, untried, and requires an experimental, groping approach.

In the first introduction of short waves, receiver manufacturers supplied receivers to cover practically all the short-wave radio services. It soon developed that public interest in some of these, such as aircraft, amateur and police, was limited, and now the low and medium-priced receivers, and even many of the high-priced ones, are designed to receive only those short wave bands which are used in foreign broadcasting.

• • • **cost**

There are two further factors in receiver development to date which have had large effect upon the system. One is the matter of cost. The prices of receivers have been reduced without any apparent relation to the complexity of their designs, the quality of their appearance and performance, or the service they render. Most of this reduction has been the normal result of large production operation, but some of it has been a competition in reduction of price accompanied by undue lessening of performance and quality of construction. This has resulted in a lessening of prestige of the radio instrument in the estimation of the public, with more or less distortion of their appreciation of proper values in the product. Consequently, and for example, few buyers today have a clear conception of the difference between the \$9.95 set and the \$49.95 one, even with respect to basic performance matters in which they are interested.

However, the enormous reduction in cost has resulted in universal utilization of the service of broadcasting. In this country, a receiver in every home is

very nearly completely realized. They are not only in the home, but in the automobile, the boat, the train, the club, and public places of all sorts. Increasing use of portable receivers is further widening the possibilities of listening. Reception of programs is world-wide. Only the limits of the earth itself now circumscribe what sound broadcasting is doing.

There is still room for improvement in convenience of operation and aesthetic aspects of construction, and by the addition of new services. The next few years will see changes to accomplish these.

• • • receiver characteristics

Let us examine receiver performance characteristics individually. Beginning with sensitivity, we find that present receivers are able to detect and reproduce radio signals of such small magnitude that the final limitation is introduced by interfering noise. The available high sensitivity is being utilized to permit use of small receiving antennas. Automobile reception is satisfactory because high-sensitivity receivers receive enough voltage from the very small antennas which are all that the automobile permits. Even smaller antennas, such as may be entirely enclosed within the receiver cabinet, provide sufficient pick-up for satisfactory reception under many circumstances, and small loop antennas and small completely portable receivers have become feasible as a result.

The status of the selectivity characteristic is difficult to analyze because it is intimately related in design and performance to fidelity. In so far as design is concerned, it is possible to arrange for any desired degree of selectivity. Furthermore, any desired nature and degree of compromise between the opposing characteristics of selectivity and fidelity may be chosen, with the limiting factor that of construction cost. It can be said that general practice in receiver design is such as to provide adjacent-channel selectivity sufficiently good in most areas of the country, in relation to transmitter frequency and power assignments. In certain rural areas, higher selectivity could be used advantageously, but the current practice of using the same receivers throughout the national distribution system prevents the marketing of special receivers in particular areas. Selectivity discrimination against signals two or more channels away from the desired channel, is so good as a result of the power super-heterodyne principle, that urban reception, that is selection of each of numerous transmitters in one locality, is eminently satisfactory in this respect throughout the country. At present

when interference between two local stations is encountered, it is practically certain to be caused by external cross-modulation, rather than by inadequate receiver selectivity where the receiver is located very close to one of the stations.

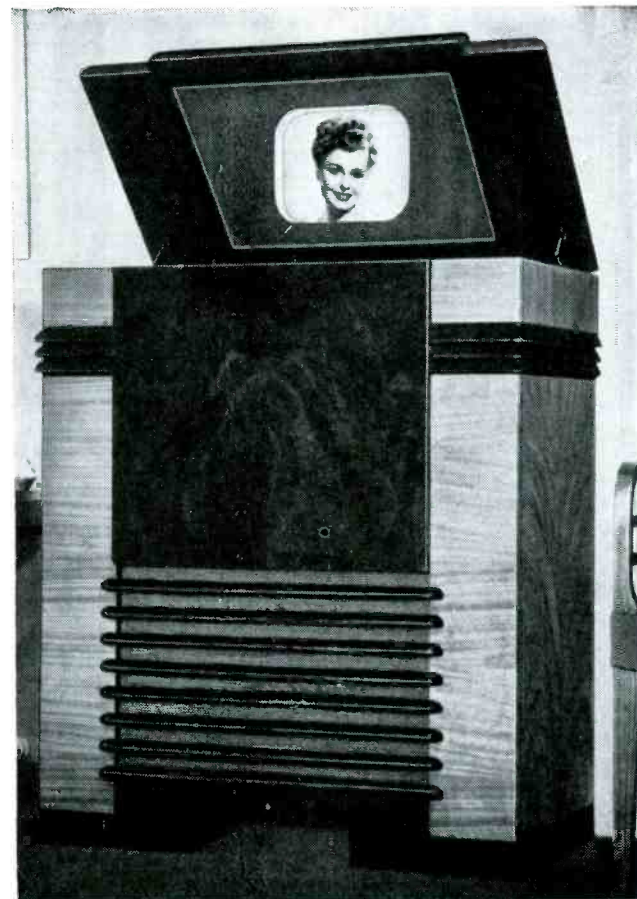
Fidelity is a characteristic worthy of most serious consideration by all radio interests, and is one which should respond to joint treatment by transmitter and receiver engineers. Unfortunately, the fidelity characteristic has fallen into disrepute, and it is almost universal belief in the radio industry that it is not important that the public is not interested in better fidelity, and even that it will not sell. Now it is perfectly true that there are conditions under which high fidelity, or even good fidelity, is less desirable to the listener than some compromise adjustment. However, it is equally true that there are other conditions under which no present receiver and few present transmitters can deliver the degree of fidelity which would be desired if it were available. It is

It may do much good if the systems' viewpoint of television, which has been applied so effectively to date, is maintained in so far as possible, rather than allowing each branch to develop independently as has often been the case with sound broadcasting.

the attempt to use high fidelity under conditions where the signal-noise ratio is not favorable, which results from the market practice of selling all designs to all areas, rather than special designs to special areas, which has caused the general feeling that high fidelity is not worthwhile. This feeling will change only when buyers are educated to seek receivers suited to their particular conditions, and do not expect one receiver to serve equally well in the suburbs of New York, the plains of Montana, and the valleys of New Hampshire.

Good as today's reproduction is, it is still considerably short of realism, or the illusion of realism, and there is no reason why we should be satisfied with the present state. It seems to be true that the bottle-neck in the path of further progress is the loudspeaker, and yet it seems also that present loudspeaker technique has not been fully utilized in commercial receivers. The problem warrants more serious attention by receiver manufacturers, I believe, but also it is desirable to continue efforts along all lines which contribute to fidelity improvement, such as: increase in transmitter power, decrease in man-made interference, better wire telephone lines, better audio-frequency characteristics in all elements of transmitters and receivers, better linearity of the phase vs. frequency characteristic.

The cost of operation of radio receivers is extremely low, but should be



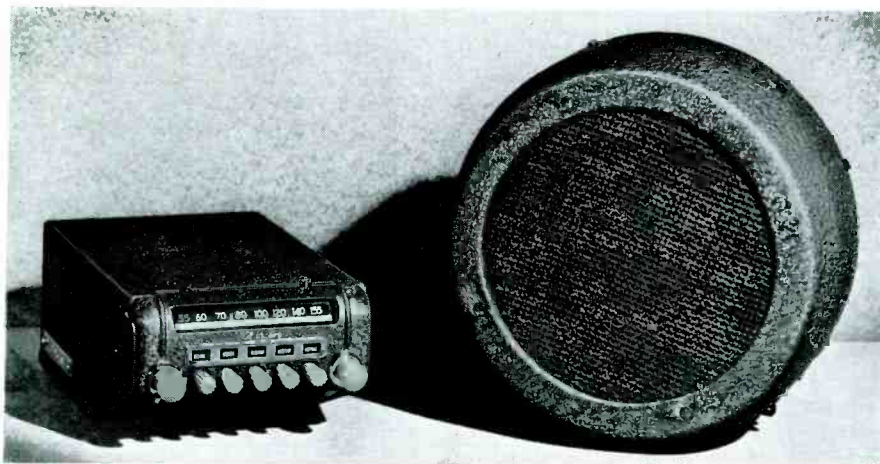
considered in order to see how much room for increase there is, in connection with additional services which will involve more cost. With assumptions based on average use as follows: Number of tubes in the receiver, 7; cost of tubes, \$7.00; hours use per year, 1000; life of tubes, 4 years; power drawn, 75 watts; cost of power, 5 cents per kw-hr; the operating cost is \$5.50 per year, 46 cents per month, or 1½ cents per day. Approximately one-third of this cost is for tubes, and two-thirds for power. Inasmuch as the tube cost for the first four years of service appears as part of the initial receiver cost rather than as a maintenance expense, the apparent cost is that of power only, or about one cent per day. Obviously new devices, or new uses of present-type receivers, may include considerably greater power requirement, or considerably greater use per day, without entailing excessive cost in receiver operation. This is fortunate because many of the new services now on the horizon will require more power, or more use, or both.

• • • future receivers

It is not intended that this section of the article shall attempt to prophesy, but rather that it be confined to observations of existing trends and their natural results. Barring radically new discoveries, which naturally have unpredictable effect, it is possible to foresee

possibilities for at least a few years in advance, whenever commercialization follows the laboratory with an interval of a few years, as it does in radio. This section of the article will attempt to show certain possibilities of broadcast service, with special reference to matters wherein utilization of the possibility depends upon coordination and cooperation between the transmitter and the receiver.

First, we should realize clearly that large improvements of the future can not be looked for inside the receiver



The receiver designer actually has succeeded in reducing the skill required in tuning to the push-a-button stage.

and transmitter, so to speak, as much as has been possible in the past. As described earlier in this paper, the receiver has approached closely to its ultimate limits in all performance characteristics except fidelity, is available in forms to suit all places where people want to listen, and is available at prices to suit all demands. Similarly the transmitter is asymptotic in its development progress. New developments, in order to have noteworthy effect, must be more than minor improvements. *They must be of such nature as will provide new service possibilities, new uses.* They must, for example, give pictures in the living room, or wash dishes in the kitchen.

Automatic tuning has taken a good start during the past two years, and will become standard and universal practice during the next few. Remote control has had less utilization, and more difficulty getting started. However, satisfactory methods are known, and when these are made available, there is little doubt that remote control will find ready public acceptance. Remote control, or any other considerable aid to operating convenience, increases the amount of listening, and therefore has significance to the system. It is desirable from various standpoints that receiver manufacturers make available satisfactory remote-control receivers.

• • • receiver appearance

Receiver appearance is now a serious problem, and as new features and services are added, it will be increasingly difficult to maintain the aesthetic aspects of home instruments, and at the same time meet technical requirements satisfactorily. There is vital need, even now, for new receiver forms which will have greater flexibility of arrangement, and permit more individuality of design. It might be said that broadcast receivers now stand at the crossroads—down one road lies development with smaller

and smaller cabinets, hidden in furniture, with the eventual goal of classification with household facilities such as the furnace and the kitchen cabinet. Down the other road lies development toward an instrument which will be perceived as the center of the home's cultural activity, classed with the piano, the fireplace, and the reading corner.

It will be interesting to see which way the radio instrument finally goes, but as an encouragement toward making the second road more attractive, I make the following suggestion for immediate improvement of cabinets. Utilize flexible shafts to connect control knobs with the chassis, and locate controls, chassis and speaker wherever necessary to accomplish desired new arrangements, with no limitation except that the controls shall be convenient to operate. This simple change frees the designer from the present highly restrictive conditions of layout, and presents enormous possibilities for attractive, individualistic designs. Such designs would do much to elevate the standing of the radio receiver in the home. Incidentally, the cost will be little if any higher, despite the addition of shafts, because chassis costs can be reduced thereby.

• • • program information

A characteristic, or function, which will be badly needed in future receivers,

and which even now is much to be desired, is that of program information. This is vitally important to the system because it affects listening habits. Nowadays, most listening is done on the basis of choice of type of program desired, which requires knowledge of programs in advance. Since the information on programs is scarce and incomplete, it is difficult for the listener to find out where and when he may find any particular type of program in which he may be interested. As a result, many listeners are discouraged from listening, and we hear of many people who listen but a few hours per week. Presumably station program departments will welcome any means of advertising their programs efficiently. Perhaps when facsimile broadcasting becomes universal, we will have an ideal means for distribution of program information, but it seems desirable to have some means sooner than the time when that condition will have arrived. At least one possible method exists, as described later, and it is one which must be developed and instituted by the technical departments.

What is most needed by the listener is information as to the characters of the programs being transmitted by all his good service stations at any given time. At present he can not obtain that information even by listening, unless he spends considerable time listening to each station. As programs are organized, when one tunes in to station ZYX and hears music, that is no guarantee that the music will not change into a political speech within two minutes, and when one is looking for a comedy program, it may be on that station which had dance music when the tuning passed it.

Now suppose that programs were classified, perhaps into the divisions of dance music, serious music, lectures and speeches, news and sport events, variety shows. Suppose further that each classification were assigned a sub-audible frequency, and that the appropriate distinguishing frequency were radiated continuously during each program. Finally, suppose that receivers were equipped with indicating devices selectively responsive to these sub-audible frequencies, probably through mechanical resonance arrangements. These devices would then enable the user of the receiver readily to find the type of program which he desires. Lest this suggestion be considered wholly visionary and impractical, let me hasten to add that tests made on a high-quality transmitter show that the added sub-audible modulation has no effect on the regular program, if kept below 5%, and that this degree of modulation is sufficient

(Continued on page 188)

YOUR OSCILLOSCOPE SPOTLIGHTS HUM

By HOWARD J. SURBEY

HUM in receivers is caused, directly or indirectly, by the supply line frequency and bears some harmonic relation to it. When it is objectionable it usually takes one of three forms.

(1). Hum present whether the set is tuned to a station or not. This can be termed steady or general hum.

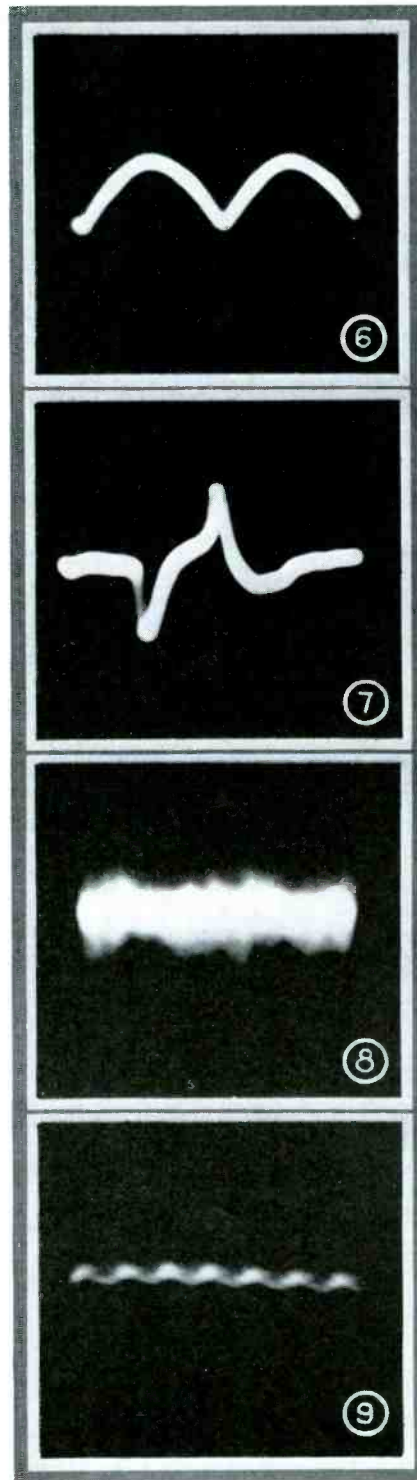
(2). Hum present only with the station carrier. This may be called tunable or modulation hum.

(3). Hum which comes from some receiver component, such as a filter choke or transformer. This may be called mechanical hum.

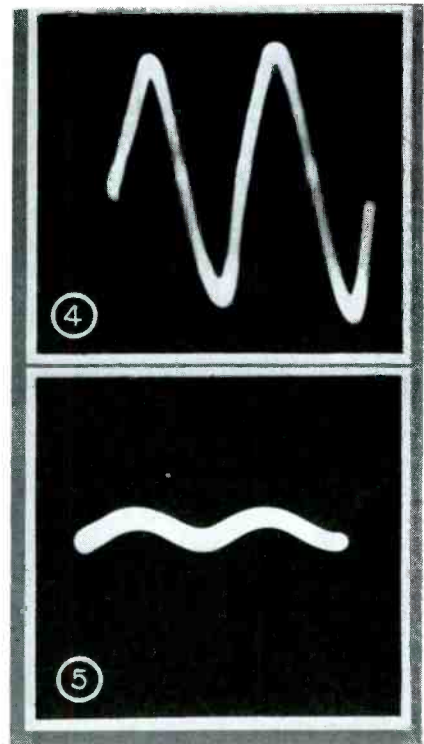
The oscilloscope may be used to advantage in tracing both steady and modulation hum. The frequency of the hum can be readily determined and considerable time may be saved in locating the source of the hum voltage.

The hum voltage must be of sufficient magnitude to operate the oscilloscope, but such is usually the case with objectionable hum. While the hum tracings or patterns vary, there are certain characteristics which can be recognized, such as whether the hum voltage is 60 cycle as picked up from the power line or filament leads, or 120 cycle due to some defect in the receiver filter system.

The following described tests were made to show just what patterns to expect under these conditions.



pect under these conditions.
A modern superheterodyne receiver,



with a full-wave rectifier, which was in good condition, an oscilloscope and a signal generator were used.

The oscilloscope and the receiver were first placed in operation, and the vertical plates of the oscilloscope were connected across the 110 volt, 60 cycle supply circuit. While so connected the linear oscillator within the oscilloscope was adjusted for 60 cycles sweep on the horizontal plates. Such synchronization of the vertical and horizontal plates produced a single wave.

The 110-volt supply was then removed from the vertical plates and test leads substituted in their place. One lead was attached to the receiver chassis and the other to a plate terminal of the rectifier tube. After reducing the gain control of the oscilloscope, a pattern very similar to that of the previous oscillogram appeared, again showing a single wave.

The test leads were then connected from the filament of the rectifier tube to the chassis and oscillogram No. 2 appeared. This is a double wave showing the 120 cycle rectified unfiltered current.

One test lead was allowed to remain on the chassis and the other was attached to the plate return terminal of the receiver output tube. With no signal in the receiver, the oscilloscope showed a horizontal line. By advancing all gain controls to maximum the pattern No. 3 was viewed, indicating only slight traces of the 120 cycle voltage.

With all connections as above, the power supply choke was short circuited, which resulted in a loud hum and the

(Continued on page 195)

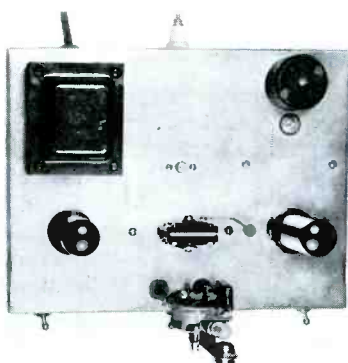
PRECISION alignment of present-day receivers is not only warranted, but is actually a necessity if correct performance is to be obtained. More stable tuning elements, better tracking and

By F. A. LENNBERG*

closer dial calibrations are incorporated in modern receivers. Permeability tuning and temperature compensation have done much to bring about improved electrical and mechanical stability.

While the frequency accuracy and stability of calibrated signal generators have also been improved considerably, electrical, mechanical and economical factors limit the results that can be obtained. Better signal generators could be constructed, but only at a substantial increase in cost.

Figs. 1 & 3. The general mechanical design used in the illustrations shown need not be considered as a standard. As a matter of fact the metal box is comparatively large for the few parts required.



• • • crystal oscillators

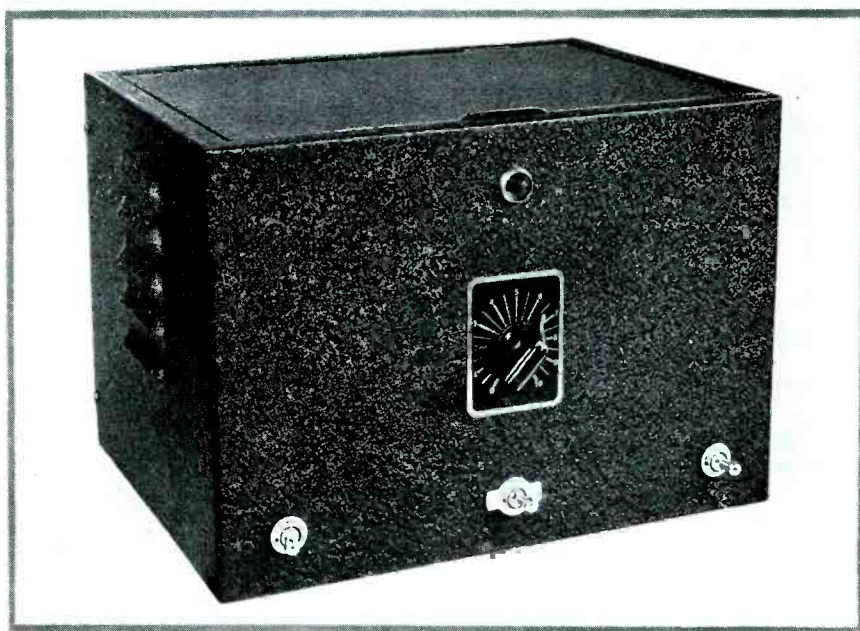
The quartz crystal oscillator with its high accuracy and excellent stability has, from time to time, appealed to some of the more technically inclined Service Men. At first thought it would seem that a series of crystals would be required to properly cover the radio spectrum. Obviously, the cost of such a layout would be prohibitive.

A more practical arrangement is to use a single crystal oscillator and employ harmonics for alignment purposes. A crystal frequency of 100 kc is excellent, for it provides harmonics throughout the spectrum from 100 kc to about 20,000, the upper limit depending somewhat upon the oscillator design and the sensitivity of the receiver under alignment.

Since no standard i-f is a direct harmonic of 100 kc, i-f peaking must be carried out with the service oscillator in the usual manner. The calibration of the service oscillator can, however, be

*Sales Engineer, Bliley Electric Co.

CRYSTAL



checked against the 100 kc crystal harmonics resulting in greater frequency accuracy. With the i-f stages peaked at the correct frequency, tracking adjustments are generally simplified.

• • • dual frequency

A 100 kc crystal oscillator is limited in one respect: the harmonic spacing is too small for convenient application in the short-wave bands. In other words, due to the large frequency coverage in the short-wave tuning ranges, the 100 kc harmonics are so numerous in relation to the receiver dial calibrations that confusion results. This situation can be corrected by the use of a second crystal oscillator operating at 1000 kc. The harmonics of this oscillator are spaced by 1000 kc and afford easier identification. The 100 kc harmonics should be employed for frequencies up to about 4000 kc and 1000 kc harmonics for all higher frequencies.

Although the use of the two different crystal oscillators provides an answer to the problem, the arrangement is not economically feasible to most Service Men because the usual type of 1000 kc crystal represents a sizable investment. Fortunately, however, a crystal is available which fully overcomes this objection. The crystal (Fig. 5) is capable of oscillating at either 100 kc or at 1000 kc. By utilizing the same crystal for both frequencies considerable economy is effected and the construction of a suitable oscillator is simplified.

The dual-frequency crystal is an X-cut bar with its dimensions so proportioned that it will oscillate at 100 kc, along its length or at 1000 kc through its thickness. Because the crystal di-

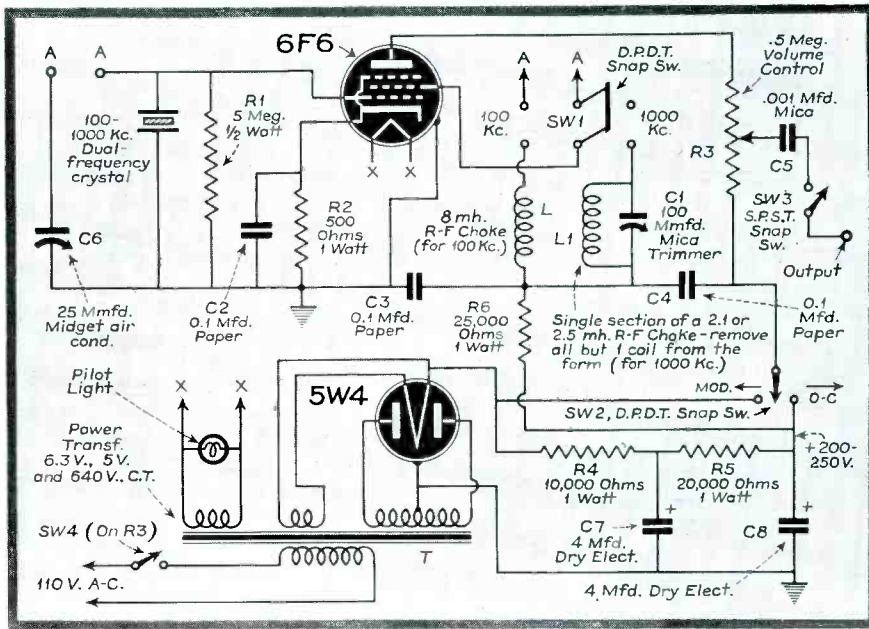
mensions for one frequency have an influence on the remaining frequency, it is not feasible to attempt to grind the crystal for oscillation with both frequencies precisely at the stated values. Greatest accuracy is usually required of the 100 kc harmonics because they are employed for alignment purposes throughout the broadcast band and for checking the calibration of servicing signal generators at intermediate frequencies. To bring about the highest possible accuracy, the crystal frequency for 100 kc is purposely made slightly high so that, by connecting a small variable condenser in parallel, the crystal frequency can be adjusted to exactly 100 kc. A tolerance of $\pm 0.05\%$ is allowed at 1000 kc inasmuch as the harmonics of this frequency are employed in the short-wave bands where extreme accuracy is unnecessary. It should be pointed out, however, that $\pm 0.05\%$ is a small figure when compared to the usual accuracy of calibrated signal generators.

