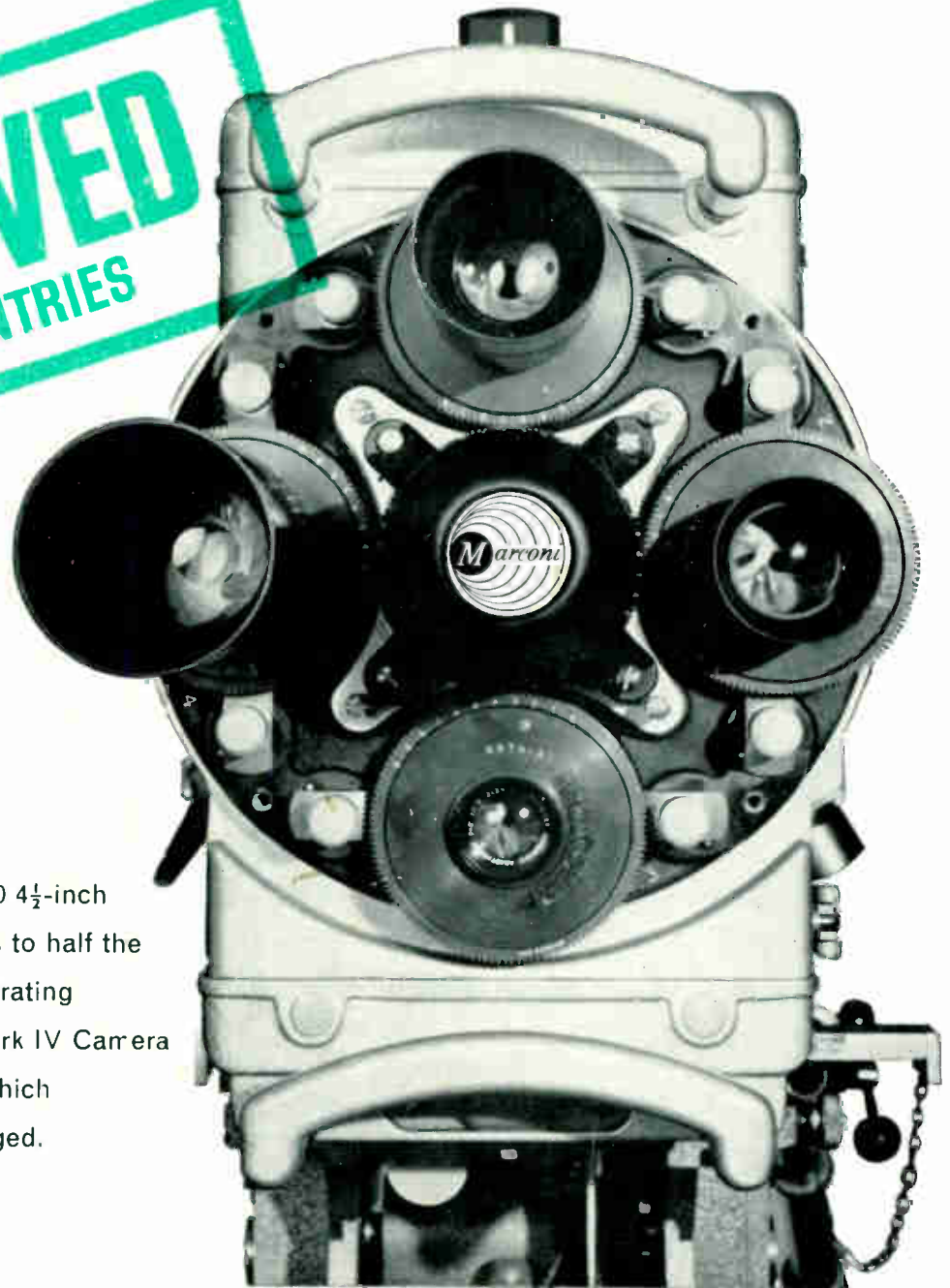




INTERNATIONAL BROADCAST ENGINEER

No 15
December 1965
3/6

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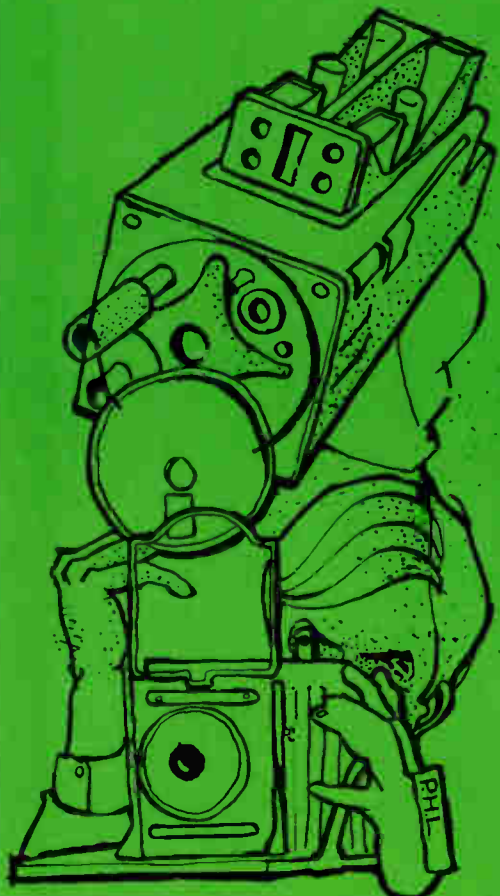


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International Broadcast Engineer



Testing an STC
microphone in an
anechoic chamber
— see story on
page 740

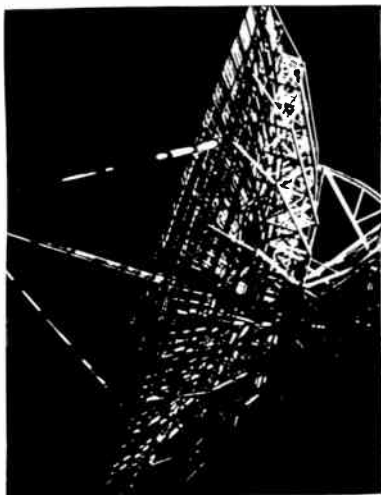
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OUTLOOK

Colour still at the crossroads?

A BBC Press release headed in 'Establishment Blue' arrived on the Television Editor's desk recently. It read: 'Until further notice the schedule of BBC experimental colour television transmissions from Crystal Palace on channel 13 on the PAL system will be as follows: Mondays, 14.00-17.00, test card, colour slides and colour bars. . . . On subsequent days of the week are transmitted live studio pictures and films. The test card periods consist of 15 minutes of test card in black and white, 10 minutes of colour bars, and 35 minutes of colour slides in each hour.

All experimental. . . .

Nobody denies the British Broadcasting Corporation is not giving the nation—and perhaps all Continental Europe, too—a valuable pioneering service.

It must also go on record that when the INTERNATIONAL BROADCAST ENGINEER editorial team were in Washington, earlier this year, we were told personally by Mr Charles Colledge, Division Vice-President and General Manager of RCA Broadcast and Communications Products Division: 'This new boom in colour TV has pushed the backlog for RCA's new four-tube colour camera to a record "high" of approximately \$10-million. Before and during the Washington Convention of the National Association of Broadcasters, orders have been received for more than 150 of these colour camera chains. This is the largest backlog of orders for RCA cameras in the history of colour television. . . .'

Of course it would be wrong to assume this US boom in colour (which they well deserve, having pioneered the NTSC system for more than a decade now) is a dead loss to other countries. For example, the energetic Jack Littler, executive of Evershed Power Optics Ltd, is finding an extraordinary demand in the United States for colour television facilities, on the part of small networks and even lone stations wanting to get on the Colour bandwagon. And these stations are turning to the British-designed zoom control systems for colour cameras, techniques which give automatic pre-set push-button control from a remote point of all five camera functions—pan, tilt, zoom, focus and iris. This system, unique in Britain, gives local control of the TV camera for busy periods of programming, switchable to remote when desired. It even makes possible automatic operation of pre-set shots over telephone lines! Evershed Power-Optics, like other great companies, are able to assist, internationally, when any nation goes over to colour. **Yet still Europe herself marks time.**

It is almost with shame we recall that in March of this past year, this very OUTLOOK page was headed 'Is Colour at the Crossroads?' At that time we congratulated a British team from RCA Great Britain Ltd (a subsidiary of Radio Corporation of America) on their journey to Moscow, at the invitation of Sergei Novakovsky, head of the TV Labora-

tory of the Russian State Committee on Radio-electronics. They took some 28 tons of colour-TV equipment to Soviet Russia, as a gesture of international goodwill, and an experimental colour studio was made available for them at Moscow's Television Centre.

But even while the team was in Moscow, European experts were arguing the relative advantages of SECAM, PAL and other systems. RCA themselves asked if colour were at the crossroads, and in our editorial we optimistically (over-optimistically, as events proved) stated: 'No longer are we at the crossroads . . . it is no secret that powerful cartels, international and economic pressures are building up in favour of rival systems. . . . Of course we cannot simply write off all the millions, the ingenuity and wisdom which have gone into development of the Henri de France system (having amplitude modulation of the subcarrier by only one colour-difference channel during each line), the later versions of SECAM, and PAL. . . .'

At that time, back in March, many were willing to write off PAL as an after-run. Perhaps we did not take enough heed of the RCA giant group who conceded (after pioneering NTSC since 1952) that the PAL system, with its line-by-line reversal of the 'I' component, involves the least change to the basic NTSC signal. Indeed, RCA said: 'It is not impossible to consider a situation where, for those administrations who wish to delay modernising their networks, precision NTSC/PAL converters could be used temporarily until such time as it is convenient to carry out replacement.'

And so events moved on throughout the middle of 1965. On October 23 it was announced that the British Government's technical sub-committee was still divided. Many were willing to back PAL, but the BBC held out for unqualified NTSC. This hitch delayed Britain, for if there had been a unanimous decision the Government's Television Advisory Committee would have passed it to the Postmaster General, Wedgwood Benn, for Cabinet approval. And the rest of Europe, including France, would in time fall into line. At this juncture, too, Soviet Russia and her allied nations announced they were backing France, lining up to adopt SECAM. The goodwill initiated by the British RCA team to Moscow seemed temporarily to have evaporated. In colour we were not only still at the crossroads, but perhaps even at battle stations.

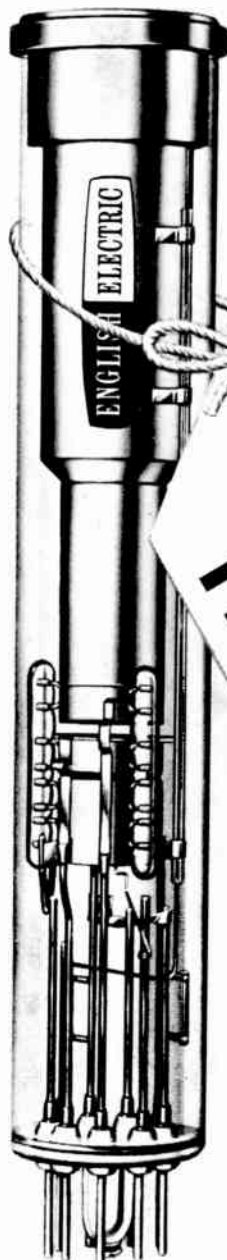
Suddenly there was a change of heart in Britain. The London Daily Mail was the first to break the good news.

'The Government is to be asked to accept the German PAL colour television system for Britain,' they reported, on November 6. 'The recommendation was put forward after a meeting of television experts in London. BBC technical experts stopped talks by a special group of the Government's Television Advisory Committee earlier 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. . . .'

However it must be noted the BBC added a rider: They will back the use of PAL on 625-line BBC 2. They are still opposed to using it on BBC 1, 405 lines. Despite their long experience of NTSC, the BBC policy change was made for the sake of a uniform colour TV system for Europe, and there now seems little doubt that Britain will develop PAL for a national colour service. Mr Sydney Allchurch, director of the British Radio Equipment Manufacturers' Association, told the world Press: 'The choice of a system is secondary to a decision on the fact that we are to have some form of colour-TV in Britain. All we want is for the Government to give us a date.'

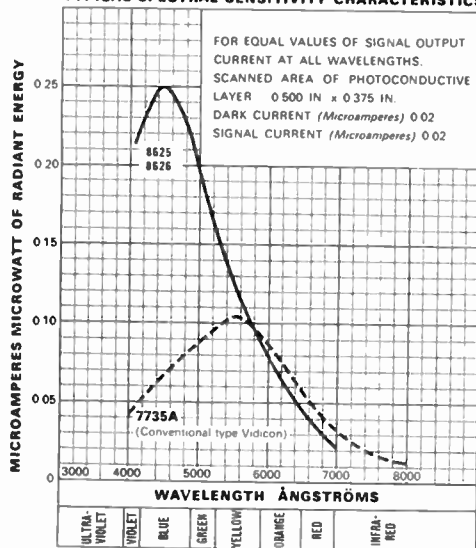
On this effective date (and not a mere political promise from a Government which happens to have a majority of one in the House, as this page goes to Press) will hang the colour-TV decision for the rest of Europe, indeed for much of the civilised world today.

by John Dickson, Ph.D



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AUDIO CONVENTION

A digest of highlight papers presented at the 17th Annual Audio Engineering Society Convention, New York, 1965

THE 17th annual AES (Audio Engineering Society) Convention was held during October in the New York Barbizon-Plaza Hotel. Two halls were devoted to an exhibition of audio equipment—mainly studio amplifiers, mixers, microphones, etc, and technical sessions were held in the well-equipped theatre. Each session or lecture lasted just over 20 minutes, and there were over 100 in all, covering disc and tape recording, studio systems, loudspeakers, audio amplification and speech analysis. Among those taking part were such well-known personalities as Dr Harry Olson, Dr Homer Dudley, Robert Langevin, Glen Southworth, Victor Brociner, Leo Beranek and Decca's John Walton.

Here is a summary of some of the most interesting:— **FIELD EFFECT TRANSISTORS IN AUDIO AMPLIFIERS** (D. L. Wollesen, Motorola). Field Effect Transistors (FETS) have a very high input impedance—in fact it is so high that the gain can be considered as a voltage function—as in a thermionic valve. Mr Wollesen had this to say, 'The voltage amplification factor increases as I_D (drain current) decreases. With this in mind the designer might be tempted to bias the drain current of the FET to a few microamperes, use a very large supply voltage and use a R load value of many megohms. This approach, would indeed increase voltage gain, but, as with all good things there are certain constraints. The AC load of the following stage is a consideration; if it is an FET there is no constraint, but the loading effect of a bi-polar transistor is a constraint. A large supply voltage allows a larger value of R to be used but it is a risky method to increase voltage gain if

it is in excess of the R_{Vdgo} (drain-gate breakdown voltage) rating of the FET. The limit of large signal handling capacity ability of the FET is the power supply voltage and the minimum possible drain—source voltage of the stage. The power supply voltage must be greater than the largest peak voltage swing to be encountered'. After discussing bias stabilising methods, Mr Wollesen then turned to noise considerations. Fig 1 shows noise voltage versus noise resistance for a FET type 3N124(5, 6) a FET insulated gate type 2N3796 (97) a low noise silicon PNP type 2N3799 compared with a 12AX7 double triode valve. The figures were taken at 1 kc/s and it is apparent that for high values of input resistance the junction FET is superior to any other device now available. In addition to this the LF noise of the junction FET is about 15 c/s compared with about 100 c/s for a bipolar transistor and about 400 c/s for the insulated gate FET. However, for source impedance less than 5K the bipolar low noise transistor may be superior. Fig 2 shows the circuit of a pre-amplifier using two FETS with passive equalisation to RIAA standard. The gain at mid-band was given as 25. A questioner asked whether the results would be improved if a feedback loop was used to provide equalisation and it was conceded that this was so. Other circuits were described and Mr Wollesen finished by saying that FETS show clear superiority over other devices in respect to lower noise for input resistances over 10k. They will be used in nearly all high impedance stages and any designer who fails to consider FETS for future designs will find himself behind the times'. At the moment FETS are rather expensive

but I saw several microphone preamplifiers using FETS in the exhibition.

In this country, STC have just released a microphone designed by M. Gayford incorporating a FET amplifier.

RECENT TRENDS IN AUDIO AMPLIFIERS (W. H. Heaven, Northern Electric, Canada).

In this paper Mr Heaven discussed the merits of Darlington pairs for amplifier input stages. Fig 3 shows the basic arrangement: The advantages are:

1. A stable circuit equivalent to a single transistor that will provide a current gain that is somewhat greater than the product of the two transistors used in the configuration.
2. When the combination is used as a single transistor in the common collector circuit the input impedance is greater than the product of the individual transistor current and the emitter resistance.
3. The output impedance when used in the common collector circuit of 2 is low, being equal to the source impedance of the generator driving the amplifier divided again by a factor somewhat greater than the product of the current gains of the individual transistor.

These three factors alone can provide an impedance transformation greater than the square of the current gain products.

To arrive at the circuit that will provide gain with these properties a complementary pair of transistors is used, although they are not really a pair because one of the transistors must have a much higher current rating than the other as the base current of it is the emitter current of the other. A pre-amplifier stage was described which uses

by **George Tillett,**

Technical Director,

Wharfedale Wireless Works,

Electronics Division,

Leeds, UK

a low noise NPN transistor plus a 'garden variety' PNP type. Such amplifiers are made primarily for the broadcast industry and can be obtained with various input and output transformers. **ARTIFICIAL VOICE** (Dr H. Olson, RCA).

This is the term used to designate a loudspeaker system which exhibits acoustic characteristics similar to the human voice. Dr Olson said, 'There are many applications where this is a need for an artificial voice for tests of microphones and rooms for pick-up conditions and distances of the kind and magnitude employed in speech reproduction in radio, television, sound motion pictures, disc recordings, etc. For these applications the acoustic impedance of the artificial voice is not too important. However, it is quite important that the directivity pattern be the same as the human voice in order that the ratio of direct to reflected sound be preserved. In addition the artificial voice should exhibit high quality performance both from the standpoint of frequency response and non-linear distortion characteristics. An artificial voice of this type may be driven by a high quality tape reproducer.'

Dr Olson went on to say that it is possible to use for A-B microphone tests, for articulation testing of microphones under operating conditions. Thus it is possible to duplicate the performance of the 'speaker' each and every time the programme is played, as contrasted to the difficulties of obtaining similar repetitions by a live performer.

Fig 1. Noise voltage versus noise resistance

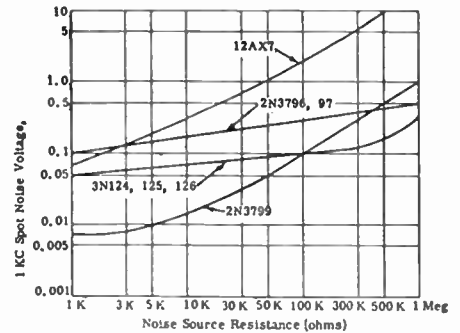


FIGURE - NOISE VOLTAGE versus NOISE RESISTANCE

Fig 2. Magnetic pickup preamplifier using two FETS

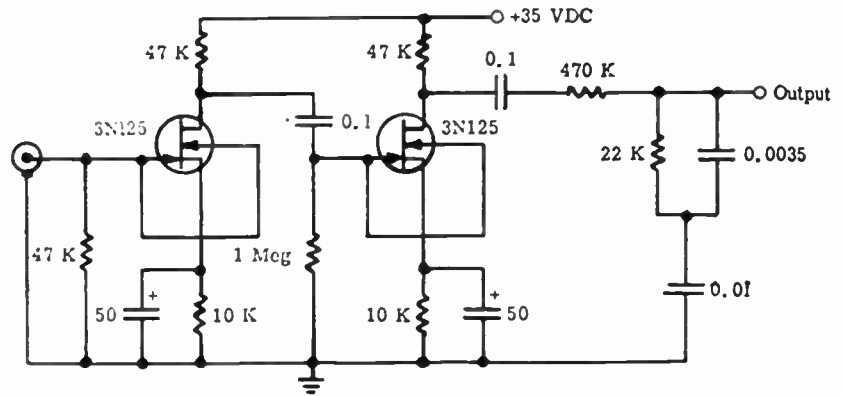
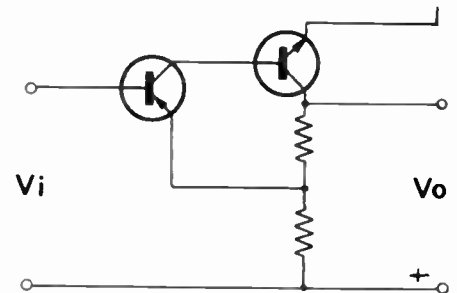


Fig 3. Darlington pair using PNP and NPN transistors



After describing the construction, Dr Olson said the correlation between the frequency characteristics and directivity indicated a very close agreement with the human voice and artificial voice. The bass speaker has a 4 in cone and the diameter of the treble unit cone is just under 1 in. The cross-over frequency is 1,500 c/s and a coupler is used to connect the low frequency speaker to the 2 in mouth opening. Two 1/2-in holes are located in the shoulder and connected to the chest cavity to simulate the human voice mechanism, which transmits some low frequency components through the chest. **AN ULTRA COMPACT LIGHT WEIGHT SPEAKER SYSTEM** (W. Elliott, Sonocolor, New York).

Mr Elliott has been engaged in developing inexpensive speaker systems suitable for connecting to domestic radio-

grams, tape recorders, etc. After saying that the cost must not exceed \$25 retail Mr Elliott said 'For reasons of bulk on one hand, and cost on the other, enclosure tests soon ruled out both the bass-reflex and the totally enclosed types. The most promising designs occurred among these combining horns and direct radiation. The voice coil circuit and mechanical network of a typical system are modified from those of Olson in his basic 1957 treatise on acoustical engineering. Consideration of space and efficiency provided sharp variations which were subjected to further testing.'

One design in particular gave a highly efficient output with reasonably smooth response from 80 to 10,000 c/s and additional coverage from 50 to 15,000. Maximum smoothing is obtained by the employment of acoustic resistance (filters at the face of the direct radiator, the

AUDIO CONVENTION

continued

mouths of the two final horn flare paths and the tweeter aperture, consisting of a rigid plastic plate with $\frac{1}{4}$ inch round holes. A final improvement is possible through elimination of sharp bends and a general rounding of the internal horn path to provide a smoothly expanding flare.

While the final formulations for enclosure design and drivers were being worked out, a simultaneous search was under way for improved structural materials for the enclosure. Prototype models were constructed of celotex, fibreglass and styrofoam, as well as combinations of these with plywood. The use of styrofoam gave desirable non-resonant features because of the unequal granular composition of this plastic, but presented certain problems of fragility. Testing was then centred on 'Uvex' a cellulose acetate butyrate compound. The speakers selected were a 8 in bass unit plus a $3\frac{1}{2}$ in tweeter and the complete system weighs less than 5 pounds. The depth is less than 4 inches.

