

# INTERNATIONAL BROADCAST ENGINEER

No. 16  
January 1966  
3/6

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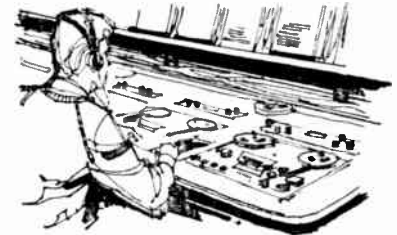


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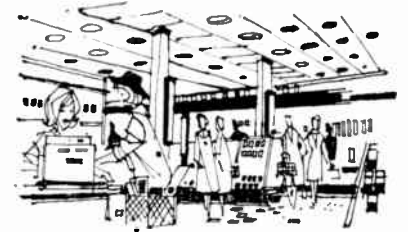


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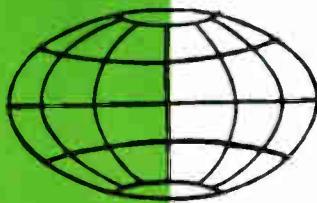
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# International Broadcast Engineer



Searching by television. . . . This frogman uses a revolutionary under-water Pye TV camera, the vidicon (small centre opening) of which is flanked by twin underwater lamps. Divers can take this CCTV down to 200 feet.

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## OUTLOOK

### Comrade and / or PAL?

**T**HE GOVERNMENT is to be asked to accept the German PAL colour television system for Britain,' the UK Press was announcing as 1965 drew to its close.

And the London *Daily Mail* Correspondent exposed a hint of heated controversy in high places when he said: 'BBC technical experts stopped talks by a special group of the Government's Television Advisory Committee this month by refusing to drop their support of the American NTSC colour system. But at yesterday's meeting, BBC technicians agreed to support the German system—and fall in line with ITV and the rest of Britain's television industry. . . .'

But will it be PAL after all? As we go to Press we hear the startling news that Moscow/TV has come up with a new system (one hesitates to say a revolutionary system) which is claimed to be an improvement on PAL.

At this eleventh hour, can the European Broadcasting Union change their minds? We were all set to go to the Oslo colour-TV conference in the Spring, backing the PAL (phase alternation line) technique developed by Herr Bruch of the Telefunken Laboratories. Is it possible now there could be a switch from PAL to . . . to what? At present only a handful of technicians in Britain even know how the system operates, and so far Soviet scientists have not given it a name which in our familiar Roman alphabet conveniently forms into initials such as PAL. Cynics say the Soviet system could be called 'Comrade.'

Bluntly, how does the Old Pal's Act work in this matter? The EBU ad hoc committee (charged with recommending a colour system for Europe) has flown two delegates to Russia to investigate the system, and the British Post Office already has a technical memo.

A licence had been granted to Britain's huge EMI group to handle PAL affairs in the UK. EMI, of course, have interests ranging from television cameras to nucleonic instruments, from community-TV systems to military projects such as proximity fuses and weapon systems, from klystrons to computer magnetic thin film stores. EMI has overseas interests extending from the Argentine to Bahrain, from Finland and Chile to Ghana, Pakistan and Singapore. But not to the Soviet Union directly.

The Marconi Company has made an enormous international forward leap with the four-tube, plumbicon, all-solid-state colour

camera, using the separate-luminance philosophy which the EMI group (and of course the Radio Corporation of America) has rigorously followed despite advocates of three-tube colour. It was therefore anticipated that Marconi's having the first triumphant four-plumbicon camera on the market, and EMI holding the licence for PAL, the United Kingdom would be in an unsailable position for colour-TV.

And now comes 'Comrade.'

If this system is as stable and practical as rumoured, the EBU is going to be faced with a most difficult situation the real thorn of which will not be known until we are informed of the degree of compatibility between 'Comrade' and the alternative systems to be presented at Oslo. The PAL type of signal can be easily transcoded from NTSC and back into NTSC, and it has been proved that so far as the domestic market is concerned it is possible to have a PAL receiver without the delay line so essential to SECAM, although it does not then have all the advantages of the more costly receiver.

As there has been as yet no official description of the Soviet system, we can repeat only rumours, which are to the effect that as in PAL the luminance and colour difference signals are formed in somewhat similar fashion to NTSC, and are quadrature modulated on to a subcarrier. One can only wonder if the Soviet scientists learned from the RCA of Great Britain Ltd television convoy which last year gave a display at the Exhibition of Soviet Achievements. An invited audience of several hundreds (VIP's politically and technically) saw RCA-style separate-luminance NTSC colour for the first time. Then, so fraternal was the meeting, the convoy went on to Moscow Television Centre, where an experimental colour studio was made available to the British contingent, with a joint team of Russian and British cameramen. Under the direction of a leading Russian TV producer, four 90-minute programmes were broadcast on-air (preceding displays at Helsinki and elsewhere had been CCTV), and during these programmes NTSC colour signals were relayed through a 6,000-km network before returning to Moscow for transmission and monitor comparison with the original signal. Ultimately the unit returned to Vienna in time for the meeting of Study Group XI of the CCIR which met there for a two-week session aimed at reaching some sort of agreement about European standards.

It would be interesting to know if at that time the Russian engineers had their new system perfected.

While the Soviet Union and other nations differ in political ideologies, there has been no curtain, no wall between East and West on many technical affairs. On this very page we have praised the international TV and radio weather 'hot line' which breaks political boundaries. And the Soviet scientists have their representatives at CCIR discussions, and have shown a great interest in the steps to bring European nations to a colour-TV-unity. However, the fact remains that this Soviet PAL has been sprung on the rest of the world.

Was it because the system had not been finalised at the time of the RCA Great Britain visit? Or was the system then being earmarked for some Space of even military purpose?

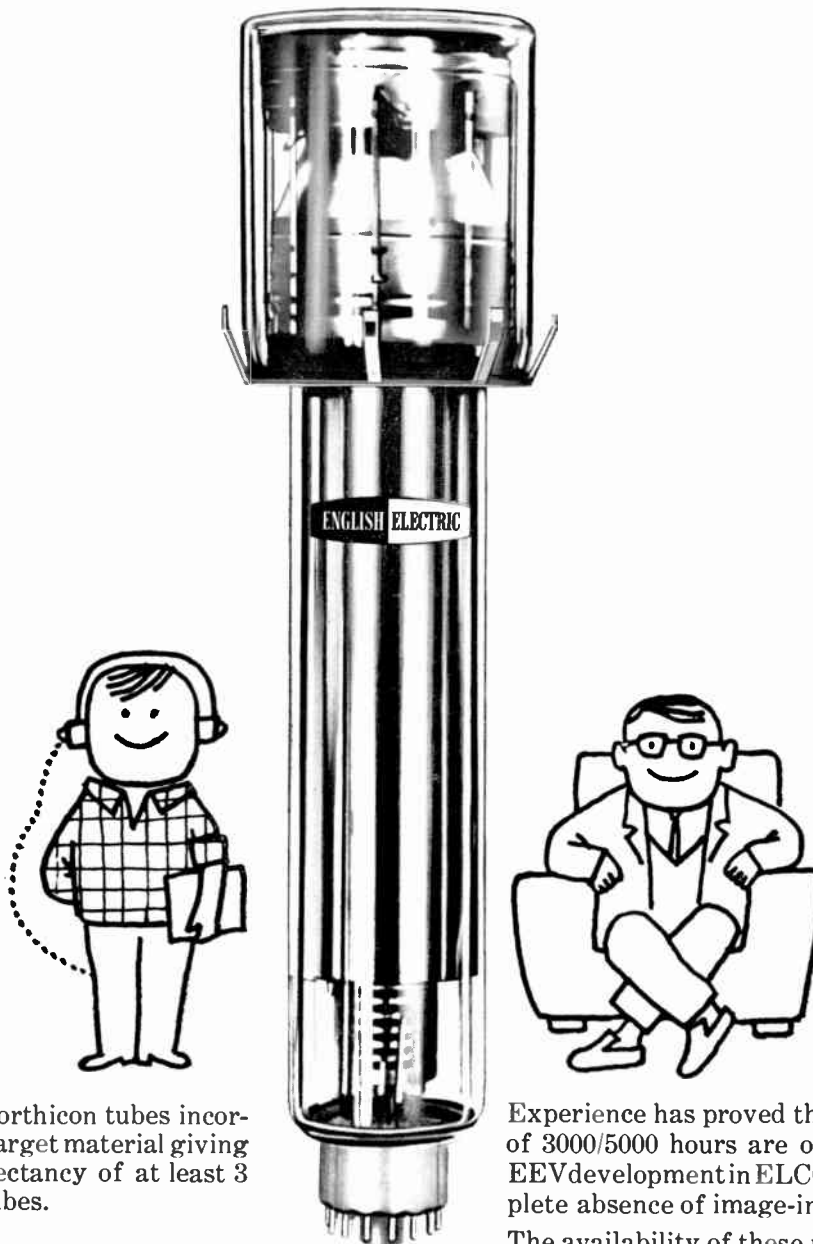
Without wishing to be flippant, we can only say to M. Sergei Novakovsky, head of the TV Laboratory of the Russian State Committee on Radio-electronics: 'Be a PAL. Let there be no delay in allowing Europe and the United States to benefit by your latest discovery. The US held back no NTSC secrets.'

And if the Soviet system is better, let us adopt it. It is bad enough to have the United States pinned to NTSC and Europe heading for PAL. Let there not be a third system loose in this oddly-civilised world.

by John Dickson, Ph.D

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# NEW RCA RANGE OF SUNBURY STUDIO SOUND EQUIPMENT

by Donald Aldous, Audio Editor

**R**CA (Great Britain) LTD recently introduced at an exhibition at Berger House, Berkeley Square, London, the Sunbury range of Studio sound equipment. This represents an important UK manufacturing development by this organisation, incorporating some radical thinking on equipment in this field of magnetic sound recorders and reproducers.

The equipment that was shown included: single-track multi-track printer; modules; studio console; and microphone recorder; 35/16 mm single-track replay machine; 70 mm with boom.

This new range of recorders (intended for use with various gauges of sprocketed film and single or multi-track heads) improves on the performance of the famed LM.99 series and have a number of additional facilities. For instance, the equipment is fully solid-state and is built up from plug-in modules. Important benefits conferred include extreme reliability under all operating conditions and low power consumption, and, of course, heat dissipation ceases to be an operating problem.

Two replay machines can be accommodated in a single cabinet. The equipment comprises a basic panel common to both recorders and re-recorders. On this is mounted the main drive assembly with switch controls, torque motors for hold-back and take-up, rewind control, indicator lamps and, in the case of all single-track machines, the pre-amplifier with its power supply unit. All machines, including multi-track versions, are self-contained and require only signal, mains and motor circuits to be connected.

#### FILM TRANSPORT

This comprises a sprocket, driven by a synchronous motor via a gear box, a specially designed filter system with two stabilising drums and damped compliance rollers and torque motors, fitted with magnetic clutches for hold-back and take-up. In addition, trip rollers are provided to shut down the machine when film runs out. A reversing switch is provided for the upper torque motor. By means of adjustable rollers, all 35 mm machines will also run 17.5 mm film — a useful facility.

#### MAIN DRIVE

The main drive motor is mounted on a rigid support to the main panel and coupled to a reduction gear box, the low

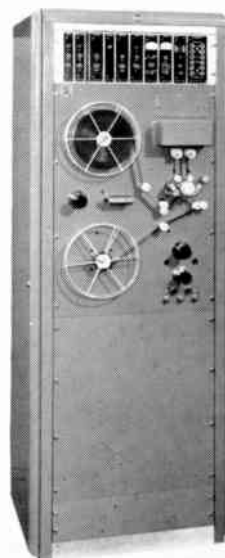
speed shaft of which drives the sprocket via a quick release device. This arrangement has two main purposes: (a) it permits manual rotation of the sprocket to adjust to synchronising marks, and (b) it enables 'searching' to be carried out. Three types of motor are normally available: three-phase synchronous; Selsyn interlock; and dual purpose, ie, Selsyn/three-phase synchronous. Motors are easily interchanged and the gear ratios altered to suit the several requirements, such as 24 or 25 frames per second or other speeds for special purposes.

#### MAGNETIC HEADS

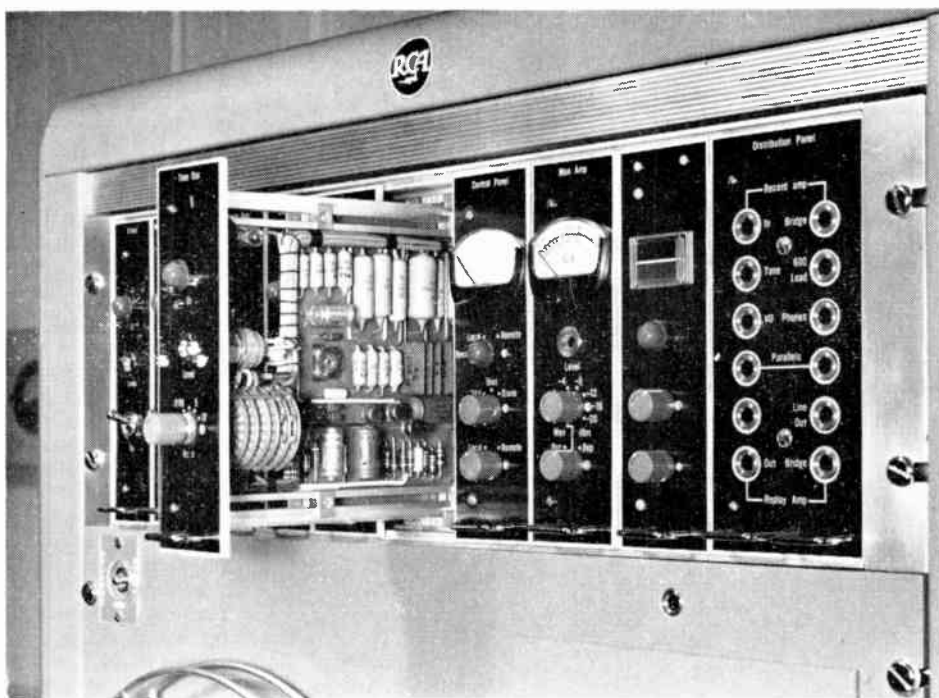
These are mounted on dowelled plates and pre-aligned for rapid interchange.

#### FAST REWIND AND SEARCHING

Controlled by a single knob giving rewind at variable speeds in either direction. Push buttons are used to put the machine into rewind mode. Rewind can be performed by (a) direct rewind from upper to lower spools and vice versa;



RCA Sunbury  
Range: Single  
track sprocketed  
film magnetic  
recorder.



