

*Farm* TELEVISION



## Television

Should a birth-date be given to television, it would probably be 1884, when a mechanical scanning system was patented by Paul Nipkow. It was not until 1925, however, that crude pictures were successfully demonstrated by John Logie Baird in London. Thereafter followed, in rapid succession, a series



of developments and improvements which established interest in television, many patents having been filed in the United States and Europe.

However, history was made when a one-act melodrama, "The Queen's Messenger," was televised at Schenectady in 1928. Due to mechanical and illumination problems, the mechanical television apparatus used in that era was unable to reproduce the pictures of high-definition that we know today.

An all-electronic system, using a camera-tube called a "dissector," was developed in 1927 by Philo Farnsworth obviating the necessity for whirling metallic disks or mirror structures which are basic to the mechanical television apparatus. Each succeeding



year is accredited with many developments in the art of television. There have been improvements in camera tubes, increasing their sensitivity and fidelity of reproduction. Electrical circuits and circuit components have become more compact and of higher efficiency. Great strides have been made in the understanding of the very high frequencies involved in high-quality television—all leading to truly fine picture reproduction. Surely, ours is an age of miracles.

There are, at this date of writing, fifty-nine commercial stations either actively broadcasting or having been issued construction permits by the Federal Communications Commission. These serve at least 23 states in whole or in part, reaching over thirty percent of the nation's population. Television services are expanding rapidly and these figures will soon be inadequate to indicate the coverage of television programming. Like radio, television is rapidly assuming a prominent place in the American way of life.

### EARLY MECHANICAL ATTEMPTS

### ELECTRONIC TELEVISION SUCCEEDS

### TELECASTING TODAY

### What You Should Know About Your Receiver

Your new television receiver is a precision instrument designed and manufactured to meet rigid specifications. Based upon pioneering leadership in the field of television, the Farnsworth label is an assurance of sound engineering and development in this, one of the most compact of television receivers employing a ten-inch picture tube. The receiver allows picture reception and,



### WHAT IT IS

receivers employing a ten-inch picture tube. The receiver allows picture reception and,

*Including information on*

ANTENNAS  
TERMINOLOGY  
TEST PATTERNS  
HOW TELEVISION WORKS

FARNSWORTH TELEVISION & RADIO CORPORATION  
FORT WAYNE 1, INDIANA

in addition, the sound portion of the program—the speech or music which accompanies the picture.

For television broadcasting, thirteen frequency bands or "channels" have been allocated. Each transmitting station occupies one channel. By ruling of the Federal Communications Commission, any single metropolitan area may have assigned to it but seven of these thirteen channels. One channel is reserved for the smaller cities, called a "rural" channel.

**CHANNEL ALLOCATIONS**

Since the reception of television signals is for technical reasons limited to about 40 miles (a single metropolitan area) there may be received by a television receiver only those stations in a given large metropolitan area plus, perhaps, the "rural" channel of a nearby smaller city. Therefore, for the reception of ALL assigned channels in your city, it is necessary to select but eight of the channels.

Your Farnsworth receiver embodies such a selective system. Since FCC ruling limits the stations received to eight in number, it will receive all television broadcasts which may be seen in your locality.

**Installation**

You will notice that there are several control knobs on the receiver with which you may not be familiar. Detailed instructions for the operation of the receiver are included in this manual and **SHOULD BE CAREFULLY READ BEFORE YOU ATTEMPT TO OPERATE THE INSTRUMENT.**

**CONTROL KNOBS**

**THE INSTRUMENT.**

The installation of your receiver, with an effective antenna, should be done only by an experienced television serviceman, for satisfactory picture reception cannot be expected unless proper installation is made. At the time of installation he will make the necessary adjustments to the several controls at the back of the cabinet. Thereafter, **THESE CONTROLS SHOULD NEVER BE MOVED.** Your Farnsworth dealer is represented by television technicians who have received specialized training and who are prepared to efficiently install your receiver.

**Antennas**

Television receivers require a specialized antenna, varying in configuration and cost between installations. Receiving conditions dictate the type of antenna necessary to satisfactory reception, a decision which may be successfully made only by one who has had considerable experience in television receiver installation.

**SPECIALIZATION OF ANTENNAS**

had considerable experience in television receiver installation.

