EUROPEAN BROADCASTING UNION

E.B.U. REVIEW

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TECHNICAL
JUNE 1966

E.B.U.

REVIEW

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Directorate : 32, avenue Albert Lancaster, BRUSSELS, Belgium - Telephone : 74.58.30 - Telegrams : Uniradio Brussels - Telex : 2-21230.

Receiving and Measuring Station : Jurbise-Masnuy (Hainaut), Belgium.

International Television Coordination Centre (Eurovision) : Palais de Justice, Brussels, Belgium.

(All correspondence should be addressed to the Directorate).

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12

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2 Solid state audio driver.
3 Solid state rectifiers.
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5 Unequalled compactness—only 69″ high, 67 7/16″ wide, 32″ deep.
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It's Collins' new 820 E/F-1 5/10kw AM transmitter. Contact your nearest Collins Sales Office for descriptive brochure.

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Eliminated by Revere-Mincom Universal Dropout Compensator...

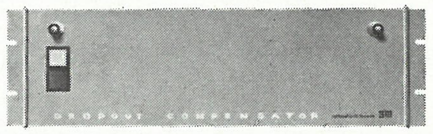
The Revere-Mincom Universal Dropout Compensator was developed for use with normal professional recorders such as Ampex, RCA or similar. Operates with various transmission standards (525, 625, etc.). Both low band and high band. Black and White or Color. Available for 50/60 cycle operation, 110/220 volt. Particularly useful in high band recorders where dropout problems are 5 to 6 times as severe as in older low band machines.

The Revere-Mincom Universal Dropout Compensator restores picture quality by detecting dropouts in the RF stage and substituting stored information from the previous line for the "lost" signal.

Moderately priced, the Dropout Compensator features maintenance-free solid state circuitry, standard rack mounting and compatibility with video tape recording equipment.

Rescue old tapes. Insure optimum playback quality in new recordings. Save money by eliminating unproductive engineering evaluation time and unnecessary wear on expensive recorder heads and video tape recording equipment.

For additional information, contact any of the listed 3M Company offices or write directly to 3M Company, International Division, P.O. Box 3800, St. Paul 1, Minnesota, U.S.A. Attention: J. L. Kamiske.



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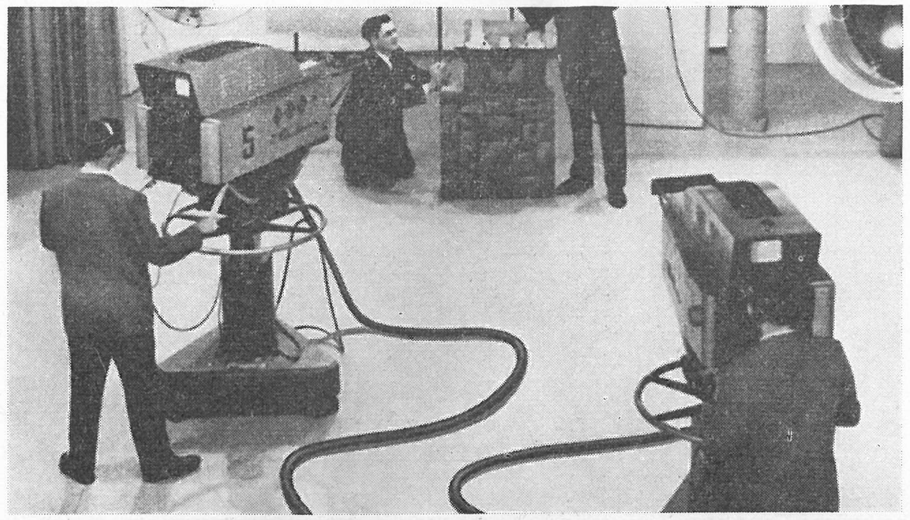
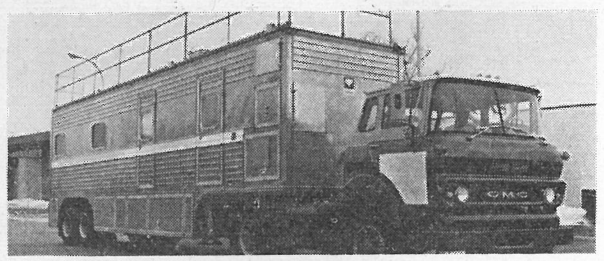
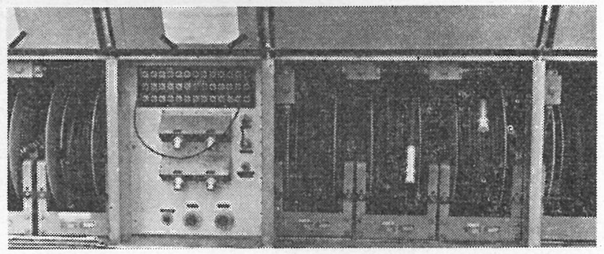
International Division 3M COMPANY







BIW for TV CABLES

For studio, mobile or remote use, BIW offers rugged, reliable cables for color and black and white cameras. All types are offered in complete factory wired and tested assemblies, cut to any desired length. Or, they can be had in bulk.

BIW TV cables are available for all models of American, British and European cameras. Particularly interesting are the BIW prefabricated custom terminations for studio wiring. These provide instantaneous hook-up and save technicians time in providing trouble free installation.

BIW has designed and made TV camera cables since TV's inception. Long experience since this time provides the knowledge to produce quality cables that:

1. Have unusual flexibility that permits easy camera action whether in complex studios, dirty, wet football fields or sub-zero St. Moritz.
2. Have tough, durable neoprene jackets that withstand the rigors of abuse from dollies, trucks and dragging.
3. Have signal and control leads grouped to minimize cross talk.

BIW also makes cables for special application television cameras. Let us know your requirements and we will send complete information, catalog and quotations.

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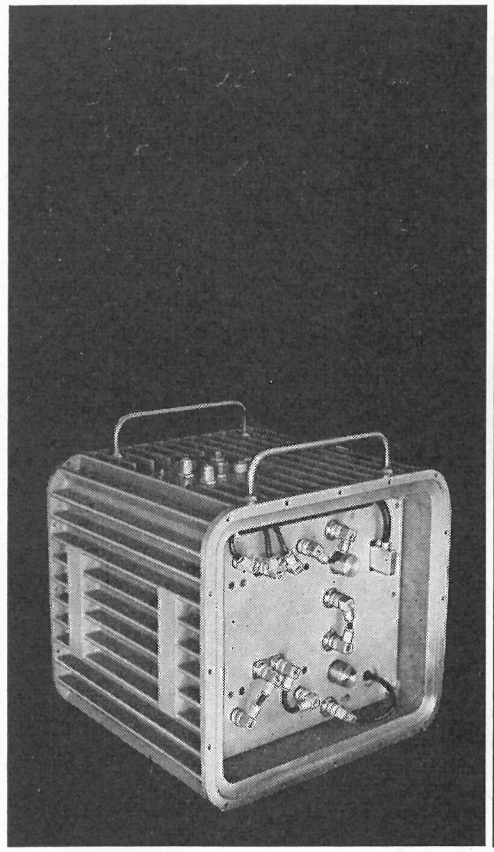
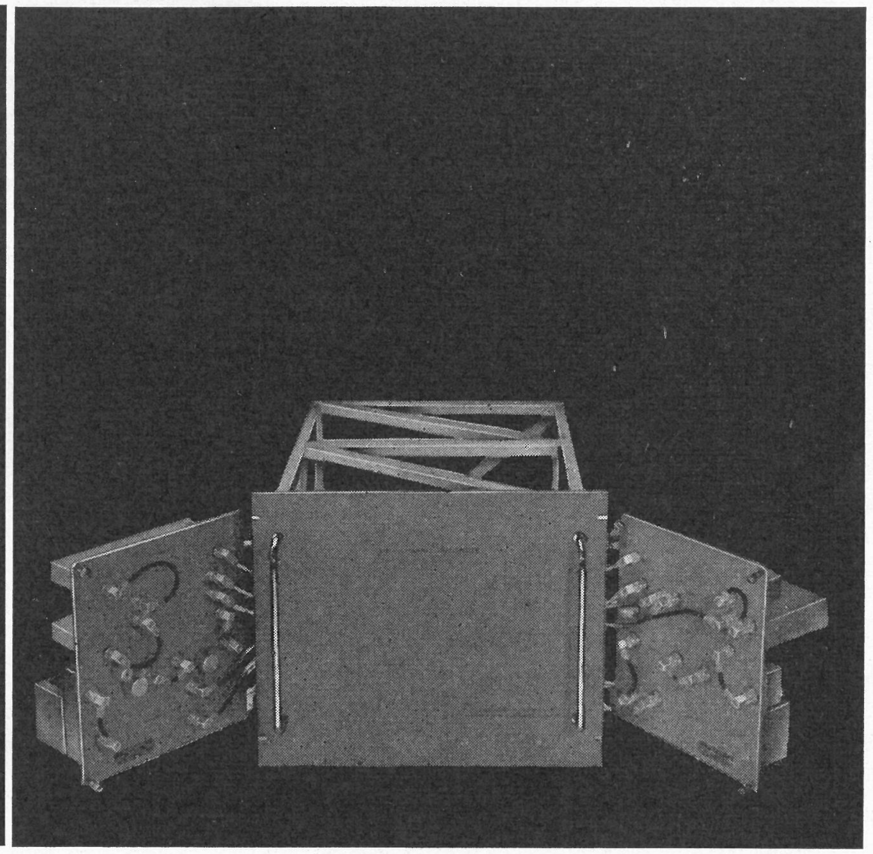
11 Rue Jeanne D'Asnières
Clichy (Sein) France

UHF*
TELEVISION TRANSPOSER
SOLID STATE
5 WATT OUTPUT



Roof top model SST/1
(weatherproofed)



Rack-mounted model SST/2
(as supplied to the B.B.C.)

Transposition of channels without demodulation throughout Bands IV and V ☐ Max. peak vision output: up to 5W (depending on frequency and video requirements) ☐ Bandwidth: 8 Mc/s $\pm$ 0.5dB ☐ Signal to Noise Ratio: 55dB at -40dBm ☐ AGC: $\pm$ 10dB reduces to $\pm$ 0.5dB ☐ Frequency Stability: $\pm$ 180 c/s on the transposed interval for 30 days ☐ Ambient: -20°C to $+50$°C ☐ Supply: 28V at 100W

Video Performance at 1W: ☐ Cross-Modulation: better than 60dB ☐ Differential Phase: 1° ☐ Sync. Pulse Crushing: 5% ☐ Group Delay: $\pm$ 20nS

**previously termed translator*

AVAILABLE SHORTLY
FM Sound Transposers
in Band II (solid state
—to B.B.C. specification)

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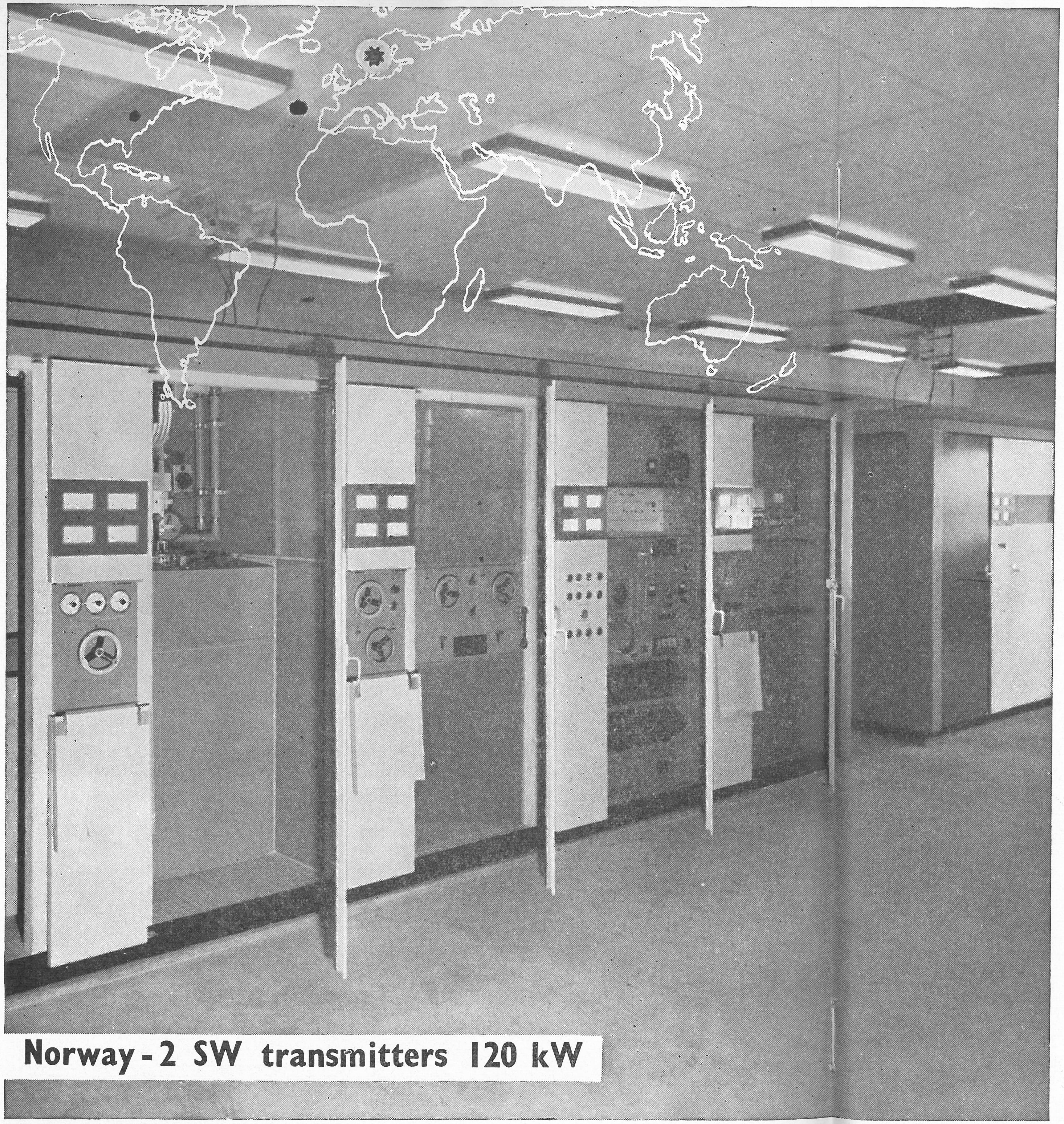
ET I



Norway - 2 SW transmitters 120 kW

Why station owners - all over the world - choose their equipment from the PHILIPS range

They do so for some very good reasons:

- Philips' reputation for reliability and after-sales service, maintained since the earliest days of radio (our first broadcast went on the air in 1923, our TV experiments date back to 1935).
- Philips engineers survey, plan and install the entire system, whether it consists of a simple audio amplifier or a complete TV network. And whether the site is on the equator - e.g. Quito, Ecuador - or within the polar circle - like the FM and TV station at Kiruna in Sweden.
- Philips equipment covers the complete range from microphone to broadcast transmitter, from TV camera to aerial, from line amplifier to radio link.

Studio equipment	Transmitters		Auxiliary equipment
microphones amplifiers equalizers control desks transcription turntables signalling lights tape recorders camera chains: image orthicon vidicon telecine programme mixers lighting	sound broadcasting: MW AM: 5 - 300 kW SW AM: 5 - 300 kW VHF FM: 10 W - 12kW	TV broadcasting: Band I: 75 W - 25 kW Band III: 75 W - 10 kW Band IV and V: 2 - 20 kW	UHF radio links VHF radio links aerials feeders towers dummy aerials power supplies

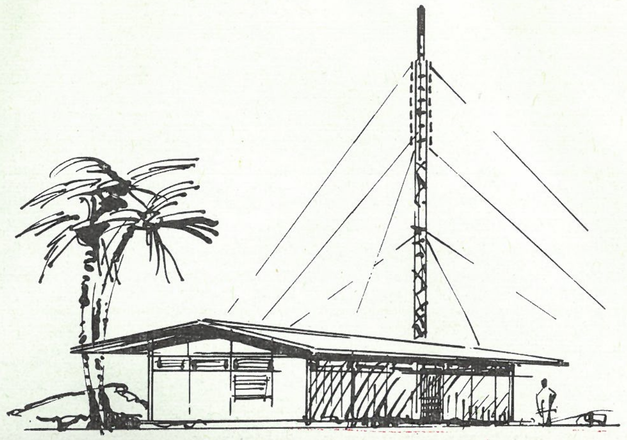
PHILIPS

ELECTRO-ACOUSTICS DIVISION, EINDHOVEN.

N.V. PHILIPS' TELECOMMUNICATIE INDUSTRIE, HILVERSUM, THE NETHERLANDS

PHILIPS

"COMPACT" T.V. STATION



SUITABLE FOR EDUCATIONAL ORGANISATIONS, AS WELL AS NATIONS AND AGENCIES WISHING TO USE TELEVISION TO WIDEN THE SCOPE OF THEIR ACTIVITIES

ECONOMICAL IN TECHNICAL STAFF AND POWER CONSUMPTION

EASY TO INSTALL AND TO MAINTAIN

- TRANSISTORISED VF CHAIN (CAMERAS FILM-SCANNER AND FILM-RECORDER)
- TRANSISTORISED AF CHAIN
- LIGHTING EQUIPMENT (100 m²)
- 500-WATT. BAND-III TRANSMITTER
- COMPLETE WITH MEASURING INSTRUMENTS

COMPAGNIE FRANÇAISE THOMSON-HOUSTON

THOMSON CFTH HOUSTON

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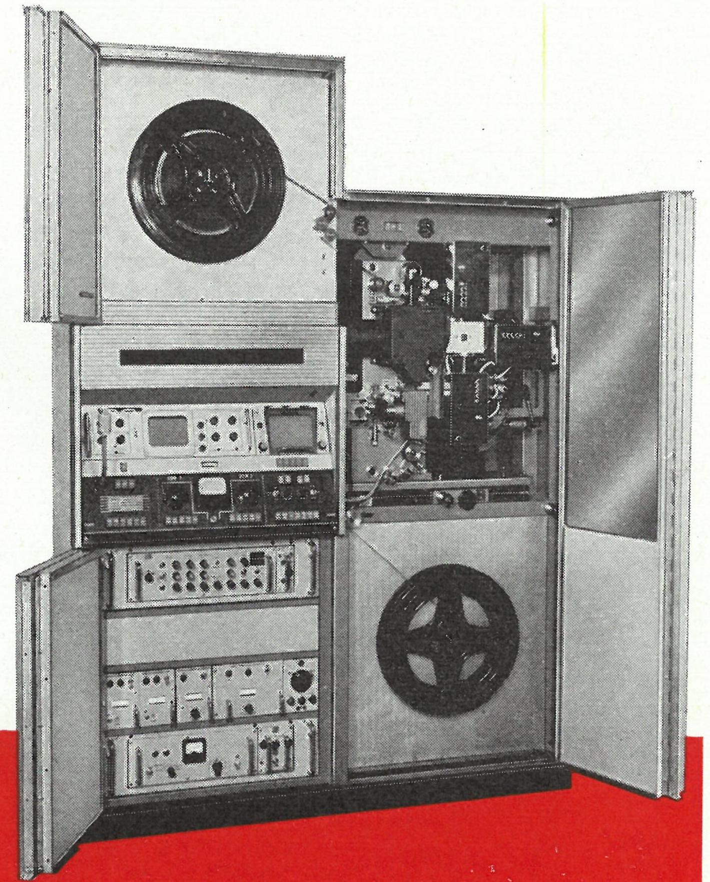
COLOUR TELEVISION

FLYING-SPOT FILM-SCANNER ▶

TH. T. 2300

For **35**-mm FILM



FLYING-SPOT FILM-SCANNER

TH.T. 2301

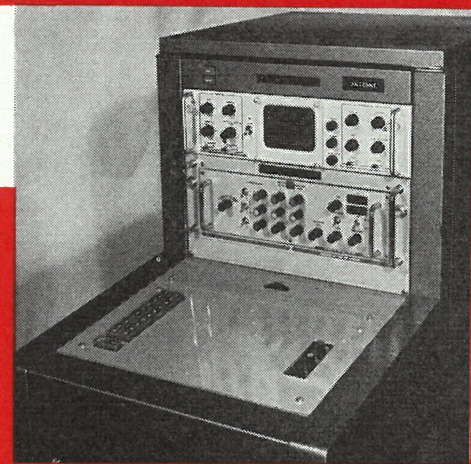
For **16**-mm FILM

FLYING-SPOT SLIDE-SCANNER

"FLYING-SPOT"

TH. T. 2100 ▶

incorporating drum for up to twenty 5 cm x 5 cm slides



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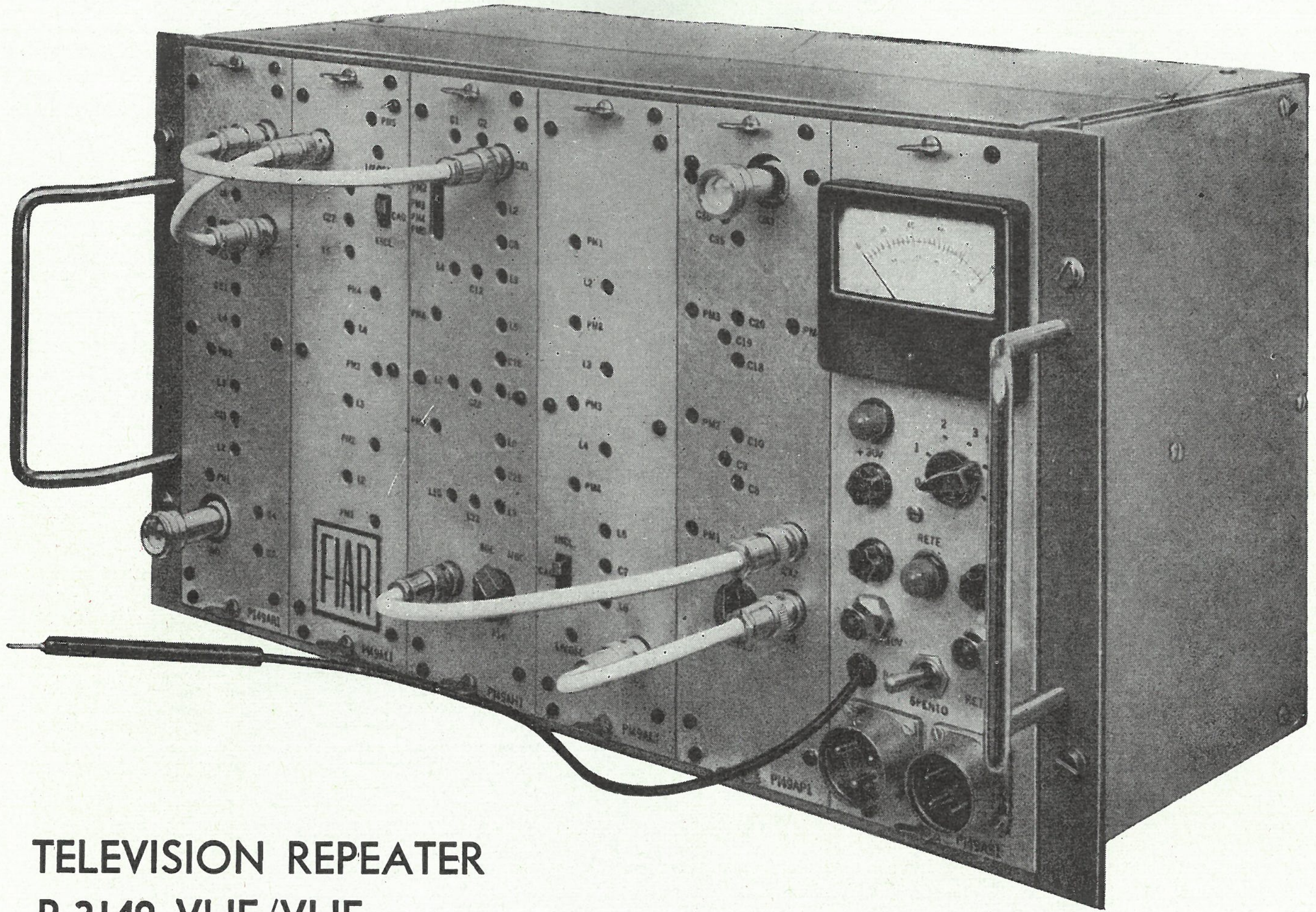
FABBRICA ITALIANA APPARECCHI RADIO

Via G. B. Grassi, 93 - MILANO - Telefono 306.241 - 306.841 - Telex 31295

PROFESSIONAL ELECTRONIC DEPARTMENT



TELEVISION REPEATER
P 3149 VHF/VHF

- This "fully transistorized equipment" uses a rack of 19" and allows the conversion of television channels according to CCIR standard.
- Conversion possibility: Band I/Band III; Band III/Band I; Band III/Band III.
- Output power: 100 mW peak video.
- Threshold sensibility: 4,5 μV.
- Power supply: from mains 220/110 V_{CA} — 30% + 20% 50 ... 60 Hz; current consumption 75 VA; from battery 48 V — 20% + 30% consumption about 50 W.
- Size: width 482 mm, height 261 mm, depth 220 mm.
- The repeater P 3149 can be supplied with an electronic tubes amplifier for power supply from mains 220/110 ± 2%, 50 ... 60 Hz, by means of which in the executions P152 and P153 it is possible to increase the output power respectively to 1 W and 5 W peak video.

NOUVEAUX VAPOTRONS

THOMSON CFTH HOUSTON

TRIODES ET TETRODES
POUR
RADIODIFFUSION
TELECOMMUNICATIONS
RECHERCHE SCIENTIFIQUE
APPLICATIONS INDUSTRIELLES

Grâce aux travaux théoriques et expérimentaux poursuivis depuis de nombreuses années, pour améliorer la technologie des tubes et augmenter la capacité de dissipation des anodes, **THOMSON** met à la disposition des constructeurs une nouvelle série de tubes **VAPOTRON** (triodes et tétrodes) leur permettant la réalisation de matériels de puissance accrue dans un encombrement plus réduit.

COMPAGNIE FRANÇAISE THOMSON - HOUSTON

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FOR UNCOMPROMISING QUALITY

Miniature Studio Microphones
Stereo Microphones
Measuring Microphones

Complete Stereo and
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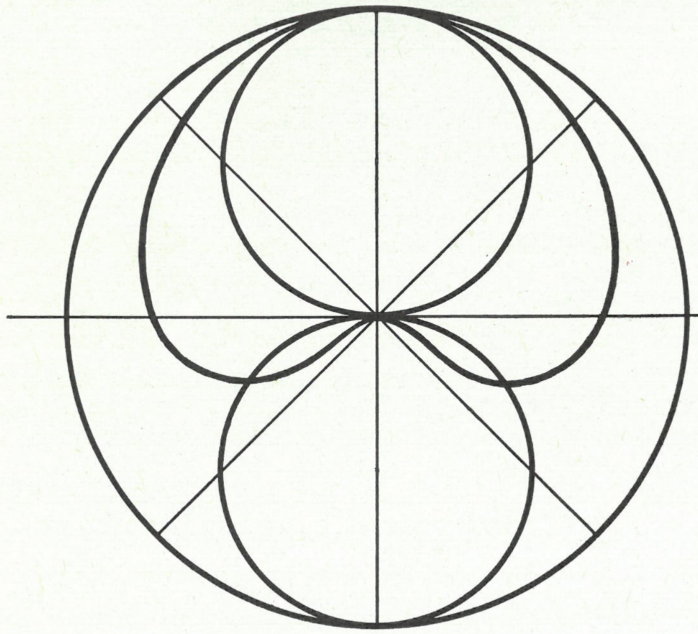

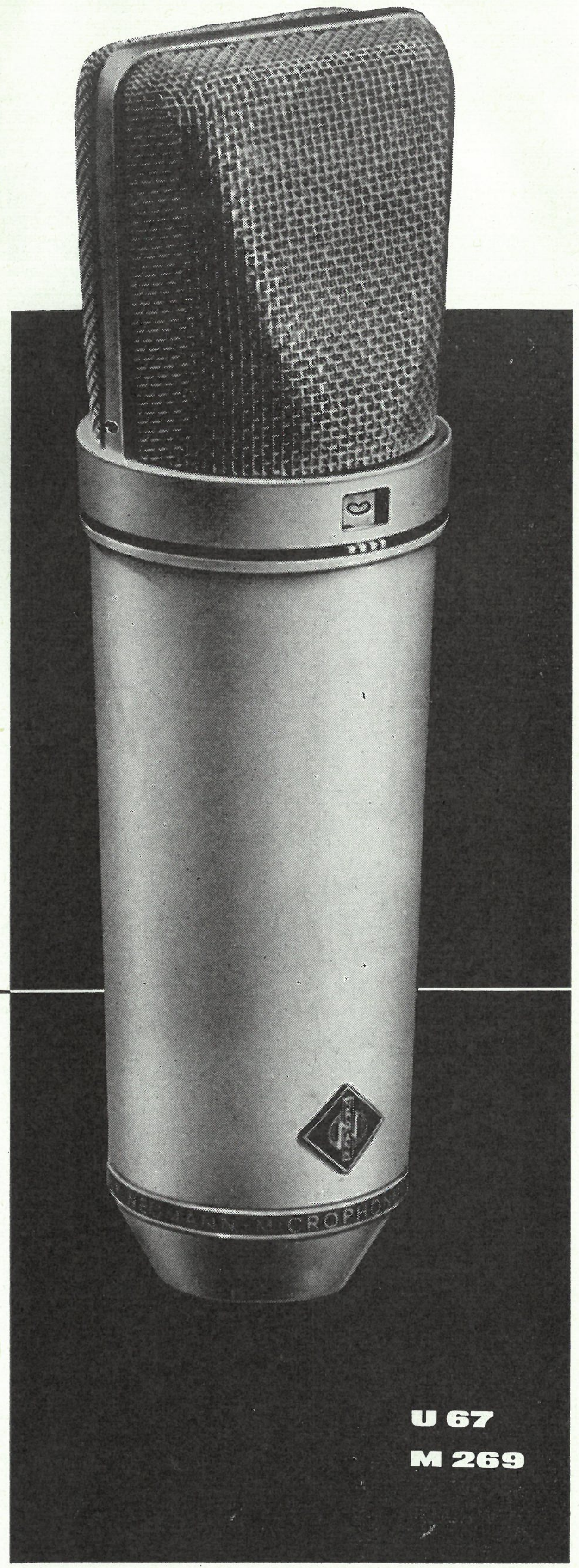

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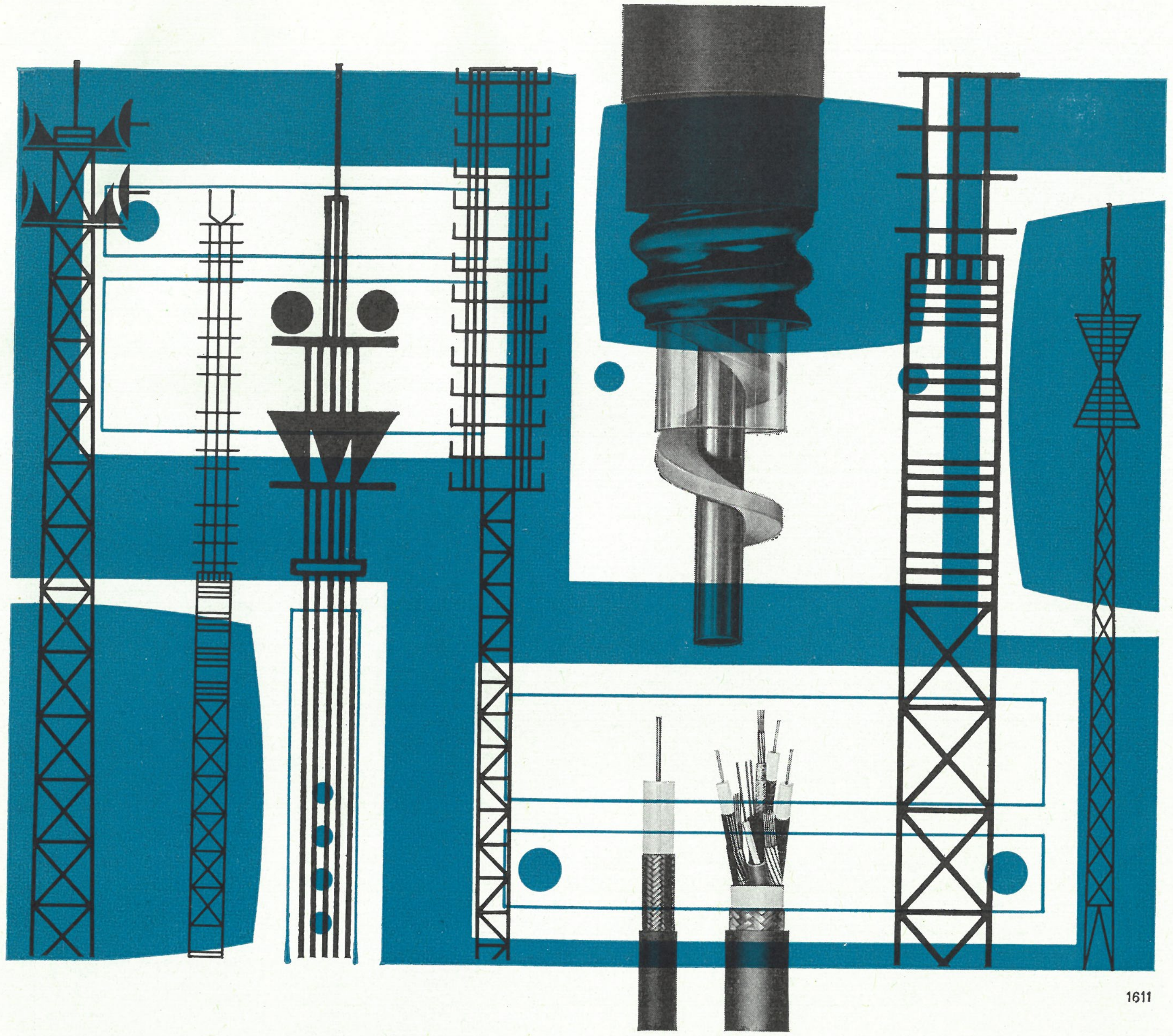


1611

F&G RF-cables all over the world

During recent decades the quality of F&G products could be proven time and again on the radio-frequency sector. Many of these products have had a resounding success in sound and television broadcasting stations and studios both at home and abroad. Special significance has been won by F&G radio-frequency cable with Styroflex tape helix insulation and seamless aluminium outer conductor. On account of its excellent properties it was already installed in 1949 in VHF transmitter stations in the Federal Republic of Germany and other European countries. German and foreign medium wave stations as well as television stations have also been equipped with this F&G cable.
Intensive research and development along with close co-operation with the users is F&G's way of working on new vistas for the future and providing products suitable for the world of tomorrow.
F&G, a firm with a very strong tradition, keeps pace with progress while working for the future.