RCA Sunbury single track sprocketed film magnetic recorder module nest.

(b) rewind over the sprocket which is then released from the main drive; and (c) rewind over the magnetic heads and on the sprocket as in (b) for searching. The footage counter remains engaged in modes (b) and (c).

1,000 ft spools use 2 in diameter centres, and 2,000 ft spools have 3 or 4 in diameter centres.

#### CONTROLS

The principal controls are: a Selsyn/synchronous selector switch is mounted on the main panel for use with dual purpose motors. This switch has an 'off' position that isolates not only the motor circuits but all mains power.

A motor control switch provides for forward and reverse running, whichever type of main drive motor is employed. A push button puts the machine into rewind mode when the torque motors are operated from the rewind control. This gives rewind at a controlled variable speed in either direction. The circuit is restored by operating another push-button. An assembly is also provided for checking lock under selsyn conditions.

#### ELECTRONIC ASSEMBLIES

The transistorised plug-in modules are carried in a 'nest' mounted above the mechanism. All operating controls are accessible from the front of the assembly. A VU meter, with test oscillator, is supplied with recorders that also have a jack panel for rapid cycle testing and interchange of circuits. Headphone monitoring from either record or replay side is provided with a selector switch for multi-track sampling. A line level monitor output circuit can be connected to an external power amplifier.

#### ANCILLARY EQUIPMENT

Erase amplifier and relay and switching circuits to provide 'roll back' and 'virgin loop' functions. For the latter purposes, a loop box with a capacity of about 120 ft of film is clipped to the front of the recorder.

#### THEATRE EQUIPMENT

Displayed for the first time in the UK was a Fedi 35/70 mm projector and Xenon lamp, which is of extremely rugged construction. Complementary to the projector is the new RCA

Sunbury series of projection sound equipment, designed to the same technical standards and specifications as the Sunbury Studio equipment.

#### LANGUAGE LABORATORIES

In this field RCA has now confirmed its position as a major supplier by the improvements added to the RCA Language Laboratory, of which a three-student position was shown. For certain applications, mainly for junior and secondary schools, there is a growing demand for a centralised tape system and the advanced Tolnai Studymaster Equipment was exhibited.

#### MAGNETIC TAPES

A few years ago RCA in America introduced their own brand of magnetic tape, after a prolonged period of development and two years of user experience in the USA back the release of the RCA 'Vibrant' range of tape in this country. Categories to be made available here, through Selecta Gramophones Ltd, London, are a full batch of domestic types, a professional grade (a low noise tape that offers a 6 dB gain in S/N ratio over standard tapes), and back lubricated tape (ie, a tape with a film of lubricant on the underside, suitable for use with continuous music equipment).

RCA's British developed prototype teaching machine—of the semi-branching type—was also displayed.

#### VIDEO TAPE RECORDERS

This new 'generation' of this equipment is completely solid-state and employs unique plug-in modular units. Models are: TR.3 (intended for use in studios for preview, editing and 'on air' playback); TR.4 (compact quadruplex record/replay machine at a competitive price, designed to meet the stringent requirements of broadcasting); and TR.5 (compact professional quadruplex recording unit, which has limited playback facilities to permit on-the-spot cueing and preview to check picture quality).

Major enquiries from overseas and home markets are already being received by RCA, whose Great Britain company at Lincoln Way, Sunbury-on-Thames, Middlesex, can supply full details to IBE enquirers.



Camera 'B' of EMI's Type 9 concept. This is a self-contained camera with only a single cable linking to the power unit. Ingenious little electronic viewfinder is optional.

# SMALLEST IN THE WORLD

— the new EMI Type 9 CCTV system

**P**ERCY ALLAWAY, managing director EMI Electronics Ltd has a geniality which conceals a blunt and truthful presentation of facts.

And when he introduced Type 9, EMI's latest solid-state CCTV system, he frankly pointed out that the EMI half-inch vidicon has made possible 'one of the smallest cameras in the world.' It is, in fact, a small tube having an overall diameter of precisely 1.705-in (4.31cm). **Other claimants for the smallest camera in the world are now awaited with marked interest at EMI Laboratories. . . !**

As a prelude to Type 9, which is a system, not a single camera, Mr Allaway referred to the pioneer work of Sir Isaac Shoenberg and his team at EMI Laboratories, in 1931, when the only kind of television which existed was a mechanical system operating on 30 lines. Shoenberg realised that, if television was to become commercially and artistically successful, a much higher definition picture would be needed. This he achieved with the development of the 'Emitron' iconoscope camera tube. This tube, which made possible the first high-definition TV service in the world employed a photosensitive mosaic which was scanned by a high-velocity electron beam. Although inherently capable of very good definition, this type of tube was not of outstanding sensitivity. The situation was soon improved, however, by the addition of an image stage (another EMI invention of great significance) and this so-called 'Super Emitron' made possible many famous TV outside broadcasts before World War II. In the 1945 development, on a low-velocity scanning tube, the CPS Emitron was introduced.

'Let us not forget,' urged Percy Allaway, 'that it was the Emitron which provided the great breakthrough that launched the world's television industry.'

'EMI has also been very active in research and development in connection with photoconductive tubes of the vidicon type. EMI led the world in the development of the 1-in separate-mesh tube. Separate mesh and the low-wattage heater were, in fact, standard features of all the EMI vidicons. And two years ago EMI had already overcome the problems of the excessive red response, and was producing very uniform prefabricated target tubes, ideal for studio broadcasting. The half-inch vidicon is a superb tube capable of high-definition pictures, with a spectral response to suit the majority of applications. The cameras which we are now going to show you make use of these tubes. . . .'

To Potter, Sales Manager of the EMI Closed Circuit Division, asked by IBE representatives, what is the essence of Type 9, and how it relates to the EMI Type 8 and other internationally-known CCTV systems, said: 'Type 9 is a network, not a camera. In fact three cameras are available in the basic Type 9 facility, and this gives us a very high degree of versatility. It is, to deal with your second question, fully compatible with the low-cost Type 8 system, which is also solid-state. The preceding Type 8 camera can, with minor modifications, also be incorporated into a Type 9 CCTV system. . . .'



Type 9 is modular. You can up what you like, using any of the three basic Type 9 cameras, or a modified Type 8 as well. The system is so flexible that it can be used as a simple CCTV system, random interlace, or additional modular units can be added to improve the overall quality to full CCIR standards.

'With every camera in the Type 9 system,' explained Tom Potter, 'a power unit and a camera control unit are used. If you want interlaced pictures, a sync pulse generator is provided. If you require the system to operate as a broadcast studio camera, a broadcast sync pulse shaper is employed.'

The three Type 9 camera heads are the main reason for the system's extreme flexibility. First is a conventional-looking tubular CCTV camera, the 'Camera A' of Type 9. This is rugged, of high instrument quality. It has a diameter of 3.625 in (9.5cm). This camera is designed to use the EMI high-resolution separate mesh 1-inch vidicon Type 9677. The optical focus is operated by a knob situated at the rear of the camera. A 32-way camera cable connects this camera head with the modular control and remote control units. The camera can be up to 4,500 ft (1,370 metres) from the monitor. Provision is made to fit a cover to enclose the lens, thus providing a completely sealed camera unit.

'In this way, you see, by choice of three different camera heads,' explained EMI's Alan Oates, tailor-made systems to suit individual requirements can be built up from the standard modules. Systems can be extended at any time to include extra cameras, monitors and various accessories which can be manually or remotely controlled. Excellent pictures are obtained under normal room lighting conditions; special or additional lighting is seldom required.

'Printed-circuit construction is used throughout and all sub-units and printed circuit cards are easily unplugged from the main frames for servicing. In the case of serious failure a new sub-unit or circuit card may be inserted in a few moments. Available as standard accessories are attachments for the remote control of focus, lens aperture (iris), zoom and lens changing. Remotely controlled pan and tilt heads are available for the control of camera movement and special camera enclosures are designed for use in wet, dusty or explosive conditions.

'Camera selectors and switching units are available to enable one camera to feed many monitors simultaneously or individually, as required. All operational controls for the camera and remote accessories may be switched through to the picture monitor, so that the entire sys-

only 20 lux (2ft/candles), assuming 50 per cent subject reflection and lens aperture of f/1.9, a normal contrast picture is obtained. Spectral response with either the 1-in vidicon or the  $\frac{1}{2}$ -in high-resolution separate-mesh tube, corresponds to panchromatic. As this is a solid-state system, power consumption is only between 15 and 30 watts, depending upon the module build-up.

The modular units? These are four, of which two at least are necessary except for 'Camera B,' which needs only a power pack. They are the same shape and size, and are free-standing designed to fit a GPO-style 19-in rack.

There is the PU900 power unit. This provides the correct supplies for the 'A,' 'B' and 'D' cameras, the camera control unit and also the sync pulse generator if this is used. This little solid-state power pack is voltage stabilised, and even if the mains fluctuate over the fairly wide margin of  $\pm 7$  per cent, there is no effect in the performance of the CCTV equipment.

Camera 'B' has its own control panel inbuilt, but both 'A' and the half-inch-tube 'D' need the camera control unit CC900. This has the necessary printed circuit boards which provide sync pulses and video amplification. At will you can use a plug-in board CC901 or a CC902, giving a choice of either random interlace or a 2:1 interlaced TV system.

## SPECIAL REPORT BY JONATHAN CHAMBERS

Next in the Type 9 selection list is 'Camera B.' This is a rectangular camera which also incorporates certain of the Camera 'A' control unit's circuit boards, and utilises the basis of Camera 'A.' This makes a self-contained camera unit requiring only a camera cable (32-way) for connection to the power unit PU 900. Remote control units, if required, can be up to 1,000 ft (305 metres) from the control module. Optical focus is achieved in the same manner as in Camera 'A.' Camera control panel RA908, or Autolight Unit RA914, can be fitted to the rear of this camera. A lens turret RA904 can be fitted to this camera as well as an electronic viewfinder.

Moving now into the controversial field of 'the smallest CCTV camera in the world,' EMI's Type 9 network offers the 'Camera D,' having a head unit and amplifier with an overall diameter of only 1.705-in, and using the EMI  $\frac{1}{2}$ -in vidicon. Optical focus is achieved by micrometer focusing of 16mm or 8mm 'D' mount lenses. Both units are sealed by 'O' rings to stop the ingress of moisture. A 22-way camera cable incorporating high-quality hermetically-sealed plugs and sockets is used to connect the camera head to the modular control and remote units. The camera head can be up to 100 ft (30 metres) from the amplifier unit and the amplifier unit can be up to 1,000 ft (305 metres) from the control modules.

tem may be controlled from a central viewing position.'

The non-technical user who needs only a simple basic system, or perhaps but one camera, and one or two monitors at most, will nevertheless wish to know the technical specification of the basic Type 9 system, to know how this fulfills his needs, and what possibilities there are for later expansion. Therefore it is important to know what the sync pulse generator is instantly switchable to different line standards. By pushing a button the network can be operated in one of the four standard systems, 405 or 625 lines, 50 fields, or 525 lines 60 fields. This is of enormous benefit if a display is required to be given on either a 405 (BBC-1 standard) domestic receiver used temporarily as a monitor, or on a 625-line monitor of much higher definition. There are also many occasions when it may be advisable to display the picture from the CCTV network on a North-American 525-line standard, and this is done just by pushing a button.

Operator controls on the basic system are simple, comprising mains on/off, beam, target and electrical focus. Preset controls include black level peak-white limiter, gain, DC level, aperture correction, cable compensation, sync level clamp delay X and Y shift, and alignment. On the whole Type 9 system, the bandwidth is 8 Mc/s standard. Sensitivity is such that with a scene illumination of

Power for this CCU comes from the PU900.

For more professional use on a wider CCTV network, it may be necessary to employ a sync pulse generator, and the Type 9 unit (CG900) is another of these four modular units coupling by interconnecting leads to the rest. This sync pulse genie uses binary dividers to obtain the correct division ratio, and, as mentioned, there is instant push-button line-standard selection. This unit is not normally supplied with a crystal oscillator, since this degree of precision is perhaps unusual in an industrial CCTV chain, but it can be provided to special requirement. Outputs of the standard SG900 are line and frame drive. Now we come to the broadcast synchronising shaper (the unit BSS900). When used in conjunction with the power pack, sync pulse generator and the camera control unit (when fitted with the CC902 2:1 interlace board), this group enables the Type 9 system to operate with the necessary sync pulses to full CCIR broadcast recommendation for studio use. There is even an accessory kit, BSS901, which will allow this system to pulse-drive a complete TV station! Outputs from the units, complying with broadcast standards, are line and field drives, mixed syncs and mixed blanking.

There is almost no end to the wide variety of CCTV requirements which users need, so EMI have attempted to make Type 9 universal. Here are ten,

# SMALLEST IN THE WORLD

continued

some of them most unusual and likely to be of greatest practical help to CCTV users.

Varying illumination offers problems to CCTV cameras, just as to motion-picture and still-camera monitoring, but the range of correction with a vidcon is wider. With Type 9 cameras one may use an Autolight unit (RA 914), which is identical in appearance and size to the camera control panel RA 908. It enables any of the three cameras, A, B and D, to adjust themselves to widely varying light conditions.

In the **Thunderbirds Book**, mention is made of the rather unusual requirement for puppet operators creating this television series to have line-scan reversal for their monitors. In this case the reason is because puppeteers are accustomed to the theatrical tradition of rehearsing before a mirror, so mirror reversal is also necessary for TV monitoring. There are many other industrial and artistic applications where line reversal or even negatively/positive reversal are useful. With all Type 9 units one can use the reversal switching kits CM902 and CM903, which allow remote operation of frame-line reversal, and also give negative or positive pictures at the touch of a switch.

There are three remote control kits likely to have wide industrial use with Type 9. First is the camera control panel (RA908) which is only one-third modular size (2½ in high, 4½-in deep), and can be fitted into the PU900 power unit or into 'Camera A,' or at any remote location. It gives manual operation of the normal user controls, target, beam, electrostatic focus, and on/off. Another little unit also one-third modular size is the RA901 remote accessory control panel. When the appropriate units are fitted to the cameras, the RA901 can be used for remote operation of focus, iris, zoom, two-lens turret, pan and tilt. For Type 9, the appropriate units are Remote Focus RA902, Remote Iris RA903, and Lens Turret RA904. This small RA901 control panel can be located in any remote position or in the remote accessory module RA905. This latter is of standard modular size and has the necessary wiring so that a number of units (camera control panel RA908, Autolight unit, remote accessory panel and the reversal switching kits) can be fitted and located next to the other camera control modules.



