New Disc Keeps Down Image-Frequency

Sanabria System Uses a Spiral Divided Into Three Sections to Scan Television Subjects and Obtains Sharp Detail and Clear Distinct Signals Within 5000-Cycle Band

By Robert Hertzberg

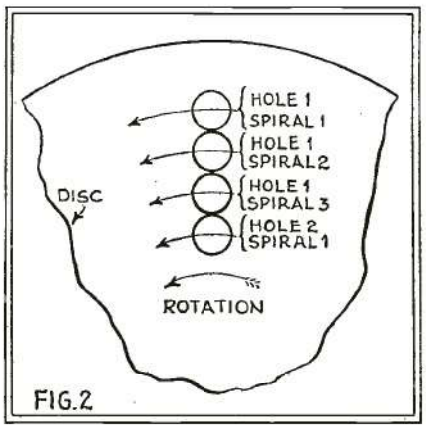
ONE of the main attractions at the Radio World's Fair held in New York during September was the exhibition of television transmission and reception staged by Ulises A. Sanabria, the young television expert of Chicago, whose pioneer television work on the broadcast band was described at length in an article appearing on page 219 of the September number of Radio News. Every afternoon and evening during the week, people waited in long lines to get a glimpse of the television images as they appeared in four receivers set up in the exhibition hall of Madison Square Garden. The apparatus was kept running almost continuously from noon till eleven o'clock in the evening, being shut off occasionally only to give the arc light and the driving motors a chance to cool off.

Mr. Sanabria displayed for the first time his new three-spiral-disc system, to which reference was made in the article cited; he thus produces 15 pictures a second, yet keeps the frequency of the image impulses within the 5,000-cycle limit prescribed by law. As a matter of fact, the television signals are actually "sharper" than voice and music signals; that is, they do not spread over the tuning dials of a receiver as much as the latter. This rather surprising effect has been the subject of comment by numerous listeners in and around Chicago, in which city a Sanabria transmitter is in nightly use at WIBO. This station broadcasts television images every morning except Sunday and Monday at 1.00 a.m., Central Standard Time.

TELEVISION AT STATION WMAQ

By the time this number of Radio News appears, the television transmitter displayed by Sanabria at the New York radio show will have been installed at WMAQ, the powerful broadcast station operated by the *Chicago Daily News*. If you are within range of this station, you can readily learn the hours of television broadcasting by consulting the daily radio programs printed in your local newspaper.

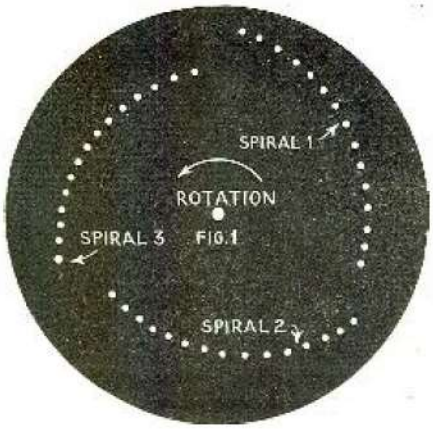
This machine and that in use at WIBO were built under Sanabria's direction by the Carter Radio Company, of Chicago. Mr. A. J. Carter, its president, stated at the New York show that several other transmitters were then under construction, and would be installed shortly in different parts of the country. It is likely that one of the new televisors will be taken over by a third Chicago station, although at the time this number of Radio News went to press the final negotiations had not yet been completed. Another transmitter is tentatively scheduled to go to Philadelphia.



Unlike other triple-spiralled discs, however, the Sanabria system covers only one-third of a picture with each spiral. The result is shown in more detail opposite.

Except for the important detail of the disc itself, the Sanabria televisor is much like the numerous other disc machines. A ten-kilowatt arc serves as the initial source of illumination, its light being broken up by a disc into slender rays which flash across the face of the subject being televised. These rays are reflected into a bank of four ten-inch photoelectric cells, which respond to the graduations of tone (reflected from the lighter and darker areas of the face) by producing a flickering current. This current, which is very weak, is amplified by a suitable bank of amplifiers and made to modulate the radio transmitter. This action has been described in detail in numerous articles in Radio News.

In practically all other disc systems designed for ordinary black-and-white transmission, the disc is drilled with a single spiral of tiny holes, which cause a series of beams of light to sweep across, or "scan," the face of the person being televised. With a single spiral (of either 24 or 48 holes, usually), 24 or 48 beams have swept across the subject. Then the outermost hole of the disc comes into position again and the subject is again scanned from top to bottom in one revolution of the disc. The holes are of such diameter that the beam of light thrown out by each just skims by or slightly overlaps the edge of the path covered by the ray of light from the preceding hole. As the holes are in a spiral, the whole surface of the subject's face is smoothly scanned, usually from top to bottom.



The arrangement of holes, in the disc used by the Sanabria system, is indicated above. It will be seen they form three spiral arcs, as in the color-television system of Baird.

