EUROPEAN BROADCASTING UNION

E.B.U. REVIEW

116-A

TECHNICAL

AUGUST 1969

E. B. U.

REVIEW

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1 Television antennas

Marconi supplied the antenna system to the BBC for the world's first public television system, and have been supplying television antenna systems all over the world ever since.

Below is the latest wideband aerial for the British four-programme u.h.f service. It will accept the outputs from four transmitters on different frequencies within a ten-channel band. Marconi television antennas cover Bands I, III, IV, and V, and omnidirectional and special radiation patterns are available. Sophisticated combining units, filterplexers, diplexers, feeder and auxiliary equipment for u.h.f and v.h.f services, are also available.

2 Television transmitters Band IV and V

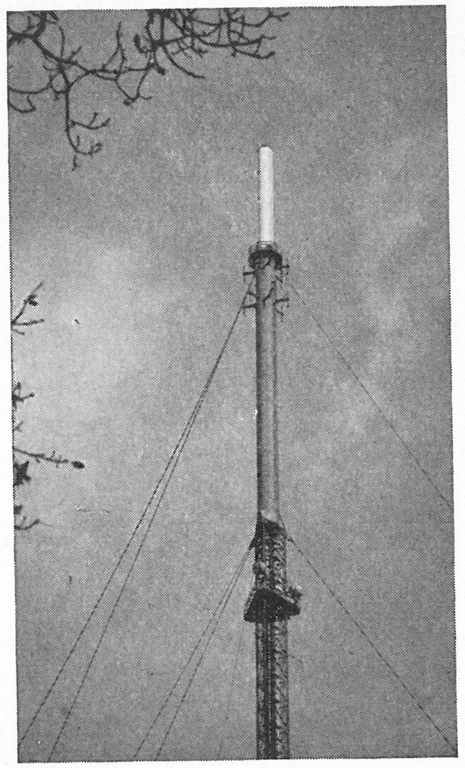
There are Marconi u.h.f television transmitters covering the range from 1kW to 55kW, which may be operated singly or in parallel and which may be remotely controlled. They can be used on all internationally recognized standards for black and white and colour television.

Marconi u.h.f transmitters have been sold in USA (where two Marconi paralleled 25kW u.h.f transmitters at WLFD Chicago were the first British television transmitters in that country), Sweden, Switzerland, Denmark and for the BBC's second programme.

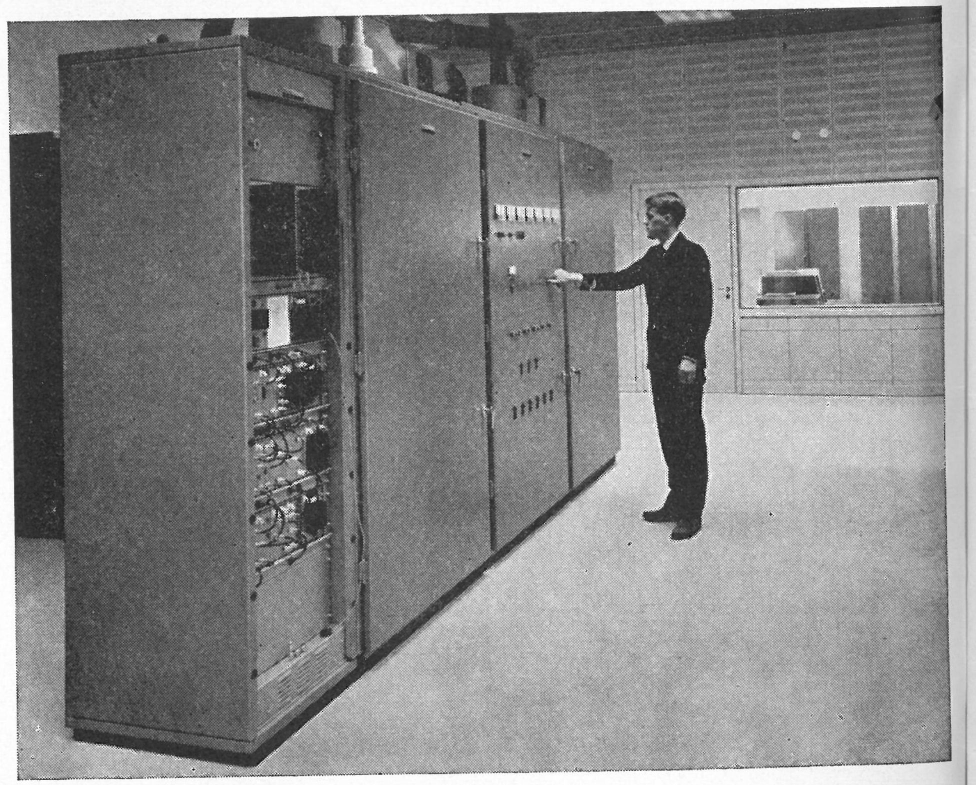
3 Television transmitters Band I and III

The highly successful range of Marconi v.h.f transmitters is being extensively used on all continents. The transmitters extend from 50W to 20kW and may be operated singly or in parallel on all internationally recognized standards of black and white and colour television. Advanced techniques have significantly reduced the need for routine maintenance and highly qualified staff.

Marconi complete television transmitting equipment



1 *Marconi U.H.F Television aerial*



2 *Marconi 40kW U.H.F transmitters at Stockholm*

4 Service area predictions

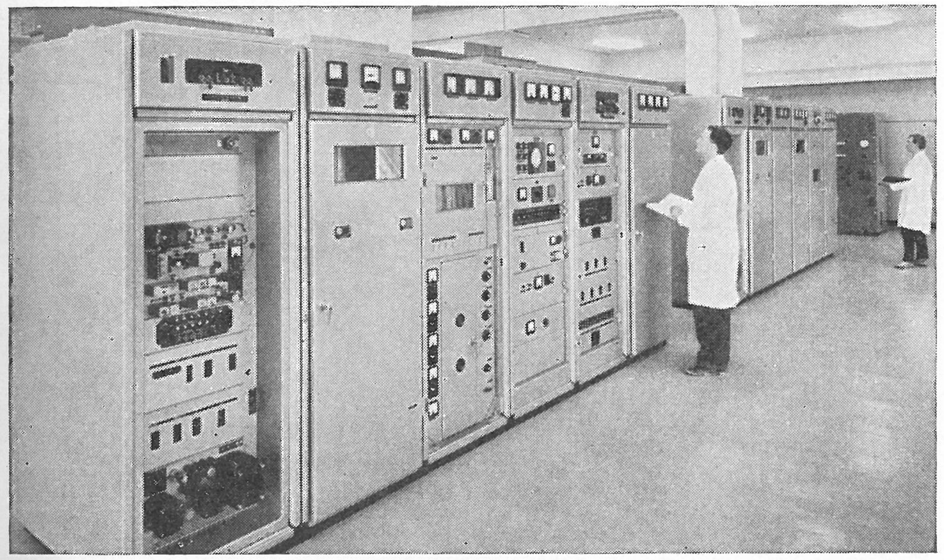
Optimum siting of the aerial and transmitter of a television or sound broadcasting station is essential if the widest coverage is to be provided at the lowest cost.

Marconi's unique prediction service is based on detailed considerations of topography, meteorological conditions, the effects of other services etc., and is backed by the experience and detailed records of many years. These predictions, calculated at the Marconi computer centre, have been proved by subsequent surveys to be remarkably accurate, and this service is in demand by broadcasting authorities throughout the world.

5 Low-power television transmitters and translators

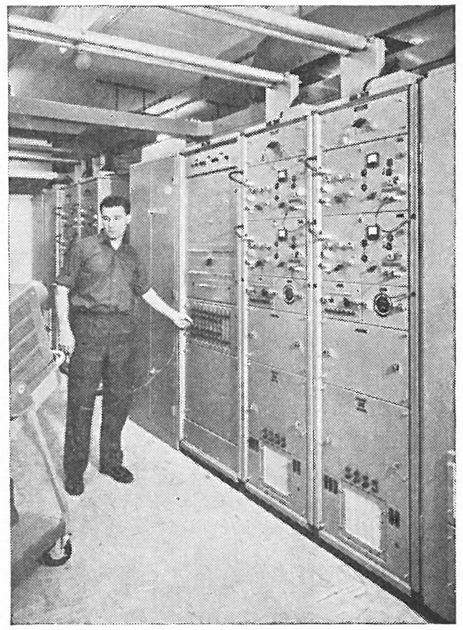
In any national or regional television service there are usually areas where, due to topographical conditions, the service is degraded. To meet those conditions Marconi provides a range of television translators and gap filling transmitters which can be operated single or in parallel and which are suitable for unattended operation.

Marconi translators and low-power transmitters are in operation in all continents and in all climatic conditions.



3 *Marconi 10kW Band 1 Television transmitters, Auckland, N.Z*

4 *Part of the Marconi service area prediction station*



5 *Marconi Band III translators at ITA station at Sandy Heath*

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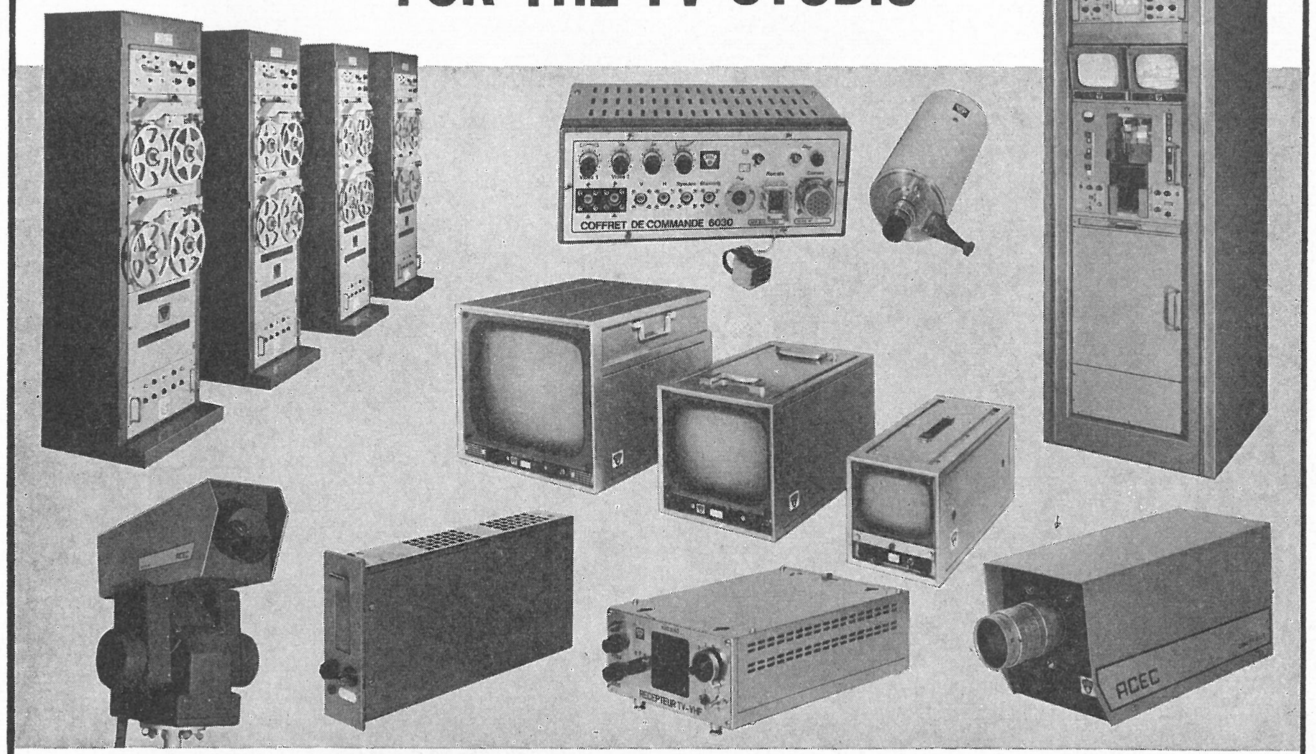

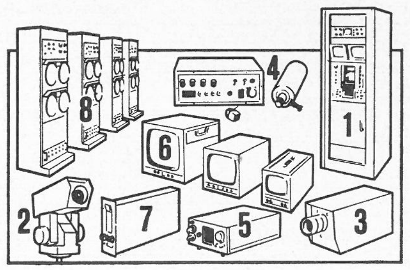

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On request, both camera cables can be supplied with attached 98- or 100-pole plugs (coaxial type).

F&G manufacture video cables as coaxial cables with a characteristic impedance of 75 Ω (60 Ω in special cases) and solid or air-space insulation. The attenuation and distortion of these video cables are particularly low, because inhomogeneities are reduced to a minimum and the characteristic impedance deviates from the rated value by only ± 1%.
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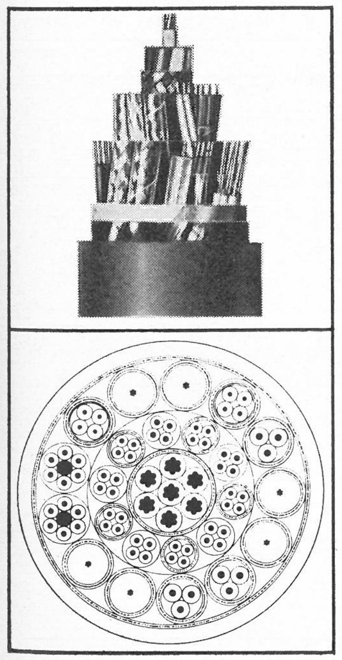
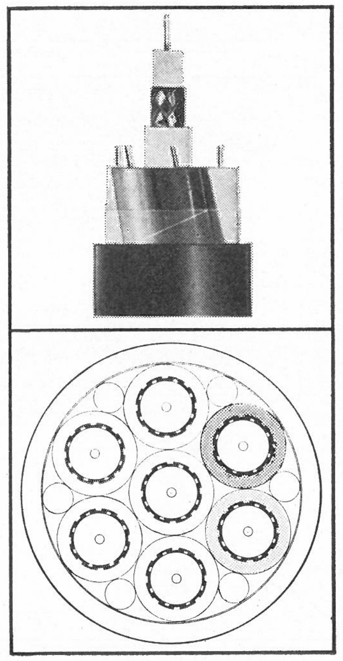
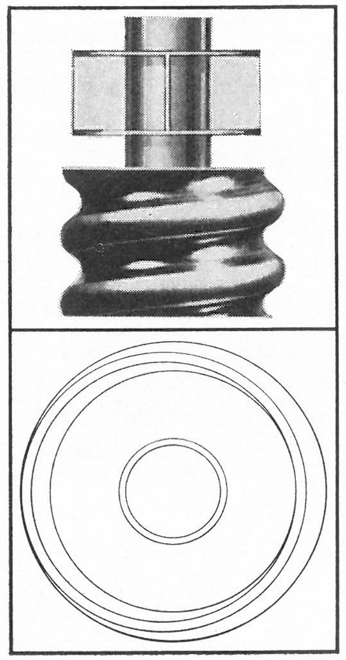
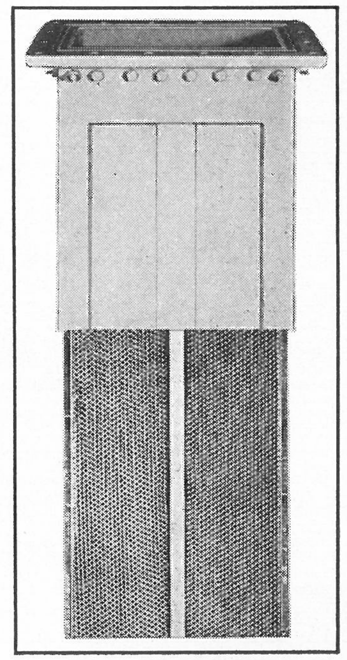
1641

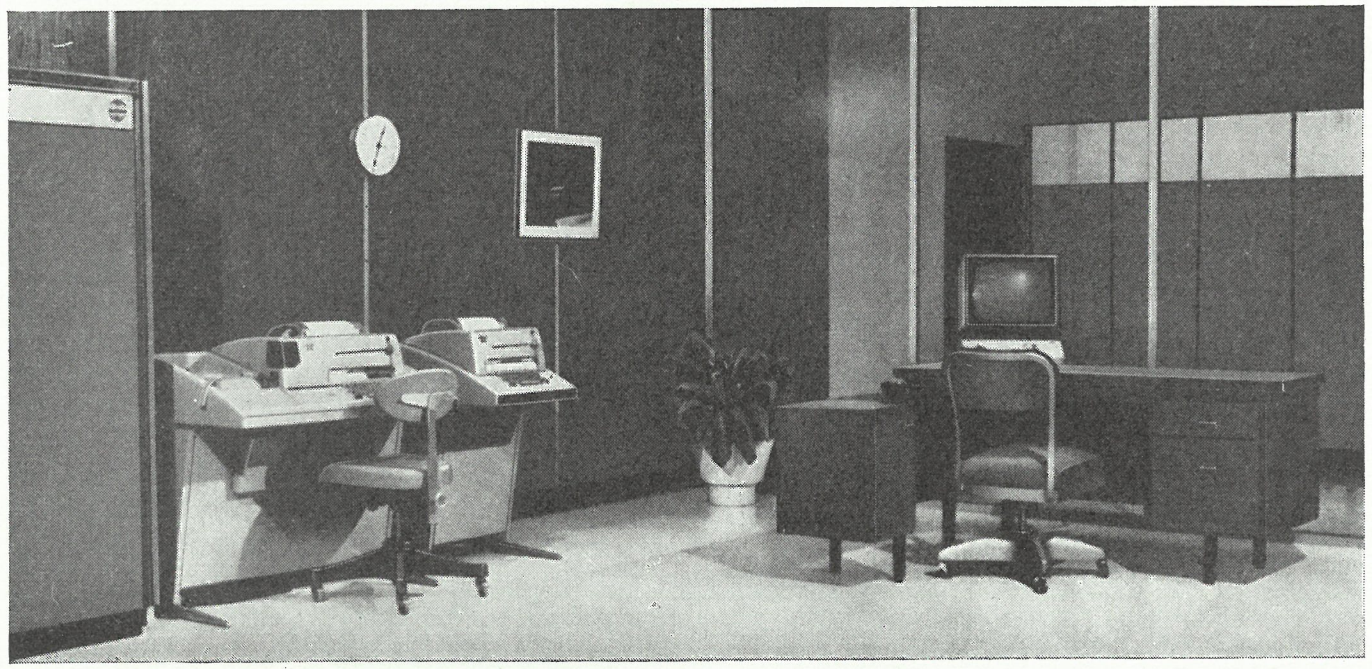








a computer-controlled, computer-monitored 250-kw transmitter



that changes frequency in 12 seconds or less

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The 821A-2 changes frequency from 3.95 to 26.5 MHz in a maximum of 12 seconds. Typical frequency changes require less time.

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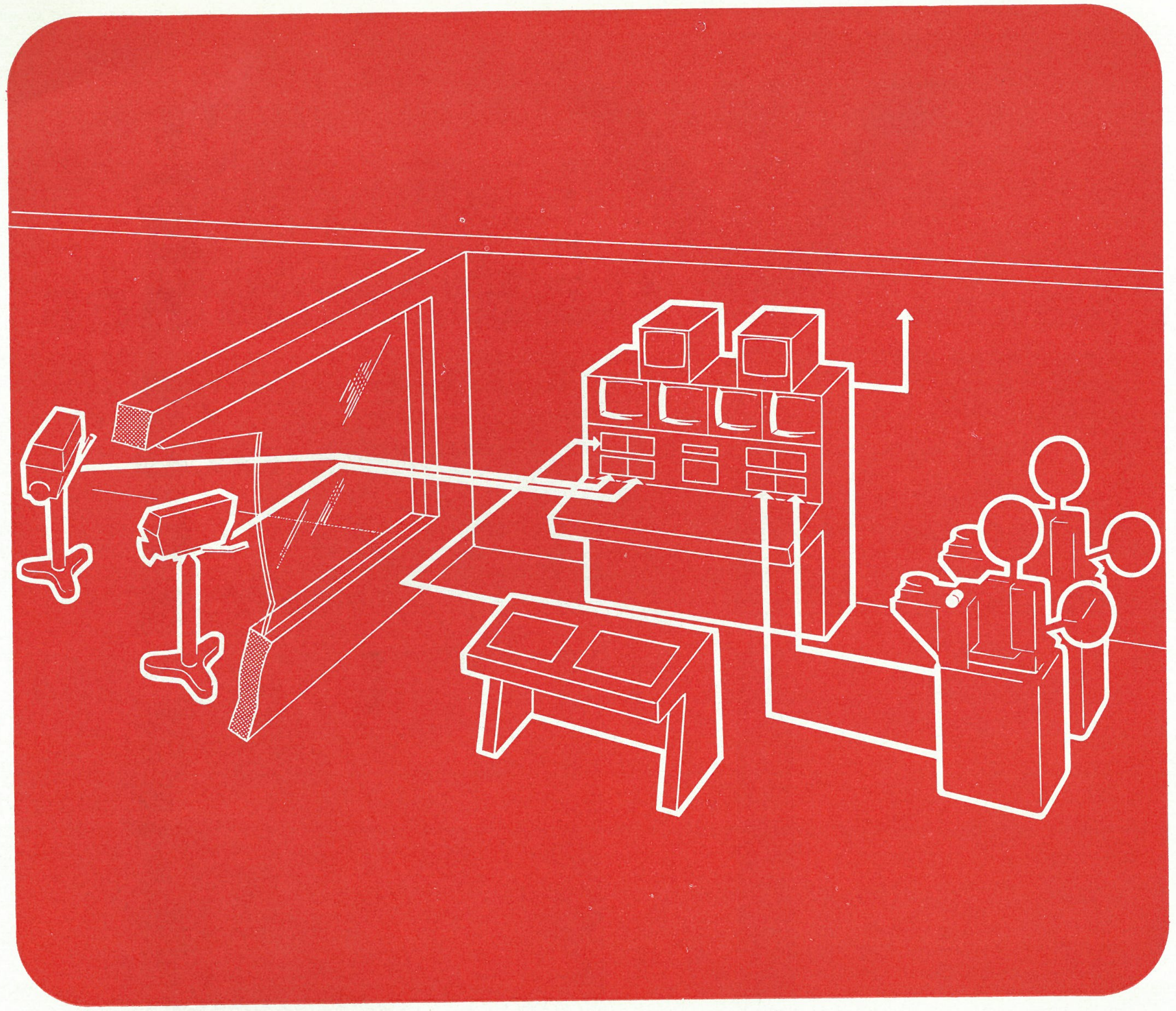

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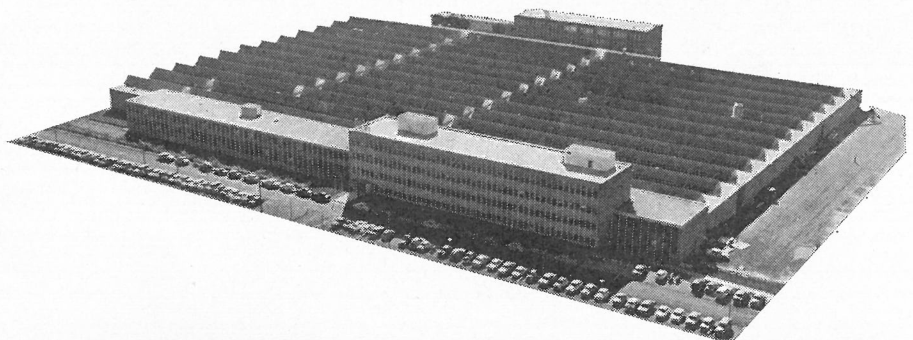

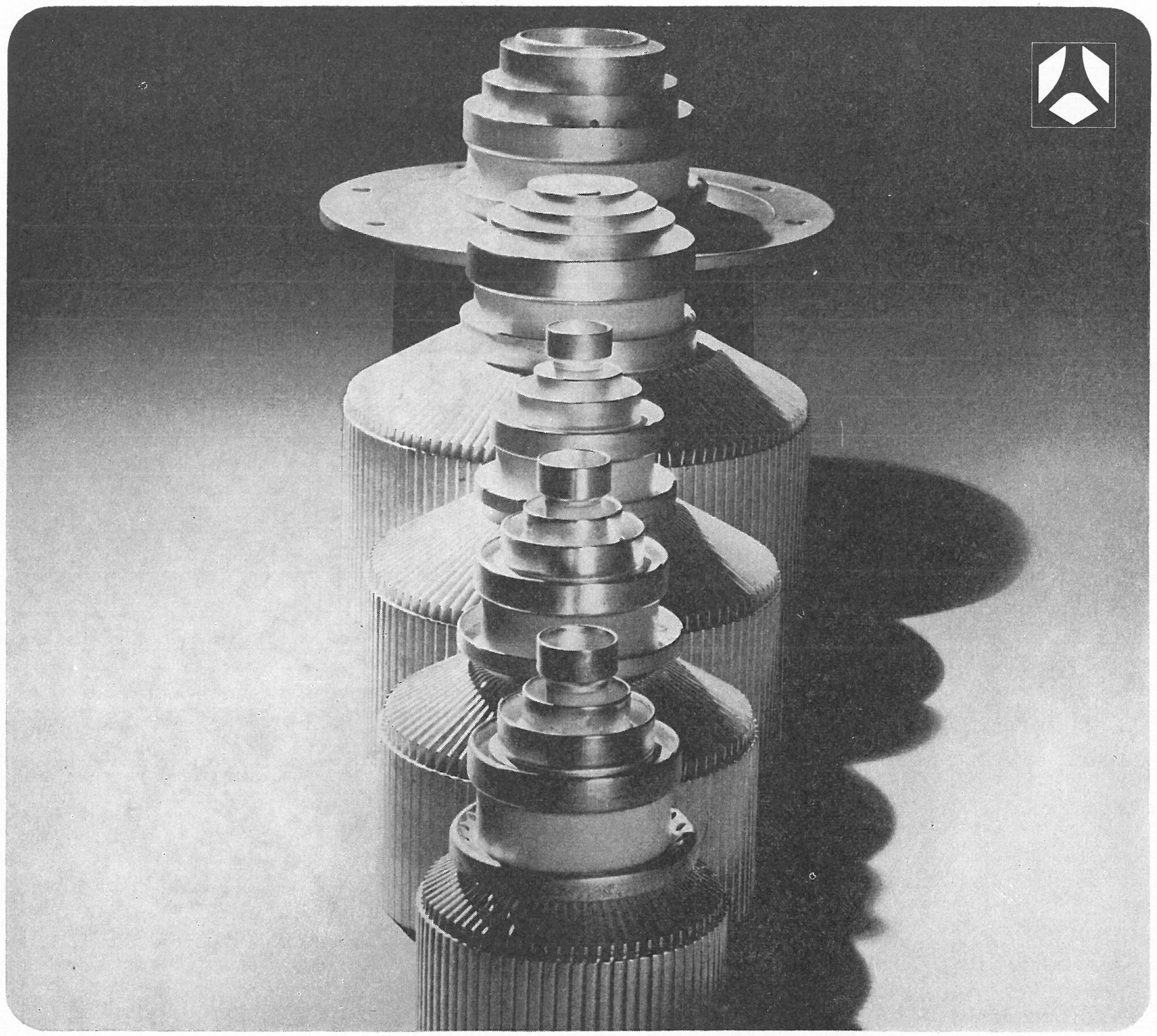

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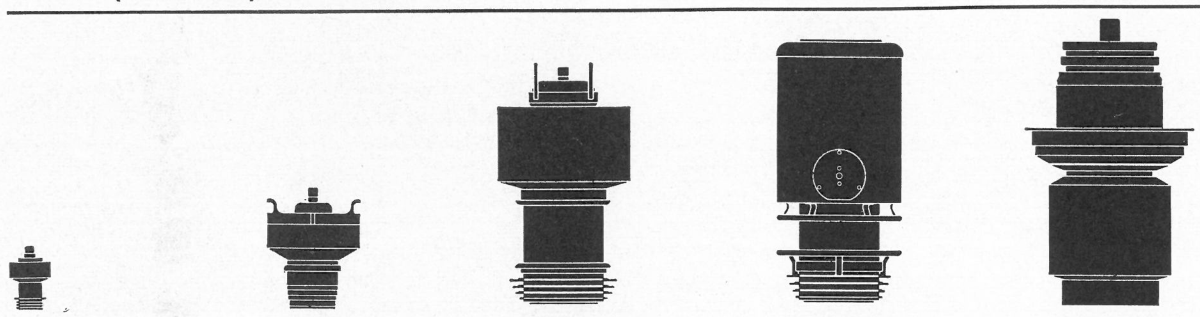
Forced-air Cooled Type	Service type	Anode dissipation max. (kW)	Output power (kW)	Anode voltage max. (kv)	Frequency (MHz)	Filament ratings (V)	Filament ratings (A)
4CX1000A 4CX1000K	—	1.0	3.2	3.0	110	6.0	9.0
4CX1500B	—	1.5	2.7	3.0	30	6.0	9.0
4CX5000A	CV8295	5.0	16.0	7.5	30/110	7.5	75
4CX10,000D	CV6184	10.0	16.0	7.5	30/110	7.5	75
4CX35,000C	—	35.0	82.0	20.0	30	10	300
CR192A (6166A)	CV8244	10.0	9.0	6.9	60/220	5.0	175

Vapour Cooled Type	Anode dissipation max. (kW)	Output power (kW)	Anode voltage max. (kv)	Frequency (MHz)	Filament ratings (V)	Filament ratings (A)	Boiler unit
CY1170J	60	82	15	30	10	300	Integral
CY1172 (RS 2002V)	150	220	15	30	21	350	CY4120



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For audio or linear single sideband amplifiers. 4CX1000K has a solid disc screen contact to permit use up to 400MHz.

