Engineer Presents His Views on the Best Waves to Use for Regular Television Service

MIRRORS ON EDGE OF ROTATING DISK INCREASE BRILLIANCY OF PICTURES

Does Work of Lens Disk Without Accompanying High Cost.

BEAM ADJUSTABLE

Author Shows Sample Outfit Housed With Sound Set in Same Cabinet.

By CLYDE J. FITCH.

Television images large and bright enough to be seen by several persons at once in a dimly lighted room with sufficient detail to clearly recognize the performers, together with the accompanying synchronized sound, all in one cabinet, is the aim of the 1932 television manufacturer. Small peephole sets are all right as a toy, but a low-priced projection set is essential before the public will accept television as it has accepted radio. Therefore manufacturers have concentrated their efforts on the design and production of projection sets. As a general rule, these sets employ a rotating disk carrying sixty lenses (for 60-line images), and each lens projects a spot of light from a neon crater lamp onto a screen. As the disk rotates each lens sweeps the spot across the screen, tracing a series of lines one under the other, so that the entire screen area is scanned by the light spot during each revolution of the disk.

The lense disk obviously must be extremely accurate; the least error in its construction will show up greatly magnified on the screen and result in both picture distortion and lack of clearness. The projection sets of practically all manufacturers have been designed along the same general principles—little originality being shown by any of them. As a result the prices charged for good projection sets are exorbitant. And this explains why we don't find them in radio stores.

To get away from the standard form of lens disk projector, the simplified mirror disk was perfected. This disk is formed completely out of one piece of metal and employs concave reflecting surfaces instead of lenses. Thus, the cost of making them, after the forming tools have been made, is negligible, as compared with the cost of making lens disks.

The basic optical principles of this concave mirror disk were first described by me in the August 1, 1931, issue of The Sun, and therefore they need not be repeated again. It is sufficient to say that a concave mirror behaves the same as a lens. Concave mirrors are used in the largest astronomical telescopes, and they are more efficient optically than lenses. But this is of little importance in the television receiver as the difference in brilliancy between an image projected through a lense disk and one from a mirror disk is too slight to be detected by eye.

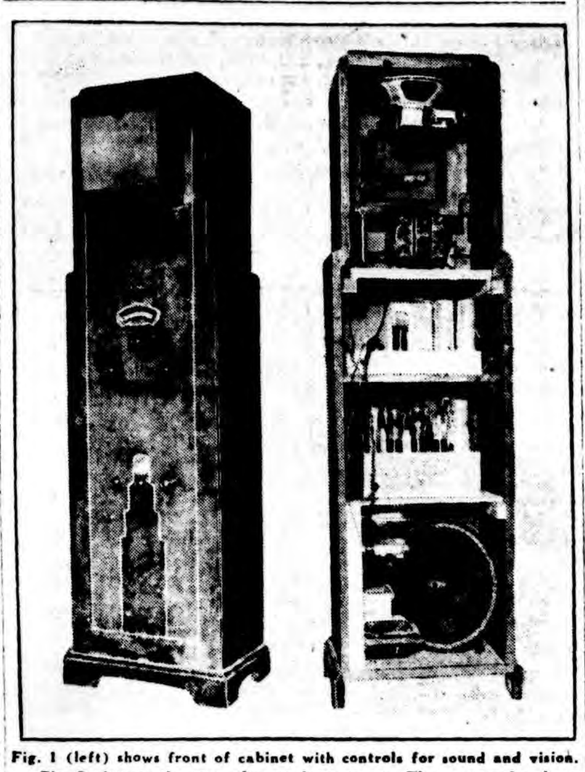


Fig. 1 (left) shows front of cabinet with controls for sound and vision. Fig. 2 pictures the rear of same instrument. The scanner has been removed from the motor in the upper compartment.

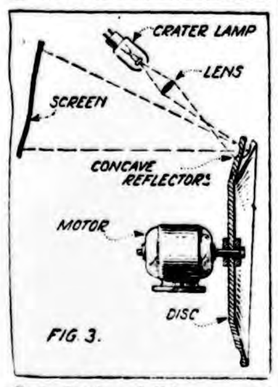


FIG. 3.

