NATIONAL RADIO NEWS

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Developing the Ability to Diagnose Receiver Troubles

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The Unknown Future of Radio

In the short period of approximately twenty years, radio has brought innumerable benefits to mankind. Continents have been drawn together, new cultural avenues have been opened up to rich and poor alike, entertainment has been brought to shut-ins, advertising methods have been revolutionized, and education of large audiences has been made possible.

But these are only a few of radio's achievements. Twenty-four hours a day in city or country, during hurricanes, floods and disasters on land or sea, radio brings help to those in distress. In the air, radio beam highways guide airplanes safely along their routes through storm, fog and darkness.

With 110,000,000 listeners and with hundreds of millions of dollars being spent yearly to provide programs, radio ranks first in American life. From breakfast to bedtime, broadcast band and short-wave stations alike pour forth entertainment, news, education and advertising, for all who own radio receivers and want to listen.

And yet today is only the beginning. Short-wave radio uses are expanding rapidly. Television, frequency modulation and electronic musical instruments are all taking on commercial status. Soon these and many more new services will be bringing even more startling marvels of sound and sight into American homes.

Yes, we have seen only the beginning of radio. Its unknown future for the years ahead is by far radio's greatest asset. And radio's future is *your future.*

E. R. Haas, *Vice President.*

Color Television

By PAUL H. THOMSEN
N. R. I. Communications Consultant

A NUMBER of organizations have demonstrated how it is possible to employ the old colormovie filter disc principle to the transmission of televised pictures. Experts state that even with a reduction in the number of lines per picture the addition of color has the effect of increasing the detail transmitted. The band width required is not reduced, however, with the present system of color television transmission.

The Columbia Broadcasting System recently demonstrated television in full color to a group of commissioners and members of the staff of the Federal Communications Commission.

The delegation was headed by Commissioners T. A. M. Craven, Frederick I. Thompson and Paul A. Walker, who viewed the demonstration in the CBS television laboratories and discussed the new development in some detail with Chief Television Engineer Peter C. Goldmark, inventor of the color television system. Chairman James L. Fly of the FCC saw a private laboratory demonstration of the color method several weeks ago.

PAUL H. THOMSEN

After showing motion pictures reproduced by television, both in color and in black and white, Dr. Goldmark presented a new and still experimental "magnified" screen development which, for comparative purposes, enlarged the color picture images by approximately 80 per cent without loss of detail.

Commissioner Craven's comment was: "Color television as demonstrated by the Columbia Broadcasting System is a valuable contribution to television development. Undoubtedly it will advance public acceptance of television. I hope color television will be made available at an early date as a service to the public."

Commissioner Thompson commented: "I think color television well confirms the commission's judgment in postponing the establishment of fixed standards six months ago."

Following the demonstration, the group discussed with Columbia officials the possibility of early color television for the public; the possibility of color pictures of two-foot size for home reception; the effect of color upon television programs and on public interest.

Members of the commission staff were particularly interested in the feasibility of converting ordinary black and white receivers into color receivers.

Dr. Goldmark pointed out that such conversion would be easy and inexpensive on sets built to anticipate such conversion, but would be more expensive, and therefore might not be practical on sets which have already been sold without provision for color.

Those who accompanied the commissioners were: Andrew W. Ring, chief engineer in charge of broadcasting; Nathan David, assistant to the chairman; William A. Bauer and Benjamin W. Cottone of the Legal Department; W. K. Boese, member of the engineering staff, and George C. Gillingham, director of information.

Although the simple rotating light filter disc is being employed there are many problems involved in the production of televised pictures in their natural color. I shall endeavor to make many of these problems evident to you by presenting the outstanding factors involved in the transmission of televised pictures in color.

There are two important characteristics of the human eye permitting the transmission of television and, of course, color television. These two characteristics are known as the persistence of

vision and the fact that the human eye has the ability to discriminate between colors. Let's learn more about these two characteristics.

The Eye and the Persistence of Vision

As an optical instrument, the human eye performs many functions. It is a well known fact that the human eye retains an impression of an object for a short time after the object has disappeared from view. This characteristic of the eye is known as the persistence of vision. Fig. 1 shows that *S* is the outer enclosure of the eye. *C* is the cornea, a strong transparent membrane, which forms a front covering for the eye. *I* is the iris, which is the colored part of the eye, with a central orifice (opening or ajustable shutter) called the "pupil" which admits light to the lens *L*. Through this lens images are thrown onto the retina, or screen, *R* situated at the back of the eye. The nerve centers which cover this screen

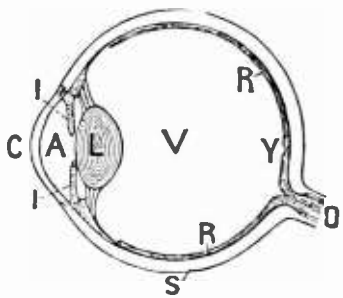


Figure 1

are stranded together like the wires in a cable and are joined to the optic nerve *O* which connects with the brain.

Persistence of vision is also the reason why the modern motion picture is possible. It is used in many daily applications, but it is absolutely essential in motion picture and in television, whether the pictures are in color or black and white. One of the simplest demonstrations of the persistency of vision is the condition which exists when you look at objects in between the blades of a motor driven fan, first when the fan is standing still and then after turning on the power to cause the blades of the fan to revolve. You now not only see the objects originally in the field of view, but also all other objects not hidden by the stationary frame of the motor. You are not seeing through the blades of the fan but retaining the views impressed upon the retina and by the aid of the persistence of vision!

Persistence of vision is a very favorable characteristic of the eye and is as stated above, absolutely essential in television. It is even more important in the case of color television.

Color Discrimination

Again the eye, like all optical instruments, discriminates in the detection of various colors. After studying the color peculiarities of the eye, Young and Helmholtz developed the theory that there are three sets of nerve terminals distributed over the retina of the eye, and one set of nerves, if stimulated gives the sensation of blue, the second a sensation of green and the third the sensation of red light.

Furthermore, each set of nerves need not be excited by a monochromatic color identical to the impression it gives to the mind. The retina of the eye can be excited to some extent by lights of other monochromatic colors as shown in Fig. 2, each giving a red, green or blue sensation depending on which set of nerves it stimulates. For example, the red sensitive nerves can be stimulated by blue light and green light to give to this set of nerves a sensation of red. The strongest sensation of red is, however, experienced from a red light which has a color content similar to the red shown in Fig. 2. Such a color is referred to as a primary red. There are, as you have already guessed, three primary

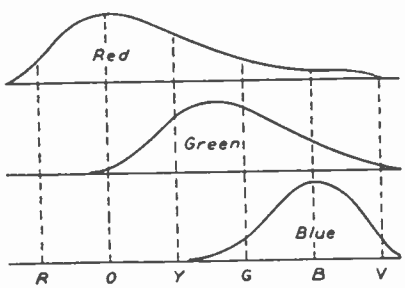


Figure 2

colors and it is still more interesting and valuable to know that all possible colors that you can see may be produced by combining a mixture of these three. This fact has already been demonstrated to all of us who have seen colored motion pictures. These pictures are produced with the aid of three primary colors.

The eye does not respond to any light unless it is strong enough to stimulate the nerves. This minimum quantity of light required for nerve excitation is called the threshold of quantity. Color is not recognized below the threshold of quantity. When all three sets of nerves are stimulated to the same degree, the impression received is white. It is also interesting to know and important to remember in the reproduction of color television that the eye is most sensitive

to yellow-green light and that objects appear with clearer definition in lights of these colors. This means that it requires many times the light energy in the blue and red ranges to give the same effect to the eye as that required when using a light containing yellow-green frequencies. Incidentally this is one of the reasons the so called fog lights on cars are yellow.

Production of Color

Every object that we see gives off light. that is, the objects are luminous. in other words they reflect light. The amount of light and the color sensation received will depend upon the relationship between the three primary colors as shown in Fig. 2. You will note that there are six letters across the bottom of Fig. 2. These represent the red, orange, yellow, green, blue and violet monochromatic colors. Of course, if any equal amount of all these colors are present then we will have white light.

Selective Reflection and Absorption

When we look at an object that has various colors present and in particular when the object is illuminated by white light, then the bodies which reflect light generally do so selectively. That is, certain wavelengths of the incident light which are not absorbed and dissipated as heat are reflected. For example, the red tile roof reflects only the red components of sunlight and turns into heat all other rays of the sun. It is also interesting to know at this time that in moonlight, the red tile roof appears black because there is no red in the light falling on the roof which it can reflect selectively. Thus, in order to show the true color of an object in artificial light. it is of importance to have the presence of all light components in the source.

Transparent bodies like colored glass owe their colors to selective absorption. If a red glass, known to many as ruby glass, so essential in a photographer's room, is held between the eye and a daylight lamp, the glass will subtract or selectively absorb all other colors of the white light falling upon it and transmit only the deep red light. It is also well to remember that if we place a piece of blue glass over the red glass then the white light must now pass through one glass after the other. Now none of the components of the white light will be transmitted and as a result no light will be visible. The red glass absorbs the green, blue and violet from the white light; the blue glass absorbs the red, orange and yellow; that is, each of the two glasses absorbs those colors which the other transmits. From this we can draw the conclusion that the light used for illumination purposes in a color television studio must contain equal amounts of light at the frequencies represented by the green, blue, violet, red, orange and yellow. You will later find out that the light source must not have strong values of energy just above and below the visible range of frequencies.

Color and the Persistency of Vision

If we change the blades of an electric motor driven fan to filter segments containing the primary colors, red, blue and green and do not allow openings in between the different segments of the disc we may then demonstrate as shown in Fig. 3, how it is possible to take advantage of not only the persistence of vision but also the color characteristics of the eye. With the disc containing the colored segments standing still you will be able to see only the greenish parts of the object when looking through the green segment. However, if the disc is rotated so that more than 15 colored segments of each of the primary colors pass alternately between the eye and the object, the eye will have an equal opportunity to view all colors passed by the 3 primary color filter an equal length of time. The rotation of the disc will not produce any objectionable flicker as the colored segments will be passing

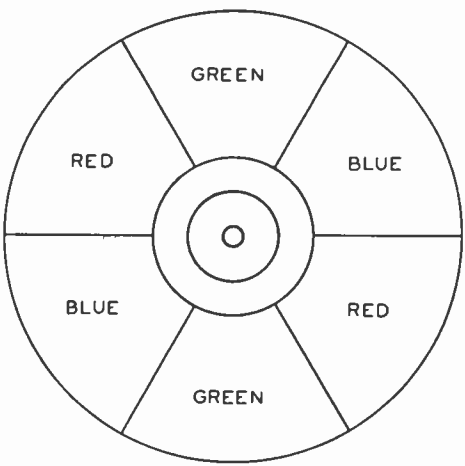


Figure 3

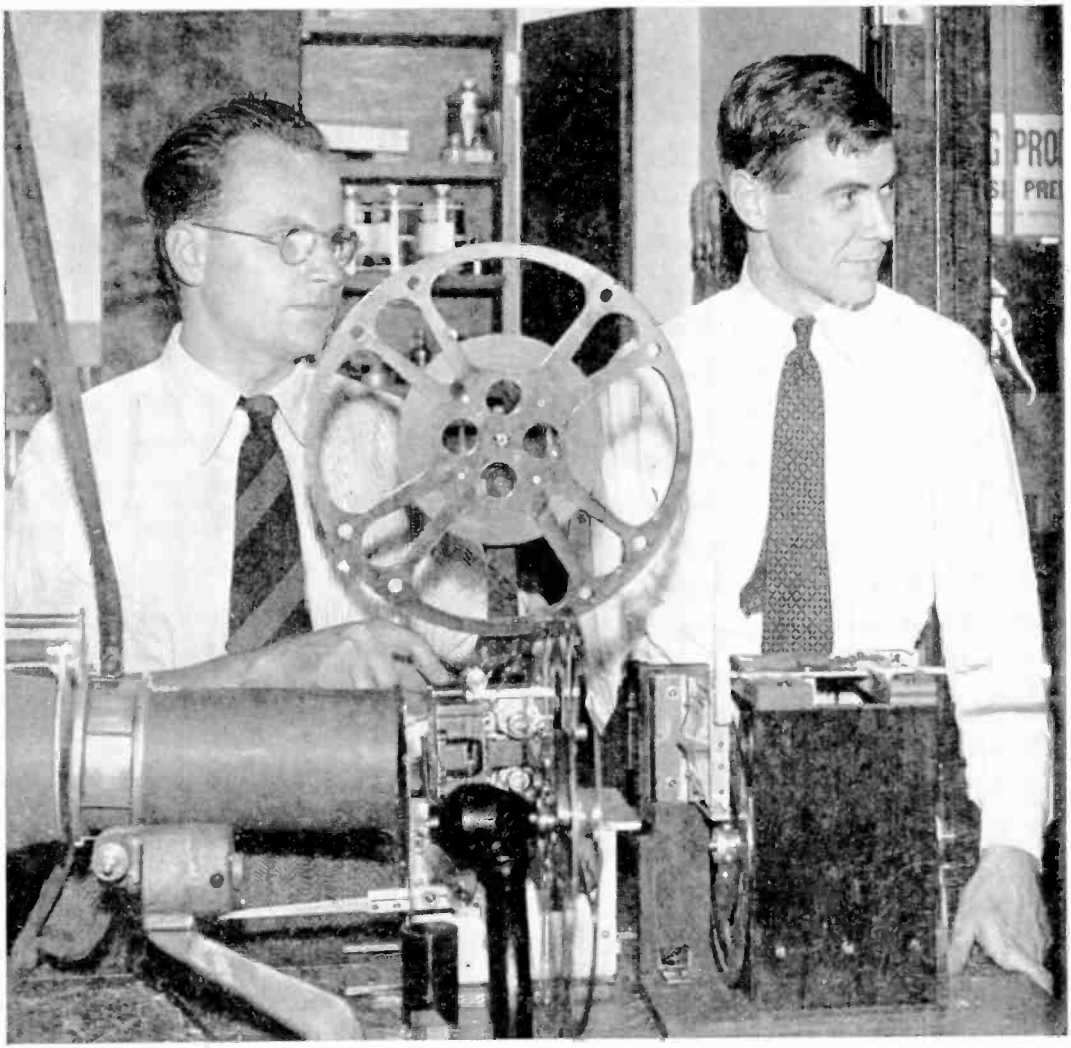
the eye at a rate high enough to permit the eye to retain each color for the duration of the other two primary colors. The relationship of the intensity of these 3 colors to each other will give us all of the colors of the visible spectrum, that is, the red, orange, yellow, green, blue and violet, depending, of course, upon the amount of light passing each one of the color filters.

