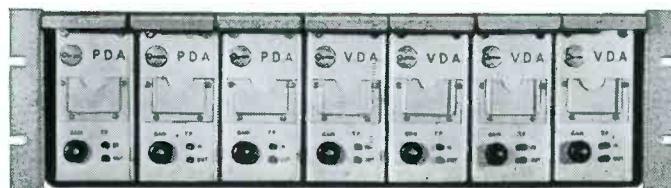


# Marconi pulse and vision distribution equipment

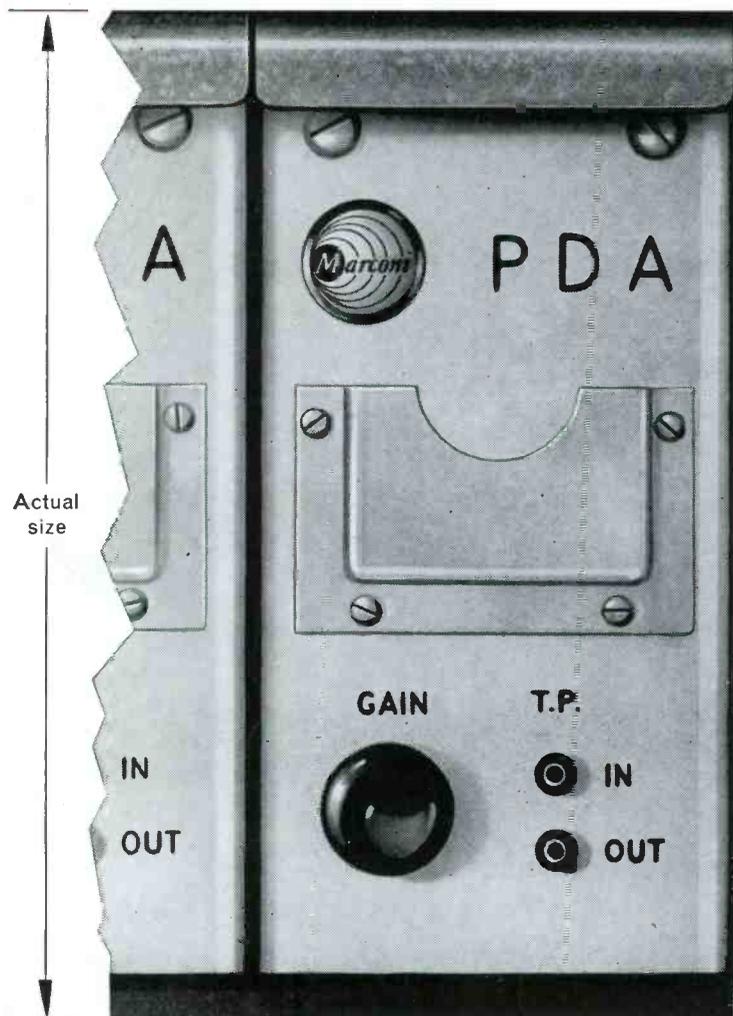
## B4002

This equipment occupies only  $5\frac{1}{4}$  in. of rack height, and provides 35 Vision or 42 Pulse Output with high input isolation.

Fully transistorized  
Integral regulated power supply in each amplifier  
Fully colour specification  
Seven amplifiers are mounted on a  $5\frac{1}{4}$  in. rackframe. Vision and pulse amplifiers may be intermixed.



Complete rack



# Marconi television systems

# Coming events

## APRIL

- 2** Lecture meeting of Television Society London, at the ITA Conference Suite, 70 Brompton Road, SW3, at 19.00. Subject: 'Advance Television Technical Problems in Japan.' A recorded lecture by Dr K. Suzuki of NHK Technical Research Laboratories, Tokyo.
- 5-8** The Physics Exhibition, Manchester.
- 8-13** The first International Exhibition of Audio Equipment and Electronic Components, Paris.
- 12-14** IPPS Conference on Atomic Spectra and Radiation Processes. Oxford.
- 13-15** IEEE Telemetry Conference, Houston, Texas.
- 14-15** IEEE/ISA Electronics and Instrumentation, Conference and Exhibition, Cincinnati.
- 20-21** ASTM Committee on Ceramics for Electronics, Chicago.
- 20-22** 19th Annual Frequency Control Symposium, Atlantic City, New Jersey.
- 21-30** International Engineering Exhibition, Olympia & Earls Court, London.
- 22** Annual general meeting of Television Society at ITA Conference Suite, 70 Brompton Road, SW3.
- 22-25** International Audio Festival and Fair, Hotel Russell, London.
- 25** Hanover Fair.
- 29** Annual Fleming Memorial Lecture organised by the Television Society at Royal Institution, Albemarle Street, London, W1, at 19.00 Subject: The Specification of an Adequate Television Broadcasting Service. Lecturer: Dr. R. D. A. Maurice of BBC.

## MAY

- 5-7** IEEE Microwave Theory and Techniques Symposium, Clearwater, Florida.
- 5-7** IEEE Electronic Components Conference, Washington, D.C.
- 13-19** International Photo-Cine Fair, Olympia, London.
- 14** The Television Society's annual dinner and dance at the Dorchester Hotel, London.
- 17-21** IEE/IERE/IEEE Conference on Components and Materials used in Electronics Engineering, London.
- 18-21** Radio and Electronic Component Manufacturers' Federation Exhibition, Olympia, London.
- 20-21** IPPS European Symposium on Electrical Conduction at Low Temperatures, London.
- 24-26** IEEE Telemetry Conference, El Paso, Texas.
- 24-28** 4th International Television Symposium, Montreux.

## JUNE

- 7-9** International Symposium on Global Communications, Boulder, Colorado.
- 12** International Exhibition of Electronics, Nuclear Energy, Wireless, Television & Cinema at Rome. (Rassegna Elettronica Nucleare edella Cinematografia, Via della Scrofa 14, Rome.)

- 18-29** International Exhibition of Nuclear, Electronics, Television Radio and Cine, Rome.
- 30 to July 2** IEE/IERE Symposium on Microwave Applications of Semiconductors. London.

## JULY

- 14-16** International Conference of the National Committee for Audio-Visual Aids in Education, London.

## AUGUST

- 24-27** IEEE WESCON Show, San Francisco.
- 25 to September 4** International Radio Show, Earls Court.
- 27 to September 5** German Radio Show, Stuttgart.
- 30 to September 1** IEEE International Symposium Antennas and Propagation, Washington, D.C.

## SEPTEMBER

- 7-11** International Industrial Electronics Exhibition, Basle, Switzerland.
- 9-11** IEEE Industrial Electronics & Control Instrumentation Conference, Philadelphia.
- 9-19** International Salon of Radio and Television, Paris.
- 12-18** International Congress on High Speed Photography, Zurich, Switzerland. (National Committee for High Speed Photography, Institute of Physics & The Physical Society, 47 Belgrave Square, London, SW1.)
- 13-18** Engineering Materials & Design Exhibition & Conference, Olympia, London.
- 16-17** IEEE Joint Eng. Management Conference, New York.
- 17 to October 3** British Exhibition, Tokyo.
- 22-24** IEEE International Convention on Military Electronics, Washington, D.C.
- 28 to October 1** European Symposium & Exhibition on Medical Electronics, Brighton.
- 28 to October 2** Institution of Electronics Annual Convention & Exhibition, Manchester.

## OCTOBER

- 4-6** International Canadian Electronics Conference and Exhibition, Toronto.
- 6-17** Communications International Fair, Genoa.
- 18-23** The 1st International Festival of Television in Hong Kong.
- 21-22** IEEE Electron Devices Meeting, Washington, D.C.
- 25-27** IEEE Electronics Conference, Chicago.
- 31 to November 5** Exhibition and Convention, Montreal.

## NOVEMBER

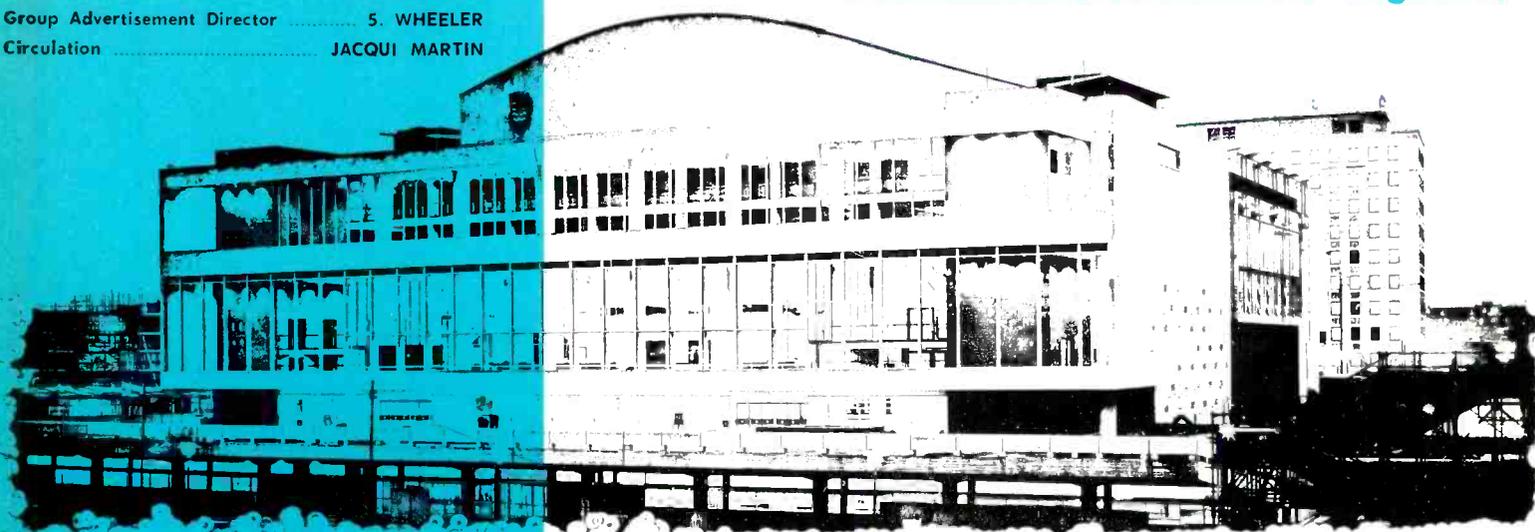
- 15-20** Industrial Photographic and Television Exhibition, Earls Court, London.

## DECEMBER

- 1-3** 14th Technical Symposium on Technical Progress in Communication wires and cables, Ashbury Park, New Jersey, USA.
- 4-7** 9th International Visual Communications Congress, Detroit, USA.

Editor ..... MARC ALEXANDER  
 Television Editor ..... KENNETH ULLYETT  
 Audio Editor ..... DONALD ALDOUS  
 Research Editor ..... PHILIP PLUMB  
 Art Editor ..... DICK DENNY  
 Advertisement Director ..... F. R. SIMMINS  
 Group Advertisement Director ..... S. WHEELER  
 Circulation ..... JACQUI MARTIN

# International Broadcast Engineer



Royal Festival Hall (see Auditoria Acoustics story page 276).

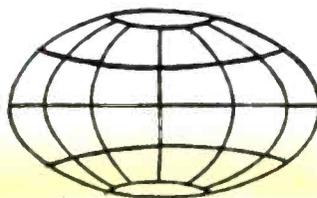
## contents

Outlook .....	249
NAB preview .....	250
International news .....	263
Public Address exhibition .....	268
Concert Hall acoustics .....	276
'See in dark' TV .....	279
New EEV tube .....	282
From the archives .....	294
Technical abstracts .....	295
US patents .....	297
Book reviews .....	298
New developments .....	300
New video recorder .....	306
Educational TV exhibition .....	313

## Special issue containing NAB and Public Address Exhibition previews

## advertisers

Ampex Great Britain Ltd .....	301
EMI Electronics Ltd .....	257, 259, 260, 261
EMT Wilhelm Franz GmbH .....	279
Eastman Kodak Co .....	274, 275
English Electric Valve Co Ltd .....	253, 303
Evershed Power Optics Ltd .....	288, 289
Goodmans Industries Ltd .....	271
Marconi Co Ltd, The .....	Front Cover
Minnesota Mining & Manufacturing Co Ltd .....	255
Mole Richardson Organisation, The .....	299
Newman & Guardia .....	305
Nippon .....	248
Pamphonic Reproducers Ltd .....	Back Cover
Peto-Scott Electrical Instruments Ltd .....	280, 281
RCA International .....	292, 293
Rank Organisation, The .....	267
Rupert Neve & Co .....	273
Thorn Electronics Ltd .....	309
W. Vinten Ltd .....	285



Incorporating International TV Technical Review and International Sound Engineer, this magazine is published and circulated in over a hundred countries by Television Mail Ltd, 31 St George Street, Hanover Square, London, W1, Great Britain. Telephone: HYD 3931; Cables: Inteevee, London. Printed by Thames Valley Printing Co Ltd, 28 High Street, Hampton, Middx.



## NEC's Wide Range of Integrated Broadcasting Systems — Geared to meet any demand anywhere!

NEC, a world leader in the manufacture of telecommunications and electronics equipment, has designed and installed a wide range of integrated broadcasting systems throughout the world. These include everything from radio and TV stations to the satellite ground station at Kashima on the outskirts of Tokyo, making possible the telecast relay of the Tokyo Olympic

Games across the Pacific via Syncom III. Indeed, NEC is geared to meet any requirement for integrated radio and TV broadcasting systems—from compact transistorized studio equipment to VHF and UHF transmitters and antennas as well as microwave relay facilities.

It goes without saying that all NEC equipment is designed for easy accessibility, simple

maintenance and minimum power consumption. It meets the highest international broadcast standards of signal quality, stability and reliability such as FCC, CCIR, etc. At present, 161 radio and 206 television broadcasting stations equipped with NEC systems are in operation or under construction both in Japan and overseas.

# NEC

## OUTLOOK



### The trend to 'Welcome, neighbour ...'

**T**HIS issue of INTERNATIONAL BROADCAST ENGINEER greets the 43rd Annual Convention of the National Association of Broadcasters in Washington, DC.

It is recognised internationally that while a section of the mammoth NAB Convention is naturally devoted to United States broadcast and television policy and management problems, the huge technical side of the Convention, culminating in the world's biggest display of professional radio and TV equipment, is one of international importance, far outshading any TV technical show ever staged in Britain or on the Continent of Europe.

The NAB represents an industry which touches the daily lives of every American who switches on one of the nation's 188-million radio sets or 58-million TV receivers. NAB also represents the industry before Congress at the White House and at Administrative Agencies, but far transcending that in international importance is the fact that the eyes of the technical television world are now focused on Washington. As it so happens, the HQ of the huge National Association of Broadcasters itself is in Washington. Last year the 42nd Annual Convention was held in Chicago (this was fully reported in International TV Technical Review, the journal which has since been amalgamated with this present journal), and now again the Convention is at the nation's Capital city.

Not only will thousands of delegates be attending (including more than 3,000 members of the NAB itself) but chief engineers and technical administrators from Great Britain, from European broadcasting networks, from Soviet Russia and of course from Japan. Last year such was world interest in the United Kingdom's TV technical progress and problems that Mr F. C. McLean, BBC Director of Engineering, was the senior speaker at the technical convention. 'We have followed with great interest the fortunes of UHF in the United States,' he told dele-

gates, 'and have followed arguments for and against intermixture. Our position is different. We cannot avoid intermixture, and are going into it in quite a big way ...'

Since that utterance at Chicago, BBC-2 has become fully founded, and while it has become immersed in programme-policy problems, there is no gainsaying its technical success. In mixing VHF and UHF techniques, the British Isles have had to face extremes of technical difficulty, and perhaps we are all better for that. Certainly the electronic industry has been keyed up, and this present issue of INTERNATIONAL BROADCAST ENGINEER carries a section devoted to the United Kingdom exhibits at Washington, many of which show the hallmark of great achievement. Our next issue will carry a full coverage report of the other technical NAB exhibits.

While of course the NAB 'show' has suddenly become a focal point of world TV-technical marketing, it is at all times characterised by the extreme friendliness of the of the gathering; a technical fraternal spirit which the United Nations would do well to study! As our correspondent points out on another page, technical delegates from many countries come to the United States chicken a la King, Philadelphia Scrapple and Angel Food Cake just as much as all-transistor transmitters and revolutionary new VTR's! Washington in general and the NAB in particular has always extended a warm 'Welcome Neighbour,' and was it not the late President Kennedy himself who said in a rather different context: 'We extend to you and to people everywhere a cordial invitation ... The United States is both like and unlike every other country on earth. Americans have borrowed much from the people of every nationality, every colour and every faith who have helped to build this nation. They have also created much that is distinctively new and different ...'

What is 'distinctively new and different' in TV electronics can be seen, from 21st March onwards, at the Shoreham and Sheraton-Park Hotels, Washington. Some of the best of Britain, including RCA, Ampex, General Electric, Collins, Gates and many more.

This is 'Welcome, neighbour' on the grand scale, for the most complete technical information is given to delegates of visiting nations. While many areas of Europe are still arguing the relative advantages of SECAM, PAL, NTSC and other systems, America has had a public colour TV service for over eleven years. And while many areas of the world still have no TV service at all, or regard two channels as something of a public luxury, in New York City the average viewer has a choice of no fewer than 13 channels. It is in this strong, competitive spirit that great professional TV manufacturers come together to Washington to pool ideas and display their wares.

It is at the moment, too, Britain's Postmaster General, the controversial Anthony Wedgewood Benn has stated (in reply to a question in the House of Commons) that developments over the past few months have strengthened the view that the American NTSC system (born of RCA, sanctioned by Federal authorities) should be adopted in the United Kingdom. 'The adoption of NTSC in Britain,' he said, 'would facilitate the interchange of programmes with other countries using NTSC, for example America.'

This is the international exchange we must have, and we must learn to live with this internationally competitive spirit, and profit by it commercially and spiritually. No man is an island. Nor is any nation. No television standard nor any single technique can stand on its own, and the NAB deserves but probably will never get the thanks of many competing nations for the opportunity to live and learn together at Washington.

by John Dickson, Ph.D.

CURTAIN UP ON

NAB

WASHINGTON

---

 by the  
 Television  
 Editor
 

---

**S**PRING comes to Washington, DC, each year with the National Cherry Blossom Festival . . . six frolicsome days of glamour, gaiety and pageantry. Around Washington's Tidal Basin, on Hains Point and encircling the stately Jefferson Memorial the brilliant, delicate Japanese flowering trees present a magnificence which each year inspires the six-day Festival shindig.

Beating the cherry-blossom by a short deadline this year is a very different sort of shindig, the mammoth 43rd Annual Convention of the National Association of Broadcasters. To the 'NAB' come thousands of delegates not only from every TV and radio station in the United States, but from most leading nations of the world. The Convention runs from March 21-24 at the Shoreham and Sheraton Park Hotels in the nation's capital city, and the annual exhibition of professional radio and television equipment—bigger, more comprehensive than ever this year—is the mecca of all senior TV executives. They cannot afford not to be in Washington before the cherry-trees blossom . . . Technical delegates from many countries come at this month of the year to the United States to sample chicken a la King, Philadelphia Scrapple and Angel Food Cake just as much as all-transistor transmitters and revolutionary new VTR's. (For the uninitiated, chicken a la King comprises chicken, mushrooms and pimento in a sherry sauce, Philadelphia Scrapple is spiced cornmeal and pork, fried in cakes, while Angel Food Cake is a light, high cake made with a dozen eggs, topped with icing. And now back to the transistors . . .)

The best of United Kingdom and European equipment, together of course with many professional items from Japan, are seen at Washington for the first time, and this year at the 43rd Convention Great Britain will have the largest and most important display of brand-new TV, radio and communications equipment.

**EMI electronics are proud to be taking an important part in the NAB display, since it is a blunt reminder to the free world that the United Kingdom was the first country in the world to give a public television service. And of course it was the EMI system developed by the late Sir Isaac Schoenberg that was adopted by the British Broadcasting Corporation for this public service way back in 1935.**

EMI Electronics products manufactured in Great Britain are shown at NAB Washington under the aegis of Whittaker Corporation, a far-seeing United States enterprise which includes not only the Electronics Division in North Hollywood, Calif., but the Power Sources Division, Colorado (primary and secondary battery power systems for aircraft, missiles and space applications), the Advanced Structures Division, Narmco Research and Development Division, Narmco Materials Division, Telecomputing Services, Inc., and the Controls and Guidance Division, at Chatsworth, Calif.

As Mr Wm. R. Whittaker, the group's president, said the other day: 'Our many operating divisions are symbolic of our tangible resources . . . More significant to us and to our customers are the intangible resources of the Whittaker Corporation. They include reliability of products dependability of services, competitive pricing and prompt delivery. They include a reputation, maintained for over twenty years, of quality products and services for the aerospace industry. They include scientific control of programmes and advanced management methods . . .'

Fitting into this programme are the revolutionary new yet rigorously tested EMI devices for television and recording. First in the TV field is the all-new Type 206 4½-in. image-orthicon camera, undoubtedly one of the best all-transistor I.O. cameras in the world today.

The former EMI Type 203 all-valve I.O. camera needs no introduction to United States TV executives, since many hundreds of these all-British cameras are now being used in US-TV stations, as well as in Australia, Canada, New Zealand, and of course in the BBC, Rediffusion, ABC and other TV networks of the United Kingdom. Excellent as is the 203, a design team was set up over two-and-a-half years ago to programme an all-transistor camera, and the result is the Type 206 now to be seen at Washington. A provisional target date for deliveries has been positively set at the Spring of 1966, since so many orders are already on the books.

Basically the 206 is a multi-line-standard (525, 405 and 625 CCIR/OIR) camera with a built-in 7-in. viewfinder and a four-position turret taking all standard fixed-focus and zoom TV lenses. Features include extensive use of plug-in printed wiring sub-units, line standards change-



BRITAIN sends an amazing new camera, the EMI Type 206 channel, to Washington. Here is the big new  $4\frac{1}{2}$ -in image-orthicon channel being lined up at the EMI Electronics laboratory immediately prior to being flown over to Washington for all the technical world to see.

able by a single switch on the control panel, variable aperture correction, switched gamma correction, and camera tube and yoke having full magnetic screening and thermostat temperature control. The camera chain gives four isolated composite or non-comp outputs, and the switched scan reverse can be remote-controlled. There are built-in test-signal facilities, and in addition to optional extra remote control by joystick there is remote operation of all lens apertures, and remote indication of turret position.

This 206 has a camera head of magnesium alloy, finished in the now-familiar EMI two tones of green, with hinged top and side covers for access to sub-units. We have had an opportunity of examining a 206 just before being packed for air transport to Washington, and find that on the left side of the camera are the amplifier, line drive and dynode supply, power supply and heat control boards. Also supported on rails in the upper half of the 206 are the camera and viewfinder line scan units. The right side of the camera contains the talkback board and viewfinder field scan unit.

In addition to the usual red cue lamp atop the camera body there is a smaller lens cue lamp mounted under the taking lens. A third cue lamp is mounted above the viewfinder tube. The 206 is mounted on a pan and tilt head by means of a standard Vinten wedge and a series of tapped holes can be provided in the wedge to facilitate mounting on US-type tripods. In addition to the stout round bars which run the full length of the lower sides of the camera, there are carrying handles atop, at front and rear. A door at the rear gives access to the deflection and focussing assembly, and a section of the magnetic shielding can be removed so that the scanning coil complete with image-orthicon tube may be removed; this makes it possible to view the orthicon shoulder contacts as they slide into the scan coils. Upon replacement, the scanning coil take up accurate alignment with the focus tube.

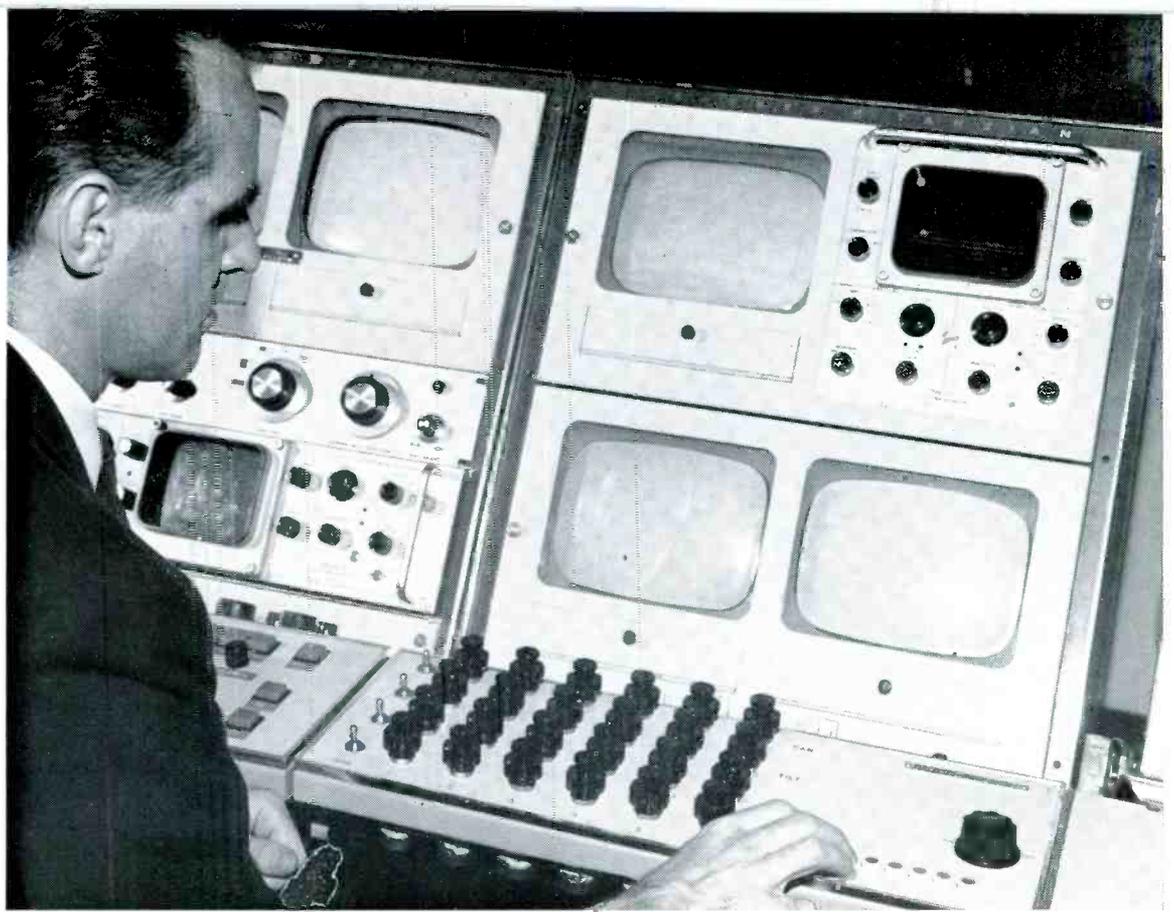
With the 206 camera go the 2106 or 2106/1 CCU and 2107 engineering control panel. The remote control panel 881/1 is an optional extra. The rack-mounted CCU (standard 19-in, 480-mm) naturally has the controls and metering at the front, connectors at the rear; there is also a case version using the same chassis and with the power-switch

sub-panel on the end. Plug-in printed wiring sub-units are mounted vertically, and are easily removed. In the engineering control panel are all the controls for setting up the camera tube and for optional control of the channel. Only passive circuits are incorporated, and the layout is designed for ease of operation.

Naturally there are a number of new features about the electronic circuitry. In the 206, for example, electronic image-orbiting and a tube hour-counter device are included; the image-orbiting can be switched off if necessary, leaving the hour-counter running. Extensive use is made of stage-by-stage and overall negative feedback techniques. In particular, the I.O. line-scanning circuit is stabilised against scan width changes; the I.O. camera amplifier takes the form of a negative feedback circuit and the I.O. dynode supply is held constant by a corana stabiliser.

The viewfinder is fed via the camera cable with the composite signal output of the channel so that the full output viewing is obtained. We find that a brilliant, sharply-focussed high-contrast picture is achieved because EMI use a stable 15-kV final anode supply derived from the horizontal deflection circuit, and a high-level output from the video amplifier. The scanning yoke is designed for excellent picture geometry, and the tube is fully screened against high-external magnetic field intensities. HF loss correction is provided on the viewfinder, for up to 2,000 feet of camera cable. As a focussing aid for the cameraman, optional video high-peaking is provided. Picture centring is adjusted on DC controls accessible on the back of the camera, and a switch on the rear of the Type 206 enables an external signal, fed into the CCU, to be mixed with the normal viewfinder picture. A built-in test signal permits a sawtooth waveform to be passed through the entire video processing chain of the camera, and of course other waveforms can be inserted from an external source at an input to the CCU.

As for dimensions and weight, the 206 camera itself measures 20-in by  $14\frac{1}{2}$ -in by 29.5-in deep (508 by 178 by 749-mm), and the all-up weight of the camera alone is 100 lbs (45 Kg). The rack-mounted CCU measures 19.25-in by 19-in by 15-in (495 by 484 by 380-mm), and weighs 65 lbs (29 Kg). The engineering control panel is slightly smaller, being 8.75-in by 19-in by 6.37-in (227 by



New British device, to be seen at the NAB Convention, already in use in the United States, at WKRG. Here is WKRG's Chief Engineer, Don Patton, who claims: 'We installed Television Zoomar's Autocam to produce live studio programmes from sign on to sign off, without additional personnel.' Autocam is a button-operated servo remote control pan-tilt head and zoom lens.

being  $\pm 6$  per cent. Consumption is approximately 300 VA, the power factor 0.9. For US working it should be noted that on 60 c/s supplies a 60 c/s hour counter replaces the UK type of 50 c/s counter.

Four independent outputs can be either composite at standard level (0.7 v picture, 0.3 v sync, or 1.0 v picture 0.4 v sync) or non-composite at the same picture levels. Isolation between inputs is claimed to be better than 48 dB at 1.0 Mc/s, better than 30 dB at 5.0 Mc/s.

Brief performance checks were taken by us before the cameras were shipped to Washington, with the following results: Sine squared pulse and bar response: the response of the entire panel for the 625-line 5 Mc/s pulse and bar waveform (with no band limiting filter),

	<i>K Rating</i>	<i>Pulse/Bar Ratio Limits</i>
625—2T	0.5%	0.98 to 1.02
625—1T	4%	0.85 to 1.0

The pulse and bar waveform performance conforms to the requirement of the BBC specification TV 106 issued for the 625-line system. The performance of the 625-line system will be proportionately better. As for amplitude/frequency response, with zero aperture correction and 100-ft of camera cable the response is flat with 0.25 dB to 5 Mc/s, 2.0 dB at 8 Mc/s and 6 dB at 10 Mc/s. Variable phaseless aperture correction is adjustable from 3 dB to 12 dB, peaking at 5 Mc/s on 405 lines and at 7 Mc/s on 525 and 625 lines.

EMI Electronics have developed this camera chain to be virtually hands-off, and pictures of transmission quality are available within twenty minutes of switching on power.

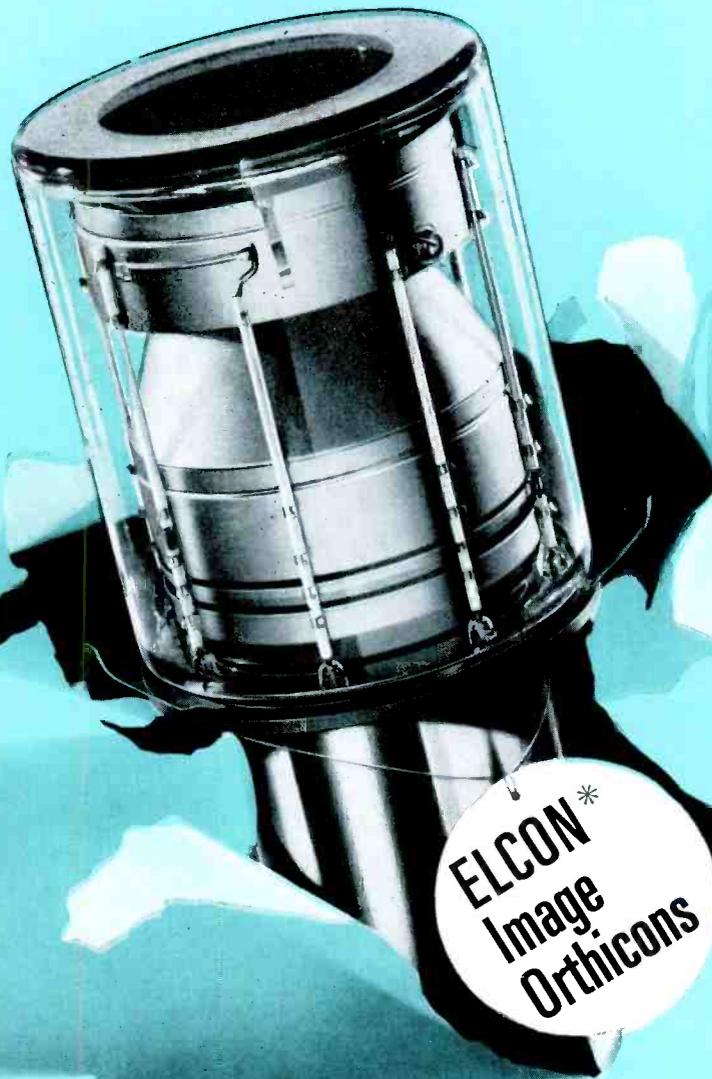
As for general stability, over a period of six hours gain stability is better than  $\pm 0.5$  dB, and black level stability relative to blanking level is better than 0.5 per cent for camera ambient temperature changes of 20-deg C within the temperature operating range, and for mains supply variations of  $\pm 5$  per cent.

We feel that NAB delegates will accept the 206 chain as one of major importance, and a supreme example of what can be done to house the 4½-in image orthicon in the grand manner. Yet another EMI camera chain may be seen at Washington, and if so details will be given in our next issue. It is, however, certain that the NAB will be among the very first to see and try the new EMI picture monitors TPM 2301, 1901, 2302 and 1902. The 23 and 19 reference numbers speak for themselves as to display screen size, and the 1901 series is for 625-line working only, whereas the 1902 series is switchable for 405/525/625 lines.

In addition, the 1902 series gives local or remote selection of two alternative inputs, as well as selection of internal or external sync inputs. There is remote contrast and brightness control, remote or local selection of line standards, and cueing indication. All these TPM monitors are completely transistorised, they have bridging or terminating input for composite or non-comp signals, video signals are black-level clamped, they have high picture black stability, and can operate with external sync input.

Finished in the attractive EMI two tones of green, these monitors have easily-removable panels for rapid servicing, and on the front are controls for brightness, contrast, on/off, horizontal hold, vertical hold, width,

# MAJOR TECHNICAL BREAKTHROUGH BY 'ENGLISH ELECTRIC' NEW TARGET MATERIAL EXTENDS TUBE LIFE



Resulting from a programme of intensive research and development *English Electric Valve Company* announce a *Major Breakthrough* with an entirely new target material for its *Image Orthicons* giving an operational life expectancy of at least 3 *TIMES* that experienced with normal tubes.

**THE ELCON\* TARGET ACHIEVES:**

■ Guaranteed life of 750 hours ■ Complete lack of image retention—no sticking pictures ■ Stability of contrast reproduction—no matching problems ■ Sensitivity fall-off greatly reduced—sensitivity remains constant for life ■ Immediate switch-on—no warm-up delay.

Reports on pre-production samples of the new ELCON\* Image Orthicons, from North America, show consist-

Write or telephone immediately for full information

**ENGLISH ELECTRIC VALVE COMPANY LTD Chelmsford England AGENTS THROUGHOUT THE WORLD**

TELEPHONE: CHELMSFORD 3491 EXTENSION 262 TELEX: 1913

ently that operational lives of between 3,000 and 5,000 hours are possible.

Another important EEV development incorporated in the ELCON\* tube is that of complete absence of image induced microphony. This together with the Major Breakthrough development makes *News*.

In addition to this outstanding development in Image Orthicons, EEV introduce a range of high sensitivity, high resolution 1-inch vidicons featuring entirely new photo-surfaces and separate mesh electrode construction. Information on the complete range of EEV products may be obtained on request.

\*ELCON is derived from the properties of the new EEV target—namely *ELectronic CONducting* as opposed to the familiar ionic conductors normally used.

# NAB

continued

height, HC (horizontal centring), VC (vertical centring), and on the 1902 series there is the input selector for choice of two video inputs. In the lower righthand corner is an area which is illuminated when the monitor is switched on, and generally this will carry a designation such CAM1, VTR1 and so forth.

Extensive use of printed wiring is used in the transistor circuits. The video input, which loops in and out and also permits the use of a Y connector, has a 75-ohm terminating switch. The signal input is taken via an amplifier to the sync separator, and via the contrast control to the output amplifier. Feedback circuits are employed to get a linear wide-band response. A black-level clamp accurately controls picture black. The sync separator operates satisfactorily even when a 25 per cent hum is superimposed on the incoming signal. A supply of separate sync pulses can be used when the video input is non-composite. Stable line and field circuits ensure steady picture and good interlace on 625 lines, and the regulated flyback EHT circuit provides 17 Kv with less than 1-megohm regulation to the CRT.

There are adjustable mains taps for 100/125 and 200/250 volts, 50/60 c/s, the permitted voltage variation being  $\pm 6$  per cent, and consumption 70 VA. Accurate reproduction is essential for a professional-standard monitor, and on this TPM series the positional error of any part of the scan raster is less than 2 per cent. A very bright picture can be obtained for viewing in studio or control-room surroundings where there is quite a degree of ambient light. In fact the peak-white brightness of these monitors can be up to 100 ft/lamberts.

Turning now to non-video equipment, EMI Electronics through Whittaker Corporation are showing two quite revolutionary new audio tape recorders.

When you think of the millions of discs and dollars made with the well-tried TR90 EMI recorders (it was through batteries of spinning TR90's that the Beatles first recorded, and of course their fortunes are controlled, too, by the same financial group which controls EMI Electronics) it is hard to think of an electronic world without this famous recorder. However, that moment has come, for now EMI are showing at Washington the BTR4, which is as big a step forward in professional audio recording as was the TR90 in its own decade. Frankly it isn't quite true to say the BTR4 will be seen in Washington for the very first time, for in fact a group of audio executives from Australia and South Africa were at the EMI laboratories the other day, and a bank of BTR4's was being shipped to Rhodesia on the very day that the freight also went off to NAB, Washington. Thus, availability of the mono BTR4 is as from now, and the stereo version will probably be coming off the lines just as the NAB Convention ends. Orders are already in from the Sudan, from Sierra Leone and from South Africa. . . .

This BTR4 isn't just a TR90 in a new mode. It is an entirely new conception of what a professional tape recorder must be. And don't let talk of The Beatles fool you. The BTR4 is suitable not only for disc and radio studios but for the complete requirements of scientific, industrial and medical research.

It is available in half or full-track monaural, two track on 0.25-in tape (head block easily changeable) or three and four track on 0.5-in tape. There are rack and console versions of the BTR4 and also a transportable unit. Conversion from one mode to another is simple. The job is fully tropicalised and has switchable equalisation for CCIR, NAB and IEC recommendations.