• • • crystal calibrators

The term "crystal calibrator" has been adopted to describe oscillators employing a dual-frequency crystal. To be of general usefulness in servicing applications the crystal calibrator must provide for instantaneous and simple choice of either crystal frequency and direct choice of a modulated or unmodulated signal output. It must have an attenuator and a means for disconnecting the calibrator output from a receiver without disturbing the setup.

Figs. 1, 2 and 3 illustrate a completed instrument which is simple in construction and contains the features outlined

CALIBRATORS



The dual-frequency crystal unit employed in this instrument is shown in Fig. 5. The general mechanical design used need not be considered as a standard to be followed; other arrangements may have greater appeal. As a matter of fact, the metal box housing apparatus is comparatively large for the number of parts required and greater compactness could easily be effected.

The wiring diagram of the crystal calibrator is shown in Fig. 4. The oscillator is extremely stable and the output is rich in harmonics. Usable harmonics can be obtained as high as 20,000 from 100 kc, while 1000 kc harmonics are usable at frequencies through 60,000 kc.

The circuit is fundamentally a triode crystal oscillator and pentode amplifier. The screen grid of the tube is tuned to either crystal frequency by means of L and L_1C_1 and thus serves as the plate of the crystal oscillator. A double-pole double-throw toggle switch, SW₁, provides instantaneous choice of either crystal frequency. In addition to serving this function, SW₁ connects the small variable condenser C₆ across the crystal for 100 kc mode. The purpose of this condenser, as previously explained, is to permit adjustment of the oscillation to exactly 100 kc. The condenser is disconnected from the circuit when SW₁ is in the 1000 kc position.

Modulation is obtained by connecting the plate of the oscillator tube to the input of the power supply filter. With a 60-cycle power-supply frequency and a full-wave rectifier as shown in the diagram, the output of the calibrator will be modulated at 120 cycles. Switch SW₂ provides the choice between a

modulated or unmodulated output. The screen grid of the 6F6 tube is always fed with d-c to prevent frequency modulation which might otherwise occur. Should a higher modulating frequency be considered desirable, an a-f modulating oscillator can be added with a corresponding increase in cost and design complexity. A frequency of 400 cycles is standard practice.

An attenuator R₃ is provided so that the proper signal output can be obtained at any frequency. The output of the calibrator is much higher at low harmonic frequencies than at the higher harmonics, and some means must be incorporated whereby the output level can be set at a desired level. The attenuator and the output lead going from the variable arm to condenser C₅, switch SW₃ and the output terminal, must be shielded to prevent stray pickup within the instrument.

Switch SW₃ allows the calibrator output to be disconnected from the receiver without disturbing the setup, changing the attenuator setting, or turning off the oscillator.

A resistance-capacity rather than an inductance-capacity power supply filter is used. The current consumption of the 6F6 oscillator is so low that resistance filtering is adequate. The use of a resistor effects a saving in parts cost.

• • • tuning in

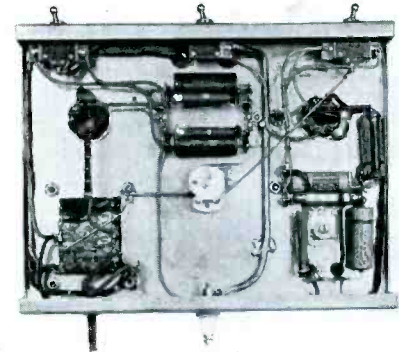
The oscillator coil L for the 100 kc crystal frequency is self-resonant, and, therefore, requires no tuning. The 1000 kc tank consisting of L_1C_1 must be tuned, but the adjustment is not at all critical. Merely set C₁ at a position where the crystal oscillates strongly and

starts readily when SW₁ is operated in and out of the 1000 kc position. The oscillation of the crystal can be checked by feeding the calibrator into a receiver and tuning the receiver to a point at which a 1000 kc harmonic will appear.

To adjust the 100 kc frequency, it is necessary to couple the calibrator into a receiver tuned to a station whose frequency is a harmonic of 100 kc. With no modulation on the calibrator output, there should be an audio beat-note produced between the calibrator 100 kc harmonic and the incoming station. Condenser C₆ is adjusted until the audio beat is reduced to zero.

A regular broadcasting station can be used as a standard for the frequency adjustment, but it is more desirable to work transmissions from WWV, the United States Bureau of Standards. This station transmits standard frequency signals several times during each week on 5000 kc, 10,000 kc and

Figs. 3 & 4. The circuit is fundamentally a triode crystal oscillator and pentode amplifier. The screen grid of the tube is tuned to either crystal frequency, as desired.



20,000 kc. The present schedule calls for transmissions every Tuesday, Wednesday and Friday on 5000 kc from 10:00 to 11:30 a. m., EST, on 10,000 kc from noon to 1:30 p. m., EST, and on 20,000 kc from 2:00 to 3:30 p. m., EST. In addition, the station transmits on 5000 kc daily, except Saturday and Sunday, from 4:00 p. m. to 2:00 a. m., EST, with modulation at 440 cycles. The frequency accuracy of the transmissions is better than 1 part in 5 million, which far exceeds the requirements.

If the frequency adjustment is made against WWV when modulated at 440 cycles or, as a matter of fact, against any station on which a fixed tone is transmitted, care must be taken to make certain that the harmonic zero beats with the carrier of the station rather than with one of the side-bands. Unless this precaution is observed, the calibrator harmonic will be in error by the frequency of the side-band. When the tone modulation is broken for a station announcement, the beat between the

calibrator and the station should remain the same; if the adjustment is incorrect, the beat will occur at an audio frequency equal to the side-band frequency.

After the 1000 kc tuning condenser



Fig. 5. A crystal is available which is capable of oscillating at either 100 kc or at 1000 kc.

is properly set and the 100 kc frequency determined, no further adjustments will be necessary for long periods of time.

• • • applications

Service Men encounter varying i-f peaks and, sometimes, an i-f somewhat different from the manufacturer's rating is desirable to provide better tracking of the r-f and oscillator circuits. The latter possibility occurs more often with receivers which employ specially shaped plates for the oscillator tuning condenser and eliminate the oscillator paddler. If changes occur in the oscillator circuit such that the frequency for a given condenser setting differs from the original value, the changes can be offset only by correcting the i-f. The amount of i-f correction will be closely equal to the frequency difference between 600 kc and the frequency at which the signal appears according to the receiver dial calibration. This, of course, is on the assumption that the dial has not slipped and that the r-f end is in alignment at the 600 kc dial setting.

The crystal calibrator can be used to advantage for aligning the receiver r-f and oscillator circuits. The calibrator, in conjunction with an output meter, is applied in the same manner as a variable service signal generator. With modulation applied to the calibrator, a series of signals will be noted as the receiver is tuned from one end of the receiver dial to the other. The signals will be spaced by 100 kc or 1000 kc, depending upon the crystal frequency. Each signal can generally be identified by its position in reference to a station of known frequency. As soon as one frequency is known, all others in a series are directly determined.

For alignment in the standard broadcast band, tune the receiver to 1400 kc and switch the crystal calibrator for os-

cillation at 100 kc. Adjust the receiver's r-f and oscillator trimmers for maximum output and then tune the receiver to 600 kc. If the receiver's oscillator has a paddler condenser, adjust the paddler, in the usual manner, for maximum output as the tuning condenser is slowly rocked back and forth through the 600 kc signal. If the condenser employs specially shaped plates and the 600 kc signal position does not closely coincide with the dial calibration, the i-f must be changed. A short-cut, which sometimes can be applied, is to set the receiver at 600 kc and then to peak the i-f, trimmers for maximum output. The next step is to retune to 1400 kc and make any necessary readjustments of the r-f and oscillator trimmers.

With the receiver accurately aligned at 600 and 1400 kc, the tracking, the overall sensitivity and the dial calibration can be checked. This can be done by tuning the receiver from one end of the band to the other and noting the receiver output and dial setting for each 100 kc harmonic. Any serious alignment or sensitivity hole can be discovered by this method since the crystal calibrator harmonic strength does not vary greatly over the tuning range for a single band. A little experience will soon acquaint the operator with the decrease to be expected from the low-frequency to the high end of the tuning range.

The same process can be followed at the short-wave bands (and the long-wave band if one is used). In the short-wave bands, when the 100-kc harmonic spacing becomes too close the 1000-kc harmonics should be used.

• • • images

When aligning at high frequencies, calibrator signals which have no apparent relation to the proper harmonic sequence, may appear in the receiver. These are images of the calibrator harmonics; the possibility of their appearance will be dependent upon the receiver r-f selectivity and the signal level. The presence of images becomes more pronounced as the receiver is tuned to continually higher frequencies.

If a superheterodyne receiver with an i-f of 465 kc (for example) is tuned to the tenth harmonic of the 1,000-kc calibrator frequency (10,000 kc), its oscillator will be at 10,465 kc (10,000 + 465). If the receiver selectivity is not too great and the input signal is high, the same 10,000-kc harmonic can be heard by tuning the receiver to its image at 9,070 (10,000 - 2 × 465). At this setting the receiver oscillator will be at 9,535 kc (9,070 + 465). This oscillator frequency beating with the 10,000-kc signal will also produce an i-f of 465 kc (10,000 - 9,535 = 465).

Likewise, the image of 11,000 kc will appear at 10,070 kc. The net result is that the 10,000 kc calibrator signal may seem to appear at two points: 10,000 kc and 9,070 kc. Because of receiver selectivity the image, 9,070 kc, will be somewhat weaker.

Images of 100 kc calibrator harmonics can be quite confusing at high frequencies because of the closer harmonic spacing. An image will occur 70 kc above (or 30 kc below) each 100 kc harmonic. Because the harmonics are numerous in relation to the receiver dial calibrations, considerable care must be exercised to discredit all images.

• • • frequency measurements

It has been mentioned that the crystal calibrator can be used to check the calibration of the regular signal generator to increase its accuracy (see Fig. 6). This is accomplished by beating the output of the oscillator and the crystal calibrator in a receiver. For example, say a frequency of 175 kc is desired. Set the oscillator to 175 kc and tune the receiver to 700 kc (4 × 175 kc) where it can beat against the seventh harmonic of the 100 kc calibrator frequency. When the two signals are at zero beat, the oscillator is accurately at 175 kc. When beating two frequencies together in this manner, no modulation should be applied to either instrument.

Where a simple harmonic relation does not exist, interpolation is necessary. Assume 455 kc is wanted. The oscillator dial reading for 450 kc and 500 kc can be determined by beating the second oscillator harmonic against the 900 kc and the 1,000 kc calibrator harmonics. Knowing the correct dial readings for 450 kc and 500 kc, the correct reading for 455 kc can be inferred, calculated, or determined by drawing a calibration curve.

Where it is desired to completely check the calibration of a servicing os-

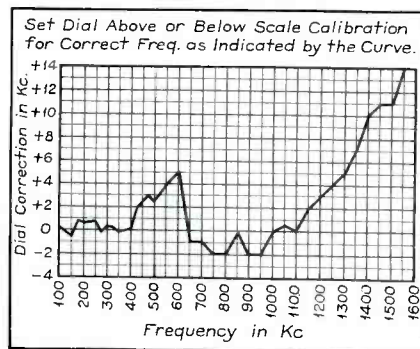


Fig. 6. The crystal calibrator can be used to check the calibration of the regular signal generator to increase its accuracy.

cillator, the calibration can be carried out with both 100-kc and 1,000-kc harmonics in the same manner as de-

(Continued on page 195)

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DASHBOARD CONTROLS

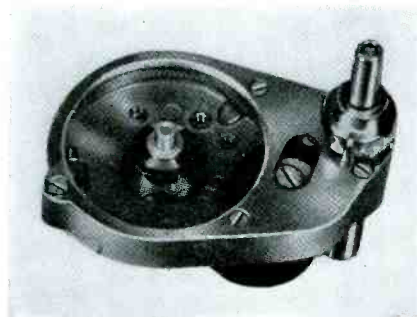
By JOHN C. SMACK, Jr.*

CONTROL heads and matching plates are available for practically all automobile models that have incorporated the control head in the dash panel. Complete data on the various types are given here so that the Service Man may be familiar with their installation in a modern car. Some of the information presented is commonplace knowledge. There is, on the other hand, much information on these pages that does not appear elsewhere. All of the information is vital and it is felt that the Service Man can save considerable time and expense by reviewing the entire field.

• • • three types

Control heads can be classified, more or less, into three distinct types.

The type illustrated in Fig. 1 is one that has been used most extensively in the past. The gear drive for the dial is enclosed in a case which allows placing of the control-shaft knob in practically any position along the circumference of a circle whose radius is the fixed dis-



Photo, courtesy F. W. Stewart Mfg. Corp.

Fig. 1. The gear drive for the dial is enclosed in a case.

ance between the center of the control knob and the center of the dial. The distance between the control knob and the volume control can therefore be anything up to twice that radius, or even greater, if symmetry is not necessary.

The type shown in Fig. 2 uses a special extra-flexible shaft drive between the tuning control shaft assembly, in which the gearing is incorporated, and the dial. This type allows extremely wide latitude in the placing of the dial and tuning control shaft.

The type pictured in Fig. 3 uses an open worm and wheel drive in which

*Industrial Division, S. S. White Dental Mfg. Co.

the position of the worm can be varied in order to compensate for the different positions of the tuning control shaft.

• • • jot it down

In selecting a remote control tuning unit for a particular installation it is necessary to compile the following data:

- (1) Make, year and model of the car in which the installation is to be made.
- (2) Control head to be mounted in, or under the dash panel?
- (3) The make and model number of the receiver to which the control is to be attached.
- (4) Gear ratio required in the control head to match the receiver.
- (5) Dial direction, clockwise or counterclockwise.
- (6) Location of power switch (located in receiver or to be incorporated in the control head). It may be attached to the volume-control shaft or tone control.
- (7) Location of the volume control (whether it is incorporated in the receiver or included in the control head).
- (8) The length of flexible shaft combination that will be required.

With all of the above information it will be comparatively easy to select the proper control head, plates and other parts necessary to make up the complete assembly, from the manufacturer's catalog sheets.

• • • count the turns

To determine the proper gear ratio to be used count the complete revolutions of the tuning shaft that are required to rotate the tuning condenser rotor from minimum to maximum capacity. The number of revolutions multiplied by two is the gear ratio required. For example; if it takes eight revolutions to move the tuning condenser from minimum to maximum capacity, the required gear ratio for the control head would be 16-1. It is also necessary to know whether the rotation of the tuning control will produce tuning from low to high frequency when rotated in a *clockwise direction, or counterclockwise direction.*

It is advisable to use panel plates and control heads made by the same manufacturer, in order to assure that they will properly fit together.

If all of the above information is sup-

plied with the order, the distributor or manufacturer should have no difficulty in supplying the correct control and other parts.

• • • an important part

The flexible shaft is an important part of the complete remote control assembly. Care should be taken to see that auto-radio shafting is used and not the speedometer type shafting. The latter has characteristics which make it unsuitable for use in remote controls. Auto-radio type flexible shafting is specially designed to give the maximum amount of transverse flexibility with a minimum amount of torsional deflection or backlash, and equal deflection in either direction of rotation.

There are two sizes of flexible shafts universally used. These are 0.130-in. diameter and 0.150-in. diameter. Most of the present models use the 0.130-in. diameter shaft, the 0.150-in. is used only for special installations requiring a shaft which is longer than the average, such as in taxicabs, rear seat remote controls, etc.

The standard flexible shaft supplied by manufacturers in complete combinations with end fittings is a live shaft; that is, the wires are wound under tension and for this reason the shaft should not be cut to length unless the layers of wires are securely fastened together before cutting.

Flexible shafts are cut to length by welding, brazing or swaging the shaft before it is cut. The most practical method for the Service Man, is to cut the shaft to length by swaging (patented process) it with a special swaging tool. There are a number of such tools available. The finished swage should be square and sufficient to carry it down through the various layers of wire. The shaft can then be cut through the center of the swage with diagonal pliers or a cold chisel. The shaft end fittings can be attached to the end of the flexible shaft by swaging or soldering. The

Fig. 4. Early type remote control heads mounted on the steering column.



latter is more easily accomplished where a special swaging tool is not available.

No difficulty should be encountered in cutting casings to length, although care should be taken to see that the cut is made with the winding, so that there is no tendency to open the wires or turn them back when cutting through. A grindstone is helpful in grinding the ends of the flexible shaft and the ends of the casing after they have been cut.

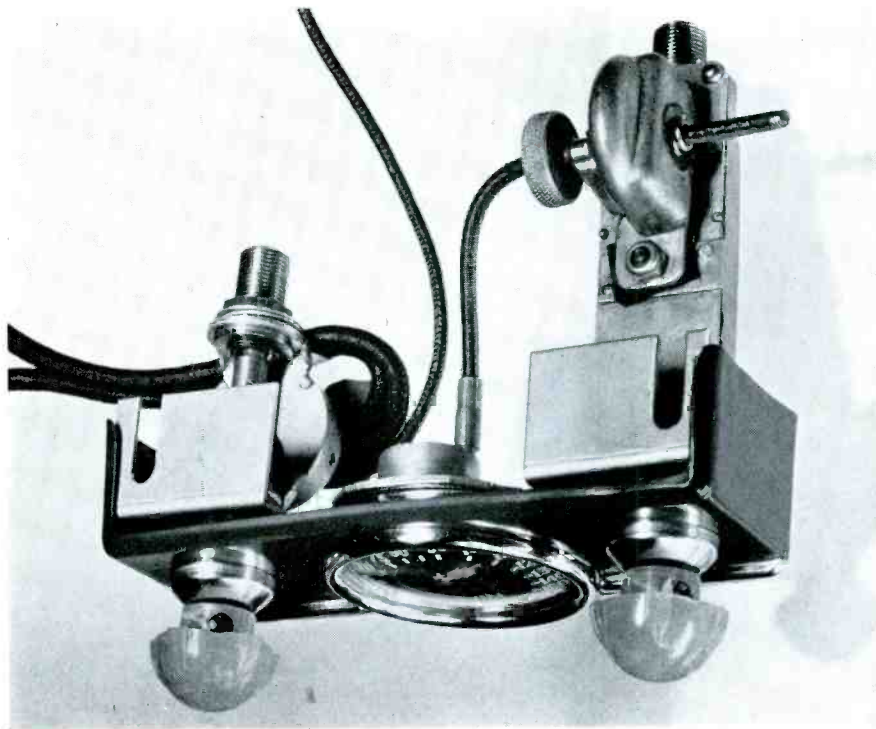
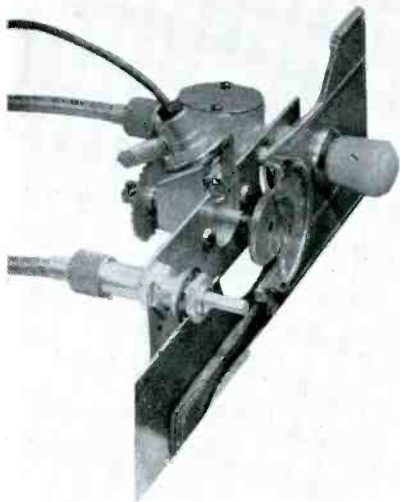
Some of the swaging tools that are on the market have attachments for removing old shaft and casing end fittings, so that the shaft and casing can be shortened, or so that the fittings can be used on new pieces of shafting and casing of the desired length. After old fittings have been pulled off the old shaft and casing, they should be reamed or drilled out so that they can be easily slipped over the ends of the new shaft and casing for assembly.

When making up a new shaft and casing combination from an old one, it is desirable to make a note of the *relative overall lengths* of the shaft and casing, before it is disassembled. These dimensions should be followed in making up the new combination. If no old combinations are available for reference, measure the extension of the flexible shaft beyond the casing fitting that is required, both on the control head end and the set end. Care should be taken to see that the combinations are made to the proper relative lengths, as otherwise, the flexible shaft may either not engage properly, or if the shaft is too long, it may be cramped in the casing, causing poor tuning operation due to binding.

There are only two distinct types of Casing used for auto radio remote controls. The most universally used is the metallic type. The less extensively used

Fig. 3. An open worm and wheel, in which the position of the worm can be varied, compensates for the different positions of the shaft.

Photo, courtesy Star Machine Mfg., Inc.



Courtesy Crowe Nameplate & Mfg. Co.

Fig. 2. A special extra-flexible shaft is used between the control drive and the dial.

is the fabric type with the metal liner. For most installations the metallic casing is preferred as it has greater strength, is stiffer and will rigidly hold its position when installed in unsupported curves. Since the purpose of the casing is to act as a guide and support for the flexible shaft, and also to protect it, it should be sufficiently stiff to counteract bending into too small a radius. The metallic type of casing can be obtained in two finishes; galvanized and parkerized. For 0.130-in. shaft, the inside diameter of the metallic casing is approximately 0.147-in. and approximately 0.235-in. outside.

• • • stock up

Service Men making a considerable number of auto-radio installations can promptly take care of most installations by having on hand the following parts and tools:

(1) An assortment of panel plates, dials and knobs to match the cars that are most popular.

(2) Gear drives of the proper ratio to operate the receivers that are most popular locally.

(3) An assortment of factory-made flexible shaft and casing combinations for the most popular car and radio models.

(4) One hundred feet of 0.130-in. diameter control shaft.

(5) One hundred feet of 0.235-in. O.D. parkerized or galvanized metallic casing.

(6) Assortment of shaft and casing end fittings that will fit the type of control head stocked, and most of the popular auto-radio models.

(7) A tool for swaging flexible shafting for cutting to length.

(8) A set of auto radio tuning wrenches.

• • • take precaution

The following precautions should be taken in making a flexible shaft operated remote control installation.

(1) The flexible shaft and casing combination should be of the proper length so that when it is installed, the radii of any bends that are made are as large as possible. If the combination is too short, and bends are made in too small a radius, increased friction will result and this will cause stiff or sluggish tuning.

(2) Care should also be taken in handling the shaft and casing to see that it is not bent into a radius that is less than its elastic limit. This causes a set, which will result in jumpy operation of the control.

(3) It is also important, as pointed out before, that the shaft and casing be made to the proper relative lengths. The proper projection of the shaft fitting beyond the casing fitting can be determined by inserting the shaft fitting in the receiver; measuring the distance that projects beyond the casing fitting, and then following the same procedure at the control head end. The set of auto tuning wrenches mentioned above will be helpful in taking such measurements.

(4) After attaching the flexible shaft to the receiver, bend it in the approximate position in which it will be installed, and turn the flexible shaft fitting at the control end and see if the flexible shaft operates smoothly.

SWAGING TOOLS

THE Service Man who is equipped with suitable tools, and knows how to properly apply them always has an efficient shop. He not only is capable, thereby, of satisfying his customers' most critical need, but is able to do so in a minimum of time and with the least expense. This is especially true of auto-radio service.

Remote-control head installations are definitely made easier through the use of one of the tools shown in the accompanying illustrations. Their use also makes the installation less expensive without any sacrifices.

A fitting remover is an integral part of either of the tools and enables removal of any fitting without destroying it. This is particularly important when odd shaped fittings, not readily available are to be used. The tools also have devices for clamping or swaging new or old fittings on both cable and housing.

• • • swage

A swage is a tool or die which will shape metal by hammering or through the application of pressure. The word is also used to express the form which the metal takes after the swaging operation.

In handling live remote control ca-

bles, such as those used with auto radios, the manufacturers recommend swaging the ends to a square cross section before cutting. So that the cable will not unravel, it should be swaged down to the fourth layer inside.