Fig. 3—Section of disk as mounted on motor shaft. Each mirror can be adjusted to proper angle by bending its free supporting lip.

Includes Broadcast Receiver.

The illustrations show an early model of a completed television receiver employing the mirror disk. Figure 1 is a front view and Figure 2 a rear view, with the back of the cabinet removed. A standard broadcast receiver is included for picking up the sound with the image. It will be noted from the illustrations that the use of the mirror disk results in a very compact receiver. The cabinet is only eleven inches deep and the translucent screen projects four inches from the front of the cabinet. The screen part is hinged to the cabinet so that it can be swung open. Then the picture may be projected, enlarged up to two or three feet square, on to a wall or other screen.

In the rear view, Figure 2, the mirror disk has been removed from the motor and placed in the lower part of the cabinet, so as to expose all parts to view. It will be noted from this illustration that the mirrors are arranged in a circular formation, rather than in a spiral, as in the case with lens disks. A slot cut between each mirror, as shown, allows the mirrors to be bent backward or forward for final adjustment in aligning them up and at the same time obviates the necessity of using a spiral formation. This is clearly shown in the sketch of Figure 3, which shows the complete optical arrangement.

In figure 3 the disk is shown in section mounted on the motor shaft. It will be noted that the mirrors are bent back considerably, forming a Fresnel shaped effect. This has the effect of spreading the scanning lines apart, as in a drum scanner, and produces pictures some 25 per cent larger than is obtained from a flat disk. Hence, a larger crater lamp spot may be employed. In the sketch the bending is exaggerated for clearness.

A lens is shown positioned between the crater lamp and the disk. This may or may not be employed, but its use may solve two problems. In the first place, it allows the lamp to be placed far enough away from the disk so as not to be in the way of reflected light from the mirrors. Second, the lens can be used to enlarge or reduce the size of the crater, and its adjustment determines the amount of overlap of the scanning lines and the resultant definition of the pictures. A crater lamp having a .020 inch diameter round spot gives excellent results without the use of a lens.

Figure 4 shows how the lens is employed to enlarge or reduce the crater spot. At A the spot is enlarged and projected to the point M. In this case the distance between M and the lens is greater than the distance between the lens and the crater. M can be considered as a new and larger crater positioned in space.

At B the crater is reduced. Here the distance between the projected crater at N is less than the distance be ween the lens and the lamp. When the crater is optically enlarged more light is used than would be used with the lamp direct with no lens. When the crater is reduced in size, as at Figure 4B, less light is used, because the lens is further from the lamp and it gathers less light. Even a lens larger in diameter will not improve matters as the additional light gathered would spread from the point N in a larger angle and would not be used. Therefore, to obtain a small crater light source we have the choice of using a small crater to begin with—and lamps having a small crater are very inefficient—or a large crater from an efficient lamp with a lens to reduce the size with its consequent loss of light. The latter method seems to be the better, as then the lamp can be properly designed to give the greatest efficiency (as far as light modulation is concerned) with the particular amplifier employed.

In later models of the receiver illustrated, the motor is mounted on separate bearings and arranged to be rotated bodily by means of a knob on the front of the cabinet. This allows for complete framing control. The disk is also coupled to the motor shaft through a spring connection, so that motor vibrations or variations in motor speed are absorbed in the spring and do not affect the speed of the disk and mar the picture.

In the reproduced photographs the upper chassis comprises the television tuner, detector and first stage audio amplifier. The power pack and second stage audio amplifier is contained in the bottom of the cabinet. The set employs three type '35 tubes in the R. F. amplifier, a type '24 detector and a resistance coupled audio amplifier using a type '27 and a type '50 tube. The rectifier is a single type '80.

The chassis in the center of the cabinet is a standard five-tube broadcast receiver. This combination brings in excellent talking pictures from stations WINS and the Jenkins television station W2XCR. A short wave converter is being installed so that the sound station on 6120 K. (49 meters) that accompanies the Columbia television station W2XAB may be received.