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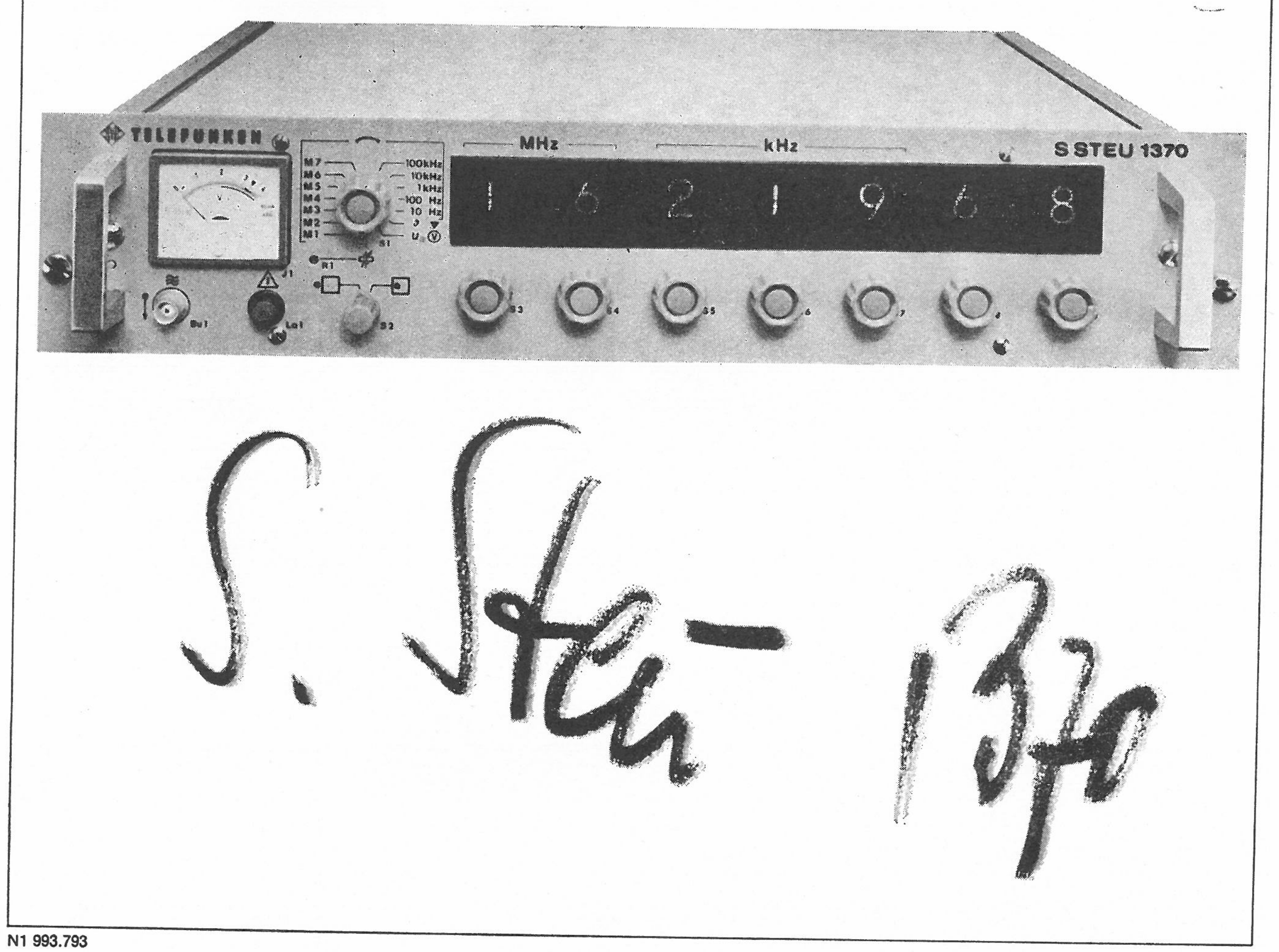

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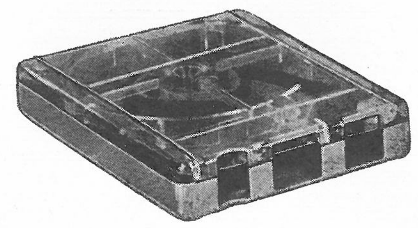

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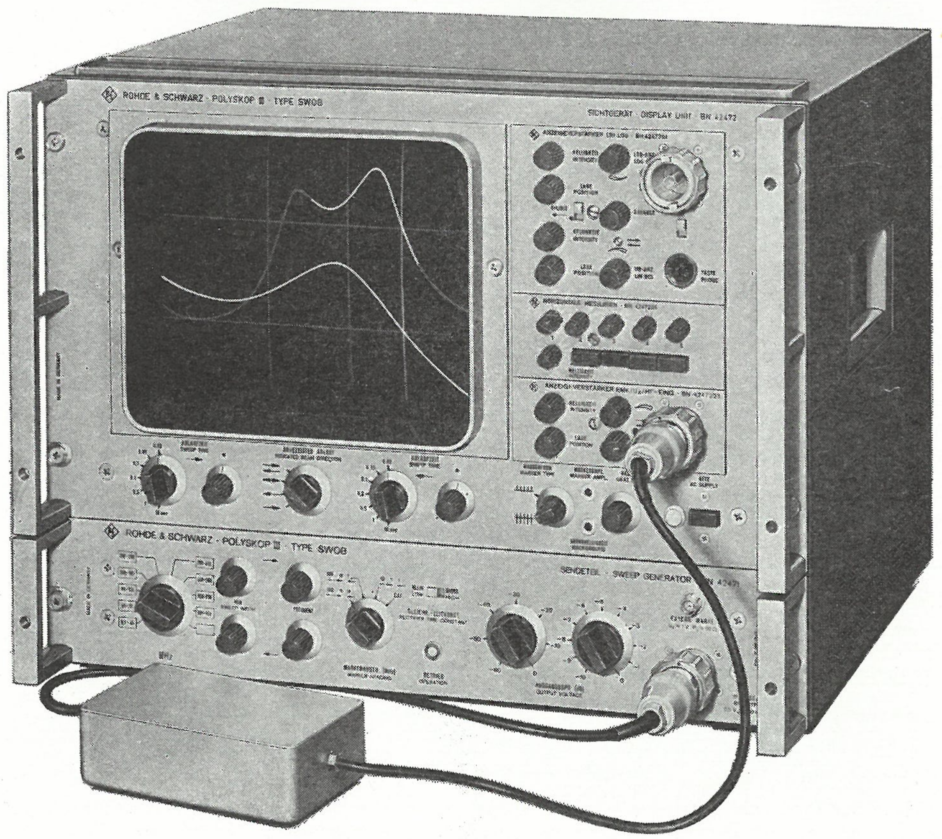

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Deflection Amplifier Lin-Log (20/60 dB) 5 mV - 5 V	Simultaneous « lin-log » display ; zero-reference line during flyback ; RF demodulator with Z termination ; second input for diode probe
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CONTENTS

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MOBILE VERSION OF LATEST ELECTRONIC-CAM SYSTEM

by M. METCALFE and G. PRYKE *

Summary.

The article describes the development of a new version of the Electronic-Cam system, utilising a 35-mm film camera and a Plumbicon television camera. Designed for colour productions, this version is currently available installed in an outside broadcast vehicle. The layout and method of operation of this vehicle are described. Figures are quoted for the technical performance, and for the cost of two pilot productions.

Introduction

The use of electronic aids to film-making has arisen from the desire of programme makers to produce high quality film, particularly colour, using television methods. If this could be achieved, it would not only reduce production costs, but would also overcome the serious technical problems associated with the international exchange of television programmes.

It is well known that the differences between the varying standards of television systems used in different parts of the world severely inhibit the free exchange of programmes, a conversion process being necessary before material recorded in one country can be played back in a country having different standards.

Originally the conversion process was an optical transfer, and in essence, consisted of a television camera operating on one standard, viewing programme material displayed on a monitor on a different standard.

Later developments have replaced the optical transfer and are purely electronic with consequent improvement of the picture quality. The system has worked well for some time for monochrome material and can be used for live or previously recorded programmes. Colour conversions are still somewhat complex, and the equipment required is rare and costly. Consideration must be given both to the line standards of the countries concerned, and the system of colour television employed, there being several in current use throughout the world.

Filmed programmes, however, do not suffer from these technical limitations as the telecine machine used to transmit a film is already working on the required system and so the process becomes automatic.

Since all television stations possess film-scanning equipment, film has long been the universal currency of programme exchange. However, film-making by traditional methods can be expensive compared with television, and various ways have been sought to combine the best of both techniques.

The idea of coupling a television camera to a film camera in order to monitor the scene remotely and to facilitate the control of several cameras simultaneously is not new. Several systems, using both 16 and 35 mm film in various configurations have been used, each having its own particular advantages.

Table 1 gives brief details of the most important systems that have been proposed or developed.

The system that has seen the most operational use is the old version of Electronic-Cam using a vidicon with industrial-grade circuits and a 35-mm Arriflex camera with an optical viewfinder. A mirror shutter is used to split the light between the film and television system. Multi-camera installations of this type, feeding picture monitors on a control desk, have been in use in Germany and elsewhere since 1959.

Continuous television-type production is possible although very difficult with this equipment, as focussing cannot be carried out satisfactorily using the optical viewfinders, and the television pictures are of too poor a quality to permit film exposure and lighting balance to be judged.

* Messrs Metcalfe and Pryke are with Mole-Richardson (England) Ltd.

Table 1. — Systems using film cameras coupled to television cameras

System	Maker	Year	Film camera	Television camera	Light split	Viewfinder
Electronicam	Du Mont	1956	35 mm	Image-orthicon 76 mm	1. Beam splitter 2. Mirror shutter	Television
Electronic-Cam (old version)	Arnold & Richter/ Fernseh/Siemens	1959	35 mm Arriflex	Vidicon	Mirror shutter	Optical
Gemini	MGM Telestudios	1964	16 mm Auricon	As used for TV: image-orthicon 115 mm	Beam splitter (70 % film, 30 % television)	Television
System 35	Mitchell Camera Corp.	1965	35 mm Mitchell MK II	Vidicon	Mirror shutter	Optical or TV (selected by mirror)
Add-a-vision	Livingston Labs.	1966	35 mm Mitchell BNC	Plumbicon	Beam splitter 90 % film, 10 % TV for colour film)	Television
Camera Mixte	CFTH	1967	16 mm Tolana	Vidicon	Beam splitter	Television
Electronic-Cam (new version)	Arnold & Richter/ Fernseh/Siemens/ Rediffusion	1967	35 mm Arriflex AF 300	Plumbicon	Mirror shutter	Television

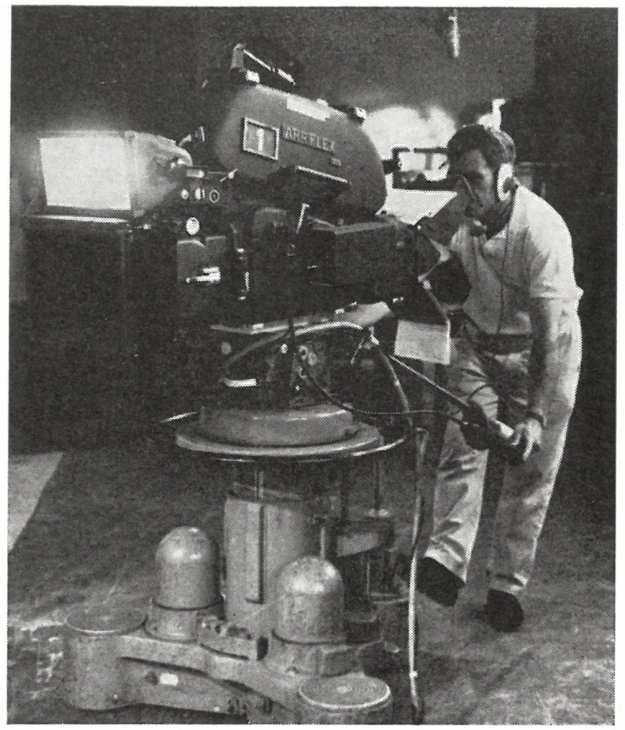

Fig. 1. — The Electronic-Cam combined film and television camera in use.

Description of camera system Mk.II (improved version)

The latest development of Electronic-Cam consists of an Arriflex 35-mm film camera and Fernseh GmbH Plumbicon television camera (*Fig. 1*). The Plumbicon camera was developed in conjunction with Rediffusion Television engineers to a broadcast specification, and much of the highly sophisticated logic switching used to control the running of the cameras was also developed by Rediffusion Television.

The system works as follows (*Fig. 2*). Light from the scene is focussed by a zoom lens on to the film in the camera gate. A specially designed reflex shutter in front of the film gate has two reflecting segments. These mirrored sections allow a proportion of the available light to be reflected through a suitable system of relay lenses into the Plumbicon camera attached to the side of the film camera.

The two mirrored sections of the shutter are of equal area, one operating during film pull-down and the other during film exposure. The shutter revolves at a constant speed of 25 revolutions per second, giving the two equal exposures per revolution necessary, one for each field of the television picture. The mirror segments are so arranged that the film receives an exposure time of 1/50 second, and the Plumbicon tube about 40 % of this.

The television picture therefore is an exact replica of the scene viewed through the camera lens and it is this picture which is fed to the cameraman's viewfinder monitor and the director's monitor at the control desk. It may also be fed to studio floor monitors to assist sound operators, for instance, in judging boom clearance during rehearsals.

Previous versions of Electronic-Cam contained a mirror shutter which, in addition to passing light to the television pick-up tube, fed a proportion to the optical viewfinder which was also incorporated. This, in general, resulted in a picture of reduced brightness for the cameraman's use, and an inferior quality television monitor picture. Discarding the optical viewfinder in the later version and providing the Plumbicon tube with all the available light reflected by the mirror segments, has resulted in a great improvement in the electronic picture. A critical assessment of camera lens focus is now provided by the operator's television viewfinder and the enhanced edge resolution, which may now be introduced, allows more acute judgement of depth of focus than previously possible. The added advantages of increased mobility of the cameraman and the decrease in the physical strain associated with the use of an optical viewfinder cannot be ignored.

The need for a focus puller and the inevitable tape measure is, therefore, removed entirely.

The cameraman has the usual television zoom and focus control on his panning handles, full talkback and cue facilities customary in television, plus a lens telemetry system visible at the edge of the viewfinder picture which provides information on lens focal length and focus settings.

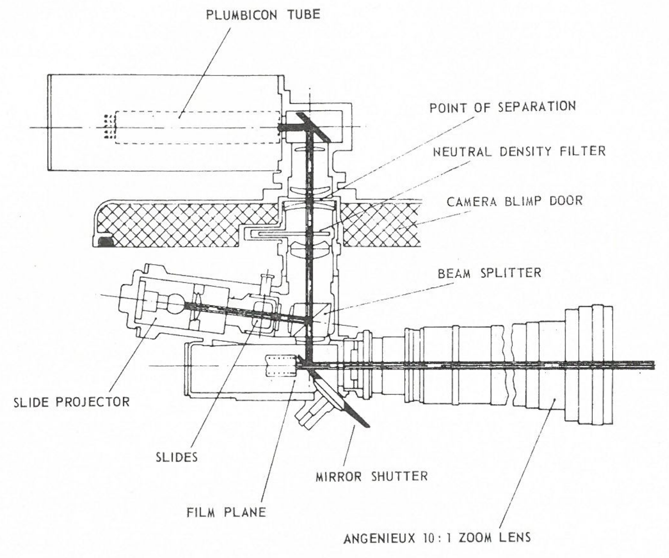

Fig. 2. — Diagram of the optical system in the camera.

The film is exposed during 180° of the rotation of the shutter; as this is at 25 r.p.s., each exposure lasts for 1/50 second. During the periods when the shutter prevents the light from reaching the film, reflecting segments direct it towards a beam-splitter and on to the Plumbicon. These segments correspond to two angles of 35°.

The slide projector enables either a bright frame surrounding the field of action or a test-card for alignment to be focussed onto the Plumbicon.

The neutral filter is positioned in the light path whenever the camera is stopped, so that the illumination on the Plumbicon remains constant at all times.

Access to the interior of the camera is provided through the door shown on the diagram, to which is attached the Plumbicon tube and part of the optical system. At the point of separation between the optical system attached to the Plumbicon and that attached to the film camera, the light beam is parallel, and thus insensitive to any displacement of the optical axes.

This modified version of Electronic-Cam was installed in Rediffusion Television's principal studio at Wembley to produce high quality colour film on a more economical basis.

However, the re-allocation of the Programme Contracts in the Independent Television Network in 1968, caused Rediffusion Television to abandon further work on the project, although a high degree of success had been achieved.

Nevertheless, the pilot productions had proved the viability of the system in three essentials :–

1. The quality of the end product.
2. The economics of the operation.
3. The successful integration of film and television techniques.

For the first time it seemed, the potential of " electronic aids to filming " had been fully realised, albeit late in the day.

However, in view of the increasing demand for high quality colour material, it was decided in the latter part of 1968, to form an independent facilities company in order to make the system universally available, but in mobile form.

Description of the mobile unit

Much thought was given to the design of the mobile unit, as it was felt that technical and production facilities must approach those found in a well equipped television studio, as closely as possible.

Fig. 3 shows the layout of the vehicle and the main technical areas, and *Fig. 4* a general view of the unit

The production area is in the forward part of the vehicle and contains a demountable monitor rack, housing in addition, programme sound and talkback loudspeakers, clock and cue lights.

To the right of the director, on the production desk, are the vision-mixer's camera run and cut buttons whilst to the left, in the production assistant's position, are situated the film footage counters. Comprehensive talkback facilities are incorporated to all production and engineering staff.

Immediately behind is the sound control area, fully enclosed and containing a 12-channel sound mixer with echo facilites, a 1/4-in tape replay machine and the necessary monitoring systems. An uninterrupted view of the production monitors is obtained and once again full communications facilities are available.

To the right of the sound cubicle is the engineering control position where a constant technical check of the Plumbicon picture is maintained. Control of all important parameters of the video signals from each camera is available on remote panels grouped around the picture and waveform monitors. The camera control units proper are situated in a low cubicle to the engineer's left, above which is the helical-scan television tapemachine, used for rehearsal check purposes. The facilities provided at this position are of prime importance during the line-up period prior to a recording, for it is at this time that one of the major advantages of the system becomes apparent. Since the Plumbicon video signal is directly proportional to the level of light falling on the film, exposure may be accurately assessed and calibrated.

Test material consisting of grey scale and colour patterns of known reflectance are recorded at the beginning of each reel. Subsequent use of these by the processing laboratories aids the production of a colour print to the required tolerances, and can eliminate, to a large extent, shot by shot colour and density grading. Remote control of the camera irises is also available at this position for minor adjustment of exposure to be made at the discretion of the lighting director. Communication facilities are again available from this position to camera operators and production personnel.

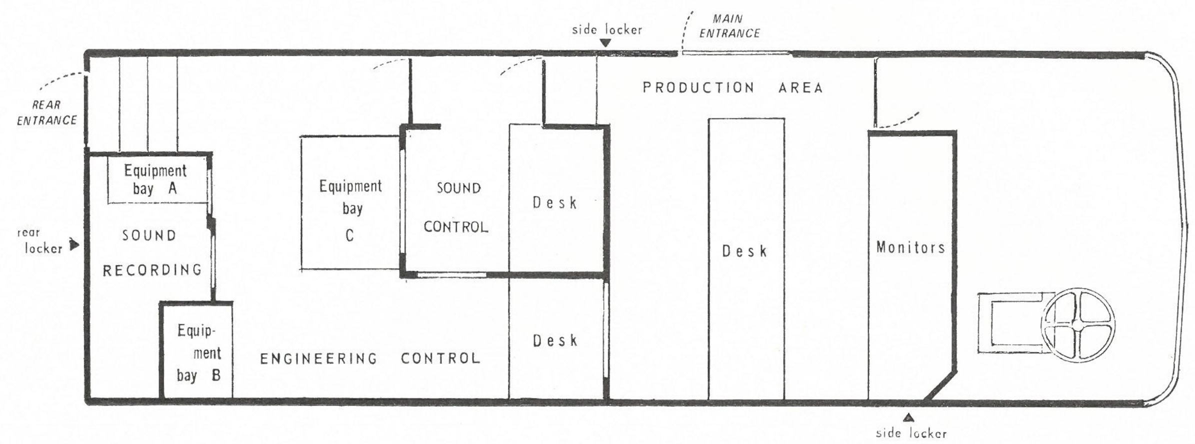

Fig. 3 *(above)*. — Layout of the mobile unit.

Fig. 4 *(on the right)*. — Exterior view of the mobile service.

At the rear of the vehicle there are two equipment cubicles, one of which contains the two sync pulse generators, together with the associated video patch panels and test signal generating equipment. The other cubicle is situated within the sound recording area and contains the majority of the sound and communications equipment. The main 1/4-in twin-track tape-machine is housed in this cubicle, programme sound being recorded on track one, whilst a pilot frequency mixed with a cue tone, is recorded on track two. As explained in detail later, the frequency of this tone is different for each camera, and is selected by operation of the vision mixer's cut buttons.

The rear locker of the vehicle contains the cable distribution panel from which all connections are made. To ensure greater flexibility in the field, the vehicle takes single-phase power at 240 volts and provides the thre-phase at 220 volts required by the cameras, via a static convertor housed in a side locker, furthest from the magnetic sound recorder.

To ensure that the high degree of stability required by the Plumbicon electronics is maintained, all technical equipment is fed from a solid-state automatic voltage regulator, the output of which is maintained at 220 volts ± 0.25 %.

For operations remote from electricity supplies, a mobile generator may be used, the demand being 15 kVA at 240 volts, 50 Hz, single phase.

The roof of the vehicle is designed to take a camera on a tripod giving a lens height of some 6.0 m. Other camera mountings consist of two light-weight dolly cranes with pneumatic tyres and hydraulically operated jibs giving lens heights between 0.5 m and 2.5 m. Two heavy duty tripods with rolling triangles complete the basic complement, but other mountings are available to meet specific production requirements. Sound booms and a full range of microphones are also available.

Inside the vehicle a high standard of comfort has been achieved with carpeted floors and air-conditioning

Film utilisation

Gross negative footage used (including all wastage, short ends etc)	1800 m
Final print footage	630 m
Gross shooting ratio	2.9:1
Actual exposed footage	1300 m
Actual shooting ratio	2.05:1
Total film process costs for production	£792
Cost per minute	£36

It is apparent from the figures above, that where a high quality colour product is required, suitable for world distribution, the film unit described and the equipment it contains have much to offer.

The ease and economy of operation and the constant control which can be exercised, are the salient features of the Electronic-Cam system. Coupled with the mobility of this unique installation, it should become a vital link in the chain of universal colour programme exchange.

* * *

The authors wish to acknowledge the permission of Rediffusion Television Limited and Mole-Richardson (England) Limited to publish this paper, and to express their gratitude to their colleagues whose work has made the project possible.

Part B (General and Legal) of E.B.U. Review, No. 116

contains, in its *General Section*, the following articles :

The history and philosophy of COMSAT's satellite television rates, by A. Bruce Matthews ;
The structure and activities of the Cyprus Broadcasting Corporation, by Andreas Christofides ;
The commercial aspects of public service broadcasting, by Dennis Scuse ;
An interesting musical experiment on Spanish television, by Félix Fernández-Shaw ;
" Survival " — Anglia Television's series of wildlife documentaries, by Colin Willock ;

a calendar of 1969 meetings and festivals ;
news items concerning the International Radio-Television University (URTI), the International Catholic Association for Radio and Television (UNDA), and the Arab States Broadcasting Union, and on recent broadcasting developments and events in Canada/United Kingdom/United States, Finland, France, Germany, Iceland, the Netherlands, Switzerland, the United Kingdom, and the United States ;
" The birth of broadcasting " — a letter to the editor ;
and reviews of recent books in the fields of : Broadcast communication, Production.

The *Legal Section* carries the following studies :

Legislation and the broadcasting institutions in the Netherlands — Part III : The Netherlands Broadcasting Act, in force from 29th May 1969, and the replacement of the N.R.U. and the N.T.S. by the N.O.S., by Dr J. van Santbrink ;
Broadcasting and privacy, Part I, by Albert Namurois ; and
The reception given to the Stockholm literary and artistic agreements, by Bénigne Mentha.

The *E.B.U. Activities Section* contains reports on the 10th Ordinary Session of the Radio Programme Committee, the 25th Ordinary Session of the Television Programme Committee, the 28th Ordinary Session of the Legal Committee, and the 41st Meeting of the Administrative Council.

A CORRECTOR FOR THE COMPOSITE COLOUR-TELEVISION SIGNAL, FOR IMPROVING THE REPRODUCTION OF COLOUR FILMS *

by G. HÖGEL *

Summary

Most colour-television programmes at present still consist of colour films. Unfortunately, in many cases these films do not meet the requirements of colour-television transmission, and it will, therefore, not be possible for the time being to do without electronic correction of the defects of the films. There are two ways of modifying the television signals for the purpose of correction : a colour correction of the *RGB* signals has already been described in detail. The present article describes a new correcting device by means of which colour corrections may be made in the coded signal. In this way, it is possible to control the overall saturation, the colour in the high-lights and the colour in the shadows, as well as reducing the saturation in the lower-level regions. With these possibilities, significant improvements may be obtained for nearly all colour-film faults.

Introduction

Since the start of colour television, the major part of the colour programmes broadcast in Germany has consisted of colour films, and there is unfortunately no doubt that a very large proportion of these colour films has fallen far short of the necessary standard of quality. The hopes that had been placed on film as a suitable store for colour programmes, principally on account of its freedom from registration defects when televised with flying-spot film-scanners, have been seriously disappointed, according to the experience gained so far. Very few film programmes will stand up to a comparison with live electronic camera productions, as regards the quality of the colour. Unfortunately, this may have a restrictive influence on the sales of colour-television receivers ; an unprejudiced viewer will only too easily blame the receiver for every colour defect, even if the real cause is to be found elsewhere.

From experience gained so far, it may be concluded that the use of films that are not optimum for colour-television, must unfortunately still be envisaged in the future. In this connection, it must be mentioned that the cinema industry, in collaboration with the broadcasting organisations, has already made great efforts to produce colour-films capable of meeting the requirements of colour-television.

* Mr. Högel is with the Institut für Rundfunktechnik, Munich. This article is based on a paper read at the 16th Annual Meeting of the Fernsehtechnische Gesellschaft at Saarbrücken, October, 1968.

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Fortunately, electronics offer some possibilities of correcting film defects, after the scanning process. We shall, however, deal here only with the correction of colour defects, as these are the most disturbing. Other faults, such as scenes printed with unequal luminance or with picture gradation that is unsuitable for television transmission, may be corrected to a large extent by means of similar devices to those already used in monochrome scanners [1, 2].

Defects of colour films

Let us begin by summarising those colour defects of a colour film that should be corrected. The overall saturation of the film picture may be too high or too low, which in itself need not be disturbing, but which should be taken into consideration when linking with electronic productions. Colour tinges** in the highlights occur through the parallel shifting of the colorant curves. The cause may be, for instance, incorrect printing filters. Colour tinges in the shadows occur when the shapes of the three colorant curves are not parallel, and they mostly occur already in the negative, due, for example, to unsuitable storage. In printing, they can, in practice, never be completely eliminated and, since they unfortunately represent by far the most important form of colour tinging, their correction would appear to be particularly necessary. Colour tinging in the deepest shadows also belongs to this class of faults, but it is less frequent, because near the black level practically no light is passed — at least from considerations of the film-scanner, whose limit as regards the picture black level is determined by the scattered light.

** an alternative term is " casts ".

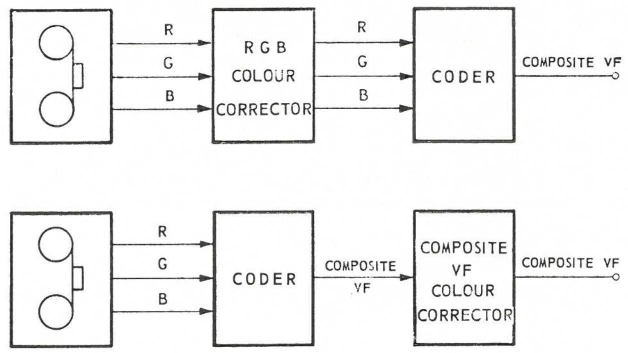


Fig. 1. — Correction of colour-film faults in the primary-colour chain *(above)* and in the composite VF signal *(below)*.

Methods of correction

Two methods are available for the electronic correction of the above-mentioned colour faults; they are used according to need and possibility. It is possible to effect the correction either in the *R*, *G* or *B* signals, that is to say, in the primary signals, or in the composite VF colour signal (*Fig. 1*). In principle, it may be said that any modification may be undertaken in the *RGB* section as well as in the coded signal, but that the circuitry may differ considerably, according to the type of correction. A detailed account of the development of an *RGB* colour corrector was given two years ago [1], [3], which makes it unnecessary to do so again here.

Such an *RGB* corrector can be inserted only in the relatively short signal chain between the film-scanner and coder, the coded composite signal only being distributed in the remainder of the studio equipment. The case may occur that a film is available for only a short time and is therefore recorded on tape. The tape-machine then also produces only a composite signal. One can therefore understand the need for a colour corrector which corrects the coded signal. The device should be remotely controlled, so that, if necessary with an additional unit, it is able to pre-programme the individual corrections for different scenes, an arrangement which even two years ago was not considered to be feasible, but which today must be given serious consideration. On the basis of these requirements and stimulated by a lecture given by Dr. W. Bruch [4], the I.R.T. has developed a composite colour-signal corrector which makes it possible to compensate all four faults of a colour film mentioned above. For this reason, the explanation of the circuitry has been divided into four sections.

The basic principle underlying the correction of the composite colour signal is that the main signal (apart from a delay of about 400 ns) passes through the equipment without being subjected to separation, demodulation or the like. Only carrier-frequency correcting signals are produced, and they are added to the main signal after blanking the burst and sync. components. In this way, the picture luminance remains completely unaffected by the colour correction.

Change in saturation

The change in colour saturation is relatively easy to achieve in the coded signal (*Fig. 2*). The chrominance information *F* is obtained from the incoming composite colour signal by means of a band-pass filter. This information has then to be added to the main signal either in the same or in the opposite phase, in order to obtain an increase or a decrease in saturation. The production of this correcting signal, which may be mixed with chrominance signals at phase-angles 0° and 180°, is shown in *Fig. 3*. It will be seen that this is not, strictly speaking, a mixer, but merely an adding unit, in which a chrominance signal in phase opposition, which is adjustable in amplitude between 0 and 200 %, is added to a chrominance signal of constant amplitude. The amplitude is adjusted in a DC-controlled stage. The phase and amplitude of the resultant signal are then functions of the amplitude of the signal in phase opposition; if the signal in the opposite phase is zero, the output signal will correspond to the 0° chrominance signal; if the amplitudes of both input signals are equal, they will cancel out on account of the phase opposition and, if the 180° signal has an amplitude of 200 %, then the output signal will have an amplitude of 100 % and a phase of 180°.