In the absence of a suitable swaging tool some Service Men use annealed cable, such as that used with speedometers. Some functions are lost, however, and it is preferable to use live cable in auto-radio installations.

• • • the process

The new shafting should be measured to the exact length required and an additional $\frac{3}{4}$ -in. should be added to accommodate the recesses in the fittings. Mark it with a file or hack saw and place it under the swaging die with the mark in the center of the die so that when the shafting is cut both ends are swaged. This process should be repeated after the shafting is given a quarter turn. It is recommended that additional swages be made, overlapping the first, so that the swaged portion of the cable will be from 1-to-1 $\frac{1}{4}$ -in. long.

Before the shafting is cut inspect the swage and make sure that it is properly and firmly swaged. After the cable is cut the ends should be soldered, es-

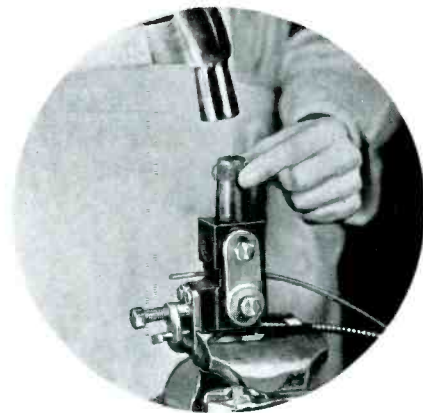


Fig. 1. Pressure for swaging and cutting with the Star tool is applied through sharp raps of a hammer.

pecially on the balance of the cable which is to remain in stock.

• • • j. f. d. cable replacer

The J. F. D. Remote-O cable replacer is designed to remove old fittings from control cables without destroying them; swage shafting to prevent unravelling; cut shafting to exact length; replace old or new fittings on shafting or casing and to facilitate the cutting of the shaft casing. (See Fig. 2.) It is about 14-in. long and should be securely bolted to one corner of the bench so that the fitting remover section will extend beyond the bench.

It is equipped with its own vise and lever bar. The lever bar is used to apply continuous pressure for swaging or cutting. The actual swaging is accomplished by turning the lever bar clockwise and applying the greatest possible pressure. The swage made by the replacer is $\frac{3}{4}$ -in. long. It is applicable to both 0.130- and 0.150-in. shafting.

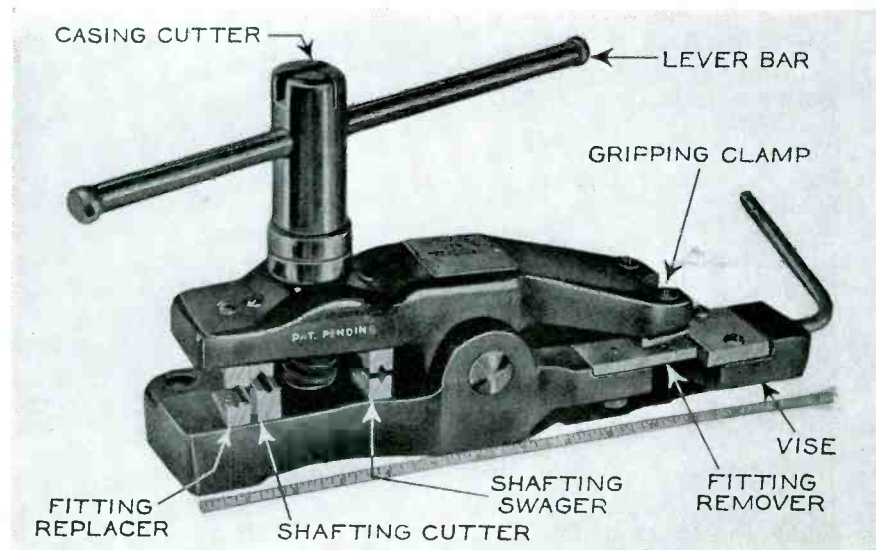
To remove fittings from shafting, open the jaws of the machine by turning the lever bar counter clockwise until the gripping clamp rests flush on the vise (see Fig. 2). Place the shafting in the slots of the gripping clamp and vise so that the fitting rests flush on the gripping clamp. Tighten the shafting in the vise securely. Hold the shafting at right angles to the clamp as closely as possible to the underside of the vise to give it additional support.

If old fittings are to be used, it will be necessary to ream the recesses until all projections are removed. A reamer is supplied with the machine.

With the swaged end of the shafting in the recess of the fitting, place the collar of the fitting in the recess provided on the cable replacer and turn the long lever bar clockwise. The pressure applied should be just sufficient to securely fasten the fitting to the cable. This should be repeated after the shaft-

(Continued on page 200)

Fig. 2. The J. F. D. Remote-O-Cable replacer is equipped with its own vise and lever bar.



"This repair was a headache

...until I used
the new **WESTON Model 669**
VACUUM TUBE VOLTMETER
and **SIGNAL DETECTOR**"



Serviceman tells how he
SAVES TIME—ELIMINATES
CALL BACKS . . . with this
inexpensive instrument

"We had made four unsuccessful attempts to isolate the intermittent noise in this 15 tube receiver with thorough point-to-point checking. We wasted much valuable time, and had a dissatisfied customer on our hands. Finally, we got a new WESTON Model 669 equipped with phone jack and located the trouble in a few minutes. We connected our Model 776 Oscillator to the antenna and sent a modulated 600 kc signal into the receiver. Using the earphones in the Model 669, we got a steady signal in both the RF and first detector stages. Everything else checked, until we got to the second stage of the bass channel. When we placed the 669 on the plate, a slight crackle came across with the signal, even though the meter reading was okay. Here we found the condenser responsible for the noise, and we were able to quickly clear up the reproduction. From now on, audible tests with the 669 will be a regular part of our testing procedure."

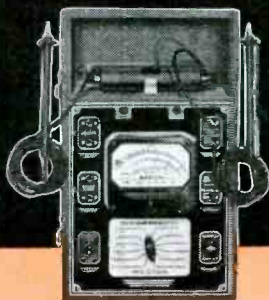


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THE
SIGNAL

HEAR
THE
SIGNAL

only
\$50⁶³

NET TO SERVICEMEN
IN U.S.A.
(HEADPHONES
NOT INCLUDED)



**MODEL 772—5000 VOLT
TELEVISION AND RADIO ANALYZER**

Sensitivity 20,000 ohms-per-volt. • Input impedance 100 megohms on top range. • Specially designed low-leakage jacks. • Breakdown voltage in accordance with A.I.E.E. safety standards...11,000 volts. • Current readings down to 1/2 microampere.

NOTE—present owners of 20,000 ohms-per-volt analyzers can bring them up-to-date with the compact WESTON 5,000 volt Televeter...an inexpensive multiplying unit which fits the carrying case.



**MODEL 787
ULTRA HIGH FREQUENCY OSCILLATOR**

Essential for television. Frequency—continuous range 22 to 150 megacycles—no band switching. All frequencies fundamental. High order of stability and re-setability over entire range. Equipped for television modulation. Battery operated (self contained). Used with rod antenna (included) or with standard output leads. Small size, light weight, provides extreme portability.

Remember, too, that Model 669 is an essential tool for servicing television. Let us send all the facts. Return the coupon below.

Weston Electrical Instrument Corporation
604 Frelinghuysen Ave., Newark, N. J.
Send bulletin describing the Model 669 Vacuum Tube Voltmeter and other WESTON Instruments.

Name _____

Address _____

City _____ State _____

AUTO-RADIO DATA

Acratest, Acratone Federated Purchasers, Inc.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
40	6	*	*	*	175
42	5	*	*	*	175
43	5	*	*	*	260
44	5	*	*	*	175
49-259B	5	1936	12/1	CCW	260
51-260B	6	1936	12/1	CCW	260
88H	6	1937	12/1	CCW	456
89H, 89J	*	1937	12/1	CCW	175
90H, 90J	*	1937	12/1	CCW	175
92	*	1935	12/1	CCW	175
190K, 190M	*	1938	12/1	CCW	175
205K	*	1938	6/1	*	465

Admiral Continental Radio and Television

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
55	5	1938	3/1	CCW	456
66, 660	6	1937	12/1	CCW	175
69	*	1938	12/1	CCW	175
77, 770	7	1937	12/1	CCW	175
78	*	1937	12/1	CCW	175
88	*	1937	12/1	CCW	175

Aero Auto Radio Chas. Hoodwin Co.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
A	6	*	*	*	*
B	6	*	*	*	*

Air Castle Radio Products Corp., R P C., Spiegel, Inc.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
14-112S	6	*	*	*	262
U6	6	*	*	*	175

Air Chief Firestone Tire & Rubber Co.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
54	5	*	*	*	456
64	6	*	*	*	456
D1322	7	1935	8/1	CCW	177.5
F257	5	1937	6/1	²	262.5
F258	5	1938	2.25/1	²	456
R1311, -14	6	1935	8/1	CCW	177.5
R1332	5	1935	8/1	CCW	456
R1431	6	1936	8/1	CW	177.5
R1651	5	*	*	*	456
R1661	6	1936	6/1	CW	262
R1781	6	1937	16/1	CW	262

Air King Air King Products

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
300	6	*	*	*	TRF
4000	6	*	*	*	175
Roadking	*	*	*	*	456

Air Line Montgomery Ward

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
Auto Radio 6	6	*	*	*	262
O62, 62	6	*	*	*	262
5Y1, 15Y1, 199	5	*	*	*	175
6L, 46L1, 236	6	1936	12/1	CCW	175
16U1	*	*	8/1	CCW	*
16S1-6S	6	*	*	*	175
46K1, 258	6	1937	12/1	CCW	175
62	7	*	*	*	175
87	6	*	*	*	262

¹CW denotes clockwise rotation, CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

102	6	1934	6/1	CW	175
118, 62-118	6	1934	8/1	CW	262
130	..	1934	6/1	CW	175
166	..	1935	8/1	CCW	175
200, 202	..	1934	12/1	CCW	175
204	..	1935	6/1	CCW	175
242	..	1936	12/1	CCW	175
256	..	*	*	*	175
263	..	1936	12/1	CCW	175
333, 62-334	5	1938	²	*	456
364, 62-364	6	1938	16/1	CCW	175
369, 62-369	6	1938	16/1	CCW	175

American Bosch American Bosch Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
45, 45A, 45C	5	*	*	*	175
79, 79C	6	*	*	*	175
80, 84	5	*	*	*	TRF
100, 920	7	*	*	*	175
113, 113X	7	*	*	*	TRF
118	7	*	*	*	175
123	7	*	*	*	TRF
123X	7	*	*	*	TRF
139	5	*	*	*	456
14, 140A	5	*	*	*	456
149	5	*	*	*	456
150A-1	6	*	*	*	175
150A-2	6	*	*	*	175
524A-1, -2	5	*	*	*	456
536, 536B	5	1936	16/1	CW	456
634A, 634A2	6	*	*	*	*
636, 637	6	1936	16/1	CW	175
736, 737	7	1936	16/1	CW	175
838	8	1936	16/1	CW	175

Andrea Andrea Radio Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
605	*	*	*	*	175
606	*	*	*	*	175
700	*	*	*	*	175

Apex U. S. Radio and Television

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
30	5	*	*	*	TRF

Arcadia, Wells-Gardner Wells-Gardner & Co.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
O6W	6	1933	8/1	CW	262.5
O62	6	1932	8/1	*	262.5
5Y	5	1934	²	CW	175
6C1	6	1937	12/1	CCW	175
6C7	6	1938	16/1	CCW	175
6C11	6	1939	16/1	CCW	175
6J	6	1937	12/1	CCW	175
6K	6	1936	12/1	CCW	175
6L	6	1936	12/1	CCW	175
6N	6	1936	12/1	CCW	175
6R	6	1935	12/1	CCW	175
6S	6	1935	8/1	CCW	175
6U	6	1934	8/1	CW	262.5
56V1	6	1933	8/1	CCW	262.5
C6	5	1938	6/1 ²	456
V6Z2	6	1933	8/1	CCW	262.5
Z6Z1	6	1933	8/1	CCW	262.5

Arvin Noblitt Sparks Industries

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
5	5	1938	12/1	CW	455
6	5	1938	²	455
7	5	1935	*	*	170

²No remote control is used.

*Information not readily available.



AUDAX
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Servicemen and

AUDAX
Compensated-Inductor
MICRODYNE

FOR the last several months there has been increasing interest among the servicing industry in the brilliant achievements of AUDAX MICRODYNE. The downright magic of our engineers in producing consistent day-to-day, *facsimile* performance at 8,000 cycles and more, has convinced even the more skeptical servicemen that at last there is *Profit in MICRODYNE Pick-ups!*

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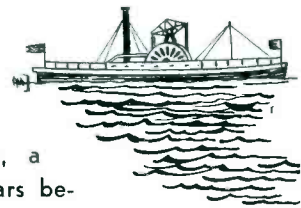
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MICRODYNE, the finest pick-up available, immune to heat and humidity, unfailingly constant up to 8,000 cycles and more, costs little more than you would pay for an ordinary pick-up.



Just as, a few years before the first steamboat crossed the ocean, doubting Thomases said "it couldn't be done"—skeptics were scoffing while AUDAX was busy proving that a pick-up can give as good music as it receives—and not be prohibitive in cost.

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Don't wait—get busy and make some money for yourself on MICRODYNES. Let AUDAX work with and for you.

Record companies are behind in production at present, and bear in mind, every record requires a pick-up.

7A, RE44	5	1939	*	*	455
8A, RE45	6	1939	2	455
10A	5	1933	*	*	175
15	5	1933	*	*	175
16	6	1934	*	*	175
17, 17A	6	1935	16/1	CW	175
18	6	1936	16/1	CCW	175
19	6	1937	16/1	CW	170
20A	6	1933	*	*	181.5
20B	6	1933	*	*	175
22A	6	1938	16/1	CW	170
25	6	1934	*	*	175
27	7	1935	16/1	CW	175
28	6	1936	16/1	CCW	175
28DM	6	1936	16/1	CW	170
29	6	1937	16/1	CW	170
30A	6	1933	*	*	181.5
32	6	1938	16/1	CW	170
33	6	1936	16/1	CCW	170
35	8	1934	*	*	175
37	8	1935	16/1	CW	175
38	*	*	*	*	175
39	7	1937	16/1	CW	170
41	*	*	*	*	45A
42	*	1938	16/1	CW	170
44C, RE46	6	1939	*	*	170
45	9	1935	*	*	175
51	5	*	*	*	456
62	6	*	*	*	456
62B	5	*	*	*	175
617B	*	*	*	*	456

Atwater Kent
Atwater Kent Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
81, 81B, 81C	7	*	*	*	TRF
91, 91B, 91C	9	*	*	*	260
126, 416	6	1936	*	CW	264
136, 446	6	1936	*	CW	264
416	6	*	*	*	264
424, 534	4	*	*	*	264
446	6	*	*	*	264
556	6	1936	*	CW	264
636	6	*	*	*	262.5
666	6	*	8/1	CCW	264
756	*	*	*	*	262.5
776	*	*	*	*	264
816	*	*	*	*	264
926	*	*	*	*	264
936	*	*	*	*	264

Auburn, Cord
Crosley Radio Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
A5A2	5	*	*	*	181
A5A3	5	*	*	*	181
A255	5	*	*	*	262
A455	5	*	*	*	262

A T R
American Television & Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
Duo-6	*	*	*	*	175
60-6	*	*	*	*	TRF
61	6	*	*	*	175
70	7	*	*	*	TRF

Audiola
Fairbanks Morse Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
23S7	6	*	*	*	177.5
33A6	5	1933	10/1	CCW	177.5
33S6	6	1933	10/1	CCW	177.5
33S7	7	1933	10/1	CCW	177.5
64	6	1935	8/1	CCW	177.5
74	6	1935	8/1	CCW	177.5
345	5	*	*	*	456
346, 346S	6	1934	6/1	CCW	177.5

*CW denotes clockwise rotation, CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

347	7	1934	6/1	CCW	177.5
B6	6	1934	6/1	CCW	177.5
C6	6	1935	8/1	CCW	177.5

AutoCrat
Autocrat Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
5	5	*	*	*	456
6D32	5	*	*	*	175
60	6	*	*	*	175
505	5	*	*	*	456
518	5	*	*	*	456
618	6	*	*	*	456

Automatic, Autorola
Automatic Radio Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
Automaster	5	*	*	*	TRF
Automatic	8	*	*	*	*
A1, J60	6	*	*	*	480
A5, J50	5	1936	6/1	CCW	480
A6	6	1936	6/1	CCW	480
J80	8	1936	12/1	CCW	456
M10	5	1937	6/1	CCW	456
M20	5	1937	6/1	CCW	456
M30	*	1937	6/1	CCW	456
M60	6	1937	5/1	CW	456
M67	*	1937	16/1	CCW	*
M70	6	1937	16/1	CCW	456
M80	9	1937	16/1	CCW	456
P70	*	1938	16/1	CCW	456

Auto-Vox
Auto-Vox Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
66	6	*	*	*	TRF
75	7	*	*	*	175
80	5	*	*	*	262
85	6	*	*	*	262

Belmont
Belmont Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
566	5	1936	6/1	CW	465
567A	5	*	*	*	465
577A, -B	5	1938	6/1	*	*
580	5	*	*	*	175
660	6	*	6/1	CW	175
661	6	1937	12/1	CCW	465
666	6	*	12/1	CW	465
666A, -B	6	1936	12/1	CW	465
667	6	1937	12/1	CCW	262.5
668	6	*	*	*	465
670, -A	6	*	*	*	175
677A, -B, -C	6	1938	6/1	*	*
680	6	1934	6/1	CW	175
690	6	1934	6/1	CW	175
880A	8	1935	6/1	CW	175
880B	8	1935	6/1	CW	175
880C	8	1936	6/1	CW	465
880D	8	1936	6/1	CW	*
881	8	1937	12/1	CW	262.5

B O P
United Motors Service

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
4036	6	*	*	*	262
980393	7	*	*	*	262
980455	5	*	*	*	262
980459	6	*	*	*	262

Buick
United Motors Service

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
54425	4	*	*	*	262
980507, -8	6	*	*	*	262
980509	5	*	*	*	262

*No remote control is used.
*Information not readily available.



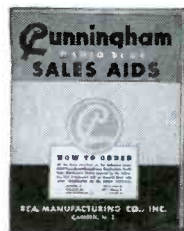
*Spring
Cleaning Time
is here—*



WITH housewives from coast to coast turning their homes upside down in the annual spring cleaning derby, you have an excellent opportunity to step in and make money selling radio service. Because now they'll have no objection to your coming in and turning their radio inside out—something they intensely dislike once their house is spic-and-span.

So take advantage of spring cleaning time. Use the powerful sales aids available to you through your Cunningham Tube distributor. They are outlined in the booklet illustrated on this page. Sell Cunningham Radio Tubes on every service job—and you'll make extra profits.

Over 95 million Cunningham Radio Tubes have been sold for replacement service work.



Time
For you to Make
**EXTRA
MONEY!**



Cunningham Radio Tubes

STANDARD SINCE 1915
A PRODUCT OF THE RCA MANUFACTURING CO., INC.

980525	6	*	*	*	262
980526	5	*	*	*	262
980529	5	*	*	*	262
980534	6	*	*	*	262
1291345	4	*	*	*	262
1304873	6	*	*	*	262

Cadillac
Cadillac Motor Car Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
O6W	6	1933	8/1	CW	262.5
O72	7	*	*	*	262
O72A, Z72Z	7	*	*	*	262
5X	5	1934	*	CW	175
6KB	6	1936	12/1	CCW	175
6Q, 56Q	6	*	*	*	175
6R, 56R	6	1935	12/1	CCW	175
6S, 56SZ	6	1935	8/1	CCW	175
6T, 56T2	6	*	*	*	262.5
6U2, 56U2	6	1934	8/1	CW	262.5
2029A, 630	8	*	*	*	175
56VI	6	1933	*	CCW	262.5
C8	8	1939	*	*	456

Champion
Champion Radio Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
400	5	*	*	*	456
500	5	*	*	*	456
501	5	*	*	*	456
600	6	*	*	*	175
601	6	*	*	*	175

Chevrolet
Chevrolet Motor Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
364411	7	*	*	*	262
600153	5	*	*	*	262
600249	6	*	*	*	262
600565	6	*	*	*	262
600566	5	*	*	*	262
601038	6	*	*	*	175
601176	6	*	*	*	262
601525	6	*	*	*	262
601574	4	*	*	*	175
601586	4	*	*	*	262
601662	4	*	*	*	262
601814	6	*	*	*	262
985100	6	*	*	*	262
985200	6	*	*	*	262
985300	6	*	*	*	262
985301	6	*	*	*	260
985400	6	*	*	*	262

Chrysler
Philco Transitone

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
C7	*	*	10/1	*	260
C1423	6	1937	*	*	260
C1450	6	1937	*	*	260
C1452	6	1937	16/1	CW	260
C1550	6	1938	16/1	CW	260
C1606	5	1939	2	*	400
C1608	6	1939	2	*	470
D	6	1933	*	*	260
G	6	1934	*	*	260
G122	6	1934	*	*	260
R	6	1934	*	*	260
T2, TZ	6	1935	*	*	260
T5, CZ	6	1935	*	*	260
T10	6	1936	*	*	260
T11	6	1936	*	*	260

Clarion
Transformer Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
TC50	6	*	*	*	175
100	7	*	*	*	*

¹CW denotes clockwise rotation, CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

100AR	5	*	*	*	465
110	5	*	*	*	*

Clinton
Clinton Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
801	*	1935	12/1	CW	456
802	*	1935	12/1	CW	456
803	*	1935	12/1	CW	447.5
804	*	1937	16/1	CW	456
805	*	1937	16/1	CW	456
806	*	1937	16/1	CW	456
807	*	1937	16/1	CW	456
808	*	1938	*	*	456
809	*	1938	16/1	CW	456

Colonial
Colonial Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
106B	7	*	*	*	175
131	6	*	*	*	*
134	5	*	*	*	*
150	4	*	*	*	480
164	6	*	*	*	175
164B	6	*	*	*	175
182	6	*	*	*	175
182B	6	*	*	*	175

Crosley
Crosley Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
95	6	1932	"	CW	181.5
96	6	1932	"	CW	181.5
98	5	1933	"	CW	181.5
99	6	1933	6/1	CW	181.5
102	5	1933	8/1	CW	181.5
103	5	1933	8/1	CW	181.5
4A1	4	1934	"	CW	156.5
5A1	5	1934	8/1	CW	181.5
5A3	5	1935	12/1	CW	181.5
A156	5	1935	12/1	CW	262.5
A166	6	1935	12/1	CW	262.5
A266	6	1936	12/1	CW	262.5
A366	6	1936	12/1	CW	262.5
A157	5	1937	"	CW	455
A167	6	1937	16/1	CW	262.5
A177	7	1937	16/1	CW	262.5
A267	6	1937	16/1	CW	262.5
A158	5	1938	"	CCW	455
A258	5	1938	"	CCW	455
A168	6	1938	"	CCW	455
A268	6	1938	"	CCW	455
A358	5	1938	"	CCW	455

Delco
United Motors Service

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
626	5	*	*	*	262
627	5	*	*	*	262
628	6	*	*	*	262
629	4	*	*	*	262
630	5	*	*	*	262
631, -A	6	1936	12/1	CW	262
632	6	1936	12/1	CW	262
633	6	1936	12/1	CW	262
634	6	1936	12/1	CW	262
635	6	1936	12/1	CW	262
640	6	1937	12/1	CW	262
641	6	1937	12/1	CW	262
642	6	1937	12/1	CW	262
643	6	1937	12/1	CW	262
644	6	1937	12/1	CW	262
663	*	1937	8/1	CCW	262
664	*	1937	12/1	CCW	262
665	*	1937	12/1	CCW	262
666	*	1937	12/1	CCW	262
667	*	1937	12/1	CCW	262
668	*	1937	12/1	CCW	262
669	*	1937	12/1	CCW	262
2035	5	*	*	*	262
3003	5	*	*	*	*
3026	8	*	*	*	175

(Continued on page 202)

²No remote control is used.
^{*}Information not readily available.

OVERALL GAIN

NO RATING can be so abused as the gain of an amplifier. This is true because of the nature of the measurements involved. The decibel is a unit of power measurements, so the resistance across which the voltage measurements are computed will influence the mathematical but not the actual result.

To compute the overall gain, a carefully measured voltage is applied to the input of the amplifier and its output voltage measured. The gain is computed in decibels (db) from the formula

$$db = 10 \log \frac{P_o}{P_i}$$

where P_o is the power output and P_i the power input.

The output voltage is usually measured across a load resistor substituted for the output transformer. The input voltage is fed to the regular input circuit of the amplifier.

It is the input impedance that can play havoc with the gain measurements. Although its value is usually very high to prevent loading the microphone, such a value is never encountered as an actual grid load. When shunted by the microphone or other input source the resultant impedance is much less. In other words, the calculated gain of an amplifier with a 5-meg input impedance would be greater than if the input were shunted with a 100,000-ohm resistance, for example. The figure obtained under the latter condition, however, would be more indicative of the usable gain of the amplifier.