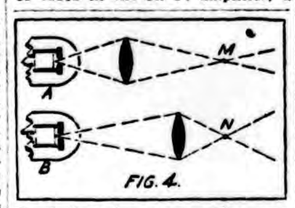


FIG. 4.

Fig. 4 shows how a second lens may be used to vary the size of the projected light spot.

TELEVISION PROGRAMS

TODAY.

W2XR—New York.

Sight on 180 meters.	Sound on W2XAR, 193 meters.

4:00—Experimental programs.
8:00—Films with sound.
9:00—Cartoons.

W1XAV—Boston.

Sight on 179 meters.	Sound on WIXAU, 135 meters.

7:00 to 10:30—Films.

W3XK—Washington.

Sight on 147 meters.	Sound on WMAL, 475 meters.

5:00 to 6:00—Experimental programs.

W2XCR—New York.

Sight on 147 meters.	Sound on WINS, 254 meters.

3:00 to 5:00—Same as WINS.
6:00 to 7:30—Same as WINS.
8:30 to 9:00—Experimental programs.

W2XAB—New York.

Sight on 107 meters.	Soundt on W2XE, 49 meters.

2:00 to 6:00—Experimental program.
8:00—Phil Maher, comedian.
8:15—Lilyan Crossman, pantomimes.
8:30—Ralph Grosvenor, songs.
8:45—Children's quarter hour, Baby Ruth, Parkin and Harriet Ann Coan, songs and recitations.
9:00—Florence Seibert, Charles Hovey and Danny Cahill, songs.
9:30—Harry Fries, musical saw.
9:45—Mildred Grizzelles, songs.

TOMORROW.

W2XCR—New York.

Sight on 147 meters.	Sound on WINS, 254 meters.

6:00—Nydia d'Arnell, songs.
6:30—American Music Ensemble; Cobina Wright, soloist.
7:30 to 9:00—Experimental programs.

W2XAB—New York.

Sight on 107 meters.	Sound on W2XE, 49 meters.

2:00 to 6:00—Experimental program.
8:00—Sue Read, songs.
8:15—Phil Maher, comedian.
8:30—Marion Harwick, dances.
8:45—Marga La Rubia, travelogue.
9:00—Yolanda Norris, songs; guitar trio.
9:15—Jack Fisher.
9:30—Floyd Neuberg and trio.
9:45—"Scotty," songs.

MONDAY.

W2XAB—New York.

Sight on 107 meters.	Sound on W2XE, 49 meters.

2:00 to 6:00—Experimental visual programs.
8:00—At home party, with Alvin Hauser.
8:15—Dorothy Rosenthal, violinist.
8:30—Italian comedy sketch, featuring James Dorso and Charles D'Angelo, assisted by David Bratton.
8:45—Doris Sharp, songs.
9:00—Giuseppe Randegger, piano lessons.
9:15—Louise Caselotti, songs.
9:30—Raymond Shannon and brothers, songs.
9:45—Elizabeth Tazelaar, artist.
10:00—Instrumental trio.
10:15—Les Quailey, sports.
10:30—Sydney Boyd, tenor.
10:45—Vincent Mondi, one-man band.

W2XCR—New York.

Sight on 147 meters.	Sound on WINS, 254 meters.

3:00—Ethel Fox, soprano.
3:30—Washington's anniversary program.
4:00—Jay Drew; Ruth Rishel, songs.
4:15—Television musicale. Gladys Haverty, soprano; Al Eagleson, tenor.
4:45—Dr. Thomas Darlington, "Choose Your Own Weights."
5:00—Jerry Geran, talk.
7:00—Old Col. Jim, songs.
7:30 to 10:00—Experimental programs.

W2XR—New York.

Sight on 180 meters.	Sound on W2XAR, 193 meters.

4:00—Experimental programs.
8:00—Films with sound.
9:00—Cartoons.

W1XAV—Boston.

Sight on 179 meters.	Sound on WIXAU, 193 meters.

7:00 to 10:30—Films.

W3XK—Washington.

Sight on 147 meters.	Sound on WMAL, 475 meters.

5:00 to 6:00—Experimental program.

