TELEVISION'S

What will be the method finally chosen for television in the United States? Should not any method that produces good results be given a chance on the air?

By Rupert Oakille

TELEVISION bids fair to bring an entirely new set of problems before the P.E.C., for at present a number of experimental stations are sending or proposing to send pictures on the 5- and 6-meter bands, the 10-meter band the 15-meter band, etc. Then there is the problem of how television programs are to be sent to different parts of the country, over wires, what kind of wires or cables, etc. Not only is this the case, but two radically different types of scanning are being used, i.e., the cathode-ray tube and the revolving disk. Each of these systems claims manifest advantages and proponents of each state that theirs will be the system adopted as the official standard when the standardization of television receivers takes place, as it is sure to do within a short time.

In this article the writer, who has been active in radio for fifteen years and in television since 1926, will attempt to analyze the claims of the various systems, with the aim of predicting future standards.

The cathode-ray types of scanners, in which Philco, RCA, and the Farnsworth group are interested represent one side of the story. The mechanical (revolving disk) scanner is represented by some of the independents, one of which, the Peck Television Corp., has produced excellent images on a large screen, in black and white.

In order to simplify a discussion of the improvements in both of these systems let us divide this article into sub-heads:

SIMPLICITY OF MECHANISM. Besides incorporating a more or less conventional radio receiver to produce the television signal, a television receiver must include a light source, a means of modulating that light in order to reproduce highlights and shadows, a scanner to spread the light over the screen or otherwise break it up into a two-dimensional picture, and a power-pack capable of supplying the voltage and current used by these units.

The cathode-ray system appears to be simpler, for in it we find a single tube, the cathode-ray tube, which performs the functions of light source, light modulator and scanner, while the disk system makes use of a three-inch disc driven by a small motor, a headlight bulb for light source, and a separate modulator cell. Carrying our inspection a step further, we learn that the disc motor operates directly from the 110-volt line and that the light source used with the disc also draws its current from the ordinary power pack of the set and that the light valve is modulated directly from the output of the standard push-pull amplifier which Peck's receiving circuit employs. On the other hand, as many as six additional tubes are used in the cathode-ray systems to afford scanning action with the cathode-ray tube and each of these six extra tubes employs its own oscillator coil, condensers, chokes, etc. A special power pack, including heavy-duty rectifiers, chokes, condensers and resistors is also required with the cathode-ray tube, which may use voltages up to 4000 or more.

Neither of these systems is quite as simple as the new obsolete system in which a tube of either the neon plate or neon counter type was used as combined light source and light modulator. This system has, however, been virtually abandoned because of deficiencies in the
SIMPlicity of operation. Tuning is unquestionably somewhat simpler in the cathode-ray system than in the Peck system. In the former, it is merely necessary to tune in the signal which is automatically synchronized by the extra 6-tube circuit. Owing to the absence of control, it was necessary to establish synchronization in the disc system. In both systems, synchronization once established, remains established as long as the set is tuned to a given station.

FREEDOM FROM TROUBLE. The two systems are about equal in respect to problems of servicing. In cathode-ray system, the scanning light-source tube may require the all of a service man every 1000-2000 hours, while in the Peck set, when replacement becomes necessary. There will be the case of the manufacturer deciding to install it in a sealed unit because of the high voltage which may require its associated tubes should be easily replaceable by the set owner.

Both light source and modulator lamps, when operating at normal set voltage in the disc system, will be replaceable by the manufacturer. The motor will be similar to that used in an electric clock—and as completely free from servicing problems.

The cost of the cathode-ray tube, with an estimated life of 1000-2000 hours, may probably be brought as low as $25 when in production, and the associated tubes should last as long as, and cost no more than, the other ordinary receiving tubes which the set employs. The Peck cathode-ray tube costs around the same price, but may last longer and have a longer life. The disc transmitter may be as low as $25, which is the same as the Peck system.

CATHODE-RAY EQUIPMENT

Experiencing with a large cathode-ray tube for television, in the laboratory illustrates an opposite page shows the same tube operating in a television receiver.

NEW COAXIAL CABLE for Television

By Victor Hall

The recent announcement by Bell Laboratories of the so-called "coaxial" cables for transmission of wide frequency-range signals from one point to another, has been of more than passing interest to telephone men and television experimenters alike. An experimental circuit is soon to be set up between New York and Philadelphia, using a double coaxial cable for further research work.

Although the idea of coaxial circuits has been investi- (Turn to page 241)
Television Progress

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In the earliest days of sound broadcasting, there was none too. (Two stations using only a few miles apart might agree on the same words at the same hour, so that the reception at either place would be poor.) From the United States Government stepped in with appropriate legislation. The Federal Radio Commission (now the Federal Communications Commission) was established, and measures were taken to assure that all stations operated in the public interest, convenience, and necessity.

At first there may be a double standard of television, but it is confidently predicted that the Federal Communications Commission will allow the standards gradually without showing any group undue favor. Eventually, television stations will establish standard number of pictures-per-second and of varying picture, but until this time the sets will most probably be in the nature of a compromise between what the various systems are trying to do at the present time.

Impedance Match

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shift” and alters the value of the reflection loss. Figure 4 is a set of curves showing how the reflection loss varies with phase relations between $Z_S$ and $Z_L$.

The phase difference between $Z_S$ and $Z_L$ is designated by $\beta$. Note that the curve for $\beta = 0$ is the same as the curve in Figure 3. You will also note that the reflection loss has a negative sign for other values of $\beta$ in the region where $Z_L = Z_S$.

This means that under certain conditions, a phase difference between $Z_S$ and $Z_L$ produces an actual reflection gain, instead of a loss. In this case the reflection loss is a minimum in the region where $Z_S = Z_L$.

Now what does this mean in terms of practical results? In the first place, if either $Z_S$ or $Z_L$ varies with frequency, the $Z_L = Z_S$ value of $\beta$ will change with frequency $Z_L$.

This means that the junction will have a better match for some frequencies than others. This favors some tones and discriminates against others. The accommodation will come in the region where the match is the best or where $Z_S$ and $Z_L$ are nearly equal $Z_L$. A practical example of such a case is an attempt to operate a 150-ohm voice coil from the secondary of an output transformer designed to work into a 75-ohm lamp. The resultant signal is attenuated, of course, over the entire range, but the higher frequencies are attenuated less, so that the impedance of the coil increases enough in this region to produce a somewhat better match.

Contrary to popular supposition, there is no universal rule as to which end of the frequency spectrum will suffer more, when $Z_S > Z_L$, or when $Z_S < Z_L$. This depends upon the phase relations between $Z_S$ and $Z_L$, as well as upon their absolute magnitudes. If, for example, $Z_S$ is primarily resistive and $Z_L$ is an inductive reactance, and $Z_S > Z_L$, the high frequencies will be favored, because the magnitude of $Z_S$ increases with frequency. Conversely, $Z_L$ is a capacitive reactance, the reverse will be true.

The desirable condition is to have impedances which do not vary appreciably over the frequency range concerned. If they do vary, $Z_S$ and $Z_L$ will vary by similar amounts in the same direction. Impedance adjustment between a source and load of unequal impedances can be most easily accomplished by means of properly designed transformers. In its simplest form a transformer provides a ratio between two lines of different impedances. They change themselves do not possess an inherent impedance, that is significant as far an application is concerned. The impedance looking into one coil of a transformer is determined by the load across the terminals of the other coil.