In comparing and investigating amplifiers as to db rating, the input impedance should always be considered. Without it the db rating has no meaning.

Jerome H. Kleker,
THORDARSON ELECTRIC MFG. CO.

WELLS-GARDNER A12

Distortion after the receiver has been operating for about 10 minutes: If mushy reproduction is encountered on a medium or strong signal after the radio has been turned on for about 10 minutes, it probably is due to grid current in the 6U7G r-f and i-f tubes. Change the 4-meg resistor R14 to a 2-meg resistor and if this does not clear up the reproduction replace either the 6U7G r-f or i-f tubes or both of them.

WELLS-GARDNER C7

Differences in models with a continuously variable tone control and rotary local-distance switch: The Series C7 service manual applies to models of this series using a two position tone control switch and toggle type local-distance switch. Some models of this series have a continuously variable rotary tone control and a rotary local-distance switch. Also, the color of the chassis case and cover is different on these models.

LOOK! TESTS ALL TUBES—

HICKOK DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER with readings in MICROMHOS

OCTAL — LOKTAL — 25, 35, 45, 50
VOLT, BALLAST and PILOT LAMPS—
this Instrument tests them all.

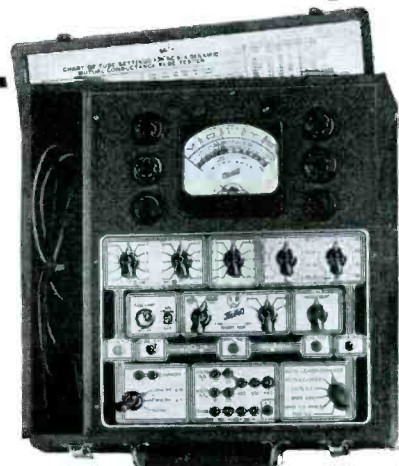
Model 51-X Tester has very wide coverage. Check these various measurements which it gives: Micromhos, A.C. & D.C. Volts, Ohms, Milliampères, Capacity, Inductance, Leakage, Output and Decibels.

MANY SPECIAL FEATURES—Features that add many dollars to the value of this instrument.

*Simple and positive noise test for demonstrating noisy tubes, including R.F. noise.

*Electronic Rectifiers that won't burn out or cause trouble.

*Patented *uniform* single scale for indicating A.C. & D.C. Volts.

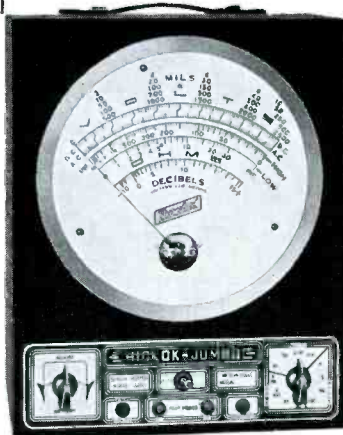


Micromhos Readings—0-3000, 0-6000, 0-15000. Also indicates, "Good," "Doubtful" and "Replace."

Manufactured under U. S. Patent No. 1,999,858.

Write for data to bring your present equipment up to date. Mail coupon for complete information.

Remember, it is not Dynamic Mutual Conductance unless it reads in Micromhos.



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with 9" meter—Model 4922.

WIDE COVERAGE: A.C.-D.C. Volts, D.C. Microamperes, D.C. Milliampères, Resistance, Decibels, Output, Amperes.

The instrument with a thousand uses in radio and for all electrical measurements. Extremely rugged and accurate. Long scale range, over seven inches, easily read from any angle. HICKOK built thruout.

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10520 DUPONT AVE.

CLEVELAND, OHIO

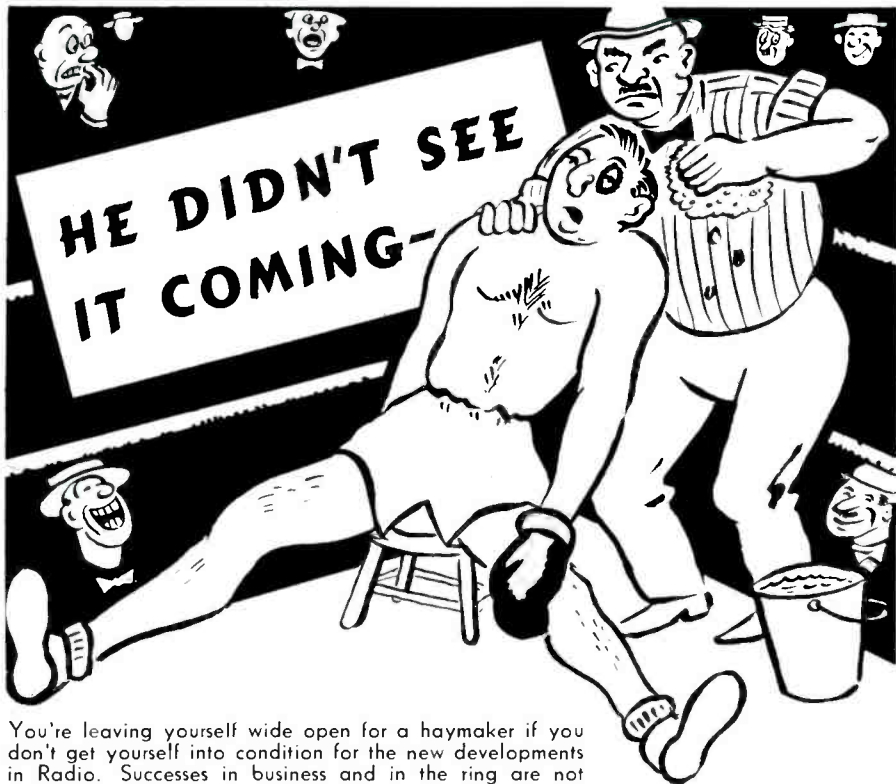
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10520 Dupont Ave., Cleveland, Ohio

Gentlemen: Please send information about Models 4922 & 51-X.

Please send data to modernize my Hickok Model No.

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You're leaving yourself wide open for a haymaker if you don't get yourself into condition for the new developments in Radio. Successes in business and in the ring are not made the night of "the fight." It's the training that counts. Be sure YOU are "ready" for the radio maintenance business of the 1940's by conditioning yourself in the basics of television, radio facsimile, the cathode-ray tube, photo electric cells, etc. You'll have to know as much about these developments as you know about a superhet—OR find the profitable part of your radio maintenance business going to better trained men.

The radio business is not a "fixed" business—it is progressing. So if you want to "be in there fighting" you had better get into training NOW! Read carefully the contents of the books described here and order today!

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"SERVICING BY SIGNAL TRACING"
 by John F. Rider

Use the system of servicing which is fastest—most modern—the system you can apply to all receivers regardless of age, type or make— independent of the kind of circuit or tubes used— independent of every limiting factor heretofore encountered. In this new book you learn what happens to the signal currents—the development of control voltages—and how all receivers are brought to a common servicing level. There is one thing which is common to every radio set—the signal. Read this book and you will be able to service the most complicated set with greater speed and less effort, for "Servicing by Signal Tracing" is based upon the most fundamental thing in any and all receivers, the signal.

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 - On D-C VOLTAGE DISTRIBUTION IN RADIO RECEIVERS
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 For Servicemen who want to be "Ready"

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A-C, D-C, BATTERY PORTABLE

THE circuit shown on the front cover is that of a portable receiver which can be operated from self-contained batteries, from the a-c or from the d-c power lines. The particular circuit shown, a 4-tube superheterodyne, will be employed shortly in receivers to be announced by several receiver manufacturers. Standard batteries are used; that is, a 1.5 volt A battery and 90 volts of B. On line power, the filaments are arranged to operate at 4.5 volts, 100 ma, which is supplied by a single 25Z5 with paralleled rectifier elements. Two switches are used: a 4-pole, double-throw switch for changing from battery to line operation and a d.p.s.t. switch on the volume control for turning the set on and off in either mode of operation.

The first section of the 4-pole switch applies positive A to the 1A7G, the 1H5G and the 1N5G while removing the shunt from the latter. The second section grounds the 1N5G and the 1C5G, making the negative A connection. The third section throws positive A on the 1C5G and the fourth section switches the B bus from the rectifier-filter to the 90-volt battery. It is possible to use a relay in the rectifier output circuit for automatic switching from battery to line operation.

Hum filtering is accomplished by means of resistance-capacity filters; individual filters are used in the A and B circuits. The first filter condenser is common to both. No chokes are necessary. The 1200-ohm A drop resistor represents a compromise that is satisfactory for both a-c and d-c. On a-c the filaments operate at full, normal voltage; on d-c, the rectifier output voltage is lower and the filaments run between 1.2 and 1.3 volts. The full filament emission is required on a-c because of the increased B voltage while the lower filament voltage is satisfactory at 90 volts or so.

• • • grid bias

Grid bias for the power tube presented an interesting problem which was solved as follows: On battery operation, the total B current flows through the 770-ohm biasing resistor and the 50-ohm rectifier resistor. On line operation, additional bias is required. This is obtained by sending both the A and B current through the 50-ohm resistor and by the drop in the series operated filaments.

The 10-mfd condenser and the two 50-mfd filter condensers serve as audio by-pass condensers, which are necessary when using this biasing method. The 0.05-mfd positive B bypass is all that is required at that point.

H. Howard

TELEVISION SERVICE



G.E. Model HM171 (above) table model has a 5-inch picture tube, is used for sight and also as a sound converter. It employs 17 tubes and covers three television bands.

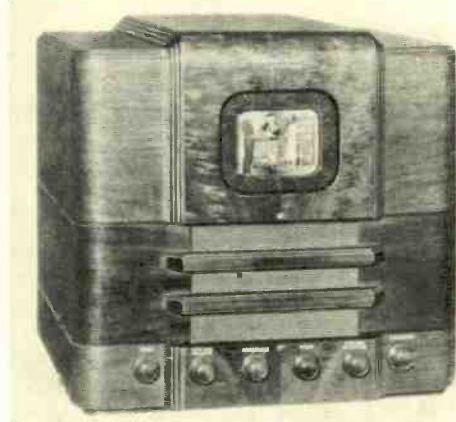


RCA Model TRK5 25-tube console employs a 5-inch kinescope and an all-wave sound receiver.

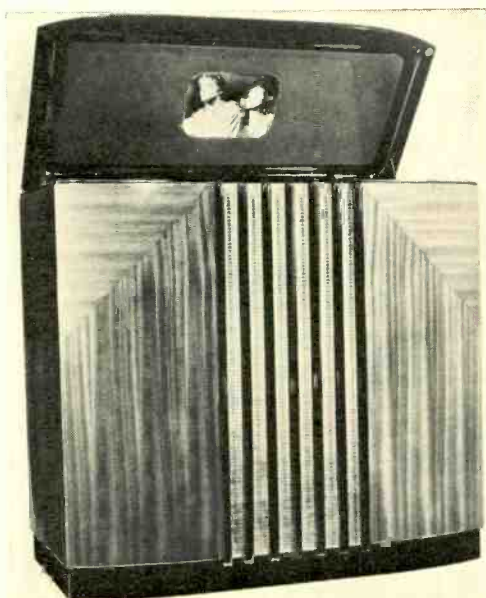


Pilot T90 is a 20-tube table model with a 9-inch cathode-ray tube.

Andea Model 1F5 is a 16-tube sight and sound receiver which covers two television bands. A 5-inch picture tube is used.



G.E. HM275 (below) combines an all-wave radio with a television receiver. It employs 29 tubes and a 12-inch kinescope.



RCA TT5 reproduces television images and utilizes the chassis and speaker of any a-c receiver for sound. A 5-in c-r tube is used and 16 others.

The Stewart-Warner console (below) combines all-wave sound with a television receiver. It employs a 12-inch picture tube.

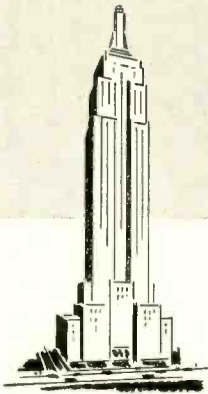


RCA and NBC Announce

TELEVISION

Television Broadcasting Begins on April 30th in the New York Area

...and *RCA Victor* Television Receivers Are Ready Now!



Years of patient effort in RCA Laboratories—millions spent on research—now convert a fantastic dream into a splendid reality . . .

April 30th marks the birth of a new industry—television. On that day sight will join with sound to bring you a wealth of new experiences.

Television offers something everyone wants. If you live in the New York metropolitan area you can have it right now. No prediction can be made as to how soon television will be available nationally, but RCA is bending every effort to meet popular demand.

When television becomes a nationwide service it should provide new opportunities for workers. Think how recently radio was an experiment and a toy. Swiftly it became a great industry. Today, radio is a source of livelihood

to thousands. RCA hopes to help in a similar growth of television in the future.

The development of television has required much research. To insure success RCA gathered in Camden, a distinguished group of scientists and engineers. A long step forward was their development of the Iconoscope, the "eye" of television, and the Kinescope, the "screen."

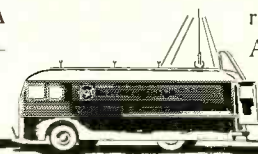
These are the bases of RCA electronic television, and have been made available to the entire industry.

Television also had to be proved in the field. RCA has spent more than two million dollars in practical field tests of television in New York. RCA and its various subsidiary com-

panies have been, and are, engaged in every phase of television—research, engineering, manufacturing, installation, broadcasting and service. This experience is unmatched anywhere.

Now the great day has arrived. A new era begins. Through RCA Victor Television Receivers you can take part in one of the greatest adventures in all scientific history. It is an adventure you will never forget.

The development of television is one more example of the ceaseless research of RCA and its various subsidiary companies. By always looking ahead, RCA seeks not only to improve the general services of radio, but to produce equipment of highest standards at moderate prices for home, industry and laboratory. That's why, in radio and television, it's RCA All the Way.



FACTS YOU'LL WANT TO KNOW ABOUT TELEVISION

Indications point to the early operation of three stations in the New York area; also one at Schenectady, N. Y., and one at Los Angeles, Calif. At the average electric rate it will cost about one cent an hour to operate a television receiver. Sizes of pic-

tures are given on opposite page. In New York, NBC, in addition to two one-hour studio programs per week, starting April 30, will provide special pick-ups of sport events, visiting celebrities, etc.



(AT LEFT) MODEL TRK-12 is the finest television instrument offered by RCA Victor. It contains an RCA 12" white screen Kinescope which provides a picture size of 7 $\frac{3}{8}$ " by 9 $\frac{3}{4}$ ", viewing is indirect through mirror attached to cabinet top. Other fine features of this instrument are as follows: 36 tubes exclusive of Kinescope, 4 chassis (1 video, 1 power supply for video, 1 all-wave, 1 power supply for all-wave), 5 television channels, selector switch for television tuning, 12-tube all-wave sound chassis, 12 watts (pentode push-pull) sound power output, high fidelity reproduction, inverse feed-back included with control, 12" high fidelity speaker, phonograph jack. This instrument uses sprayed silver compensated condensers and Styrol R-F and I-F transformers as mentioned below in description of Model TRK-5. Backed by \$2,000,000 field test.

RCA Victor Model TRK-9 (not illustrated) is similar to Model TRK-12, except that it is direct viewing and uses a 9" Kinescope.



(BELOW) MODEL TT-5 RCA Victor Television Attachment is for use connected to modern radios through which sound is heard. It contains an RCA 5" white screen Kinescope . . . presents a picture about 3 $\frac{3}{8}$ " by 4 $\frac{3}{8}$ " in size . . . uses direct method of viewing . . . has 16 tubes exclusive of Kinescope . . . is a table model . . . has 5 television channels and selector switch for television tuning. Like the TRK-5 this instrument uses sprayed silver compensated condensers and Styrol R-F and I-F transformers. Backed by \$2,000,000 field test.



(ABOVE) MODEL TRK-5 RCA Victor Television Console. Features of this instrument in which you will be interested include an RCA 5" Kinescope with white screen . . . 24 tubes exclusive of Kinescope . . . 3 chassis, one an all-wave radio receiver, one an all-wave power supply and one for television . . . 5 television channels . . . a selector switch for television tuning . . . an 8-tube, 3-band push-button radio . . . 5 watts (pentode push-pull) of sound power output and a 12" loudspeaker. This instrument reproduces a picture in size of about 3 $\frac{3}{8}$ " by 4 $\frac{3}{8}$ ". Picture may be seen by direct method of viewing. Sprayed silver temperature compensated condensers are used in this instrument. These have proper temperature coefficient to maintain circuit stability regardless of temperature changes. This instrument uses Styrol R-F and I-F transformers to greatly simplify mechanical and electrical construction and to give highest type insulation. Backed by \$2,000,000 field test.

You can buy RCA Victor Television Receivers on C.I.T. easy payment plan . . . For finer radio and television performance—RCA Victor Tubes. In Radio and Television—It's RCA All the Way.



RCA Victor

TELEVISION RECEIVERS

RCA Manufacturing Company, Inc., Camden, New Jersey • A Service of the Radio Corporation of America

- DUMONT 180, 181, 182, 183 TELEVISION RECEIVER -

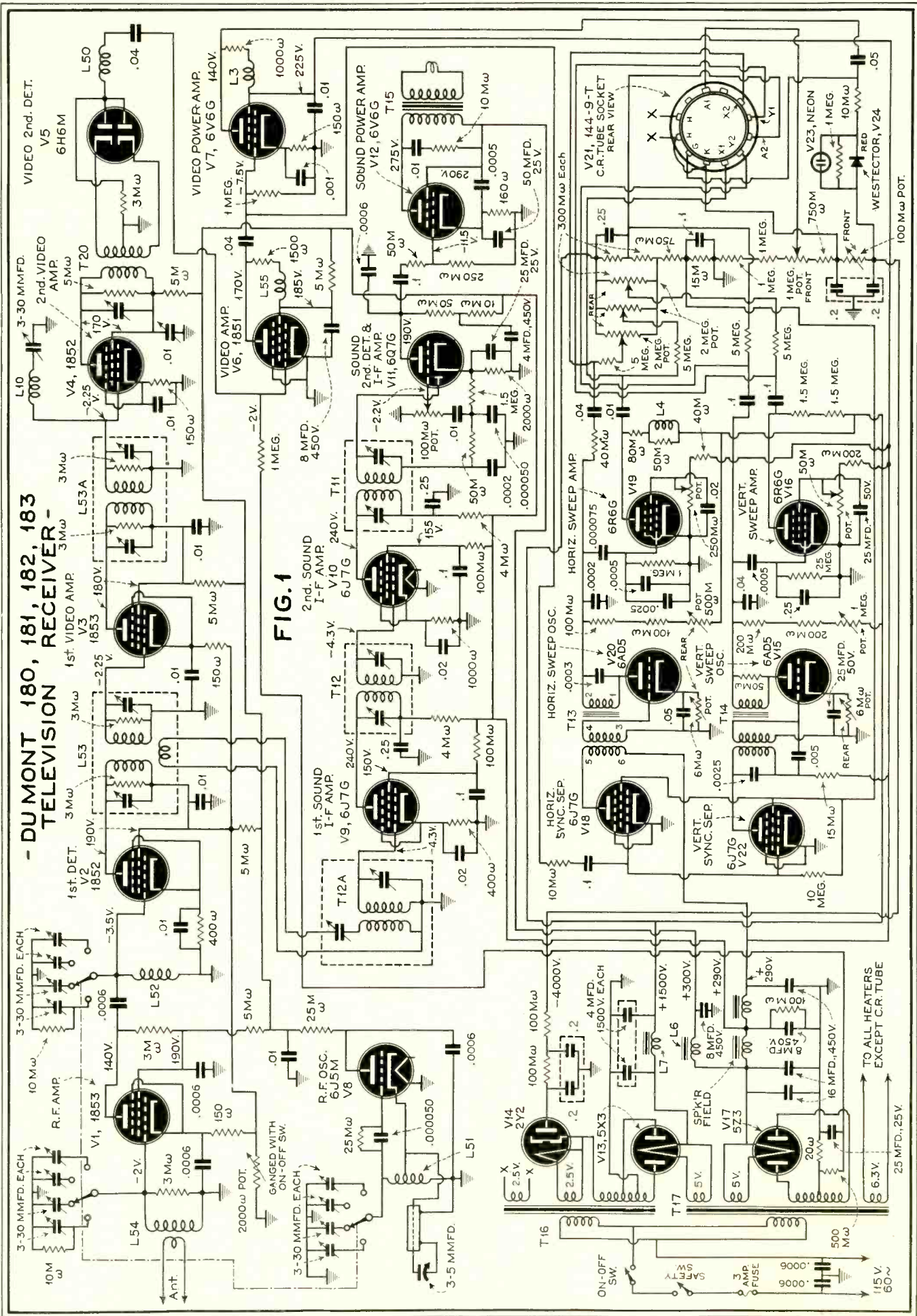


FIG. 1

DUMONT 180, 181, 182, 183 TELEVISION SET

IN the accompanying illustration is shown the circuit diagram, and tube layout of the DuMont Type 180 a-c superheterodyne television receiver. This 22-tube receiver employs electrostatic deflection for the 14-inch picture tube which is of the direct-vision type.

Synchronizing, signal separation and sweep circuits used in this receiver are shown in Fig. 1. The two 6J7G tubes (V18 & V22) function as the synchronizing signal separators. The outputs of the two plates are fed to the respective synchronizing windings of the horizontal and vertical oscillation transformers. Linear saw-tooth deflection is effected using a 6AD5G triode as an oscillator and a 6R6G triode as an amplifier.

The d-c component necessary for background level, is introduced by the action of the copper-oxide rectifier V24. The neon lamp V23 is provided to protect the rectifier from high-voltage surges when the equipment is first turned on.

Assuming that the controls are properly set and handled, the first step will be to determine the location of the trouble and isolate the defective portion. In this you will be aided by the design of the receiver, for the various sections are separately located.

• • • specifications

Frequency range: 4-bands, 49.75 and 55.75 single side-band and double side-band transmissions.
I-F channels
Sight: 7.4 mc.
Sound: 2.9 mc.
Scanning: 441 lines.
Interlace: 2 to 1.
Frame frequency: 30 per second.
Field frequency: 60.
Aspect ratio: 4 to 3.
Type of deflection: Electrostatic.
Power supply: 110 to 120 v., 50 to 60 c.
Power consumption: 250 watts.
Picture size: 8 by 10 in.
Picture color: Black and white.
Controls: On front panel, contrast and off-on switch, band selector switch, tuning, audio volume, focus, inten-

city. At the rear of chassis: Vertical frequency, horizontal frequency, vertical position, horizontal position, vertical size, horizontal size, astigmatic position.

Tubes

R-F: 1853.
Oscillator: 6J5.
Mixer: 1852.
Video i-f: 1853, 1852.
Video sec. det: 6H6.
Video pwr. amp.: 6V6G.
Sound i-f: 6J7G (2).
Sound sec. det.: 6Q7G.
Sound pwr. amp.: 6V6G.
Sync. separators: 6J7G (2).
Sweep osc.: 6AD5G (2).
Sweep amp.: 6R6G (2).
High-voltage rect.: 2Y2.
Median voltage rect.: 5X3.
Low-voltage rect.: 5Z3.
Cathode-Ray: 114-9T (14-in.)
Overall dimensions: (Chassis) 20¾ high, 13¼ wide, 24¼ in. long.

Price

Model 180: \$395.00.
Model 181: \$540.00.
Model 182: \$445.00.

MEISSNER 10-1153 TELEVISION KIT

THE Meissner television receiver kit Model 10-1153 provides both video and u-h-f sound channels in a single compact receiver chassis. The set uses a 5-in. tube and provides a 3-by 4-in. picture in black and white or black and green. It is designed to RMA standards.

Controls include: Volume (with on-off switch) focusing, background, contrast, channel selector, horizontal sweep frequency, vertical sweep frequency and centering control. Several controls, which have to be adjusted only when changing tubes, have been placed at the side of the chassis, leaving a minimum number on the front panel.

A wide-band picture i-f channel is provided with permeability-tuned iron-core coils.

The power supply for the Meissner 10-1153 television kit is designed to fit in a completely enclosed can. The high voltage leads and components are all within this section.