We must not overlook the important fact that the efficiency of the filter segments must be taken into consideration. As stated above, the eye does not respond to any light unless it is strong enough to stimulate the nerves and if one filter is not

very efficient that primary may be entirely missing, that is, below the threshold quantity. The color relationship in the object viewed will not be correct. There will be color distortion! That is, the light passed by the light filter must be well above the threshold quantity. This means that the revolving light filter must be efficient and the higher the efficiency, the easier it is to get good color television pictures.

Line or Element Scanning a Necessity

So far we have shown how the eye may view all of the colors in their proper relationship when each of the three primary light filter segments have the same degree of efficiency. The next step is the transmission of the picture viewed over a single radio channel. This can be done by what is known as scanning. The scanning system may



Dr. Peter C. Goldmark, Chief Television Engineer, and John N. Dyer, Assistant Chief Television Engineer,—making adjustments on the color television transmitting equipment and at the same time watching the results received on the television monitor in the television laboratories of the Columbia Broadcasting System at 485 Madison Avenue, New York City.

use the straight form of scanning as we read the page of a book or some form of interlacing. The same system of scanning must be employed at the receiving end in order that the proper sections of the picture be viewed. Regardless of the scanning system used, the mastery of the present color television picture transmission system will be understood and especially when using the revolving color filter disc. Of course, each system will have its individual problems.

Fig. 4 indicates the important sections and the working principle of the new color television system employed by Dr. P. C. Goldmark of the Columbia Broadcasting System and Dr. E. W. F. Alexanderson of Schenectady, New York. The arrangement shown in Fig. 4 is for use with Kodachrome color film. From the light source at the left, energy travels, literally speaking, to the right to the eye at the viewing position. The light source must contain equal amounts of the green, blue, violet, red, orange and yellow. In other words, it must be what is known as white light with very little energy at frequencies above and below the visible range.

Light energy then travels from the white light source, thence through the multi-section three primary revolving color filter to the film and then to the photo sensitive surface of the image pickup tube. By selective absorption of the color segments in the revolving color disc and the colored element of the picture in the film being scanned, only light of a given frequency will pass onto the photo sensitive surface of the image pickup. The relative intensity of the light energy passed by the film will determine the intensity of the signal fed to the grid of the first tube in the pre-amplifier stage of the video amplifier. If the relative sensitivity of the image pickup is the same for all light frequencies and the efficiency of each of the revolving color filter segments is the same, then the signal emitted by the transmitting antenna for all colored elements of the picture will be of the proper value for its reproduction on the screen of a black and white televisor. The image on the face of the picture reproducing tube will appear in proper halftone values. The aid of the second revolving color filter will, when properly synchronized, give us the colored televised picture.

Although both systems employ the revolving multi-color filter disc, each have some minor variations in order to compensate for some of the undesirable characteristics of the equipment used.

Relative Sensitivity of the Eye and Image Tube

Since the selective absorption of the revolving color filter segments vary from the true value and the color sensitivity of the image pickup tube varies from the relative sensitivity of the human eye, the intensity of the various electrical values at the output of the transmitter will not be faithful. Some control of the color sensitivity must be incorporated in the television system. Some idea of the variation of the relative sensitivity of the eye and an image pickup tube may be obtained from Fig. 5. It can be seen that the image pickup tube drops in sensitivity where the sensitivity of the eye increases. This then means that some form of color sensitivity control must be introduced to compensate for the different characteristics.

If we could construct red, green and blue color filters having the same relative sensitivity as that of the eye as shown in Fig. 2, then we would find that the compensation for the image pickup tube from the relative eye sensitivity would en-

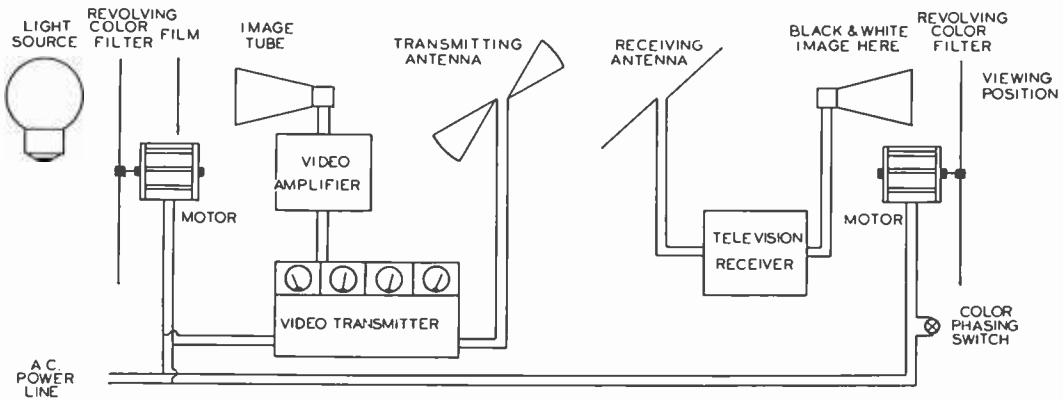


Figure 4

able the passage of the correct signal intensities in the video amplifier circuit and consequently on the image reproducing screen, that is, providing the latter has all the properties of white light. This then means that a television receiver which is not equipped with color television apparatus may be used for the reproduction of standard televised programs. Furthermore, the use of a revolving color disc at the receiving end will permit true color reproduction of the scene being televised.

We must not overlook the relative sensitivity of the light used to flood the object or entertainers

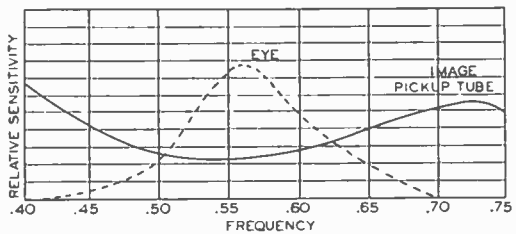


Figure 5

as a possible variation in true color reproduction at the transmitter end of a color television picture transmission system. Overloading of the image pickup tube may easily occur if its sensitivity is high at one or both ends of the visible frequency range. For example, if the ultra-violet end is strong, the first few stages of the video amplifier may be overloaded and may not introduce the proper amplification. This will lead to halftone distortion.

It is understood that Dr. Goldmark has devised a way of controlling the color balance even with all of the many variable factors that I have presented as possible causes of color distortion and the final loss of picture detail. The system used by Dr. Goldmark employs a three channel electronic color mixer which is electronically switched during the line and frame synchronizing impulses so that only one channel is employed at a given time. The three channels are referred to as the red, green and the blue channels. A better understanding of the method may be obtained by studying Fig. 6. The output of the pre-amplifier feeds into the input circuits of each of the three channels. Each channel has its gain or primary color level control. Furthermore, the electronic switch which is controlled by the sweep circuit synchronizing unit is so connected and designed to allow only one channel to operate at a given time and to operate when its respective segment of the rotating color filter is passing between the film and the image pickup tube.

Although no definite information is available on the method employed by Dr. Alexanderson, it is my opinion that he changed the illumination, that is, placed a special stationary light filter between the light source and the rotating color filter. This is very evident as the cover photo shows that a standard type black and white television receiver is used with no additional equipment other than the color revolving disc.

Incidentally, the cover photo is by courtesy of the General Electric Company. It shows a group of very distinguished men viewing the demonstration in Dr. Alexanderson's home. They are from left to right: Dr. Peter C. Goldmark, in charge of television engineering for the Columbia Broadcasting System; Philip D. Reed, Chairman of the Board of the General Electric Company; Dr. Alexanderson, and George Henry Payne, member of the Federal Communications Commission from Washington, D. C.

It is not very difficult to use a rotating color filter with 16-mm. Kodachrome movie film as that originally employed by Dr. Goldmark. It is another problem to get sufficient intensity of artificial light to make live studio pickups satisfactorily. This is a studio pickup limitation as the amount of heat generated while picking up "black-and-white television" studio pictures is tremendous. The large amount of light loss in the filters is due to the fact that the light transmission efficiency of the filter disc is about 30%. The No. 25 standard Wratten gelatin filter was used by CBS for the red, the No. 47 for the blue and the No. 58 for the green.

Since the color filter is but 30% efficient, we can only assume that three times as much light must be produced to obtain the same sensitivity or

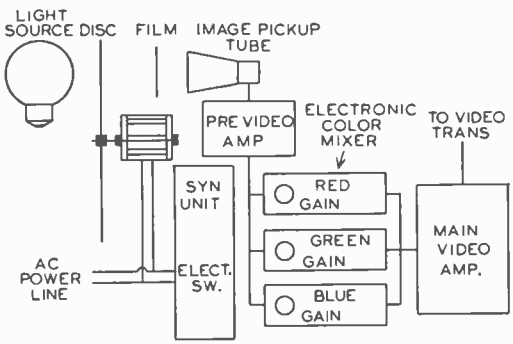


Figure 6

degree of pickup by the image tube as that obtained when using "black and whites." At the receiving end both engineers employed a rotating color filter of exactly the same characteristics as the one used at the transmitter. When using this system the motors rotating the discs must be of the synchronous type to enable filter segments of identical color to pass simultaneously.

When using the motor driven color filter in the home a color correcting switch is required to synchronize the colors or motors. This switch is cut off and on allowing one color segment to slip by when in synchronism, the picture will be properly colored and it will remain in step.

The use of synchronous motors on power lines that are not locked in frequency control would be of very little value. In order to permit the use of revolving discs for this purpose it is understood that a single beam power amplifier tube can be used to control the speed of a motor driven disc to give satisfactory color reproduction.

Flicker

In order that flicker due to the revolving discs be kept at a minimum Dr. Goldmark constructed a disc having queer shaped color segments. The general shape of the filter is shown in Fig. 7. The aluminum disc used was about 8 inches in diameter and supported the gelatin filters. The special shaped filters are employed to permit the use of non-storage type camera image pickup tubes as the filter must cover at any instant of time that portion of the image tube which is being scanned. The disc rotates at 1200 R.P.M. An 1800 R.P.M. synchronous motor with a reduction gear unit was employed.

CBS Scanning Method

The scanning method devised by Dr. Goldmark differs somewhat from that used in most black and white systems. The picture is completely scanned every 1/60th of a second instead of every 1/30th of a second. However, at the end of the first 1/60th of a second only 2 colors have been used. The third color requires an additional 1/120th of a second, bringing the total to 1/40th of a second for a single picture in full color. The following sequence may help to make this clear:

The odd number lines are scanned in red in 1/120th of a second. The even number lines are scanned in green in 1/120th of a second. At this point the whole picture has been scanned, but there is yet no blue in the picture. Time thus far: 1/60th of a second.

Now the red on the odd number lines has faded and these same lines are scanned in blue in 1/120th of a second. At this point the whole picture has been scanned one and one-half times, but in full color only once. Time thus far: 1/40th of a second.

Now the green on the even number lines has faded and these same lines are scanned in red in 1/120th of a second. At this point the picture has been scanned twice but in full color only once and a third. Time thus far: 1/30th of a second.

Now the blue on the odd number lines has faded and these same lines are scanned in green in 1/120th of a second. Time thus far: 5/120th of a second.

Now the red on the even number lines has faded and these same lines are scanned in blue in 1/120th of a second. At this point the whole picture has been scanned three times and in full color twice. Elapsed time thus far: 1/20th of a second.

And now the whole progressive cycle begins again with the even number lines being scanned in red.