Two of these systems were demonstrated but it was difficult to judge the quality as the pick-up appeared to be faulty and the distortion was high. However, coloration seemed to be quite low—as might be expected.



During a recent visit to the United States, J. L. Dominguez, Technical Director of Suministros Electricos Maldonado of Madrid, accompanied Alvin J. Schwartz, Singer Products Company Vice-President, inspects the final assembly line of Sinteric 250-watt FM Broadcast Transmitters.

A MATHEMATICALLY DEVELOPED LOUDSPEAKER (L. Walsh, Walsh Engineering, Millington, NJ).

Mr Walsh said, 'One of the main degrading factors in loudspeaker performance is the lack of diffusion which is the ability to transmit the same high quality voice or music to all points where a listener's ears might be located. The objective of the whole communication or recording system is to reproduce at the listener's ears the same sound that exists at the microphone. There are many variable factors that intervene, some controllable and some not, and some compensation may be made for some of these factors, such as loudness compensation for lower volume. But the inability of a loudspeaker to deliver the same high fidelity of music and voice to all points in the listening area is a factor that cannot be compensated. . . . The practical matter of moving air in sufficient volume for good performance at low frequencies requires a diaphragm whose diameter is equal to a number of wavelengths of the highest frequency sound to be reproduced. This number would be a minimum of about five in a 5-inch loudspeaker and it might be 15 in larger loudspeakers. With the diameter equal to five wavelengths of the highest frequency, the total angular width of the beam of optimum quality is slightly less than $2 \times \sin^{-1} 1/5$ or approximately 20 degrees. This is assuming that the diaphragm is acting as a rigid piston, but this never happens. Cone 'break-up', as it is called, widens the beam of optimum quality, but breakup is unpredictable and it is not subject to analysis. . . .

'The theoretical concept of the new loudspeaker is that a conical diaphragm mounted with its axis vertical can be designed to generate sound waves that are cylindrical or nearly spherical. Furthermore, the new loudspeaker in the theoretical concept can be designed to have a uniform response over any desired range of audio frequencies.'

Mr Walsh went on to say that 'A conical diaphragm is a simple thing in both appearance and in manufacture. But its modes of vibration at any of the frequencies in the audio range are extremely complicated. It is not a piston even at the lowest audio frequencies. The vibratory modes do not lend themselves to direct calculation, but there are methods of obtaining a useful analysis.'

In this new loudspeaker concept the following two conditions must be present:

1. The velocity of transverse wave propagation *vt* at a point on the diaphragm should be such that its component in the desired direction of sound radiation would be equal to the velocity of sound in air, *c*. This requires that *vt* be equal to the ratio

$c/\cos a$, where *a* is the angle between the diaphragm surface and the desired direction of radiation. This makes the transverse wave velocity in the diaphragm substantially greater than the sound velocity in air, in practice about three times, but ranging from about 1.2 to about 7.

2. Each wave in the diaphragm should radiate sound only during a single transit across the diaphragm.

To obtain these two necessary conditions, the conical diaphragm is treated as a mechanical-wave transmission line with the wave input at one end. The speaker is mounted vertically and the cone material, actually aluminium foil-covered plastic, is arranged to give a spherical wavefront as shown in Fig 5. The speaker is mounted on a box some 5 in deep by about 12 in square filled with damping material to absorb the 'frontal wave'. In practice, of course the absorption would only be partial but when these speakers were demonstrated the bass seemed to be quite good.

The omni-directional characteristic produced a poor stereo image in the fairly large hall (as might be expected) and overall quality was difficult to assess due to the rather poor demonstration.

A SOLID STATE HIGH FREQUENCY COMPRESSION HORN (H. Schafft, Motorola).

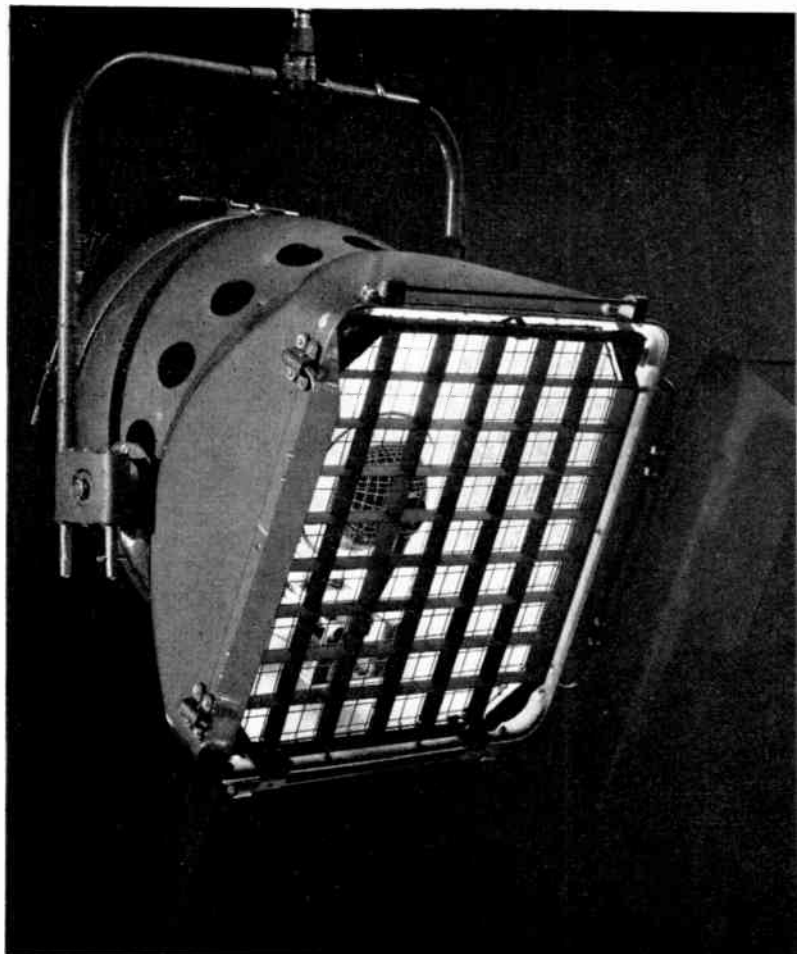
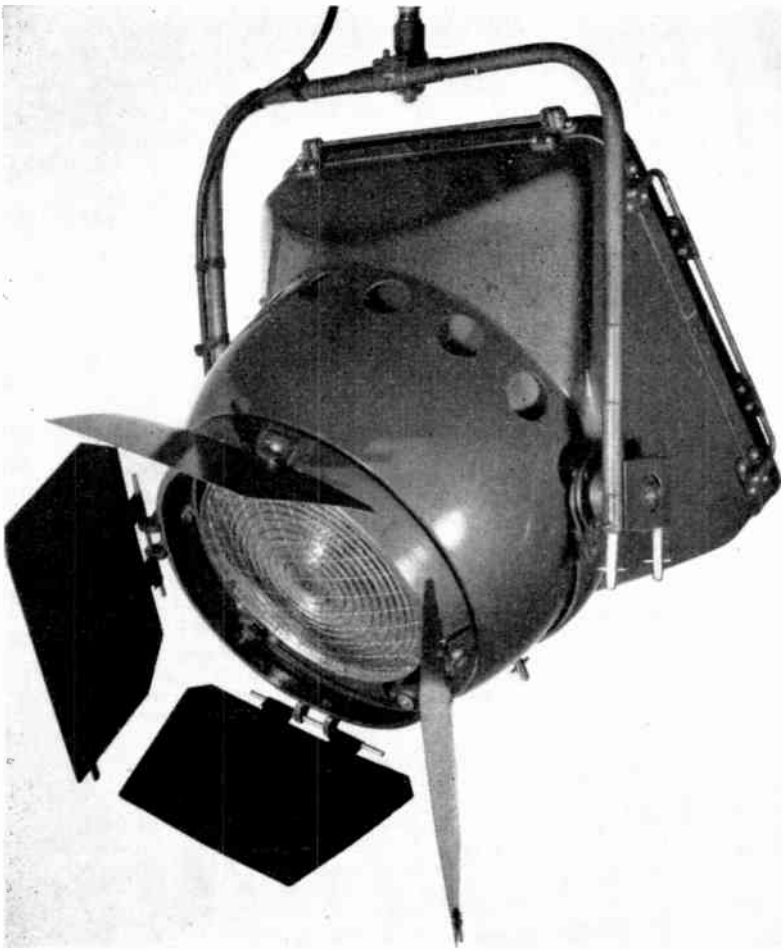
This is a horn-loaded high frequency speaker using a Piezo-Ceramic (PZT) driving element.

Mr Schafft described various methods of using PZT elements as audio devices. Three 'driving modes' were analysed—thickness, transverse and shear. A modified transverse mode using a length expander was adopted as being the best compromise in respect to sensitivity, driving voltage, impedance, etc. Fig 6 shows the arrangement. The length of the ceramic tube was fixed at 2.5 in to act as a $\frac{1}{4}$ wave resonator at 12 kc/s, the diaphragm is made from aluminium and has an elliptical taper to provide the necessary stiffness. The horn itself is made of plastic and is about 10 in long. The frequency response shows a gradual rise from 2 kc/s to 10 kc/s thence falling fairly rapidly to 20 kc/s. The shape of the curve is caused by the falling impedance characteristic and the response at the extreme high end determined by the driving system which becomes mass-controlled above 12 kc/s.

STYLUS MASS AND ELLIPTICAL POINTS (John Walton, Decca).

John Walton had this to say: 'There has recently been a trend for the minority of the better pick-ups to be fitted with elliptical styli in order to reduce the geometric distortion of tracing. . . .

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Audio CONVENTION continued

'There is an indication that the fitting of elliptical styli has, in practice, even in that minority of better pick-ups, not necessarily resulted in any significant reduction of distortion and can even result in more. A more unexpected result was the observation of certain conditions involved in the production of "modulation noise" from disc.'

After reviewing various types of distortion and methods of measurement and assessment Mr Walton concluded as follows:

'1. The complex nature of the effects of stylus radius make it necessary to

measure distortion over a wide range of frequencies and levels before assessing the merits of increasing or decreasing the effective stylus radius.

'2. The method of measuring distortion as harmonic amplitudes displayed upon a harmonic analyser is well suited to this task.

'3. The fitting of an elliptical stylus to most pick-ups at present will result in more distortion—not less. Only those pick-ups with a *measured* effective stylus mass in the region well *below* 1 mgm can benefit by a 0.0003 in minor radius, and the present radius of 0.0005 in seems best suited to the majority of average good pick-ups with their stylus masses in the 1-2 mgm region.'

OTHER PAPERS IN BRIEF

Geoffrey Wilson dutifully read his father Percy Wilson's papers on RECORD CLEANING AND A REPEATABLE TECHNIQUE FOR LISTENING TESTS, Daniel Queen of Perma-Power

gave a lecture on the APPLICATION OF REVERBERANT FIELD MEASUREMENTS TO THE EVALUATION OF LOUDSPEAKERS AND MICROPHONES, G. Grover of EUPHONICS gave a brief description of the EUPHONICS SILICON TRANSISTOR PICK-UP (see April 1965 INTERNATIONAL BROADCAST ENGINEER) and J. Jarvis of Langevin described a PROTECTED STABILISED POWER SUPPLY which limits current to 3.5A with 10 μ sec after application of a direct short to output, watts 50 msec, then if the short is still present, removes all voltage from output terminals.

Summing up: I thought it a pity that the time allotted was so restricted—most speakers were a little disconcerted at the apparent premature sound of the bell! Nevertheless, a most interesting five day session. A complete set of Pre-Prints can be obtained from: AES, PO 383, Madison Square Station, New York, NY, price \$12.

NEWS

Appointment

■ IT WAS ANNOUNCED on November 2 by Lord Nelson of Stafford, Chairman and Chief Executive of English Electric, that Mr F. N. Sutherland had been appointed Chairman of The Marconi Company and of Marconi Instruments, and Mr R. Telford has been appointed Managing Director of The Marconi Company in his place.

Sir Gordon Radley has relinquished the chairmanship of these two Marconi Companies in order to devote the whole of his time to English Electric's business in computers and automation. Sir Gordon remains a Director of The English Electric Company and of The Marconi Company and of Marconi Instruments Ltd and Chairman of English Electric Leo-Marconi Computers Ltd and of English Electric Valve Co Ltd.

Order

■ INTERTEL, a major European television group, has ordered four Marconi colour cameras and a range of supporting equipment using NTSC colour coding, for a completely new colour television outside broadcast unit which was demonstrated in London today for the first time. This will be the first such unit, specifically designed for broadcasting, to become operational in Europe. Earlier Marconi colour units have been used primarily for closed circuit work.

The first major assignment for this new unit, will be the videotape recording of the American Ed Sullivan Show in full colour at the Circus Krona in Munich. This programme will be shown on the CBS network in early December.

The cameras are of an existing Marconi design which is still the most modern colour camera available in the world in production quantities. Stability is a particular feature, providing the same 'hands off' operation as with the highly successful Mark IV black and white camera.

The cameras, type B3200, use three 3-inch image orthicon tubes, giving a high degree of

operational flexibility both for studio and outside broadcast use. Any of the colour coding standards can be used with this equipment. The four cameras will be fitted with zoom lenses, and mounted in a vehicle designed by Intertel, together with eight NTSC colour coders, eight 17 inch colour monitors, a vision mixing equipment, two 12-channel sound mixers and associated distribution and sound equipment. The NTSC colour coding is the standard system for the American television services, which will form one of the main outlets for Intertel's colour recordings.

Of the five mobile black and white units already operated by Intertel, three were supplied by Marconi, including a massive two-vehicle programme recording unit, supplied in 1962 and still one of the most comprehensive in operation in the world.

Contract

■ IN LONDON, Gresham Lion Electronics have been awarded a contract by the British Post Office for television test equipment associated with land line and micro-wave links connected with the BBC 2 network. This brings the total value of Gresham TV test equipment ordered by the Post Office to £50,000.

Gresham Test equipment is also used in the Early Bird television links and the company has supplied equipment to most British television networks and to many other countries including New Zealand, Australia, Portugal, Spain, Malaysia, Canada, Rumania, Czechoslovakia and Malta.

Date

■ IN BRITAIN the Television and Radio Show 1966 is to be held at Earls Court, London, from August 22-26 1966. The show will be promoted and presented by Industrial and Trade Fairs Ltd, with the full support and backing of the Radio and Television Retailers' Association. It will be open to trade visitors only.

The decision to hold the show follows a country-wide poll of leaders' opinions conducted with the co-operation of the Radio and Television

Retailers' Association. Leading companies already taking part include Philips Electrical Ltd, Pye, Rank-Bush Murphy Ltd, Standard Telephones and Cables Ltd and two sectors of the Thorn Group (Thorn-AEI Radio Valves and Tubes Ltd and the Marconiphone Division).

Participation in the exhibition will be open to all home and overseas manufacturers of television and radio sets, high fidelity audio equipment, radiograms, record players, amplifiers, discs, tape recorders, musical instruments, transmission and studio equipment and allied products and services.

Space in the exhibition will be allocated following a ballot, further details of which will be advised later. Provision will be made for both display stands and private dealer reception areas.

Full-scale international advertising, promotional, publicity and press relations campaigns, including a special nation-wide dealer publicity campaign, will be arranged by the organisers' Public Relations Division, ensuring that all potential trade buyers and visitors are kept fully informed concerning the show.

Changes

■ DUE TO the considerable increase in the activities of the closed circuit television and nucleonic equipment fields, EMI Electronics Ltd is making several changes in its marketing organisation which take effect from November 1 1965.

As from this date sales of closed circuit television will be handled by EMI's Broadcast and Recording Equipment Division. Thus the sales and systems planning functions for the whole of the Company's television activity will be the responsibility of one Division. T. G. Potter is appointed Sales Manager CCTV. He will be responsible to J. D. Tucker, Manager of the Division.

D. A. Alderton is appointed Sales Manager of a new division formed to handle the sales of nucleonic equipment, including EMI's rapidly expanding range of nuclear health equipment which is now the most extensive in Europe.

Industrial Instruments including oscilloscopes will in future be handled by the Company's Automation Division and PST capacitors will be the responsibility of EMI's Telephone Equipment Division.



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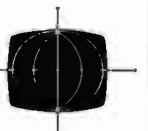
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The STC 4126 miniature capacitor microphone

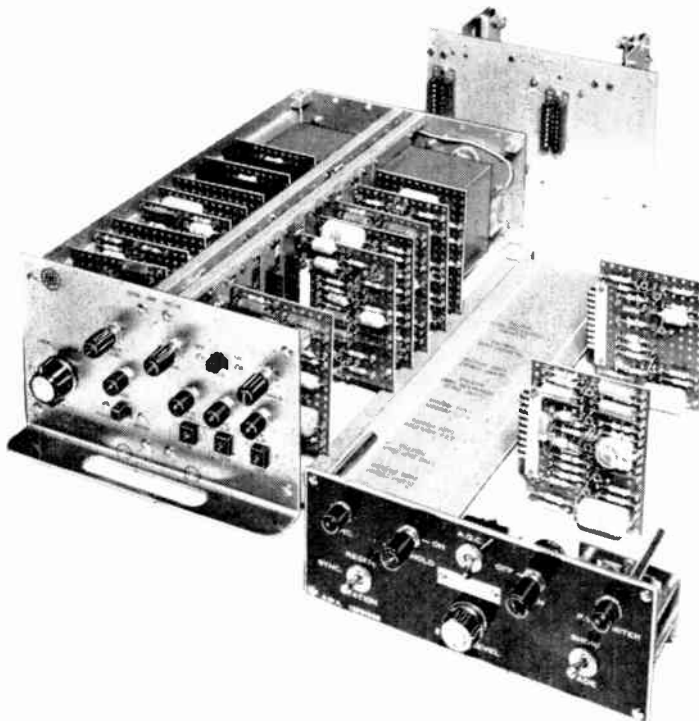
MICROPHONES FROM S.T.C.

by Donald Aldous,
Audio Editor

THE S.T.C. organisation and its fore-runner, the American Western Electric Company, have produced electroacoustic equipment of the highest quality from the beginnings of sound reproduction.¹ The research and development work of S.T.C. and their earlier associates have, on several occasions, produced designs far in advance of their time. These designs have now formed the basis for a large number of the microphones produced by other manufacturers in many different countries. The precision stretched-diaphragm condenser microphone and the acoustically-equalised moving coil microphone are outstanding examples of patented designs of 30 to 40 years ago which now form the basis of the vast majority of capacitor and moving coil microphones in the world of today by a variety of makers. These patents have now expired, so that the original inventions may now be used by everybody. Tangential edge corrugations on diaphragms and the coupling of acoustic resistance to the cavities behind diaphragms are two examples now seen in most dynamic microphones.

The 'know-how' and scientific knowledge behind the present S.T.C. designs is continually fostered and

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AND
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AMPLIFIER
TAS-11**

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FEATURES

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- Two mount side-by-side in a 19-inch rack frame.
- Modular construction.

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Microphones from S.T.C. continued



STC design studio ▲

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In England the S.T.C. Electro-Mechanical Division make a range of high grade microphones and ear-phones, in addition to various specialised types of communication microphones, etc. in their modern and well-equipped factory at Harlow, Essex. The engineering department, led by Mr L. Gayford, design microphones and perform exhaustive tests of all kinds. The modern need for good appearance and functional design is catered for by the S.T.C. industrial design department, led by Mr R. W. Stevens and assisted by famous design consultants such as Kenneth Grange (Duke of Edin-

▼ Microphone engineering design of the 4126



burgh Gold Medal Award winner). S.T.C. microphone designs by Kenneth Grange have been exhibited at the London Design Centre. His assignments include new ribbon and moving coil microphones, as well as modern light-weight stands and accessories.

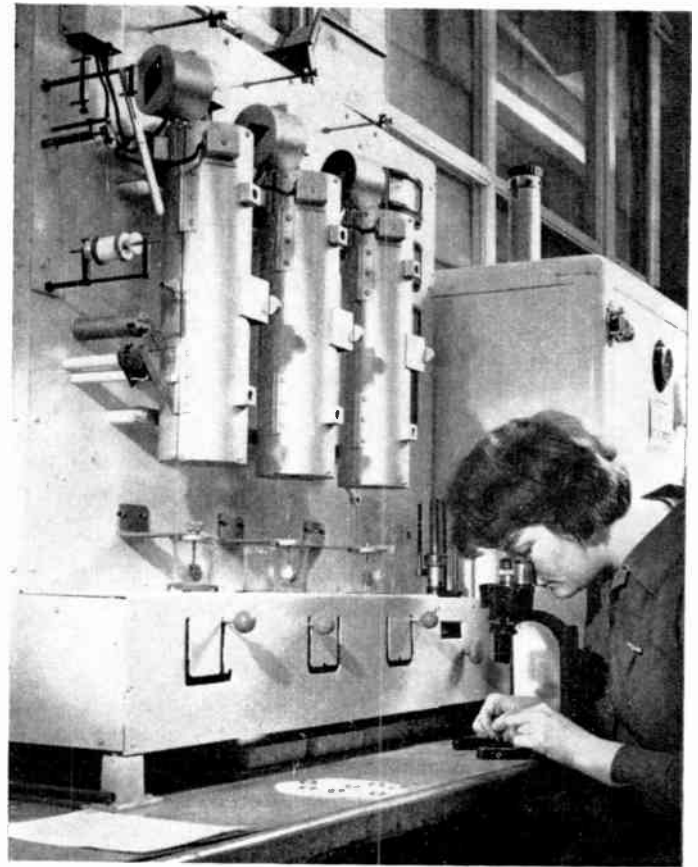
An environmental laboratory tests microphones for tropical conditions, cold, vibration, etc. The S.T.C. Harlow factory also has extensive and highly specialised ultra-clean work shops where microphones are assembled and are subjected to meticulous mechanical and acoustical testing procedures.

The production equipment such as special



Inspection of completed 4126 capsules

Winding ►
aluminium speech
coils



machines, jigs, tools and the measuring facilities represent a considerable capital investment and have been largely designed and made to the specialised requirements of the S.T.C. engineers. Visitors have remarked that this factory with its light, airy working areas and comprehensive specialised equipment, is ideal for the production of microphones.

The accompanying pictures show various stages in the design and manufacture of S.T.C. microphones. All microphone units and sub-assemblies are subjected to electrical and mechanical checks. In addition, various specialised acoustic impedance measurements are performed on certain acoustic impedance and labyrinth elements. Some of these elements equalise the response and others produce the cardioid directional response which is required of many microphones.²

Diaphragms are checked for weight, mechanical form, resonant frequency and compliance. Some diaphragms which are too light to handle with even the smallest tools are lifted and positioned with vacuum lifting devices. After a rigorous mechanical inspection, microphones are calibrated in one of two anechoic rooms which are treated with the latest types of sound absorbing wedges.