Television reception is often subject to "ghost" images (dual images upon the screen rather than a single image) which are the result of signal reception over more than one path of transmission. Such dual or triple paths of reception arise from reflections of the television waves from large buildings or other structures. This reflection of television signals is a natural phenomenon exhibited by the very high frequencies employed in television transmission and may be overcome only by rejecting the undesired reflected signal. Of course, congested metropolitan areas involving many large buildings give rise to more serious reflection problems than do sparsely-settled locations.



**GHOSTS**

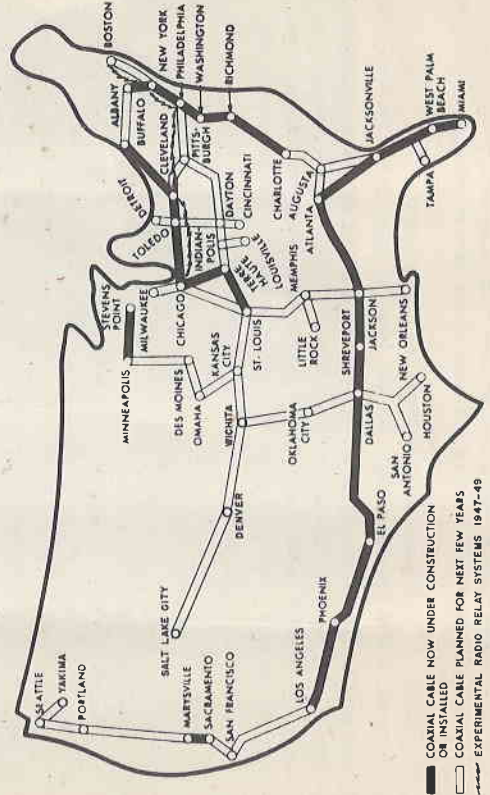
Rejection of the reflected signal(s) is accomplished by a specialized antenna which has certain directive properties; it receives better from certain directions, with respect to a given position, than from other directions. Receiving more efficiently from certain directions, it must be rotated upon changing from one station to another when the broadcasting stations are geographically widely separated.

**REFLECTIONS**

Certain types of antenna are more discriminant than others. The single-element antenna, the dipole (fig. 1) exhibits directivity properties to a mild degree and will in most localities suffice to provide satisfactory reception. Should the signal received be weak or serious reflections of signals be present, then a more complex configuration will be necessary—the addition of directors and/or reflector elements to the simple dipoles, (fig. 3 and 4).

**DIRECTIVITY**

**Bell Telephone System of Coaxial Cable**



— COAXIAL CABLE NOW UNDER CONSTRUCTION OR INSTALLED  
 - - - COAXIAL CABLE PLANNED FOR NEXT FEW YEARS  
 --- EXPERIMENTAL RADIO RELAY SYSTEMS 1947-49

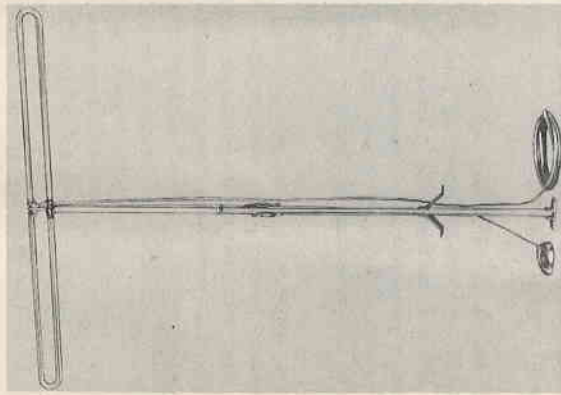


Fig. 1. A simple antenna, satisfactory when no reflections are present and signal strength is great.

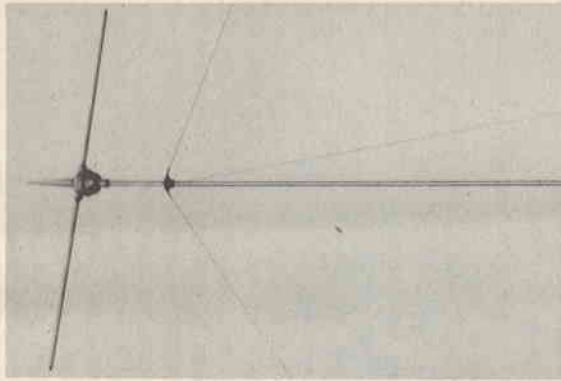


Fig. 2. Rotable single-element antenna, mildly discriminant against reflections.

