MAKING COMMERCIAL TELEVISION POSSIBLE

(Continued from page 7)

At other times the Television studios make use of standard motion picture film, which is run through a special form of pick-up apparatus so that every inch of the film is scanned and translated into electrical terms by a photoelectric cell. The films may be silent or accompanied by regular sound recordings, as desired or necessary.

In addition to the usual broadcast receiver tuned to 1180 kilocycles for the W3CRD signals, a special short wave television receiver is required, operating in the 2,000-2,500 kilocycle (100-150 meters) band in which television transmitters now operate. The television receiver is tuned to 2035 kilocycles, bringing in the W3CRD signals. The Televisor or image weaving device takes the place of the loudspeaker, when receiving Television signals.

Located in the very heart of New York City, the leading entertainment and news center of the nation, the Radio talkies studio will bring no end of interesting features to its audience.

With suitable home receiving equipment now being made available, the Television art is rapidly taking its place alongside sound broadcasting as a most important and even indispensable aid.

---Be a Pal—tear off here and mail---

What about your Pal

When you're on top, will your old pal be able to blame you if he isn't enjoying success equal to your own?

Think of the fellow you've chummed around with. Maybe you went to school with him; or he's a fraternity brother; maybe you played on the same team.

You shared confidences; were real buddies. Will you let your future success separate you?

Radio's a great game—getting bigger every day. Don't let your pal get in a rut—get him into Radio. Send me his name—and I'll give him the names of the two friends you'd like to see succeed. I won't mention your name when I write them.

I'll help you "be a pal."

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Making Commercial Television Possible

By J. A. DOWIE, Chief Instructor

RadioTalkies, or combined sight and sound television programs, have made their debut in the New York metropolitan area, as a means of entertainment, by combining the television facilities of Station W2XCR with the sound broadcasting facilities of the Broadcasting Station WGBS.

The television transmitter, with an output of 5,000 watts, operates on 2635 kilocycles (147.5 meters). WGBS operates on 1380 kilocycles (254 meters). Signals of Station W2XCR are tuned in by means of a special television short wave receiver with Radiovisor, for the pictorial component of the program. Tuning the broadcast receiver to 1180 kilocycles provides the synchronized sound component transmitted by WGBS. The visual and aural combination is practically the same idea as the present-day talkies contrasted with the former silent pictures.

The television transmitter and Radio talkie studios are in the same building, the latter is not unlike the usual broadcasting studio with heavy draperies and other acoustic treatment.

In a room adjoining the studio is the control equipment. Here control room engineers switch from film pick-up to direct pick-up, on the various program features according to schedule, as well as from disc record or film sound pick-up, to the microphone before the flesh-and-blood performer. Control room engineers follow the visual and aural pick-ups by Radiovisor and loud-speakers. Looking into the Radiovisors, they see the pictures exactly as they go out over the air. Listening to the loud-speakers, they hear the sound component as it is going out. The picture and sound pick-ups must be amplified to a greater or less degree so as to strike the happy medium for uniform results at the home end, this function being served by the control room.

In addition to the microphone, the television performer has direct pick-up, which may be either the so-called flying spot, which is a beam of light which scans the image to be transmitted, and which is placed in a small room directly off the main studio, or the television camera.

The flying spot method of scanning the subject is employed in these studios. The front cover of this issue pictures H. G. Brown, of the Jenkins Television Corporation, with the flying spot scanner built by the DeForest Radio Company for Station W2XCR.

Page two
A Chat With the
N. R. I. Director
Who Pays the Broadcasting Bill?

A SHORT time ago, Mr. M. H. Aylesworth, President of the National Broadcasting Company, estimated that operating costs and fees for talent in the case of the National Broadcasting Company would approximate $30,000,000 during 1931.

It is logical to assume that the expenses of the Columbia Chain are equal to this amount. The total runs to an enormous figure, especially when the independent stations not affiliated with the chains, are also taken into consideration.