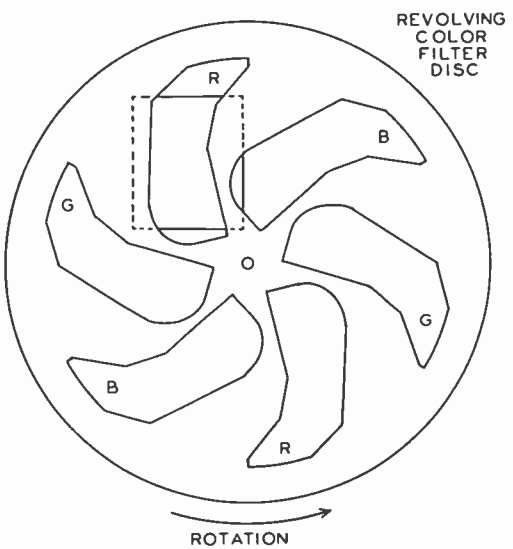


Figure 7

At the receiving end, Columbia employed a disc similar to the one used at the transmitter. The disc was about 20 inches in diameter and driven again by an 1800 R.P.M. with the reducing gear unit to revolve the disc at 1200 R.P.M. A projection type of C.R.O. tube was used to permit brighter than ordinary image production during the first color television demonstrations.

Closing Comments on Color Television

The recent practical demonstrations of color television have proved again that that which appeared to be a difficult task was worked out using basic fundamentals and based upon those which proceeded. As we progress we use those basic fundamentals in working out our problems. The cleverness of both Dr. Goldmark and Dr. Alexanderson cannot readily be appreciated until

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Puzzling Radio Questions From Students

Soldering a Crystal Cartridge

QUESTION: *Through a process of elimination I found that the trouble in my wireless phonograph was a dead crystal cartridge. I understand that you must be very careful when installing a new unit as they are delicate and easily damaged by heat. Please give me some pointers on soldering leads to my new cartridge.*

ANSWER: Crystals used in phonograph pick-ups and recorder heads are permanently damaged if they are subjected to temperatures above 130° F. even for a very short interval of time. This makes it essential to use extreme care when soldering leads to crystal cartridges, so that they are not over-heated and ruined. The following precautions must be observed to do a good soldering job.

1. *Use a hot iron.* If the iron is not hot enough, it will be necessary to hold it against the soldering lug for a relatively long time before the solder will flow. This long contact will permit heat to flow to the crystal, raising its temperature beyond the safe limit.

2. *Be sure the connecting wires are thoroughly clean.* If the connecting wires are old or dirty, the solder won't take immediately. The continued heating and application of solder may easily ruin the crystal. It is always a good idea to clean and tin the wire first so you will be sure the solder will take properly.

3. *Be sure your soldering iron tip is clean.* A heavily corroded soldering iron won't melt and flow solder properly.

4. *Work quickly.* If the iron is hot and clean, and the terminal wire properly tinned, all you need for a good job of soldering is a quick touch of iron and solder to the connection. Take the iron away just as soon as you see the solder flow.

5. *Never solder a lead to the case of the crystal cartridge* to serve as a ground. This will invariably raise the cartridge temperature above the safe limit.

Visual Tuning Indicator

QUESTION: *In a high fidelity receiver using a visual indicator, I sometimes find that there are two points on the dial when tuning through a given station which causes maximum deflection on the indicator. Which point should be used for proper tuning?*

ANSWER: A listening test will show that best reception is obtained when the receiver is adjusted to tune between the two peaks. This action is due to a dip in the response curve of the receiver at resonance, leaving two tuning adjustments either side of resonance where more amplification is obtained. By tuning to either of these peaks, side band cutting and consequent distortion will result. Although reception may be passable when the receiver is tuned between the peaks, the set should really be aligned to give flat top response with perhaps a broad peak at resonance. This is accomplished most easily by using a cathode ray oscilloscope in conjunction with a frequency modulated signal generator. With more trouble and care it may be adjusted with an ordinary signal generator and output meter.

A. V. C. Amplifier Alignment

QUESTION: *I am working on a receiver which has an ordinary second detector and a separate tube for A.V.C. This is a duo-diode pentode tube. The pentode section is fed from a separate I.F. transformer and the amplified signal is then fed to the diode section where it is rectified to produce the A.V.C. voltage. I aligned the circuits in the usual way, peaking them for maximum output, but I encounter serious distortion on powerful local stations. I think my alignment procedure is wrong and I would like to know what to do about it.*

ANSWER: Your diagnosis is correct and the distortion is due to improper alignment, resulting in lack of A.V.C. voltage and consequent distortion. Remember that the A.V.C. voltage reduces the gain of the receiver and therefore when adjusting the A.V.C. I.F. trimmers, maximum output means least A.V.C. voltage. Simply adjust the A.V.C. trimmers for least output from the speaker or output meter and you will then have maximum A.V.C. voltage and a protection against overloading on strong locals. If you wish, a sensitive voltmeter may be connected across the A.V.C. load resistor and the A.V.C. trimmers adjusted for greatest A.V.C. voltage.

Loop Antennas

QUESTION: *Are all loop antennas used in recent receivers noise reducing?*

ANSWER: Yes, any loop which may be rotated is noise reducing since by rotating the loop for maximum output you are adjusting the loop for maximum signal to noise ratio. However in the strictest sense of the word a noise reducing loop is one which has an electrostatic shield prevent-

ing the pick-up of the electrical components of noise interference. Inexpensive receivers do not use such a shielded loop and it is therefore necessary to rotate the loop, or if it is not movable, the receiver cabinet for least interference.

Filter Condenser Breakdowns

QUESTIONS *One of my customers has a receiver which I have serviced three times for broken-down filter condensers. I use the best grade of electrolytics with the highest working voltage I can obtain and the condensers never last more than one month. The set had previously been serviced several times by another man for the same condition. My customer states that the trouble started after the power transformer was replaced. This transformer is a small one and looks very cheap. I would replace it but this would be an expensive test and the voltage delivered by the transformer to the rectifier is normal.*

ANSWER: The filter condenser trouble you have encountered is obviously due to the fact that excess voltage has been applied to them. On first thought your problem seems difficult and is complicated by the fact that the voltages appear to be normal. However your observation regarding the transformer size is a clue.

The cheap replacement transformer which was installed is the cause of the trouble. When the tubes are hot and are drawing normal current the voltage is normal and a check with a voltmeter will verify this. When the tubes are cold, as they are when the set is first turned on, little current is drawn from the power transformer and its poor regulation characteristics result in the application of excess voltage to the rectifier and hence to the filter condensers. Eventually this will cause the condensers to break down.

To remedy this condition you could install a new power transformer but as you have pointed out this would be rather expensive, even though it will solve the problem. It would be better to increase the working voltage of the filter condensers. This may be done by connecting two 16 mfd. condensers in series across the input of the filter. This will give twice the working voltage of a single condenser. Separate 50,000 ohm 2 watt resistors should be placed across each condenser so that the same voltage will be applied to both of them.

Another method would be to connect a 50,000 ohm 20 watt resistor across the single input filter condenser. In this way there would always be a load on the power transformer and excess voltage would not be applied to the input condenser. This extra drain would not have a great deal of effect on the operating voltages. However should a test show that neither of these methods is suitable, it will be necessary to install a correct replacement power transformer.

Different Voltmeter Readings

QUESTION: *I have two different voltmeters, and I find they do not agree with each other at all. In trying to measure plate voltages for instance, I find a considerable difference in the readings. How can I tell which meter is not correct?*

ANSWER: You may be surprised to learn that both of your meters could be accurate! A very important principle to remember is that meters cannot be compared if they are used one at a time. Meters have different sensitivity ratings which are normally expressed in "ohms-per-volt." If the meters to which you refer have different ohms-per-volt ratings, they will read differently when you use them in any circuit having appreciable resistance. The same would be true for meters having the same ohms-per-volt rating, when you try to use different ranges.

The ohms-per-volt rating is a rating which indicates the current drain of the meter. As this current must flow through the circuit resistance, the voltage distribution of the circuit will be upset due to the meter current flowing through the circuit resistance. The additional voltage drop in the circuit resistance will cause a different voltage to be read at the terminals where the meter is connected. If another meter is then connected in place of the first meter the different current flow causes a change in voltage.

In order to compare meters, it is very necessary that both be connected to the same terminals at the same time. The combined currents of the two flow through the circuit but since both meters are connected simultaneously, the voltage at the particular point will be the same and they will agree with each other then, according to their respective tolerances.

Of course, if two meters connected in this manner failed to agree, then one of them is not in good condition. In order to check further, to determine just which meter is defective, it would be necessary to use some known source of voltage or another voltmeter which could be trusted. A good source for comparison purposes of ordinary meters would be a 45 volt battery, to which both meters could be connected at the same time.

News Items from F. C. C.

This article was released to National Radio News by the Federal Communications Commission, Washington, D. C.

Development of television to a workable unified system is being speeded by an aggregate of $8,000,000 which has been budgeted for that purpose by some two score individuals and firms which, to date, have been authorized by the Federal Communications Commission to engage in such practical research and experimentation on a nation-wide basis.

Expenditure of more than $3,000,000 is proposed by 10 television projects which received Commission approval recently. Two of these grants are to the Hughes Productions Division of the Hughes Tool Co., which has $2,000,000 available for stations in Los Angeles and San Francisco. The establishment of Howard R. Hughes proposes to experiment in program production development in cooperation with Hughes Productions of Hollywood. In both cities the Hughes concern will operate on Television Channel No. 2 (60,000-66,000 kilocycles) with 10 kilowatts aural and visual power.

At the same time the Commission authorized like experimental operation for five other Los Angeles applicants:

Columbia Broadcasting System, Inc., to operate on Channel No. 8 (162,000-168,000 kilocycles), 1000 watts aural and visual power.

Earle C. Anthony, Inc., to operate on Channel No. 6 (96,000-102,000 kilocycles), 1000 watts aural and visual power.

Leroy's Jewelers, to operate on Channel No. 10 (186,000-192,000), 1000 watts aural and visual power.

May Department Stores Co., to operate on Channel No. 12 (210,000-216,000 kilocycles), with 1 kilowatt aural and visual power, for general research and experimentation in the Los Angeles area.

Television Productions, Inc., a subsidiary of Paramount Pictures, to operate a television relay station on Channels Nos. 13 and 14 (234,000-240,000; 240,000-246,000 kilocycles), 250 watts visual power, to supplement television broadcast station W6XYZ, also in Los Angeles, for which the applicant has a construction permit. The latter, using Channel No. 4 (78,000-84,000 kilocycles), proposes experimentation with the "DuMont standards."

In addition, the Commission granted stations to New York, Chicago, and Manhattan, Kans., as follows:

Metropolitan Television, Inc., New York, to operate on Channel No. 8 (162,000-168,000 kilocycles), 1 kilowatt aural and visual power; to develop program techniques for determining public tastes, including the use of two television theatres where daily programs will be projected for free public viewing.

Columbia Broadcasting System, Inc., Chicago, to operate on Channel No. 4 (78,000-84,000 kilocycles), 1 kilowatt aural and visual power; to participate in CBS television research by developing data on Chicago conditions that may assist in the ultimate determination of polarization and synchnorization for a national television service.

Kansas State College of Agriculture and Applied Science, Manhattan, Kans., to use Channel No. 1 (50,000-56,000 kilocycles), 100 watts aural and visual power; to determine propagation characteristics, study horizontal and vertical polarization, and experiment with synchronizing systems using various numbers of lines and frames.

These contemplated programs of research and experimentation are pursuant to Commission requirements looking to development of television to a point that will enable the industry to agree on a uniform transmission system of acceptable technical quality.

Cooperation of the industry is further reflected in the comprehensive survey of the television situation now being conducted by the National Television Systems Committee. Organized last July through the joint efforts of the Radio Manufacturers Association and the Commission, this committee represents the pooled engineering experience of the industry.

An investment of $5,000,000 is represented in previous television authorizations by the Commission. This list, which shows wide distribution of facilities, includes Balaban & Katz Corp., Chicago; Bamberger Broadcasting Service, Inc., New York; Columbia Broadcasting System, New York; Crosley Corporation, Cincinnati; Allen B. DuMont Laboratories, New York, Washington and Passaic, N. J.; Don Lee Broadcasting System, Los Angeles, Hollywood and San Francisco; First National Television, Inc., Kansas City, Mo.; General Electric Co., Schenectady; General Television Corporation, Boston; National Broadcasting Co., New York, Philadelphia and Washington; RCA Manufacturing Co., Camden, N. J.; Philco Radio & Television Corporation, Philadelphia; Purdue University, West Lafayette, Ind.; Radio Pictures, Long Island City, N. Y.; State University of Iowa, Iowa City; WCAU, Philadelphia; Zenith Radio Corporation, Chicago, and The Journal Co., Milwaukee, Wis.