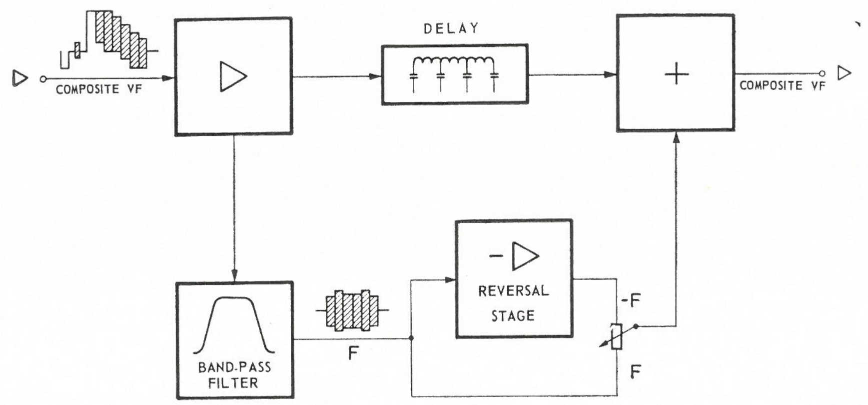


Fig. 2. — Block-diagram of the correction of saturation.

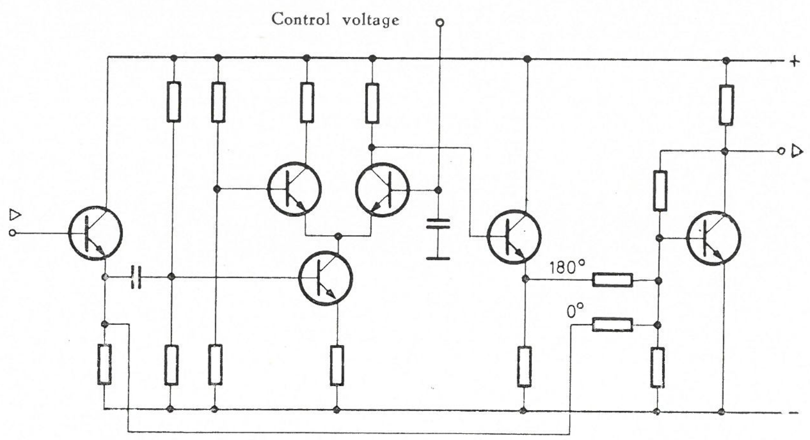


Fig. 3. — Circuit for adding a chrominance signal in phase-opposition.

Tinges in the high-lights

The white correction is used to eliminate tinges in the light parts of the colour film. Tinges of this kind may be assimilated to incorrect white balance of the film-scanner, that is to say, the relative amplitudes of the three primary signals are different. Thus, the tinge increases linearly with the signal amplitude.

It is necessary, therefore, to produce a signal whose colour vector increases linearly with the signal amplitude (*Fig. 4*) and which is in phase opposition with the tinge, and this correcting signal has to be added to the main signal, which process may be compared with the use of a compensation filter in front of the colour-monitor. The effect of such a filter is a function of the brightness of the corresponding part of the picture, from maximum coloration in the white to zero effect in the picture black.

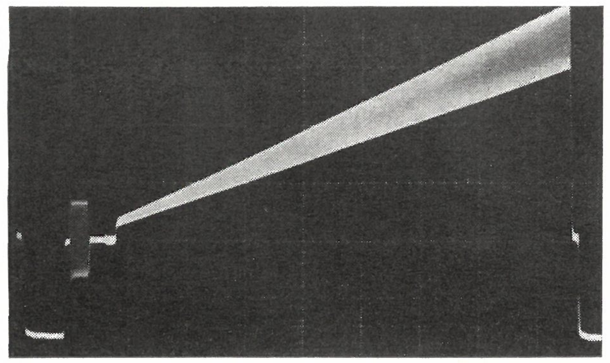


Fig. 4. — Oscilloscope display of the high-light correction signal.

The theoretically correct solution of the problem would be, first of all, to obtain the three primary signals by demodulation and, subsequently, to modulate one or two of these signals with a colour carrier whose phase would have to correspond to the *R*, *G* or *B* axis. The addition of this newly produced correcting signal to the main signal has the same effect as a modification of the white balance in the film-scanner. As this arrangement involves a considerable quantity of equipment, another solution was chosen in which the same correction is obtained, at least subjectively, in a much simpler fashion. This method is based on the idea that, in the case of colour films, which in general have rather low colour saturation, the three colour signals do not deviate very much from the luminance signal.

Fig. 5 is a block schematic of the white correction. First, by way of a low-pass filter, the luminance information (*Y* signal) is obtained from the composite colour signal. The 3-dB point of this low-pass filter is

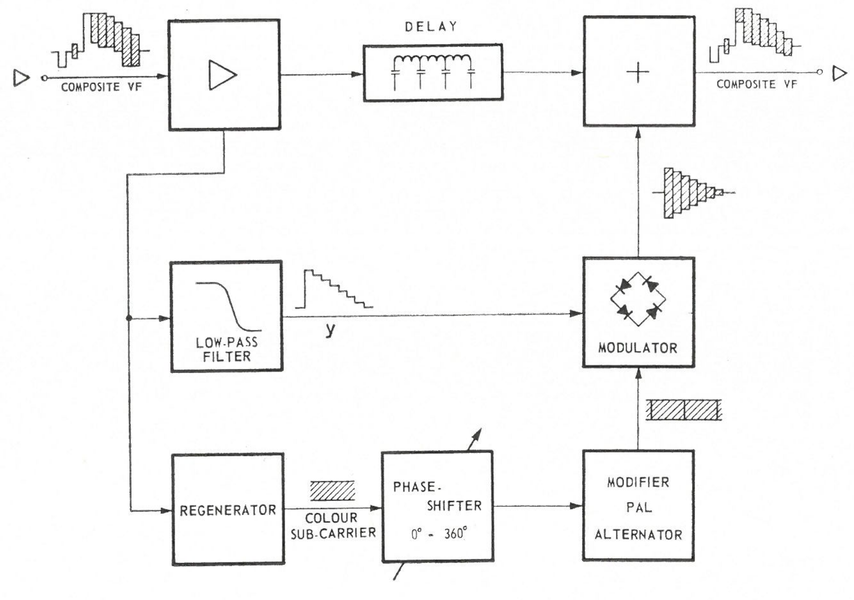


Fig. 5. — Block-diagram of the high-light correction.

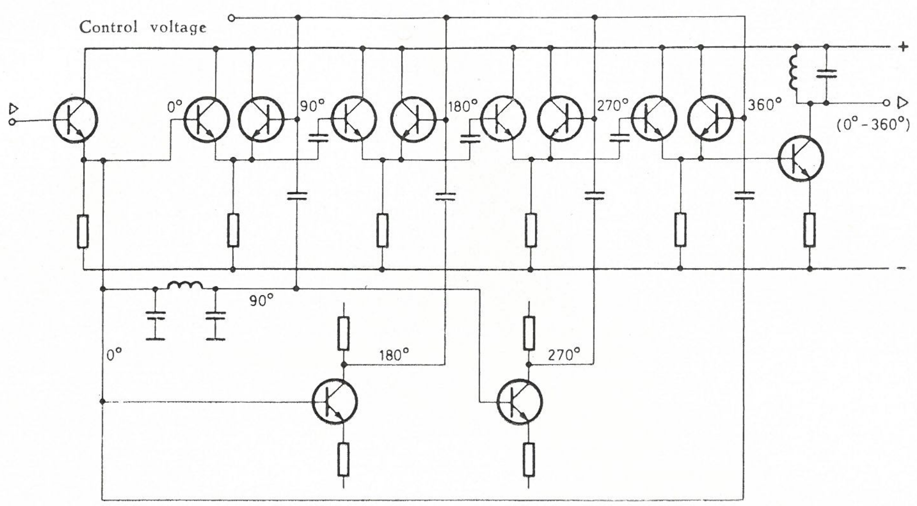


Fig. 6. — Circuit for producing a chrominance signal with phase-shift variable between 0° and 360°.

at 1.5 MHz, the falling off is relatively gradual, so that the *Y* signal has practically no overshoots. The narrow bandwidth of the *Y* signal is adequate, as it is required only for the subsequent production of a chrominance signal which need not have a wider bandwidth. Next, by means of a regenerator, a locked colour-sub-carrier oscillation (4.43 MHz) is obtained from the burst of the input signal. In the following phase-shifter, any phase between 0° and 360° — corresponding to any colour of the colour diagram — may be obtained.

Fig. 6 depicts the circuit of the phase-shifter used for phase-angles between 0° and 360°. It consists in the main of four mixing stages, which are spaced at about 2 V in the mixing potential and to which are connected colour-carriers having phases spaced at 90°. Thus, for instance, in the first mixing stage, the mixing is between a 4.43-MHz sinusoidal signal of the reference phase (0°) and another in quadrature (90°). There are produced output signals with a high harmonic content, whose fundamental shifts from 0° to 90° with the mixing. In the same way, by increasing the control voltage, the next mixing stage, which is effective up to 180°, is brought into operation, and so on. The fundamental is finally separated by filtering. This sinusoidal signal is now fed to a *modifier* which produces the phase " mirrored " on the 0 axis (*B-Y* axis). The original signal and the " mirrored " signal are then switched at the PAL alternation rate. This colour-sub-carrier is then modulated with the luminance signal, the modulation producing the correction signal which represents a colour vector adjustable in phase, whose amplitude is controlled by the luminance signal. If one now adds this signal to the main signal, there is obtained in the monitor picture the desired coloration dependent on the brightness. If it is desired, for example, to eliminate an amplitude fault towards green, the vector added to the main signal must be in phase opposition, that is to say, in the direction of magenta. Optimum compensation is obtained by means of an amplitude control.

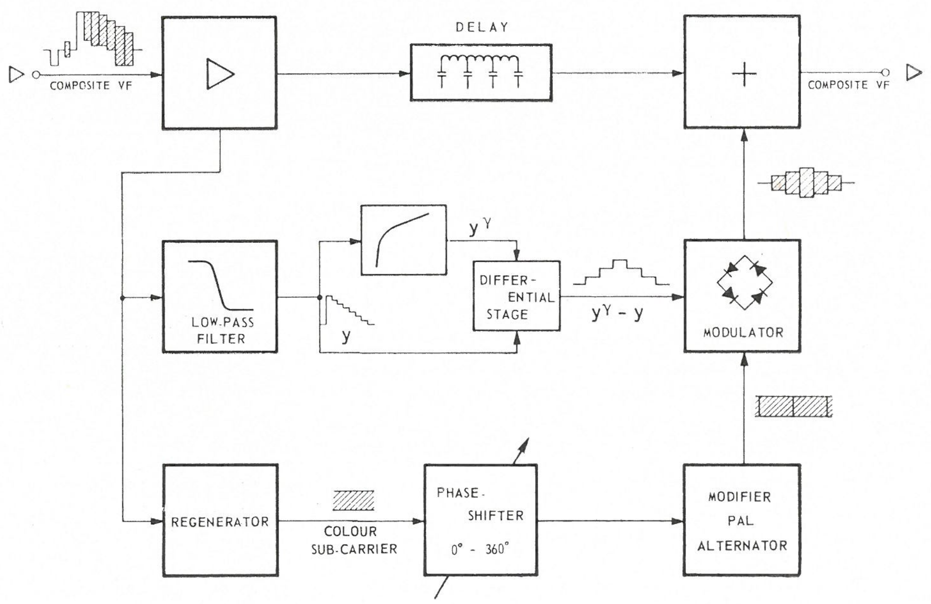


Fig. 7. — Block-diagram of correction for the shadow areas.

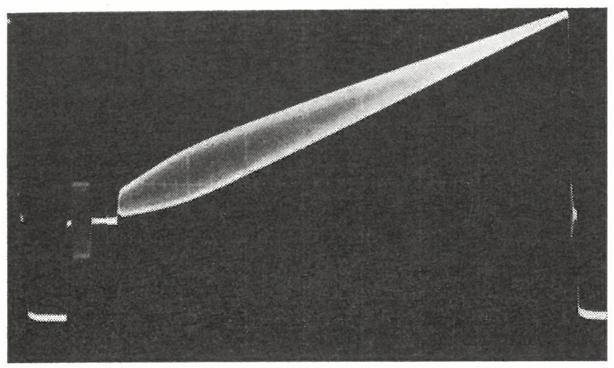


Fig. 8. — Oscilloscope display of the shadow correction.

Tinges in the shadows

For shadow-correction, that is to say, when eliminating tinges in the shadows, a method similar to that for white correction is used (*Fig. 7*). Here, too, a signal is produced which is in phase opposition to the tinge, and this is added to the main signal, which in this case should be restricted only to the lower and medium levels (*Fig. 8*). Thus, before modulating the sinusoidal signal (which, again, may be rotated through 360°) of the colour-sub-carrier frequency, it is necessary to obtain from the luminance signal a signal that contains only the medium levels. For this purpose, the *Y* signal is passed through a non-linear element (*Fig. 9*), and the unprocessed *Y* signal is then discarded. By way of example, the resulting characteristic in the case of a sawtooth signal is depicted in *Fig. 10*. This signal, which now only contains the desired levels, modulates the colour-sub-carrier amplitude, as in the white correction described above, and there results the correction signal (*Fig. 12*) which, after addition to the main signal, can modify its colour at its medium levels. Translated to the *RGB* range, this corresponds to a change in the characteristic of certain colours, which is required for compensating tinged shadows.

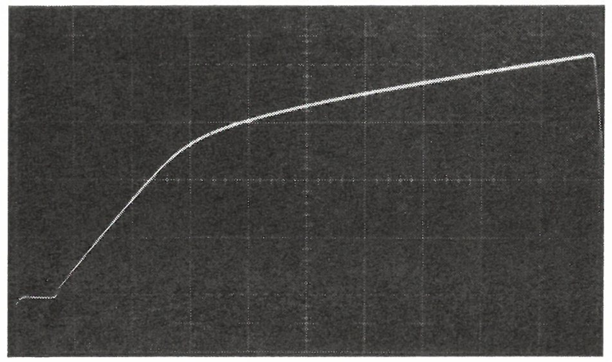


Fig. 9. — Shaping characteristic of the *Y* signal.

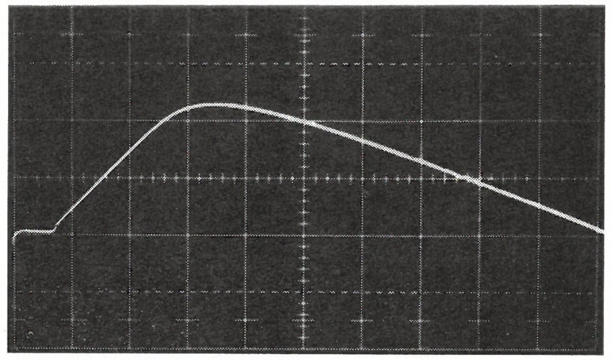


Fig. 10 (*above*). — Correction characteristic in the shadow areas, after subtraction of the *Y* signal before re-shaping.

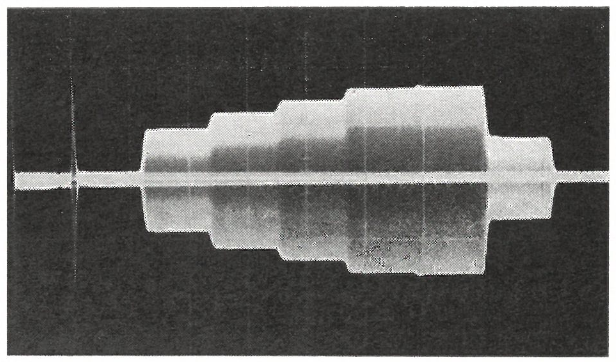


Fig. 11 (*opposite*). — Oscilloscope display of the shadow correction.

Tinges in the picture black

The elimination of tinges in the picture black can hardly be termed a correction, because the solution chosen here merely consists in the removal of all the colour information at the lower signal levels. As is depicted in *Fig. 12,* one obtains from the composite colour signal first the luminance signal, and this is passed through an element having a characteristic *(Fig. 13)* limiting, for example, at 30 %. After a reversal stage and clamping at the chosen level of limitation, it is multiplied with the chrominance signal in phase opposition. The product is a signal *(Fig. 14)* which, in the picture black of the main signal, contains all the colour information in phase opposition, which is then reduced in amplitude, corresponding to the increase of the luminance signal, up to the predetermined level. After adding this signal to the main

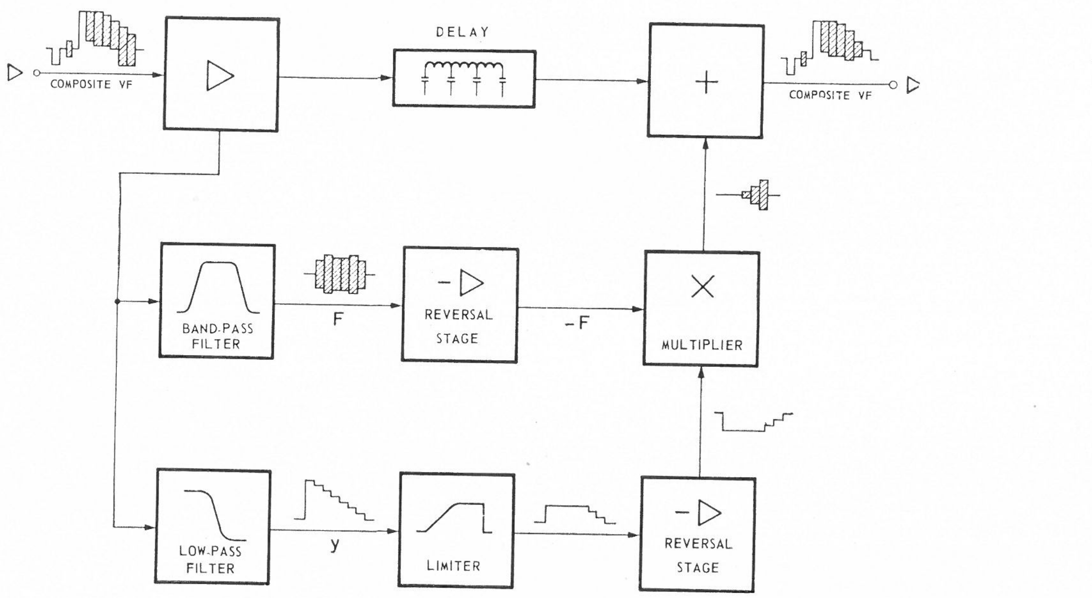
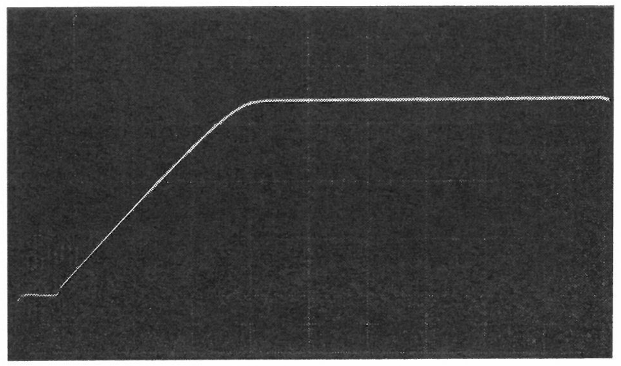


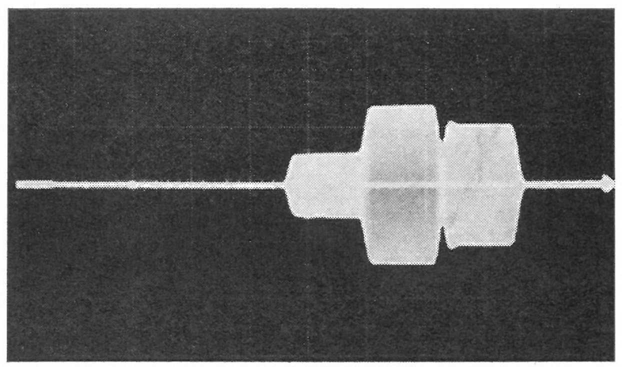
Fig. 12 *(above).* — Block-diagram of the desaturation in the " blacks ".

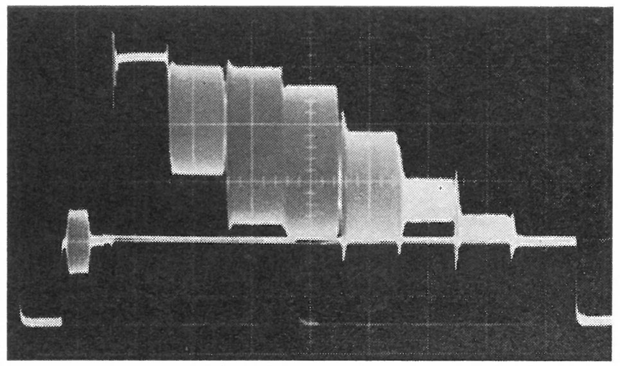
Fig. 13 *(on the right).* — Limiter characteristic.

Fig. 14 *(below left).* — Oscilloscope display of the desatu-ation correction.

Fig. 15 *(below right).* — Oscilloscope display of a colour-bar test-signal with "black " desaturation.







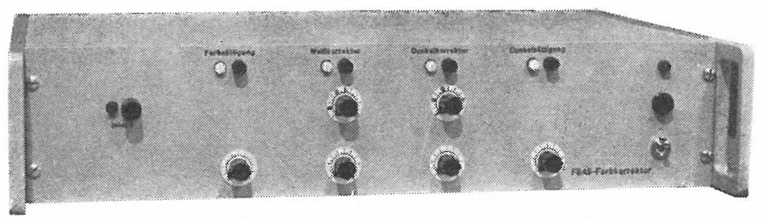


Fig. 16. — The electronic colour-film corrector acting on the composite video signal.

signal, a decrease in colour saturation results, starting at a level of, for example, 30 %, to complete decoloration at picture black *(Fig. 15).*

This method gives good results with colour faults in the near-black parts — which, incidentally, could also occur through faulty adjustment of the black level in the scanner or through the residual carrier of the coder — without reduction in colour saturation at low levels being observed subjectively as a deterioration of the quality.

Conclusions

By means of these four methods of correcting the composite colour-signal, the main colour faults of colour films may be eliminated very successfully, although it is not contended that the result will in every case correspond to a first-class print. Here, too, it will at times be necessary to accept a compromise. Moreover, it will not always be possible to pre-programme the correction from scene to scene, but often it will be necessary, for simplicity's sake, to reproduce an entire film with a single average correction. The optimum solution in any case still remains a faultless print, and an electronic colour corrector can in no way replace the work of the printing laboratories, which is certainly not always very straightforward. It should merely be available for emergencies, when, for example, time does not permit obtaining better prints.

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SYSTEM BANDWIDTH AND CHANNEL SPACING IN AM SOUND BROADCASTING*

by R. SÜVERKRÜBBE **

Summary.

With double-sideband amplitude modulation, the required RF bandwidth is equal to twice the AF bandwidth. In the ideal case, the transmitter does not radiate any components of the spectrum outside the RF bandwidth, and the receiver, by virtue of its selectivity, accepts exactly the required frequency band. The article demonstrates that, in the interest of good adjacent-channel selectivity, the RF bandwidth of the transmission system as a whole must not be much wider than the channel spacing and that an increased frequency spacing between adjacent channels would offer certain advantages.

1. Introduction.

The discrepancy between the radiated bandwidth in LF and MF amplitude-modulated sound broadcasting and the pass-band of the receiver has led to investigations [1, 2] which aimed at an improvement of the entire transmission system, with a view to its optimalisation. It may be regarded as appropriate to aim at the same bandwidth for the transmission and for the receiver pass-band curve, and to use in both cases filters with very steep slopes. A transmission system wherein the above-mentioned conditions are fulfilled, and wherein this system bandwidth has a reasonable relation to the channel spacing, makes possible throughout the entire service area the utilisation of the whole bandwidth with the most favourable protection ratio with respect to adjacent-channel interference. This, however, leaves unanswered the question as to what relation between the system bandwidth and the channel spacing may be regarded as " reasonable ".

2. Measurement of RF protection-ratios.

For the purpose of explaining the connection between the RF protection-ratio, channel spacing and system bandwidth, the Institut für Rundfunktechnik at Hamburg carried out measurements of the RF protection ratio for adjacent-channel interference, using the objective double-signal measuring method [3, 4]. In representing the results, a parameter *Q* was introduced, representing the ratio of the AF bandwidth to the channel spacing. The transmitted AF bandwidth in present-day double-sideband AM sound broadcasting is half the system bandwidth.

2.1. *Receiver characteristics.*

For the measurements, use was made of a commercial receiver of the highest quality, having unusually good characteristics, which came extraordinarily close to the " ideal receiver " with a " square " selectivity characteristic. The good selectivity of this receiver was obtained chiefly by the use of a particular method of frequency-changing and of low-pass filters in the IF stage [5]. The bandwidth could be adjusted in steps, the extraordinarily steep slope of the selectivity curve remaining constant. With a bandwidth of ± 6 kHz, the form-factor (60-dB bandwidth/6-dB bandwidth) was, for example, 1.07. The AF characteristic obtained with the various bandwidth adjustments are depicted in *Fig. 1.*

2.2. *Transmitter characteristics.*

For the purpose of limiting the modulation spectrum of the measuring transmitters to the chosen value of the receiver pass-band, use was made of low-pass filters whose 6-dB point was in each case the same as the 6-dB point of the chosen receiver selectivity curve. The slope of these filters was 60 dB per octave.

A similar good limitation of the wanted band, as in the receiver, could, in theory, be obtained at the transmitter by using very steep low-pass filters in the modulator input. However, as distortion products of the order of magnitude of 1 % of the amplitude of the modulation occur in the transmitter, the bandwidth limitation obtained by means of such low-pass filters is only a little more effective than that applied here.

Fig. 2 depicts the spectrum of an unwanted transmitter which, instead of noise modulation, is modulated with three tones spaced at 100 Hz from each other, which were slowly moved through the entire AF band.

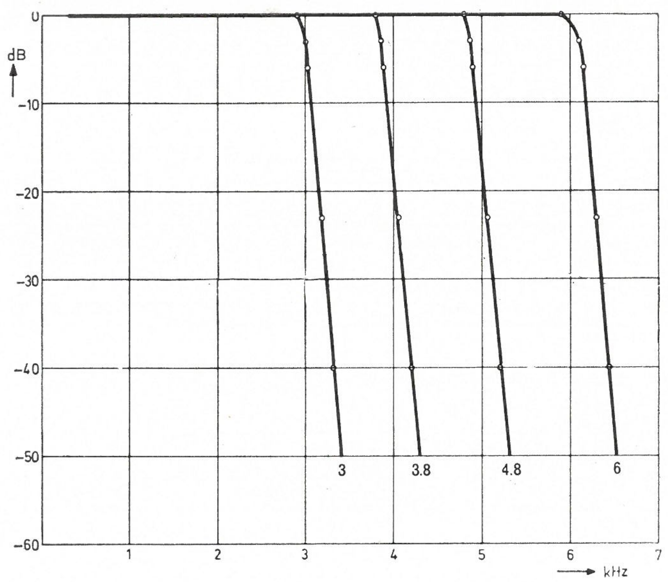

Fig. 1. — AF pass-band curves of the receiver.
Abscissa : frequency in kHz
Ordinate : relative AF output level in dB
Parameter : AF bandwidth in kHz.

* Dieser Aufsatz ercheint gleichzeitig in Deutsch unter dem Titel " Systembandbreite und Kanalabstand beim AM-Tonrundfunk " in Rundfunktechnische Mitteilungen, Heft 4, 1969, S. 175 bis 178.

** Mr. Süverkrübbe is with the Institut für Rundfunktechnik, Hamburg.

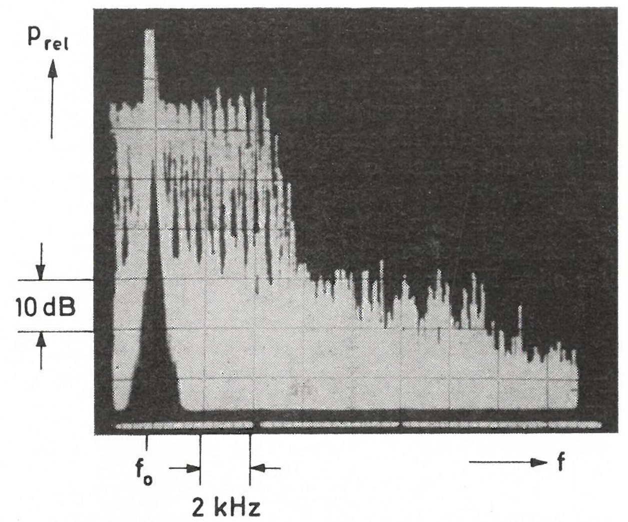

Fig. 2. — RF spectrum of the unwanted transmitter.
Abscissa : frequency, 2 kHz per division
Ordinate : relative level, 10 dB per division.

All the spectral lines were stored in the screen display. A low-pass filter of the type described above, having its 6-dB point at 4.8 kHz, was inserted at the transmitter input. The figure clearly shows the interference due to the distortion products of the transmitter; it extends to about three times the wanted bandwidth.

3. Evaluation of the results.

The results of the RF protection-ratio measurements on the receiver mentioned are represented in *Figs. 3* to *5*. *Fig. 3* depicts, for various values of the parameter *Q*, the dependence of the adjacent-channel protection-ratio (referred to the case of shared-channel-interference) on the channel spacing.

As the widest receiver bandwidth available was ± 6 kHz, it was unfortunately not possible to measure any results for high values of *Q* ($Q \geqslant 1$) with wide channel spacings. For this case, however, it is easy to obtain reliable values by extrapolation. Because, in effect, with this receiver the interference tone between the wanted and unwanted carriers can occur only when $Q \geqslant 1$ on account of the very steep filter slope, and because in this case the magnitude of the interference and thus of the RF protection-ratio is a function only of this interference tone and of its evaluation by the psophometer filter, the RF protection-ratio curve follows that of the psophometer filter. Extrapolated values for $Q = 1$ are indicated in *Fig. 3*, connected by a broken curve.

It will be seen at once in the illustration that, even with very complex receivers, a good adjacent-channel protection-ratio, which is appreciably below the shared-channel protection-ratio, can be obtained only with values of *Q* that are well below 0.6. It will also be seen that the variation of the adjacent-channel protection-ratio as a function of *Q* is particularly large for $Q < 0.6$. With a channel spacing of 9 kHz, for instance, the relative RF protection-ratio is improved by 14 dB (from — 16 dB to — 30 dB) when *Q* is reduced from 0.6 to 0.5. *Fig. 4* again depicts this for a channel spacing of 9 kHz. Here, too, it is clear that the greatest change in the RF protection-ratio may be expected when the AF bandwidth is about 4.5 kHz ($Q = 0.5$).

