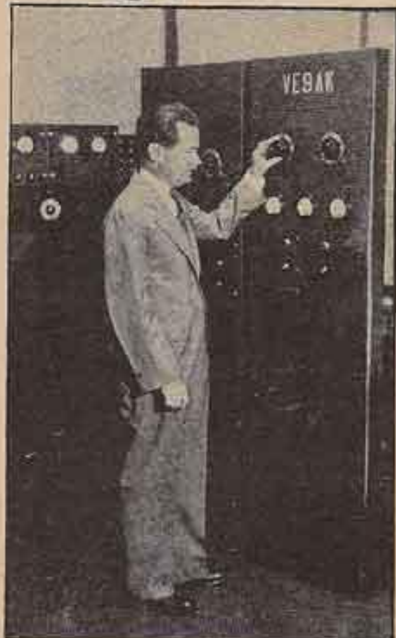
Reporting TELEVISION'S



MONITORING TELEVISION
J. L. Cassell at the Canadian television station VE9AK monitoring a program.

¶ 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 F.C.C., for at present a number of experimental stations are sending or propose to send their pictures on the 5- and 6-meter bands, the 10-meter band the 170-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 space of time.

In this article the writer, who has been active in radio for fifteen years and in television since 1928, 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 (or 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.

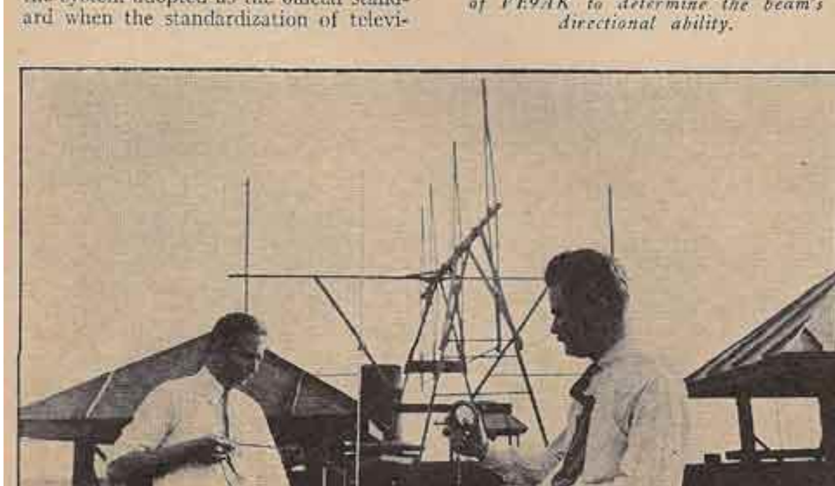
In order to simplify a discussion of the improvements in both of these systems let us divide this article into sub-heads.

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 the light in order to reproduce high-lights 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 performing 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 farther, we learn that the disc motor operates directly from the 110-volt light lines 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 employ its own oscillator coils, 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 now obsolete system in which a tube of either the neon plate or neon crater type was used as combined light source and light modulator. This system has, however, been virtually abandoned because of deficiencies in the

MEASURING TELEVISION BEAM INTENSITIES
Making actual field-strength measurements near the short-wave antenna of VE9AK to determine the beam's directional ability.



PROGRESS *in America*

brilliance and size of the pictures it produced.

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. One additional control is necessary to establish synchronization in the disc system. In both systems, synchronization, once obtained, remains established as long as the set is tuned to a given station.

FREEDOM FROM TROUBLE. The two systems are about equal in freedom from problems of servicing. In the cathode-ray system, the scanning-light-source tube may require the aid of a service man every 1000-2000 hours, when replacement becomes necessary. This will be the case if the manufacturers decide to install it in a sealed unit because of the high voltages which it may require. Its associated tubes should be easily replaceable by the set owner.

Both light source and modulator tubes, operated at normal set voltage in the disc system, will be replaceable by the owner. 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 its associated tubes should last as long as, and cost no more than, the other ordinary receiving tubes which the set employs. The Peck light source and modulator tubes will have a combined retail cost below $2, and a life of approximately 5000 hours.

DETAIL AVAILABLE. Images reproduced by cathode-ray systems will be composed of about twice as many lines per frame as will those of the disc system, which (*Turn to page 241*)

TELEVISION PICTURES "A LA DISK"

Large-size screen television pictures of a motion-picture cartoon character, projected on a screen at the top of a television receiver.

CATHODE-RAY EQUIPMENT

Experimenting with a large cathode-ray tube for television, in the laboratory. Illustration on opposite page shows the same tube operating in a television receiver.

New COAXIAL CABLE *for Television*

By Victor Hall

SHOWS COMMISSIONERS TELEVISION CABLE

Dr. F. B. Jewett of the Bell Labs exhibits new type coaxial cable to be used for television between New York and Philadelphia, before members of the Federal Communications Commission. Photo below shows two examples of cable construction.

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 249*)

Television Progress

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uses 180-line images. As a result, perfect detail will be visible to an observer stationed about five feet from the cathode-ray set, or about ten feet from the Peck set. Incidentally it is claimed that approximately twice as many lines-per-picture are necessary with the cathode-ray system in order to give detail equal to the Peck picture. (This is because the scanning spot remains uniform in size, under the disk system, while it decreases in size when its brilliance is modulated downward in the cathode ray tube. The resulting black spots must be filled in by utilising additional lines.)