RADIO-TRICIAN
REG. U. S. PAT. OFF.
Service Sheet
Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

SPARTON SUPERHETERODYNE MODELS 580-X

VOLTAGE CHART

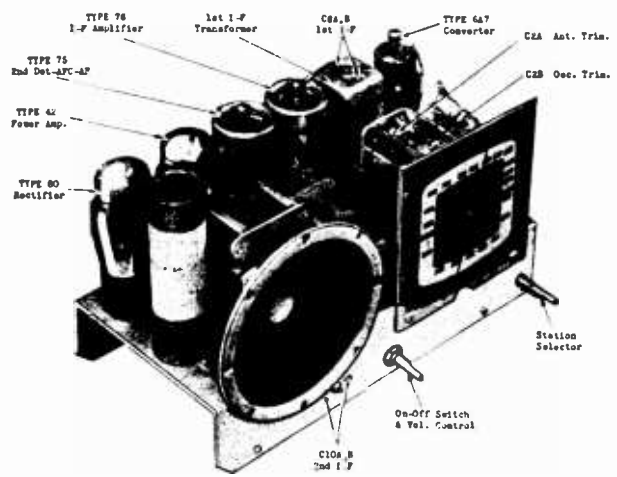
Line Voltage: 115 volts — Position of Volume Control: Full with Antenna Disconnected

Tube	Function	Voltage of Socket Prongs to Gnd. (See Prong Nos. on Schematic Diagram)								
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Grid Cap
6A7	Converter	6	257	68	160	-14	0	-	-	0
78	I.F.	6	257	68	0	0	0	-	-	0
75	Det. AVC	6	92	-1	-1	-1.4	0	-	-	.7
42	Power Amp.	6	241	257	0	17	0	-	-	-
80	Rectifier	338	300	300	338	-	-	-	-	-

Notes: Voltage readings are for schematic diagram on back of sheet. Allow 15% + or - on all measurements. Always use meter scale which will give greatest deflection within scale limits. All DC measurements made with 1000 ohms per volt voltmeter. All AC voltages made with rectifier type voltmeter. Unless designated otherwise, voltages in table are + DC voltages.

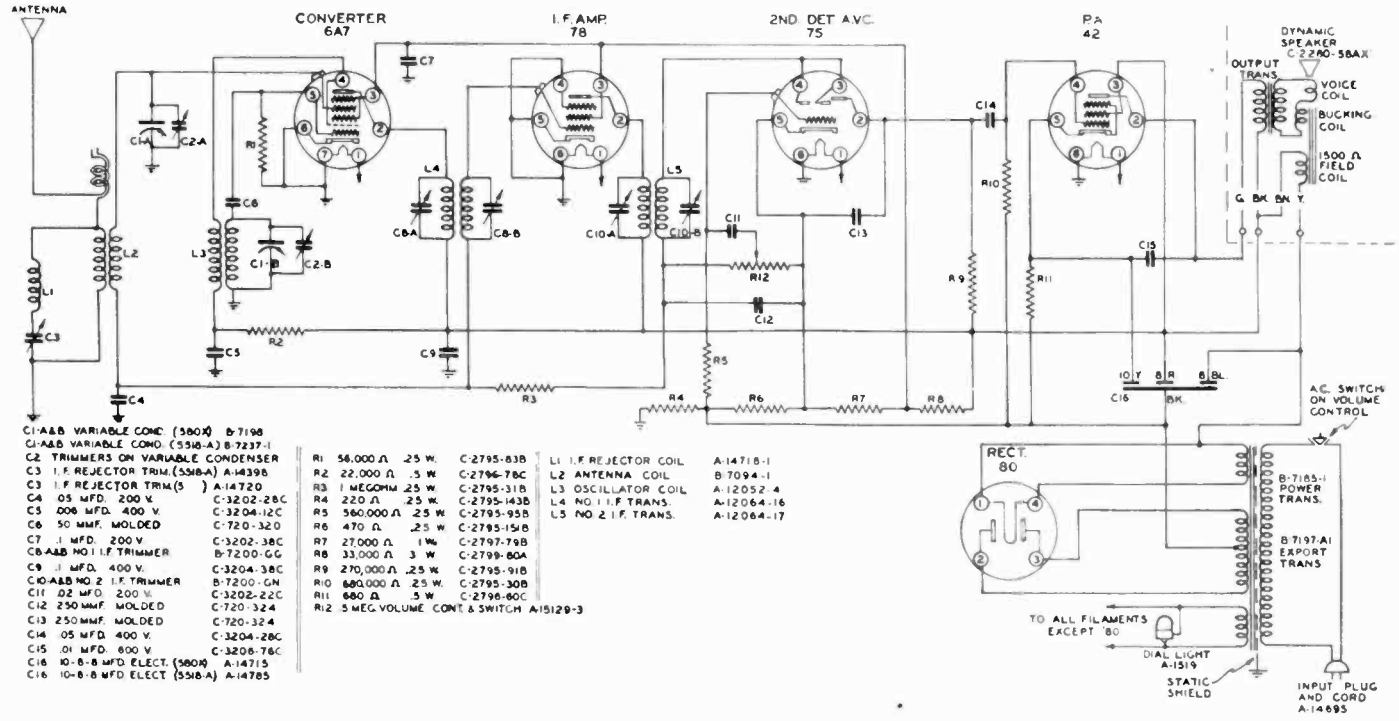
ALIGNMENT

OPERATION	ALIGNMENT OF	GENERATOR CONNECTED TO	DUMMY ANTENNA	GENERATOR FREQUENCY	TUNING COND. SETTING	TRIMMER	REMARKS
1	(Set dial pointer to end of scale with condenser gang closed)						
2	I.F.	6A7 Grid	.1 mf.	456	Closed	C10 A,B	(2nd I.F.)
						C8 A,B	(1st I.F.)
3	Rejector	Ant.	150 mmf.	456	Closed	C3	Adjust to min.
4	Broadcast Band	Ant.	150 mmf.	1500	1500	C2 A Ant.	
						C2 B Osc.	
5	(Check for dial reading and sensitivity at 600 kc., 1000 kc.)						
6	(Check operations 1 to 5 inclusive)						



Readers who file Service Data in separate binders remove page carefully, trim on dotted line for same size as data published heretofore.

SCHEMATIC DIAGRAM
SPARTON SUPERHETERODYNE MODEL 580-X
INTERMEDIATE FREQUENCY 456 K.C.
TOP VIEW OF ALL SOCKET CONNECTIONS



Novel Radio Items

—BY L. J. MARKUS—

Radio men whose duties at a station include operation of the transcription turntables are sometimes called *pancake turners.*

———*n r i*———

A mysterious disturbance almost completely blocked out broadcast band radio reception in Concord, New Hampshire for two entire evenings recently. Short-wave police stations were not affected. Atmospheric conditions were nearly perfect for radio reception on both evenings, indicating that the interference was man-made.—*N.R.I. Graduate Eugene Hoyt.*

———*n r i*———

A beam of light is being used experimentally to carry radio programs of frequency modulation transmitter W2XOR from the studio to the transmitter. The light beam will be set up eventually as an emergency circuit for use in case of damage to the existing telephone wire links between studio and transmitter.

———*n r i*———

Three years is the life expectancy which has been set on the large and costly cathode ray tubes used in DuMont television receivers. This figure was released after two years' field experience with these 14-inch diameter tubes in hundreds of television receivers. The few failures occurring were due to accidents rather than faulty tubes.

———*n r i*———

An auxiliary plug-in loop aerial for portable radios is announced by Philco. Plugging this large loop into jacks provided on the side of the portable automatically disconnects the self-contained loop. Suction cups hold the auxiliary loop in position. It provides improved reception under adverse conditions, such as in steel buildings, automobiles or moving trains.

———*n r i*———

An amazing radio pathway between North and South America was discovered recently by Dr. J. H. Dellinger of the U. S. Bureau of Standards and Dr. Cosentino of Argentina. U. S. short-wave stations which shoot programs over this Pan-American radio skyway by means of directional beam antennas can deliver signals 25 times stronger than similar signals aimed at Europe.

A tiny radio-controlled tank which can drop "eggs" of compressed TNT in the path of advancing enemy armored units has been designed by A. J. Baker, a 61-year old mechanic. It is only 15 inches high, 24 inches wide and 42 inches long, yet carries a five-eighths h.p. engine and all equipment necessary for complete control by radio from a remote point.

———*n r i*———

To help demonstrate the effectiveness of rotatable loop antennas in reducing interference, Philco is now selling a little black box which contains a vibrator, battery and miniature loop. The salesman holds this 4-inch square box in his hand and presses the button, causing a thunderous roar of interference noise in the receiver being demonstrated. The customer is then asked to rotate the receiver loop himself to the setting at which the noise is eliminated.

———*n r i*———

More than half of the radio sets in Latin America are equipped for short-wave reception. Static below the equator seriously impairs broadcast band reception, yet seldom affects high-frequency channels.

———*n r i*———

Building crystal sets in medicine capsules is the hobby of 17-year-old Archie Jones of Waco, Texas. His smallest set is less than one-fourth inch long.

———*n r i*———

A man living next-door to the transmitter of KOY in Phoenix, Arizona, reports that his hot-water tank provides perfect reception of KOY programs, but complains that he cannot turn off the program at night. The oven of the kitchen gas stove in a Waukegan, Illinois home reproduces programs of an amateur station in a similar manner. In both cases, poor pipe connections provide rectification (detection) of signals and set into vibration the large metal surfaces, thereby reproducing sound waves.

———*n r i*———

When station KDYL of Salt Lake City went off the air without warning just 30 seconds before an important program was due on the network lines, frantic radio operators searching for the trouble finally found a mouse in the condenser cage. It had shorted two contacts.

Developing the Ability to Diagnose Receiver Troubles

By J. B. STRAUGHN
N. R. I. Service Consultant

In this article we will refer from time to time to the diagrams of the Sparton models 601-B and 580-X appearing in the Service Sheets on pages 13, 14, 21 and 22 of this issue. To easily follow the discussion, remove the Service Sheets from the News.

JOHNNY JONES the service ham, grabbed his meters and worked them fine,
He tested this and he tested that; the trimmers he failed to align.
The time grew short, the Boss did snort: "What kind of a guy have I hired"?
The end of the day brought one relief, for Johnny, poor fellow, was fired.

The ability to locate quickly the cause of trouble in a defective receiving set marks the difference between an expert serviceman and a screw-driver mechanic. Too many servicemen, fellows who have been in the field for years, still test each and every part in a defective receiver until the bad one has been found. Such men are lucky to complete three or four jobs a day, working steadily at the bench.

The expert approaches a defective receiver in an entirely different manner. He does not start out by blindly testing parts nor is he tied down to one or two servicing techniques. He knows them all and chooses for each type of complaint the one which will give him useful information, the kind of information he needs to diagnose the trouble.

First he considers the receiver which is to be repaired. Sets coming in for servicing may be divided into two classes: those which are dead (do not play) and those which play improperly, that is, they have distortion, hum, oscillation, are weak, intermittent, etc.

In the case of a dead receiver it is first inspected for surface defects, to see if the tubes all light, if the antenna and ground connections are intact, if smoke is coming from the chassis, if the tube top caps are in place and if the speaker is plugged in. Should everything be apparently O.K. a circuit disturbance test is made, working back from the power tube to the input of the set.

In ninety-nine times out of one hundred this will isolate the defective stage. From here on the procedure employed depends entirely upon the individual serviceman. After checking the condition of the tube, he may measure the operating voltages of the dead stage, point to point, or he may check electrode circuits for continuity with an ohmmeter. I generally use an ohmmeter because in a dead receiver some part in a voltage supply circuit has generally broken down and may easily be located by checking between points which yield useful information. A voltmeter could just as well be used but after finding the electrode which lacks voltage it will be necessary to check the circuit with an ohmmeter anyway. Why waste time?

Using this method, a serviceman can locate the cause of trouble in the average dead receiver in ten minutes or so. Correction of the defect may take longer, depending on his skill with tools, the nature of the defect and how cleverly the manufacturer has hidden the bad part away under mounting boards, shield cans, etc.

Naturally this does not complete the service job, for the rest of the tubes must be checked and the set operated for at least an hour to see if any other defects develop. If you work in a large shop an assistant can do this, even to the installation of the new part, making you, the expert, a sort of glorified diagnostician.

Perhaps all this sounds too easy and the time too short, but I know most experts will agree that a dead receiver is "duck soup" to the serviceman. Let us spend a little time with one.

Pretend that the Sparton model 580-X is dead and to make matters easy suppose condenser C_5 has broken down, burning out resistor R_2. An inspection for surface defects reveals nothing so we start a circuit disturbance test.

Withdraw and replace the 42 tube; a click will be heard in the speaker. Touch the top cap of the 75 (volume control all the way on during

these tests) ; a shrill buzz is heard in the speaker showing that the set is alive from this point on. Touch the top cap of the 78; this may not produce a click even if the stage is operating. If no click is heard, removing and replacing the top cap connector will cause a click if a signal can pass through the stage. Repeat this procedure on the 6A7 top cap.

Bearing in mind that C_5 and R_2 are defective, will a click be heard when the top cap of the 6A7 tube is removed and replaced? Think hard for this is the fact upon which our diagnosis is based. The answer is that a click will be heard and this fact coupled with lack of reception points to oscillator failure.

I would look for causes of oscillator failure since ninety-nine times out of one-hundred the diagnosis would be correct. The hundredth time a signal killing defect, such as an open antenna coil or shorted tuning condenser, will exist between the 6A7 input (top cap and cathode) and the signal source which is the antenna.

Now if you don't understand why this click on the 6A7 comes through even with a dead oscillator you couldn't figure out the trouble. The reason follows: When there is a sudden change in current through a resonant circuit, oscillations are set up in the circuit at the resonant frequency. They only last momentarily, quickly dying out. The fact that the strength of the oscillations is not constant means that the signal produced in this manner is modulated, and when detected, can be heard. The technical name for this action is shock excitation.