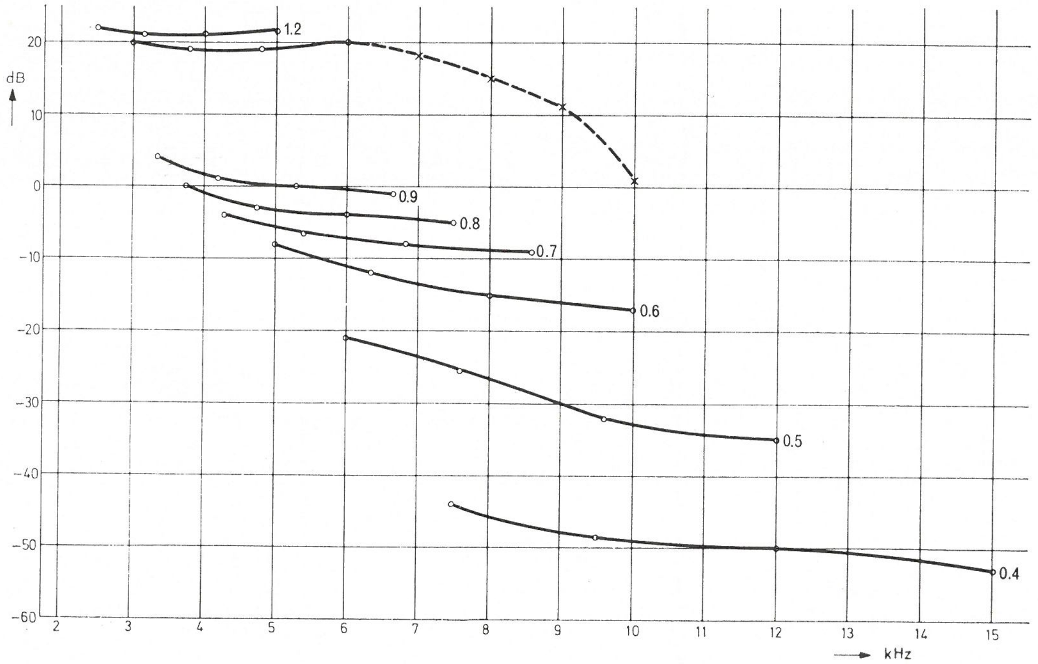

Fig. 3. — Adjacent-channel protection-ratios.
Abscissa : channel spacing in kHz
Ordinate : relative RF protection-ratio in dB

$$\text{Parameter}: Q = \frac{\text{AF bandwidth in kHz}}{\text{channel spacing in kHz}}$$

full lines : measured broken lines : calculated.

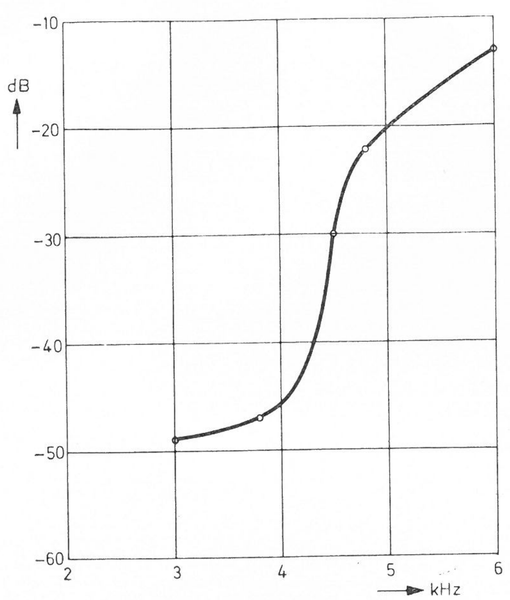

Fig. 4. — Adjacent-channel protection-ratios for a 9-kHz channel spacing.
Abscissa : AF bandwidth in kHz
Ordinate : RF protection-ratio in dB referred to the shared-channel value.

It is difficult to make corresponding measurements with receivers that may be used in practice, that is to say, that are less complex, because with these a change in the bandwidth is always accompanied by a change in the steepness of the slope. However, if, for measurements with such receivers, Q is varied in the range between 0.5 and 0.6, it is possible to recognise the same strong influence on the RF protection-ratio in the case of adjacent-channel interference.

Of particular interest in *Fig. 3* is the fact that all the curves slowly fall off with increasing channel spacing. Thus, with wider channel spacing, one obtains the same adjacent-channel protection-ratio for a greater value of the ratio Q, that is to say, the transmitted AF bandwidth increases more than the channel spacing.

The reduction of the RF protection-ratio, while the ratio Q remains the same, but the channel-spacing increases, is explained by the decrease in the amplitudes at the higher frequencies in the AF spectrum. However, the advantage of increasing values for Q can be bought only at the expense of a reduction in the number of channels. *Table 1* indicates, for various channel spacings, the permissible AF bandwidths for a constant adjacent-channel protection-ratio. Corresponding values for other RF protection-ratios will be found in *Fig. 5*.

Table 1

Permissible AF bandwidth for a given adjacent-channel protection-ratio (30 dB below shared-channel protection-ratio).

Channel spacing kHz	AF bandwidth kHz
7	3.3
8	3.9
9	4.5
10	5.1
11	5.7

4. Practical applications.

The relations depicted in *Fig. 3* apply, as already explained, only to the " ideal receiver ". It is very difficult to indicate the limitations that must be observed when commercial receivers are included in the investigations, because only a very unreliable prediction can be made of the characteristics of future receivers.

A solution to this problem may nevertheless be found if one bases the considerations not on the receiver characteristics, but on the planning parameters, and if, accordingly, certain assumptions are made for the receiver. If, for instance, the channel structure and the RF protection-ratio for the adjacent-channel are fixed, the corresponding value of Q may be obtained from *Fig. 3*. The transmittable AF bandwidth is thus determined for an ideal transmission system. This bandwidth should also be fully present at the transmission, as the transmitter characteristics may be made as close as desired to the ideal. The requirement for receivers, however, is only the definite maintenance of the given adjacent-channel protection-ratio. The receiver manufacturers can obtain this value, for inexpensive receivers, at the expense of the IF (and thus of the AF) bandwidth. However, they could also construct more complex receivers, capable of reproducing almost the full radiated AF quality.

Let us demonstrate this method by means of an example chosen at random. Let the channel spacing be fixed at 10 kHz and the adjacent-channel protection-ratio at 20 dB below the shared-channel protection-ratio. From *Fig. 3* one obtains the interpolated value $Q = 0.58$. This implies that the bandwidth of the transmission is restricted to $\pm$ 0.58 x 10 = $\pm$ 5.8 kHz. An extremely good receiver is capable of reproducing an AF bandwidth of 5.8 kHz. A simple receiver (for example, the E.B.U. reference receiver MBF) would be able to reproduce an AF bandwidth of 2.5 kHz (6-dB point), while respecting the protection-ratio condition. A receiver constructed for laboratory purposes, using an inexpensive mechanical filter in the IF stage, passes an AF bandwidth of 4.3 kHz under the same conditions.

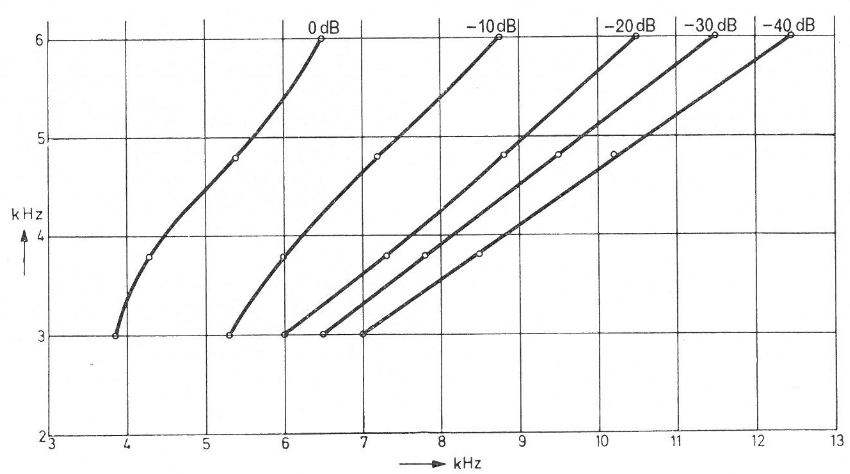

Fig. 5. — Exploitation of the frequency spectrum.
Abscissa : channel spacing in kHz
Ordinate : AF bandwidth in kHz
Parameter : RF protection-ratio in dB referred to the shared-channel value.

Conclusions.

In AM sound broadcasting, there exists an unequivocal relation between the channel spacing, the AF bandwidth and the adjacent-channel protection-ratio. In a transmission system with the same bandwidth for the radiated signal and for the receiver pass-band curve, the AF bandwidth is half that of the system bandwidth. *Fig. 5* shows, for the case of an almost ideal receiver, the relation between the three parameters mentioned. For a given channel spacing, there exist many pairs of values for AF bandwidth and adjacent-channel protection-ratio. If the adjacent-channel protection-ratio is prescribed also (this influences the degree of coverage obtainable), then both the AF bandwidth and the system bandwidth (which is twice the AF bandwidth) are determined.

Contrary to the existing practice, an increase of the system bandwidth permits advantage of the better quality to be taken. This still permits the construction of receivers in different price categories ; of course, it is likely that a lower price would, in general, entail a reduced AF quality.

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The Round Table Conference at the Montreux Television Symposium

The sixth International Television Symposium was held at Montreux from 19th to 23rd May, 1969. For the first time, a Round Table Conference was organised, with the various technical possibilities for the distribution of supplementary television programmes as its theme. The techniques under discussion were the following :

- terrestrial broadcasting in the 11.7 to 12.7 GHz band;
- direct broadcasting by satellites;
- television distribution by cable.

The first talk was given by Mr. G. Heinzelmann of the F.T.Z. Research Institute (Darmstadt), who discussed terrestrial broadcasting in the 12-GHz band. In fact, in the Federal Republic of Germany, where there is much interest in the development of privately-owned television services, the Deutsche Bundespost is anxious to know to what extent terrestrial broadcasting could be used to enable supplementary programmes to be broadcast. At present, utilisation of the VHF and UHF bands permits almost the whole of the population to be served by three programmes within a few percent. The utilisation of the sites of the UHF transmitters for transmitters in the 12-GHz band would not, however, give more than limited coverage, due to the pronounced shadow zones and the severe attenuation caused by rain or snow. It appears that the only possible solution would be the construction of a network of low- or medium-power transmitters, which were relatively closely spaced. The D.B.P. envisages transmitters having a power of 100 W, with aerials at an effective height of 37.5 m and an omnidirectional gain of 10 dB. The distance between co-channel transmitters would be 80 km and the radius of coverage of each transmitter would be 15 km. By using 600 MHz, that is 75 channels each 8 MHz wide, eight additional programmes could be broadcast. The coverage would however be only partial, with a probability of satisfactory reception at only 50 % of the locations. Furthermore, it assumes that 600 MHz would be available for terrestrial broadcasting within the 12-GHz band, while it is quite possible that only 300 MHz, for example, may be allocated.

Propagation studies undertaken in Berlin and measurements made on an experimental network of 12-GHz transmitters under construction in an urban area have indicated the difficulties in ensuring complete coverage. The receiving aerial position must be chosen carefully so that it is within sight of the transmitter. In consequence, the D.B.P. experts are at present of the opinion that it would be necessary to make use of reception by communal aerials situated at a certain number of favourable positions. The distribution to the individual viewers would then be via cables. To supply the principal centres of the cable-distribution system (extending to whole districts within the town, or to satellite towns) it would in future be possible to use radio-relay links. This would no longer be broadcasting, then, but point-to-point communications *.

Regarding direct broadcasting from satellites, Dr. G.J. Phillips (B.B.C.) pointed out that, with the powers which one might expect to have available, it would not be possible, contrary to what is sometimes believed, to cover surfaces as large as continents. One is led to consider beamwidths of 1 to 2° (perhaps even 0.5° to meet the requirements of the coverage of a country or a region). The utilisation of the 12-GHz band still involves certain problems, in particular regarding power amplifier tubes, but this band would make the preparation of a frequency plan much easier, because of the bandwidth available, which is larger than that in the UHF band, and the greater directivity of receiving aerials (an aerial diameter of 1 m corresponds to a beamwidth of about 2° at 12 GHz). The utilisation of FM offers considerable advantages from the aspect of the transmitting powers required. With a bandwidth of 25 MHz per channel, Dr. Phillips considers that it would be possible to broadcast over an unlimited area 1 programme for each 100 MHz of spectrum used (separate programmes in each service area being possible).

A similar opinion was expressed by Mr. P. Blancheville, on the basis of work undertaken by the O.R.T.F.

In Europe, Dr. Phillips envisaged the distribution of two supplementary programmes by some thirty satellites launched during a 10-year period, having beamwidths of approximately 1°, overlapping exactly. The beams might need to have elliptical cross-sections rather than circular ones. The cost, including development and launching, would be 1 200 million dollars. For reception, Dr. Phillips proposed an aerial with a diameter of approximately 1 m, followed by an amplifier-mixer-discriminator delivering the signal at the output of the video detector of receivers equipped for VHF and UHF operation. The cost of such installations would be from 80 to 100 dollars each (in mass production) which would lead to an expenditure of 10 000 million dollars on equipping 100 million households.

Mr. Richard (Electrobel, Brussels) commenced by describing the present state of development of systems for the distribution of television by cable which in the United States are called Community Antenna Television systems (CATV). There are currently 2060 CATV systems in the United States, serving 3.6 million subscribers. The authorisations granted and negotiations now under way indicate that the number of systems will soon reach 5500. In the United Kingdom, there are several hundred systems serving approximately 1 million subscribers (some of whom are served by a system using a multi-pair cable and " simplified " receivers). There are also systems in Canada, Belgium and Switzerland, and to a more limited extent, in Germany, France and the Netherlands.

* For these links, higher frequencies (18 GHz, for example, as in the United States) could be used as the directivity would enable higher radiated powers to compensate for the greater losses due to rain, snow or fog. *(Editor.)*

The advantages of the systems of distribution by cable are the high quality of reception and the elimination of individual aerials. They also permit the distribution of programmes from relatively distant transmitters, sometimes by means of radio-relay links, where this has been authorised (channel allocation and copyrights). In general, it is true to say that these systems permit the reception of a larger number of programmes than the traditional systems of broadcasting. Modern CATV systems transmit a bandwidth greater than that occupied by sound and television broadcasting ; they may thus be used to transmit complementary programmes, such as those previously recorded, educational programmes, programmes of local interest etc.

The installation costs are relatively high (4 500 dollars per km on average in a built-up area in Europe). A delicate problem of finance has to be solved each time a new system is started in a given town or region.

Mr. R.P. Gabriel (Rediffusion International, United Kingdom) then described a new system of distribution by cable which gives an even greater choice of programmes by enabling each subscriber to obtain, by dialling a number, any one of a very large number of programmes (36 for example) available at a central " exchange ". Each subscriber has a normal television receiver and also a box containing a frequency-converter and a telephone-type dial. This installation is connected by a twin-pair cable through a junction-box (to which the neighbouring subscribers are similarly connected) to a programme centre serving up to 5 000 subscribers within a 0.1 square-mile area, This system has been used experimentally at the Rediffusion Television studios at Teddington, and has recently been demonstrated to the F.C.C. in the United States.

Following these talks, the representatives of the various regional broadcasting associations were asked to express their opinions : Mr. Matsuura for the Asian Broadcasting Union (A.B.U.), Mr. Juskevicius for the O.I.R.T., Mr. Antar for the Union of National Radio and Television Organisations of Africa (U.R.T.N.A.), Mr. Hansen for the E.B.U. and Mr. Bartlett for the N.A.B.

The majority of these delegates referred to the great diversity of languages (or religions) in their part of the world, which rendered direct broadcasting by satellite less attractive. In certain cases, as Mr. Juskevicius remarked, it was also necessary to take account of differences in local times. The present state of development of the sound and television networks also influences the choice of solutions. Mr. Hansen (E.B.U.) said that it was now generally accepted that broadcasting direct from satellites to individual receivers would not be possible during the next decade. On the other hand, satellite broadcasting for distribution by communal aerial systems might well be possible by 1975. He referred in this context to the report of the working group on direct broadcasting by satellites of the Committee for the Peaceful Use of Outer Space *. Communal aerials could be used without modification in small communities or schools in the developing countries, and as the starting point for systems of distribution by cable in the more developed ones.

In the United States, there was no need for supplementary programmes, according to Mr. Bartlett, who did not foresee any change in the existing sound and television broadcasting system " during the lifetimes of the participants in the Symposium ". This opinion is not, however, shared by the President's Task Force on Communications Policy, whose final report, now officially published, states " ... that complete reliance cannot be placed on a system of local over-the-air stations to achieve our goals " and " although a number of methods can be imagined for expanding the number of channels, the most promising is cable television ".

During the general discussion which followed, Mr. Chauvierre (France) asked if the use of other types of modulation such as PCM had been considered. Dr. Phillips replied that PCM had been investigated by the B.B.C., but the conventional type of PCM occupied a very large bandwidth, as a sufficient number of pulses to eliminate the " quantification noise " were required. An intermediate solution, which the B.B.C. had called " Hybrid PCM " had been found to be interesting, and theoretically superior to FM. One or two articles had been published on this subject, but the most important question was to know whether receivers utilising this system could be manufactured at a sufficiently low price.

Mr. Holden (United Kingdom) drew attention to the difficulty in establishing a frequency plan for the UHF band, as, if a 1° beam was directed towards Europe, the nearest area in which the same channel could be used would be almost at the equator. This is because little directivity can be obtained with UHF aerials. A wide separation was also necessary between an area served by UHF transmissions from a satellite and that served by terrestrial transmitters operating in the same channel.

The Round Table discussions at the Montreux Symposium have not, of course, provided a definite solution to the problem of the procedures to be utilised for broadcasting supplementary television programmes ; they were only a preliminary and necessarily brief examination of this problem, but they have nonetheless helped to clarify certain important points for the participants.

* Documents A/AC 105/51 and A/AC 105/50, February 1969, submitted by the American delegation.

INTERNATIONAL NEWS

International Special Committee on Radio Interference (C.I.S.P.R.)

Meeting of Working Groups at Montreux. — The Working Groups and Steering Committee of the C.I.S.P.R. held meetings in Montreux from 19th to 30th May, 1969 ; these meetings were organised jointly with those of the sixth International Television Symposium. The previous meetings, held at Delft in June, 1968, have already been reported* and therefore only the progress which has been made since that time is mentioned here.

Working Group 1, whose task is to specify measuring equipment, has prepared a draft for a C.I.S.P.R. report on the measurement of interference in the audio frequency range. It has also completed draft specifications for an instrument covering frequencies below 150 kHz, as well as the draft of a report on measurements at frequencies greater than 300 MHz. In collaboration with Working Group 6, it has produced a report on the absorbent clamp developed by this Group ; the form in which the conclusions of this report are to appear in C.I.S.P.R. publications was also discussed. Working Group 1 has furthermore prepared a draft report on the standardisation of impulse generators, and discussed the publication of another report concerning field-strength measurements.

Working Group 2, which is studying interference due to industrial, scientific and medical apparatus, discussed the measurement of the radiation from apparatus of these classes in the presence of interfering signals from other transmissions. It was concerned with measurements at frequencies greater than 470 MHz, and the allocation of frequencies for wood-gluing. The question of the extent to which measurements of very large apparatus could be made, either at their place of operation, or in factories, was discussed. The Group also considered the interference produced by microwave ovens, and by high-frequency arc-welding equipment, as well as the allocation of additional frequencies for diathermy equipment.

Working Group 3, which is concerned with interference caused by high voltage lines, examined the question of complaint statistics, the statistical analysis of the interfering spectrum, and the interference produced by direct current lines. In the latter field, it was now well established that only the positive polarity was a generator of interference, that the interference level decreased during rain, and that, for equal levels of interference as indicated by C.I.S.P.R. apparatus, the subjective annoyance is less than that produced by an alternating-current line. The Group was also studying the interference due to series of insulators, and that caused by electrified railways.

Working Group 4, which deals with interference due to the ignition systems of internal combustion engines, proposed that all the recommendations appearing in various C.I.S.P.R. publications and referring to interference of this type should be re-issued in a single leaflet. The personnel responsible for measurements in this field would thus have available in a single document all specifications regarding the apparatus, the limits, and other information required for these measurements.

Working Group 5 (Receivers) has continued its study of radiation emanating from the chassis of receivers on the one hand, and from the aerial and power cables on the other. The question of the relationship between the Group and I.E.C. Sub-Committee 12A remains on the agenda ; it will be recalled that the latter is responsible for determining methods of measurement for receivers, and that the choice of limits is closely linked to the methods of measurement adopted. A certain amount of progress has been achieved regarding the utilisation of V and Δ networks.

Working Group 6, which is studying interference due to motors in domestic appliances and to lighting equipment, has continued its examination of methods permitting outdoor measurements to be replaced by those in the laboratory. Several details of measurements to be made on small items of equipment were discussed. Various contributions regarding the connection of these items to the artificial network, the interference produced by lighting equipment, and the limits for interference in the VHF band for apparatus containing small motors, were also examined. Measurements to be made in the case of semiconductor equipment had made some progress.

Working Group 7 (Safety) added the production of a guide to the utilisation of capacitors in interference-suppressing equipment to its terms of reference.

Working Group 10, which is responsible for studying the presentation of statistics of complaints, has made a certain amount of progress towards the standardisation of this presentation by the organisations responsible for investigating interference in various member countries.

* * *

The Steering Committee received the reports of the various Working Groups. It agreed that those Groups wishing to meet before the next Plenary Assembly should do so between 15th and 29th March, 1970 in Yugoslavia. Finally, the delegate from the U.S.S.R. confirmed that the next Plenary Assembly could be held from 24th August to 5th September, 1970 at Leningrad.

* See E.B.U. Review No. 110-A, pp. 186-187.

International Electrotechnical Commission (I.E.C.)

Meeting of Technical Committee 60 (Recording). — This Technical Committee and the two Sub-Committees 60A (Sound recording) and 60B (Video recording) met from 16th to 21st June, at Baden-Baden. Dr. H. Schiesser presided over the meeting of Committee 60. The meeting of Sub-Committee 60A was presided over by Mr. D.A. Weale (United Kingdom), appointed as successor to Mr. H. Davies, who was Chairman of Sub-Committee 29A for many years. The meeting of Sub-Committee 60B was presided over by Mr. Roizen (United States). The E.B.U. was represented at the meetings of Sub-Committees 60A and 60B respectively by Prof. J.J. Geluk (N.O.S.) and Dr. P. Zaccarian (RAI) who are the Chairmen of Sub-groups G1 and G2 of Working Party G, respectively. They have kindly sent us the following report on the main subjects that were discussed.

Preparation of a vocabulary

Technical Committee 60's Working Groups 1 and 2 dealt with vocabularies. It has been decided to group documents for this terminology in three sections, i.e. general, disk recording and tape recording. Because of the existing vocabulary prepared by the E.B.U., the work of Working Group 2 (responsible for television tape recording) has been made easier, and the section concerned specifically with the terminology of video recording will possibly be circulated earlier.

Sound recording (Sub-Committee 60A)

Revision of existing publications

Publication 98 (Processed disk records and reproducing equipment) was reviewed by the Sub-Committee 60A, and besides editorial changes the following points will feature in the Six-Months' Rule document :

a) change in the bottom radius of fine-groove records from 4 μm to 8 μm ;
b) deletion of reference to non-spherical reproducing styli and the omission of all specified dimensions.

A questionary concerned with the thickness at the periphery of holes in records (157 mm/7 in) having the large centre hole will be sent to all I.E.C. National Committees in view of the enlargement of its tolerance (between 0.6 mm and 1.2 mm). For autochangers, this dimension is of great importance.

Publication 94 (Magnetic tape recording and reproducing systems, dimensions and characteristics) was also studied, with particular attention to four items.

a) It was generally agreed to standardise the tolerances on the relative levels in recording and reproduction. The proposal which will be circulated for comments within four months will include four clauses relating respectively to the recorded level only, reproducing equipment response only, overall frequency response and to stereophonic tape recordings. For speeds of 38.1 and 19.05 cm/s (7½ and 15 in/s) used in broadcasting, the lower limit of the frequency response in recording or playback increases from — 2.5 dB at 40 Hz to — 1.5 dB at 80 Hz, remains constant at — 1.5 dB from 80 to 8000 Hz, and decreases from — 1.5 dB at 8000 Hz to — 2.5 dB at 16.000 Hz (the value of 0 dB being taken as an upper limit) ; the tolerance range is doubled for the overall response.
b) After examination of the recording characteristics only the foot-note concerning the tape speed of 19.05 cm/s (7½ in/s), for which the time constants of 70 μs and ∞ are standardised, was changed ; it is added in the foot-note that the time-constant of 50 μs + 3180 μs is used in some countries. Although the discussions about the matter of this standardisation were of a fundamental nature, the text will be changed unless a Six-Months' Rule document is issued for other reasons.
c) Tape identification, either along the whole tape, to indicate the sensitive side, or at its beginning and end, was discussed at length. A preparatory Working Group set up during the meeting will draw up new proposals on this subject. It is worth mentioning that for new chromium oxide magnetic tapes marking the tape throughout its length seems to reduce significantly the improvement obtainable with such tapes.
d) It has been decided to refrain from any active participation in the field of reference tapes for sound recording. However, it was judged useful to compile, as an appendix to Publication 94, details of existing reference tapes in several countries.

Tape cartridge recordings

Endless-loop magnetic tape cartridges of the N.A.B. type, were discussed by Sub-Committee 60A. Although several delegations were in favour of taking these cartridges as the basis for an I.E.C. Recommendation, the majority thought it premature to take such an action. At the next meeting the position will be reviewed and the document remains on the work programme of the Sub-Committee.

A Secretariat's proposal will be circulated concerning the 8-track technique in special cartridge-systems. The United States delegation promised to supply the necessary details with the aim of including this technique in Publication 94.

Problems of a technical nature

Methods of measuring recorded levels on magnetic tape were drawn up in a finalised form and will be circulated as a Six-Months' Rule document. The principle of recorded flux rather than surface-induction will be taken as a basis for the method of measurement.

Requests had been received from I.E.C. Sub-Committee 12A concerning radiation from tape recorders ; but it seems likely that the C.I.S.P.R. will be more appropriate for dealing with this question. Guidance was given to I.E.C. Sub-Committee 12A as to what kind of programme and tape reproducer should be used for listening-tests on radio-receivers.

The measurements of wow and flutter in recording systems was studied by Sub-Committee 60A, and the unanimous decision was taken that the one-half of the peak-to-peak deviation of a tone (either 3150 Hz or 3000 Hz) after passing through a weighting network, should be the only figure to be given in the result.

Television tape recording (Sub-Committee 60B)

Transverse-track video recordings

Sub-Committee 60B has adopted a certain number of specifications concerning this type of recording, which will be submitted to the National Committees under the Six-Months' Rule.

The problem of video track dimensions is being investigated by Working Group 1 (Secretary : Dr. Zaccarian). It was decided to adopt a specification for the transverse dimensioning of the tracks, to a greater accuracy than the one drafted by the C.C.I.R., since the I.E.C. specifications affect the manufacturers of the equipment. However, no important differences can be found between the new proposed I.E.C. specifications and the ones of the E.B.U. or of the C.C.I.R.

The longitudinal dimensioning of the video tracks suggested during the last meeting of E.B.U. Sub-group G2 (see page 189 of the present issue) has been adopted with some changes ; however, only the nominal value for the spacing of the video tracks is specified.

The problem of tape spools is being investigated by Working Group 2 (Secretary : Mr. Remley). The dimensioning of the I.S.O. for instrumentation spools has been adopted ; however, only the spool sizes indicated in the C.C.I.R. draft Recommendation E.1.e(X) are specified.

The SMPTE proposed recommended practice for the configuration of the tape between input and output guides of tape-machines has been adopted and modified in order to take into account the main amendments suggested by E.B.U. Sub-group G2.

The clauses of the C.C.I.R. draft recommendation relating to the recording of the control track and the sound track have been adopted ; however, no specification is given for the reference tone level. Furthermore, the tolerance on the distance between corresponding audio and video information is made tighter.

Moreover, a questionary will be prepared on the definition and measurement of dropouts, based on the E.B.U. contribution.

Helical-scan video recordings

Questionaries will be prepared on the following subjects by the Secretariat of Sub-Committee 60B :
- Standards for a helical-scan domestic video recorder (based on a suggestion from the Netherlands).
- Connection between video recorders and television sets for domestic or semi-professional use.
- Spools for domestic video recorders.

Other subjects

Sub-Committee 60B has considered a document of the C.C.I.R., in which it is requested that the I.E.C. should study the problem of the standardisation of the basic synchronising signals for television. A reply has been prepared, concerning the signals required for proper operation of television tape-machines.

It has been decided that the study of labels and leaders for television tapes is within the scope of Sub-Committee 60B.

Questionaries will be prepared on the following subjects :
- Electron-beam recorders and recordings ;
- Coded information to be recorded on the cue track as a help in editing ;
- Measuring methods peculiar to television recorders and recordings ;
- Mechanical and magnetic specifications for television tape.

* * *

Technical Committee 60 and Sub-Committees 60A and 60B will hold their next meetings simultaneously in September 1970.

International Telecommunication Union (I.T.U.)

Administrative conferences. — At its twenty-fourth session, which was held at Geneva from 3rd to 23rd May, 1969, the I.T.U. Administrative Council passed two resolutions concerning the preparation of two administrative conferences in the field of broadcasting.

Space conference

It was decided that a World Administrative Radio Conference for Space Telecommunications will meet at Geneva on 7th June, 1971 for a duration of six weeks, provision being made for one additional week. The Administrative Council drew up the agenda, which will deal mainly with the following points :
- the examination and revision of the existing Radio Regulations with a view to adopting new provisions applicable to the various services using space radio techniques ;
- the revision of the table of radio frequency allocations to take account of services that may use space radio techniques and the radio astronomy service ;
- the revision of the provisions regarding frequency sharing between space and terrestrial services ;
- consideration of the feasibility of coordinated frequency planning for radiocommunication satellites ;
- the changes necessary to the Radio Regulations for the effective implementation of the decisions of the Conference.

