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MODERN TELEVISION

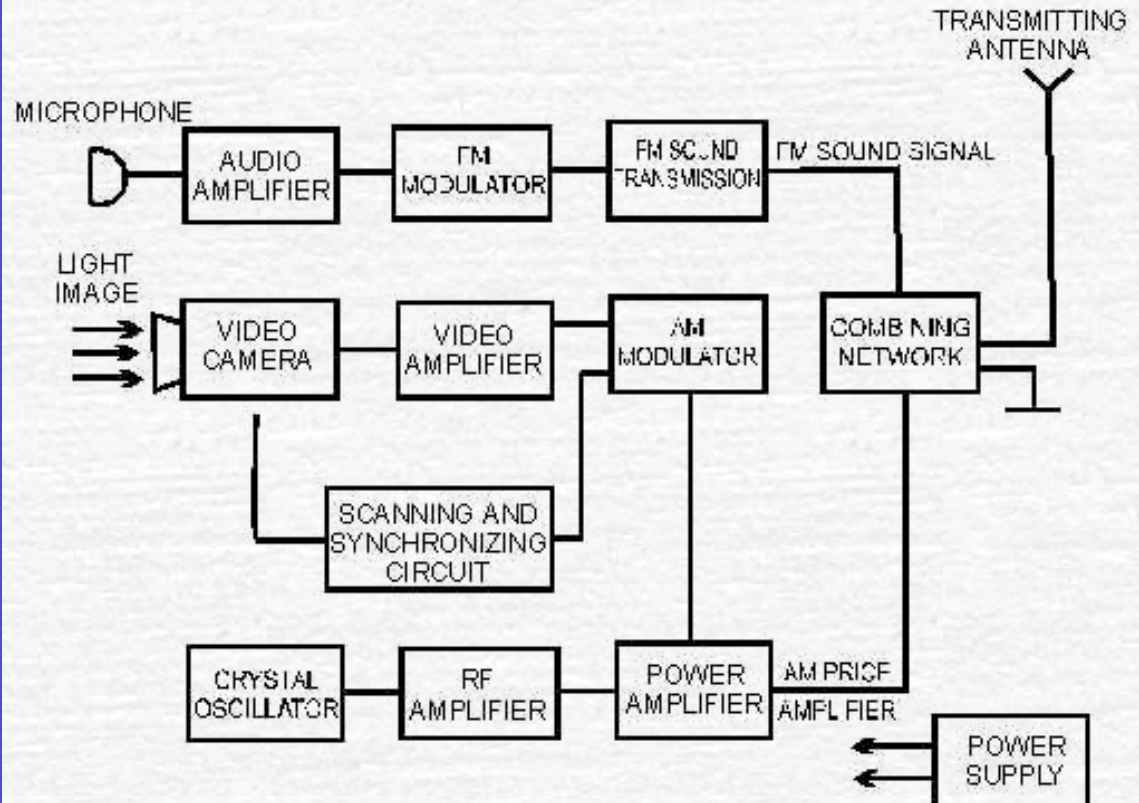
K. BHARATHAN

Development of Television systems has made a revolutionary change in the field of Electronics. Television has become the most popular, powerful, mass media for communication and entertainment.

Tele-Vision means "To see at a Distance". The word television is derived from a combination of two words - "Tele" - a Greek word denoting "far" and "vision" is taken from the Latin word "See"

The demonstration of the first television was made from 1925 to 1927 by J.L. Baird in London and C.F Jenkins in Washington. Both developed the system independently by using the technique of Mechanical Scanning with the help of rotating discs. The actual system took shape with the invention of cathode ray tube and the perfection of the Camera Tube (The Iconoscope) based on storage. The Development of valves, Devices, Circuits for Electro Magnetic Scanning, beam deflection, Video Amplification, blanking etc., had a significant impact in the perfection of Television Systems. The intercarrier sound system, linking the sound and the picture carrier together, was introduced for a better tuning system on the frequencies allotted for television telecasting.