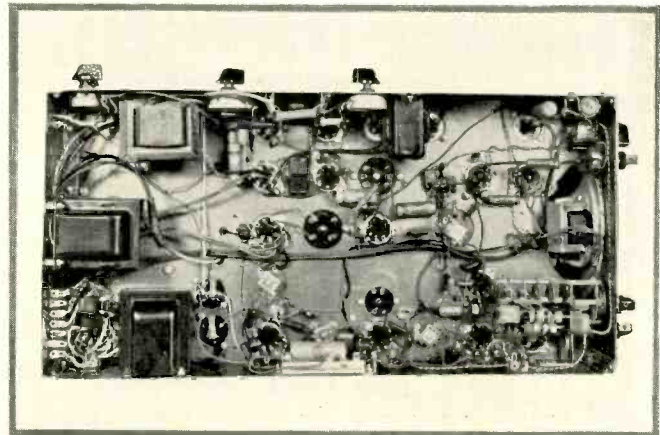
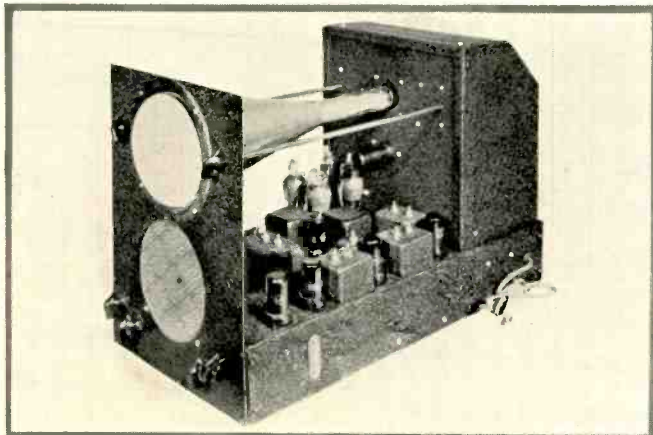


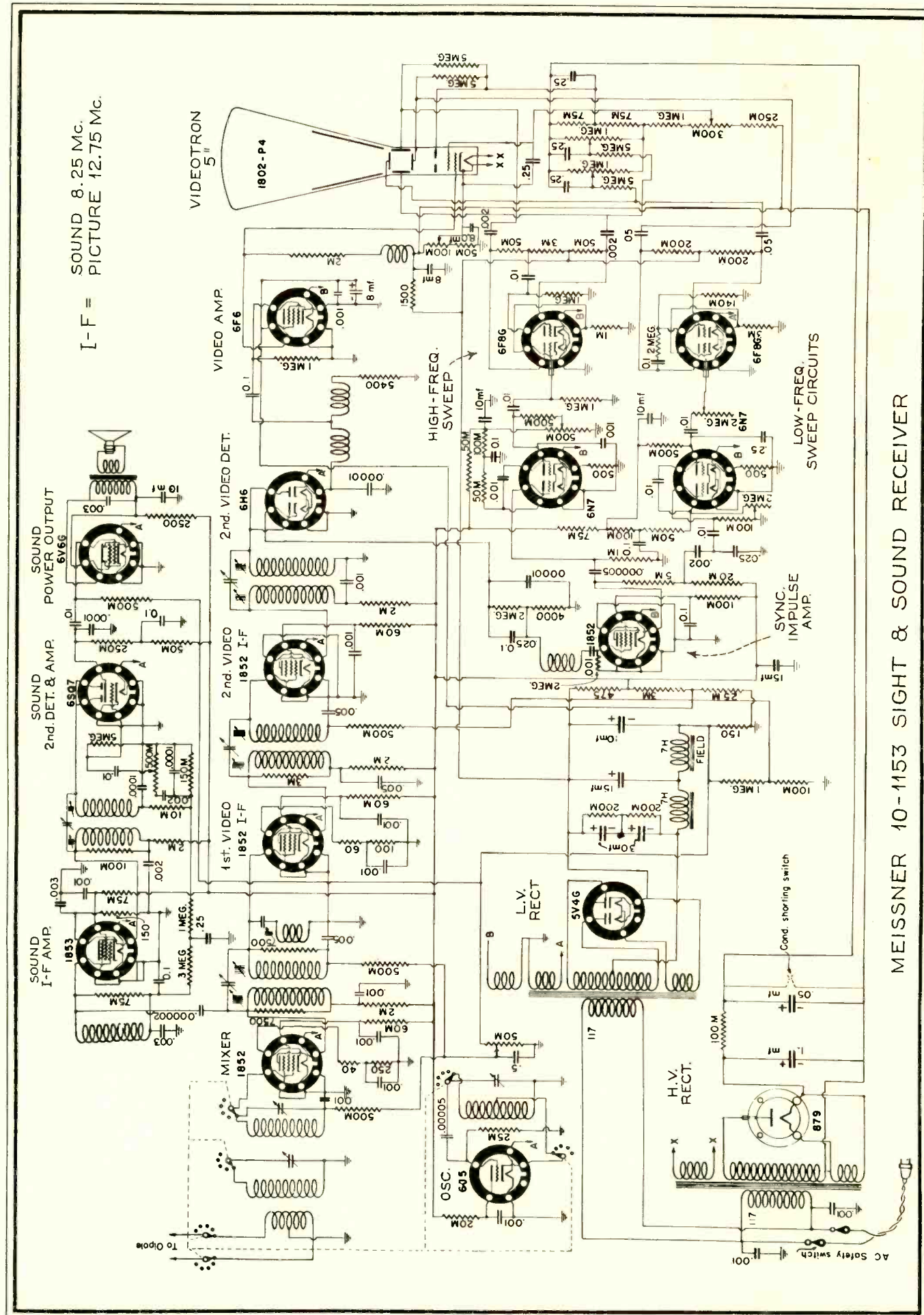
The DuMont 180 series of television receivers employ 22 tubes including a 14-inch electro-statically deflected cathode-ray tube.

The high-level synchronizing chain includes preset coils requiring no adjustment by the operator. High-voltage leads and components are completely protected by suitable enclosures and two safety switches affording protection against accidental shock to the operator.

• • • specifications

Frequency range: 44-50 mc, 50-66 mc.
I-F channels
Sight: 12.75 mc.
Sound: 8.25 mc.
Scanning: 441 lines.
Interlace: 2 to 1.
Frame frequency: 30 per second.
Field frequency: 60.
Aspect ratio: 4 to 3.
Type of deflection: Electrostatic.
Power supply: 110v, 60c.
Power consumption: 125 watts.
Picture size: 3 by 4 in.
Picture color: Black and white.
Controls: Video gain, vertical sweep frequency, centering, channel selector, horizontal sweep frequency, volume (on-off switch), focusing, background, tuning. (Others at side of chassis).
Overall dimensions: 10¾ wide by 14¾ high by 22 in. deep.
Price (with tubes): \$125.00 net (as a kit of parts).





I - F = SOUND 8.25 Mc.
 PICTURE 12.75 Mc.

MEISSNER 10-1153 SIGHT & SOUND RECEIVER

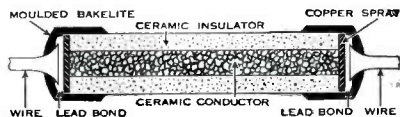


YOU WOULDN'T USE A FIRE HOSE TO WATER THE PLANT

Nor does it make sense to replace a small resistor with a LARGE one. In fact, most resistors in radio sets actually carry less than 1/4 watt load. It is changes resulting from high chassis temperature and humidity that actually cause breakdown . . . not overload. Replacements of the same material, but in larger sizes are no sure remedy.

Use CENTRALAB Ceramic Resistors and play safe. The type 710 is convenient to use because it is small in size and fully insulated. It rates at one half watt, and will carry substantial overloads.

Baptized in fire at 2500 degrees...hard as stone. Center ceramic core, and ceramic jacket fired together to form a single shock-proof unit. Pure copper covers resistor end for wire lead contact.



Solid Ceramic . . . impervious to humidity or any probable operating temperature. Priced so low you can well afford to keep a stock on hand.

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See your jobber, or write for Bulletin 647.

TYPE 710, rating 1/2 watt, size 1/8 x 3/8 inch. List price 60¢ for five.

TYPE 714, rating 1 watt, size 1/4 x 1 inch. List price \$1.00 for five.

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AXIAL LEAD RESISTORS

DIVISION OF GLOBE-UNION INC., MILWAUKEE, WIS.

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SAYS: You'll have one gosh awful time getting anything but perfect performance with Centralab Volume Controls, Fixed Resistors, and Wave Change Switches.



EXACT- Duplicate REPLACEMENT CONDENSERS

● Having pioneered the exact-duplicate idea for years, AEROVOX is happy indeed to have it universally accepted today. And doubly so because, having refused to take the easier way of so-called general-utility types, AEROVOX has built up a really complete line backed by the most extensive listings in use.

Fit RIGHT

Because *exact* needs of standard sets in use have been critically studied, AEROVOX *exact* replacement units readily fit in place of original condensers. No jamming. No taping. No sloppy wiring. You save time and trouble.

Work RIGHT

Because electrical as well as mechanical considerations have received thorough attention, AEROVOX replacements not only duplicate but usually excel the performance of the replaced units. You need fear no return calls to "make good."

Look RIGHT

Last but not least, an AEROVOX replacement restores the radio chassis to its original "new" status. Set owner is satisfied the job has been done right. That means a fair price—and a real profit.

Ask Your Jobber to show you the latest AEROVOX replacement chart and pick out the required unit for that set. Ask for our catalog. Or write us direct.



LOOKING AHEAD

(Continued from page 162)

to actuate low-cost indicators on receivers in the primary service area of the station. I submit that this feature would be welcomed and appreciated by the listening public, and that it is not impractical technically, or in program or advertising aspects.

• • • other possibilities

The use of sub-audible modulation has several possibilities of usefulness, all requiring study and action which are coordinated between the transmitter and the receiver. For example, it could be used for volume range expansion with control furnished by the transmitter control room engineer in accordance with the musical or technical needs of the program. However, it does not seem that the value of this provision would be sufficient to justify its cost.

Several other examples of possible service through use of sub-audible modulation do not seem to have sufficient importance to justify cost, or the tying-up of so much of the sub-audible spectrum.

There is one use of sub-audible modulation which does seem to me to be not only worthwhile at present, but even that it will be necessary in the near future. I would like to suggest this one as an immediate possibility for an extension of broadcast public service usefulness. It is one which requires cooperation between transmitter and receiver interests, and can be described very simply. It is the turning on and off of receivers by signals from the transmitter, accomplished by a special control signal having either audible or sub-audible modulation. I have said that it may be necessary even, because in facsimile broadcasting, possibilities of usefulness are much greater if the receiver can be turned on and off at any time by control from the transmitter, rather than be turned on and off by a time clock at the receiver at specific times only. Furthermore, in ordinary sound broadcasting, it would be highly useful if receivers could be turned on by transmitters, in the event of important news flashes, for example. Especially in times of national emergency or international crises, such a device would be appreciated. During recent events such as the New England hurricane, the Munich crisis, and the sinking of the "Cavalier," thousands of receivers were left on continuously, to catch news bulletins occurring at intervals of hours.

In such an arrangement, of course, one of the first steps of coordination should be agreement among broadcasters not to turn on receivers for

special spot advertising announcements, and to confine use of the turn-on facility to its intended purpose.

Of course this service requires a stand-by receiver, continuously energized. However, it can be designed with only two or three tubes, conservatively powered and therefore long-lived, and with low cost. It is estimated that the retail price of such an attachment receiver, as a completely separate accessory to control any present receiver, would be between five and ten dollars. If built into new receivers, the addition to the regular receiver would of course be less than this figure. At present, there is a feeling among receiver manufacturers that any increase in cost, for any reason, is a sales deterrent. Experience has shown, however, that this is not true where the addition is accompanied by a new and desirable service. It is usually true when the added cost is caused by a mere improvement in an existing service, but the situation is quite different when a totally new service is added. It is *only* by such added service, or added value to the user, that average sales prices can be elevated to profitable levels in a sound, permanent manner. I recommend this possibility to serious consideration, with the idea that it offers worthwhile opportunity to extend the service of broadcasting in a manner which is needed by and will be appreciated by the public. It will give information as to the general character of each program, and it will enable broadcasters to reach the full audience, whenever that is desirable, whether or not all receivers are turned on at the moment.

• • • new basic services

In the foregoing, we have considered only improvements, refinements, or extension of the existing basic service of sound broadcasting. Obviously, new basic services are more important. Such new services, and the only ones now on the horizon, are facsimile and television. It is beyond the scope of this article to go fully into these extensive subjects, but it is in order to remark their wide opportunity and even necessity for greater coordination between receivers and transmitters.

It is well and thoroughly recognized that a high degree of coordination in basic technical matters is necessary in the case of television, and the excellent, effective standardization work which has been carried on in this country for many years past is tangible evidence of this. It is difficult, in a service which has had no actual public experience, and wherein basic problems are as yet unsolved, to foresee possibilities for improvement of relatively minor matters. It might be said even, that it is wholly

unnecessary to attempt to do so. However, it may do much good if the systems' viewpoint of television, which has been applied so effectively to date, is maintained in so far as possible, rather than allowing each branch to develop independently as has been so largely the case in sound broadcasting. For example, the possibility of turning on receivers by signal from the transmitter, as discussed previously in connection with sound broadcasting may be even more worthwhile in television where scheduled programs will presumably not utilize many hours per day for some time to come, and therefore where unexpected and unscheduled events are more likely to occur.

Facsimile broadcasting likewise presents opportunity for coordination, and requires a considerable degree of it for satisfactory performance. Synchronization, form and speed of copy, wave frequencies to be used, control of receivers, are among the matters subject to more satisfactory result from more complete cooperation between transmitter and receiver interests.

It is quite certain that broadcasting is about to enter a new era of its development, and one of even greater magnitude, significance, and effect. We who are engaged in the work of bringing it about will be very close to the trees, but if we keep the forest in perspective as well, we may look forward to experiencing many a thrill and satisfaction of useful public service accomplishment as we carry on.

CADILLAC 1939 AUTO ANTENNAS

THE 1939 Cadillac custom radios are equipped with an automatic vacuum actuated antenna. When these aerials become sluggish or completely unable to rise or drop, it has been found that by removing the two tubes which go to the valve from the antenna, and working some windshield-wiper oil into the barrel of the aerial, the movement will be restored. It is very necessary to use the proper oil for this purpose because of the detrimental effect on the piston in the aerial that ordinary oil might have.

When noise on rough roads can be traced through the radio to the aerial the cause will be found to be a poor contact from the antenna lead to the antenna rod via a brush arrangement. The entire assembly is sealed in the airtight barrel and consequently inaccessible. By rubbing the rod generously with colloidal graphite and working the aerial up and down, the trouble will be minimized. The colloidal form of the graphite will tend to keep the rod corrosion-free and prevent any film of non-conductive material from readily forming on the aerial. *Eugene Triman*



The Kind of Letters Manufacturers Dream About But Seldom Get:

"The Chanalyst will do all you claim for it and also the following things. In conjunction with the instruction book the Chanalyst affords the best education in aligning and tracking, in all its phases, that I have yet encountered. It also clarifies all those mysterious circuits which were so much of a headache to servicemen, such as various oscillator circuits, A.F.C. circuits, audio degeneration and regeneration, inverse feedback, phase inversion, etc. One can test all these circuits, their effects, defects, components, etc., just as easily as he can check an ordinary T.R.F. set. The instrument is so simple to use that in a short time a serviceman can become quite adept with it and, as he goes about measuring voltages and checking circuits he never dreamed possible, it's so natural and easy he just takes it for granted that all this has come to pass. I like the Chanalyst and don't

know how I got along without it before and would never do without it now. It is not only an instrument, it's an education."—Walter Stepanovich, Steubenville, Ohio.

"This instrument will be the only thing that will not become obsolete. Sure can find intermittent and noise quickly."—Carl Becker, Scotland, S.D.

"The speed with which trouble can be located with the Chanalyst and the ease of operation is amazing."—Leonard Roberts, Jr., Precision Radio Service, Steubenville, Ohio.

"It has taken the nightmare out of my radio servicing.

Have seen nothing to equal it in my twenty years of servicing."

—R. H. Reed, Waco, Tex.
"The best instrument in my shop, it becomes more useful as I learn more about it."—John A. Thoma, Emsworth, Pa.

"The Rider Chanalyst is the instrument of today and tomorrow. I like every part of it and all the channel circuits are very good."—Joseph Uzdarwin, Nashua, N. H.

"I do not see how anyone could do without a Chanalyst. It certainly is a big time saver. Your instruction book is the most complete I have ever seen with any instrument."—C. L. Vannerstrom, Highland Park, Mich.

Net Price **\$107.50**

With Rack-Panel Assembly **\$122.50**
Rack-Panel Assembly (sold separately) **\$15.00**

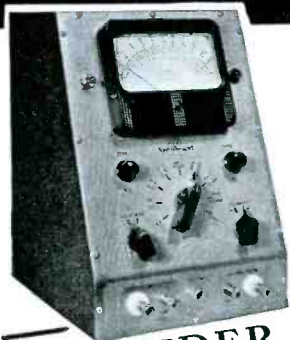


Send 25c for 80-Page Book

Completely explaining performance, ease of operation of the Chanalyst.

GO TO YOUR JOBBER AND DEMONSTRATE IT TO YOURSELF

The RIDER Chanalyst



The RIDER VoltOhmyst

The VoltOhmyst is unlike anything heretofore available to the servicing industry. It will remain useful for years to come in the servicing of radio receivers, television, facsimile, sound and such equipment.

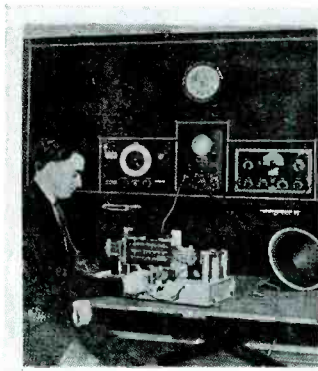
This New Electronic D-C Voltmeter-Ohmmeter measures voltage wherever you wish, without your being concerned with its value and irrespective of circuit complications. For, the Rider VoltOhmyst has one scale—one zero adjustment. You just put the proper probe at the point to be measured and look at the single scale.

The VoltOhmyst has an extremely wide range—0.05 volt to 5000 volts d-c, 0.1 ohm to 1,000,000,000 ohms.

Send today for complete specifications and literature. See your jobber for a demonstration.

Net Price **\$57.50** 25-60 cycle. Power consumption 12 watts.

SERVICE INSTRUMENTS, INC., 404 Fourth Avenue, New York City
FOREIGN DIVISION, 145 W. 45th Street, N. Y. C., Cables — "Servicin"



FOR
"ELGIN'S
BEST
RADIO
SERVICE"

PHONE
3779

• Fairchild's Radio Service can restore your Radio to perfect performance. If you have noise and crows talk he would like to talk to you about a cure.

• With the Radio Service Industry's Latest and Finest Equipment installed in his Radio Home at 629 Wright Avenue, Mr. Fairchild gives his 15 years' experience to solve your radio problems. Also, a unique service of his is the designing of New Radios from old ones, thus saving his customers many Radio dollars.

C. L. Fairchild SELLS PERFORMANCE

ALTHOUGH stranger things are possible, the Fairchild Radio Service is located on an unpaved street about a half block from the city limits and yet it gets more business than any of its downtown competition. Sales and service have increased 33 1/3 percent during 1938 over that of 1937. This marks the fifth consecutive year that shows gains over the previous year.

C. L. Fairchild, proprietor, feels that his gross business not only makes his investment worth while, but also "proves that radio service has a substantial future if those transacting that kind of business will get out of the rut and into sound business sense for their operations.

"Contact your customer on the basis of delivering performance for his dollar. All receivers have resistors and condensers, tubes and transformers . . . but do they all get the same results? . . . Some of them get the performance that the customer pays for and it is a happy customer that gets satisfactory results when he dials his radio, rather than one that just buys a tube or a condenser.

"Be sure you do the best job you know how to do, get a fair price and stand back of your work to deliver the results you promised and for which the customer has paid. This policy, together with the ability and salesmanship to get the job, backed up by com-

plete equipment and honest dealing, will spell success in the service industry."

Mr. Fairchild has been a Service Man for 16 years and has owned his own business for the last 9 years. His chief product is service; he does not sell sets. For two years past he has employed an assistant, full time.

• • • the shop

A view of the service bench is shown below. Mounted in the panel under the electric clock can be seen a Clough-Brengle audio oscillator on the left; a RCA 3-in oscilloscope in the center and a RCA Model 150 frequency modulated r-f all-wave oscillator, on the right. Each instrument is set on a shelf in the rear of the panel and can be removed for use away from the panel. Under the panel, to the right, a small resistor and condenser cabinet; a Clough-Brengle universal substitute speaker (under the RCA r-f oscillator) and a Solar condenser tester. Out in front, on the rack, is a Rider Chanalyst and a Clough-Brengle Model OC r-f oscillator. To the rear of the Chanalyst is a Weston

Fairchild Radio Service is located about a half block from the edge of town, yet it attracts more business than any of its downtown competition. The sound equipped truck is an important stimulant in aiding sales. From left to right, in front of truck, C. L. Fairchild, Fred Morley and R. L. Fairchild. The mailing piece (above) also helps sales.

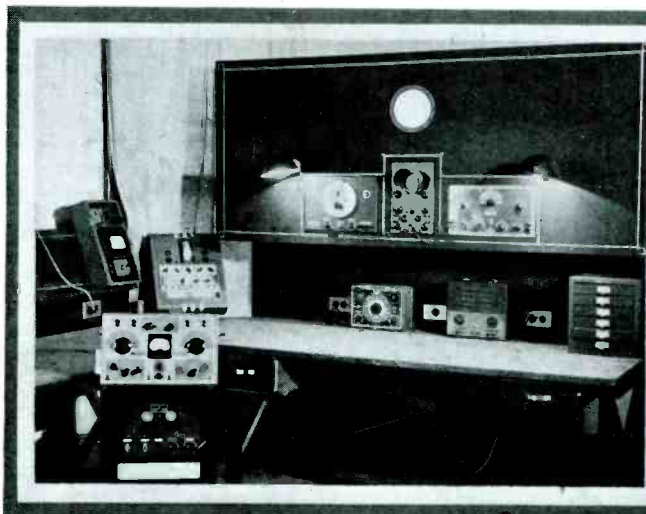
Model 772 20,000-ohm-per-volt analyzer and a Hickok Model OC 51 tube tester. All other equipment which is not up to date is kept out of the shop.

The bench has just been cleared to get ready for the day's work. With the exception of test leads and a few jigs, which are kept in the two drawers under the bench top, the equipment is interconnected as required for rapid service work. Tools are also kept in the two drawers.

A full set of Rider's Manuals are housed in a cabinet for service literature. On the outside the service truck shown in the accompanying illustration is used. It is completely equipped for sound. In addition it carries a complete stock of tubes and parts and also a Supreme Model 89 Deluxe set and tube tester. Standing in front of the truck, from left to right, C. L. Fairchild, owner and chief Service Man; Fred Morley, bill collector, detail man, etc., and R. L. Fairchild, in charge of shop and counter work.

• • • advertising

In soliciting new business, Mr. Fairchild uses a mailing piece, slightly larger than a post card, on which a view of the service bench with its up-to-date equipment is shown together with a suitable sales message and, of course, the name, address and telephone number of "Elgin's Best Radio Service."





You've asked your jobber.



—and you've asked us hundreds of questions about the new SUPREME 504 Tube and Set Tester since it was introduced a few short weeks ago. Grouping and analyzing these questions we have attempted to answer them all in the seven paragraphs below.

WHAT IS THE OVER-ALL ACCURACY OF THE 504?

The 504 has an OVER-ALL GUARANTEED accuracy of 2% on all D. C. and 3% on all A. C. functions. Contrast this with instruments in which ONLY THE METER is guaranteed to 2%, or ONLY THE RESISTORS to within some percentage. SUPREME guarantees the accuracy of the ENTIRE INSTRUMENT—not just one component part.

IS THE COPPER-OXIDE RECTIFIER GUARANTEED?

Unconditionally! The copper-oxide rectifier is completely guaranteed for 90 days—exactly the same as every other part. As far as we know, SUPREME is the only company which guarantees instrument rectifiers.

WILL THE A. C. VOLTAGE READINGS VARY WITH TEMPERATURE?

The 504 incorporates an entirely new "Perma-Grad" TEMPERATURE compensated circuit. Each rectifier is individually matched with a specially wound spool of HYTEMCO wire which nullifies the result of temperature change on the rectifier by re-acting in the opposite direction. Thus accuracy is not guaranteed at only one temperature but is guaranteed to be well within 3% over a wide range of 40 degrees to 95 degrees. Even above or below these limits variation is negligible. THIS IS AN EXCLUSIVE FEATURE.

WILL THIS TESTER CHECK LEAKAGE OF ALL ELECTROLYTICS?

The 504 is also a complete condenser analyzer and will check leakage of all electrolytics, regardless of the CAPACITY or the WORKING VOLTAGE. There are seven D. C. test voltages from 25 to 450

volts with complete listings on the roll chart. Tests are made on an English reading scale and discard limits were set with the co-operation of three of the leading condenser manufacturers.