When we asked the EMI recorder development team for the salient features, expecting a round half dozen, we were somewhat startled to be listed **twenty**. But on reflection each is of major importance, and some represent a breakthrough. They include: (1) Tape deck in the console version is pivoted and can be turned through 180-deg for access. (2) Record and replay amplifiers are plug-in units. (3) Three- or four-track recording on 0.5-in (12.6-mm) tape possible by simple mods. (4) Plug-in head blocks of rigid construction permit pre-aligned units to be instantly interchanged. (5) Special version can be supplied for recording tape wound **oxide out**, the head block then being reversed. (6) Individual track erasure available on multi-track versions of the BTR4. (7) Single switch operation of motor speed change automatically selects appropriate equaliser network, and alters all pre-set gain controls. (8) Extra record or replay head can be fitted for film synchronising. (9) Three-position switch for record/replay equalisations, characteristics changeable between CCIR, NAB and IEC. (10) Variable spooling in either direction with automatic removal of tape from heads by retractable guides. Automatic action governed by manual over-riding control which can be locked in running position during spooling. (11) Instant start in 0.2-secs. (12) End-of-tape switch. (13) Visual and aural monitoring on 'line in,' 'line out,' and of recording signal after equalisation. (14) Monitor output channel can be switched from input to output to check A-B balance. (15) Meter switch for modulation, bias and erase indication. (16) High-grade record-replay attenuator, calibrated in decibels, on front panel. (17) Provision for remote control of Off, Replay, Record, and Spool. (18) Full tropicalisation. (19) Long operating life through use of large-diameter, slow-running capstan. (20) Accurate timing device driven by tape-operated bollard, with brake to prevent over-run. . . . Yes, there are many more technical innovations in the BTR4, and as just a word of consolation to small studios tied to their TR90's, EMI have no foreseeable future for ceasing to produce TR90 spares, so presumably this old stager will go on into history, as it well deserves.

Examining one of these new BTR4's before being packed for Washington, we were impressed to find so many essential details covered ingeniously. For example, NAB, Cine or 11.25-in (28.5-cm) European spools can be accommodated, and a switch ensures correct back-tension when changing from NAB to cine-size spools. The whole tape deck is built on to a cast alloy deck plate, ribbed for rigidity and treated with a special normalising process to ensure accuracy of flatness. This job comes console or rack mounted, working equally well in a vertical or horizontal position. The synchronous-hysteresis drive motor is of a completely new design, produced entirely in the EMI laboratories, and it is coupled to a 6-in diameter flywheel/capstan assembly, with solenoid-operated idler pulleys.



**of all taped programmes  
in the western world  
are recorded on  
Scotch  
Video Tape No. 379**

Even that doesn't do our tape justice. 'SCOTCH' Video Tape is 100%. And we go to extraordinary lengths to make it that way.

Our tape plant is the most modern in the world. Inside it, conditions are as clinical as an operating theatre. And inside that again, we have a 'clean cell' where the most sensitive work is carried out to eliminate tape imperfection.

One 'germ' a 33000th of an inch across can kill a whole tape. We don't tolerate infections like that.

Our standards are second to none.



# NAB

continued



Television Editor Kenneth Ulyett, ready to give a test run-through of the brand new EMI professional tape recorder, the BTR4, to be seen at the NAB Convention, Washington.

► Circuitry of this BTR4 has many unusual features. The bias and erase oscillator is integral with the Record amplifier, and consists of a master oscillator and push-pull amplifier. Separate bias controls are fitted and sufficient erase current is available to erase the highest coercivity tape to within 2 dB of the bulk-erased figure. Where several amplifier assemblies are in use for multi-track recordings, only one basic oscillator is operative, and this drives the remaining HT output circuits through a common busbar connection. So that the slave units shall be interchangeable, particular attention has been given, we find, to ensure that the oscillator frequency is accurate and remains stable. During multi-track recordings it is possible to erase any track or combination of tracks.

Just as the BTR4 outshines the historic TR90, so NAB Washington sees a brilliant new professional portable recorder, the L4, which makes the old L2 and its later version the RE 321 also 'old hat.' As Britons know, the L2 was the very first portable tape recorder of its type ever to be used by the BBC, and if one had a dollar for every boardcast produced on L2 decks, the Rockefellers would have to run for it. But of course the L2 was a tube job, so it has had to give place to the L4, which is not only all-transistor but is twospeed, lighter, and in most other ways a totally different conception of what a fully professional recorder ought to be and do.

Basically the L4 is a cheeky little box, 7-in by 11½-in

by 6¼-in (17.5 by 30 by 16-cm), weighing 10¾ lbs (4.9 Kg), of lightweight PVC-clad alloy with break resistant plastic end cheek mouldings and a clear plastic clip-on lid. You sling it over your shoulder, press the appropriate button, and in comes that news recording or urgent interview. The L4's deck caters for up to 4½-in spools, and at 7½ ips with EMI 100 double play tape, twenty minutes of recording can be achieved.

What other features does the L4 give? Well, a choice of 7½ or 3¼ in/s. Half or full track versions. Press-button operation. Two mike inputs with separate gain controls. Rechargeable battery (this is included in the all-up weight of 10¾ lbs) driving the world-proven EMI 14-volt battery motor. There is meter monitoring of battery, RF bias, and modulation. Full erase facilities, and fully-equalised replay amplifiers. There is a loudspeaker with a separate 200 mW amplifier. On the L4 itself there is a mike base cut switch, position for fourth head (sound sync), remote control feature. Of course the little job is all-transistor, and fully tropicalised. This is certainly professional sound recording in a small pack.

At last year's Chicago NAB Convention Jack A. and Bill Pegler of New York's Television Zoomar Company were joined by Angenieux and Evershed Power-Optics delegates from Europe. They created a furore at Chicago with various devices such as the Angenieux Zoomar 35-350-mm f/3.8, with minimum focussing distance of 3 feet, and the zoom rod and servo controls brought a keen professional purchasing public to Booth 8E. Now this year at Washington there are more exciting developments of the Evershed servo controls. **Operation of Evershed servo-controlled TV zoom lenses and camera mounting is now possible absolutely remotely, over telephone lines!**

It was following the successful launching of Evershed remotely-controlled TV cameras and associated zoom lenses in the London BBC-TV news studios, that RAI-TV in Rome and NDR Hamburg quickly followed suit with later and even more advanced Evershed equipment. We know who will be among the interested public at NAB Washington, for the first installation of this remote-control equipment in the United States was made at WKRG TV, Mobile, Alabama. Mr C. P. Persons, Jr, vice-president and general manager of WKRG has said: 'This equipment makes it economically practical to offer live studio facilities from sign-on to sign-off.' Washington delegates examining these controls will be interested to know that similar installations are already being delivered to WDR studios in Cologne Germany, to Granada TV in London, Televis Eireann in Dublin, and to ABC Studios, Sydney, Australia.

With this type of Autocam control you get remote operation of zoom lens and of pan-tilt head. By presetting pan, tilt, zoom and focus, one man can easily operate up to four cameras. For instance, at WKRG one of these servo controls is fitted to quite an economic camera, the General Electric broadcast vidicon, and this station produces late news, weather, sports, interviews and even commercials by remote camera control!

Four important features of the Autocam device as made available in the US by Television Zoomar are (1) Automatic pre-set push-button remote control of pan, tilt, zoom, focus and iris functions. (2) Smooth manual remote control with bump-less transfer from pre-set to manual operation. (3) Local-remote control at TV camera for busy

# YOU CAN RECORD FROM RANGOON TO REYKJAVIK



Professional quality recordings, anywhere, anytime. That's the new EMI L4, a low cost professional recorder of the highest quality . . . fully tropicalised. Tape speeds are 7½" and 3¾" p.s., wow and flutter less than 0.2% r.m.s. and frequency response at 7.5" p.s. ± 2dB, from 50 c/s to 12 Kc/s. Signal to noise ratio is better than 45 dB unweighted. A fourth head can be provided for film and sound sync. Transistor circuits are used throughout, so all this performance comes in a unit weighing only 10½ lbs—complete with re-chargeable batteries. OTHER FEATURES OF THIS IMPRESSIVE SPECIFICATION INCLUDE:— ■ fully equalised replay amplifiers ■ two microphone inputs with separate gain controls ■ re-chargeable batteries (charger available) ■ full erase facilities ■ motor rewind ■ press-button operation ■ remote control ■ A-B switch, meter and audio ■ loudspeaker with separate 200 mW amplifier ■ line in and line out jack sockets ■ microphone bass cut switch ■ meter monitoring of battery, RF bias, modulation ■ half or full track versions ■ Microphones, protective cover, battery charger, headphones are optional extras.

## —WITH THE NEW **EMI L4** ALL THE WAY!



Full details on request to:—

**EMI ELECTRONICS LTD**

LEADERS IN THE WORLD OF SOUND

BROADCAST AND RECORDING EQUIPMENT DIVISION · HAYES · MIDDLESEX · ENGLAND  
TELEPHONE: HAYES 3888 · CABLES: EMIDATA LONDON · TELEX: 22417

**STAND 314** (WHITTAKER CORPORATION)  
**NAB CONVENTION**  
WASHINGTON D.C. MARCH 21-24

# NAB

continued

Typical of the entirely new colour-TV equipment displayed by The Marconi Company through Ampex Corporation at NAB, Washington. This group is the Type B4109 colour bar generator, invaluable for setting up and checking performance of colour sync and coding equipment.



periods, combined with distant-remote control (which of course releases camera crews) for off-peak working. (4) Automatic fading at pre-determined speeds from one pre-set to the next.

Chatting with executives who saw such devices used and displayed at NAB last year, we found general agreement that this form of Autocam Evershed operation means production and operations personnel can be re-scheduled to work more productive hours, and the remote-control technique reduces 'goofs' and 'make-goods,' and camera assignments are pre-selected. It is possible to produce simple commercials 'live,' to reduce taping costs, and of course lower production costs make possible more live programming during off-peak hours. Incidentally, the facility to remote control all important camera functions means an executive can free large studios for uninterrupted tape-recording sessions simply by installing Autocam in his separate news or interview studio.

Nobody would want to embark on remote servo control, even with these practical studio costing and planning advantages, if it were just a 'box o' tricks.' In fact the Evershed system, founded basically on techniques tested and proved in weapon control in the Royal Navy, uses solid-state components requiring a very minimum of servicing. Several units have averaged over two years' continuous use before servicing; and indeed it has been in daily use for over five years at the London BBC.

At present servo-controlled pan-tilt head and zoom lenses are available for all vidicon and 3-in image-orthicon cameras. A while ago we heard from Evershed's popular Jack Littler that heavy-duty heads for RCA TK60 and GE PE 20 cameras were under final development and—who knows?—they may be at NAB Washington this year. Producers have soon found that with electronic control you can pan, tilt, zoom and focus with the Autocam faster than with manual control, and electronically one can vary speed from imperceptibly slow to instantaneous reaction. A novel facility is the Shot Box, which pre-sets camera assignments.

This is how it works. On a small panel on the box the desired degree of pan, tilt, zoom and focus are pre-selected by adjusting four potentiometers. These four functions go to make up '1 shot' which is thus pre-set in the little electronic brain, **and which can be precisely and instantly recalled by touching a push-button.** To produce a studio programme or commercial, it is necessary only to pre-set the camera assignments into the Shot Box, then depress push-buttons as the shots are called for.

Displayed in conjunction with Ampex Corporation, The Marconi Company Ltd. Chelmsford, England, have a last-minute major surprise which is being flown to Washington as this page goes to Press. Full technical details will be given in next month's INTERNATIONAL BROADCAST ENGINEER. However, in other Marconi spheres it is true to say that at NAB Washington this year will be possibly the widest range of Marconi-TV equipment ever gathered together in one display.

Among top-liners is a trio of colour-TV facilities of the sort Marconi are now putting into a number of international TV centres where colour television is on the eve of public-service presentation.

These colour units are (a) The B 3640 colour synchroniser, (b) the B 3370 colour coder module, and (c) the B 4109 colour bar generator. The synchroniser, working together with a TV sync pulse generator, provides sub-carrier and locking signals to enable waveforms to be encoded and used in accordance with the NTSC system. This 19-in by 5½-in by 15½-in synchroniser generates a sine-wave output at the required colour sub-carrier frequency, producing a frequency suitable for 525- and 625-line standards. The basic oscillator is crystal-controlled, housed in a change-of-state oven for a highly stable output. This output from the module oven is fed to a high-frequency counter which provides a jitter-free output at twice line frequency, and this is the output used to lock the system synchronising generator.

'It has been the practice in the past,' Marconi's tell us, 'to provide separate burst gating pulse units to key the sub-carrier into the back porch of the line sync pulses, to achieve colour synchronisation. Transistors have now enabled us to combine a burst gating module as part of the B 3640. . . .'

The colour coder (B 3370) working in conjunction with a sync generator such as the B3600 and the aforementioned B 3640 colour sync unit, provides all the signals necessary to code RGB video inputs into a composite colour signal of NTSC form. It is suitable for 525 and 625, has integral power supply, is of modular construction and naturally is fully transistorised. This little unit is normally fitted with matrices to derive Y, I and Q signals in accordance with NTSC, but these matrices can be altered; also, to cater for various systems, I and Q pre-modulator filters provide various bandwidths. The unit also contains control of phasing, so that between two encoders phasing can be adjusted to provide a range of sub-carrier phase of greater than 360-deg. Finally, provision is made to include a suitable notch filter if required in the luminance channel only centred on the sub-carrier.

As for the colour bar generator (B 4109), Marconi's say: 'This unit is an ancillary to the synchroniser and coder, and is designed to set-up and check performance of colour systems, particularly colour synchronising and coding. It can also be used for the adjustment signal for setting up some of the controls on colour monitors. . . .'

Main features of this colour bar generator are that it is transistorised, is suitable for 525 and 625, is of modular construction, and colour bars are switchable between 100 and 75 per cent saturation. The output signal can be used to calibrate levels throughout the studio. There are five plug-in modules which can be housed in a standard 19-in rack, while there is a mobile case for OB applications. It was the mobile form of this generator which we saw in use at the London Hilton nation-wide colour-TV relay, fully detailed in last month's issue. The output signal pulses

# EMI SOUND MOVES IN INTERNATIONAL CIRCLES

## NEW TAPE RECORDER TYPE BTR4

Here is a truly international tape recorder, advanced in concept and designed to the highest professional standards—NAB, cine or 11.25 inch (28.57 cm). European spools can be accommodated and special versions are available with the head block reversed for operating with tape wound oxide out.

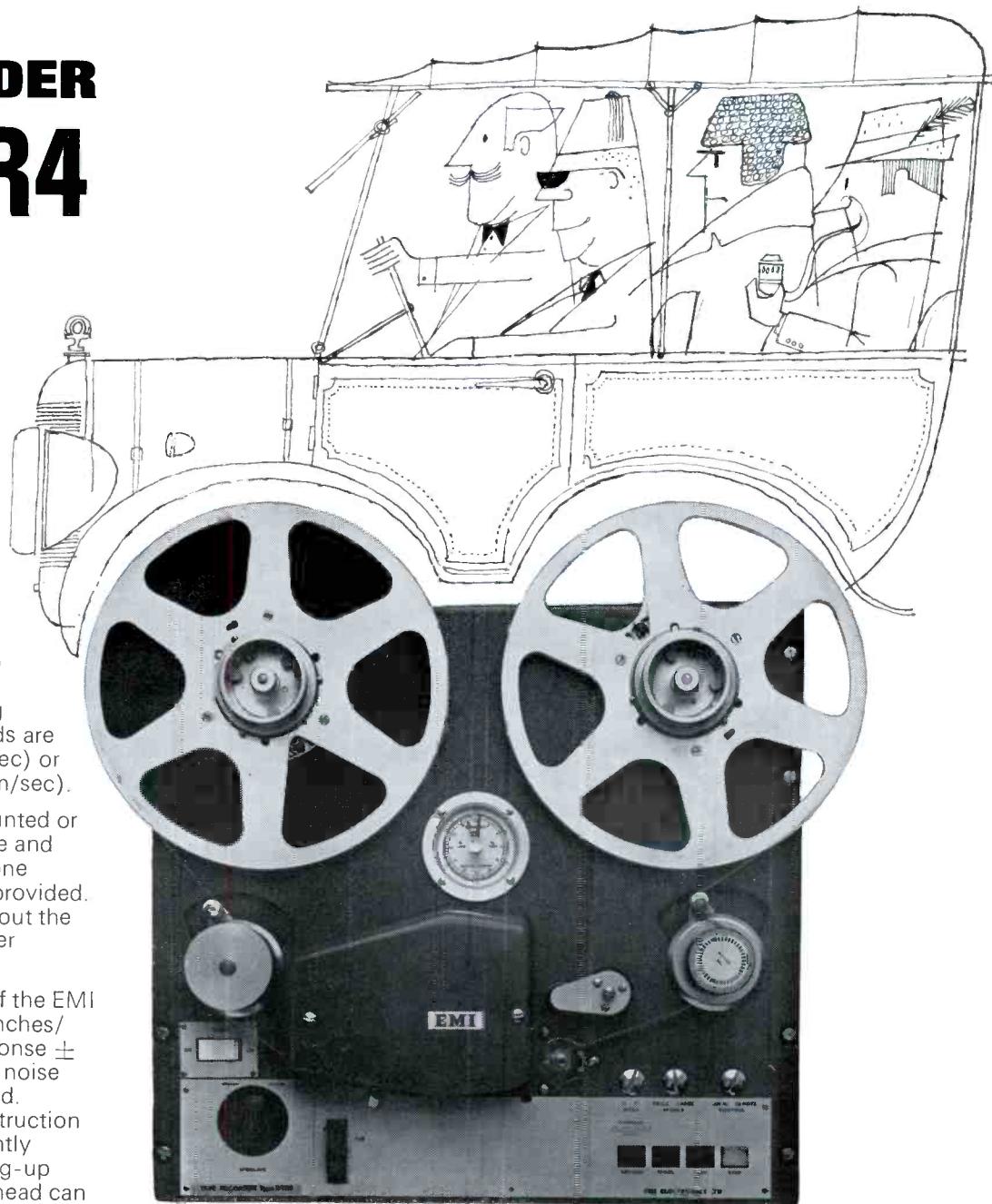
The BTR4 can be supplied for full track, half track or twin track stereo recording on 0.25" (6.3mm) tape and for three or four track recording on 0.5" (12.6mm) tape. Tape speeds are 15-7.5 inches/second (38-19cm/sec) or 7.5-3.75 inches/second (19-9.5 cm/sec).

Transportable, console, trolley-mounted or rack-mounted versions are available and compatible units, such as microphone amplifiers and mixers, can also be provided. The tape deck is also available without the amplifier assembly for use with other electronic units.

Here are just a few of the features of the EMI BTR4:— ■ Wow and flutter at 15 inches/second, 0.1% r.m.s. Frequency response  $\pm 2$ dB from 30 c/s-20 Kc/s. Signal to noise ratio is better than 60dB unweighted.

■ Plug-in head blocks of rigid construction permit pre-aligned units to be instantly inter-changed with minimum setting-up procedure. ■ Extra record or replay head can be fitted for film synchronising.

■ Three-position switch enables record/replay equalisation characteristic to be changed between C.C.I.R., N.A.B., and I.E.C. standards. ■ Variable spooling in either direction with automatic removal of tape from heads by retractable guides. Automatic action governed by manual over-riding control which can be locked in running position during spooling. ■ Instant start 0.2 seconds at 15 inches (381mm) per second.



Send for illustrated literature to:—

**EMI ELECTRONICS LTD**  
LEADERS IN THE WORLD OF SOUND

BROADCAST AND RECORDING EQUIPMENT DIVISION · HAYES · MIDDLESEX · ENGLAND  
TELEPHONE: HAYES 3888 · CABLES: EMIDATA LONDON · TELEX: 22417

**STAND 314** (WHITTAKER CORPORATION)  
**NAB CONVENTION**  
WASHINGTON D.C. MARCH 21-24

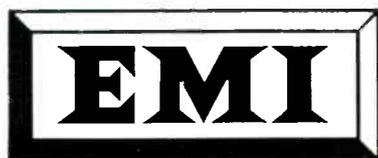


**2**  
**SOLID**  
**CAMERAS**  
**E**

## TYPE 206 4½ INCH IMAGE ORTHICON CAMERA

EMI's new 4½" image orthicon camera channel is a multi TV standard, solid state design, having full facilities for studio and outside broadcast use. Four position lens turret accommodates a range of lenses from 1⅜"—40" focal length. Transistor circuits are used throughout and plug-in printed wiring sub-units provide excellent accessibility and ease of maintenance. Other features include:—

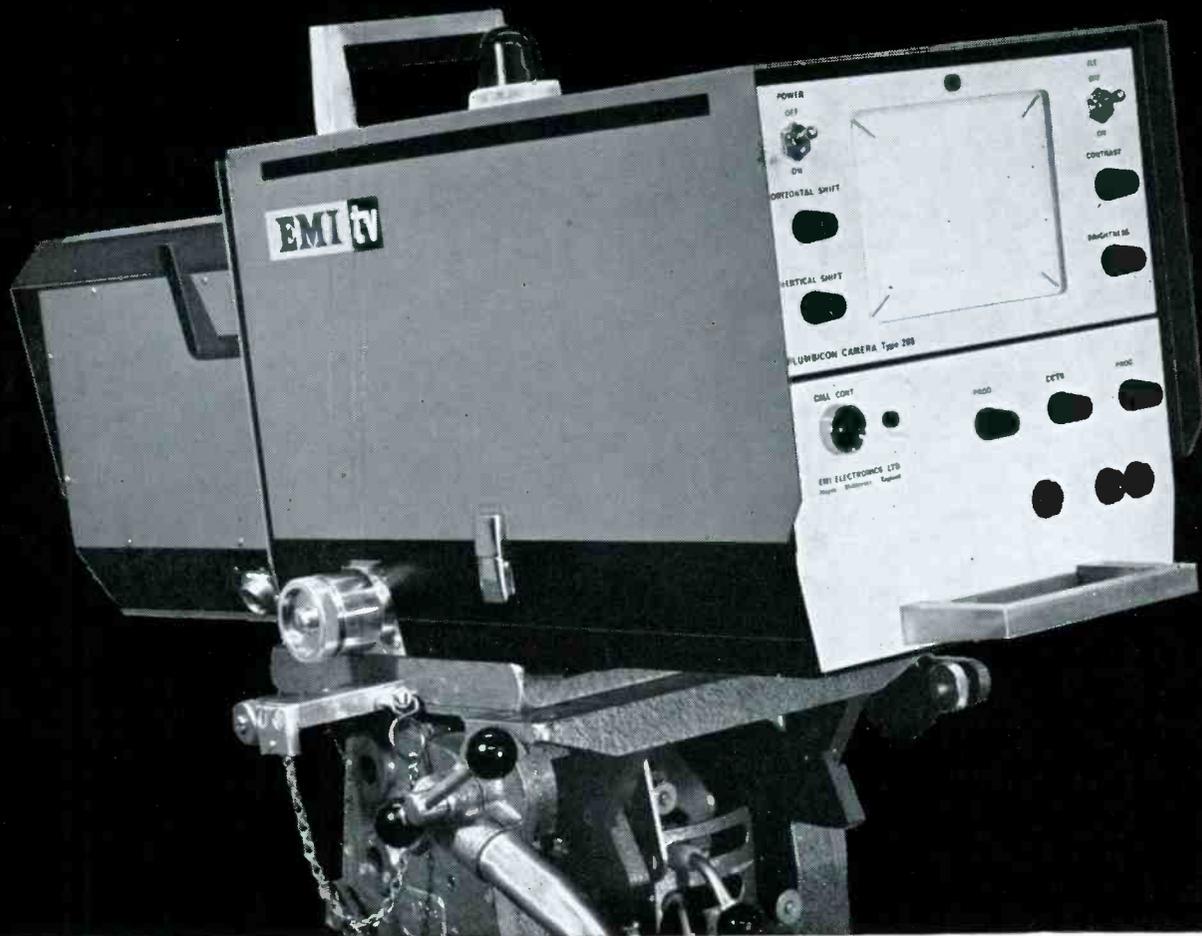
- R.T.H. or Angenieux Zoom Lens can be fitted to the turret or direct to the camera by means of an adaptor in place of the turret
- Remote control of lens apertures and remote indication of turret position
- Built-in 7" electronic viewfinder
- Pre-set station filter wheel
- Variable aperture correction
- Switched gamma correction.
- Switched positive/negative picture output
- Switched scan reverse which may be remote controlled
- Integral electronic image orbiting device
- Built-in test signal facilities
- Four isolated composite or non-composite outputs.
- "Joystick" remote control panel (if required) for one-man multi-camera control
- Quick-release camera cable connector.
- Multi TV standard (625 lines C.C.I.R./O.I.R., 525 lines I.R.E./E.I.A., 405 lines U.K.) simply changed by a single switch on the engineering line-up panel.



**INTERNATIONALLY RECOGNISED**

EMI ELECTRONICS LTD · BROADCAST AND RECORDING EQUIPMENT DIVISION · HAYES · MIDDX · ENGLAND

**NEW  
STATE  
FROM  
EMI**



## **TYPE 208 PLUMBICON/VIDICON CAMERA**

This new compact lightweight camera channel with integral zoom lens is suitable for studio or OB use having full broadcast facilities. Transistor circuits are used throughout and this camera combines ease of control with ease of maintenance. Here is excellent picture quality and high sensitivity at a low cost. Camera channel 208/1 is similar to 208 but is designed for fully remote operation. Either type can be supplied fitted with plumbicon or vidicon tube. Features of 208 include:— ■ 10 : 1 Zoom Lens incorporates servo controlled zoom and iris ■ Built-in 7" electronic viewfinder ■ Variable aperture correction ■ Switched gamma correction ■ Switched positive/negative picture output ■ Switched scan reverse which may be remote controlled ■ Four isolated composite or non-composite outputs ■ Built-in test signal facilities. ■ "Joystick" remote control panel (if required) for one-man multi-camera control. Camera Channel 208/1 is servo-controlled for fully remote operation, and is not fitted with a viewfinder ■ Multi TV standard (625 lines C.C.I.R./O.I.R., 525 lines I.R.E./E.I.A., 405 lines U.K.) simply changed by a single switch on the engineering line-up panel ■ Extensive use of plug-in printed wiring sub-units provides very good accessibility and ease of maintenance ■ Quick-release camera cable connector.

**IN BROADCASTING**

TEL: HAYES 3888 · CABLES: EMIDATA LONDON · TELEX: 22417

**STAND 314** (WHITTAKER CORPORATION)  
**NAB CONVENTION**  
WASHINGTON D.C. MARCH 21-24

# NAB

continued

representing red, green and blue, when displayed on a colour monitor show as vertical bars going (left to right) white, yellow, cyan, green, magenta, red and blue. The R, G and B pulses are timed so that, when fed into an NTSC coder, they provide a coded signal of the three primary colours.

The transistorised sync pulse unit (B 3600) already mentioned is shown at Washington in two forms. As Marconi's told us: 'There is a *dual* version (complete with gen-locks if required) housed in a printed-wiring case, and also a single version in a 19-in rack-mounting chassis. This latter version provides sync pulses only (that is, with no genlock facilities), and in the single form it is suitable for very small studio installations, or for driving test-waveform generators at transmitter sites, and so forth. In the dual version, a pair of generators with associated units are housed in a single printed-wiring case of either mobile or rack-mounting form. The complete assembly of printed-circuit boards can be withdrawn on runners for inspection, and individual counter circuits and similar facilities plugged into the main board.' The MO is either crystal-controlled or locked to local or external mains through a two-mode locking circuit; alternatively it may be manually adjusted by an internal control. This locking circuit gives the very desirable feature of a fast pull-in but a slow following characteristic when in lock. Stable binary counters are then used to count-down.

As an indication of the versatility of outputs, a feature likely to hold special interest for NAB delegates from European countries, the outputs from the B 3600 comprise (a) Line drive. (b) Field drive. (c) system blanking. (d) composite sync. Amplitude 2 or 4 ( $\pm 10$  per cent) conforming to 525, 405, 625 CCIR, 625 OIR or 625 Belgian line standards. The 4-v pulses are not matched sending impedances. (e) Field-frequency burst-eliminating pulses at 5-v into 1,000-ohms for colour-TV.

Of course the world famed Mk IV camera has pride of place at the Marconi, Ampex Washington exhibit, and a novel feature of the display also is the Marconi B 3651 communication unit. We mention this in conjunction with the Mk IV camera, for of course the basic camera communications (camera to camera-control, and vice versa) are incorporated in every camera channel in the Mk IV series, using transistor amplifiers mounted in the power units.

'The whole success of a TV production,' said a Marconi engineer, 'depends upon the rapid and accurate distribution of instructions to operational crew and communication between studios, telecine, master control, recording and other areas. The range of equipment is flexible and capable of being adapted to any production procedure. . . . The B 3651 communication unit is a draw-out printed-wiring case, suitable for rack or mobile use, and it will house up to ten plug-in transistor amplifier units. It contains, also, ten relays and power supplies for the amplifiers, relays and cue circuits. It is provided as standard with facilities for a four-camera studio or outside broadcasting unit, but additional or alternative facilities are easily arranged by extra plug-in amplifiers and connections made to existing tagboards. This unit also serves to distribute cues to cameras, and can be wired for central standards switching. . . .'

The transistor amplifier normally plugs into the 3651 communications unit, but it can be used in other assemblies for special applications. Four transistors are used in a circuit which, by means of alternative feedback connec-



INTERNATIONAL BROADCAST ENGINEER'S own Television Editor, Kenneth Ulyett, gets a preview from S. G. Griffiths of the EMI design team of the revolutionary new L4 portable professional tape recorder, seen for the first time in Washington at the NAB Convention.

tions determined by the wiring of the socket into which the unit is plugged, can be used with moving-coil or carbon mike inputs. Approximately  $\frac{1}{2}$ -watt output is produced for feeding a speaker or about 20 sets of headphones. There is a preset gain control. Because of the way in which communications facilities must be closely integrated with a TV studio's operating techniques, it is inevitable that special control and outlet panels must be produced, and Marconi's are showing a very interesting range of these at NAB, Washington.

For example, there is the ETP (engineering talkback panel) which is used at the camera control operator's position and enables him to hear and talk either separately or in omnibus to up to four cameras under his control. A talkback mike kit is often used with this panel, but full communication is possible with a headset only, and no control-room loudspeaker. In addition, volume controls are provided for Programme Sound, Talkback, Mixed Camera Talkback and a monitor speaker.

Also showing at Washington as part of this TV studio intercom set is the PTP (production talkback panel), which allows the director to talk to any of the positions in the studio or control rooms, and to receive MCTB, MCRTB and PS. Under normal operation, programme sound will be heard, but MCTB or MCRTB can be superimposed over it by operating a key. Finally, there is a production talkback and communication panel, designed specifically for outside broadcast use. This gives identical facilities to the PTP, thus permitting talkback to one or two commentators and an order wire.

Other Marconi exhibits on Ampex at Washington include a new four-channel vision mixer, a semi-automatic master switching system, picture and waveform monitors, vision and pulse distribution amplifiers, a sine-squared pulse and bar generator, and an entirely new grey-scale generator. Full details of these, together with a comprehensive report on all the other exhibits at the 43rd Annual NAB Convention will be given in the next two issues of this journal.

# INTERNATIONAL NEWS

## NAB election

Washington

**I**N USA the National Association of Broadcasters announces the election of thirteen prominent broadcasters to its Radio Board of Directors. All were elected to two-year terms starting on Wednesday, March 24, the concluding day of the NAB's 43rd Annual Convention in Washington.

Those elected:

**District 1** (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont).

Donald A. Thurston, WMNB, North Adams, Mass.

**District 3** (Delaware, Maryland, Pennsylvania, West Virginia and the District of Columbia).

Cecil Woodland, WEJL, Scranton, Pa.

**District 5** (Alabama, Florida, Georgia, Puerto Rico and the Virgin Islands).

Charles C. Smith, WDEC, Americus, Georgia.

**District 7** (Kentucky and Ohio).

Gene Trace, WBBW, Youngstown, Ohio.

**District 9** (Illinois and Wisconsin).

Edward Allen, Jr., WDOR, Sturgeon Bay, Wis.

**District 11** (Minnesota and North and South Dakota).

John H. Lemme, KLTF, Little Falls, Minn.

**District 13** (Texas).

David H. Morris, KNUZ, Houston, Tex.

**District 15** (Northern California, Hawaii and Nevada).

Hugh E. Turner, KTIM, San Rafael, Calif.

**District 17** (Alaska, Oregon and Washington).

Lester M. Smith, KJR, Seattle, Wash.

**AM Stations (Class "A" market)**

Frank Gaither, WSB, Atlanta, Ga.

**AM Stations (Class "B" market)**

Jack W. Lee, WSAZ, Huntington, W. Va.

**AM Stations (Class "C" market)**

Richard D. Dudley, WSAU, Wausau, Wis.

**FM Stations**

Harold R. Krelstein, WMPS-FM, Memphis, Tenn.

The results of the mail ballot election were certified by a three-member Election Committee appointed by NAB President Vincent T. Wasilewski.

Lloyd W. Dennis, Jr., vice president and general manager, WTOP, Washington, served as Chairman. Members are Harry A. Karr, Jr., manager, WRC, and Norman Reed, vice president for public relations, WWDC, both of Washington.

## Record sales

New York

**T**ECHNICOLOR, INC, and its diversified subsidiaries ended their first half century of operations on a high note by establishing record sales and earnings in 1964. Melvin H. Jacobs, president and chief executive officer of the company announced last month that net income for 1964 was \$4,450,069 or \$1.46 per share compared

with \$3,688,079 or \$1.18 per share for 1963 and \$683,690 or 22 cents per share for 1962. Net sales for 1964 were \$108,521,172 as compared to \$86,239,292 for 1963 and \$64,194,560 for 1962. (The 1963 and 1962 figures have been restated to include the operations of the companies acquired in 1964). Both net sales and net income were the highest for the company since it was founded in 1915.

## CCTV system

Vancouver

**A** CLOSED-CIRCUIT television system which enables downtown business houses to monitor the quotation boards of the Vancouver/Canada Stock Exchange recently went into service. The closed-circuit quotation service, first of its kind in North America, was designed by British Columbia Telephone Company, a subsidiary of General Telephone & Electronics Corp.

The company is offering the lease service to brokerage firms, banks and other business houses approved by the exchange. Transmission of the TV signal is carried out through a coaxial cable network.

During the course of a day's trading, eight

TV cameras scan the quotation board, with each camera providing a specific selection of the 360 listed stocks. An automatic switching device moves the system from one camera to the next in sequence until a picture of the entire 90-foot quotation board is provided. Customers monitor the board on TV sets which have screens ranging in size from 11 inches to 23 inches and are provided on a leased basis.

Television equipment for the system was produced by Sylvania Electric Products Inc, a GT & E manufacturing subsidiary. The Sylvania 800 TV cameras with 75 millimetre lenses were mounted 13 feet above the trading floor some 32 feet from the quotation boards.

## Baird scholarship

London

**T**HE Television Society, Great Britain, invites applications for the third award of the John Logie Baird Television Scholarship. This Scholarship, of value up to £200 is open to post-graduate students (in United Kingdom educational establishments) who are concerned with television engineering or an allied technology. It is expected that the

## RADIO INDUSTRY AND BBC2: An uneasy truce? by Rod Allen

**SIGNS THAT** the truce between the radio industry and BBC 2 is more than uneasy became apparent last month at a discussion meeting of the Television Society on the subject of experience with BBC 2 to date. Main speaker was BBC 2 chief of programmes Michael Peacock; with him (and against him) on the platform and the floor were representatives of the radio industry.

One of Michael Peacock's strongest doubts about BBC 2 lay in the fact that he felt that perhaps the Corporation had had to do too much of the industry's job in selling the new service to retailers. He asked the meeting whether the BBC had not taken up too much of its time concerning itself with the sale of sets, bearing in mind that the money involved was that contributed by licence payers.

Radio Industry representatives at the meeting, on the other hand, claimed that the industry had in fact never wanted the BBC to start transmissions in 625-lines uhf at all. This was countered by quotations from Pilkington and by attacks from the meeting on the radio industry for setting unsatisfactory engineering standards unilaterally once the principle decision to go ahead in uhf had been made. These attacks referred in particular to the intercarrier FM sound system which had proved unsatisfactory in practice and to the poor standard of current receiving sets—especially sets without DC components on the video side which had given rise to attacks on the BBC for transmitting less 'sparkling' pictures in uhf than those available in vhf. It was also mentioned that the radio industry had set the standard of negative picture modulation in transmission, which made it much more difficult to inject 'sparkle' into the picture.

There was general agreement, however, that programmes had taken an important turn for the better. Michael Peacock outlined some of his problems in programming to the audience, mentioning in particular the great difficulty—still besetting the Corporation—of arriving at a proper definition of the term 'alternative choice.'

Looking to the future, he said that this was determined by four factors: (1) money and the, as yet, unsolved future of the licence fee; (2) hours, the Corporation and Peacock himself being highly dissatisfied by the present system of permitted hours; (3) inter-industry co-operation, not only in the field of pressure marketing of 625-line sets but also in the growingly important question of colour receivers and (4) programme capacity. With a target of 70% of the nation to be covered as early as January 1 1966, said Peacock, 'BBC 2 has to be adequate to this historic period of expansion in British Television.'

Only passing mention was made of colour television, though great play was made by all sides of the industry represented at the meeting of the proposed 'total switchover' from programming on 405-lines to 625-lines. It is currently the manufacturing industry's view that this should never happen, and that Britain should continue dual-standard transmission indefinitely, though transmission engineers at the meeting expressed grave doubts as to whether Band 1 (used by the BBC 1) will continue to be workable for very much longer because of growing co-channel interference from the Continent.

The overall picture given by this meeting was one of uncertainty and difficulty in the problems of transmission standards and the future of British television.

# INTERNATIONAL

award will be made to someone in the age group of 21-30 years of age, and the successful applicant will be known as the Baird Scholar.

The Scholarship is intended to assist the successful applicant in undertaking a period of investigation abroad of approximately 6-8 weeks. During this period some aspect of television, or an allied technology, will be studied.

Applicant will, in the first instance, be recommended for consideration by the Head of the educational establishment concerned, and an application form (available from the Hon Secretary of the Society) will then be completed by the applicant. An indication of how the applicant proposes to take advantage of the scholarship should be stated. Consideration will also be given to any relevant technical papers or memoranda submitted with the application. Applicants may be called for interview by a Committee set up by the Society. The successful Baird Scholar on return from his visit abroad will be expected to make a report of his work to the Society.

Application are now invited for the 1965 Award which will be announced during May. The Scholarship will then take effect during the following period, June-September 1965. Application forms must be submitted to the Hon. Secretary of the Television Society, 166 Shaftesbury Avenue, London, WC2, not later than April 17 1965.

## Viscous processing

Hollywood

**A** SPECIAL SESSION on Viscous Film processing—a method unlike conventional immersion processes—has been added to the Society of Motion Picture and Television Engineers' 97th Conference programme because of the wealth of papers submitted on the subject.

According to Programme Chairman Richard J. Goldberg, Technicolor Corp, Burbank, Calif, the session is tentatively slated for Monday morning, March 29; the semi-annual conference, set for March 28 to April 2, will be held at the Ambassador Hotel in Los Angeles.

Motion-picture film processing of all types will be emphasised at the conference as evidenced by the full day of papers scheduled for Tuesday, March 30, by Topic Chairman W. Daniel Carter, Consolidated Film Industries, Hollywood.

## Noise conference

Berlin

**A**N International Conference on Noise Abatement is to be arranged in Dresden by the East German Chamber of Technology from November 23rd-26th this year.

The following themes will form the basis of the conference:

- Physiological and psychological problems of noise with special emphasis on working conditions.
- Noise measurement and evaluation.

Architectural acoustics and protection from noise in town planning.

The development of noise in industrial and traffic centres and protective measures, against it.

The Conference will be held in German, Russian and English. Official invitations may be obtained from the Kammer der Technik, 108 Berlin, Clara-Zetkinstrasse 114-117, German Democratic Republic.

## Improved tube

Paris

**A** NEW, improved picture tube for colour television receivers is being jointly developed by CFT—Compagnie Francaise de Television and Selit—Societa Elettronica Italiana S.p.A.

An agreement for its development has been signed by Mr Maurice Ponte, CFT President and Professor Calosi, SELIT President and Vice President for Europe of Raytheon Manufacturing Company.