TV STANDARDS



In the early days of television telecasting, three monochrome (Black&White) systems grew independently. They are : The 525 line (The American system), The 625 line (The European System) and The 819 line(The French System). Later, International Radio Consultative Committee (CCIR) the worldwide committee on Radio and Television adopted the 625 line system. Television telecast started in India in the year 1959, and the 625 B Monochrome system was then adopted.

Three different standards of B&W television have resulted in the development of three different colour television systems. They are NTSC (National Television System Committee) PAL (Phase Alternation with Line) and SECAM (Sequential Technique with Memory). India has adopted the PAL colour System which is compatible with the 625 B monochrome system. First colour transmission

started in USA in the year 1954 followed by Japan and Canada. India started widespread colour transmission in 1982, with the advent of the Asian games.

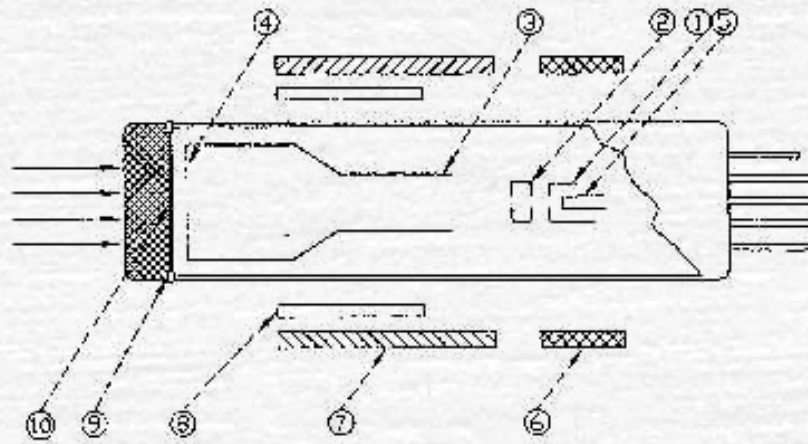
All Television systems consist of 2 parts : Television Telecasting and Receiving. Television telecasting includes Picture and Sound Transmission.

Video Camera is used to convert picture information into corresponding Electrical Signal Voltage, the amplitude of which varies in accordance with the variation of brightness. The Television Camera Tube used for conversions are the Imageorthicon, Vidicon, and Plumbicon. Vidicon gained its popularity because of its small in size, its picture quality, and because it is easy to operate.

THE VIDICON CAMERA TUBE

Figure (2) shows a simplified cross sectional view of a vidicon Television Camera Tube. The picture to be taken is focused on by the lens assembly on a rectangular glass face-plate of the camera tube. The inner side of the glass face-plate has a transparent conductive coating with a thin layer of photo conductive material. This photolayer is sensitive to light and its resistance varies in accordance with the brightness of light falling on it. This produces charge image that is scanned by the Electron beam from the gun to develop the video signal voltages.

VIDEO TRANSMISSION



The signal from the camera is amplified and synchronizing pulses are added and it is fed to the modulating amplifier. a Crystal controlled oscillator generates the allotted picture carrier frequency. The continuous sine wave output is amplified to the sufficient level and its amplitude is made to vary (Amplitude Modulated) in accordance with the modulating signal received from the

modulating amplifier. This modulated signal output is fed to the combining network, where the frequency modulated sound signal are combined and fed to the transmitting antenna for radiation of energy in the form of

SOUND TRANSMISSION:

Microphone converts the sound frequency of the associated picture being telecast into Electrical Signals. These low level signals are given to an amplifier which amplifies the signals to the sufficient level and it is passed on to the Frequency Modulator. The signals are modulated at the assigned carrier frequency. In FM (Frequency Modulation) the amplitude of the carrier signals are held constant, where as its frequency is varied in accordance with the amplitude variations of the modulating signals. This modulated signal output is combined with modulated picture output through combining network and fed to the transmitting antenna.

TELEVISION RECEIVING SYSTEM

The television receiving system block consists of an antenna known as a " Dipole " antenna and a receiver known as a television or T.V. The receiving system collects the radiated picture and the sound carrier signals, processes the signals and converts it into associated telecast original picture and sound.