I AM AFRAID TO BUY A TUBE TESTER BECAUSE MANUFACTURERS ARE SWITCHING AROUND THE ELEMENTS ON THE NEW TUBES.

The 504 has a "PATENTED DOUBLE FLOATING FILAMENT RETURN SELECTOR" and an obsolescence-free basic circuit which automatically re-connects every tube socket to the proper arrangement while the instrument is being set-up according to the tube chart. This is done REGARDLESS OF PRESENT OR FUTURE TUBE BASE CONNECTIONS. There are now about 120 different bases—the Model 504 does not care if there are 1000 or more. THIS IS AN EXCLUSIVE FEATURE.

WILL THE 504 TEST 50-VOLT TUBES?

Yes, the 504 will check 50-volt filament tubes as well as 35, 32, 7, 1.4, and all other types. It will check locals, single-ended "S" types, gaseous rectifiers, magic eyes, ballast tubes, pilot and flash lights, G, MG, M, GT, octals and non-octals.

I AM SOLD ON THE INSTRUMENT BUT I DON'T THINK I CAN AFFORD IT.

If you can afford a telephone or if you can afford to buy your cigarettes you can afford the Model 504. This big Model 504 laboratory, combining a 7-way tube tester, a 31 range set tester, and a complete condenser analyzer, is but 17c per day on the world's easiest installment terms.

If you want further details on this newest of new instruments, send coupon below.

SUPREME

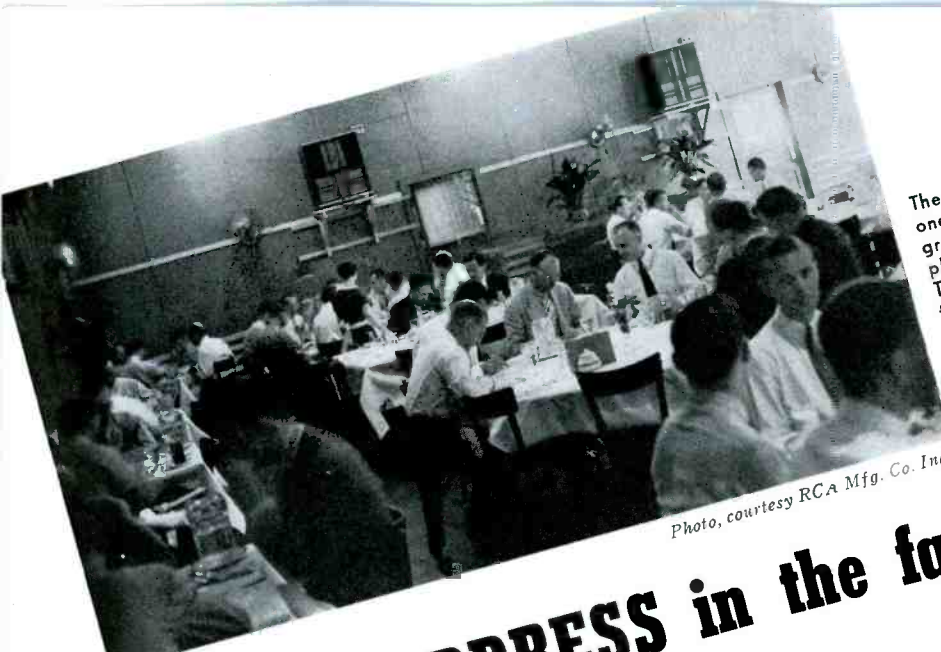
**SUPREME INSTRUMENTS CORP.
GREENWOOD, MISSISSIPPI, U. S. A.**

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MAIL COUPON TODAY!

SUPREME INSTRUMENTS CORP., Dept. S-5
Greenwood, Miss.
Please RUSH me your newest information on SUPREME 504 and many other completely new SUPREME 1939 Models.

Name _____
Address _____
City _____ State _____



Photo, courtesy RCA Mfg. Co. Inc.

The successful p-a specialist is one who keeps his ear to the ground in search of new applications for sound systems. The illustration shows a portion of the RCA Victor lunchroom at Camden. The sound reproducers form part of an elaborate system.

PUBLIC ADDRESS in the factory

By L. W. MARKO*

THE successful p-a specialist is one who keeps his ear to the ground in the search for new applications of sound systems. In the now ordinary applications such as amusement places, schools and the like, it is becoming increasingly difficult to get the business because of competition; for the same reason, the profits are oftentimes something less than could be desired. But if you work out an uncommon application and can sell a prospect on the idea the job is likely to be yours without competition and it is in such jobs that the greatest profits lie.

Such an application, not entirely new but still new enough to be uncommon, is the use of radio sound systems in factories to improve working conditions and better employee relations. Perhaps this appears to be a rather intangible objective and one which would be hard to sell to an employer but "let's look at the record" as Al Smith used to say.

The fundamental idea dates back many, many years. Story tellers and readers have been employed in European industry for a century or more, and in Cuba it is the accepted practice in the cigar factories (as shown in one of the accompanying photos) to have a reader whose sole duty it is to read to the workers from morning to night—news, fiction, anything which will interest them. The direct advantage is that conversation is reduced and production is stepped up accordingly.

*Sound engineer, Wholesale Radio Service Co., Inc.



Speakers distributed throughout the plant bring radio programs to all the workers. Reduced fatigue and increased production has been the demonstrated result.

Such schemes have failed of adoption by American industry in years past primarily because it is mechanized and where there are machines there is enough noise to make the old reader idea impractical. The use of a sound system overcomes this obstacle, however, with the result that a number of plants have introduced the modern equivalent of the reader in the form of a continuous fare of broadcast programs by means of loudspeakers suitably located throughout the work rooms.

An installation was made, for instance, in the dry cleaning plant of the

Kent Stores, Inc., Flushing, L. I., where 300 employees are engaged in routine work of a type that involves both the hands and the mind. The installation consists of a 7-tube radio, a 30-watt amplifier and six loudspeakers, representing a total investment of approximately \$250.

After this system had been in service for 2 years, I. Paul, manager and one of the owners of the business stated, "If the cost of this radio equipment had been ten times as great we would not hesitate to install it as the music is reflected in a more even-going and contented personnel."

Some of the facts gleaned from this demonstrate the practical utility of such an installation:

In 1929, when this plant employed only 30 workers, overtime brought the working day up to 12 hours during the peak season. As an experiment a small portable radio was introduced and played during overtime hours. To the amazement of the management overtime fatigue decreased and production increased to a level equal to or exceeding regular-time production.

The use of the radio was then extended into regular hours and was put into operation during normal fatigue periods. Here again the management came in for a surprise because a distinct let down in the work was noticed

For a century or more it is the accepted practice in Cuban cigar factories to have a reader whose sole duty is to read to the workers from morning to night.



STREAMLINED FOR YOU



The Mighty 1939 Radio Parts Industry Show

It's your show . . . this year more than ever! . . . A mighty gathering of the Radio Parts Industry . . . planned for you and streamlined for action . . . up and down the streets of Radio Parts City and its exhibits.

Two days will be devoted to Jobbers—and two days to Servicemen, Retailers, Amateurs and others in the trade . . . insuring fullest attention and maximum benefit for each of you.

JOBBER DAYS . . . Wednesday, June 14 and Thursday, June 15. In cooperation with all branches of the Industry, these two days will be devoted to Jobbers only.

SERVICEMEN DAYS . . . Friday, June 16 and Saturday, June 17. The Convention of the Radio Servicemen of America will open on Friday, June 16—with special lectures, meetings, and exhibits of new parts and apparatus for the Servicemen.

AMATEUR DAY . . . Saturday, June 17. This will be a big day for all the Hams. There'll be new Ham Gear to see, new developments to discuss with factory men, engineers, and fellow-hams. Booths manned by technical men on Servicemen and Amateur Days.

NEW PRODUCTS . . . NEW IDEAS . . . NEW EXHIBITS

It's your one and only opportunity of the year to meet the complete Parts Industry—face to face . . . to make personal contacts with Manufacturers, Jobbers, Engineers, Sound Specialists, Servicemen and Amateurs—from all parts of the world . . . to see all the very latest developments in Parts and Apparatus, Public Address, Ham Gear . . . and get valuable ideas you can use in your own field.

IT PAYS TO ATTEND THE TRADE SHOW
This is your Annual Homecoming. You owe it to yourself to come. Make your plans now—and don't let anything stop you!

Stevens Hotel-Chicago

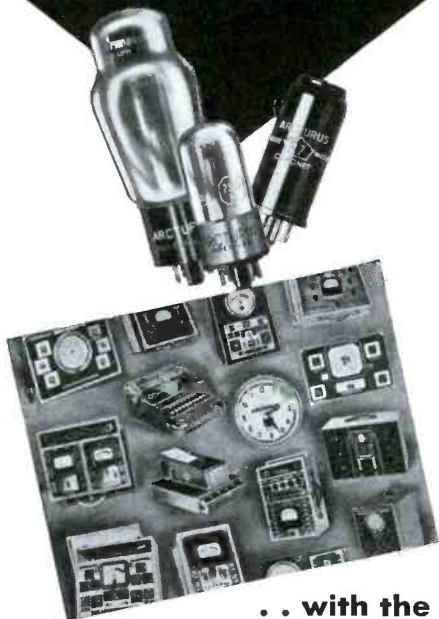
1939 JUNE 1939			
WED	THU	FRI	SAT
14	15	16	17
<p>OPEN these two days to Jobbers, Manufacturers, Manufacturers' Agents, and Manufacturers' Engineers only.</p>		<p>OPEN on these two days to Servicemen, Amateurs, Retailers, Students and others in the trade.</p>	



National Radio Parts Trade Show

Sponsored by Radio Manufacturers Association and Sales Managers Club
★Executive Office—53 West Jackson Boulevard, Chicago, Illinois

**THESE TUBES
PAY FOR THE
EQUIPMENT
YOU NEED!**



**... with the
ARCTURUS
EQUIPMENT DEAL!**

The Arcturus Equipment Deal brings you an almost unlimited variety of the newest store and shop equipment . . . practically FREE! It enables you to make your shop more efficient, absolutely up-to-the-minute . . . it actually gives you EXTRA PROFITS in the form of valuable equipment!

NEW EQUIPMENT . . . PRACTICALLY FREE!

You'll find the Arcturus Deal gives you more for your money than any other. Lower Down Payments. Low Tube Requirements. Immediate Delivery—and only Standard Prices for tubes!

Send for details, and your FREE copy of the ARCTURUS DEALER HELPS folder. See how simple it is to get new equipment—how your purchases of Arcturus Tubes actually pay for it—how Arcturus Cooperation helps you sell!

NEW TUBES . . . NEW PROFITS!

Arcturus recently introduced several new tube types . . . more are on the way! These, and the famous Arcturus GT "MIDGETS", will further increase the huge replacement market now open to Arcturus dealers. Cash in on it! "Go Arcturus!"

MAIL THE COUPON!

ARCTURUS

ARCTURUS RADIO TUBE CO., Newark, N. J. S-18
Without cost or obligation, send my copy of the
ARCTURUS DEALER HELPS Folder and details
of the ARCTURUS EQUIPMENT DEAL.

Name.....
Street.....
City.....State.....
 I am a dealer I am a serviceman. My
jobber is.....

For your convenience this coupon can be pasted on a penny postcard

when the set was shut off. As a result of these findings, full-time operation of the radio was inaugurated with definitely beneficial effect, as indicated by the manager's statement quoted above.

Except for occasional broadcasts of national interest, the radio fare is entirely musical as this was found best suited to the requirements of this particular plant. As shown in the photo, the equipment is installed in the manager's office with the loudspeakers mounted overhead at suitable points throughout the workroom. Volume is maintained at a level just high enough to overcome the noise of the machines.



The reader in an American plant is a Lafayette radio and 30-watt amplifier with the output distributed through six speakers.

Another example is found in the experience of the Hatch Hosiery Mills, Belmont, N. C. Here the work is of such a character that all types of radio programs are utilized. The practice is to keep tuned to the local station (WBT, at Charlotte) during the day but at night when distant stations are more dependable the night shift is given its choice of stations. J. Mack Hatch, president of the company, credits the radio installation with a 3 percent increase in production. Referring to it further in a recent conversation, he said:

"It is the finest thing in the world and the most effective method we have discovered for increasing the speed of work without the slightest inconvenience or burdening of workers."

Thus for the Service Man who dares to venture off the beaten path here is a relatively new field where radio-sound systems show results that can be measured in terms of dollars and cents; where the competition is less keen, the pay prompt and the profits worth-while.

FOR PROFITABLE SERVICING

Standardize on
CORNELL - DUBILIER
*Capacitors**



The most complete capacitor line with a unit for every service requirement. Send today for Catalog No. 161 describing capacitors for radio, television, amplifier, transmitter, facsimile and A.C. motor service applications.

*Both Radio Receiver and Refrigerator Motor Starting
WORLD'S LARGEST MANUFACTURERS OF CAPACITORS



**CORNELL-DUBILIER
ELECTRIC CORPORATION**
1026 Hamilton Blvd., So. Plainfield, N. J.
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**SEND US
50c
(IF YOU'RE GAME)**

A Radiart jobber will send you a complete Radiart "Performance Prover" Kit, including display and advertising supplies and a test device that shows the improved reception of Radiart's longer, better aerials, right on the customer's own car, through his radio. This convincing test takes only a couple of minutes.

IT SELLS AERIALS
(Profitable Aerials)

THE RADIART CORP.
133d at Shaw . Cleveland, Ohio

SEND STAMPS OR COIN
If you don't think it's worth 50c you can have your money back

OSCILLOSCOPE SPOTS HUM

(Continued from page 163)

pattern of No. 4. After removing this short circuit from the choke, one of the power supply filter condensers was disconnected. Such action produced a fairly loud hum and the tracing of No. 5.

After placing the receiver in normal condition again, the test leads were attached to the receiver voice coil to note the results from such position. With no signal in the receiver a horizontal line appeared. The filter condenser was disconnected once again and oscillogram No. 6 was noted, which also indicates a double wave or a plate power supply defect.

The filter condenser was reconnected in its circuit, and the 60-cycle line voltage was coupled to the radio frequency circuits of the receiver. Such coupling resulted in a hum whenever a station was tuned in.

The signal generator was placed in operation and connected to the receiver antenna and ground circuit in the usual manner with the controls adjusted for an unmodulated signal. The unmodulated signal and the hum voltage shown as pattern No. 7, a single wave or 60 cycle voltage, appeared.

Oscillogram No. 8 illustrates interference from an electric vacuum cleaner with the oscilloscope leads across the receiver voice coil and no other signal tuned in. No. 9 was made at the voice coil of an auto receiver which had an open filter condenser.

CRYSTAL CALIBRATORS

(Continued from page 166)

scribed. By the use of harmonic ratios, the number of calibration points can be increased. This is illustrated in the following table:

Oscillator Frequency	Oscillator Harmonic	Calibrator Harmonic Frequency	Calibrator Harmonic of 100kc.
200	4	800	8
210	10	2100	21
220	5	1100	11
225	4	900	9
250	4	1000	10
275	4	1100	11
300	2	600	6
1000	fundamental	1000	10
1025	4	4100	41
1050	2	2100	21
1075	4	4300	43
2000	fundamental	2000	20

Fig. 6 shows a typical correction curve for a direct reading signal generator. The curve was made by beating the generator output with that of the crystal calibrator in a superheterodyne receiver that had been properly aligned in advance. The deviation between the calibrator frequency and that



There's a brand new sector in the scale of instrument quality

SPEAKING of "English reading scales," there is a new sector at the top of testing instrument value today, and the name of this higher plane is SIMPSON!

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MODEL 215 — The first small instrument with big 4 1/2 inch meter. Five A.C. and D.C. voltage ranges — five decibel ranges — 0 - 10 - 100 - 500 milliamps; 0-250 microamps; 0-4000 - 400,000 ohms; 0-4 megohms.
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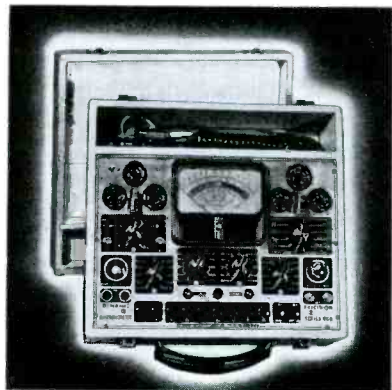
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PRECISION Series No. 900 "Laboratory Electrometer"

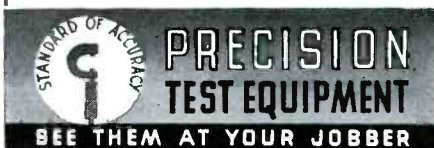
Tests all tubes including the new LOKTAL and SINGLE ENDED types. A MODERN "push-button" operated dynamic mutual conductance tube tester. Combined with a 25 multi-range A.C. and D.C. volt-ohm-decibel-milliammeter . . . plus a ten ampere range for complete point to point set analysis. . . . includes ballast test facilities. . . . A complete laboratory in compact form. Size only 12 x 12 x 6. **\$49.95** Net price



ELECTRONOMETER SERIES 510

An efficient modern tube analyzer capable of testing all types including the new LOKTAL and SINGLE ENDED tubes. . . . incorporates ballast test facilities. Usual PRECISION Standard of Accuracy and ability to accommodate FUTURE tube releases. Portable **\$29.95** hardwood case. Size 12 x 12 x 6. Net price.

All "PRECISION" testers include telephone cabling, wire wound shunts and matched metalized multipliers of 1% accuracy. . . . INDIVIDUALLY calibrated and checked against laboratory standards to maintain CLOSE ACCURACY. Catalog describing 12 models available upon request.



PRECISION APPARATUS CO.

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Export Dept., 458 Broadway, New York City, U. S. A.
Cable Address: MORHANEX

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indicated on the generator dial was recorded.

- • • additional applications

Quite often, with older type receivers, it will not be possible to obtain accurate tracking with the receiver dial calibrations. Through the use of the crystal calibrator the error at each frequency, if any, can be easily checked and a compromise made to distribute the errors over the dial scale.

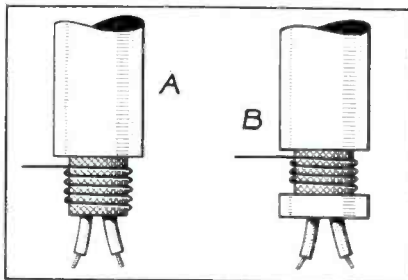
Occasionally one or more bands of a multiband receiver may have low sensitivity, or be dead, due to a poor contact in the band selecting switch. A rapid scanning of the entire receiver tuning spectrum can be made with the calibrator harmonics and any serious loss in sensitivity from one band to the other will be readily determined.

The crystal calibrator is a service tool of extreme value to Service Men who want more accurate receiver alignment with less effort and at an actual saving in time consumed. In some cases the calibrator can be used for the complete alignment of superheterodyne receivers, including i-f peaking, but it should be understood that this instrument cannot completely replace the usual form of signal generator. Once a Service Man becomes accustomed to using a crystal calibrator, he will be lost without it.

RUBBER-COVERED SHIELDED WIRE

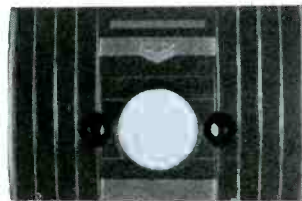
PERHAPS the commonest, and probably the worst, method of dealing with rubber covered shielded wire is that shown in Fig. A. Here, part of the braided shield wire is exposed, a length of the ground wire wrapped around it and solder applied so that the ground wire and shield make electrical contact. Very simple, but a constant source of trouble because strands of the braided shield work loose and result in a short circuit to ground. This can be partially, but not completely overcome by covering the ground and shield with rubber tape. (Never use ordinary friction tape in microphone circuits.) The objection to the use of rubber tape is that the resulting wire becomes too bulky. If small microphone plugs or

A simple, but unsatisfactory, method of finishing shielded wire is shown at A. An improvement is indicated at B.



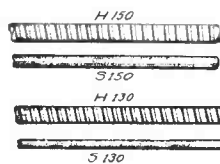
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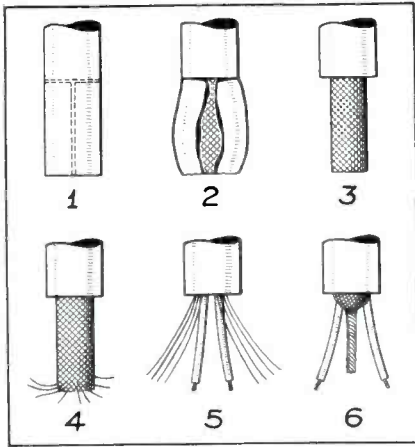
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A neat and professional looking method of dealing with rubber covered shielding.

connections are used, the rubber tape method cannot be used as there is insufficient room.

A rather neat method which is frequently useful is shown in Fig. B. A section of rubber insulation is cut away; a ring of rubber covering is left on the end of the wire, however, to prevent any possibility of the braid wires working loose. A wire is wrapped around the cleaned shielding, solder applied, and the groove filled up with rubber tape. This method, however, is not suitable for use with a small microphone plug.

A technique for manipulating rubber-covered shielded wire, which is not only neat in appearance and electrically very satisfactory, but also well adapted for use as the connection to microphone plugs and connectors follows:

- (1) Snip the rubber insulation around its circumference and then straight down toward the tip of the wire.
- (2) Tear this rubber covering off with the aid of the snips.
- (3) Remove all of the cloth insulation; there then results a section of clear shielding.
- (4) Insert a scriber, or other pointed instrument under the first few strands of the braided shielding and pull the scriber toward the tip of the wire, thereby unbraiding these few strands. Give the wire a quarter turn and repeat the operation. Continue loosening a few strands each time the wire is given a quarter turn until the shield wires have all been unbraided down to the outer rubber base. (In performing these operations great care should be taken not to get the scriber point underneath the strands of the braided cloth which lies beneath the braided shield wires. For, if this cloth covering is penetrated, the cloth threads will also become intermixed with the shield wires. This is undesirable as it is difficult to separate the cloth threads from the shield wires.)
- (5) Push the unbraided wire back so as to be out of the way. Execute the unbraiding operation on the cloth in-

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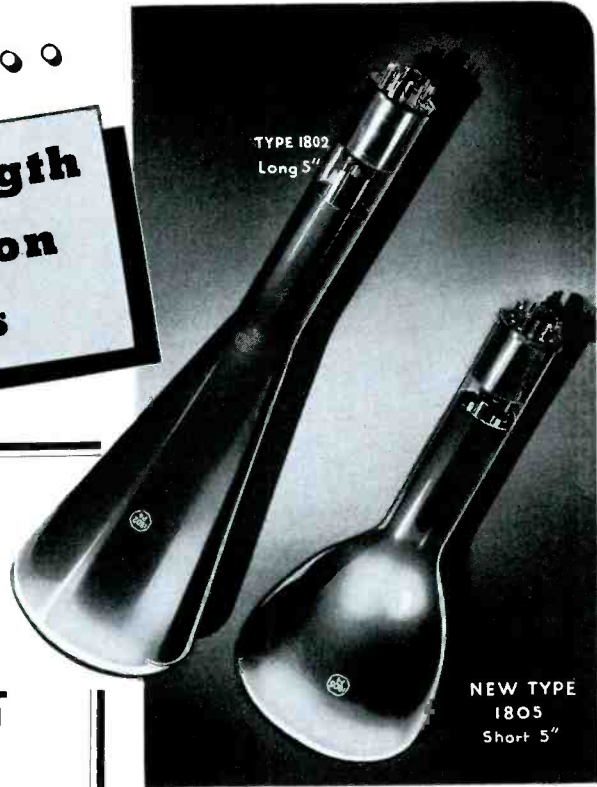
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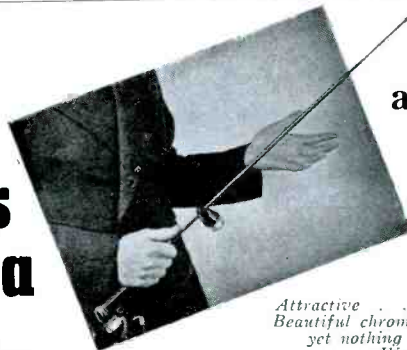
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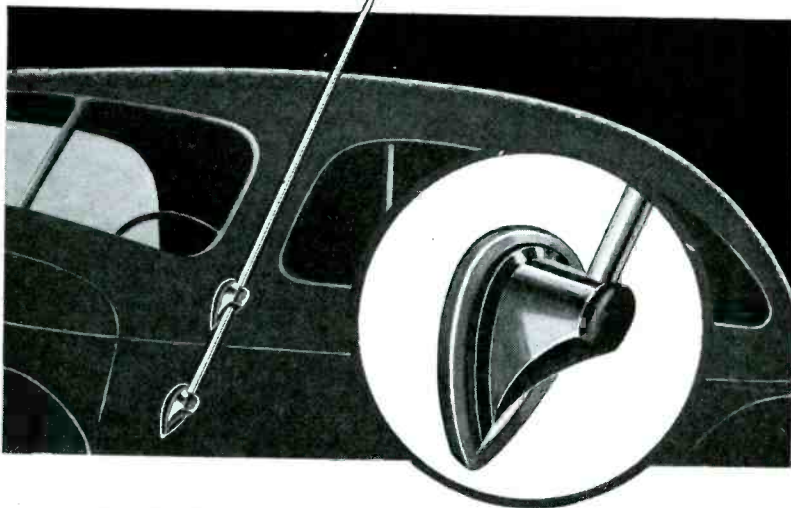
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sulation. Cut off the unbraided cloth threads and also the filler cords close at the base.