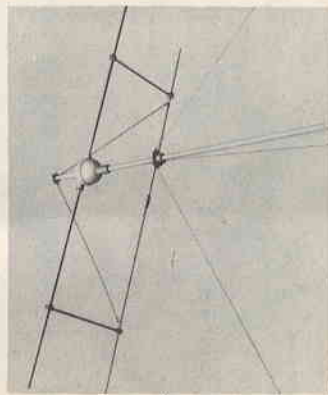


Fig. 3. Two-element antenna which is more discriminant against reflections and which affords more efficient pickup if the signals are weak.

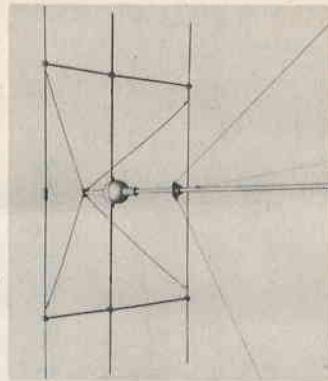


Fig. 4. A three-element antenna exhibiting very pronounced directivity and much increased pickup efficiency in the presence of a weak signal.

## How To Operate For The Best Picture

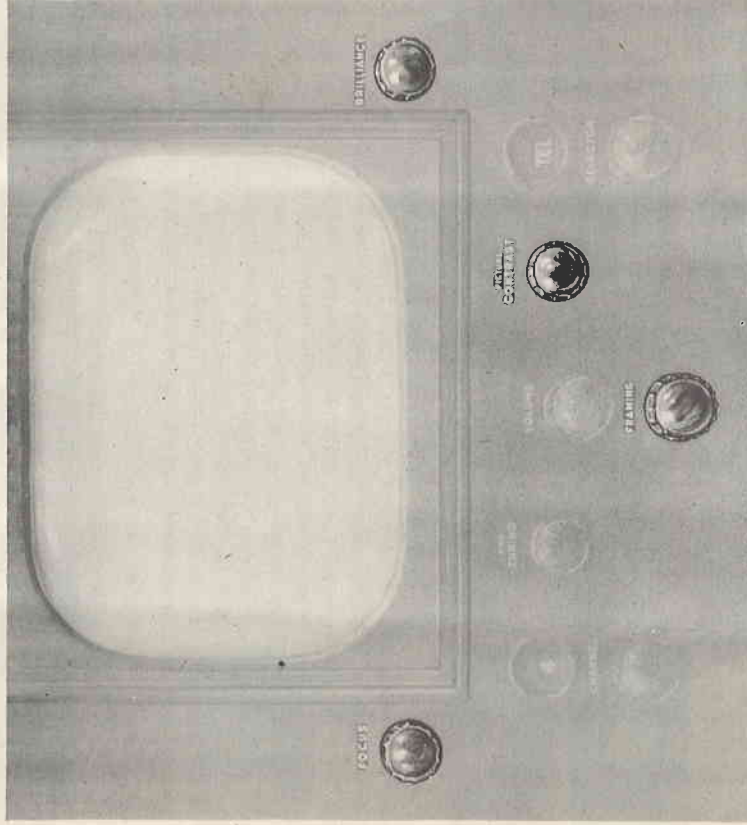
### CONTROL FUNCTIONS

On the front of your receiver you will note the following controls:

1. Selector
2. Channel
3. Fine Tuning
4. Volume
5. Brilliance
6. Picture Contrast
7. Focus
8. Framing



**Control 1:**  
Your television receiver uses this control as the on-off switch. Rotation of the knob until "TEL" appears in the window turns on the set.



The receiver controls shown in relief are the same as those found on your radio receiver—volume, tuning and band selector.

There remain but four controls which are new to the user of the Farnsworth Television receiver—Brilliance, contrast, focus, and framing.

### Controls 2 and 3: CHANNEL

These controls allow you to select and to properly tune in the desired television station. Your serviceman has installed tabs which appear in the window above the "CHANNEL" knob, which tabs indicate the numbers of different television station channel assignments. To select a station, turn the "CHANNEL" knob until the channel number of the desired station appears in the window. Your serviceman can tell you the numbers assigned to your television stations.



The "Fine Tuning" knob is for precise tuning of the set, as later explained.

### Control 4: VOLUME

This is the volume control which sets the volume level of the sound portion of the program, as in a conventional broadcast-band receiver.