When the top cap of the 6A7 is removed and replaced the plate current changes sharply and sets up a modulated I.F. signal in the I.F. amplifier which goes through the receiver circuits just like a program from a transmitter. The effect is comparable to that obtained when the output of an I.F. signal generator is fed in the input of the 6A7. It is worthy of note that the defect in parts C_5 and R_2, while removing voltage from the oscillator anode grid, does not prevent plate current from flowing. If it did, no click would be heard when removing and replacing the 6A7 top cap and the trouble would simply be isolated to the 6A7 tube and its associated circuits instead of to a particular circuit.

Since we have diagnosed the trouble as a dead oscillator, what will we do now? We can verify the diagnosis or we can check for causes of oscillator failure. Therefore, you must know how to check the oscillator. One infallible check for oscillation is to measure the voltage across R_1 with a high resistance voltmeter. No voltage—no oscillation.

We are satisfied that the oscillator doesn't work, so look at the diagram. What does make the oscillator work? Here is the downfall of the screwdriver mechanic. He—sad to say—has no idea why or how the oscillator works; "it just do" and that's that! Shades of Marconi! If he doesn't know how or why it works, is it possible for him to determine why it won't work or what could stop it from working? No sir, it is not possible, so score one hundred points for a *theoretical* understanding of oscillators. Remember any kind of defect is possible in this circuit and you must have some idea of what you want to find. Look at the parts value. R_1 is supposed to be a 56,000 ohm resistor. We check it with an ohmmeter and find it to be 45,000 ohms. Have we found the trouble and shall we put in another resistor? No, because such a change in value of the oscillator grid resistor will not make the oscillator dead. How do I know that? Ah, ha! Score one hundred for practical experience. I have changed the value of many oscillator grid resistors at one time or another just to see what would happen. If the value is too low, the oscillator stops completely ; if almost too low, it stops at low frequencies (set works on high frequency end of dial only) and if too high, the oscillator blocks, working intermittently and giving a chopped up reproduction on all stations.

Look again at the diagram and see what parts are most likely to break down. Those parts which have a high voltage cross them or which carry considerable current. These are the plate winding of L_2, condenser C_5 and resistor R_2. Trouble in any of them would remove plate voltage from the oscillator and would most certainly stop it from working. If you wish, confirm your suspicion by measuring for voltage between socket terminal 4 of the 6A7 tube and the chassis.

Lack of voltage shows the trouble and we now proceed to check its cause. Remove the 6A7, turn off the set, put one ohmmeter probe through hole 4, the other through hole 2. We should measure about 20,000 ohms, the approximate value of R_2. L_2 is only a few ohms so its value won't register in comparison to that of R_2. We don't get continuity so the circuit is open. The circuit disturbance test proved that there was voltage on socket terminal 2, placing the defect in either L_2 or R_2. The resistor is checked first and we find it to be open, L_2 is checked, just in case, and it proves to be intact.

Would you immediately replace R_2 and turn on the set? The diagram shows the presence of C_5 and if it is broken down, R_2 would pass excess current and burn out so we first check C_5 and sure enough it is broken down. Replace it and the job is done.

Wait a minute! The parts list calls for a 400

volt condenser and you don't have a 400 volt condenser. Well, use a 600 volt condenser for it won't break down as easily as one rated at 400 volts. We check over our stock of parts and find many 600 volt condensers—.1mfd., .05mfd. and .01mfd., but no .006mfd.—what to do?

First what is C_5 there for anyway and what is the theory of its operation? C_5 is a bypass condenser and serves to keep the end of L_5 at R.F. ground potential. We realize that increasing the capacity of a condenser reduces its reactance and makes it a better bypass and therefore know that increasing the capacity of C_5 will have no ill effects. We grab the .01mfd. 600 volt condenser, the soldering iron, the resistor and with a deft flip of the wrist (apologies to Jay and Ozzie, Technical Editor Markus' fiction heroes) complete the job and thus bring peace and music back to the home of the Sparton 580-X.

The improperly playing receiver is a horse of another color. There is no easy and definite procedure which will show up the defect quickly. The expert, however, is not stumped. He will check a few definite parts, then lo and behold—he has the bad one in a relatively short time. When he checks a certain part he is not doing so aimlessly, neither is he playing a hunch. He has catalogued the defect by its symptoms and knows what parts or circuits in the receiver could cause such trouble. This does not mean he has had previous experience with the same trouble in that particular set. He is simply applying effect to cause reasoning. He knows what can and what can't cause the trouble so he checks possible causes in the order of their likelihood.

With improperly operating sets a schematic is useful. Simply look at the schematic and figure out what can cause the trouble, then locate the part and check it with instruments or by substitution.

If a receiver hums, study first of all the filter system on the schematic. If electrolytic condensers are used, check them, preferably by substitution. Is the choke tuned; if so, what is the condition of its shunting condenser? Is a hum bucking coil used in series with the voice coil and could the connections have been reversed? Your eyes should next swing to the electrode supply circuits of the tubes, to see if resistance-capacitance filters are employed; if present, check them. If the schematic shows the A.F. amplifier to have potentially high gain, try new tubes even though the present ones check O.K. as cathode to heater leakage might not show up on the tube tester. Then you might see if the positions of the control grid leads have any effect on the hum; by moving them around to different positions.

In an oscillating receiver your eyes will first be drawn to the by-pass and output filter condensers, then you might see a bleeder resistor which if open could increase the screen voltages to the point where oscillation could occur.

Does the set distort; if so, at high volume control setting or at low settings? If at low setting excessive bias on some tube is indicated while at a high setting the bias on some tube is too low. The schematic shows what could cause this so these points are checked first. You further know that distortion is due to some tube working off the straight part of its curve; perhaps the plate voltage on the first A.F. is too low and if there is a resistive-capacitative filter you check the condenser for excess leakage. Sufficient leakage to lower the plate voltage of the tube to the point of distortion would not affect the other B voltages due to the series filter resistor so you have to know what to check.

We are called in on a dead Sparton 601-B. An inspection for surface defects with the set turned on shows the tubes and pilot lamp fail to light. On turning the set off we could check with an ohmmeter each section of the series filament circuit or we could test the tubes in a tube tester. Suppose we find that the section of the rectifier tube filament shunted by the pilot lamp, and the pilot lamp are burned out. In case of any other tube filament failure, we would just replace the tube and try the set. In this case, however, examine the diagram closely. We see that the lamp shunts part of the filament of the 35Z5GT. Also, the plate is connected to this filament tap, so plate current flows through the pilot light and filament section in addition to the filament current.

This accounts for the pilot light being bright when the set is first turned on, then getting dim and finally lighting normally when the set works properly. When the set starts, the tube filaments are cold and have low resistance. Fairly high current flows through the lamp making it quite bright. As the tubes heat up, the filament resistance increases allowing less current to pass through the lamp and dimming its light. When the tube filaments get hot the heat is transferred to the cathodes, they start emitting electrons and current is drawn from the rectifier. Hence, the plate current flow serves to bring the pilot light back to normal brilliancy.

If too much current is drawn from the rectifier this would cause the lamp and filament section to burn out. Do the tubes in the set do this? Possibly, if shorted, and we will remember to check for this later if we don't find the trouble elsewhere. The trouble could have been just a surge condition or could be a short circuit in the B supply. The most likely reason is broken down filter condensers for they could cause excess drain on the rectifier and they are a probable weak point in any set, because they have a high voltage across them. Also, practical experience gained from observation of many receivers tells me this.

Before going to the trouble of locating the condensers and unsoldering their leads for an ohmmeter test, let's make another test. Check the resistance across the output of the rectifier and see if it is normal. First, between what points shall we check? Between the rectifier cathode (terminal 8 of the tube socket) and the set side of the on-off switch. These points are readily located and the measurement made, an almost zero resistance reading showing the presence of a short. We then proceed to check the condensers and finding the input section of C_{17} bad, replace it.

Suppose on the other hand we obtain an ohmmeter reading of 30,000 ohms when making our test—is anything wrong? Look at the diagram and trace the path through which the ohmmeter current flows, adding up the resistance values. Starting at the cathode we go through the speaker field (450 ohms), R_5 (7,500 ohms) and R_6 (22,000 ohms). This makes a total of about 30,000 ohms so nothing is wrong here and the filter condensers are not shorted. We therefore check the tubes and may find a short in the 35L6GT which only shows up when the tube is hot as it is when checked in a tube tester. If we fail to find any trouble, it may have been the surge condition mentioned before. We must now replace the tube and pilot lamp to be sure. If everything is normal, we need not worry further as this surge condition is rare, being due to some power line voltage change at the moment the set was warming up in the home of the owner.

Now we are confronted with the toughest problem a serviceman must face. The Sparton 580-X is intermittent. We verify the complaint at the customers home, carefully check his aerial-ground-lighting arrestor system and depart for the shop after assuring the customer we will phone him as soon as the trouble has been isolated.

At the shop we place the set in operation and make an inspection for surface defects, then connect a high resistance D.C. voltmeter across the diode load resistor (volume control R_{12}). The voltmeter will deflect an amount depending on the diode current of the 75 type tube. If the signal reaching the 75 decreases this will be indicated on the meter. We let the set play and go about our other shop work and soon the intermittent occurs, the signal dropping to just a whisper.

On examining the voltmeter we find that its reading is just about the same as before, proving that the signal is still reaching the diode plates and is being rectified. The trouble therefore is between the volume control and the loud speaker.

We concentrate on this section of the receiver, pulling on leads and wiggling parts to see if we can bring back the volume. In between wiggles and pulls the set suddenly snaps back by itself and before we can catch our breath it cuts out again!

We continue to pull and wiggle and through carelessness our long nose pliers which we are using short the positive terminal of section 8R, condenser C_{20}, to the chassis. We jerk back the pliers and the set starts to play. Now what, have we found the trouble—is this condenser bad? The set cuts out again and we momentarily short the condenser, the set immediately coming back to life. Definitely we have found something, but what? Can you conceive of any kind of trouble in this condenser which would cause intermittent reception of this type? The condenser is in the B supply circuit of all the tubes and therefore it is not breaking down because this would make the stages ahead of the 75 inoperative. We doubt if the condenser is opening up but we check it by unsoldering its B+ lead. As we thought, the intermittent action is not affected.

It is obvious however, that the sudden removal of B supply voltage has taken the stress off the defective part thus allowing it to heal itself. Let's look at the diagram and see which parts would most likely be affected. We can at once eliminate current supply parts since a defect in them would cause terrific noise and that is not the complaint. This leads us to the signal circuits and almost without hesitation to coupling condenser C_{14}. We try wiggling this condenser and the set cuts off. Another wiggle and it comes back on. There is evidently a poor contact between one of the condenser lugs and the foil of which the condenser is wound. To complete the job we install another .05 mfd. condenser rated at 600 volts. The set is then played an hour or two just to be sure there wasn't another intermittent part.

We have traced through the typical repair of an intermittent receiver. The part about shorting the filter condenser is *not* to be followed in jobs of this sort. It was introduced as being an accident because no service man would intentionally short the output of a receiver power pack. Such a short could damage other parts in the receiver. However, many servicemen have made such accidental shorts and have been puzzled and wasted time due to the effects we have described. You now know that it does not mean the part which was shorted was at fault and it could conceivably be in any of the A.F. signal circuits.

By this time you have a fair idea of the powers of deduction possessed by an expert. You perhaps wonder "will I ever be like that" and "can I ever learn to diagnose defective receivers"? The answer is YES both times and it will not be hard to gain this ability. Thousands of N. R. I. men have it and they got it through diligent study of radio fundamentals (theory) and by gaining practical experience.

To be a service expert you must have theory, and for your theory to be of any value, you must know how to use it. To get your theory you must study your text books with the idea of understanding them. It is not enough to simply read the books and get the answers to the test questions. You should learn and understand something new each time you complete a study lesson. This also applies to your experimental outfits—profit from them by thinking about what you are doing. It is not enough to blindly make a specified change in a circuit and answer the report statement. Analyze in your own mind just what has occurred in the circuit and the reason for the answer you make. Do all this and you are beginning to get some place.

Book learning *by itself* is not sufficient to give you this knowledge. Nowhere else does the old saying "knowledge and practice go hand in hand" hold so true. I can write an article about distortion and describe the causes and effects but the written word cannot tell you how distortion *sounds* so you will recognize this symptom in an improperly operating receiver. Then, too, I can tell you that non-linearity will cause distortion—just so many words, but once you place an improper bias on an amplifier tube causing the negative swings of the signal to be amplified less than the positive swings, you will know what non-linearity means in an amplifier and won't forget how it sounds.

This is how N. R. I. has solved your problem of gaining practical experience: Get a second hand A.C. superheterodyne which is in working condition, with at least five tubes. An all-wave receiver is not necessary but try and get a standard brand receiver such as Philco, General Electric, RCA or other well known makes. If you do not have A.C. power use a six volt receiver or an auto radio since they will give you the same experience as may be gained with an A.C. set.

This receiver is to be used as your experimental set and you are to dissect it just like a student doctor would a dead body. You however, have the advantage of the medical student in that your receiver is alive and kicking and you can get first hand information on its reaction to different illnesses and accidents. These troubles are to be introduced into the receiver by you and you are to note the effect on the sound of leaky condensers, open filters, burned out (open) resistors, etc.