Frequency planning for LF/MF broadcasting

After examining a memorandum by the I.F.R.B. and a report by the Director of the C.C.I.R., the I.T.U. Administrative Council was of the opinion that a Regional Administrative Radio Conference on frequency planning for LF/MF broadcasting in Regions 1 and 3 (Europe, Africa and Asia) should be held. Administrations of I.T.U. Member countries were invited to present their views on the desirability of holding such a conference not later than 1974.

The I.T.U. Administrative Council requested the C.C.I.R. and the I.F.R.B. to continue their studies on this question and to submit reports to its next session.

Seminar on the improvement of sound and television broadcasting in Africa. — A seminar was organised by the I.T.U. from 9th to 21st June, 1969. Under the auspices of the U.R.T.N.A., which had proposed that it be held for the benefit of all African countries, it was attended by delegates from twenty-nine countries in that continent.

At the request of the Secretary-General of the I.T.U., the E.B.U. collaborated in the seminar by arranging and coordinating the designation of lecturers by its Members (a total of 12 speakers).

The seminar was opened officially by Mr. A.K. Gaye, Minister of Foreign Affairs of the Republic of Senegal. This was followed by a speech given by Mr. Mohamed Mili, Secretary-General of the I.T.U. and by an address of welcome from Mr. Bassiouni, Secretary-General of the U.R.T.N.A.

The seminar consisted of two parts : the first concerned Panafrican frequency-planning ; the second dealt with the organisation and development of the broadcasting services. The subjects of the first lectures were as follows :
- Radio-wave propagation, by L. Boithias (CNET, France) ;
- Frequency allocation and distribution, by C. Terzani (RAI, Italy) ;
- The main types of aerials used in sound and television broadcasting, by C. Parmeggiani (RAI, Italy) ;
- The optimum utilisation of the LF and MF spectrum, by H. Eden (I.R.T., F.R. of Germany).

Transmitting stations were the subject of three lectures :
- Transmitting equipment, by R. Martin (O.R.T.F., France) ;
- Premises and power supplies, by F. Bolt (B.B.C., United Kingdom) ;
- Feeders and aerials, by C. Parmeggiani (RAI, Italy).

Panafrican frequency-planning was discussed during two lectures by H. Eden (I.R.T., F.R. of Germany) on techniques for VHF transmissions and techniques for the MF band, and also by C. Parmeggiani (RAI, Italy) on techniques in the HF bands. The first part of the seminar ended with an address by P. Guillot (C.C.I.R.) on the C.C.I.R. Recommendations concerned with the standardisation of broadcasting equipment.

The second part consisted of the following lectures :
- Transmission systems, by F. Anguera (O.R.T.F., France) ;
- Operation and maintenance, by B. Berntsson (Swedish P.T.T.) ;
- Studio techniques (sound recording, filming, etc.), by L. Mignot (O.R.T.F., France) ;
- Film-scanners, by M. Agresti (RAI, Italy) ;
- Magnetic recording, by L. Griffiths (B.B.C., United Kingdom).

Recruitment and training were discussed in an address prepared by G. Galligioni (RAI, Italy) (which was delivered by M. Colapietro in his absence), and a lecture by A. Clavé (O.R.T.F., France).

The general organisation of technical broadcasting services for sound and television was the subject of a lecture prepared by M. Sponzilli, and was given in his absence by M. Agresti.

Finally, two lectures were given by F. Anguera (O.R.T.F., France) on the development of a Panafrican national and regional network with fixed-term objectives in view.

The lectures were followed by meetings of Working Parties which formulated the questions to be put to the speakers regarding the subjects of their addresses, and by debates in plenary session, in which these questions were discussed. The number and the subjects of these questions illustrated the interest of the participants in the seminar, and the wide range of problems about which the African broadcasting organisations wish to obtain technical information.

Publication of service documents. — During July, 1969, the I.T.U. published new editions of the service documents customarily produced by the I.F.R.B. :

International Frequency List (Fifth Edition)

This new edition of the List, dated 1st February, 1969, retains the presentation of the previous issues. It consists of a Preface and four Volumes containing details of frequency assignments between 10 and 4995 kHz ; 4995 and 9995 kHz ; 9995 and 28 000 kHz; 28 and 40 000 MHz. Volume IV is itself divided into four parts : one covers the range 28 to 50 MHz, but omits all broadcasting assignments ; the other three cover the rest of the spectrum, each applying to one of the Regions.

List of Broadcasting Stations operating in the bands below 5950 kHz (Fourth Edition)

This document, also dated 1st February, 1969, lists the broadcasting stations whose assignments were entered in Volume I of the International Frequency List. The stations are listed by countries, and in each country in alphabetical order.

ALGERIA

New international television circuit inaugurated. — Although occasional live television programmes from Algeria have been transmitted to Europe — notably on 14th July, 1958, as described in E.B.U. Review No. 51-A — the Radiodiffusion-Télévision Algérienne has been unable to contribute regularly to Eurovision exchanges as there was no permanent television circuit in the direction Algeria to Europe. From July, 1969, however, the international television circuit from Perpignan to Algiers has been equipped for reversible operation.

The new circuit was used immediately to relay the opening of the first Panafrican Cultural Festival on 21st July, and to provide news reports of this event during the following ten days. The transmissions included items in colour, using the SECAM system, which were produced with some technical assistance from the O.R.T.F. Although the international circuit utilises tropospheric propagation over two links of more than 300 km (see E.B.U. Review No. 63-A, p. 223) the quality of the colour pictures received in Brussels was satisfactory.

AUSTRALIA

Development of communication satellite Earth-stations. — There are two permanent communication satellite Earth-stations currently operating in Australia. These are :

(a) *Moree, New South Wales.* This station is permanently linked to the national communications network via a broadband channel capable of carrying television programmes.

(b) *Carnarvon, Western Australia.* This station is at present remote from existing broadband television links.

At the present time there is a third temporary station at Toowoomba, Queensland, belonging to N.A.S.A.

Two further stations are planned for the Overseas Telecommunications Commission, Australia, these being a second station at Carnarvon, W.A. and a station at Ceduna, S.A. The Ceduna station will point westwards towards an Indian Ocean satellite. This station will be linked, via a short spur, to the east-west microwave link now under construction, and thence to the Australian telecommunications network. The construction of this station will enable the direct exchange of television programmes on 625/50 standards between Australia and Europe.

Extension of television services. — Plans for the first five stages of the development of television in Australia covering the period from 1956 to 1967 were reported in E.B.U. Review No. 99-A, whilst details of the sixth stage of development were included in E.B.U. Review Nos. 107-A and 108-A.

The Federal Government has now authorised the expenditure of almost $ 5 000 000 for the establishment of a further 38 low-power national television stations during a period of four years.

On completion of the sixth stage of development now in progress, 96 % of the population of Australia will have a television service available to them. The task of extending the service to the remaining 4 % of the population is most difficult, as the 500 000 persons concerned are distributed over approximately 85 % of Australia's total area. It is estimated that the additional 38 stations referred to above will provide a service for approximately 110 000 persons.

The majority of the new stations are hundreds of kilometres from existing television services, and this creates problems in feeding signals to the transmitters. Some circuits will be established along existing or planned Post Office broadband radio-relay or coaxial cable telephony routes using a separate carrier, or via the protection channel for the telephony system. Others in the more remote areas will be fed with programmes by means of an unprotected single-channel microwave link provided for the purpose.

Special measures will be required to provide the service for Alice Springs as this town is more than 600 miles from the closest existing station and there are no radio-relay channels to Alice Springs at present.

These new national stations are listed below, and the map on page 171 illustrates the location of these centres together with the location of all other existing or planned television transmitters.

New South Wales : Mungindi.

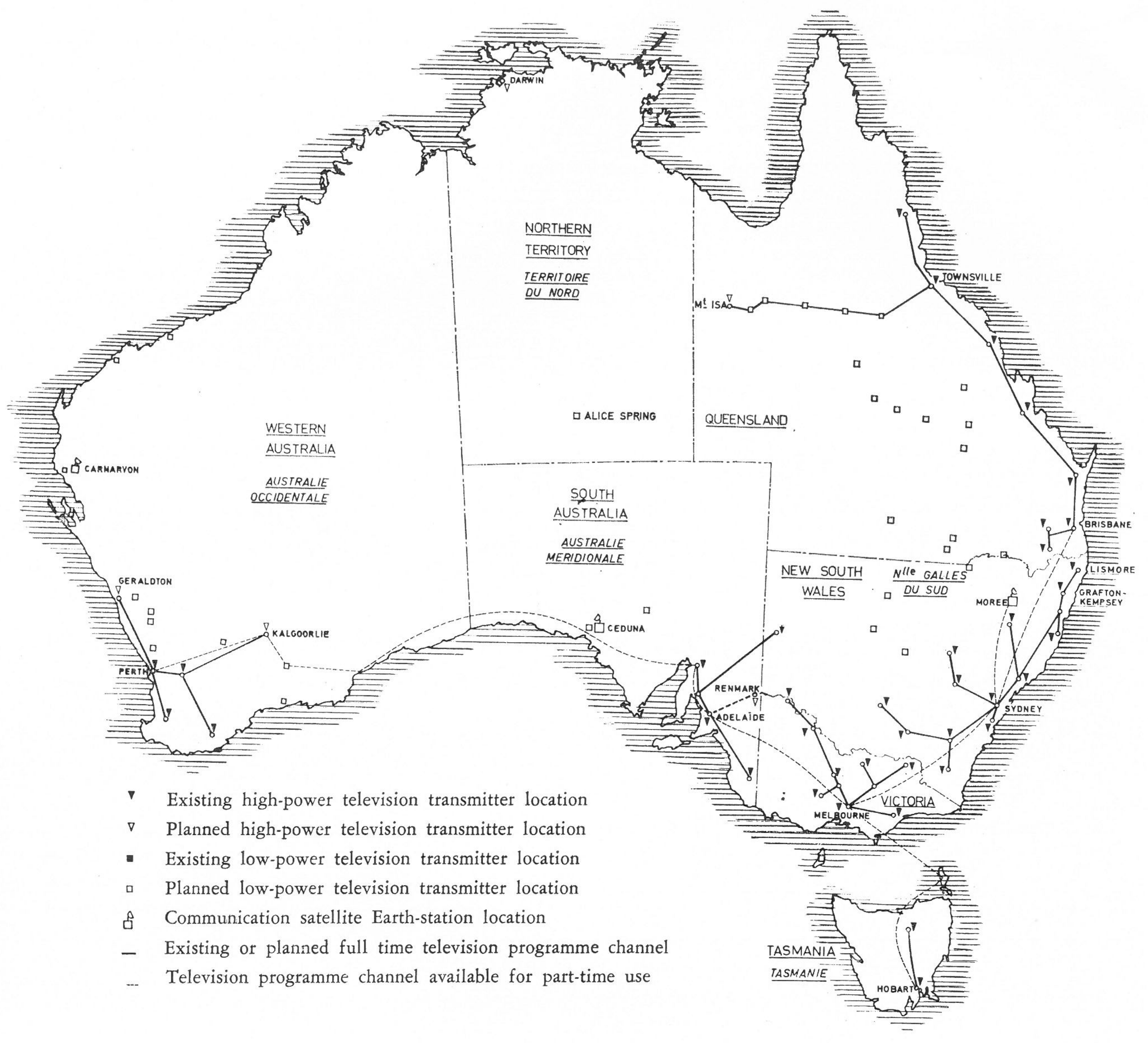
Queensland : Hugnenden - Barcaldine - Alpha - Mitchell - Richmond - Blackall - Goondiwindi - Morven - Julia Creek - Longreach - St. George - Augathella - Cloncurry - Winton - Dirranbandi - Charleville - Mary Kathleen - Clermont - Miles - Cunamulla - Emerald - Springsure - Roma.

South Australia : Ceduna - Woomera.

Western Australia : Southern Cross/Bullfinch - Mingenew - Port Hedland - Moora - Esperance - Dampier - Carnamah - Norseman - Three Springs - Carnarvon.

Tasmania : King Island.

Northern Territory : Alice Springs.



State of development of television in Australia

A Bill has been introduced to amend the Broadcasting and Television Act to provide for the licensing of low-power television stations in some remote areas. This is mainly intended to benefit mining centres, where it is unlikely that normal commercial stations would ever be provided and where, because of the high costs involved, the establishment of national stations is difficult to justify.

For this service it is proposed that programmes of the Australian Broadcasting Commission (A.B.C.) be transcribed to television tape which would then be forwarded to these stations for replay without further attention.

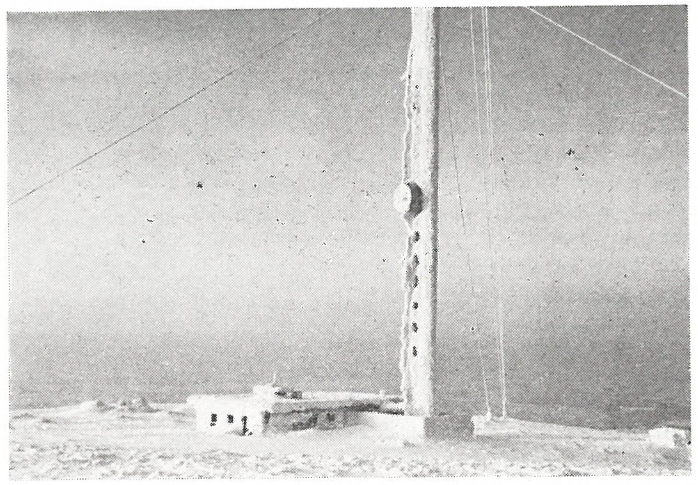
A number of mining companies have indicated their interest in establishing and operating such stations and the proposed amendments to the Act will give the Australian Broadcasting Commission the authority to provide programmes to such stations. At least six of these stations would be required before the provision of a special recording and transcription studio by the A.B.C. could be justified.

It has not yet been decided in which areas these stations may operate as this will depend on firm proposals being made by individual members of the Mining Industry Council.

* * *

No decision has yet been made by the Government concerning the date of introduction of colour television in Australia, However, when the decision is reached, at least 18 months clear notice will be given to allow the industry sufficient time to prepare for its introduction.

FINLAND



The Yleisradio transmitting station in Lapland. *(Yleisradio photo)*

Transmitting station in Lapland. — The start of service from a sound and television broadcasting station in Lapland, in 1968, marked an important stage in the development of the Yleisradio network. Situated at Yllästunturi, this station processes a 212-m mast, the top of which is 909 m above sea level.

The station is contained within a three-storey building having a total volume of 1650 m^3. Two floors are below ground level, so that only the top storey is visible above the summit of the Arctic mountain. The television transmitter room and the control room, among others, are at this level. Under normal conditions, the equipment is remotely controlled from the station at Rovaniemi, which is close to the Arctic Circle at approximately 130 km to the south of the new station. The lower floors of the building contain the sound-broadcasting transmitters and the emergency electrical generator.

The sound programmes are broadcast by two 10-kW VHF/FM transmitters with an ERP of 60 kW on 95.3 and 92.2 MHz. Two reserve transmitters of 1 kW each are also available.

The television transmitter, with 10 kW output power, operates in Channel 11. Its aerial is horizontally-polarised, and the ERP is 60 kW, except towards the east, where it is reduced to 10 kW. The station's service area is very large, and includes a part of Sweden in which there is a Finnish community. A reserve 2-kW transmitter is available also. At the top of the aerial mast, a space of 20 m has been reserved for future UHF aerials. The programmes are brought from the Rovaniemi station via Pello on radio-relay links.

Despite the existence of the Yllästunturi station, there remain certain areas in Lapland with a low population density which are still without a television service. During the next few years, it is hoped to extend the coverage to include these regions. However, VHF/FM sound transmissions are already available to almost the whole population.

FRANCE

Remotely-controlled transmitting stations. — In constructing the transmitter network for the Second Television Programme, the O.R.T.F. has utilised the existing infrastructure of the First Programme, in the form of permanently-staffed transmitting stations. However, to complete the installation of the Second Programme utilising Band IV/V (while making provision for a later third programme), it is necessary to build gap-filling transmitters serving areas which lie outside those that can be covered at high frequencies from the original sites. The construction of staffed transmitting stations for this purpose would incur high operating costs, and this is why the O.R.T.F. Engineering Division has envisaged that these new stations should be controlled remotely from the existing ones.

The first installation of this type has just entered service, at the La Rhune transmitting station, in the Basque region near the Spanish frontier. This station is designed to be completely remotely controlled and remotely monitored from the Bordeaux-Bouliac transmitter, some 200 km away. During the official inauguration, held on Thursday 19th June, 1969, those attending the ceremony at Bouliac were in fact able to observe the execution of the instructions sent from the control desk at that station, by means of closed-circuit television. Similar installations will follow, at other locations in France, at the rate of approximately one per month for the next two years.

The installations at La Rhune consist of :

- three VHF/FM sound transmitters, with a nominal power of 3 kW ;
- a Band-III television transmitter comprising two sections each with a nominal peak vision power of 0.8 kW, which can be switched independently in case of failure ;
- a Band-IV television transmitter comprising two sections coupled together, each having a nominal vision power of 5 kW.

The remote control of these transmitters is conveyed as data in a telegraph-grade channel at a rate of 200 bauds (480 Hz) on the service circuit of the radio-relay system used to bring the programme signals to La Rhune from Bouliac (via two intermediate repeater stations). The pictures and sound broadcast by the two television transmitters, and the output of the three sound transmitters, are monitored continuously by a group of receivers, which immediately detect any faults that may occur. The operator at the control station, for his part, intervenes by switching the transmitters off and on, selecting the input programme, and the replacement of faulty sections. In particular, he is able to switch the vision signals to direct reception of the transmissions from the Pic du Midi in the event of failure of the radio-relay system normally used. At the terminals of the link, the information is encoded in digital form and transmitted ; after reception it is demodulated, decoded, and used to initiate the required operation, or to set off an alarm.

At present the following faults are indicated :

For the vision transmitters :

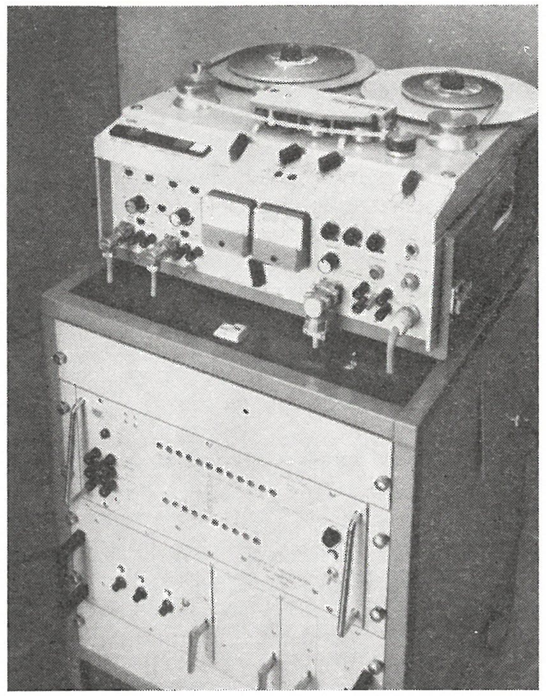
- absence of signal ;
- synchronising pulses too small ;
- white level too high or too low (on the test line).

For the sound transmitters :

- absence of programme signals in the transmitter output ;
- volume too high or too low during a given period ;
- difference between the input and output levels of the transmitter.

The telemetry signals are displayed on a synoptic panel on the control desk in the master station. By means of push-buttons, the operator is able to exercise control. The existence of a fault operates an audible alarm, and a red lamp flashing on the synoptic panel indicates to the operator which transmitter is faulty. Using the " pre-selection " keyboard, the operator can then select the transmitter for which he wishes to know details of the operating performance. The preselection keyboard also enables him to control this transmitter.

The control desk at the Bouliac transmitting station has been designed to control remotely not just one, but up to seven gap-filling transmitter stations. The keyboard, the pre-selection logic and the alarm system have been constructed on this basis. The equipment necessary for remote control of the sound and vision signals, and in particular the high-stability telemetry transmitters and receivers were designed and built by the O.R.T.F. Research Department. The data transmission equipment was manufactured by the La Signalisation company, according to O.R.T.F. Research Department specifications. We hope to publish an article describing the equipment utilised in this installation and its operation in more detail, in a future issue of the E.B.U. Review.



Sound tape-machine associated with the system for synchronisation by means of counting, enabling it to work synchronously with a television tape-machine. *(O.R.T.F. photo)*

Synchronous operation of television tape-machines. — The O.R.T.F. has introduced a system enabling a television tape-machine and sound tape-machine or two television tape-machines to be operated synchronously with each other, so that the two tapes keep exactly in step. At present, this technique meets a requirement in sound mixing ; when the video component of a programme is recorded, the accompanying sound is sometimes incomplete, and it is thus necessary to reproduce the sound signal and mix it again in a control room, so that the definitive version can be recorded on a temporary medium.

Previously, this temporary medium was a 50.8-mm (2-inch) tape which a second television tape-machine transported synchronously with the master recording. Now, a 6.25-mm (¼-inch) tape is utilised instead, providing two tracks ; one each for the programme and the synchronising signal. In the second stage, this tape is reproduced synchronously with the television programme tape, and the sound signal transferred to the latter.

The synchronous operation is controlled by the apparatus for synchronisation by counting which utilises the field synchronising pulses of the television waveform. This equipment has been designed and constructed by the O.R.T.F. Research Department.

GERMANY

New W.D.R. Regional Production Centre at Dortmund. — The main structural work on the construction of a Regional Production Centre by the Westdeutscher Rundfunk at Dortmund, which had been begun in July, 1968, was completed in April, 1969. This television and sound broadcasting studio-centre is sited some 3.3 km to the south of the town and, when complete, will have a volume of 16 200 m^3 on a site of 7840 m^2. The engineering and programme-production departments will be housed in the same building, arranged as follows: on the ground floor, the general services; on the first floor, the administrative and news departments; on the second floor, the sound programme department, on the third floor, the television programme department.

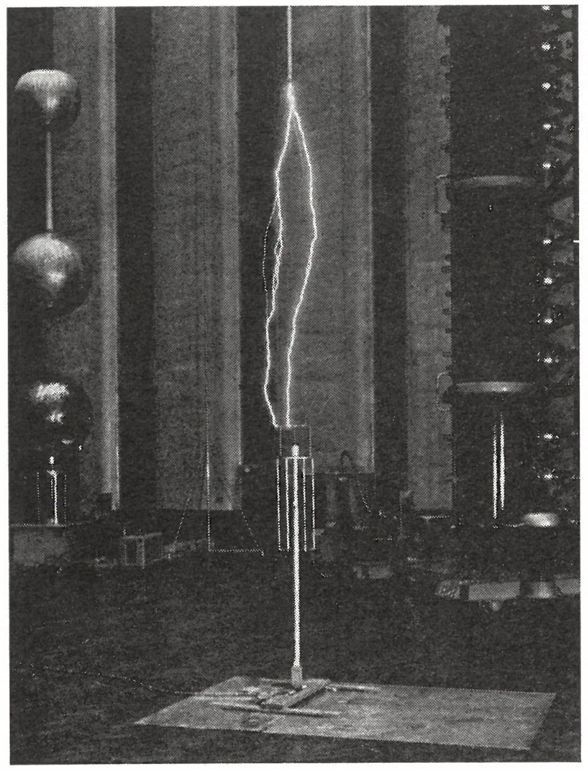
The studios will be accommodated in single-storey buildings connected to the main building. The plans provide for one sound-broadcasting studio, suitable for the production of dramatic programmes. Two talks studios for local news-bulletins and for regional contributions to the main Cologne programme are also provided for. The Television Service will have a studio of about 120 m². It is hoped that the new Centre will be ready for operations by the summer of 1970.

S.W.F.'s local news centre at Ludwigshafen. — The Südwestfunk has just opened a local studio-centre at Ludwigshafen, in the Palatinate, for the production of sound and television actuality programmes. The 140-m² complex contains three suites: an interview studio containing a Polaroid camera for producing photographs rapidly, an apparatus room provided with a simple control desk and audio tape-machine and a small film room. The actuality pictures are transmitted over D.B.P. circuits to the Mainz or Baden-Baden main production centres. The complex was taken into service in September, 1968.

Rebroadcast transmitter supplied by means of a fuel cell. — One of Hessischer Rundfunk's television transposers has already been energised for more than nine thousand hours by means of a fuel cell. The transmitter in question is at Ruppertshain in the Taunus Mountains, and it has been broadcasting the A.R.D. First Television Programme in Channel 11 since early in 1968. The fuel cell is a prototype fed by bottled hydrogen and oxygen, and supplies 100 W at 12 V, DC. It makes possible unattended operation for three months; the period of unattended operation could be extended without difficulty by increasing the capacity of the fuel containers. The cell operates in the open, without protection, and can work in temperatures ranging from — 35° to + 55° C, without change in the power or voltage. It weighs about 125 kg and its dimensions are 66 × 48 × 110 cm.

New active receiving aerial. — An active receiving aerial covering a range from 100-156 MHz has been designed jointly by the Munich Technical University and the Rohde & Schwarz company, of Munich. Measurements and trials carried out to date have given satisfactory results. The advantages of aerials of this type are their low noise, good performance as regards intermodulation, insensitivity to lightning and, in general, to bad weather, as well as being small in size.

The aerial is designed as follows: beneath a disk of diameter 30 cm there is a metal cylinder containing a solid-state amplifier, which is connected to the disk above it through a tuned circuit consisting of capacitors of small capacitance. The disk is itself protected by two metal bars, connected to earth and rigidly fixed to the earth-screen. The amplifier power supply is fed to it by means of the same coaxial cable, inside the support-tube, which conveys the amplified RF signal.



Discharge test of an active receiving aerial in the HV laboratories at the Munich Technical University.
(Rohde & Schwarz photo)

In case of a direct lightning stroke, the discharge current is carried by the two metal bars, and there is no magnetic field inside the cylinder containing the solid-state amplifier. If the lightning strikes the ground near the aerial, again there is no discharge through the amplifier.

The passive part of the aerial, that is to say, the upper disk, known as the " roof ", is designed so as to act as a bandpass filter for the specified frequency bands; there is consequently no need to introduce any separate filters between this passive element and the amplifier.

Even when using a long feeder, introducing considerable attenuation between the aerial and the receiver, reception is said to remain satisfactory, because of the gain of the solid-state amplifier.

Broadcasting Exhibition. — The 1969 German Broadcasting Exhibition will be held from 29th August to 7th September, at Stuttgart. The A.R.D. and the Z.D.F. will operate jointly a colour-television studio having a stage of about 750 m², with seating for an audience of about 1500 on an area of 875 m². The Exhibition itself will cover an area of 42 000 m², arranged in fifteen halls, where some 120 exhibitors will display their products.

Meeting of the Fernsehtechnische Gesellschaft. — The next meeting of the F.T.G. will be held at Bremen from 7th to 9th October, 1969.

* * *

Television in Eastern Germany. — A second television programme will be broadcast, beginning on 3rd October, 1969, in Eastern Germany. The transmission schedule will be twenty-one hours weekly, including four hours in colour, and it will be broadcast on UHF by stations at Berlin, Dresden, Dequede and, for colour only, Schwerin. The colour programmes, using SECAM III-B standards, will take place on Fridays, Saturdays and Sundays.

ITALY

Mobile film processor. — Until recently the film processing vehicles utilised by the RAI required to be connected to an external water supply before use, so that the washing operations during and after processing could be performed. This requirement has been found to be a serious disadvantage, since it restricts the choice of sites where these vehicles may be used.

To eliminate this problem, the RAI has designed a vehicle which can be made completely independent of water supplies. This design has been possible due to the use of Maurer developing equipment: the " Matic 153 M ", suitable only for processing 16-mm negative film, does not in fact utilise any stage of washing in running water. The chemical process performed in this equipment consists of a single combined developing and fixing bath followed by a rapid stop-bath without a final wash. The stability of film treated in this way is sufficient to allow it to be used up to 10 days later. If the material is to be retained longer, it should be passed through a normal fixing bath.

In this system, the film may be scanned for broadcasting within a very short time. The equipment is very simple, and can be operated in daylight, by the use of 30-m and 120-m magazines. The average production speed is approximately 150 m/hour, depending on the chemicals and types of film used.

The small size of processing machines of this type makes it possible to install two in a van (such as the Lancia Superjolly) *(Fig. 1)*, in which the bodywork has been specially adapted to permit editing facilities to be installed also.

As can be seen in *Fig. 2*, the two processors have been mounted symmetrically on the two sides of the vehicle, and a hood fitted above them to extract the hot air arising from the drying apparatus.

The editing facilities are installed directly behind the driving cabin. They may be separated from the developers by a black curtain, so that the magazines may be loaded while editing is in progress. The editing desk and the film-rewinding disk can be seen in the centre of the photograph. The editing disk, which was built by the Italian firm " Intercine " to specifications issued by the RAI, is able to transport up to four films in either direction at normal speed (25 frames/s) or at double speed. Sound tracks recorded on magnetic stripes, or on separate 16-mm film can be reproduced also. The shelves visible in the photograph are used to store the photographic chemicals and editing materials.

It is also possible to adapt the vehicle to accommodate portable equipment for transferring sound tracks on 6.25-mm tapes to perforated magnetic film.

Changes in the management of the RAI. — As the result of an error in translation, the news item published on p. 128 of E.B.U. Review No. 115-A is partly incorrect.

Mr. L. Paolicchi has in fact become Managing Director in place of Mr. Granzotto. Mr. E. Bernabei remains the Director-General of the RAI.