### Control 5: BRILLIANCE

Overall brightness of the picture is governed by the setting of this, the "BRILLIANCE" control.

### Control 6: CONTRAST

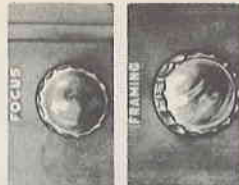
Contrast is defined as the relative intensity of the various light and shaded portions of the picture. A picture, photographic or television, having insufficient contrast will appear to be "washed-out"; one having too great contrast appears to be "harsh"—the shaded areas are too dark. The contrast control regulates the amount of contrast present and should be set to a position giving the most pleasing relative rendition of light-and-shaded-areas of the picture.

### Control 7: FOCUS

This control determines the sharpness of detail of the picture, even as adjusting the lens of a camera brings the picture into focus.

### Control 8: FRAMING

The Framing control centers the picture on the screen. If there is a black space on one side of the picture, or a white area in the picture at either side, the Framing control should be adjusted.



### RECEIVING A PICTURE

Operation of your Farnsworth receiver is not complex and you will soon be able to properly tune in a picture program. At first, however, it is suggested that the following detailed procedure be followed:

- A. Turn the set on by rotating the SELECTOR knob to "TEL." position. Allow 30 seconds for the receiver to come into operation.

- B. Turn the CHANNEL knob to the channel number of the desired station. Rotate the FINE TUNING knob until the sound portion of the program is received best. For this adjustment, the VOLUME control must be turned clockwise to provide adequate volume.

- C. Adjust the four picture controls, PICTURE CONTRAST, BRILLIANCE and FRAMING for the most pleasing picture. A more precise method for setting the CONTRAST and BRILLIANCE controls is:
  - (1) rotate the contrast control to its extreme counterclockwise position.
  - (2) adjust the brilliance control until the light upon the screen is just extinguished.
  - (3) advance the contrast control for the most pleasing picture. The focus control should, of course, be set for the sharpest focus—the best rendition of detailed portion of the picture.



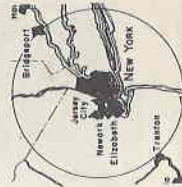
IF WHITE LINES APPEAR ACROSS THE PICTURE, AS SHOWN AT THE RIGHT, TURN THE BRILLIANCE CONTROL COUNTERCLOCKWISE SLIGHTLY.

- D. If your antenna is a rotatable type, rotate the antenna for best picture.
- E. Readjust the FINE TUNING control for the best quality of sound reproduction.
- F. Set the VOLUME control for the desired reproduction of the sound. After the receiver has warmed up (about five minutes), it may be necessary to readjust the fine tuning control for the best sound.

## Factors Affecting Television Reception

The reception range of television signals is usually limited, by reason of the high frequencies involved, to a maximum of about 40 to 50 miles. In many cases reception is limited by the earth's terrain to a lesser distance. Therefore, you may expect to receive stations only within the metropolitan area in which you reside. There are, however, means of relaying programs from one station to another by a special wire line called a coaxial cable and by radio relay so that it is possible to receive pictures from your local station which originate at a distant point.

### TELEVISION RELAYS



Such relaying facilities are today not extensive, being confined to some portions of the eastern seaboard, but additional facilities are rapidly being supplied. Present plans indicate that soon a coaxial cable between the east coast and Chicago will be completed. In addition, construction has been started on a 7000 mile cable connecting major cities along the southern east-to-west coast route. (See Page five). You may expect, therefore, within a short time to see events of national interest from distant points.

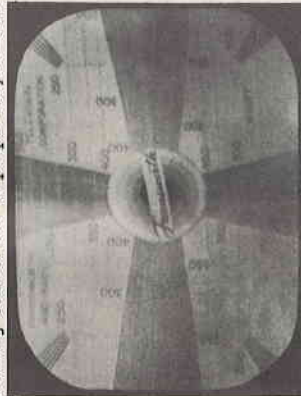
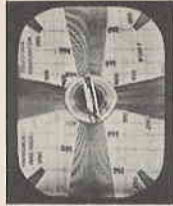
Just as interference sometimes occurs in radio-broadcast reception, interference from electrical apparatus may be experienced in the reception of television pictures. Whereas such interference is evidenced in the radio receiver by bursts of noise, it appears in picture reception as bursts of light upon the picture screen or as momentary breaking-up of the picture being received.