When you get your receiver write to us giving its make, model number and the type numbers marked on the tubes used in it and the fact that the receiver is to be used for training purposes. We will send you a diagram together with suggestions for getting practical experience with it.

This is the only easy and sure way of getting started. Some men try to do service work with no experience to back them up and while they may succeed its a long hard road full of disappointments so take my advice and follow a logical systematic method which will lead you quickly and surely to your goal of being an expert serviceman.

Now while theory and the N. R. I. plan will give you the ability to diagnose and repair defective receivers it will not let you decide which of a given number of parts is most likely to cause trouble. For example, in the Sparton 580-X, an overload on the 80 tube would cause its plates to become red hot. This could be caused by a break down in the filter condensers, a grounded B+ lead, a short between the screen and cathode of the 42 tube or a short between the filament winding of the 80 tube and the grounded static shield of the power transformer. What would you look for first? I would look for broken down filter condensers, then a shorted B+ lead, then a shorted tube and last a defective power transformer. I have never encountered a transformer defective in such a manner and would check it only as a last resort simply because the schematic shows it could cause trouble.

As a beginner you have no means of getting first hand information of this sort. You must get your experience second hand. Reference book 14X-1 which you receive early in your course, is

(Page 24, please)

RADIO-TRICIAN
REG. U.S. PAT. OFF.
Service Sheet
Compiled Solely for Students and Graduates
NATIONAL RADIO INSTITUTE, WASHINGTON, D.C.

SPARTON SUPERHETERODYNE MODEL 601-B

VOLTAGE CHART

Line Voltage: 117 volts AC — Position of Volume Control: Full (with no signal)

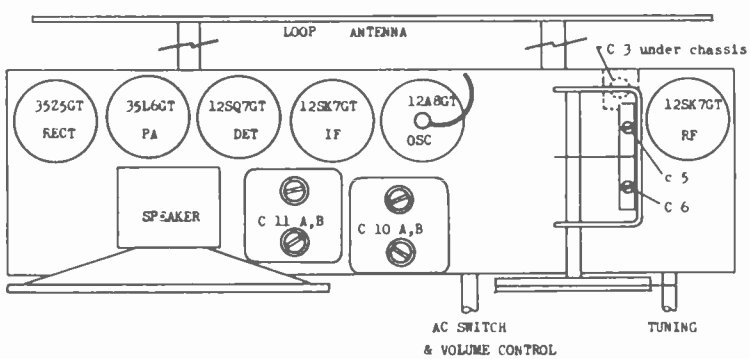
TUBE	FUNCTION	Voltage of each socket prong to Prong No. 3 of Type 12SQ7GT								
		No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	G. Cap
12SK7GT	R-F Amplifier	0	40*	0	0	2.25	53	27*	73	--
12A8GT	Oscillator - Converter	0	12*	100	53	-12 a	105	0*	0	-.05
12SK7GT	I-F Amplifier	0	27*	0	-.1	0	53	12*	100	--
12SQ7GT	Det - AVC - 1st A-F	0	-.1	0	**	**	17	40*	53*	--
35L6GT	Power Amplifier	0	85*	98	105	0	0	53*	7	--
3525GT	Rectifier	0	115*	115*	0	115*	0	85*	130	--

Notes: Voltage readings are for schematic diagram in this bulletin. Allow 15% + or - on all measurements. Always use meter scale which will give greatest deflection within scale limits. All DC measurements made with 1000 ohms per volt voltmeter.
All voltage measured from terminal No. 3 of 12SK7 I.F. amp tube socket.
*-AC scale.
**-Cannot be measured with 1000 ohms per volt voltmeter.
a-25 Volt scale.

ALIGNMENT CHART

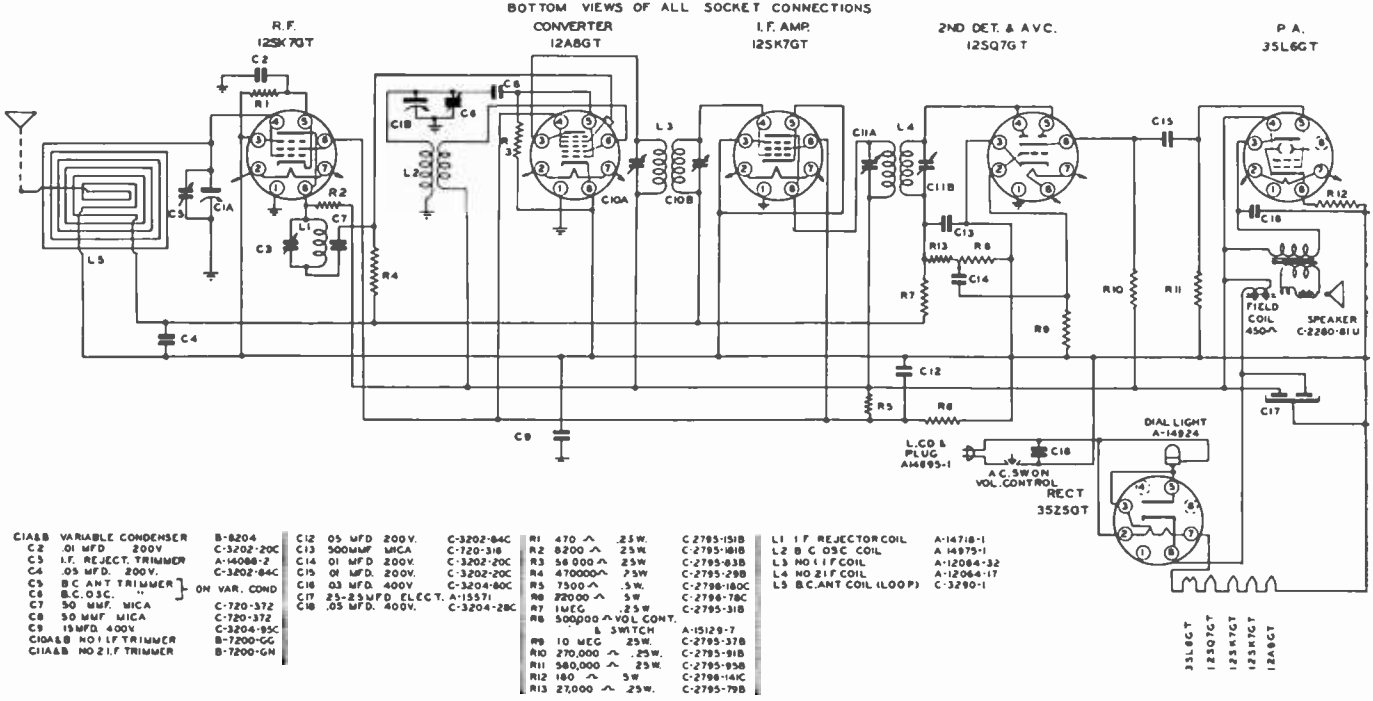
OPERATION	ALIGNMENT OF	GENERATOR CONNECTED TO	DUMMY ANTENNA	GENERATOR FREQUENCY	TUNING COND. SETTING	TRIMMER	REMARKS
1	(Set pointer even with last calibration mark when condenser gang is closed.)						
2	I.F.	12A8GT Grid Cap	.1 mf.	456 KC	Open	C11 A & B	2nd I-F
						C10 A & B	1st I-F
3	Rejector	*	200 mmf.	456 KC	Closed	C3	Adjust to minimum
4	Broadcast Band	*	200 mmf.	1500 KC	1500 KC	C6	Osc. Trimmer
						C5	Ant. Trimmer
5	(Check calibration and sensitivity at 1500 KC, 1000 KC and 600 KC.)						
6	(Check operations 1 to 6 inclusive.)						

Notes: *Connect dummy antenna to blue wire of loop winding.



Readers who file Service Data in separate binders remove page carefully, trim on dotted line for same size as data published heretofore.

SCHEMATIC DIAGRAM
SPARTON SUPERHETERODYNE MODEL 601-B
INTERMEDIATE FREQUENCY 456 K.C.
BOTTOM VIEWS OF ALL SOCKET CONNECTIONS



C1A&B	VARIABLE CONDENSER	B-8204
C2	.01 MFD 200V	C-3202-20C
C3	I.F. REJECT. TRIMMER	A-14088-2
C4	.05 MFD. 200V.	C-3202-84C
C5	B.C. ANT TRIMMER } ON VAR. COND	
C6	B.C. OSC. " }	
C7	50 MMF. MICA	C-720-372
C8	50 MMF. MICA	C-720-372
C9	.1 MFD. 400V	C-3204-85C
C10A&B	NO 1 I.F. TRIMMER	B-7200-GG
C11A&B	NO 2 I.F. TRIMMER	B-7200-GN

C12	.05 MFD 200V.	C-3202-84C
C13	500MMF MICA	C-720-318
C14	.01 MFD 200V.	C-3202-20C
C15	.01 MFD. 200V.	C-3202-20C
C16	.03 MFD. 400V.	C-3204-80C
C17	25-25 MFD ELECT.	A-15571
C18	.05 MFD. 400V.	C-3204-28C

R1	470 Ω .25W.	C-2795-151B
R2	8200 Ω .25W.	C-2795-181B
R3	56,000 Ω .25W	C-2795-63B
R4	470000Ω .25W	C-2795-29B
R5	7500 Ω .5W.	C-2796-180C
R6	22000 Ω 5W	C-2796-78C
R7	1 MEG .25W	C-2795-31B
R8	500,000 Ω VOL CONT. & SWITCH	A-15129-7
R9	10 MEG .25W.	C-2795-37B
R10	270,000 Ω .25W.	C-2795-91B
R11	560,000 Ω .25W.	C-2795-95B
R12	180 Ω 5W	C-2796-141C
R13	27,000 Ω .25W.	C-2795-79B

L1	I.F. REJECTOR COIL	A-14718-1
L2	B.C. OSC. COIL	A-14975-1
L3	NO 1 I.F. COIL	A-12064-32
L4	NO 2 I.F. COIL	A-12064-17
L5	B.C. ANT COIL (LOOP)	C-3290-1

The Service Forum

Conducted by

J. B. Straughn, N. R. I. Service Consultant

Send in your service notes. We will re-word them for publication. To qualify your note for the News *you must have observed the same trouble on two or more identical receivers.*

AIRLINE MODEL 62-305 INTERMITTENT
This condition accompanied by weak signals and loss of volume may be due to the shield of the grid lead for the second detector tube shorting out to the tube top cap. Either shorten the shield or tightly tape its end so that it cannot touch the top cap of the tube.

DALE BOUGHNER, Ohio.

———— n r i ————

ZENITH 1939 MODELS DEAD
When these receivers are dead and give symptoms of a short across the output of the rectifier tube (plate glowing red and blue glow in the vacuum) check the filter condensers. If they are in good condition, locate the .05 mfd. by-pass condenser from the wave band switch to the chassis. This shunts the output filter condenser and if shorted will give the same effect as a broken down filter condenser. Use a replacement of the same capacity rated at 600 volts.

JOHN KELLY, Illinois.

———— n r i ————

ZENITH CHASSIS 5805, 1005 AND 1103 OSCILLATES AT 550 KC.
This is generally due to improper adjustment of the wave trap or to excessive resistance in the plate circuit of the 1232 tube.

———— n r i ————

ZENITH CHASSIS 5805, 1005 AND 1103 AUTOMATIC DEAD
If this condition is encountered or if the antenna trimmer cannot be peaked, the trouble is usually due to an open winding on the compensating coil. Noisy tuning is often due to the ground braid of the gang rubbing against the flywheel. Burrs on the drive shaft shorting to the volume control shaft will also cause this action as will rubbing of the dial pulley against the dial or chassis. If the tuning indicator is inoperative the resistor inside of the socket may be shorting to a socket prong, there may be a loose lead in the socket or the cathode lug on the voltage divider may be grounded by excess solder. Blocking is generally due to a broken resistor in the A.V.C. circuit of the first detector.

ZENITH CHASSIS 5724 AND 5725 NOISY TUNING ON AUTOMATIC
Check for the following: poor contact on speaker socket, washer on latch bar grounding lug, poor contact on band switch, aeroplane lug on automatic grounding to No. 5 push rod and automatic trimmer shorting.

———— n r i ————

ZENITH CHASSIS 5724 AND 5725 DEAD ABOVE 1400 KC.
This is generally caused by the 5 megacycle trimmer being screwed in too tight. If signal cuts out on the local-distance switch try a new 6AS type tube. If no change is noted when the treble button is used the insulation of the blue tone control lead has been cut by the fastening lug.

———— n r i ————

ZENITH CHASSIS 5724 AND 5725 WEAK AUDIO
Check for a poor contact in the television switch and for an open coupling condenser. Oscillation can usually be traced to open screen by-pass condenser, to improper adjustment of the wave trap or to an open in the wave trap. Improper positioning of the grid lead of the 6K7 tube will cause trouble. Keep this lead away from the A.V.C. lug or the plate lead of the 6A8.

———— n r i ————

ZENITH CHASSIS 1007, 1208 AND 1504 INSENSITIVITY OR WEAK PHONOGRAPH
Check the phonograph switch and plug contacts and the shield on the lead from the crystal for a poor ground.