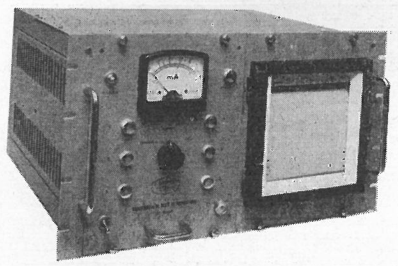
FELTEN & GUILLEAUME

CARLSWERK AG
KÖLN-MÜLHEIM
Federal Republic of Germany

SOLVES THE PROBLEM OF MEASURING
AND RECORDING PROGRAMME
VOLUME WITHOUT INERTIA,
for AM and FM signals

PEAK VOLUME ANALYSER

AP/644-T



manufactured by

TEAM
TELECOMANDI ELETTRONICI AUTOMATICI MILANO

Entirely solid-state design

measures and records the volume
of any programme signal.
Adaptable as level-analyser
for audio-frequency signals.
(Twelve sets have been supplied
to the RADIOTELEVISIONE ITALIANA, Milano).

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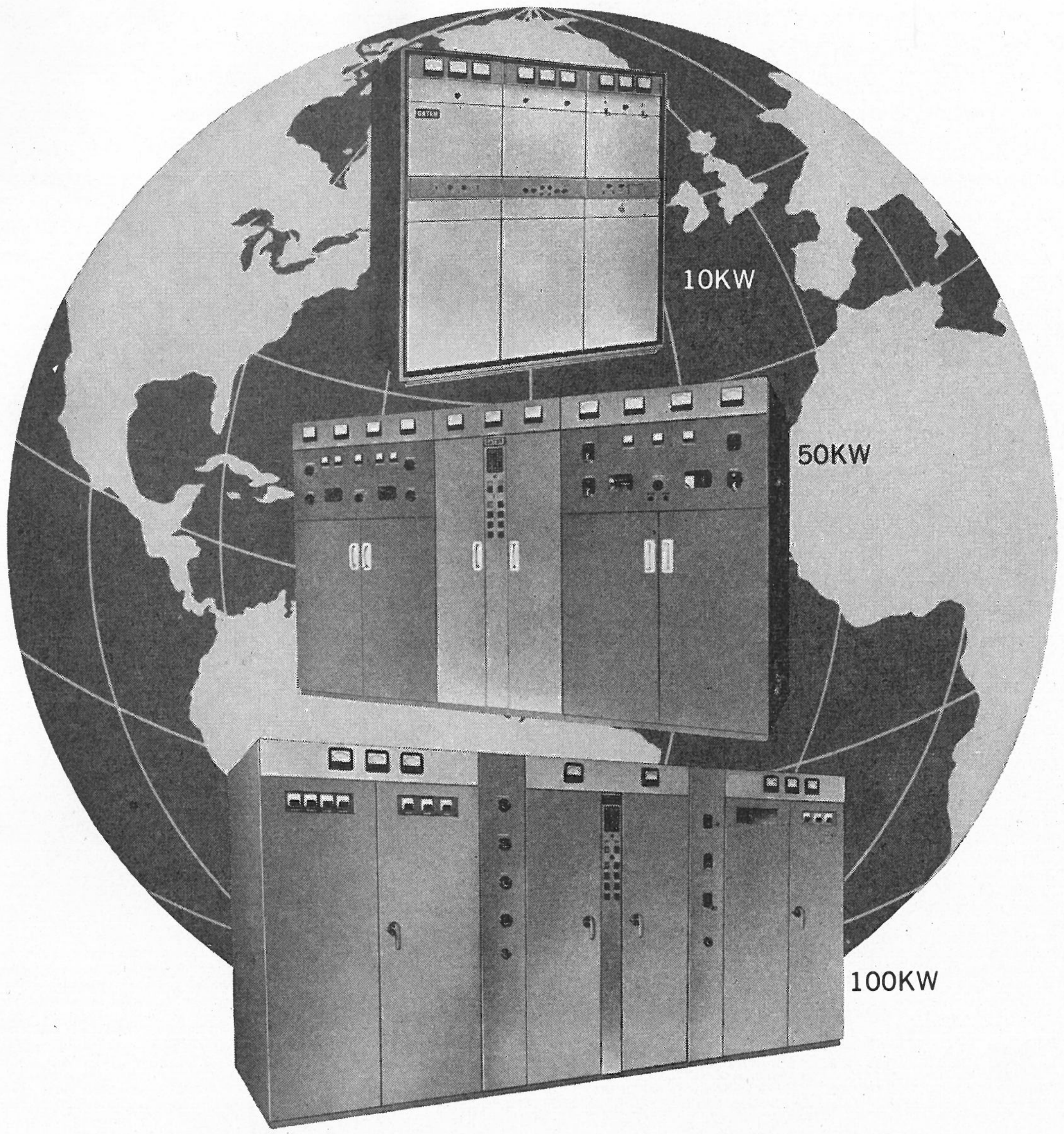

A world of high-power transmitter experience

In the field of high-powered, medium-wave AM transmitters, Gates is a world leader. Why? Take the model BC-10P. It's a completely self-contained 10KW transmitter, designed for reliability... wide frequency response... less floor space... and low operating cost. Or the model BC-50C which offers the lowest hourly tube cost of any 50KW transmitter. Or our model BC-100G... a 100KW transmitter that provides unsurpassed reliability even in areas of extreme temperatures and humidity. All Gates high-powered broadcast transmitters utilize high-level plate modulation and long-life silicon power supplies. Write or cable for full information.

GATES Medium-Wave Broadcast Transmitters

Power Output	100KW	50KW	10KW	5KW	1000 500 250 WATTS	1000 500 250 WATTS
Type No.	BC-100G	BC-50C	BC-10P	BC-5P-2	BC-1G	Vanguard I (transistorized)

HARRIS INTERTYPE CORPORATION

GATES

GATES RADIO COMPANY • QUINCY, ILLINOIS 62301 U.S.A.
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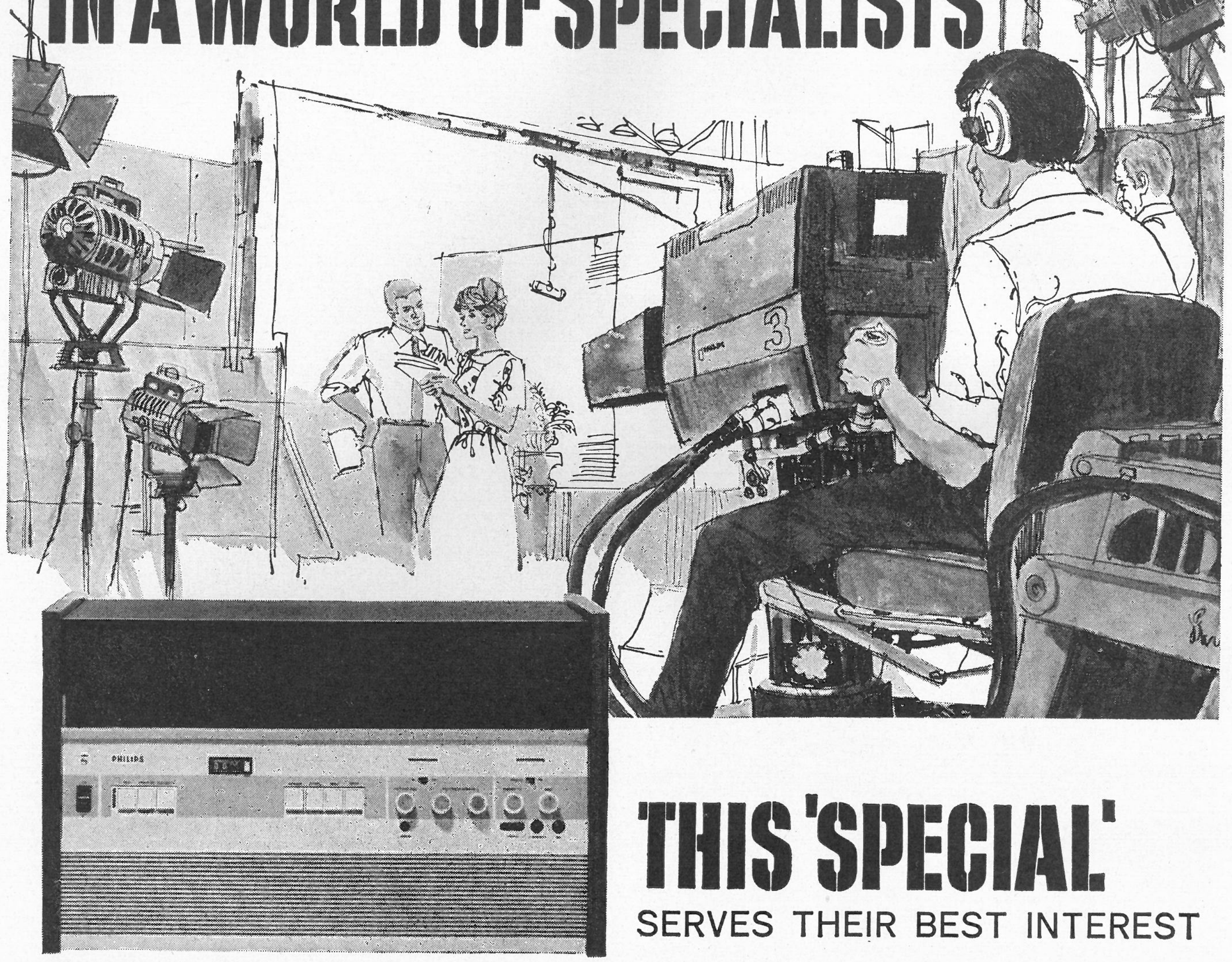
IN A WORLD OF SPECIALISTS



THIS 'SPECIAL'

SERVES THEIR BEST INTEREST

In broadcasting studios this little machine, the Philips EL 3400 Video Recorder, so compact that it can be stored in a cupboard; will do its job with unruffled calm sitting on the floor if need be.

It can release the costly studio recorders from all but their own special job of recording programmes that are going to be fed straight to the transmitters.

All rehearsals, auditions, dry runs and records of transmitted programmes, that are purely "for the record", can be handled with ease by this ingenious machine.

It can be the director's right hand, and the producer's scratch pad, day in, day out at many times below the cost of the "big stuff".

Its size, its conception and its price make the Philips Video Recorder what it is: **a high quality tool at low capital and running cost.**

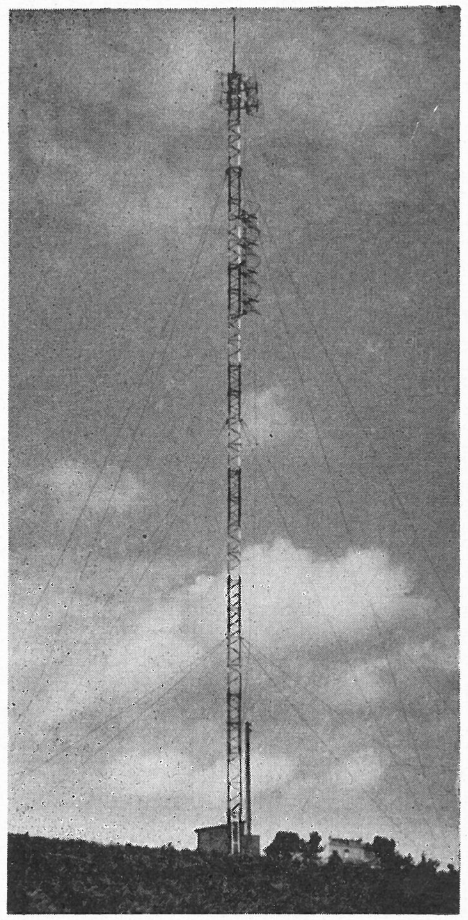
PHILIPS EL 3400 VIDEO RECORDER

FOR FULL INFORMATION tear off the foot of this page, pin it to your letterhead and post to:
N.V. PHILIPS' GLOEILAMPENFABRIEKEN, ELA DIV. (S.P.) EINDHOVEN, HOLLAND

A

TV AND VHF FM TRANSMITTERS AND TRANSPOSERS

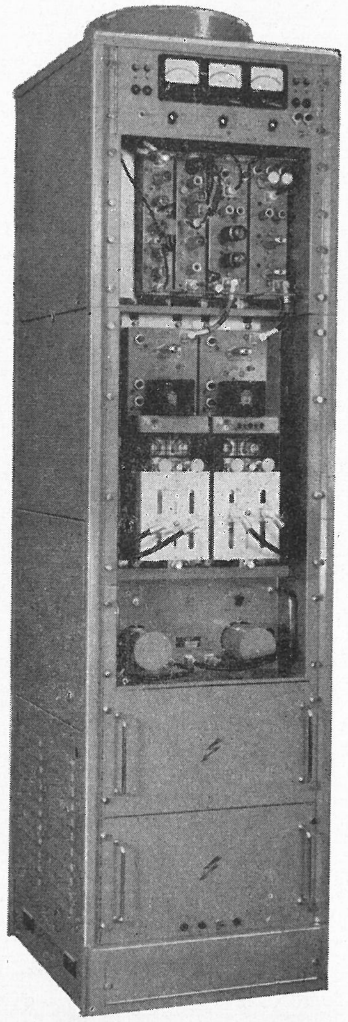
100 mW (transistorized) to 1,5 kw.



RADIO LINKS ▪
400 to 2000 mc/s

AERIALS ▪
Yagis-Corners-Reflectors-Panels

MISCELLANEOUS ▪
Combiner Units-Cavities-Filters



▪ RADIO-TELEPHONES
base - mobile - portable stations
Bands : 40 - 80 - 150 - 450 mc/s

▪ AIR-BORNE VHF TRANS-RECEIVERS "NAVCO"
480 channels

▪ CLOSED CIRCUIT TELEVISION
Cameras-Monitors

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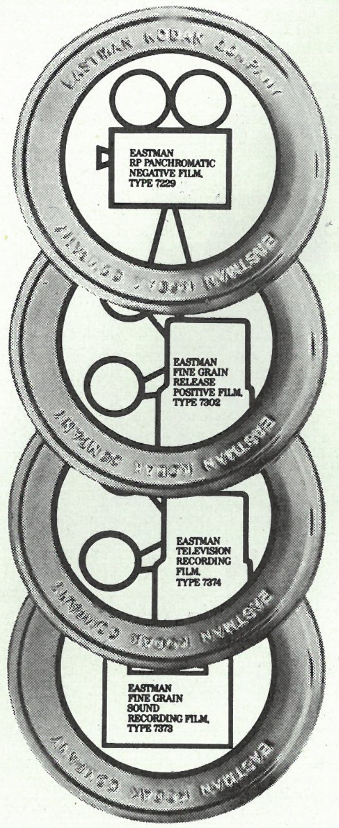
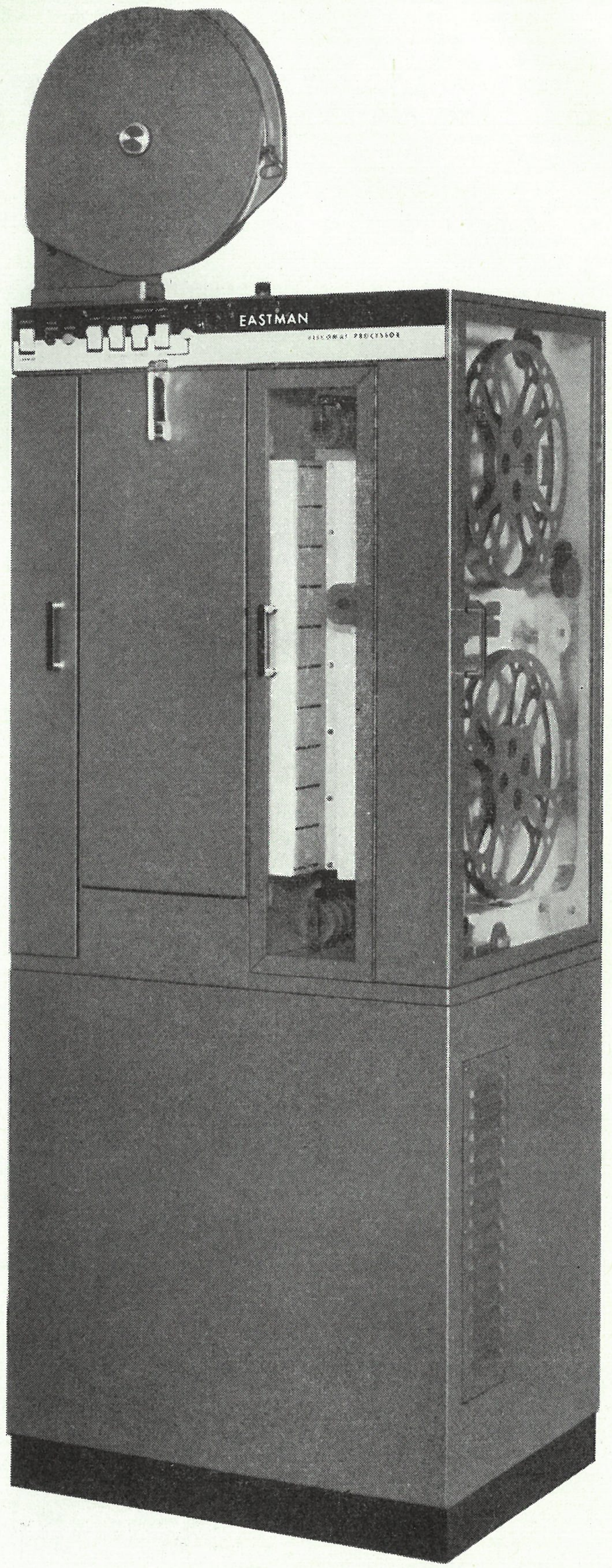
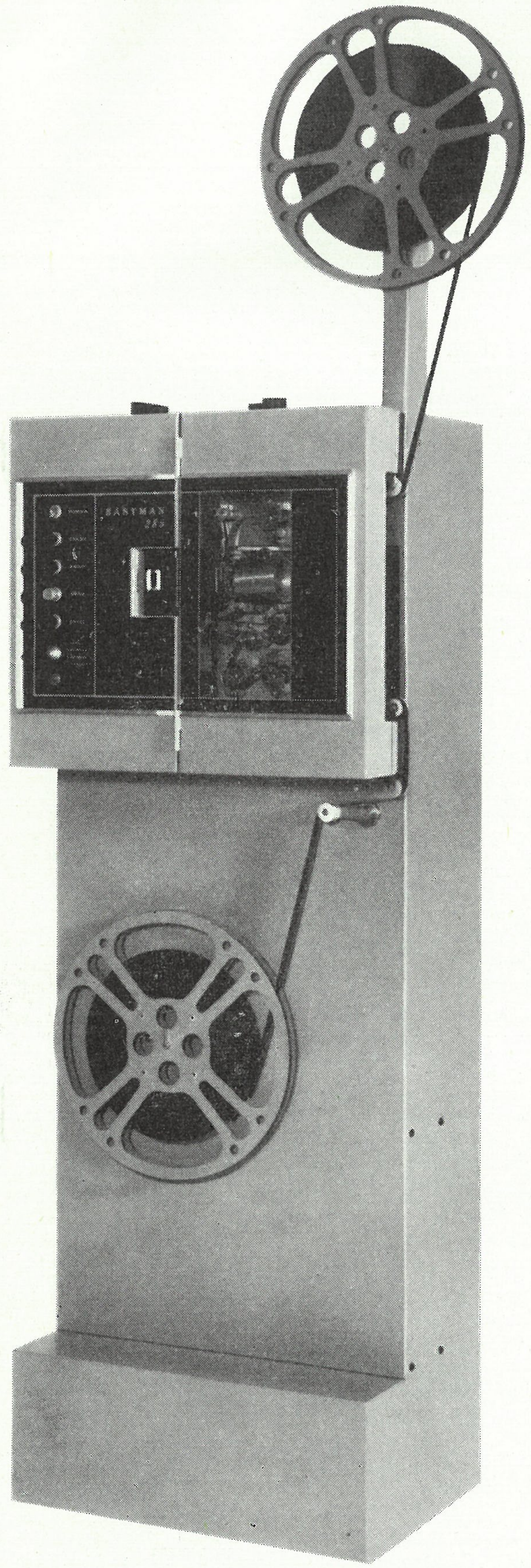
Equipment used by French and European Broadcasting Networks

With these films...and these machines ...your news is on the air in minutes







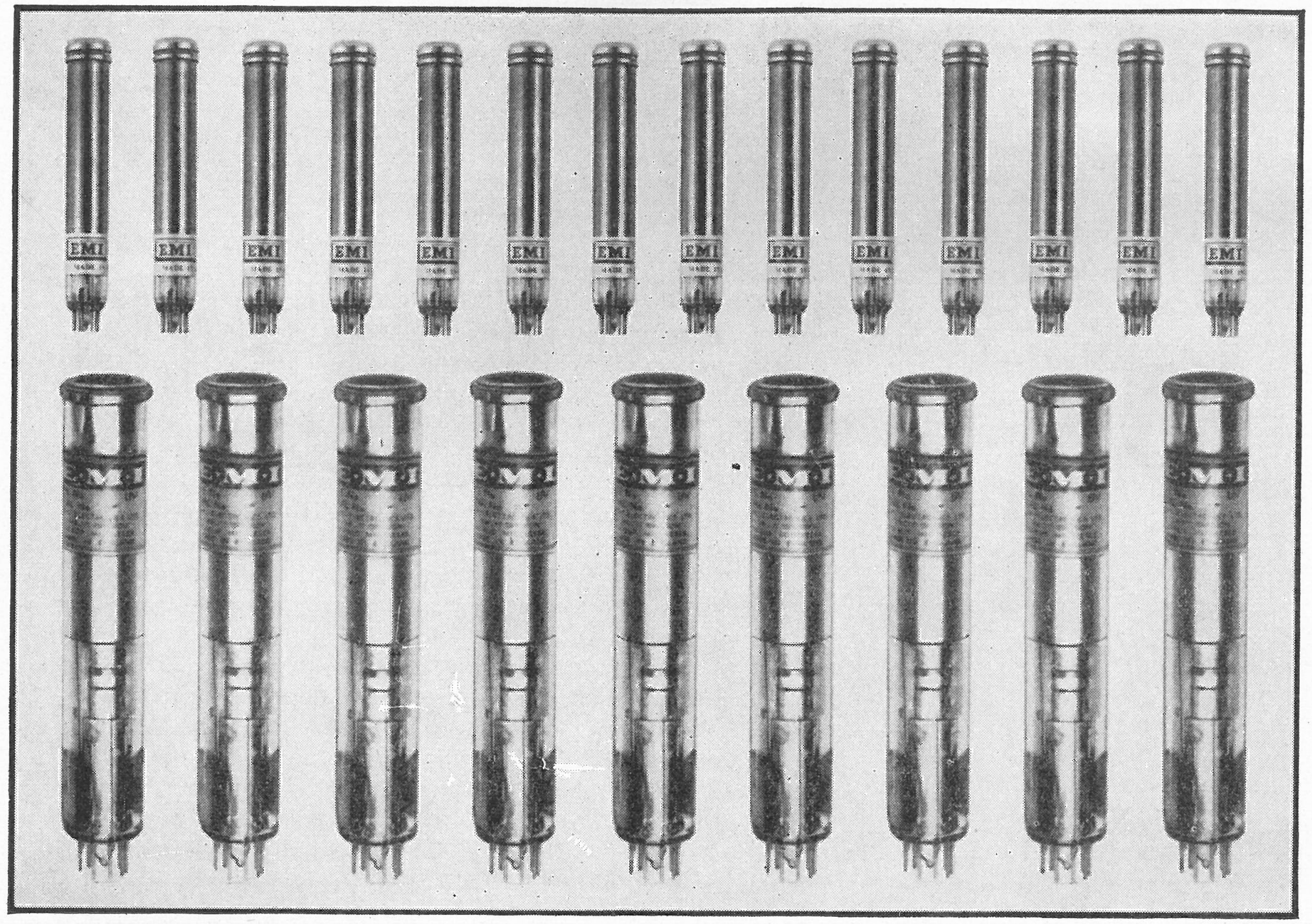
The Eastman Rapid Access System is designed to put fast-breaking news events where you want them—on the air—in the shortest time possible. It gives you a selection of negative and positive 16mm films, including EASTMAN RP Panchromatic Negative Film, Type 7229, which is pre-hardened, high-speed (ASA 250) and magnetically pre-striped. It's the one to use for tight deadline shooting. Heart of the System is the EASTMAN VISCOMAT Processor which delivers the film ready for broadcast, dry to dry, in two minutes. How do you operate the VISCOMAT Processor? Merely press the "start" button; clean-up takes twenty seconds. You're assured of uniformly excellent results because viscous processing does away with the variables of agitation and replenishment of chemicals. And now you're ready to put the film into the EASTMAN 16mm TV Projector, Model 285. Not only does this projector give you unsurpassed image quality, it is the industry standard for reliability. It assures uninterrupted top performance by isolating shock forces. For full details about the superbly practical Eastman Rapid Access System, contact your Kodak representative.

Kodak

International Markets Division
Eastman Kodak Company, Rochester, N.Y., U.S.A.

EMI ELECTRONICS MAKES
A WORLD OF DIFFERENCE

VIDICON LEADERSHIP



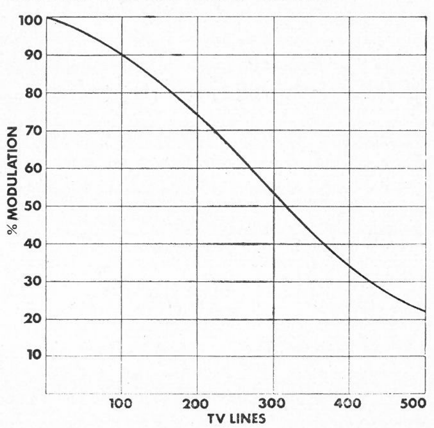
SEPARATE MESH IS NOTHING NEW TO EMI!

EMI led the world in the development of the 1″ separate mesh vidicon* and continue to do so with the Type 9697 ½″ separate mesh tube. Separate mesh and low wattage heater was in fact a standard feature of all EMI vidicons two years ago and EMI had then already overcome the problem of excessive red response and was producing very uniform prefabricated target tubes, ideal for studio broadcasting. The ½″ vidicon is a superb tube capable of high definition pictures with a spectral response to suit the majority of applications. Apart from versatility in performance, this tube has a ruggedised gun assembly. The depth of modulation can be seen in the response curve below. The range is comprehensive and for several years EMI have also led with outstanding vidicons for special applications, Ultra-Violet, Infra-Red and for rugged conditions. The word "Service" really means something at EMI. Engineers experienced in projects associated with camera tubes are always ready to discuss special requirements and EMI maintains a service to studios for all camera tubes—for "off-the-shelf" delivery phone Hayes 3888, Ext. 2076.

* The paper "Some Problems of Resolution in Low-Velocity Camera Tubes" was presented at the International Television Conference, on 1st June, 1962, by H. G. Lubszynski, Dr. Ing., F. Inst.P., and J. Wardley, B.Sc., A. Inst.P. of EMI.

Above: The top line of tubes are EMI ½″ vidicons and for comparison the bottom line are 1″ tubes.

Below: Depth of modulation of ½″ vidicon Type 9697 for wall anode at 290 V, and Mesh at 500 V, signal current of 0.15 μA, and scanned area 6.60 mm. x 4.95 mm.



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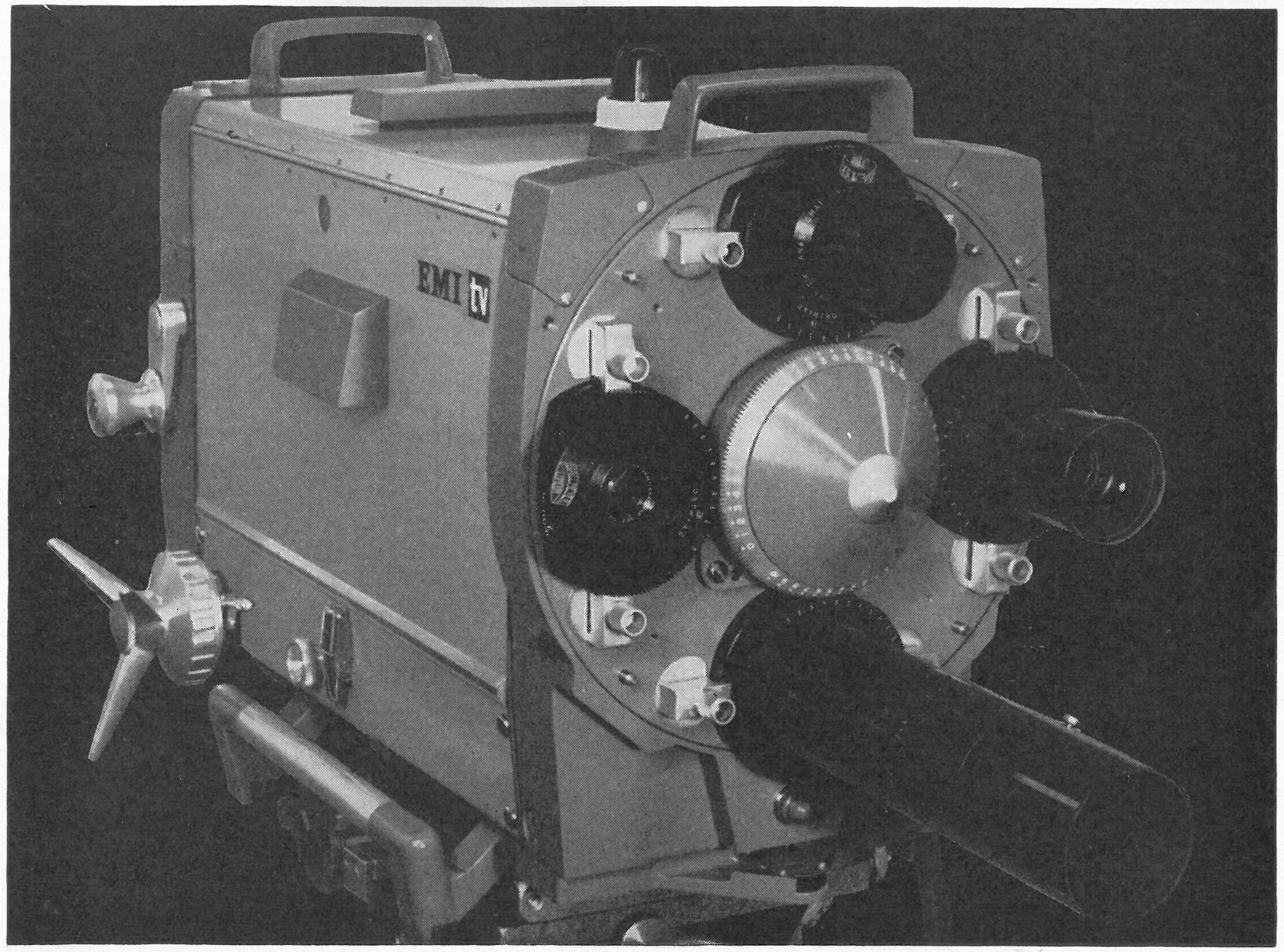

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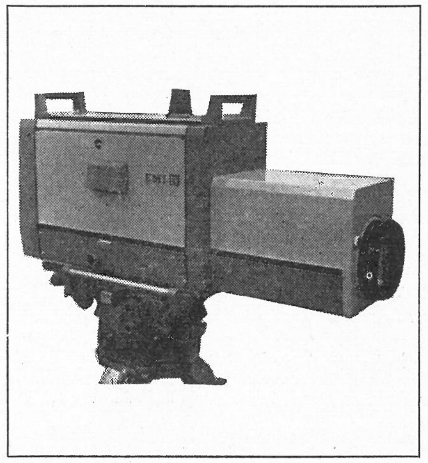

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FIELD-STRENGTH MEASUREMENTS AT FREQUENCIES IN EXCESS OF 30 Mc/s

The method used at the RAI's Monitoring Station at Monza

by G. GENTILE *

Summary.

If one tries to utilise, on VHF and UHF, the methods adopted for measuring LF and MF field-strengths, several anomalies are observed, resulting from the undulatory nature of the field and from the reflections that occur between the transmitting aerial and the point of reception. The author draws attention to the difficulties that arise in such circumstances and describes the method of " vertical sounding at one point " which is utilised by the RAI for measuring field-strengths at frequencies above 30 Mc/s.

In order to make clear the principle of the method, he explains how the resultant field, whose components are the direct field and the field reflected from a horizontal plane, varies as a function of the height above the ground. He applies these data in order to interpret the results of measurements of the field-strength at various altitudes ; he gives some graphs depicting the variation of the field-strength as a function of height observed in several actual cases and indicates how the direct field-strength to be determined may be derived from these data.

General.

The ever-increasing use of VHF and UHF for broadcasting has, in the past decade, more and more frequently resulted in the need for field-strength measurements as part of measuring and monitoring operations. As regards the Radiotelevisione Italiana (RAI), these measurements have been effected at its Monza Monitoring Station, first of all in Bands I, II and III for the installation and supervision of the FM and television networks, and later also in Band IV for the stations of the Second Television Programme.