**INTER-FERENCE**

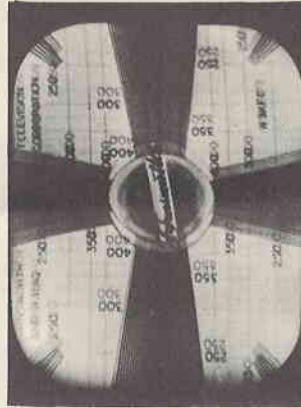
The short-waves used for television are almost immune to weather-produced static such as may be heard in the radio receiver. On the other hand, they are more susceptible to man-made noise arising from electrical equipment (automobile ignition, oil-burning furnaces, electric shavers, etc). Aside from automobile ignition causes, defective pictures resulting from electrical machinery may be corrected by corrective measures applied to the offending equipment; by repairing defective equipment and/or placing electrical filters in the electric lines at the equipment. Your authorized Farnsworth serviceman can advise you concerning corrective measures if excessive interference is experienced.

Ignition noise from automobiles may be eliminated only by so placing the antenna that it is far-removed from the highway. Placement of the antenna in a strategic location may also serve to eliminate other interference.

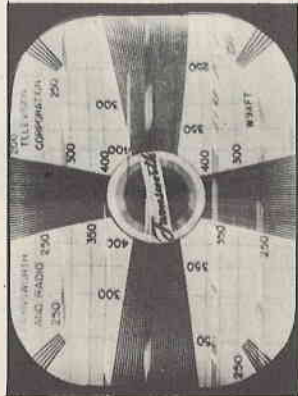
Below are illustrations of the effects upon the picture of a weakly-received signal (a shallow speckled appearance of the picture); of reflected-signal reception ("ghost" images); of interference (spots of light upon the picture) and effect of the framing control out of proper adjustment.



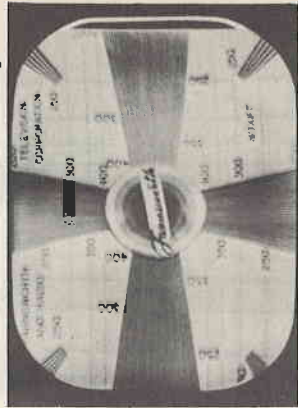
Effects of a weak signal



Ghost (double image) caused by signal reflection from a building



Spots of light caused by automobile ignition noise



Framing control not properly adjusted

**The Test Pattern**

At intervals during the time of broadcasting from a television station, you will see upon the receiver screen the reproduction of a test pattern. Test patterns, one type of which is shown in the preceding illustrations, assume several configurations of lines, circles and black bars. These are broadcast by the

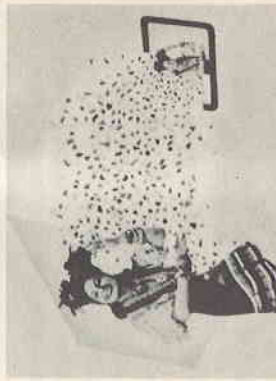


**WHAT IT IS AND WHY**

transmitting station primarily for testing purposes and analysis of the reproduced image of such a pattern tells the experienced technician much about the behavior of the electrical circuits in the transmitter and in the receiver. The television receiver serviceman often uses such a reproduction to locate faults within the receiver and to ascertain whether the receiver is functioning properly. While broadcasting the test pattern, sound may be transmitted in the form of music or of a steady whistle-like sound.

**How Your Television Receiver Functions**

To understand the mechanics of the television receiver, we must first consider the signals before they reach the receiver—at the transmitting station. The "eye" of television is an electronic camera tube into which is focused, by a lens system, the image of the scene being tele-



vised. This is precisely the same manner in which an image is focused upon the light-sensitive film in a picture camera. By a process known as "scanning," this picture is broken up into some 300,000 separate pieces. Each of these pieces, represented by an electrical potential, is transmitted one-at-a-time in rapid sequence. The sequence is so rapid that all 300,000 separate pieces (electric potentials) are transmitted in one-thirtieth of a second. Therefore, 30 complete pictures are transmitted in one second.

**THE PICTURE SCANNING**

At the receiver, these separate pieces are reassembled in proper sequence upon the front surface of the picture-viewing screen. The human eye exhibits a property known as "persistence of vision"—the property which causes you to see, as an apparently continuous picture, the rapidly-changing individual pictures projected by a moving-picture projector. It is this property of the eye which causes you to see the rapid assembly of the 300,000 separate picture-pieces as a continuous whole picture. Television is, therefore, quite similar in some respects to motion pictures.