THE TELEVISION ANTENNA

An antenna collects the telecast Radio Frequency (R.F.) carrier waves from the distant telecasting center. A Folded dipole antenna (for 300 Ohms impedance or a straight dipole for 75 ohms impedance) is commonly used to collect the electromagnetic waves in the form of signal voltages. The antenna is a wide band tuned antenna. The complete range of frequencies allotted for television telecasting cannot be tuned by a single antenna. Hence, three separate antennas are typically used to collect the full range of allotted frequencies. (Band IT (88 to 108 MHZ)is used for FM radio broad casting).

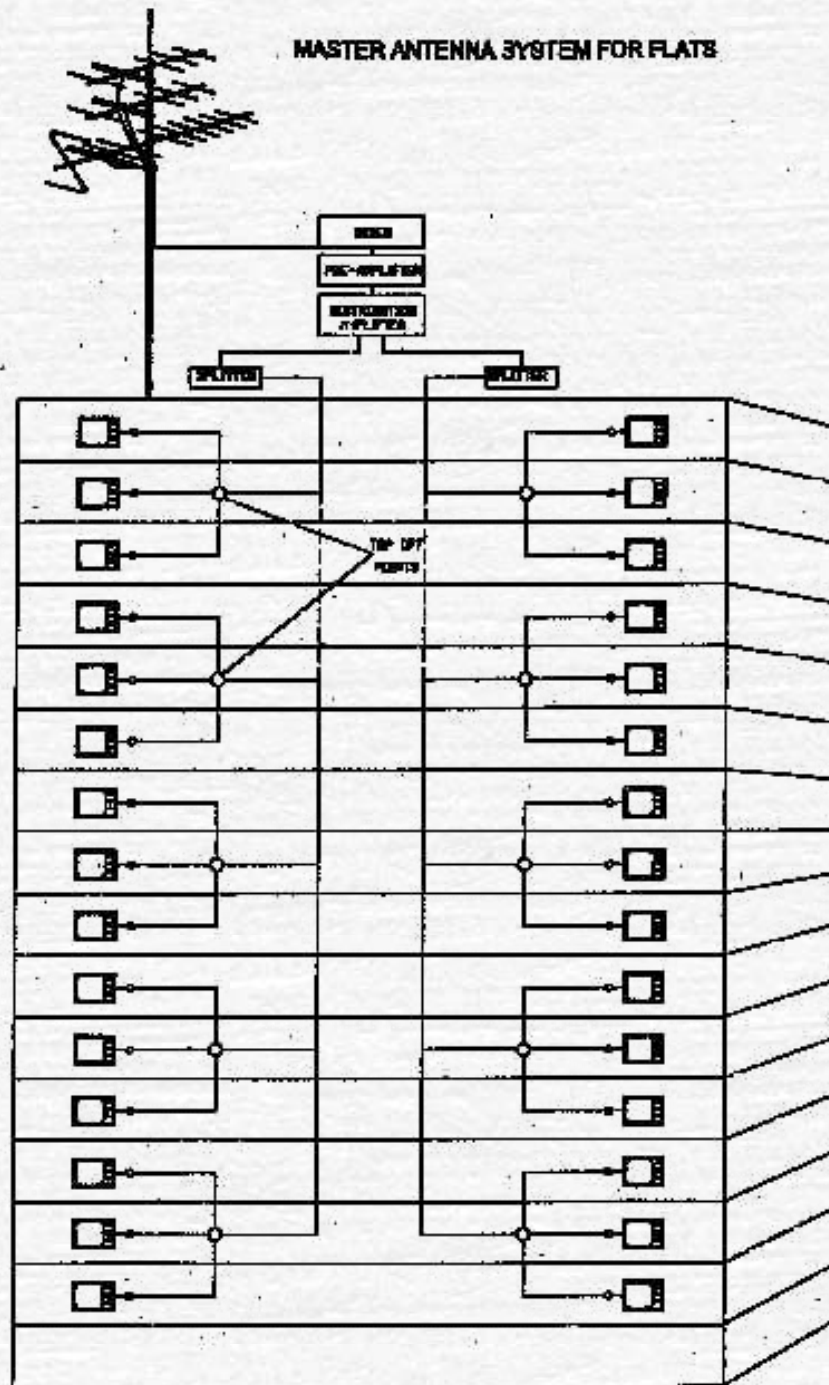
These three types of antennas (BI, B III and UHF) assembled together with a common boom (mast or rod) is known as a multiband antenna.