The performance of cardioid microphones at extreme low frequencies is measured in a new type of

plane-wave acoustic duct which gives a negligible reflection factor down to below 30 c/c. The standard microphones used in these calibrations are given primary calibrations by the National Physical Laboratory and also by reciprocity methods in the S.T.C. Laboratories. The precision of the response measurements is thus maintained to the required high order of accuracy.

The manufacturing schedules now in operation at S.T.C.'s microphone plant are designed to ensure that most types of microphone are readily available and that customer's repairs are dealt with very promptly. A rush service is often operated for customers genuinely needing replacements within a matter of a few hours. Carefully planned production has enabled prices to be set at a very competitive level.

A recent 'world first' from S.T.C. Harlow is the new 4126 miniature transistorised capacitor microphone. The microphone and head amplifier unit is 7/8 in in diameter by 2 in long and can operate from small long-life batteries in a separate container, or from a mains unit. It is a high quality cardioid which does not depend on complicated RF circuitry. A full range of special accessories is available. One of the interesting features of this microphone is its versatility. It is a miniature unit suitable for all studio purposes. Its unobtrusive appearance makes it suitable for 'in-shot' use and it can be used on all normal types of stands and booms. It performs well as a lavalier or personal microphone when used with a special electrical equaliser and can be used as a high quality feed for a radio microphone system.



▲ Testing diaphragm tension on capacitor microphone capsule Type 4126

REFERENCES

- 1 The STC Story. *International Sound Engineer*. Vol 2 no 3, March-April 1964.
- 2 *Acoustical techniques and transducers*. M. L. Gayford, Macdonald and Evans, 1961.

INTERTEL'S MOBILE COLOUR EQUIPMENT

INTERTEL'S mobile colour unit is the culmination of four year's ambitious planning, not only by Britain's InterTel (VTR Services Ltd) but by Ampex Corporation, The Marconi Company and the many other contractors.

Outcome, as we saw last month in INTERNATIONAL BROADCAST ENGINEER, is a mobile unit including Marconi three-tube image-orthicon colour cameras, an Ampex 2000 video recorder, and a comprehensive audio network including a transistorised 24-channel audio console. I gave salient features of this equipment in last month's issue.

Interest naturally centres on the ancillary equipment, for potential users of the InterTel facility will need to know the operational limits, and naturally others interested in the specification of a mobile colour unit will want to discover the apparatus necessary to get fine results and economical operation from an image-orthicon colour channel.

Taking sound-coverage first, InterTel have installed in their colour van a B1103 Marconi sound mixer modified for 24-channel working, with echo and fold-back facilities. In essence this is a double-twelve bank, and each group of twelve is complete with input impedance selector, pre-set gain control and plug-in quadrant fader. In each unit there are basically two groups, one for six low-level channels, and one for two low-level channels. The remaining four will accept either high or low-level inputs, and can be switched separately to either group. The two main programme outputs are at 75 and 600 ohms, and there is also a 'clean feed' output which can be fed from either group, or the main output (at 75 to 600). In addition there is a programme meter, with 12-way selector, and a monitor selector with gain controls and loudspeaker dimming.

InterTel can thus provide a public-address facility on each channel of the mixer, external cue to two inputs, and a pre-fade listen facility incorporated in the fader back stop. As mentioned last month, Trevor Wallace of InterTel uses a special German-built echo facility, and on the Marconi mixer the echo extension unit includes differential echo-mix control for eight channels, echo cut and selector for each group, and fold-back switch for each group, without output-level control.

InterTel's basic mixer unit is functionally split into 6 + 6 + 6 + 6 inputs, with a fader on each group. The first six microphone inputs are always fed to group B. Under normal conditions, channels 7, 8, 9 and 10 are fed as low-level channels into group B, but it is possible to switch *any* of these channels to group A, and also each one can be switched to

accept a high-level input. Each input has an impedance-selector switch (150 and 600 ohms) and a pre-set gain control of 30 dB. This control is followed by a plug-in quadrant fader. In fact each channel amplifier is a plug-in unit removable from the front.

A Marconi executive, showing me the InterTel equipment, stressed these operational points: 'Pre-fade facilities are available on each channel using the over-press mike switch at the bottom of each channel fader travel. The output is taken via a rotary gain control and output amplifier. Each channel may also be selected for feeding a PA system, using this key situated beside each channel-impedance selector. Then the output is through a cut key and rotary gain control. The 'clean feed' output is taken through separate amplifiers from the group fader output, and, as you see, a three-position switch selects either group output, or both. . . .'

Heart of the video colour system is the Marconi sync pulse unit, which of course is transistorised. The dual version is used, housed in a printed-wiring case. In fact one single case contains two independent generators, two power units and change-over switch, and there is also provision for two built-in automatic genlocks. The whole thing can be withdrawn on runners for inspection, and the individual counter circuits and so forth plug into the main board. InterTel use the exclusive Marconi two-mode mains locking circuit, which gives rapid pull-in with slow follow once the lock is established. In the automatic mode, stable binary counters are used to count-down, and the whole unit has a master oscillator which can be either crystal controlled or locked to local or external mains, or adjusted by hand.

InterTel's colour operation in the mobile unit is up to the highest technical standards associated with permanent studios, and to this end special pulse, coding and test equipment are used. One important link in this chain is the B3640 colour synchronising unit which, together with the sync pulse generator, provides sub-carrier and locking signals to enable TV waveforms to be NTSC encoded. The sync unit uses a sine-wave output at the required colour sub-carrier frequency, and is designed to produce a frequency suitable for either 625 or 525 working. Its basic oscillator is crystal-controlled and housed in a change-of-state oven which helps towards a very stable output. This output from the oven module is fed to an HF counter which provides a jitter-free output at twice line frequency. This output is used to lock the system sync generator. It is a great help in a mobile unit that the counters require no day-to-day adjustment.

by Kenneth Ulyett

Television Editor

'It has been the practice in the past,' say Marconi's, 'to provide separate burst gating pulse units to key the sub-carrier into the back porch of the line sync pulse, to achieve colour synchronising. Transistors have enabled us to combine a burst gating module as part of this B3460 colour sync unit. Also it has an integral regulated power supply, which is contained in one of the plug-in modules. . . .'

Then comes the colour coder, next in the chain. This provided all the signals necessary to code RGB video inputs into a composite colour signal of the NTSC form. Like the rest of the InterTel equipment in this section, it is modular, transistorised, and works on 525 and 625. The unit is normally fitted with matrices to derive Y, I and Q signals in accordance with NTSC practice, but these matrices can be changed to provide other signals should these ever be needed for InterTel's European working. It will be appreciated by those not well versed in colour television that to form a suitable compatible signal for broadcasting within the allocated bandwidth of normal monochrome TV, three *simultaneous* colour signals are encoded to form a single composite colour signal. This comprises the luminance signal (conveying the standard black-and-white information, and the chrominance signal (conveying colour information). The colour coder, in addition to its main task, has control of phasing. Thus between two encoders the phasing can be adjusted to provide a range of sub-carrier phase of greater than 360 deg. Provision is made to include a suitable notch filter, if required, in the luminance channel only, centred on the sub-carrier.

Very latest B4002 vision and pulse distribution amplifiers are used by InterTel. Compactness is naturally essential in a mobile van, so it is of interest that the self-contained transistorised 'V & P DA's' are modular, and up to 35 vision outputs or 42 pulse outputs are available in only 5½ in of a standard 19-in rack. There's a preset gain control and output-level test points on the front panel of each module. Circuit of the vision version uses eight transistors, and includes an overall feedback, an arrangement which I find gives a stable performance and good differential phase and gain parameters. If necessary on an InterTel job, several amplifiers can be linked in cascade to distribute colour signals. Six transistors are used in the pulse version of this network, and again a large measure of feedback is used to give stable working. The input circuit is protected from accidental surges by a 12 k series resistance, and this also defines the input impedance even with the power off. Pulse delay on the pulse distribution amplifier is less than 0.06 microseconds, and the HF transient

response is such that with an input pulse having a sine-squared rise and fall time of 0.1 microsecs, the output pulse rise and fall time is less than 0.115 microsecs with an overshoot of less than three per cent.

Vision mixing can be accomplished with an A/B mixer with twelve inputs and six outputs, a switching matrix using high-speed plug-in relays, and built-in protection against mixing on non-synchronous signals. By ingenious circuitry, cuts are arranged to take place during the field blanking period. This is a well-planned mixing arrangement, and crosstalk protection in a five Mc/s circuit is better than 50 dB.

In this system the vision matrix is built on a 19-in rack-mounting chassis, and takes up just under 30 in of rack space in the InterTel layout. High-speed, high-reliability IBM plug-in relays are used for switching, in preference to semiconductors. Semiconductors in switching involve the use of at least three semiconductors at each cross-point, as well as other components, and the IBM relays give a simple, trouble-free arrangement. Furthermore, relays (with several sets of contacts) greatly simplify the provision of cues. In elaborate Outside Broadcasts as carried out by InterTel, this facility can be important. In fact in the layout here, a seventh bank of relays provides 'logic' switching.

How does the sync comparator give complete protection against the mixing of an asynchronous signal? Well, when two signals are pre-selected, the sync comparator is placed across them before they are mixed, and if they are not synchronous a 'DO NOT USE' light for mix or wipe is illuminated, and this remains on until one or both signals are disconnected, or adjusted to synchronism.

Checking all colour equipment in the InterTel unit is carried out with the aid of three special devices, a colour bar generator, a special colour monitor, and a vectorscope.

Looking at the colour bar generator with a Marconi technician, I was told: 'This unit, an ancillary to the colour synchronised and colour coder, is designed to set up and check the performance of sync and coding systems. It can also be used for giving the adjustment signal to set up some of the controls on colour monitors. . . .'

It is a compact little unit in a 19-in rack in the InterTel Ford van, and consists of five plug-in modules. There is also a mobile case version for Outside Broadcast use. It is transistorised, and works on 525 and 625 standards, and as it is of what colour-TV engineers call 'sub-standard stability' the output signal can be used to calibrate levels throughout the whole studio and OB chain, which is the normal InterTel practice.

LPE goes colour

Report on some new experiments in colour TV advertising in Britain

by Rod Allen

MUCH ATTENTION to and emphasis on the colour TV question has been paid recently because colour TV advertising will mean almost as great a revolution in advertising as the coming of commercial TV itself did ten years ago.

And while politicians and engineers have been wrangling about the merits and demerits of this or that transmission system, on a more practical level, questions are being asked, and sometimes answered, about the operational and aesthetic problems associated with colour TV.

One of the most vociferous competent of answerers has been the TV department of the London Press Exchange. Well known already for its research into commercial testing with Telpex and other methods, the LPE has now turned its attention to the problems of colour television.

Even though there does not seem to be the remotest possibility of a colour commercial service for at least two years (though we may see colour on BBC 2 before the end of 1967), the LPE sees as its duty, according to Harold Purcell, managing director of LPE Television, to point out to its clients some of the advertising problems associated with colour, as well as make one or two suggestions as to the answers to these problems.

Accordingly, in association with the Peto Scott Electrical Instrument Company, who market the Dutch Philips TV equipment in the UK, the agency has been conducting a series of colour TV tests and demonstrations in the past few weeks.

Says Purcell: 'Much can be learnt about colour TV now by studying the master signal produced in the studio. There is—or should be—virtually no difference between the picture shown on monitors in the studio and which viewers eventually will see on their screens.'

The LPE's tests made use of the new Philips Plumbicon camera, a major advance in colour TV technology which uses camera tubes with lead-coated targets. Definition and resolution are claimed to be higher and though the model in use in St Martin's Lane this week was designed for industrial use, its quality was such that it could quite easily have been used for broadcast applications.

Schwerin tests in the US, says Purcell, have shown that colour is obviously more effective, by Schwerin's reckoning, than it is for others. Colour commercials for products with strong sensory appeal, such as foods, had proved 78 per cent more effective, by Schwerin's reckoning, than black-and-white commercials.

It seems that the prime problem facing

advertisers going into colour, however, is that of the packshot. On this the success of the whole commercial depends, for without accurate colour rendition of the pack, the consumer might not recognise the product in the store, or might even reject it when offered, because of non-correlation with the pack as seen on the screen.

This problem is even more acute in the US than it would be over here, for in the States viewers have both hue and saturation controls on their sets which enables colour values in the pictures to be altered at will by the viewer, thus making the advertiser's communication problem a little more difficult to overcome than it would be over here if—as seems likely—the PAL system is introduced, in which colour balance is completely in the hands of the studio engineer.

The LPE demonstration consisted of a series of colour shots of packs of products handled by the agency; inherent typographical and colour design problems in relation to colour TV were described, and some of the most interesting points arose from the use of differing backgrounds to the same pack and the effect that these varying backgrounds had on the colour renditions of the packs themselves.

A particularly interesting feature of the demonstration was the 'instant' creation of a short commercial on the spot for an imaginary cosmetic. Those present saw both the original scene and the scene as it would be transmitted, and were able to compare the effects of different lighting combinations and levels as well as the all-important skin tones and product rendition.

The press was certainly impressed and LPE staff say that the clients who were present at the series of demonstrations have also shown a great deal of interest in the LPE's theories on this problem.

The LPE experimentation is, of course, still on a very simple level. It is foreseen that in the initial stages a major proportion of colour TV advertising will be originated from film, and until adequate telecine equipment is made available, the trials must be confined to 'live' or (soon) VTR TV.

The point has been made, however. And this week's demonstrations have shown beyond any doubt that advertisers and agents will have to re-examine their packs and products pretty carefully before leaping into colour TV feet first. The LPE's foresight in pointing this out practically is particularly to be welcomed and should prove the basis for more extensive research into what have been shown to be quite serious problems of colour TV advertising.

Marconi provides a complete range of sound and television broadcasting equipment. Complete systems surveyed, planned, installed, and maintained in all parts of the world.

Marconi semi-automatic master switching system B3720

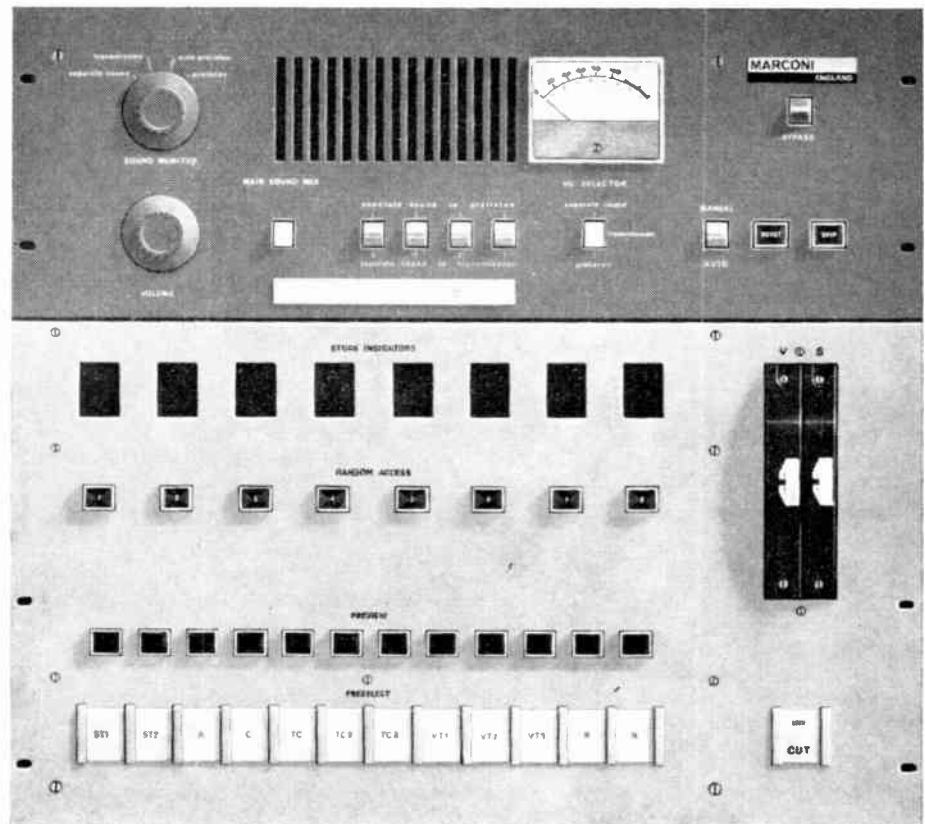
The B 3720 Switching Equipment is a master control switcher with a memory store to control programme sources in correct sequence, allowing the operator to concentrate on the correct timing of the programme change, the next source being selected automatically.

Vision and sound switching for 12 inputs

Automatic sequencing of up to 8 events

Full colour standards

Fully transistorized



Marconi sound and television
broadcasting systems

\$1,000,000 MOBILE COLOUR

the full technical story

by E. P. L. Fisher

THE OTHER NIGHT as the national newspapers in London were being prepared for Press, the news ticker-tapes began punching out a news item: 'British TV firm InterTel has won a contract worth more than £400,000 (\$1-million) to produce live colour TV programmes in Europe for American networks.'

Now the surprising technical facts can be given of the story behind this news story. Not only is this British unit giving UK highlights in colour to millions of American viewers, but the source is mobile. Even while the news was being sent around the world on tape, InterTel (VTR Services) were starting on their first assignment with a huge new mobile television unit.

By the time this page appears in print, InterTel's new colour unit will have completed an Ed Sullivan show from Munich, and a colour-spectacular ice show in Amsterdam. Among the many December highlights from Europe to the USA is a live relay across the Atlantic direct from the Sistine Chapel at the side of St Peter's, Rome, where High Mass is celebrated on Christmas Eve.

Unique

Line standards present no problem to this mobile colour unit, for the whole technical layout is on a relay system. Immediately a switch is touched on Camera Control, the network shifts from 625 to 525, or back. The unit's own diesel generator is simultaneously speeded to give a 60-cycle supply for US working, or Westinghouse-governed back to a 50 cycle supply for European coverage.

Such a mobile colour unit, unique in the world, is the culmination of some four years' ambitious planning and achievement on the part of two British TV executives, Michael Style and Trevor Wallace.

It was on September 7 1962 that the British InterTel unit first went into action, to fill an international need which only these two ex-ATV executives could foresee. Five years ago InterTel was an internationally-known broadcasting group, already with

some degree of TV coverage throughout Europe. But the new facet, InterTel VTR Services arose simply because at that time Trevor Wallace and Michael Style were impressed with the almost complete lack of mobile VTR and editing facilities. Requests came to British technicians and networks from US and Continental stations. Several British TV companies could offer camera crews for Remotes (OB's), but putting OB's on mobile VTR was considered to be too difficult. Thus countless opportunities to televise from British and Continental European scenes were lost.

Qualifications of Style and Wallace to offer the world a mobile VTR service were in a way unique. Michael Style, after a lengthy British TV experience, went to Canada in the 1950's, and prior to the advent of Independent Television in the UK there was all-too-little scope. He sold everything in Canada, starting with shoes, and by coincidence followed much the same course as Roy Thomson who sold radios and programme time in Canada before coming to Britain as a TV and Press Lord. Style found his way into the Canadian film industry, into television, where he produced and directed. And in remote Canadian areas made the most of VTR in its pioneering days. Trevor Wallace also worked in Canada in TV and motion pictures, helping to design the technical facilities of the studios in which such TV series as RCMP was produced, in Quebec Province. In fact he helped to instal the first Ampex machine to operate in Canada.

Separately they came back to the United Kingdom, their paths not having crossed. On return to London, Wallace took up the appointment of ATV's Supervisory Engineer in charge of videotaping. Michael Style, also just recommencing a career in London, was responsible for programmes such as 'The Warning Voice' and 'French from France.' Wallace video-edited this latter programme, scene by scene. The two men met and worked together, and eventually Wallace developed a pioneer process of videotape editing which was used in major productions including the Royal Variety Performance.

Then came the growing international demand for mobile videotape facilities, and

better mobile camera channels than were at that time available.

'We thought of pooling our resources, forming a team and perhaps buying a van to set up in it a secondhand Ampex or RCA machine,' said Michael Style. 'Then we were in touch with an executive of the European InterTel group, and we all mutually agreed it would be better to work with this group and eventually provide VTR services for monochrome and colour.'

Their first mobile unit went into operation in September 1962. It was not simply another mobile TV van, but a complete production unit. The EMI vidicon camera channels were almost at once changed for image-orthicons. All gear was carried on a modified Ford commercial truck chassis provided by Gould's, and the features introduced by Wallace embraced Frigidaire air conditioning (neatly fitted above the driver's cab), EMI eight-channel modular sound mixer, Ferrograph sound recorder, RCA neck and AKG condenser microphones, Ampex VTR, and power either from local mains (8 kV maximum, single phase, through the van's control unit) or from a 15 kV diesel generator carried separately on a Land-Rover truck.

Comprehensive

Successful as this was, it was but a beginning. The specification to present-day InterTel experts reads like a period-piece. The new colour production unit is housed on a Ford chassis, modified to Trevor Wallace's specification, but there the resemblance ends.

Millions of American viewers had the first opportunity of seeing InterTel's high-quality work when The Ed Sullivan Show went to the Circus Krona, the resulting relay being networked by CBS. This programme, like others being handled through the same equipment, was given with the aid of Marconi BD3200 3-in image-orthicon colour cameras. Marconi's have the proud claim that that this camera channel is 'still the most modern colour camera available in the world, in production quantities.' It gives

the same sort of hands-off stability as the Mk IV monochrome image-orthicon channel. Any of the colour coding standards can be used with this camera, and InterTel have no fewer than *four* of these costly camera channels in use.

The BD3200's are equipped with Rank Taylor Hobson Varotal V zoom lenses, and the colour van also carries eight NISC colour coders, eight Conrac 17-in colour monitors, a vision mixing equipment, two 12-channel sound mixers, and associated distribution and sound equipment. It is interesting, I feel, that of the five monochrome-TV units already operated by InterTel, three were supplied by Marconi. These included a massive two-vehicle programme recording unit, devised in 1962 and still one of the most comprehensive in operation anywhere in the world.

Video recording is carried out on one of two Ampex 2000's (Ampex 1000C and LOG2 recorders are also available in other InterTel units), and while some sound recording is on Ferrograph equipment, InterTel also use the latest Ampex 315 sound recorders.