OFFERS VIEWS ON BEST WAVE

Ultra Low Bands May Not Be Panacea for All Ills.

Two groups of wave lengths have been assigned by the Federal Radio Commission for the development of television. The first group of these frequencies is in the region just above the regular broadcasting band, running from 1,600 to 2,800 kilocycles. Four television bands have been allotted in this range, the four centering on 1,650, 2,050, 2,150 and 2,800 kilocycles. Each of these waves covers a spread of 100 k. c., which gives free scope for the transmission of 60-line pictures. On the other hand, if 120-line pictures are transmitted on these channels it is assumed that some scheme of frequency compression to prevent overlap into adjacent wave channels and consequent interference will be used.

Second Group Set Aside.

The second group set aside for television is in the ultra high frequencies, about which relatively little is yet known. Here the television frequencies extend from 43,000 to 46,000 k. c., 48,500 to 50,300 k. c. and from 60,000 to 70,000 k. c. The former band is 3,000 k. c. wide or thirty times as great as each of the medium frequency bands. The highest frequency range covers 20,000 kilocycles or a spread of 200 times the normal television channel. Obviously there is ample "frequency space" here to allow transmission of 120-line pictures.

The primary disadvantages of the normal frequencies are supposed to be the few channels available and the fading and multiple image effects often observed in televisio. transmission. According to John V. L. Hogan, whose experimental work in television is being carried on from W2XR, he believes many of the comments as to inevitable scrambling of pictures has been much exaggerated. "Our station," he says, "has been on the air transmitting pictures on 2,920 k. c. for more than a year and only recently shifted to the 1,670 band. On both of these waves we have found that the multiple image problem could be mitigated if not entirely solved for a reasonable service area."

Ultra Shorts Being Tried.

He further stated that many comparative observations have been made by engineers, and with reports received from unofficial observers, show that even at considerable distances from New York there is little fading or "ghosting" of images from W2XR. Thus, it seems entirely feasible to deliver a dependable television service on the medium frequency waves in spite of many claims to the contrary.

The ultra high frequency waves, he says, do not show the same kind of ghost images, but do suffer from irregular absorption and reflection effects. W2XR has had a 250 watt transmitter in experimental operation at 44,000 kilocycles for many months and has made special measurements of reception from it both in the heart of the city and in the suburbs. To receive the ultra high frequency signals effectively at all times and all locations is not yet a simple problem, not only because of transmission irregularities, but on account of various kinds of electrical noise interference. Considerable work remains to be done before a regular television service can be provided over large areas on the ultra frequency waves.

BERLIN VERY ACTIVE

Germans Rush Television Work on Micro-Waves.

BERLIN (A. P.).—Micro-waves have passed the stage of mere laboratory tests and regular broadcasts on these diminutive wave lengths will be started as soon as practicable.

The Telefunken company has erected a "dipol," a short vertical antenna, on the highest building in the heart of the city to enable an even extension of the waves to all directions. A broadcasting and television studio is being installed.

Perfecting the realm of television will be the main field of the new station. Every television device, including the latest type cathode ray tubes, will be tested.

Furthermore, it is planned to rebroadcast the regular Berlin program to investigate the possibilities of supplying Berlin radio fans with two different programs in the future.

The station will transmit alternately on 7.5 meters and 9 meters.

DANCER ON TELEVISION

Marion Harwick, who will be featured over the sight and sound stations of the Columbia system tomorrow at 8:30 P. M.

FIGHTERS WORK IN MINIATURE RING FOR TELEVISION

Amateur boxing bouts are now broadcast each week over the Columbia television station W2XAB, with round by round description over short-wave sound station W2XE. Left to right are William A. Schudt Jr., director, at the microphone; Tony Scarpati and Dick Madeo, contestants, and Referee O'Hanlon.

HOW TO TUNE IN TELEVISION

Signals Must First Be Heard, Then Scanned.

The primary essential for the reception of television signals outside the radio receiver is a device that will assemble the television signals into a picture. The simplest form of such a device is the use of a spiral perforated disk driven by a synchronous motor and interposed between the eye of the observer and a neon glow lamp.