Camera 'A' of the startling new EMI Type 9 CCTP concept. This unit is only 9.5-cm in diameter, is solid-state. A 32-way cable connects with the modular control and remote-control units.

There are several pan and tilt units available for Type 9, depending upon the weight of the camera used, the housing to be mounted, and environmental conditions. As to lenses, all D-mount and 16-mm C-mount focusing lenses are suitable, and a special mount adaptor (7A/A5681) is needed for 16-mm C lenses. Wide-angle, telephoto and zoom lenses are available, together with microscope adaptor tubes. Various environmental conditions demand special protective housings (working temperature of Type 9 cameras without housings is -5 to +50-deg C, 134-deg F), and the housings for all Type 9 cameras include those with remotely-controlled screen wipers, heating, cooling and demisting facilities. Also available are dust-proof, acoustic and underwater housings.

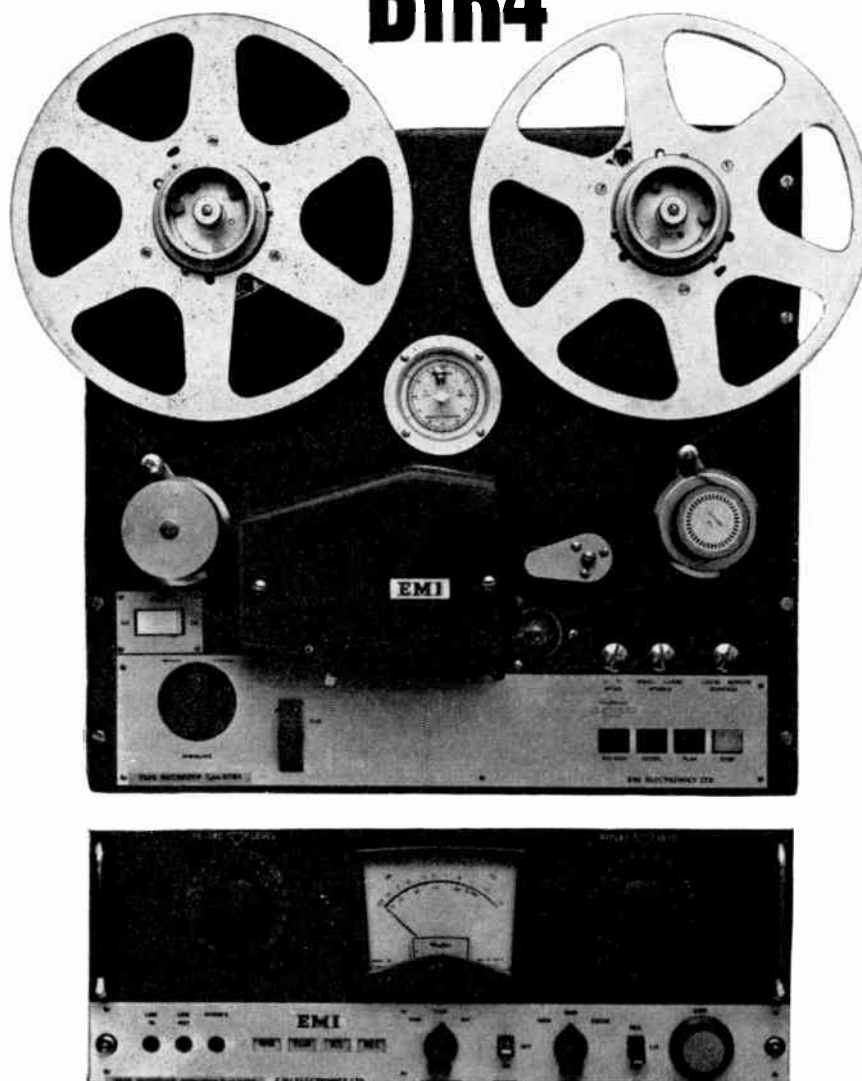
A 4-in viewfinder by Sony is available for use with 'Camera B,' and this is simply attached to the top of the cameras as with a professional broadcast camera, or can be used in a rack, or as a free-stand-

ing video monitor by the addition of a power unit.

Finally, with the Type 9 network goes a full range of video and pulse distribution kit. This allows one camera with video output to be connected to several monitors, or many cameras to one monitor, including separate sync pulse distribution if needed. EMI laboratories also supply for Type 9 a range of RF distribution equipment, using microwave link (broadcast, or alternative landline). These include simple video RF modulator units, and combined video and audio RF modulators.

When IBE representatives were introduced to the Type 9 system by EMI Electronics managing director Percy Allaway, he gave an optimistic forecast: 'This Type 9 system is the latest from our very active Development Laboratories at Wells, in Somerset. These labs are housed in a spacious modern building, staffed by some of the most talented electronic engineers in the country. I confidently expect we will have several more interesting developments from Wells soon, and in other spheres than CCTV. . . .'

# NEW TAPE RECORDER TYPE BTR4



## EMI SOUND IS INTERNATIONAL

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



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PL, PROJECT GEMINI  
First TV photo taken by Ranger 7 was this Polaroid Land print, here being examined by (left) Charles Peterson, RCA Product Assurance Administrator, and (right) Donald H. Kindt, project engineer, Ranger subsystems, Jet Propulsion Laboratory. (Photo: courtesy Jet Propulsion Lab, Pasadena).



## POLAROID, PROJECT GEMINI AND TELEVISION

\* *Moonshots, TV commercials, two-man space-shot monitoring from Cape Kennedy, and back-projection for television Spectaculars . . . these are the Polaroid Land TV | photographic developments now disclosed by JOHN DICKSON, Ph.D., author of 'Instant Pictures' (The complete Polaroid Land Guide), Pelham Books.*

**R**ADIO Corporation of America built the equipment used for Ranger 7's picture-taking. And this was RCA's resident manager Bill Clair talking.

It was just as the first televised still photos of the moon's surface were being seen by JPL (Jet Propulsion Laboratory) engineers and scientists when Ranger 7 neared the moon.

'Polaroid pictures were incorporated in the original concept of the Ranger moonshot here for a quick-look verification that the signals were being received. They have been part of the procedure since the station became operational.'

As Ranger 7 neared the moon, ten-second prints were being made on Polaroid Type 47 Land film, and it was these instant black-and-white pictures which confirmed that videotaped reception of the historic moon-surface close-ups from the spacecraft's six television cameras was good—very good. One of the first to view the 3,000 speed Land prints was Jet Propulsion Laboratories' director William H. Pickering, who promptly reported: 'Their resolution is several times better than any pictures taken from earth. . . .'

All this took place shortly after my own visit to the Polaroid Corporation, at Cambridge, Mass, when I saw big preparations in hand for forthcoming television, radar and spaceshot use of the process.

We were not to know, then, how successful results from Ranger 7 would be. In fact, by television within ten minutes from this Atlas-Agena-launched spacecraft, 4,316 pictures of the face of the moon were received at the ground station. The first photos, sent by two TV cameras with 1,152-line scan, were so clear that they were indistinguishable from fine photographs, and a quick look at Polaroid camera shots taken off the VTR caused one deliriously happy JPL scientist to shout: 'Every one's a bull's-eye.'

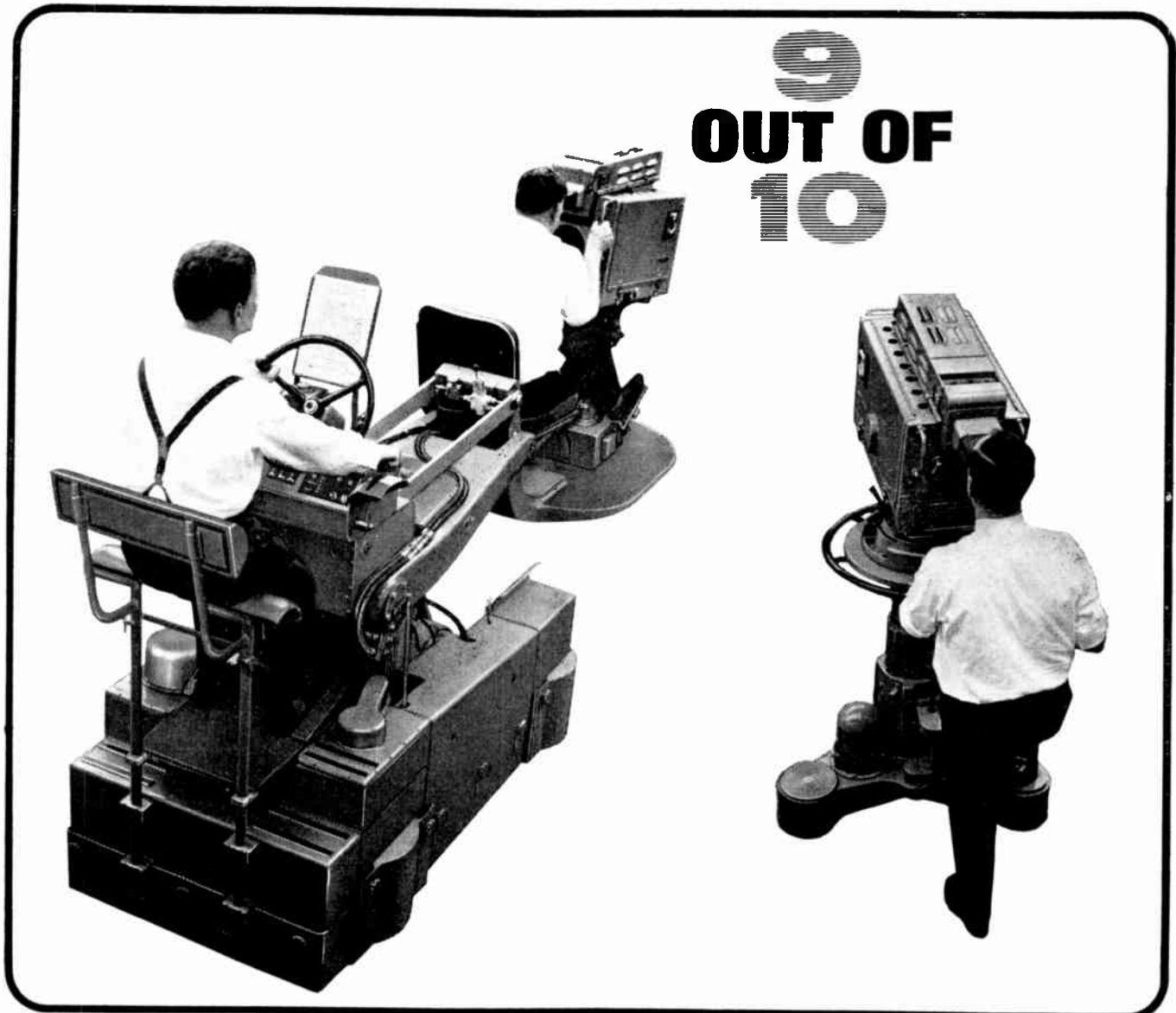
Then, when Ranger 99 was launched, millions of viewers watching network TV coverage of the moonshot from JPL at Pasadena, saw technicians again using the ten-second process to check picture and signal reception. In NASA's Jet Propulsion Lab Deep Space Instrumentation and Film Recording System at Goldstone, Calif, both Polaroid and 35-mm camera records were taken of CRT's to capture the entire sequence of lunar photos.

Next came Project Mercury (flights involving capsules occupied by one astronaut), and Project Gemini, with two-man capsules; and once more a novel TV, line-picture and radar application is used involving Polaroid Land techniques. Here's what happens.

The US Weather Bureau stations in Daytona Beach, Miami, and Tampa, Florida, all photograph radar scopes with Polaroid Land cameras for several days prior to Project launch at Cape Kennedy. All photos are transmitted (by wire) to the Miami office and manually composed with the Miami pictures for a complete radar composite. This shows precipitation echoes over the Florida Peninsula and for 150 nautical miles or more off-shore. The composite of Polaroid Land prints is then transmitted by wire from Miami to Cape Kennedy for operational use prior to the launch. Radarscope photos are taken at 250 nautical mile range and one-degree elevation, using a Graflex camera equipped with a Polaroid Land 4 x 5 film holder. Pertinent data such as ground clutter, anomalous propagation, interference and so on, are marked on the tab-end of the ten-second prints before being wire-transmitted. In Miami, the prints are enlarged via an opaque projector, and composed by tracing the three pictures (one each from Daytona, Tampa and Miami) on a single 1 : 5,000,000 Mercator chart of Florida and vicinity. This complete radar composite is transmitted to Cape Kennedy in less than 20 minutes after the initial time of observation.

Television technical executives more directly concerned with pumping out a good klystron UHF signal, poking Plumbicon-equipped studio cameras at nice NTSC-coloured subjects, or coping with third-generation video tapes of a serialised TV Western, may feel that the moon, or even Cape Kennedy, is a long way off. And that Polaroid Land techniques don't help with bread-and-butter TV. Just how false this philosophy is I began to tell as long ago as February 1962, when my first UK paper on PL/TV was published in **International TV Technical Review**. At that time the greatest TV use was in oscilloscope photography to check TV waveforms. This aspect was further detailed in my book *Instant Pictures*, the *Complete Polaroid Land Camera Guide* (Pelham Books Ltd), in which a large section is devoted to television and oscilloscope work. Since then many television workers have developed techniques, not only for recording direct off the tube, but in using the Land process for television slides.

In particular, Ralph J. Olivieri (Film Director, KSLA-TV, Louisiana) has a novel method of making black-and-white 2 x 2 slides for TV, using 46-L material and a Polaroid Copymaker, Bert Goldrath in our contemporary **Broadcast Engineering** (Howard W. Sams & Co Inc, Indianapolis)



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.

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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.