These field-strength measurements relate, in particular, to the following :

a) Inherent problems of *transmitting aerials,* such as the determination of the gain and of the directivity in the horizontal and vertical planes, as well as the determination of the power radiated in various directions.

b) Problems relating to *radio-wave propagation* and therefore to the study of the influence thereon, both qualitatively and quantitatively, of the ground, of natural and artificial obstacles and other factors that may modify the propagation between two given points.

c) Problems relating to *receiving aerials* and to the reception of radio signals : the study of the correct installation of the aerials, cases in which reception is disturbed by the effect of obstacles (reflections, distortion etc.) or by radio interference and the like.

d) The determination of the area in which the unvarying reception of a programme is possible, that is, the determination of *service areas.*

For effecting such measurements, the RAI's Monitoring Station has, since 1954, used a particular method which, in addition to advantages of a general nature which are described elsewhere, makes it possible to obtain a high precision, especially when the measurements are effected over broken ground, which is often the case in Italy.

This method was based upon various experiments and facts, including the following :

i) The first field-strength measurements effected in the VHF band showed that the methods valid for kilometric and hectometric waves cannot be reliably applied in the VHF bands, especially over broken territory.

ii) From measurements effected at points of different orographical characteristics, it was found that the variation of the field-strength obtained by displacing the aerial at a constant height from the ground does not obey any general rule : over flat country, the field-strength often remains constant ; over broken territory it varies in an unpredictable fashion that cannot be explained from first principles.

iii) The variation of the field-strength at one point, as a function of the height above ground, is not always linear. Linearity with altitude is observed over flat ground if the transmitting aerial is distant and not too high. On the other hand, over hilly or moun-

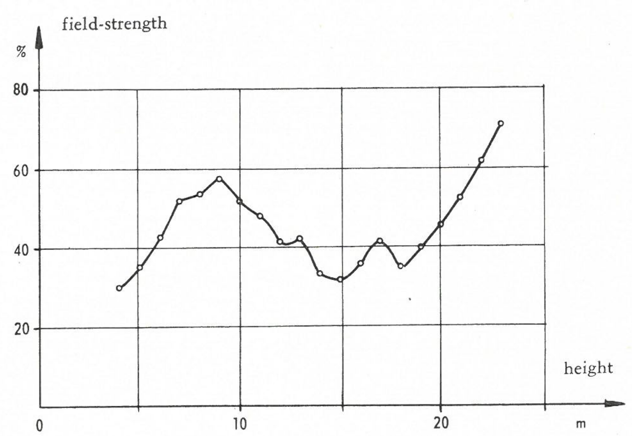

Fig. 1. — An example of the variation of the field-strength as a function of the height of the measuring aerial above the ground, for propagation over very irregular terrain.

* Mr. Gentile is with the Radiotelevisione Italiana.

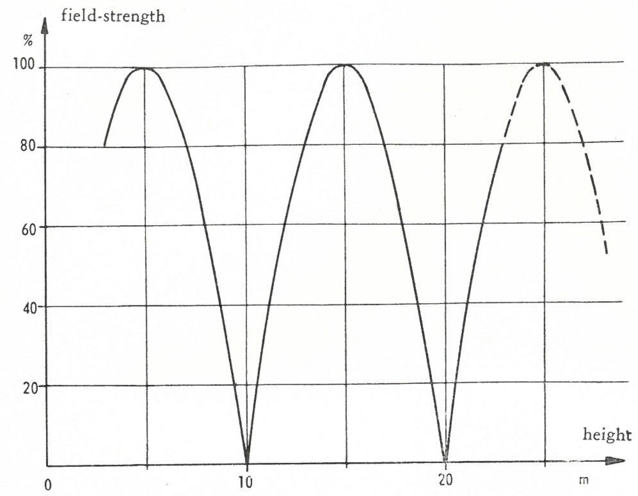

Fig. 2. — Theoretical variation of the field-strength as a function of the height of the measuring aerial above flat ground, when there is a large difference of level between the transmitting and measuring aerials.

tainous ground, the curve of the field-strength as a function of the altitude above ground can have any shape (see *Fig. 1*).

iv) Over flat ground, not far from the transmitter or with important differences of level between the transmitting aerial and the ground surrounding the point of measurement, the variation of the field is periodical, corresponding to a series of half-wave sinusoids *(Fig. 2).*

Undulatory nature of the field.

Many of the above, and other similar facts not cited, may be explained by remembering the undulatory nature of the field. As has in fact been noted, the wave, on striking the ground and other obstacles, is reflected, refracted and diffracted. At a point in space, we can therefore observe the direct field due to straight-line propagation and also reflected, refracted and diffracted fields. As a result, the field-strength is a parameter which is not easy to measure. The difficulty lies not so much in the actual execution of the measurement, as in the interpretation of the result obtained.

Moreover, further difficulties arise if it is desired that the result obtained at the point of measurement be representative of the field throughout the surrounding area, from a minimum of some hundred square metres to a maximum of several square kilometres.

Field-strength measurement difficulties.

Notwithstanding the field's being proportional to the radio-frequency voltage read on the field-strength measuring instrument, this does not signify that the field-strength measurement is as easy and simple as that of a radio-frequency voltage.

The only case in which this happens is when the transmitters and receivers are isolated in space and far from any reflecting bodies. The measurement of a field is complicated, as has already been said, by the propagation phenomena that result from the undulatory nature of the field, and in particular, by reflections and diffraction of the ground and of other natural obstacles.

Since the importance of these phenomena varies with the frequency bands at any given point of measurement, besides the principal wave, there will be present other waves, whose intensity and importance will vary from band to band.

In the face of difficulties due to the superposition of many waves or rays (which add vectorially), the field-strength measurement should be made with particular caution, in such a fashion that the result obtained is that due to the ray or rays which we wish to observe and that it is independent of the unwanted rays (reflected, indirect etc.). Mention should be made of the fact that the field-strength due to the unwanted rays can be equal to or even as much as twice that of the ray to be measured, so that the result of a single measurement, which should give the value E, can give any value between zero and $2E$, or even more. In order to avoid errors and so that the result should be valid in the widest area possible, it is recommended, so as best to obtain the wanted result, to adopt the following method for the measurements.

Measuring method.

The measuring method used in the Monitoring Station of the RAI, a method which may be called the method of " vertical sounding at one point ", consists of displacing the aerial of the field-strength measuring instrument along the vertical at the point of measurement, noting the field-strength at various heights above the ground. In this way, at a suitably chosen point, one determines the variation of the field as a function of the height above the ground. The variation observed, appropriately interpreted, as will be shown below, makes it possible to determine both the direct and the reflected field in the measuring area.

This method gives optimum results over ground of every type, is very exact and can be justified theoretically. Moreover, it takes account of the ground effect and makes it possible to eliminate the influence of any possible obstacles near the point of measurement.

Composition of the field in a simple case.

In order better to explain the general mechanism of field-strength measurements at frequencies in excess of 30 Mc/s, especially using the vertical-sounding method, it is necessary to give some theoretical consideration to the influence of the height above the ground on the field-strength. The results obtained are very interesting and are not at all evident at first sight. The illustration in *Fig. 3* depicts a very simple case of direct practice over flat ground within the optical horizon of a transmitter situated on the summit of a hill.

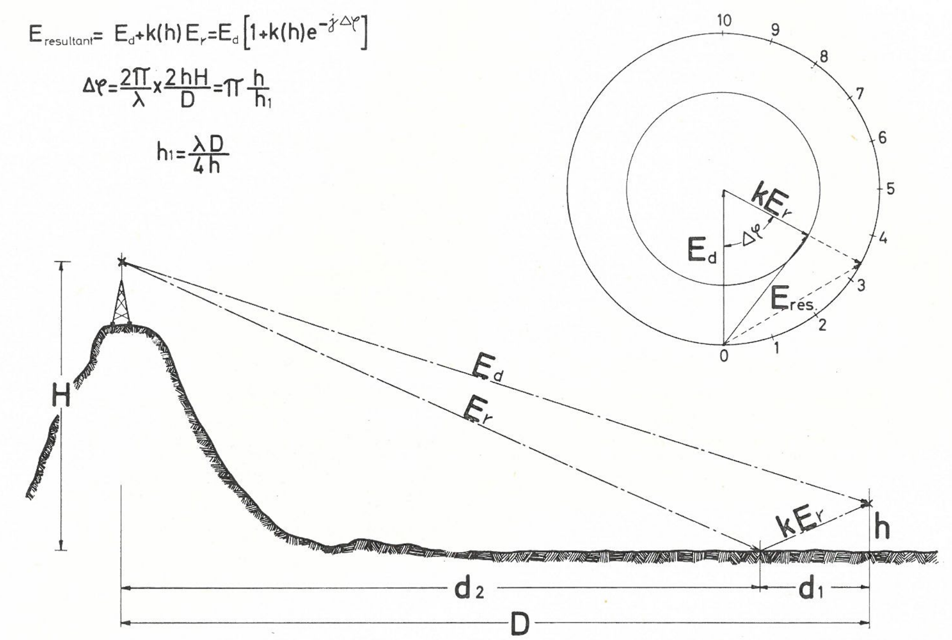

Fig. 3. — Vector-addition of the direct field E_d and the reflected field E_r; the simple case of a transmitter located on a mountain top.
k is the reflection coefficient, $\Delta\varphi$ is the phase-difference between the direct and reflected rays.

At a point situated at a height h above flat ground, two rays meet, arriving from a transmitting aerial in sight. One of these rays of field-strength E_d arrives directly without touching the ground. The other ray arrives at the measuring point after having been reflected at the ground.

If it is assumed that, on leaving the aerial, the field-strength of this second ray be E_r, the field-strength of the ray which arrives at the measuring point will be kE_r due to the effect of the ground (k being the reflection coefficient). In practice, the phase of kE_r will differ from that of E_r by 180°, because of the effect of the reflection, and it will also differ from that of E_d, because the two rays have travelled over paths of different lengths. The resulting field at height h will be given from the vectorial sum of the fields due to ray E_d and ray kE_r.

It is easy to demonstrate that the resulting field-strength at a height h is given by the following expression (assuming the modulus of E_d to be equal to that of E_r):

$$E_{res} = E_d(1 - ke^{j\Delta\varphi})$$

where $\Delta\varphi$, which is the phase difference of the optical paths of E_d and E_r, is:

$$\Delta\varphi = \frac{2\pi}{\lambda} \cdot \frac{2hH}{D} = \pi\frac{h}{h_1},$$

with
$$h_1 = \frac{\lambda D}{4H}$$

The height h_1 has an interesting physical interpretation and is the most important datum for the execution of the measurement according to the vertical-sounding method; *h_1 is the height at which the resultant field-strength attains its first maximum.*

At the top right-hand side of *Fig. 3* is depicted the graphical combination of the two vectors E_d and kE_r. It will be seen that, with the changing of $\Delta\varphi$ and of the height above the ground, the resulting field-strength increases steadily from $(1 - k)E_d$ to $(1 + k)E_d$ then decreases again to $(1 - k)E_d$ and so on. The maximum values are 0 and 2 E_d.

Theoretically, in the simple case illustrated, it therefore results, either from the formula given for E_{res} or from the graphical addition of the vectors E_d and kE_r, that the resultant field-strength varies with the height above the ground according to a sinusoidal law as in *Fig. 2*.

Fig. 4 shows the theoretical variation of the field as a function of the height in the cases of k (reflection coefficient of the terrain) equal to unity and of k equal to 0.6.

Because, in general, the reflection at the ground for frequencies beyond 30 Mc/s is in practice always total (except in cases due to the broken nature of the ground over which the point of reflection is displaced), in the simple case illustrated we may consider that k is always unity and that the variation of the resultant field-strength is given by the continuous-line curve in *Fig. 4*, which oscillates from 2 E_d to zero.

The graph in *Fig. 5* depicts the variation of the field-strength along the vertical of a point, due to two transmitters, one on 500 Mc/s and the other on 200 Mc/s. Both the transmitters are in the same transmitting station, that is, they are at the same distance

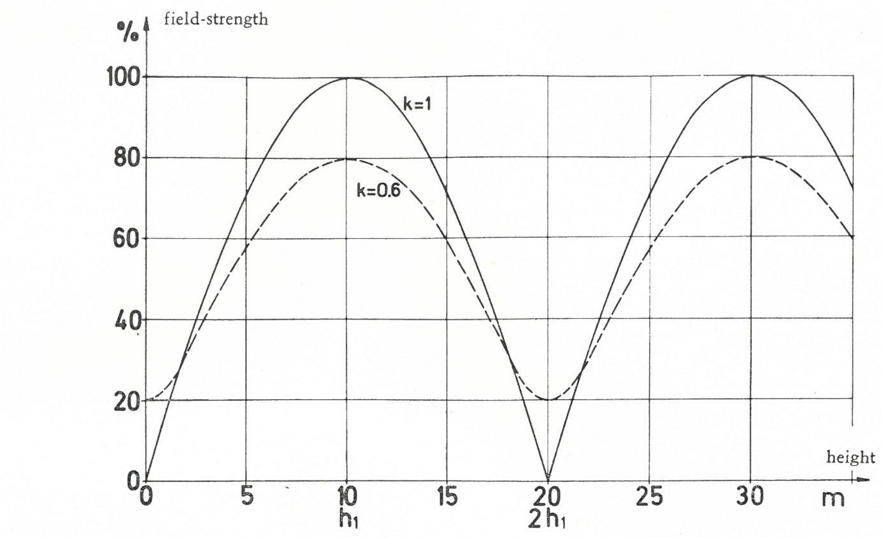

Fig. 4. — Theoretical variation of the field-strength as a function of the height above the ground of the receiving aerial, due to the combination of the direct and reflected rays, for the cases where the coefficient of reflection $k = 1$ (full line) and 0.6 (broken line).

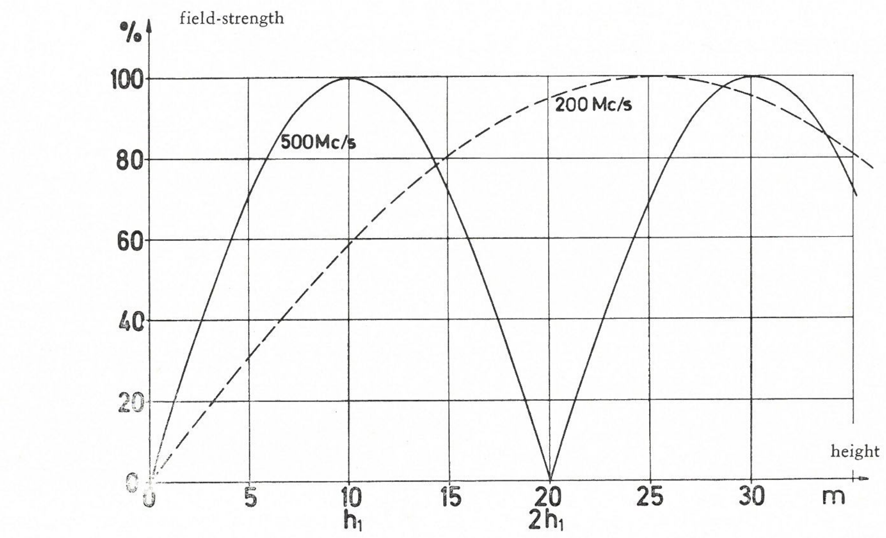

Fig. 5. — Variation of the field-strength as a function of the height of the receiving aerial, for the cases of transmission on 200 Mc/s (broken line) and 500 Mc/s (full line).

and at the same height above the ground. For reasons of simplicity, these graphs have been drawn on the assumption that the distance and height of the transmitters are such that the first maximum of the resulting field occurs at a height of 10 m for 500 Mc/s and, consequently, of 25 m for 200 Mc/s. Such a situation occurs, for example, when the point of measurement is situated at a distance of 30 km from the transmitters and the aerial, transmitting over flat ground to the measuring point, is 450 m high.

Fig. 5 clearly shows the effect of the frequency on the variation of the resultant field. It will be seen, moreover, from this figure that around 20 m there is a minimum of the Band-IV field and a maximum of the Band-III field. Moreover, if we decide to make the measurements at a fixed height above ground, it will be seen how the field-strength measured, both in Band IV and Band III, can have any relation with respect to the direct field E_d and gross errors could then occur. Finally, it results from *Fig. 5* that shortcomings cannot in general be remedied by multiplying the results by suitable coefficients.

Execution of the field-strength measurement and interpretation of the results.

The measurement of the field-strength at frequencies in excess of 30 Mc/s, especially over irregular ground, is readily carried out by means of the vertical-sounding method. For this purpose, it is necessary to have available vehicles equipped with masts capable of lifting the aerial of the field-strength measuring installation from

Fig. 6. — VHF/UHF field-strength measuring vehicle used by the RAI. The OM type " Tigrotto " 4-wheel-drive chassis carries a body built to Scall of Torino. The " Barberi " hydraulic mast can raise the aerial to a height of 23 m above the ground; its fully-retracted height is 2.5 m. The height of the aerial is indicated within ± 1 cm by the device for running out the coaxial feeder.

a minimum height (about 3 m) to the maximum possible height. The RAI Monitoring Station carries out all its measurements beyond 30 Mc/s by the vertical-sounding method and has for this purpose three specially-designed vehicles at its disposal.

Each of these (installed in an OM 3.5-ton motor-van) is equipped with a hydraulically-operated telescopic mast capable of lifting the aerial up to a height of twenty-three metres from the ground *(Fig. 6)*.

Inside these vehicles, which are adapted also for cross-country driving, is installed all the necessary apparatus, including :

a) a diesel-electric generating set of about 2 kW ;

b) field-strength measuring equipment, television and sound-broadcast receivers, frequency-meters etc. ;

c) mechanism for automatically rewinding the cable and for indicating exactly the aerial height etc.

At points that are inaccessible for motor vehicles, the measurements as a function of the height are effected with light-weight telescopic masts that can easily be set up by hand. They are very quickly erected and are supported by stays (*Fig. 7*).

On the basis of the theory of the field-strength as a function of the height above ground, when measurements are made with the vertical-sounding method, first of all the variation of the field-strength as a function of the height above the ground is determined, either by recording or by reading at every metre or every half-metre, as the aerial is raised.

From this variation, if the measurements are made to determine the service area, it is possible to calculate at once the fields at the various heights at which are found the aerials of the listeners and viewers.

For all the other purposes of measurements, because as a rule it is desired to know the direct field E_d, the measured variation of the field-strength should be compared with the theoretical, foreseen variation. From this comparison it is possible to obtain the value of the direct field E_d, which is the final useful result of the major part of measurements beyond 30 Mc/s.

In fact, only from the direct field E_d is it possible to determine the power radiated, the radiation diagram and the gain of a transmitting aerial, the efficiency of a transmitting installation, an appraisal of the quality of the propagation etc.

Real cases of field-strength variation as a function of the height.

The graphs in *Figs. 8, 9, 10* and *11* depict the real variation of the field-strength as a function of the height, obtained by measuring with transmitters, one in Band III and one in Band IV, situated at 450 m above flat ground at the point of measurement, at a range of

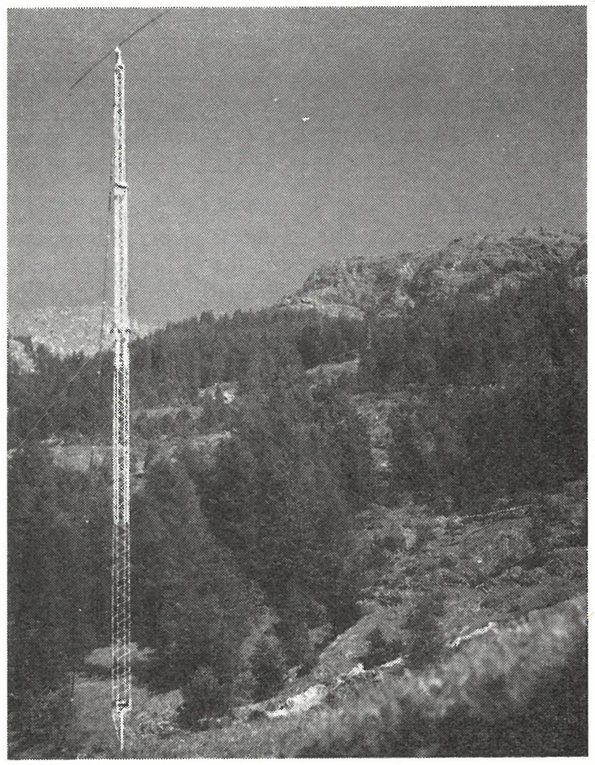

Fig 7. — A " Fracarro " transportable telescopic mast used by the RAI for field-strength measurements in high mountains. Max. height : 18 m; min. height : 5,6 m; weight : 30 kg.

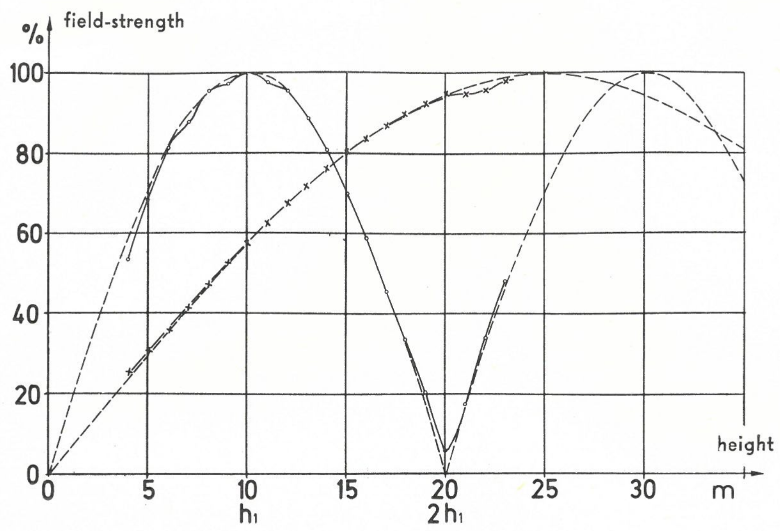

Fig. 8. — Measurements made with unobstructed propagation between the transmitting and receiving aerials and with reflection at a plane surface.

Behaviour of the field-strength in Bands III and IV (200 and 500 Mc/s) vertically above the receiving point, as a function of the height of the receiving aerial above the ground.
The value 100 % corresponds to 14.7 mV/m.

—○—○— Band-IV measurements
—×—×— Band-III measurements
– – – – – – Theoretical curves

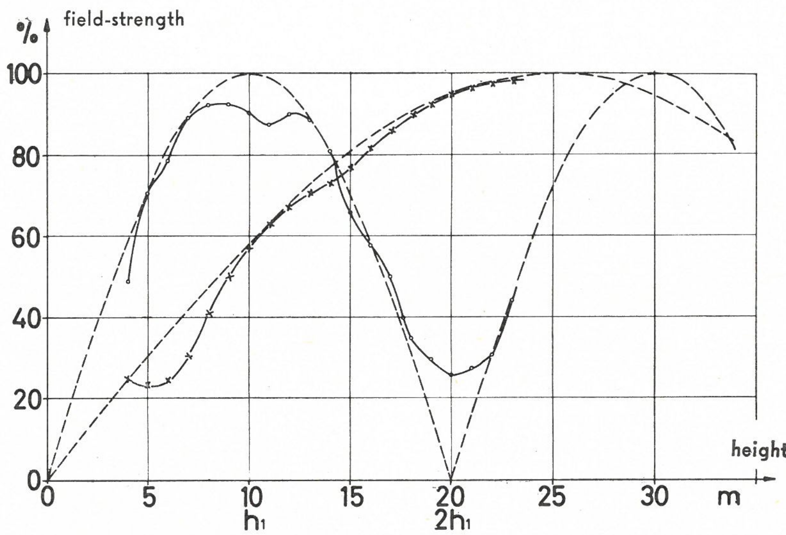

Fig. 9. — Measurements made with terrain irregularities partially obstructing the reflected ray.

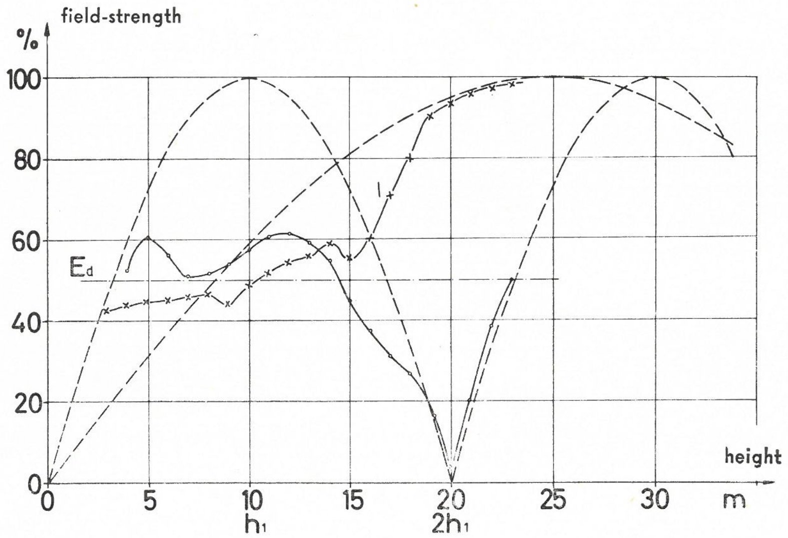

Fig. 10. — Measurements made with the reflected ray obstructed for certain heights of the receiving aerial.

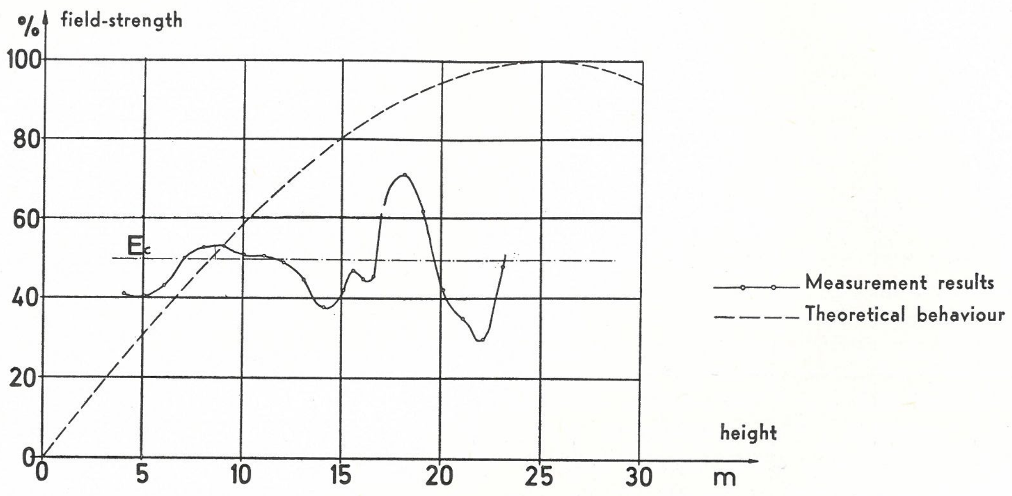

Fig. 11. — Behaviour of the field-strength in Band III (200 Mc/s), as a function of the height of the receiving aerial, when the resultant field-strength is due to a combination of complex phenomena.

30 km. In order to facilitate the comparison, the values of the field-strength are referred to an ERP of 1 kW.

In *Fig. 8,* the theoretical and real variations are practically coincident. This happens when the transmitters are within the optical horizon, the point of measurement is on flat ground and especially if the point of reflection is also on very regular ground (sheet of water, air-field, meadows or fields without trees etc.). Under these conditions, the direct field is equal to half the maximum measured value.

The graph in *Fig. 9* represents one of the most common cases, in which the results of the measurements deviate slightly from the theoretical forecasts. Usually, such deviations from theory give rise to lower field-strengths near the maxima and to higher field-strengths near the minima. This is a consequence of the interception of part of the reflected rays, due to obstacles or irregularity at the point of reflection. It is, however, not difficult to see that the direct field E_d is half of the extrapolated maximum.

The case presented in *Fig. 10* is more complex. The reflected ray for all heights between about 5 and 15 m is almost totally intercepted. Determining the direct field-strength is still possible by extrapolation as in the preceding case, but with greater difficulty and therefore with a higher probability of error.

There may also occur cases in which the variation of the field as a function of the height above ground is in no way in conformity with the theoretical forecasts. On the basis of the above-mentioned theory it is therefore difficult or quite impossible to determine the direct field-strength (see, for example, *Fig. 11*). In this case, in order to determine the direct field-strength, the measurement should be repeated at another point, only a few metres distant from the preceding point. The variation obtained at the new point can be very different from the first and probably still difficult to interpret. In such a case, it will perhaps be possible to observe that the results of the two measurements have in common a value which is half-way between the maximum and the minimum field-strength measured, independent of the height at which these values are obtained. This value, which we call the *characteristic field* E_c, coincides with good precision with the direct field-strength, if the sounding has been effected at least as far as the height of the first theoretical maximum of the resulting field.

Finally, we have the case in which the maximum height from the ground at which are effected the measurements is below that of the first maximum. In this case, too, it is possible to determine the direct field-strength. It is necessary simply to calculate the height corresponding to the first maximum and then to compare the measured field-strength as the percentage of the direct field with the height at which the measurements were made.

THE INTRODUCTION OF STEREOPHONIC BROADCASTING IN THE NETHERLANDS

*by J.J. GELUK **

Summary.

Quite apart from the choice of the transmission standards, stereophonic broadcasting poses many problems of a technical nature regarding studio practice, the distribution network and the transmitters. The author discusses the more important questions relating to microphone technique, mixing facilities, tape and disk recording, continuity suites, transmitter switching, receiver adjustment and programme distribution. In each case, he describes the solutions adopted by the N.R.U. since the introduction of stereophonic broadcasting in the Netherlands in 1963, as well as the technical conclusions drawn from service trials.

General.

Regular stereophonic programmes have been broadcast on VHF in the Netherlands since July, 1963, the system adopted being the " pilot-tone " system, whereby the additional information required for stereophony is transmitted in a coded form. The numerous international conferences which led up to the adoption of that system certainly made available a great deal of information relating to the radio-frequency and audio-frequency transmission quality ; nevertheless, apart from the choice of the system itself, many difficulties of a practical nature were encountered when introducing stereophony into routine broadcasting practice in the Netherlands. We propose to discuss those difficulties which were specifically technical and which required changes in the apparatus or working methods in many of the constituent items of the broadcasting chain. However, it should be noted that, since stereophonic broadcasting began in the Netherlands, more than 1500 programme-items of all kinds, musical and dramatic, have been broadcast by the N.R.U. In most cases, these programme-items were recorded in the N.R.U. studios or in the well-known Concertgebouw at Amsterdam.

Microphone technique.

It is very often stated that modern stereophony is based essentially on the creation of differences of *intensity* between the *A* and *B* signals, and this consideration has led to the development of " coincident " microphones (see *Fig. 1*). However, it is only in exceptional circumstances that satisfactory results can be obtained using a single coincident microphone-pair. If an auxiliary microphone also is used, new intensity and phase differences between the stereophonic signals are created, so that not only will the direct sound-field in the studio have different arrival-times, but also the indirect sound-field will cause random irregularities in amplitude and phase.

In practice, then, it must be considered that it is incorrect to use the term " intensity stereophony " ; even if only a single coincident microphone-pair is used, the relative positions of the sound sources in the studio are only rather inadequately represented by the stereophonic reproduction. In effect, the direct sound-field can produce intensity differences of only 6 decibels at the most with cardioid microphones, whereas the indirect sound-field produces signals which have quite a large degree of correlation. Consequently, the sound-image due to the diffuse sound-field will be observed midway between the two loudspeakers. It is possible, however, to achieve some improvement in both respects by providing 6 decibels of additional amplification of the difference signal of the two microphone cartridges.

Even better localisation is possible by separating the two microphone cartridges by a small distance, so that time-delays add to the subjective separation of the channels and render the indirect sound-field more diffuse.

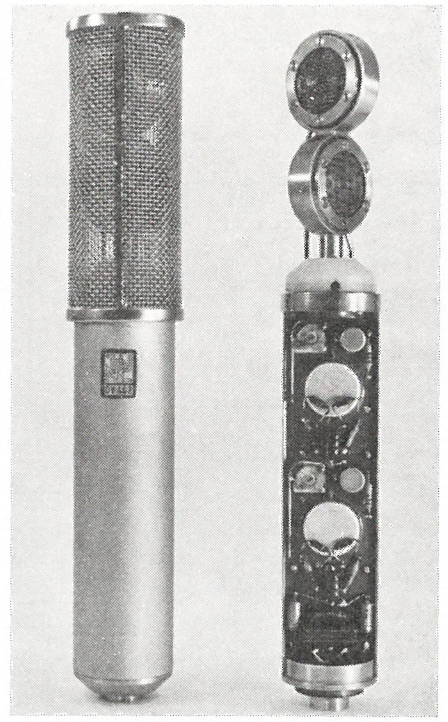

Fig. 1. — " Coincident " microphone-pair using capacitance cartridges and equipped with solid-state amplifiers.

* Prof. Geluk is Head of the N.R.U./N.T.S. Laboratories. This article is based upon a paper read by him at the Fifth International Acoustical Congress, held at Liège in September, 1965.

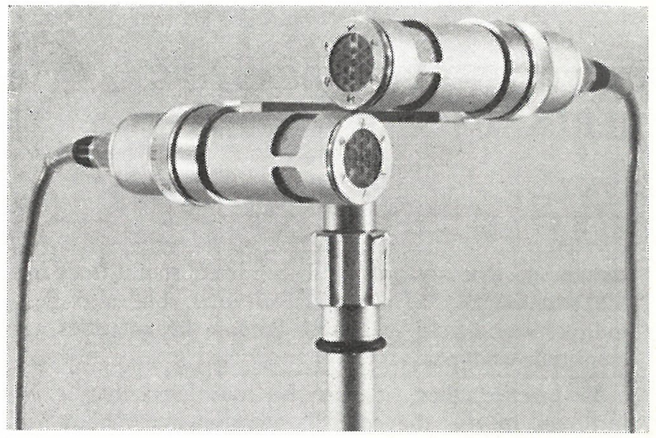

Fig. 2. — Two capacitance microphones of the type standardised by the N.R.U., equipped with solid-state RF pre-amplifiers, mounted on a support whereby they can be arranged either as a " coincident " pair or slightly separated.

From the point of view of broadcasting studio technique, it is a great advantage to use only standard microphones which can be assembled as " coincident " or " spaced " microphone-pairs, as required *(Fig. 2)*. The microphone standardised by the N.R.U. has a nickel membrane, a cardioid directivity pattern and a solid-state pre-amplifier, the circuit diagram of which is depicted in *Fig. 3*.