When such a device is connected to a radio receiver especially designed for television reception the receiver should be tuned slowly in much the same manner as any radio broadcast set, watching the lighted neon lamp through the scanning disk. The volume control should be full on while tuning and may be adjusted for best detail after a picture has been found.

Adjusting Picture.

When the picture appears it may not be in frame or may appear split either vertically or horizontally. This can be easily remedied by the moving of the framing device and by the stopping and starting of the motor.

Flashes of light appearing instantaneously across the lighted screen are usually due to interference such as static or disturbances caused by local electrical equipment. At times by listening to the loud speaker one may determine which of these two classes of interference is causing the trouble. If it is local, the flashing will be of a steady nature, while with static it is intermittent.

Again, the picture may drift out of frame, due to the transmitting and receiving scanners being out of step with each other. If the drifting occurs badly then some means of synchronization must be obtained. Such a synchronizing device which can be added to the scanning motor is said to eliminate completely this annoyance.

Should black lines appear steadily across the screen certain holes in the scanner disk are probably clogged with dirt and should be cleaned by clearing the holes with a piece of fine wire. Black bands darting across the screen sometimes vertical, but more often oblique, are signals from radio broadcast stations and may be eliminated or minimized by careful tuning of the receiver to television signals.

Shielded Aerial Helps.

Lack of brilliancy may be ascribed to a defective neon lamp or a —45 power tube, but lack of contrast is due to a weak signal, improper volume control adjustment or poor modulation at the transmitter.

Occasionally two or more images may be seen in one frame, which may be attributed to the fact that one signal is coming direct from the transmitter while one or more duplicates are being received indirectly by reflection from the Heaviside layer.

The reflected signals travel further and therefore arrive later than the ground or direct signal. This phenomenon may be minimized by placing several grounded wires a few feet above the antenna and parallel with it.

WMCA'S BABY STATION

Miniature Transmitter in Use First Time Tonight.

A miniature transmitter with a power of only one watt and weighing but a few pounds will be used by WMCA tonight to broadcast a description of the Motion Picture Club Ball from the Waldorf-Astoria. This baby station, with a range of five miles, has been licensed for the specific purpose by the Federal Radio Commission.

Frank Marx, technical director of WMCA, designed the transmitter. It measures 20 inches by 14 inches and is equipped with straps which are used to swing it from an attendant's back. Through the use of the device it will be possible for the announcer to walk about the ballroom, interviewing guests at tables in all parts of the room. The weak signals transmitted from the dance floor will be picked up by a special receiver at WMCA and then retransmitted on that station's regular wave of 570 kilocycles.

FEATURES FOR THE WEEK

Sight Programs Offer Mystical Tricks and Novelty Acts.

A marked improvement in visual reception has been reported by the increasing number of lookers-in since the premiere broadcast of the first sight and sound program from the Columbia studios seven months ago.

This improvement is due to the many experiments in arranging and adapting suitable programs to the limited field for transmission, with the result that the features scheduled for the week begining today offer varied and unusual entertainment.

Beginning at 8 P. M. over W2XAB Phil Maher, the television clown, will be featured in a program followed by Lilyan Grossman and Ralph Grosvenor. At 9 P. M. over the same station Charles Hovey, Ethelyn Holt and Ruth Kerner will be presented in a program entitled "Television Varieties."

W2XCR Features Ensemble.

Tomorrow W2XCR will present a one-hour program with Nydia d'Arnell, followed by the "American Music Ensemble," with Cobina Wright as guest soloist.

Elizabeth Tazelaar, Lou Hanlon and Herbert Vernon will sketch a varied number of subjects in charcoal, pen and ink. These sketches are scheduled for Monday, Wednesday and Thursday over W2XAB.

Richard Kenny, the magician, returns to television with a new collection of mystic tricks, which he has adapted for visual broadcasting. This feature is to be broadcast Thursday at 8:30 P. M. over W2XAB.

The "Television Musicale," featuring Marion French and May Sprintz, contraltos, with the Burnett sisters, will be presented over visual station W2XCR on Thursday, beginning at 4 P. M. At 6:15 P. M. over the same station the "Justice Brandies Society Forum" will be presented, followed by "Old Colonel Jim" in a group of songs.