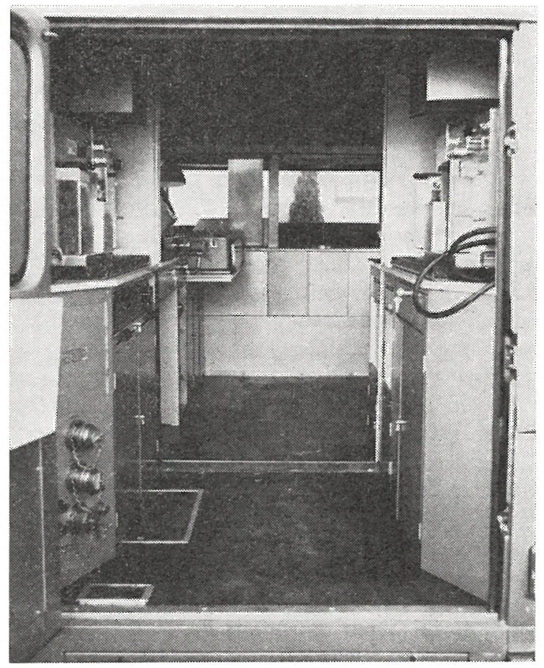


Fig. 1 *(above)*. — The RAI's rapid film-processing vehicle.
(Trevisio photo)

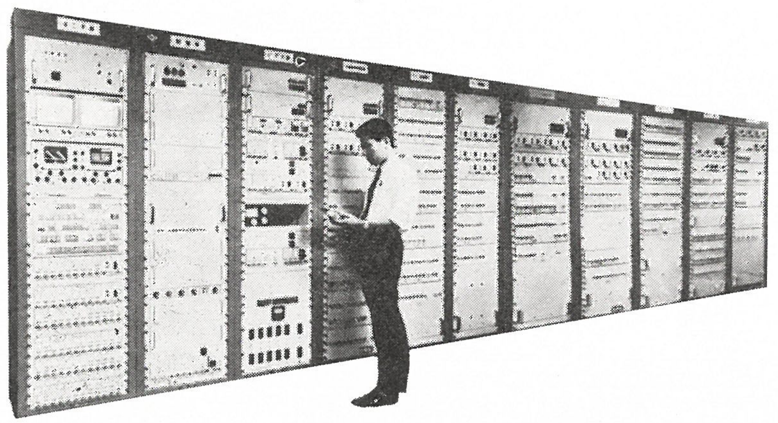
Fig. 2 *(opposite)*. — Interior of the film-processing vehicle. In the foreground are the developing machines; the editing desk is on the left at the rear.

JAPAN

Development of the N.H.K. standards-converter. — It will be recalled that on the occasion of the demonstrations* of 525/60 (NTSC) : 625/50 (PAL) conversion in London in January, 1969, arranged by the Conversion Sub-group of E.B.U. Working Party M, the Nippon Hoso Kyokai presented tapes of signals converted by means of an experimental converter whose development was then nearing completion. The results demonstrated were nevertheless considered promising. The development model of the converter has recently been completed and demonstrations of conversion in both senses between 525/60 (NTSC) and 625/50 (PAL and SECAM) were given in Tokyo at the beginning of June, 1969, attended by representatives of the Japanese Telecommunication Administration, the K.D.D. (Japanese oversea telecommunication authority) and the National Association of Commercial Broadcasters. A similar demonstration was arranged for Mr. G. Hansen, Director of the E.B.U. Technical Centre, when he visited Tokyo recently. The general opinion was that the quality of the converted pictures is very good.

The principle of functioning is based upon the use of a switchable cascade of delay devices, and the development model demonstrated in Tokyo still retained the shortcoming of the experimental model used for the London demonstrations, in that the scanning of the converted signal is necessarily synchronised with that of the input signal, whereas operationally it is almost essential that it should be possible to synchronise the output signal with the other local picture sources. At present this involves tape-recording and reproduction. Development work is, however, already well advanced on a design which will provide the necessary flexibility, and it is expected that its development will be complete in time for the EXPO-70 in Japan next year.

* reported in E.B.U. Review No. 113-A (February, 1969), pp. 51-52.



The development model of the N.H.K. standards-converter, providing conversion with transcoding in either direction between the 525/60 (NTSC) and 625/50 (PAL and SECAM) television signals.

(N.H.K. photo)

KENYA

Growth of the Kenya Institute of Mass Communication. — The final stage of the construction of a fully-equipped training centre for broadcasting staff was recently completed when the sound and television studios of the Kenya Institute of Mass Communication were officially opened. The Institute, which started in temporary accommodation in July, 1965, was set up under the first five-year development plan of the Kenya Government, in order to provide qualified staff to take the place of European specialists returning to their home countries and to meet the needs of expanding operations. A former Chief Engineer of the Voice of Kenya, Mr. R.G. Davey, directed the Institute from its foundation until his retirement in July, 1969.

The permanent buildings, whose foundation stone was laid in October, 1967, occupy a 2-hectare site in the surburbs of Nairobi. They include offices and classrooms as well as the studios and a film theatre in a single block having a surface area of 1100 m², and there are separate laboratories and a common-room for teaching staff. Future expansion will add an administration building, five more laboratories and residential accommodation for a hundred students. The technical facilities in the new studios and their control rooms, such as the sound and television tape-recording equipment, will enable students to obtain experience under realistic conditions.

Fifty-two students are attending courses at present ; ten in each of the four years of the Engineering course, and two classes of six are attending the Technical Operations course. The completion of the studios will enable an additional seventy-two trainees in sound and television production and associated subjects to be accepted. The teaching staff will total fifteen, including seven lecturers responsible for the Production courses.

Other functions undertaken by the Institute are the provision of revision and supplementary training for employees of broadcasting organisations and the duties of an examining body in issuing certificates of ability to those students qualifying for them.

Although the Institute is intended primarily for broadcasting staff, persons following certain other occupations may benefit from a knowledge of modern communication technology. For this reason, the introduction of courses in audio-visual techniques for schoolteachers and agricultural advisers is now being considered. The value of the present courses in meeting African needs has already been appreciated beyond the frontiers of Kenya, and applications have been received from students in several other countries wishing to attend them in the coming months.

NETHERLANDS

The VARA's new concert studio. — On 3rd May, 1969, the new concert hall constructed for VARA was officially inaugurated in the presence of the Dutch Minister of Culture. This hall is to be the home of the Philharmonic Orchestra, which is the principal broadcasting orchestra in the Netherlands. An interior view of the new building is reproduced in *Fig. 1.*

The hall can accommodate an audience of 400, and its stage is large enough to take a chorus of 180. The acoustic design has received particular attention. Panels of five different thicknesses have been attached to the walls ; they also fulfil an architectural function. A reflecting screen has been suspended over the stage, to direct the sound towards the audience. Microphone booms project through the screen ; they may be adjusted from behind it.

The average reverberation time of the hall, which has a volume of 7350 m³, is 1.9 s. The seating is arranged in tiers, thus ensuring that all members of the audience have a clear view of the stage. Technical facilities include a sound control room, a recording cubicle, three echo rooms, an announcer's booth, and several dressing rooms and rehearsal areas. The whole of the stage can be seen from the sound control room. All equipment is suitable for stereophonic operation.

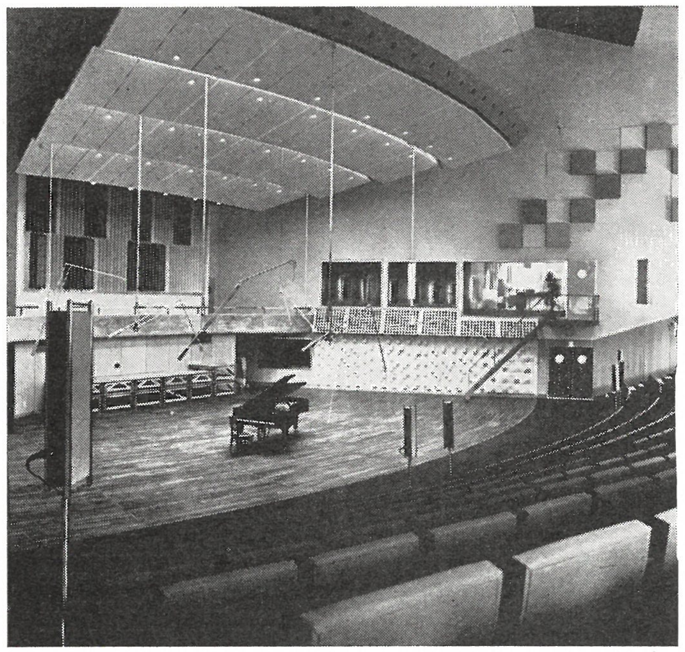


Fig. 1. — Interior view of the VARA's new concert studio. The control room can be seen at the rear on the right. The directional loudspeakers are mounted in front of the reflecting screen. *(Studio-AP photo)*

The air-conditioning and heating installations are in the basement. In order to satisfy the needs of sound broadcasting, particularly large ventilation ducts fitted with noise absorbent material have been utilised.

The stereophonic equipment was designed in close collaboration with the N.O.S. Research Department. It is similar to that which has recently been installed in other studios. *Fig. 2* shows the stereophonic sound desk.

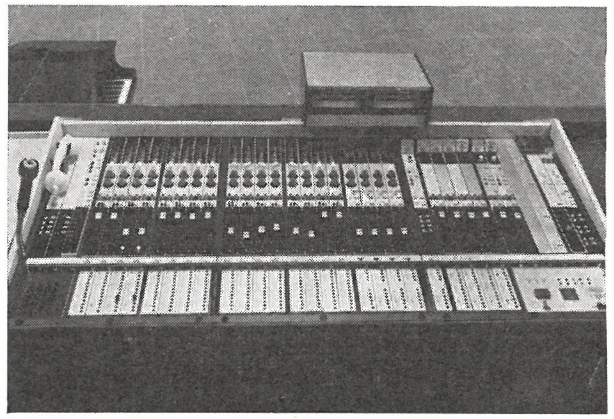


Fig. 2. — Stereophonic sound-control desk designed by the N.O.S.

(J.H.C. Vermeulen photo)

It provides 16 microphone channels, and may be expanded by the addition of a mobile mixer with 8 inputs. Tape or disk reproducing equipment may also be connected to it.

A public address system may be operated from the sound control room. To avoid interference to the studio microphones, an array of directional loudspeakers has been installed in front of the reflecting screen, and extra loudspeakers may be provided among the audience also.

So that the acoustic characteristics of the hall could be studied before its construction was started, a model at one-tenth scale was built : frequencies were ten times higher than normal, and model instruments and spectators were one-tenth life-size. Very small loudspeakers and capacitor microphones were used ; *Fig. 3* shows the interior of this scale model, with the " conductor " and several " musicians ".

With the help of this model, the reverberation time, the diffusion and clarity of sound, and annoying echos were studied. The model was also used for subjective judgements ; recordings were made in free space without acoustic pre-conditioning, various instruments or groups of instruments being recorded on separate tracks.

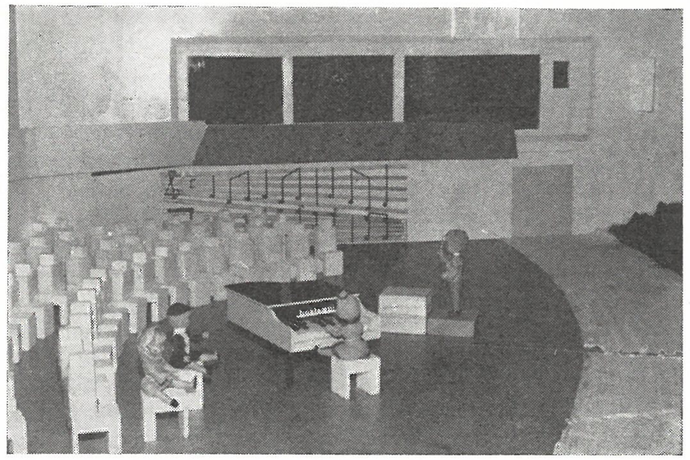


Fig. 3. — The interior of the 1/10th scale model of the hall.

(LAB photo)

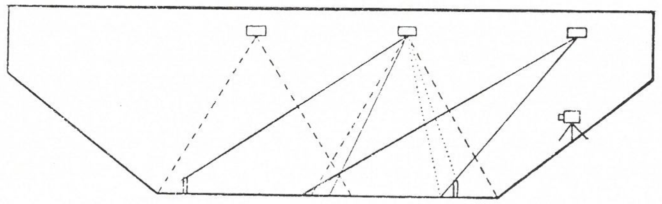
After transposition to frequencies ten times higher, the recordings were reproduced by miniature loudspeakers within the model. The high-frequency sound diffused by the various surfaces in the model was then re-transposed back to the original frequency range, and reproduced through head-phones. The effect was that of being in the hall. This method was used at various locations within the model in order to evaluate reflections at different frequencies.

Reduction of bandwidth transmitted on MF. — Following the news item published on this subject in E.B.U. Review No. 115-A (p. 129), it should also be reported that, as well as Hilversum III, two other transmitters have been equipped since 1st July, 1969 with a filter reducing the bandwidth according to the characteristic reproduced in that issue. They are Hilversum I, transmitting on 746 kHz, and Hilversum II, on 1007 kHz.

SWEDEN

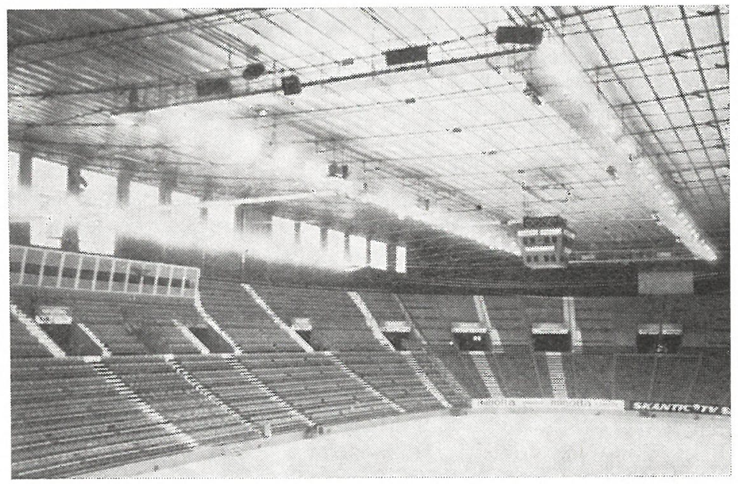
World Ice-Hockey Championship. — Sveriges Radio utilised colour-television cameras for its coverage of the World Ice-Hockey Championship which was held in Stockholm from 15th to 30th March 1969. As S.R. does not yet have any colour outside-broadcast vehicles, the equipment which had been supplied for the Stockholm Television Centre and which had not yet been installed there was used instead. The following equipment was installed for the occasion :

a) a complete video installation with four colour cameras ;
b) four radio-relay links from the ice-stadium to the Television Centre ;
c) a slow-motion television tape-machine, and a colour sync. pulse generator, hired specially ;
d) special lighting equipment ;
e) facilities for 25 commentators.



——— Key lighting
- - - - - - Fill-in lighting

Section through the ice-hockey stadium used for the world championship matches, showing the position of the lighting gantries.



Overall view of the stadium showing the three lighting gantries.
(Sveriges Radio photo)

Three cameras were equipped with Varotal IX zoom lenses and one with a Varotal XVI lens. All four cameras could be controlled by a single technican. Two vidicon cameras were used for captions indicating the teams and results, etc.

The original lighting arrangements consisted of two gantries, 15 m above the ice-rink, with luminaires beaming straight down, and producing 400 lux. In order to increase the intensity, and to eliminate the players' shadows arising with this installation, S.R. installed supplementary lighting which provided key illumination for the cameras. The new luminaires were mounted on an extra gantry, and together with the original installation adequate intensity was obtained without any reflected light reaching the spectators. To eliminate the shadows in the corners which might mislead the players, five 2-kW spotlights with 4° beams were

directed along the sides of the field. All luminaires used 2-kW tungsten-halogen lamps with a short lifetime (200 hours). The total of 120 light sources having an aperture of 36° provided a uniform luminous intensity of 1700 lux throughout the rink with a colour temperature of 3100° K. The natural colouring of the ice was not altered.

The camera output signals were fed to a six-channel mixer, from which they were relayed to the Television Centre, six kilometres away. The output from the slow-motion television tape-machine was sent back to the control room at the ice-rink, where a two-channel mixer enabled the choice to be made between the live signal and the recordings. The live signals were also recorded at the Television Centre so that they might be broadcast again later, with additional slow-motion inserts if desired.

Collaboration between film and television experts. — Experts from film and television circles in the four Scandinavian countries (Denmark, Finland, Norway and Sweden) meet periodically under the auspices of an organisation know as the " Nordic Film and T.V. Union " (NFTU), when they can discuss common problems, particularly technical information and training, as well as standardisation and the training of production staff.

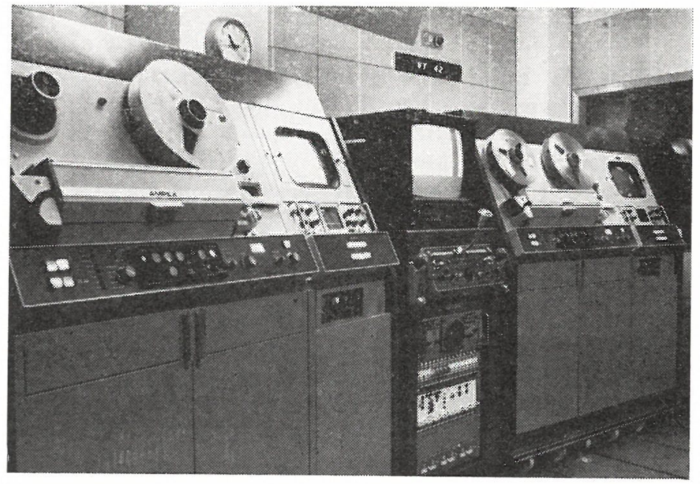
UNITED KINGDOM

B.B.C. Television Service's new television tape transmission area in service. — Suite No. 2 in the B.B.C.'s new television tape transmission area at the Television Centre, London, was brought into service recently, followed a few weeks later by Suite No. 1.

The complete area comprises two identical suites of four rooms which are utilised separately for the machines, the apparatus, their control and review purposes. It represents a new concept in which each television tape-machine is installed for the specific operation of either recording, replay or editing, whilst still being capable of universal use to a limited extent. The whole new area, of which each Suite forms one half, is primarily intended to provide replay facilities for direct transmissions by both B.B.C. networks ; it has limited recording capabilities and is not equipped for electronic editing.

Each machine room contains two of the latest Ampex VR 2000 B machines which are a later version of the VR 2000, and are fitted with Amtec, Colortec and Velocity Compensator, so providing high-quality, fully colour-synchronous reproduction. It also contains a console on which are mounted the recording and colour-monitor selection push-buttons, intercom-selection switches, a vectorscope and telephones for both machines.

An interesting feature of the installation concerns the mounting of the machines themselves and the associated consoles in the machine rooms. Because of the limited space available, it was necessary to mount them as close as possible to the wall, which would have rendered rear access for maintenance purposes virtually impossible.



The television tape transmission area at the B.B.C. Television Centre.

Above : the television tape-machine cubicle showing the two Ampex VR 2000 B machines and the control console.

Left : the control room, with the main control desk, the tape-machines, and the sound and vision monitoring facilities.

(B.B.C. photos)

The difficulty has been overcome by mounting the units on castors and providing flexible cable and ventilation connections, thus enabling each unit to be pivotted forward when rear access is required. The adjoining control room in each suite provides good monitoring conditions and is equipped with a colour-picture monitor, two monochrome-picture monitors and a control desk on which are mounted the control panels for the remote control of the recorders, video, sound and facilities routing, communications, interconnections with the adjacent suite and a waveform monitor.

Each apparatus room, to the rear of its associated control room, contains the bay-mounted vision and sound equipment for the suite.

The review room, on the other side of each suite, is a small cubicle equipped with a colour monitor, control box and waveform monitor, together with an intercom-set and peak-programme meter. A high-quality loudspeaker is also fitted, together with a digital elapsed-time indicator. These engineering review cubicles are provided so that the second machine in each suite can be used independently when the first VTR and the control room are in use.

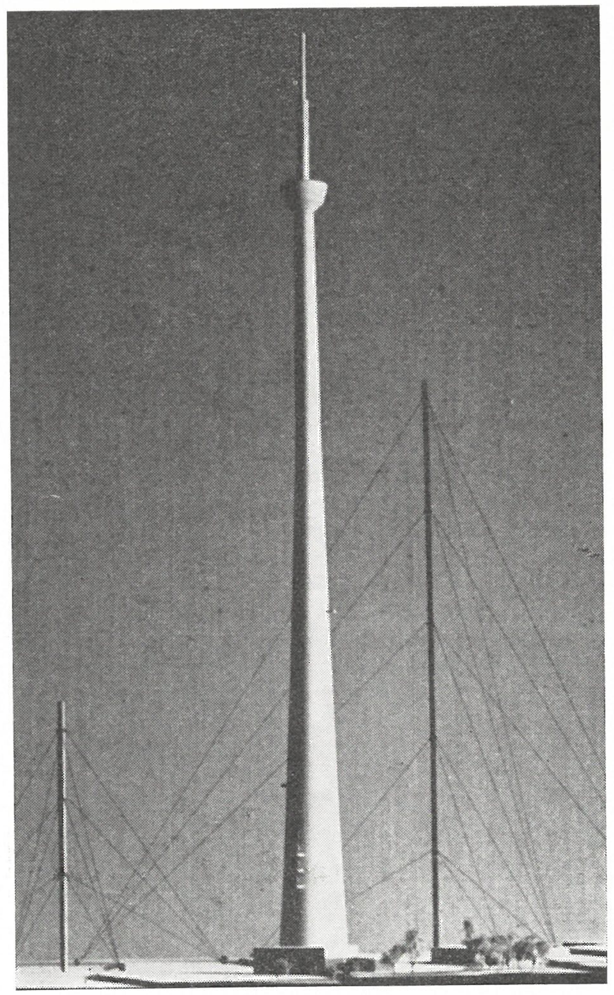
The two suites in the new area are arranged as mirror-images, but are otherwise identical. It is intended that each suite will serve one Network, replaying all transmission tapes for it.

I.T.A. to build U.K.'s first concrete aerial support tower. — The Independent Television Authority is to build a 329-m high concrete aerial support tower at Emley Moor, Yorkshire to replace the 386-m tubular steel mast which collapsed last March (see E.B.U. Review No. 114-A, April 1969). To the 274-m level, the new tower will be a self-supporting reinforced concrete structure ; this is the first time that a high tapered concrete tower has been proposed in the United Kingdom to carry television broadcasting aerials. The new aerials are expected to be in use before the end of 1970 ; in the meanwhile, Yorkshire Television programmes will continue to be radiated from the I.T.A. 205-m lattice steel mast which was erected, as an interim measure, in the four weeks following the collapse of the 386-m mast.

The new concrete tower will have a base diameter of 24 m tapering to 6.1 m at the 274-m level, where there is to be an enclosed room equipped as a radio-relay link receiving station for outside broadcasts. This will be surmounted by triangular lattice steel sections carrying UHF and VHF aerials, and bringing the total height to 329 m. The aerials will be enclosed within glass-fibre panels. It may prove possible for these lattice sections to be assembled within the base of the tower and then lifted in single operations ; this would save up to two months in construction, but is thought to be the first time that such an operation has been proposed. The concrete tower and foundations will weigh more than 14,000 tons.

Although a concrete tower to this height is more expensive than a conventional stayed mast, I.T.A. engineers consider that it can be completed much more quickly than the possible alternatives, and will be more pleasing aesthetically. Construction of the concrete tower, at a rate of about 10 m per week, will take from about mid-November 1969 to about mid-June 1970 ; the UHF aerials will then be installed and brought into operation before the end of the year.

Meanwhile the investigations into the collapse of the Emley Moor tubular stayed mast have been continued by the Independent Committee of Inquiry in association with the Authority's engineers and consultants, but are proving a most complex technological " detective story ". In an interim report the Committee discounted the possibility that the mast could have collapsed solely as a result of differential ice loading on the stays, as had been initially thought likely. As a result, very thorough surveys were made immediately on the two further I.T.A. masts of this type at Winter Hill, Lancashire and Belmont, Lincolnshire. The examinations brought to light some dents and possible structural weaknesses. Immediate steps were taken to strengthen the masts and to install further monitoring



Model of the new I.T.A. tower at Emley Moor, showing also the temporary BBC-2 aerial mast (left), and the temporary I.T.A. mast (right).

instruments. In the interest of safety, it was felt advisable, until the completion of the strengthening alterations, to operate both stations in an unmanned mode for periods of a few weeks.

To allow this to be done, temporary control and monitoring points were established in caravans some distance from the stations. The radiated power of the ITV transmissions at Belmont is 20 kW (peak white) vision, while at Winter Hill it is 100 kW (peak white) both on the 405-line standard. VHF transmitters of similar powers broadcasting the BBC-1 programme, and 500-kW VHF transmitters radiating the BBC-2 programme are also installed at both stations.

UNITED STATES

Development of VHF/FM sound broadcasting. — The number of VHF/FM sound broadcasting stations has grown from 1575 in 1966 to 1706 in 1967 and the total income of those stations increased by 23 % during the year. An example of the increased importance attached to this service by American Broadcasters is given by the decision to appoint an engineer-in-charge in VHF/FM stations associated with MF stations ; previously a single person was usually responsible for the operation of both stations.

The proportion of households able to receive VHF/FM broadcasts had reached 47 % by 1968.

SMPTE Convention. — The 106th Convention of the Society of Motion Picture and Television Engineers will be held from 28th September to 3rd October, 1969, at Los Angeles. During the first three days, some fifty lectures will be given ; the final two days are to be devoted to Super-8 films, and a dozen communications will be presented on this subject.

As usual, an equipment exhibition, in which some sixty firms will participate, will be held during the Convention.

Broadcasting stations on the high seas

Toward the end of 1968, the German press reported the forthcoming entry into service, off the coast of the German Federal Republic, of a new pirate transmitter installed aboard the Galaxy, which had previously been utilised by the Radio London transmitter which closed down in August, 1967*. The ship, which is registered in Honduras, belongs to a company with headquarters in Switzerland. It has been in the port of Hamburg since the beginning of this year, awaiting the completion of the transmitting equipment before sailing.

It is unlikely that this projet will now materialise, because on 2nd January, 1969, the German Federal Parliament passed an Act bringing into force the terms of the European Agreement of January 1965, aiming at suppressing pirate broadcasting stations. This Act prohibits any participation in the activities of broadcasting stations on the high seas or of the ships in which they are installed. It provides for sanctions against any person or company supplying or maintaining the equipment, provisioning the ship or taking any part in the broadcasts themselves. The Act also considers it illegal to broadcast advertising material from such stations.

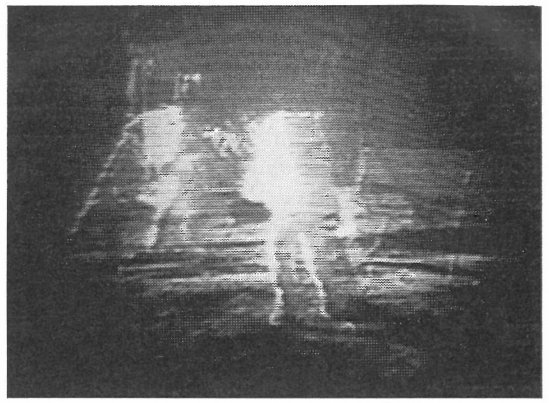
* See E.B.U. Review, No. 104-A, August 1967, p. 168.

Expansion of television during 1968

A mistake has been discovered in the tables published on pages 92 and 93 of E.B.U. Review No. 114-A, in which the expansion of television services was compared for each country at the end of 1967 and at the end of 1968. The number of hours per week at the end of 1968 for the second television programme in Federal Germany (ZDF 2) should be :

53.20 total hours of programmes
9.15 hours of programmes in colour

instead of the figures printed.



(B.B.C. photo)

Live transmission from the Moon, as seen by European viewers.

Televised broadcast of the Apollo 11 operation

Every year, since the inauguration of Eurovision in 1954, there has been at least one international television programme transmission which has caught the imagination of the public. The most outstanding transmissions in 1968 were those from the Olympic Games in Mexico, but in 1969 it is the Apollo 11 moon-landing on Monday, 21st July, which will long be remembered.

The arrangements for the television coverage of this historic occasion were basically similar to those for the previous Apollo missions*. The programmes distributed by Eurovision were produced by a small E.B.U. team based at the Mission Control Center at Houston, Texas, making use of the U.S.A. network pool signals as well as the output of its own colour cameras. This international team was led by Mr. R. Francis (B.B.C.), as Coordinating Producer, with Mr. J. Bouillon (O.R.T.F.) as Coordinating Engineer.

The pictures received from the Command Module ("Columbia") were produced using a specially-developed field-sequential colour camera, operating on the 525-line 60-field system. Conversion to the standard NTSC colour signal was performed on the ground, using a disk store and a tape-machine to compensate for errors in frequency due to the Doppler shift. Because of power-supply limitations, however, the camera set up by the astronauts on the surface of the moon was the earlier monochrome design, and it produced ten pictures per second of 320 lines each. The resolution was noticeably reduced, but was sufficient to show clearly Commander Neil Armstrong and Lunar Module Pilot Edwin Aldrin performing their duties, despite the high contrast of the illumination on the lunar surface.

According to the original plans, the television signals should have been routed across the Atlantic Ocean via the Intelsat-III (F2) satellite, but as this satellite became faulty at the end of June, 1969 it was necessary to make use of the Intelsat-III Pacific and Indian Ocean satellites instead, linked via the Ibaraki and Yomaguchi Earth-stations in Japan. This path introduced a delay of approximately 0.5 second, and special arrangements had to be made to retard the sound channels, routed via the transatlantic telephone cables, in order to retain synchronisation. The European Earth-station was normally Goonhilly, so as to minimise the terrestrial distance to the B.B.C. electronic colour standards converter in London, but the Earth-station at Raisting was also used on a number of occasions.

Each of the twenty-three European and North African Members of the E.B.U. linked by the terrestrial Eurovision networks received some or all of the twenty-eight multilateral transmissions having a total duration of more than twenty hours. The signals were also relayed via the Intervision network to seven countries in Eastern Europe. Fourteen E.B.U. Members made use of the colour programmes, although only half that number have as yet officially started colour broadcasting. Despite the distance of more than 500 000 km covered by the colour signal (which thus set a new record), and the several transcoding processes to which it was submitted, fully satisfactory reception was reported in Europe.

Public interest in the mission reached a climax in the early hours of Monday, 21st July, when the astronauts first set foot on the lunar surface. At 0300 GMT, the live transmission was being watched by so many viewers that electrical power consumption was reported to be exceptionally high in many European towns.

An attempt was made to launch a replacement Intelsat-III telecommunication satellite into the mid-Atlantic position in time for it to be used in relaying the "splash down", but this was unsuccessful. In consequence, the live broadcast of the astronauts' arrival aboard the aircraft carrier USS Hornet and the speech of welcome by President Nixon were transmitted by the same route as for the earlier stages of the mission, except that a transportable Earth-station had been erected aboard the Hornet to provide the initial link to Houston. This is believed to be the first time that broadcast television signals have been relayed by three Intelsat satellite links in tandem.

* See E.B.U. Review No. 113-A, p. 44.

ABSTRACTS AND REVIEWS

Under this heading we shall mention, in each number, recent publications and a selection of articles published in technical periodicals which seem to us to be of real interest to sound and television broadcasting engineers. We shall restrict ourselves to giving, in a very concise form, an idea of the contents, at the same time indicating its technical level by means of the following symbols.