A clear picture on the television screen requires a certain minimum signal strength at the antenna socket on a television. A signal strength less than this required minimum results in loss of picture quality observed on the screen. The picture can be seen as snowy, hazy, rolling etc., an antenna

can collect maximum signal when it is pointed and aligned towards the transmitting antenna. The television signal collected by the antenna will be weak in the following conditions even in strong television signal areas :

Where line of sight between transmitting antenna and the receiving antenna is obstructed by tall buildings, hills, mountains etc., Fringe area where television receivers are located outside the transmitting radius area. In the above conditions a television signal booster (a wide band RF amplifier) is essential along with the antenna to provide required signal strength to get a clear, sharp picture on the screen. (see Figure 5)

RF TUNER



Signals collected by the antenna are given to the tuner through a matching transformer called as "balun" transformer. This is to match the 300 ohms impedance of this folded dipole antenna with 75 ohms input impedance of the RF Turner. The TV tuner consists of a Selector, RF amplifier, Local Oscillator and Mixer. Tuner stage works on super-hetrodyne principle.

At the selector stage, the selector selects a single desired frequency from the different frequencies picked up by the antenna. A tuned circuit selects the desired frequency and it is fed to the RF amplifier which amplifies the signal which then is then fed to the mixer. The Local Oscillator generates a frequency which is higher than the selected frequency and it is given to the mixer stage. The

mixer stage mixes the selected frequency and the local oscillator frequency and this mixing results in production of picture and sound intermediate frequency (IF) at the frequencies of 38.9 MHz as picture IF and 33.4 MHz as sound IF. The Local Oscillator frequency is automatically controlled by an arrangement known as Automatic Fine Tuning (A.F.T.).

Mechanical tuner and electronic tuner are the two types of tuners commonly used in a television. The electronic tuner is now gaining popularity because of its selectivity. The electronic tuner can

separately tune in to adjacent channel, while the mechanical tuner usually is not so selective, particularly at Band II & UHF. Further the Electronic tuner can be interfaced with a microprocessor & memories, for automatic frequency scanning & storing the selected Channels in memory.

VIDEO IF STAGE:

Picture and sound IF signals from the tuner is given to IF preamplifier for necessary amplification. A surface acoustic wave filter or two or three wave traps are provided at the input of the IF stage to suppress the signals from the adjacent channels and to eliminate interference of these signals with the picture. A Saw Filter is used in the modern colour televisions to improve the picture quality.

The functions performed by this section are the amplification of video IF (38.9 MHz) and sound IF (33.4 MHz) signals, detection of video IF signals to obtain the colour composite video signals (CCVS) mixing of picture and sound IF signals to obtain intercarrier sound signals (5.5 MHz).

Additional functions such as production of AGC voltage for controlling the gain of video IF amplifier, production of delayed AGC voltage for the tuner and generation of voltage for automatic fine tuning (AFT). AFT is an arrangement normally present in colour Television receivers to check and correct automatically the frequency of the local oscillator in the Tuner.

VIDEO AMPLIFIER

Composite video signals obtained from the video IF section are fed to the video amplifier. This section consists of a buffer amplifier and a final amplifier. The buffer amplifier amplifies the composite video signals which consists of the luminance signals, chrominance signals, sync signals and colour sub-carrier burst. The amplified signals are then passed on to a Chroma section, sync separator and final video amplifier. The final video amplifier amplifies the luminance signals and then given to the Chroma section.

CHROMA SECTION:

The most important section of a colour television is the chroma section. The Chroma section processes the colour signal from the modulated and coded chroma signal and produces Red, Green, Blue (R-G-B) outputs. (See fig. 7)
R-G-B Amplifier.