Because of original techniques perfected in CFT Laboratories, the new tube gives brighter and higher quality pictures than now offered by other tubes. It can be used by any colour television systems. Above all it will help assure the wide success of colour television in coming years by lowering the price of receivers.

CFT—a joint venture, equally financed by CSF and Compagnie de Saint-Gobain—is already well known as the Pioneer of the SECAM colour television system. SECAM uses frequency modulation which intrinsically makes for higher picture quality as well as low cost and reliable operation of colour television networks. SECAM receivers are simple and require no colour adjustments by the viewer.

The agreement which has just been signed marks a new step in the already close relations between the SAINT-GOBAIN and CSF groups and Italian industry. It opens new and large perspectives for co-operation in the Common Market at the precise moment when Europe is getting ready to choose a colour television system in which the industries of each country will participate.

## Antenna towers

Washington

**V**INCENT T. Wasilewski, president of the National Association of Broadcasters, recently discussed legislation which recognises the Federal Communications Commission as the final authority in determining the height of radio and television antenna towers.

Testifying on the legislation before the House Commerce Committee, he said: "A recognition of the need for tower heights of 2,000 feet in certain instances, and for towers in excess of that in others, as this bill does, is a policy which we consider sound."

Under terms of the bill, the Commission could authorize the construction and use of towers higher than 2,000 feet after deciding in consultation with the Defense Department, the Federal Aviation Agency and all

other interested parties that they would not constitute a hazard to air navigation.

Mr. Wasilewski said he felt the pending legislation "recognizes the compromising, or the balancing of the interests, that are necessary in accommodating the utilization of the airspace by two important public-service oriented industries."

He prefaced his remarks with a review of broadcaster co-operation with the FCC and the FAA which, among other things, has led to recommendations for improved lighting and marking systems for antenna towers, the development of single-structure multiple antennas, and the concept of antenna tower farms.

Since 1960, he said, "relatively few serious difficulties have arisen regarding aeronautical hazards."

In these few cases, he added, there have been "excessively long and drawn out negotiations between and among broadcasters, the FAA and the FCC" and broadcast applicants often are "frustrated by the failure or unwillingness of government agencies to express their views and reasons on the public record."

He hoped the Committee hearings would contribute to "improvement in this regard."

## New leader

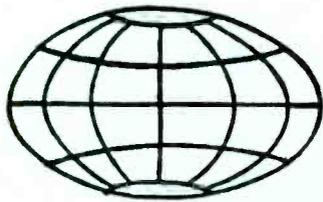
New York

**A** NEW LEADER for all motion-picture film release prints has been announced by the Society of Motion Picture and Television Engineers. Called the SMPTE Universal Leader, it replaces the old Academy and Society leaders which are no longer suitable for modern film pictures.

Though the SMPTE Universal Leader includes many new features, the major aspects of the old leaders were retained to permit established film laboratory and theatre practices to be followed while meeting the new requirements of television transmission.

Changes incorporated into the Universal Leader include:

- (1) Timing or count-down in seconds at 24-frame/second running instead of the present 16-frame, 'footage' count down;
- (2) A continuously moving clock-type wedge to denote passage of time;
- (3) Reduction of flashing to prevent instability in automatic telecine projection;
- (4) Use of slightly redesigned 35mm and 16mm sound cues in the anticipation of international acceptance;
- (5) Provision of space in the synchronizing section to be replaced by a similar number of Control Frames to provide technical checking frames or duplicated tests of the black-and-white or colour picture frames.
- (6) Inclusion of 35mm and 70mm magnetic cue positions;
- (7) Provision of three successive frames, marked Head, O, and Picture, to guide the operator printer when threading in the dark room;
- (8) Retention of the former cue for television which can also indicate to film examiners, cutters and projectionists, when a leader has been spliced too often, shortening its effective length;
- (9) Addition of a series of X's and O's on separate frames and on opposite sides



## NEWS

of the film to provide print-through cues for sound on tape sync.

The length of the new leader has been kept the same as the original Academy Leader to avoid errors in printing and sound cuing and to permit operators to continue using well-established practices.

### Expanded service

London

**S**TANDARD Telephones and Cables Limited, of Great Britain, has expanded its service for the measurement and suppression of radio interference in industry. New screened rooms, extra staff, new equipment and facilities for on-site testing have been added to the service which covers

aircraft, marine and industrial equipment and installations.

STC has carried out surveys and made recommendations for radio interference suppression on almost every British civil and military aircraft in the past 20 years. Work has also been carried out for the Admiralty and the merchant marine.

The STC interference suppression service is equipped and staffed to offer a comprehensive service to all relevant NATO and MIL specifications. The service is backed by the manufacture of separate ranges of suppression capacitors for aircraft, ships and general industry. In this way the equipment manufacturer and the user can obtain suppressors in the right price range for the job.

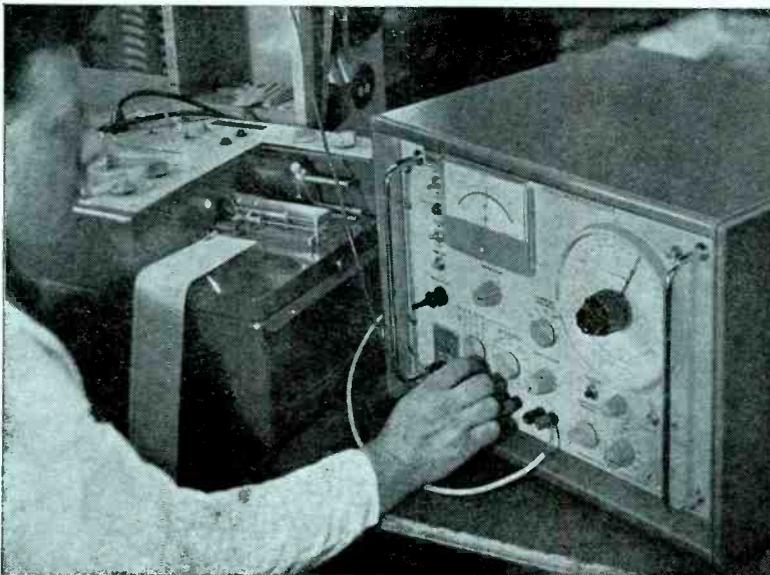
Details of the service are available from STC Capacitor.

### Thermistor booklet

London

**"THERMISTORS For Solid State Thermal Switching"** is the title of a new STC leaflet (MK/189) which describes the PTC range of positive temperature coefficient thermistors.

This new thermistor range is primarily for detecting excessive temperature in industrial equipment. The thermistors are very small spherical components (4.73mm diameter) that can be incorporated into electrical windings. In this way they are being used for thermal overload protection of the windings of motors, generators, transformers and electromagnets.



**A** new sweep oscillator covering the audio range from 20 c/s to 20 kc/s on a single logarithmic scale has been introduced by Dawe Instruments Ltd, Western Avenue, Acton, London W.3. Designated the Type 443B, it provides a constant voltage output over the whole frequency range, even when connected to a non-linear or frequency-dependent network. The frequency scale is fully rotatable and provision has been made for coupling the frequency control to the Dawe Type 1406 High-Speed Level Recorder to record responses automatically. The sweep can be started by operating a front panel switch or by remote control to synchronise with the Type 1406. An adjustable frequency marker is provided.

The oscillator works on the heterodyne principle, the outputs from two high-frequency oscillators (one working at fixed frequency, the other at a frequency varying over a small range) being fed into a mixer. The difference frequency in the audio range is filtered and amplified, a transformer-coupled output stage giving output impedances of 6, 60, 600 or 6000 ohms. Output is variable in 10 dB steps from 12.5 V to 125 $\mu$ V, output voltage at the load terminals or to the input of the attenuator being continuously variable and displayed on a front panel meter.

Frequency is varied by a specially designed capacitor giving a truly logarithmic scale within  $\pm 1\% \pm 1$  c/s. Coarse and fine manual frequency drives are provided on the front panel or externally from the high-speed level recorder, and the frequency can be modulated internally or externally by up to 200 c/s at any setting.

A voltage compression circuit controls the output of the oscillator to maintain constant current or voltage output.

#### New audio sweep oscillator

Distortion is less than 0.1% from 200-2000 c/s rising to not more than 1% at 20 c/s and 20 kc/s on attenuator output of 10 V. The instrument is available for rack or bench -mounting and draws about 70 watts from a 50 or 60 c/s mains supply. Weight is 55lb with case.

The instrument is most suitable for automatic measurements, for example for the recording of frequency response curves of four-terminal networks, audio amplifiers, tape recorders and the like. It could also be used for vibration measurements, and for recording the acoustic properties of loudspeaker enclosures, recording studios or concert halls.

## FOCUS

# NEW AUDIO SWEEP OSCILLATOR

# NAB . . .

## . . . US Headliners

**N**EWs is still coming through of major US-TV groups exhibiting at the 43rd Annual NAB Convention in Washington, which is now the world's largest shop-window for professional television and broadcast equipment.

In addition to the cream of United Kingdom technical exhibits detailed in this issue, Ampex Corporation have just released details of their Washington exhibit, which this year is on the theme of 'The Turning Point in Television Tape Recording.' The Mk IV image-orthicon, 321 and 322 vidicons and the 3310 colour vidicon manufactured by The Marconi Company are described on other pages of this issue, but the Ampex theme is well set by a complete teleproduction unit which includes the latest VR-2000, the VR-600 portable broadcast recorder, the 303 closed-circuit recorder, together with a Videotrainer mobile CCTV recording system.

Ampex's newest videtotape TV recorder, the VR-2000, operates on new high-band standards, and uses a high-band carrier-deviation frequency of 7.16 to 9.3 Mc/s, which permits a *single* standard both for colour and monochrome. As delegates will be able to see for themselves at Washington, the 2000's performance specifications are impressive, including an S/N ratio up to 46 dB, basic frequency response to 6 Mc/s, and virtually non-existent moire. Although it possesses all this upper-range ability, the 2000 is instantly switchable to present low-band standards in either 625 or 525.

In the audio field Ampex Corporation are sending to Washington the latest MR-70 professional audio master recorder, the PR-10-4 professional portable recorder, and the novel PD-10 audio tape duplicator. The MR-70, which was first introduced at Chicago, NAB, last year, has an S/n ratio of 70 dB (full track at 15 ips), a full 10 dB better than preceding Ampex professional master recorders. Improved dependability comes from the use in this machine of industrial/military grade nuvistors, which have a failure rate 10/20 times better than conventional valves, and about twice as good as germanium transistors. This year, too, Ampex are giving a special demonstration and display of 600 professional recording tape, of special tape for the VR-303, and of novel tapes ideal for transverse-and helical-scan recorders.

Dick Harmon of Cohu Electronics Inc cables us that Cohu's Engineering Systems Manager Gene Crow and Bob Boulio, TV Product Line Manager, will be representing Chou at Booth 316 in Washington, and they will be introducing among new TV facilities the 3100 series high-resolution self-contained cameras. In this series is contained all the modular circuitry for all camera and control functions. All you need in addition is a monitor! Optional video bandwidths (10 to 20 Mc/s) and a selection of scanning patterns from 525 through 945 lines present a wide choice of horizontal and vertical resolutions. In this new 3100 series there is all solid-state plug-in circuitry, a white peak clipper, adjustable aperture correction, and automatic light level compensation for variations as great as 10,000/1.

Cohu's 2000 series miniaturised TV cameras were fully described in our issue of September, 1964 (reprints available from Cohu Electronics), and now at Washington delegates can test for themselves this latest miniaturised

integral zoom camera, of 3-in external diameter with a 4-to-1 zoom in standard housing. This series operates from -17-deg C to +60-deg C, in high altitudes, high humidity and explosive environments.

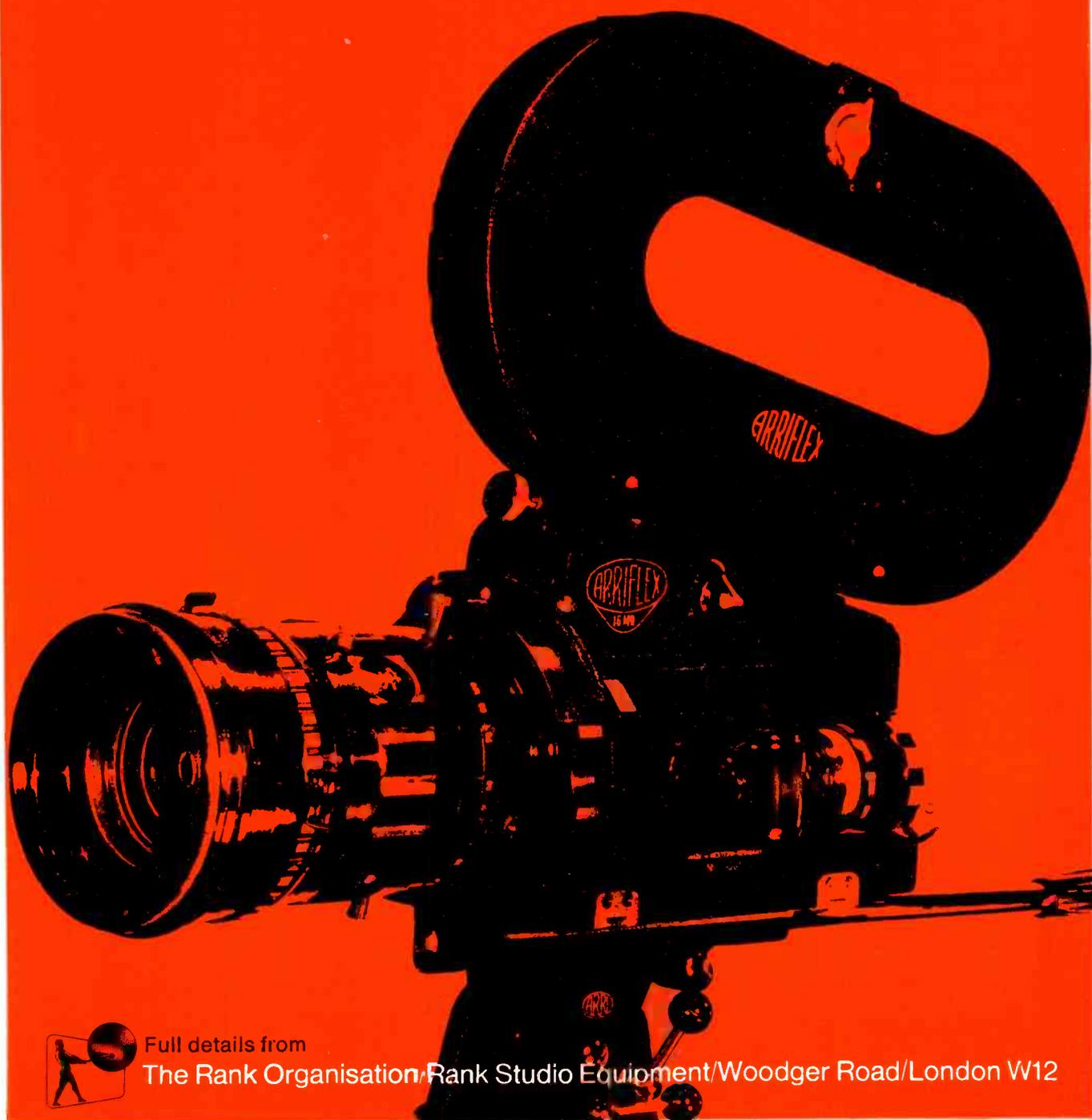
Gates Radio Company, too, will have some surprises in store at Washington, for they will be unveiling a family of four new transistorised remote broadcast amplifiers, and many other new lines.

RAC's major theme at Washington this year is 'A Television Studio of Tomorrow' fitted out with the most advanced broadcast equipment. This display will show how items of the 'New Look' introduced by the Radio Corporation of America can be assembled as an operating system to gain maximum benefit from the new technology they represent. We have had a cable from RCA telling how Mr C. H. Colledge, Division Vice-President and General Manager, Broadcast and Communications Products Division, has planned this Washington DC display, so that broadcasters visiting the exhibit in the Sheraton-Park Hotel can see a specially-built master-control centre handle the remote operation and switching of live and film cameras, TV tape recorders and other programme-originating equipment. Mr Colledge cables that several new TV products will make their debut, including a new I/O camera for field use, a deluxe TV tape recorder incorporating the latest technical improvements, and new CCTV equipment. Four types of RCA monochrome camera and a production model of the revolutionary new live colour camera, the TK-42, will be in operation and available for first-hand inspection in the exhibit's technical studio area. The TK-42 was first seen at Chicago last year by our Television Editor, and it is gratifying to note that the last production version (as well as the companion TK-27 colour film camera) now being delivered commercially, use the four-channel concept as developed by RCA. This provides a separate monochrome channel (separate luminance, as the technique is known in Europe) for more detailed colour pictures and for sharper black-and-white. In addition to these revolutionary colour cameras RCA will be showing for the first time at NAB Washington new items in the transmitting, film-sound recording and audio equipment areas.

## Correction

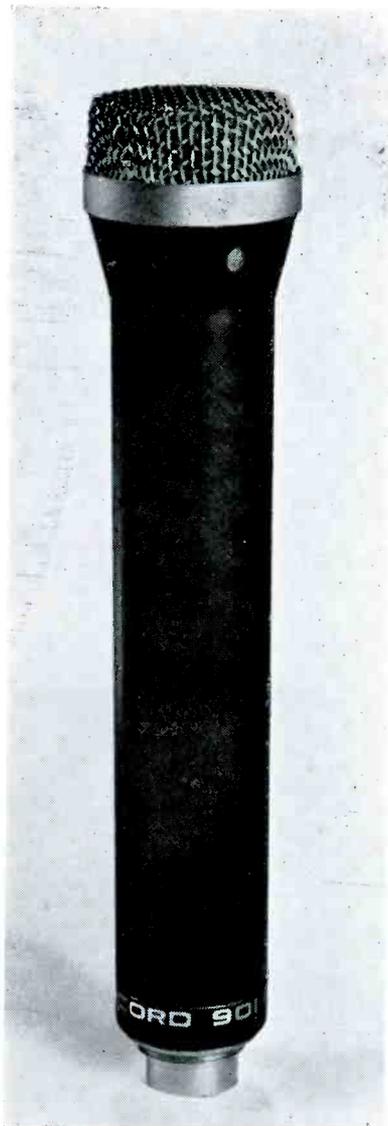
IN the recorded interview with Mr. D. L. G. Lodge, of EMI Electronics Limited, our Correspondent John Miller points out that in reply to the question about figures of gain and cost (at the top of page 212, last month's *International Broadcast Engineer*), Mr Lodge actually quoted £45 as a basic price for an amplifier for main trunk circuits. The reply to the question at the start of page 214 should end: 'This means allowing for splitting losses and so forth we can have a transmission line of approximately 500 yards before an amplifier is required.' The cost figures also quoted on that page should read: 'Provision of a single Emitap and double outlet box costs about 24s 6d per subscriber, but when a double Emitap can be used this is cut to 22s per subscriber . . . Distribution network varies, but could be as high as £2 10s a head. Subscriber connection at £1 4s each, and with a third of the total actually wired would be 8s . . . thus you see the total cost per house is £8 2s 5d.' John Miller in apologising for these minor errors says it must be due to the fact he was not using Emitape in his recorder for this interview!

# RANK STUDIO EQUIPMENT PRESENT THE NEW ARRIFLEX 16 MBL SILENT CAMERA



Full details from  
The Rank Organisation, Rank Studio Equipment/Woodger Road/London W12

# INTERNATIONAL GOLDEN JUBILEE PUBLIC ADDRESS EXHIBITION



Fi-Cord International introduce two new microphones of their own design—both studio quality moving-coil models — small, slender and robust. Externally alike, the FC.901 is directional with a frequency range of 40 to 18 kc/s, and the second, FC.801, is omnidirectional with a frequency response of 50 to 18 kc/s. Prices to be announced. The 901 is illustrated.

King's Head, Harrow-on-the-Hill  
March 17 & 18, 1965

## Preview by Donald Aldous (Audio Editor)

**T**HE first known use of public-address equipment, as we understand the technique today, was in San Francisco, U.S.A., in 1915 at the Panama-Pacific Exposition. The work was undertaken by Mr. Peter Jensen and Mr. Edwin Pridham, responsible for the dynamic (moving-coil) loudspeaker, patented in the January of 1913. Loudspeakers were concealed high in the "Tower of Jewels", and later the same year the system was set up again for Christmas carols outside the City Hall in San Francisco. Such was the first public usage of P.A. but there may well have been prior demonstrations, perhaps by the Armed Forces of the time.

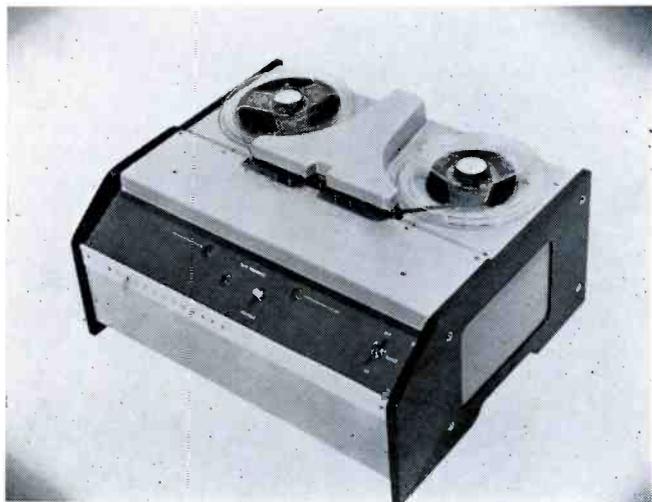
Jensen—later to become known as "The Father of the Loudspeaker"—died less than two years ago and to honour his contribution to the radio, TV and audio industries, the 1965 Annual Exhibition of the Association of Public Address Engineers has been christened the **International Golden Jubilee of Public Address**. Mr. Jensen was born in the island of Falstar, Denmark, on May 16th, 1886 and was educated in Denmark. To

mark the occasion of his anniversary the exhibition will be opened at noon on the 17th March by His Excellency Albert Konigsfeldt, the *Chargé d'Affaires* of the Danish Embassy in London, together with Mr. Peter Winterso, the Scientific Attaché at the Embassy, who knew Mr. Jensen. The ceremony will be held in a specially constructed BBC studio and will be televised on closed-circuit TV throughout the exhibition.

In the early afternoon of that day a two-day broadcast is being organized between New York and Harrow. In America a panel of prominent P.A. engineers will take part from the BBC New York studios exchanging comments with a team in Harrow consisting of Mr. Albert Konigsfeldt, Mr. Peter Winterso, veteran BBC announcer Frank Phillips and John Gilbert (Northern Polytechnic).

The **British Post Office Telephone Service** is staging 50 years of telephones and will show the first telephone used in the UK, as well as various types in widespread use right up to the telephone of tomorrow, all of which models will be operational. Also to be seen will be the first microphone employed in this country and a working model of the Goonhilly Down (Cornwall) Post Office Radio Station and its aerial systems.

**Mr. Haydn Warren** has arranged a working exhibit



Pamphonic Reproducers Reflectograph Model EA  
high quality tape playback unit.

of some very early PA equipment, loaned to the APAE by various museums and companies in many parts of the world, including the USA, West Germany, Holland. **Standard Telephones & Cables Ltd.**, will display the microphones used by King George V at the opening of the British Empire Exhibition at Wembley, in 1924.

Last year's accommodation was hard pressed, but this year's 40 odd exhibitors on nearly 80 stands will tax the facilities to the utmost, although the growing support is a great encouragement to the hard-worked honorary organizers. The importance of efficient public-address would seem to be at last being recognized in this country (although there are still many back-spots) and the basic objects of the APAE—the raising of the standard of PA presentation coupled with the best use of the correct equipment for the job in hand—are receiving increased attention.

This preview is based on advance information and is necessarily incomplete at this stage. Any PA or audio engineer able to visit the exhibition will find it of absorbing interest. It will be open from 10 a.m.

to 6.0 p.m. on each of the two days and admission is free by trade card or invitation ticket, available from the Association at 394, Northolt Road, South Harrow, Middlesex, or from any of the exhibitors.

**Pamphonic Reproducers** (7, 8 & 9), in conjunction with their associate company, **W. Bryan Savage Ltd.**, will display their comprehensive range of sound reinforcement, PA and background music equipment. The many models of amplifiers employing the proven and versatile Pamphonic "Brick System" in units from 10, 30, 50 and 100 watts output, and three typical cabinet and rack assemblies for mounting a variety of standard equipment will be on show. Supporting the amplifier range are various specimens of "Line Source" loudspeakers manufactured to the original Pamphonic specification, with sharply tapered sound distribution characteristics, accompanied by numerous cabinet type speakers, microphones and accessories.

The sophisticated designs of "Reflectograph" tape recorders and players will be supplemented by a new type cassette loading tape unit suitable for background music, PA teaching and other applications. In addition to this background music equipment, a comprehensive library of taped music for many requirements in industry and entertainment will be available. A new development from Pamphonic will be a Radio Microphone System of compact and advanced design, crystal-controlled having the full technical approval of the British Post Office.

**Lustraphone** (28 & 29) exhibits have been grouped to show the various microphones, "Radiomic" systems, transistor, amplifiers, mixer units, matching transformers, floor/table stands, microphone booms, plus accessories, available from this company for: educational services; public address; broadcasting; recording studios; tape recorder users; and social services. The "Radiomic" system—since it received G.P.O. approval—is now in big demand, and an entirely new radio microphone-cum-transistor, conforming to Post Office specification will be introduced for the first time, with valve/mains single and multi-channel receivers. Useful items among the many accessories displayed will be the flexible "Stayput" positioning tubes of various lengths and cable exit bushes and plug/socket releases enabling microphones to be lifted from stands, used as a roving or hand microphone, and then readily replaced without interfering with the cable connections.

## Public Address Exhibition-contd



Pamphonic Reproducers' special microphone paging unit for the Pasir Panjang Power Station, Malaya.

► **Rola Celestion** (37 & 38) will offer a selection from their extensive range of PA special purpose units. The collection includes Pressure Driving Units from 10—30 watts, straight and re-entrant horns, re-entrant loudspeakers with totally enclosed line transformers, in addition to various mobile and industrial loudspeakers. Motor-cycle and car loudspeakers are now available to the trade, which models are Home Office approved designs formerly of restricted application. Of particular interest to the small PA operator are the inexpensive driver unit DC.10 and the SD.27 re-entrant for mobile applications. Also on show will be the 50 watt outdoor column loudspeakers, supplied to many large sports arenas.

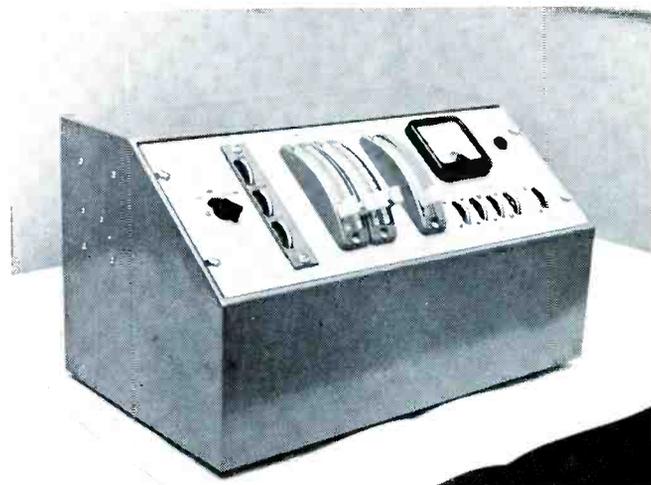
Fully transistorized sound equipment suitable for installation in recording/broadcasting studios will again be exhibited by **Elcom (Northampton)**. (72) Designed for portable or console fitting, these units can include a vast array of facilities including input switching, tone equalization, channel and group fading by quadrant faders, mid-lift units, pre-fade listen and all facilities demanded by professional applications. Among the separate modules to be shown will be plug-in units including line amplifiers, microphone amplifiers, com-

pensating units, faders, PPM units, and other high quality components.

**Electrical & General Development (London)** (42) offer a variety of loudspeakers (including columns) and amplifiers. Recently added to their range is the 501 amplifier. This model basically consists of a standard main amplifier, one microphone pre-amp., one music pre-amp.; plus bass/treble controls. To this combination can be added a maximum of four of any of the following modules: microphone pre-amps.; microphone priority unit; signal generator; and fire-alarm.

**Sound Coverage** (1, 2 & 3) will introduce a completely new collection of loudspeakers, designed with the experience of the past two years in mind. Improvements to their range of amplifiers are announced, and these will now incorporate printed circuit panels and silicon input transistors offering exceptional gain, consistency of performance, with low noise content. The amplifiers and mixers are fully transistorized. An automatic continuous tape reproducer, employing the proven Sound Coverage tape deck and a transistorized amplifier/control unit, derived from the present Series II machine, will be demonstrated.

**Fi-Cord International** (60 & 61) will show a number of new **Beyer** microphones, including the M.80, a cardioid model with a frequency response of 50 c/s. to 16 kc/s. and the M.110, which is a dynamic directional type that can be used as a lavalier model for reporting. Fi-Cord will release at the exhibition two new microphones of their own design—both studio quality dynamic models, small and robust. One, the FC.901 is directional, and the second, the FC.801 is omni-directional.



An example of an exclusive Elcom design of transistorised switching/mixing control unit using quadrant faders.



New PA amplifier SR.415 from Reslosound Ltd. 15 watts output.

**Douglas A. Lyons & Associates (75)** offer studio items of French origin, including the widely used Super Megaflex self-contained, transistorized portable PA system, with casing made of unbreakable plastic and various LEM microphones. **Reosound Engineering (30)** add to their standard catalogue a new smaller instrument case (4 by 3 by 2 ins.) and a smaller size sloping panel instrument case, primarily to accommodate a 2 in. meter.

**Lockwood & Co. (Woodworkers) (53 & 54)** exhibit will consist of Lockwood Monitoring loudspeakers and the Lockwood Academy Reproducers for domestic use. During the run of the exhibition demonstrations of loudspeakers will be given at the nearby works of Lockwoods at 67 Lowlands Road. **Reslosound (11 & 12)** will display their range of ribbon and dynamic microphones, PA amplifiers/loudspeakers, together with "Stentofen" intercom. equipment. New to this show will be their switched version of the Pencil Dynamic PD microphone introduced last year and a new group of specially designed amplifiers for PA applicants, the SR.415 (15 watts); SR.430 (30 watts) and the SR.460 (60 watts).

**Film Industries (33)** provide their range of high-quality ribbon and moving-coil microphones and various stands and mountings to meet most requirements. The ribbon models are available matched to any desired impedance up to 57K oms.

**Warren Public Address (48 & 49)** display several additions to their products for the PA operator. The 3-way fader enables three microphones to be coupled to the single microphone input of an amplifier. Designed for standard low impedance microphones, the fader has balanced inputs and output. The hybrid microphone distribution coil is a true hybrid transformer, developed from the MMU.2 unit introduced last year, and the 100 volt line level meter is a simple

# Professional Standard —

# GOODMANS MAXIM

## MAXIMUM FIDELITY MINIMUM SIZE

The MAXIM *true* High Fidelity Loudspeaker System is already in use as a monitoring loudspeaker in professional studio equipment.

The degree of fidelity essential for such applications is equally sought after for domestic High Fidelity installations. Such refinement of sound, added to fantastic compactness, makes the Maxim an outstanding achievement in advanced design — ideal as a portable monitor speaker.

### SPECIFICATION

Power Handling ..... Up to 8 watts (r.m.s.)  
 Frequency Range ..... 45-20,000 c/s  
 Impedance ..... 15/16 ohms  
 Dimensions: 10½" x 5½" x 7¼" deep.

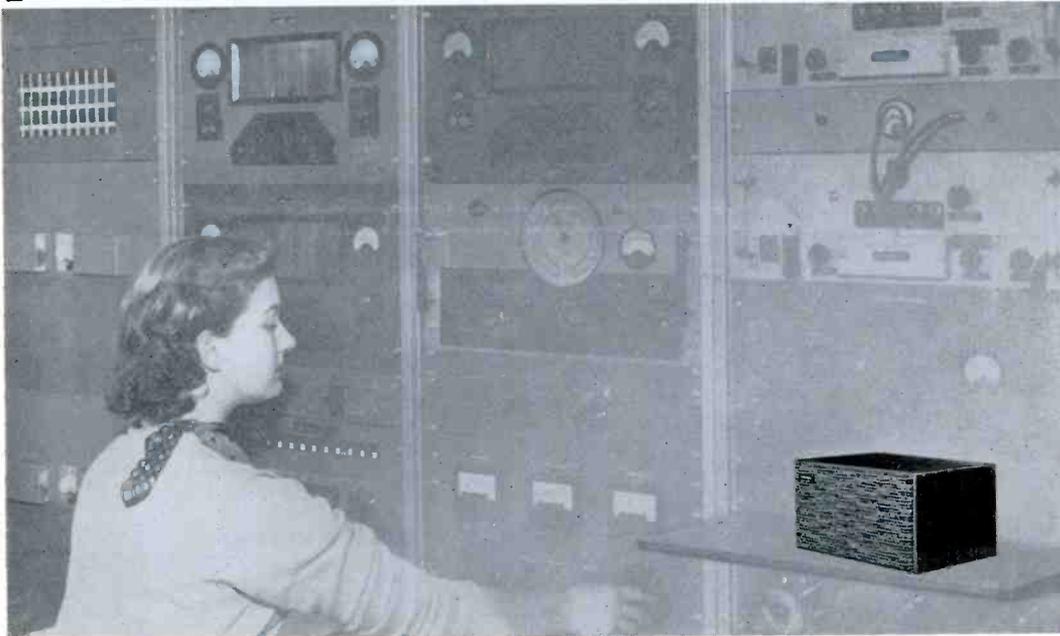
Available in either Walnut or Teak finish to order.

**RETAIL PRICE: £15.0.0 + P.T. £2.10.6**

For full details, write to  
 Technical Advisory Department IBE3

## GOODMANS

**GOODMANS INDUSTRIES LIMITED**  
 Axiom Works, Wembley, Middx.  
**WEMBLEY 1200** A Member of the Renlase Group



RESPONSE CURVE



### L. S. TYPE (S):

MAXIM System.

### INPUT:

Constant Voltage.

### MICROPHONE:

B & K 4133.

### FURTHER DATA:

Free standing.

Anechoic conditions

# INTERNATIONAL GOLDEN JUBILEE PUBLIC ADDRESS EXHIBITION 1965

## EXHIBITORS AND THEIR STAND NUMBERS

### PLAN OF UPPER HALL STANDS 1—44

Stand No.	Exhibitor
1, 2 & 3	SOUND COVERAGE LTD. Decibel House, Wellington Town Road, East Grinstead, Sussex.
4, 5 & 6	MAGNETA (B.V.C.) LTD. Goblin Works, Leatherhead, Surrey.
7, 8 & 9	PAMPHONIC REPRODUCERS LTD. Heath Works, Baldock Road, Royston, Herts.
10	GOODMANS INDUSTRIES LTD. Lancelot Road, Wembley, Middx.
11 & 12	RESLOSOUND LTD. Spring Gardens, London Road, Romford, Essex.
13 & 14	SHURE ELECTRONICS LTD. 84 Blackfriars Road, London, S.E.1.
15 & 16	AUDIX B.B. LTD. Bentfield End, Standstead, Essex.
17 & 18	VITAVOX LTD. Westmorland Road, London, N.W.9.
19 & 20	CTH ELECTRONICS Hoddesdon, Herts.
21 & 22	PYE TELECOMS. LTD. Middlesex Sales, Colham Mill Road, West Drayton, Middx.
23—25	S.T.C. LTD. Electro Mechanical Div., West Road, Harlow, Essex. S.T.C. LTD. Private Communications Div., Footscray, Sidcup, Kent.
26 & 26	E.M.I. ELECTRONICS LTD. Instruments Div., Hayes, Middx.
27	RENDAR INSTRUMENTS LTD. Victoria Road, Burgess Hill, Sussex.
28 & 29	LUSTRAPHONE LTD. St. George's Works, Regent's Park Road, London, N.W.1.
30	REOSOUND ENG. & ELECTRICAL CO. Reosound Works, Reddicap Trading Estate, Sutton Coldfield, Warks.
31 & 32	VORTEXION LTD. 257/263, The Broadway, Wimbled- on, London, S.W.19.
33	FILM INDUSTRIES LTD. 90 Belsize Lane, London, N.W.3.
34 & 35	GRAMPIAN REPRODUCERS LTD. Hanworth Trading Estate, Fel- tham, Middx.
36	POLITECHNA (London) LTD. 3 Percy Street, London, W.1.
37 & 38	ROLO CELESTION LTD. Ferry Works, Thames Ditton, Surrey.
39	WIRELESS WORLD WIRELESS & ELECTRICAL TRADER Dorset House, Stamford Street, London, S.E.1.
40 & 41	CLARK & SMITH MFG. CO. LTD. Melbourne Works, Wallington, Surrey.

42	ELECTRICAL & GENERAL DEVELOPMENT (London) LTD. 229 Dawes Road, Fulham, S.W.6.
43 & 44	PHILIPS (Peto Scott Ltd.) Addlestone Road, Weybridge, Surrey.

### LOWER HALL PLAN STANDS 45—78

Stand No.	Exhibitor
45	G.P.O. PUBLIC S.T.D. TELEPHONES
46 & 47	G.P.O. EXHIBITION. "50 Years of Telephone"
48	GOLDEN JUBILEE DISPLAY
49	WARREN PUBLIC ADDRESS EQUIPMENT 88 Wellington Road, Luton, Beds. (Note Mr. Warren is responsible for display of old equipment.)
50	INTERNATIONAL BROADCAST ENGINEER (Woodworkers) LTD. 31 St. George Street, Hanover Square, London, W.1.
51 & 52	MINNESOTA MINING & MFG. CO. LTD. 3M House, Wigmore Street, W.1.
53 & 54	LOCKWOOD & CO. 67 Lowlands Road, Harrow, Middx.
55	ELECTRONICS WEEKLY ELEC. & RADIO TRADING Drury House, Russell Street, W.C.2.
56 & 57	HIRD-BROWN LTD. Flash Street, Bolton, Lancs.
58 & 59	WHITELEY ELECTRICAL RADIO CO. LTD. Victoria Street, Mansfield, Notts.
60 & 61	FI-CORD INTERNATIONAL 40a Dover Street, London, W.1.
62—65	JENNINGS MUSICAL INDUSTRIES LTD. 115 Dartford Road, Dartford, Kent.
66 & 67	ULTRA ELECTRONICS LTD. Long Drive, Greenford, Middx.
71	RADIO RETAILING 46 Chancery Lane, London, W.C.2.
72	ELCOM (Northampton) LTD. Weedon Road Industrial Estate, Northampton.
73	DECCA RADIO & TV LTD. Ingate Place, Queenstown Road, S.W.8.
74	MULLARD LTD. Mullard House, Torrington Place London, W.C.1.
75	D. LYONS & ASSOCIATES LTD. 32 Grenville Court, Dulwich, London, S.E.19.
77	F. W. BAUCH LTD. G.P.O. "GOONHILLY DOWN" (MODEL)
78	E.M.I. RECORDS LTD. Manchester Square, London, W.1

## Public Address Exhibition—continued



CTH Electronics PA-100 transistorised amplifier provides 100 watts from a 12 volt battery, at 5% total harmonic distortion.

indicator unit showing peak signal content as read across the actual loudspeaker feed, providing a useful indication of programme level. The meter requires no power supply.

The extensive **Trix** range of sound equipment for innumerable applications will be seen on the **Ultra Electronics** stands 66 and 67. Innovations include Model RA.108 radio-amplifier—a combined FM radio tuner and 8 watt amplifier—Model B.66 portable battery-operated transistorized PA system, all self-contained in the 37 in. column speaker, and several microphones, including the G7852/FP priority microphone, on desk stand.