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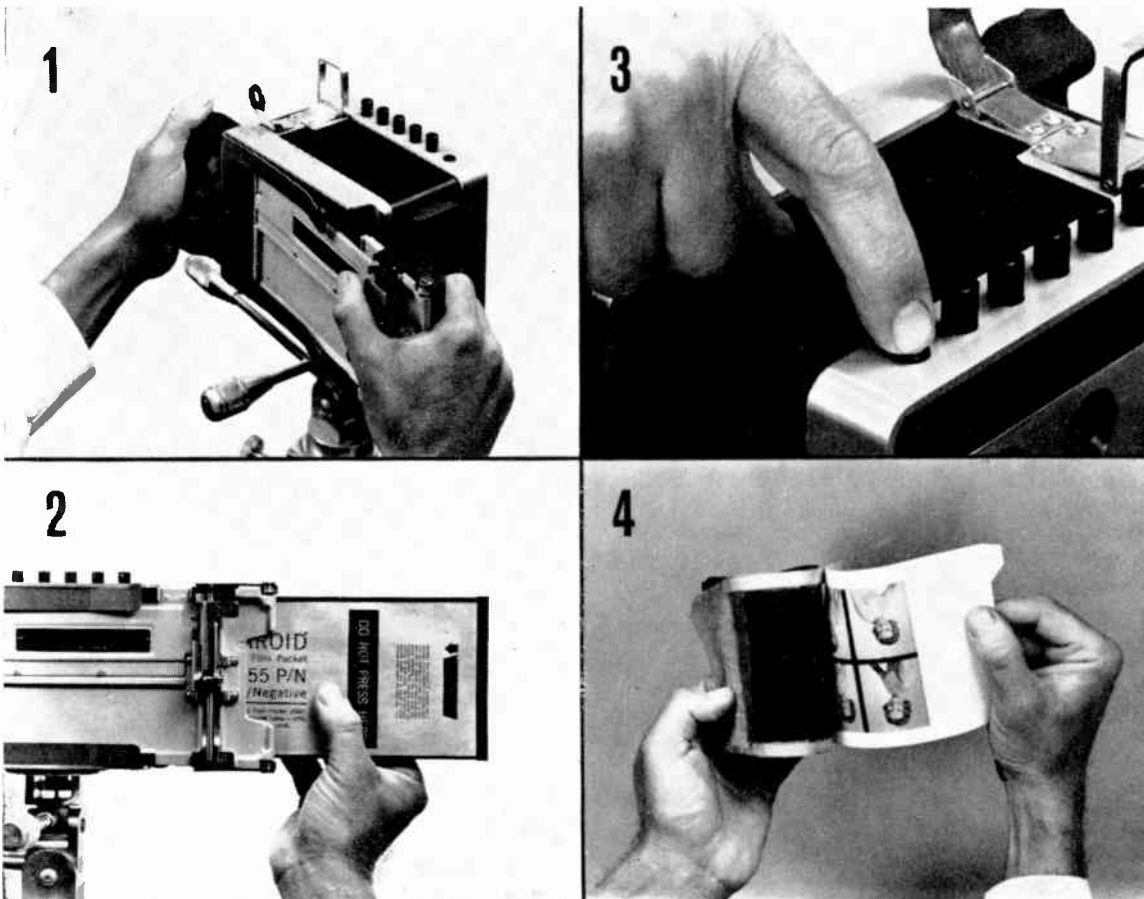
The unique Vinten cam principle provides a very wide angle of tilt, and perfect balance throughout the full range of movement—features unobtainable with spring counter-balanced systems. Cameras up to 250 lb in weight can be carried safely and both pan and tilt movements are fitted with locks and friction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

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Four-step sequence of the new Polyfoto camera used in television for ID and casting. This six-lens camera gives six pictures on Polaroid 20-second 5 x 4 pack, producing near-instant negative, permanent black-and-white proof, with facility for conventional enlargements.

## POLAROID, PROJECT GEMINI AND TELEVISION

continued

has developed a copying system for TV news slides, and Eugene S. Thomas of KETV (Omaha) uses Polaroid Land photography even in TV panel games! Here are some of the latest developments.

### PHOTOGRAPHING OFF THE TV SCREEN

Types 37, 47 and 107 black-and-white films should be used, as the 3,000 speed makes it unnecessary to take time exposures. I am told by a Polaroid expert at Cambridge, Mass: 'We do not recommend the use of Polacolor to photograph colour TV and projected colour images. This is because the spectral energy distribution of the light emitted by a TV monitor screen is not balanced to equal the colour temperature of the Polacolor film. Also the relatively slow speed of colour film makes it impossible to stop any action on the TV screen. Similarly, colour reproduction of projected slides or movie frames is not satisfactory . . . projection lamps have a different colour temperature from Polacolor.'

For ordinary off-the-tube photography, best results are obtained when contrast and brightness are set higher than for normal viewing. Turn the brightness control as high as possible without reducing contrast. Care must be taken that no lamp in the room is so placed that it reflects from the tube face or greatly lessens image contrast; however, it is not necessary to photograph off the tube in absolute darkness.

Use of a close-up lens may not be necessary, but there is a close-up kit Type 540 for all cameras such as the 800, 850 and 900 (these take roll film), a Type 550 kit for the 110 and 120, and a different Type 581 kit for the film-pack model 100.

Variations in monitors as well as types of fluorescent screen make it difficult to quote precise exposure times. However, my own TV work is covered with the Automatic 100 Land camera, which has a transistor-operated shutter, and in Cambridge they gave me this advice: 'Set the lighting selector to "Outdoors or Flash." This means you will be working

at the smallest aperture, which gives greatest depth of field, and sharp pictures. In addition, the shutter will operate more slowly, probably not faster than 1/30th second. This is important, for if the shutter moves faster than 1/30th, the picture will have a dark shadow across it which is actually making up the TV image.

'If the shadow does appear, you can further slow down the shutter speed by moving the trim control towards "Lighten." At the same time, the television monitor screen can be darkened slightly, although not so much as to kill good contrast. You may sometimes find that you cannot get exactly the exposure you want without causing the shadow of the scanning lines caused by a too-fast shutter speed, but the image will usually be acceptable. . . .'

On models 110A and B, set to RV13 and engage interlock. Then turn the shutter speed to 1/30. If action on the screen is slight, use slower shutter speed and smaller lens opening (such as f/16) to give maximum depth of field. If picture is too light set to RV14; if too dark, at EV12. Then engage interlock. With the model 110, set the shutter to 1/25th and aperture to f/11, changing to f/8 if too dark. With the amateur J66 and J33, set the lighten-darken control at the half-way setting, and if the picture is too light, move the ring to Normal.

### LAND PROCESS FOR SLIDES

Apart from off-the-tube photography, most television applications involve the use of transparency film to produce slides ready for projection within minutes after the exposure is made. I use the Polaroid MP-3 Industrial View Land camera for making TV slides, since this has a ground-glass reflex viewing system scribed for four image areas: 35-mm Polaroid Land transparencies (area  $2\frac{7}{16} \times 3\frac{1}{4}$ ), Polaroid Land prints (area  $3\frac{1}{4} \times 4\frac{1}{4}$ ), and  $4 \times 5$  prints. The Copymaker is a camera stand which can be used with most Polaroid Land cameras using 40-series size roll film, except the J66, 900 and 850. Also there are no transparency film types to fit the Automatic 100 series, which of course use packs. The Copymaker handles originals up to  $11 \times 14$ ".

Another convenient tool for making TV slides is a professional  $4 \times 5$  camera such as the Graphic series, equipped with a Polaroid roll film back (roll film types), and of course it is an advantage to use a Graflex type camera which accepts various focal length lenses and offers double extension bellows to obtain many format sizes.

I have tried two methods for making  $2 \times 2$  35-mm TV slides. The first is **Reduced Image Size**. By reducing the area covered by the subject on the film plane, images can be produced for use in small-size slide

formats, and 35-mm slides can be made on the Copymaker from originals up to 5 x 7". For one-time use, simple cardboard frames may be used, but for greater durability glass-slide holders are available such as Lindia snap-in mounts, and EMDE aluminium frames, the Polaroid transparency being cut down to the size of the glass. Of course the transparency must be completely dry before it is mounted, and it is recommended that at least 12 hours be allowed between removal from the hardening Dippit, and insertion of the slide between glass.

Second technique is by **Multiple Exposures**. In this way one can produce four 35-mm slides on one frame of Type 46L film, using an original of 5 x 7" or less. Use the No 8 square on the Copymaker easel (10½ x 14) for the outside of the four-picture format. Mask off three-quarters of this area with black cardboard, and place the copy in the remaining quarter. Photograph the original, then use the remaining quarter areas one at a time, masking the open three-quarters before each exposure. Of course if all four originals are ready at once, they can be photographed simultaneously. The resultant transparency is cut into four pieces, and each mounted in a 2 x 2 slide.

#### TELEVISION TRANSPARENCIES

Once a Polaroid Land transparency has been dipped, the image is effectively protected and it can be handled in any standard slide projector such as the Gray Telejector, the RCA TP7A vertical twin drum projector, Selectroslide continuous automatic projector, or the new machine being developed by Evershed Power Optics Ltd. However, it is important to allow each transparency to remain in the Dippit for at least 20 seconds, or longer if the transparency remains undipped for more than 10 to 15 minutes after removal from the camera. In TV projection, slides generally require a clear scanning field around the essential slide area, and this is easily supplied by placing the subject matter on a large grey backing. Titles for commercial breaks and (outside the UK) for station-breaks can be made with Polaroid Land projection film and the Type 211 titling and chart-making set. This is a plastic lettering system which can be used with the Copymaker format, and by using double exposures titles can be superimposed over or under pictures. Retouching can be done with white photographic pencils, and in the US Polaroid recommend the Victorlite (Victorlite Industries, 4117 West Jefferson Blvd, Los Angeles, 16), and with this markings should be applied to the

glossy side of the transparency after it has been dipped. For notation markings, as needed in TV documentaries, a Koh-I-Noor Acetograph technical pen used with the special acetate ink (Koh-I-Noor Pencil Co, Bioomsbury, NJ) is suitable.

TV projection of black-and-white paper prints is possible by a number of techniques, and in my experience the best professional results are obtained with standard 4 x 5 cameras such as the Graflex Speed Graphic, using the Type 500 Land film holder. A technique used in many small US stations (where Polaroid Land prints are used for commercials) is to take a Polaroid monochrome Land picture, and then to copy this on to a slide. There is a slight loss of detail in copying, but as the process is virtually free from grain, results are most satisfactory. Further, standard 4 x 5 or 3½ x 4½ (40 series) prints make good originals for opaque slides such as those used on the Gray Telop machine, or the optical device known as the Balop, formerly produced by Bausch & Lomb for US General Electric, but not available since 1965.

TV waveform monitoring can be done with any standard camera, or with cameras such as the 850 using the special 10,000 speed roll film for CRO trace recordings. A recent development, however, is the Type 510 for professional 4 x 5 holders (for instance, the Type 500 film holder which fits Graflex cameras). This is sold in boxes of 12, has a daylight speed of 10,000, has pan characteristics of high contrast. Apart from CRO trace recordings, it is useful for low-light photo-micrography and metallography. Latitude is approximately half a stop either side of the optimum exposure, and while normal development time is ten seconds, maximum contrast can be obtained up to 20 seconds.

I have recently seen a great deal of professional TV studio work carried out with the Type 55 P/N stock, in the 4 x 5 size, which has the startling facility of producing not only an almost-instantaneous print, but also a useful negative. Development time of this positive-negative stock is normally 20 seconds at 55-95°F, and I find that quite considerable over-development does not really increase contrast. I would think that although Polaroid do not use ASA ratings, but state their own speeds, they are correct in describing the P/N stock as equivalent to 100 ASA. There is really no precedent in photography for rating a film speed for both positive and negative at the same time!

For most rush television jobs, the print portion of a 55 P/N packet is used only as a proof. Hence, mottle in the picture is not a serious

## THE NEW PSM 6

a six channel portable sound mixer of modular design employing solid state circuitry



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## POLAROID, PROJECT GEMINI AND TELEVISION continued

problem, and the quality of the negative when properly cleared is superb. Any mottle in the negative is due either to (a) Delay in placing the negative in the clearing solution, during which time the negative dries in patches, or (b) failure to agitate the negative while in the sodium sulphite solution. Also if the negative is not placed in the solution (or in plain water) within a minute or two when relative humidity is higher than 45 per cent, an overall mottled effect or uneven density may be found on the cleared negative. It is really a good idea to drop the negative in plain water for a few seconds before placing it in the sodium sulphite solution. As this P/N technique is so useful for TV Remotes getting a proof to show, for example, the result of a sporting event, and still providing a negative from which a transmission print can be obtained, it is often necessary to develop the P/N packet away from a studio. A polyethylene container with a snap-on cover can be used to hold the sodium sulphite. This solution does not deteriorate or exhaust either with age or use. For OB's, where perhaps a 4 x 5-back camera is used for record, negatives can remain in the sodium sulphite solution for up to several hours in the TV van on the way back to base. The solution is a hardening agent, and it is important the negatives should be thoroughly washed on return.

For television casting, it is a good plan to use a Polaroid Land camera adapted for 'ID' work. This technique was first started in US military and space research, where identification pictures are required urgently. Now ID ten-second pictures are used on security-centre passes. Cameras developed for this work are useful in TV to supplement the conventional studio portraits used by casting agencies. For example, the Fairchild Camera & Instrument Corp have a self-contained system producing four head-and-shoulders pictures on one 3½ x 4½ Polaroid Land print. The two pairs of pictures can be of the same person, or of two different people. ID or casting pictures in colour are possible, since the Fairchild ID camera has a Land camera back taking Type 48 colour film (ASA equivalent 75) as well as black-and-white. Another interesting ID camera for TV applications is made by Avant Inc (Box 88, Concord, Mass). This is the Quad ID 32-40, which features a matched set of four lenses with geared apertures, making it possible to obtain simultaneously four identical pictures on one Polaroid Land roll-type frame.

A different system is used by Mast Development Co (2212, E Twelfth Street, Davenport, Iowa) in their ID camera which makes two duplicate image pairs (or a total of four ID photos) on each 3½ x 4½ Polaroid Land frame. This unit was designed to meet military requirements listed in MIL-C-9857, and features a Polaroid Land roll-film back using any of the 40-series types, black/white and colour. In some applications all that is needed is a passport-type of portrait, plus notes, details, and 'vital statistics,' and of course this has ample TV potentiality. Natural Lighting Corp (630 South Flower Street, Burbank, Calif) produce the FotoSure ID camera which uses the Polaroid Land Type 32 film to give a black-and-white print 2½ x 3½" carrying caption data as well as a picture. The subject completes an ID form which is placed on the copy board inside the camera, and this is photographed with the subject.