Another authority further states that under the present system of sponsored programs, the popularity of Radio will increase the country's broadcasting bill to $150,000,000 annually within the next five years.

The present estimated cost of broadcasting is $75,000,000 a year. There are approximately 14,000,000 Radio receiving sets in the country. By this rate, if we were operating in this country on the plan followed by some foreign countries, it would cost the set-owner about $5.50 a year in taxes to own and operate a receiver.

It is easy to see, from these figures, that the Radio public, under the American system of broadcasting, is extremely lucky. They are presented with this entertainment free of cost by the sponsors of the programs, and under this system there is no doubt that the authority quoted above has a logical reason to believe in the future popularity of Radio.

This "tax free" system of Radio is a good selling point for the receiving-set-buying public, although, one which I fear has not been advantageously used by Radio salesmen. Stress the point, to your prospective purchaser, when selling a set, that $75,000,000 worth of entertainment is on the air, each year, free to him. Someone else is paying his broadcasting bill.

Graduate Riddle Jenkins reports that with the assistance of the N. R. I. Employment Department he has landed a position as Sales Engineer with Riddle's Radio Service, Saranac Lake, New York. Incidentally, Mr. Riddle is also an N. R. I. graduate.

A Thought for the Month

If there are some of you who still doubt the value of character in the business world, let us turn to the classified section of any newspaper and read one ad after another in which employers are looking for men.

We'll find an abundance of requirements such as the following:

- who are "loyal"
- who have "initiative"
- who are "honest"
- who are "dependable"
- who are "ambitious"

These things which go to make up character can be built up without cost. A man's most valuable possession is his character.

E. R. HAAS,
Vice President and Director.

CLARION SUPERHETERODYNE MODELS 80 AND 81

Poor Sensitivity

This might be due to a high resistance connection in antenna coil, first detector, intermediate, second detector or oscillator primary, or secondary windings, short circuited turns in these windings or grounds due to loose strands of wire or excess solder or poor contact at control grid cap and at tube prongs, should be looked for.

Poor Selectivity

This condition may arise from the same causes and appear simultaneously with poor sensitivity. Where tuning is usually broad and the local broadcasting station is not causing the trouble, it is a good idea to check for high resistance in the grid circuits.

A high resistance connection in an r.f. circuit need not run to thousands or hundreds of ohms, especially in the oscillatory circuit, i.e., the circuit comprising the variable condenser and secondary, or tuned primary winding, and tests with a continuity meter may not give sufficient indication of the poor connection. In a case of this type where the connections are suspected, a practical remedy would be to go over these connections with a hot soldering iron. An improvement should be immediately apparent.

Oscillation

It should be remembered that with an intermediate frequency of 175 k.c., a heterodyne whistle, similar to oscillation, will be picked up at 700 k.c. This is due to the fourth harmonic of the receiver's oscillatory frequency beating with the carrier frequency of the broadcasting station to produce an audio note in the loudspeaker. However, this condition has been minimized in CLARION receivers because the intermediate frequency 175 k.c. has been selected by all manufacturers as the one intermediate frequency having most advantages and least disadvantages.

In addition, oscillation may be brought about by a poor ground, or ground at all being used. High line voltage may also cause oscillation. Omission of tube shields aggravates this condition. "Hot tubes" will seldom cause oscillation in a superheterodyne due to the wide tolerance shown by this circuit.

(1) An open screen grid by-pass condenser.
(2) An open r.f. cathode by-pass condenser.
(3) An open det. cathode by-pass condenser.
(4) Poor ground at the installation.
(5) A high resistance connection in series with a by-pass condenser.
(6) Tube shields removed and high line voltage.

Noisy Operation

Due to its extreme sensitivity, the superheterodyne may appear a trifle noisy on distant reception. However, it will be found that in turning down the volume on any station to equal that of a tuned radio frequency receiver, the superheterodyne will perform as quietly, and possibly more quietly, than the tuned radio frequency set does.