When monophonic microphones are used for stereophony, an artificial effect of localisation can be achieved by using a " panoramic " potentiometer. For the indirect sound-field, which is constant throughout the studio, a part of the signal obtained from a given microphone is mixed with that of the other microphones, which produces an almost perfect diffuse image between predetermined directions. A special effect may be obtained by inverting the signal in one of the channels, and provision for this should be made in the control desk.

The most flexible solution would be the provision of all the facilities mentioned above, but with prior consideration always given, in the design, to the requirements of monophony.

Mixing technique.

A universal mixing circuit for stereophony should incorporate at least two primary programme channels, as well as a number of secondary channels for, for example, echo and sound augmentation.

Until recently, to meet the requirement to give priority to the production of the compatible monophonic signal, the M and S signals were adopted for the mixer channels. The N.R.U. equipped eight studios with apparatus of this type, of which a short description follows *(Fig. 4)*.

Each source (microphone channel), as well as having the usual facilities such as tone-control and pre-fade listening, has a " direction-control "* whereby to the S signal may be added, with either polarity, the M signal at any amplitude up to twice its normal value. Moreover, the M signal can be cut off altogether, so that all that remains is the S signal, as pre-set, in the channel in question. The M and S signals then pass through a matrix which produces the A and B signals, which are fed into the main stereophonic fader. For each microphone there are, therefore, two signals corresponding to $A = M + S$ and $B = M - S$, where $S = \pm \beta M$ and $0 \leqslant \beta \leqslant 2$.

It is evident that if $\beta = +1$, the signal B vanishes, whereas if $\beta = -1$, it is the signal A that vanishes, which represents the normal panoramic range. If two microphones are placed close to one another and are connected to two adjacent channel-faders, the apparent direction of the sound-image is determined by the setting of the two corresponding direction controls. Because the widest angle that can be obtained with $\beta = \pm 1$ and a coincident pair of cardioid microphones is only $\pm 30°$, the additional amplification was provided to permit β to attain ± 2, making the intensity-difference range 14 db, as indicated in the table below.

The additional amplification has also two other beneficial effects, namely an improvement in the " conformity " (accuracy) of the sound-image and an increase in the diffusion of the reverberant part of the signal. The first-mentioned effect may be confirmed by comparing the total power dissipated by the two loudspeakers when the sound source in the studio is, on the one hand, located in the centre of the stage and on the other hand, on the axis of one of the microphones, as made clear in the table below. It will be noticed that the total power for the case of the central source is less, corresponding to a subjective concavity of the sound space. The enhanced diffusion can be deduced from the correlation between the signals K_1 and K_2 for a diffuse sound-field in the studio. The completely correlated part comes from the sound-pressure com-

* The functioning of this direction control was explained in detail in an article by the same author, entitled " A direction-meter for stereophony " published in E.B.U. Review No. 72-A (April, 1962).

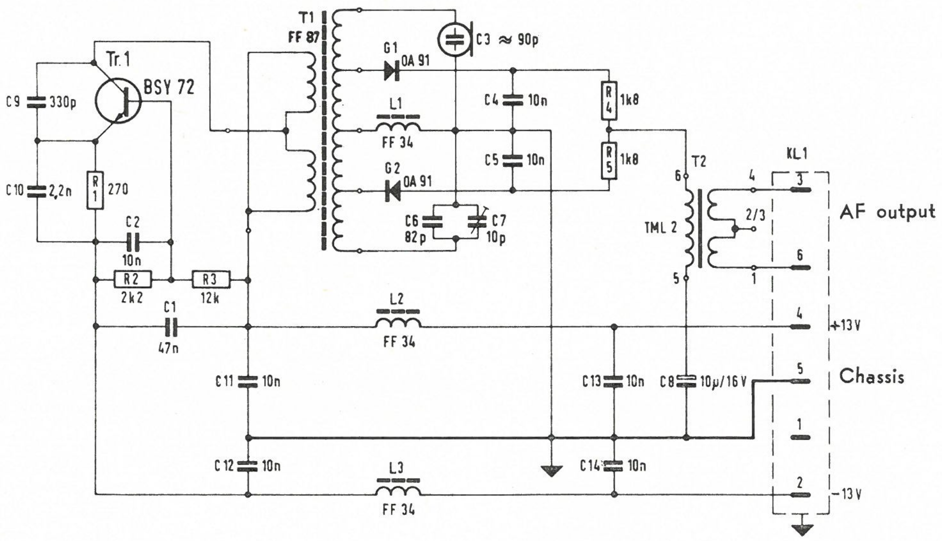

Fig. 3. — Circuit of the RF pre-amplifier of the N.R.U. standardised capacitance microphone. Balanced envelope detection is used in order to eliminate spurious frequency modulation.

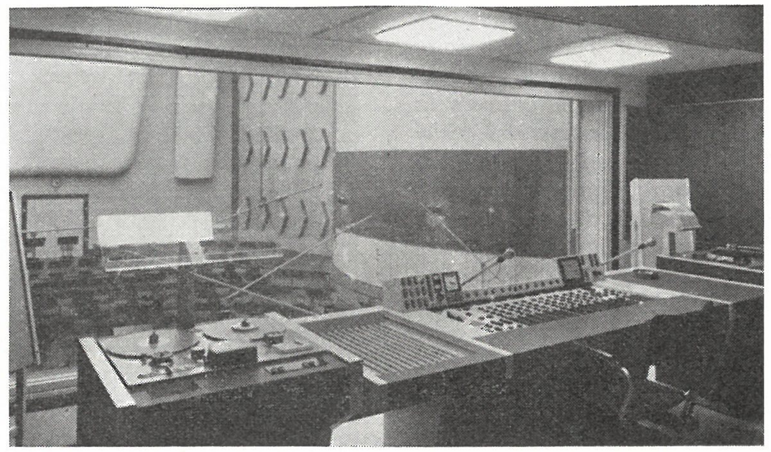

Fig. 4. — Mixing desk fully equipped for stereophony installed in the A.V.R.O. studio IX at Hilversum.

Effect of the value of β, depending upon the direction control setting, on the amplitude of the A and B signals.

Position of the sound source	Microphone outputs	Direction control	Matrix output A = M + S	Matrix output B = M − S	Direction control	Matrix output A	Matrix output B
Central	$K_1 = 0.85$ $K_2 = 0.85$	$\beta = +1$ $\beta = -1$	1.7 0	0 1.7	$\beta = +2$ $\beta = -2$	2.55 −0.85	−0.85 2.55
			$A = 1.7$	$B = 1.7$		$A = 1.7$	$B = 1.7$
		intensity difference		0 db	intensity difference		0 db
		total power		5.8 W	total power		5.8 W
Axis of microphone K_1	$K_1 = 1$ $K_2 = 1/2$	$\beta = +1$ $\beta = -1$	2 0	0 1	$\beta = +2$ $\beta = -2$	3 −1/2	−1 3/2
			$A = 2$	$B = 1$		$A = 5/2$	$B = 1/2$
		intensity difference		6 db	intensity difference		14 db
		total power		5 W	total power		6.5 W

ponent, whereas the pressure-gradient merely increases the random nature of the signals. These two components, corresponding to the pressure and the pressure-gradient, produce reverberation localised respectively in the centre and in the directions of the loudspeakers. The calculation shows that the power ratio between the " central reverberation " and the " edge reverberation " for a coincident microphone-pair is $6/(1 + \beta^2)$ which has the value 3 for the normal setting of the direction-control ($\beta = \pm 1$), and the value 6/5 when $\beta = \pm 2$ (the case of the additional amplification).

For a non-coincident microphone-pair, spaced at about 30 cm, with a direction-control setting of $\beta = \pm 1$, both the conformity and the diffusion are better than with a coincident pair, as both the time-differences and the reduced correlation of the sound-fields act in the favourable sense. No reduction in the compatibility has been observed, although in theory the frequency response of the combination is rather curious under free-field conditions.

Artificial reverberation may be added in different fashions. In principle, the reverberant signal may be regarded as a separate source, whose direction may consequently be controlled. However, the result of using anti-phase, although realistic in theory, is found in practice to be suitable only for certain special effects. Moreover, the use of the direction-control for the reverberant sound gives rather disagreeable results in general.

A better approach is the generation of two less correlated reverberant signals and to feed them into the *A* and *B* channels, either directly or by way of two

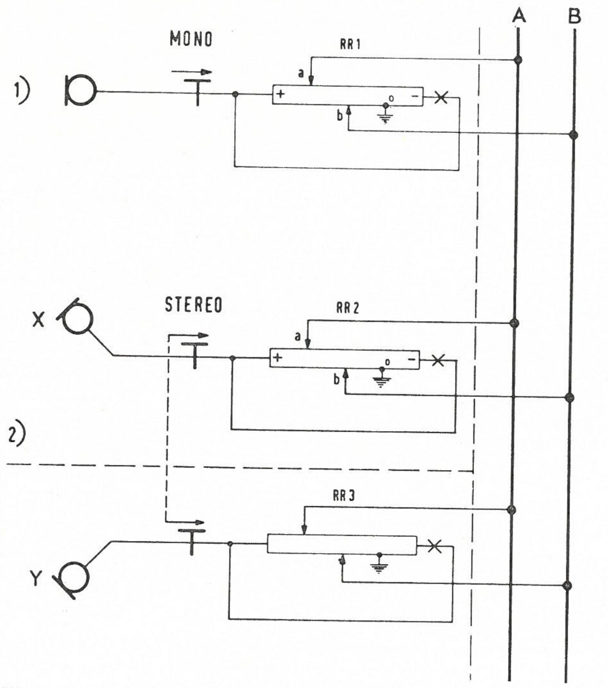

Fig. 5. — The *A*/*B*-channel mixing technique requires two outputs in phase-opposition per channel in order to allow the use of a panoramic potentiometer in the *S* channel and the direction-control (added amplification) when microphone-pairs are used.

microphone channels. The simplest way of obtaining the two signals is to use *two* receiving transducers in a single reverberant system, whether an echo-room, steel plate or spring. Even if the artificial reverberation is required only for the compatible monophonic signal, it is advantageous to start from two uncorrelated signals in order to spread the reverberation over the width of the sound-image with stereophonic listening.

For a number of reasons, however, a different mixing technique from that described above has been adopted. The most important reason was the desirability, in monophony, of being able to handle more microphone channels independently. Four programme channels became necessary, two of them being utilised for stereophony, but with that arrangement it was found that the *A*/*B* mixing technique was simpler.

In order to retain the features of extended direction-control ($\beta > 1$) and of anti-phase working for each microphone channel, it was obligatory to have the output voltage available with both polarities and with sufficiently increased level. With the increase in the number of programme groups, the number of secondary channels also increased, and the channel units consequently became rather complicated *(Fig. 5)*. We may mention at this point some of the technical features of the equipment developed by the N.R.U., although of course these considerations are not specific to stereophony :

a) each mixing-bar and group-amplifier operates principally at *zero input impedance*. This avoids any risk of cross-talk in the unbalanced channel system, whether due to capacitative or resistive coupling between channels ;

b) the output of the group-amplifier can be routed to the input of any of the programme channels, which offers almost unlimited variety in operational practice ;

c) for stereophony, where two programme channels are utilised, it is possible to combine the stereophonic signals in a third channel, thus providing a separate fader for the *M* signal.

It goes without saying that modern modular construction has been adopted, using Si-planar transistors, printed circuits and dry-reed relays. In this new equipment the special requirements of stereophony represent only a relatively minor complication and therefore did not entail any appreciable increase in cost.

Recording problems.

For tape recording with the tape speed of 38 cm/s, no special difficulties were encountered, although in the design of the amplifier particular attention had to be given to the question of noise, and, because it was necessary to accommodate twice as many recording and reproducing amplifiers in the recording machines, it was necessary to adopt miniature technique *(Fig. 6)*. When the head-assembly is changed from monophony to stereophony, a 6-decibel change has also to be made

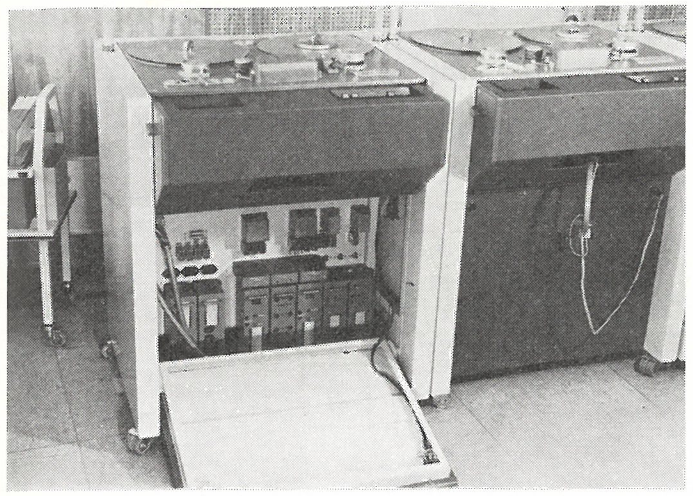

Fig. 6. — Stereophonic tape-recording machines with solid-state amplifiers used by the N.R.U.

in the amplification. One problem has still not been completely solved, namely, when reproducing a stereophonic tape with a monophonic head-assembly, the output level is some 2 to 3 decibels lower, but this can readily be corrected by additional amplification, at the expense of a corresponding degradation of the signal-to-noise ratio.

The reproduction of stereophonic disks required, of course, the introduction of stereophonic pick-ups, but in practice it was found more convenient to use these also for reproducing monophonic disks, by merely changing the stylus and amplifier adjustment. However, it is becoming standard practice to dub high-quality disks on to tape immediately, as a precaution against damaging the disk during transmission.

Programme control and continuity.

Stereophonic items are included at irregular intervals in the normal programme service and frequently announcements have to be inserted in live or recorded items, so that stereophonic mixing facilities have to be provided in the continuity suites. Moreover, it is always necessary to have available for control and monitoring the compatible *M* signal, which in the Netherlands is fed to the MF transmitting station and to the Telecommunication Administration's wire-distribution network. So far, the N.R.U. has converted four of its continuity suites for stereophony, and these are in continuous operational use *(Fig. 7)*.

The programme-volume meters used are of the peak-indicating type, having a special circuit which lengthens short pulses to a minimum length of 300 ms, which renders the indication less lively, while still following the rhythm of the music and indicating the quasi-peak with an integrating time of 15 ms.

Transmitter switching and receiver adjustment.

There are, of course, several methods of switching the transmitter encoder between the monophonic and stereophonic modes, using only the programme-modulation circuits. In the Netherlands, however, the nearest transmitting station is only 30 km from the studio-centre and it was practicable to use a separate telegraph circuit, over which switching in both senses is effected by a relay which changes over each time a pulse is applied to it *(Fig. 8)*. The monitor receiver indicates whether the pilot-tone is being radiated and hence whether the change-over has been correctly effected.

One of the encoders is of a special design, whereby two auxiliary functions can be accomplished *(Fig. 9)*. The first is the single-sideband modulation of the *S* channel on the 38-kc/s sub-carrier, and the second is the production of the phase-verification signal for receiver adjustment. By modulating the sub-carrier in quadrature relative to the normal *S*-signal modulation, it is possible to radiate a signal which is inaudible when the phase adjustment of the receiver is correct. A second adjustment has then to be made to the *S*-signal amplitude to give the maximum separation between the two stereophonic signals, and this is much easier to effect.

Programme distribution.

Several alternative methods of distributing stereophonic signals to the various FM stations of a network have been proposed. Of these, the first and least attractive was that of using separate cable circuits, for not only is it very difficult to balance them, but it is an expensive solution, as encoding equipment is required at every transmitting station.

A better solution is that of direct rebroadcasting, but this is subject to limitations regarding the common-

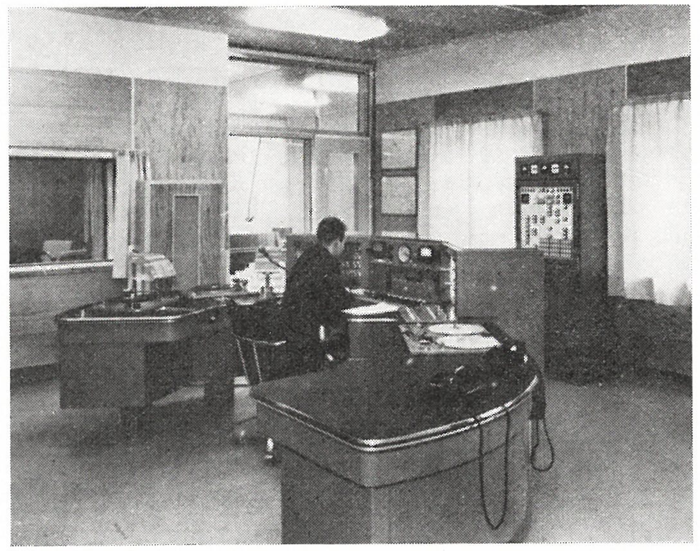

Fig. 7. — Continuity suite fully adapted for stereophony in service in the V.A.R.A. studio-centre at Hilversum.

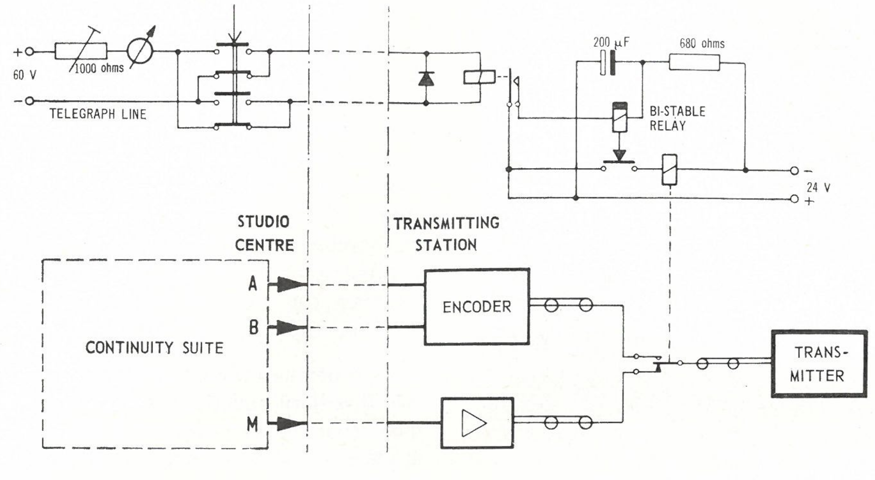

Fig. 8. — Arrangements for switching the stereophonic encoder at a transmitter from the studio-centre (distance about 20 km).

channel and adjacent-channel protection that has to be assured at the receiving point, and in addition the frequency response should have a substantially linear phase characteristic up to 53 kc/s. A method at present under study is that of multiplexing three composite stereophonic signals on a single video radio-relay circuit. This work has led to the development of a system which has been described in detail elsewhere *, wherein sub-carriers of 0.66, 1.7 and 3.9 Mc/s — these frequencies being chosen to facilitate the design of phase-linear band-pass filters having high attenuation for the adjacent channels — are each frequency-modulated with a maximum deviation of about 8 %. The advantage of this system is that the pilot-tone, in each channel, can be used to switch the transmitter input from the cable circuits conveying the monophonic programmes to the radio-relay circuit conveying the multiplex signals. It is evident that the transmitter input must be wide-band and phase-linear.

* see E.B.U. Review No. 96-A.

Conclusion.

Apart from the choice of the RF transmitting standards for stereophonic broadcasting, several precautions have to be taken in the field of studio technique. In addition to the necessary modifications to the equipment, it is also necessary to adopt different operational procedure to assure the smooth continuity of the programmes.

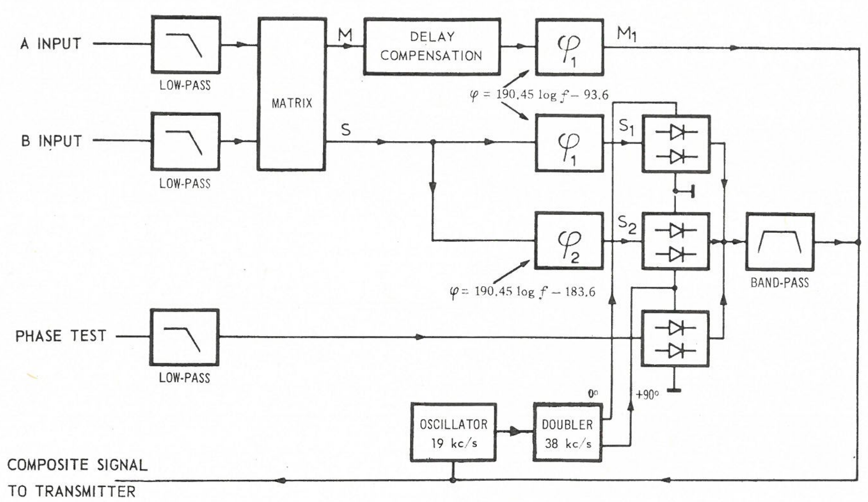

Fig. 9. — Block-diagram of a stereophonic encoder producing single-sideband modulation of the sub-carrier.

AUTOMATION OF MASTER SWITCHING SYSTEMS

by H. MIRZWINSKI *

Summary.

Automation can be usefully introduced into any switching system where the sequence of operations and the duration of each event are known well in advance. In a television station, master control usually works to a daily schedule and the operator's activities are concentrated during a few minutes of station breaks between the main programme. Therefore the automation of master control switching is feasible and desirable.

The choice of the type of the automation employed depends largely on the specific conditions of any given station. Automation of the whole day's programme, which is controlled by a 24-hour clock, is termed real-time working. A simpler type of clock operation is cue-clock working where each station break is timed individually. On some stations, schedules might not be sufficiently rigid to allow any form of clock operation. In this case a sequential working can be adopted in which only sources or events are entered into the memory, but the timing is entirely under the operator's control.

The article surveys the simpler types of master control automation giving examples of actual switching systems. It shows how the automation can be introduced step by step with simple means, without changing radically the operational procedures.

1. Introduction

Automation is a very popular word nowadays and its impact is felt not only in factories, but also in our private lives. It is inevitable that automation of one form or another will exercise an ever increasing influence on the operation of television stations. The opponents maintain that any form of automation introduced into television production will destroy its artistic qualities. No doubt they would be right if automation were used indiscriminately just for the sake of automation, but in certain switching operations, especially in the master-control area, a degree of automation will eliminate human errors, relieve the operator's nervous tension during panic periods and free some of the staff for more productive duties.

The complexity of television broadcasting has increased over recent years, due to the growth of networking, wider variety of signal origination equipment and also due to longer hours of programme production per day. This has probably had the greatest single impact on the operation of master-control areas within television stations. Master control is the nerve centre where programmes originating from studios, outside broadcasts, films or television tape recordings are combined into a complete smooth presentation. It is here that commercial advertisements, public-service films, station identification and apology captions are inserted into the main programme. Since the number of incoming sources increases almost daily and station presentation techniques become more sophisticated, master-control switching has to be more exacting. Normally during the main programme, the master-control operator has very little to do and his activities are concentrated during the few minutes of station breaks, that is to say, the periods between different programme items or at predetermined points during programme items, when a series of short advertising sequences are transmitted. The pattern of manipulations required to switch the correct vision and sound sources on-air at the correct time, by means of the correct type of transition, becomes so complicated that it taxes the operator's capabilities almost to the limit. Luckily master control works to a daily schedule which is rigidly followed for most of the time. The sequence of switching operations and the duration of each event are generally predetermined. Therefore a certain amount of automation is feasible and desirable in Master Control Switching.

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2. Types of automation

There is a variety of types of automation that can be used in master control. The choice depends largely on the specific conditions of any given station and its financial resources. The decision as to the extent of automation applied must be taken very carefully. It is easy to be over ambitious : automate every operation, cut down the operational staff by about 50 % and then... be compelled to recruit a team of highly specialised maintenance engineers to service the complex automation equipment.

The principle of master-control automation is simple : once the switching schedule is available it has to be transferred into a suitable store or memory which in turn will control the master switcher. The memory can be as simple as a number of multi-position switches or as complicated as a magnetic-drum storage [1]. There are, of course, numerous other solutions between these two extremes : capacitors, relays, uniselectors, ferrite stores, punched paper tape or cards etc. The choice of memory depends on the extent of automation desired. If one requires to enter into a memory only a limited number of operations, as for example the sources required for one station break, then a relay or uniselector store is ideal. If on the other hand, it is desired to put into store the operations required for the whole day's programme, then punched paper or magnetic tape is more suitable.

event, the store will automatically return to the first event and the sequence can be continued indefinitely. In this way, although the memory can only store eight events at one time, unlimited sequences can be handled with ease. A " skip " button is included in case it is desired to reject an event already entered into the memory.

At any time when the schedule is changed at the last minute and there is no time for corrections, the operator can throw the switch to " manual " and carry on with switching according to the new schedule.

SAMS is designed basically for married vision and sound operation and the four separate sound sources cannot be loaded into the memory. If most of the inputs are unmarried, then a single eight-event store is insufficient and an extension of the system is necessary.

Fig. 4 shows the control panels of a Master Switcher catering for 25 unmarried sound and vision sources [4]. The basic automation system is similar to SAMS except that two eight-event stores are employed. There are two rows of pre-selection buttons, one for sound and another for vision sources. The top panel contains a dual store display. To load the stores, first vision then sound sources can be entered, or sound and vision sources for each event can be loaded together. The position of each store is indicated by a light in the respective row of random-access buttons.

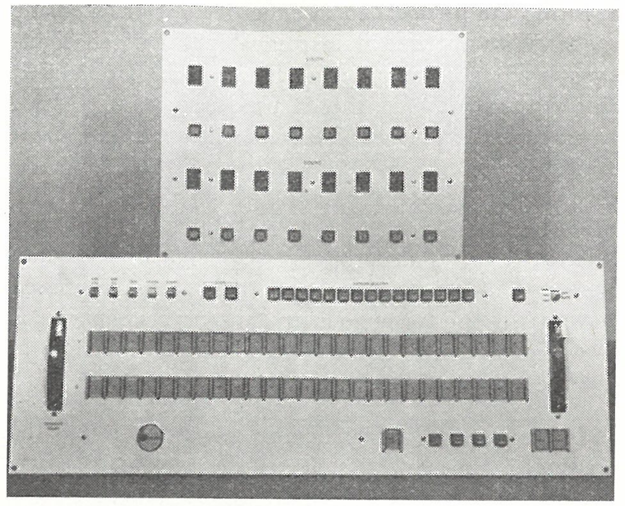


Fig. 4. — The control panels of a master switcher designed for unmarried operation.

Machine control

During station breaks mostly pre-recorded programme sources are used : slides, films and television tape recordings. Therefore, in addition to pre-selecting a machine as the next event the operator must make sure that it is started at the right time, watch the moving pictures from the machine on the preview monitor and then transfer it to on-air when it becomes stabilised. All the machines assigned to master control can be controlled from an additional panel mounting all the buttons necessary for starting, showing, stopping, changing slides, etc. But this approach still leaves the operator with some anxious moments because a wrong machine can be easily started.

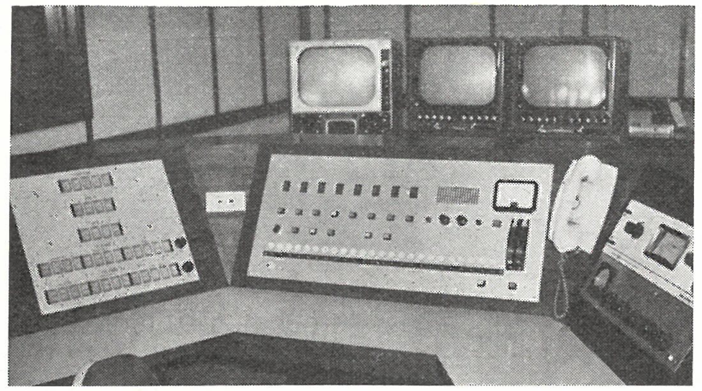
The next step is to integrate all buttons necessary for machine control with the main switcher-control panel. If the start controls of the machines are routed via the switcher, then any machine pre-selected as the next event can be started by operation of a single button. The only limitation of this method is that the film-scanner or television tape recorder must remain on preview for at least the time necessary for run-up. Thus the minimum duration of an event preceding a pre-recorded source is determined by the pre-roll time of the next event machine. If multiplex film-scanners are employed, a separate pre-selection button for each film projector must be used so that each projector can be treated as a separate source. Any machine taken off the air can be stopped automatically. Normally any projector will be " shown " as soon as the " start " button is operated, provided that no other projector of the same multiplexed machine is running. In this latter case, showing will be delayed and will coincide with the transfer of this projector to on-air. As an additional refinement a non-locking " still " button can be added which will permit preview of a still frame of any next event source.

In the interests of simplicity of operation and scheduling it is desirable that the run-up times of all the machines be made equal. In some cases this can be achieved by adjustment of the machines. Alternatively, a suitable length of leader can be added to films or tapes on " faster " machines. If the run-up times are equalised, then a delay circuit can be built into the switcher so that an automatic transfer to on-air can take place after a fixed delay following the operation of the " start " button.

In this way, during the station breaks, the operator has to push the same button each time a transfer to a new source is required, the remaining functions being performed automatically.

If all the material used during commercial breaks comes from pre-recorded sources, then a further operational simplification is possible. It is assumed that the run-up times of all the machines are equalised to five seconds for example, and that cartridge-tape casettes are used with caption scanners, slide projectors and other sources which have no married sound. Therefore, every machine can be started 5 seconds before it is scheduled to be transferred to on-air. By inserting cues on films and tapes 5 seconds before the end of each spot, it is possible to start automatically the next-event machine,

Fig. 5. — Master-control desk in United Telecasters, Sydney, Australia.



which is pre-selected by the eight-event store. In this way the operator has only to initiate the break by starting the first machine ; all other operations including the transfer back into the main programme are performed automatically.

The cues inserted on films could be in the form of metallised paper strips wrapped around the sprocket edge of the film. A cue sensor, which can be a proximity switch or metallic rollers, converts the cues into earth pulses of suitable length which in turn are routed by the switcher to start the next-event machine. The same pulse, after passing through a delay longer than the standardised run-up time, can be used by the first projector to stop itself.

A tone cue of a specific frequency can be entered on the cue track of a television tape recording. A filter type cue sensor converts this cue into an earth pulse that can be used to start the next-event machine and stop the television tape-recorder in the same way as it is done on the film-scanners.

Most types of tape casettes have a facility for entering a number of different frequency tone cues on the cue track, therefore it is easy to provide start cue, cues for changing slides etc.

The fully automated station break switcher is used by United Telecasters at Sydney, Australia. *Fig. 5* shows a photograph of the master-control desk. The switcher can be operated in three modes : manual, sequential and automatic. In the automatic mode the operator has only to initiate the break. Pre-selection of the next-event sources is carried out by the eight-event store, the machines are started and stopped by cues on film and tape and the starting information, suitably delayed, transfers the machines to on-air. In the sequential mode all the facilities of the automatic mode are available except that starting of machines is initiated by a " start " button on the main control panel. In the manual mode all automatic equipment is inoperative ; pre-selection of sources and transfers to on-air are done manually. The machines are controlled from a separate panel on the left of the main control panel.

5. Cue-clock operation

The method of controlling the switching operations by film and tape cues, although simple and economical, suffers from several limitations :

(a) Only pre-recorded events can be used during the break.

(b) Operator has no visual check of timings.

(c) Insertion of cues on films or tapes may be in some cases unacceptable.

As an alternative, the control of switching in the automatic mode could be on an elapsed-time basis, that is to say, controlled by a cue clock. The sources to be used during the break are entered into the eight-event store and the switching time of each event (actually machine-start time which, of course, is a few seconds earlier than the actual on-air switching time) is entered into the eight-event time store. Both stores are designed on the same principle, except that in the time store miniature plug-in uniselectors are used. All the normal facilities, such as random access for corrections, skip and reset are retained. The cue clock, shown in *Fig. 6* consists of a chain of three or four uniselectors (depending on the maximum duration of the station break required) driven by one-second pulses obtained from the station crystal clock. Additional refinements, like free-running the clock in case of failure of pulses, driving it from mains or field drive, are also available.

The control panels of a cue-clock controlled switcher are shown in *Fig. 7*. On the top panel are mounted : cue-clock digital read-out, time-store indicators with random-access buttons underneath, event-store indicators and then corresponding random-access buttons. The cue-clock display has three digits giving a maximum duration of 9 minutes 59 seconds. In the middle of the

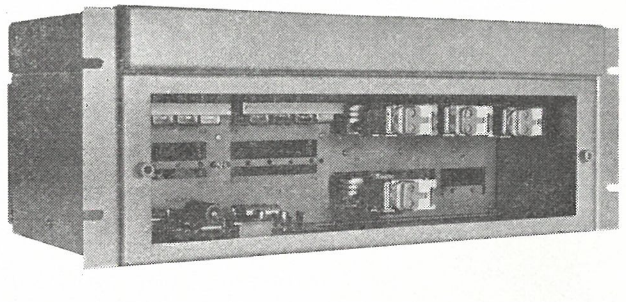


Fig. 6. — Front view, with cover removed, of the cue-clock.

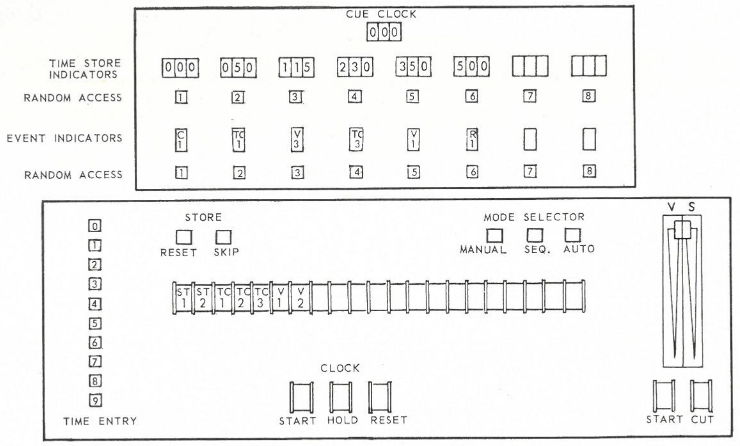


Fig. 7. — The control panels of the time-controlled master switcher.

main control panel is the row of pre-selection buttons, on the left ten time-entry buttons, and on the right vision and sound faders with the " start " and " cut " buttons underneath. The cue clock is controlled by three buttons at the bottom of the panel. At the top left are the store " reset " and " skip " buttons and on the right the mode-selector buttons.