For television casting, executives like to see several positions of a subject, and this is really better than any 10 x 8 glossy. It is of interest that Anthony J. Jaffe, MA, managing director of the British Polyfoto group, introduced an extremely novel solution, with a six-lens camera developed specially for Polyfoto by the Polaroid Corporation. This uses the Type 55 P/N film giving a 20-second proof of the six shots, plus the usual 4 x 5 negative from which studio blow-ups can be made. The camera operator is free to concentrate on posing and expression since the camera needs no focusing nor exposure adjustments. There are six matched meniscus acromat lenses, with focal lengths of 100 mm and fixed apertures of f/16. They are pre-set for a subject some 65" from the camera, and because of the small aperture the zone of sharp focus extends from 60 to 72". There is a fixed shutter speed of 1/50th, and each shutter is separately synchronised for electronic flash. Six separate exposures are made on each single 4 x 5 film in the Type 500 holder. A novel electric flash unit with a potential life of up to 3,000,000 flashes is developed for this new portrait service which is likely to come into wide use in TV casting. The unit is manufactured by Langham Photographic Instruments Ltd to specifications laid down by Polyfoto Research and Technical Department, intended for a life of at least a million flashes at a 100-watt/second rating, or three times that total at a 60-watt/second rating. The capacitors are non-electrolytic, and the power pack gives an 8-second re-cycle interval. There is automatic voltage regulation between 210 and 250 volts AC. This unit together with the six-lens camera, was first shown at the Hanover Trade Fair, and is now coming into use in television studios and production units throughout Europe.

## PAY TELEVISION STARTS IN BRITAIN

**T**HE BOARD of Pay-TV Limited recently announced in London that their three-year pay television experiment would commence on January 7 1966. The new 625 line service will offer viewers regular alternative programmes to those broadcast by the BBC and commercial television stations. Anthony Wedgwood Benn, the Postmaster-General, will officially open the service and is expected to be the first person to appear.

Programmes will be transmitted approximately 50 hours per week over the existing wire services of British Relay, initially to subscribers in Westminster and Southwark and later to those in Sheffield.

Transmitted on weekdays between the hours of 7.00 pm and midnight and on Saturdays and Sundays between the hours of 11.00 am and midnight from the Pay-TV studios and head office at 66 Dean Street, London, W1, the programmes will mainly comprise current feature films and a number of 'live' and specially recorded programmes devoted

to sport, concerts, opera, hobbies, education, ballet and theatre.

An agreement has been concluded with film production companies whereby Pay-TV Limited will be able to transmit current feature films within approximately six months of their general release.

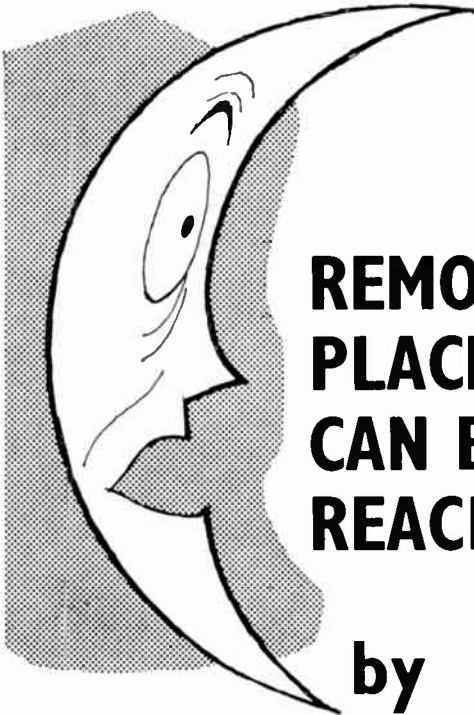
Income will be drawn from subscribers who will have a small, unobtrusive two shilling piece meter attached without charge to their receivers. The meter will operate in the same way as an electric or gas slot meter, although programme charges will vary according to type, content and duration.

The experiment in Westminster and Southwark will determine the popularity of pay television's programmes with up to 10,000 subscribers. A computer will provide a 100 per cent accurate audience measurement and programme planning will be completely flexible to suit public demand. At the termination of the experimental period, the Government will decide whether or not a permanent and regular service is justified and in the public interest.

Michael Frostick, General Manager of Pay-TV Limited, commenting on the announcement said: 'Generally speaking big feature films will be repeated three or four times within a fortnight to offer subscribers a number of opportunities to view the programme of their choice. All sports programmes will be shown in their entirety and viewers will not be switched from one sports event to another in the vain hope of pleasing everybody—an idea seldom achieved in practice.'

Pay-TV Limited is one of the five companies which were originally issued licences by the Postmaster-General for the pay television experiment and is now the only company remaining, the other four having withdrawn. The Company, whose chairman is Lord Brabourne, is owned in equal shares by Associated British Picture Corporation Limited, British Home Entertainment Limited and British Relay Wireless and Television Limited.





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The Pan and Tilt Head P105 provides control over 360° of panning and ± 45° of tilting and accommodates a combined camera and zoom lens weight of 150 lbs.

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## NEWS

### Changes at Marconi

■ THE MANAGEMENT STRUCTURE of The Marconi Company has recently undergone a series of organisational changes culminating in the appointment of Mr F. N. Sutherland, CBE, MA, MIEE as Chairman and Mr R Telford, MA (Cantab), MIEE, MIProdE, MBIM as Managing Director.

Dr E. Eastwood, CBE was appointed Chief Scientist some months ago and the senior management team has now been further strengthened by the following appointments:— Commercial Director, D. G. Smee, MBE; Director of Engineering, H. J. H. Wassell, OBE; Director of Research, G. D. Speake; and Director of Product Planning, A. W. Cole, OBE.

The number of Product Divisions in the Company has been increased to cope with the expansion in the Company's business and these Divisions have now been divided into three groups, each headed by a General Manager who is in turn responsible to the Managing Director. The Product Divisions continue to provide the customer contact for the day to day operation of the Company's business.

General Manager, Telecommunications, Dr T. W. Straker; Manager, Broadcasting Division, T. Mayer; Manager, Radio Communications Division, A. R. Laws; Manager, Line Communications Division; P. R. Keller, MBE; Manager, Space Communications Division; W. J. Quill, MBE; Manager, Mercantile Marine Division, J. Watt; General Manager, Electronics, Dr B. J. O'Kane; Manager, Radar Division, J. W. Sutherland; Manager, Aeronautical Division, L. R. Mullin; Manager, Computer Division, E. F. Atkins; Manager, Closed Circuit Television Division, J. E. H. Brace; Manager, Mechanical Products Division, G. F. W. Adler; Manager, Automation Division, P. Way; General Manager, Components, M. Morgan; Manager, Specialised Components Division, D. Gill; Manager, Microelectronics Division, I. G. Cresswell; Manager, Hackbridge Products (Crystals), D. W. Fairweather, MBE; and Manager, Central Division, P. J. Donnell.

### Delegation

■ A DELEGATION from the Broadcasting Division of the British Electronics Engineering Association recently met Sir Hugh Greene, KCMG, OBE, Director General of the BBC, and Mr F. C.



F. N. Sutherland



R. Telford

McLean, CBE, Director of Engineering. The purpose of the meeting was to discuss ways in which the BBC with its great international prestige could, through its procurement, development and other policies, assist the British electronics industry in its drive for overseas markets.

The Association believes that if new services, both sound and television, are introduced in Great Britain in the near future as part of an accepted national policy, the industry can exploit the growing world market for broadcasting equipment, and indeed increase exports by nearly 100 per cent by 1970.

At the meeting a number of possible areas of collaboration were discussed and arrangements were made for regular meetings at working level in future.

This meeting with the BBC was one of a series which the EEA are arranging as part of its programme of calling the attention of influential public bodies in Britain to the help they can give in building up the international status and reputation of the British electronics industry.

### Contracts

■ EMI ELECTRONICS LTD has been awarded two contracts worth a total of £76,000 to supply and install central control and network switching equipment for the Spanish Television network.

Under the first contract, worth some £66,000, EMI engineers will install equipment for a complete central control at Television Espanola's newly-completed production centre at Prado del Rey, near Madrid. The equipment will co-ordinate the outputs of nine studios, extensive video tape recording and telecine facilities and remote signals.

The installation, due to be operational by next spring, provides presentation and engineering control for the simultaneous transmission of two programmes. It also incorporates equipment for control and distribution of three independent sets of pulses for the various programme areas.

Facilities are provided for switching married sound and vision, and all vision programme switching will be carried out using EMI's plug-in semi-conductor modular equipment. Special effects equipment will also be included and a storage system will allow up to 10 picture sources to be pre-set on each programme.

The second contract, worth about £10,000, is for the supply and installation of equipment for Television Espanola's switching centre in Madrid. This installation will provide facilities for net-

working programmes from the production centres in Prado del Rey and Barcelona, as well as local programmes and remote outside broadcasts. The network switcher is scheduled to be operational early in 1966.

### Conference

■ THE ever increasing demand for mobile radio communications by both civil and military users has resulted in the more efficient use of channel spacing and channel allocation in the vhf bands and has led to the exploitation of the higher frequency bands. The Electronics Division of the Institution of Electrical Engineers, and the Institution of Electronic and Radio Engineers have arranged a two-day conference on vhf and uhf mobile communication systems and equipment to be held at the IEE headquarters in London, January 12-13 1966, when many system and equipment design problems will be discussed.

The 20 contributions to be presented will cover both civil and military mobile communication services. These will include area cover for fire and police services, private and public mobile telephone networks, selective calling and paging systems, aeronautical and maritime services and systems for tactical use in military operations.

The latest developments in the application of new components and techniques to equipments, including those carried by a man or mounted in a fighting vehicle, and in the applications to aerials and power supplies for fixed and mobile terminals will also be discussed.

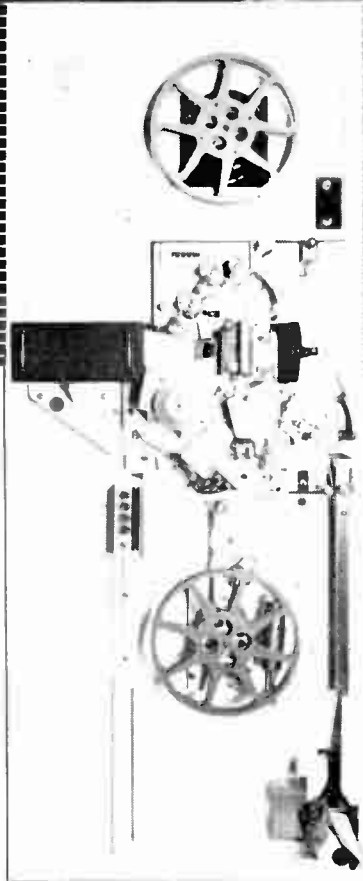
A small scientific exhibition will be held in the IEE building during the Conference.

### ETV system

■ THE LARGEST single educational television system yet planned in Britain, has been ordered from The Marconi Company for the new first year science building at Edinburgh University. No less than nine fully automatic television cameras and 51 receivers will be installed, with a comprehensive control room and wired vision and sound distribution network linking lecture theatres and viewing rooms throughout this partly completed building.

The use of closed circuit television in schools, universities and training colleges has grown rapidly over the past few years, and this growth seems likely to continue. The Committee on

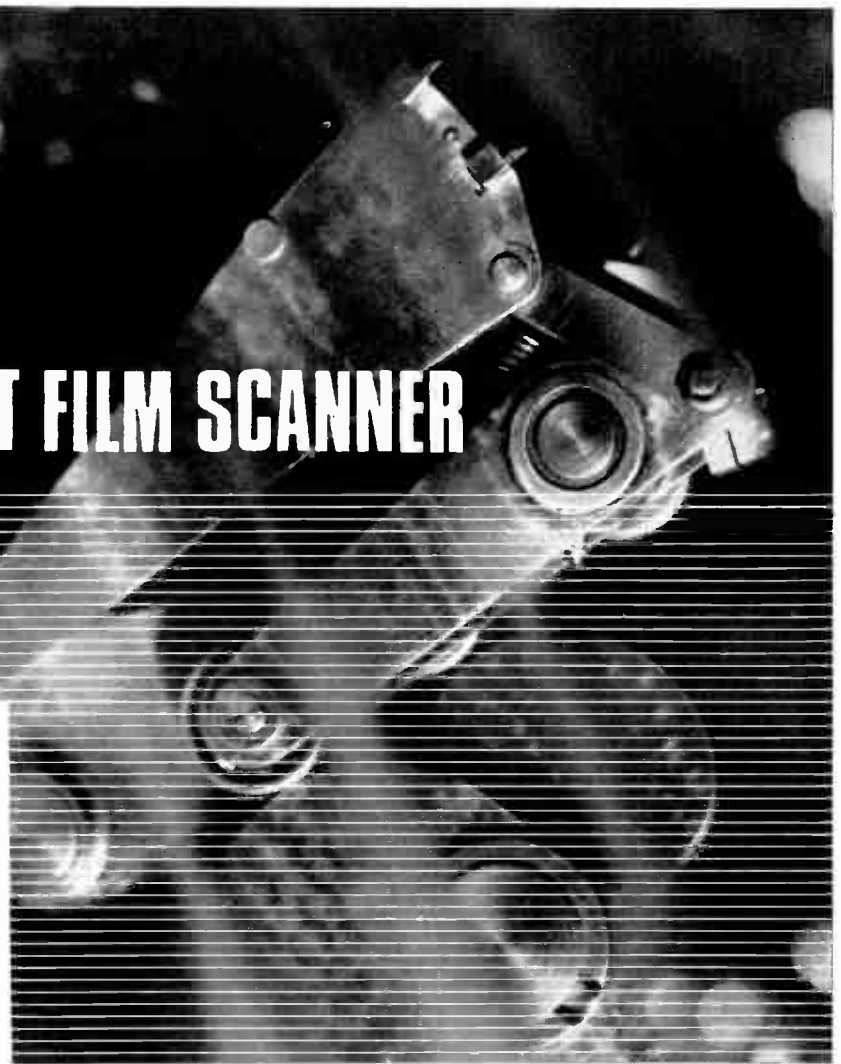
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television



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- Excellent signal/noise ratio and grey scale reproduction.
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- High resolution flying-spot scanning system.
- Continuous motion mechanism designed specifically for television requirements.

A revolutionary feature of the New Rank Cintel Scanner is its continuous motion, constant-speed, claw-type film traction.

For colour operation, three video channels are incorporated, providing separate composite or non-composite red, green and blue outputs.

The Rank Cintel Scanner will give superlative colour performance and can be changed from monochrome to colour with only minor, readily effected modifications.

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Welwyn Garden City Hertfordshire England  
Tel: Welwyn Garden 23434 Telex: 22174 Cables: Rankboom Welwyn Garden City

## NEWS continued

Audio-Visual Aids in Higher Scientific Education, set up by the University Grants Committee, The Department of Education and Science and the Scottish Education Department, under the chairmanship of Dr Brynmor Jones, has recently published a report in which it states that 'the value and potential of CCTV are manifest and we would urge institutions to take full advantage of them.'

The nine cameras and their associated sound channels will be connected to a central Control Room, from which up to three different programmes can be distributed simultaneously to selected viewing rooms throughout the building. Apart from the size of the scheme, a feature of this system will be the comprehensive control facilities. A lecturer will be able to control the programme channel selection and volume from a single point, close to his desk, for all receivers in the room.