Other than this, loose connections causing intermittent open circuits or short circuits are probable causes. Ninety percent of noise operation arises in location, installation or 110-volt supply. Tubes are the most common source of noise operation, but we are assuming, of course, in all these texts that everything external to the chassis and speaker are kept to a minimum.

Where loose connections are suspected, go over all connections with a wood or fiber stick, moving each connection firmly BUT NOT ROUGHLY, listen for clicks or humming noises from the speaker. A vibration at a particular tone occurring repeatedly during the playing of music generally due to a loose or vibrating part on the speaker, and roughness or rasping at all tones is usually due to a rubbing voice coil. Tackle these troubles if the tube shields bear against one another.
What N.R.I. GRADUATES ARE DOING

Some notes made by the Editor while glancing through the N.R.I. Employment Department record:

Raymond W. Terry is Radio Operator on the S. S. President Harding.

Earl Downey is with Station WBIG, Greensboro, N. C.

Alfred Hissong’s job is Production Manager for the Trimm Radio Mfg. Co. of Chicago.

Louis Bruchiss is European Editor for Radio Industries Magazine.


C. S. Mao is in the U. S. studying Radio and automatic Telephone systems for the Chinese Government.

Fred Nichols is proprietor of the Eaton Radio Co., Sound Specialists, Greeley, Colo., and employs four other N.R.I. men. A 100% N.R.I. organization.

J. G. Dewar is Radio operator on the Canadian National Railway.

Carl Bischoff is operator at WPAD.

Robt. Brady is sales and service man for Montgomery Ward, Las Vegas, N. Mex.

Warren Thurston is with the Palmer Radio Co., Kansas City, Mo.

Making Commercial Television Possible

(Continued from page 3)

W2XCR. The scanning mechanism comprises a powerful arc light, a scanning disc, three lenses mounted on a turret for ready interchangeability, adjustable mirrors and stand. The operator can direct the scanning beam by means of lenses and mirrors, so as to pick up a close-up, a half length or a full length of the performer or performers. By means of lenses of different focal lengths, the operator can change from a close-up to a long shot without altering the relative positions of performer and scanner, adding greatly to the entertainment possibilities, as in motion picture technique. The photoelectric cells may be placed at any angle with relation to the subject, thereby obtaining various lighting effects in picking up the reflected light.

A nearby microphone picks up the voice music or other desired sounds while the performers face the television pick-up and converts these sounds into electrical values and greatly amplifies them. They are then impressed on the carrier waves of the WGBS broadcast station.

Since at any instant the subject is illuminated by a single spot of light, the reflection from which is picked up by the photoelectric cells and subsequently transmitted, while at the receiving end a single dot of corresponding light value appears before the looker-in, it is essential that both dots be exactly at the same point with respect to the entire image. This function is called synchronization. Where a common A.C. power system is available, the receiving and transmitting scanners are kept in perfect step by means of synchronous motors electrically geared together. Where different A.C. power systems are employed, there are other methods of maintaining the essential synchronization, including a synchronizing feature included in the television signal.

The change from the former 48-line, 15 pictures per second scanning to the present 60-line, 20 pictures per second scanning system of W2XCR and other television stations, provides not only greater pictorial detail but also reduces flicker to a negligible minimum.

At the home end the usual broadcast receiver is tuned to 1180 kilocycles, bringing in the usual sound program of Station WGBS, which, when the television is operating together serves as the sound accompaniment for the television program.

(Please sixteen, please)
THE FARNSWORTH TELEVISION SYSTEM

By A. C. kalbfleisch

N. R. A. Consultant on Television

The system of television invented by Philo T. Farnsworth, a graduate of N. R. A., is of vast importance to the television enthusiasts for several reasons. First, he has successfully transmitted pictures of far greater detail within the limits of a single broadcast channel, namely, 16 Kc. Secondly, he has eliminated the cumbersome and noisy scanning disc which is a necessary part of the transmitter in the "Flying Spot" method of transmission.