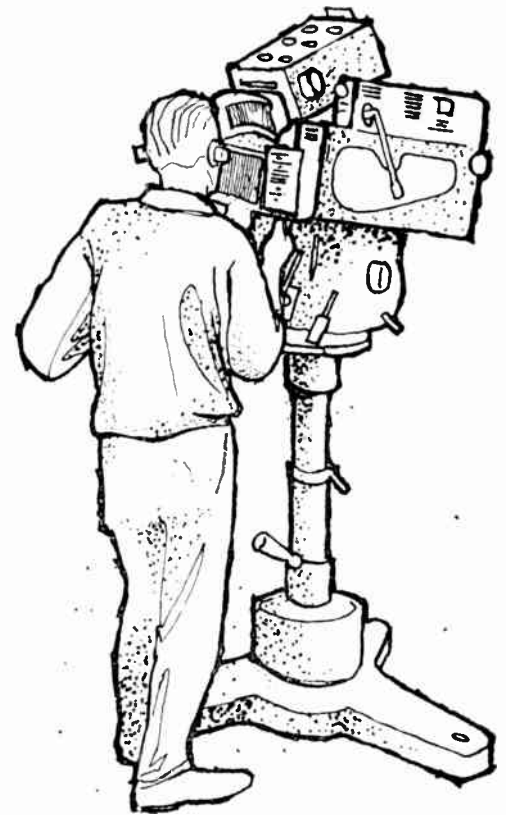
All colour equipment is housed in the new van mounted on a Ford chassis, steering of which is modified to give a tighter turning circle of only 32 ft despite the considerable length. Suspension is modified with heavy-duty front springing, and softened rear suspension. InterTel do not

believe in anti-vibration mounting of components and racks as a general policy. 'It only makes things wobble more,' explains Trevor Wallace. 'We prefer to get the mobile suspension right, fundamentally. Then most equipment can be rigidly mounted as in a TV control room in a building. This philosophy has been proved correct on occasions, sometimes quite dramatically. There was the time when a van was on its way to Edinburgh for a BBC assignment, and accidentally skidded in bad weather, turning full circle and ending up in a ditch. When a crane pulled it up again a few minutes later, none of the gear was damaged. We were not late for that assignment.'

Cooling

Just as Frigidaire air conditioning was used in the first InterTel specification, so special attention has been paid to cooling in the new colour van. There are now dual air compressors to cope with ambient heat, and naturally the partial transistorisation of the VTR helps to minimise heat problems.

'An important factor,' Wallace explained to me, 'is the special care we take to prevent any voltage surge when the compressors are switched on. With colour transmission there is always the risk of drift



resulting from voltage surge. Two heavy-duty Claude Lyons Variacs cope with the surge problem.'

So stable is the BD3200 camera chain, with its novel tilting viewfinder, that in normal InterTel operation only two controls need to be used, namely those concerned with panning and tilting. The TTH zooms are remote controlled.

Light enters the camera through the Varotal V and forms an image at the field lens which is mounted inside the turret.

An optical relay system follows, and the final image is formed at a distance which allows a light-splitting system of prisms and mirrors to be interposed. Light is divided by two prisms mounted in V-formation, having a surface deposit which allows only a green light to pass straight through, whilst deflecting blue and red light to opposite sides.

Front-silvered mirrors are then used to bring the three paths back into line which (after further shaping of the spectral response by filters) are finally focused on to the photo-cathodes of the 3-in image-orthicon tubes. This use of prisms in the optical system marks a step forward from the older system of using dichroic mirrors, and gives a reduction in secondary images. The light input is remotely controlled by an iris in the optical system.

Output from each image-orthicon is fed to a separate head amplifier in which good circuitry gives a flat response over the whole frequency range from 50c/s to 10 Mc/s. No 'high-speaker' control is needed, as correction is made automatically and of course this relieves the InterTel operator of another control.

Each head amplifier is provided with an

British television studio presented to Mexico



Great Britain is sending a complete television studio centre, made by Pye TVT Ltd, to Mexico. The equipment, a gift from the British Government, will be installed in the Instituto Politecnico Nacional, Mexico City for educational purposes. The gift is the result of an offer made by Prince Philip during his recent tour of Mexico where he stressed the importance of television as an aid to teaching. Picture shows Tom McGann, Sales Manager of Pye TVT Ltd, explaining the operation of the sound and vision mixing desk to Miss Dorothy Nicholls of the Ministry of Oversea Development. The studio equipment also includes two station broadcast cameras, a telecine unit and slide projector, two record playing consoles, audio tape facilities, six monitors and ancillary units.

MOBILE COLOUR continued

input for test waveform application, and separate controls for adjusting the height and width of the picture are located at the camera control panel. Thus the Green controls may be adjusted as a reference, followed by the separate Red and Blue controls. InterTel cameras frequently have to be operated under difficult site conditions, and it is useful on the BD 3200 channel that the single multi-core cable is brought away at the camera centre of gravity. The whole camera is very solid and stable, and as the deflection yoke is made to an extremely close tolerance a very high degree of registration of the three component images can be obtained.

One member of the InterTel crew is occupied with the colour-chain's operating console in the van, and in fact the complete unit really incorporates two separate consoles mounted side by side. One contains the camera control unit and camera operating panel, and other the picture and waveform monitor and remote control panel. These panels are edge-illuminated for operation under the sort of low ambient-light levels which one expects in a mobile unit.

'The camera control unit,' explains a Marconi engineer, 'contains the electronic circuits for processing the signal, such as black-level clamp, gamma correction, aperture correction and clipping circuits, and, as you see, includes these controls which are brought out to the front panel for InterTel operation. . . . Line and field shading, linear and parabolic for each tube, master lift and lift for each tube, gamma correction, waveform input selection to the picture and waveform monitor, and picture input selection to the picture and waveform monitor.'

Then, while InterTel operators were setting up the chain for a colour test, we examined the rest of the console.

'This camera control panel,' continued the Marconi executive, 'contains the image orthicon control for the Red, Green and

Blue channels, the meter for checking focus current and negative camera voltages, and the power supplying unit which gives us the negative voltages for focus regulation and align generators. As a matter of fact, focusing potentials and currents are stabilised here to a very high order to reduce focus drift over long periods.'

On examination I noted that the remote control panel is mounted beneath the picture and waveform monitor and includes the iris control transmitter, the communications amplifier and the centring supply unit. It is an important facet in equipment such as this, used in a mobile van, that in the event of power failure communications can be maintained by switching to an external 12 or 24 volt battery.

With the colour camera channel go Varotal V zoom lenses. It is a fine achievement to be associated with InterTel, and Keith Walker of The Rank Organisation told me: 'Incidentally, all InterTel's lenses are Rank Taylor Hobson. . . .'

When this fine 10-to-1 zoom was introduced, its chief designer Mr Gordon H. Cook said to me, during a demonstration: 'In providing the cameraman with a lens of such extensive focal ratio, it is possible that, with time, production techniques will be considerably modified. . . . A four-lens turret with a standard range of 2, 3, 5 and 8-in lenses has led to a method of working which restricts the use of both shorter and longer focal-length lenses. Now the Varotal V provides a 16-in focal-length lens and short focusing distance without prejudice to the full focal length required.'

InterTel operators are finding with the Varotal V zoom that a close-up shot at 6 ft distance yields the same size of picture as an 8-in lens at 3 ft, but gives a much better perspective. And it has the same depth of field.

Through a complex lens (the zoom incorporates no fewer than 16 glass elements and

11 glass components), the overall length is only 17 in. Focal range, of course, is 1.6 in to 16 in and maximum relative aperture throughout this range is f/4.0 (T/4.5). On the colour camera the image format covered is 3-in image-orthicon (4.5 in on other cameras), the nominal cathode format is 1.26 in by 0.96 in, and transmission is actually 81 per cent. The minimum size at 6 ft distance with the lens set at maximum focal length is 5 in by 4 in. Angular fields of view for nominal 1.6 in diagonal format is (*diagonal*) 54 deg to 5.4 deg, and (*horizontal*) 44 deg to 4.4 deg.

Most of the colour video recording is now carried out with the Ampex VR-2000 which was first introduced to the UK in London, at Ampex International's symposium in June and July 1964, but which was introduced a little before that to INTERNATIONAL BROADCAST ENGINEER when our Television Editor had a demonstration of the 2000 at the NAB Convention, Washington. Ampex claim with justification that this colour-compatible VTR is capable of producing higher quality recordings than any previous recorder. Indeed, the new high-band record/reproduce standard on the 2000 permits third-generation tape copies of unusually high quality.

The VR-2000 is well suited for mobile applications since it is only 61-in high, 63-in wide, and weighs some 1,100 lbs. Input (UK standard) is 230 volts, 50 c/s, 15amps.

Operating characteristics are as follows: Tape speed is selected by front panel switch, 7½ or 15 ips. Recording time is 96 minutes at 15, 192 minutes at the 7½ ips speed. As for picture and sound separation, 18½ frame, sound leads, at high speed, and 37 frame, sound leads, at 7½. On standards, two pre-set deviation, pre-emphasis and scanning standards can be selected by a two-position switch. The pre-set standards are determined by three plug-in circuit modules, one set of three for the desired combination of modulation level, pre-emphasis or scanning standards.

The 2000 is a multi-standard machine, with the following performance, so far as the 525 and 625-line requirements of InterTel are concerned:

5.5 Mc/s—5.79 Mc/s—6.5 Mc/s Dev.
Colour pre-emphasis, 525 line, Colour
5.0 Mc/s—5.54 Mc/s—6.8 Mc/s Dev,
CCIR

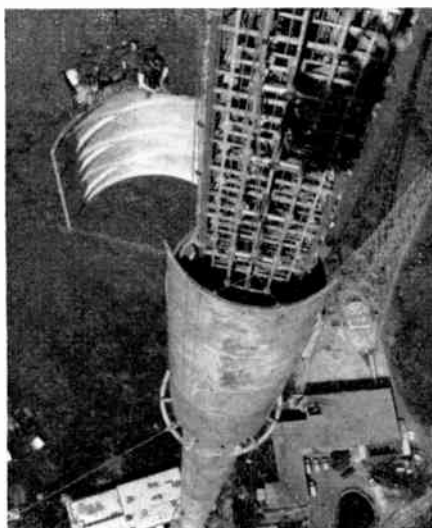
Monochrome pre-emphasis, 625 line,
low band

7.16 Mc/s—7.8 Mc/s—9.3 Mc/s Dev,
Mono/Colour

Pre-emphasis, 625 line, high band
7.06 Mc/s—7.9 Mc/s—10.0 Mc/s Dev,
Mono/Colour

Pre-emphasis 525 line high band.

A great deal of InterTel work is naturally done on the 525/60 high band range of the VR-2000, when the following conditions apply:



Birth of a mast

British Insulated Callender's Cables workmen lifting a 12 ft diameter glass-fibre segment to the top section of a cylindrical TV mast. Masts of this type are being erected for the British ITA at Winter Hill, Lancs (1,015 ft), Emley Moor, Yorks and Belmont, Lincs (each 1,265 ft). BIC Construction Co were awarded the contract for the design, supply and erection of the masts by EMI Electronics Ltd. ITA hope to start test transmissions at Emley and Belmont early in 1966.

Waveform patterns are checked with a Tektronix RM 527, and for colour working a Conrac CYA17/RS colour monitor is available. In addition, a built-in 'A' scope provides monitoring of the following: control track playback (normal head), control track playback (simultaneous monitor head), expanded control track playback (simultaneous monitor head), switcher RF output, drum tachometer signal input to servo, drum error, capstan error, drum oscillator for setting frequency, capstan oscillator for frequency check, and record control track current. The 5-watt audio amplifier has frequency response ± 2 dB, 40 c/s to 20 kc/s. Six-position switch monitors line-in, line-out, cue-in, cue-out, instant audio, and spare.

MONOCHROME

Band-width 4.5 Mc/s—3 dB. Signal/noise, 46 dB peak to peak video RMS noise on interchange basis (monochrome and colour). Transient response (using 2T sine² pulse) 2 per cent blanking to white (max). Rise time 0.12 micro-secs max.

COLOUR

Signal/noise, 46 dB video to RMS noise. Differential gain, less than 4.0 per cent blanking to white. Differential phase less than 5 deg at 3.58 Mc/s off tape. Maximum colour phase error, 2 deg max.

On 625/50 high band, the following apply for colour:

Signal/noise, 43 dB peak-to-peak to RMS noise on an interchange basis. Transient response maximum K factor 2.0 per cent. Differential gain, less than 5.0 per cent blanking to white, differential phase less than 5 deg at 4.43 Mc/s off tape. Moire (colour bars 75 per cent modulation, 4.43 Mc/s subcarrier), — 30 dB max.

On the VR-2000 the audio figures are ± 2 dB, 50 c/s to 12 Kc/s at 15 ips (cutting off near to 10 Kc/s at the 7.5 ips speed), signal/noise 53 dB below 3 per cent distortion at 400 c/s. Wow and flutter 0.15 per cent RMS at 7½, and 0.10 per cent at 15 ips, measuring components from 0.6 to 250 c/s. On the cue track wow and flutter are as on the audio channel.

As mentioned, some audio recording is carried out with the Ampex Universal 351, which is switchable CCIR/NAB equalisation, for stereophonic and monophonic work. InterTel use the machine giving choice of 15 and 7½ ips speeds, although Ampex produce similar machines switchable in the range 7½ and 3½ ips.

As is to be expected, the Ampex heads are of high precision to hold exact gap tolerance regardless of wear, and it seems that heads in use for over 15,000 hours give as-new performance. A separate erase head for each stereo channel permits InterTel recording of either channel independently for narration, sound-on-sound and other

special recording techniques. The capstan assembly uses positive, direct drive from a heavy-duty hysteresis synchronous motor, and the capstan itself is balanced and machined concentric to a tolerance of some 100 micro-inches, which helps to reduce wow and flutter. The 351 series is not transistorised. The Record amplifier is a four-stage, high-gain resistance coupled, with two dual triode tubes. Transformer coupling is used for microphone or balanced bridge inputs. The Reproduce amplifier uses three dual triodes for three stages, is resistance-coupled with phase inversion and push-pull output. Bias and erase oscillator uses a dual triode as a push-pull oscillator to provide high-frequency bias and erase signals, of approximately 100 Kc/s.

At the high 15 ips speed wow and flutter are less than 0.15 per cent RMS. InterTel find it most useful that the starting time is only 1/10th sec to full tape speed, and even when operating at 15 ips the tape moves less than 2 in after the stop button is depressed.

Naturally interest chiefly centres on the colour facilities of the new InterTel unit, and next month I will deal with the accessories including the vision and pulse distribution amplifier, the colour monitors and colour-bar generators.

(To be concluded)

VALVE AND TRANSISTOR PICTURE MONITORS BY TELEVISION INSTRUMENTS LTD.



ILLUSTRATION SHOWS GENERAL PURPOSE MONITOR M1400S
OTHER MODELS AVAILABLE

BRIEF SPECIFICATION

Model Illustrated M 1400S

Power Input: 100—125v 50 or 60 ck
200—250v 50 or 60 ck

Video: Input Z 75 ohms $\pm 5\%$ to 10 Mc/s or High Impedance. Switchable Termination or Bridging Output.

Gain: 1v composite 70 : 30 + 6 to -10 Db produces 25v blanking to pk wh at C.R.T.

I.F. Response less than 2% tilt on 50 cs square wave.

Differential Non Lin.: less than 2% up to 40v blanking to pk wh.

H.F. Response: ± 25 Db to 8 Mc/s - 3 Db 11 Mc/s.

Centre Resolution: 800 lines.

Sync: Input Z: 75 ohms $\pm 5\%$ to 6 Mc/s or High Impedance.

Switchable Termination or Bridging Output. Accepts Composite Sync Signal of 2v pp + 6 Db - 20 Db.

Clamp: High Level Clamp.

Video overrides Clamp at 50v blanking to pk wh. Hum equal to video reduced to less than 5% at C.R.T.

Scanning:

Field: Nom linearity less than $\pm 1\%$.

Height Variation + 25% - 20%.

Blanking applied to C.R.T.

Line: Flywheel pull in $\pm 2\frac{1}{2}\%$ of Nom Line frequency.

Picture correctly phased with respect to raster. Non Linearity less than $\pm 1\%$.

Width Variation $\pm 10\%$. Flyback Time less than 8.5 micro secs.

16 kv E.H.T. from Flyback.

Regulation adjusted for minimum picture size change with beam current (less than 1%).

E.H.T. discharged on switch off, or plug removed.

Geometry within $\pm 1\%$ of rectangle 10 in. x 7½ in.

Positional Hum: less than $\pm .125\%$ of height or width.

Focus: Parabolic waveform applied to focus electrode of C.R.T. for optimum focus.

Components: All components rated at 70°C class H.2. conditions to R.C.S. 11. E88CC valves used where possible. Exceptions are long life types or are suitably derated.

Heavy duty construction of steel and aluminium.

All valves fitted retainers.

Safety glass easily removable to permit cleaning.

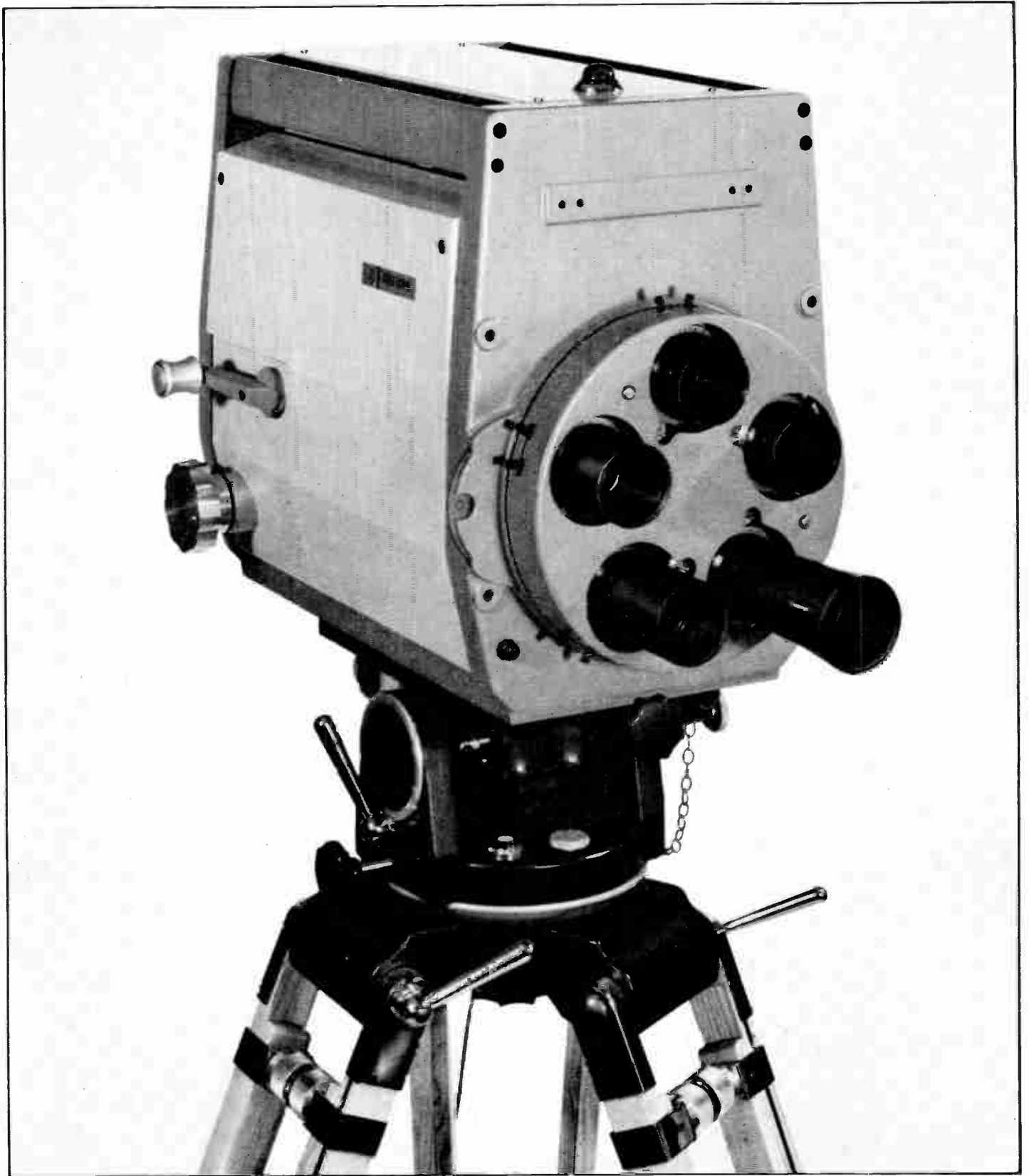
Scanning yoke moulded in polyester.

Line scan and E.H.T. transformer vacuum impregnated in polyester.

Finish: Beige and black hammer. Silver anodised front and back panel.

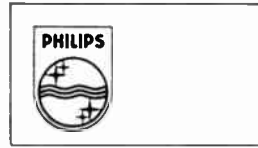
Size: 20 in. deep 15½ in. high incl. feet. 14½ in. wide.

Television Instruments Ltd., Elstree Rd., Elstree, Herts. England Tel: Elstree 2205



THE PHILIPS PLUMBI

a major breakthrough in television broadcasting



PHILIPS

Kin to the already famous Philips Plumbicon colour television camera, this is the first monochrome live TV camera to work on a Plumbicon pick-up tube. Outstanding in its ease of operation, this pick-up tube gives a picture which is free from shadow signals to say nothing of its other qualities, such as • absence of lag even at low illumination levels • high sensitivity • high resolution • straight illumination versus signal current characteristic • no need for extreme stabilization of currents and voltages • no burn-in effects and thus no need for orbiting. This advanced Philips studio camera, equipped with the Plumbicon, is, therefore, simple in operation and adjustment and features a high signal-to-noise ratio. It needs only three minutes warm-up time, which makes it the first 'instant' TV camera giving pictures that meet studio standards. Fitted with a five-way lens turret (easily exchangeable for a zoom lens support, with a 10 : 1 Angénieux Evershed zoom lens) and lenses, the focal lengths of which range from $\frac{3}{4}$ to 6 inches* this new Philips camera meets all requirements of studio and outdoor television work. The ease with which this camera can be operated makes it ideal for educational television. The camera is in series production now. Delivery times are relatively short.

* These focal lengths give the same viewing angles as $1\frac{1}{2}$ - to 12-inch lenses on an image orthicon camera.

■ Scanning system: CCIR 625 lines, 50 fields/s or RTMA 525 lines, 60 fields/s ■ Power supply: 100... 125V in 5-V steps; 200... 250V in 10-V steps ■ Power consumption: 80 VA nominal ■ Resolution: modulation depth at 5 Mc/s with full aperture correction: centre 100%; corners 60% ■ Illumination level to achieve a signal-to-noise ratio of at least 45 dB, with an average Plumbicon and with the lens iris at f:2 : 10 ft-cd (100 lux) ■ A signal at which the noise is within acceptable limits will be obtained at 1.5 ft-cd (15 lux) ■ Gamma correction: variable pre-set over the range from 0.4 to 1.0; operational on-off switch ■ The on-set level of aperture correction, to improve signal-to-noise ratio in the blacks, can be preselected.