THE SANABRIA 3-SPIRAL DISC

The Sanabria disc, however, is drilled with *three* spirals, as shown in Fig. 1. Each spiral comprises fifteen uniformly spaced holes, with the spirals themselves set differently in relation to the center of the disc. To understand exactly how the holes are arranged, study Figs. 1 and 2 very closely. Fig. 2 shows how hole 1 of spiral 1, hole 1 of spiral 2, hole 1 of spiral 3 and hole 2 of spiral 1 would look if all four of them could be made to appear together along the vertical diameter of the disc.

Let us start with hole 1 of spiral 1 in the position it occupies in Fig. 2, and start the disc rotating in the counter-clockwise direction. This hole sweeps past the arc light, and is followed by hole 2, of the same spiral, and by the remaining thirteen holes. Notice carefully that holes 1 and 2 of spiral 1 *do not overlap* or even run closely, edge to edge; in fact they are quite widely separated. Now when the 15th hole of spiral 1 has flashed by the arc, hole 1 of spiral 2 comes into position. This hole just skims beneath the path cut by hole 1 of spiral 1; similarly, hole 2 of spiral 2 runs by just beneath the path traversed a few moments previous by hole 2 of spiral 1. When all 15 holes of spiral 2 have run by the arc, covering half of the dark paths left by the passage of spiral 1, hole 1 of spiral 3 comes into position. This sweeps under the path cut by hole 1 of spiral 2, and above the path cut by hole 2 of spiral 1. The other 14 holes of spiral 3 cover the remaining dark or unscanned strips of the subject's face. The disc revolves at 900 r.p.m., giving 15 pictures per second.

If all this sounds confusing at first, read it over a second time. The system is a rather peculiar one, but it works.

HOW THE EYE HELPS

At this point you are probably asking: "If the holes of each individual spiral are so far apart, why won't thick, black lines appear in the receiver?" The answer is found in that much-discussed property of the human eye: namely, its ability to retain an image after the original picture has completely disappeared. Actually, what a three-spiral receiving disc builds up is a series of three *separate and distinct* images, each consisting of 15 widely separated lines, as shown in Fig. 3. Practically, however, the eye retains the lines produced by the first scan for some time after spiral 1 has

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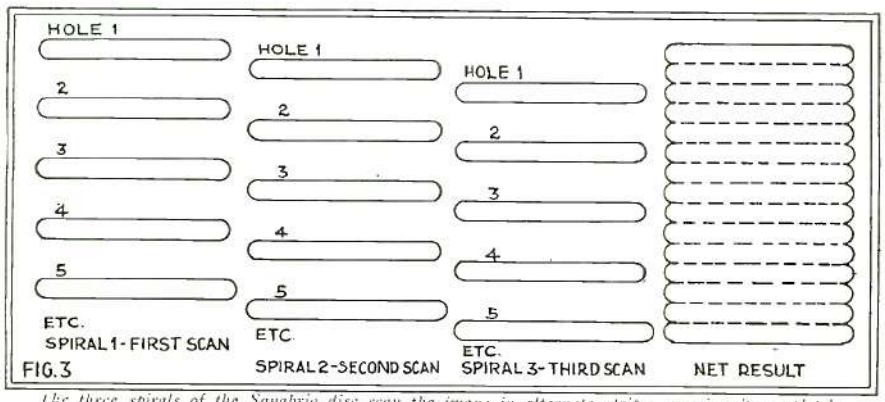


FIG. 3

The three spirals of the Sanabria disc scan the image in alternate strips, covering it completely at every revolution, however, just as do the other types of disc in use.

swept by the neon glow-lamp. It also retains both the first and second "scans" while the third spiral is active. The net result, as far as the eye is concerned, is a complete image built up of closely-adjoining beams of light.

The illusion of solidity produced by this arrangement of spirals is very effective in that the received images are not at all badly streaked. Of course, we cannot expect something for nothing: the images are not perfect, and some streaks are evident, but considering the extremely important fact that the image impulses *do not exceed 5,000 cycles*, the results must be considered quite good. With the 15-image-a-second rate, the subject at the transmitting end can move from side to side without fear of having his image at the receiving end look like a slow-motion comedy scene.

At the New York radio show Mr. Sanabria showed the usual 1½-inch-square images built up on the plate of a neon-gas glow-lamp, with only the head and part of the shoulders of the subject visible. However, in his own laboratory in Chicago he has been able to show the entire figure of a man, without making any changes in the apparatus. The scanning light is sufficiently powerful, and the photoelectric cells sufficiently sensitive, to make this feat possible. The image of the man at the receiving end is very small, but his whole form may be seen.

SIGHT AND SOUND TOGETHER

One of the interesting experiments Mr. Sanabria performed in Chicago, just before leaving for the New York exhibition, was that of transmitting both voice and images on the same 5,000-cycle broadcast channel, *at the same time*. At the transmitting end he simply connected the microphone in one of the intermediate stages of the audio amplifier working with the photoelectric cells. At the receiving end he inserted a low-frequency filter in the plate circuit of the last audio amplifier tube, with the loud speaker in the proper position in the circuit.