The camera used in this system will be the new Marconi V322 series, designed specifically for educational television. Each camera is fully automatic in operation, being able to cater for a full range of lighting conditions without attention from an operator. In normal use, the ON/OFF switch is the only electronic control that need be touched.

Four of the cameras will be mounted on light-weight tripods fitted with wheels for mobile use. These cameras will be the studio version type V322B fitted with integral electronic viewfinder.

The other five cameras type V322A will be permanently mounted in the lecturer's bench in selected lecture theatres. These cameras do not incorporate the viewfinder. Each camera will be mounted behind a screen and will be used either as electronic blackboards, or for document transmission. A monitor will be installed next to each of the fixed camera positions.

The complete system has been engineered into this new building at the planning stage. The vision and sound wired distribution system has been designed and will be installed by Rediffusion Ltd, who will also provide the receivers.

### Swiss order

■ PYE TVT LTD of Cambridge, England, have been awarded a contract by the Swiss Post and Telegraph Administration for the supply and installation of two 10 kilowatt UHF (Ultra High Frequency) television transmitters. The transmitters will be part of the expansion of the Swiss Television Service.

The order was placed after technical discussions between representatives of the Swiss PTA and Pye TVT Ltd in Berne and its value is in the region of £100,000.

This is the first order ever obtained by Britain for the supply of UHF television transmitters to Europe and is the first UHF television transmitter to be purchased by Swiss PTA. The equipment will be installed at Mount Rigi in central Switzerland.

### Tower

■ WORK on a 1,180 feet television tower has started in East Berlin. The constructors claim that the tower, almost twice the height of the recently completed GPO tower in London's Howland Street, will range among 'the tallest buildings in Europe, if not the world,' and will be 'considerably higher than the Eiffel tower.'

The project, which is to be completed by 1968, provides for a restaurant and an observation platform at a height of 600 feet.



Seen here lining up his sights and about to 'shoot' one of his fellow MP's, is Ben Ford, Member of Parliament for Bradford North, England. His victim, second from left, is Bernard Conlan, MP for Gateshead East. Mr Ford's weapon is the fully transistorised Marconi Mk V television camera, the latest in a long series of cameras which Marconi have been producing since 1946.

Mr Ford and Mr Conlan were from a party of seven MP's who were guests recently of The Marconi Company in Chelmsford. The party, seen here in the studio at the television development laboratories included, from left to right: W. E. Garrett, MP for Wallsend; Bernard Conlan; John Binns, MP for Keighley; Ian Lloyd, MP for Langstone, Portsmouth; Sir Harwood Harrison, MP for Eye, Suffolk; R. Telford, Managing Director, The Marconi Company; Ben Ford.

During a day's tour of the Company, the party saw the extensive research and development facilities at Great Baddow, examples of Marconi achievements in the important new technology of micro-electronics, high power telecommunications equipment including the Marconi Self Tuning (MST) system and the new television development laboratories and studios.

Mr Ford who, until his election in October 1964, was Convenor of Shop Stewards for The Marconi Company, still retains a great deal of interest in Marconi's.

The height proposed for the East Berlin tower compares with a total of 620 feet for the London GPO tower (including 40 feet for television aerials). The revolving restaurant of the GPO tower is placed at a height of 550 feet. The Eiffel tower of Paris has a total height of 1,033 feet, including 15 feet for transmitter installation.



A small ceremony was held recently at Bangkok at the occasion of the 1,000th broadcast studio to be equipped with AKG microphones. T. B. Sow's daughter presented a C 12 Condenser Microphone to H. M. King Bhumibol of Thailand. The King himself is a well known composer of classic music and also an expert of modern music. Thailand owns some of the most up-to-date recording and TV studios and has several FM multiplex stereo programmes on the air. AKG, a Viennese company, is the world's largest manufacturer of professional microphones.

### Election

■ THE ELECTION of B. T. Ness as Deputy Managing Director RCA Great Britain Ltd was announced last month. RCA Great Britain Ltd is a subsidiary of Radio Corporation of America. Mr Ness has served since March 1963 as President of RCA Mexicana SA the RCA Mexican subsidiary.

### TV for India?

■ MRS JOSEF NAGY, Hungarian Minister for Light Industries who is leading a trade delegation to India, indicated in Bombay that a proposal for the manufacture of television equipment and sets in India in collaboration with Hungary would be examined by the Hungarian Government shortly.

Mrs Nagy told newsmen that during its discussions with the Government of India at Delhi, the delegation had come to know of India's interest in such a collaboration. This would be followed up by her country. She pointed out that Hungary had a well-developed electronics industry.

The Hungarian Minister also disclosed that another trade delegation from her country was expected to come to India in January. She expected that by March some trade plan might be finalised incorporating the results of all the discussions and providing for increased trade between the two countries. She said that trade between the two countries had trebled in the past three years.

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demand for their lighting  
equipment as well as for  
the most modern developments  
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# NEWS

continued

## Conference

■ THE INSTITUTION of Electronic and Radio Engineers, and the Electronics Division of the Institution of Electrical Engineers are to hold a joint Conference at Imperial College of Science and Technology, London, from July 11 to 15 1966 on 'Application of Thin Films in Electronic Engineering.'

This technique is now moving from the research laboratory into the realms of practical applications and it is thus an appropriate time to assess the many promising possibilities.

The Conference will deal with the theme under the following headings:

**Preparation of Thin Films**—large scale production processes including electron beam machining and other new techniques.

**Thin Films and Integrated Circuits**—passive circuit elements such as capacitors and resistors, progress in the development of active elements, especially the thin film field-effect transistor, and complete circuits.

**Computer Applications.** The majority of these will involve magnetic films and contributions will describe practical applications including actual computer stores. Cryogenic films will also be discussed but here emphasis will necessarily be on the results of research into devices rather than actual applications.

The final but very important group of papers will deal with other applications such as, for example: magnetoresistive films as strain gauges; thermoelectric thin film devices; luminescence

in thin films; space-charge-limited currents in dielectric thin films; hybrid thin-film/semiconductor circuits.

The Joint Organising Committee will welcome offers of papers falling under the above headings or on related topics. Details should be sent as soon as possible accompanied by a 200-word synopsis, to the Secretary of the Joint Conference on Thin Films, c/o The IERE, 8-9 Bedford Square, London, WC1.

## Gift

■ A GIFT of a 100 kilowatt Marconi radio transmitter, costing with associated equipment about £145,000, is being made to the Nepalese Government by the British Ministry of Overseas Development as part of the £1 million capital grant made to Nepal in 1960.

The Nepalese asked for the new transmitter to enable them to cover all parts of Nepal and also enable their countrymen living in other parts of Asia to listen to Radio Nepal.

## Colour training

■ IN BRITAIN two colour TV cameras, colour monitor sets and all the necessary equipment for studio production in colour have been purchased by TWW for staff training at their studios in Cardiff and Bristol.

This was announced by Lord Derby, Chairman of TWW, following a Board Meeting.

He said 'TWW believes in looking to the future and colour TV might come sooner than we think. Techniques for colour TV are different from black and white and it is time that our engineers, lighting men, designers, producers, make-up girls and others had some regular prac-

tical experience of operating a small colour TV unit.

When colour does come we still hope that all channels will be allowed to transmit colour programmes which can also be seen in black and white and that it will not be limited to 625 lines.

However, that is not the reason for buying this equipment. We want to train our own TV personnel so that they will be capable of producing programmes of a high standard when the time comes.'

It is also hoped that the equipment will give TWW technicians opportunities to contribute towards engineering development now that they have basic equipment permanently in the studios.

TWW, which serves Wales and the West of England with twin services, is the first ITV company to install a colour unit for general staff training. They have also begun to select suitable documentary subjects to film in colour as part of their present programming.

The purchase of this two-camera studio unit will not bring colour TV any nearer for the public but will help ensure that British programme production can start smoothly if ITV companies are given the 'go ahead' for colour.

## Dates

The annual NAB Convention will be held at the Conrad Hilton Hotel, Chicago, from March 26 to 30.

The International Exhibition of Electronic Components and the 2nd International Exhibition of Audio Equipment will be held at the Porte de Versailles, Paris, from February 3 to 8.

# BRITISH TV ENGINEERING GROUP OPENS NEW COMPANY IN USA

THE huge professional television engineering needs in Canada and the United States will now be served by a new American company, a subsidiary of the internationally-owned United Kingdom group, Evershed Power-Optics Ltd.

This new company in the United States, Power-Optics Inc, is located at the plant of the James G. Biddle Company, Township Line & Jolly Roads, Plymouth Meeting, Philadelphia, 1, Pennsylvania, USA. (Mitchell 6-9200 Code 215). Power Optics Inc is a wholly-owned subsidiary of Evershed Power-Optics Ltd, 214 Harlequin Avenue, Brentford, Middlesex, England.

In view of the very rapid development of colour television in the United States, it will be extremely helpful to have this on-the-spot representation, and will provide very adequate servicing facilities for Power-Optics products, particularly zoom lenses and servo drive systems for the television industry.

American-built colour cameras, together with those coming over from Europe, necessitate zoom lenses, since the essential design of a multi-tube colour channel precludes the use of retractable tubes. Accurate focusing and greater camera rigidity are therefore obtained by use of a zoom instead of a racking turret, and this alone has greatly speeded the demand for Power-Optics controls and Angenieux zoom lenses in the North American Continent. The new group, Power-Optics Inc in Philadelphia, will thus cater primarily for the rapidly-growing colour-TV industry,

and considerable stocks of spare zoom lenses and drive units will be held, to provide prompt servicing.

The James G. Biddle Company has been associated with the parent company Evershed Power-Optics Ltd for over 60 years, and has been manufacturing many of the parent company's products in the United States, notably the portable Megger testers. The Biddle plant covers an area of over 100,000 sq ft, and the operatives have considerable experience in mechanical and electrical engineering. To ensure the new television work is carried out to the high standards associated with Evershed Power-Optics and with the Biddle company, US engineers appointed to the new company will spend several months on a rota system at Evershed Power-Optics in Britain to familiarise themselves with the equipment. Further, Mr Jack Littler, the General Sales Manager of Evershed Power-Optics Ltd flew to Philadelphia on January 1 to supervise production and servicing and to promote the interests of this new US Company.

Power-Optics systems are already in use in all major US-TV networks, including NBC, CBS and ABC. And it is a matter of pride to Evershed Power-Optics that the first Marconi Mk V image-orthicon cameras to go to the United States for Television Chicago (for Field Communications Corp, whose Newspaper Division publishes the Chicago Sun-Times and the Chicago Daily News)—the first export sale for the Marconi Mk V, introduced only last March—are equipped with Angenieux zoom lenses and Evershed Power-Optics servo drive, and pan and tilt heads.

# technical

# abstracts

- 323. FERYSZKA, R. and GARDNER, P.** Push-pull saturated core tunnel diode inverters. *RCA Review*, vol 26, no 3, 323-356, Sept, 1965. A theory has been developed for the operation of push-pull saturated square-hysteresis-loop (Merzolf) tunnel-diode inverters: diags, graphs, photos, bibliog refs.
- 324. SCOTT, J. and OLMSTEAD, J.** A solid-to-solid diffusion technique. *RCA Review*, vol 26, no 3, 357-368, Sept 1965. The technique permits precise control over a large range of surface concentrations used to produce p-n junctions: diags, graphs, bibliog refs.
- Propagation**
- 325. AIYA, S. V. C. and LAKSHMINARAYAN, K. N.** Atmospheric radio noise bursts in the LF band at Bangalore. *Radio Science*, vol 69D, no 10, 1351-1358, Oct 1965. An atmospheric radio noise burst represents the radiation received from one complete lightning flash at the frequency to which the receiver is tuned and within the receiver bandwidth. The characteristics of such noise bursts arising from sources at various distances have been investigated: graphs, bibliog refs.
- 326. BRONSDON, E. G. and PILKINGTON, T. O.** Radio communications for North Sea drilling rigs. *Point to Point Telecommunications*, vol 10, no 1, 6-18, Oct 1965. Special hf radiotelephone and radiotelegraph services are provided for drilling rigs operating in the North Sea. Using isb modulation, the radiotelephone service will provide three telephone circuits to be shared by all the rigs: map, diags, photo.
- 327. COLE, R. K.** The Schumann resonances. *Radio Science*, vol 69D, no 10, 1345-1349, Oct 1965. The resonances of the earth ionosphere

cavity are considered directly as a cavity problem rather than as a limiting case of propagation in a quasi-waveguide with an arbitrary (spherically symmetric) conductivity profile: graphs, bibliog refs.

- 328. FOAKES, P. F. J.** The potentialities of thin line tropospheric scatter. *Point to Point Telecommunications*, vol 10, no 1, 20-30, Oct 1965. For ranges of 100 to 200 miles, tropospheric scatter is an attractive alternative to hf propagation if suitable terminal equipment can be made available at a sufficiently low cost: diags, bibliog refs.
- 329. KING, R. J. and MALEY, S. W.** Model experiments on propagation of groundwaves across an abrupt boundary at perpendicular incidence. *Radio Science*, vol 69D, no 10, 1375-1381, Oct 1965. The propagation of electromagnetic groundwaves along nonhomogeneous paths has received considerable attention. A laboratory study has been undertaken to evaluate solutions to the problem of calculating the portion of a wave transmitted across a coastline: graphs, bibliog refs.
- 330. LEAVENS, W. M.** Scattering resonances of a cylindrical plasma. *Radio Science*, vol 69D, no 10, 1321-1333, Oct 1965. The Vlasor equation has been solved for the plasma resonance spectra of a realistic model by the conductivity kennel method. The results give a clearer picture of the nature of plasma resonance than heretofore available: graphs, bibliog refs.
- 331. WAIT, J. R. and SPIES, K. J.** Influence of finite ground conductivity on the propagation of VLF radio waves. *Radio Science*, vol, 69D, no 10, 1359-1373, Oct 1965. Calculations of the modal characteristics of the earth-ionosphere waveguide are presented for a wide range of ground conductivities: graphs, bibliog refs.
- Antenna**
- 332. HARRIS, J. H. and others.** Radiation patterns from plasma enclosed cylindrical hypersonic vehicles. *Radio Science*, vol 69D, no 10, 1335-1343, Oct 1965. The effect of plasma sheaths on the radiation patterns of antennas on hypersonic vehicles is theoretically investigated. A simplified mathematical model is employed that consists of an infinitesimal longitudinal magnetic dipole on a plasma-enclosed cylinder: diags, graphs, bibliog refs.
- 333. LEE, K. S. H. and PAPAS, C. H.** Irreversible power and radiation resistance of antennas in anisotropic ionized gases. *Radio Science*, vol 69D, no 10, 1313-1320, Oct 1965. A new theory for the calculation of the radiation resistance of antennas in gyroelectric media is presented which ensures the irreversibility and finiteness of the radiation resistance: bibliog refs.
- Television general**
- 334. Medicine, education, motion pictures, television.** *J. SMPTE*, vol 74, no 9, 729-754, Sept 1965.