**PERSISTENCE OF VISION**

You might ask, "How is the sequence of assembly at the receiver made the same as that of dissection at the transmitter?"

#### SYNCHRONIZATION

Broadcast along with these "picture elements" are other electrical signals called "synchronizing pulses." These serve to keep in step at all times

the circuits at the receiver with those at the transmitter and it is the disruption of the synchronizing pulses which causes the picture to be unstable if a very great burst of electrical interference is experienced.



### What People Are Asking

Herein are presented several questions which have been often asked by set owners. The answers might be helpful to you.

1. Does it cost much to operate a television receiver?  
The Farnsworth television set costs for electricity approximately as much as two 100-watt bulbs.
2. Is the maintenance cost high—such as necessity for frequent tube replacements and so forth?  
Experience on more than 6,000 television sets has shown an extremely low maintenance cost. Tube replacements are little more frequent than the average for standard AC-operated home radios.
3. Is it necessary to darken the room to watch television?  
As long as direct sunlight or bright artificial lights are not falling directly on the screen, satisfactory results are obtained without darkening the room. Television is less critical of exterior lighting than home movies or regular motion picture theaters.
4. What is the maximum number of television stations that can be received at a given receiver location?  
At present, a maximum of seven channels of transmission are allocated to any single metropolitan area. The number of station applications varies from one to seven.
5. Will television replace or only richly supplement radio, movies and newspapers?  
Television will not replace standard broadcasting, at least for many years to come. It will offer many new possibilities in education and other fields and greatly enrich entertainment opportunities of the American family.
6. Will the competition of television be so great that none of the interesting entertainment events can be broadcast? In other words, will you see a good new movie on television, or must you watch an old outdated one? Will the baseball management object to televising the World Series on the basis that it affects attendance?

Television will develop its own brand of programs and will represent a large enough audience with sufficient buying power to command the best type of films, sporting events and other news interests. Standard broadcasts of baseball games have in no way injured attendance and the extra income derived from these broadcasts has actually been equivalent to a far greater attendance as far as the ball clubs are concerned.

7. Is the high voltage used in television receivers a potential danger to the user?  
Farnsworth television sets have safety inter-lock switches which disconnect all power when the set is opened up.
8. What is "projection television?"

Projection television is a system in which a small but brilliant picture on a cathode ray tube is enlarged with lenses and projected on a viewing screen, very much like that of a home-movie outfit. Such a home projection-television picture may measure 18 x 24 inches.

9. Is color television practicable?

A number of color-television systems have been demonstrated and at present they require more elaborate apparatus than standard black and white pictures. As problems are solved, color television will be practical for the home.

10. If color television comes in, will it obsolete the early receivers, or can they be converted?

Color-television systems based on present experimental types will not give color pictures on regular black and white sets. It may be possible, however, to receive black and white pictures of the color transmission. It may be possible to have an adapter to add color to these pictures. At present, however, this is not definitely settled.

### Television Terminology

That you may be conversant with television terminology, these selected terms and their meaning are presented:

<b>Audio</b>	(I hear). A term applied to any part of a radio or electrical system handling frequencies in the audible range.
<b>Brightness Control</b>	A control on the receiver for regulating the overall brightness of the picture.
<b>Cathode Ray Tube</b>	An electron tube in which streams of electrons from a cathode are formed into a pencil-like beam and directed by means of electric or magnetic fields over a target, usually a fluorescent screen which glows wherever the beam strikes.
<b>Centering</b>	The position of the picture with respect to the axis of the cathode ray tube is accomplished by adjustments in the receiver.
<b>Coaxial Cable</b>	A particular type of cable capable of passing a wide range of frequencies without the usual prohibitive losses. Such a cable in its simplest form consists of a hollow metallic conductor with a single wire accurately confined along the center of the hollow conductor.

**Contrast** This refers to the ratio of the black to white portions of a picture. Pictures having high contrast have very deep blacks and brilliant whites, while a picture with low contrast has an overall gray appearance.

**Contrast Control** A control on the receiver which regulates the video signal strength. This has the effect of changing the ratio of the black and white portions of the picture. It corresponds to the volume control in an aural receiver.