(6) At the base cut off, if necessary, $\frac{1}{2}$ to $\frac{3}{8}$ of the untwisted wire braid, depending upon the size of hole into which they are to go. Then, starting at the base, tightly twist the remaining unbraided wire. This twisted wire, which is actually an extension of the shielding, should be connected to the ground terminal of the microphone plug or connector.

It will be observed that a clean, professional looking job results, and, what is even more important, the likelihood of stray wires, which cause so much trouble in microphone circuits, is greatly minimized.

D. Bee.

CHRYSLER 1939 AUTO-RADIOS

Installation notes on Chrysler custom auto radio for Plymouth; Dodge; DeSoto; and Chrysler cars: Before installing the center-mounted 1939 model custom radio, remove the plate which covers access to the push-button tuning adjustments to the right of the radio grille on the instrument panel. Be very careful in removing this plate. Due to variations, some plates will be harder to remove than others. The harder-to-remove ones usually break where they are fastened, and much time is lost in overcoming the difficulty.

To be certain that the pins which hold the plate do not break off, push the pins from the rear of the instrument panel, *do not push the plate.*

After following the manufacturer's instructions it has been found necessary to readjust all push-button tuning adjustments a few minutes after the initial adjustments have been made, the necessity exists regardless of how long the set is allowed to warm up further than the specified twenty minutes. The care taken in the adjustments, and the additional time spent in repetition will be compensated for, by the resulting performance of the receiver. Customer satisfaction will be gauged directly by the results of the accuracy of those adjustments.

When the entire installation is complete, and one is certain that the adjustments are right, it is advisable *only then* to replace the cover plate on the instrument panel. *It is strongly recommended to first remove the radio before attempting to remove the plate mentioned which should be removed as described.*

Eugene Triman

WELLS-GARDNER A-C, D-C SETS

To reduce surge voltages: A 25-ohm resistor has been added in series with the plate circuits of the 25Z6G rectifier tube. This resistor will reduce voltage surges and will serve as an added protection both to the electrolytic condenser and the rectifier tube.

BOOK REVIEWS

RADIO TROUBLE-SHOOTER'S HANDBOOK, by A. A. Ghirardi, published by Radio and Technical Publishing Co., 45 Astor Place, New York City, 1939, 518 pages, price \$3.00.

An enormous amount of work must have been entailed in compiling the fifty-two sections which comprise this encyclopedic volume. The magnitude of the labor involved may perhaps be appreciated when it is realized that the case histories of more than 3,300 receivers are given, as well as the intermediate frequencies of over 15,000 superheterodynes.

A large amount of information is given for auto-radios, for example, an auto-radio trouble-shooting chart, gear ratios and dial directions of auto-radio tuning controls, data on auto-radio installation, car ignition data chart, the elimination of persistent auto-radio ignition interference for 76 car models, and the electrical wiring diagrams of 107 automobile models.

Hard to find information such as the servicing of portable sound recorders as well as the servicing of intercommunicator systems are contained in this book.

Data is given on a host of subjects, including coils, condensers, resistors, transformers, filters, decibels, dial lamps, ballast resistors, and vacuum tubes. At this point attention should be called to an omission appearing on page 441. In the second paragraph no mention is made that the numeral 1 designates 1.4 volt tubes as well as 2-volt tubes.

The book is highly recommended.

R. L.

RADIO'S MASTER ENCYCLOPEDIA, 1939 edition, published by the United Catalog Publishers, 258 Broadway, New York City, 1938, 670 pages, price \$2.50.

This book is somewhat misnamed, since in reality it is a master catalog and not an encyclopedia. However, it does contain a comprehensive listing and description of the products of practically all important manufacturers in the industry. Illustrations, technical information and prices are provided. Prices shown are list in every case. Inconspicuously, at the bottom of each page the Service Man's discount is indicated in code.

A classified directory at the beginning of the volume gives the names and addresses of the various manufacturers of parts and accessories, alphabetically by products. This should prove valuable as an exhaustive buyer's guide.

Indexing and cross indexing is exceptionally good.

The volume is highly recommended.

R. G. H.

TRADE SHOW

THE number of booths at the Radio Parts Industry Show, Stevens Hotel, Chicago, June 14 to 17, inclusive, continues ahead of last year's record. The records, as of April 1, showed only 25 booths available.

Special trains, chartered buses, and motor caravans will supplement the regular methods of travel as the Radio Parts Industry makes its annual trek to the Show.

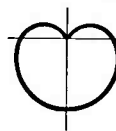
The Show office has been advised that arrangement for the Radio Industries Special, leaving New York and Boston, are again in the hands of Perry Saftler, Manufacturers' Agent, in New York City.

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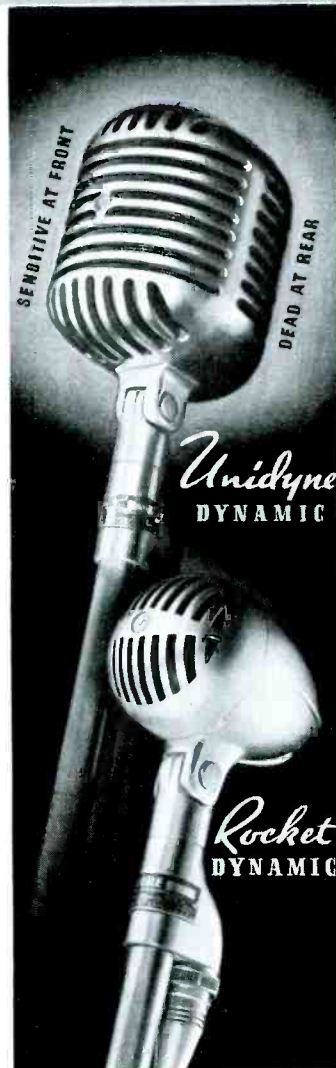
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SWAGING TOOLS

(Continued from page 170)

ing is given a quarter turn. This makes four indentations.

• • • **star swager**

The Star cable swaging tool is designed to mount in practically any small vise. Pressure for swaging and cutting is applied by means of sharp blows with a hammer at the end of the swaging die. (See Fig. 1.)

The device will operate on either 0.130- or 0.150-in. shaftings. It will remove any fitting from old cables without destroying it. It will give a fairly good swage, down to the fourth layer. The tool is also equipped with a device which will clamp or swage old fittings to either shafting or casings.

• • • **know your tool**

Any tool will accomplish its best results, most efficiently, if properly used. To become adept in working with remote control cables you should devote some time to a careful study of the functions of the particular cable replacing tool which you use.

In preparing this short article, the Editor extends his appreciation to J. F. D. Manufacturing Co., and the Star Machine Manufacturers, Inc., for supplying the information upon which this article is based.

AMCON CONDENSERS

American Condenser Corp. have announced a line of high voltage paper condensers sealed and impregnated by new methods. These units are designed for heavy-duty work in transmitters and in industrial applications. They are equipped with ceramic, power-house type insulators and connections.

Additional information may be obtained from *American Condenser Corp.*, 2508 S. Michigan Ave., Chicago—SERVICE.

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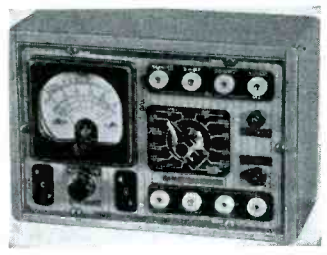
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Tests according to RMA specifications at rated voltages and loads.

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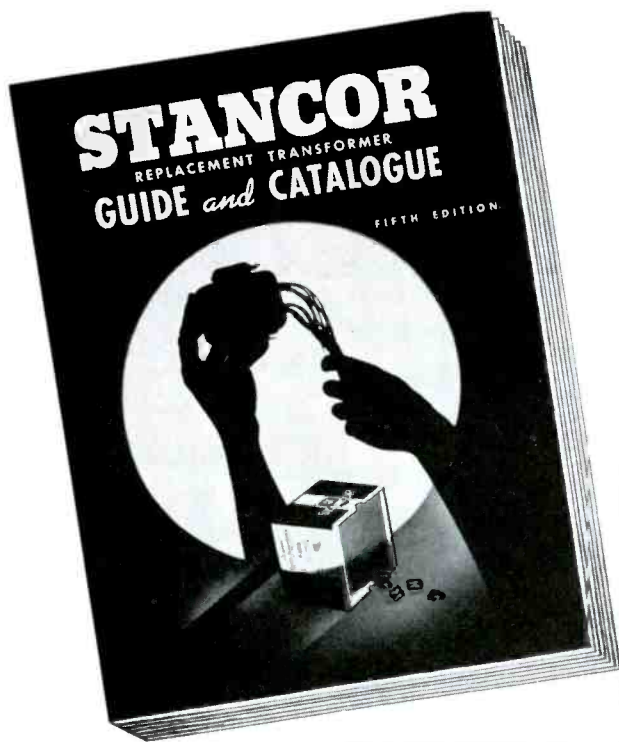


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Every Service Man should have the new 1939 STANCOR Guide and Catalog. It is the most valuable replacement transformer guide ever compiled . . . has many new features, additional items and increased listings . . . it saves time.

This new **ALL-IN-ONE** Replacement Guide and Catalog contains:

- Lists all Transformer and Choke requirements for popular radio models, including 1939 models.
- Listings from Rider manuals and original factory service notes, to assure accurate physical as well as electrical characteristics.
- Correct tube listings for all sets.
- All prices shown—no need to refer elsewhere.
- Output chart—instantly shows correct unit with any available tube—exclusive.
- The only 100% replacement transformer service.
- Additional listings to the famous Type-M Transformer line—the industry's most popular power replacement.
- Lists new Universal Motor-Winding Power Transformers—exclusive.
- Lists new complete line of Universal Output Transformers.
- Only complete uncased audio line, from 1/2" to 1" cores with all ratios available.
- Small uncased driver transformers, the hard-to-find kind.
- Exact duplicates.

Ask your jobber for your **FREE** copy today or write us.

STANDARD TRANSFORMER CORPORATION

1500 N. Halsted Street, Chicago

AUTO-RADIO DATA

(Continued from page 176)

Detrola Detrola Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
6A	6	*	*	*	262
6M	6	1935	8/1	CCW	262
6R	6	1935	8/1	CCW	262
111	5	1936	12/1	CCW	262
112	6	1936	12/1	CCW	262
166	5	1937	12/1	CCW	456
171	*	1937	12/1	CCW	262
Roadchief	5	*	*	*	*
Roadmaster	5	*	*	*	175

De Soto

See Chrysler

Disregard letter prefixes on set model numbers.

DeWald Pierce-Airo Inc. (Radio Company)

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
52	5	1934	6/1	CW	175
54, Dynette	5	1935	1/1 ²	CW	TRF
61, 61X	5	1935	6/1	CW	456
517, 517LW	5	1936	6/1	CW	455
527	5	1937	8/1	CW	456
605	6	1936	6/1	CW	175
605R	6	1936	6/1	CW	175
606	6	1935	6/1	CW	175
607	6	1935	6/1	CW	456
608	6	1935	6/1	CW	177.5
617	6	1937	8/1	CW	175
640	6	1934	6/1	CW	175
702	6	1937	8/1	CW	175

Dodge

Use same listings as Chrysler and disregard prefixes.

Electric Auto Lite Electric Autolite Co.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
11	6	*	*	*	TRF
062A	6	*	*	*	262
072A	7	*	*	*	262
3622A	6	*	*	*	262
3722A	7	*	*	*	262

El Rey

El Rey Radio Mfg. Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
A	6	*	*	*	465
C	5	*	*	*	465
15	5	*	*	*	465

Emerson

Emerson Radio & Television Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
1A	*	1935	10/1	CW	175
5A	5	1935	10/1	CW	172.5
6A	6	1935	10/1	CW	172.5
667	7	1935	6/1	CW	172.5
678	5	1935	6/1	CW	172.5
965	5	1935	6/1	CW	172.5
E128, F122, F133, G135, F141, G127	6	1935	10/1	CW	172.5
U154	6	1937	16/1	CW	262.5
V155	8	1937	16/1	CW	262.5

Erla, Sentinal

Electrical Research Labs.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
7M	6	*	*	*	465
10M, 10MF	5	*	*	*	370
11M	6	*	*	*	465
520	5	*	*	*	175

521	5	*	*	*	175
600	6	*	*	*	265
601	6	*	*	*	265
602	6	*	*	*	265
603	6	*	*	*	265
4400	4	*	*	*	370
5500	5	*	*	*	370

Fada-Motoset
Fada Radio & Electric Co.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
101, RK	7	*	*	*	175
102, RP	7	*	*	*	175
104	6	*	*	*	470
104B, RV	6	*	*	*	175
166	6	*	*	*	175
266	6	1936	16/1	CW	175
267, 267X	*	1937	16/1	CW	*

Fischer Smith
Fischer & Smith

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
40	5	*	*	*	TRF
42	5	*	*	*	TRF
50	6	*	*	*	TRF
62	6	*	*	*	175
71	7	*	*	*	262
72	6	*	*	*	262
74	7	*	*	*	262

Ford
Philco Transitone Corporation

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
1440	6	1937	16/1	CW	260
1442	6	1937	16/1	CW	260
1540	6	1938	16/1	CCW	260
1640	6	1939	16/1	*	470
N	6	1934	*	*	260
T6	6	1935	16/1	CW	260
T9	6	1936	16/1	CW	260

Grigsby-Grunow Co.

111	6	1932	*	*	175
111-40	6	1933	*	*	175
113	6	1933	*	*	175
118	6	1934	*	*	175

Zenith Radio Corp.

5690	6	1934	*	*	262.5
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Franklin
Franklin Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
100	6	*	*	*	175
200	6	*	*	*	177

Freed-Eisemann
Freed Television & Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
A7	4	*	*	*	456
A9	6	*	*	*	456
464	6	*	*	*	*

Garod
Garod Radio Corp.

Model	Tubes	Year	Gear Ratio	Dial Direction ¹	I-F
G-6	6	*	*	*	175

Grunow
General Household Utilities

Model	Tubes	Year	Gear Ratio	Dial Direction	I-F
614, 618	6	1936	16/1	CCW	262
625	6	1936	16/1	CCW	262

¹CW denotes clockwise rotation, CCW, counterclockwise. By clockwise rotation is meant that receiver is being tuned to a higher frequency when the dial scale or pointer rotates in a clockwise direction when viewed from the front of the control head.

²No remote control is used.

*Information not readily available.

(To be continued)

DEALER'S NAME



COMPLETE
RADIO
SERVICE

We Recommend

SYLVANIA SET TESTED RADIO TUBES

GET THIS **ELECTRIC**
CLOCK SIGN
FOR YOUR STORE

AFTER MONTHS of searching and testing, we are at last able to offer an electric clock sign that is high in quality—yet low enough in price to meet Mr. Average Serviceman's needs.

Done in rich colors and satin-finished metal, this clock sign will add a real note of distinction to your shop—will draw more attention and business to your place. The sign is illuminated with two light bulbs controlled by a separate switch, while the clock itself is run by a dependable, self-starting movement. Available in 20" x 13½" size—at \$6 with imprint in top panel, \$5 without imprint. Send the coupon today—or see your Sylvania jobber.

SYLVANIA SET-TESTED
RADIO TUBES

ALSO MAKERS OF HYGRADE LAMP BULBS.

Hygrade Sylvania Corp., Emporium, Pa. S-49

Send me..... Sylvania electric clock signs, with imprint , without imprint . I enclose \$.....
 Not ready to buy now, but send your circular giving complete information.

IMPRINT (please print).....

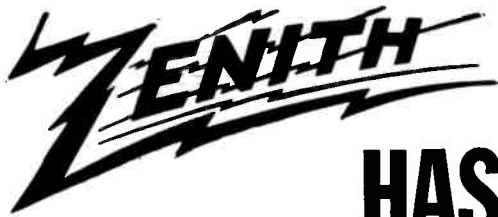
NAME

ADDRESS

CITY..... STATE.....

NAME OF JOBBER.....

RADIO DEALERS!



HAS TELEVISION SETS

ZENITH'S television transmitting station W9XZV is operating daily and is the only television transmitter licensed by the Federal Communications Commission in the whole Chicago area.

Today ZENITH'S television receivers are loaned . . . not sold.

ZENITH IS READY-- BUT TELEVISION IS NOT

Even government television standards are not yet established.

The Federal Communications Commission, in its annual report to Congress in January this year, stated: "However, it is generally agreed that television is not ready for standardization or commercial use by the general public."

ZENITH believes it is UNFAIR to the public and KNOWS it is UNFAIR to the dealers to ask them to finance the television industry's experiments.

RADIO DEALERS have been penalized and punished by premature television publicity starting last Fall.

Prospects were led to believe that television would cover the country overnight.

ZENITH will not break faith with its dealers.

When ZENITH believes television is ready for general use in the store and the home . . . ZENITH will supply you with television receivers and not before.

President,
Zenith Radio Corporation

April 5, 1939

Radio's MASTER ENCYCLOPEDIA

The Radio Industry at your Finger tips

REFERENCE BOOK
•
BUYING GUIDE
•
SALES CATALOG
•
ENCYCLOPEDIA

1939 EDITION—OVER 600 PAGES

THE ONLY OFFICIAL EQUIPMENT MANUAL of the Radio Industry!

Illustrations—Specifications—Prices

Compiled in cooperation with and approved by Radio Manufacturers, this authentic source book of over 600 pages is crammed full of vital, essential information that is indispensable to everyone identified with Radio and allied lines.

GIVES THIS IMPORTANT DATA

The New 1939 Edition of Radio's Master Encyclopedia is the most comprehensive ever issued. No other book like it. Important data that you need in your business—conveniently cross-indexed for split-second reference. Thousands of illustrations, specifications and prices on every conceivable type of Equipment, Accessories, Parts; ranging from Tubes to Transmitters, and including the latest in television tubes and parts.

Contains Directory of over 1000 Manufacturers, where located and what they make—gives index of trade names.

UNIVERSALLY USED

Used and accepted as the Official Manual by the Radio Industry, Schools, Colleges and Governmental Agencies. The Service Man and Dealer will find the encyclopedia a valuable aid in soliciting business whether it be a quotation on a replacement part or a complete amplifying system. Only List Prices are shown, so that the book can be readily opened before the prospective customer.

SAVES TIME—SAVES MONEY

Radio's Master Encyclopedia is truly a complete Radio and Equipment Manual all bound under one cover taking the place of files and files of miscellaneous catalogs and information. WHERE—WHAT—HOW MUCH, instantly at your fingertips! Thousands in everyday practical use proving invaluable and unsurpassed as a REFERENCE BOOK, SALES CATALOG or BUYING GUIDE.

MONEY BACK GUARANTEE!

Radio's Master Encyclopedia, now in its third year, has served the industry well. That's why, with complete confidence we are ready to send it to you on an absolute "Money Back in 5 Days" Guarantee. If you are not 100% satisfied. To save the cost of transportation, send your remittance with order.—\$2.50 in U.S.A., \$3.00 Elsewhere. Or if you prefer, we will ship C.O.D., plus postage charges—in either case, our "Money Back in 5 Days" is your assurance of complete satisfaction.

UNITED CATALOG PUBLISHERS INC.
7 WARREN STREET, NEW YORK, N. Y.

RCA WAVE TRAP

A small multi-range wave trap which protects receivers against unwanted interference has been announced by the RCA Mfg. Co., Inc. The new unit has an average attenuation of 40 to 1 over the frequency range of 45 to 2100 kc. The unit is tuned by means of a magnetic core which provides a simple linear and permanent adjustment.

Additional information may be obtained from *RCA Mfg. Co., Inc.*, Camden, N. J.

ROSE ANTENNA

A streamlined, stainless steel over the top auto antenna has been introduced by



Frank Rose. Additional details can be obtained directly from the manufacturer, *Frank Rose Mfg. Co.*, Hastings, Neb.

HICKOK TUBE TESTERS

Hickok dynamic mutual conductance tube testing equipment, including Models 51X, T53P, T53C and 5348 have been revised to test loktal tubes, plug-in resistors, 50-volt tubes and pilot lights. A noise tester is also included on these instruments.

Additional information may be obtained from *Hickok Electrical Instrument Co.*, 10520 DuPont Ave., Cleveland, Ohio. Write for catalog No. 10.—SERVICE.

SPEEDEX WIRE STRIPPER

The Speedex wire stripper is a hand tool designed to skin the ends of insulated wire without damage to the wire. It will operate on solid or stranded wire in sizes from 12 to 20.

Additional information may be obtained from the manufacturer, *Wood Specialty Mfg. Co.*, Box 632, Rockford, Ill.—SERVICE.

BELL TALK-BACK

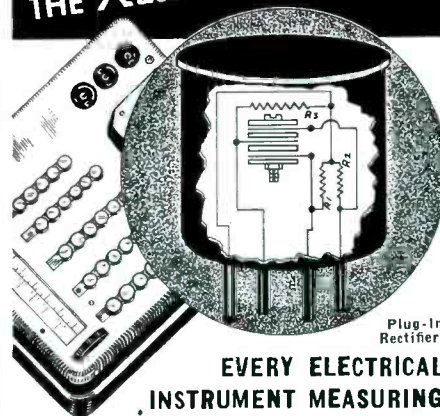
The latest Bell Sound talk-back system is designed chiefly to fill the requirements of schools, colleges and commercial establishments. It provides radio, phonograph



or voice amplification as well as intercommunication with as many as 40 outlying stations. An 8-in monitor speaker, a 25-watt amplifier, radio tuner and phono turntable and pickup are provided at the master. The 40 outlets are controlled by key type individual switches and also a master for emergency use.

For additional information write to *Bell Sound Systems, Inc.*, 1183 Essex Ave., Columbus, Ohio.—SERVICE.

THIS Little DEVICE HAS CHANGED THE Radio Tester World



Plug-In Rectifier
EVERY ELECTRICAL INSTRUMENT MEASURING A C. VOLTAGES AT HIGH RESISTANCE SHOULD HAVE IT

• Previous Problem:

Deactivation of copper oxide rectifiers caused by overloads, caustic gases or humid atmospheric conditions prevalent in every locality at some period of time has heretofore necessitated the complete recalibration of the tester circuit in which the rectifier was incorporated on insertion of a new copper oxide rectifier. In most cases this meant return of the complete tester to the factory, with its attendant delay and expense.

• Triplett's Answer:

A plug-in unit incorporating a new copper oxide element precalibrated to a factory standard and thus when plugged into the tester gives you factory calibration. As simple as plugging in a tube. Obtainable through jobber or direct. Rectifier elements are the best obtainable—completely sealed for maximum protection against humidity and caustic gases. The great practicability of this little device has in truth changed the Radio Tester World.



These and Other MODELS have Plug-In RECTIFIERS



MODEL 1601
DE LUXE
SET TESTER

Complete in Leatherette Case
DEALER NET PRICE \$49.33. In Metal Case. DEALER NET PRICE \$45.33.

MODEL 1611
PUSH-BUTTON
TUBE-TESTER
AND VOLT-OHM-
MILLIAMMETER

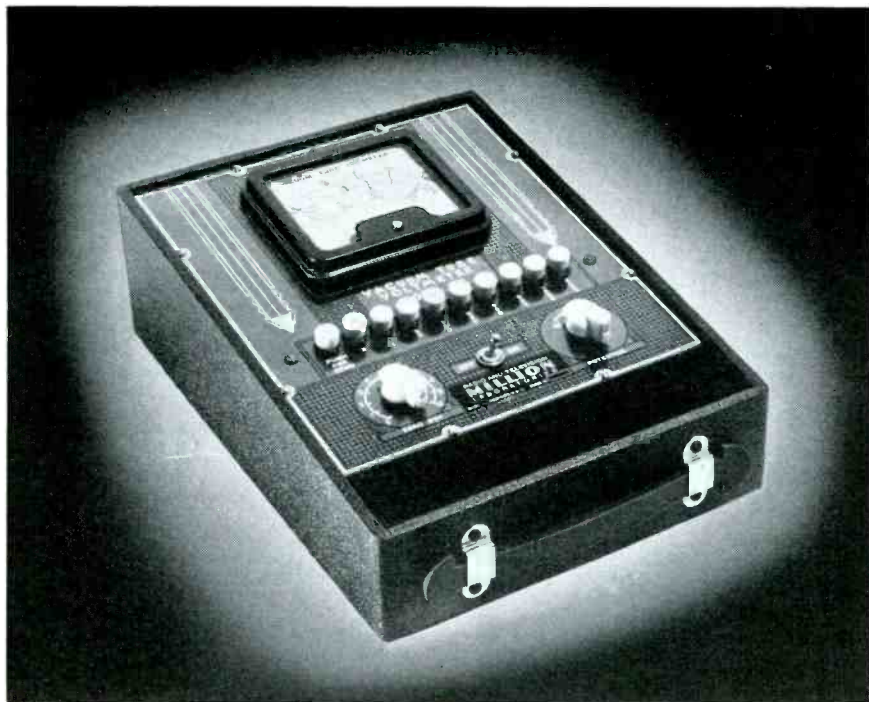
Complete in Metal Case DEALER NET PRICE \$49.50.