Ten papers deal with various technological advances in theory and engineering including cine and TV methods of analyzing search in Roentgen diagnosis; the use of dual-monitor closed-circuit television in teaching engineering courses and an 8mm film system for educational television.

## Colour TV

- 335. DE HAAN, E. F. and VAN DOORN, A. G.** A Plumbicon colour broadcast camera. *J. SMPTE*, vol 74, no 10, 922-926, Oct 1965
- 336. TAYLOR, D. M.** A transistorised colour television film camera. *J. SMPTE*, vol 74, no 10, 930-935, Oct 1965. The RCA latest colour film camera. TK-27 is the second of a series employing standard transistorised modules and has been designed to provide better stability, reliability and picture quality: diags, photos, bibliog refs.

## Television transmission

- JARVIS, D. G.** A compact VHF television transmitter. *Sound and Vision Broadcasting*, vol 6, no 2, 6-13, Summer 1965. Equipment for areas of less concentrated population and to fill gaps left by the higher power transmitters is described. This is the Marconi 500-W television transmitter, available for Band I and Band III.
- 338. SELLIN, B. G.** A chain of four television translators in the north of Sweden. *Sound and Vision Broadcasting*, vol 6, no 2, 23-30, Summer 1965. Difficulties and problems encountered during a project to provide a television service to maintenance staff of the railway carrying iron ore through North Sweden to Norvik are described.

## Cameras

- 339. BENSON, K. B. and WHITTAKER, J. R.** A gyro-stabilised lens system. *J. SMPTE*, vol 74, no 10, 916-917, Oct 1965. Rather than stabilising or isolating the television or film camera and lens assembly from vibrations, it is suggested that an appropriate bending of the optical path is introduced to follow the movement of the camera relative to the scene being televised or filmed: diags, photos.
- 340. COPE, A. D. and others.** The capabilities and prospects of television camera tubes in applications for astronomy. *J. SMPTE*, vol 74, no 9, 765-769, Sept 1965. The image-orthicon camera and its possible development for this purpose are described: diags, graphs, bibliog refs.
- 341. HUSSELBURY, A. G.** Variable or fixed focal length lenses. *Sound and Vision Broadcasting*, vol, no 2, 35-37, Summer 1965. The philosophy of the relative advantages of fixed and zoom lenses is discussed. The zoom camera seems certain to quickly dominate the scene in the future.
- 342. PAY, D. A. and MAYER, T.** Advanced developments in studio television cameras. *J. SMPTE*, vol 74, no 10, 927-929, Oct 1965. The Marconi Mark V 4½-in image-orthicon camera includes the use of semiconductors, a single (zoom) lens and automatic timing. The design and development of a new colour camera is considered: diags, photos.

These abstracts are indicative, rather than informative and are intended to lead the enquirer to the original article rather than be a substitute for it.

International Broadcast Engineer cannot supply copies of the original papers but these should be obtained from the publishers of the journals concerned or through the local public, special or technical library.

The abstracts are grouped by subject according to the Universal Decimal Classification and each contains the following information in this order:

Author, title of article, name of journal, volume number, part number, page numbers, date, language of article (if other than English), summary of text, inclusion of diagrams, graphs, maps, plans, photographs, and bibliographic references. Where the paper has previously been delivered to a symposium or special meeting this is noted.

ibe



## NEW DEVELOPMENTS

### Sound reproduction

■ CLEVELAND ELECTRONICS INC announces the availability of a new Plumbicon\* Deflection Assembly designed to operate in conjunction with the new North American Philips Plumbicon\* tube, using the basic 30-40 gauss field as design centre.

Incorporated in this assembly is a Deflection Yoke, a Focus Coil and an Alignment Coil. The Deflection Yoke portion is a high quality component that will furnish line resolution in accordance with the tube capabilities and with geometric distortions held to less than 1%. The Focus/Alignment Coil portion of the assembly is covered with a MuMetal shield, thereby reducing normal ambient electrical interferences and attenuating the deflection fields from radiating. This assembly is designed into the shape of a cylinder to simplify general adjustments.

\* Plumbicon, trademark of North American Philips Company.

### Audio heads

■ ANNOUNCING a series of ferrite magnetic heads for professional audio recording equipment Mullard say they are the first to be offered as a standard range.

Unlike laminated-metal heads the electrical properties of ferrite record and replay heads remain unchanged throughout their long working life. Thus amplifier circuits associated with ferrite heads do not need the frequent compensatory adjustments which have to be made throughout the much shorter life of a metal head. Tests showed that after 300 hours running time at a tape speed of  $7\frac{1}{2}$  in/s, the output of a ferrite head measured at 8 kc/s was reduced by only 1.5 dB and remained substantially constant after a further 5,000 hours.

Because ferrite heads have a lower HF core loss and a lower eddy current loss than metal heads much lower bias currents can be used. This enables a lower drive current to be used so simplifying recorder circuitry and reducing head noise. A further useful reduction in drive current can be obtained by increasing the bias frequency—a technique which may only give a marginal advantage with metal heads.

The frequency response of a ferrite head is generally much better than that of a metal head because the effective electrical gap length corresponds closely to the physical gap length. This is due to the stress-free nature of ferrite which allows it to be machined accurately during manufacture without altering its electrical characteristics—an advantage not shared by metal heads.

Both record and replay heads are being produced. Half, full, stereo-twin and two types of

quarter-track twin heads are available. Replay heads have 3  $\mu$ m gaps. Record heads are available with 25  $\mu$ m (full track only), 12  $\mu$ m or 7  $\mu$ m gaps. All are colour coded.

The heads can be supplied as either fixed or adjustable assemblies. The adjustable heads are housed in a Mumetal screened assembly. Facilities are provided for pre-set adjustment of 'height' and 'tilt,' and for final azimuth adjustment with the Mumetal screen in position. A magnetic or non-magnetic outer screen can also be supplied. With the fixed versions, shims are available to adjust the height of the head; mounting adaptors can also be supplied. Single and double Mumetal screening cans are available.

### New additions

■ ENGLISH ELECTRIC VALVE CO announces new additions to its already broad range of precision display tubes. Included in this group of high quality tubes are two radar types, T963D and T970Z, and a TV viewfinder, type T960W.

The 12" T963D Cathode Ray Tube has been specifically developed to meet the increasing demand for a high quality tube, capable of handling either alpha-numeric or processed radar displays. This tube provides a flicker free, high brightness 'read-out,' which in no way degrades the high degree of resolution obtainable.

Constructed to tight mechanical and electrical tolerances, the performance of the T963D conforms to the highest standards in both optical resolution and alignment. For example, line widths of 0.2 mm (0.0008") are attainable with the use of a good quality focus coil. Coupled with this, the accuracy of the tube neck alignment is such that the mean neck axis will pass within 2 mm of the geometric centre of the tube face. Divergence of the mean neck axis is also limited to within one degree of arc from the normal formed at a tangent plane taken on the face plate centre.

The advantages of a flicker free, high brightness picture at low repetition rate inputs are obvious, and are obtained in the T963D through the use of EEV Phosphor 'Type D.' This phosphor has a light decay curve that is characterised by an appreciable plateau region preceding 'fall-off,' permitting a freedom from picture flicker even when signals at repetition rates of 10 cycles per second, or less, are being fed into the tube.

The T963 is also available with EEV 'Y' or 'Z' screens.

The 16" T970Z CRT is basically a larger version of the T963D. Despite the greater overall length of this tube with its consequent increase in magnification ratio, the line width does not exceed 0.35 mm. In the case of the T970Z, neck alignment is better than 3 mm eccentricity and



L to r: J. P. Collis, managing director, Rank Audio Visual Division, Howard Cricks, well-known technical writer and consultant, and Michael Brown, Rank Studio Equipment, with Gemini television film recording equipment (the recording is made at the same time ordinary direct transmission is being carried out) which was being shown publicly for the first time in the UK at the Fourth Industrial Photographic and Television Exhibition, Earls Court, November 15—20, 1965.

$\pm 1$  degree of tilt. Similarly, the electron gun of the larger CRT has been designed to deliver the same electron density at the screen as that of the T963D. This, of course, means that the two tubes have equal brightness.

Main deflection and character coils can be used on the T970Z.

The design features of the T963D and T970Z make both tubes ideally suitable for widespread application, including air traffic control and digital computer displays.

The T960W Monitor CRT. This new TV viewfinder tube provides a picture bright enough to allow the television camera operator to dispense with the use of a viewing hood.

The tube itself measures  $9\frac{1}{2}$ " in overall length and has a 6" (diagonal) rectangular screen. The optical resolution of the T960W is more than adequate for use with the 625 line television displays.

### Frequency meter

■ THE General Radio Type 1143-A Frequency-Measuring Assembly is a combination of the previously described Type 1153-A Digital Frequency Meter and a heterodyne converter, the Type 1133-A Frequency Converter. A frequency multiplier, which multiplies the 100 kc standard frequency output of the counter to the 5 Mc reference frequency required by the converter, is included. This assembly will measure frequencies to 500 Mc/s with simplicity and with a sensitivity and optional selectivity not available elsewhere.

In the converter the input frequency is heterodyned against a 10M multiple of the counter's time-base-oscillator frequency and the less-than-10-Mc difference frequency is applied to the counter. In-line numerals indicate directly the heterodyne reference frequency to be added to the counter reading, and a panel meter indicates proper input and output level. Level adjusting controls are provided.

The converters can be operated in one of two modes: a wide-band mode for simplified measurement of clean signals of greater than 100 millivolt, rms, level; and a narrow-band



mode for measurement of noisy signals of greater than 10 millivolt level. In the narrow-band mode a tuned amplifier is switched into the system to provide selectivity and increased sensitivity. Panel lights indicate proper control settings. In this assembly, ruggedness and lasting reliability accompany several unique features—high sensitivity, optional selectivity, and simple operation—to produce an instrument of outstanding performance for frequency measurement to 500 Mc/s. **Range:** dc to 500 Mc/s. **Sensitivity:** Better than 10 mV, rms, on narrow band (above 100 kc/s); better than 100 mV on wide band. **Data-Output Connector:** 10-line decimal for each digit—one wire binary 1 (+14-V level) and nine wires binary 0 (0 to +4-V level); source impedance 2.4 k $\Omega$ ; +20-V power; ground; and print-command pulse. **Power Required:** 105 to 125 or 210 to 250 V; 50 to 60 c/s, 140 W. **Input Terminal:** GR874 Coaxial Connector; use Type 874-Q Adaptors to connect to other coaxial types. **Accessories Supplied:** Patch cords for inter-connection, spare fuses, hardware for rack mount. **Dimensions:** Width 19, height 11 $\frac{1}{4}$ , depth 19 inches (485 by 290 by 485 mm). **Net Weight:** 54 lb (24.5 kg). **Shipping Weight:** 84 lb (39 kg).

## Amplifier

■ STC have added a new, low-voltage travelling wave amplifier to their range of microwave tubes. Designated Type W7/5G, the new tube has been designed for use in 1,800-channel radio communication links in the 3.6 to 4.2 Gc/s range.

The new amplifier has a typical gain of 43 dB at a working output of 20 W. Saturated output is 30 W. This means that, in an existing system, the W7/5G can be substituted for a 40 dB gain tube with an output of 10 W and, using the same drive power, the W7/5G will produce twice the previous output.

The W7/5G tube operates in a robust periodic permanent magnet mount, Type WM110A. Incorporated in the mount are: rf input and output waveguide connections (a choice of WG12A or WR229 is offered); mechanical alignment; deflection and matching adjustments; tube ejection control at either end of the mount; a convection cooler and facilities for easy field replacement of tubes.

## Sync generator

■ A TRANSISTORISED SYNC GENERATOR and accessory system for basic broadcast TV studio operation in black and white or colour—all contained in a 19" rack unit 1 $\frac{1}{2}$ " high—is now available from Cohu Electronics, Inc, San Diego, California.

Cohu's 2470 series plug-in circuit assemblies for the complete broadcast system include a 525-line sync generator, genlock, colour standard with colourlock, and a power supply. Outputs are compatible with EIA and FCC standards.

Additional accessories include dot-bar generators and accessory changeover switches.

The dot-bar generator plugs into the enclosure with the sync generator and genlock or replaces the colour standard during system linearity checks.

The changeover switch occupies equal space in the rack. It features preset choice of local, remote or automatic changeover from one sync generator to another in the event of sync-signal failures, providing switching for all system outputs, including colour subcarrier and burst flag.

The changeover switch also operates with sync used for other scanning standards common in closed-circuit television.

Other sync generators are available for 729-line, 873-line and 945-line scan rates for closed-circuit TV use. Each sync generator enclosure has a plug-in power supply.

## Communal aerials

■ THORN ELECTRONICS have now introduced the first range of broad band transistorised communal aerial equipment available in this country. The technical standards of the 'Triple T' range as these new units are called, are equivalent to the 'R' series, and the prices of the units are very competitive.

Two units will be immediately available and the specification of these is shown below. Provision is made for the injection of converted UHF channels and a range of UHF/VHF transistorised converters is also available.

### Triple T Minor Type No TT101

#### Gain

Band I input (40-70 Mc/s) Typically 24db  
Band II input (85-105 Mc/s) Typically 20db  
Band III input (174-225 Mc/s) Typically 24db  
All Band input (40-225 Mc/s) Typically 24db

#### Output

Maximum from two outputs 100mv

#### Price £25

### Triple T Major Type No TT102

#### Gain

Band I input (40-70 Mc/s) Typically 44db

## Data sheet

■ GRESHAM LION ELECTRONICS have now issued an A4 technical data sheet TVS4 which describes their PL.4 solid-state Picture Line-up Generator for TV network testing.

This international reference data sheet is in two colours and describes the PL.4 commonly known as 'Pluge,' which enables TV monitors to be set up throughout a station or TV network at consistent levels of brightness and contrast.

The PL.4 is a multi-standard instrument which can be switched for 405, 525 or 625 line operation and is based on BBC designs. The unit is designed for standard 19 inch rack mounting.