A brief description of the frequency band required for the "Flying Spot" method of television might serve to show why the Farnsworth system is such a stride toward the reception of good pictures. About the best detail that has been obtained so far with the use of the scanning disc is a 72 line picture. By this is meant a picture one inch square with two horizontal lines across it. Now suppose we divide our picture into 72 vertical rows. Our one inch square is now divided into 72 x 2 or 5144 picture elements. In order to get a continuous scene, that is, a moving picture, which does not appear to be a series of snapshots to the observer, we must have 16 complete pictures transmitted per second. Then for the transmission of our 72 line picture we must have 5,144 x 16 or 82,384 current pulses which are produced by the photo-electric cell as it responds to the variations of light and shade impressed on it by the 72 small holes in the scanning disc. As two pulses constitute one cycle, we have for the frequency of the system 82,384 or 41,102 cycles, or approximately a range of 41 Kc. If transmitted by radio a channel width of 41 x 2 or 82 Kc. will be needed. This you will see is a bandwidth equal to 8 broadcast channels. This fact at once limits the number of available channels for television.

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Let us study for a moment the circuit that has caused such radical changes in the television field. A simplified diagram of the Farnsworth transmitter and receiver is shown in Fig. 1. An optical image of the moving object O is focused through a lens L onto a silvered mirror M. This mirror M is being rotated with a light sensitive substance which emits electrons when exposed to light. These parts constitute a sensitive photo-electric cell of the vacuum type enclosed in a cylindrical glass tube T. The mirror M is the cathode. Closely adjacent and parallel to it is an anode A which is maintained 500 volts positive with reference to the shield K by means of B batteries, or other direct current source. The anode consists of a finely woven wire cloth mesh through the meshes of which the liberated electrons are projected into a space formed by the shield K.

Swiping across this space are two electro-magnetic fields which are set up by alternating currents, in two sets of coils placed at right angles around tube T. When no set of coils, represented by L, is supplied with a 16 cycle current having a saw-tooth shape from an oscillator OSC, it causes a magnetic field to sweep vertically across the scanning disc 16 times every second. When the other set of coils, which is not shown in the diagram, can be seen in Fig. 2 is supplied with a 2,300 cycle alternating current also of saw-tooth shape a magnetic field is swept horizontally across the scanning tube T 2,300 times per second. The result of this horizontal and vertical motion of the two magnetic fields is to cause the electrons to form into a cathode ray image which successively scans from each tiny picture element, corresponding to 720 or 200 line pictures. This cathode ray is then magnetically focussed through the small opening P onto the target or electron collector C.

A series of electrical pulses of 200 x 16 or 320,000 cycles in width, is produced on the collector. Each pulse corresponds to an instantaneous change in light and shade in each picture element which is successively scanned by the cathode ray tube. Thus the variations in light and shade in the picture are converted into corresponding variations in electrical current. These small current pulses are passed through a five-stage amplifier AMP, which is designed to pass a band of frequencies 60 kc wide. Naturally the amplifier must have no distortion over the entire band and this in itself was a serious problem.

Let us consider for a moment the receiving end of Fig. 1. Neglecting the filter P and the network between transmitter and receiver we will assume that a 640 kc. radio channel is available to transmit the amplified current through our receiver. The receiver is another cathode ray tube which is swept by two sets of magnetic fields in exactly the same way as was outlined at the transmitting end. The two sets of coils for creating these magnetic fields are 16 cycle and 2,300 cycle components of the 320 kc. band. These low frequency components now have a very peculiar shape so that they are readily extracted or filtered out from other frequencies and are used through local oscillators OSC to induce the required magnetic fields which cause a cathode ray to sweep across the receiver screen thus reproducing the original picture in exact synchronism with the original moving object O at the transmitter.

In the receiving tube, or "oscilloscope" as it is called, the electron emitting element is a hot filament. When emitted, the electrons are attracted to and projected onto the aperture of a plate P, the number of projected electrons being controlled by the current pulses on the grid GR. The intensity of these current pulses according to the intensity of the light received.