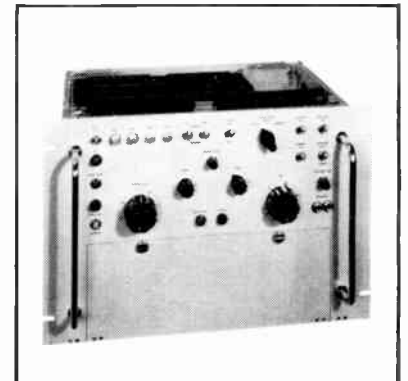
For further information please write to the ELA Division of Philips, Eindhoven, the Netherlands (in the United Kingdom, Peto Scott Electrical Instruments Ltd., Weybridge, Surrey).

The camera is fitted with a fully transistorized, self-contained $6\frac{1}{2}$ -inch electronic viewfinder. An external picture signal can be fed to the viewfinder to substitute for or be mixed with the original camera signal.

Iris setting is servo-controlled from the camera control unit, simultaneously for all five lenses.



The fully transistorized camera control unit is of modular design. In addition to the normal controls, the unit carries a positive/negative switch and two switches for picture mirroring and complete picture reversal. The unit is only 12 inches high and can be accommodated in a standard 19-inch rack. Its weight is a mere 50 pounds.



The revolutionary Plumbicon tube - $7\frac{1}{2}$ inches in length - combines the ease of operation of a vidicon with the studio picture quality of an image orthicon.

Between Plumbicon and lens turret a filter disc is mounted to give room for a maximum of eight grey or colour filters, so that the pick-up tube can be matched to the most diverse illumination conditions.



CON STUDIO CAMERA



Receiver on Ampex Videotrainer captures sharp image of model conducting classroom experiment. The mobile Videotrainer, which contains a videotape recorder, television camera, receiver and all other equipment necessary for closed circuit television production, is ideally suited for use in education, medicine and the military services. Programmes produced with the Videotrainer may be played back on any number of conventional television receivers for classroom or other remote viewing.

NEW 'VIDEOTRAINER' FROM AMPEX

A NEW low-cost professional videotape recorder and a mobile videotape recording system for closed circuit use in education, training and various industrial applications has been placed on the market by Ampex Corporation.

The Ampex VR-7000 videotape recorder, which records high quality television pictures and sound on magnetic tape for immediate playback, is priced at \$3,150, a third the cost of previous Ampex recorders of similar performance and durability. The 78-pound unit is offered in a rugged luggage mounting.

The Ampex VR-7100 Videotrainer combines the new recorder with a television camera, television receiver and all related equipment necessary for the production and display of videotape programmes. The videotrainer, self-contained in a heavy duty, compact mobile console, is priced at \$5,945.

Both units were displayed for the first time at the National Association of Educational Broadcasters' convention in Washington, DC, early this month.

Ampex officials said that the VR-7000 and Videotrainer are designed to fill the gap between broadcast-quality portable videotape recorders and those built specifically for home use. They will serve the expanding requirements of closed circuit television in schools and colleges, industrial and military training, medical research and practice, merchandising, sports and a growing number of other applications.

The VR-7000 employs the helical scan recording principle proven in the Ampex VR-1500 and VR-660 series recorders, more than 1,000 of which have been placed in service in the last two years.

It records at a tape speed of 9.6 inches per second,

using one-inch wide Ampex Series 147 video tape specially developed for use with the recorder. It performs at a bandwidth of 3.5 megacycles, a signal-to-noise ratio of 42 dB and horizontal resolution of 310 lines, providing higher picture quality than any recorder in its price class.

The VR-7000 permits a recording time of 63 minutes on a 3,000 foot reel of video tape. The single video head is guaranteed for 500 hours of playing time assuming a prescribed adjustment is made at 250 hours.

Audio response is from 50 cycles to 12 kilocycles. Low impedance audio inputs and outputs are provided.

The VR-7000 has a stop-motion capability superior to any videotape recorder in its price class.

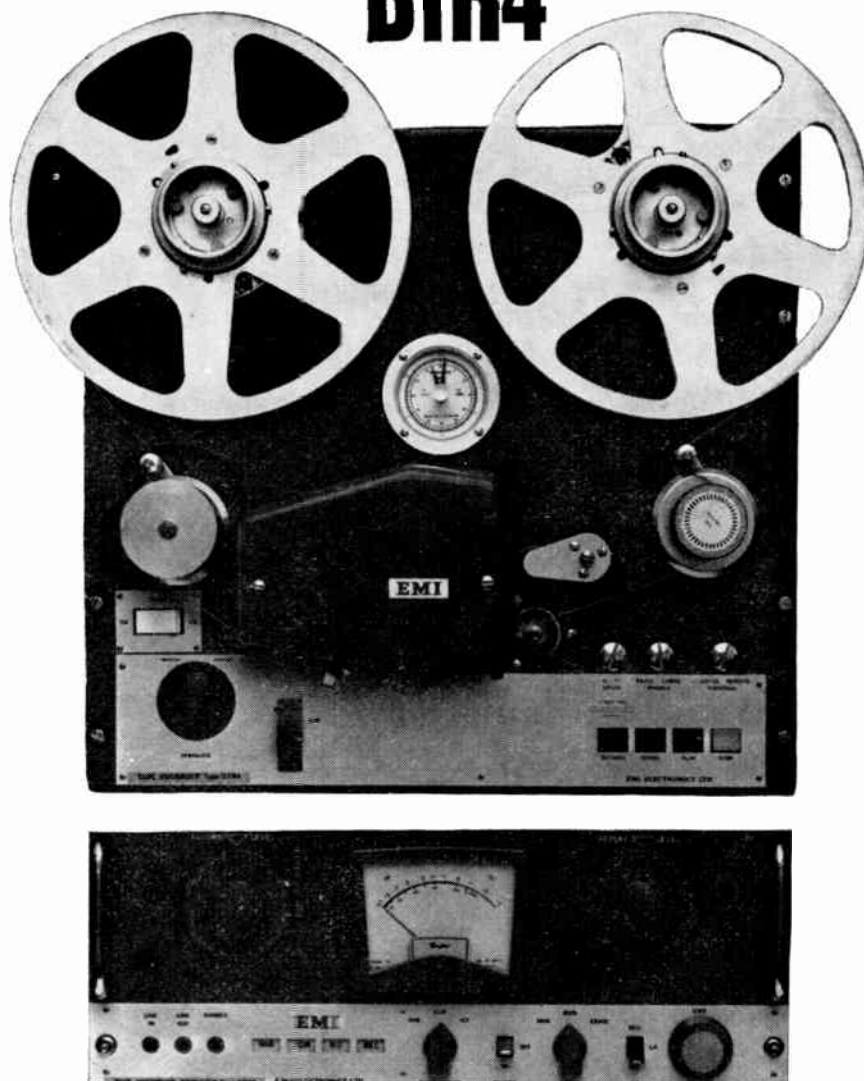
The VR-7000 is designed to complement the widely used Ampex VR-660 series recorders. Master tapes made on the model 660B, which sells for \$11,500 may be duplicated for playback on the lower priced VR-7000. Tapes recorded on VR-7000s may be played back on another VR-7000, permitting exchange of educational or training materials.

The Videotrainer system offers complete closed circuit videotape production capability in a self-contained, easy to operate and maintain package. Programmes produced with the Videotrainer may be played back on a number of conventional television receivers for classroom or other remote viewing.

The VR-7000 and Videotrainer operate on standard household current.

Marketing of the two new products in the United States will be through closed circuit television systems distributors and will begin this month for the VR-7000 and next February for the Videotrainer. International versions of the two systems will be available in six months.

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 ± 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 equal sation 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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UHF - 1966

IN 1962, when it was decided to embark on nation-wide network of UHF transmitters, the data available were clearly insufficient to form a sound basis for planning what could necessarily be a costly undertaking. . . .

The speaker? Mr F. C. McLean, CBE, BBC Director of Engineering.

The place? London's world-famed Institution of Electrical Engineers, scene of an international Conference on UHF Television and Communications, sponsored by the Institution of Electronic and Radio Engineers, the Institution of Electrical Engineers (Electronics Division), the Institute of Electrical and Electronics Engineers (UK and Eire Section), and The Television Society. To this top-level joint meeting came 300 electronics engineers from 17 countries, including many from the USA and the USSR, welcomed at the opening session by Sir Willis Jackson, FRS, DSc, MIEE.

As an indication of the valuable UHF information communicated, and the important companies providing lecturers and demonstrators, the following edited list is given of the four main sessions, covering UHF planning and propagation, transmitters and translators, aerials and parametric devices, and UHF receivers.

'Television Coverage on UHF.' F. C. McLean, CBE (British Broadcasting Corporation).

'Frequency Planning in the Development of the 625-line UHF Service.' R. S. Sandell (British Broadcasting Corporation).

'Vestigial Sideband Transmission at UHF.' W. Wharton (British Broadcasting Corporation).

'Factors Affecting the Propagation and Reception of Broadcast Signals in the UHF Bands.' E. Sofaer and C. P. Bell (British Broadcasting Corporation).

'Simultaneous Long Distance Tropospheric Propagation Measurements at 560 Mc/s and 774 Mc/s over the North Sea.' J. W. Stark (British Broadcasting Corporation).

'A High Power UHF Television Transmitter: Part I — Carrier Power Generation and Modulating Systems.' D. Ingle (Pye TVT).

'A High Power UHF Television Transmitter: Part II — Radio Frequency Diplexing, Filtering and Monitoring

Exclusive report on the London International Conference on UHF Television and communications, by IBE's Audio Editor Donald Aldous, and Television Editor Kenneth Uilyett FRSA

Systems.' G. C. Peel (Pye TVT).

'A UHF Television Transmitter.' W. J. Morcom and J. Sutton (The Marconi Company Ltd).

'A 50 kW UHF Klystron.' M. Babillon (CSF).

'Intermodulation Characteristics of High Power Klystrons used in Frequency Transposers for Colour Television.' C. N. O'Loughlin (English Electric Valve Co Ltd).

'UHF Translator Design.' G. G. Johnstone, E. H. Barratt and B. C. Taylor (British Broadcasting Corporation).

'Experience with the Travelling-Wave Tube YH1020 in UHF Television Translator Service.' H. Heynisch and A. Rother (Siemens und Halske AG).

'Aerials for UHF Television Broadcasting.' S. U. Nolan (The Marconi Company Ltd).

'UHF Transmitting Aerial Design.' G. H. Millard and A. B. Shone (BBC

Research Department).

'UHF Transmitting Aerials housed in Plastics.' M. Babillon (CSF).

'Construction and Properties of Coaxial Feeders for the UHF Band.' E. Scheffler (Hackethal-Draht und Kabel-Werke, AG).

'Measuring Methods for RF Cables in the UHF Range.' H. Peters and Th. Fischer (Felton und Guillaume Carlswerk, AG, Cologne).

'UHF Television Receiving Aerials.' R. S. Roberts (Northern Polytechnic and Antiference Ltd).

'A Travelling-Wave Unbalanced Yagi Aerial.' T. S. M. Maclean (Birmingham University).

'Performance of a Parametric Amplifier for UHF Television Reception and Communication Equipment.' P. J. Gibson (Mullard Research Laboratories).

'A Parametric Amplifier for the Frequency Range 400-800 Mc/s.' J. D. Pearson (Ferranti Ltd).

'Some Physical Considerations of High Frequency Transistors.' D. S. Grant (ASM Ltd).

'UHF Television Tuner Design.' J. C. Beckley (Mullard Central Applications Laboratory).

'UHF Television Reception with Incidental Field Strengths of under 100 microvolts per metre.' B. W. Osborne (Rediffusion Research Ltd).

'Sound Buzz in Intercarrier Television Receivers.' M. V. Callendar (E. K. Cole Ltd).

'Practical Deficiencies in Sound Performance in Intercarrier Sound Television Receivers.' T. Pascoe (Philips Electrical Pty Ltd, Australia).

'An Experimental 625-line Television Receiver for Bands IV and V.' J. W. H. O'Clarey and S. W. Collier (British Broadcasting Corporation).

'A UHF Low-Power Sound and Vision Test Generator.' G. W. Dilworth (British Broadcasting Corporation).

INTERNATIONAL BROADCAST ENGINEER'S Audio Editor Donald Aldous and Television Editor Kenneth Uilyett, FRSA, attended this international conference, and by courtesy of Press facilities provided by the IEE Public Relations Officer Sheila Hardy, and the additional material put at their disposal by the editors of the official IERE Conference Proceedings No

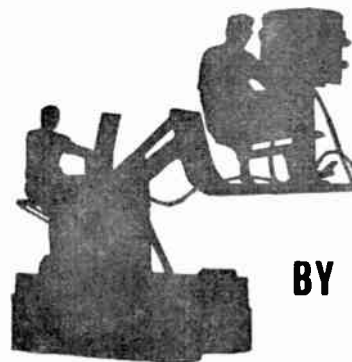
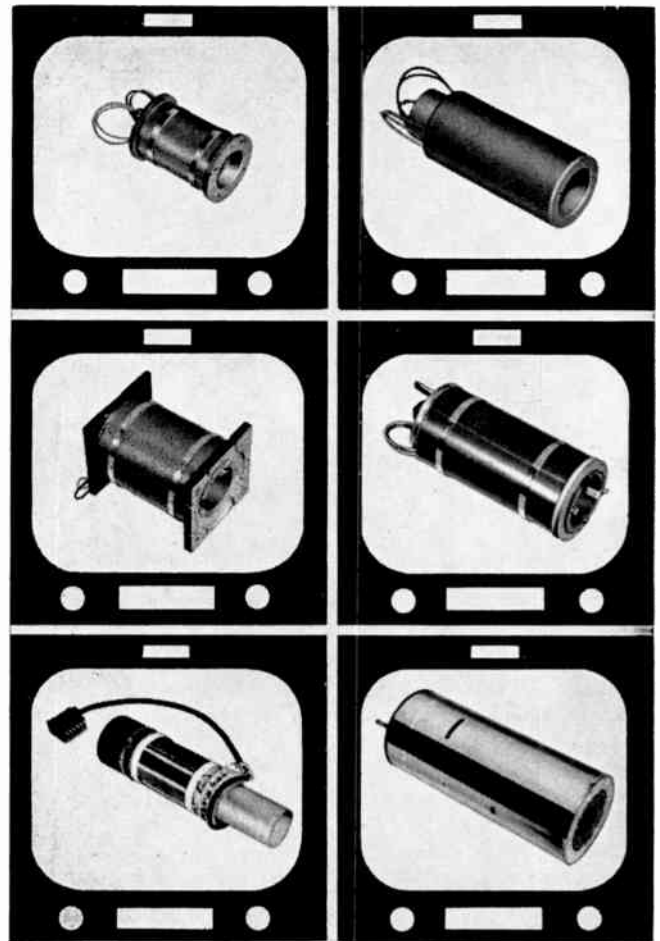
6. the following is an edited account of the conference. And it must be put on record that the outcome of this international meeting in London is a credit not only to the Institution of Electronic and Radio Engineers and the other three sponsors in general, but to the IERE Organising Committee in particular, Mr F. S. Barton, CBE, MA, Mr R. C. Harman, OBE, MIEE, Mr I. G. MacWairter, AMIEE, Dr G. B. Townsend, PhD, MIEE, and Dr R. C. G. Williams, PhD, MIEE, under the chairmanship of Mr P. L. Mothersole, MIERE, AMIEE.

Opening the first session, BBC's F. C. McLean, CBE, turned back the clock to the 1930's, when Britain pioneered the world's first public television service, and even Band I was virtually unexplored territory. When did a conception of a UHF service first begin? Mr McLean explained that, following the advent of the ITA service on Band III, in 1955, the Government White Paper, published in July 1962 foreshadowed two main developments: the introduction of a second BBC television programme, and possibly also a second ITA programme, and the use of the 625-line standard for these new programmes. The White Paper also envisaged the introduction of colour television and the eventual re-engineering of the two existing 405-line networks to 625 lines. The White Paper recognised that these developments would make it essential to escape from the strait-jacket imposed by the limited bandwidth available in the VHF bands and that the UHF bands would have to be exploited both for any new programmes and for any duplication of the existing programmes that might be necessary to permit the re-engineering of the VHF bands for 625 lines. Thus it was necessary to plan for a total of four programmes in the UHF bands and to adopt a channel width of 8 Mc/s to accommodate 625-line transmissions.

Under the Radio Regulations, Geneva 1959, the whole of the frequency range 470-960 Mc/s had been allocated to broadcasting in Region I, though parts of the band are shared with other services. In the United Kingdom only 14 channels in Band IV between 470 and 582 Mc/s and 30 channels in Band V between 614 and 854 Mc/s have so far been allocated to broadcasting, and some of these are not yet available for this purpose.

The experience gained on VHF did not constitute a reliable guide to the planning of a UHF network and experience already obtained in other countries (notably the USA and Western Germany) with UHF television transmissions was limited, although a valuable study was subsequently made by the FCC in the USA.

It was therefore decided that a comprehensive series of field trials should be carried out. The first series took place in 1957-8 with the participation of the



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BY



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UHF—1966

continued

General Post Office, the Department of Scientific and Industrial Research, the Independent Television Authority, the Mullard Research Laboratories, the Radio Receiver Industry and the BBC. The second series of UHF trials was carried out during 1962 and 1963 and the results have been published. To make sure that the latter series of trials yielded all the information that would be required for the planning of a four-programme transmitter network suitable for 625-line monochrome and colour television a number of planning committees were set up on which the GPO, the ITA, the British Radio Equipment Manufacturers' Association, the Electronic Engineering Association, the Radio and Electrical Component Manufacturers' Federation, the DSIR and the BBC were represented.

Although these field-trials were carried out with high-power UHF transmitters under realistic conditions, it was felt that, as soon as 625-line television became available to the public on UHF in the London area and later elsewhere, comprehensive surveys ought to be made to see whether the experience of viewers corresponded with the data obtained from the trials.

Two methods are being used in these surveys: (1) observations by mobile BBC teams, particularly in parts of the service area where reception is likely to be difficult, and (2) the analysis of questionnaires filled in by viewers possessing dual-standard receivers; 1,074 questionnaires have so far been returned from within the service area of the Crystal Palace station, which contains some three million households.

The survey is continuing and it is not yet possible to say with confidence that a UHF service could completely replace a VHF service. The restricted number of channels available for four programmes limits the number of relay stations that could be provided in any area and there would undoubtedly be small shadow

areas that would be extremely difficult to fill by this means. Nevertheless it is expected that substantially national coverage can be given by the 64 main stations planned, supplemented by some hundreds of relay stations.

Another BBC lecturer, Mr R. S. Sandell, then dealt with the vexed problems of frequency planning in the development of a UHF service. He pointed out that the basic plans for the distribution of channels to the network of television stations in the ultra-high-frequency bands were negotiated at the European Broadcasting Conference held at Stockholm in 1961. The scheme for the United Kingdom provided for the coverage of four distinct programmes, transmitted by a network of 64 high-power stations. Because the coverage thereby available would not be complete, a network of low-power relay stations is also necessary, but provision for these was not included in the Stockholm Plan.

By international agreement, two bands in the UHF range have been allocated to European countries for broadcasting. They are known as Bands IV and V, and have the frequency limits 470-582 Mc/s and 582-960 Mc/s respectively. The bands contain 61 channels, each of 8 Mc/s width, numbered from 21 to 81. Not all of these channels are immediately available for television broadcasting within the United Kingdom, and at Stockholm, planning was confined to channels 21-34, and 39-68 inclusive. Thus 44 channels have so far been employed to plan the United Kingdom Service.

Each of the 64 stations was awarded assignments for a group of four channels. The spacing of the channels within each group was a compromise between Continental requirements and the intermediate frequency adopted for British television receivers.

Explained Mr Sandell: 'The primary object of frequency planning is to permit the establishment of a satisfactory service without affecting other facilities. The arbiter for the negotiation of all such services within the United Kingdom is the Postmaster-General, and the planning of broadcasting stations requires close consultation between the GPO and the broadcasting authorities. The UHF proposals which were presented at Stockholm were the results of extensive discussions between the GPO, the broadcasting authorities and the industry. Although they were devised with complete knowledge of technical standards then available, it was inevitable that changes would come about. The first of these occurred at Stockholm itself, where modifications were necessary in order that the United Kingdom plan should coalesce with those of other countries. Since that time there

has been a steady stream of minor alterations, and it is very likely that as the implementation proceeds, more changes will have to be made.'

Subsequent to recommendations contained in the Pilkington Report and proposals in a governmental White Paper, schemes for the implementation of the Stockholm Plan were put into operation. It was assumed that the coverage would be provided by the BBC and the ITA, and in view of this it was essential to co-site the transmitting stations of the two organisations. The BBC and the ITA each agreed to plan the coverage of one-half of the UHF network, in co-operation with the GPO, so that each broadcasting authority is responsible for the areas nominally covered by 32 main stations. Discussions have been held at frequent intervals between engineering representatives of the GPO, the BBC and the ITA to exchange and agree coverage plans.

An early appraisal showed that a satisfactory service would be achieved by installing 30 of the 64 main transmitters in existing broadcasting stations.