See the new Triplet 1939-40 line at the June National Radio Parts Trade Show BOOTHS 403-405

THE TRIPL'ETT ELECTRICAL INSTRUMENT CO.
174 HARMON AVE., BLUFFTON, OHIO





MILLION GIVES YOU THE FIRST VACUUM TUBE VOLTMETER

- TO READ FROM .1 TO 3000 VOLTS
- WITH NINE SEPARATE SCALES
- HAVING PUSH-BUTTON SELECTION

— and costing only —

\$24.95

NET

Scientifically designed to provide portable multi-meter convenience. Measures any type of voltage. Values of DC, RF or AF potential determinations are simply and conveniently made without disturbing the circuit under test. Coaxial cable input to 24 megohm divider. 24 megohm input resistance on all ranges. The circuit is of the half-wave type, in a fixed bias arrangement, having a self-contained source of buck-out potential—with only one control for the zero adjustment. Panel mounting. External multipliers will extend range to 12,000 volts.

Measures Any Type of Voltage
In its design line voltage changes are minimized due to the regulated power supply. The instrument is calibrated to read the RMS or effective value of a wave. The harmonic content of a voltage will not affect the measurement more than —5% to +12% with a 50% second harmonic or total of +12% with a 50% third harmonic content. Complete with cover. MODEL XM-DEALERS NET CASH PRICE \$24.95

MILLION TUBE TESTERS

All Million Tube Testers have built-in Loctal sockets. Older models can be modernized. Write for prices.

MILLION RADIO and TELEVISION

671 W. OHIO STREET

CHICAGO, ILLINOIS



B9 CRYSTAL
LIST \$22.50

D5T DYNAMIC
LIST \$32.50

D6T DYNAMIC MICROPHONE

A sturdy, Multi-use, Quality Microphone, with Higher Output and advantageous Directivity Characteristics.

Output level —46, usable range 30-7000 cps.

D6T, High Imp., **\$27.50** D6, Low Imp., **\$25**

Including Cable

General catalogue describes other attractive models. Request copy.

AMERICAN MICROPHONE CO., INC.
1915 So. Western Ave., Los Angeles, Calif.

VALPEY

Type DFS, 100- and 1,000-kc crystal, mounted in a compact bakelite holder with embossed cover, especially designed for use with a crystal calibrator

Net Price \$7.25

THE VALPEY CRYSTALS

BOX 321

HOLLISTON, MASS.

HOW DO YOU DO IT?

How do you solve the many servicing problems with which you have to contend . . . what special kinks have you worked out which help you in servicing receivers . . . have you developed shortcut schemes for testing, or built test devices that do the work better and faster? No matter what the scheme or the device, there are many Service Men who would like to know the how's and why's—just as you would like to know about the schemes and devices employed by others. All you have to do is give us the outstanding points, and a rough pencil sketch of the device if it happens to be such—and we will do the rest. Write up those ideas now and send them into the . . .

SERVICE — ON THE JOB DEPARTMENT — 19 E. FORTY-SEVENTH ST., NEW YORK



PERMEABILITY TUNING IS HERE

SEND FOR
Free Book!

Q CONTROL
TRADE-MARK

ALADDIN RADIO INDUSTRIES, INC.
466 WEST SUPERIOR STREET
DEPT. D.
CHICAGO, ILLINOIS

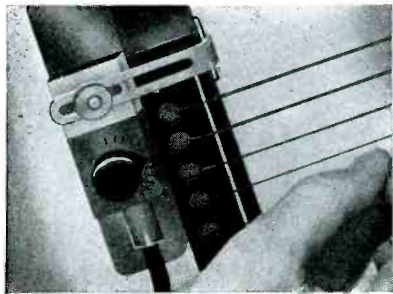
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2,018,626
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Other patents issued and pending.

MANUFACTURERS

(Continued from page 205)

KONTAK UNIT

With the new Amperite Kontak unit with hand volume control, Model KKH, the volume can be adjusted at the instrument. Any number up to five of these units can be connected in parallel. A T-pad connection is used in the volume control. The output



of the Kontak unit is —40 db. Further information may be secured from *Amperite Co.*, 561 Broadway, New York City.—SERVICE.

HIGHLIGHTS

THORDARSON ENCYCLOPEDIA

A new supplement to the Thordarson Replacement Transformer Encyclopedia No. 243, No. 243-D, gives complete information regarding replacement power transformers, filter chokes, audio or output transformers for all 1938-1939 receivers as listed in Rider's Manual, Vol. IX.

Copies may be secured free of charge from the Thordarson Electric Mfg. Co., 500 W. Huron, Chicago.

TUNER DETAILS

Aladdin Radio Industries, 466 W. Superior St., Chicago, have issued a 12-page instruction booklet featuring the Aladdin Q control permeability tuner. The unit is a 5-tube permeability-tuned superheterodyne tuner with its own power supply.

Copies of the instruction booklet may be obtained directly from Aladdin Radio Industries.

IRC GUIDE

International Resistance Co., Philadelphia, Pa., have issued edition No. 2 of their "Volume Control Guide" and catalog. The 130-page guide contains an alphabetical listing of replacement controls as well as an IRC numerical list for identification.

Copies may be obtained directly from IRC.

TELEVISION CAPACITOR BULLETIN

Solar Manufacturing Corp., 599-601 Broadway, New York City, have issued a bulletin dealing with their line of television capacitors. Five different types of special paper capacitors are listed. Copies of the bulletin are available from the above organization.

STANCOR GUIDE AND CATALOG

The latest edition of the Stancor "Replacement Transformer Guide and Catalog" is available directly from Standard Transformer Corp., 1500 N. Halsted St., Chicago. The guide lists exact duplicates as well as universal replacements for popular receivers up to and including 1939 models.

C-D HOUSE ORGAN

Volume 2, No. 4 of the Cornell-Dubilier house organ, The C-D Capacitor is now available. Copies may be obtained directly from Cornell-Dubilier Electric Corp., S. Plainfield, N. J.

TRIPLETT CATALOG SHEETS

Triplett Electrical Instrument Co., Bluffton, Ohio, have released catalog sheets Nos. 51-T and 51-I. These sheets include current items and several price changes. Copies may be obtained directly from Triplett.

N. U. JOB CARD

The National Union Radio Corporation's "4-in-1" job card—the firm's latest dealer aid—utilizes a single printed piece slightly larger than a baggage tag to carry out several tasks.

Perforations separate the card into three parts which include a job ticket to be attached to the set or chassis taken to the shop for repair, a receipt form (the back of which later serves as a guarantee form) and a job record card of standard 3 by 5 in. file size. The record card provides for entering detailed information regarding work done, when, how and how much. This data enables the dealer to intelligently answer complaints, handle future jobs and follow up for more business. Additional details may be obtained from National Union Radio Corp., Newark, N. J.

UNITED CATALOG TO MOVE

Effective May 1, United Catalog Publishers, Inc., will be located at its new and larger quarters, 230 Fifth Ave., New York City. Samuel Roth, president, states that expanding business has made this move necessary.

In addition to its special catalog service for radio jobbers throughout the country, United Catalog Publishers is the publisher of "Radio's Master Encyclopedia."

KENYON CATALOG

The Kenyon Transformer Co., 840 Barry St., New York City, have issued a 14-page catalog describing their T line of transformers. The catalog features new apparatus with price revisions, with diagrams showing various power supplies and a complete chart of driver and modulator combinations. Also various circuit diagrams of speech and audio equipment with complete circuit constants.

Copies may be obtained directly from the manufacturer.

TEST EQUIPMENT

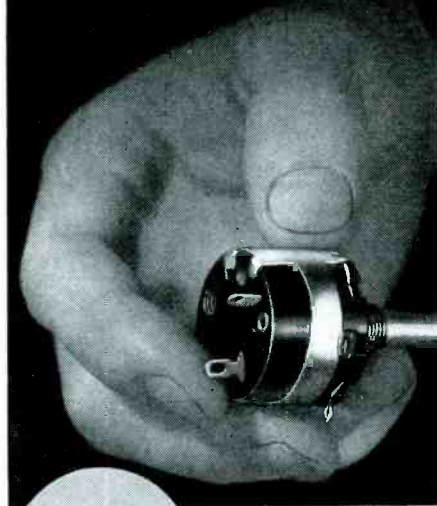
The Approved Technical Apparatus Co., 57½ Dey St., New York City, have issued a catalog of their test equipment for the Service Man. Copies may be obtained directly from Approved Technical Apparatus Co.

SPRAGUE REPLACEMENT CATALOG

The problem of duplicate condenser replacements receives full attention in the new Sprague condenser catalog, copies of which may be obtained from the Sprague Products Co., North Adams, Mass.

Besides the long list of exact duplicate replacements included in the Sprague catalog, the manufacturer will supply any duplicate replacement promptly. To obtain the proper unit it is necessary to give the set manufacturer's name, part number on the original condenser, the capacity, voltage, dimensions and state whether it is a can or cardboard type.

Because it's
a CLAROSTAT



Accurate

Mechanically, the product of tool makers and machinists second to none in industry. Electrically, the experience of two decades of specialization.

One-piece sliding contact of special alloy, working on new composition element under proper pressure. Positive conduction throughout. Smooth resistance changes in tapers. Comparative noise tests invited.

Noiseless

Permanent

Negligible resistance change even after cycling 10,000 times. Antenna and C-bias control still perfect after 28,000 cycles.

New element virtually immune to humidity and climatic changes. Humidity-chamber tests prove it. Heavily cadmium-plated metal parts. Tight-fitting casings.

Impervious

Profitable

All of which, PLUS the CLAROSTAT Service Manual, means picking out the right replacement for a stay-put profitable job. Ask local jobber about it—or write us direct. New 1939-40 Manual on request.

See us at Booth 620-622 Hertz Ave., Radio Parts Manufacturers National Trade Show

CLAROSTAT

MANUFACTURING CO.
Incorporated

285 North Sixth St.
Brooklyn, N. Y.

OHMITE

"DIVIDOHMS"

Quickly Adjustable to
Exact Resistance



You're ready for any wire-wound resistance requirement or a quick replacement—when you have Ohmite Adjustable Dividohm Resistors handy in your kit. You can quickly adjust the Dividohms to the exact resistance you want and put on one or more taps wherever needed. Available in 7 ratings from 10 to 200 watts; resistances up to 100,000 ohms. Patented percentage of resistance scale. Time-proved Ohmite all-porcelain wire-wound, vitreous enamel construction insures unflinching service.

Ask your Jobber or Write for Catalog 17

Ohmite Manufacturing Co.
4877 Flournoy Street, Chicago, U. S. A.

Be Right with **OHMITE**
RHEOSTATS • RESISTORS • TAP SWITCHES

1934-1939 PANEL KITS



COMPLETE STOCK

of

STEWART AUTO RADIO CONTROL HEADS and FITTINGS for CUSTOM INSTALLATIONS.

Standard equipment for RCA, G.E., Zenith,
Wells-Gardner, etc.

Write for new illustrated catalog.

SYLVAN - WELLINGTON, Inc.
353A Canal Street New York, N. Y.

A GOOD NAME GOES A LONG WAY



The Ken-Rad name has stood for many years for the finest and most technically advanced radio tubes. Ken-Rad Radio Tubes are dependable.

KEN-RAD TUBE & LAMP
CORPORATION
Owensboro, Kentucky

KEN-RAD

DEPENDABLE RADIO TUBES

SIMPLIFIED



Receiver ALIGNMENT

The alignment of multi-band radio receivers is greatly simplified with a Crystal Calibrator. This inexpensive instrument not only minimizes time and effort, but also assures frequency accuracy. For a rapid over-all check of sensitivity and alignment, it has no equal.

Requiring only a few standard parts, a Crystal Calibrator can be easily constructed with a Bliley SMC100 Dual-Frequency Crystal Unit. Leading distributors will supply the Bliley SMC100 Unit for only \$7.75. Bliley Electric Co., Erie, Pa.

BLILEY DUAL FREQUENCY CRYSTAL

SAVE \$1.00!!!!

- The Group Subscription Plan for *Service* enables a group of service men, dealers or jobbers to subscribe at one-half the usual yearly rate.
- The regular individual rate is \$2.00 a year. In groups of 4 or more the subscription rate is \$1.00 a year (in foreign countries, \$2.00).
- The service departments of thousands of dealers, independent service men, etc., have used this Group Plan for years, in renewing their subscription to *Service*.
- Each subscriber should print his name and address clearly and state his occupation—whether a dealer, jobber, independent service man, service organization, etc.

Remember this Group Plan when
Your Subscription Expires

SERVICE

19 EAST 47TH STREET, NEW YORK, N. Y.

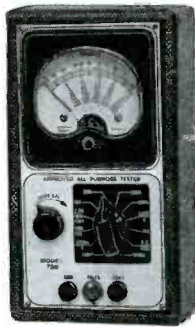
Solve your instrument problem with A. T. A.

710 SELECT-O-TESTER

Acclaimed as the greatest buy ever offered to the serviceman. 3" D'Arsonval meter at 1000 ohms per volt assures 2% accuracy. Fifteen separate tests available: 0/2.5/10/25/50/100/250/500/1000/2500 Volts D.C. 0/10/100/1000 Mills D.C. 0/2500/25,000/250,000 ohms.

With Prods and Battery

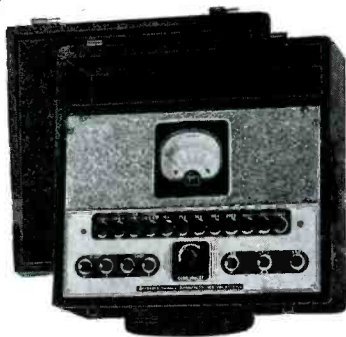
\$5.85



MODEL 720 A.C. D.C. SELECT-O-TESTER

Similar to above but also includes the following ranges: 0/15/150/1500 Volts A.C. 0/15/150/1500 Output indicator —10 to plus 19/38/53 db. Complete only

\$7.85



1200E PUSH BUTTON SELECT-O-TESTER

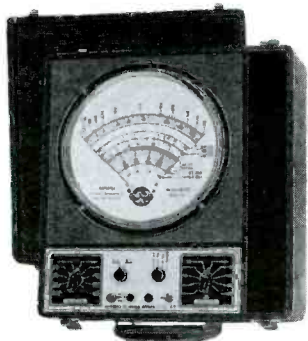
Push a button and there's your desired range. It's as simple as that!

Notice the 24 available tests. 0 to 2500 Volts D.C. in five steps; 0 to 1500 Volts A.C. in three steps; 0 to 1000 Ma. in four ranges; 0 to 250,000 ohms in three ranges; from —10 to +53 db. in three separate ranges; 0 to 25 D.C. amperes in two steps; Watmeter from .006 to 600 watts; 1-700 henries inductance; Qualitative paper condenser tests in addition to electrolytic leakage test.

All these are available on the 3" D'Arsonval 1000 ohm per volt meter.

\$12.95

Net Complete Price.....
Cover for portability.....extra .75



740 GIANT LABORATORY TESTER

Tests 0/15/150/750 volts D.C.; 0/1/15/150/750 D.C. Ma.; 0/15/150/750 volts A.C.; 0/15/150/750 Ma. A.C.; .001-1 and .05 to 200 mfd.; 0-500 ohms and 500 ohms to 5 megs.; —10 to +19, 38 and 53 db; 0/15/150/750 Output; 1/700 henries; .006 to 600 watts. Uses huge 9" D'Arsonval foundation meter. 1000 ohms per volt sensitivity with a 1 Ma. movement.

\$18.95

Complete Net Price.....
Cover for portability..... \$1.00

Approved Technical Apparatus Co.

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SEND FOR NEW 1939 CATALOG.

DYNAMIC MICROPHONES

Two new types of dynamic microphones, known as the "Unidyne" and the "Rocket," have just been announced by Shure Brothers.

The Model 55 Unidyne is a cardioid type, uni-directional moving-coil dynamic microphone for broadcast, recording, public-address and similar applications. Uni-directional action is secured by phase-shifting acoustical networks in a single element.



Model 50 Rocket dynamic microphones utilize the principle of a moving-conductor in a magnetic field. They are intended for public-address, remote broadcasting, recording, call systems, communications radiotelephone and similar applications. Response is high-quality wide-range with semi-directional pickup characteristics.

Further information may be secured from Shure Brothers, 225 W. Huron St., Chicago, Ill.—SERVICE.

TELEVISION PICTURE TUBE

Hygrade Sylvania have recently made available their type 1802 cathode-ray picture tube. This tube may be obtained with a green (1802-P1), yellow (1802-P3), or white (1802-P4) screen. This 5-inch tube is designed for use in television receivers and other applications. Further information may be secured from Hygrade Sylvania Corp., 500 Fifth Ave., New York, N. Y.—SERVICE.

AUDITORIUM SPEAKERS

Just announced by Jensen... a new line of 18-inch permanent magnet auditorium speakers. The manufacturer states that



these new p-m speakers have efficiency equal in every respect to the field coil models of equal size. They are offered in four types to meet different response requirements. Jensen Model BR-18 Peridynamic enclosure is provided for all the new 18-inch speakers. Complete descriptive literature available on request to the Jensen Radio Manufacturing Co., 6601 S. Laramie Ave., Chicago, Ill.—SERVICE.

Your GUIDE to ECONOMICAL CONDENSER REPLACEMENTS!

SPRAGUE ATOMS

Save Time—Save Money—Save Space on Dry Electrolytic Replacements.

Cap. No.	Cap. Mfd.	Working Voltage	Metal Tube Diam.	Length	Net Price
TA-10	10	25	5/8"	1-5/8"	\$0.24
TA-25	25	25	5/8"	1-5/8"	.30
TA-55	5	50	9/16"	1-5/8"	.27
TA-510	10	50	11/16"	1-5/8"	.30
TA-525	25	50	11/16"	1-5/8"	.33
UT-41	4	150	5/8"	1-5/8"	.24
UT-81	8	150	5/8"	1-5/8"	.27
UT-121	12	150	5/8"	1-5/8"	.30
UT-161	16	150	11/16"	1-5/8"	.33
UT-201	20	150	3/4"	1-5/8"	.36
UT-401	40	150	15/16"	1-5/8"	.39
UT-42	4	250	9/16"	1-5/8"	.27
UT-82	8	250	5/8"	1-5/8"	.30
UT-122	12	250	3/4"	1-5/8"	.33
UT-162	16	250	3/4"	1-5/8"	.45
UT-43	4	350	5/8"	1-5/8"	.30
UT-83	8	350	3/4"	1-5/8"	.33
UT-123	12	350	7/8"	1-5/8"	.42
UT-4	4	450	11/16"	1-5/8"	.33
UT-8	8	450	13/16"	1-5/8"	.36
UT-12	12	450	15/16"	1-5/8"	.45
UT-16	16	450	7/8"	2-1/8"	.54
UT-20	20	450	15/16"	2-1/8"	.60

Dual Combination Atoms

TA-100	10-10	50	5/8"	2-3/8"	\$0.39
TA-212	12-12	200	13/16"	2-3/8"	.57
TA-216	16-16	200	7/8"	2-3/8"	.63
TA-816	8-16	200	13/16"	2-3/8"	.57
AT-816	8-16	250	3/4"	2-7/8"	.66
UT-88	8-8	450	1"	2-3/8"	.60
UT-816	8-16	450	1"	2-5/8"	.81
D-6696	2C-20	150	Emerson	4HC-348	.60

WHERE TO USE THEM...

Sprague ATOMS are "tops" for any dry electrolytic replacement where you want a first class job at rock-bottom cost. Don't worry about the larger size of old-style condenser to be replaced. ATOMS are the smallest drys on the market, but they'll stand the gaff. And how! They shake off high surges and come back for more. They have lower leakage and lower power factor. They absolutely will not "blow up." One or two handy Kits equip you for almost any replacement job. Don't let your competitors beat you to the punch. Get next to ATOMS today—the latest selling midgets BECAUSE they're far and away the most reliable.

SPRAGUE PRODUCTS COMPANY
North Adams, Mass.

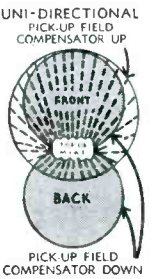
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Now..
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 COMBINED IN
AMPERITE VELOCITY
 WITH ACOUSTIC COMPENSATOR



- it's a* **VELOCITY**
- it's a* **DYNAMIC**
- UNI-DIRECTIONAL**
- NON-DIRECTIONAL**
- HIGH OR LOW PITCH**



By moving up the Acoustic Compensator, you change the Amperite Velocity Microphone to dynamic operation — without peaks. At the same time you reduce the back pickup, making the microphone practically **UNI-DIRECTIONAL**.

With the Acoustic Compensator down, the microphone is **BI-DIRECTIONAL** . . . 120 degrees front and back without frequency discrimination. Rotating the microphone until it parallels the ceiling makes the microphone **NON-DIRECTIONAL**.

THE ACOUSTIC COMPENSATOR is a regular feature of these models: RBHk (hi-imp); RBMk (200 ohms) LIST \$42.00. RSHk (hi-imp); RBSk (200 ohms) LIST \$32.00

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* Complete in Quartered-Oak Case

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- CHECKS ALL TYPES RADIO RECEIVING TUBES**
- Tests New 1.5, 35 and 50-volt Series, Loctal Base Types, OZ4 and Other Gaseous Rectifiers.
 - Separate Plate Tests on Diodes and Rectifiers.
 - Neon Short and Leakage Tests.
 - Ballast Tube Continuity Test.
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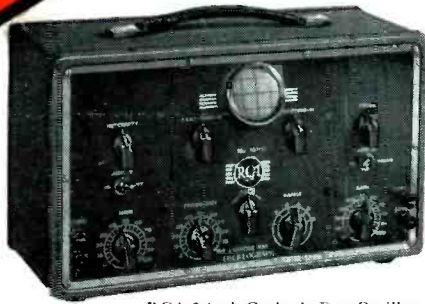
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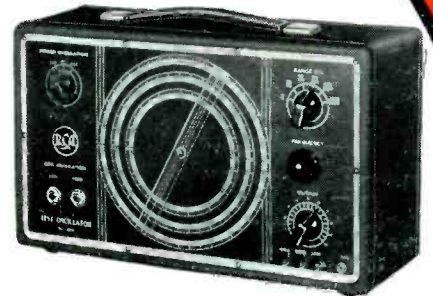
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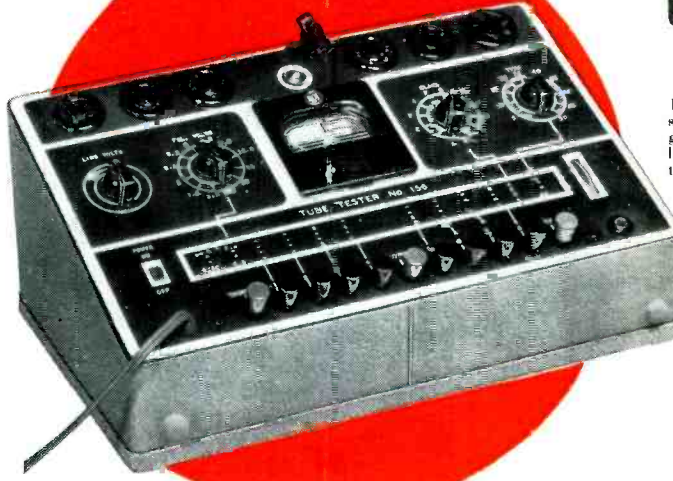
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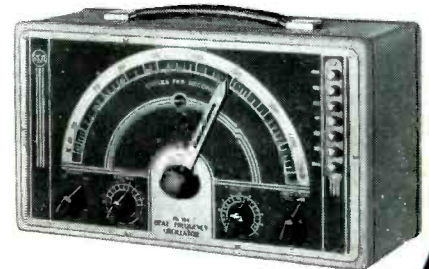
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