It is possible for this simple system to work only because the voice frequencies are comparatively low, and the image frequencies relatively high. The voice impulses do tend to break up the images at times; but the experiment was performed with marked success. In fact was actually tried "on the air;" and several experimenters in Chicago reported that they were able to reproduce the voice and images simultaneously.

It is obvious from the foregoing description of the Sanabria television system that a special receiving disc is necessary. The 48-hole disc which has become virtually the standard for television work, for no reason at all, will produce no results. By the time this magazine appears inexpensive three-spiral discs undoubtedly will be available.

Several Wavelengths Used for High-Frequency Radio Movies and Television

STATION WIXAY, located at Lexington, Mass. (near Boston), is now broadcasting both television and "radio movies" on a wavelength of 61.5 meters, a 48-hole disc, revolving at 900 revolutions per minute, being used. This station has been authorized by the Federal Radio Commission to use a wide modulation band for experimental purposes. No definite schedule of transmission has been given; but owners of short-wave receivers can easily pick up the signals and learn the schedules from the broadcast announcements.

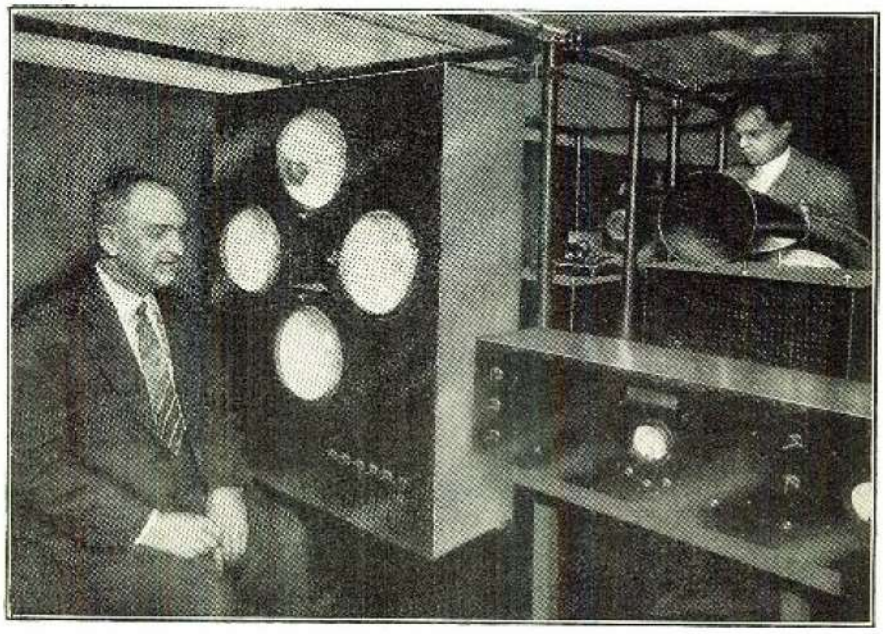
The transmitter of WIXAY (which is a companion station of WLEX) is rated at 500 watts, and was designed especially for radiovision work. It should be heard without trouble in most parts of the United States and Canada. Alfred J. Poté, formerly in charge of the experimental laboratory of the Raytheon Manufacturing Company, of Boston, is chief engineer of the station and the designer of the television apparatus.

As the studios of WIXAY-WLEX are located in the same building housing the short-wave transmitter, it will be possible to broadcast the images of performers, either before or after they appear before the microphone. The television transmitter has been built in semi-portable form; so that it may be wheeled from one room to another. It is Mr. Poté's plan to cut a hole in the wall of the main studio and to stand the televisor inside this; so that the apparatus will not crowd the studio itself.

For the "radio-movie" transmissions, specially prepared motion-picture film will be used. RADIO NEWS will publish further details of the apparatus, and will give the full transmitting schedules, as soon as the information is released.

THE Jenkins "radio movies" are now being broadcast on 186 meters, in addition to the 46.72-meter transmissions, announced on page 420 of the November number of RADIO NEWS. This wave falls a little short of the tuning range of most broadcast receivers; but it can be tuned in with the biggest coil of the usual plug-in-coil short-wave set. If you cannot pick up the 46.72-meter signals, because of "skip-distance" effects or merely because of your location, try the higher wave.

The "radio movies" are broadcast on Monday, Wednesday and Friday nights from 8:00 to 9:00 p. m., E. S. T. Announcements are made in both phone and code; the call letters of the station are W3XK. The Jenkins Laboratories, from which the transmitting is done, are located at 1519 Connecticut Ave., N. W., Washington, D. C.



Above, left, A. J. Carter of the Carter Radio Co. being televised by the transmitter which U. A. Sanabria is operating. This apparatus was exhibited at the radio shows held recently in New York and Chicago. The "checking" receiver appears at the right.

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