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Figure 1—The simplified schematic layout of the Farnsworth system for narrow band transmission of moving pictures. The line L is the interrupted line connecting the transmitter while the receiver is on the right. (Courtesy Radio News.)

Figure 2—A perspective drawing of the "Dissector Tube," employed in the Farnsworth System, showing details. (Courtesy Radio News.)
“Wholesaling” Radio Service

By P. J. MURRAY, Manager,
Employment and Graduate Service

TWO classes of Radio organizations offer the Radio-Trician the best market in the Wholesale Radio Service field.

One class comprises Radio Sales Organizations, which do not care to handle service, not having space, time, nor personnel to render efficient work. The other class includes the small dealer who cannot afford to operate his own service due to limited capital, lack of mechanical knowledge, or the fact that he handles Radio sales as a sideline.

In either case, they must let out their service and installation, because whether they like it or not—service is a necessity—demanded by purchasers of their products.

The far-sighted Radio-Trician will soon have as many of these firms as possible under contract for all their service work. This in short is what is meant by Wholesaling Radio Service.

I know of one organization which did a business of $35,000 in one year—the year of 1930. During that time they employed from five to thirty-five service men. The peak of the business was around the holiday season—Christmas and New Year.

Usually the service wholesaler will not handle the sale of any Radio sets. In this way he is looked upon more favorably by his dealers; he is not in competition with them. On his service bill he endeavors to keep the individual customers of these dealers sold on Radio and on the store from which they bought. He must often be a diplomat in this regard.

Wherever possible, he conceals the fact that he is the "wholesaler" or the "wholesaler's service man," as the case may be. He acts as the direct representative of the store which sold the receiver in the first place.

The "wholesaler" service man must be capable of repairing any Radio he comes up against—he cannot be a specialist on any one set, but must know them all. He must never show partiality to any receiver. To the customers they must all be good—wonderful, helpful inventions.

At least one case is on record where the representative of a wholesale Radio service company lost his firm the account of a large department store, and lost himself a good job by criticizing the set owner’s selection of a particular Radio.

It will not be possible to stick to any "cut and dried" contract arrangement. You may find it necessary to make a slightly different deal with each of your dealers. The essentials will be the same, naturally, and governed by the business policy you set out to follow, but the details will be altered to the mutual satisfaction of yourself and the dealer.

For instance, in the matter of replacement material for service work, you can either supply it at cost, plus 10%, or allow the store whose work you contract, to furnish it. The former plan is preferable. It saves time and gives you an added profit—but it must be remembered that it also necessitates carrying parts in stock—ordering, and other details.

Rates usually run at $1.50 per hour flat unless the set must be brought to your shop. In that case make a $2.50 charge for the regular service and a shop charge of $1.50 per hour with a minimum shop charge of $1.50—making the total minimum $4. Of course, to large customers—those giving several hundred service calls a year for instance, a special price of $1.25 or $.95 per hour should be offered. These rates, however, are only tentative—and must be governed more or less by the standard rate for Radio service work in the particular locality in which you are operating the business.

If the size of the business permits, a special "aerial crew" can be used—to save time for the more experienced service man. Give a good aerial job and don't try to make a big profit on it. For about $6 you can afford to give two ten-foot steel poles, lighting arrestor of the best type, wire, lead-in, etc., to the aerial binding post of the receiver. Add approximately 40% to this price if the aerial installation is to be on a peaked roof.
The Farnsworth Television System

(Continued from page 9)

depends upon the intensity of the light which creates them. Consequently, as they emerge from the aperture in the plate into the space beyond, through which the two magnetic fields are sweeping, they are formed into a cathode ray which rapidly scans the area of the receiver screen, thereby forming the moving picture.

Up to the present time in our discussion we have considered a 640 kc. channel to be available. In actual practice we cannot do this because in the entire 900 kc. band used by broadcasting stations in America there are only one and a half such channels available. Farnsworth claims to have solved this greatest problem in television, namely, to use a narrow channel for the production of moving pictures with sufficient clarity and detail. Mr. Farnsworth actually worked out this problem and as was stated at the beginning of this article he was able to transmit a 400 line picture within the space of 10 kilocycles.