Outstanding among the dramatic sketches listed on this week's program is the first act of a three-act playlet presented by the John O. Hewitt Players, entitled "Murder in the Manor," a mystery drama, with the following cast of distinguished artists, Frank McMunn, Dennis Esmond, Marga La Rubia, Mabel Montgomery, Murial J. ret, Rosemary Lee, James Ayres, Ted Bussman and John O. Hewitt. This unusual feature is scheduled for Tuesday, from 8 to 8:30 P. M.

Comedy Sketch on W2XAB.

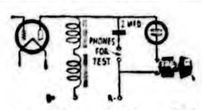
"Just the Two of Us," a comedy sketch featuring Holly Smith and John McAllister, present the third of a series of programs of fast dialogue and songs on Friday at 9 P. M.

Stephanie Wall, soprano, will be seen and heard in a short recital on Thursday at 8:45 P. M. on W2XAB.

CONTROLS IMAGE

Proper Resistor Helps to Obtain Sharper Contrast.

There are several methods in coupling a neon tube to a power tube in a television receiver, but regardless of which method is used the neon tube becomes rather critical in its requirements of voltage and current for satisfactory contrast of the image, with each particular tube having its best characteristics under certain conditions of voltage and current.



Resistor Controls Neon Tube.

The circuits shown herewith illustrates one method of obtaining sharper contrast and more realistic reproduction by adjusting the current through the neon tube to a value such that on strong negative impulses the light goes out, while with positive impulses the glow intensifies, thus producing the sharp contrasts of light and shadow that are so necessary to television reception.

A clarostat having a range of from practically zero to 5,000,000 ohms is suitable for this purpose.

Amateurs to Conduct 5-Meter Phone Tests

Tomorrow and Monday from 10 A. M. to 2 P. M. the Bloomfield Radio Club will conduct the first in a series of 5-meter phone tests. These tests, as were explained in The Sun last Saturday, will give the television experimenter an opportunity to test out ultra-short wave receivers on these bands. Reports as to signals heard and their strength should be sent to D. C. Akers, 181 Greenwood avenue, in East Orange, N. J.

SOME HINTS ON SIX-METER SETS

Attention Must Be Given to Layout of Apparatus.

The success of television transmission on the ultra-short waves depends just as much, if not more, on the receiver as on the sending equipment.

If the equipment intended for operation at the "end of the ether line" is not up to snuff, little will be gained if the best of signals is distibuted on the five to seven meter bands, says a writer for the Associated Press.

Space Saving Important.

Since high frequency or ultra-short wave reception requires coils of few turns and condensers that take up little room, space-saving immediately becomes evident.

This is highly important, as it means short interconnecting wires, a factor in eliminating stray effects that might tend to increase the capacity and inductance, and thus lower the set's over-all efficiency.

Careful shielding is absolutely essential, and even with its elaborate use some of the signal may be lost due to the fact that the tremendously high frequency, on the order of from 40,000 to 60,000 kilocycles compared with 550 to 1,500 for sound broadcasting, doesn't seem to stick to the electrical laws obeyed by frequencies of fewer digits.

For instance, two comparatively short wires, if run parallel for an inch or so, may give a condenser effect that will rob the signal of much of its punch.

Tuning coils, with the turns spaced too close together, will produce the same effect and may raise the wave length range above the point desired. The remedy, of course, is wide spacing of turns, even up to a quarter of an inch.

Choke Coil Isolated.

It is only in the tuning section that particular pains should be taken, as the audio amplifier is the same for this type of receiver as it is for any other. There is one exception, and that is that the choke coil designed to keep radio frequency current out of the audio circuit be isolated from the high frequency section.

This can best be accomplished in resistance coupled audio by placing the choke between the coupling condenser and the plate resistor of the detector tube. The choke is then bypassed by a divided condenser with its middle section grounded.

An insulator slightly larger than an ordinary teacup, which will stand the weight of one million pounds, is now used at the base of WABC's new vertical antenna in New Jersey, which rises 665 feet in the air, weighing 62½ tons.