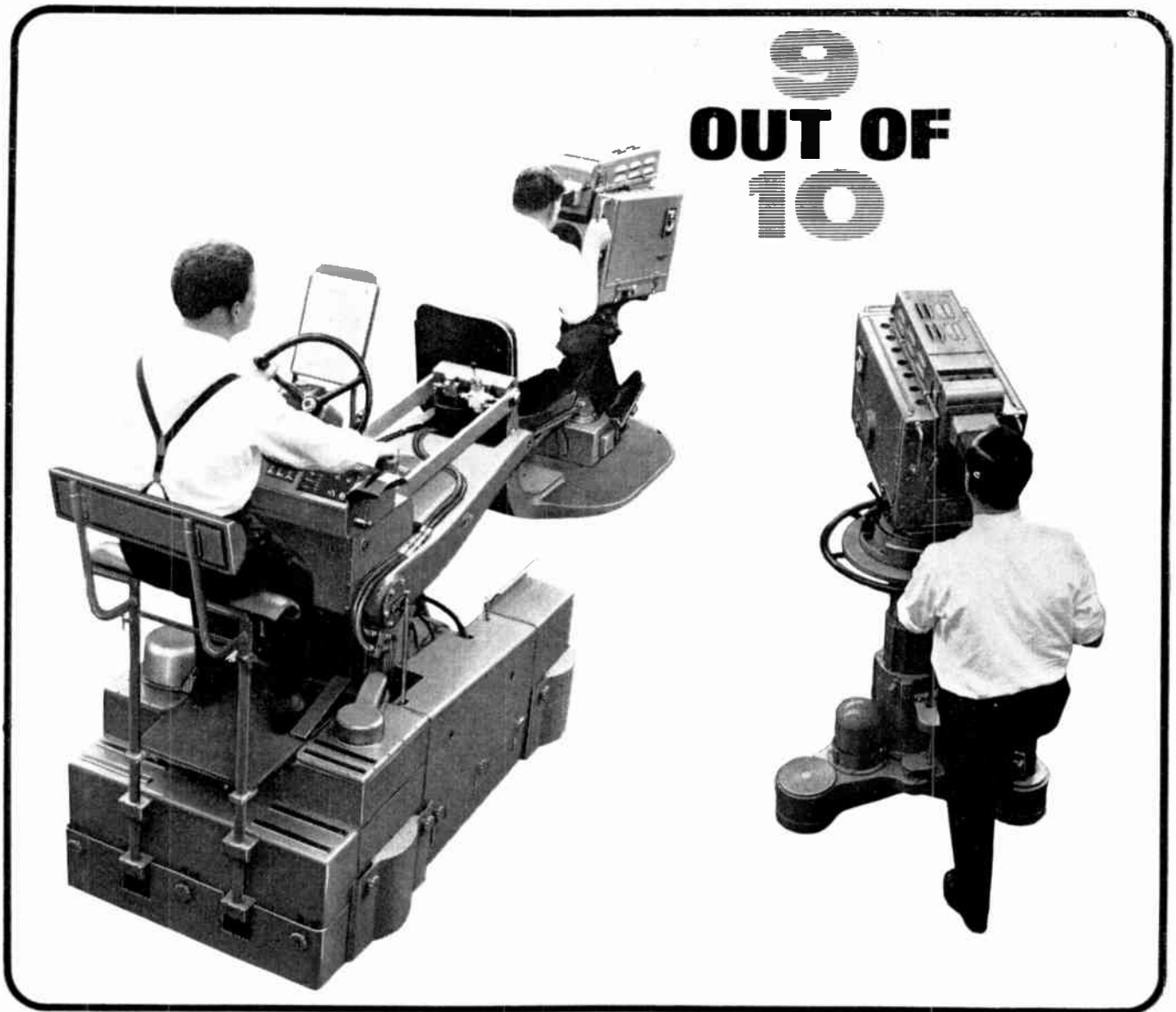
Mr Sandell pointed out that the principal types of interference of concern in planning the service are:

- (i) Co-channel interference caused by transmitters using the same channel as the wanted service.
- (ii) Local oscillator interference generated by UHF receivers.
- (iii) Image channel interference.
- (iv) Adjacent channel interference.
- (v) Harmonic interference from the local oscillators of Bands I, II and III receivers.

'The calculation of co-channel interference is a very important aspect of frequency planning,' he said. 'The parameters to be used are internationally agreed so that difficulties due to differing technical standards are reduced to a minimum. The level of this form of interference may be taken as an indication of the standard of service, and current plans are to protect a minimum field strength of 70 dB above $1 \mu\text{V/m}$ for at least 95% of the time. This standard applies to the service area of the main stations. It is probable that at relay stations the field strength protected for 95% of the time will be about 80 dB ($1 \mu\text{V/m}$).

The calculations required for the assessment of co-channel interference levels are arithmetically simple but tedious and time consuming. In planning the service the work has to be performed many times, and is extremely susceptible to error if completed manually. For these reasons the BBC has used a digital computer to perform the calculations. . . .'

(This report will be concluded in the January issue of International Broadcast Engineer)



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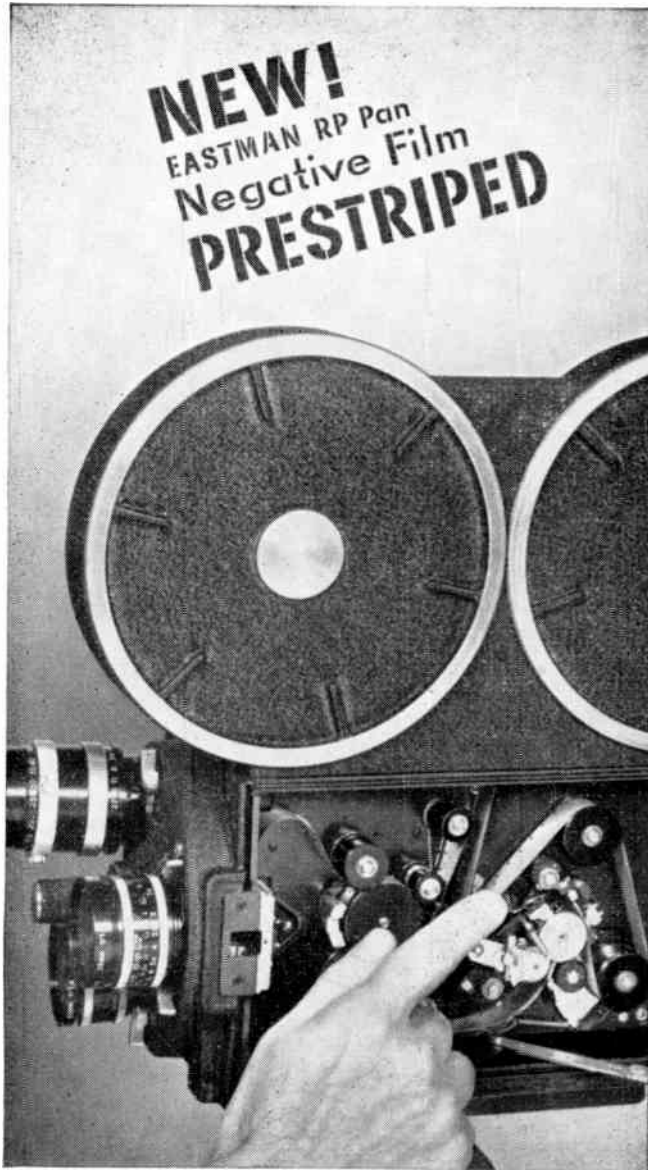
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The Vinten Falcon is designed to offer the producer of outside broadcasts camera mounting facilities equal to those in a studio. It can be quickly dismantled into four main sections for transportation and its light weight allows ease of handling in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

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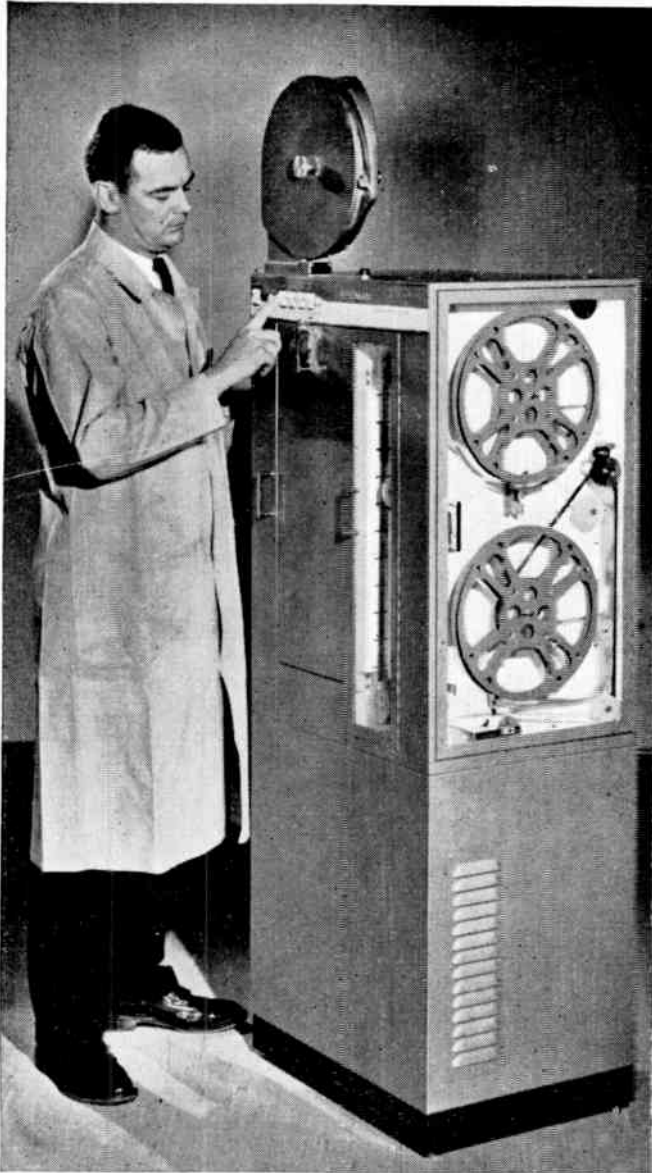
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Radio Caroline

Offshore private radio stations stand firm

THE private radio stations off the coast of Britain forewarned of their fate by the Postmaster-General have, for the most part, taken it very calmly. Radio Caroline issued a formal statement so did Reg Calvert of Radio City.

Radio London, on the other hand, virtually ignored the PMG, contending that he said nothing new and that they had answered his serious points when he first made them. The company had budgeted for a long stay, if necessary, and had thoroughly investigated its legal position before the ship left port for UK waters.

But the fresh and popular Radio 390 currently campaigning for the public's practical backing called a conference, talking to press men, collectively and individually.

Ted Allbeury, the Kent farmer who is managing director of Radio 390, said that the PMG has been misinformed about offshore radio and that he would welcome the occasion to explain to him exactly what they are doing, how they are doing it, and why they are doing it.

He contradicted the PMG's main points of criticism. 'No-one to his knowledge,' he said, 'has been unable to get medical or physical help because their transmissions have intercepted communication. The company would willingly give £100 to any charity the PMG chooses if such can be proved. Radio 390 is using an unauthorised wavelength but is one of many, like Vatican City, Radio Berlin, the American Forces Network, Tel Aviv, Spanish stations. None of these were allocated wavelengths at the Copenhagen Conference.'

Radio 390 broadcasts from an unused fort outside territorial waters and its use is legalised by its salvaging possession. He asks that if its occupation is illegal now, why wasn't this emphasised months and months ago. Radio 390's predecessors, Radio Invicta and Radio King, have each transmitted from the same fort occupied by the present ten-strong staff.

He told IBE that he'd been asked what his men would do if Government officials or service men arrived to close the station.

'Do you roll a Leviathan against minnows?' was his answer.

Radio 390 has been likened to the BBC Light Programme he said. The comparison is a fair one, he added, but unlike the BBC which tries to satisfy all of the people some of the time, Radio 390 sets out to please some people all of the time.

Referring to the PMG's request that they should shut down he commented that his board had left the decision to him. Radio 390 would continue broadcasting and at the first chance afforded him by better weather would personally campaign for practical public support through the station.

He said that he was prepared to go to prison rather than abandon this popular project.

Radio Caroline's official statement says:

'Not only does the PMG use false reasons against us, because contrary to his statement we do pay copyright in the form of rights society payments covering every day of broadcast that Radio Caroline has ever made, but he seems to be at loggerhead with his Prime Minister who on Friday November 12, considered using our experience for broadcasting to the Rhodesian people.

'We have been accused of both endangering life at sea by interfering with ship to shore signals and of interfering with continental programmes. We have never ever received any complaints from any continental broadcasters.

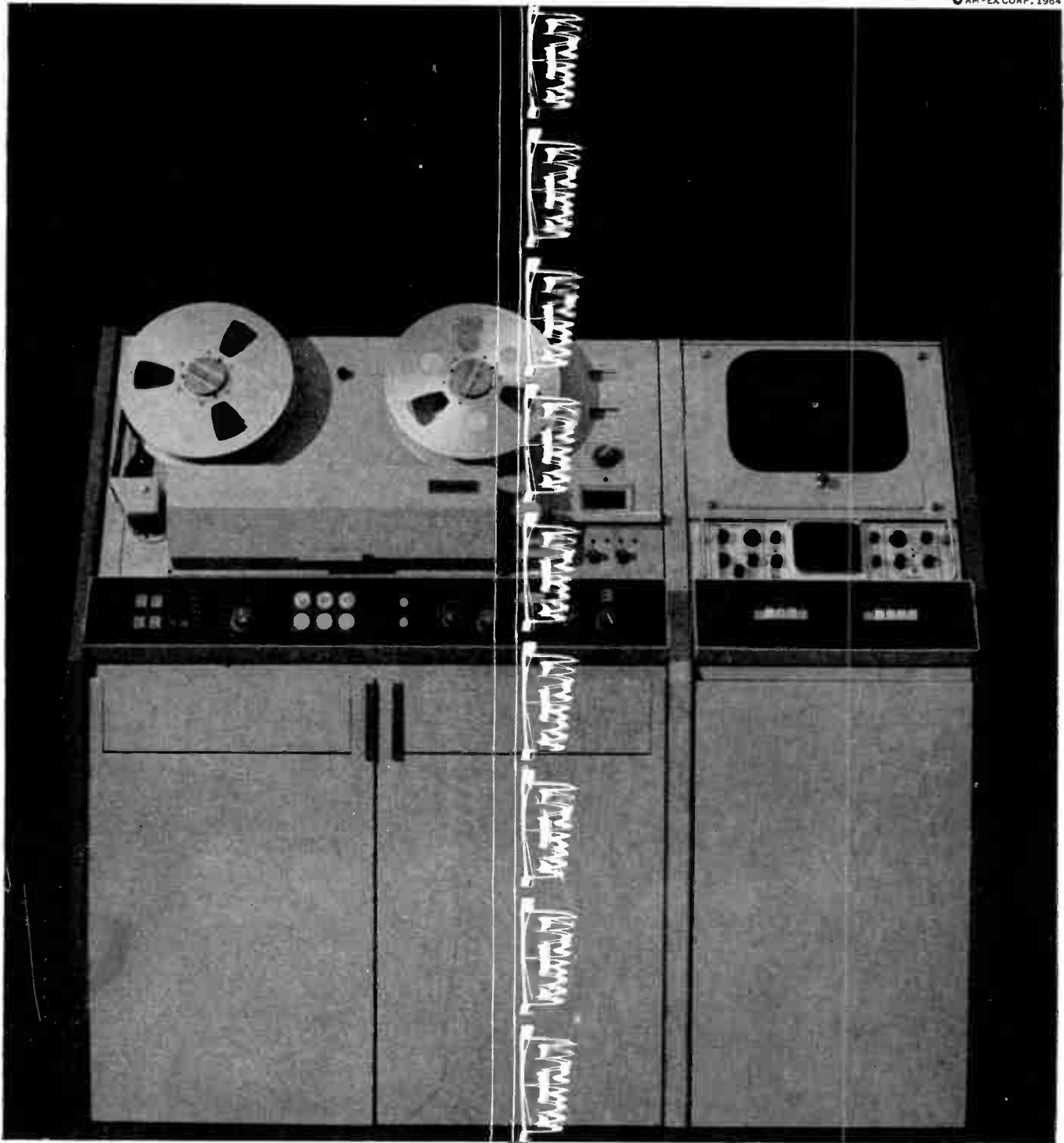
'There is nothing recorded of us ever endangering life. We employ skilled engineers to prevent this happening and far from it we have actually saved life.

'The BBC itself is responsible from time to time for transmitting spurious signals. Perhaps this is what the PMG is referring to.

'We are prepared for any eventuality but still feel that with the enormous and continually growing support we have from the public and advertisers it would be both unfair to them and unwise for the Government to act against us.'

Radio London, Radio City and Radio Essex also intend to continue and Radio Scotland will start transmissions as announced.

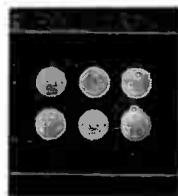
The serious press reaction was interesting in that while treating the 'pirates' like a headmaster might speak to pleasant pupils who'd been party-ing without permission, it expressed sympathy with the needs which they supplied and advised the Government not to behave in a negative fashion. If the pirates agree to go then what they are doing must be taken on by somebody else. This brought up the issue of local broadcasting which one paper said the BBC had paid only lip service to for many years. Regional accents and local editions of the national news are not the answer and if many millions want pop music and ads telling them what's on and on sale then if the BBC doesn't want to provide it or the Government in any case refuses to let it, then someone who can should be given the job, advised the *Financial Times*.



The video recorder that sets a new standard: The Ampex VR-2000

Ampex's newest Videotape* Television Recorder, the VR-2000, is expressly designed to operate on new high band standards. It utilizes a new high band carrier/deviation frequency (7.16 to 9.3 mc), which permits a single standard for both colour and monochrome. The VR-2000's performance specifications are impressive: a S/N ratio up to 46 db; basic frequency response to six megacycles; excellent transient response and virtually non-existent mo-re. Performance is so good, in fact, that multiple generation copies made on the VR-2000 equal original tapes made on present equipment. Although it possesses all this upper range ability,

*T. M. Ampex Corp.



the VR-2000 is instantly switchable to present low band standards in either 625 or 525 lines. And for all its sophistication, it is the most reliable and easy to operate recorder ever built. A complete line of VTR accessories is available now for the VR-2000: Intersync* (standard on all VR-2000s); Amtec;* Electronic Editor; Colortec;* and Editec.* The VR-2000 and its accessories are products, not promises. The VR-2000 is presently being installed at one major European network. Write today for complete information. Ampex Great Britain Limited, Acre Road, Reading, Berkshire. Telephone Reading 64111. Sales and service throughout the world.

ibe



NEW DEVELOPMENTS

New Series

ENGLISH ELECTRIC VALVE COMPANY have produced a new series of compact 'X' Band reflex klystrons to meet the expanding demand for relatively inexpensive, fully ruggedised local oscillators, having a wide range of Frequency Temperature Co-efficients.

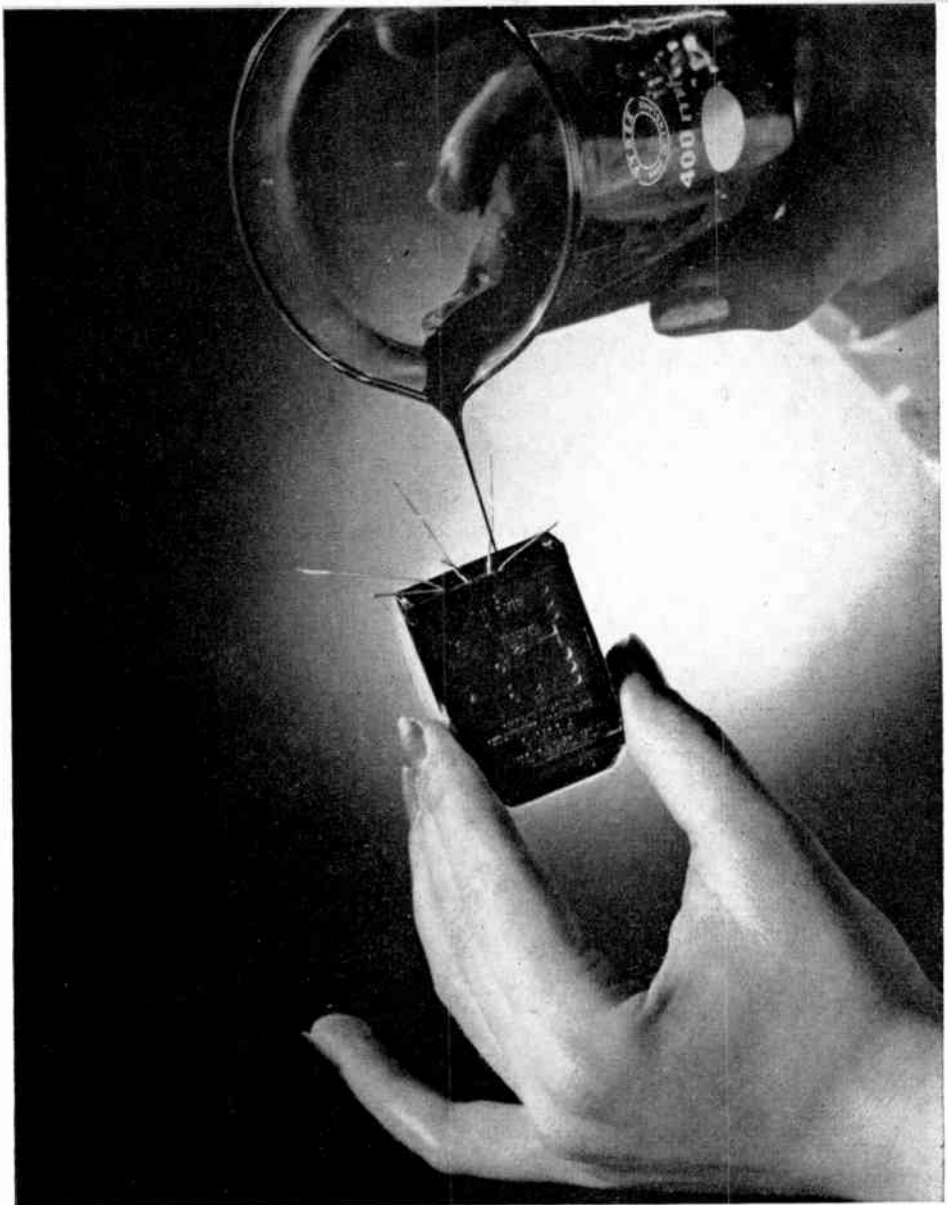
This latest group of tubes embody the same stringent production techniques as those employed in the construction of ruggedised EEV klystrons intended for military use. The obvious advantages that stem from 'building-in' such experience are immediately apparent in the enhanced performance and reliability achieved with the new tubes.

A feature of this series of klystrons is the ability to choose one with a Frequency/Temperature Co-efficient suited to the particular application. The K3007, for example, has a co-efficient of $-130 \text{ kc/s}^\circ\text{C}$, which is designed to match that exhibited by most commercially available 'X'-Band magnetrons. Coupled with this, a broad degree of manufacturing interchangeability exists between the new tubes, permitting the ready permutation of performance parameters to suit individual requirements for non-standard klystrons.

Typical of the tubes included within this series is the K3003, which is electrically identical to its flying lead variant the K3020. Ideally suited for marine use, the excellent frequency drift characteristics of the K3003 are of particular note, having remained within a 10 Mc/s variation during testing of over 3,000 hours. In addition to this, the peak frequency modulation of the tube is held to a specification maximum of 200 kc/s under vibrational loadings of 10 g.

The ruggedised reflex klystron types that go to comprise this new series are listed below:

EEV Type	Frequency Range	Electronic Tuning Range	Typical Output Power	Temperature Co-efficient of Frequency
K391	9,160—9,340 Mc/s	40 Mc/s	40 mW	$-130 \text{ kc/s}^\circ\text{C}$
K391A	8,800—8,900 Mc/s	60 Mc/s	60 mW	$-100 \text{ kc/s}^\circ\text{C}$
K3001	8,500—9,000 Mc/s	40 Mc/s	70 mW	$+50 \text{ kc/s}^\circ\text{C}$
K3002	9,000—9,500 Mc/s	40 Mc/s	70 mW	$+50 \text{ kc/s}^\circ\text{C}$
K3003	9,350—9,550 Mc/s	50 Mc/s	55 mW	$-130 \text{ kc/s}^\circ\text{C}$
K3007	9,295—9,395 Mc/s	32 Mc/s	40 mW	$-130 \text{ kc/s}^\circ\text{C}$
K3020	9,350—9,550 Mc/s	50 Mc/s	55 mW	$-130 \text{ kc/s}^\circ\text{C}$



▲ The final stage in the production of one of the new range of Marconi solid state switches

Switches

AN ENTIRELY NEW RANGE of solid-state high-speed switches has been designed by Marconi as a direct, plug-in replacement for the mechanical telegraph relays universally used in all types of telegraph and telex communications equipment.