The manual and sequential modes do not differ in operation from the systems already described. When the switcher is in the automatic mode, the operator can enter into the stores the sources and times required for the break. To make a time entry, three buttons have to be operated sequentially. The time of the first event is 000. At the beginning of the break the operator has to press the clock " start " button which starts the clock counting and initiates the first event. Both stores step to the second event. When the cue-clock read-out coincides with the second event time entry, the second event is initiated. When it is desired to keep any event longer than the scheduled time, the " hold " button can be operated just before the coincidence time for the next event. The cue clock will stop and will restart when the hold button is released. When the eighth event is transferred to on-air both stores will reset themselves to event 1, but the cue clock will continue counting in case additional events have been entered in the first positions of the stores. The cue clock can be reset and stopped after the end of the break by operation of the clock " reset " button. If the operator forgets to reset the clock, it will continue counting until 9 minutes 59 seconds then it will reset and stop itself.

In the automatic mode, only cut transfers to on-air are possible. " Fades " or " cross-mixes " are available only in manual and sequential modes. This limitation can be overcome by the use of a simple transfer-mode store requiring two relays per event. Additional indicators, random-access buttons on the display panel and the transfer-mode selector buttons on the main panel will be required. This extension of the system will permit more refined presentation even in the automatic mode.

With the system described above the operator has to enter the switching information from the schedule into the stores and then to initiate the break. The daily schedules are usually prepared at least a few days in advance. By the use of a special typewriter it is possible to obtain, as a by-product of typing, a punched paper tape containing all the switching information for the whole day. The tape can be loaded into the tape reader which when energised reads the information for one station break into the stores. The operator has only to press one button to start the break. At the end of the break when the cue clock resets itself to zero, the tape reader is energised again and it reads the information for the second break into the store. To make this type of operation possible the schedules have to express the duration of events during the breaks in cue-clock time.

If a 24-hour digital clock is added and the beginning of each break is entered on the tape on a real-time basis, the complete automation of the whole day's switching is achieved.

6. Real-time operation

The real-time control of automatic switching can usefully be employed only if the timing schedule is very strictly adhered to. Unfortunately plays and network programmes have a habit of over-running or under-running the scheduled time. In this case the operator has to take action to delay or advance the beginning of the break. If this happens too often real-time operation loses it usefulness and simpler cue-clock working is adequate.

In real-time working when punched paper tape is used as a store for the whole day's programme, the existence of intermediate stores like the eight-event store or the time store may seem to be unjustified. Punched tape has been used to control the switcher directly, but this method of operation works smoothly only when everything goes according to the schedule. Any changes to punched tape are difficult to make and usually, if the changes are known well in advance, an amendment tape has to be prepared. With the intermediate stores the operator can see the pattern of switching a few events ahead and he can take the corrective action well in advance.

7. Conclusions

Automation of master-control switching need not require highly complicated equipment and need not change radically the operational procedures. It can be introduced gradually with simple means chosen to suit the specific conditions of any given station. It can be extended to cover additional functions when the need arises. In this way the automation can fulfil its main purpose : to relieve the man of the burden of routine operations but still leaving him in charge.

* * *

The author wishes to thank the Director of Engineering of the Marconi Company Limited, for permission to publish this article.

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The photographs illustrating this article were provided by the Marconi Company Limited.

INTERNATIONAL NEWS

INTERNATIONAL TELECOMMUNICATION UNION (I.T.U.)

International Frequency Registration Board (I.F.R.B.)

Documents relating to HF broadcasting. — The I.F.R.B. has just published the third editions of two of the service documents required by the Radio Regulations and relating to short-wave broadcasting.

Annual high-frequency broadcasting frequency list.

This 725-page list, which appeared at the beginning of May 1966, covers the period from September, 1960 to February, 1965. It contains, classified by frequencies, details of all the HF broadcasting stations notified to the I.F.R.B. and mentioned in the HF broadcasting schedules. Its presentation is very similar to that of the preceding edition, which was issued in July 1965, and which covered the period from September, 1960 to February, 1964.

The columns are, as far as possible, numbered to correspond with those in the International Frequency List and the characteristics noted for each transmitter include its geographical coordinates, frequency, area of reception and aerial characteristics. Column 13a is subdivided for the four seasonal schedules for each year, beginning with September 1960, and contains symbols which indicate, for each assignment, whether the Administration concerned considered that assignment as satisfactory.

List of broadcasting stations operating in bands between 5950 and 26 100 kc/s.

This 750-page document, which is the List III-B required by Art. 20 of the Radio Regulations, was published early in June, 1966. It covers the transmitters mentioned in the Annual List referred to above and, like that List, it relates to the period from September, 1960 to February, 1965. The transmitters are listed by countries and classified alphabetically within each country.

The presentation of this edition is the same as that of the preceding edition, which was published in December, 1965. The characteristics of the stations are set out in a table of fourteen columns, the last of which is subdivided in the same fashion as that of column 13a of the Annual List, with the same symbols for indicating the quality of each assignment for each seasonal schedule.

BELGIUM

Westdeutscher Rundfunk opens a studio in Brussels. — In view of the increasing need for reports and news-items from its representatives in Brussels, mostly associated with the activities of the Common Market, the W.D.R. has recently established a broadcasting studio-unit not far from the headquarters of the European Economic Community. It is a small production-centre comprising three offices each for the television and sound broadcasting staff, together with a studio for their use in common. The unit was officially opened on 3rd May, 1966 by Dr. Klaus von Bismarck, the Director General of the W.D.R.

It will be recalled that in November, 1965 the Press and Information Service of the E.E.C. itself took into service a broadcasting centre in Brussels, principally for the benefit of broadcasting reporters accredited to the Common Market. This unit comprises a studio, a film-viewing room which can also be used for dubbing, a control room and an editing suite. The technical equipment consists at present of 16-mm cameras, two microphone channels, two tape-recording channels and the ancillary technical apparatus. Provision has been made for feeding contributions from their representatives in Brussels directly to Members of the E.B.U. by way of the Eurovision Permanent Network. It is envisaged to add in due course a television studio in order to provide facilities for live reports and interviews.

DENMARK

Extension of Danmarks Radio's television production facilities. — In order to supplement the existing rather limited television production facilities in the Broadcasting House in Copenhagen, Danmarks Radio began building in 1961 a separate television centre at Gladsaxe, some 8 km to the north-west of the centre of the town. Three studios have been taken into service since August 1964 and we hope to be able to give some detailed information about them and other features of the centre in a future issue of the E.B.U. Review.

In the meantime, readers may be interested to know that Danmarks Radio has recently placed an order with the Fernseh company of Darmstadt for the supply of eighteen solid-state 4 ½-in image-orthicon cameras during the next two years for permanent installation in the three studios.

New television tape-recording facilities.

Danmarks Radio's facilities for recording television programmes on magnetic tape have recently been extended by the installation in Broadcasting House, Copenhagen, of three Ampex VR 2000 recorders *(Fig. 1)* to supplement the existing four Ampex VR 1000 C recorders. All seven machines are equipped with " Intersync ", " Amtec " and electronic editing devices. Moreover, the VR 1000 C machines are also equipped with Mincom drop-out compensators.

Connections between the programme sources and the television tape recorders are made by means of a patch panel *(Fig. 2)* employing special multiple connectors containing eight coaxial and sixty single connections *(Fig. 3)*. In this way it is possible to establish in one operation all the necessary connections, including the video and sound programme, signalling, cue, time-indication and intercommunication circuits. The tape recorders may also be connected through this panel to one of three mixing desks which make it possible to fade or cut from one machine to another. A further facility is that an RCA TR22 tape recorder installed in a van may be connected into the system by means of the patch panel.

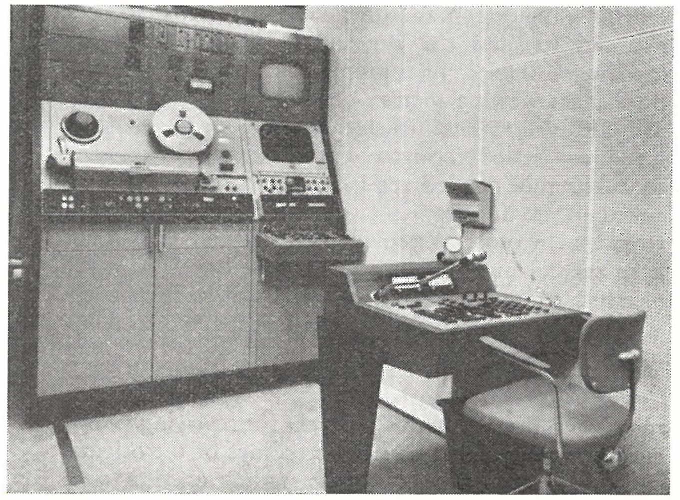


Fig. 1. — A view of one of the new Ampex VR 2000 television tape recorders recently installed in Broadcasting House, Copenhagen, with, in the foreground, one of the mixing desks.

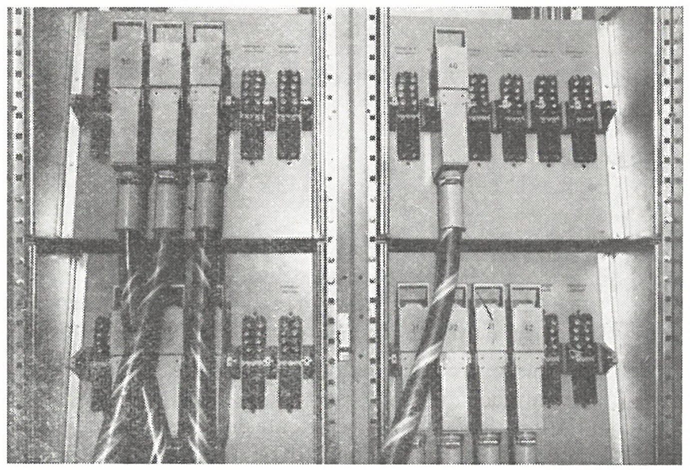


Fig. 2. *(above)* — The patch panel in the television tape-recording suite.

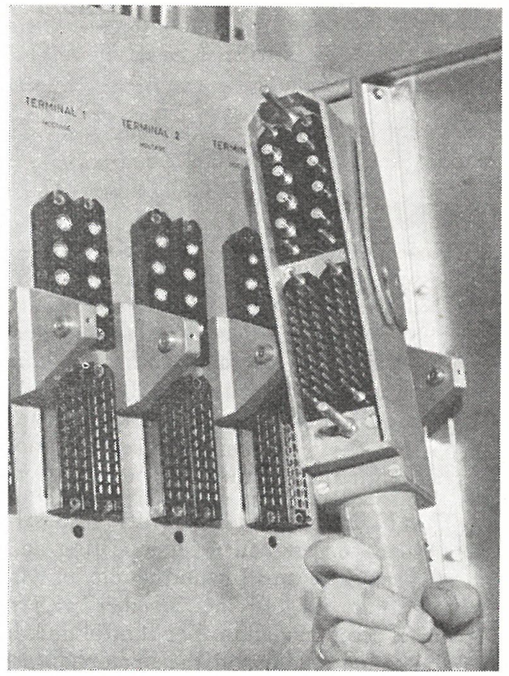


Fig. 3. *(opposite)* — A close-up view of one of the multiple connectors.

FRANCE

International Television OB Competition. — The competition, known as the CIRAD (Concours International de Reportages d'Actualités Réalisés en Direct), organised under the auspices of the E.B.U., was held for the second time at Cannes, from 19th to 22nd May, 1966. The competition, which is open to all television services, is restricted to recordings of programme items that were broadcast live at the time of the occurrence ; there are separate categories for events for which it is possible to plan the television coverage in advance and for those unexpected events for which little or no preparation is possible.

As for the first of these competitions, the O.R.T.F. organised the contest and provided the technical services necessary to allow the jury and the invited specialists to view the entries under proper conditions. There were three main viewing rooms : one for the jury, provided with a curved table at which the twenty members of the jury were seated facing five television receivers, the second for the invited specialists, with seven receivers, and the third for representatives of the press, with six receivers. In order to provide better sound than could have been obtained by utilising the loudspeakers in the receivers, the sound component was distributed separately at appropriate levels to directional loudspeakers installed in the viewing rooms.

The O.R.T.F. had installed a comprehensive apparatus room, with the necessary equipment for replaying filmed entries (which had to be film-recordings of the original live broadcasts) on either 35-mm or 16-mm film, with any of the recognised sound-track arrangements. For reproducing entries submitted on tape, a mobile television tape-recording unit was parked alongside the Municipal Casino, in which the competition was held. The pictures were distributed to the total of thirty receivers over coaxial cables as RF signals in Band 28 (frequency : 527.25 Mc/s), the 625-line standards being used except in the case of the American taped entries on 525 lines.

Provision was made in the technical installation for live announcements and linking information — for which purpose the stage of the Casino Theatre had been adapted as a temporary television studio — and also for the simultaneous interpretation of the commentaries that were in languages other than French or English, as well as for the jury's discussion after each item. For this latter purpose, four interpreters' cubicles were provided in the jury's viewing room, each member of the jury having at his disposal headphones, a microphone and a selector-switch enabling him to hear either the sound-track (or speaker) or the simultaneous French or English interpretation. A total technical staff of twenty persons was engaged on the operation and maintenance of the installation, including the radio-relay equipment provided to enable the O.R.T.F. to let the participants see *"hors concours"* two live transmissions from the Camargue, in the River Rhone delta, which were broadcast on the first day of the competition. For this purpose, a temporary radio-relay was established between the O.R.T.F. television station on the Pic de l'Ours and the Municipal Casino at Cannes, in case it should not prove possible to effect a rebroadcast under satisfactory conditions of the broadcast signals.

GERMANY

New studio-centre at Kiel. — The new Schleswig-Holstein production centre built at Kiel by the Norddeutscher Rundfunk was officially opened on 16th May, 1966. Studios for sound and television programmes have been arranged in the cultural centre set up by the State of Schleswig-Holstein in Kiel Castle. The sound studios had in fact been in use since April, 1965, but the television facilities were not taken into service until the opening ceremony.

The N.D.R. now has at its disposal at Kiel a 10 000-m³ concert hall accommodating an audience of 1250 persons, a small sound studio of 90 m², a television studio of 170 m², together with the ancillary technical accommodation. The control desk in the cubicle of the sound studio and the microphone arrangements in the concert hall are suitable for stereophony.

New Z.D.F. production centre. — Towards the end of March, 1966, the Zweites Deutsches Fernsehen began the construction of a new television production centre at Mainz.

At present, the various departments of the Z.D.F. are accommodated in some twenty buildings at Mainz and Wiesbaden, while the outside-broadcast engineering department is still housed on the site of the Z.D.F.'s first station at Eschborn, near Frankfurt-am-Main.

With the object of concentrating all its departments in one place, the Z.D.F. is to build during the course of the next few years a large administrative and technical centre on a site of some 100 hectares about six kilometres to the south of Mainz, not far from a satellite town already being built. Access is by way of an existing by-pass road clear of crossings, constructed recently to reduce the traffic through the centre of Mainz ; in addition, there is a direct main road to Frankfurt-am-Main airport.

The first section to be constructed will accommodate the OB engineering department and the motor-transport department. The building for the former will contain offices and rest-rooms, as well as measuring laboratories and workshops, a nearby garage housing the OB vehicles. For the motor-transport department, the offices and stores will be located in a separate building ; maintenance workshops and washing areas are planned, as well as a general garage.

It is expected that this first section will be completed by Spring 1967. Subsequently, a building for the administrative departments will be constructed, followed by those for the programme and production departments.

LF and MF transmitters. — On 5th February, 1966, a new 300-kilowatt medium-wave transmitter at Hamburg was officially inaugurated by the Norddeutscher Rundfunk. This new transmitter, built by the Telefunken company, renders the Billwerder-Moorfleet transmitting station one of the most powerful in the Federal Republic.

This station is equipped with three aerial systems :-

(i) a 184-metre tubular mast, insulated at the base, for the 300-kW transmission on 971 kc/s

(ii) a 120-metre tubular mast, which acts as a reserve for the 971-kc/s service, but which is used also for the night-time programmes on 701 kc/s, and

(iii) a 300-metre tubular mast carrying the television and VHF/FM aerials.

The Hamburg station broadcasts the following programme-services :-

First programme	971 kc/s	100/300 kW
	90.3 Mc/s	80 kW
Second programme	99.2 Mc/s	80 kW
Third programme	87.6 Mc/s	80 kW
Night-time programme	701 kc/s	10 kW
First television progr.	Channel 9	100/20 kW

The LF transmitter at Mainflingen on 151 kc/s operated by the Deutsche Bundespost, which broadcasts the Deutschlandfunk programme, is to move during the summer of 1966 to Mudau, in the Odenwald.

The power of the MF transmitters at Mainflingen (1538 kc/s) and Braunschweig-Königslutter (548 kc/s) will very shortly be increased to 600 kW in both cases.

It is planned to instal a new MF transmitter at Neumünster in Schleswig-Holstein, to broadcast the Deutschlandfunk programmes intended for reception in the United Kingdom and Scandinavia.

The Bayerischer Rundfunk's MF transmitter at Landshut (1484 kc/s), which has hitherto broadcast the B.R. First Programme, is shortly to be withdrawn from service. Its audience is already being served by a new VHF transmitter on 90.2 Mc/s.

Stereophonic facilities at Radio Bremen. — The main studio of Radio Bremen is at present being modified for stereophony. When this work is completed, which is scheduled for the late summer of 1966, Radio Bremen will be able to produce its own stereophonic programmes, and an increase in programmes of this type is foreseen for the autumn.

D.B.P. reserve transmitters. — The Deutsche Bundespost has recently ordered four mobile UHF transmitters, which are intended for use when an existing transmitter is, for one reason or another, temporarily out of service, and for use at new stations pending the delivery and installation of the transmitting equipment, provided that the aerials and feeders are already installed.

The start of colour television in Western Germany. — A joint meeting of the A.R.D., Z.D.F., D.B.P. and the Zentralverband der Elektrotechnische Industrie (Z.V.E.I.) was recently held at Frankfurt-am-Main, during which it was confirmed that regular colour-television transmissions will be introduced in the Federal Republic in the autumn of 1967, the system to be used being the PAL system. The A.R.D. and the Z.D.F. foresee transmitting at the beginning some four hours of colour programmes per week each.

The stereophonic receiver market. — According to the broadcasting section of the Z.V.E.I., some 1 250 000 stereophonic receivers were manufactured in the Federal Republic during the past two years. About a million of them were sold in Germany, the rest was exported, mostly to neighbouring countries.

It is noteworthy that at present eight of the broadcasting organisations in Western Germany are together broadcasting about seventy hours of stereophonic programmes per week.

It should be noted, by way of indication, that the number of licensed sound-broadcast receivers was in excess of eighteen millions on 1st April, 1966 whereas on the same date there were nearly twelve million television licences in force.

Courses with the Westdeutscher Rundfunk. — During 1965, a total of thirty-eight persons from twenty-one countries attended courses in the sound-broadcasting department of the W.D.R. Most of the training was given in the form of individual tuition followed by professional classes and instruction in the German language. Seventeen of the trainees completed their courses by the end of 1965.

The sound archives of the Bayerischer Rundfunk. — The B.R. has at present the most comprehensive sound archives in Western Germany, comprising some 160 000 magnetic tapes and 18 000 disks. This number is being increased each month by an average of about 1800 tapes and 200 disks.

Scientific gathering. — The fourteenth meeting of the Fernsehtechnische Gesellschaft will be held this year from 19th to 23rd September at Heidelberg, in the auditorium of the Institute of Organic Chemistry of Heidelberg University.

JAPAN

The N.H.K.'s new Tokyo Broadcasting Centre. — In our descriptions * of the arrangements made by the Nippon Hoso Kyokai for the broadcast coverage of the 1964 Olympic Games in Tokyo, we mentioned that the Olympic Broadcasting Centre built at Yoyogi represented the first stage of a new permanent broadcasting centre for the N.H.K. Like many other broadcasting organisations, the N.H.K. was led to undertake the construction of this new centre by the need to concentrate into a single building programme production facilities that had hitherto been scattered throughout the city. The site of the new building *(Fig. 1)*, which is in the eastern suburbs of Tokyo near the former Olympic village, has an area of 82 645 m². It is bordered on the east by the National Indoor Stadium, on the north by a wooded park and on the south by a public hall.

The building and installation programme was divided into two stages. Work on the first stage was begun in April, 1963, and completed in September, 1965, having been suspended for a while in the autumn of 1964 on account of the Olympic Games. At that time, the greater part of the building work was already finished, together with many of the technical installations, and these were used with certain alterations and additions for the broadcast coverage of the Olympic Games. The complete first-stage facilities, which cover a total floor area of 64 450 m² disposed over seven floors, were officially taken into service in October, 1965. They consist of eight television studios, six sound-broadcasting studios, ten recording and editing rooms and other auxiliary facilities including a number of sub-control rooms, film-scanner and television tape recording rooms, a Technical Operation Centre and a central control room for technical services.

Of the eight television studios, one has a floor area of 1 150 m² and a height equivalent to five storeys, five others, one of 660 m², two of 500 m² and two of 330 m², are four storeys high and have above them large sound-broadcasting studios or rehearsal rooms of a height equivalent to three storeys. The remaining two television studios are relatively small, having a floor area of 230 m² and a height equivalent to two storeys. Some indication of the distribution of the various studios and other rooms over the different floors is given by *Fig. 2*, and *Fig. 3* shows the interior of one of these studios.

In planning the layout of the centre, particular care has been taken to ensure a smooth flow of staff and materials. Thus, there is a clear separation between the scenery storage areas, the artists' dressing and waiting rooms and the television technical areas, and the main passage ways leading to these areas and from them to the studios are so planned that they do not cross one another.

* See notably E.B.U. Review No. 81-A p. 213 and No. 86-A p. 178.

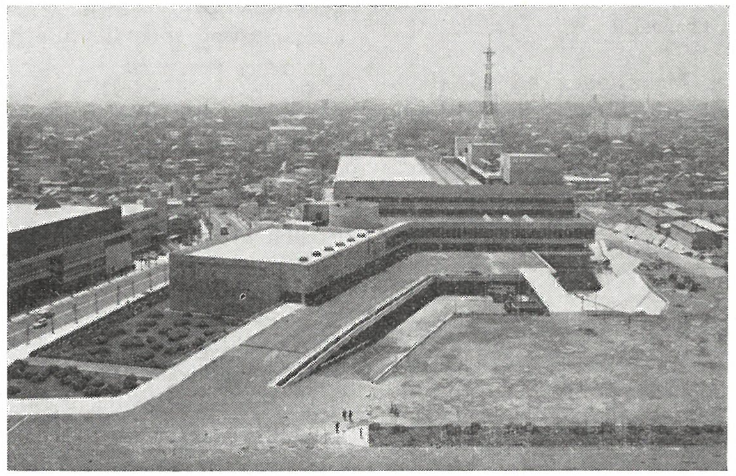
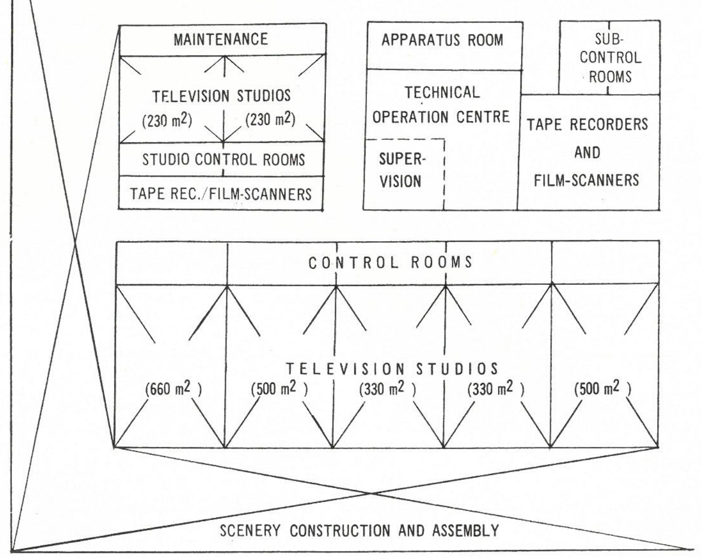


Fig. 1. — A general view of the N.H.K.'s new broadcasting centre at Yoyogi, Tokyo.

Fig. 2. — Organisation chart of the television studios in the new N.H.K. Broadcasting Centre.



A particular feature in this connection is the special provision made for visitors, of whom more than a million are expected each year. Starting from a reception room on the second floor, visitors will circulate through special passage ways, separate from those used by the staff, along the television studios, looking into each of them through specially provided observation windows. They will then be taken by escalators up to the fifth floor where they will look into the sound studios and then descend by a spiral passage way to the second floor to look into the largest television studio.

The layout of the television production areas is based on the concept of a flow system whereby the "raw material", mainly in the form of the scenery, is fed into the studios from the periphery and the "product", in the form of the vision and sound signals, appears in the Technical Operation Centre at the centre of the building. Thus, the scenery storage areas and carpentry workshops are located along two sides of the building and communicate directly with the television studios via wide doors and passage ways. The artists' dressing rooms and waiting rooms are situated on the opposite sides of the studios, in the centre of the building and on the same floor level as the studios. Above the artists' rooms are located the studio control rooms which contain only the items of technical equipment that are directly necessary for production purposes, such as the vision and sound-control desks. Other equipment, such as the camera-control desks and the rack-mounted elements of the video-switching equipment, is concentrated in the Technical Operation Centre *(Fig. 4)* which is separated from the studio control rooms by a corridor.

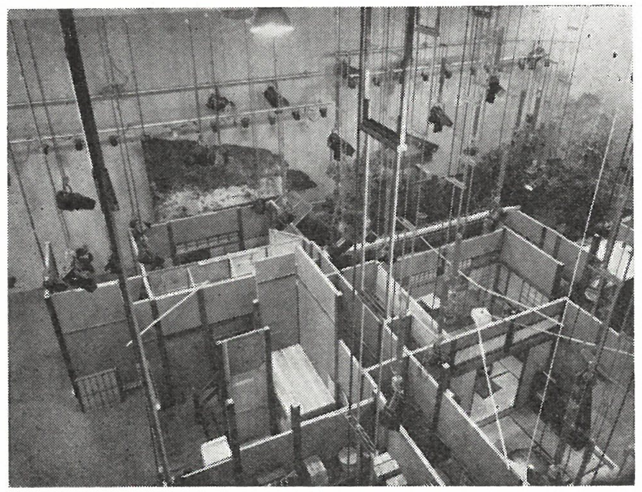


Fig. 3. — A view into one of the television studios, showing the single-point lighting suspension.

In addition to the equipment mentioned above, the Technical Operation Centre contains synchronising-pulse generators, stabilising amplifiers, distribution amplifiers of various types, relay groups and power-supply units. The grouping of all this equipment into one place greatly facilitates its maintenance, and the concentration of the camera-control units makes it possible for a large number of studio cameras to be controlled by relatively few engineers. The majority of the sound and vision equipment is transistorised and its low power consumption and heat dissipation have helped to keep down overall costs for electrical power and for air-conditioning.

Production equipment, such as film scanners and television tape recorders are installed in rooms on both sides of the Technical Operation Centre. This arrangement makes it possible for production staff from the studio control rooms to change films and tapes, whereas the setting-up of the equipment and any faults are dealt with by engineers from the Technical Operation Centre.

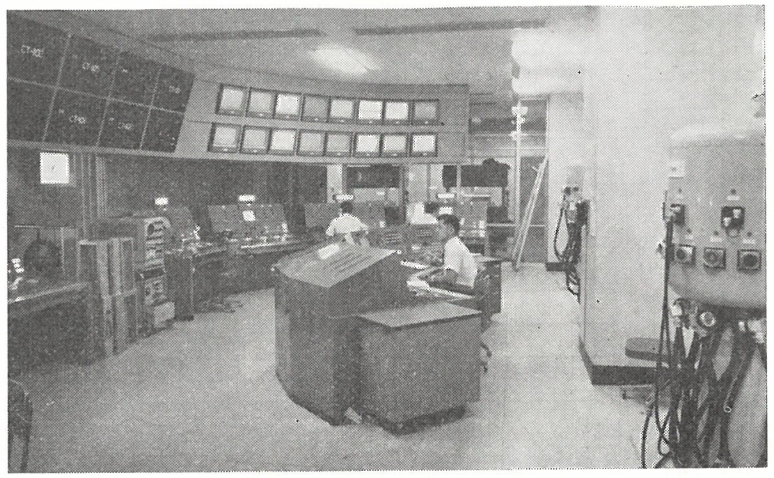


Fig. 4. — The Technical Operation Centre in the new N.H.K. Broadcasting Centre in Tokyo.

Among the technical facilities for sound broadcasting of particular note, is a control room for stereophonic programmes. Its floor has the shape of an equilateral triangle, each side being 3 m long. The loudspeakers are set up in two corners and the control operator is situated at the third. The architectural design and construction are such as to provide a satisfactory balance of side-wall reverberation and back-wall sound absorption.

Another feature of interest is the central control of such services as air-conditioning, the electrical power supply system, the water supply and drainage. This is effected from a central control room *(Fig. 5)* situated on the first floor. The air-conditioning system is divided into seven main groups in order to take account of the arrangement of the various areas within the building. These main groups are subdivided into smaller groups, so that a total of sixty-five air-conditioning groups may be operated independently as required.

Detailed plans are now being prepared for the second stage of the construction programme, which it is expected will be completed in 1968. The additional facilities to be provided will probably include twelve more television studios, some sound and dubbing studios and film processing facilities. The existing N.H.K. centre at Uchisaiwaicho in Tokyo will continue to be the headquarters and transmission centre of the N.H.K.'s sound and television networks.

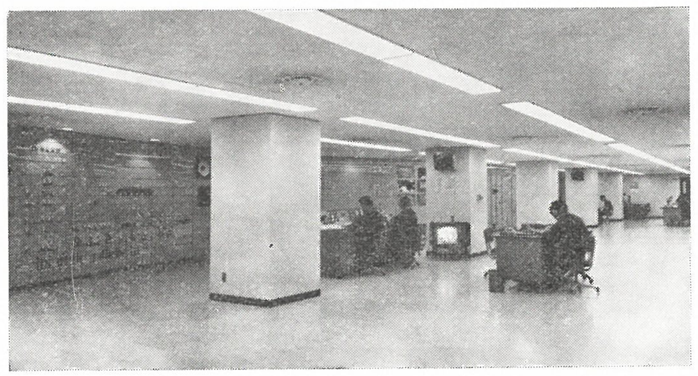


Fig. 5. — The Central Control Room for house services (electricity and water supplies, air-conditioning etc.)

An image-orthicon camera tube using a multi-alkaline photo-emissive surface. — As a result of the increase in colour-television programmes, outside broadcasts at night and the use of telephoto lenses, the Nippon Hoso Kyokai felt an acute need for image-orthicon camera tubes with greater sensitivity. The sensitivity of such tubes may be effectively increased by increasing that of the photo-emissive cathode, and since the end of 1963, work has been carried out in the N.H.K. Technical Research Laboratories with this end in view.

In 1964, an image-orthicon tube with a silver-bismuth cathode and a compound aluminium and magnesium oxide accumulating target was produced experimentally. Further work has resulted in the production of a tube having an alkaline photo-emissive surface consisting of activated antimony, sodium, potassium and caesium, which is capable of practical use.

This experimental tube has been found to be capable of satisfactory operation in full moonlight (incident illumination of 0.1 lux) and is now being used for colour-television broadcasts as well. Measurements made using as light source a standard electric-light bulb having a colour temperature of 2870° K, have shown that the maximum sensitivity of the photo-emissive surface in this tube is 160 μA/lm, which is about equal to that of the R.C.A. tube type S-20 and about three times that of normal image-orthicon tubes. Moreover, the resolution of this tube is superior to that of existing image-orthicon tubes.

Life tests of the new tube have shown that its sensitivity falls by about 3 % after about 1000 hours use and that the "sticking-time" of the compound magnesium oxide target increases slightly. Apart from these two points, the tube's functioning has been found to be very stable. There remain, however, a few irregularities in its generally very satisfactory performance, mainly due to the complex manufacturing process, and further work is in hand to eliminate them.

KENYA

Broadcast coverage of the East African Safari Motor Rally. — One of the major and most difficult outside-broadcast operations handled each year by the Voice of Kenya is the coverage of the East African Safari Motor Rally. As a result of the extremely wet weather conditions which earned it the unofficial title of the "Saturated Safari", the 1966 Rally, the fourteenth in the series, provided the V.O.K. with many problems. The 4800-km course of the Rally is divided into two halves, each in the form of a loop, starting and finishing at Nairobi, the first going south into Tanzania to Dar es-Salaam and returning to Nairobi via Mombasa, and the second going north-west to Kampala in Uganda, on the shores of Lake Victoria, and returning to Nairobi by a different route.

Coverage of the Rally began a few days before the official start, with live outside broadcasts of the draw for starting positions, interviews with visiting and local drivers, course officials and representatives of participating firms.

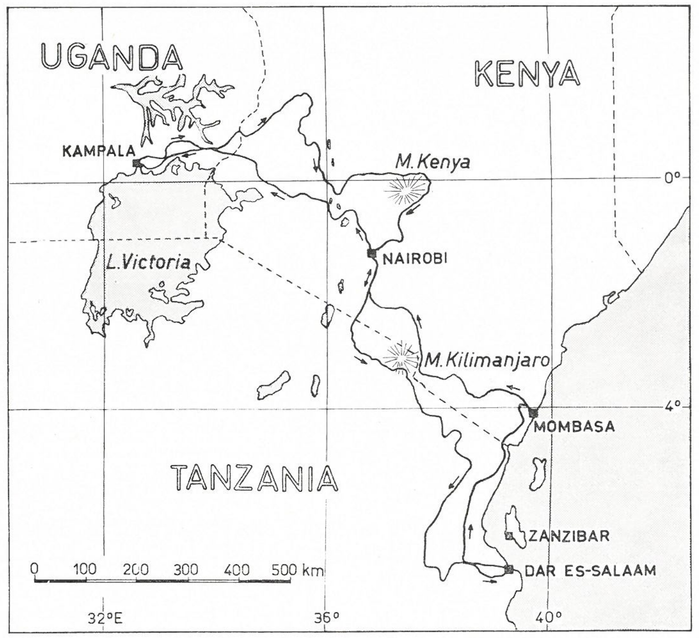
On Thursday, 7th April, the start of the Safari was broadcast in all three of the national sound services and was televised live using an outside-broadcast vehicle equipped with two 4 ½-in image-orthicon cameras and an Ampex VR 1100 television tape recorder. The television signals were transmitted very successfully over a 2.5-km cable laid for the event by the Post and Telecommunication Authority, use being made of special correcting amplifiers which were flown specially from the United Kingdom.