The R.G.B outputs from the chroma section are not sufficient to drive the cathode of the picture tube. These R.G.B Signals are given to three identical amplifiers to amplify the signals to a sufficient level and the outputs are fed to the cathodes of the picture tube.

PICTURE TUBE:

A Picture Tube is a specially made cathode ray tube with a large screen. It converts signal voltages into picture with the help of Vertical and Horizontal sweeps. It consists of 3 cathodes, one each for the Red, Green & Blue colours. R.G.B outputs from the R.G.B Amplifiers are given in to the respective cathodes of the colour picture tube. The picture tube converts these outputs into picture with the original colours. Precision-In-line (PIL) colour picture tubes are commonly used in colour Television being manufactured in our country. A colour picture tube has three separate guns. Each of these guns have cathode, grid, screen, focussing anode, final anode and a common heater. (See Fig. 8)

SWEEP SECTION:

Two sweeps are required to illustrate a picture. They are known as vertical or frame and horizontal or line sweeps. This section consists of sync separator, vertical sweep generator, horizontal sweep generator and line output section.

The Sync separator separates the sync signals from the composite video signal and further separates combined sync signals into horizontal and vertical sync signals. These are given to the respective sweep oscillators for synchronizing their Phase and Frequency.

The vertical sweep generator produces a Vertical Sweep at a rate of 50 Hz and it is given to the Vertical Deflection Coil. Fly back pulses for suppressing vertical retrace lines are also produced. The Horizontal sweep generator produces Horizontal sweep frequency at a rate of 15625 Hz.

The Line out put section amplifies the horizontal sweep signals and it is given to the horizontal deflection coil. Other auxiliary voltages are also produced in this section. The horizontal deflection coil deflects the Electron Beam from left to right and back, and the Vertical Deflection coil deflects the electron beam from top to bottom and back.

SOUND IF SECTION:

Frequency modulated (FM) intercarrier sound IF signals (5.5 MHz) are given to the sound IF

section. The signals are amplified, limited and detected to produce audio signals. Electronic attenuation is provided in the modern Television for controlling the sound output.

AUDIO OUTPUT SECTION:

The Audio Signals obtained from the sound IF section are preamplified and given to the output amplifier. The output amplifier section produces sufficient level of audio power and it is moved to the loud speaker. The loud speaker converts the audio signal currents into corresponding original sound waves.

POWER SUPPLY:

The energy for working of the different sections of the television is taken from AC mains supply and the AC voltage is processed in the required forms and levels.

REMOTE CONTROL:

Modern television receivers are provided with remote control facility. It makes possible to change channels, picture Brightness, Contrast etc from a distance. The most important functions are changing of channels, tuning of channels, pre selection of channels (Programmes) varying sound out puts, sound mute, varying contrast, brightness, colour intensity, switching the television On and Off etc. The handheld Remote Control sends out Infra Red (I.R.) light pulses, that are received by a special detector on the TV set. A Remote Control System consists of a Transmitter and a Receiver

TRANSMITTER:

Pulse outputs are produced when the functional buttons are pressed on the remote control. Inside circuit produces modulated infrared signal and it is beamed towards the remote controlled television.

RECEIVER:

The beamed pulse modulated infrared signals from the remote transmitter are picked up by the sensor in the television receiver. The signals are processed and produce appropriate output to perform ordered functions inside the television.

INDIAN TELEVISION INDUSTRY:

India started producing B&W televisions around the year 1959. The Components industry for B&W televisions grew at a remarkable speed, producing almost all the components necessary for B&W TVs. The Colour TV was introduced in India during 1982 and large number of television manufacturers started producing colour TVs.

The launching of communication satellites has made viewing national and international programmes an everyday affair. This in turn, has resulted in a huge demand for colour TVs.

Introduction of cable television networks has given a further boost to the production of colour televisions. India today produces Hi-Tech colour TV components and TV sets to meet national and international demand. Many TV sets produced in India are made with advanced technology and meet international standards, and even exported.

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