**CTH Electronics** (19 & 20) will show not only their existing range of PA equipment (loudspeakers, transistor amplifiers, etc.) but an entirely new range of mains/battery operated transistor amplifiers having

outputs of up to 100 watts. These units are suitable for mains or 12 volt battery supply and, when coupled to the mains, will revert automatically to battery in the event of mains failure.

Last—but certainly not least—of the attractions of this year's APAE show will be a repeat programme (at various hours during the days) by Miss Joan Coulson (**EMI Records**, 78) of her lecture on choosing the right music for any PA job. These talks illustrated by records will take place in the BBC Control cubicle and will be seen over the closed-circuit TV channel.

Trix Electronics Model RA108 combined FM tuner and 8 watt amplifier





BRICK  
BUILT?  
AUDIO  
EQUIPMENT



meet changing needs with a *NEVE* modular audio console

Dividing up equipment into a number of BRICKS, or circuit units, is a technique we have developed to make individual design possible without impossibly high development costs.

Its flexibility is enormous, future modifications to meet changing studio requirements can be carried out easily, often leaving the main equipment in service. BRICKS are built, for example, for microphone amplifiers, equalisers, line and recording amplifiers.

Financially flexible too, facilities can suit your present needs and grow with you, giving you performance to laboratory standards plus all the advantages of the system

electro-acoustic engineers  
and consultants

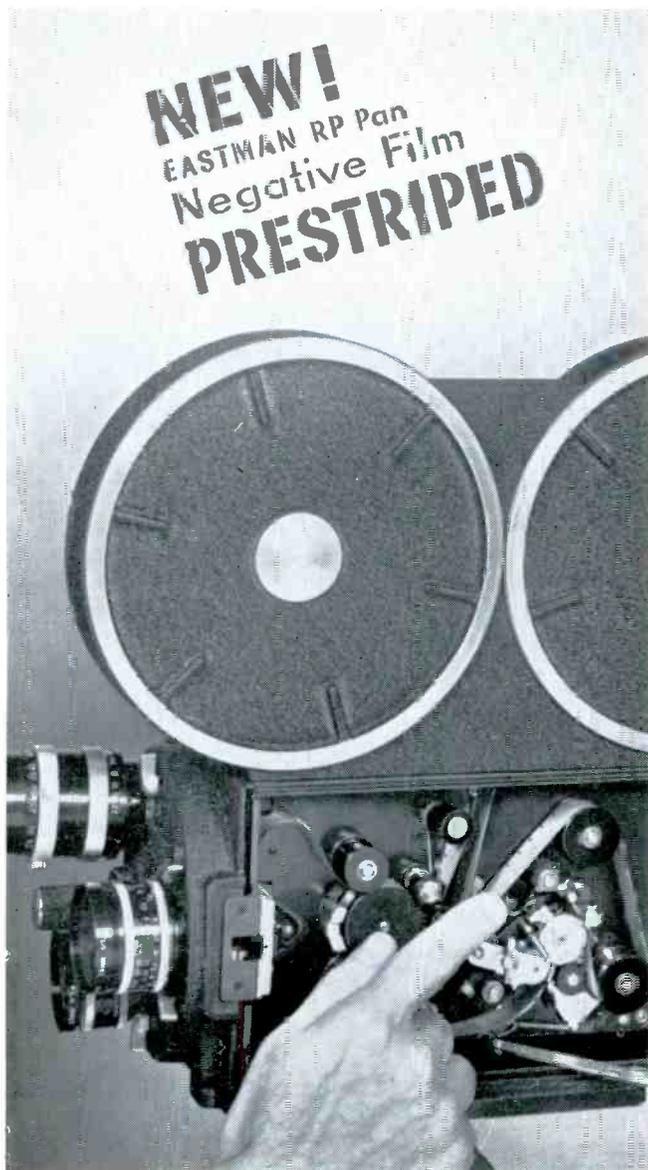
Portable and permanent mixing consoles  
Special amplifiers and control gear Curve  
benders, equalisers and filters Limiters  
and compressors Tape duplicators. Tele-  
metering equipment. Special magnetic re-  
corders Electro-acoustic transducers



RUPERT NEVE & COMPANY

'Priesthaus' Little Shelford, Cambridge,  
Telephone Shelford 3537

# LOAD, SHOOT, SHOW... IN MINUTES



## LOAD...

with new **Eastman** RP Panchromatic Negative Film, Type 7229! Here is a film designed for tight deadline shooting. It's magnetically prestriped for single system work. It has a high-quality, fine-grain emulsion that has the same speed-granularity ratio as Plus-X negative but it is really fast . . . ASA 250. It's designed specifically for the **Eastman Viscomat** Processor!



## SHOOT...

the event with a **Kodak** Reflex Special Camera. Adapted for single system magnetic sound recording, it's designed to meet the most critical professional needs. It has brilliant reflex through-the-lens viewing and astoundingly accurate frame positioning for rock-steady screened images plus a broad line of accessories that make this camera unexcelled in the world.

# GET KODAK QUALITY ALL THE WAY



## PROCESS...

the film in minutes with the new 16mm **Eastman Viscomat** Processor. Evenly—beautifully! It operates at a sizzling 36 ft/minute, delivering dry, ready-to-project footage. It has push-button simplicity, no chemicals to mix or replenish and a unique one-time-use chemical system that provides considerable savings in labour, time and consumable supplies.



## PROJECT

the film with the **Eastman** 16mm Television Projector, Model 275. It's built for critical accuracy, long, long life, *and* it's designed for use in both 50- and 60-field television. A unique heavy-duty film advance assures more power in the film drive. Accessory available for magnetic playback. **Kodak Ektar** Television Projection Lenses assure maximum sharpness and brilliance.

*Camera, processor and projector are available in both 50- and 60-cycle models. Write for detailed literature or see your local Kodak Representative. Motion Picture Products Sales Department, EASTMAN KODAK COMPANY, ROCHESTER, N.Y. 14650*

**Kodak**



## AUDITORIA

Royal Festival Hall, London, showing the sound canopy that incorporates the 'assisted resonance' devices.

DONALD ALDOUS (Audio Editor) discusses some of the problems of architectural acoustics, with special reference to recent concert hall designs. Some of the techniques employed today by acousticians to improve listening conditions are outlined.

**T**HE FUNDAMENTAL PROBLEMS of auditoria design have always been the conflicting ones of how well can performers be seen and heard by the audience? In a lecture last November at University College, London, Mr John Landels, Lecturer in Classics at Reading University, said that a small coin dropped on the stone stage of the Greek theatre at Epidaurus could be heard clearly by every one of nearly 20,000 spectators.

This is twice the maximum audience at the Albert Hall and six times the capacity of the La Scala opera house in Milan, Mr Landels commented, and yet even Aristotle had only a naive theory of how sound waves behaved and the ancient Greeks did not construct artificial mounds for their auditoria.

Greek shepherds calling to one another across hillsides probably discovered that their voices carried much more strongly across a concave slope than over flat ground and consequently Greek architects selected such sites for their theatres. In these Greek theatres the sound of actors' voices attained maximum intensity at the edge of the stage and, after that, instead of dispersing, they converged rather like pouring the sounds through a funnel. This enabled spectators at the back of the auditorium to hear much better than they would at the same distance and height without the intervening structure. But, Mr Landels added, the shape of these theatres substantially eliminated reverberation as, when the audience was seated in its places, the vertical part of the stonework did not significantly reflect the sound waves. Any reflected sound tended to shoot up into the air, and, of course, there was no roof to throw sound downwards, as the Greek climate permitted mostly open-air theatres.

The imitation Greek theatre at Bradfield College did possess a slight period of reverberation, probably because the height of the scene structure was sufficient to catch the sound reflected from the lower tiers and direct it back over the rear seats. Mr Landels described as a device of the age of decadence the late Greek habit, reported by Vitruvius, of using a stereophonic 'wandering voice' effect in singing-halls or odeons by the aid of bronze jars, each selected to resonate at a particular pitch, sited across the theatre.

How far have we progressed today in designing auditoria for optimum listening conditions? Despite many

locken; Jacksonville, Dartmouth College, Hanover; and San Diego) by his company Bolt, Beranek and Newman, Inc of Massachusetts. The accompanying table lists the reverberation times of well-known concert halls and opera-houses, as quoted in Dr Beranek's admirable book.

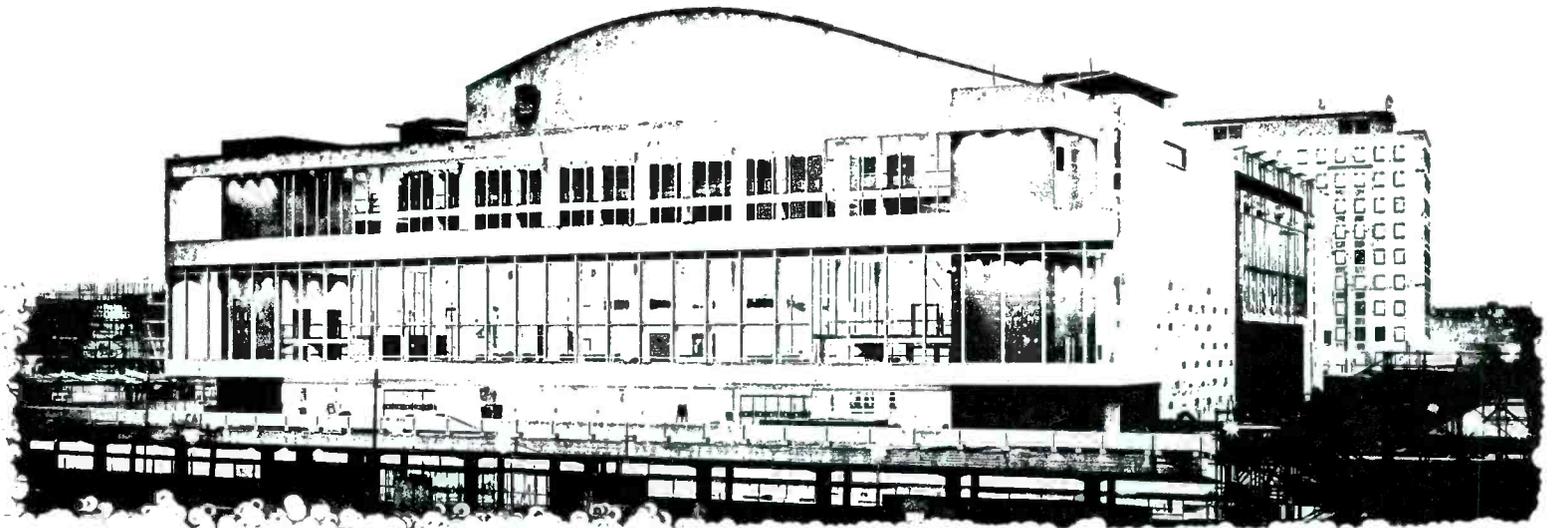
Studio or Concert Hall	Volume in Cubic Feet	RT in Seconds
Talks Studio	2,000	0.3
Light Entertainment Studio	60,000	1.0
Light Music Studio	113,000	1.5
Music Studio	180,000	1.7
Large Music Studio	220,000	1.8
Royal Festival Hall, London	775,000	1.47
Free Trade Hall, Manchester	545,000	1.6
Usher Hall, Edinburgh	565,000	1.65
Concertgebouw, Amsterdam	663,000	2.0
Beethovenhalle, Bonn	555,340	1.7
Grosser Musikvereinssaal, Vienna	530,000	2.05
Carnegie Hall, New York	857,000	1.7
Symphony Hall, Boston	662,000	1.8
Royal Opera House, London	432,500	1.1
La Scala, Milan	397,300	1.2
Metropolitan Opera House, New York	690,000	1.2

The reverberation times are mean values over a frequency range from 500—1,000 c/s. Reverberation times from 'Music, Acoustics & Architecture,' L. Beranek. (John Wiley & Son).

# ACOUSTICS

fundamental investigations and a wealth of critical experience in constructing concert halls and other buildings, important problems are still unsolved and we are far from having fixed and final rules for the acoustical design of concert halls.

The problems are concerned with the degree of sound absorption by the audience, the role of diffusion, the ratio of low-frequency to mid-frequency reverberation, and—most significantly—the desirable ratio of direct to reverberant sound. At a packed joint meeting recently, in the Imperial College of Science and Technology, of the



Acoustics Group (of The Institute of Physics and The Physical Society) and Society of Acoustic Technology, some of the latest listening experiences and measurements in halls in the USA and Germany were presented by Dr Leo Beranek and Dr H. Kuttruff.

The renowned concert halls of the past seated around 1,500 people but present-day economic and social requirements demand a doubled capacity. Dimensions, however, cannot just be doubled and forward-looking architects are not content to continue designing and building auditoria to a standard general pattern. Fan-shaped, hexagonal, and the usual rectangular ground plans are all being employed in various halls with, in Berlin, even an 'in-the-round' shape has been incorporated in the new Philharmonie. The orchestra is placed almost in the centre of the building, with no reflecting back wall and a section of the audience is seated on steeply raked 'vineyards.'

In Dr Beranek's massive 1962 text 'Music, Acoustics and Architecture,' John Wiley, he proposed a method of factor analysis for halls, in which each factor was given an empirically determined rating. At this recent London meeting, Dr Beranek examined in detail the results of applying this method to six halls (in Montreal; Indianapolis; Inter-

Experience with the Lincoln Centre Philharmonic Hall, in New York, when first opened a couple of years ago, proved how critical is the void or gap size between reflecting panels suspended from the ceiling. If made too small, no effective use is produced of the large volume of the auditorium but, if made too large, the panels reflect too little sound. Dr Beranek believes that modification of the 1962 ratings could well lead to satisfactory design of multi-purpose halls, provided the same basic scheme is followed.

Dr Kuttruff (of Goettingen University) described several concert halls that have been opened during the last five years in Germany, including the Beethovenhalle in Bonn and the Philharmonie in Berlin. The possibilities of designing very large halls or halls of unconventional shapes that have proved to be acoustically satisfactory are limited only by lack of reliable measurements and knowledge. Apart from the factors indicated earlier, the emotional and intellectual reactions of the listeners in any given surroundings, all influence the final assessment of a hall's properties.

This statement is another way of saying that the musical ear is the final arbiter in concert hall acoustics.

## Auditoria Acoustics — continued

It now seems to be generally agreed that the satisfactory balance, as heard by the listener, of the energy levels at different frequencies, between the reverberant sound and that arriving at his ears (modified by the hall's surfaces) within one-twentieth of a second is highly critical. This concept—called in 1931 the 'acoustic-ratio' by the late Dr L. E. C. Hughes—was apparently unacknowledged to this source, but its importance in passing judgment on the behaviour of an auditorium is now recognised.

If a trend is discernible in auditoria design, based on American experience, it is towards multi-purpose halls, which—aided by motor-operated ceiling panels of different absorption qualities, orchestral screens at platform level and appropriate arrangements of the orchestra or artists—can be usable for full-scale orchestra, opera, drama or intimate chamber groups.

One of the standard techniques employed to measure the reverberation period of a hall is, of course, to use a spark generator (and, in some cases, a small electrostatic loudspeaker as a directional sound source), an ultrasonic microphone, an oscilloscope and a graphic level recorder. Additionally, acousticians determine the degree of attenuation of sound waves passing as grazing incidence over the seating area, the distribution of sound energy due to reflective and absorptive surfaces, the presence of any special acoustical snags, and the all-important ratio of early to reflected sound. A year or so ago some details were published of—what was claimed to be—a recently perfected technique that promised good acoustical planning in the original design of auditoria.

The method—due to Professor Friedrich Spandock of the Technological University of Munich, Germany—consists of recording a musical composition in an anechoic chamber. The tape is then played-back inside, say a one-tenth scale model of the hall, using an ultrasonic head on the tape machine and an ultrasonic microphone. The latter relays the high-speed music to a tape recorder operating at ten times the normal speed. The tape finally is heard at normal speed. In this way, it was stated, the experimenter will supposedly hear what the music will sound like in the completed hall.

To simulate the effects of the proposed hall, the absorption capacity of the building materials was matched, and corrugated egg packing was used to simulate people and blind listeners evaluated the results of the tests. Many acousticians have grave doubts about the value and accuracy of such experiments on scale models and, in any case as Dr Beranek has pointed out, high-speed tapes for this purpose were used in 1959 in a 1/10-scale model of the Sidney Opera House.

Turning to methods of enhancing reverberation in auditoria, conventional methods like echo chambers and metal reverberation plates have long been used, to be supplemented in recent times by the 'ambiophony' technique, due to the Philips organisation. This elegant system makes the acoustics of an enclosure appear more 'live' by electro-acoustic means. Basically, the idea is feeding loudspeakers (70 or more, for instance) fixed to the walls of the studio with the amplified and delayed output of micro-

phones (at a level to avoid howl-around) so that the loudspeaker outputs simulate reflective (rather than absorptive or dead) wall surfaces. The appropriate delay is obtained from a magnetic recording system, having several replay heads, so spaced that their outputs are delayed to simulate the time it would take for the sound waves to reach various parts of the enclosure. These improved acoustics help the orchestral players to hear themselves properly, and a further development of the technique is to make the studio enclosure appear to be much larger than it actually is. This is done by increasing the time delay in the loudspeaker feeds.

The use of such electro-acoustical methods does introduce problems of critical positioning in a concert hall to avoid feedback and coloration of the sound, as heard by a listener within the auditorium. These considerations led to the development of the 'assisted resonance' technique, incorporated experimentally in London's Royal Festival Hall last March, and now in use in the reopened RFH.

The 'assisted resonance' system functions not by amplifying the whole sound spectrum (as with a normal reinforcement system) but by prolonging specified frequencies which, in small steps, cover the desirable range of about 30 to about 1,000 c/s. The reverberation time above this frequency appears to have little subjective effect. The method is made possible by the use of flask-shaped devices (Helmholtz tuned acoustic resonators), which can be tuned to any desired frequency by varying the enclosed volume, simply by adjusting the distance of the base from the neck.

Acoustic engineers P. H. Parkin and K. Morgan, of the Building Research Station of the Department of Scientific and Industrial Research, are directing this 'assisted resonance' research, which has proved so successful that further experiments are being conducted to extend the effect first to lower frequencies and then to the higher frequencies. The effect of this subtle increase in the reverberation time is to 'warm up' the acoustics of the auditorium.

This enhancement of acoustic properties by electronic methods may disturb the purists, but it does not approach the complex audio system that *completely* replaces natural acoustics in the Palace of the Congresses in the Kremlin, Moscow. An outstanding example of recalcitrant acoustics in this country that provided exceptionally difficult, if not unique, problems for the acousticians is the new Coventry Cathedral. The high absorbent roof canopy, the reflecting engraved glass curtain window at one end of the nave, and the tapestry at the other end, defied customary methods of sound reinforcement to enable the large congregation to hear satisfactorily. F. Hugh Brittain, and his colleagues, of the Hirst Research Centre of the General Electric Co Ltd have solved the snags by employing a single array of loudspeakers high in the roof. The group comprises two short column arrays, a medium-frequency three-cell horn and two pairs of HF units. The sound distribution is directed mainly towards the back of the nave where the required delay, of the order of 60 milliseconds, is obtained simply by the increased height of the source, and not electronically. The directional characteristics of the loudspeaker array are such that in the front pews there is negligible reinforcement to conflict with the direct hearing of the preacher's voice. In all, there are 27 microphone positions controlled from a sound mixing console at the rear of the nave. Two 50 watt amplifiers are fitted, but for normal speech distribution some 7 watts only are used.

The desire of modern architects to depart from long accepted and traditionally shaped auditoria and buildings is well exemplified in these fascinating examples of theatre design, now in existence and to come. We acknowledge with grateful thanks 'The Sunday Times' (Feb 21, 1965) for the use of these basic outlines; it must be noted that the sketches of the projected National Theatre and the future Barbican home of the Royal Shakespeare Company are only outlines, subject to alterations.

This survey leads one to hope that with co-operation between architects, acousticians and performers of many kinds, optimum conditions for listening and seeing in auditoria will become more general in the years to come.

## New pickup tube development for 'See-in-dark' TV

**A** MAJOR DEVELOPMENT in image orthicon design that will make possible the use of low-light-level television in applications previously precluded by the size and weight of such systems, is announced by International General Electric Company of New York Ltd.

In the new GE 'see-in-the-dark' television pickup tube the beam is focused and deflected electrostatically rather than magnetically, thereby eliminating the need for associated yokes and alignment coils which constitute a large portion of the bulk of conventional image orthicons.

As a result, the new tube, the Z-7804, is one-fifth the size and one-twentieth the weight of a comparable magnetic image orthicon and requires only a thirtieth the power. Still further reductions in size, weight and power requirement are anticipated for future versions of the electrostatic tube.

Overall length of the Z-7804 is 13.125 inches, about two inches shorter than existing image orthicons. Weight including self-contained electrostatic focusing and deflection elements (deflectron, Einzel lens and non-linear spiral

lens) is only 11 ounces, against more than 14 pounds for a magnetic tube with its associated yokes and coils.

The drastically reduced power requirement will be another major advantage in many applications. Approximately 30 watts are needed for the yokes of a magnetically focused tube, whereas the Z-7804 requires only one watt for deflection, focusing and collimation.

The GE electrostatic image orthicon can be housed in a lightweight, compact camera head capable of completely remote operation away from amplifiers and controls. It employs a high-gain, thin-film magnesium oxide target that has a sensitivity 10 to 20 times that of glass targets and can store signals for long periods prior to read-out, an advantage in the case of low frame rates or beam pulsing.

System circuitry can easily be developed to produce variable scan and frame rate capability for the new tube. In addition, the electrostatic image orthicon minimises halo and blooming effects which can be a problem with conventional tubes.

The Z-7804 uses an S-10 or S-20 photo cathode with spectral response characteristic of these surfaces. One version of the tube uses a fibre optic face plate with an S-20 photo cathode and can be employed with visible, infra-red or ultra-violet image intensifiers with fibre-optic face plates for 10 to 30 times more sensitivity, permitting operation with no more illumination than starlight.

General Electric expects the electrostatic image orthicon ultimately to achieve sensitivity comparable to that of existing magnetic models, but, while performance of the two types will be similar under normal scan conditions, magnetic systems may be somewhat superior in maximum obtainable image quality and able to outperform the electrostatic tube in very high resolution applications. Resolution of the Z-7804 is currently 600 lines.



## NoisEx<sup>®</sup>

The new process for noise reduction by means of signal-controlled compression and expansion in professional tape-recording.

- Lower distortion.
- Less print-through.
- Reduced modulation noise.
- Negligible background noise.
- Imperceptible action of automatic controls.

Startling improvement in quality.

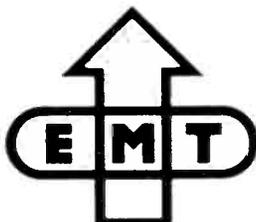
The NoisEx system uses transistorised compressors and expanders in the input and output circuits of the tape-recorder. Soft passages are recorded at a much higher level and loud passages at a lower level than usual.

The secret of the NoisEx system lies in the absolutely novel design and operation of the compressors and limiters, which act in a way that is imperceptible to the ear even in the case of difficult programme material.

The tolerances of the system are sufficiently close to allow programme interchange.

In most cases it is possible to maintain a quality, better than that of a normal original recording, even after several re-recordings. This gives enormous advantages and permits the use of splice-free copies.

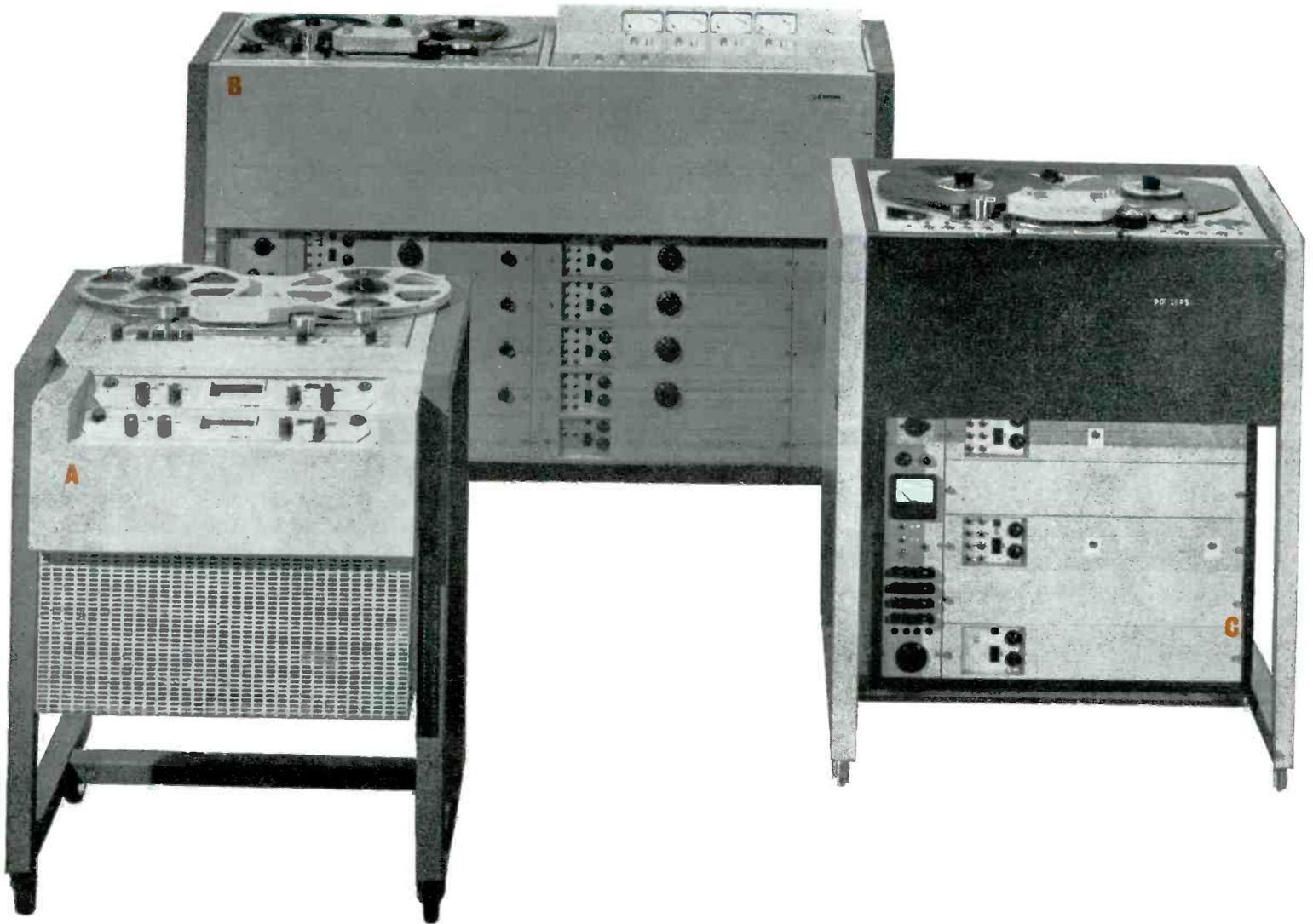
NoisEx is also eminently suitable for stereo and multi-channel recordings.



# NEW STANDARDS IN SOUND AND CAM

—a complete range of

## PROFESSIONAL SOUND RECORDERS



A new range comprises four types of recorder, available for 50 c/s operation, and with CCIR or NARTB equalisation.

All models are available in unit form for mounting in customer's own consoles.

In all cases, values of wow and flutter and of signal-to-noise ratio are appreciably better than accepted standards.

### A PRO 20 and D PRO 25

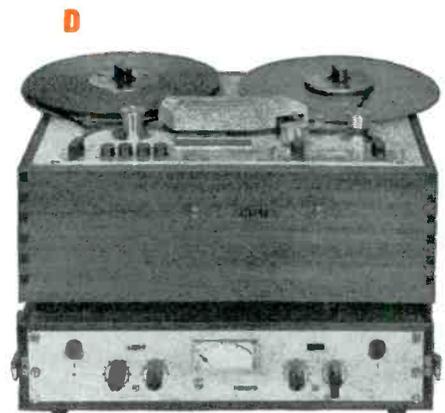
High quality range, capable of an exceptional standard of sound quality. For mono, stereo or half-track recording on  $\frac{1}{2}$ -in. tape. Console (Pro 25) or rack mounting or in teak cases for transportable use (Pro 20).

### B PRO 50

for mono or stereo recording,  $7\frac{1}{2}/15$  or  $15/30$  ips. Ferrite heads for long life. Electronic tape tension control. Photo-electric end-of-tape switch permits also of stopping on transparent inserts.

### C PRO 70

for 3 or 4 track recording on  $\frac{1}{2}$ -in. or 1-in. tape,  $7\frac{1}{2}$  ips. Ferrite heads for long life. Particularly suitable for dubbing, post-synchronising or transfer.



**P** Scott  
**P**eto

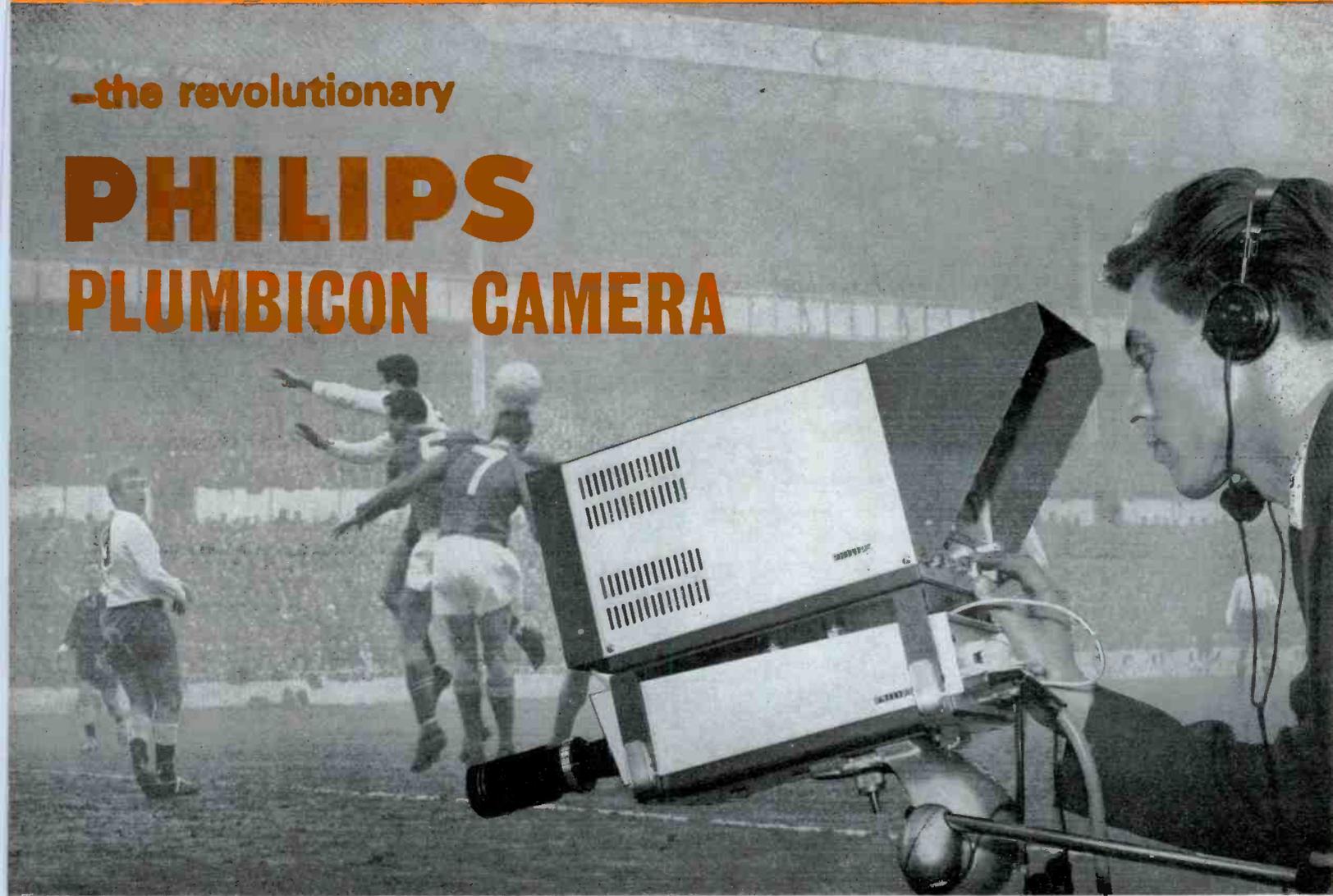
**PETO SCOTT ELECTRICAL INSTRUMENTS LTD.**

Sound and Vision Systems

# CAMERA EQUIPMENT FROM PETO SCOTT

-the revolutionary

## PHILIPS PLUMBICON CAMERA



The Plumbicon Camera offers the picture quality of an image orthicon, combined with the compactness, the ease of control, and the low cost of a vidicon. 26709 110

Because of its high sensitivity at low brightness, the Plumbicon tube is capable of yielding a satisfactory signal at light levels as low as 10 or 12 foot-candles, at  $f/2.8$ , when the depth of focus is comparable with that of an image orthicon at  $f/5.6$ .

## NOW - THE COLOUR PLUMBICON CAMERA!

This unique Colour Camera which uses the Plumbicon tube is available for hire and demonstration.

The camera has gained world-wide recognition of its outstanding performance and is in current use in many major broadcast studios.



Addlestone Road, Weybridge, Surrey. Telephone Weybridge 45511

Telex 262319

## A long-life television camera tube with improved operating characteristics

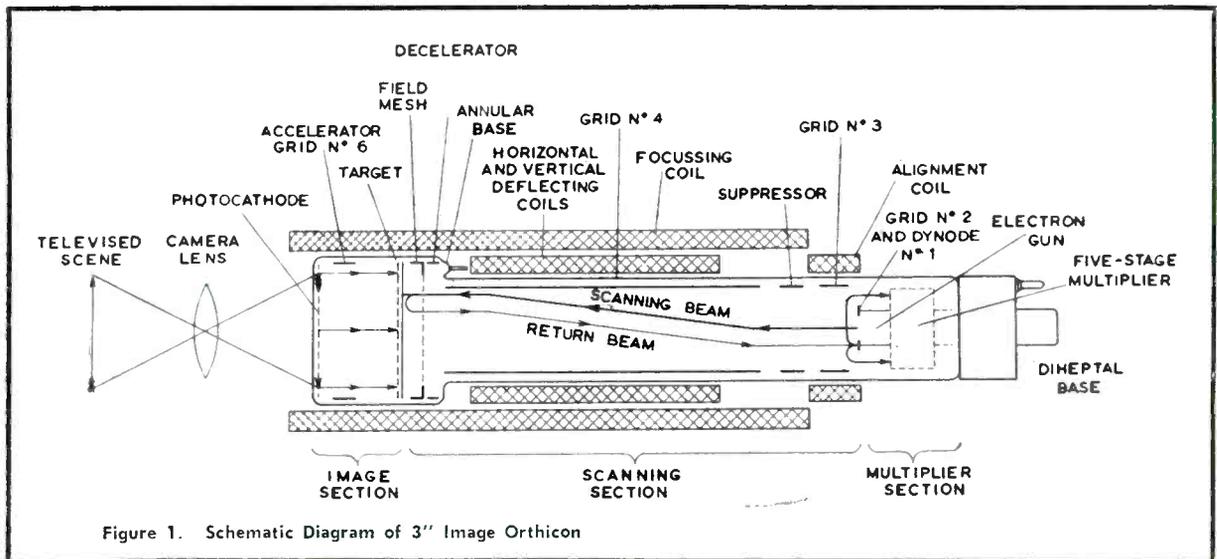


Figure 1. Schematic Diagram of 3'' Image Orthicon

A paper presented by Peter Baldwin Banks, Ph.D., Research Engineer, Walter Ernest Turk, B.Sc., AMIEE, Manager of the Photoelectric Tube Division, English Electric Valve Co., Ltd., Chelmsford, Essex, England at the 14th Annual IEEE-GB Broadcast Symposium Willard Hotel, Washington, DC, September 26, 1964

**T**HIS PAPER concerns the image orthicon television pick-up tube which, in spite of various attempts to supplant it, still remains today's most widely used tube in television broadcasting. More particularly the paper describes a new target material which will eliminate one of the most serious drawbacks remaining with the tube, namely the deterioration in performance resulting from the ageing of its target.

It is well known that the function of the target in the image orthicon is to receive an electron image from the photocathode of the tube, produce secondary electrons strictly proportional to the electron density and, in consequence of releasing these to the target mesh, store and maintain the resulting pattern of positive charges. This positive charge pattern induces the scanning beam to deposit a similar pattern of negative charge on the opposite face of the target, the remaining beam being suitably pro-

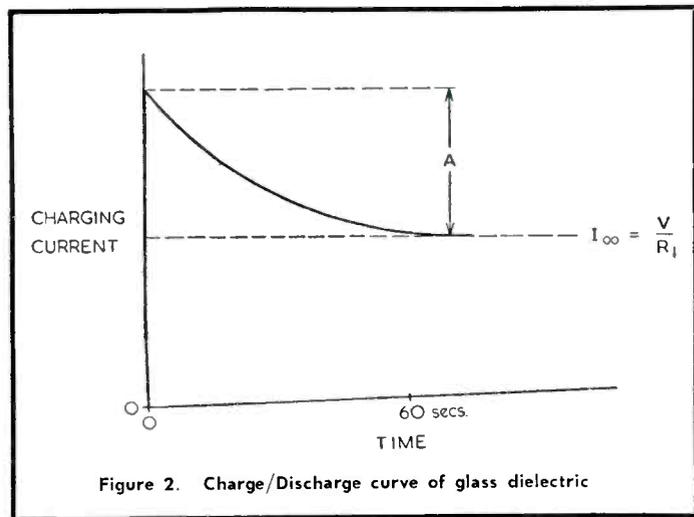


Figure 2. Charge/Discharge curve of glass dielectric

cessed to constitute the video signal. If the tube is to continue operating for more than a few frames it is necessary for the pattern of dipoles, resulting from the charging of the two faces of the target, to be discharged. This is achieved by selecting as target material a glass of sufficiently low resistivity; too low a resistivity will cause loss of resolution by lateral leakage of the charge image. The latter effect is minimised by keeping the target as thin as practically possible; even so, only a limited range of resistivity is permissible. At values above this range, signal remanence will result as the dipole pattern would fail to decay fast enough.

Targets are usually made of a modified soda glass having a conductivity of some three orders higher than that of ordinary window glass. Experiment shows that with such a target, sodium ions are responsible for its conductivity. During tube operation, discharge of the dipole patterns is effected by migration of positive sodium ions from the photocathode side to the beam side of the target. No mechanism exists for the replenishment of these conduction ions and, in time, the conduction process deteriorates due to the formation of a sodium deficient, highly resistive layer on the photocathode side of the target. Tube performance begins to fail and the target becomes 'sticky.'

All broadcasters and pick-up tube engineers appreciate only too well the significance of a 'sticky orth.' With such tubes the camera has to be carefully controlled and adjusted in order to avoid double exposure effects. Static camera shots and speculars are taboo, and the producer is restricted in his operational flexibility; orbiters only partially solve the problem.

Some years ago English Electric Valve Company initiated a programme of research directed towards finding an alternative target material which would use a different conduction process and eliminate deterioration.

The partial success of work being carried out elsewhere

on magnesium oxide and lead glass had been reported but it was considered that the attendant disadvantages precluded their adoption as target materials.

Magnesia, for example, has a tendency to be microphonic owing to its extreme fragility. Its thinness also permits the secondaries, produced by the photoelectrons, to pass right through it to generate objectionable picture background. (3).