Level A : articles requiring a knowledge of advanced mathematics or considerable other specialised knowledge on the part of the reader.

Level B : articles corresponding in technical level to the average engineer's training.

Level C : articles that do not call for any very special technical knowledge on the part of the reader.

It must be emphasised that this classification refers uniquely to the degree of difficulty of understanding the articles, and in no way the value of the articles as such. The mention of an article under this heading should not be taken as indicating in any way the E.B.U.'s opinion on the matter in question.

(Editor)

Some noteworthy articles

Bernanek, L.L. : **Audience and chair absorption in large halls. II.**
The Journal of the Acoustical Society of America, No. 1, 1969, pp. 13-19.

Level B.

Describes three methods of calculating acoustic absorption : the equivalent sound-absorption coefficient, the absorption per unit of floor area, the absorption per person. Results of these measurements.

* * *

Walliser, K. (Munich Technical University) : **Über die Abhängigkeiten der Tonhöhenempfindung von Sinustönen vom Schallpegel, von überlagertem drosselndem Störschall und von der Darbietungsdauer** (On the relation between the apparent pitch of sinusoidal tones and their loudness, the superposed masking sound and the duration of the observation).
Acustica, No. 4, 1969, pp. 211-221.

Level B.

Experimental study of the factors, apart from frequency, which affect the subjective sensation of the pitch of a sinusoidal tone. Systematic and reproduceable variations of up to half a musical tone.

* * *

Shorter, D.E.L. and Manston, W.I. (B.B.C.) : **The automatic control of sound signal level in broadcasting studios.**
B.B.C. Engineering Division Monograph, No. 77, March 1969.

Level B.

Examination of the problems involved in the automatic regulation of the volume of sound programmes, in particular in ensuring that the operation is sufficiently unobtrusive. Fundamental limitation due to the impossibility of predicting changes in levels and the regulation of high, low and intermediate signal levels are discussed with reference to various characteristic curves and programme types. Survey of prospects for future developments.

Bäder, K.O. and Blesser, B.A. : **Ein Kompressorsystem mit variablen Eigenschaften und Pulsdauermodulation** (An adjustable compressor for pulse-width modulation).
Radio Mentor Electronic, No. 12, December 1968, pp. 865-868, No. 1, January 1969, pp. 31-34.

Level B.

Basic design of a dynamic compressor, suitable for stereophony. Static and dynamic characteristics adjustable over a wide range and adaptable to the nature of the programme, thanks to automatic gain controls included in the limiter and compressor.

* * *

Leuthold, P. (E.T.H., Zurich) : **Das Abtasttheorem als Hilfsmittel zur anschaulichen Darstellung der Theorie der Einseitenbandmodulation** (The sampling theorem as a means of visual presentation of the theory of single sideband modulation).
Nachrichtentechnische Zeitschrift, No. 2, February, 1969, pp. 65-69.

Level A.

Treatment of the theory of SSB on the basis of the presentation as the sum of functions of time having a limited bandwidth. Consequences on methods of modulation.

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Egidi, C. (IENGF, Turin) and Oberto, P. (CSELT, Turin) : **Modulation enveloppes. Tables of contours and harmonic components.**
Alta Frequenza (English edition), No. 5, May 1969, pp. 385-389.

Level B.

Tables for calculating AM envelopes subject to distortion, completing the earlier articles on the same subject by these authors.

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van der Plaats, J. (Eindhoven Technical University) : **The power spectrum of a video signal.**
NTZ Communications Journal, No. 5, May 1969, pp. 292-296.

Level A.

Recapitulation of the autocorrelation function. Contributions of the parallel lines of the picture, which belong to the same field, on the one hand, or to two different fields, on the other hand. Power spectrum of the 625-line system. Distribution of the power as a function of the structure of the picture.

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Gralén, K. (Göteborg Technical University) : **Die Bildabtastung mit Zeilensprung der Ordnung fünf** (Fivefold interlaced scanning).
Archiv der Elektrischen Übertragung, No. 5, May 1969, pp. 258-260.

Level A.

Theoretical study of the spectrum of the signal corresponding to a picture scanned with fivefold (instead of double) interlacing, which should lead to a substantial increase in the information transmitted without requiring a wider frequency band or giving rise to flicker. Condition for proper aperture correction.

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Kante, H. (F.T.Z.) : **Verfahren zur Übertragung einzelner Fernsehbilder auf normalen Fernsprechleitungen** (A method of transmitting individual television pictures over an ordinary telephone circuit).
Fernmelde-Praxis, No. 6, 25th March, 1969, pp. 230-233.

Level B.

The information is stored on a magnetic disk rotated, in recording, at high speed and, in reproduction, at a much lower speed (e.g. one-thousandth of the recording speed), which provides the necessary reduction of the bandwith required.

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Shorter, D.E.L., Chew, J.R., Howorth, D. and Sanders, J.R. (B.B.C.) : **Pulse-code modulation for high-quality sound-signal distribution.**
B.B.C. Engineering Division Monograph No. 75, December, 1968.

Level B.

The application of pulse-code modulation techniques to transmission is discussed, with particular reference to comptability with existing p.c.m. systems used for telephony. Various coding and decoding techniques are compared, and the advantages of the utilisation of compression are examined. The incorporation of the sound component of a television programme in the form of a p.c.m. signal inserted in the synchronising pulses of the video waveform is described, and the design procedure for a system providing an effective bandwidth of 14 kHz and signal-to-noise ratio of 70 dB is outlined.

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Kersten, R. (Siemens) : **Fernsehübertragung mit Pulscodemodulation** (Television transmission by coded-pulse modulation).
Fernseh- und Kino-Technik, No. 5, 1969, pp. 139-141.

Level C.

Specific requirements for coding television signals. Description of a coding device. Possible application.

* * *

Hüschemenger, R. (Osram) : **Moderne Lichtquellen für Film, Photo und Fernsehen** (Modern light-sources for film, photography and television).
Fernseh- und Kino-Technik, No. 4, 1969, pp. 106-110.

Level C.

Details of manufacture and utilisation of the types of halogen filament lamps at present on the market. Recent trends (use of bromine, annealed glass, low-voltage supply, miniaturisation). Reasons for certain operational instructions.

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Kügler, I. (Osram) : **Entwicklungstendenzen von Entladungslampen für Projektion und Farbfernsehen** (Trends in the design of discharge lamps for projection and colour television).
Fernseh- und Kino-Technik, No. 4, 1969, pp. 111-114.

Level C.

Details of manufacture and utilisation of modern discharge lamps : xenon, halogen, metallic-vapour, short-arc and long-arc lamps. Operational use.

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Schulze, A. (Saarländischer Rundfunk) : **Betriebserfahrungen mit Farbfernsehmaterial** (Operational experience with colour-television material).
Fernseh- und Kino-Technik, No. 5, 1969, pp. 145-146.

Level C.

Some problems encountered in obtaining consistent copies with the film-stocks at present on the market.

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Wood, C.B.B. (B.B.C.) : **Some considerations in the television broadcasting of color-film.**
Journal of the SMPTE, No. 4, April 1969, pp. 256-260.

Level B.

Examination of the characteristics of the film and reproducing equipment liable to lead to unsatisfactory televising of colour films : the film, camera and film-scanner contrast, the film and display-tube whites, the colour-analysis in the film-scanner, the colour saturation. Possible means of correction : variation of the film-scanner gamma, standardisation of film-scanners, electronic masking.

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Quinn, S.F. (Canadian Broadcasting Corporation) : **An engineering approach to color telecine - Introduction.**
Journal of the SMPTE, No. 3, March 1969, p. 137.

Level C.

Description of the problems encountered when scanning colour films. Statement of three criteria leading to better colour reproduction from the film-scanner and more consistent appraisal of films intended for televising. These criteria have been put into practice and are described in the three articles mentioned below.

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Quinn, S.F. (Canadian Broadcasting Corporation) : **Film review rooms for color television.**
Journal of the SMPTE, No. 3, March 1969, pp. 138-140.

Level B.

Advantages of a viewing room for appraising films intended for televising in colour. Details of the viewing room designed by the C.B.C. (and since then taken into operational service) : it contains essentially a projection screen of the same size as the screen of an average receiver, with an illuminated white surround for ensuring the adaptation of the eye to a constant reference white. These principles are at present under study by E.B.U. Sub-group G3 with a view to international standardisation.

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McRae, D.H. (Canadian Broadcasting Corporation) : **High-quality color rendition in color telecine.**
Journal of the SMPTE, No. 3, March 1969, pp. 140-145.

Level B.

Study of the photometric characteristics of a film-scanner suitable for televising colour-films in the optimum fashion, complying with the criterion adopted by the C.B.C. for objectively defining the quality of the scanning : identical brightness and chromaticity of the picture obtained by optical projection at 6500°K and that displayed on the picture-monitor.

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Corley, F.D.E. (D. & S. Corley Ltd.) : **Color telecine alignment slides.**
Journal of the SMPTE, No. 3, March 1969, pp. 145-148.

Level B.

Description of three types of test-slides designed by Canadian manufacturers on the basis of a C.B.C. specification : one slide has a five-step grey-scale obtained by colorants, a second has six colour-bars and the third has a silvered pattern of five black squares on a white ground, used for detecting stray light in the film-scanner chain. Method of manufacture and instructions for use.

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Progress Committee Report for 1968.
Journal of the SMPTE, No. 5, May 1969, pp. 315-362.

Level C.

Summary of progress accomplished during 1968 in the various parts of the film and television world. New equipment placed on the market and new techniques employed in the United States in the following field : studio lighting ; films, both negative and positive ; processing and editing of films ; camera lenses ; magnetic recording of sound and picture ; use of 8-mm film ; cameras and projectors for 16-mm and 35-mm film ; high-speed cinematography ; design and operation of cameras in artificial satellites ; the development of television cameras, outside-broadcast and transmitting equipment, in particular for colour television. Expansion of the Eurovision network and operations. Development of the cinema and, to a large extent, television in various countries. 147 bibliographical references to documentation published during the year on the development of this technology.

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Wintringham, W.T. (SMPTE) : **Report on the Color Television Study Committee Meeting.**
Journal of the SMPTE, No. 4, April 1969, pp. 280-282.

Level C.

Summaries of papers read at the second meeting of this working party of the Joint Committee on Intersociety Coordination, whose creation was reported in E.B.U. Review No. 113-A. Results of trials carried out at Chicago under the aegis of the Committee with the objective of determining the subjective effect, on the picture reproduced on an ordinary receiver, of variations of each of the characteristics of a colour signal, within the limits permitted by the F.C.C. regulations.

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Lord, A.V. (B.B.C.) : **Future trends in television broadcast engineering.**
The Radio and Electronic Engineer, No. 6, June 1969, pp. 323-328.

Level B.

Survey of likely and desirable developments in television broadcast engineering during the next decade. Reference to overall objectives, camera technology, film and tape machines, studio centres, transmission systems, and the domestic receiver.

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Mangenda, D. (Radio-Télévision Congolaise) : **Radio-Télévision Nationale Congolaise.**
RCA Broadcast News, No. 141, March 1969, pp. 27-31.

Level C.

Brief description of studio and transmission facilities of the Radio-Télévision Nationale Congolaise television service in Kinshasa, Democratic Republic of the Congo.

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Casabianca, M. (O.R.T.F.) : **Le Central Nodal Son TV de l'U.E.R. aux Jeux Olympiques de Mexico** (The E.B.U. Television Sound Control Centre at the Mexico City Olympic Games).
Revue Française de Radiodiffusion et de Télévision, No. 9, 1969, pp. 93-96.

Level C.

Detailed description of the centre equipped by the O.R.T.F., supplementary to the details given in the general article on the Olympic Games by A. Riccomi, published in E.B.U. Review No. 113-A.

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Riedel, K.H. and Heidorn, G. (N.D.R.) : **Ein neuer Farb-Magnetaufzeichnungswagen des Norddeutschen Rundfunks** (The N.D.R.'s new colour-television tape-recording vehicle).
Rundfunktechnische Mitteilungen, No. 3, June 1969, pp. 116-122.

Level B.

Complete description of the vehicle, which has been in service since November, 1968.

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Remy, M. and Mignot, L. (O.R.T.F.) : **Synchronisation des équipements de télévision par un signal de base unique décodable par circuits logiques séquentiels** (The synchronisation of television equipment by means of a single basic signal decodable by sequential logic-circuits).
Revue Française de Radiodiffusion et de Télévision, No. 9, 1969, pp. 63-70.

Level B.

Reasons for the choice of the basic signal, consisting of positive- and negative-going 300-ns pulses. Principe of encoding. Functioning of the decoder in the case of an ordinary line, of an active line without burst and of the field-blanking. Construction of the decoder.

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Tan, S.L. (Philips, Eindhoven) : **Versuchs-Farbfernsehkamera mit Miniatur-Plumbiconröhren** (An experimental colour-television camera using a miniature Plumbicon tube).
Fernseh- und Kino-Technik, No. 4, 1969, pp. 103-105.

Level C.

Design of the tube, in which the image is scanned by a combined optico-electronic system, over an area of 8.4 × 6.3 mm. Description of the camera, whose dimensions are similar to those of a 16-mm film-camera ; it weighs 3 kg.

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Crowell, M.H. and Labuda, E.F. (Bell Telephone Labs, U.S.A.) : **The silicon diode array camera tube.**
The Bell System Technical Journal, No. 5, May-June 1969, pp. 1481-1528.

Level B.

Description of a new electronic television camera tube intended for closed-circuit applications, but also suitable, with modifications, for broadcast purposes. The image-sensing target of the camera consists of a planar array of reverse-biased silicon photodiodes, which are scanned by a low-energy electron beam. Details of experimental results demonstrating the good spectral response, high efficiency and absence of lag.

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Brown, E.F. (Bell Telephone Laboratories) : **Television : The subjective effects of filter ringing transients.**
Journal of the SMPTE, No. 4, April, 1969, pp. 249-255.

Level B.

Steep cut-off low-pass filters can cause, on the response to a square wave, a " ringing " oscillation on both sides of the transition, which may increase its amplitude and thus improve the contrast and sharpness of the picture. Experiments have led to the opinion that the optimum ring should have an amplitude of the first peak of 12 % of the signal amplitude.

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Wise, R.S. (Ball Brothers Research Corporation) : **A combined video processing AGC amplifier.**
Journal of the SMPTE, No. 4, April 1969, pp. 261-265.

Level B.

Description of a new generation of such equipment, entirely solid-state and suitable for colour.

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Mayer, N. and Sand, R. (I.R.T., Munich) : **Stereoskopisches Fernsehen** (Stereoscopic television).
Rundfunktechnische Mitteilungen No. 3, June 1969, pp. 123-134.

Level B.

Principles of such a process : picture generation, transmission, reproduction. Results obtained with an experimental installation. Basic geometrical relations.

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Bardens, A.T.B. (Rediffusion (Hong Kong) Ltd.) : **A complete wired television system.**
The Royal Television Society Journal, No. 6, Summer 1969, pp. 122-126.

Level C.

Description of a television system originating two programme services and distributing them to more than 80 000 subscribers by means of an HF wired broadcasting network. Notes on maintenance, manpower and training, studio facilities, and discussion of the problems of dual-language operation.

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Köhler, A. (Robert Bosch, Berlin) : **Technik des Kabelfernsehens in den USA und Kanada** (Television cable-distribution practice in the United States and Canada).
Funk-Technik, No. 7, 1969, pp. 242-244 and No. 8, 1969, pp. 281-283.

Level B.

Types of aerials used for reception. Switching equipment in the distribution centres. Processing of the vision and sound signals. Types of distribution cables used. Characteristics of the distribution amplifiers. Connection of several amplifiers in cascade. Characteristics of the equalisers. Some figures for the quality parameters.

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Nieland, Th.J. (Philips) : **300-kW short-wave transmitter type FB010.**
Philips Telecommunication Review, No. 2, May 1969, pp. 49-58.

Level C.

Description of a new transmitter using tetrodes and pentodes, covering 3.2 to 26.1 MHz. Semi-automatic tuning using logic-circuits. Variable inductances without sliding contacts. Semi-conductor supply unit.

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Vaynshteyn, G.M. : **Balloon station for relaying television.**
Telecommunications and Radio Engineering, No. 10, October 1968, pp. 140-141 (Translated from Russian).

Level C.

Description of a rebroadcasting transmitter borne by a moored elliptical balloon and supplied by a wind-driven generator.

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Aizenberg, G.Z., Olifin, L.K., Tsvetayev, A.A. and Romanov, Yu.I. : **Rotatable broadcast antenna.**
Telecommunications and Radio Engineering, No. 11, November 1968, pp. 12-19 (Translated from Russian).

Level B.

Mechanical design, geometrical and electrical characteristics, horizontal and vertical radiation patterns of an HF aerial.

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Savitskiy, G.A., Popov, S.G. and Sluchanovskaya, Z.P. : **Aerodynamic stability of antenna structures.**
Telecommunications and Radio Engineering, No. 7, July 1968, pp. 50-54 (Translated from Russian).

Level B.

Presentation of the physical phenomena associated with the action of the wind, on masts and stays. Devices for reducing the vibration without recourse to a general increase in the rigidity.

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Meinke, H.H. (Munich Technical University) : **Aktive Empfangsantennen** (Active receiving aerials).
Internationale Elektronische Rundschau, No. 6, 1969, pp. 141-144.

Level B.

Possibilities of reducing the side of receiving aerials, without reducing the bandwidth, by " integrating " them in solid-state amplifiers. Effect on the signal-to-noise ratio, which can be improved compared with the case of passive aerials, and on the intermodulation, which can be adequately reduced with a well-designed aerial. (See news-item on this subject page 174 of this issue of the E.B.U. Review.)

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Schröter, F. (AEG-Telefunken) : **Les possibilités du grand écran en télévision et télécinéma** (The possibilities of the large screen in television and telecinema).
Bulletin Technique des PTT suisses, No. 7, 1969, pp. 298-304.

Level B.

Possibilities of reducing the sie of receiving aerials, without on a screen, requiring a definition of 1000 lines, a brightness of 200 lux and 50 periods per second (Eidophor, Titus tube, mosaic of cylindrical lenses and elements illuminated by neon discharge).

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Mothersole, P.L. (Mullard Ltd.) : **Television receivers - A survey of current design trends.**
The Radio and Electronic Engineer, No. 6, June 1969, pp. 329-336.

Level B.

Article based on a paper presented at the International Broadcasting Convention, London, September 1968. Description of modern domestic colour and monochrome television receivers, with emphasis on the introduction of semi-conductor devices including integrated circuits.

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Knight, P. and Thoday, R.D.C. (B.B.C.) : **Influence of the ground near transmitting and receiving aerials on the strength of medium frequency sky waves.**
Proceedings of the I.E.E., No. 6, June, 1969, pp. 911-919.

Level B.

The intensity of the wave radiated practically horizontally by an MF aerial depends on the soil-conductivity at a distance of several wavelengths in the direction of propagation. The field-strength is greater for propagation over the sea and decreases when the distance between the transmitter and the coast increases. Measurements have confirmed the thermal variation of the field-strength, and the effects of the ground and irregularities of the ionosphere are discussed.

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Wakai, N. (Japanese Telecommunication Administration) : **Mean variations of the night-time ionospheric E layer.** Journal of the Radio Research Laboratories, No. 79, May 1968, pp. 109-132.

Level B.

Brief summary of earlier measurements. Examination of measurements made between 1957 and 1961 at Boulder, on frequencies between 50 and 2000 kHz : determination of the critical frequency and the virtual height from ionograms ; mean nocturnal variations of the echoes in the E region. Variation of the critical frequency at midnight as a function of the solar activity ; values of that frequency at sunrise and sunset ; variations, as a function of the latitude, of the calm and disturbed E layer.

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Kühn, U. (R.F.Z., East Berlin) : **VHF and UHF propagation measurements in irregular terrain.** Proceedings of the I.E.E., No. 6, June 1969, pp. 905-910.

Level B.

Discussion of measurements made at 100, 480 and 780 MHz with a view to improving the C.C.I.R. curves. The terrain correction factors indicated by the C.C.I.R. appear to need increasing above 500 MHz.

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Sakowski, K. (F.T.Z., Berlin) : **Ausbreitungsuntersuchungen bei einer 12-GHz-Rundstrahlung** (Propagation experiments with omnidirectional radiation on 12 GHz). NTZ Communications Journal, No. 3, March 1969, pp. 180-184.

Level B.

Theoretical presentation of the conditions of the propagation of centimetric waves (reflection and diffraction, effect of the atmosphere). Description of experiments carried out in Berlin with the objective of determining the possibilities of utilising this frequency band for television. Results of measurements.

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Stracca, G.B. (University of Trieste) : **Propagation tests at 11 GHz and 18 GHz on two paths of different length.** Alta Frequenza (English edition), No. 5, May 1969, pp. 345-361.

Level B.

Results of measurements carried out, over paths of 20 km and 9 km, from May until October, 1967, in the north of Italy. Examination of the effect of rain (measured at nine stations on the 20-km path).

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Libois, L.J. (C.N.E.T.) : **Le Centre National d'Etudes des Télécommunications** (The French National Telecommunication Research Establishment). Revue Française de Radiodiffusion et de Télévision, No. 9, 1969, pp. 71-86.

Level C.

Functions of the Establishment. Organisation. Detailed presentation of research undertaken. External relations.

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Drummond, J.D. : **Color-tv wheel takes a spin in space.** Electronics, No. 14, 7th July, 1969, pp. 114-117.

Level C.

Description of principles and practice of the field-sequential colour-television system used during the Apollo-10 space voyage. Techniques for compensation of Doppler shift and for transcoding to the NTSC standard, using a multi-track disk recorder.

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Radio-astronomy and space research; review of requirements for allocations of frequencies. U.R.S.I. Information Bulletin, No. 171, June 1969, pp. 21-27.

Level C.

List of frequencies which the Inter-Union Committee on Frequency Allocation considered desirable for the development of space research and radio-astronomy. The I.U.C.A.F. represents the scientific interests of the U.R.S.I., the International Astronomical Union (I.A.U.) and the Committee on Space Research (COSPAR).

SOUND AND TELEVISION BROADCASTING STATIONS in the European Broadcasting Area

Changes observed in the spectrum during May and June, 1969

LF and MF.

A few modifications have been observed affecting medium- and high-power transmitters during the last two months :

- the power radiated by Langenberg (Germany F.R.) on 1586 kHz has been increased from 400 kW to 800 kW during the night ;
- the frequency of the 200-kW transmitter at Thourah (Iraq) has been changed from 908 to 910 kHz ;
- the frequency of the 20-kW transmitter at Baghdad (Iraq) has been changed from 1307 kHz to 1352 kHz.

We have also been informed that a 50-kW transmitter entered service at Squinzano (Italy) at the end of 1968 on 1448 kHz, a frequency already utilised by an Italian synchronised network. The power of the transmitter at Oran (Algeria) on 548 kHz was raised from 300 to 600 kW in February, 1969.

A number of other changes in frequency have taken place affecting stations in Egypt, Greece, Spain and Turkey, and the 1-kW Italian station at Trento has changed from 1331 to 1061 kHz.

VHF/FM.

The only major transmitter entering service recently is that at Haardtkopf (Germany F.R.) on 90 MHz with an ERP of 25 kW.

The two transmitters at Kokkola (Finland) on 97.6 and 99.7 MHz have had their ERP raised from 0.7 to 3 kW. Two groups of three 3-kW transmitters were placed in service at Karlshamn (90.3, 93.4 and 98.3 MHz) and Oesthammar (89.1, 92.8 and 95.5 MHz) in Sweden.

Other changes in the spectrum concern only re-broadcasting stations having powers of less than 500 W, of which one entered service in Denmark, one in Finland, one in Germany (F.R.), 3 in Italy, 3 in Norway, 22 in Sweden, 2 in Switzerland and 3 in the United Kingdom.

Television.

A number of high-power transmitters have entered service in Bands IV and V. Those having an ERP greater than 100 kW are listed below :

	Channel	ERP
Besançon-Montfaucon (France)	23	250 kW
Chartres-Montlandon (France)	50	250 kW
Hochsauerland (Germany, F.R.)	40	250 kW
Schnee-Eifel (Germany, F.R.)	40	250 kW
Bad Marienburg (Germany, F.R.)	44	138 kW
Eggegebirge (Germany, F.R.)	48	110 kW
Pfarrkirchen (Germany, F.R.)	57	250 kW
Alfabia (Spain)	48	125 kW

Transmitters with ERPs of between 30 and 40 kW have entered service in Switzerland at Haute Nendaz (channel 43), Monte Ceneri (channel 46), Gebidem (channel 52), Monte San Salvatore (channel 54) as well as at Beja (channel 9) and Sfax (channel 8) in Tunisia.

As usual, the number of new low-power rebroadcast stations is very high. During the period in question, we have been notified of the start of service from 14 such stations in France, 43 in Germany (F.R.), 5 in Italy, 8 in Norway, 7 in Sweden, 14 in Switzerland and 7 in the United Kingdom.

E.B.U. ACTIVITIES

Fifth meeting of Sub-group G2 (Television tape-recording) of Working Party G

Brussels, 10th and 11th June, 1969

Last April, the E.B.U. Technical Committee requested Sub-group G2 to hold a meeting at the beginning of June in order to prepare contributions to the work of C.C.I.R. Study Group X, which is to meet next September. The Sub-group therefore held its fifth meeting at the E.B.U. Technical Centre in Brussels on 10th and 11th June, 1969, under its Chairman, Dr. P. Zaccarian (RAI).

The first item on the agenda was the examination of a new S.M.P.T.E. Recommended Practice giving specifications for the tape configuration and also the head-wheel panel of television tape-machines. The Sub-group considered that certain parameters likely to affect the position of this region of the tape were not expressed sufficiently explicitly, and several comments were formulated, which were communicated by the Chairman to the S.M.P.T.E. in the form of a letter addressed to the secretariat of its committees.

One recording characteristic whose importance has been revealed in practice is the tape speed ; if this speed is not defined precisely, neither will be the position of the transverse tracks on which the video signals are recorded, and such tapes cannot satisfactorily be spliced electronically or mechanically. Two possible methods were proposed for the accurate measurement of the tape speed : the reproduction of a standard tape recorded under controlled conditions, or the precise measurement of the separation between successive video tracks. The former method is difficult to apply without specifying precisely the tension and elasticity of the tape ; moreover, recent experiments carried out at the O.R.T.F. had shown that the second method is inexact because the spread in the measurements is of the same order of magnitude as the desired tolerance. It is nonetheless the latter method which was preferred by the Sub-group, in specifying the position of the tracks with a tolerance of 2 ‰. Measurements will be performed by other organisations to determine the precision with which this dimension may be measured.

To improve splices between tapes having different origins, it appeared to be essential to specify a very strict tolerance (± 0.1 mm) on the position of the field-synchronising pulse recorded on the video tracks. As modern television tape-machines can comply with this tolerance, the Sub-group recommended that its application should be considered, except in the case of tapes not intended for editing.

The two parameters which have just been defined and which increase the precision of the dimensions of the recorded tracks, have been the subject of a draft contribution to the work of the C.C.I.R., prepared by the Sub-group. Other specifications in the " E.B.U. Standards for television tape recordings " should also be modified, but after discussion the Sub-group preferred to postpone the question until its next meeting, so that additional information could be obtained. This was the case in particular for the definition of the pre-emphasis and de-emphasis of the video signal, as well as the tolerance on the longitudinal position of the control track.

This latter point is related to the types of signals likely to be recorded on the control track, which is being used more and more frequently by television organisations for recordings of coded data. The most common application, which the Sub-group wishes to see growing in future, is the recording of timing references. As several ways of encoding such signals have already been proposed by manufacturers, the Sub-group does not wish them to proliferate further ; it therefore asked for this problem to be studied immediately on the international plane, and produced a draft study programme for submission to the C.C.I.R. In the immediate future, while desiring that the control track should remain at the disposal of the receiving organisation, the Sub-group considered that, if the recording of time references became general, they should represent a time increasing uniformly from the start to the end of the programme.

The Sub-group proceeded as usual to a long exchange of views on methods of measuring various parameters and on the use and operation of equipment. Two faults, which received particular attention, were differential phase distortion and moiré ; methods for measuring them or for reducing them are already under study by several organisations. The Sub-group discussed the utilisation of slow-motion and helical-scan television tape-machines, as well as auxiliary equipment such as velocity-error compensators and drop-out compensators. It examined the current trends regarding techniques of tape editing, and formulated a number of advantages and disadvantages of several types of recently developed magnetic tapes. Two new types of tape-machines were of particular interest : one utilised tape cartridges and the other had a control panel which automatically actuated the operation and editing of tapes.

The Sub-group also examined the possibility of specifying an alignment leader for colour-television tapes, by means of a pattern of colour bars with the lower third replaced by a red panel. This test-pattern, which is useful only for NTSC or PAL signals, will be used experimentally by several Members.

At the request of the Technical Committee, the Sub-group interested itself in the new multiplex sound-in-vision recording system recently developed by the B.B.C. However, it was unable to reach any conclusion regarding the possibility of tape-recording the encoded signals. The B.B.C. will investigate this question.

The Sub-group has fixed the Spring of 1970 in principle for its next meeting, which will be concerned principally with the revision of the E.B.U. Standards, taking into account the work accomplished by the C.C.I.R. and I.E.C. in 1969.

After the meeting, the participants were able to visit the principal installations of the new Broadcasting House in Brussels, in which the first television studios entered service early in 1968.