The picture signal is amplified at the transmitter by means of a special type of amplifier known as an admittance neutralized amplifier. This amplifier must respond to band widths of 600 kc. which was a problem in itself.

The amplified signal now is fed to a low pass filter which eliminates the higher harmonics of the picture signal, permitting the transmission of a 200 line picture on a channel one mile wide. A superheterodyne circuit at the receiving end, of which the circuit details are not known as yet, is capable of reproducing the harmonics along with the fundamental picture signal, thus restoring the 320,000 cycle signal at the receiving end.

Let us return again to a study of the receiver circuit. Connected in series with the line is a resistor $R$ which feeds a shunt circuit consisting of an inductance $L_i$ and a variable resistor $R_i$. The resistive impedance of resistor $R$ is of sufficiently high value to control the current regardless of the effect of $L_i$. The flow of current through $R_i$ causes a voltage drop $E_i$ and through inductance $L_i$ a voltage drop $E_2$, which is proportional to the rate of change of currents in line. The sum of the two voltages, $E_1 + E_2$, is impressed on the grid of a vacuum tube $VT$ which has a high output impedance, such as the screen grid tube. Its

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National Radio News

Trade Notices

National Radio News accepts no advertising. Trade notices are published solely for the information of our readers. We assume no responsibility nor can we handle correspondence for these firms. They are glad to give full information. In writing them please mention National Radio News.

TRIMM HEADPHONES

The Trimmm Radio Manufacturing Company, 1528 Armitage Avenue, Chicago, has developed and placed on the market a FEATHERWEIGHT Headphone weighing less than one ounce. Cobalt steel magnet gives it a supersensitivity. All bakelite case and cap. No outside connection. Especially adapted for Service Men, Amateurs, Aviators and Hard of Hearing.

SUPREME RADIO DATA BOOKLET

Supreme Instruments Corporation, Greenwood, Mississippi, announce their new Radio Data Booklet, containing eighty-five pages of analytical data and Radio diagrams are now available. Request for copy should be accompanied with twenty-five cents in stamps or coin to defray postage and mailing expense.

BELDEN LIGHTNING ARRESTER

Belden Manufacturing Company, 4689 W. Van Buren Street, Chicago, announces a new Lightning Arrester with a $100 guarantee that lists for twenty-five cents.

The new arrester, or Lightning Buster, as they have named it, is resistor type with a bakelite shell. Unit approximately 2" long; weighs one ounce. Small size makes for convenient handling and neat, unobtrusive installation. In performance it does everything that a larger size arrester does. Compact housing encloses same size and type resistance parts used in the large arresters.
The Farnsworth Television System

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plate current, which is an amplification of the line current. In addition, the grid circuit causes a voltage drop Vg, which is proportional to I1 and I2. The same currents in indutance L2 cause a voltage drop proportional to their rates of change, thus producing two new currents which are fed into the condenser C1, which stores up the pulses fed to it. The pulsations which are fed to the grid control the intensity of the cathode ray which creates the picture. Resistors R1 and R2 are variable so that the values of the different parts of the circuit can be adjusted until the picture has the greatest detail.

Figure 2 is a perspective drawing of the "dissector tube" used in the Farnsworth system of television and is intended to show the constructional details of the tube.

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AND HERE'S A COMPLAINT

We're getting so used to having bouquets tossed in our direction from "News" readers who like our style that maybe we were slipping.

At least here's what we received from a Washington boy—just as the August issue goes to press.

"You're telling us too much in "The News" about what N. R. I. men are doing in the field. I don't think that makes such good reading."

Maybe he's right. Perhaps we should cut out the Mailbag—"How They Do It" and "Human Interest" stories and stick to editorial and technical material.

The Mailbag is open to discussion of this matter. If you care to answer "Our Friend from Washington," address your letter to "The Mailbag.

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