———— n r i ————

ZENITH CHASSIS 1205 AND 1503 ERRATIC VOLUME CONTROL ACTION
This is generally due to the 6J5G tube in the audio stage and another should be tried. Poor radiorgan action is often caused by defective 6F8G tube in the audio system.

———— n r i ————

CROSLEY 1227 DIAL STOPPAGE
In order to eliminate dial stoppage on the motor driver, replace the driver belt and rubber sleeve on the tuning shaft with the new factory type No. 45449 sleeve and 45448 belt.

(Page 27, please)

Developing the Ability to Diagnose Receiver Troubles

(Continued from page 20)

full of probable causes of different types of defects. Study this book and try to visualize the reasons why the listed causes will result in the described defects. It is an excellent policy to refer to this book when you encounter some unfamiliar receiver symptoms.

Another excellent source of second hand experience are the service notes, published in the NEWS and in other radio magazines. As a matter of fact the true value of these notes lies in the fact that they tell you: Filter condensers are often defective, coupling condensers can cause intermittent reception and distortion, volume controls eventually get noisy and so on. The original purpose of service notes was to list weak points in receivers but sets are built better nowadays and weak points in a complete line seldom develop. Therefore service notes should be viewed as individual defects which might not again be encountered in the specified model. But read them and use them by remembering that a leaky coupling condenser in an Atwater Kent will cause distortion just as quickly in a Grunow.

The Service Notes presented in the NEWS are checked to see if they are authentic—not so with all service notes. Johnny Jones made famous in verse at the start of this story, has a Sparton 580-X which distorts and, to his everlasting dishonor, finds that shorting R_8 in the voltage divider eliminates the distortion. So a service note is born, and all the other Johnny Joneses make a mental note to correct distortion by shorting resistors.

Now you, one day if not now, reason thusly: Resistor R_8 is the bias resistor for the 75 tube. If shorting it out removes distortion there is too much voltage across it. This is due either to a change in value of the resistor or to excess current through it. The resistor value is correct so those parts which, if bad in a certain way, could cause excess current are checked for such trouble. Resistor R_7 is checked to see if it has decreased in value as is R_8 and we check for leakage in condenser C_{13}.

The moral is to take service notes with a grain of salt and to forget about them if you can *see* that they are unreasonable.

Color Television

(Continued from page 9)

one realizes that ordinary television receivers giving black and white pictures can receive color television broadcasts by the simple addition of a color disc attachment.

Although I do not recommend that individual servicemen attempt to install rotating discs on their television receivers, I will state that manufacturers of television receivers will not find it costly to add this attachment. Dr. Goldmark stated that

Courtesy, Gen. Elec. Co.

Color television, using a standard-type receiver with no additional equipment other than color revolving disk, was demonstrated by Dr. E. F. W. Alexanderson of General Electric to members of the National Television Systems Committee in Schenectady. Viewing the demonstration in Dr. Alexanderson's home are Dr. Alexanderson (left) and George Henry Payne, member of the Federal Communications Commission.

the cost of a small motor and a gelatin disc of proper characteristics would bring color television to the looker-in.

The simplicity of the color television attachment and the fact that the Columbia Broadcasting System expects to make commercial color television broadcasts early this year should prove to be of real interest to those who are within the range of a telecaster.

———————*n r i*———————

To help the young soul, to add energy, inspire hope, and blow the coals into a useful flame; to redeem defeat by new thought and firm action, this, though not easy, is the work of divine men. —Emerson.

N.R.I. ALUMNI NEWS

Dr. Geo. B. Thompson ..... President
Edward Sorg, F. E. Oliver ..... Vice-Pres.
Alfred E. Stock, Peter J. Dunn ..... Vice-Pres.
Earl Merryman ..... Secretary
Louis L. Menne ..... Executive Secretary

N. R. I. Alumni Association Elects Officers for 1941

In a friendly contest that was nip and tuck until the closing week, Dr. George B. Thompson of Los Angeles was elected President of our Alumni Association for the year of 1941.

John Stanish ran a strong race, but the late vote from the western coast was in favor of Dr. Thompson and enabled him to forge ahead in the final tally. Stanish, who has gained much prominence as Chairman of Detroit Chapter cast his vote for Dr. Thompson because he felt Dr. Thompson was deserving of the office of President after serving several terms as Vice President. In the words of Stanish, no man in our organization is better fitted for the honor.

In paying this tribute to our new President, Stanish expresses the sentiment of the great majority of our members and he also typifies the fraternal spirit of our organization which is based on good fellowship and an unselfish purpose to serve one another.

Dr. Thompson, as was pointed out in these columns last issue, is a professional man of wide reputation, who has a warm spot in his heart for home study training as is amply proved by the fact that he has found time to complete twenty-three home study courses in spite of the great demands upon his time as a practicing physician. His interest in Radio, his ever willingness to be of assistance to our members, his great understanding of human nature, bring us a man for President who will serve us well and of whom we are genuinely proud.

In the contest for Vice Presidents, Earl Oliver of Detroit and Alfred E. Stock of New York were re-elected. Pete Dunn of Baltimore comes back as a National officer by being elected a Vice President. Edward Sorg of Chicago also was elected a Vice President. The vote was close and all candidates in the race made a good showing even if not elected.

Earl Merryman was re-elected Secretary. Earl has held this office ever since our Alumni Association was organized in 1929. He is extremely popular with our members.

L. L. Menne also received a strong vote and was re-elected Executive Secretary. He will be at his regular station at Headquarters ever ready to take care of the many duties that are the responsibility of the Executive Secretary of an organization including members in all parts of the world.

With our roster of officers complete our Alumni Association is ready to march forward to another big year in 1941. Your suggestions, your compliments and your criticisms are solicited and appreciated. Your officers desire that you give expression to any thoughts you may have which will better enable us to be of service to our members and to the Radio industry in general.

New York Chapter

It is the consensus of opinion of our officers and members that our Round Table discussions are most helpful. Our increasing attendance also seems to prove this. Of late we have had more of these discussions and, while it is our plan to have a prominent speaker now and then, for the most part we are going to stick to our formal discussions.

At the meeting conducted by Mr. Kaufman and Mr. Straughn from Headquarters, the entire evening was devoted to a discussion of Radio problems of various nature. A member encounters a problem—he wants a solution. He submits the question and Kaufman or Straughn would give the answer. This was a very popular meeting with seventy-six present, but it was not at all different than our regular Round Table discussions which are presided over by our own officers. In other words, every meeting is a productive one. Every one present has an opportunity to participate, either by asking questions or offering possible solutions. That's what the fellows want.

Getting back to the Kaufman-Straughn meeting we are submitting some photos which were taken

A meeting of New York Chapter. Chairman Gordy is seated in the center and Secretary Kunert at the extreme left.

by our own Frank Zimmer to whom we are grateful for his interest and services. Likewise a vote of thanks is given to Al Stock, our Vice President for supplying the P. A. System. This spirit of cooperation abounds in our Chapter and is genuinely appreciated by our members.

Chairman Gordy, the center figure, first row in the group photograph, worked hard to make this meeting one of the outstanding affairs of the year and the splendid attendance speaks well for the thoroughness of his efforts.

A number of the members of the Philadelphia-Camden Chapter attended and we were glad to get a photo of them as a keepsake of the fraternal spirit which is manifested by all the members of our Alumni Association.

Mr. Stokes the retiring President of the N.R.I. Alumni Association spoke briefly and was accorded a rousing reception. Others who responded to an introduction were Norman Kraft, Charley Fehn, and Lou Michalski.

Irving Gordy of New York, Norman Kraft and Clarence Stokes of Philadelphia, L. L. Menne and J. Kaufman of Washington and Charles Kerr of Philadelphia, rear row. Louis Michalski, Charles Fehn, Charles Kuhns and Marcel Coulon of Philadelphia, front row, at a meeting of New York Chapter.

At another of our meetings Chairman Gordy reviewed one of the N.R.I. textbooks. After a short intermission Gordy explained how to align a Philco receiver. This explanation was based on a practical demonstration. Gordy, by the way, is now connected with Philco in New York.

Nominations and election of officers for 1941 will be reported as promptly as determined but this will have to go over until the next issue of the News because we will be unable to get the information to you in time for this issue.

Louis J. Kunert, Secretary.

———*n r i*———

Our yesterdays follow us: they constitute our life, and they give character and force and meaning to our present deeds.—Joseph Parker.

The Service Forum (Continued from page 23)

CROSLEY MODEL 1227 — MOTOR NOT STOPPING OR DRIFTING PAST STATION

Mix a 50% solution of mineral oil and kerosene. Remove the chassis and dab the solution in the clutch and clutch finger assembly with a small camel hair brush, at the same time working the tuning knob back and forth in order to allow the solution to penetrate. If the clutch is very dirty it may be necessary to repeat the above operation in a short time although in most cases a single cleaning will be sufficient to assure satisfactory operation.

———*n r i*———

BOSCH MODEL 140 — AUDIO OSCILLATION

Check the position of the control grid lead for the 75 type tube. Proximity of the lead to the 41 type tube will result in oscillation. Make the lead stay close to the 75 by twisting the grid clip or place a shield over the lead and ground it to the chassis.

———*n r i*———

BOSCH MODEL 370 — HISSING AND WEAK SIGNALS

This is indicative of an open primary in the antenna coil. If weak oscillation is noted on all stations, check for an open in by-pass condenser C33 located in the same circuit.

———*n r i*———

CLINTON MODEL 52 — HUM

This is due to pick-up by the grid lead of the 6C6 tube in the detector stage. Re-route the grid lead directly to the top of the tuning condenser. It may be necessary to use shielded wire over the lead to entirely eliminate hum pick-up. The shielding may be grounded to a convenient point such as the frame of the tuning condenser gang.

———*n r i*———

FAIRBANKS MORSE MODEL 44 — AUDIO OSCILLATION

If this difficulty disappears when the tone control is set to the bass position, try a new bias cell in the grid circuit of the output tube. Be sure and clean all contacts so that a good connection will be made to the new cell.

———*n r i*———

GRUNOW CHASSIS 8B — VOLUME TOO LOUD

If it is impossible to reduce the volume control sufficiently on local stations, check for a short or open in the second detector cathode bias by-pass condenser. For replacement purposes a 10 mfd. 25 volt condenser may be used.

———*n r i*———

MOTOROLA MODEL 82A — OSCILLATION ON SHORT WAVE BAND

Squealing or thumping on the high frequency end of this band around 20 megacycles may be cleared up by inserting a small suppressor resistor in the grid lead of the mixer tube. A 60 ohm or thereabout non-inductive resistor placed directly in the grid lead to the grid cap of the mixer tube will do the trick.

ZENITH CHASSIS 5907 AND 1206 — DISTORTION

If the distortion is similar to that obtained by a defective A.V.C. system and yet the A.V.C. system is intact, try new filter condensers.

———*n r i*———

ZENITH CHASSIS 5907 AND 1206 — TUNING EYE FLUTTERS

This is caused by an open A.V.C. filter condenser. Over-lapping of the eye on strong signals is due to open A.V.C. resistors while lack of eye action is generally caused by a short in condenser C7. This is a .05 mfd. A.V.C. filter condenser.

———*n r i*———

ZENITH CHASSIS 5714 — CHIRPS ON MEDIUM TO LOUD SIGNALS

This is caused by a leaky .002 mfd. condenser connected across the speaker leads. Install another condenser of the same capacity rated at 600 volts or more.

———*n r i*———

ZENITH CHASSIS 5714 — RADIORGAN TROUBLES

No effect:
Insulation on the 33,000 ohm resistor has cut through and the resistor has shorted to the cathode lug.

Open leads, poor contact at switch and an open condenser are to be suspected.

The plate lead of the I.F. may be too far away from the chassis—push down close to metal base.

Too much change on some, none on others:
Caused by a shorted condenser or lead shorting to the switch.

Tone changes with different settings of volume control:
Caused by a defective volume control or shorted terminal either of tone switch or volume control.

Poor contacts and defective or shorted volume control taps will cause the trouble.

Noisy when tuning:
This is usually caused by dirty wipers on the gang tuning condenser, by the flywheel touching the band switch lug, by the volume control or drive shaft not making good contact to the ground or by the volume control shaft and drive shaft being out of line.

Volume control has two peaks and distorts at low volume:
Isolate the 6F5 grid circuit from the I.F. plate leads. (Later sets have I.F. plate lead shielded.)

———*n r i*———

ZENITH CHASSIS 5714 — SET WHISTLES AT MEDIUM VOLUME

This condition is due to an open filter condenser. If the receiver is noisy between signals, look for a loose connection or open condenser across the R.F. choke.

Here and There Among Alumni Members

A baby girl came to the home of George Chamberlain, Dawson Creek, B. C., Canada, while the thermometer showed 40 below. Chamberlain says it is beginning to get cold up there now. Beginning!

———n r i———

Our good friend, Samuel T. DeWald of St. Clair, Penna., is recovering from the shock of a serious automobile accident which marred the Christmas Season for the DeWald family.

———n r i———

John Biaselli, former Secretary of Philadelphia-Camden Chapter, called at Headquarters while on furlough. He is now in the Marines and is putting his Radio training to good use in the Signal Corps.