During the southern leg of the Rally, position reports were broadcast regularly and the sound coverage included rebroadcasts from Radio Tanzania of the arrival of the cars at Dar es-Salaam and a live outside broadcast from the Mombasa check point. V.O.K.'s evening television transmissions included scoreboard flashes, interviews with unsuccessful drivers and with Rally officials from the City Hall, and films of the cars on the southern leg, taken by film cameramen flown to Tanzania and shown on television within twenty-four hours. Of some ninety cars that started the Safari, only sixteen completed the southern leg.

The coverage of the northern leg of the course was handled in a similar manner and, for the sound services, included rebroadcasts from Radio Uganda of the cars' arrival at Kampala and an outside broadcast from Nakuru, about 160 km north of Nairobi. The television coverage included film shot near Jinja in Uganda.

The return of the cars to Nairobi was broadcast live in three separate sound services and in the television service which opened in the morning to show the arrivals at the Nairobi City Hall. Only nine cars completed the whole course.

There were, in all, thirty-eight Swahili, forty-three English and thirty-one Hindustani broadcasts in the sound services, and, in the television service, eighteen live broadcasts transmitted over the cable from the City Hall, in addition to a number of programmes recorded on tape and some film sequences.



Map of East Africa showing the 4800-km course of the East African Safari Motor Rally which consists of a southern and northern leg starting and finishing at Nairobi.

NETHERLANDS

A new sound control room for regional theatre broadcasts. — In order to facilitate the increasing number of broadcasts being made from the theatre known as the Twentse Schouwburg at Enschede by the R.O.N.O. (the regional broadcasting organisation for the north-eastern Netherlands), the Technical Department of the Nederlandsche Radio Unie has recently installed a sound control room in the theatre.

An impression of the theatre, which has a volume of about 9000 m³ and seating for an audience of 980 persons, is given in *Fig. 1*. A small window in the side wall of the auditorium *(Fig. 2)* enables the sound engineer to have a good view of the stage. *Fig. 3* shows the equipment installed in the control room.

In the case of a live transmission, the output from this control room is fed to the main R.O.N.O. regional studio centre at Groningen by means of circuits ordered from the Telecommunication Administration on an occasional basis.

The control desk, which is of commercial manufacture and consists entirely of solid-state devices, was modified by the N.R.U. to meet the particular operational requirements. It has eight input channels which may be switched to accept signals either from dynamic microphones or from high-level sources. In the latter condition, the two disk reproducers and the two tape-replay machines may be connected and a fifth channel may be fed from an incoming programme circuit. Three " presence " filters are provided, each of which may be connected into any one of the eight channels at will. The desk provides for three output channels controlled by group faders : programme, effects and reverberation, a high-pass filter being connected in the last-mentioned channel. Push-button selection enables each of the eight channels to be connected to any of the mixing groups. Two tape-recorder inputs are connected in parallel with the programme output. Pre-fade listening is available on all eight inputs and the three output groups.

There is also an announcement cubicle which is provided with listening feeds from all programme sources and from a receiver ; moreover, the sound engineer has the usual talk-back facilities with the announcer.

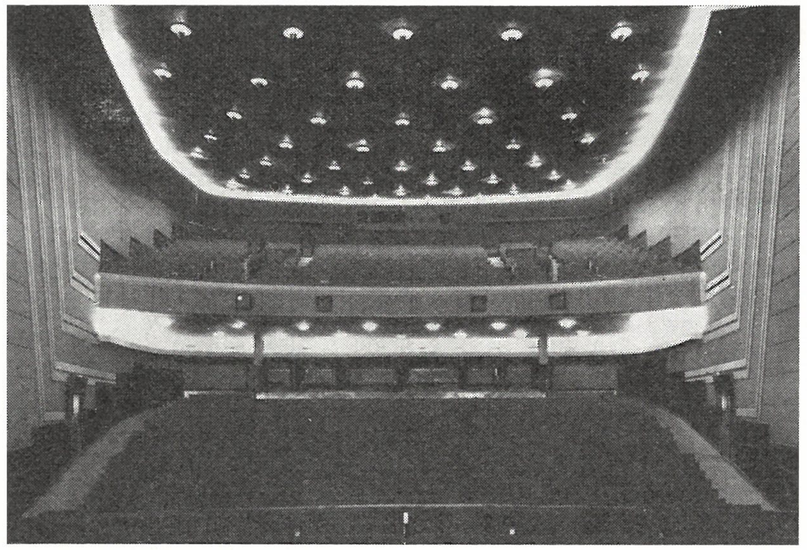


Fig. 1. — The auditorium of the Twentse Schouwburg at Enschede, as seen from the stage.

(Henk Brusse photos)

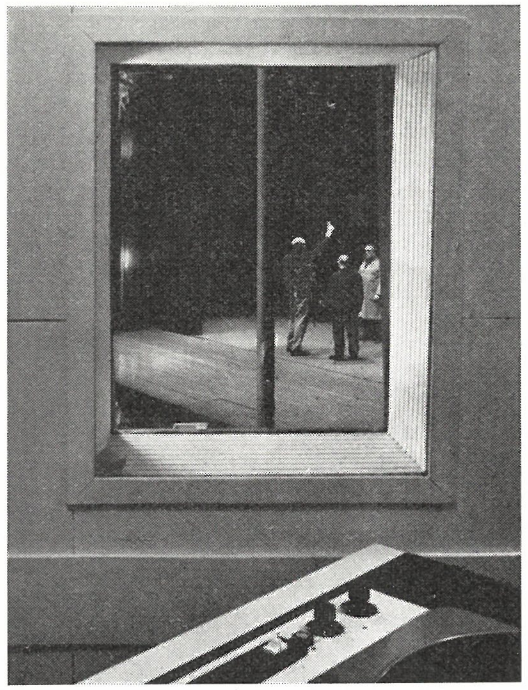


Fig. 2. — A view of the stage seen through the observation window of the control room.

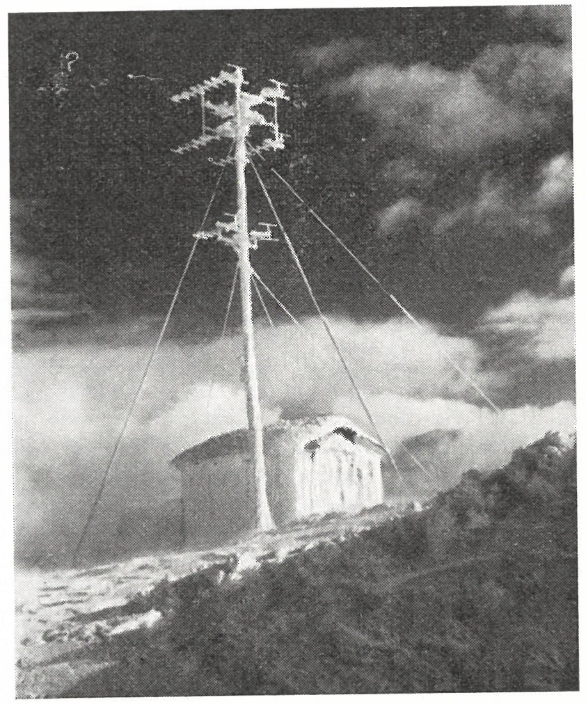
Fig. 3. — The equipment installed in the control room.

SWITZERLAND

Rebroadcast transmitter powered by a fuel cell. — The Swiss Telecommunication Administration is shortly to begin the installation of a transmitting station on the Gebidem, a 2300-m mountain close to Brigue (Valais), a very exposed site which is at present extremely difficult of access. Nevertheless, a small temporary station has already been set up there, to house a solid-state television rebroadcast transmitter. Initially, the equipment was supplied with energy by a lead-acid accumulator, the discharge of which was partially made good by a solar battery, so that the transmitter could operate unattended for six weeks. Periodical visits were made on foot or by helicopter, during which the batteries were fully recharged by means of a small petrol-electric generating set.

Since December 1965, a fuel cell has provided the energy for the station. This cell, which was supplied by the Brown Boveri company of Baden (Switzerland), can power the apparatus for 7000 hours for one charge of the carburant, methanol. The transmitter and the cell are installed in cabinets which are very well insulated thermically, so that the few watts dissipated by the apparatus provide enough heat to maintain its temperature above 0°C, in spite of the very low external temperature. The station has now been operating in this manner for several months without incident, and this experiment makes it possible to envisage the construction of unattended low-power stations of high reliability in places deemed up to now unutilisable.

In E.B.U. Review No. 95-A, p. 30, we reported that a station in Western Germany was also using fuel cells.



The rebroadcasting station at Gebidem which is powered by a fuel cell.

* * *

UNITED KINGDOM

Sound and television broadcasting arrangements for the 1966 World Cup football competition. — The sound-broadcasting arrangements for the thirty-two matches culminating in the Final at Wembley Stadium in London on 30th July will be handled by the British Broadcasting Corporation.

The television arrangements are being made by the " World Cup Television Consortium " acting on behalf of the E.B.U., and comprising staff and equipment belonging to the B.B.C. and to the independent television companies (I.T.V.).

The Consortium was formed to organise and provide the facilities and services necessary for the television coverage, both live and recorded to Europe and the rest of the world, of the World Cup International Football Championship. This is the largest television sports operation ever undertaken in Britain, and is the first major operation handled jointly by the B.B.C. and I.T.V. It is estimated that some five hundred Consortium staff will be engaged on the television operation for the World Cup matches, which will be relayed live or recorded to forty-two countries, reaching an estimated audience, for the Final at Wembley, of some four hundred million people.

A "World Cup Operation Centre" has been established in the extension of the B.B.C. Television Centre in London and this will act as the focal point of both the sound broadcasting and television operations.

Installations at the venues.

At each of the eight grounds at which World Cup matches are being played, the facilities and technical services will include commentary positions for home and foreign broadcasters totalling as many as forty for the Final at Wembley. In order to provide the necessary facilities, a total of about 140 commentators' units, generally in conformity with the E.B.U. standard design, will be used. About a hundred of these are being lent by the Finnish, French, Italian, Swedish and Swiss broadcasting organisations, the remainder being provided by the B.B.C. and I.T.V. In addition, each ground will have an interview studio, control room, tape-editing room and a line-termination room from which commentaries will be routed over British Post Office circuits to their destinations. In the case of programmes for the United Kingdom, normal contribution circuits from the appropriate B.B.C. Regional Headquarters to Broadcasting House, London, will be used. Oversea sound commentaries will be routed over separate circuits to the World Cup Operation Centre and to the British Post Office Trunk and International Exchange in Faraday Building, London, whence they will travel via cable or radio circuits to their ultimate destinations. Special linking circuits are being provided between the various grounds so that information on the state of play in other matches can be kept under review by the various commentators and news items from these other games included in their commentaries at will.

The British Post Office had set up two additional radio-relay vision circuits from London to Tolsford Hill near Folkestone and thence, in conjunction with the French Telecommunication Administration, across the Channel to Lille, so that four separate programmes may be fed simultaneously to Continental Europe.

One or more mobile control rooms will be stationed at each ground to control the outputs of the television cameras covering the various games. In general, four cameras will be used, one of which will be located in an interview studio to cover captions and interviews with players and officials after each match. At Wembley, however, three mobile control rooms are being provided. The B.B.C. will use two of these to provide coverage for the Consortium and the B.B.C. domestic networks, the third will be used by I.T.V. to provide coverage for commercial television only. This arrangement has the advantage that should any equipment failure occur during transmissions, either the B.B.C. or I.T.V. mobile control rooms could provide a feed to all networks.

Installations at the Operation Centre in London.

In the World Cup Operation Centre in London, and in each of the other towns where matches are being played, commentators' offices are being provided. These will afford working accommodation for the commentary teams and are located in the same building as, or close to, the Football Association Press Centre in the town concerned. Interpreters will be in attendance at the offices, moving to the grounds for the matches. Telephones, catering, transport (between offices and grounds) and car-parking facilities are also provided.

The World Cup Operation Centre in London occupies a large part of four floors in the extension of the Television Centre and provides programme and engineering facilities together with equipped office accommodation for foreign television and radio organisations and for B.B.C. sound broadcasting. Telephones are connected to two switchboards devoted entirely to World Cup television and sound broadcasting. Telex facilities are provided for Eurovision, Consortium and domestic and external sound broadcasting together with a teleprinter link to Broadcasting House.

The television technical control area provides for coordination of production control giving the executive producers direct contact with all outside broadcasts, mobile control rooms and commentary vehicles. The area includes four cubicles through which all sound and vision signals from outside broadcasts will pass whether for recording or live transmission. Each cubicle has control lines to the appropriate commentary vehicle, as well as talk-back to the recording channels. Recordings of programmes can be made on magnetic tape or 16-mm film and the appropriate language commentary provided.

A television studio is included in the Operation Centre for use by those organisations requiring unilateral transmissions or recordings. It will be equipped with two working cameras and a caption camera, and can accept inserts from film scanners or television tape machines.

The sound broadcasting authorities are provided with similar accommodation at the Operation Centre, except that sound studio and recording facilities are being provided in mobile studio and control-room vehicles parked just outside. Additional provision for sound broadcasting has also been made at Broadcasting House, London, where equipment has been provided permitting up to ten commentators to describe matches as seen on television picture monitors. These commentaries will be routed direct to the British Post Office International Exchange for transmission to the countries concerned.

On the High Seas

Since the preceding number of the E.B.U. Review appeared, numerous changes have taken place in the situation of the pirate broadcasting stations working off the coasts of the British Isles.

As a result of damage caused by storms to Mi Amigo, the ship in which the station "Radio Caroline South" (1493 kc/s) was installed, the company that exploited it replaced it temporarily by Cheeta 2. At the beginning of April 1966, Mi Amigo returned and took station off Harwich, near Cheeta 2, and on 17th April, 1966, it began to broadcast on 1169 kc/s a programme different from the one that Cheeta 2 continued to broadcast on 1493 kc/s. After an interruption of several days, Mi Amigo began again to broadcast on 25th April, 1966, this time on 1187 kc/s, with a power which would appear to be in the neighbourhood of 50 kW. The transmissions from Cheeta 2 still continued for a few days on 1493 kc/s, and then stopped finally on 2nd May, 1966. According to reports in the newspapers, Cheeta 2 then left the place where it had been moored, in order to take up a position off the west coast of England, in the Bristol Channel, where it was to broadcast television as well as sound programmes.

At the beginning of May, 1966, a further ship equipped with broadcast transmitters, Olga Patricia, anchored off the south-east coast of England, not far from "Radio London" and "Radio Caroline South", where it began to broadcast two different programmes, the first, which started on 18th May, 1966, on 845 kc/s being announced as "Radio England", and the second, which started on 23rd May, 1966, on 1320 kc/s, being announced as "Radio Britain".

The field-strengths of these transmissions as measured at the B.B.C.'s Receiving Station at Tatsfield, were 9 mV/m and 2 mV/m respectively. According to reports in some newspapers, the power of their transmitters was supposed to be 100 kW. However, on 3rd June, "Radio Britain" broke down and had to stop transmitting; it had not restarted when this number went to press.

At the end of April, 1966, the ship in which was installed the "Radio Scotland" transmitter left its anchorage in the Firth of Forth, passed round the north of Scotland and took up a position in the Firth of Clyde, on the west of Scotland, off Ardrossan. It is still working on the same frequency, namely 1259 kc/s.

On 7th June, 1966, the frequency of the "Radio London" transmissions was changed from 1133 kc/s to 1115 kc/s.

The "Radio Tower" transmissions which, it will be recalled, came to an end late in December, 1965, have recently restarted, although in a rather sporadic fashion; programmes were broadcast from 5th to 24th March, then from 29th April to 4th May, when the frequency was changed from 1262 kc/s to 1282 kc/s. It was reported again on 12th May, 1966, but has not been heard again since then.

The ship in which the station "Radio 270" is installed is still reported as being anchored off Scarborough (north-east of England), but it does not appear yet to have started broadcasting.

SOUND AND TELEVISION BROADCASTING STATIONS

EUROPEAN BROADCASTING AREA

Conditions in the spectrum at 1st May, 1966.

Long and medium waves.

The only important change in the European MF broadcasting band during the past two months concerns the transmitter on 602 kc/s at Lyon, France, the power of which was raised from 100 to 300 kW at the end of April, 1966.

Frequency changes observed at the E.B.U.'s Receiving and Measuring Station at Jurbise concern essentially those of the pirate transmitters on the high seas and certain stations in Spain. Minor variations of frequency were noted in the case of several of the Spanish stations, but in general they were never very far from those assigned to them in the new reorganisation plan for broadcasting in Spain.

The 200-watt transmitter at Kempten, Federal Republic of Germany, which worked on 520 kc/s, has been withdrawn from service.

A low-power (50-watt) transmitter at Kötschach, Austria, has recently been taken into service on 1562 kc/s.

This issue of the E.B.U. Review includes the usual chart showing the situation in the long- and medium-wave spectrum as at 1st May, 1966. It replaces the chart published in E.B.U. Review No. 94-A.

It will be recalled that this chart forms an appendix to the Long- and Medium-wave Reports published every six months by the E.B.U. Technical Centre, the latest edition of which is dated 1st May, 1966. This document is based essentially on observations made by the E.B.U. Receiving and Measuring Station at Jurbise-Masnuy, near Mons (Belgium), and by other receiving stations belonging to Members of the E.B.U. It is brought up to date by supplements every two months.

The chart retains its usual presentation, which clearly shows which stations are working in conformity with the Copenhagen Plan on the one hand, and those that do not conform with the Plan (shaded parts of the frequency bands) on the other. Each station is mentioned by name, except in the cases of a group of stations in the same country and having the same nominal frequency, when only the name of the country (or of the main station) and the letter S are indicated. The channels in which changes have occurred since the publication of the last chart have their numbers surrounded by circles. Vertical shading indicates that there is a jamming transmission in the channel.

VHF/FM.

The only reported changes during March and April, 1966 were the following:

In Austria, the power of the Pfänder transmitter on 89.7 Mc/s was increased from 2 to 50 kW;

In Belgium, the frequency of the 50-kW transmitter at Houdeng was changed from 99.1 to 96.6 Mc/s;

In Sweden, six new transmitters were taken into service, the following four being of 60 kW: Bäckefors (99.1 Mc/s), Borlänge (97.7 Mc/s), Gällivare (98.5 Mc/s), Östersund (94.0 Mc/s).

Several gap-filling transmitters of power ranging from 50 W to 1 kW were taken into service in several countries, more particularly in Italy, where some fifteen such stations were opened.

Television.

Several high-power UHF transmitters were taken into service during the past two months, notably:

	Channel No.	ERP (kW)
Brest (France)	21	1000
Amberg (Germany, F.R.)	43	500
Heidelberg (Germany, F.R.)	53	500
Hohes Lohr (Germany, F.R.)	22	40
Spessart (Germany, F.R.)	51	220
Hörby (Sweden)	43	500

As usual, also, the installation of many low-power rebroadcast transmitters has been reported, in particular, two in Austria, two in Finland, five in France, ten in Germany, eight in Italy, three in Norway and two in Switzerland.

UNION EUROPEENNE DE RADIODIFFUSION
CENTRE TECHNIQUE
AVENUE ALBERT LANCASTER, 32
BRUXELLES

EUROPEAN BROADCASTING UNION
TECHNICAL CENTRE
AVENUE ALBERT LANCASTER, 32
BRUSSELS

STATIONS DE RADIODIFFUSION EN ONDES LONGUES ET MOYENNES
(Situation du spectre au 1[er] mai 1966)
ZONE EUROPEENNE

LONG- AND MEDIUM-WAVE BROADCASTING STATIONS
(Conditions in the spectrum on 1[st]. May, 1966)
EUROPEAN AREA

LEGENDE

PUISSANCE

- Egale ou supérieure à 100 kW
- Inférieure à 100 kW
- Inférieure à 10 kW
- Inférieure à 1 kW
- Puissance inconnue.

S=Stations d'un même pays utilisant la même fréquence et souvent synchronisées.

CANAUX DANS LESQUELS UN CHANGEMENT S'EST PRODUIT PAR RAPPORT AU TABLEAU PRECEDENT.

- Apparition d'une nouvelle station
- Disparition d'une station
- Passage d'un canal à un autre
- *Emission de brouillage dans le canal*

LEGEND

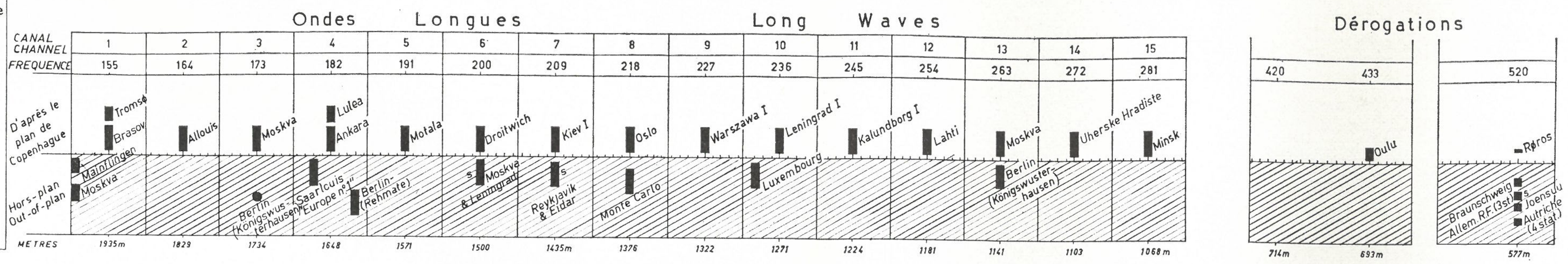
POWER

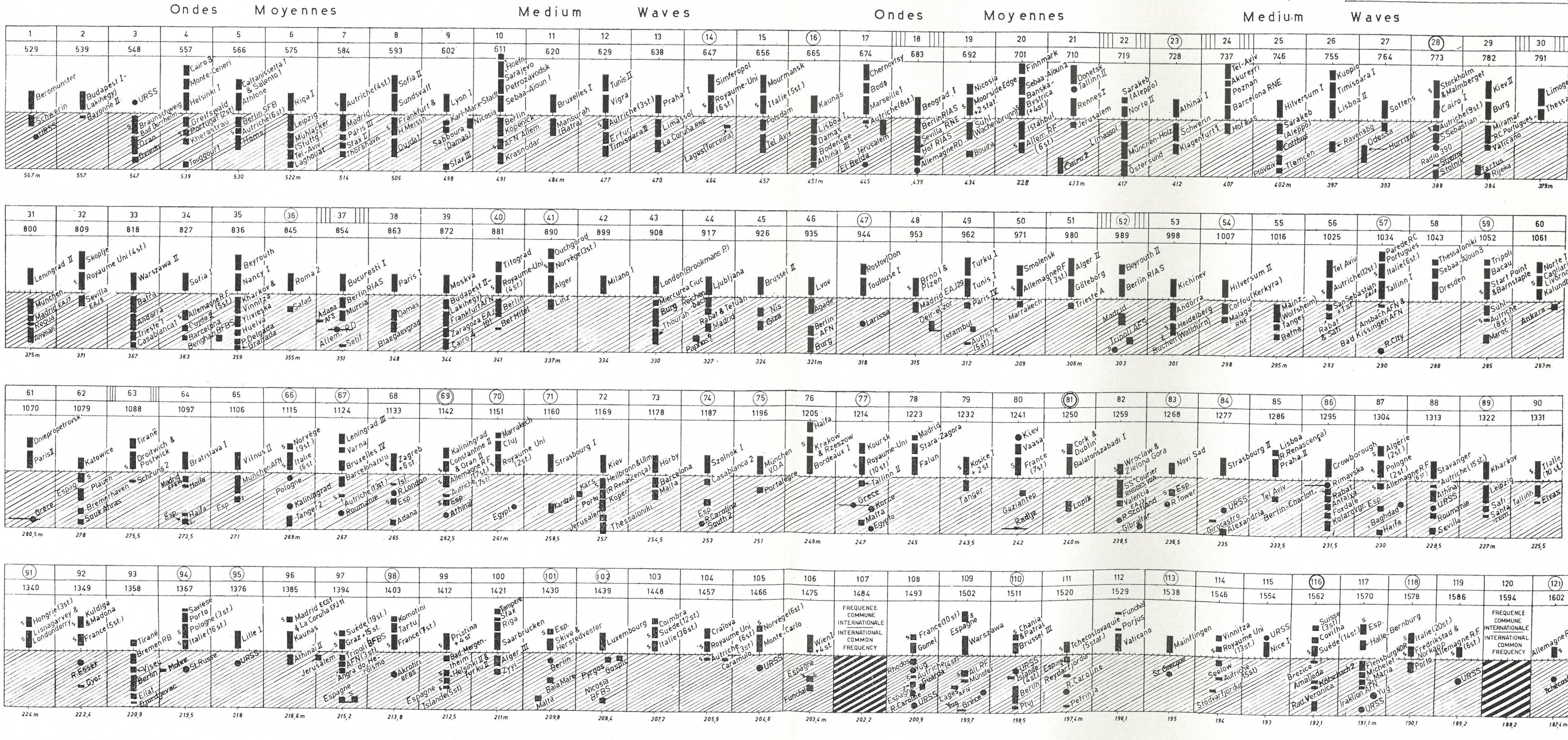
- Not less than 100 kW
- Less than 100 kW
- Less than 10 kW
- Less than 1 kW
- Unknown

S= Stations, usually synchronised, in the same country in the same channel.

CHANNELS IN WHICH CHANGES HAVE OCCURRED SINCE THE LAST CHART.

- Appearance of a new station
- Disappearance of a station
- Transference from one channel to another
- *Jamming transmission in the channel*





SOME NOTEWORTHY ARTICLES

Under this heading, we mention, in each number, a selection of articles published in technical periodicals which seem to us to be of real interest to sound and television broadcasting engineers. We restrict ourselves, however, to giving, in a very concise form, an idea of the contents of each article, 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 to 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)

Werner, P.H., Bänziger, H. and Zingg, F. (PTT/CH) : **Untersuchungen an Schallabsorben tiefer Frequenzen** (Research on acoustic absorbers for the lower frequencies).
Technische Mitteilungen PTT, No. 3, 1966, pp. 77-88.

Level B.

The importance of investigating more thoroughly vibrating panels for bass absorption, designed specifically for each individual application. Results of tests to determine the properties of various methods of construction : flat membrane resonators, panels on battens, Helmholtz resonators. Conclusions regarding the absorption of various materials as a function of their dimensions.

* * *

Mess- und Betriebsgeräte für die Rundfunk-Stereofonie (Measuring instruments and monitoring equipment for stereophonic broadcasting).
Neues von Rohde & Schwarz, No. 20, March 1966, pp. 5-28.

Level B.

A description of the pilot-tone system and professional apparatus manufactured by the Rohde & Schwarz company for use with it. The following articles should be mentioned :

Stereo-Messdecoder MSDC (MSDC stereophonic measuring decoder);

Stereo-Messender SMSF (SMSF stereophonic measuring generator) ;

Stereo-Ballempfänger ESB. Stereo-Ballempfangsanlage NU 6201 (ESB stereophonic rebroadcasting receiver, NU 6201 stereophonic rebroadcasting installation);

Stereo-Einrichtungen für den Senderbetrieb (Stereophonic transmitting installations);

Umbau des Frequenzhubmessers FMV auf Stereo-Tüchtigkeit (Adaptation of the FMV frequency-deviation meter for stereophony).

* * *

Philips, G.J. (B.B.C.) : **Measurement of phase errors in the pilot-tone system for stereophonic broadcasting.**
The Radio and Electronic Engineer, Vol. 31, No. 3, March 1966, pp. 157-159.

Level B.

An oscilloscope method for rapid measurements of phase-errors of the pilot-tone relative to the sub-carrier, by means of a signal of about 400 c/s, modulating the *S* channel to a depth of about 10 %. If there is a phase-error, the waveform seen on the oscilloscope has no horizontal axis of symmetry. The numerical relation between the asymmetry and the phase-error is determined. This method is suitable only if the initial phase-error is less than ± 45°; it permits a rapid adjustment to within 1° to 2°.

* * *

Hoeg, W. and Wasner M. (R.F.Z., East Berlin) : **Automatic test signal for RF Stereophony.**
Radio and Television (O.I.R.T.) No. 1, 1966, pp. 35-39.

Level B.

A description of a generator supplying a series of signals from 400 to 1000 c/s applied to the *A* and *B* channels of a pilot-tone stereophonic encoder. By means of suitable measuring instruments, these signals can be used for the following adjustments to stereophonic equipment and, in particular, decoders : verification of the phase of the sub-carrier and the gain and phase symmetry of the channels, level, non-linearity, cross-talk and *M/S*-ratio measurements, intermodulation tests and measurements of the noise and of the amplitude of the pilot signal.

* * *

Schampaul, N. : **Die Stereofonie in der Praxis - Probleme der Aufnahmetechnik** (Stereophony in practice - Studio and control-room problems).
Funkschau, No. 8, April 1966, pp. 229-232.

Level C.

A discussion of the various problems posed by the nature of stereophony, from the studio and control-room point of view : compatibility, phase and intensity stereophony, microphone placing, mixing circuits, switching, practical limitations.

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Birgels, P. and Sauerland, H. (Rohde & Schwarz) : **Stereo-Ballempfang** (Rebroadcasting stereophony).
Internationale Elektronische Rundschau, No. 3, March 1966, pp. 153-160.

Level B.

Requirements of stereophonic transmissions. Discussion of the A.R.D.'s purchasing-specifications for rebroadcasting receivers. Difficulties in designing such receivers ; their construction and characteristics.

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Jones, R.A. and Randolph, G.G. : **Radio-station floor plans.**
Broadcast Engineering, Vol. 8, No. 3, March 1966, pp. 21-25.

Level C.

Some suggestions for small sound broadcasting-station buildings. Reproduction of five suggested lay-outs : two of them are of actual small studio-centres, the other three are typical lay-outs of stations containing studios and transmitters.

* * *

Beck, R. (McCurdy Radio Industries, Ltd.) : **Remote control of audio signals by solid-state electronic attenuation.**
Journal of the SMPTE, Vol. 75, No. 2, February 1966, pp. 111-115.

Level B.

Review of the problems entailed in modulation monitoring in transmitting stations. Performance required of attenuators. Description, block diagram, method of functioning and characteristics of an electronic attenuator avoiding the necessity of passing the AF signals through the studio control-desk.

* * *

Burchard, B. : **Diversity-Einrichtung für drahtlose Mikrophone** (Diversity installations for radio microphones).
Rundfunktechnische Mitteilungen, No. 2, April 1966, pp. 80-82.

Level B.

Arguments in favour of diversity reception and technical possibilities of the method (AF switching, aerial selection, coupled control voltages). Design of a comparatively simple diversity receiver for short ranges, where there is no disturbing RF phase-difference. Discussion of the circuit of this receiver.

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Spong, L.A. (Associated Television) : **Radio Microphones.**
International Broadcast Engineer, No. 18, March 1966, pp. 106-108.

Level C.

Brief consideration of factors affecting design of radio microphones and their use by television organisations in the United Kingdom : required signal-to-noise ratio, dynamic range, limitation of radiated power, avoidance of " dead spots ".

* * *

Möller, R. (Fernseh GmbH) : **Ein Filmschnellschaltwerk für das Fernsehen** (A fast-pulldown device for film-scanners).
Radio Mentor, Vol. 32, No. 4, April 1966, pp. 294-298.

Level B.

Description of a frame-by-frame drive recently designed for a flying-spot film-scanner giving fast pulldown of the film during the field-blanking interval. Value of this feature, particularly for colour films. The film is moved forward pneumatically. Method of measuring the film movement. Tables indicating the mechanical features of the system and the results obtained with 16-mm and 35-mm film.

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Dubbe, R.F. (Minnesota Mining and Manufacturing Co.) : **Television film recording using electron exposure.**
Journal of the SMPTE, Vol. 75, No. 3, March 1966, pp. 191-194.

Level B.

Comparison of conventional television film-recording with a method of printing directly on the film by means of an electron beam, as regards the quality of the pictures obtained. The latter process has better resolution and less background noise, facilitates the adjustment of the exposure and obviates the problems of remanence during pulldown.

* * *

Siocos, C.A. (C.B.C.) : **Vertical interval test and reference signal (VITS) in the CBC television network.**
Journal of the SMPTE, Vol. 75, No. 2, February 1966, pp. 81-84.

Level B.

Description of the special insertion-signals now, after an experimental period, in routine use for monitoring the technical performance of the C.B.C. television network. Three lines are utilised, carrying a reference-white signal, together with a sine-squared pulse, a frequency " burst " and a " staircase " signal with a superposed sinusoid of frequency 3.58 Mc/s. List of equipment used to generate the signals. Considerations regarding the possible use of automatic methods for utilising the data obtained by means of the insertion signals.

* * *

Brownless, S.F. and Harnath, R.W. (Australian Post Office) : **Vertical interval test signals in Australian television.**
Journal of the SMPTE, Vol. 75, No. 2, February 1966, pp. 84-88.

Level B.

Brief description of the Australian television network and of its operational supervision, for which insertion signals are used. The signals chosen are C.C.I.R. test-signals Nos. 2 and 3. Allocation of the field-blanking interval between the Administration and the television services. Review of methods of utilising the data obtained by means of the insertion signals and of future evolution in this field.

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Rhodes, C.W. (Tektronix) : **Monitoring of vertical interval test signals.**
Journal of the SMPTE, Vol. 75, No. 2, February 1966, pp. 94-98.

Level B.

Oscilloscope methods of verifying the insertion signals standardised in the United States and Canada. Special features of the equipment designed to provide this control, and problems encountered in developing the equipment : design of line and field selectors, cathode-ray tubes used, time-bases, vertical amplification, frequency response indicated by means of markings on a transparent sheet. Limitations to be borne in mind when using insertion signals for monitoring the quality of television pictures.

