QST Looks at Television—1944

The "State of the Art" from an Amateur Viewpoint

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For many years leading experimenters in the amateur ranks have interested themselves in television and some notable work has been accomplished. Since Pearl Harbor all amateur television has of course been discontinued, but the commercial broadcasters have continued to experiment and plan for the future. QST presents herewith an account of present-day television as it looks from the amateur viewpoint.

Of all the electronic miracles which have been promised to the postwar world the most widely anticipated probably is television. Ever since the early days of radio broadcasting the possibility of being able to see as well as hear by radio has intrigued the public's imagination and every faltering step forward in this new art has been eagerly hailed with the statement that "television is just around the corner." This great public interest, accompanied as it has been by many irresponsible predictions of immediate availability, has not been an unmixed blessing. There is no television equivalent for the crystal detector or simple one-tube receiver—even the crudest early attempts at video transmission by means of rotary scanning discs required comparatively complicated equipment—and most of the serious workers in the field have done their best to head off premature promotion.

The eventual place of television in amateur radio is not yet clear. As early as 1925 QST carried articles about the scanning disc systems of that day and since then has consistently presented the facts about new developments in the art when they seemed to offer possibilities for amateur use. At the same time the limitations and problems still to be overcome have been clearly set forth, a notable instance of "debunking" being the article, "Television — What About It?" which Ross Hull wrote in 1931.1 Late in 1937 QST started on a sys-

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1 Hull, "Television, What About It?" QST, November, 1931, p. 20.


The studio staff at WABD during the televising of "Panama Memories." It takes a full size crew to operate all of this paraphernalia. The man in the left foreground is manipulating the microphone boom to pick up the singer's voice without letting the mike show in the picture.

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WARD's transmitters, main control room, and studio A are located on the 42nd floor, while offices and studio B are on the 2nd floor. The studios are somewhat similar in arrangement to those used for standard broadcasting but they contain much more equipment. One wall is covered with scenery—back drops, stage furnishings, etc. Overhead are banks of incandescent flood lights, the type in which the reflector is a part of the bulb itself. Two camera dollies, small rubber tired trucks which carry iconoscope camera, preamplifier, power supplies, and cameraman, trail a tangle of coaxial cables and power wires behind them across the floor while other cables run to an enormous spotlight and to the microphone which is suspended from an overhead boom, a la Hollywood. It takes a full size crew to operate all of this paraphernalia. In addition to the people normally used in any broadcast studio, such as sound effects men and announcer (in television a charming young lady), there are camera men, men to push the camera men around on their rubber tired mounts, spotlight operators, microphone boom swingers, property men to move scenery, announcement cards, etc., and a couple of assistant directors. Camera men and directors are "wired for sound"—they wear headphones through which they can receive orders from the principal director in the control room.

Television employs many techniques of the theater but there are some rather startling differences. Because the monochrome camera does not respond well to red, the lovely girl singer who was about to go on appeared for work wearing

WARD in Operation

WARD is on the air three nights a week from 8 until usually about 11 P.M. Practically the entire staff of engineers and technicians is made up of regular DuMont employees who are operating this television station on an overtime basis in addition to their full-time job of wartime production in the plant at Passaic, N. J. As might be expected, most of them are amateurs or have an amateur background.

While WARD operates under a commercial license and many sponsored shows are regularly transmitted, the entire set-up is still of a more or less experimental nature. DuMont provides all of the technical facilities and personnel but programs are largely furnished by New York advertising agencies who have gladly accepted this opportunity to gain practical experience in the newest of advertising mediums. This cooperation has resulted in many interesting shows for the TVLs (television lookers), a notable example being the recent transmission of an entire Broadway musical comedy complete with orchestra, chorus girls, and all the trappings.

Promptly at 7:30 P.M. we arrived at 515 Madison Avenue, New York City, and were greeted by Morris C. Barton, Jr., ex-W4CRV, chief of operations.

Above—The control room of Studio A. The small monitors on top use the familiar 5-inch tube. The picture is green but these tubes serve the purpose until new equipment is available. Left—The main control room at WARD. The large monitoring scopes have 14-inch screens and reproduce the picture in black and white.