Magnesium oxide films are also extremely difficult to produce without blemishes and, in consequence, its use for studio type image orthicons is not really feasible. Lead glass targets were equally difficult to manufacture consistently for, among other things, their transfer characteristics were extremely variable from tube to tube.

Before dealing with the practical aspects of target technology it is perhaps appropriate to consider very briefly a theoretical approach.

It is known that a pure insulator, such as mica, will function as an image orthicon target. Its signal output, however, soon ceases because the photocathode side will rise to a potential at which there is no net release of electrons to the mesh. As was mentioned earlier, it is necessary for there to be some leakage between the two target surfaces. This allows the photocathode side to fall to cathode potential after being discharged by the scanning beam. The standard glass target, whilst behaving as a leaky capacitor, has, additionally, an inconveniently high anomalous dielectric absorption. This phenomenon, discovered by B. Franklin in 1748, is described in detail by G. W. Morey. (1) Briefly, the result of this is that a target element behaves rather as a capacitor in parallel with a resistor but also with a third component, consisting of a resistor and capacitor in series, of such values as to have a charging time of about one minute.

Thus the flow of current into a glass dielectric follows the curve shown in Figure 2.

Decrement A is known as the Absorption Current and is recoverable over a similar period of time as that required for its establishment. The effect of this property is that the signal resulting from exposure to a given light level will decrease with prolonged exposure, even with a new tube.

With a conventionally operated image orthicon target, discharge by the beam occurs well before the final value of A is established.

Bearing these facts in mind it is possible to construct a circuit analogue for the target so simplifying further discussion of its behaviour. (Figure 3).

For a new target of sodium glass,  $R_3$  and  $C_3$  are substantially non-existent. They represent the resistive layer resulting from the migration of sodium ions to the beam

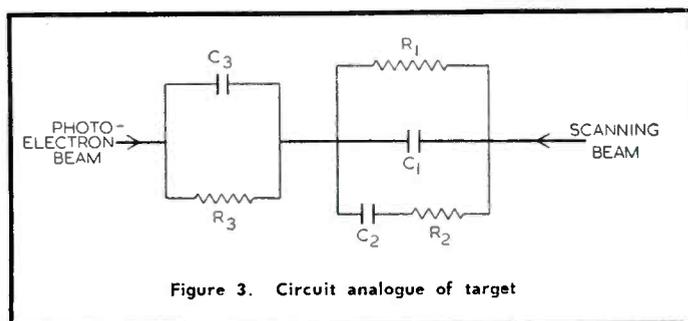


Figure 3. Circuit analogue of target

## Long-life television camera tube - continued

side of the target. As the target ages, however, they assume significant values.  $C_2$  with its attendant  $R_2$  is responsible for the decrement  $A$  in Figure 2. Our present knowledge suggests that for ideal target operation only  $C_1$  and  $R_1$  should exist.

In practice it may be reasonably considered that the conditions represented in Figure 2 hold for those parts of a target which are receiving a constant flow of photoelectrons. These areas never become completely discharged but the white signal from them gradually falls. It is clear that if by panning the camera, for example, this same photoelectron density is moved to a relatively underexposed part of the target a higher white signal than hitherto is obtained and the former white areas appear dark. A so-called sticking picture, in negative contrast, is then observed.

As  $R_3$  and  $C_3$  of the circuit become effective, the scanning beam is less able to efficiently discharge the target and sticking, more persistent than that associated with the absorption current occurs.

From a practical, manufacturing point of view, probably the most suitable target material is glass. In order to avoid deterioration however, it must conduct electronically and not electrolytically as is usual.

Glasses consist of combinations of various oxides and it is generally accepted that conduction in oxides is due to the presence of an element in two different states of oxidation. Conduction then takes place by electron transfer between the ambivalent ions of this element.

Preliminary experiments made on this basis confirmed that glasses containing substantial amounts of the oxides of Vanadium, Iron, Molybdenum, Tungsten and Titanium were electronic conductors. Of these, the type containing titanium would normally be an insulator because, when melted in the usual way, only the quadrivalent oxide occurred. However, by working in a reducing atmosphere it was found possible to convert some of the titanium to the trivalent state and the glass became conductive. The other glasses mentioned, when subjected to the caesium atmosphere necessary for activating the image orthicon photocell, underwent uncontrollable changes in their proportions of high and low oxides and their resulting conductivity was completely unpredictable. As such, these glasses were unacceptable and means had to be devised to use titanium glass which, for reference purposes, has been named ELCON.

The conventional 'soap-bubble' target manufacturing technique proved not applicable to the new material and a completely new process has been established.

The problem of working in an adequately reducing atmosphere proved extremely difficult, as minute amounts of oxygen contamination gave unacceptable results. However, the problem was overcome and successful non-stick image orthicons have been produced.

As sticking is a time dependent-function, is it not possible to illustrate the effect pictorially in this paper. However for lecture purposes a short kine-recording was

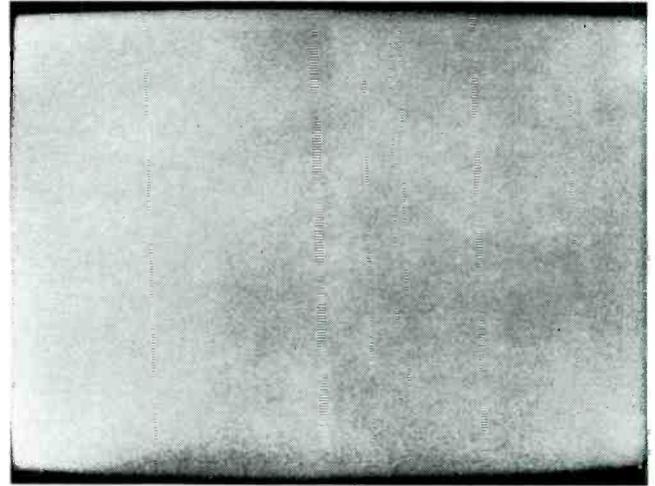


Figure 4. Picture from cameras before exposure

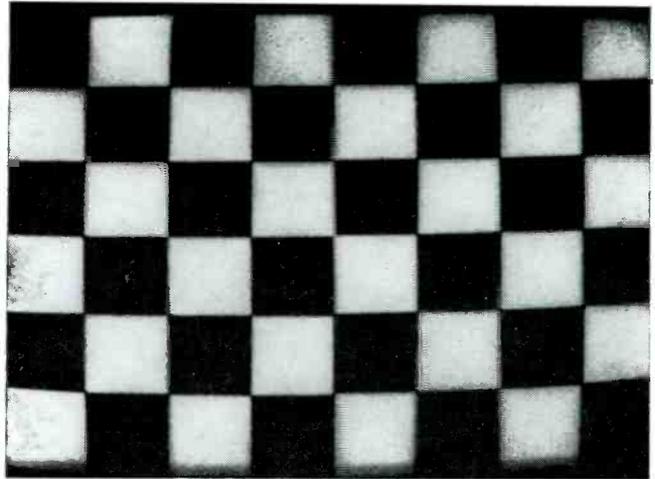


Figure 5. Matched exposure from each camera

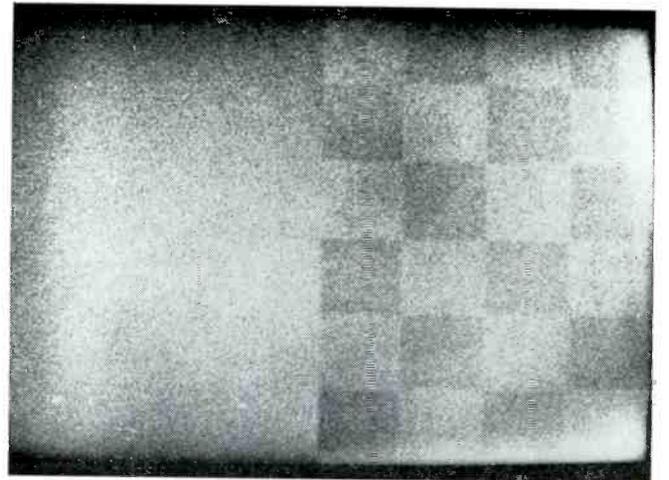
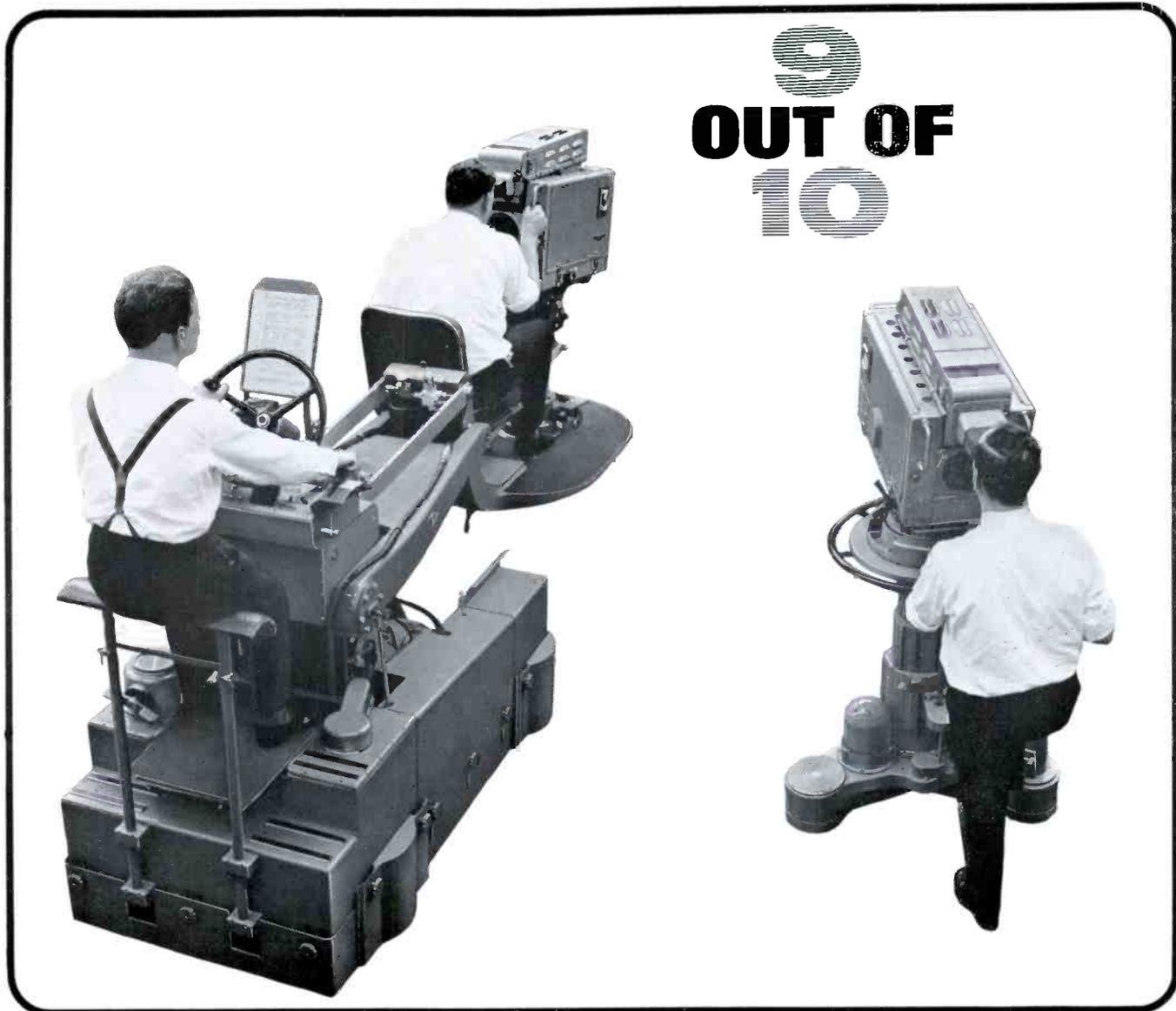


Figure 6. Lack of image retention of Elcon tube after removal of test charts



More than 90% of all T.V. studio mountings in Britain are supplied by VINTEN

What's more, the name is as well known overseas as at home and Vinten studio mountings are in use in at least 34 countries, from the U.S.A. to Japan, from Norway to Ghana.

The reason? Very simply—it's the finest equipment.

**HERON CRANE**

The most advanced camera crane in the world, the Heron is fully mobile with all movements hydraulically controlled. Smooth, quiet running and two-man operation combine to make this the most versatile studio vehicle obtainable.

**HYDRAULIC PEDESTAL**

The H.P. Pedestal has a vertical travel of 30 inches, the centre column being operated by hydraulic rams in three stages. Fluid pressure is maintained by a nitrogen pressurized accumulator.

**SPRING BALANCED PEDESTAL**

Of simpler construction this camera pedestal has a ver-

tical travel of 20 inches and offers ease of use and maintenance.

**PAN AND TILT HEAD**

The unique Vinten cam principle provides a very wide angle of tilt, and perfect balance throughout the full range of movement—features unobtainable with spring counter-balanced systems. Cameras up to 250 lb in weight can be carried safely and both pan and tilt movements are fitted with locks and friction adjustments.

**FALCON O.B. DOLLY**

The Vinten Falcon is designed to offer the producer of outside broadcasts camera mounting facilities equal to those in a studio. It can be quickly dismantled into four main sections for transportation and its light weight allows ease of handling in difficult environments. The Falcon offers camera shots previously unobtainable and combines this feature with smoothness, silence and rigidity.



W. VINTEN LIMITED, 713 NORTH CIRCULAR ROAD, LONDON, N.W.2. ENGLAND. Telephone: GLAdstone 6373

## long-life television

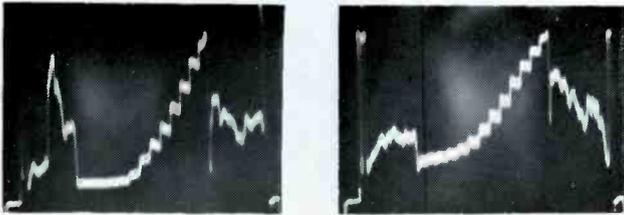


Figure 7. Waveforms of step-wedge exposed to the 'knee'

made. This latter is of a mixed monitor picture of a test card, half being from a camera containing an image orthicon with a normal target and half from a camera with an ELCON target tube. Each target was 500 hours old. The film sequence opens with each camera looking at a white card. These are then exchanged for chequer boards. After an exposure of about one minute the chequer boards are removed and the white cards replaced to indicate the difference in image retention for the two tubes.

In this paper are reproduced three stills from the kine recording.

The opening shot in Figure 4 shows some difference in picture level between the two half pictures with the darker right half showing some white edging. The darkening indicates the ageing which has occurred in the scanned picture area of the normal glass target and the white edge that part of the target which has not been used. As stated earlier, this change in surface properties is due to the reduction in the sodium content of the target surface resulting from the passage of picture charge. Compensation for the change, operationally, is made by adjusting target mesh voltage. Accompanying the change also is a loss of knee sensitivity. This is due to a reduction in target secondary emission and photocathode sensitivity caused by a reaction between the oxygen released from the target and the constituents of the photocathode.

Figure 5 shows that the picture set-up for the two targets was the same—matching being obtained by a judicious setting of target mesh potential, exposure and black level.

NOTE: In each of these three illustrations, Figures 4, 5 and 6 below, comparison is made between an ELCON target and normal target tube—each having completed 500 hours of operation. In each figure, the Elcon tube image is on the left.

N.B. The grain is from the high speed kine film used.

Figure 6 shows the monitor picture immediately after removing the test charts and illustrates the lack of image retention with the ELCON target—it remains substantially unchanged.

Also unaffected is knee sensitivity. This is defined as the photocathode illumination necessary to place the highlights of a scene at the knee of the transfer characteristic. Figure 7 shows a grey step wedge so exposed. At any light level, full modulation of the target depends on the luminous efficiency of the photocathode, the storage capacity of the target and the secondary emission coefficient of the target surface. A different target material changes only the latter. With ELCON glass, not only does the secondary emission coefficient remain constant with life but it does so at a somewhat higher value than is customary with other glasses.

Full target modulation is obtainable at lower light levels because the ELCON target is more sensitive.

A further benefit from high secondary emission is to reduce black compression—a common drawback of elderly image orthicons. Figure 7 illustrates this point. The difference in the tail ends of the two grey scales can easily be seen. Disproportionately low signals in the darker greys are due to signal cancellation, firstly, by secondary electrons from the mesh, and secondly, by redistributed secondary electrons from the target. The latter are more likely to be responsible for black compression since in these areas the field gradient prevents mesh secondaries from landing on the target.

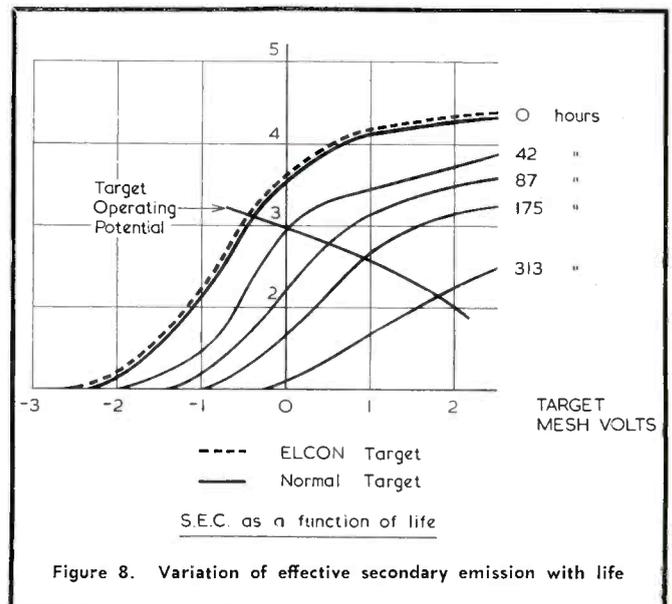


Figure 8. Variation of effective secondary emission with life

camera tube—continued

It may be argued that signal depression,  $S^d$ , is proportional to secondary electron emission; ie

$$S^d = K_1 \cdot E$$

where  $E$  is the secondary electron emission coefficient. The signal output,  $S^o$ , produced from any point in the image is proportional to the light level,  $L$ , and the gain of the target ( $E - 1$ ); ie

$$S^o = K_2 \cdot (E - 1) \cdot L$$

If  $S^d$  is equated to  $S^o$ , then the threshold light level,  $L^t$ ,

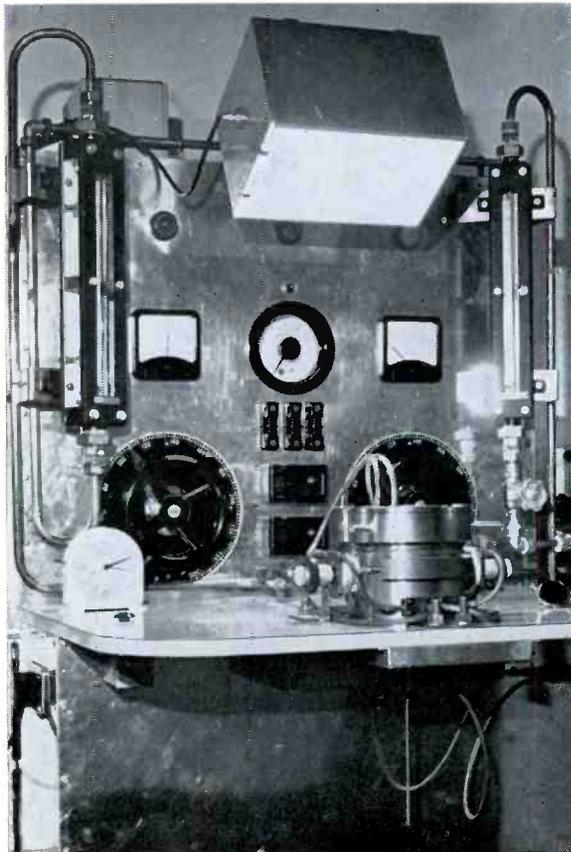


Figure 9. Equipment used in the manufacture of ELCON targets

at which signal output equals signal depression, is obtained.

$$K_1 \cdot E = K_2 \cdot (E - 1) \cdot L^t$$

$$L^t = K_3 \cdot \frac{E}{E - 1}$$

Obviously  $L^t$  is lower as  $E$  increases.

Figure 8 shows the variation of effective secondary emission with life, of typical samples of ELCON and normal glass targets. Conventional values of target operating potentials are also indicated.

Target potential is a full subject on its own but one appropriate facet is worth a mention. If the benefits accruing from operation at higher values are desired, the

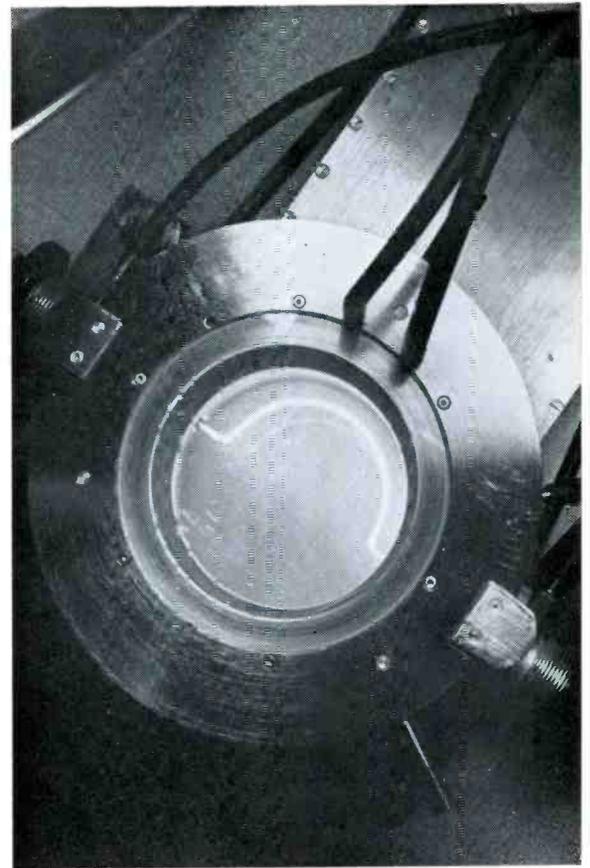
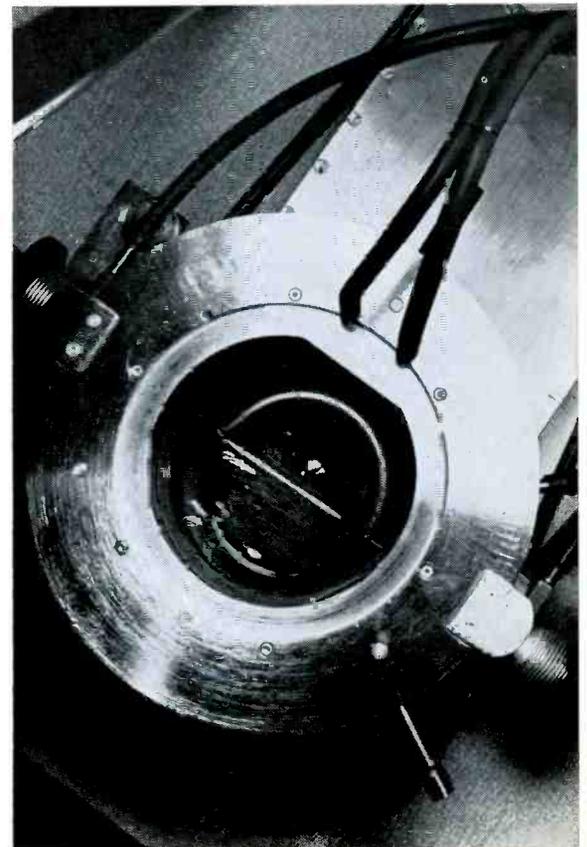


Figure 10. Forming the target film

Figure 11. Formed target film



# MANUAL CONTROL and PUSH BUTTON REMOTE CONTROL . . . . .

## How to maintain continuous programming economically by means of EVERSHED Servo Controlled Zoom lenses and T.V. Camera Mountings

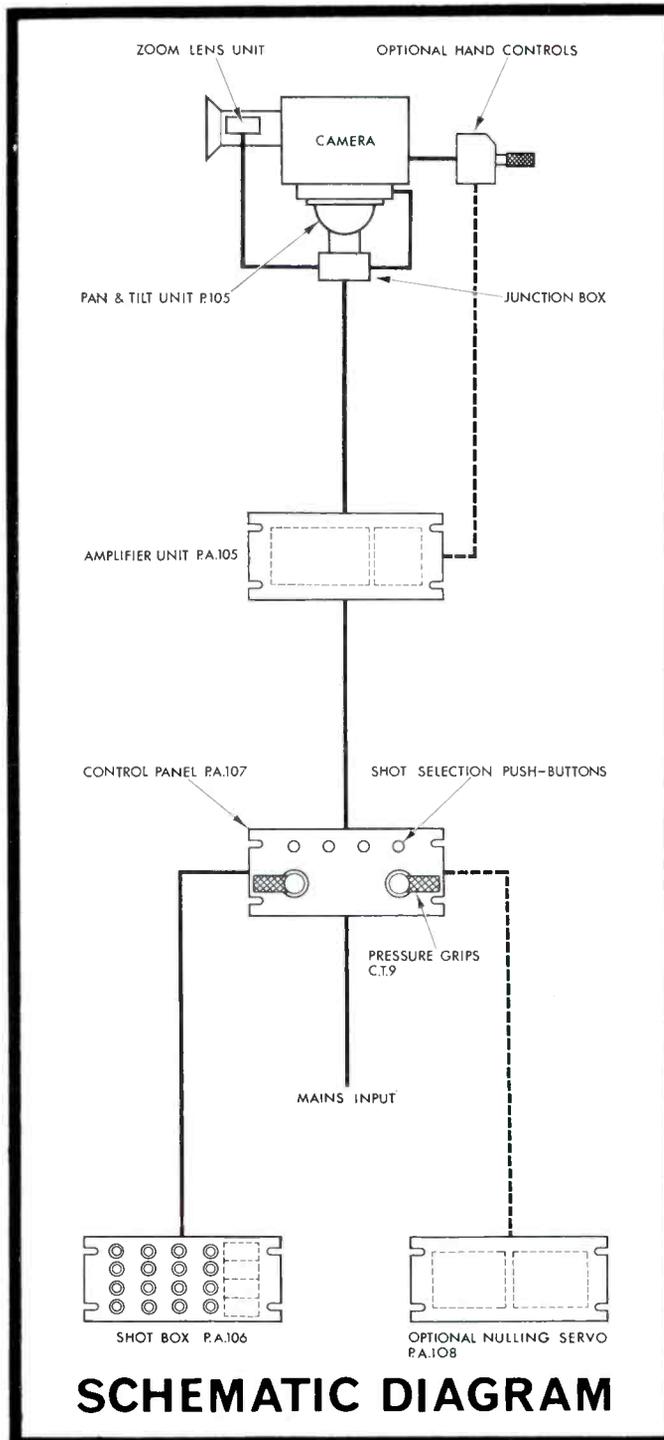


"We never closed" has become the catch phrase of at least one well-known English theatre, but how to maintain continuous studio facilities from sign-on to sign-off must be the problem of every progressive station.

Evershed Power-Optics equipment requires no warming up, just the flick of a control room switch provides instantly the basic facilities of remote control of Pan, Tilt, Zoom and Focus settings (Iris optional). Add to this the advantage of

pre-setting of any number of situations for push button call-up, together with smooth manual control for trickier camera work, and we can justifiably say that 100% of off-peak programming requirements can be met. If you are still in doubt, perhaps we should add that to back our system all ways, Evershed Power-Optics equipment allows a cameraman control of the zoom lens and camera orientation for those very special peak programme commitments.

**See it at the N.A.B. Convention at Washington D.C. March 21st-25th STAND 216**



**THE ESSENTIAL ELEMENTS IN THE EVERSLED SYSTEM ARE**

- 1 servo controlled ANGENIEUX 10:1 zoom lens for orthicon, vidicon or plumbicon TV formats
- 2 servo controlled panning and tilting camera head type P.105—for all makes of monochrome cameras
- 3 solid state transistorized rack-mounted amplifier
- 4 operator's control panel for remote control of pan, tilt, zoom, focus and iris (optional)

**INDIVIDUAL OPERATIONAL REQUIREMENTS THAT CAN BE PROVIDED INCLUDE**

- \* automatic pre-set push button control from a remote point of all five functions—pan, tilt, zoom, focus and iris
- \* smooth manual control at a remote point with bumpless transfer from pre-set shot to manual operation
- \* automatic fading from one pre-set shot to the next at pre-determined speed of operation
- \* local control at TV camera for busy periods of TV programming—switchable to remote when desired
- \* automatic operation of pre-set shots over telephone lines

All enquiries to:

**IMPORTANT POINT: Control panels are custom built to your own specifications**



214 HARLEQUIN AVENUE, BRENTFORD, MIDDLESEX, ENGLAND

Telephone: ISLeworth 6151

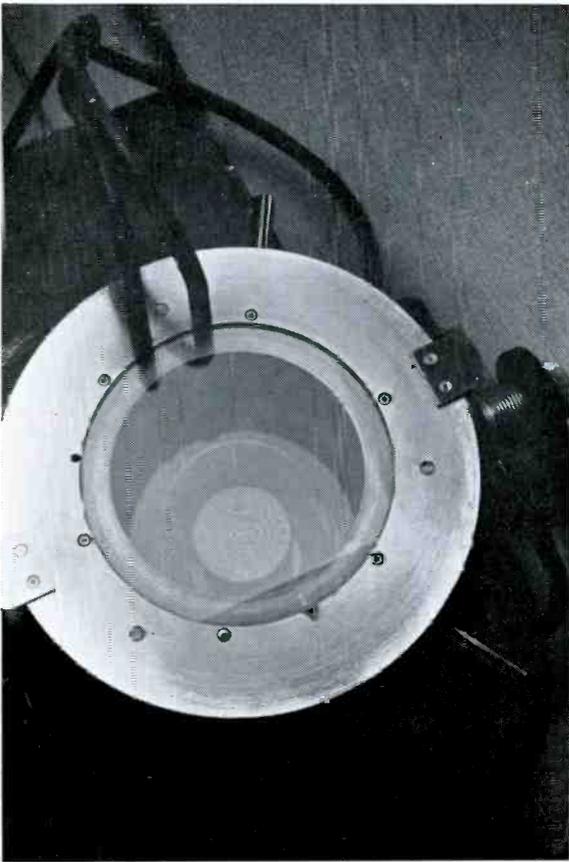
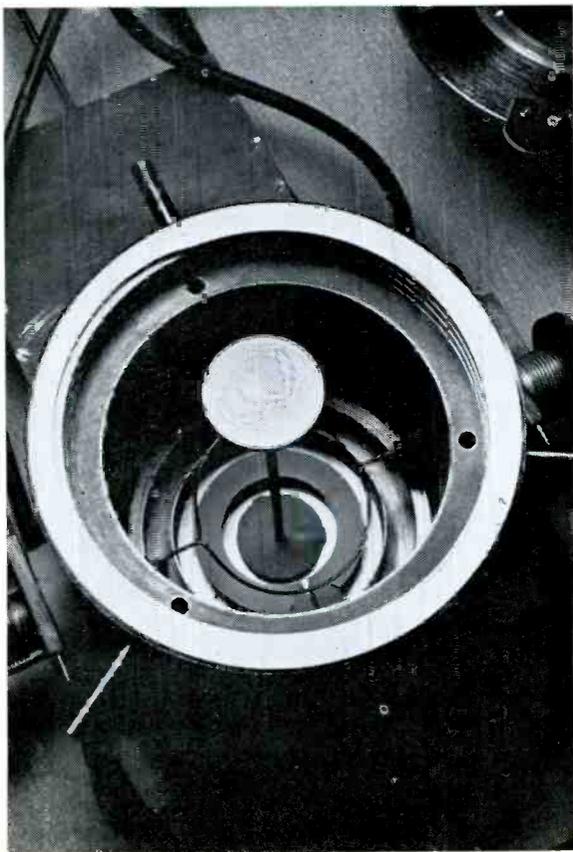


Figure 12. Target film sealed to the target ring

Figure 13. Completed assembly



## Long-life television camera tube -continued

fear of a shortened tube life is removed with the ELCON target. The argument that high charge currents, resulting from high target potentials, shorten tube life, no longer obtains. It has been found that, especially for multi tube colour cameras, the longer linear light transfer characteristic, resulting from target potentials slightly above customary values, leads to better tube matching. Also the tracking of large and small areas is more easily obtained. (2)

The subject of operating temperature is also much involved. Undoubtedly from the manufacturer's point of view it would be ideal if all tubes were operated at a fixed and constant temperature, but this, in practice, is impossible. Compromise conditions must be accepted both by the manufacturer and the operator. The ELCON target tube is no exception to this requirement but it does become operational immediately the camera is switched on—no warm up time to avoid sticking is necessary. This is not to say that the camera demands no more attention than, say, a studio spotlight or a microphone. For, as the equipment stabilises, slight adjustments may be necessary to orthicon electrode potentials. Due also to a small increase in the secondary emission coefficient of the target with temperature, target voltage may need to be slightly decreased during approximately the first 15 minutes after switch-on—a small price to pay for an immediate on-air facility.

On the question of operational life, only general claims can be made for longevity. Of necessity, laboratory life tests have been limited to a small quantity of tubes. However, the tests made were, and are, definite. They have been carried out under controlled conditions and give real comparisons with normal tubes tested under exactly the same conditions. The results therefore are meaningful and they indicate that lives of up to four times normal can be expected from the ELCON tube.

In field tests, it will be appreciated that clear statistics are difficult to obtain. So much depends upon the individual and, sometimes, personal requirements of station operators, and it is in this respect that only general figures can be quoted. In the USA and Canada, several stations have reported tube lives of over 3,000 hours. One tube has a recorded life of 5,000 hours to date. In Europe, where the tendency is to retire tubes earlier, lives of up to three times the normal maximum have been experienced.

The manufacture of ELCON targets calls for specialised techniques and manipulatory skills. A brief description of these follows.

As indicated earlier, it is essential that the molten target glass must not come into contact with oxygen or oxidising agents. The whole operation of forming the films

is therefore undertaken in a reducing atmosphere contained in a pressurised double walled vessel.

Figure 9 gives a general view of the equipment showing, in the centre, the melting cylinder with its gas and cooling supplies. Contained in the cylinder is a split wire loop one half of which can be rotated through gas tight glands. The first step in the process is the forming of a film in the gap between the two wires. (Figure 10). When conditions are then correct, the loops are quickly separated to form the film. (Figure 11).

To seal the film to its support ring the latter is heated to sealing temperature in the bottom of the chamber and then pushed up through the film.

The target is allowed to cool to ambient temperature before removal to the assembly room (Figures 12 and 13).

Careful control is maintained at all stages. This is particularly so where the glass resistance is concerned and also with the glazing cement used for sealing the target film to its support ring. This latter must be applied to the ring within carefully controlled thickness limits and to ensure this a custom built capacity bridge is used after being calibrated empirically. (Figure 14).

The absorption current of the glass is virtually zero but in order to monitor the production process a sample check is made on each batch of glass used. For this measurement and for that of resistance a simple sensitive galvanometer is used, mercury globules serving as contacts. (Figure 15).

At the time of the Symposium, sufficient progress had been made to enable the quantity production of 3-inch image orthicons incorporating the new target. It is anticipated that 4½-inch types will become available shortly and these will be in full scale production by Spring 1965.



Figure 14. Capacitance bridge

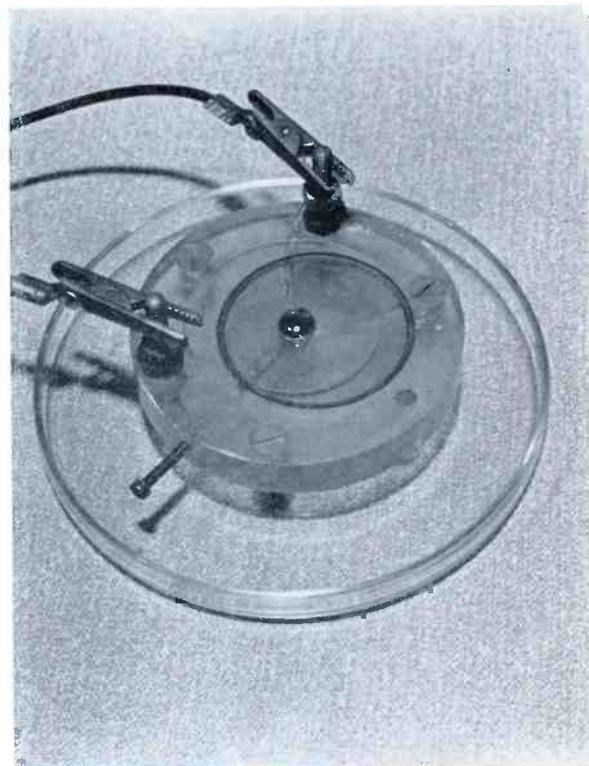


Figure 15. Resistance and absorption current measurement

#### Acknowledgements

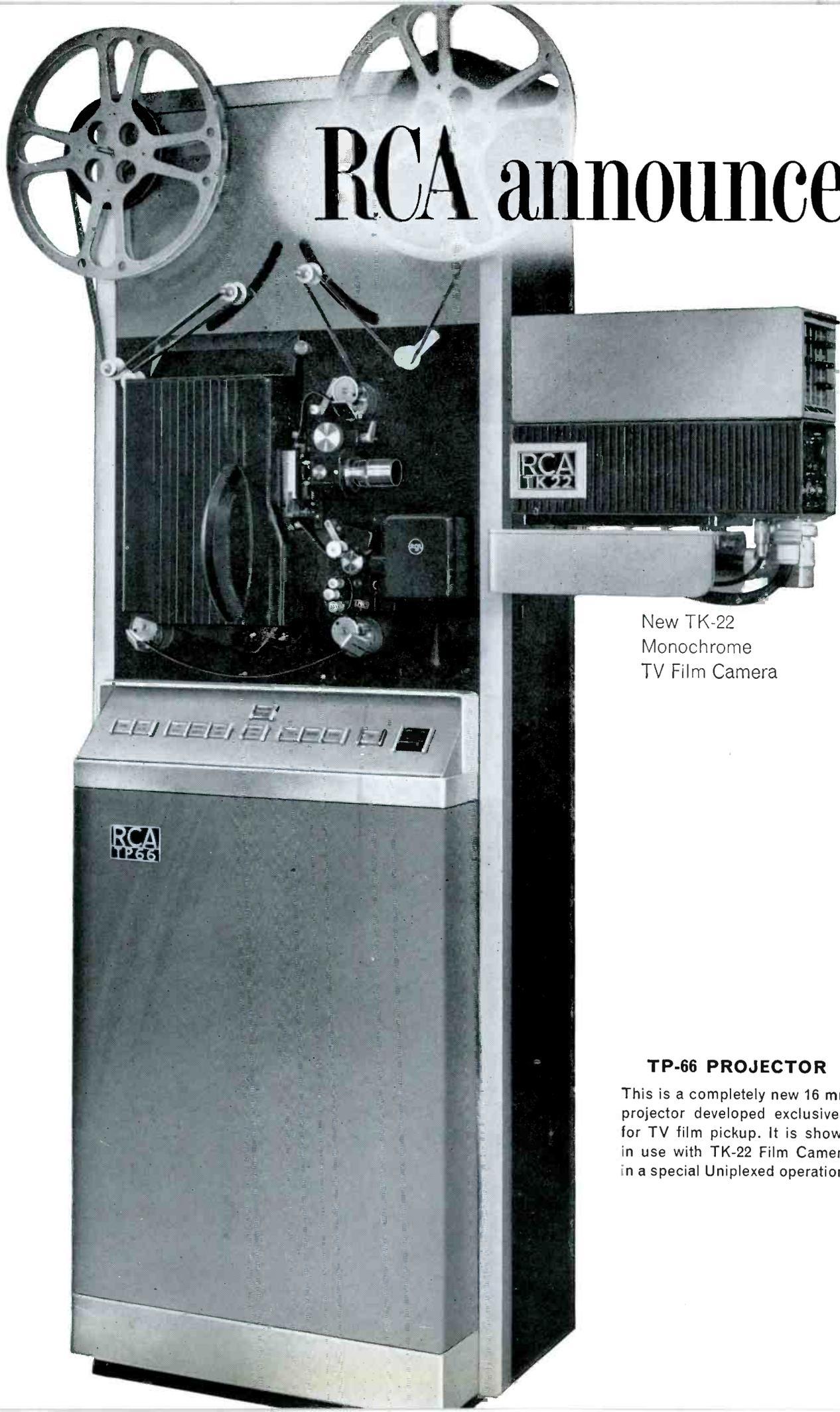
The authors gratefully acknowledge the help received from their several colleagues.