**Dipole Antenna** An antenna consisting of two conductors, usually of equal length extending in the same straight line, with a pair of lead or feeder wires connected at or near the inner ends, is known as a doublet. For short waves the physical dimensions are such that self-supporting metal rods or tubes can be used.

**Director** A section of an antenna used to increase the pick-up from the side on which the director is placed.

**Fluorescent Screen** A chemical coating on the inside of a cathode ray tube which emits light at the point where a cathode ray beam strikes.

**Focus** In a cathode ray tube this refers to the size of spot of light on the screen. The tube is said to be focused when the spot is smallest. This term also refers to the optical focusing of the camera lenses.

**Frequency Modulation** A process by which the frequency of the carrier is modulated in accordance with the information to be transmitted.

**Ghost** A secondary picture formed on a television receiver because the signal from the transmitter reaches the antenna by more than one path. Ghosts are usually caused by the radio signal being reflected from objects within approximately one mile of the receiver antenna.

**Interference** Random electrical signals which cause noise in the audio system and disrupt the picture in television. This includes automobile-ignition impulses, some diathermy apparatus, neon signs, etc.

**Ion Spot** A discoloration on the center of the screen of a cathode ray tube caused by heavy negative ions striking it.

**Linearity** A term used to refer to the uniformity of distribution of a regular pattern on a picture tube.

**Line of Sight** A straight, unobstructed path between two points.

**Live Talent** "On-the-spot" televising of events and people in contrast to transmission of film material.

**Megacycle** One million cycles.

**Multipath Transmission**

The condition in which the radio signal from the transmitter travels by more than one route to a receiver antenna usually because of reflections from obstacles. This condition usually results in ghost pictures.

**Negative Ghosts**

Ghost pictures in which the black and white areas are opposite to those of the real picture.

**Picture Element**

A small section of a given scene as reproduced by the cathode ray spot at any instant.

**Picture Noise**

Interference signals causing spots of light and other irregular patterns on the received picture.

**Radio Channel**

The "space" in the frequency spectrum allotted to each station. In present television standards the channel is six megacycles.

**Raster**

A term applied to the group of lines appearing on the cathode ray tube in the absence of an incoming video signal.

**Reflector**

A part of an antenna used to prevent pick-up of signals in one direction and increase it in the opposite direction.

**Sync Control**

A control on the receiver for adjusting the number of lines per second to correspond with that of the transmitter.



## WARRANTY

The Farnsworth Television & Radio Corporation warrants each new home television receiver manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to us, to our authorized dealer or distributor from whom purchased, or to the Service Depot which has issued to the owner of the television receiver its "Installation and Service Certificate for Farnsworth Television Receiver," intact, for our examination, with all transportation charges prepaid to our factory, within ninety (90) days from date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective.

The Farnsworth Television & Radio Corporation, in conjunction with the manufacturer of the picture tube, warrants the picture tube to be free from defects in design and workmanship for one (1) year from the time it is placed in service. Replacement without charge will be made of a picture tube in which the defect appears within ninety (90) days after it is placed in service. Where the defect appears in any month after the ninety (90) day period, the new tube will be supplied at a price proportionately adjusted on the basis of one (1) year's service, that is, decreasing allowances are made against the current sales price for each of the ensuing nine (9) months at the rate of one-ninth (1/9th) of the current selling price for each month of service obtained subsequent to the ninety (90) day period. (A period of sixteen (16) days or more will be considered an additional month. A period up to fifteen (15) days will be deducted from the tube life).

This warranty does not extend to any of our home television receivers or picture tubes which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside of our factory, nor extend to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by our authorized dealer or wholesaler or by the Service Depot which issued its "Installation and Service Certificate for Farnsworth Television Receiver," without charge to the owner.

This warranty expresses the sole legal liability of Farnsworth Television & Radio Corporation to the owner. When the owner takes advantage of the Installation and Service Plan, the owner must look to the Service Depot which issues its "Installation and Service Certificate" to him. In such cases the manufacturer participates in the Plan, to the extent of its liability under this Warranty, by furnishing any new parts in place of defective parts, through the Service Depot which has issued its "Installation and Service Certificate" to the owner.

### Claims for Damage

All claims for merchandise damaged in transit must be made to carrier as the responsibility of Farnsworth Television & Radio Corporation ceases after a clear receipt is obtained from the transportation company.

FARNSWORTH TELEVISION & RADIO CORPORATION