Thirteenth meeting of Working Party B
(Ionospheric propagation on kilometric, hectometric and metric (Band I) waves)

Paris, 18th to 20th June, 1969

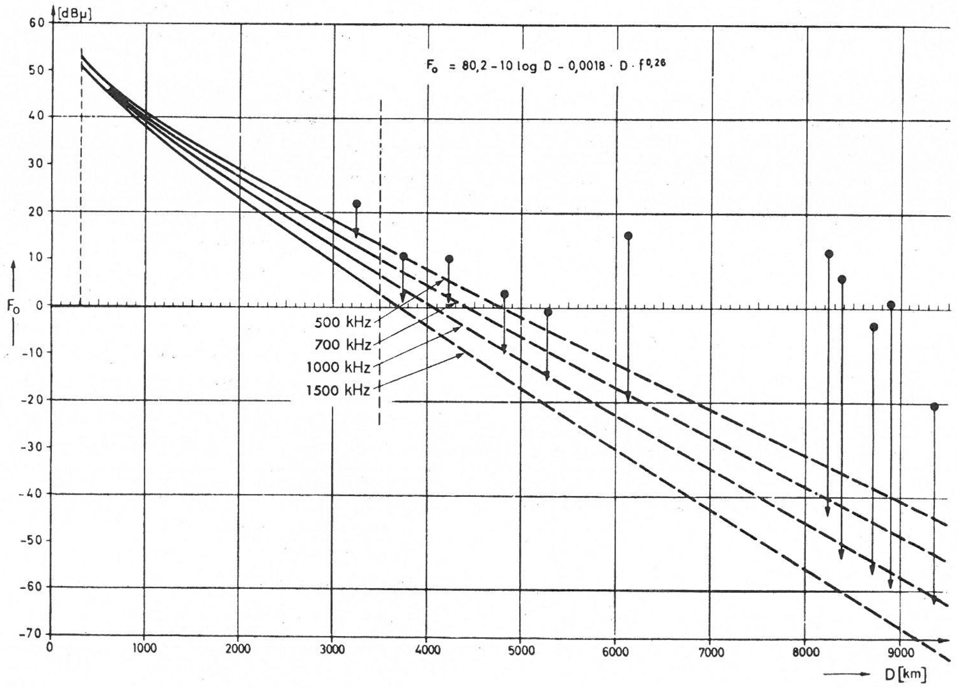
The forecasting of field-strength on LF and MF, which remains the principal subject of study by Working Party B, and which is the basis of all the work involved in preparing frequency plans for those bands, is at present effected by using C.C.I.R. Report 264-1. That report has been criticised on several occasions, mainly as regards the influence of certain phenomena such as the Earth's magnetic field, and the correction that should be made to take account of the vertical radiation patterns of the aerials. It also has the disadvantage of omitting any indication of the confidence limit of the forecasts. Finally, field-strengths are given only for distances between about 300 and 3500 km, and it is difficult to make valid extrapolations, especially for longer distances.

This problem was consequently the subject of most of the work at the recent meeting of Working Party B, which was held in Paris from 18th to 20th June, 1969 at the invitation of the O.R.T.F. In order to improve the reliability of the forecasts, it is necessary to reconsider the results of all the measurements obtained by Working Party B and to derive new formulae for

the prediction of field-strength on the basis of these data. Two methods of attacking the problem were considered. The first method is based on physical assumptions for establishing a model of the ionosphere. The results of the measurements are then used to determine statistically the differences between the field-strength that would be obtained with such a " mean and calm " ionosphere, and the actual field-strength. In this way, one obtains either empirical correction coefficients or, in the most unfavourable case, a confidence factor for the deviation. This method has the disadvantage that the ionosphere normalised in this way is a physical fiction and that it is difficult to determine the values of the parameters taken into consideration. The B.B.C. Research Department intends to apply such a method, doing so in close collaboration with Working Party B.

The second method seeks to avoid making any assumption regarding the laws governing the action of the ionosphere which results in the field-strength actually measured, or at any rate to make such an assumption only when absolutely necessary. In this way, the laws are determined by a purely statistical calculation, only those parameters which can have an influence on the propagation being fixed. It is on this basis that Working Party B intends to proceed with the theoretical work. It was recognised during the course of the discussions that neither of the two methods has, compared with the other, sufficiently clear merits or demerits to make possible a definitive choice at the present time. In any case, both methods call for the use of a computer, and it is in this field that progress has evidently been made since the time when the curves at present in use for the prediction of field-strength were determined.

The Working Party also reviewed the propagation paths at present being used for the measurements. Several paths in Europe are now the subject of recording, with the essential aim of obtaining measurement results covering a complete solar cycle ; measurements throughout the whole night were begun only in 1959, and these will therefore continue until 1971. For the recordings of the field-strength obtained at distances in excess of 3500 km, it is necessary to use transmissions originating in other continents (from countries in Asia, Africa and the Americas). The Working Party examined the results already obtained over these paths and drafted a contribution intended for C.C.I.R. Study Group VI, summarising the results obtained so far. They relate to twenty paths, of which twelve have been studied for a period of at least twelve months, and the results are summarised in the graph reproduced below. It will be seen that, in general, the field-strength measured is substantially greater than would be expected from a purely mathematical extrapolation of the propagation formula given in C.C.I.R. Report 264-1. It is too early to draw any quantitative conclusions, but it will be necessary to be able to forecast field-strengths at



Field-strength of the indirect ray measured during the E.B.U. measurement programmes, for 11 paths of lengths ranging from 3000 to 10 000 km.

Each dot represents the annual mean value of the half-hourly median values of the field-strength measured over the path, corrected for a reference transmitting aerial. The four propagation curves were calculated by means of formula 1a in C.C.I.R. Report 264-1, reproduced on the graph. The length of the arrow adjacent to each dot indicates the difference between the measured field-strength (annual mean) and the figure corresponding to the C.C.I.R. propagation curve (extrapolated).

such distances before the frequency assignment conference that the I.T.U. has planned for 1974 (see p. 169 of this present issue). It is evident that this matter is primordial for the success of any future efforts to prepare frequency plans, and consequently Working Party B is concentrating all its attention on it. The Working Party discussed also some points of detail regarding the field-strength prediction curves, including the effect of path orientation and of polarisation and propagation at distances of less than 300 km.

Working party B also deals, of course, with ionospheric propagation on VHF, with particular reference to Television Band I. The measurement programmes which have been in progress since 1961 in Europe are to be continued until 1973, also in order to cover a full solar cycle. This matter was very thoroughly examined by C.C.I.R. Study Group VI at Boulder in 1968, and Working Party B discussed some suggestions made by the members of that Study Group, in order to improve not only the presentation of the results obtained, but also the methods of analysing the recordings. It is to be hoped that, when this work is completed, there will be available figures for making a reliable forecast of field-strength in Band I, at any rate as far as Europe is concerned.

First meeting of Sub-group K3 (Direct television broadcasting by satellite) of Working Party K

Brussels, 3rd and 4th July, 1969

At its last meeting at Split, from 18th to 20th March, 1969*, Working Party K proposed to entrust to a specialised Sub-group all technical questions associated with direct broadcasting from satellites. This Sub-group, K3, which was set up by the Technical Committee in Vienna, met for the first time at the beginning of July at the E.B.U. Technical Centre in Brussels, under its Chairman, Mr. C. Terzani (RAI).

At that meeting, the Sub-group first proceeded to examine its terms of reference, which consist essentially of the task of assembling all the basic data enabling the next World Administrative Space Conference to be presented with the needs of broadcasting in the bands allocated to space services (according to the Radio Regulations, broadcasting from satellites is a space service). It then examined a series of documents, some of which had been submitted directly to the Working Party and the others had been issued by the C.C.I.R., the United Nations and the C.E.T.S.

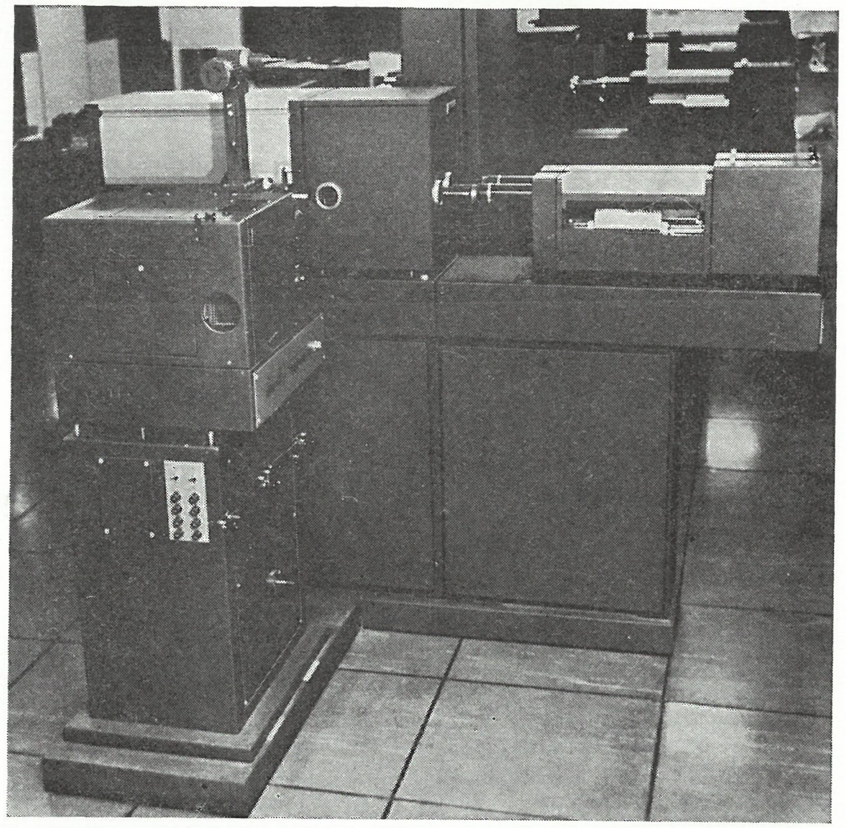
The discussion enabled the Sub-group to formulate some fundamental ideas in the domain of the characteristics of a future system of sound or television broadcasting by satellites. It confirmed that, if such services were to be provided in the SHF band, frequency modulation would be utilised. If amplitude modulation were to be used, in other frequency bands for example, the question of the system would not arise, as the systems at present used for terrestrial broadcasting would be suitable. In order to facilitate possible sharing between terrestrial broadcasting and satellite broadcasting, it would be useful to foresee frequency-modulation television systems having a bandwidth which is a multiple of 8 MHz ; later studies will be based on this assumption. The Sub-group also considered that it would be useful to take account of economic data in its studies.

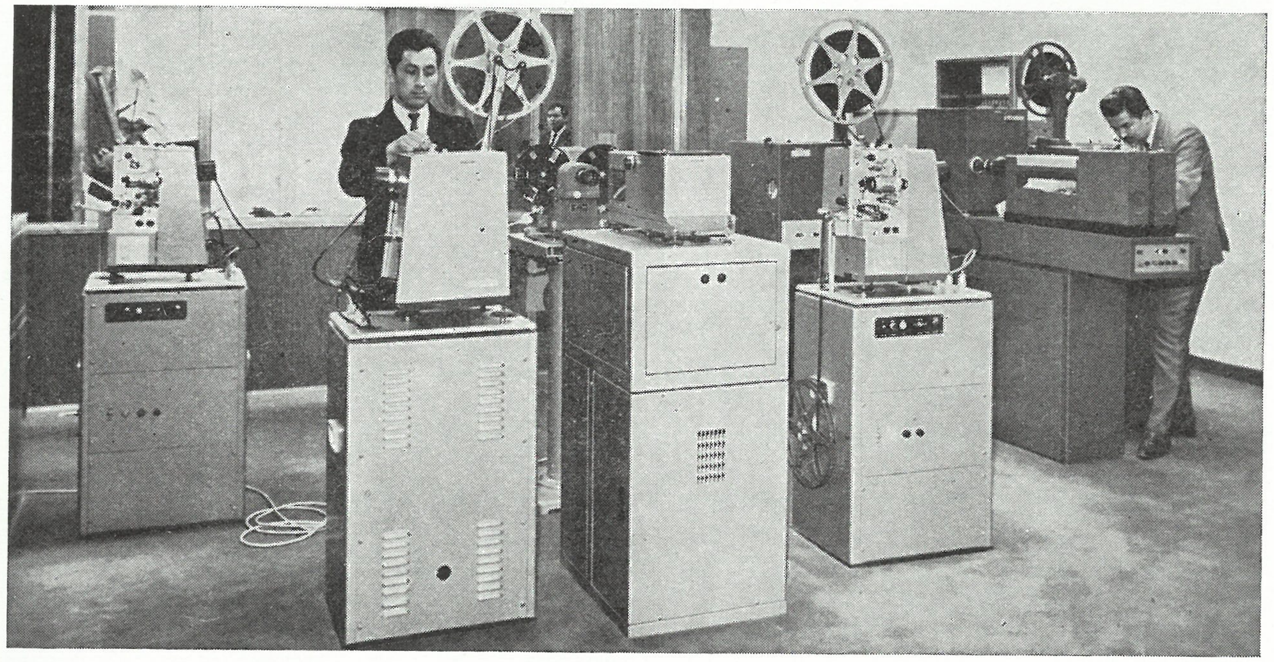
The Sub-group then examined the problem of protection ratios ; it will attempt to set values for these parameters, particularly in the case of the mutual protection between frequency-modulation systems, and in the case of interference between frequency-modulation and amplitude-modulation systems. Questions concerning aerials will have to be resolved in order to achieve the desired objective. Under present conditions, it will remain indispensable to envisage a number of possibilities, and each study should be based on a series of possible parameters.

The Sub-group was interested to hear that research carried out by the B.B.C. had provided information regarding the problem of the minimum field-strengths to be utilised. On this topic, the fact that a given picture quality will be available throughout almost the whole of the area of coverage of a satellite is an important factor ; the situation is different for terrestrial services where coverage studies are based on the picture quality in the fringe zones of the service area of the transmitters. The Sub-group was also interested in B.B.C. studies which relate the position and angular separation of satellites to the problems of the preparation of frequency-assignment plans ; it expressed the view that these studied should be pursued.

The Sub-group finally drew up a catalogue of questions for study, and, as far as was possible, divided the corresponding tasks among its members.

* See E.B.U. Review, No. 114-A, p. 97.





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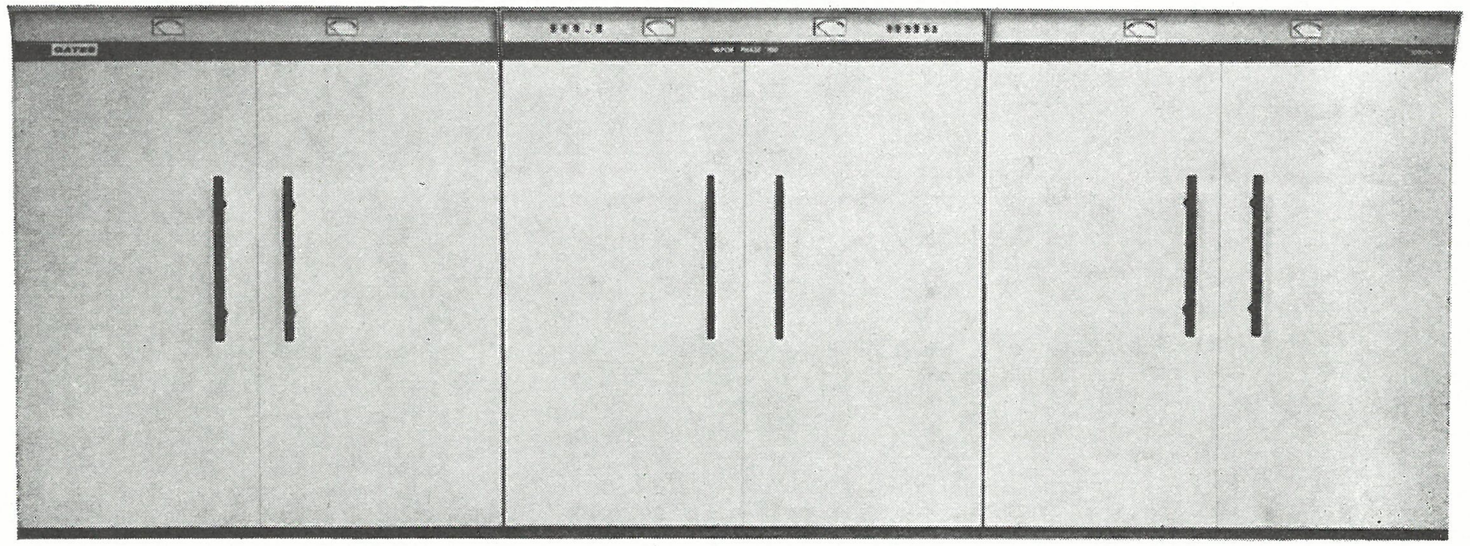

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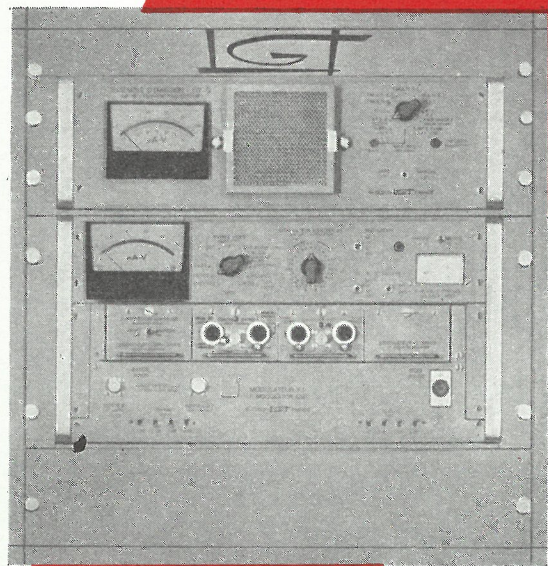

USES

- As driver for power amplifiers
- As reference instrument for measuring other transmitters
- As test signal source for distribution in domestic receiver factories
- For teledistribution

PRINCIPAL TECHNICAL CHARACTERISTICS

- All standards
- All bands

e.g. STANDARD B AND G (complies fully with Swiss and German ARD 5/6 specifications)

- Negativ modulated vision
- Frequency modulated sound
- Intermodulation 51 dB
- Thermal unweighted noise vision 63 dB, sound 60 dB
- Differential gain 0.95
- Static linearity 0.95
- Differential phase ⩽ 3°
- Group delay time
  - ± 50 ns 0 to 3 MHz
  - ± 30 ns at 4.43 MHz
  - ± 100 ns at 4.8 MHz
- Audio harmonic distortion ⩽ 1 %
- Frequency stability Normal 10^{-6}, Optional 10^{-8}

e. g. STANDARD L
- Fully complies with french O.R.T.F. SN 734 specification.

Power amplifiers which use the basic 1 watt transmitter as driver can also be supplied 5 W, 10 W, 100 W, 1 kW (solid state up to 10 watts).

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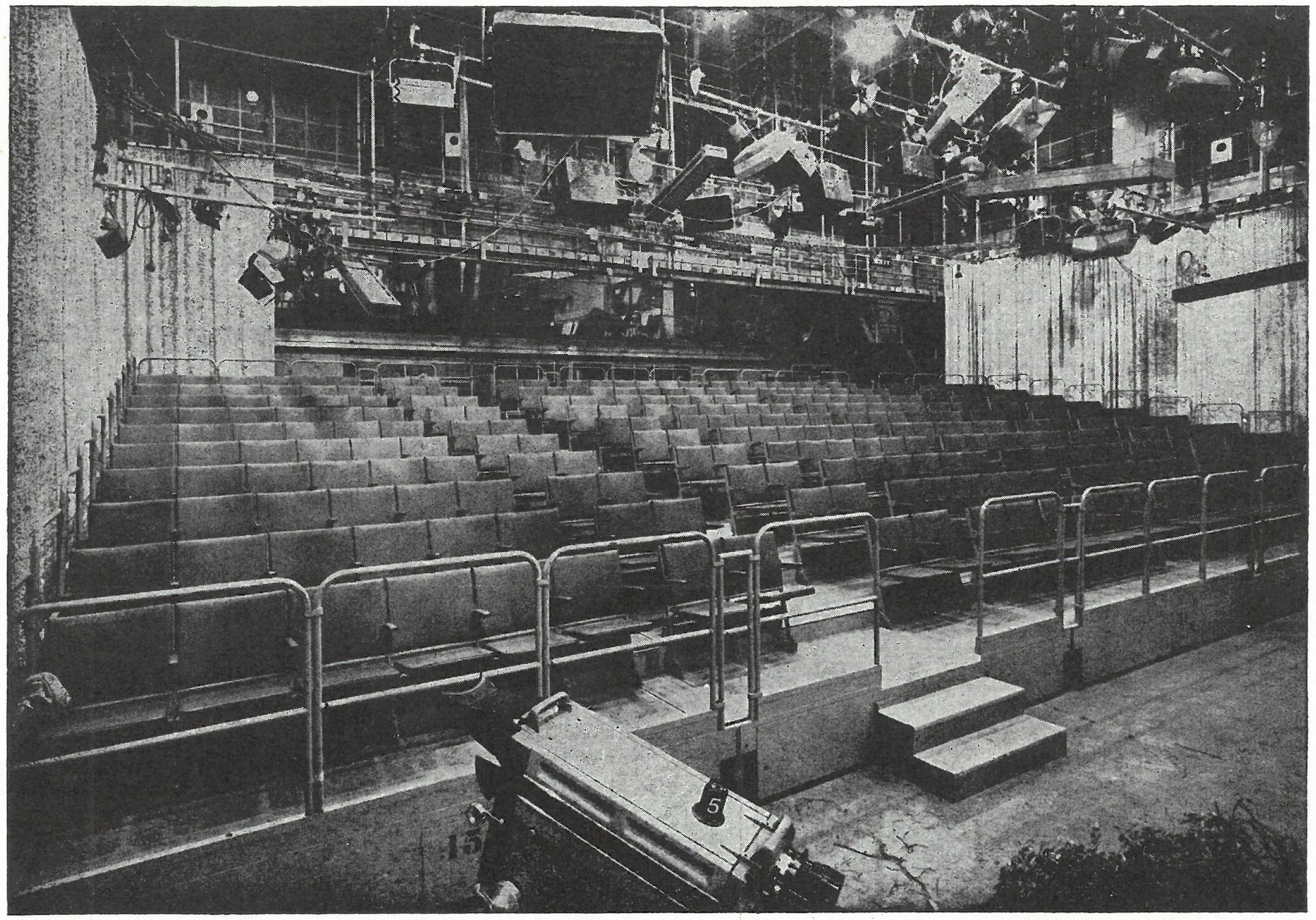
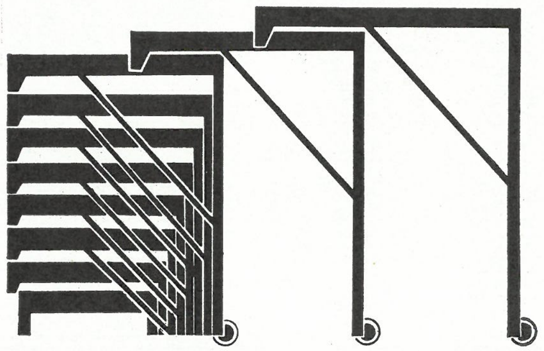


Photographed above is the Lodge portable/retractable seating as supplied to the B.B.C. Television Centre, London and manufactured to B.B.C. Specification. ■ The seating is comfortably upholstered and folds down flat into the unit when retracted. Each unit is 6 seats wide by 10 rows deep, with two units made up as centre gangways with 4 seats. The inset picture shows the compact retraction and easy mobility of the installation. ■ Lodge make all kinds of auditorium seating and tailor them to your special needs. Many of the finest television studios and sports halls in Britain have been equipped by us. That is why we can justly claim « Lodge Leads » ! A call from you will bring our technical representative to your office to discuss your own special needs.



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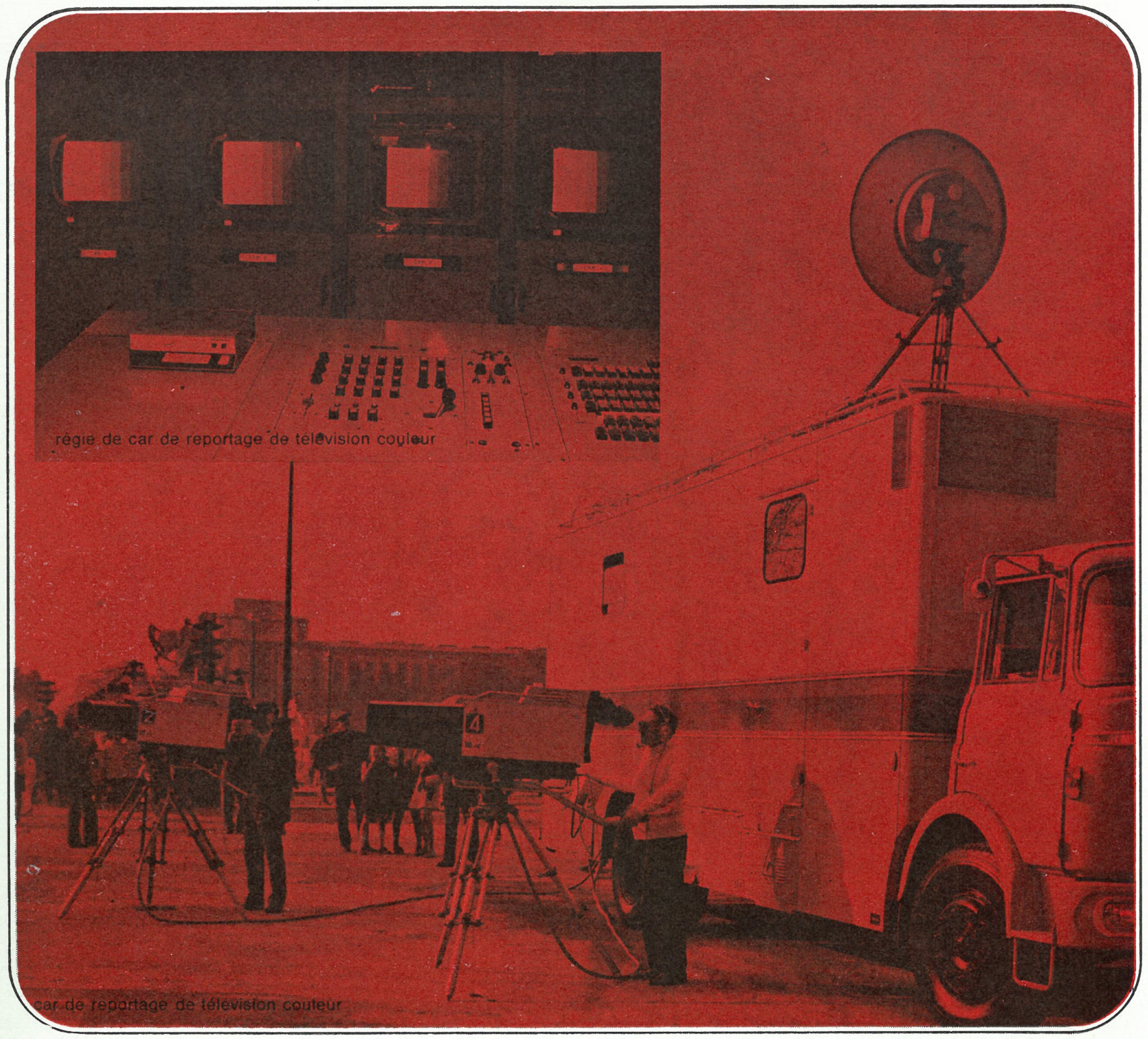

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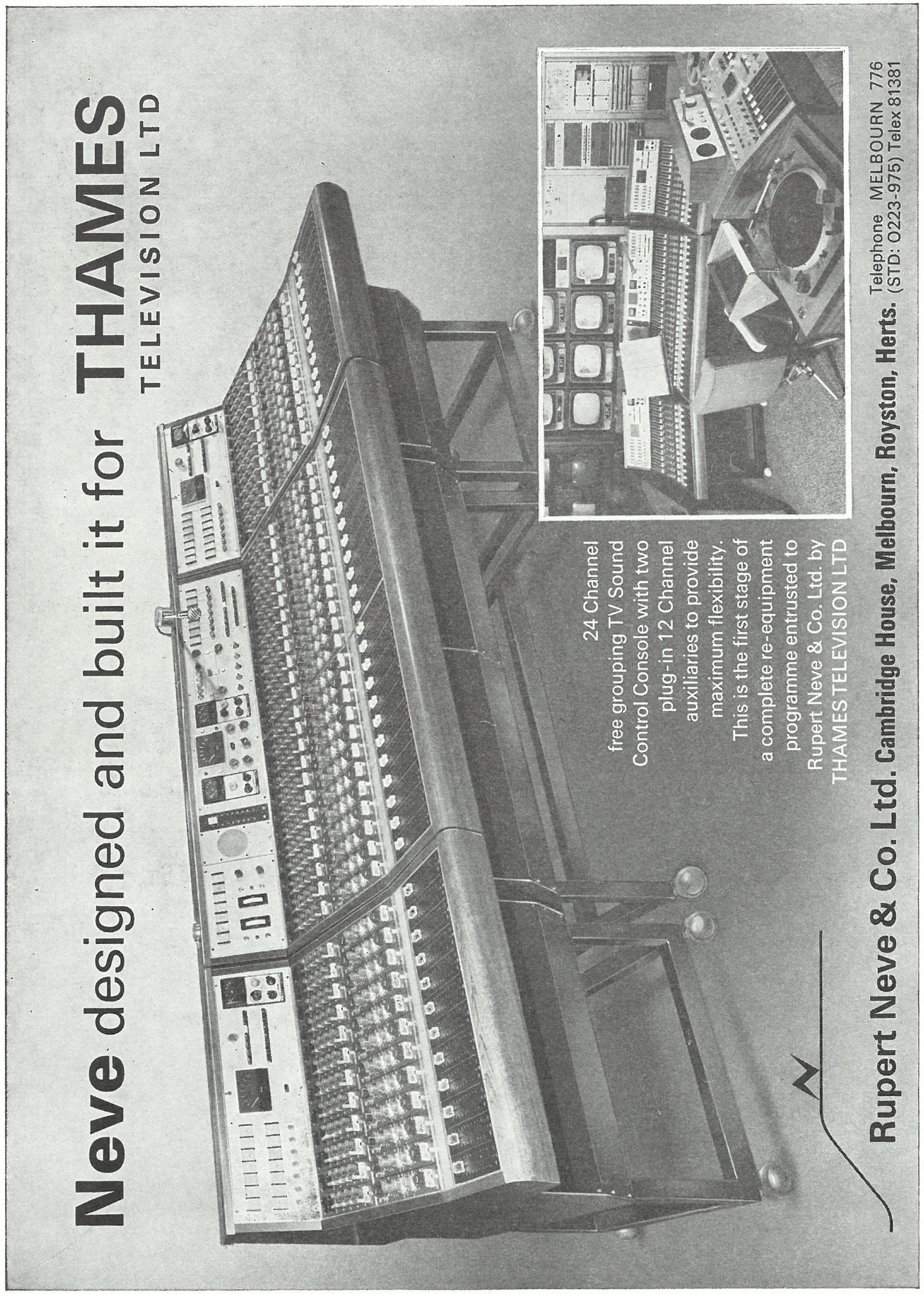
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