The authors also wish to express their thanks to Mr A. J. Young, Managing Director of English Electric Valve Company Ltd, for his permission to publish the paper and for his constant support and encouragement without which the project could not have been carried through.

#### References

1. Morey. Properties of Glass, 2nd Edition. pp 496-501, Reinhold Publishing Corporation, 1954.
2. Turk. International TV Technical Review, volume 5, no 1, pp 26-32, January 1964.
3. Turk. The TV Society Journal, volume 10, no 8, October/December 1963. pp 254-262.

# RCA announces...



New TK-22  
Monochrome  
TV Film Camera

## **TP-66 PROJECTOR**

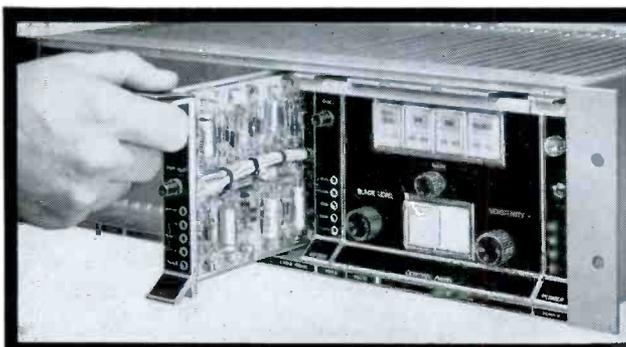
This is a completely new 16 mm projector developed exclusively for TV film pickup. It is shown in use with TK-22 Film Camera in a special Uniplexed operation.

# a new fully transistorized TV Film Camera

**The only tube in the TK-22 is its  
1½" vidicon picture tube with electrostatic focus,  
and this gives the camera its picture power!**

This compact, all-transistor, all automatic equipment is the most stable camera ever designed! With its larger 1½" vidicon tube developed specifically for use with transistorized circuitry, it provides the finest film reproduction ever offered.

- Automatic sensitivity control—to handle the widest range of film densities.
- Automatic black level control—to keep picture at most suitable contrast range.
- Automatic gain control—to maintain video at proper level and picture at peak quality.
- Highest stability—once setup, quality pictures last day after day without adjustment.
- Built-in test facilities—test pulses to check out the camera with minimum effort.
- Fully compatible with present multiplexer systems.
- Control equipment requires only 5½" rack space.



#### **TRANSISTORIZED ELECTRONICS**

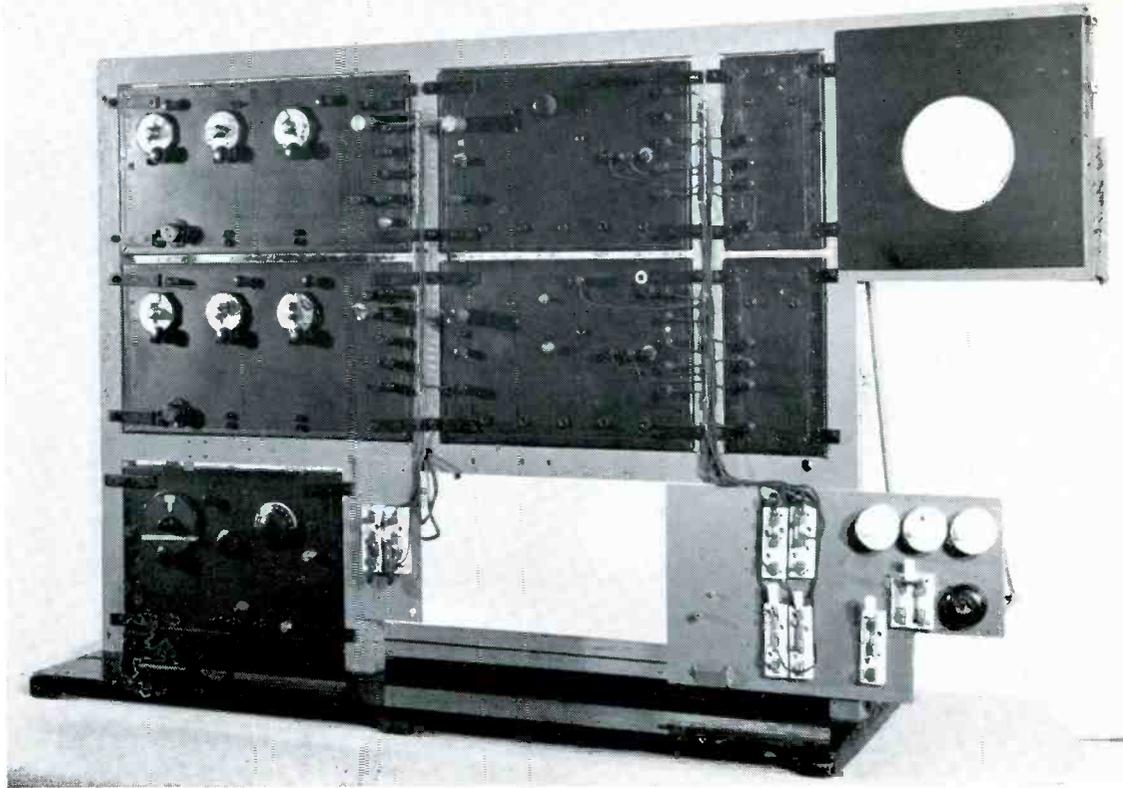
New rack mounted control module for TK-22 Film Camera is unusually compact—occupies only half a rack shelf—features interchangeable modules with TK-27 color film and TK-42 color studio camera modules.

For full particulars, write to Radio Corporation of America, Bureau de Controle, 13 Quai de L'île, Geneva, Switzerland; or RCA International Division, Department 200A, Central & Terminal Avenues, Clark, New Jersey, U.S.A.



**The Most Trusted Name in Television**

## FROM THE ARCHIVES



*Original Radar Receiver 1935*

**T**HE EQUIPMENT shown here was used by R. Watson-Watt and A. F. Wilkins in the historical experiment carried out near Daventry in February 1935 which demonstrated that radio echoes of measurable intensity could be received from aircraft in flight.

The equipment consists briefly of two stable super-heterodyne receivers having a common-beat frequency oscillator connected to the cathode ray tube.

The apparatus was set up at a temporary location near the BBC's short-wave transmitter at Daventry. The wavelength used in the experiment was 49.8 metres, employing

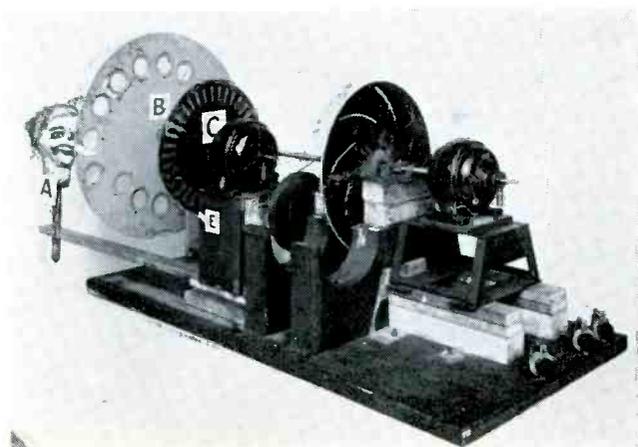
an aeral system consisting of two horizontal dipoles spaced 50 feet apart.

Faced with the threat of war with Germany and the risk of attack by hostile aircraft, Watson-Watt had proposed early in 1935 that the reception of radio-echoes re-radiated from aircraft in flight, might form the basis of a detecting and warning system.

The success of his experiments led to the development of the building of a chain of RDF (Relay) Stations around the coast of Britain in the few years prior to the outbreak of World War Two.

— by Morris Freedman

## World's first successful television apparatus



**T**HIS is the original apparatus used by John L. Baird which led him to the transmission of living human faces with light shade and detail. In January 1925, he used first a doll for his experiments.

(A) Shows the objects to be transmitted, the original doll used by Baird.

(B) The revolving disc with lenses causing a succession of object A to pass over the disc C.

(C) The slotted disc revolving for image.

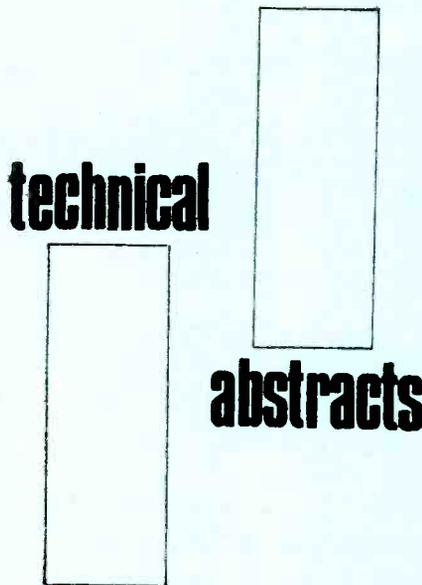
(D) The light passes through in rotating spiral slot giving a further subdivision of the images.

(E) The aperture through which the light passes to the light-sensitive cell.

The action of the discs BCD is to cause the light image to fall on the cell in a series of flashes, each flash corresponding to a small square of the image. These flashes falling on the cell generate electrical impulses which are transmitted to the receiving machine, where they control the light for a lamp placed behind an optical device, which is similar to and revolves exactly in step, with the transmitting machine.

By this means a spot of light of varying intensity is caused to traverse a ground glass screen. The light is bright at the high-lights and dim at the shadows. This light-spot traverses the screen so rapidly that owing to the persistence of vision the whole image appears instantaneously to the eye.

*It was with this weird apparatus in March 1925 that Baird televised the face of a young office boy named William Taynton—the first person ever to be televised.*


 technical

abstracts

#### TRANSMISSION

148. CASSEDY, E. S. Waves guided by a boundary with time-space periodic modulation.

Proc IEE, vol 112, no 2, 269—279, Feb 1965. Paper 4629E.

The author considers electromagnetic waves guided by a plane surface impedance which is modulated periodically in time and space in the travelling-wave sense. The problem treated is a linearised statement of the nonlinear parametric interaction of waves on an open waveguide structure: diags, graphs, bibliogs, refs.

149. LANE, J. A. and SOLLUM, P. W. VHF transmission over distances of 140 and 300 km.

Proc IEE, vol 112, no 2, 254—258, Feb 1965. Paper 4644E.

A description is given of measured field-strength characteristics on 186 and 174 Mc/s over distances of 140 and 300 km, respectively. The results show that for v.h.f. paths extending just beyond the normal horizon, with path lengths of 100—200 km, there are large variations in the amplitude and fading rate of the received signal. The field is influenced by components from the ground wave, reflection at elevated layers and scattering from random fluctuations in the refractive-index structure: diag, graphs, bibliog, refs.

150. PHILLIPS, G. J. and KNIGHT, P. Effects of polarisation on a medium-frequency sky-wave service, including the case of multihop paths.

Proc IEE, vol 112, no 1, 31—39, Jan 1965. Paper 4623E.

One aspect of propagation loss at medium frequency (m.f.) over long distances, namely the contribution due to what may be termed 'polarisation-coupling' losses is discussed. These must be considered quite separately from absorption losses: diags, graphs, bibliog, refs.

151. SESHADRI, S. R. Excitation of guided v.l.f. modes below a lossless anisotropic ionosphere.

Proc IEE, vol 112, no 2, 242—248, Feb 1965. Paper 4643E.

The excitation efficiencies due to a magnetic line source of the first four vertically guided modes below a lossless sharply bounded ionosphere are investigated, for the case of propagation transverse to the external magnetic field: diags, graphs, bibliog, refs.

152. SESHADRI, S. R. Radiation from an electric dipole in a plasma column.

Proc IEE, vol 112, no 2, 249—253, Feb 1965. Paper 4668E.

The study of radiation characteristics of antennas surrounded by plasmas is of relevance to radio-communication and telemetry to and from space vehicles re-entering the earth's atmosphere. Surface waves are found to be excited with maximum efficiency at about half the plasma frequency: graphs, bibliog, refs.

153. VLERKEN, W. H. Th. van. Radio communication and centralized traffic control for a railway system.

Philips Telecomm Rev, vol 25, no 3, 125—136, Dec 1964.

A single-track railway, 165 miles long, with nine sidings in Liberia has been provided with a telecommunication system which also caters for local traffic in the mine and harbour areas. In addition, the railway traffic is controlled centrally by means of a Centralized Traffic Control (CTC) system with facilities for two-way radio-telephony contact with train drivers and maintenance crew. A chain of repeater stations operating in the 7 Gc/s band is used: maps, diags, photos, bibliog, refs.

#### SATELLITE COMMUNICATION

154. CHAMBERLAIN, J. K. Interference between an earth station of a communications-satellite system and the stations of terrestrial line-of-sight radio-relay systems.

Proc IEE, vol 112, no 2, 231—241, Feb 1965. Paper 4638E.

A simple method is given of estimating the mutual interference that may arise between an earth station of a communication-satellite system and neighbouring line-of-sight radio-relay stations using the same frequency band. Criteria is suggested for deciding whether a proposed mode of earth-station operation is compatible with the maximum per-

missible values of telephone-channel interference noise recommended by the CCIR: diags, graphs, bibliog, refs.

155. DALGLEISH, D. I. and JEFFERIS, A. K. Some orbits for communication-satellite systems affording multiple access.

Proc IEE, vol 112, no 1, 21—30, Jan 1965. Paper 4642E.

This paper considers the influence of orbital parameters on the economic provision of simultaneous multiple interconnections between large numbers of earth stations in a global communication - satellite system: maps, graphs, bibliog, refs.

#### BROADCAST & TELEVISION RECEIVERS

156. AUSTIN, W. M. and DEAN J. A. A self-oscillating vertical circuit using a dual-control pentode tube.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 34—40, Nov 1964.

This paper describes a self-oscillating vertical circuit that is simpler and more reliable than the present multivibrator type and that has substantially improved performance characteristics. The increased simplicity and reliability will greatly ease the maintenance problem and substantially reduce circuit costs: diags, bibliog, refs.

157. FISHER, M. S. Protection of transistors in Class B audio output stages.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 26—29, Nov 1964

Failure of transistor class B output stages can occur when adverse conditions cause the output transistors to operate beyond their intended limits. This note describes a practical protection circuit which limits current flow from the power supply to the output transistors and thus protects the class B stage against the damaging effects of voltage surges, shorts, or other adverse conditions: diags, graphs, bibliog, refs.

158. GAUSMAN, T. E. Photoconductor high voltage regulator.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 23—25, Nov 1964.

The photoconductor regulator is an effective means of regulating high voltage at the input of the horizontal output tube in a colour TV receiver without affecting the scan. The development of higher dissipation horizontal tubes, or the lowering of high voltage requirements for small screen sets will enhance the use of this approach to high voltage regulation: diags, graph.

159. HIRSCH, C. J. A study of the need for colour controls on colour TV receivers in a colour TV system operating perfectly.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 71—96, Nov 1964

A complete investigation of the need for controls to adjust "hue" and "saturation" requires a careful study of possible errors in the whole colour

TV process from the original scene to the human brain. A few causes of colour variations that occur even in a perfectly adjusted system are discussed. These include viewer preference, ambient illumination, differences in individual colour response and deficiencies in the "taking" primaries of cameras: diags, graphs, bibliog, refs.

**160. McTAGGART, J. E.** A high performance transistor IF amplifier for hybrid television receivers.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 60—65, Nov 1964.

The transistorized IF described will replace a quality 3 tube IF satisfactorily, meeting the four main objectives of performance, adaptability to an existing tube receiver, producibility and comparable cost: diags, photos, bibliog, refs.

**161. MORRELL, A. M. and HAROY, A. E.** Development of the RCA 25-inch 90-degree rectangular colour picture tube.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, No 3, 15—22, Nov 1964.

The new RCA-25AP22 25-inch rectangular 90-degree shadow-mask colour picture tube represents a basic advance in picture-tube development. Improvements include a new bulb design, a four-point mask-support system, and an electron-gun structure having a reduced size. The RCA all-sulphide screen used adds to the efficiency of the 25AP22: diags, graphs, bibliog, refs.

**162. PLUS, L; SANTILLI, R. A.; and THANOS, H.** A new UHF/VHF silicon transistor for the consumer market.

IEEE Trans on Bdcst & TV Receivers, vol BHR-10, no 3, 46—54, Nov 1964

The author, of RCA describe a new n-p-n silicon uhf-vhf transistor, RCA Dev No TA2503, having electrical characteristics tailored for consumer amplifier applications at frequencies up to 900 megacycles. Gain and noise through the useful frequency range are discussed, and relative performance is given for various vhf and uhf applications: diags, graphs.

**163. REYNOLDS, W. H.** A high quality economical UHF tuner.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 41—45, Nov 1964

An easy-to-manufacture high quality UHF tuner is described which is currently lower in cost than other high quality tuners and where design emphasis was placed on years of completely trouble-free operation. The author is with the Zenith Radio Corporation: diags, photos.

**164. RUSH, J. W. and HENDRICKSON, D. D.** A novel approach to a low cost high-gain television intermediate frequency amplifier.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 30-34, Nov 1964.

A new tube, consisting of a dual control and a sharp cut-off pentode in the same envelope, has been developed. This tube, the GE Company Y-1187, makes possible a one-tube, two-stage, IF amplifier that attains the same performance level as most three-stage IF amplifiers that are used in black and white television receivers at considerably less cost: diags, bibliog, ref.

**165. SCHWARTZ, S. A.** Simplified processing circuitry for a television receiver.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 55—59, Nov 1964.

The video amplifier described in this paper overcomes most of the objectionable features of more conventional d-c and a-c coupled amplifiers. In addition, it causes transistor capability to be more fully utilized and thus provides better performance and larger safety margins: diags.

**166. SEGRAVE, P. A. C.; COURT, P. R. J. and REITER, A. M.** A unique method of rendering television intermediate frequencies independent of tuner oscillator drift.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 8—14, Nov 1964.

This paper describes the development of a circuit which stabilizes television intermediate carrier frequencies, without the aid of feedback or servo systems, to the accuracy of a crystal-controlled oscillator yet allows tuner oscillator frequency variations of the order of + 1.25 mc: diags, bibliog, refs.

**167. SPIES, R.** A subtractive synchronous colour-killer circuit for colour television receivers.

IEEE Trans on Bdcst & TV Receivers, vol BTR-10, no 3, 66—70, Nov 1964.

Adding a low-cost silicon diode to the existing colour phase detector results in a very reliable noise-immune phase detector which provides the proper signal voltage for the killer tube. An output voltage will only occur when the colour reference oscillator is locked by the burst signal. This voltage is high enough to cut off the killer tube: diags, graph.

**168. HACKING, K.** An analysis of film granularity in television reproduction.

Journal SMPTE, vol 73, no 12, 1015—1029, Dec 1964.

The transfer of emulsion granularity in a television system when film is the picture source is considered in some detail using the Wiener spectrum of the film-grain to describe its near-random statistical properties: diags, graph, bibliog, refs.

(a reprint of BBC Engineering Monograph No. 54)

**169. LANGE, M. and BRETTING, K.** Die TV 21c-Anlage im Sternpunkt des Fernschleitzungsnetzes (I. Programm) in der Bundesrepublik Deutschland.

Rundfunktechn. Mitt, vol 8, no 6, 347—357, Dec 1964.

The TV 21c installation in the network centre of the First Television Programme in the German Federal Republic is described: maps, photos, diags, bibliogs, refs. (In German).

**170. MAYER, N. and SAND, R.** Geräte zur Messung der differentiellen Phase und ihre Anwendungsmöglichkeiten.

Rundfunktechn. Mitt, vol 8, no 6, 358—366, Dec 1964.

Apparatus for measuring differential phase and its applications is described and attention drawn to a relatively simple instrument which makes use mainly of the circuit technique of a colour-television receiver: diags, graphs, photos, bibliog, refs. (In German).

**171. QUINN, S. F. and DICKSON, J. B.** New CBC vidicon-telecine operating standards.

Journal SMPTE, vol 73, no 12, 1009—1015, Dec 1964.

Presented at the Society's Technical Conference, Los Angeles, 1964. Results presented are from an investigation to obtain optimum picture quality in 16 mm vidicon-telecine installations of the Canadian Broadcasting Corporation. Picture quality is examined in terms of signal-to-noise, ratio, resolution, gray-scale rendition and lag: diag, graphs, bibliog, refs.

**172. SCHURER, J.** Verfahren und Einrichtung zur regiemässigen Bearbeitung von Videomagnetband- und Pilotonaufnahmen.

Rundfunktechn. Mitt, vol 8, no 6, 367—369, Dec 1964.

Control equipment and technique for television tape and pilot-tone recordings are described. It is possible, in the one track of a television tape, to mark the individual pictures by means of a continuous sequence of numbers in coded form. In this way, the handling of two recorded strips is considerably facilitated. For the choice of individual pictures, a selection of the pictures in question may be transferred to a still-storage device, together with the coded numbers: bibliog, refs. (In German).

**173. TAGER, P. G.** Image distortions due to misalignment of head wheel and vacuum guide.

Journal SMPTE, vol 73, no 12, 1029—1031, Dec 1964.

A theoretical research is made to find the location of recorded TV signals on transverse track video tape. Equal location will take place if the eccentricity is zero. The study also explored the qualitative and quantitative aspects of monitor image distortions in a general case, where the vacuum guide in playback is not too far from a close to, the head wheel, but is also higher or lower than it is in recording. Theoretically calculated distortions are in good conformance with hitherto published experimental data: diags, graphs, bibliog, refs.

- 3,156,769 JEROME MARKOWITZ**,  
821 N. 30th St., Allentown,  
Pa.  
Stereophonic tonal output from single  
audio input channel. Nov 10 1964
- 3,156,770 HERSHMAN MUSICAL IN-  
STRUMENT CO, INC, New  
York, NY.**  
(Charles C. Trainor).  
Method and apparatus for selectively  
controlling sound emission.  
Nov 10 1964
- 3,156,785 AMPEX CORPN, Redwood  
City, Calif.**  
(Harold G. Hummel).  
Tape editing aid. Nov 10 1964
- 3,156,787 HENRY K. PUHARICH, 87  
Hawkes Ave, Ossining, NY &  
JOSEPH L. LAWRENCE,  
570 Fort Washington Ave,  
New York, NY.**  
Solid state hearing system.  
Nov 10 1964
- 3,156,915 RAYTHEON CO, Lexington,  
Mass.**  
(Richard E. Lang & Robert  
L. Wychoff).  
Multi-channel systems. Nov 10 1964
- 3,156,916 MARCONI CO, LTD, Great  
Baddow, England.**  
(Dennis W. G. Byatt).  
Radio direction finders. Nov 10 1964
- 3,157,736 GEORGES VALENSI, 3 rue  
des Chaudronniers, Geneva,  
Switzerland.**  
Electronic device for synchronizing  
colour television receivers.  
Nov 17 1964
- 3,157,737 TELEPROMPTER CORPN,  
New York, NY.**  
(Hubert J. Schlafly).  
Subscription television distribution  
system with recording means at the  
receiver. Nov 17 1964
- 3,157,738 SHIRO OKAMURA, 2-26  
Shiroganedaimachi, Shiba,  
Minatoku, Tokyo, Japan.**  
Standards conversion for television  
signals. Nov 17 1964
- 3,157,739 SHIRO OKAMURA.**  
Signal recording and reproducing  
system. Nov 17 1964
- 3,157,740 ROBERTSHAW CON-  
TROLS, Co, Delaware.**  
(Cecil A. Crafts).  
Transmitter and receiver for phase  
modulated signals of the relative phase-  
shift type. Nov 17 1964
- 3,157,742 PYE LTD, Cambridge, Eng-  
land.**  
(Michael J. D. Nurse).  
Frame and line synchronizing signal  
separator using sinusoidal keying  
pulses. Nov 17 1964
- 3,157,749 AGFA AKT, Leverkusen-  
Bayerwerk, Germany.**  
(K. Bammerberger & others).  
Method and apparatus for super-  
imposing an additional recording upon  
an existing sound record.  
Nov 17 1964
- 3,157,814 SIEMENS & HALSKE AKT,  
Berlin & Munich, Germany.**  
(Franz Gross).  
Relay line for travelling wave tubes.  
Nov 17 1964
- 3,157,871 R. A. MacPLUM INDUS-  
TRIES, Inc, New Jersey.**  
Shopping cart provided with radio  
receiving apparatus. Nov 17 1964
- 3,158,683 PHILCO CORPN, Philadel-  
phia, Pa.**  
(Richard E. Waggener).  
Composite signal producing apparatus  
with means for producing sync pulses  
by offsetting black level.  
Nov 24 1964
- 3,158,695 IIT RESEARCH INSTI-  
TUTE, Illinois.**  
(Marvin Camras).  
Stereophonic system. Nov 24 1964
- 3,158,696 SANDERS ASSOCIATES,  
INC, Nashua, NH.**  
(Paul F. Hayner & others).  
Tape recorder. Nov 24 1964
- 3,158,774 US SECRETARY OF THE  
AIR FORCE.**  
(John F. Fleming & Daniel  
C. Buck).  
Image orthicon focusing coil and field  
flaring ring. Nov 24 1964
- 3,158,778 ROBT H. JOHNS, Bryn  
Athyn, Pa.**  
Phase modulated television camera  
tube. Nov 24 1964
- 3,158,831 US SECRETARY OF THE  
NAVY. (George L. Boyer).**  
Underwater acoustic intensity meter.  
Nov 24 1964
- 3,158,863 DECCA LTD,  
(Wilfred St. John White).**  
Hyperbolic radio navigation system.  
Nov 24 1964
- 3,159,711 N. A. PHILIPS CO, INC,  
New York, NY.**  
(Theodoor G. Schut).  
Device for the magnetic recording of  
television pictures. Dec 1 1964
- 3,159,782 MOTOROLA INC, Chicago,  
Ill. (Harold Tyzack).**  
Motor driven television tuner having  
safety switch preventing channel step-  
ping while fine tuning. Dec 1 1964
- 3,159,791 BUNKER-RAMO CORPN,  
Stamford, Conn.**  
(Joseph L. Czubiak).  
Narrow band audio frequency filter-  
ing system. Dec 1 1964
- 3,159,830 SPERRY RAND CORPN,  
New York, NY.**  
(Malcolm Macaulay).  
Method and apparatus for visual pre-  
sentation of digital and analog infor-  
mation. Dec 1 1964



## BOOK REVIEWS

**The History of Broadcasting in the United Kingdom, volume II: The Golden Age of Wireless, by Asa Briggs (Oxford University Press, 75s)**

**Das Fernsehen in den Ländern Westeuropas: Entwicklung und gegenwärtiger Stand, by Gerhard Eckert (C. Bertelsmann Verlag, Gütersloh, 18, 50 DM)**

by **RENE ELVIN**

WHEN I first came to this country from my native France thirty years ago, I was armed with a few useful letters of introduction, and one of the first persons I met was Gerald Cock, who had just been appointed BBC Director of Television. At that time, in the early spring of 1935, TV, to the uninformed public, was hardly more than a fanatical glint in John Logie Baird's and Gerald Cock's eyes, in fact, almost a Cock and Baird story. Nevertheless, experiments had been going on at the BBC since 1929, in co-operation first with Baird alone, later also with Marconi-EMI, and though the results were technically fairly primitive, they were enough to inflame the pioneers with a burning and catching enthusiasm. Cock, who arranged a demonstration for me in a small room deep down in the bowels of Broadcasting House, blurted out that TV was 'the greatest medium for communication the world has ever seen'—and so it has proved.

The early days of television in Britain, the first country in the world to have a regular television service, which started operating daily for an hour on November 2, 1936, make a fascinating history. It is admirably told in Professor Asa Briggs' massive history, the second volume of which, covering the period from 1927, when the BBC ceased to be a private company and became a public corporation, up to the outbreak of war in 1939 was published recently. That period comprises the advent of television, from the first experiments of John Logie Baird in 1923 to the memorable words included in the last item to be televised on September 1, 1939, a Mickey Mouse film, 'Ah tink ah go home.'

In fact, the fifth section, *The New World of Television*, running to well over 100 pages, is easily the best description of the infant invention and of its first flowering that I have yet come across. Though based on mountainous documentary material, it never ceases to make lively reading, and the author has an eye for picturesque detail, the telling anecdote, that animates what might have been bogged down by the masses of memoranda, minutes and other evidence that had to be gone through to ensure the accuracy of this standard work. The pen sketch of Baird, 'a model for the schoolboy's picture of a shock-haired, modest, dreamy, absent-minded inventor,' makes the man come to vivid life. The figure that dominates the whole volume is of course the giant one of Sir John (now Lord)

Reith, the son of the manse who, more than any single individual, shaped the 'age of broadcasting' after his own image, and 'spent sixteen years of his life in creating one of the most distinctive and impressive of modern British institutions.' He discovered wireless as a toy, and left it as the most powerful medium of communication ever.

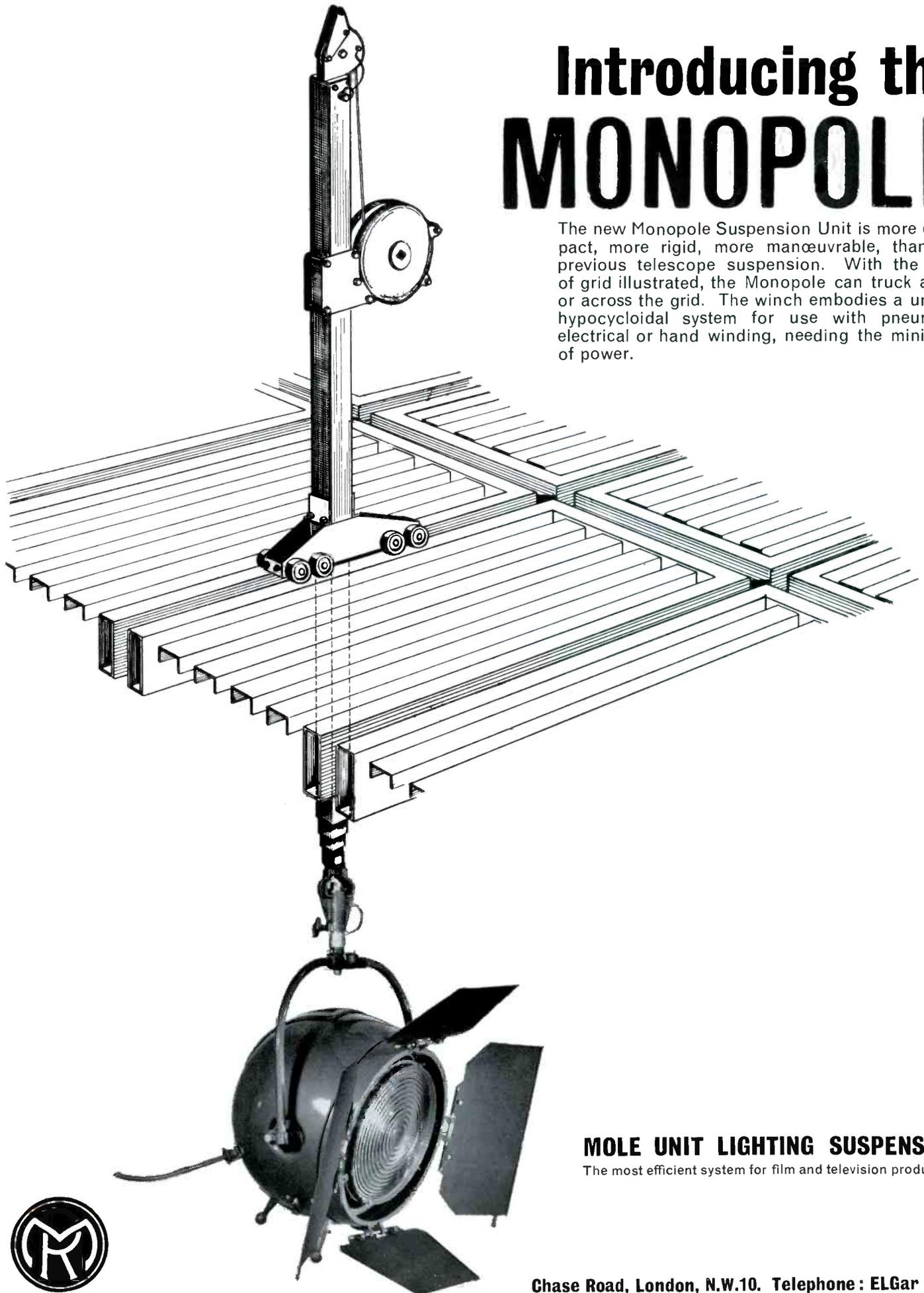
The whole huge tome of nearly 700 pages, one of four volumes that will eventually bring the history of broadcasting and television down to the present day, is as fascinating and unique as that medium itself. It is, of course, scrupulously fair, yet does not attempt to whitewash occasional failings, and the gallery of characters it etches is a sharply drawn and true to life as can be expected in a work dealing with personalities many of whom are, fortunately, still alive and kicking.

The second volume under review, though far shorter than Professor Briggs' magnum opus, completes it in some useful respects. It is, in fact, the first survey I know that covers the history and present situation of television in all West European countries, including the problems of programme building, studio organisation, viewers' research, relations with the State, Eurovision, etc. Dr Gerhard Eckert, who was actively engaged in broadcasting during the war and later had considerable practical experience in television, enjoyed the help of the German Government in his study, to compile which he travelled extensively throughout Western Europe in order to collect the considerable material on which it is based. Not the least interesting part of the book is an item by item comparison of the TV programmes sent out by all West European stations during four typical days (March 12 to 15 1964). In all its variety, this synopsis does indicate the beginning formation of a European television style, mingling, in strikingly familiar proportions, news, entertainment, education, sport, etc.

The author has, incidentally, some very pleasant things to say about British TV, praising in particular its masterly camera work and its technically high standards, that, according to him, make it stand out pictorially even when the origin of the film is not known. He also likes the natural acting of performers and the fluid, easy direction that makes the programmes enjoyable to watch. He finds in both ITV and BBC programmes a unity in diversity that strikes him as the very style TV should aim at.

# Introducing the MONOPOLE

The new Monopole Suspension Unit is more compact, more rigid, more manoeuvrable, than the previous telescope suspension. With the type of grid illustrated, the Monopole can truck along or across the grid. The winch embodies a unique hypocycloidal system for use with pneumatic electrical or hand winding, needing the minimum of power.



## MOLE UNIT LIGHTING SUSPENSION

The most efficient system for film and television production



**MOLE-RICHARDSON (ENGLAND) LTD.**

Chase Road, London, N.W.10. Telephone : ELGar 6834  
Cables : Molereng London Telex 221227

Branch companies and agencies throughout the world,



## Receiving tubes

■ SYLVANIA ELECTRIC PRODUCTS INC, USA, announced the development of a special line of receiving tubes that allows operating voltages of colour TV sets to be reduced from 400 to 250-270 volts. The tubes will enable colour set manufacturers to achieve greater economy, better performance, improved reliability, and more latitude in circuit design.

Low-voltage types and multifunction tubes have been developed for critical applications such as deflection amplifiers, dampers, colour demodulators, video amplifiers, high-voltage rectifiers, and focus rectifiers.

Receivers using these new Sylvania tubes can be designed without a power transformer, and with lighter, less expensive filter circuits. Substantial reduction in the over-all cost of set manufacture is the end result.

The development of the low-voltage receiving tubes ranks alongside Sylvania's earlier announcement of the development and availability of the Color Bright 85 picture tube as one of the most significant advances in colour television in recent years. The Color Bright 85, introduced in June, uses a new combination of phosphors, containing the rare earth element europium, to produce a colour picture that is more than 40 per cent brighter than currently available picture tubes.

Presently available in Sylvania's 21-inch, 70-degree round tube, the phosphor combination also will be used in Sylvania's 25-inch, 90-degree rectangular tube.

## Processing plant

■ THE RANGE of Geyer equipment — hitherto often sold under the trade name 'Union' — is now marketed in the UK by Cinematograph Export Ltd.

The Geyer range includes processing plant

for all types of negative, positive, colour reversal and black and white film, together with a most comprehensive list of printers. Optical picture printers, contact step printers, continuous contact printers, optical sound printers and their accessories are available for 8 mm, 16 mm and 35 mm film and the range includes enlarging and reducing printers working between these sizes. Models are supplied for both monochrome and colour printing.



Geyer double-sided developing machine

Geyer processing equipment is built largely as special purpose installations from a comprehensive range of standard units; it has achieved a world-wide reputation for the quality of the processed film and the high engineering standards observed. Cinematograph Export Ltd are able to offer the full range of Geyer Equipment in the UK and their resources enable them to service or install equipment as required.

# NEW DEVELOPMENTS

## Preset potentiometer

■ THE TYPE 62 is a new screwdriver-adjusted preset potentiometer made by Morganite Resistors Limited. It is intended specifically for use in miniature equipments where small size is all-important. The component measures approximately 12 x 9 mm.

Tags are spaced to suit standard 2.5 mm (0.1 in) module piercing. The contact can be adjusted from either side of the component and the resistance track is protected against accidental damage during adjustment.