SIZE OF PICTURE. Cathode-ray receivers thus far demonstrated have produced pictures about three inches square, though pictures up to nine inches square are claimed. While the Peck television receiver normally shows a 14-inch picture on its self-contained screen, pictures up to 3 ft by 4 ft square have been demonstrated when the screen is removed. The 14-inch Peck picture and the cathode-ray picture are of approximately equal brilliance; bright enough to be shown in a lighted room. The 4-foot picture is somewhat duller.

NUMBER OF IMAGES PER SECOND. Both systems have shown 24 frames-per-second, the same as standard motion-picture film. It is said that one cathode-ray system is experimenting with 48 frames, but the advantage of this increased number is not clear to the writer.

ORIGINAL COST OF RECEIVER. As neither the disk nor the cathode-ray standard receivers are as yet on the market, it is impossible to give other than estimated prices. However, William Hoyt Peck, president of the Peck Television Corporation, definitely states that manufacturers building sets which use his system will be able to retail receivers at prices ranging from $150 to $250. Other authorities predict that cathode-ray receivers will list at prices ranging from $250 to $750. In quoting these figures, it has been assumed that both types of sets will include, in addition to television and its associated sound channel, a complete multi-wave broadcast receiver. The prices are estimated as of sets complete with tubes.

PROGRAM MATERIAL. No plans have as yet been made public by any television company relative to the actual material which will be broadcast. It is, however, logical to believe that motion-picture producers will enter into television agreements; that outstanding radio programs will be televised; and that portable transmitters will be used to broadcast public meetings, sports events and similar occurrences of public interest. Obviously, this material will be equally available for owners of either type apparatus.

ADAPTABILITY. Should both systems be in general use, the problem of building receivers to receive both standards of images is encountered. Neither the cathode-ray nor the disk system will receive signals intended for reception by the other system unless certain adjustments are made. In the cathode-ray system it will probably be necessary to have the scanning oscillator re-calibrated in order to receive disk-type pictures. With the disk system a quick-demountable scanning wheel will be provided, to be snapped onto the motor shaft in order to receive the pictures intended for cathode-ray reception.

"NETWORK" POSSIBILITIES. The problem of limited service area has been a major worry of all television concerns until very recently. According to proponents of the cathode-ray system, the maximum distance which can be traversed dependably, on the short wave which television will use, is about twenty miles. Yet the Peck television station, VE9AK, in Montreal, Canada, has for the past several months been sending strong signals over a distance of 80 miles, with only a 100-watt antenna input.

A special high-frequency "coaxial" cable, suited to carrying television signals, will soon be under construction to link New York and Philadelphia. Its cost may prove prohibitive as far as its extension to a nationwide system, similar to radio's telephone networks, is concerned.

COLOR OF PICTURE. Cathode-ray tubes normally provide a picture which is in tones of apple green, though it is said a black and white tube is in the process of development. In Peck's disk system, the picture is black and white, the same as the customary motion picture, which it closely resembles.

As far as program material is concerned, there will doubtless be a scramble for talent, with frantic bidding between the broadcasters in an effort to get a corner on the "big name" stars. However, as even now there are more than enough stars to go around, a fairly equitable division should result.

With two types of systems, each of which has certain advantages and each of which is capable of producing television images which should satisfy the most exacting critics, it would certainly seem that transmitters designed to serve cathode-ray receivers as well as those sending signals for the mechanical system should be given a place in the television spectrum. Even if there is some inconvenience or even chaos in using different systems with different details of transmission, they should be given a trial and soon a definite "start" in television must be made.

In the earliest days of sound broadcasting, there was chaos too. (Two stations only a few miles apart might operate on the same wave and at the same hours, so that the reception of neither was possible. Then 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 insure that all stations be 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 allot the channels equitably without showing any groups undue favor. Eventually, perhaps, a standard number of pictures-per-second and of lines-per-picture will be mandatory; if so, this will probably be in the nature of a compromise between what the various systems are using 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 the reflection loss for various phase relations between Z_S and Z_L.

The phase difference between Z_S and Z_L is designated by ϕ. Note that the curve for $\phi = 0$ 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 ϕ in the region where $\frac{Z_S}{Z_L} = 1$. 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 all cases the reflection loss is 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 value of $\frac{Z_S}{Z_L}$ will change with frequency. This means that the junction will have a better match for some frequencies than others. This favors some tones and discriminates against others. The accentuation will come in the region where the match is the best or where Z_S most nearly equals Z_L. A practical example of such a case is an attempt to operate a 15 ohm voice coil from the secondary of an output transformer, designed to work into 500 ohms. The resultant signal is attenuated, of course, over the entire range; but the higher frequencies are attenuated less, because the impedance of the coil increases enough in that 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_L increases with frequency. Conversely, if Z_L is a capacitative 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 should vary by similar amounts in the same direction. Impedance adjustment between a source and load of unequal impedance, 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. The windings themselves do not possess an inherent impedance that is significant as far as application is concerned. The impedance looking into one coil of a transformer is determined by the load across the terminals of the other coil.