* * *

Potter, J.B. (Melbourne University) : **Methods and equipment techniques for multiline VITS insertion in TV relays.**
Journal of the SMPTE, Vol. 75, No. 2, February 1966, pp. 89-93.

Level B.

General assessment of the value of special insertion signals of various kinds in the field-blanking interval. Description of equipment for inserting a sequence of up to eight signals in a predetermined order. Circuit diagrams of the principal units of this equipment, which includes an automatic gain control, as well as an error detector for taking the whole equipment out of service without interrupting the transmission.

* * *

Rappold, A. (Standard Elektrik Lorenz) : **Einfluss des Vertikalsynchronimpulses auf die Stabilität der Synchronisierung beim Fernseher** (Influence of the field-synchronising pulses on the synchronisation stability of television receivers).
Radio Mentor, Vol. 32, No. 4, April 1966, pp. 292-293.

Level B.

The effect of the main synchronising pulses, which is different depending upon whether there is an odd or an even number. Possibility of remedying the picture disturbance which this causes, by changing the shape or number of equalising or synchronising pulses.

* * *

Koreny, J. (Hungarian Television) : **New front-projection system for television studios.**
Radio and Television (O.I.R.T.), No. 2, 1966, pp. 24-27.

Level C.

Description of equipment for " transparent " projection, wherein the " background " is projected on the screen by means of a semi-transparent mirror. Construction of the screen, which has high reflectivity, and of the projector. Advantages and disadvantages of the method.

* * *

Wallace, P.R. and Seyler, A.J. (Australian Post Office) : **Acquisition of statistical data of television signals.**
Proceedings I.R.E.E. Australia, Vol. 26, No. 11, November 1965, pp. 343-354.

Level A.

Principles of functioning and construction of equipment for obtaining automatically the statistical distribution of the amplitudes of the elements of a television picture. Other applications seem possible, notably in the analysis of stochastic processes.

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Seyler, A.J. (Australian Post Office) : **Probability distributions of television frame differences.**
Proceedings I.R.E.E. Australia, Vol. 26, No. 11, November 1965, pp. 355-366.

Level A.

Results of investigations effected by means of the equipment described in the preceding reference, with the object of determining the probability of differences between the information contained in two successive fields in television; it was found to be a gamma distribution.

* * *

Digital Television Transmission.
Wireless World, Vol. 72, No. 3, March 1966, pp. 114-118.

Level C.

Survey of recent experimental work on the transmission of television signals by pulse-code modulation. Although a bandwidth greater than that of the original video signal is required, a greater signal-to-noise ratio can be obtained than with other systems. Description of encoders and decoders utilised.

* * *

Kiefer, D. (I.R.T., München) and Schedel, W. (W.D.R.) : **Ein aktives Allpassnetwerk mit kontinuierlich einstellbarer Gruppenlaufzeit im Videobereich** (An active all-pass network with continuously adjustable group-propagation-time in the video band).
Rundfunktechnische Mitteilungen, No. 2, April 1966, pp. 67-74.

Level A.

The difficulty of the continuous adjustment of a vestigial-sideband system by means of a set of passive all-pass networks of given characteristic impedance. Possibility of designing an all-pass network independent of the characteristic impedance, by means of a single tuned circuit associated with active elements (solid-state stages). Description of apparatus containing eight all-pass filters of this type in cascade, which also enables purely low-pass systems to be connected, if the cut-off frequency is not too far from the vestigial-sideband system. Results of service trials.

* * *

Parker-Smith, N.N. (Marconi) : **Colour television cameras - the designer's choice.**
Sound and Vision Broadcasting, Vol. 7, No. 1, Spring 1966, pp. 1-7.

Level B.

Discussion of the factors taken into consideration in the design of a new colour-television camera : performance and reliability, operational flexibility, sensitivity, size and weight, immunity to environmental conditions. Examination of the available choices and reasons for selection of a design employing four plumbicon camera tubes, but capable of using standard image-orthicon television camera lenses. Reference to a four-vidicon colour camera for film scanners.

* * *

Heightman, A.N. and Underhill, W.T. (Marconi) : **A new four-tube colour television camera.**
Sound and Vision Broadcasting, Vol. 7, No. 1, Spring 1966, pp. 8-21.

Level B.

Description of the Marconi Mk VII colour camera, including its optical system, controls and control unit, construction, special design features and performance.

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Bruch, W. (Telefunken AG) : **Neuere Entwicklungen für das PAL - Farbfernseh-Übertragungsverfahren** (More recent developments in the PAL colour-television system).
Funk-Technik, No. 5, March 1966, pp. 154-160.

Level B.

Description and explanation of the differences between the version of the PAL system whose characteristics were fixed by the E.B.U. Ad-hoc Group on Colour Television in June, 1965, and the earlier versions : modulation signals, synchronisation, blanking, sub-carrier frequency. Description of a phase-error compensator.

* * *

Doury, J.P. (C.F.T.) : **Das Farbfernsehsystem SECAM** (The SECAM colour-television system).
Radio und Fernsehen, No. 4, February 1966, pp. 103-107.

Level B.

Very general considerations on colour synthesis. Brief description of the principle of the SECAM system. Block diagrams of the encoder and decoder. More detailed circuit diagrams of the luminance and chrominance sections of the receiver.

* * *

Neuhaus, G. (Fernseh GmbH) : **Farbmetrik und Farbfilmabtaster** (Colorimetry and colour-film scanners).
Rundfunktechnische Mitteilungen, No. 2, April 1966, pp. 49-55.

Level A.

Limits of the possibility of reproducing colours by the additive mixing of three primary colours. Disadvantages of using simplified colour-mixing curves, with which the faults which appear on reproduction are not independent of the chromatic stimulus. The case of the reproduction of flesh tones; good results obtained with a film-scanner using reversal film, by using the S.64 mixing curves; comparison with optical projection.

* * *

Kustarev, A.K. and Deryugin, N.G. : **Influence of random signal variations in a color television channel on the faithfulness of color reproduction.**
Telecommunication and Radio Engineering, No. 11, November 1965, pp. 46-56.

Level A.

Determination of equations in the form of matrices relating the colorimetric coordinates at the input and output of a transmission channel, irrespective of the colour-television system utilised. The following variations are discussed : modifications of the primary signals before and after gamma correction, non-linearity of the transmission characteristics, variations of the luminance and colour-difference signals, fluctuations of the composite signal, variation of the primary colours of the receiver. (Translated from Russian)

* * *

Shot box for colour television.
International Broadcast Engineer, No. 18, March 1966, pp. 82-86.

Level B.

Application of servo mechanisms to the remote control of television cameras; panning, tilting, pre-selection of shots and control of zoom lenses. Brief review of the development of such mechanisms.

* * *

Boithias, L. and Battesti, J. (C.N.E.T.) : **Les faisceaux hertziens transhorizon de haute qualité** (Good-quality transhorizon radio-relays).
Annales des Télécommunications, Vol. 20, Nos. 7-8, July-August 1965, pp. 138-150, Nos. 11-12, November-December 1965, pp. 237-254.

Level A.

Description of various phenomena making possible radio-relay links beyond the horizon : scatter propagation, propagation by spherical diffraction and by diffraction over sharp ridges. Curves and abacs for evaluating the attenuation. Equipment used : aerials, transmitters, receivers. Choice of frequency. Performance required of each section in order that the whole chain should comply with the C.C.I.R. Recommendations. Optimum characteristics of the equipment (thermal noise, threshold, intermodulation) needed to meet these quality criteria. Case of telegraph transmission.

* * *

Endler, W. (R.F.Z., East Berlin) : **Low-distortion AM demodulator for medium-wave and long-wave radio ranges.**
Radio and Television (O.I.R.T.), No. 2, 1966, pp. 39-43.

Level B.

Description and block diagram of the apparatus, intended as a quality monitor for LF and MF broadcast transmitters. Methods adopted for reducing non-linearity distortion and for improving the signal-to-noise ratio. Some indications of the construction and functioning of the apparatus.

* * *

Pohl, R. (R.F.Z., East Berlin) : **A Ballempfang receiver for the VHF band.**
Radio and Television (O.I.R.T.), No. 2, 1966, pp. 28-33.

Level B.

Value of direct rebroadcasting of VHF transmissions. Description of a receiver used for this purpose. Quality necessary and design of the principal stages : RF unit, IF and AF amplifiers. Block diagram. Principal technical features of the receiver.

* * *

Frequency standards.
Proceedings of the I.E.E.E., Vol. 54, No. 2, February 1966, pp. 103-230.

Level A.

This number contains the following articles devoted to the theory and practice of modern frequency standards :

Gerber, E.A. and Sykes, R.A. : *State of the art — Quartz crystal units and oscillators.*

McCoubrey, A.O. : *A survey of atomic frequency standards.*

Cutler, L.S. and Searle, C.L. : *Some aspects of the theory and measurement of frequency fluctuations in frequency standards.*

Davidovits, P. and Novick, R. · *The optically pumped rubidium maser.*

Lacey, R.F., Helgesson, A.L. and Holloway, J.H. : *Short-term stability of passive atomic frequency standards.*

Barnes, J.A. and Allan, D.W. : *A statistical model of flicker noise.*

Hafner, E. : *The effects of noise in oscillators.*

Vessot, R., Mueller, L. and Vanier, J. : *The specification of oscillator characteristics from measurements made in the frequency domain.*

Barnes, J.A. : *Atomic timekeeping and the statistics of precision signal generators.*

Allan, D.W. : *Statistics of atomic frequency standards.*

* * *

Hatch, J.F., Struszynski, W. and Thurgood, H. (Marconi) : **The Marconi eight aerial Adcock H.F. direction finder type S. 480.**
The Marconi Review, Vol. XXIX, No. 160, First Quarter 1966, pp. 1-23.

Level B.

A detailed description of the development of a new type of HF direction finder. Particular attention is paid to the improvements in accuracy, sensitivity, polarisation-error protection and increased frequency coverage (1.5 — 30 Mc/s).

* * *

Staiger, F. (Bayerischer Rundfunk, München) : **Auslenkung von Antennenträgern in Stahlbetonausführung durch Sonnenbestrahlung** (Deformation of reinforced-concrete aerial supports by solar radiation).
Rundfunktechnische Mitteilungen, No. 2, April 1966, pp. 75-79.

Level B.

Causes of the deformation of reinforced-concrete towers. The necessity to limit it and, in order to do so, to measure it. Descriptions of apparatus used and results of measurements made, at various seasons of the year and times of the day, on the aerial towers on the Ochsenkopf and the Brotjacklriegel.

* * *

Dalladas, G. (Kathrein) : **Vier Programme für 400 Teilnehmer Fernseh-Grossgemeinschaft-Antennenanlage in Laufen/Schweiz** (Four programmes for 400 subscribers. The large-scale television common-aerial installation at Laufen, Switzerland).
Radio Mentor, No. 3, March 1966, pp. 166-170.

Level B.

Conditions of reception and arrangements adopted for the installation of the common aerials supported on a mast erected on a 400-m hill. Description and circuits of the amplifiers, which comprise a main amplifier at the foot of the mast and fifteen groups of line-amplifiers by which the signals of each channel are amplified separately. Thermionic valves are used.

* * *

Dixon, J.M. (Australian Broadcasting Control Board) :**The absorption of medium frequency sky-wave by close coupling to the extraordinary mode.**
Proceedings I.R.E.E. Australia, Vol. 26, No. 12, December 1965, pp. 369-380.

Level A.

Considerations regarding a mode of MF transmission whereby the energy reflected by the ionosphere is absorbed to a much greater extent than with ordinary vertically-polarised transmission. Description of propagation tests effected in Australia to verify the theory. The reduction observed ranged from 12 db for low field-strengths to 20 db for high field-strengths, the average being 16 db. Possibility of using this method in favourable cases to reduce interference due to indirect propagation and to increase the primary service area of the transmitter.

* * *

Special issue on Sporadic E.
Radio Science, Vol. 1, No. 2, February 1966.

Level A.

Fourteen articles reproducing papers read at the " Seminar on the cause and structure of temperate latitude Sporadic E " held at Swiss Village, Colorado, U.S.A., in June, 1965.

* * *

Kreil, S., Metzger, E. and Haas, R. (Siemens & Halske) : **Intermodulationsgeräusch bei Satellitensystemen mit Frequenzmodulation infolge harter Bandbeschneidung des FM-Signals** (Intermodulation noise on FM transmissions via satellites when the band of the FM signal is severely cut).
Nachrichtentechnische Zeitschrift, No. 3, March 1966, pp. 129-135.

Level B.

Experimental investigation of the increase in the intermodulation noise when the frequency deviation is increased while maintaining the receiver bandwidth constant. Measuring methods and results. Determination of the optimum deviation. Comparison with theory.

* * *

Stanesby, H. (British Post Office) : **Early Bird and the Goonhilly earth station.**
Electronics and Power, Vol. 12, March 1966, pp. 75-77.

Level C.

General description of the trans-Atlantic telecommunication system employing the Early Bird satellite and of the terrestrial network connecting the four European Earth stations. Reference to the modifications made to the equipment of the Goonhilly Downs station to enable it to work with the Early Bird satellite. Indication of the results obtained both in telephony and in television.

* * *

Wettstein, G.A. (PTT/CH) : **Die Konferenz der Regierungsbevollmachtigten der Internationalen Fernmeldeunion 1965 in Montreux** (The International Telecommunication Union. Plenipotentiary Conference, Montreux, 1965).
Technische Mitteilungen PTT, No. 3, 1966, pp. 57-67.

Level C.

Organisation of the conference. Proceedings and results obtained : revision of the International Telecommunication Convention, organisation of the I.T.U. and its specialised agencies, drafting of a charter, staff problems, financial questions, elections

THE DRAFTING OF SAFETY REGULATIONS

The fifth of the current series of technical monographs to be published by the E.B.U. Technical Centre in Brussels has just appeared. It is entitled **Safety regulations for the staffs of broadcasting organisations,** the Principal Author being Mr. E.L.E. Pawley, Chief Engineer (External Relations) of the B.B.C. and Chairman of the E.B.U. Technical Committee.

It is not the intention of this monograph to provide ready-made safety regulations directly applicable to any broadcasting organisation — indeed this would be practically impossible, in view of the different equipment used and the different methods of operation adopted, as between one organisation and another. Moreover, opinions differ considerably as to how such regulations should be drafted and as to the extent to which they should go into details.

The principal object is rather merely to provide some guidance for the persons charged with drafting safety regulations meeting the particular requirements of individual broadcasting organisations. Reference is made to regulations already in force in various broadcasting organisations and many basic principles which appear to be generally applicable are indicated. The authors set themselves the task of listing all the risks that should be considered and of drawing attention to all the precautions that should be taken not only by the engineering staff, but also by the programme production and presentation staff and by the manual workers. A comprehensive alphabetical index renders this 48-page monograph a very practical reference-book.

The new monograph is **No. 3105** and it is available from the E.B.U. Technical Centre, 32, avenue Albert Lancaster, Bruxelles 18 at 80 Belgian francs, surface-postage included.

E.B.U. ACTIVITIES

Eighteenth Plenary Meeting of the E.B.U. Technical Committee

Luxembourg, 18th to 22nd April, 1966.

The E.B.U. Technical Committee, which comprises the technical directors and chief engineers of E.B.U. Members, held its 1966 Plenary Meeting in Luxembourg from 18th to 22nd April, 1966, at the invitation of the Compagnie Luxembourgeoise de Télédiffusion. It was attended by fifty-five delegates from thirty-six organisations, the chair being taken by Mr. E.L.E. Pawley, Chairman of the Committee. The Plenary Meeting was preceded, as usual, by a short preparatory meeting of the Bureau of the Technical Committee.

The Committee dealt first of all with the activities of the Technical Centre, giving special attention to the progress of the 1966 re-equipment programme of the Receiving and Measuring Station at Jurbise, where automatic methods are being introduced progressively to enable the station, in spite of its depleted staff, to continue to meet the Members' demands for data and reports. The Committee decided to recommend the replacement in 1967 of the LF/MF field-strength measuring installation at Jurbise, which is already thirty years old, as well as of the VHF receiving equipment, in order to enable Jurbise to contribute effectively to the current study of sporadic-E propagation. The Committee also approved three draft contributions relating to international monitoring, for submission to the C.C.I.R. Plenary Assembly in Oslo.

Next, the Committee turned to the E.B.U. Technical Monographs that had appeared since its last meeting ; it was satisfied with their success and also with the progress being made with those to be published during the coming year.

On the subject of Eurovision, the Committee noted the steadily increasing scale of activity — 1551 transmissions had been planned and supervised by the Technical Centre during 1965, an increase of nearly 20 % compared with 1964. Automatic methods are being introduced to accelerate the statistical and clerical work in this department also. Further apparatus for the Coordination Centre was approved, including automatic telephone equipment to enable more efficient use of the permanent control circuits to be made by Members. Preliminary arrangements were also made for equipping the Coordination Centre for handling colour-television signals and for training the staff in the new techniques involved.

The Technical Committee then went on to examine the achievements and future plans * of its several Working Parties. With regard to Working Party A (Amplitude-modulation sound broadcasting), it was decided to hold a meeting in May, 1966 to clear up one or two points in the E.B.U. contribution dealing with LF and MF coverage already submitted to the C.C.I.R. (p. 136). A proposal of Working Party B (Ionospheric propagation on kilometric, hectometric and metric (Band-I) waves) that the Technical Centre should transfer to punched cards the results of all the organised propagation measurements accumulated over the past fifteen years, in order to render it possible later to extract the maximum of information from them by computer methods, was adopted, and the Committee will ask the Council for a grant to finance this operation. The Committee also approved for submission to the C.C.I.R. a contribution dealing with the ionospheric propagation of metric waves. Turning to Working Party G (Recording of sound and pictures), the Committee approved the reports of the three sub-groups, and invited Sub-group G2 to add the study of different types of four-head television tape-recorders and of slow-motion recording and reproducing machines to its programme of future work. For Working Party K (Television and FM sound broadcasting) the Committee approved the creation of two new sub-groups, to deal with the implications of colour-television broadcasting in Bands I and III and with the use of electronic computers for the determination of service areas. Working Party K is to undertake also a study of programme distribution by means of satellites and for this purpose several new members were invited to join the Working Party.

It will be recalled that Working Parties L (International network operations) and M (International network transmission) have recently been reorganised to improve their efficiency and facilitate cooperation. The Committee approved the arrangements adopted to put this reorganisation into effect, and in particular a formula for electing additional members to the Executive Group of Working Party L and a proposal that future plenary meetings of Working Party L should take the form of study sessions on appropriate themes. The Committee also approved a draft contribution to the C.C.I.R., intended to permit operation without a " pedestal " in the standard 625-line waveform. For Working Party M, the Committee approved a revised version of the C.C.I.R. contribution proposing a standard monitoring signal for insertion in the field-blanking interval, which had been submitted to the interim meetings (Geneva, 1965), as well as revised terms of reference and membership for the Working Party and its sub-groups. After congratulating the Sound Sub-group on the successful " launching " of the E.B.U. programme-volume indicator, the Committee approved its draft C.C.I.R. contribution on the measurement of non-linearity distortion.

* Reports on the recent meetings of the Working Parties, giving these details, have already appeared in the E.B.U. Review.

At the request of Working Party P (Collaboration with the C.I.S.P.R. and interference counter-measures), the Committee arranged for action to be taken to discourage the adoption, by groups of countries such as the European Common Market, of standards in the field of interference counter-measures that are, for economic reasons, less effective than those already standardised by the competent specialised international organisations.

A proposal to extend the terms of reference of Working Party S to include the study of methods of broadcasting several independent monophonic programmes on one carrier-wave was referred to the Bureau, although the working programme and membership of the new sub-group dealing with the question of television with two sound channels were approved.

The Committee warmly congratulated the Ad-hoc Group on Colour Television on its work and concluded that no decision regarding its future could be taken until after the C.C.I.R. Oslo meeting. The fullest possible information about the several variants of the systems under consideration would be made available to the C.C.I.R., but it was confirmed that the Ad-hoc Group had not yet been requested to consider the SECAM IV variant. At the request of certain Members, the Technical Centre was invited to issue some practical recommendations for television services about to make preliminary arrangements for introducing colour. The Committee also reviewed the arrangements for the colour-television demonstrations in Rome (see below).

With regard to the Eurovision Permanent Network, the Committee noted that projects for acquiring a permanent vision network were at present in abeyance awaiting the completion of a comprehensive traffic-study, and the Committee expressed the view that the future possibilities of telecommunication satellites must not be overlooked in this context.

After discussing a number of points concerning collaboration with other international organisations, and also the participation of the E.B.U. in certain international technical conferences, notably the C.C.I.R. Plenary Assembly in Oslo, the Committee accepted invitations of the N.R.U./N.T.S. and the T.R.T. to hold the 1967 and 1968 meetings of the Technical Committee in the Netherlands and Turkey respectively.

The Committee then proceeded to the election of its Chairman, Vice-Chairmen and Bureau for the period 1967/1968 ; the result was :

Chairman	Mr. E.L.E. Pawley	(B.B.C.)
Vice-Chairmen	Mr. C. Mercier	(O.R.T.F.)
	Dr. H. Rindfleisch	(A.R.D.)
Members	Mr. E. Gavilan	(T.V.E.)
	Mr. C. Terzani	(RAI)
	Mr. J. von Utfall	(S.R.)

together with a member to be nominated jointly by the S.R.G. and the Swiss Telecommunication Administration.

During the period of the meeting, Dr. Zaccarian read a paper entitled " The influence of tape-recording on television programme production " in which the author, Dr. Orsini (RAI), who was indisposed, explained the fundamental changes, by no means all beneficial, which the introduction of television tape recording has entailed. Also, Professor Geluk (N.R.U./N.T.S.) gave a demonstration, over a circuit of about 1500 km, of a system * developed in his laboratory, for transmitting several monophonic and stereophonic signals over television radio-relay circuits. Both these items were followed by very interesting discussions.

* The system demonstrated by Prof. Geluk was described in E.B.U. Review No. 96-A.

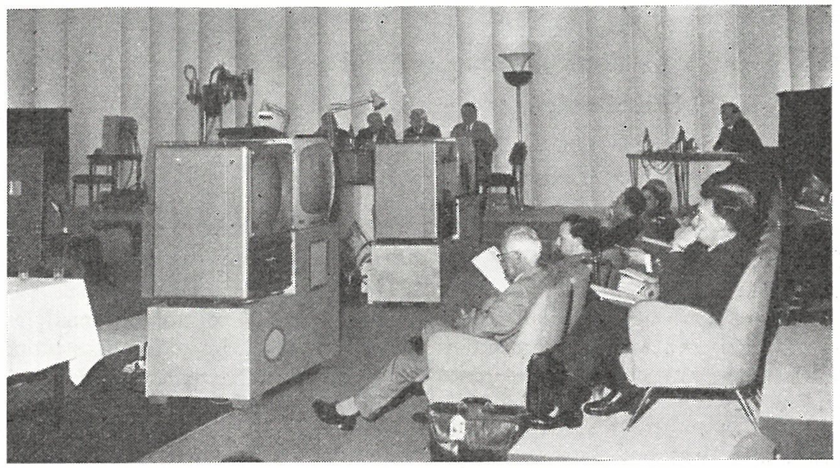
Colour-television demonstrations

Rome, 3rd to 5th May, 1966.

Under the aegis of the E.B.U. Ad-hoc Group on Colour Television, the Radiotelevisione Italiana gave a series of special demonstrations in Rome from 3rd to 5th May, 1966, for the primary purpose of giving the Members of the Union which are not represented in the Ad-hoc Group, as well as representatives of the Telecommunication Administrations and radio manufacturers of their countries, an opportunity to study the performance of the colour-television systems which are likely to be discussed at the forthcoming C.C.I.R. Plenary Assembly (Oslo, June-July, 1966). The delegations, which were in principle restricted to four persons per country, totalled some seventy persons, including invited representatives of the C.C.I.R. and the O.I.R.T.

The first session was opened by Mr. Pietro Quaroni, the Chairman of the Radiotelevisione Italiana, who welcomed the delegates. He was followed by Professor Theile, Chairman of the Ad-hoc Group, who made a brief comparison of the systems which would be demonstrated, namely the PAL and SECAM III-b systems, and by Dr. Orsini, Technical Director (Television) of the RAI, who explained the details of the demonstrations, most of which were given in the principal studio of the RAI's sound-broadcasting production centre in Rome, where eleven pairs of monochrome and colour picture-monitors were installed. During each demonstration, the monitors were switched successively from system to system, a visual indication and a spoken announcement accompanying each change.

In order to render the comparisons as valid as possible, in each test, common picture sources, either flying-spot film and slide scanners, television tape-



The colour-television demonstrations in Rome.

Above : Two of the pairs of picture-monitors in a studio of the RAI.

Opposite : The Chairman's table. By means of a slide and caption scanner, the various speakers were able to display diagrams etc. on the picture-monitors in front of the delegates.

recording machines or colour cameras, fed PAL and SECAM encoders, the encoded signals being next subjected to the distortion, interference or other test conditions and decoded, the decoded signals being applied to the sequential-display equipment. Whereas the common sources, the distortion simulators and the display facilities were provided and operated by the RAI, the PAL encoders and decoders were provided and operated by the Telefunken company and the SECAM encoders and decoders jointly by the O.R.T.F. and the C.F.T. company.

The demonstrations consisted of two series of tests, namely video-frequency tests and radio-frequency tests.

The video-frequency tests were intended to show the degradation of the colour pictures when the video signal was subjected to certain forms of distortion and interference. The effects taken into account included compatibility, attenuation of the chrominance upper-sideband, repeated tape recording, non-synchronised sources, long-distance (3000 km) transmission, noise of various kinds, echoes and the combined effect of several kinds of distortion or interference simultaneously. All of these tests compared the PAL and SECAM III-b systems.

The radio-frequency demonstrations were given in another hall, fairly close to the Monte Mario transmitting station, which radiates 140 kW in Channel 28, but in this series the PAL system was compared with a 625-line version of the NTSC system, as SECAM receivers were not yet available. The performance of the two systems was assessed under various conditions of reception, including weak signals, multiple reflections, noise of various kinds, interference from a station in the same channel and receiver mistuning.

The delegates were unanimous in congratulating the RAI on the excellent practical organisation and execution of the demonstrations. It was easy at any time to know exactly what effect was being demonstrated and it was a happy inspiration to use the monochrome monitor, provided alongside each colour monitor primarily to demonstrate the compatible monochrome picture, to display circuit diagrams, characteristic curves and other data helpful in appreciating the test conditions.

All agreed that these demonstrations succeeded admirably in serving their purpose of reviewing the performance of the colour-television systems in question, before they have to be discussed in Oslo.

Sixth meeting of Working Party A
(Amplitude-modulation sound broadcasting)

Brussels, 10th to 12th May, 1966.

This meeting of Working Party A, which was held in the E.B.U. Technical Centre, was to a large extent a continuation of the meeting * held in Paris from 13th to 15th December, 1965, and was in effect almost entirely devoted to the problem of protection ratios for AM sound broadcasting.

It will be recalled that it was not possible, at the Paris meeting, to reach complete agreement, although it had been possible to bring the viewpoints of the members of the Working Party considerably closer together. The E.B.U. Technical Committee, at its recent Luxembourg meeting, came to the conclusion that a further meeting of the Working Party might well result in finding a unanimous opinion in this matter, which is indeed one which has been under discussion almost since the beginning of broadcasting, at any rate as far as long and medium waves are concerned. The date of this meeting was chosen to allow the possibility of submitting a contribution to the C.C.I.R. XIth Plenary Assembly (Oslo, June/July, 1966).

The Working Party discussed the problem in two stages. First of all, it made a survey of new data relating to the study of the relative RF protection ratio, that is to say, the quantity of which it is necessary to modify, as a function of the frequency spacing, the RF protection ratio determined for two transmissions of the same frequency. It will be recalled that, at its interim meeting in Vienna in April 1965, C.C.I.R. Study Group X specified the variation of that quantity by means of a curve based essentially on the reports of Working Party A. That curve was reproduced in E.B.U. Review No. 92-A (p. 168). In the meantime, experiments have been made by the B.B.C. and I.R.T. in order to determine the extent to which the curve should be modified for the case when the wanted and unwanted signals undergo additional dynamic compression before being broadcast. It appeared that, not only in the case of HF broadcasting, where it is the well-established practice, broadcasting organisations are now using automatic compressors to an increasing extent on LF and MF. The Working Party also decided to undertake an inquiry to find out what technical processes were being used and what degree of compression is obtained. As a result of the experiments, the Working Party proposed modifications to the shape of the curve of the C.C.I.R. draft recommendation in question, which applies to the case of two uncompressed signals (apart, of course, from the manual " control " normally effected at the originating studio). In addition, a proposal was put forward for a second curve applicable when both signals undergo an additional compression of at least ten decibels.

The Working Party next dealt with the problem of the RF protection ratio in the case of two LF or MF transmissions in the same channel. It quickly reached agreement on the substance of the question, but nevertheless discussed at considerable length the form in which the agreement should be presented. The agreement that was ultimately reached — it took the form of a draft contribution to the C.C.I.R. — provides in the first place for a protection ratio of 40 db when both signals have constant amplitudes. The same figures may be used for interference calculations when the interfering signal is subject to fading. In order that there should be no ambiguity as to the meaning of this last proposition, the Working Party specified at the same time that this ratio entails the utilisation, for the European Broadcasting Area at any rate, of propagation curves giving the annual median value (for 50 % of the time) valid for midnight (local time) at the midpoint of the path. These data evidently make it readily possible to calculate the protection actually provided at any other time of day and any other percentage of the time.

The research already undertaken by the O.R.T.F. on the relations between protection ratio, service area, power and other basic data for frequency-assignment work, is being continued. Results were communicated to the Working Party as well as constituting a C.C.I.R. contribution. The Working Party is to pursue this investigation in due course.

The Working Party had very little time left to deal with the other questions assigned to it by the Technical Committee. However, it took note that the I.R.T., Hamburg, had almost completed its preparations for a measuring campaign entailing recording at five places in Western Germany, using completely automatic equipment, signals modulated at 1 kc/s radiated by several transmitters in Europe. The object of this campaign is to determine the extent of the distortion caused by the ionosphere as functions of the more important parameters likely to play a part in this phenomenon, namely distance, frequency and orientation of the path. The campaign is planned to start in July, 1966.

* reported upon in E.B.U. Review No. 95-A, February 1966, p. 41.