## Wide band

■ THE MOST RECENT addition to the popular C-COR line of 'Min-Econ' amplifiers is the Model 3596 wide-band amplifier. Housed in the Min-Econ package (1 $\frac{1}{4}$  x 2 $\frac{1}{4}$  x 3 $\frac{1}{4}$  inches), this unit covers the frequency range of 10 mc to 175 mc, with 18 dB of gain, and an output capability of 1 volt p-p into 50 ohms.

Particularly well suited to sweeping applications, the Model 3596 is priced at \$200, FOB State College, Pennsylvania, and is available within three weeks from the factory.

## Headset

■ AMPLIVOX LIMITED announce the release of a new version of a Jetlite Headset designed for language laboratories and educational training.

This new headset provides considerably increased acoustic output compared with our earlier series and will be compatible with all known language laboratory equipment. This new Jetlite, which will be known as the JL.266, will also provide improved bass response from the boom mounted microphone and full audio frequency coverage from the new type high quality moving coil transducer.

This lightweight headset has been specially designed to be worn for long periods without fatigue and is, therefore, well suited to language laboratory applications. Other features of Jetlite include the very comfortable and hygienic foam ear cushions which also provide some noise exclusion; its lightweight yet robust construction, full adjustment and attractive styling. This new British-made headset will be available in January 1966.

## Colloquim

■ A COLLOQUIM on active filters will be held at the British Institution of Electrical Engineers, Savoy Place, London, on Monday 17 January 1966, starting at 2.30 pm. The meeting has been arranged by the professional group on semiconductor devices of the IEE Electronics Division. The colloquim has been divided into two sessions, at 2.30 pm and 5.15 pm, at which nine short contributions will be presented and discussed.

## College Studio

THE Broadcast and Recording Equipment Division of TEMI Electronics Limited has been awarded a contract for the supply of television equipment to the Plymouth College of Technology. The order includes a broadcast camera channel and solid state vision switching/mixing equipment with special effects facilities, as well as synchronising pulse generators and various items of test equipment.

Plymouth College is among the first to place orders for full broadcast-standard equipment, and the order is indicative of the predicted trend towards a more professional approach in the use of television in universities, colleges and schools.

The Head of the Electrical Engineering Department, Mr B. R. Webster, and his colleagues have engineered and planned the studio and facilities, and will be carrying out the installation and commissioning of the entire system.

# UHF - 1966

1. 'Band-edge' problem. This concerns the degree of suppression of the vestigial sideband to be used at stations employing either channels 21 or 39. The first of these can affect point-to-point radio services in the spectrum immediately below 470 Mc/s. The second affects part of the band 606-614 Mc/s, which is the channel devoted to radio astronomy observations.
2. Harmonic interference to radio astronomy in the vicinity of the Hydrogen line (1,400-1,419 Mc/s). The need by the radio astronomer to detect field strengths as low as  $-54$  dB ( $1 \mu\text{V/m}$ ) implies a high standard of suppression.
3. Intermodulation products. Each of the four channels allocated to a UHF television station may have a vision and sound carrier together with a colour sub-carrier. Many spurious frequencies could be generated in these conditions which may affect other services.

As a complete contrast to these planning considerations, Mr D. Ingle of Pye TVT Limited gave some practical details of UHF high-power TV transmitters, and in particular referred to a 25 kW Pye Tx in which power klystrons were chosen for the output stages of the vision and sound sections of the transmitters, on account of their robustness, low cathode loading and long life expectancy. The series of klystrons used have been developed both in the USA and UK especially for television service. The tubes have high permeance, the required bandwidth being readily obtained by stagger-tuning the second and penultimate cavities, practically no external damping being required on the cavities in most cases.

The collectors and drift tubes are water cooled and the advantages of this type of cooling have been exploited to the full by arranging that the drift tube cooling water also flows through ducts built into the electromagnet coils of the focus mount. This limits the temperature rise of the coils, thereby aiding stability in two ways; the change in resistance due to the temperature coefficient of the copper is minimised, so also is the heating effect of the coils upon the klystron cavities. The final and penultimate cavities are cooled by means of forced air. Klystrons with vapour cooled collectors are now available as alternatives.

The same type of klystron is used in both the vision and sound output stages, the beam power supply being common to the two tubes. The beam power required by the sound output klystron is of course much less than that required by the vision tube and this requirement has been

## Continuation of a report on the London International Confer- ence on UHF Television and communications, by IBE's Audio Editor Donald Aldous, and Television Editor Kenneth Uilyett FRSA

fulfilled by the use of the modulating anode with which the klystron is provided. By connecting this electrode to a point of suitable potential in a resistive network connected across the beam supply, the beam current is adjusted as required. The modulating anode of the vision klystron operates at earth potential, allowing the normal beam current to flow.

Complete details were given by Mr Ingle of the video modulating and drive equipment for this transmitter, and those requiring a full explanation are advised to get the IERE Conference Proceedings No 6, which contains block diagrams and performance curves. A second Pye TVT Ltd speaker, Mr G. C. Peel then dealt with the passive filter networks which make up the high-power diplexer and the low-power vestigial sideband filter. Problems Pye's encountered were frankly discussed, and a high-power UHF change-over switch and test load were discussed.

As a contrast of Company techniques, The Marconi Company's Mr W. J. Morcom and Mr J. Sutton then dealt with a new range of UHF/TV transmitters. . . . 'Designed from the outset,' they stressed, 'to be suitable for colour, basically NTSC with a video bandwidth of up to 6 Mc/s, and a colour sub-carrier frequency of 3.58 or 4.43 Mc/s . . . and they will be suitable for PAL.'

The Marconi lecturers again came down heavily in favour of the klystron. 'On the count of reliability,' they said, 'the klystron appears to score heavily.

On a representative 10 kW tetrode, the cathode-to-grid spacing is less than 1 mm, and failures due to cathode/grid short circuit are by no means uncommon. No such small spacings occur in the klystron.

In addition, the various blocking capacitors required in the tetrode amplifier are difficult to design because of the limited space, and this tends to increase their unreliability. No such capacitors are required in the klystron amplifier. Again, although contact fingers are required for both klystrons and tetrodes, because of the greater robustness of the klystron, greater contact pressures can be used, and the contact fingers are therefore likely to be less troublesome. A tetrode transmitter will include a larger number of tuned circuits, compared with a klystron transmitter, particularly at the higher output powers. For example, at an output power of 20 kW, a tetrode amplifier would have at least 12 tuned circuits in the vision chain, compared with four for a klystron. Moreover, it will probably be more difficult to cool the tuned circuits on the tetrode amplifier. This will tend to make the tetrode transmitter less stable with regard to maintenance of performance over long periods, which is important for unattended operation. . . .

As to video modulation, Mr Morcom and Mr Sutton explained that two methods of video modulation are currently in use.

- (a) Grid modulation of triode or tetrode valve.
- (b) Cathode or series modulation of a triode or tetrode valve.

Both have proved adequate for monochrome operation, but have certain limitations for colour transmission. In view of these possible difficulties, a new method of video modulation has been devised, operating basically on the absorption principle, which has the following advantages:

- (a) Adjustment to the correct operating conditions is much simpler than for grid modulation.
- (b) A high degree of linearity is obtained without critical balancing of rf voltages in amplitude and phase.
- (c) The load on the driver is constant over the modulation cycle, so that there is no drive regulation problem.

Again, full details including circuit diagrams are given in IERE Conference Proceedings No 6, from which these extracts are taken, and full details may be obtained from the Institution at 8-9 Bedford Square, London WC1.

## Recent Books

- 3,219,932 GEC, New York. (R. F. Foster).**  
Power supply for a transistorised stage in a broadcast receiver. Nov 23 1965
- 3,219,933 RCA, Delaware. (R. D. Brand).**  
Television tuner switching circuit. Nov 23 1965
- 3,219,975 RYAN AERONAUTICAL CO, San Diego, Calif. (R. C. Finvold).**  
Proportional remote radio control system. Nov 23 1965
- 3,221,098 E. S. FELDMAN & O. WING, New York.**  
Multiple lingual television in a multiplex broadcast system. Nov 30 1965
- 3,221,110 RONETTE PIEZO ELECTRISCHE INDUSTRIE NV, Amsterdam, Netherlands. (M. de Vries).**  
Stereo transducer with interchangeable stylus holders. Nov 30 1965
- 3,221,208 KABUSHIKI KAISHA HITACHI SEISAKUSHO, Tokyo-to, Japan. (S. Takei & M. Hibi).**  
Dual-beam, short-line storage-type camera tube. Nov 30 1965
- 3,221,209 FERNSEH GmbH, Darmstadt, Germany. (H. Greiner).**  
Electron-image tube apparatus with improved acuteness of the image corners. Nov 30 1965
- 3,221,255 MICRO-RADIONICS, INC, Van Nuys, Calif. (I. Rabovsky & N. P. Weinhouse).**  
Ferrite T circulator for coupling an antenna to a transmitter-receiver. Nov 30 1965
- 3,221,258 MARCONI CO LTD, GB. (D. A. Pay).**  
Signal clipping circuit arrangements. Nov 30 1965
- 3,222,452 T. A. BANNING, Chicago, Ill.**  
Pre-pay or subscription radio or television operations. Dec 7 1965
- 3,222,455 GEC, New York. (E. R. Golik).**  
Aural stereophonic balance indicator. Dec 7 1965
- 3,222,459 AMPEX CORPN, Redwood City, Calif. (P. E. Drapkin).**  
Wideband frequency modulation systems. Dec 7 1965
- 3,222,601 MARTIN-MARIETTA CORPN, Baltimore, Md. (D. R. Sartorio & E. R. Flanagan).**  
Antenna beam scanner. Dec 7 1965
- 3,222,674 COMPAGNIE FRANCAISE THOMSON-HOUSTON, Paris, France. (J. Villepelet).**  
Radio detection and automatic tracking equipment. Dec 7 1965
- 3,223,777 US SECRETARY OF THE NAVY. (J. A. Crawford & W. H. Woodworth).**  
Scanner system (televising earth's surface). Dec 14 1965
- 3,223,782 AKUSTISCHE U KINO-GERATE GmbH, Vienna, Austria. (B. Weingartner).**  
Directional microphone with distance control. Dec 14 1965
- 3,223,789 N. A. PHILIPS CO INC, New York. (J. L. Ooms).**  
Automatic control of groove spacing in phonograph records. Dec 14 1965
- 3,223,790 N. A. PHILIPS CO INC, New York. (H. Brandt).**  
Dubbing circuits for magnetic recorders with means for reducing feedback. Dec 14 1965
- 3,223,872 PARAMOUNT PICTURES CORPN, New York. (P. Raibourn).**  
Colour screen with electron- and light-absorptive material separating adjacent colour strips. Dec 14 1965
- 3,223,886 H. GLASER, Hamburg, Germany.**  
Television picture screen. Dec 14 1965
- 3,223,927 B. WEINSTEIN, Newton, Mass.**  
Warning device for radio receivers. Dec 14 1965
- 3,223,929 AMPEX CORPN, Redwood City, Calif. (R. B. Hofstad & M. Swyryd).**  
Binary frequency modulation demodulator. Dec 14 1965
- 3,224,000 GOODYEAR AEROSPACE CORPN, Delaware. (F. Bloetscher, J. O. Gibson & W. B. Cross).**
- 3,219,754 GEC, New York. (W. C. Bates & T. T. True).**  
Modulation circuit including an electron beam deflection amplifying device. Nov 23 1965
- 3,219,757 GEC, New York. (M. J. Palladino).**  
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- 3,219,759 GEC, New York. (R. B. Dome).**  
System for de-emphasising and separating amplitude modulation components from a signal. Nov 23 1965
- 3,219,760 HAZELTINE RESEARCH INC, Illinois. (B. D. Loughlin).**  
Mono-stereo control apparatus for FM multiplex stereo signal receiver system. Nov 23 1965
- 3,219,764 GEC, New York. (P. E. Pritchard).**  
Stylus assembly for a phonograph pickup cartridge. Nov 23 1965
- 3,219,765 AKUSTISCHE U KINO-GERATE GmbH, Vienna, Austria. (E. Pless).**  
Handle microphone. Nov 23 1965
- 3,219,931 RAYTHEON CO, Lexington, Mass. (G. V. Lennon & L. J. Kohnen).**  
Transceiver modulator-demodulator employing common elements. Nov 23 1965
- ALVAREZ, E. C. and FLECKLES, D. E.**  
Introduction to electron tubes and semiconductor. McGraw-Hill, 56/- x, 294 p.
- LYTEL, A. H.**  
Transistor AF and RF circuits. Foulsham, 24/- viii, 125 p.
- CROWHURST, N. H.**  
ABC's of tape recording. Foulsham, 16/- viii, 93 p.
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- ANDREWS, A.**  
Introduction to telemetry. Foulsham 18/- vii, 93 p.
- GUNSTON, D.**  
Guglielmo Marconi: father of radio (for younger readers). Weidenfeld & Nicolson, 15/- 128 p.
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- HAWKER, J. P.**  
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RSGB amateur radio call book, 1966. RSGB, 6/-
- MIDDLETON, R. G.**  
Trouble shooting with test meters (VOM and VTVM). Foulsham, 21/- viii, 158 p.
- LAMPITT, R. A.**  
Network analysis for telecommunications and electronics. Iliffe, 63/- viii, 269 p.
- HILL, D. W.**  
Principles of electronics in medical research. Butterworths, 67/6 xiii, 288 p.
- HOLLAND, L. (edition)**  
Thin film microelectronics. Chapman & Hall, 50/- x, 284 p.
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- BRITISH BROADCASTING CORPORATION.**  
Drop-out in video tape recording by W. K. E. Geddes. BBC 5/-, 15 p.
- BBC**  
Sine-squared pulse and bar testing in colour television by L. E. Weaver. BBC, 5/- 26 p.
- LYTEL, A. H.**  
Solid-state power supplies and converters. Foulsham, 20/- viii, 108 p.
- ADAMS, T. M.**  
Radio circuits. Foulsham, 24/- vi, 160 p.
- PIERCE, J. R.**  
Electronic waves: an introduction to the science of electronics and communication. Heinemann, 15/- xiii, 226 p.
- RUNYAN, W. R.**  
Silicon semiconductor technology. McGraw Hill, £6 12 ix, 277 p.
- SEVIN, L. J.**  
Field-effect transistors. McGraw-Hill, 80/- ix, 130 p.
- Other books of importance to engineers**
- DE VRIES, L and HERRMANN, T. M.**  
German-English technical and engineering dictionary, second edition. McGraw-Hill, £11 1178 p.
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71st edition, 1966. Morgan Bros, 95/- 2 vols.
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