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dark brown lipstick. The scenery was painted in various shades of gray which have been found by experiment to give the most natural appearance on the screen. The nonbalance with which scenery was moved during the performance also was rather surprising until we realized that no stage curtain ever invented could conceal such activities as well as switching off the camera.

We did not get to see the whole show as we were too busy asking questions of the engineers and trying to find out "what made the wheels go 'round." The part that we did see was highly interesting and well worth watching. There has been much comment lately about the quality of present day television pictures. We viewed the WABD show on the control room monitor which operates directly from the coaxial line running to the transmitter and on the main station monitor which picks up the program from the air.

Both of these use 14-inch tubes and the picture appears to be about 8 X 10 inches or slightly larger. This is not nearly as large as will be available on good home television receivers in the future — it is expected that a projection type set capable of producing a picture 18 X 24 inches in size will have been announced before this article appears in print. It is possible, of course, to get close enough to the screen so that the line structure becomes visible but the same is true of almost any kind of pictorial material. Moving pictures are very crude when seen from the front row and; world famous oil paintings cannot be appreciated until viewed from far enough away so that the brush strokes are not predominant. From a normal viewing distance the 525 lines of present day television are not noticeable. This is in no sense an argument against a greater number of lines. If better television can be produced we are all for it, but the present version is good enough to make us put some of those war bonds into an envelope marked "television receiver."

**Control Room**

To get back to WABD. The studio control room also is much like the conventional b.c. type but with extra equipment and personnel. The sound control desk, which in ordinary broadcasting is the center of attraction, here is relegated to one side of the room. In its place before the plate glass window is a large console containing video controls, camera monitoring scopes, main studio monitoring scope, small scopes which show the detailed characteristics of the various video signals, scopes which show the "shading voltage" by means of which minor defects in lighting the picture may be corrected or special effects produced, and in fact more scopes than we had ever before seen in one place. In spite of the fact that Dumont manufactures these tubes WABD has to get along for the most part with prewar equipment, all new production being needed for war use at present.

As in the studio itself, the control room requires a large staff. One sound engineer is sufficient but there are video engineers for each camera, a principal video engineer at the main monitoring scope, and the program director who supervises the entire production. By means of two simple gain controls the principal control engineer is able to make "lap dissolves," that is, fade from one scene to another, which would be the envy of any Hollywood technician.

At the rear of the control room a large panel contains amplifiers and the synchronizing pulse generator which is the heart of the entire system. This generator provides the timing, vertical and horizontal sawtooth voltages, blanking voltages, and synchronizing pulses.

Terrestrials and main sound control panels at WABD.

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type of fluorescent material which responds in black and white. Incidentally, the contrast and brilliance of the pictures on these black and white tubes was much better than we had anticipated, although it is claimed there is still room for improvement. As is also true of moving pictures, black and white are purely relative terms; the unilluminated screen of the scope itself being white. However, the variations of brilliance between the illuminated and unilluminated portions of the screen do produce a very satisfactory degree of contrast.

From the studio control room the program goes to the master control room located next to the transmitter room on the 2nd floor. All video signals are carried by coaxial cables while the sound goes over an ordinary wire system. In the master control room the program is monitored again before being fed to the transmitter. In addition, master control switches between studio connect the special equipment which permits movie film to be televised.

Transmitters

The transmitters themselves are mounted in a typical broadcast fashion in a large steel console extending the length of the room. Behind this imposing exterior, however, the rig looks strangely familiar, particularly to anyone who has done much work on the v.h.f. ham bands.

In the transmitter console the f.m. audio rig occupies the sections at either end and the video equipment fills the other five sections. WABD operates on channel four—78 to 84 Mc. The audio channel starts off with a crystal on 128,244 kc. and multiplies by means of quadruplers, etc., to reach 41,575 Mc. in the f.m. exciter unit. Modulation is introduced through a compressor and a pre-emphasis amplifier and is accomplished by means of a phase shift method similar to the Armstrong system. After leaving the exciter the audio signal goes through an 807 doubler, an 829
buffer, a pair of 100 THz, and into the final pair of 450 THz. The output, approximately one and a half kilowatts, goes to a ring antenna mounted on top of the tower. The center frequency of the audio channel is 83.75 Mc. and the deviation is 75 kc. plus or minus.