Fully transistorised, these switches have no moving parts, and are completely encapsulated in hard Araldite. They are virtually indestructible and will operate almost indefinitely under the most arduous conditions, without adjustment or maintenance. They have received full British Post Office approval for telex and telegraph circuit operation.

Reliability for these units is almost impossible to prove, since they are likely to outlive the equipment in which they are used. The standard

mechanical telegraph relays have moving contacts which normally require routine maintenance and resetting every few months at least.

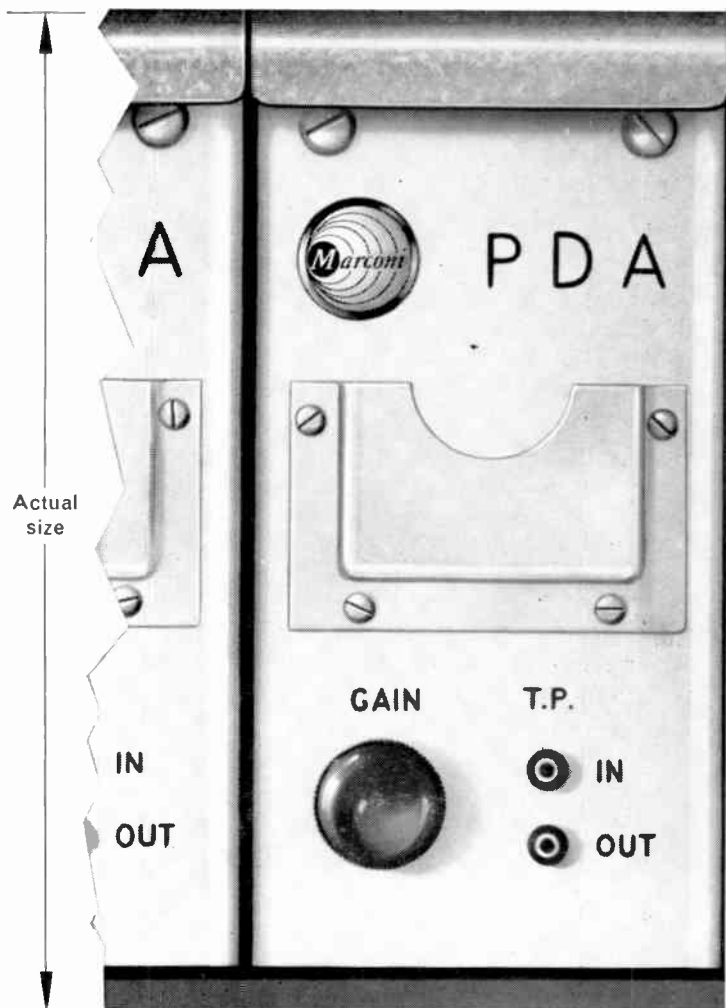
These switches, with their very high performance and reliability are similar in size to existing mechanical types and can be supplied with suitable plug bases as a direct replacement. For new applications, they are supplied with wire connections which can be soldered permanently into the circuit. Prototypes from this new range have been rigorously tested at the Company's laboratories and one batch has been operating for 24 hours a day for the past four months without a single fault. During the first six weeks of this period 440 million consecutive switching operations were performed. The test was then reduced to a slightly lower switching speed and has been in continuous operation ever since.

Because of its Araldite encapsulation, the switch is able to operate without any practical environmental limits. The unit will even operate successfully in boiling water.

The new range is being introduced by the Marconi Specialised Components Division at the INTERKAMA 1965 exhibition in Dusseldorf recently.

continued on page 766

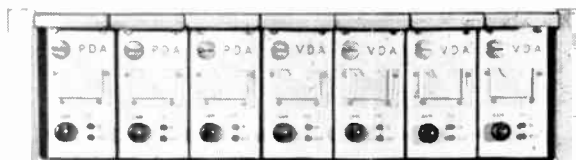
Marconi pulse and vision distribution equipment



B4002

This equipment occupies only 5¼ in. of rack height, and provides 35 Vision or 42 Pulse Output with high input isolation.

Fully transistorized
 Integral regulated power supply in each amplifier
 Fully colour specification
 Seven amplifiers are mounted on a 5½ in. rackframe. Vision and pulse amplifiers may be intermixed.



Complete rack

Marconi television systems

NEW DEVELOPMENTS

continued

TECHNICAL NOTE

The switch, type F3071, is available in three versions, varying only in size to accommodate a number of different standard relay bases. This enables the switch to be used not only in new equipments but also as a direct plug-in replacement in existing circuits.

The F3071-01 version has flying leads allowing it to be wired directly into printed circuit boards. It may also be used in other applications where no direct connection is available.

The F3071-02 and 03 versions have various replacement relay bases enabling them to plug directly into relay sockets in existing circuits.

The switch is basically a DC amplifier which accepts inputs of ± 3 to ± 30 volts and converts them to an output of ± 80 volts, with a maximum current rating of 100 milliamps. The switch can be used in three ways. It will give either a positive or a negative output with no signal input or it may be used as a side-stable device where the output remains at the same potential to which it was last switched despite the removal of the input.

The switch circuit will operate without distortion, up to a speed of 1,000 bauds. This corresponds to a switching speed of 1,000 operations per second. A teleprinter operating at 50 bauds will print out at a rate of 66 words per minute. Thus the new range of switches is able to accommodate teleprinter printing rates of up to 1,320 words per minute, well within all foreseen developments in teleprinting techniques. Present day teleprinter circuits operate at speeds up to 96 bauds.

The switches have a number of different applications in all modern ARQ, telex and telegraph circuits. Marconi Autoplex and Autospec error detection and correction equipments are now supplied with these switches as a standard fit.

Production quantities of these switches will be available from the Company's Specialised Components Division at Billericay, Essex, at the beginning of next year.

DATA SUMMARY

Input impedance: 2.2 kilohms. (This can be shunted to earth via 2.2 kilohms to meet British Post Office Technical Memorandum TG 1/8/49 requiring input impedance to be 1,000 ohms).
Input current sensitivity: Less than 1 mA.
Input voltage: ± 3 to ± 30 volts (2.2 kilohms). ± 30 to ± 100 volts (120 kilohms).
Output current: 100 mA maximum.
Supply voltage: Polar 120-0-120 v maximum.
Telegraph distortion: Negligible to speeds less than 1,000 bauds with resistive loads.
Weight: 3½ oz approximately.
Size: F3071-01, 02: 1½" wide, 2½" high, ¾" deep. F3071-03: 1½" wide, 2½" high, 1½" deep.
Maximum ambient temperature: 100° C.

Systems

■ A NEW solid-state, ruggedly constructed closed circuit television system—Type 9—which is compact and exceptionally flexible in its application has been developed by EMI Electronics Ltd.

Three different cameras, including one of the smallest in the world, have been designed for use in the new system, thus providing a high degree of versatility. They operate with modular



Elcom (Northampton) Ltd announce that they have recently installed a sound mixing equipment in the studios of West One Entertainments Ltd at EMI House, Manchester Square, London, W1.

The mixer is a self-contained unit in a metal housing, single slope front and contains all the necessary facilities for mixing six channels monophonic system. Equalisation and input switching on all channels is provided, with echo send on three channels. The mixer also incorporates talk back and cueing facilities.

power and control units, which are considerably smaller than any other units with similar functions currently available.

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 system may be controlled from a central viewing position.

The Tvoe 9 equipment is also fully compatible with the low-cost EMI Type 8A self-contained, solid-state closed circuit television camera. The previous Type 8 camera with minor modifications can also be incorporated into a Type 9 closed circuit television system.

Camera 'A' (BC900). A high-quality camera ruggedly constructed having a diameter of 3.625 in (9.5 cm). This camera is designed to use the

EMI high-resolution separate mesh 1 in 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.

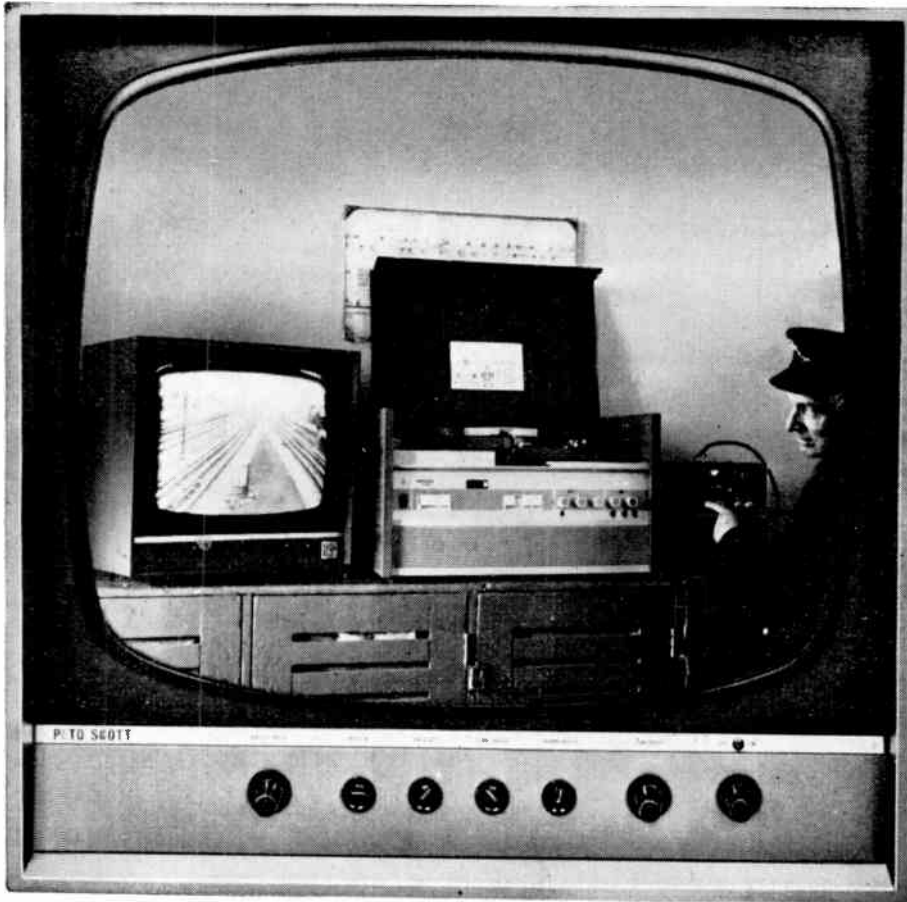
Camera 'B' (BC910). A rectangular camera which also incorporates certain of the Camera 'A' control unit's circuit boards, and utilises the basis of Camera 'A'. This makes a self-contained camera unit requiring only a camera cable (32-way) for connection to the Power Unit PU 900. Remote control units, 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.

Camera 'D' (BC930). One of the world's smallest television cameras, having a head unit and amplifier with an overall diameter of only 1.7 in (4.3 cm). This camera utilises the EMI separate mesh ½-in Vidicon Type 9697. Optical focus is achieved by micrometer focusing of 16 mm or 8 mm '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.

The modular power units, control units, and

continued on page 768

Eye on Peto Scott



How would you use the advantages of Private Channel TV?

The uses for Peto Scott Private Channel TV are as varied as industry itself. Above you see just one recent example: railway surveillance against hooliganism at Elm Park on the Eastern Region. The installation is remote-controlled from the Porter's room, where a monitor screen shows a constant picture of the track, and a video tape recorder makes required recordings. Other examples of Peto Scott Private Channel TV applications include production control, night security, transmissions to overflow audiences, traffic-flow checks on bridges. Companies and authorities of all kinds are at this moment studying the advantages that Peto Scott Private Channel TV can offer them. How would you use this new tool? Let us help you find out.



Professional Recording Systems



Whatever your need for recording equipment, contact Peto Scott - specialists in professional sound and video recording systems to any degree of complexity. Typical installations include recording facilities in law courts, broadcasting and recording studios and airports.

Communicate and sell



A sound system is a vital part of the equipment in any large retail operation. Peto Scott have the equipment, the personnel and the experience required to tailor sound systems for any situation. Write for information.

Contact Peto Scott

Peto Scott Limited, Addlestone Rd., Weybridge, Surrey. Telephone: Weybridge 45511.

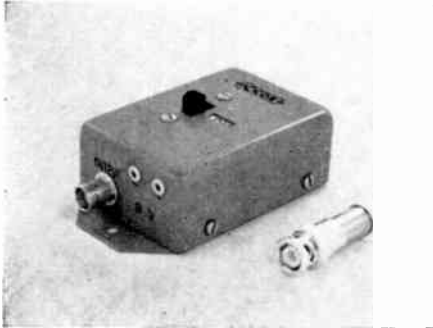


Peto Scott supply sound and vision systems, educational aids, video tape recorders and the Eidophor cinema-screen TV

NEW DEVELOPMENTS

continued

synchronising generators are added to Camera 'A', 'B' or 'D' to meet the user's required specification. The modules are designed so that they can be easily joined together as a free standing unit. Four units thus joined and fitted with mounting brackets will fit United Kingdom General Post Office standard 19-in racking. All modules are supplied with module inter-connecting leads 4E/B2422.



New wide band amplifier

Amplifiers

■ THE C-COR Model 1390 Amplifiers are self-contained, wideband units, designed to amplify pulse or video signals, or low distortion sine wave signals at output levels up to 20 volts peak to peak. They may be combined with other units in the C-COR line to provide high gain amplifier systems, with very wide dynamic range. The Model 1390 is optimised for pulse and video use, while the Model 1390-SW is designed primarily for amplification of sine wave signals. Either model, when used with the C-COR Model 1319-F, will result in an overall gain of 55 db, a 1.0 db passband of 5 cps to 12 mc, a noise level of 10 uv rms equivalent input, and an output capability of 20 volts peak to peak (into 75 ohms).

SPECIFICATIONS

Model 1390—Gain: 15 db nominal. **3 db Passband:** 2 cps to 20 mc (5 cps to 12 mc ± 0.5 db). **Ringings:** 2% max. **Tilt:** 2% max **60 cps.** **Rise Time:** 20 ns. **Output Capability:** 20 v p-p with linear response. **Impedance:** 75 ohms in and out. **Connectors:** SO-239 (UHF). **Power:** 105-125 v, 50-400 cps. **Dimensions:** 19" wide x 3½" high x 10" deep, both models (exclusive of connectors). May be mounted on rack panel individually or with one C-COR Model 1319-F.

Model 1390-SW—Gain: 15 db nominal. **3 db Passband:** 10 cps to 12 mc ± 1.5 db. **Output Capability:** 20 v p-p for 5% max THD, 15 v p-p for 2% THD. **Impedance:** 75 ohms in and out. **Connectors:** SO-239 (UHF). **Power:** 105-125 v, 50-400 cps.

Filter

■ A NEW LF FILTER by Wayne Kerr consists of two identical channels which can be used independently, in cascade, or in a band pass arrangement. A single tuning control operates over 28 ranges to permit both sections to be set precisely to any desired frequency between 0.1592 c/s and 1592 c/s.

As twin low-pass filters, the SA500 is particularly valuable for measurements on the performance of control systems. One filter is inserted in the output lead of the system to improve the signal-to-noise ratio. The second filter is inserted in the reference signal path to introduce the

identical characteristic and so leave the overall transfer function of the system unaffected by the filter.

With the two low-pass filters in cascade the attenuation rate is 36 dB/octave. In the band-pass condition there is unity gain and zero phase-shift at the centre frequency and an attenuation of 18 dB/octave either side.

The input impedance of each channel is 2 megohms (resistive) and the output impedance is less than 60 ohms. The SA500 is available for 19" rack mounting or in a portable case (20" x 9" x 9"). It consumes only 20 W from normal ac supplies, and weighs 23 lb.

Connectors

■ TWO NEW wire wrap edge connectors have been added to the large range of miniature, sub-miniature connectors produced by Ultra Electronics (Components) Ltd. Designed originally for trial use in Post Office Electronic Switching Systems, they are already being found by other equipment manufacturers to have an advantage over all other types of edge connectors.

The two connectors—12 + 12 and 18 + 18 way—have a contact pitch of 0.2 ins (5.08 mm) and termination of 0.046 sq in (1.168 sq mm). The contact form is of bellows action, and the contact/termination assemblies have the added facility of being removable.

The connectors are open-ended, but perfect alignment of the printed wiring board is catered for by the use of a friction fit nylon reference key. The connectors have the additional advantage of being able to be stacked on the building brick principle, giving any number of ways required in multiples of 12 or 18.

Solid state

■ STANDARD TELEPHONES & CABLES LTD has engineered what it believes to be the first example of a completely solid state power and control system for a stabilised eht supply to a travelling wave tube. The units will be used in

uhf television translator units to be supplied to the BBC by the company.

The new STC power units are a closed loop system for voltage output stabilisation. Included in the units are sub-assemblies of thyristor control stacks, silicon avalanche eht rectifiers which are self-protecting against voltage transients and three-phase thyristor trigger units.

Operating from normal mains supplies to the unattended translator stations, the STC power units will function under fluctuations of ac supply voltage to provide 3,200 volts dc at 0.75 amperes to the TWT's with a stability of $\pm 0.5\%$.

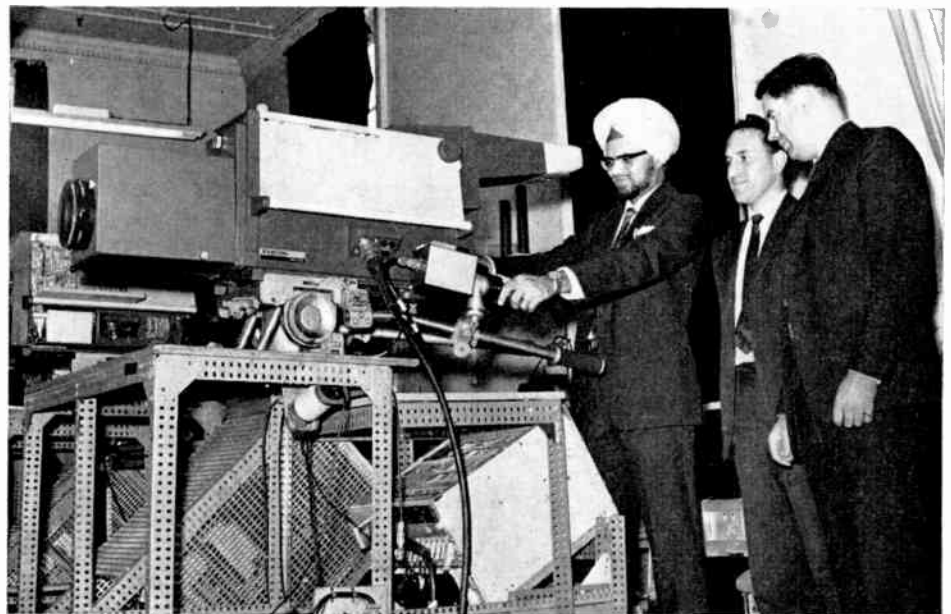
Solid state eht supplies for travelling wave tubes are smaller and cheaper than conventional equipments using transducers. In addition to their adoption for TV transmitters it is expected that the new equipment will find applications in national and international communications systems.

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.

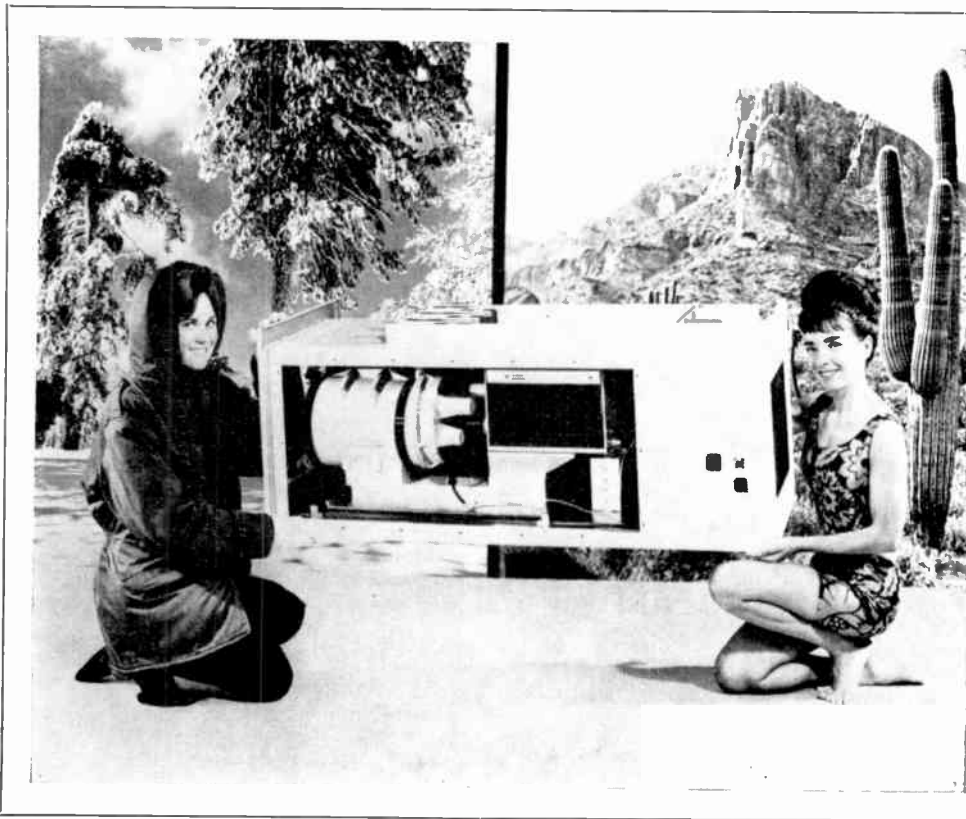
The 12" T963D Cathode Ray Tube has been specifically developed to meet the increasing demand for a high quality tube, capable of handling either alpha-numeric or processed radar displays. This tube provides a flicker free, high brightness 'read-out,' which in no way degrades the high degree of resolution 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 (0.008") 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



Kirpal Singh, the Chief Planning Officer of the Malaysian Ministry of Broadcasting was a recent guest of the Marconi Company at Chelmsford. After discussions with the Company's Broadcasting Division, he was conducted on a tour of the television broadcasting and studio equipment test sections. He is seen here with C. Teed, centre, and H. Lavington-Evans, of Broadcasting Division, examining the Marconi Mk V television camera.

The Marconi Mk V television camera is the latest in a long series of television cameras produced by The Marconi Company since 1946. It is completely solid state, using high quality silicon transistors in all but the eht circuits. Weighing only 98 lb, it is the smallest and lightest 4½" image orthicon camera in production anywhere in the world. Features include a fully integrated zoom lens which is either manually or servo-controlled and a tilting viewfinder which can be entirely removed from the camera.