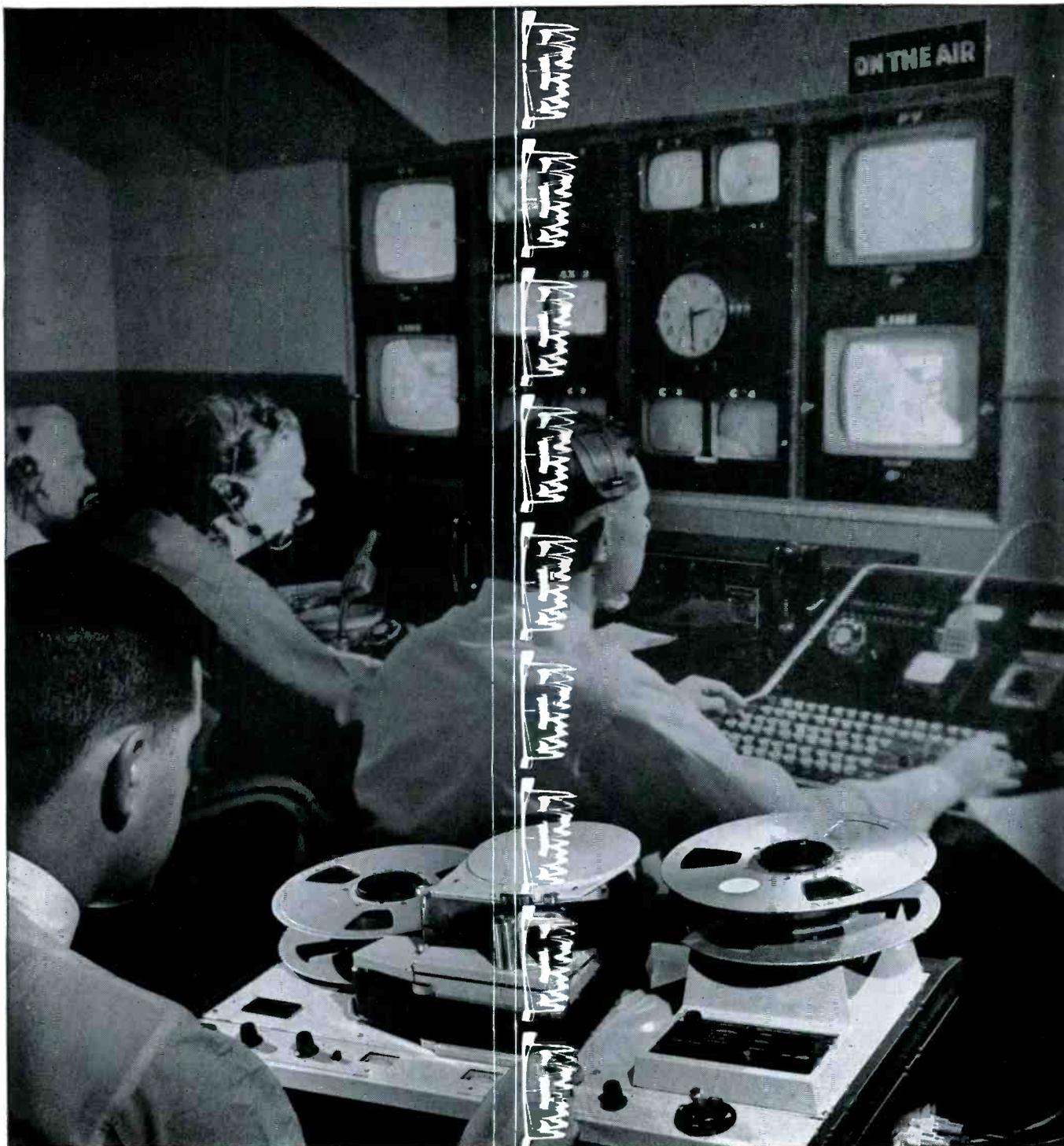
Of the two versions offered, both plug directly into the printed circuit board. The Type 62H mounts horizontally and the Type 62V mounts in an upright position. Power rating: 0.2W @ 40°C ambient. Resistance Range: 100Ω — 1 MΩ.

## Miniature transformers

■ A COMPREHENSIVE RANGE of miniature transformers and chokes suitable for pulse, audio, power and instrument transformers and close tolerance inductors and chokes is available from Parmeko Limited of Leicester.

Models from this range—development was based mainly on a progression of core sizes—have many applications throughout the electronics industry where complete reliability and high electrical performance are required. They are already widely used in space probes, radio satellites, rocket guidance systems, aircraft instruments and systems, underwater communications, safety systems for mines, and high quality stereo and audio equipment.

This range, known as the 4000 series, has been awarded certificates of Advanced Quality Approval in the Humidity Class of H2 and Temperature Category of 40/70 (RCS 214)



### What's new in broadcast VTRs?

### AMPEX VR-650

Hear Ampex Stereophonic demonstrations in Room 121 or Booth 15 at the International Audio Festival & Fair

Now: Ampex has a low-cost, portable VTR with full broadcast stability . . . the VR-650. It is capable of handling any broadcast application. And the complete price is less than half as much as other Ampex video recorders. It weighs less than 100 pounds and is small enough to fit in a station wagon for a mobile unit. It's ideal for recording special events, local sports and news. It has signal compatibility with all other VTRs. And, when played through your station's processing



amplifier, its signal meets broadcast specifications. The new Ampex VR-650 has two audio tracks. It records at 4.1 ips—or more than two and one half hours on a single 10½ inch reel. (60 cps versions travel at 3.7 and can handle up to five hours of tape.) It is extremely simple to operate . . . easy to maintain because it's fully transistorized . . . and it offers Ampex reliability. For more information, write to Ampex Great Britain Ltd., Acre Road, Reading, Berkshire.

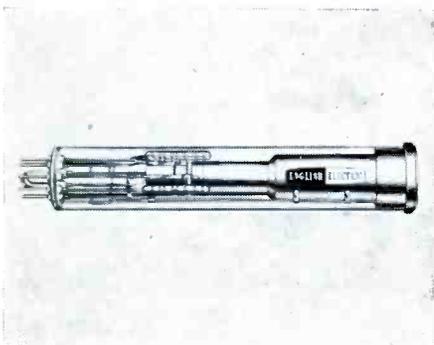
continued from page 300



by the Joint Service Radio Components Standardisation Committee. General construction of these transformers and chokes, the result of many years of research into the design of miniature components, is in accordance with DEF 5214.

Open models from the 4000 series utilise the complete Parmeko range of single and double bobbins and are particularly suitable for applications where compact reliability is required. Most of these open models are available with ferrite cores. Terminations are made to pins moulded into the bobbin cheeks. Three types of clamp can be supplied to suit individual mounting requirements.

Three alternative forms of assembly are available: encapsulated, aluminium cased, and magnetically screened. The encapsulated models are resin cast and have the additional advantages of greater mechanical rigidity and electrical insulation. The aluminium cased potted models employ epoxy resin or other suitable compounds to present a simple form of mounting with all the advantages of the encapsulated models. The problems of magnetic interference are overcome by using mumetal cases, and double or triple screened models can be supplied when required. The terminations of these alternative forms may be supplied to suitable pins or flying leads, depending on the form of assembly and the number of winding ends.



## One inch vidicon

THE RANGE of English Electric Valve Company high resolution, separate mesh 1-in vidicons, has been further extended with the introduction of two types having high peak response in the 'blue' region of the spectrum.

These tubes, the P846 and P847, incorporate entirely new photo-surfaces providing:

Very high and uniform sensitivity.

Extremely low lag and reduced long term sticking characteristics.

Correct panchromatic response with tungsten illumination.

High resolution at high signal currents.

Excellent signal uniformity is achieved with improved manufacturing techniques whereby photo surfaces are 'prefabricated' to ensure an

overall even deposition. Studio lighting levels may be considerably reduced due to the very short lag times promoted by the new photo surfaces.

A further important advantage is extremely good reproduction of flesh tones, due to the well balanced spectral sensitivity of these vidicons.

The introduction of the new photo surfaces, in combination with separate field mesh construction, makes the P846 and P847 vidicons eminently suited for live and telecine pick-up in both colour and monochrome television. The extra blue sensitivity gives a useful improvement in signal to noise ratio in colour TV cameras, and also promotes high signal output in applications where light with high blue content is used, eg fluorescent lamps, natural daylight, etc.

The P846 has a standard 6.3V/0.6A heater, and the P847 has the new low consumption 6.3V/.095A heater.

Information on the complete range of EEV vidicons is available on request from the EEV Sales Department, Chelmsford, Essex.

## Akai recorders

FOLLOWING the formation of Pullin Photographic, The Rank Organisation intends to fully develop its acquired interest in the UK distributorship of Akai professional tape recorders and accessories.

The Akai recorders are available in four models, three of which are making their first appearance on the British market. All are monoaural/stereo machines with advanced features and capable of fully professional quality results.

The Akai 44S is a four-track, three-speed ( $7\frac{1}{2}$ ,  $3\frac{3}{4}$ , and  $1\frac{7}{8}$  ips with provision for 15 ips) machine, capable of stereo and monoaural recording and playback. Use of a micro-gap head results in frequency responses of 40–14,000 cps  $\pm$  3 dB at  $7\frac{1}{2}$  ips, 40–8,500 cps  $\pm$  3 dB at  $3\frac{3}{4}$  ips and 40–4,500 cps  $\pm$  3 dB at  $1\frac{7}{8}$  ips with respective wow and flutter levels of less than 0.15%, 0.25% and 0.35% rms at these speeds. A 5-in speaker is incorporated for monitoring, and the true quality of the 6-watt (3-watts per channel) amplifier is achieved by the use of additional matched speaker enclosures.

The Akai X4 is the world's only rechargeable battery/mains portable stereo/monoaural recorder. Into a 10-in by  $9\frac{1}{2}$ -in by 4-in case are packed more features than ever considered possible before. These include interlocked piano key controls, and a quarter-track record/play, erase and cross-field bias system of heads together with a new design of constant speed dc micromotor to ensure superb quality at the four tape speeds. Performance figures are: 40–20,000 cps  $\pm$  3 dB and wow and flutter less than 0.16% rms at  $7\frac{1}{2}$  ips with equally impressive figures at  $3\frac{3}{4}$  and  $1\frac{7}{8}$  ips; and an outstanding 30–5,500 cps  $\pm$  3 dB with wow and flutter less than 0.35% rms at 15/16 ips. Maximum reel size is 5-in. The transistor amplifier gives 2-watts maximum on each channel and can be monitored on the internal 5-in elliptical speaker or fed to hi-fi speaker enclosures. Two high-sensitivity dynamic microphones are

supplied for stereo recording, and twin VU meters (as well as providing a battery check) ensure perfect recording level. Up to  $6\frac{1}{2}$  hours running time are achieved with a single charge.

The model M8 also uses the Akai cross-field head system to gain exceptional performance. A four-speed, four-track machine, it imparts far richer depth of stereo replay by introducing a vertically directed loudspeaker system, in the recorder itself, to supplement the output from the standard matched twin stereo speaker system. Power output of the M8's amplifier is a maximum of 6-watts per channel. Exceptional versatility is provided by a host of features: highly efficient ventilation, large VU level meters, four-digit index counter, superimposition and auto-stop.

## Electrical connector

THE FERRANTI low force electrical connector has found widespread acceptance in industry as a reliable back-mounting connector for rack-mounted equipment, principally because it eliminates the need for any additional toggle or screw devices for insertion or withdrawal.

As it can also be used with either free plug or free socket for front panel applications—increased use is being made of it in this role—Ferranti Ltd of Dundee have introduced a range of aluminium alloy covers suitable for use with 35 pole, 70 pole and 91 pole plugs or sockets.

Captive screws enable the covered plug or socket to be locked securely to the equipment; screwed holes or bushes must be provided in the equipment panel to receive the captive screws. Cable outlets are available in three positions, ie top entry, angle entry and side entry. A strong glass-loaded nylon cable clamp, which will accept a wide range of cable diameters, is attached to each cover. The clamp is easily adjusted by means of a single screw which requires only moderate tightening to ensure a firm grip on the cable. As the clamp is tightened, the space vacated by the cable is shielded by a sliding tongue attached to the compression saddle.

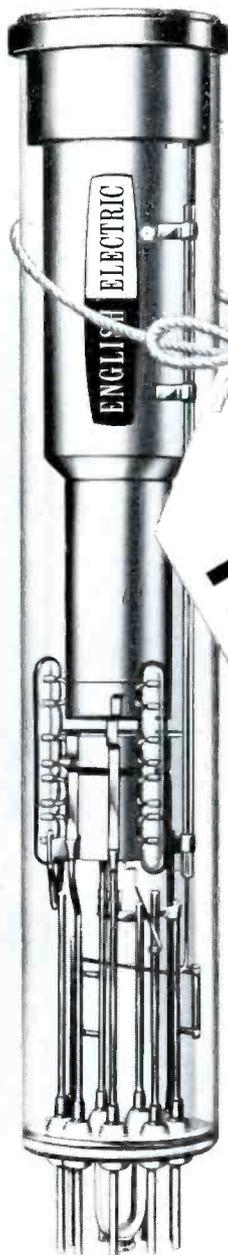
## Coated wires

JOHNSON, MATTHEY & CO, LIMITED are now able to supply their ranges of resistance and potentiometer wires coated with Trimel(R) a new high temperature enamel that can be used up to 200°C.

Trimel is a synthetic enamel of the poly-imide type, and although there is at present no British Standard specification that relates to enamels of this type, the new enamel has been tested in accordance with the procedures laid down in BS 1844: Part 1: 1961. All the tests that are linked to stability at elevated temperatures were carried out at 130°C, the temperature specified in BS 1844, and also at the very much more stringent temperature of 200°C.

Even at the higher temperature, Trimel enamelled wires successfully passed the tests.

# NEW DEVELOPMENTS



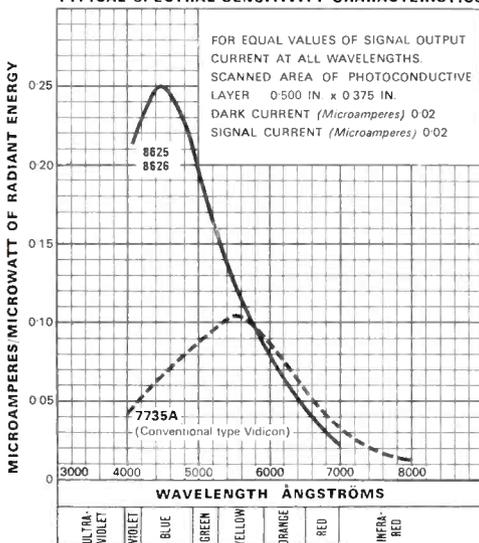
**NEW**

high-sensitivity

**VIDICONS**

*(with short lag)*

TYPICAL SPECTRAL SENSITIVITY CHARACTERISTICS



**ENGLISH ELECTRIC**

ENGLISH ELECTRIC VALVE COMPANY LIMITED can now supply from stock new high sensitivity vidicons which represent an important development in television camera tubes.

These new separate mesh tubes are characterised by their high sensitivity, short lag and high resolution. The spectral response peaks in the blue to provide correct panchromatic reproduction when used with tungsten lighting yet the sensitivity is equal to that attainable with "red sensitive" types such as the 7735A. Although primarily intended for broadcast television these tubes have many industrial applications especially where fluorescent lighting is employed. Two types are available, differing in heater ratings:

8625 with 6.3V/0.6A heater.

8626 with 6.3V/0.095A heater.

Please write for comprehensive data on these and other EEV vidicons.

**ENGLISH ELECTRIC VALVE CO LTD** CHELMSFORD ENGLAND  
Telephone: Chelmsford 3491, Ex 262, Telex 99103 | AGENTS THROUGHOUT THE WORLD

**EEV**

## NEW DEVELOPMENTS



■ C-COR ELECTRONICS has developed a new line of amplifiers, designated their Min-Econ line. Utilising standard packaging techniques, and standardising on common parts wherever possible, this line offers a wide variety of amplifier designs.

Among the models currently available are wide-band units with passbands ranging from a few cps to 500 mc/s, US Navy preferred video circuits, ultra-stable, and low distortion amplifiers, impedance matching amplifiers scope preamps, and VHF and UHF narrow-band amplifiers.

### New model

■ THE WELL-KNOWN RANGE of sync pulse generators manufactured by Thorn Electronics Ltd will shortly include a new and versatile model in which the use of silicon semi-conductors establishes an even higher standard of long-term dependability.

Its features will include:—

(1) 'Clock pulse' control resulting in close tolerance timings from jitter or drift, and avoiding the need for internal timing adjustments. (2) Accurate rise times. (3) Availability of line drive timing advance to accommodate camera cables of up to 2,000 feet in length. (4) Separate slaving ('Sync Lock') unit providing a maximum field 'pull in' time of  $2\frac{1}{2}$  seconds and a choice of line lock response times. (5) Continuously variable manual field phasing control. (6) availability of multi-standard versions with push button standard selection. (7) Trigger pulses for field interval test signal insertion and field identification. (8) Colour gate pulse. (9) Provision for external twice line frequency drive derived from subcarrier. (10) Remote control of all switch facilities if required.

No selected components are used, and individual plug-in printed cards may be interchanged.

The availability of a separate 'Sync Lock' unit enables the user to add slaving facilities at a later date and will also permit the substitution of alternative forms of synchronisation demanded by future changes in slaving techniques.

### Diodes

■ THREE new high-output gallium arsenide light-emitting diodes (LED's) that greatly increase the application scope of devices of their kind, are now available from International General Electric Company of New York Ltd, British marketing subsidiary of General Electric, USA.

Room temperature infra-red output of the new LED's is an order of magnitude higher than that of previous models, making them well matched to present-day silicon detectors and opening the way to card-reading by reflective means.

Other potential pulsed and continuous wave applications for the devices, LED-9, LED-10 and LED-11, include security photo-electric systems; high-speed infra-red photography; thickness

monitoring of semi-transparent material; optical-coupled computer elements where fast information transmission without cables is desired; and high-voltage isolation, with the LED's used in conjunction with a light-activated switch.

Minimum continuous output of the LED-10 at room temperature is 100 microwatts, with a typical output of 300 microwatts. This is achieved with an input of 100 milliamperes at a wavelength of 9,000 angstroms and a spectral bandwidth of 210 angstroms. Pulsed output at  $-77^\circ$  Kelvin (the temperature of liquid nitrogen) is as high as three watts (8,450-angstrom wavelength, 170-angstrom spectral width).

The new LED's also have a high frequency modulation capability (well above 10 megacycles), which is particularly useful in data and communications systems where large amounts of information are to be put on light beams. This characteristic, together with the small size of LED's, gives them significant advantages over the tungsten filament lamps frequently used in computer card read-out and security photoelectric systems. The LED's also provide an extremely uniform and well-defined light source across the radiating surface and operate over a very wide temperature range (from  $-77^\circ$  K to  $+125^\circ$  C).

In addition, the ruggedness of the tiny components has been proved in a year of life testing with no catastrophic failures.

The LED package consists of a TO-46 header with a TO-18 style cap with lens. It is 0.225-in in height and 0.230-in in diameter. The LED-10 and LED-11 are essentially alike except that the latter has a removable lens cap that permits designers to supply their own optics. The LED-9 is a lower-output version of the LED-10.

### Improvements

■ WILLY HUNGERBUHLER announces important improvements in the Sondor loop-tape holder appliance which was described in detail in the October issue of International Broadcast Engineer. These machines now incorporate the following new features:

- (i) Built-in pre-listening head.
- (ii) Complete solid state control.
- (iii) They can be synchronised with video tape recorders together with automatic remote control.
- (iv) They can be supplied with built-in CRT enabling complete control of synchronism.

### Power amplifiers

■ A NEW RANGE of pocket-size power amplifiers has been produced by Cambridge Consultants Ltd, of England. These amplifiers will find application in hi fi units, public address systems, vibrator drives and research. Fully transistorised, they are claimed to have efficiencies of 90 per cent which makes them specially suitable for battery operation.

Announcing this development, the managing director, Timothy Eiloart—who, while still an undergraduate, first made news by attempting a balloon crossing of the Atlantic—said that the amplifiers would be available either in board form to manufacturers wishing to incorporate them in new equipment or as self-contained units.

All the amplifiers have been designed to the most exacting hi fi specification to give frequency response from DC to 15 Kc/s. Noise and distortion figures are claimed to compare favourably with those of the best valve amplifiers. Full protection has been incorporated against short circuits.

The present range of cased amplifiers complete

with mains power units is made in three sizes, up to 100-watts, up to 500-watts and up to 2-Kilowatts. Models up to 250-watts are available now, but so far the firm has made the larger amplifiers only to special order, and the first 2-Kilowatt amplifier will be completed later this year.

### Important addition

■ ENGLISH ELECTRIC VALVE COMPANY LTD announces the important addition of coaxial versions of all EEV ignitrons within the international size groups A to D.

The new coaxial types supplement the existing A to D size ignitrons, the latter continuing in production at the Company's Lincoln factory.

Full technical information on the complete range of EEV ignitrons now available may be obtained on request from English Electric Valve Company Limited's Sales office, Carholme Road, Lincoln. Enquiries from government departments and overseas customers should be directed to the Sales Department, Chelmsford, Essex.

### Solid state

■ HEWLETT-PACKARD ASSOCIATES announce a new solid state photon coupled amplifier (hpa 4302), which combines recent developments in semiconductor sources and detectors with improvements in fibre-optic technology to provide a truly new concept in practical functional electronic building blocks. This four terminal signal isolator has no mutual input-output electrode, and can be used to transfer signals from one circuit to another without electrical contact.

The optical coupling is accomplished by driving a GaAs injection luminescent diode and channeling the photon radiation generated to high gain silicon phototransistor. A fibre-optic lightpipe is employed for a high transmission efficiency from the photoemitter to the photodetector.

The new device can be used as a general circuit isolator, for remote sampling of current waveforms, to replace transformers or relays, and to eliminate ground loops in electronic systems. It can provide DC coupling with microsecond response over potentials of up to 10,000 volts.

Typical electrical characteristics include: A large signal current transfer ratio equal to 0.1, a small signal current transfer cut off frequency of  $1 \times 10^5$  c/s, and a power dissipation of each device of 100  $\mu$ W at  $25^\circ$  C. The isolation between input and output exceeds  $10^{13}$  ohm shunted by less than  $10^{-14}$  farads. For larger bandwidth applications another photon coupled isolator is available. Namely the hpa 4301 which uses a PIN photodiode, rather than a phototransistor, thus extending the bandwidth to 100 Mc/s with a corresponding reduction in gain.

### Pulse generators

■ THREE FULLY TRANSISTORISED pulse generators made by Intercontinental Instruments Inc of New York are now available in the UK through Claude Lyons Ltd.

Models TPG-1D, TPG-2 and TPG-3 form a range of versatile pulse and square wave generators, each providing simultaneous positive and negative outputs in excess of 20 volts into 50 ohms, with rise and fall times better than 8 nanoseconds and unlimited duty factor. Loud currents of up to 400 mA can be obtained and no damage will result if outputs are shorted. A panel meter provides accurate calibration of

## Marker

frequency, amplitude, width and delay. All models permit external bias up to 200 mA.

The TPG-2 has a frequency range of 1 c/s to 12 Mc/s for square wave or delayed pulse, 1 c/s to 8 Mc/s for double pulse and 1 c/s to 16 Mc/s for single pulse. Either the first or second pulse, or both pulses, can be individually selected to appear at either the positive or negative output. Width of both pulses is the same and is variable between 30 nanoseconds and 0.15 second. Pulse delay can be adjusted between 60 nanoseconds and 15 milliseconds.

The TPG-3 also provides double pulses, but with pulse widths independently adjustable, and is characterised by a maximum pulse repetition rate in excess of 20 Mc/s. Pulses are generated at both the leading and lagging edges of the square wave frequency source, making available two alternating trains of pulses, each capable of independent width adjustment over the range of 30 nanoseconds to 0.25 second. In addition, a symmetry control permits the training edge pulse to be adjusted approximately  $\pm 10$  per cent about its true centre. Leading- and lagging-edge pulses can be brought with 10 ns of each other. The ability of the TPG-3 to provide alternating pulses of variable width and having variable spacing between pulses makes it an ideal instrument for testing of code transmission, telemetry and similar equipment.

Both the TPG-2 and the TPG-3 feature the availability of alternate positive and negative pulses from the same output, and continuously variable reference, making them ideally suited for bipolar testing of magnetic cores and rapid testing of logic circuits through ground.

The TPG-1D provides square waves and delayed single pulses from 1 c/s to 12 Mc/s, with pulse width from 30 ns to 0.15 sec and delay from -10 ns to 0.15 sec. Dual outputs and associated switches permit choice of positive and negative pulses independently at each of the two output connectors. The pulse baseline is variable and can be adjusted independently of amplitude.

The TPG-1D, TPG-2 and TPG-3 can all be synchronised or triggered with an external signal from DC to 12 Mc/s, and can be externally gated to obtain a synchronised pulse train. A sync output of 3 volts positive, pulse width 50 ns is provided. All have overall dimensions of 8" x 9" x 14" and weight of 20 lb.

## Indicators

**HOROCONTROLS** are precision electro-mechanical elapsed time indicators designed to work from 50 c/s AC supplies. They consist of a small synchronous electric motor driving a train of five numbered wheels. Models are available to work from 127 or 220 volts. The latter model will also work from 380 volts with the addition of a resistance of 15,000 ohms, 3 watts.

Type 'H' is a wall mounted unit, whilst type 'HE' is designed for front panel mounting. There are two versions of each type, one reads up to 9,999.9 hours, the other up to 999.99 hours.

## Second generation

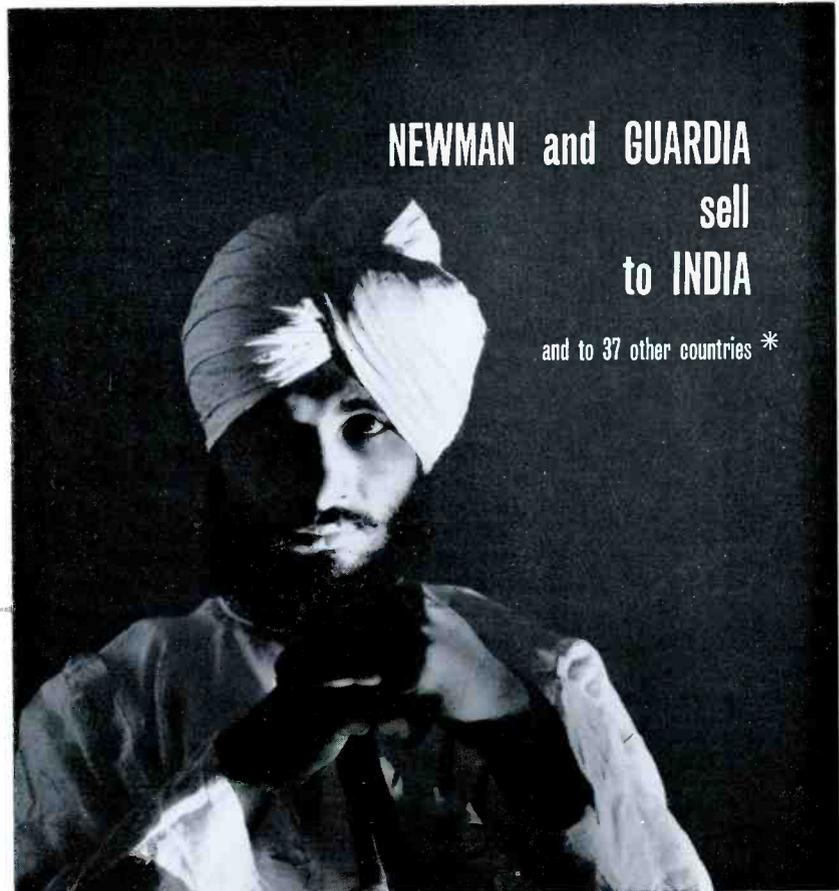
**AVELEY ELECTRIC LIMITED**, announce that North Atlantic Industries Inc, originator of the phase angle voltmeter, now offers a completely new three frequency instrument designated the '21.' This is a second generation instrument. It is available with removable end bells for either bench or rack use.

Designed for military or commercial application, the instrument features plug-in modules for interchangeability of fixed frequency channels

with no soldering or external test equipment required.

Measurement capability includes operation as a conventional VTVM from 10 cps to 100KC. As a phase angle voltmeter, channels are available for any three frequencies from 30 cps to 20 KC, all  $\pm 5\%$  band width without adjustment. Phase sensitive null sensitivity is better than 1.0 microvolt. All functions operate over 13 ranges, 300 microvolts to 300 volts full scale.

**THE MODEL TMS-1 Microwave Marker Generator** is a unique instrument recently announced by Telonic Engineering, Inc. The TMS-1 provides accurate indication of frequency markers at discrete intervals on swept frequency displays. Designed for use with a sweep generator the TMS-1 will operate on any frequency within the range 5 Mc/s to 10 Gc/s. Marker intervals of 5, 10, 50 or 100 Mc/s accurate to  $\pm 0.01\%$  are selected by front panel push buttons. Other markers at intervals of 2 Mc/s to 200 Mc/s may be generated by application of a signal of the appropriate frequency to a front panel socket.



**NEWMAN and GUARDIA**  
sell  
to **INDIA**

and to 37 other countries \*

India is just one of 38 countries to which Newman & Guardia have exported Lawley Laboratory Equipment during the past 10 years.

In fact, wherever there is a need—in film and TV studios, in Government Departments and the armed forces—for the processing and printing of film of any gauge, in any quantity, negative/positive, reversal or colour, there you will find Lawley Laboratory Equipment.

\* Lawley Equipment has been supplied to:

Finland · Norway · Sweden · Denmark · Germany · Poland · U.S.S.R. · Belgium  
France · Italy · Portugal · Turkey · Iraq · Cyprus · Malta · Kenya · Gibraltar  
Sierra Leone · Ghana · Nigera · South Africa · Malaysia · Eire · Hong Kong  
Australia · Jamaica · Canada · U.S.A. · New Zealand · United Arab Republic  
India · Switzerland · Mauritius · Jugoslavia · Austria · Liberia · South Arabian  
Federation · Tanganyika.

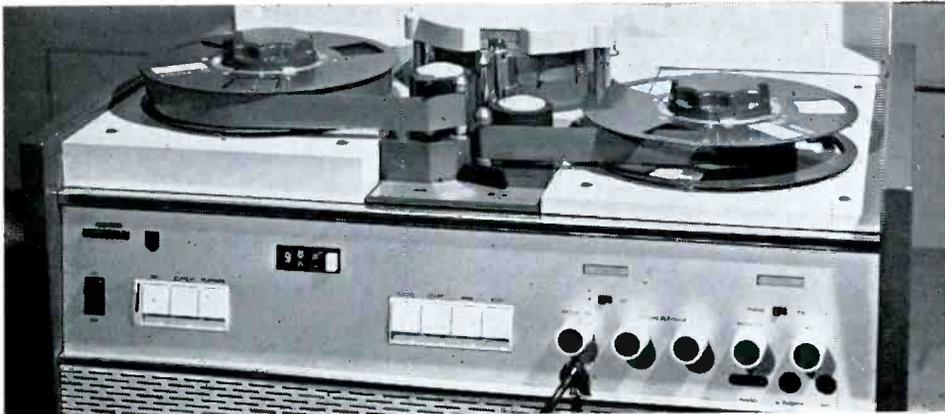
LAWLEY CONTINUOUS PRINTER  
LAWLEY OPTICAL PRINTER  
LAWLETTE STEP PRINTER

LAWLEY SENIOR PROCESSOR  
LAWLEY JUNIOR PROCESSOR  
LAWLETTE PROCESSOR

**NEWMAN and GUARDIA sell international**

NEWMAN & GUARDIA LTD · LAWLEY WORKS · HARLOW · ESSEX  
TEL: HARLOW 24222 · A MEMBER OF THE BEARD & FITCH GROUP

# VIDEOTAPE BREAKTHROUGH:



by J. W. T. Field

## the technical story

ONLY now can first full technical details be given of the revolutionary single-head video recorder first announced by Philips at the great London International IEE Conference, in July last year.

At this huge convention, opened by the Rt. Hon. Quintin Hogg, QC (at that time Lord President of the Council), hundreds of delegates, many of them from the United States, Soviet Russia and Japan, heard first accounts of two revolutionary single-head recorders, one by Philips, the other (dealt with in detail at the IEE by Mr N. Kihara and Mr M. Morizono) by Sony. We were privileged to give constructional details of the Sony recorder in the pages of *International Technical Review* Vol 5, No 7, July 1964, but for technical and international marketing reasons it has only been possible to make a similar disclosure of the Philips system.

Salient facts are:

- (1) One-inch tape is used, running at only  $7\frac{1}{2}$  i.p.s.
- (2) With a standard 8-in. spool, 1,800ft. (540 m) the playing time is 45 minutes.
- (3) TV standard, CCIR, single-head, helical scan.
- (4) Video frequency range is 0-2.5 Mc/s, within 6 dB.
- (5) In addition, the tape can record a full audio channel of 120-12,000 c/s within 6 dB.
- (6) The recorder will accept from the IF stage of

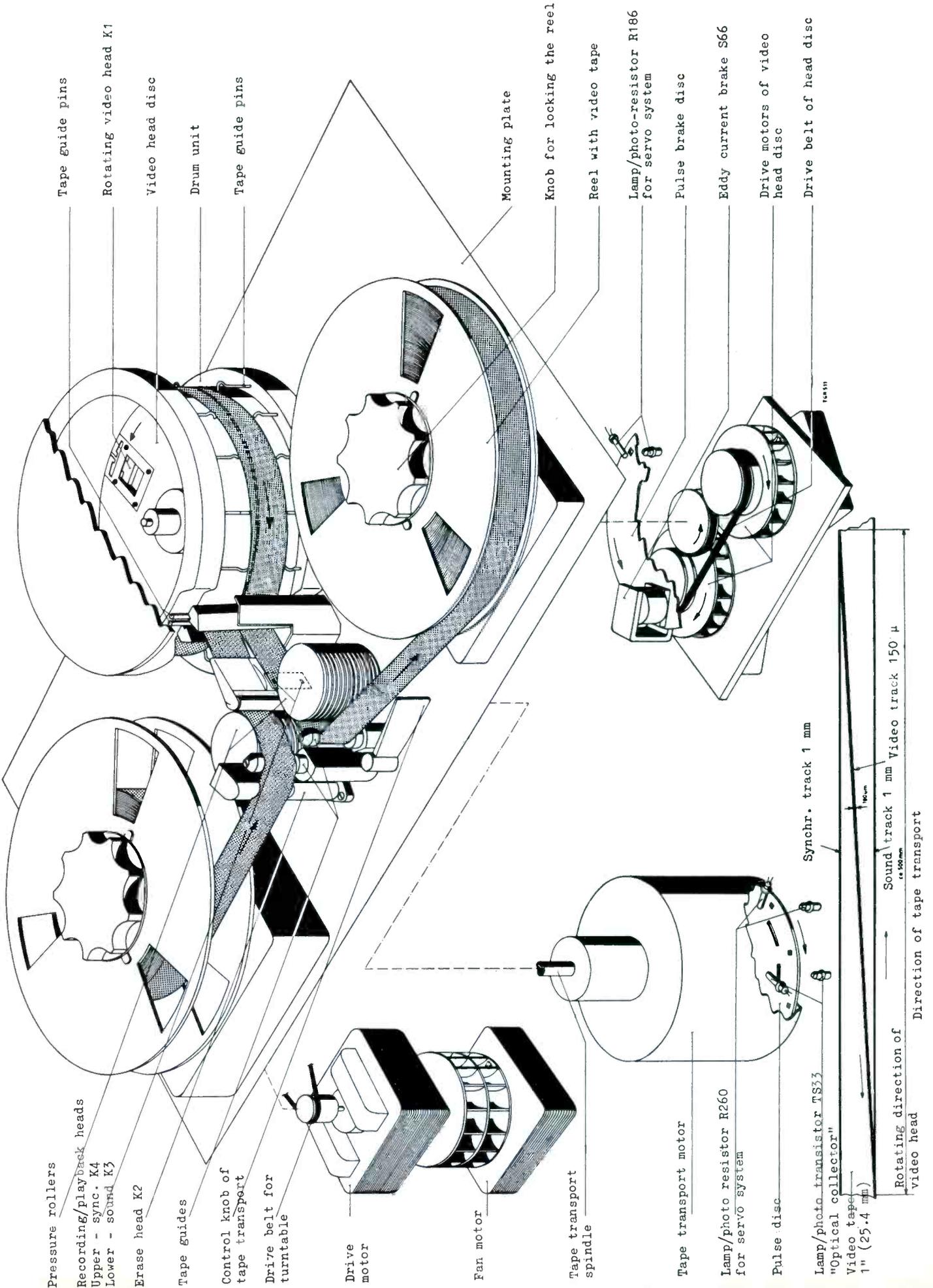
any domestic or professional TV receiver, with a special 75-ohm coupling from the final IF stage. The CCTV camera input is the usual 1-volt p/p, 75 ohms. Audio microphone input not less than 1-mV, and gram or tape input not less than 200 mV. The video output for a TV receiver: picture and sound, 300 ohm HF signal Band 1, channels 2-3-4. For monitor, picture 1.4-v p/p, BAS signal negative.

### SINGLE HEAD WORKING

'As it is impracticable to record TV frequencies with a stationary head at  $7\frac{1}{2}$  i.p.s. as in a sound recorder,' a Philips technician explained to me, the 1-in. (25.4-mm) video tape is arranged to be helically wound with the aid of two pressure rollers on a stationary drum, the pitch of the helical line being slightly less than the tape width, in fact 22.5-mm. There is a gap across the entire circumference of the drum, and the video head rotates in this gap at a speed of exactly 3,000 r.p.m., or 50 r.p.s. Thus, for each rotation a track approximately 500-mm in length is recorded on the tape. . . .

Due to the slight tape displacement during each rotation of the video head, each adjacent track is recorded with hardly any waste space. The gap width of the video head is approximately  $1.5 \mu\text{m}$ , and the core height (and therefore the track width) is only  $150 \mu\text{m}$ . It is stated at

# Tape-deck layout of the Philips portable video recorder, showing path of the 1 in. tape on its helically-scanned circuit and (inset) details of video and sound track



## Videotape

### breakthrough—continued

Eindhoven that the centre-to-centre distance of two adjacent tracks amounts to 180  $\mu\text{m}$ . It will be appreciated that as the number of revolutions of the video head is 50 per second, and a 625-line CCIR picture has 50 frames per second, it follows that one complete television frame is scanned per revolution of the video head. It is arranged that during recording the number of revolutions of the video head and tape transport motor are synchronised with the aid of frame pulses originating from the TV signal. With the help of the two recording/playback heads K3 and K4 in the accompanying diagram, the sound and sync. signals respectively (derived from the frame pulses) are modulated on the tape.

Recorded sync. signals serve to control the tape transport motor in an ingenious manner which will be described in some detail. The tape position is such that the video head accurately scans the recorded track: therefore they operate in effect in much the same way as a magnet film perforating system.

In this video recorder the tape deck carries five units: the left winding unit, drum unit, tape transport, and right winding unit. As the tape is led some 22.3-mm in a downwards direction during transport around the drum, the left-hand winding unit is arranged to be that much higher than that on the right, but otherwise both units are identical—except of course for the direction of motor rotation. The turntable drive motors are cooled by two individual fans, the motors of which are fitted below the turntable motors. It is important to note that during recording and playback the turntable drive motors provide only the necessary winding friction or counter-friction, the actual tape transport being effected by the two pressure rollers. These two winding units are fitted with brake brackets which slow down the turntables as soon as the pressure rollers are released from the transport spindle.

During playback, the voltage applied to the left hand motor can be controlled by a potentiometer. This provides the counter-friction which is necessary because scanning errors may otherwise occur through tape temperature changes on a long run. These errors tend to show up on the reproduced picture as a horizontal shift at the top. It can be corrected, however, by the potentiometer control to regulate counter-friction.

#### DRUM UNIT

The drum unit consists of two rings fitted approximately 2-mm one above the other, with three spacers. It will be seen from the master diagram that on the outside of the drum are a number of adjustable pegs which accurately guide the tape on its helical path. In view of narrow track width and the fact that the video head scans only one track, it follows that the adjustment of these pins is quite critical. At the top of the recess between the two drum sections is mounted a rotating disc in which the video head itself is fixed. This head (of Ferroxcube, which can easily be replaced) projects about 55  $\mu\text{m}$  from the two drum sections, and presses against the tape. The head is driven by two asynchronous motors, belt coupled, and the speed of the head disc is controlled by an eddy-current brake energised by the servo system. In this way the correct speed of 3,000 r.p.m. is maintained, and the phase

of this head with respect to the frame pulses (during recording) and with regard to the mains phase (during playback) is kept constant.

In an ingenious Philips manner, the speed reference and phase of the video head for the servo system are obtained by taking off a pulse by means of a lamp and photo-resistor during each rotation of the disc. It will be understood that the tape transport motor is of the DC type having what is known to Philips as an 'optical collector.' Details of this can be seen in the diagram. The necessary DC power comes from a transistor amplifier, and speed is regulated by controlling the amplifier.