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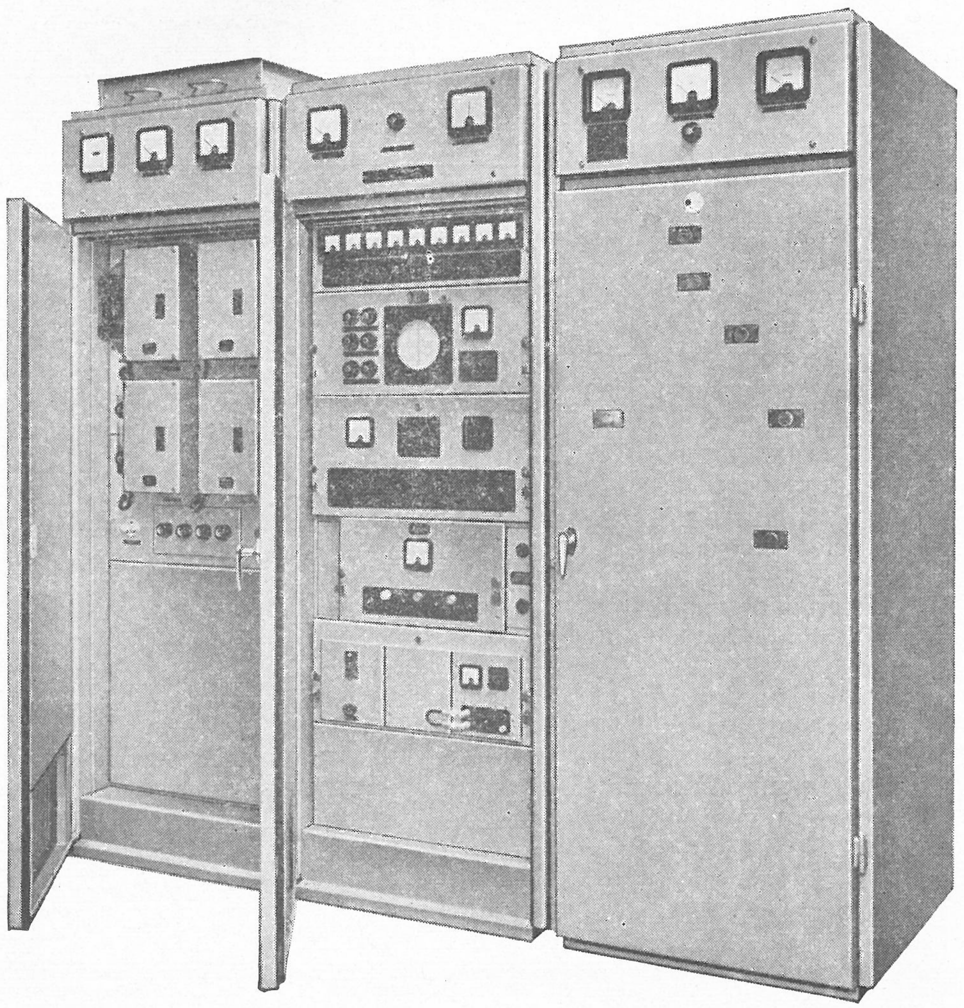

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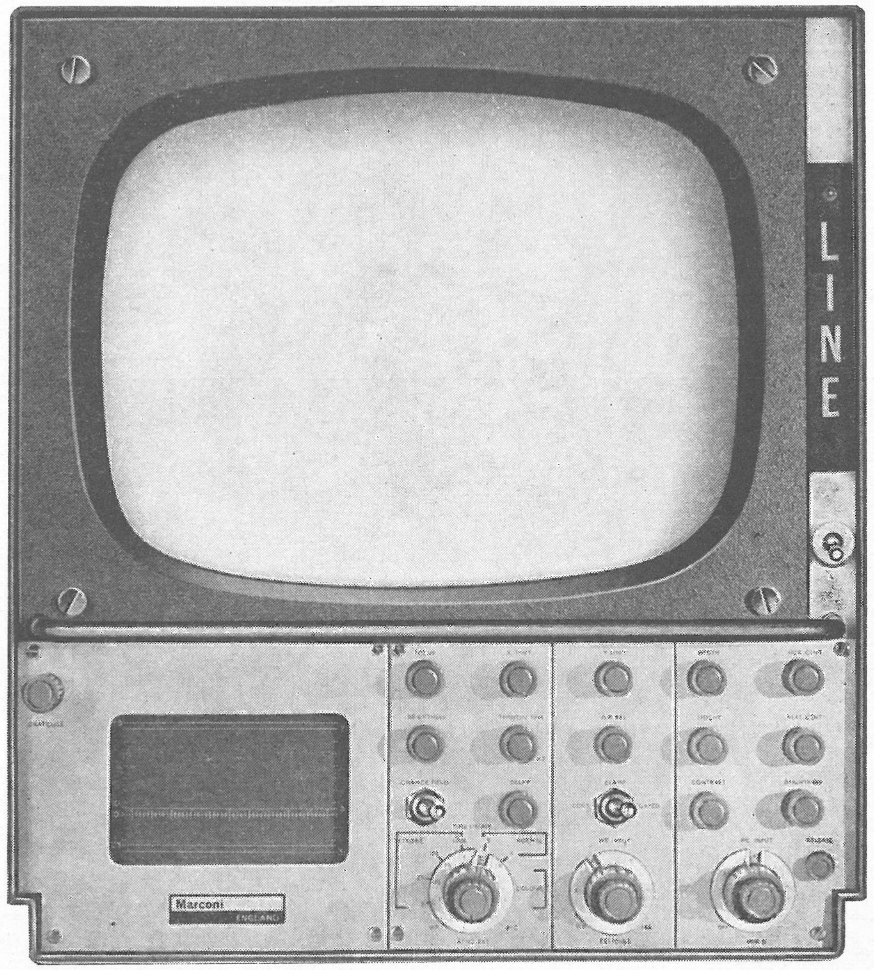

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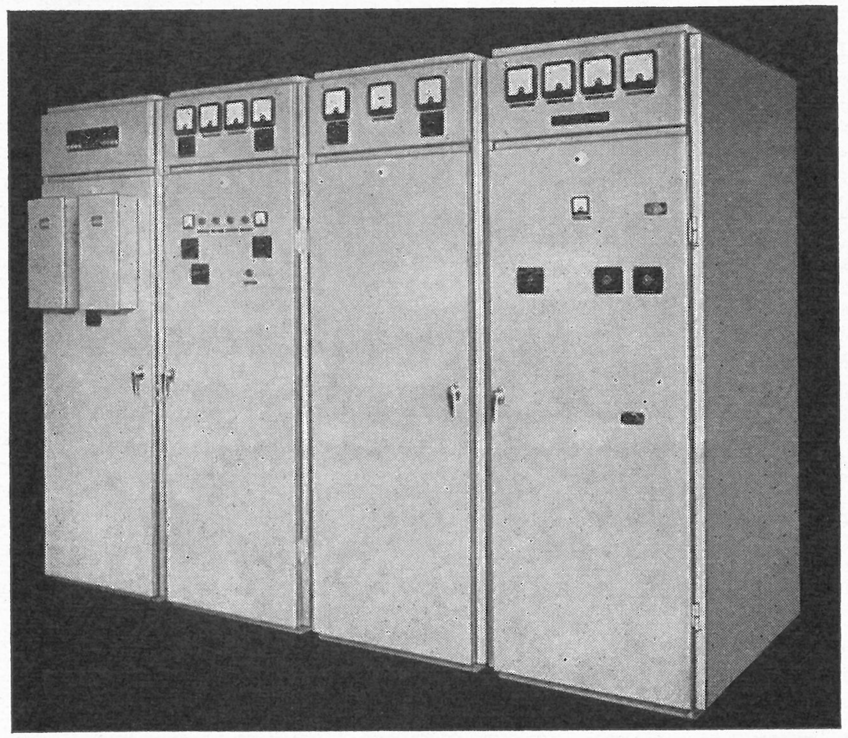
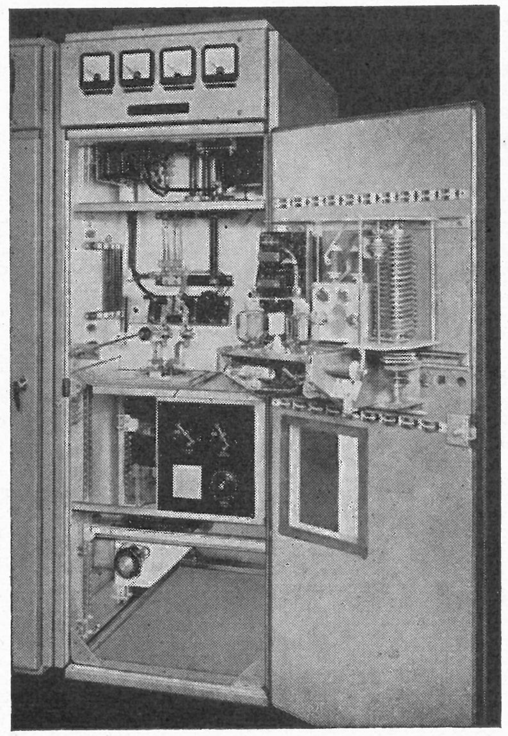


B 6024 10 kW MF Transmitter. General exterior view.



B 6120 10 kW HF Transmitter. Interior view of final stage.

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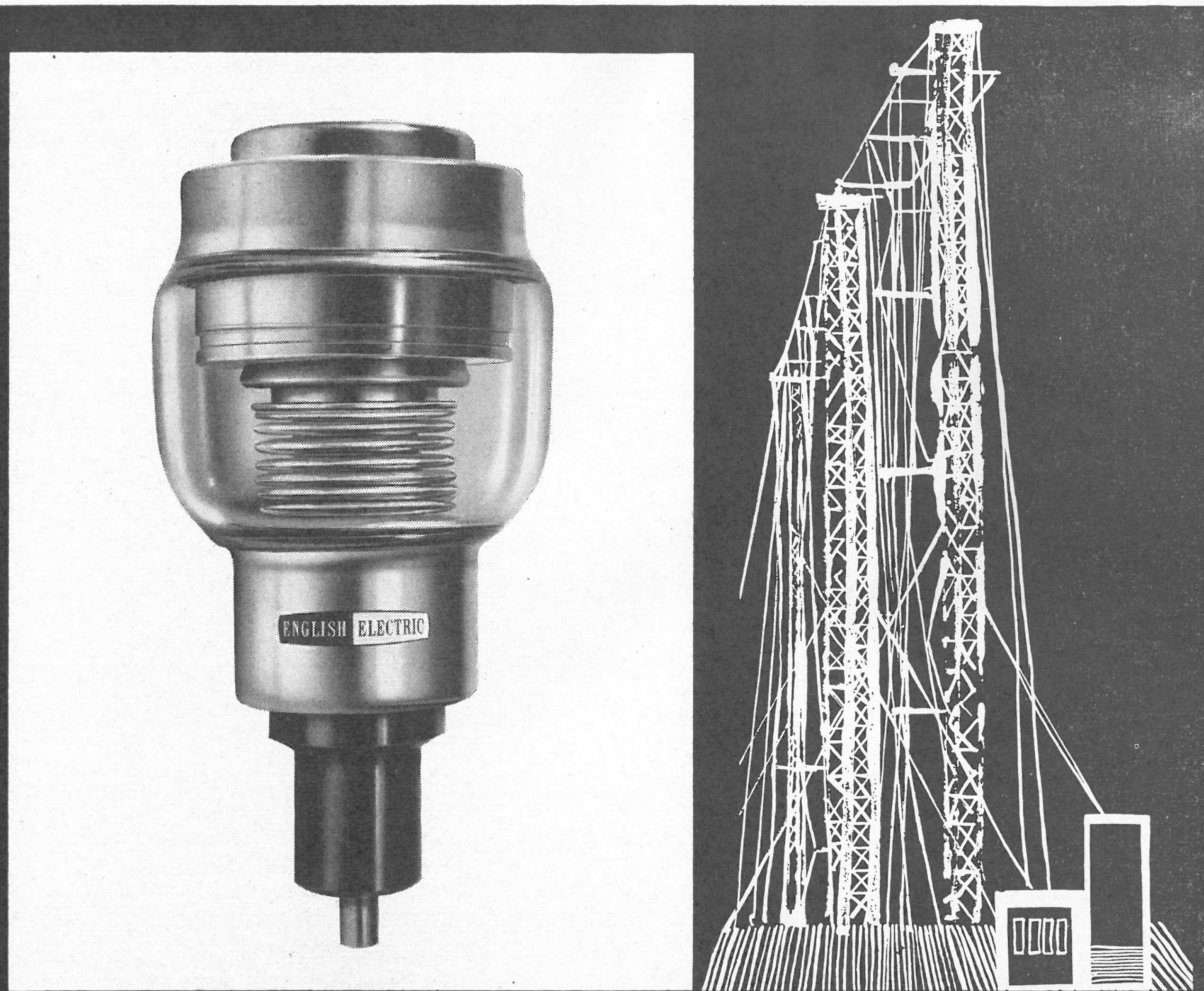

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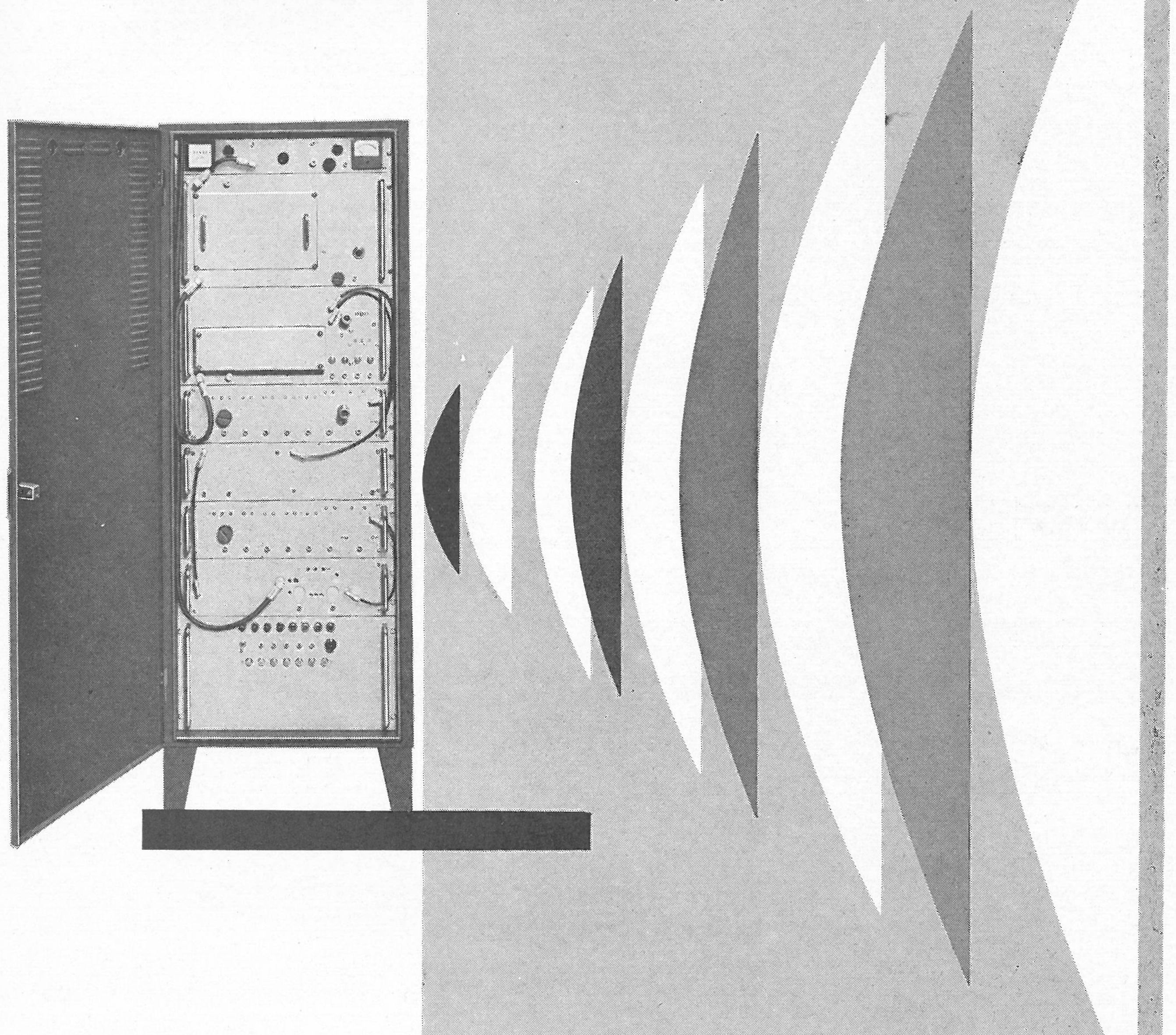

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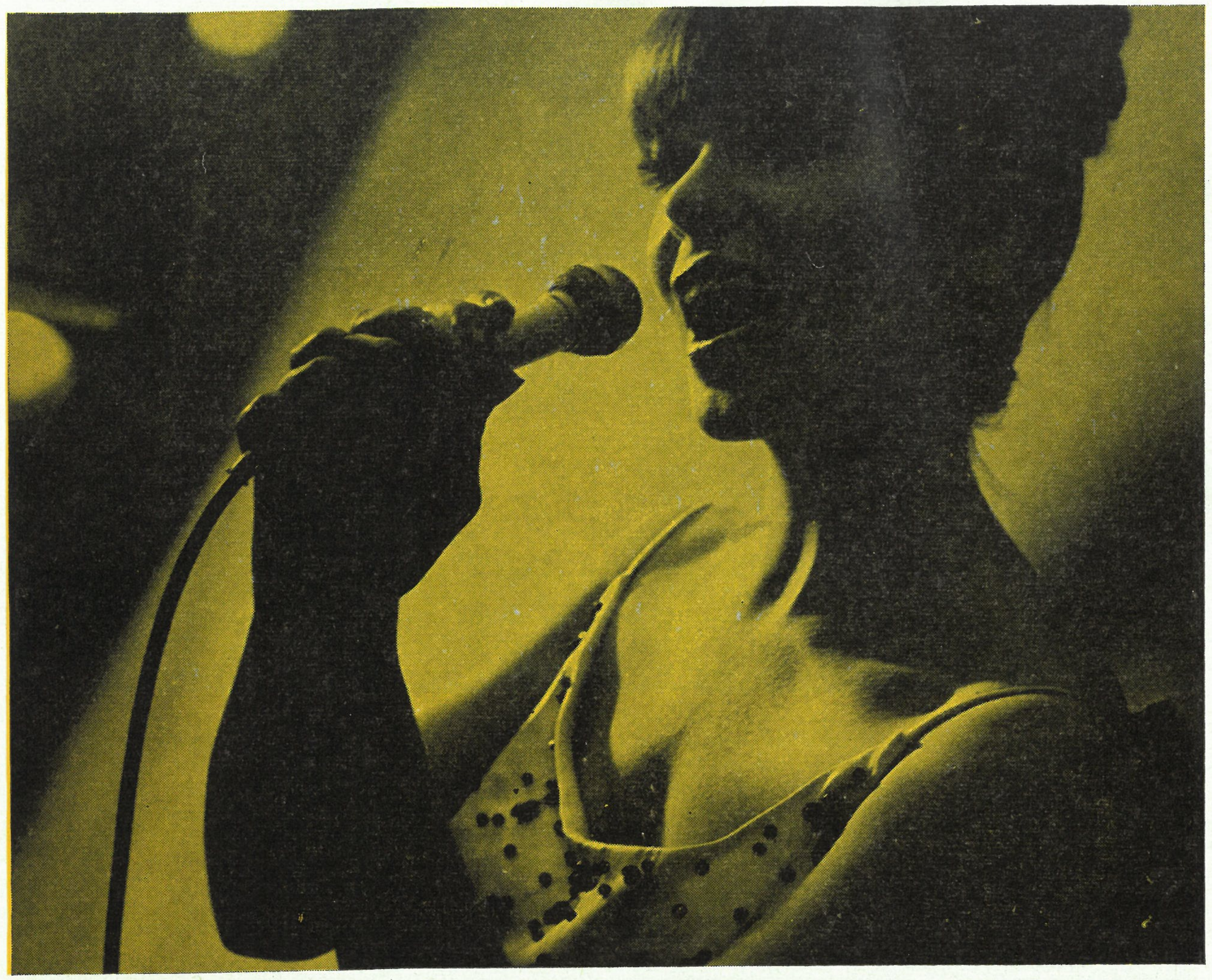

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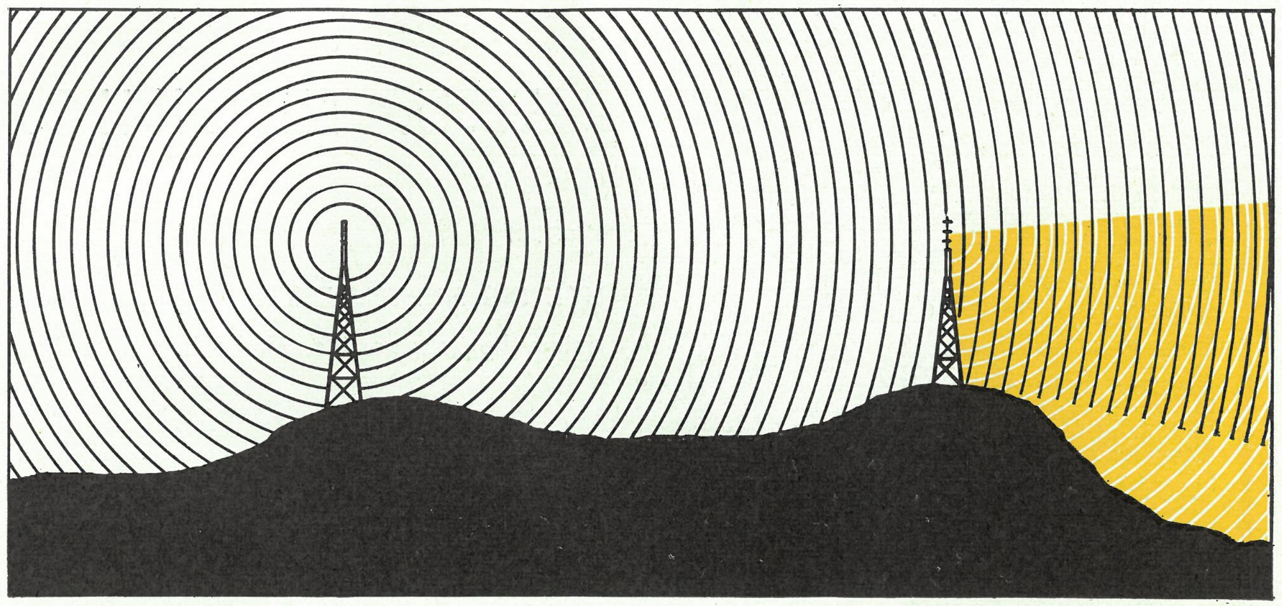
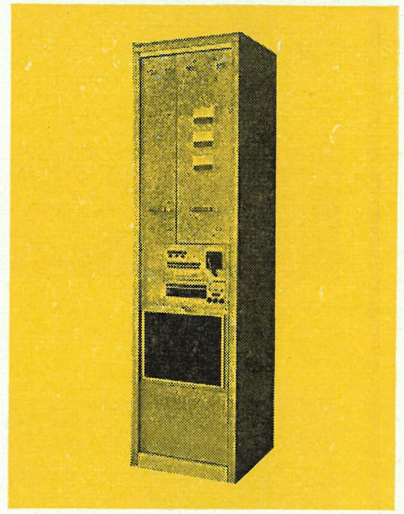


Filling in the shadows



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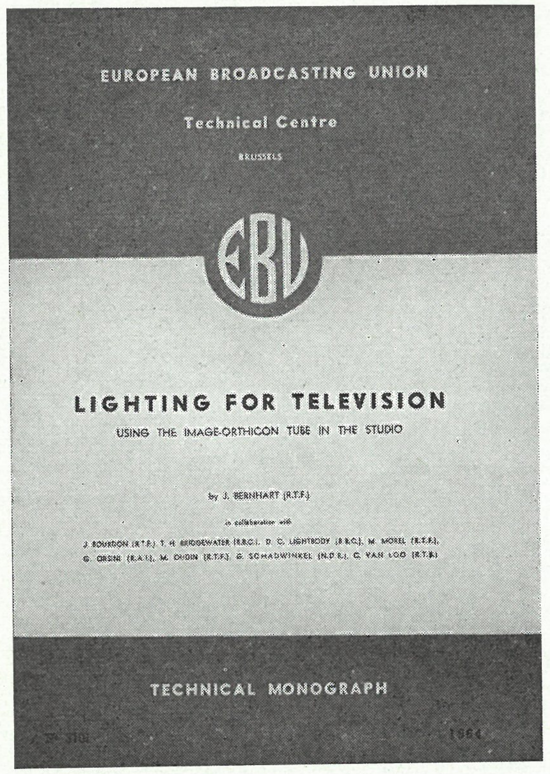

Nº 3101

LIGHTING FOR TELEVISION

Using the image-orthicon tube in the studio

This monograph is the first of a new series of technical monographs edited by the **Technical Centre of the European Broadcasting Union.**

It describes the techniques applied in studios where the image-orthicon camera tube is used and gives a synthesis of the methods employed in Belgium, France, Germany, Italy and the United Kingdom.

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Editor : Technical Centre of the European Broadcasting Union

Nº 3103

TOWERS AND MASTS

for VHF and UHF transmitting aerials

This eighty-page document is illustrated by some eighty diagrams, graphs and photographs. The monograph considers successively the different factors affecting the design of an aerial support, the constructional characteristics of the principal types of supports utilised and the conditions to be fulfilled in order to ensure a satisfactory broadcasting service; it examines also the possibility of utilising existing masts, as well as the problem posed by the maintenance of the aerials and their supports.

Nine examples of aerial supports, chosen from the most typical European structures, are described at the end of the monograph, with a table of technical data, a dimensioned drawing and a photograph.

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Nº 3104

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for VHF and UHF transmitting stations

This monograph analyses the problems posed by the selection of sites for VHF and UHF transmitting stations, from the establishment of the network plan up to the measurements made with a test transmitter.

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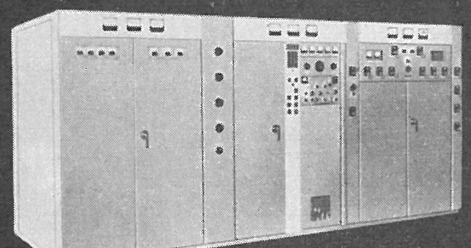

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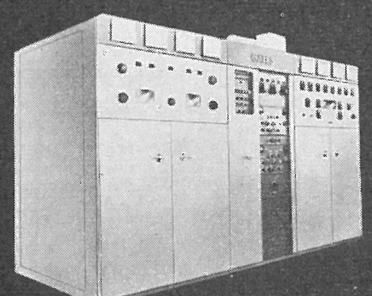

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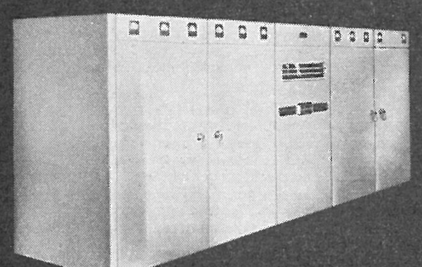
3.9-30 mc



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Frequency Range	3,95-26,5 mc	3-26,1 mc	3,9-30 mc or 3-26,5 mc	2-22 mc or 4-22 mc	2-22 mc or 4-30 mc	2-22 mc or 4-30mc	2-32 mc

* The HC 114 is automatically tuned to any one of 20 preset frequencies.

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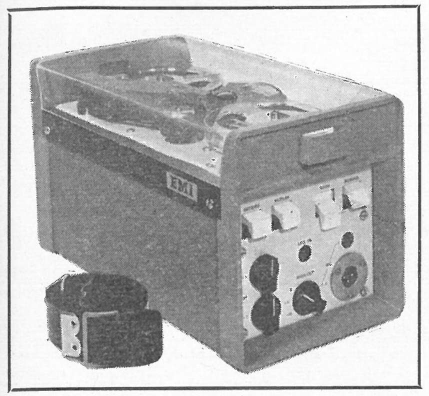

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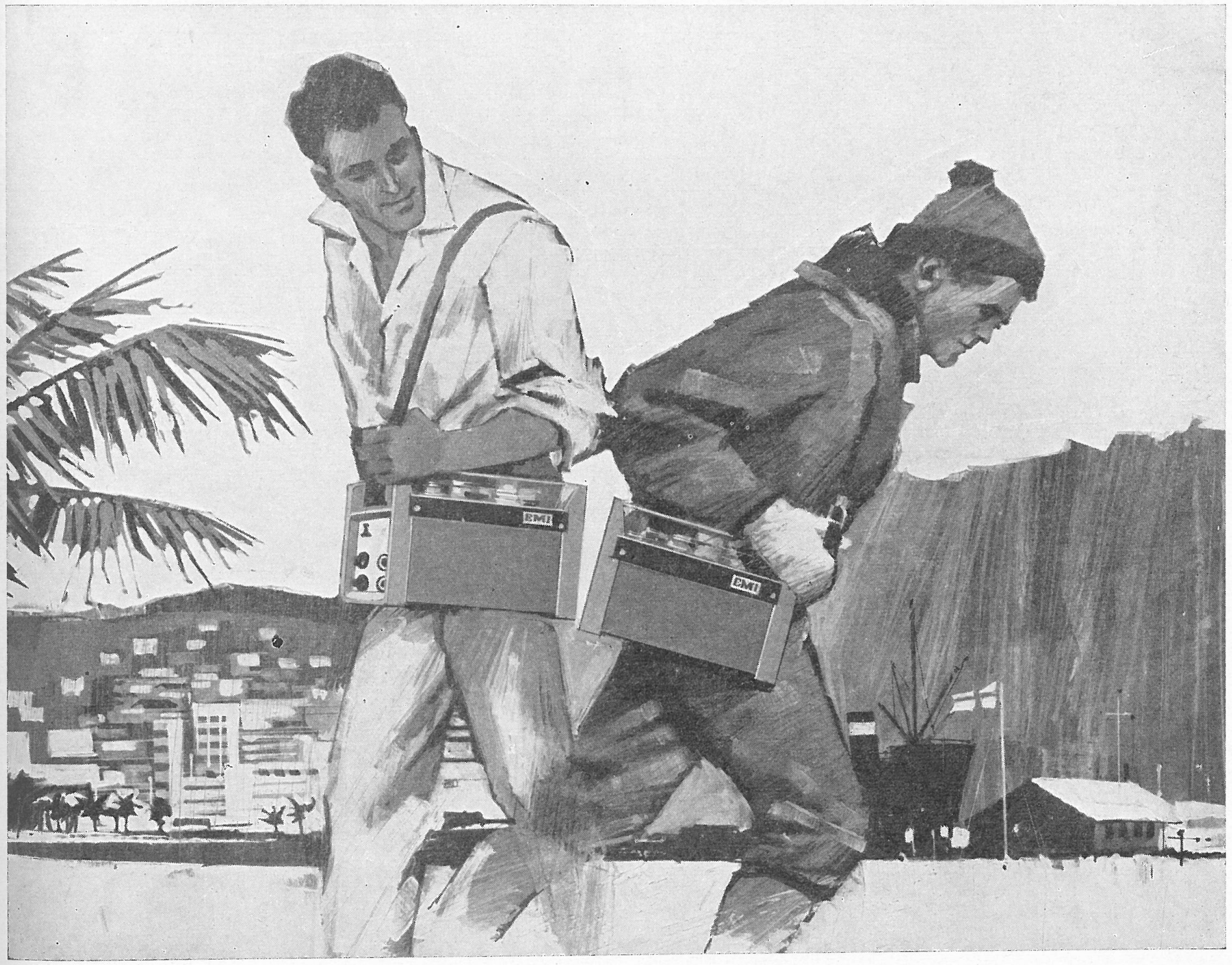

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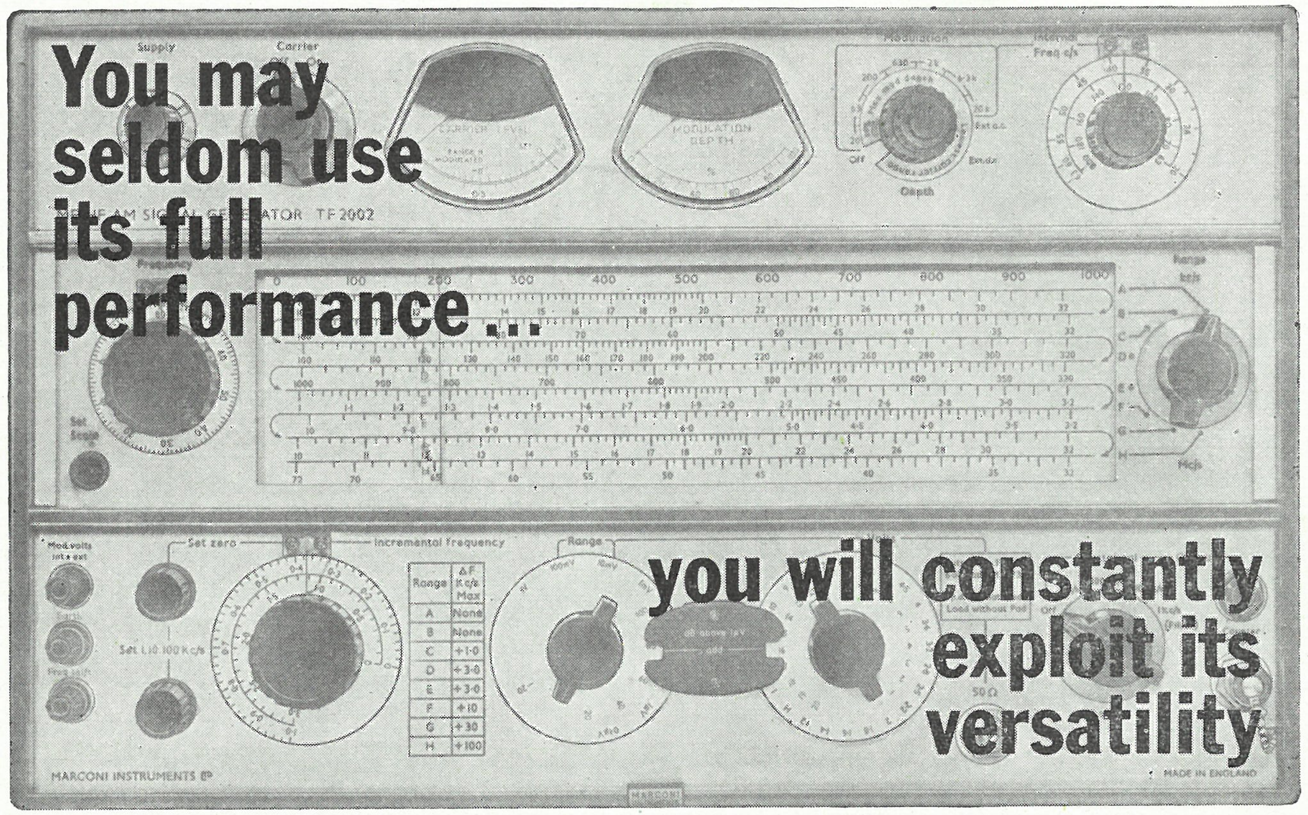

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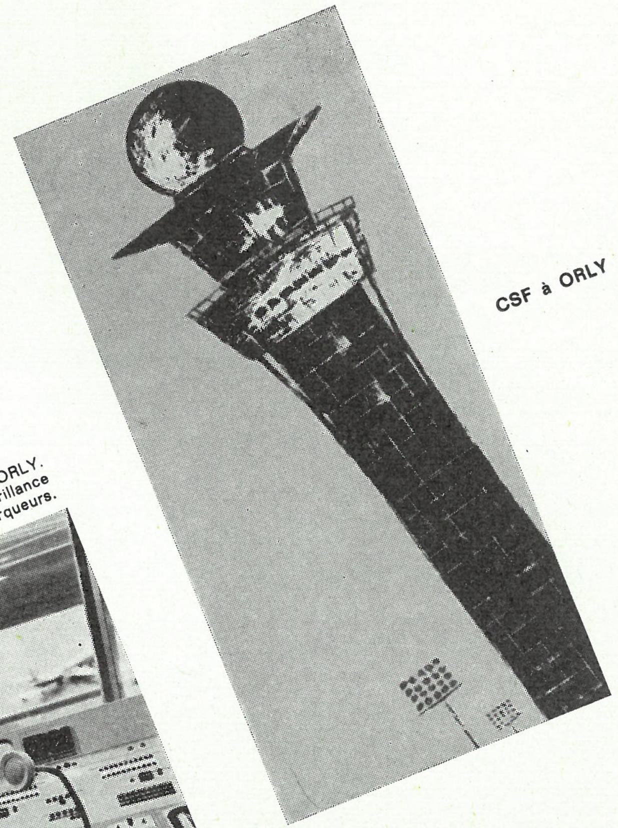

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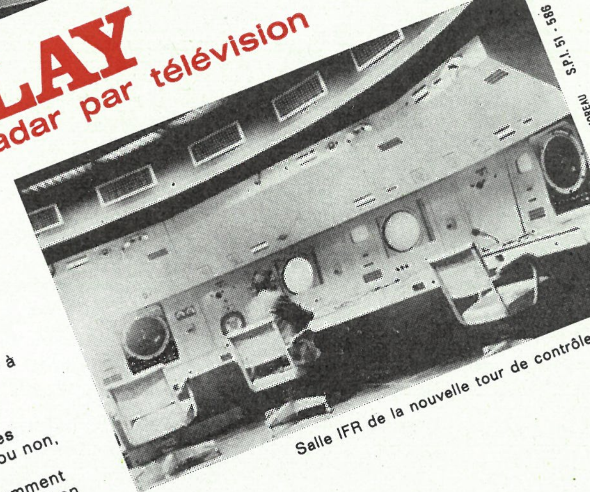

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