———n r i———

R. Bock finds his Radio training valuable in his work as Phonograph motor inspector at Elyria, Ohio. He is preparing for advancement to inspector of home recorders. All kinds of jobs in Radio.

———n r i———

Kendrick Head of Nashville, Tenn., was making $30 a week as a Radio serviceman. Along came an offer from his local airplane factory to install Radio and electrical equipment in planes at $47.50 a week. Needless to say he took the job and likes it very much.

———n r i———

Our best wishes for a speedy recovery go to our good friend F. R. Hills, Regina, Sask., Canada, who has been very sick.

———n r i———

And here is good news. Robert Beaule, Lewiston, Maine, has fully recovered from a long illness. Sends in some pictures of his Radio shop. Has a nice place, fully equipped.

———n r i———

Secretary Grasser of Baltimore Chapter says the proposed dance is to be private for N. R. I. members, their wives and sweethearts. What do you mean—private!

———n r i———

A great big thanks for the many holiday cards and letters of good wishes received by us at Headquarters. They were all sincerely appreciated.

———n r i———

Stokes Gresham, Jr., is Chief Engineer at Radio Station WBOW, Terre Haute, Ind.

———n r i———

Melvin F. Berstler has joined the technical staff at Radio Station, WKBH, La Crosse, Wis.

———n r i———

John J. Cleaver of Perth, Ont., Canada, is doing about $21,000 worth of business a year. He paid for his stock and building out of his earnings. A real live wire, this man Cleaver.

Any of our fellows in San Francisco who would like to see a nice Radio Laboratory will be welcome at the shop of F. W. Beckman, 155 Howth St. Beckman, who is better known in Radio circles as Beck, built this fine business on sheer determination to get out of a rut. When he enrolled with N.R.I. he had been out of work six months. Something had to be done. He turned to Radio and with the help of his wife built a prosperous business. He is in the money now.

———n r i———

Claire E. Dye has been sending Mr. Straughn some nice service notes which will appear in the News *soon. Mr. Dye is Service Manager for Montgomery Ward and Company, Ashland, Ohio.*

———n r i———

Our own Samuel A. Gornick of Detroit, Mich., is the author of an article "Locating Defective Capacitors" which appeared in a manual put out by the Cornell-Dubilier Electric Corp.

———n r i———

One of the nicest letterheads we have seen in a long time is that of Hatcher's Radio Service, Anderson, S. C. Hatcher graduated in 1933 *and has been doing a fine Radio business ever since. Has two assistants.*

———n r i———

Two years ago Jackson C. Ream, Albuquerque, New Mexico, went into the Radio business with little more than his Radio knowledge. Today he claims to have the largest and busiest shop in the state.

———n r i———

If Stokes will bring his wife to more of the Philadelphia-Camden Chapter doings it will be O. K. with the members. Boy, is she cute!

———n r i———

Carl C. Roth of Goose Creek, Texas, is doing nicely in his Radio business. Has his own building with space for auto Radio work. Wonder whether he knows our Arlie J. Froehner of Goose Creek who is also doing all right by himself in Radio.

———n r i———

James O. Conde is now in the Army Air Corps at Randolph Field, Texas. He is with the 52*nd School Squadron and likes it. Getting a big kick out of life.*

———n r i———

Last issue we mentioned that Herman Doberstein was married recently. Then we met Mrs. Doberstein at a party in Philadelphia and she informed us they have been married eight years. Somebody is being kidded and we think it is us.

———n r i———

A. Parmentier had his car wrecked in an accident. While waiting in the Police Station of an Illinois city to report the accident he became interested in the two way Radio equipment. He was asked if he knew anything about it—he did—and was offered a job which he will accept.

Philadelphia-Camden Chapter

Our social party, held at the Tacony Club, was a gala affair. The attendance was not up to expectations owing to extremely bad weather, but what we lacked in numbers we made up in spirit. The music was good and refreshments were aplenty. After the dance broke up a number of the fellows and their wives went to the home of Clarence Stokes where the festivities continued for another several hours.

Menne and Straughn came over from Washington accompanied by Dunn and Gosnell from Baltimore. Each was required to step to the microphone for a few remarks.

Bert Champ, Norman Kraft, Charley Fehn, Clarence Stokes, Lou Michalski, Herman Doberstein and Al Wysoczanski were in charge of the arrangements and, assisted by their ladies, did a fine job.

A group of the fellows went to New York to visit the Local Chapter there. They were royally received by the New York officers and members. We have also promises from quite a number of our members to attend the dance in Baltimore to which Dunn and Gosnell extended invitations to us.

We, too, are devoting ourselves to Round Table discussions at our meetings. We find other Chapters follow this procedure very much along the lines we do.

As soon as our 1941 officers are elected we will have some interesting announcements to make regarding our programs for the balance of the winter.

L. A. Michalski, Secretary.

———*n r i*———

Louis J. Kunert, the very efficient Secretary of New York Chapter.

Chicago Chapter

We are pleased to announce that our new meeting place is Douglas Park Field House, 15th and Albany Streets. Meetings are held on the first and third Thursday of the month, at 8:15 P.M.

This new meeting place should enable us to increase our attendance because it is more centrally located than our former place and decidedly more convenient for our members to reach.

On January 16 a special meeting is scheduled at which time we are to be visited by L. L. Menne from Headquarters. This meeting will be fully reported in the next issue of the News.

Stanley Lukes, Chairman, and James Cada, Secretary, newly elected officers of Chicago Chapter.

Our new Chairman is Stanley Lukes. He is a live wire and promises plenty of action throughout 1941.

We shall be very glad to have N. R. I. men in the Chicago area drop in on us at anytime. Visitors are always welcome.

James Cada, Secretary.

———*n r i*———

A Newspaper Pick-up

A full charge of shot struck Mr. ——— squarely in the back door of the henhouse.

—*Peoria (Ill.) Star.*

Baltimore Chapter

Election of officers has been held and the following will serve during 1941.

Chairman—E. W. Gosnell
Vice-Chairman—H. J. Rathbun
Secretary-Treasurer—John W. Grasser
Sergeant-at-Arms—Edward George
Librarian—H. J. Rathbun
Finance Committee—H. Z. Snyder, C. Hachmeister, A. Hooper
Consultants on Radio Problems—H. J. Rathbun, H. Z. Snyder

Mr. Gosnell, our new Chairman, long has been one of our most loyal members. He has attended meetings regularly, sometimes at considerable sacrifice to himself, and has always taken an active part in the affairs of our Chapter. His devotion to duty in less important offices he has held,

E. W. Gosnell, the 1941 Chairman of Baltimore Chapter.

has won the admiration of our members and it was fitting that he should be elevated to the office of Chairman.

A busy and constructive program is being mapped out by Chairman Gosnell. In his remarks, at the time the chair was turned over to him, Gosnell assured the members that he will always be on the job in their interests and he was pledged full support by all of the new officers and members. This is going to be a big year for Baltimore Chapter. Every meeting promises to be fruitful.

One of our prominent guests was Mr. James G. Pope, Radio Officer, British Merchant Marine. Mr. Pope related some of his experiences in a most interesting talk. His ship was in port at Baltimore, but since has taken off for an undisclosed point. Our best wishes for a safe voyage went with Mr. Pope, a very likeable chap.

Mr. A. Hooper lost his father. A resolution expressing the sympathies of the members of our Chapter, was adopted and other appropriate action was taken.

Chairman Gosnell gave us an inkling of what he has in store for us when he spoke of some of the ideas he has in mind—lantern slides explanatory of diagrams, question box and practical demonstrations. To begin with a social meeting is scheduled to open the year at which time officers will be installed. This meeting will be held during the interim between this report and the time this issue goes to press—a more complete report shall have to wait until the next issue.

The dance is still a subject of interest. Chairman Gosnell announced that the committee in charge has decided to make the dance a private affair for N. R. I. members, their wives and sweethearts. Philadelphia-Camden and New York Chapter members will be invited.

If you live in the Baltimore area, come to our meetings. They are held on the first and third Tuesday of the month at Fishpaw's Hall, 2nd floor, Baltimore and Gilmor Streets.

JOHN W. GRASSER, Secretary.

Detroit Chapter

A special meeting is scheduled for January 22 at which time we are to receive a visit from Executive Secretary Menne. We expect a large attendance at this meeting. Aside from an interesting program of constructive work this special meeting promises to have its social side in which all present take part. Menne always brings us an inspiring message from Headquarters.

Chairman Stanish passes the following message to all members and prospective members in the Detroit area and to all members of the Alumni Association at large:

"This is the beginning of a new year for Local Chapters. We are all ready to settle down to work for another year. Let's all get behind the wheel and do our level best to push N.R.I. Alumni out in front where we belong.

"After all is said and done, you and I, as members make the Alumni what it is. National Officers of the Alumni and the faculty of N.R.I. are ready and anxious to serve us at any time, in any way. This is an organization of cooperation. If you have not joined the N.R.I. Alumni Association, or if you are not taking a keen interest in its affairs if you have joined, you are neglecting your responsibility to yourself and to all Radio servicemen throughout the country."

Meetings are held regularly on the second and fourth Thursday of the month, at Vernor Super Station, 2500 Jos. Campau. We meet at 8:15 P.M.

F. EARL OLIVER, Secretary.

We Like Suggestions

I like the questions and answers on Radio that are published each issue. I have a suggestion which I believe would help the students and graduates. It is to publish a Radio diagram and make two or three mistakes in the diagram and let the students and graduates correct them. Publish the names of those that send in the best report on the diagram.

J. R. VIVIERETTE, JR.
Rocky Mount, N. C.

———— n r i ————

Service Forum Is A Help

I found trouble in a Majestic Model 60 and cured it as described in an issue of the NEWS. I have received enough money to pay for the NEWS for the next ten years just by a little information which was in one of your issues about squealing Philcos.

FRANK J. GARENTY,
Maryd, Penna.

———— n r i ————

From An Alumni Member

I am proud to be lined up with what I call a co-operative Radio organization. I love Radio. May the N. R. I. continue to grow in the future as it has in the past.

JOHN M. GEORGE,
Borger, Texas.

———— n r i ————

Pleased With Recent Articles

I just finished reading N. R. NEWS and find the article on Oscillators by J. A. Dowie is really a knockout, and also the article by George J. Rohrich on Resistors, a real enlightenment. It's amazing how a fellow can forget some of these things over a period of time, if he does not refresh his memory. I hope articles such as these will appear more frequently.

SAMUEL A. GORNICK,
Detroit, Mich.

Wants to Exchange Letters

Our NATIONAL RADIO NEWS is certainly "hot." I surely enjoy its educational articles. It is one of the finest little books in the Radio world. I think more of us Alumni members should correspond with each other. How about it, fellows?

VICTOR KELLEY,
Tela, Honduras, Central America.

———— n r i ————

Jay and Ozzie Are Still Popular

Your NEWS gets better and better each number. I especially enjoy the "Jay and Ozzie" stories and get a great deal of good out of the Service Notes.

JAMES R. POU,
Courtland, Miss.

———— n r i ————

You See! Send In Your Personal Items

Needless to say I enjoy every word of your bi-monthly magazine very much, and take special interest in the section devoted to "Here and There Among Alumni Members."

R. DAVID ROBINS,
Sherbrooke, Que., Canada.

———— n r i ————

You Are Right. We Promise

Allow me to express my appreciation for your fine magazine, NATIONAL RADIO NEWS. But please don't print the Service Forum notes back to back; use separate pages. I, like perhaps many others, clip these notes out and file them according to the set and model, as well as under the particular type of trouble encountered. If these notes are printed back to back I either have to copy them from the magazine or choose the ones I prefer to keep and lose the others. This suggestion is made not in criticism, but to add to the utility of the magazine.

R. M. SADLER,
Kansas City, Mo.

Bulletin Analyzes Power Line Radio Interference Faults

Servicemen who have made it a point to study Radio interference elimination as a means to increased profits in this rapidly growing phase of the business, will find much of general interest in an entirely new 8-page bulletin, "Radio Interference Elimination for Public Utilities," just issued by Sprague Products Company of North Adams, Mass.

This bulletin includes a complete description of the causes and cures of Radio interference on

power transmission and distribution lines as developed by Sprague engineers in more than three years of field and laboratory work. Although it is written primarily from the angle of the public utility company and deals with problems relating directly to public utility power lines, the booklet should prove helpful to servicemen. It will serve as a guide in helping them diagnose Radio noise complaints, to tell whether the interference is coming from some appliance or electrical equipment connected to the line or from the line itself. A copy will be sent free upon request to bona fide Radio servicemen. Write direct to Sprague Products Company, North Adams, Mass.

———*n r i*———

How To Court A Radio Girl

If she wants a date—Meter.
If she comes to call—Receiver.
If she wants an escort—Conductor.
If she wants to be an angel—Transformer.
If she proves you were wrong—Compensator.
If you think she is cheating—Detector.
If she eats too much—Reducer.
If she is wrong—Rectifier.
If her hands are cold—Heater.
If she wants a vacation—Transmitter.
If she talks too much—Interrupter.
If she is narrow in her views—Amplifier.
If her way of thinking is not yours—Corrector.
If she won't be true—Eliminator.

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L. L. MENNE, EDITOR
L. J. MARKUS, TECHNICAL EDITOR

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