The video channel starts with a 4953.125 kc. crystal in a Pierce oscillator using a 7C5. After quadrupling twice the signal is amplified and applied to the modulated stage, a pair of 100 THz. Grid modulation is used and the modulator consists of two 1N726s. Three broad-band Class-B linear amplifier stages follow the modulated stage. The first is a pair of 1227s using a coil and capacitor in the grid circuit while the plates go to a linear tank. The following two stages use linear tanks throughout with hairpin coupling loops, all on a rather massive scale judged by amateur standards. The driver consists of two water-cooled type 8003 tubes and the final of two 889s which are water cooled and in addition have a blast of air blowing on the glass seals. The final stage operates as a grounded grid amplifier, excitation being applied to the filaments while the grids are by-passed to ground. This arrangement is much easier to drive at these frequencies than the usual system and nearly eliminates the need for neutralization. The antenna for the video signal consists of folded dipoles arranged in a cross just below the doughnut which radiates the audio signal.

The unmodulated video carrier is at 79.25 Mc. with an output power of approximately 6 kilowatts and has one side band partially suppressed. All of the video amplifying equipment in the station is essentially flat to 5 Mc, but the signal that finally goes out is cut off at 42.25 Mc. The disposition of the two carriers in the 6 Mc channel is shown in Fig. 1.

QST has published many articles dealing with the theory and operation of television equipment so no attempt will be made to cover the same ground here. The most recent of these, an explanation of iconoscope operation, appeared in July, 1944. However, one feature of modern television transmission which has mystified many hams is the method by which moving picture film of 24 frames per second is transmitted over a system employing 30 frames and an explanation of the method may prove interesting. Actually this is not as complicated as it sounds. Because of the interleaving action of the television scanning beam the picture is covered by 60 fields per second, that is, the beam starts at the upper left-hand corner of the picture and scans alternate lines and then returns to the top of the picture and scans the other half, filling in the vacancies left the first time through. Thus two of the 60 fields are required to completely fill in a single picture or frame. As this scanning action is continuous there is nothing in video transmission which exactly corresponds to the shutter action of a moving picture projector.

The conversion of 24 frame-per-second movies to 60 field-per-second television is accomplished by scanning one frame of film for 2 fields and the next for 3. In this way half of the frames are scanned twice, 12 frames — 24 fields, and the other half three times, 12 frames — 36 fields, making a total of 60 fields or 30 television frames. With the high-speed continuous action of the electron scanning beam this process gives results that are as smooth as could be desired.

Future Prospects

Disregarding for the moment the postwar use of television by amateurs let us consider its probable commercial form. In the very nature of things television programming will have to be far different from the practices which have grown up in the broadcasting industry. Ordinary broadcasting has come to be, in many homes, a normal background accompaniment to all household activities, the day-long parade of soap operas, shopping advice, and the like, constituting a gentle obligato to the song of the vacuum cleaner. Such cannot be the case with television. Once admitted to the home this new medium will prove far more exciting — demanding as it does, our complete and undivided attention. Unless the

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The transmitter at WARD, Panel at extreme left contains exciter and modulator for f.m. sound channel. Unit at the right contains final amplifier for sound. The rest of the equipment is all video.

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housewife can develop eyes in the back of her head and a dual personality she will certainly be unable to peel the potatoes, mind the baby and do the week’s washing while raptly listening to and watching the adventures of “somebody’s other wife.”

The pioneers in this new industry are well aware of these difficulties in program planning and are prepared to take appropriate action. It is very doubtful if continuous programs of the type now offered by standard broadcasting will be available, certainly not until a real demand arises. For the immediate future it appears that television broadcasting will take place during two well-defined periods of the day, a few hours in the afternoon devoted mainly to educational subjects, perhaps actually presented in cooperation with local school or college classes, and an evening program of entertainment running from 7 to 11 or 12 p.m. The costs of television programming are much higher than comparable sound broadcasts and this factor, combined with the inability of the TVL to sit still and look for more than a few hours at a time, seems reason enough to expect that our postwar television programs will be furnished

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