As can be seen from the diagram, the motor drives what is known as a pulse disc, having slots and holes. This disc has two functions:

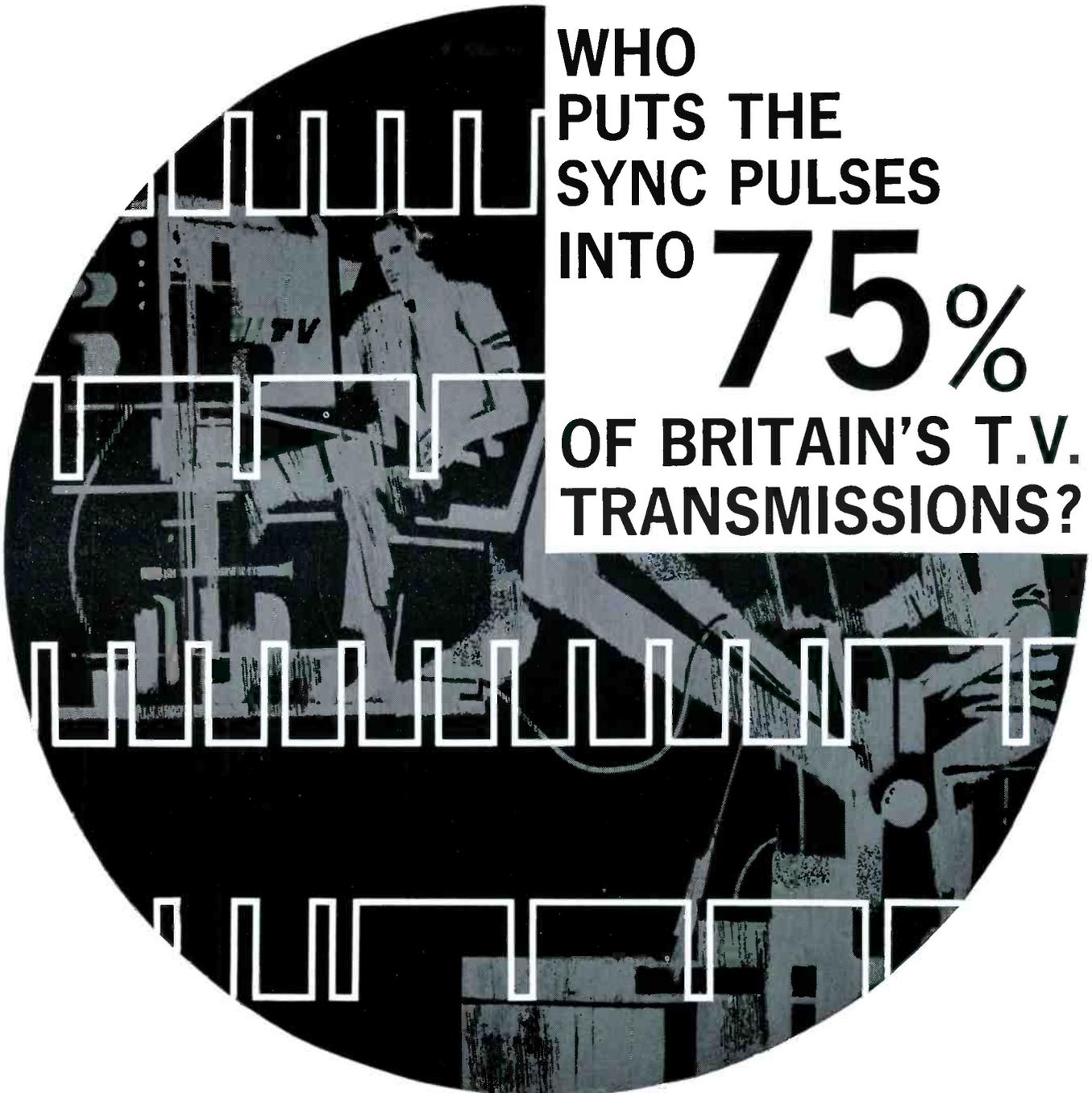
- (a) Alternative energising of the motor coils by means of slots and a lamp/photo-transistor layout incorporated in the 'optical collector.'
- (b) Pulse generation for the servo system during recording, using the disc holes and the photo-transistor.

In the normal 'wind' mode the tape transport motor obtains maximum power from the transistor amplifier, the speed being then not controlled by the servo system, and in practice the motor runs at about 4,500 r.p.m. Before changing to the rewind mode, the motor coils are changed over by switching relay so that the direction of rotation is reversed. Both pressure rollers and the brake brackets on the spool units are operated by the lever near the tape transport unit, and the pressure rollers are locked magnetically. This protects the machine against the possibility of loop-forming, should there be a sudden cut in the mains supply. In the event of a mains failure, the pressure rollers are released and the transport is stopped. Normal stopping time is about 2-secs and the maximum starting time to full-run takes 15-secs. Wind and rewind of an 8½-in spool occupy 4½ minutes.

#### ELECTRICAL OPERATION

Here is a simple explanation of the electronics so far as the amplifier in the second 'record' position is concerned. Details are given in an accompanying block diagram. The input signal (from CCTV camera or TV receiver) is applied to the B17 stage via the input socket BU5. After amplification the IF signal (32-40 Mc/s) is demodulated by the rectifier circuit U6 so that the video signal and the IF sound signal (5.5 Mc/s) become available, the video signal is then applied to the IF amplifying valves B8B and B12A, after which it is demodulated by the FM sound detector U9. The LF sound signal is then applied to the amplifier via selector SK9 and the modulation control R85. It is impossible to record a pick-up signal via input BU2, and for this selector SK9 has to be set to position PU. Input BU4 applies an additional microphone audio signal, and the modulation depth of this can be adjusted by R88.

The amplifier sound signal is then applied to the LF output BU3 so that monitoring is possible during recording. Secondly, the signal is applied to valve B13 which serves to indicate modulation depth. The signal is also applied to the recording/playback head K3 for recording the signal



WHO  
PUTS THE  
SYNC PULSES  
INTO **75%**  
OF BRITAIN'S T.V.  
TRANSMISSIONS?

# THORN DOES!



Directly, or indirectly, Thorn Sync Pulse Generators play their part in some 75% of Britain's Television programmes. Over two hundred are already in use in the U.K. and overseas and they have given hundreds of thousands of hours of fault-free service. Built to the highest standards, they are used with the confidence that only proven long-service reliability can bring.

- Multistandard 405/525/625 lines.
- Completely transistorised.
- Slaving and non-slaving versions available.
- Exceptional timing accuracy and long term reliability.
- No preset adjustments—all pulse edges locked to "clock pulse" source.
- Optional line drive advance of 4 or 8 s.
- Remote control facilities.
- Portable or rack mounted versions.

## THORN ELECTRONICS LIMITED

Wellington Crescent, New Malden, Surrey, England. Tel: MALden 8701

A MEMBER OF THE THORN ELECTRICAL INDUSTRIES GROUP OF COMPANIES



## Videotape

### breakthrough—continued

on the tape. This audio head is fitted to the tape guide behind the tape transport spindle, and records the signal as a track of approximate width of 1-mm., on the lower side of the tape. The tape is also erased with the erase head K2, connected to the oscillator B15 which erases the entire tape, audio and video. The same Colpitts oscillator also provides the required pre-magnetisation current for the K3 head.

Depending upon the position of selector SK8, the input of the picture-recording amplifier is connected to (a) the signal of the video input unit BU1, or (b) the TV signal of BU5. The video signal is applied to the video amplifying valves B7A and B9B via the potentiometer which also controls the modulator frequency; and from this point the amplified signal is applied to the picture modulator B10a-B11a via the cathode follower B8a.

This picture modulator operates as a multivibrator. The video signal applied alters the DC setting and hence the frequency of the modulator. Thus it will be seen the video signal is frequency-modulated.

#### MULTIVIBRATOR

**Frequency sweep of the multivibrator is controlled with R40 in such a way that the frequency sweeps between 3.0 and 4.3 Mc/s, going from extreme black to extreme white.**

In this FM signal the 3.0-Mc/s frequencies correspond to the bottom of the line pulses ('blacker than black'), and the 4.3 Mc/s frequency to the white in the picture. True black corresponds to about 3.2 Mc/s, and grey to 3.8 Mc/s. Part of this video signal is taken from the anode of the cathode follower B8a for the indicator tube B16 and for driving the modulator. Another portion of the signal is also fed to the sync separator B9. This valve is so driven by the video signal that only the sync pulses are amplified. These pulses are then fed to an integrator network X7 in which the frame pulses are filtered out and applied to the servo system (multivibrator TS3-TS4). The DC voltage for the automatic speed control of the video head K1 is taken from the cathode of the sync separator R9. From the modulator, the FM signal is applied to the push-pull amplifier B10b-B11b; this amplifier feeds the signal to an output transformer and, moreover, provides the necessary recording frequency response.

From the secondary winding of the rotating transformer S19, and the video head (which of course applies the FM video signal to the tape) is connected to the secondary of this rotating transformer.

To ensure stable operation of the FM modulator, part of the FM signal is taken from the primary of this transformer to help stabilise the modulator frequency. The signal is therefore fed to a tuned circuit, one flank being tuned to 3.0 Mc/s. The rectifier circuit (diodes X5-X6) serves to rectify the voltage across the filter circuit and to apply the signal to the regulator B12a, this valve being DC-coupled to the cathode follower B8a.

Should the lowest modulator frequency deviate from 3.0 Mc/s, then the rectifying circuit supplies a direct voltage for correcting the modulator frequency by changing the DC setting of B10a-B11a.

#### VIDEO HEAD SERVO SYSTEM

As a complete television frame must be recorded on the tape for every single revolution of head K1, this head must, as already stated, rotate at precisely 50 rev/sec. The speed of this head is stabilised with the aid of the frame pulses from the TV signal during recording. In fact these frame pulses are taken from the sync separator and applied to the mono-stable multivibrator TS3-TS4 via the integrator network and diode X7.

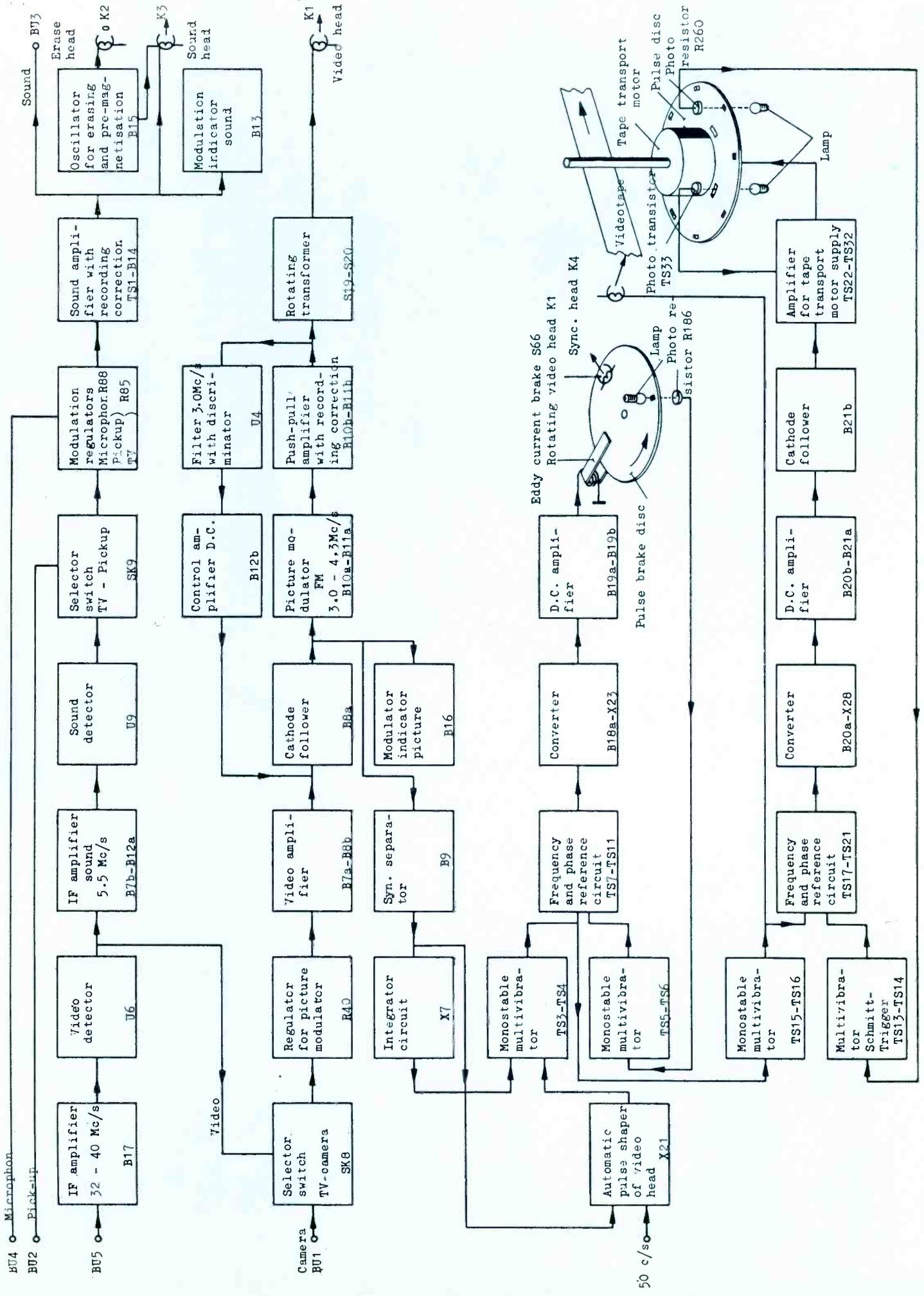
The multivibrator converts the frame pulses into square-wave voltages which are applied to the frequency and phase reference circuit TS7-TS11. As it may occur that the frame pulses fail during recording—due to interference, or to channel change-over of the TV receiver—a network has been incorporated which supplies a 50 c/s voltage instead of the frame pulses to the multivibrator Ts3-TS4. This network comes into action when the DC voltage which is taken from the sync separator B9 fades out. It will be appreciated, of course, that the DC voltage fades when no sync pulses are applied to the sync separator. As a result, the speed of the video head will remain constant, **but the phase will differ.** Upon return of the frame pulses, only the phase of the head has to be adjusted.

To check the speed and position of the head, a pulse is taken from it at each revolution, with the layout of the photo-resistor R86 and a lamp, this pulse then being applied to the mono-stable vibrator TS5-TS6. Here the pulse is converted into a square-wave voltage which is fed to the frequency and phase-reference circuit. **The pulse width of the output pulse of this circuit is a measure of the phase deviation.** When the frequency of both pulses is not equal, the circuit provides a negative or positive output voltage. The speed of the video head (which has a no-load rate of 3,500 r.p.m.) is maintained at the correct 3,000 r.p.m. by the eddy-current brake S66. The frequency and phase-reference circuit has a square-wave output, the width of this square-wave voltage being a measure of the deviation which the head has with respect to the correct position. The square-wave voltage is applied to converter B18a-X23, which converts this voltage into a proportional direct voltage. This DC voltage is then applied to the DC amplifier B19a-B19b, connected to the eddy-current brake.

#### TAPE TRANSPORT SERVO

This servo system of the tape transport motor operates in much the same way as the video head servo. In fact the tape transport motor should rotate at exactly 375 rpm. To provide reference of this speed to the frame pulses, 8 pulses are taken from the motor during one revolution by means of the photo-resistor R260. The frame pulses are taken from the multivibrator circuit TS3-TS4 of the video head servo system, and applied to the mono-stable multivibrator. The impulse from the tape transport is also applied to this circuit via the multivibrator, and the circuit operates in the same fashion as that of the video head servo. A proportional direct voltage is applied to the DC amplifier B20b-B21a via the converter B20a-X28. To this DC amplifier the cathode follower B21b is connected. The direct voltage of this cathode follower is applied to the amplifier for voltage of this cathode

Block diagram of the Philips recorder in the 'record' mode. Note the use of a photo-transistor and lamp, and pulse brake disc.



## Videotape breakthrough

### —continued

▶ follower is applied to the amplifier for driving the tape motor, this operating because the direct voltage regulates the power supplied to the motor coils, and thus the speed.

The motor coils are switched over by means of the 'optical collector' photo-transistor TS33.

This transistor is alternately exposed through the slots in the motor switching plate; when the phot-transistor is exposed, one set of coils is energised, the other set being energised when the photo-transistor is **not** exposed.

During recording, the frame pulses are taken from the mono-stable multivibrator and applied to the recording/playback head K4; and, as reference pulses for the servo system of the tape transport motor. During winding, the output of the servo system is disconnected from the cathode-follower output B21b. As, moreover, the supply voltage is increased by changing over the primary supply transformer, the transport motor receives full power; and that is why the speed then increases up to about 4,500 rpm.

#### IN PLAYBACK MODE

During playback the tape is scanned by the video head, and the signal taken from the tape is fed to the playback amplifier via the rotating transformer. Philips have designed this playback amplifier to have a bandwidth of 1.5 Mc/s, and frequency-correction is also provided. The signal is then applied to the FM limiter (B4a-B5a) which is a form of multivibrator the frequency of which is determined by the frequency of the signals applied to the control grids.

If no signal is applied the frequency corresponds to approximately 3.8 Mc/s, which corresponds to grey shading. As the output signal of this multivibrator has a constant amplitude, this circuit operates as a limiter. Subsequently the signal is fed to the FM demodulator circuit, and here the video signal becomes available again. To cut off all interference frequencies, this video signal is applied to a low-pass band filter **in which all frequencies above 3 Mc/s are removed.** The video signal is then applied to the modulator circuit and to the video output amplifier. This output (emitter follower) applies the video signal to the output socket.

With the video recorder is provided a special link EL 1952 which has an integral bush to be slid on to the final IF valve of a TV receiver. This provides capacitive coupling. However, if the receiver does not have a single pentode (such as EF184 or EF80) but a multiple valve such as the PCF200, then a connector EL/1952/02 has to be used, this being provided in addition with a filter which attenuates the sound carrier by approximately 20 dB.

On examination of the controls it will be seen that a

Standby position is available. In this mode **the amplifier is connected as for recording.** The video head K1, the erase head K2, the recording/playback head, audio, K3 and K4 (recording/playback, synchronisation) are not connected to the amplifier.

As to the general specification of the EL3400A, the standard version designed for a 50-cycle 220-volt supply, power consumption being about 400 watts. The machine measures 24½ in. by 16½ in. by 15¼ in. (630 by 420 by 390-mm) and weighs some 99 lbs. (45 kG). On video (CCIR TV standard) it is for use in channels 2-3-4, and in practice the tape wrap is 355-deg. so the very most is made of the helical scan. That is one reason why the frequency coverage (video) is 0-2.5 Mc/s within 6 dB, and the p/p signal-to-noise ratio is better than 40 dB. Over the 120-12,000 c/s audio band sound distortion is a maximum of 5 per cent, wow and flutter being  $\pm 5$  per cent. At 4 per cent possible distortion, audio, the signal-to-noise ratio is far better than 50 dB, the signal-hum ratio better than 40 dB. Erase level is 60 dB, and in fact the bias and erase frequency used with the aforementioned Colpitts oscillator is 70 Kc/s.

For professional use this type of video recorder is generally used with a closed-circuit camera, and in this case the standard video output of greater than 1-volt p/p, 75-ohms, is suitable. When taken from a domestic-type TV receiver, the video recorder needs (IF 38.9 Mc/s) a signal better than 20 mV, 75 ohms. Sound is taken from the usual IF 33.4 Mc/s.

The recorder's output for a TV receiver is picture and sound 300 ohms, HF signal TV Band 1, channels 2-3-4. When used to feed a monitor the signal averages 1.4-v. peak-to-peak, BAS signal negative, 75 ohms, 100 per cent modulation. For application to an external audio amplifier, the signal is better than 1-volt, into 20 ohms.

We understand that at present there is no intention of producing an all-transistor version of this portable recorder, since greatest stability and reliability appear to be attained by the present mixture of valves, transistors and diodes, plus two type ORP 61 photo-resistors. Nearly a dozen each of popular transistors such as AC 132 and AC 127 are used, together with six ASZ 18 and other perfectly standard types. There are no special-performance valves needed, the circuitry accepting six ECF 80's five ECC88's, and other quite normal varieties such as ECC 85, ECL 84 and EM 87. For these and other reasons it seems certain that the high promises made at the IEE Convention last year will be well justified, and we now have a portable video recorder of modest price (under £1,000 in many areas of the world) and with professional standard of operation on a 1-in. tape scanned by a single head.

# Britain's first CCTV Educational Exhibition

by John Dickson, Ph.D.

**Q**UITE obviously closed-circuit television is going to have a tremendous contribution to make to education in many ways,' said Sir William Alexander, LL, Secretary, Association of Education Committees, when officially opening the February (10—20) exhibition of CCTV for education, at Britain's National Audio-Visual Aids Centre.

The purpose of this Centre is the attempt by the National Organisation to help education in finding the best ways of using these aids. And at this semi-permanent exhibition (sections of which will be seen at other centres throughout Britain during 1965), the following leading electronic companies are showing the latest in ETV aids: Ampex (Gt. Britain) Ltd., Beulah Electronics Ltd., Carrion Television Systems Ltd., EMI Electronics Ltd. (Instrument Division, the Marconi Company Ltd., Peto Scott Electrical Industries Ltd., Pye/HDT Ltd., Rank Audio-Visual Division, Closed-Circuit Television Department, Thorn Electronics Ltd., and Visual Engineers Ltd.

Why are they accepting the invitation of the National Organisation for Audio-Visual Aids to exhibit throughout the country, with this special opening staged at the National Audio-Visual Aids Centre?

Primarily because of the national—indeed, international—importance of the Audio-Visual Aids organisation itself. Fact is that the national organisation for audio-visual aids has evolved over the years in response to the needs of teachers and other educationists. The National Committee for Audio-Visual Aids in Education was set up originally in 1946, by the Local Education Authorities and teachers' organisations to represent at a national level the views of administrators and teachers. The Committee consists of 36 members (appointed by the Local Authority organisations and teachers themselves), and three assessors who maintain close contact with the Ministry of Education. The Central Committee of Teachers' Visual Aids Groups is a permanent sub-committee, first set up in 1951 to provide direct representation of teachers in schools and colleges at the policy-making level. Then there is the Educational Foundation for Visual Aids (EFVA), which was originally set up by the Minister of Education in consultation with the Local Education Authorities in 1948. It provides visual equipment, and a technical service, and its financial arrangements were re-organised in April 1957 so under this new constitution

the Foundation became a non-profit company, and now the Foundation receives a proportion of the money contributed to the National Committee by the Local Education Authorities to provide for the production of new teaching films for schools. EFVA also controls the Foundation Film Library, and of course the coming of closed-circuit television is swiftly widening the scope of all this.

**F**EBRUARY's initial CCTV display was held at the new National Audio-Visual Aids Centre, Paxton Place, Gipsy Road, London, SE27, under the shadow of the Crystal Palace TV aerials—perhaps the most appropriate site in all London for a television exhibition. In this ultra-modern building is being maintained a permanent exhibition of all the latest audio-visual teaching aids, and there is an extensive area for TV and film demonstrations, a lecture theatre, a development laboratory and a workshop.

Visitors to the CCTV display were compelled to realise that the Centre owes a great deal to the generosity of many organisations. The LCC made the site available, and the Mullard organisation provided finance to build the Lecture theatre. The Film Producers Guild, Granada Television, Rediffusion, ATV, ABC, Neville Brown & Co, Colour Film Services, Kodak Ltd, World Wide Pictures, Unilever, Technicolor and International Tutor Machines all contributed to the cost of this highly functional building in which the best of CC-ETV equipment is now on show.

Low-priced CCTV as an instructional kit has a dual appeal to many educationalists, and Beulah Electronics Ltd (126 Hamilton Road, London, SE27) have moved over to the NAVA Centre some of their most instructive camera kits and monitors to form a complete CC-ETV network. The basic Beauvision kit, costing only £40, gives the student an opportunity to build his own CCTV camera, having 2.5 Mc/s resolution. This project makes an ideal introduction to the principles of transistorised electronic design, and it can be used with a domestic TV set as a monitor. The same camera is also available factory-made and tested, complete with vidicon and lens, for 79 gns. For more general schools use, there is the Beulah D.80 camera (5 Mc/s resolution) which is supplied to operate with normal schools TV receivers. There is a range of transistorised video monitors, including the 14-in Beulah 1400 and the 8½-in-screen model 800. Beulah

## Britain's first CCTV

### Educational Exhibition—continued

A multi-camera control console, at which pictures of widely differing subjects were inspected and selected for transmission to TV receivers around the room was the highlight of EMI Electronics' display at the Exhibition of Closed-Circuit Television Equipment for Teaching Purposes, held at the National Audio-Visual Aids Centre, London, from February 10 to 20.



achieved another 'first' at the CCTV exhibition by demonstrating the first transistorised video tape recorder to be marketed in the UK at only £150. This VTR is also available in kit form.

**C**ARRION Television Systems Ltd and Ampex (Gt Britain) Ltd brought new techniques to this CCTV display, and Mr Patrick Johnson, OBE, MA, head of the Experimental Development Unit which produced Report No 2 last month on closed-circuit television in Education pointed out: 'There are obvious economic and practical advantages in recording programmes for repeated use over a closed-circuit system. The recent introduction of less expensive recorders will attract attention among those who have or are planning installations. The current prices range are £900, £4,000 and £22,000. Before purchases are made it would be advisable for planners to consider whether or not they wish the recorder to be compatible with other recorders (that is, whether video tapes prepared on other machines can be used on their own recorder, and vice versa) . . . consideration should also be given to the facilities provided for editing the tape-recorded programme. . . .'

In this field Ampex show their latest VR-650, which is a low-cost, portable VTR with full professional broadcast stability. The VR-650 weighs just under 100 lbs, and has signal compatibility with other VTR's. It has two audio tracks, and records at 4.1 in per sec, giving more than 2½ hours on a single 10½-in reel. There is also a 60 cps version with tape speed of 3.7 in per sec, which can handle up to five hours of tape.

EMI's exhibition of equipment for teaching is by far the largest equipment display in the exhibition, and is virtually a complete CC-ETV demonstration laboratory in itself. Everything from a simple Type 8 camera to equipment for a complex inter-schools network is on show, with related lighting and TV sound equipment by Mole-Richardson (England) Ltd and Westrex Co Ltd. Highlight of the EMI exhibit is a control console at which pictures from four cameras are inspected and selected for transmission to six monitors strategically positioned around the demonstration room. Of particular interest is a new EMI 'mini' electronic viewfinder which shows a 4-in by 3-in picture of the scene being transmitted by the camera. At the display this is shown operating on a Type 6 CCTV network.

Included in the four CCTV cameras feed-

ing the control console are two Type 6 cameras scanning captions and a blackboard. Another Type 6, trolley-mounted, with a two-lens turret including a zoom lens, is used to transmit live subjects. There is also a minicamera with simple telecine equipment for slide projection. A remotely-controlled Type 8 camera is arranged to pan and tilt around the demonstration room from its 8-ft perch, while another Type 8 is used, coupled to a microscope, to inspect biological sections and display enlarged pictures to a rank of 8-in and 23-in monitors. Broadcast EMI cameras on view, of the type required for inter-school networks, include a studio vidicon and an image-orthicon camera, while camera tubes on show range from the interesting new ½-in vidicon to a 4½-in image orthicon. A TR52 professional tape recorder and technical displays of various grades of Emitape complete this section of the exhibit.

**W**E were particularly interested in the Type 8 camera as fitted with Autolight Kit CM 802. This kit provides automatic target control ensuring constant video output from the camera despite varying scene illumination. A cadmium-sulphide cell fitted inside the housing on the camera front panel can be adjusted to 'see' approximately the same zone area as the camera lens. This cell is light-sensitive, providing a variable resistance dependent on light intensity, and as the ambient light changes corresponding changes are made on the voltage applied to the vidicon target. With this cell in operation the camera can cope with changes from normal sunshine (1,000 ft/lamberts) to average room lighting (10 ft/lamberts). Among other new accessories for the Type 8 is the RA-812 microphone and integral amplifier kit. The amplifier is only 3½-in long, 1½-in in diameter, weighs 6-lbs, and is integral with a crystal microphone coupled by a 5-ft 9-in connector cable to the camera body. The 250 millivolt amplifier output is matched to a 25-ohm loudspeaker (such as is fitted to the CCU RA-811) which can be sited up to 200 ft from the camera itself.

EMI's Mk 6 camera is used for CC-ETV by many educational bodies including Queen Elizabeth College, London, and the Department of Human Anatomy, Oxford. In the Mk 6 chain is used the standard BC600 camera and separate camera-control unit, and the BC 601A mini-camera (only 3-in in diameter and just over 10-in long) can be

used for educational training where use of a larger camera is difficult. Among the several EMI monitors were shown examples of the TPM7/23T range, specially designed for display of 625 line CCTV pictures. The tube used is the Thorn 19/23 SP4 or equivalent 110-degree 'wide angle' tube, having a glass bonded face-plate. The light output is better than 80 ft/lamberts peak white, giving a brilliant picture in the average classroom.

With their experience in providing CCTV at Leeds University, Sheffield University, the Bradford Institute of Technology, the Royal Scottish Academy of Music and other centres, it might be expected that The Marconi Co Ltd would be in a unique position to stage an instructive CC-ETV demonstration, and this is certainly so at the Audio-Visual Aids Centre.

For the small user Marconi's have produced the new V321, which we feel heralds a new era in professional CCTV. This camera is so stable it gives completely hands-off operation even over periods of several months of continuous working.

'New techniques in vidicon operation and allied circuit design are included,' we were told at the official opening of the exhibit. 'For optimum vidicon performance the wall electrode voltage and focussing field have been considerably increased. This improves picture resolution and signal-to-noise ratio, but in addition it makes the beam current setting very much less critical. So it increases the range of light levels over which automatic operation of the equipment is possible. Also incorporated is an entirely new circuit for automatic black-level control . . . Using a neutral-density filter, the channel can accommodate scene illumination between 2 and 2,000,000 ft/lamberts. . . .'

**O**F even more ambitious specification, the V322 series is ideal for a wide range of CC-ETV applications. As standard, the 322 uses the new separate-mesh vidicon, and the circuitry provides a higher-than-normal vidicon focussing flux and a new precision scanning yoke. On so many instructional programmes there is simply no time nor opportunity to carry out camera adjustments, and the V322 series is entirely self-adjusting, having circuits to maintain constant output despite illumination changes over a 2,000:1 range, and there is also an automatic black-level control circuit.

New to us all at the Audio-Visual Aids Centre is the Marconi V322B, which we saw

in brief at the NAB Convention in Chicago last year, but which has now been perfected for educational and other small-studio requirements. Basically similar to the single-lens 322A, the series B camera has a lens turret and an ingenious electronic viewfinder. In this the electronic driving pulses are obtained from the camera, but the scanning circuits are otherwise isolated to avoid interaction.

Among the several Marconi picture monitors on show we selected the V6140, a 21-in display, as being ideal for CC-ETV use. This series is suitable for 405, 525 and 625-line working, and embodies simple, reliable circuits using long-life, close-tolerance valves. Inputs of 100-125 and 200-250 volts AC are suitable, and the total mains consumption per monitor is only 130 VA. Actual size of picture display on the 21-in diagonal tube is 19-in by 15-in.

As distributors of International Philips equipment, Peto Scott Electrical Instruments Ltd offer not only a range of extremely stable, high-performance CCTV networks, but also professional sound recorders. In this latter field there is great interest in the PRO 20 transportable recorder for mono and stereo recording,  $3\frac{3}{4}/7\frac{1}{2}$  or  $7\frac{1}{2}/15$  ips. This model is housed in two wooden cabinets, one containing the tape deck, the other the amplifier, oscillator and power pack. The PRO 20 is also available for rack or console mounting. The revolutionary Philips Eidophor big-screen TV projector has enormous potential in the field of instruction. It produces a picture up to 30-ft wide from normal 405- or 625-line TV pictures.

AS not all realise, the 'HD' in the name Pye HDT Ltd (a company in the Pye, Cambridge group) implies high-definition, and this is indeed the keynote of much CCTV equipment they supply for education. Mr Peter R. Hale, Senior Lecturer, Visual and Aural Aids, Brentwood Training College, has described to us how HDT 625-line cameras are used at Brentwood, and at the Audio-Visual Aids Centre we saw Pye Lynx and Sentinel camera chains which are eminently suitable. The Lynx TVC/1A is an economy all-transistor camera with automatic sensitivity control, working as standard on 625/525 lines, but which with an adaptor can work on 405. It provides a 1.4-volt p/p video signal, and is suitable for all standard C-type lenses. The Sentinel is a high-definition camera chain based on K114E and DEF 5000 specifications where applicable to TV. It gives inter-

laced scanning, automatic or manual control of sensitivity, and there are three units in the chain (apart from the monitors), the camera head, camera control unit, and a small camera control panel. There are optional facilities for remote focus, remote iris and remote lens-change. Extremely ambitious educational productions can be conducted with the Type 2083 remote zoom and focus attachment, providing by remote control a continuously-variable field of view.

HDT Teletalk System was demonstrated for the first time at the opening of the Audio-Visual Aids exhibition. This is a truly amazing device for inter-class teaching. It must be realised that with conventional CC-ETV, different classes in different places can participate in the same lesson at the same time, but to make full participation possible there is the question of feedback. Pupils in any of the lecture rooms must be able to ask questions, so that the teacher at the central studio and in all classrooms can hear. The Pye HDT Teletalk uses plug-in transistorised amplifiers in a novel switch network so that question, answer and all subsequent discussion can be heard by all the linked classes. It does not require microphones to be passed around, nor elaborate wiring. Pye HDT also supply the HDT/27/DS2 405/625-line CCTV monitor, which among several interesting technical features has a silver-contact UHF tuner giving long life free from switch troubles. To increase the safety factor in schools, this monitor has an isolating transformer (not a standard fitting nowadays with the average domestic TV receiver), and also the mains supply is switched off when the monitor doors are closed. There are twin high-flux speakers, and a 27-in screen.

RANK Audio Visual CCTV for education is based largely on Dage cameras and control desks, and Murphy monitors available in 19- and 23-in models. The networks available range from the simple Dage industrial camera, ideal for lecturehall relays, to the comprehensive ETS-leducational television system using two or three series 320 vidicon cameras, synchronised. Not every training establishment may wish to undertake the capital investment necessary for a large CC-ETV network, and Rank Audio Visual showed at this exhibition, for the first time in the sphere of education, how their CCTV equipment may be hired, yet matched to suit special lighting and display requirements.

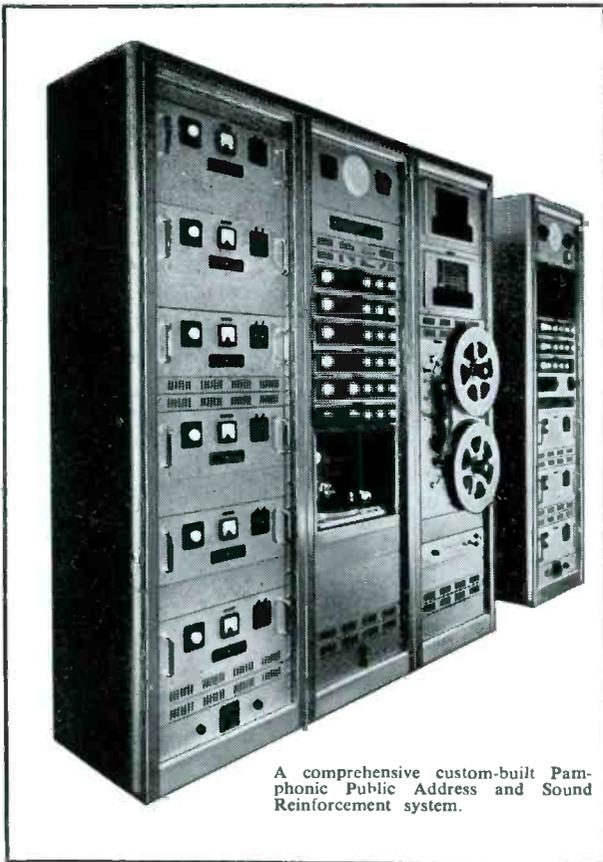
Within the Thorn Electronics Limited

Group there are a number of well-ried CCTV networks highly suitable for educational training. There are also monitors including the VM606 and VM608 (19- and 23-in respectively), with the excellent 110° tube as fitted to many other makes of monitor at the Audio-Visual Aids Centre. A novel feature of the Thorn series is that there is *automatic* (or manual, at the touch of a switch) selection of 405, 525 or 625-line pictures, and also remote control of brightness and contrast. Remote selection of two alternative video inputs is also available. A new feature for Thorn is the 500 series camera, a fully-professional and all-transistor unit, in a cylindrical case only 3½-in in diameter. Sensitivity is such that a good picture can be obtained at full f/2 opening, with a scene brightness of only 5 ft/lamberts. This is a 625-line camera, and for special educational work infra-red-sensitive and U/V camera tubes can be used.

Visual Engineers Ltd is a company within the Negretti & Zambra group, and the facilities available for CC-ETV are based on Grundig cameras, together with an interesting range of CCTV equipment developed in Visual Engineers' on laboratory. Complete systems are planned and provided for CC-ETV, and these can be based on camera units such as the rugged FA11, or the compact, all-transistor FA41, basic cost of which is only £190. At the other extreme is a complex Visual Engineers educational telecine installation, using a VE camera directly coupled to a professional film projector, to display the films on a whole battery of 19-in monitors. The little FA 41 camera, the central facet of several CC-ETV networks seen at the Audio-Visual Aids Centre, operates on 625 lines with random interlace or, by adding a frequency-divider circuit inside the camera housing, can be worked with full interlace corresponding to CCIR broadcast standards. There are various versions of the FA41, according to whether an RF, video or mixed output is needed. Output of the camera at RF can be obtained on any channel from 2-13 (CCIR) so this camera can then be used with broadcast-type receivers as monitors. This is one of the several cameras at the exhibition which work on 110/240 volts AC and also from a 12-volt car battery. The range of accessories for this and other Visual Engineers cameras is so comprehensive that many educational authorities use the VE planning service when setting up a CCTV system.

While devoted entirely to CCTV, this display at the Audio-Visual Aids Centre is in a sense a warm-up for the major 1965 Annual AVA Conference, which this time is to be truly international. Still further examples of CCTV will be tested, and the Conference will have speakers from the United States, France, Germany and the Netherlands. Mr W. G. Beaton, director of the Glasgow Educational Television Service, will give a complete description of the ambitious Glasgow CCTV system, and other aspects will be dealt with by Mons Lefranc (head of research into co-ordination of audio-visual services) and Professor Lester Beck of the Teaching Research Division, Oregon State System of Higher Education. This international conference organised by the National Committee for Audio-Visual Aids in Education and EFVA will be held on July 14, 15 and 16 at Whitelands College, London, SW15.

# DISTINCTION IN SOUND REINFORCEMENT



A comprehensive custom-built Pamphonic Public Address and Sound Reinforcement system.

Linesource Loudspeakers:  
Model 779 illustrated is a 4' 8" indoor line column loudspeaker, suitable for quality reproduction of speech and music. It can be wall or tripod mounted.

30 Watt Amplifier—Type 661W.  
A compact versatile amplifier with a wide frequency response and low distortion having mixing facilities for two microphones, gramophone and radio or tape. Each input has its own gain control and separate bass and treble controls are provided. Free standing or rack mounting.




■ Pamphonic have been making sound amplification systems for over 30 years, and the present range of equipment is a result of the wider knowledge gained in that time.

#### ■ 'BRICK' SYSTEM

The Pamphonic 'Brick System' with power amplifiers of 50 watts and 100 watts permits a wide variety of input and output facilities with a minimum of effort or special engineering. The equipment has a very high standard of performance for all applications.

## *Pamphonic*

*for sound — NATURALLY*

**PAMPHONIC REPRODUCERS LTD.,**

Heath Works, Baldock Road, Royston, Herts.

Telephone: Royston 2412, 2424, 3466

Cables: 'Decibel Royston' Telex: 81174

*THE PYE GROUP SPECIALISTS  
IN SOUND REINFORCEMENT*