ALL PURPOSE CCTV SYSTEM

■ TV—An all-year closed-circuit television system, designed to operate in sandstorms, tropical rain, desert heat and mountain cold, has been announced by Cohu Electronics, Inc, San Diego, Calif. The new unit—with high resolution, self-contained camera—includes a refrigerator for summer, a heater for winter, a defroster for the viewing port (windshield), a sunshield and a 40-inch f5.6 lens. The entire camera system is sealed against the elements and will function efficiently from 20 degrees below zero to more than 125 degrees Fahrenheit.

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.

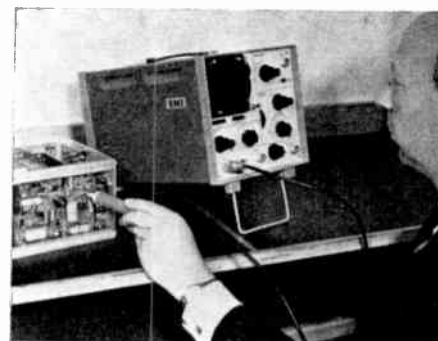
The T963 is also available with EEV 'Y' or 'Z' screens.

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 9½" in overall length and has a 6" (diagonal) rectangular screen. The optical resolution of the T960W is more than adequate for use with 625 line television displays.

With a PDA ratio as high as 12:1, the T980H can produce an extremely crisp, bright trace. In addition, the writing speed of this CRT is particularly good, traces at speeds of 10 metres per microsecond having been observed with the naked eye.



Oscilloscope

■ A NEW LOW-PRICE, solid state measuring oscilloscope with high performance characteristics is announced by EMI Electronics Ltd. Known as the Oscilloscope 101, its advanced circuitry provides stable triggering up to 30 Mc/s. The Y-amplifier bandwidth of 15 Mc/s, coupled with a maximum sensitivity of 50 mV/cm, ensures that waveforms are faithfully displayed on the new 3" cathode ray tube, type MX54, specially developed by EMI for the 101.

Reliability has been built in by the use of a very rugged mechanical design and high quality printed circuit boards. It can be powered either by a 12 v battery or by the normal AC supply mains. Because of its low weight (17 lb), compact size and rugged construction it is expected that the new oscilloscope will find many applications in mobile operations on land, sea and in the air, as well as in the educational and research departments. In industry its small size and high performance coupled with low cost (£170) should make it attractive as a standard instrument for electronic and electrical engineers.

Rectifiers

■ INCLUDED in a new line of Sylvania silicon rectifiers is a series of controlled avalanche rectifiers for high-surge application which have been shown to withstand surges up to 1,000 amps.

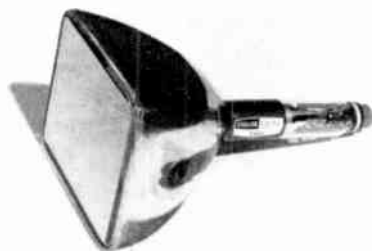
These units have peak reverse voltages of 200 to 1,000 volts, with rated forward current of 1 amp. The forward peak non-recurrent surge is rated at 50 amps and forward peak recurrent surge at 20 amps.

The units are available in a bullet-shaped, moulded epoxy package with the cathode lead in the pointed end for easy identification of polarity. Extensive tests have been conducted on life, with variables such as moisture, shock and temperature, to assure quality.

Instrument tube

■ THE T980H is a 5" instrument tube specifically designed by English Electric Valve Company to be used with transistorised circuits. For this reason, the deflection sensitivity is high, 2.7 V/cm in the 'X' direction and 8 V/cm in the 'Y' direction. Greater sensitivities can be achieved if the gun voltage is reduced.

Anode modulation plates are incorporated, allowing the beam to be cut off without any perceptible spot movement. In fact, the specification limit on spot movement blanking is zero, whilst the voltage required for blanking is less than 30 volts.



EEV Monitor C.R.T. type T960W

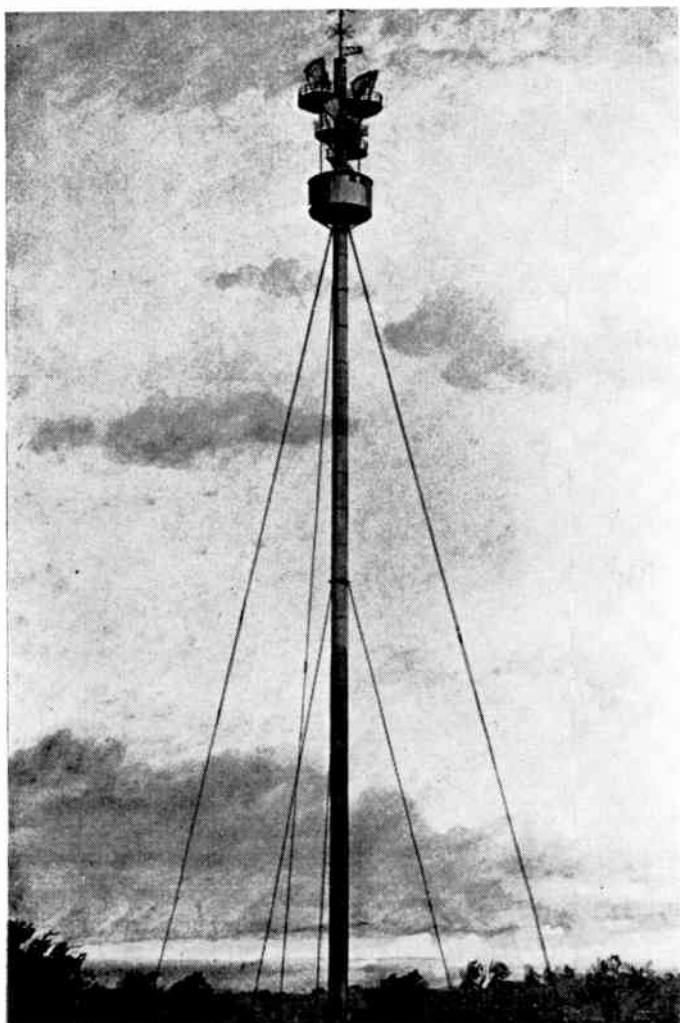
The 16" T970Z CRT is basically a larger version of the T963C. Despite the greater overall length of this tube with its consequent increase in magnification ratio, the line width does not exceed 0.35 mm. In the case of the T970Z, neck alignment is better than 3 mm eccentricity and ±1 degree of tilt. Similarly, 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

SOVIET TV STATIONS_____

by David Aizenburg, Chief Engineer



AT the beginning of 1965, 168 powerful TV centres and nearly 300 relay stations were operating in the Soviet Union. In April 1965 television programmes were successfully transmitted from Moscow to Vladivostok via the **Molniya-1** relay satellite, and at the end of May a colour TV programme was transmitted through the same station.

Eighteen Soviet TV stations are now telecasting two programmes, while the Moscow and Leningrad TV centres present three each. The zone of reliable reception of television programmes embraces a territory with a population of 90 million people. Another 20 TV centres and about 100 relay stations will go into operation this year.

The television centres' entire transmitting and auxiliary equipment is produced serially by Soviet industry. Mobile TV vans are used for remote telecasting.

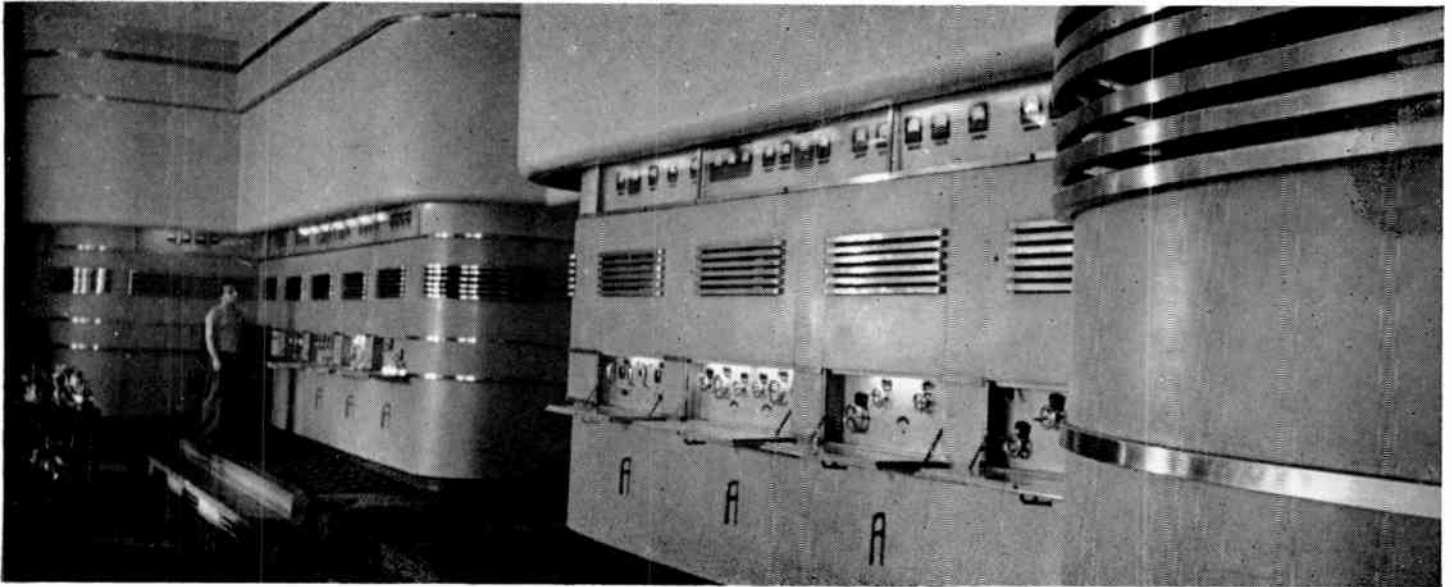
The 625-line 25-frame system ensuring high-quality reception is the accepted standard in the USSR. There are at least eight tonal gradations on the black-and-white screen. And there is very little linear or non-linear distortion.

TV transmitters are designed for two frequency bands—the first five channels are in the frequency band of 48 to 100 megacycles, while the 6th to 12th channels are in the 174-230 megacycle band. Their power differs. For instance, the **Yakor** transmitter is of 5/1½ kilowatts, while the **Uragan** is 50/15 kilowatts. The **Igla** (5/1½ kilowatts) and **Lyon**, which is produced in two variants (25/7½ and 50/15 kilowatts respectively), function in seven channels of the second frequency band.

All these transmitters are designed for black-and-white and colour programmes and fully meet the requirements of compatibility.

The frequency band of each TV channel is 6 megacycles. The transmitters are equipped with reserve systems in the output for higher reliability.

Now a new, improved complex of TV equipment



Interior view of station

USSR Ministry of the Radio

made up almost completely of semiconductor devices is being developed. This complex will go into action at a new TV centre now under construction in Moscow. It will ensure the simultaneous transmission of five TV programmes, including one in colour.

A network of radio relay lines has been put up in the USSR for the exchange of TV programmes between cities and also with other countries. The first of them, the Moscow-Ryazan line, was opened in 1965. Now programmes of the Central TV Centre are transmitted to more than 60 large cities.

Programmes are also sent to Poland, the German Democratic Republic, Bulgaria, Czechoslovakia, Hungary and Rumania via the Intervision system. There are also transmissions through the Eurovision system, whose member-countries include Finland, Britain and other countries.

Every relay line represents a chain of receiving-transmitting stations standing some 40-60 kilometres apart, and 120-150 kilometres in mountainous areas. These stations are equipped with parabolic, periscopic and horn-type parabolic antennae and apparatus enabling TV programmes to be relayed a distance of 2,500 km, and with hundreds of phone calls. This apparatus operates in the 3,400-3,900 megacycle range with frequency modulation, the power of the transmitter being 3 watts. TV signals and sound are transmitted in a single high-frequency line. The antennae employed, horn-type parabolic with 40-decibel amplification, are connected with the apparatus by waveguides.

There are also receiving-transmitting devices making it possible to send TV programmes and telephone calls for a distance of about 1,000 kilometres. Their range of working frequencies is 1,600-2,000 megacycles. The power of the transmitter is 3 watts, frequency modulation, 6-megacycle frequency band of the TV channel, 30-10,000 cycle sound channel.

A videotelephone system is operating between

Interior view of control panel



Moscow, Leningrad and Kiev, as well as between Tashkent and Andizhan (Uzbekistan). TV signals are amplified and fed into the coaxial cable connecting the videotelephone point and the trunk-line office. After amplification and correction they get into the apparatus for multiplexing the coaxial cable, where the video spectrum is transformed into a linear one, is again amplified and transmitted to another city via the trunk line. After the reverse conversion the signals reach the TV screen of the videotelephone point.

THE SEEKERS

Leigh M. Scully gives full technical details of three amazing 'searching-by-television' cameras from Pye Laboratories

THE fact that it can be easily held and manoeuvred with one hand will appeal to frogmen,' the Pye Laboratories Ltd vidicon-camera expert was saying, as we stood around a huge fish-tank in the centre of a lush-carpeted Waldorf reception salon, watching gold-fish silently circling this underwater TV camera.

'Now, when we are carrying out inspection of ships' hulls, dock, harbour and port installations, it is important that the in-water weight is only nine pounds. . . . Because the camera is radiation resistant, it can also be used for nuclear applications. . . .'

Warm comfort of this first Press demonstration of one of the Pye Laboratories' amazing 'searching-by-television' cameras seemed to be in sharp contrast to the salt-tang ocean zones where frogmen weave in and out through muddy green water, trailing TV camera cables, buoyancy tanks and dazzling lighting units, probing hidden dangers in hulls, pipes and fathoms-deep structures.

Nevertheless, it is in the warm comfort of marine boardrooms, and not down in the chill of Davy Jone's Locker that the real benefit of these searching CCTV cameras is evident. An underwater chain based on the latest Pye Laboratories CM 21683, may cost around £2,600 all in, for camera, cables, control and monitors, but can effect a saving ten to fifty times greater every twelvemonth, depending on maintenance and operational need.

Origination of the three new cameras (underwater, articulated, and pipe-inspection) has been the task of Pye Laboratories Ltd, whose brilliant work for the United Kingdom Atomic Energy Authority was first disclosed in *International Broadcast Engineer*, July, 1965.

when I was privileged to have several long discussions with Mr J. W. Dalglish, managing Director of the then-new Laboratories organisation within the Pye group.

'Pye Labs' had been formed barely a twelvemonth prior to our meeting. It was conceived as a research and engineering group operating mainly in the fields of product development and design contracting which were not being actively worked on by other Pye companies.

Typical of the work 'Pye Labs' had been engaged upon included (at the time of my paper dealing with the Pye radiation-resistant camera chains, last July): (1) The supply and commissioning of a 100-kW nuclear reactor for research and education, on instructions from the UKAEA for the Universities of Manchester and Liverpool. (2) Supply and commissioning of a remote-handling facility for environmental tests of ordnance supplies for the Ministry of Defence. (3) Design and manufacture of gunsights and other precision optical and mechanical equipment for the Defence Ministry. (4) Design and manufacture of miniature electronic assemblies—of great complexity and paramount reliability—for investigation by rocket and satellite of properties of outer space. (5) Engineering for production by Pye Group companies of the Archoic stereo record reproducer. (6) Design and production of an electronic accounting machine, in effect a miniature computer for the office. (7) In the electro-medical department, facilities for what are known as implant electronics, plus nurse-call and patient monitoring systems for hospital. (8) Engineering and supply of 'smooth-speed' motor speed controls.

Two other big development pro-

grammes of the 'Labs' covered nuclear resistant cameras, and, secondly, the trio of cameras now colloquially known as 'the Seekers,' and in some respects they naturally have a family resemblance to the nuclear resistant CCTV chains. In these latter, the housing has not only to withstand a high incident gamma flux rate of photons, but needs to be cooled with carbon dioxide gas. Different problems arise in the three latest cameras.

Taking the underwater camera first, this is housed in a cylindrical tube of stainless steel, and is designed for underwater use down to a depth of 200 feet (60m). It is equipped with remote focus, and the Staticon tube assembly together with its video amplifier is contained in a plug-in unit, easily removed for servicing. Like its reactor-heart companions, the CM 21683 is fitted with stabilised glass and lens, and is radiant-resistant. It can be located up to 1,000 ft (300m) from its control unit, all power and control circuits being carried by a single multi-way cable.

Scanning standards available (all fully interlaced) are 625 or 405 lines 50 fields, and US-standard 525-line 60 fields. The picture tube is a 1-in Staticon C932 or vidicon 7735, spectral response of which is similar to that of pan film. Precision viewing is essential for underwater use, and the resolution exceeds 550 lines at the centre of the picture, scanning linearity is less than 2.5 per cent departure from ideal, and picture geometry is such that no part of the picture will depart by more than 2.0 per cent from a rectangle averaged over the picture. Bandwidth is ± 1 dB to 6.5 Mc/s.

Well shielded, the camera is designed to operate in water conditions of tem-

peratures up to 60-deg C, and as for radiation resistance, the specification states gamma -5×10^6 rads any dose, although the lens would need reannealing after 10^9 rads. Power supply is 100-125 or 200-250 volts AC, 50 or 60 cps, permissible voltage variation being ± 5 per cent. Diameter of the underwater (65cm). Weight is 15 lbs (6.9 kg) in air, but 4 lbs (1.8 kg) negatively buoyant in water. Possible attachments include a buoyancy tank which fits around the camera; a lighting attachment consisting of 2 100-watt quartz-iodine lamps with reflectors, this being a fully-sealed 12-volt AC system; third, an adjustable probe attachment for setting the exact distance between the object and the camera.

Non-stabilised Dallmeyer lenses are available: (1) 15 mmf/2.9, diagonal viewing, 56-deg, and (2) 25-mm f/1.9, diagonal viewing, 35-deg. The stabilised lens available is 25-mm f/1.9 (fixed iris), diagonal viewing angle 35-deg.

Second in the family of TV 'Seekers' is the camera which can literally see round corners.

This tiny snake-like camera has been developed by the 'Labs' to monitor around bends, and is designed for use in the complicated pipeline networks of many major industries. While its diameter is not the smallest in the world (this can at present be achieved only by use of the $\frac{1}{2}$ -in vidicon), it is amazingly compact for a camera able to take a standard 1-in C932 Staticon, and the entire length of the camera, with its amplifier and lighting system, is only 28-in.

'It has been specially designed for small-bore pipe inspection, a Pye Labora-

tories technician told me, as we tested this revolutionary articulated camera in a number of typical pipe sections containing internal flaws detectable only by CCTV.

'It will save time and cost in industries throughout the world, including oil refineries, chemical plants, power stations, gasworks, and shipping companies. Pipe inspection and maintenance have been an acute problem in industry, because long lengths of pipe so far have had to be physically disconnected for periodic checks and repairs. This articulated camera overcomes inspection problems, by enabling continuous lengths of up to 1,000 feet to be inspected. . . .'

This waterproof, stainless-steel-clad camera consists of two sections linked by a flexible metal coupling. The front section consists of a camera tube assembly which is fitted with an articulated unit containing the lens and lighting. The rear section contains the video amplifier and connector assembly.

'Main features,' I was told, 'are high definition, simplicity of operation (you just push it down the tube, all the way up to 1,000 feet if you wish, and watch on a monitor), interlaced scanning, and built-in illumination.'

Like the underwater camera, the articulated job, CM 21717, is available for 625, 525 and 405, all fully interlaced scanning. Either with a Staticon, or a 1-in vidicon 7735, the spectral response is panchromatic, and matches well with 35-mm or Minox colour slides.

Picture resolution exceeds 550 lines at the centre of the picture, and scanning linearity is less than 2.5 per cent from the ideal, no matter how the camera is worked. This camera is not primarily designed for under-water use, but is proof against accidental immersion up to a depth of 30 ft. It operates well in ambient temperatures up to 40-deg C. Power consumption is only 210-watts (100-125 or 200-250 volts, 50 or 60 c/s).

As to the minimum pipe bend radius, this will obviously depend to some extent upon the pipe diameter. But under average 'bad' conditions, for a 2.5-in (63mm) inside diameter pipe, the inside bend radius is 16-in (406mm). Attachments include a sealed, self-centring lighting attachment with 12-volt 21-watt car-type bulb, the supply coming from the camera control unit. Centring spiders are also available as an optional fitting. The lens is a 15mm f/4.0 Dallmeyer instrument lens with fixed iris, the diagonal viewing angle being 56-deg. Focusing is

► to next page

The Seekers—continued

► from previous page

mechanical after removal of the lighting attachment. Camera cable is armoured with PVC over the entire length, and can be quickly detached from the articulated camera. Viewing is by a monitor, and there are types available from 8½-in to 23-in, including the 14-in Pye Precision unit.

Overall cost of an articulated unit obviously depends upon facilities needed, but a good average figure is £1,800 for the camera, control and one monitor.

Third of the 'Seekers' is the CM 21716 pipe inspection cameras, an invaluable aid for quick and thorough inspection of interiors of pipes with larger inside diameters, from 3-in up to 42-in, and it is supplied with lighting and centring attachments to accommodate pipes within this range. All-up weight is approximately 6½-lbs. This CM 21716 is, like its companions, completely housed in a stainless-steel cylinder, and without external skids is suitable for pipes from 3-in (76mm) to 9-in (229mm) inside diameter. The adjustable skid assembly with built-in lighting is available for use in pipes having an id up to 42-in (1067mm). Like the other cameras, it may be operated up to 1,000 ft (300cm) from its control unit, all power and control circuits being carried in a single multicable.

As the minimum id is 3-in, the standard 1-in 932 Stacion is very suitable and, as with the smaller pipe-inspection camera, the response is similar to that of panchromatic film. Resolution (exceeding 550 lines at picture centre) and scanning linearity (less than 2.5 per cent departure from ideal) are as with the other cameras in this group, and the bandwidth covered is ± 1 dB to 6.5 Mc/s.

Did Pye Laboratories plan this larger pipe-inspection camera to be waterproof? Is there such a general demand in in-

dustry for pipe inspection to be carried out with conduits where there may be liquid remaining in certain loops? I am told that while the camera is not primarily designed for immersion in water, it is proof against accidental immersion up to a depth of 2-ft (619mm). The maximum recommended ambient temperature is 40-deg C, which should satisfy most industrial needs.

A camera of this type must be as short as the Stacion or vidicon tubes makes possible, since even with larger-diameter pipes sharp bends may be encountered. The CM 21716 without a lighting unit is 22.5-in long (572mm), and with the standard 21-watt lighting unit is 31-in (787mm). There is an alternative 48-watt lighting unit which has a rather greater physical length, and this brings the total length of camera and light to 33-in (838 mm). In general the 21-watt unit is more than adequate for pipes up to 6-in (152 mm), and the 48-watt unit is recommended for larger pipes. A wide range of lenses is available to suit pipe conditions. Focus is by remote control, and there are several accessories available making this camera chain suitable for many applications in the civil-engineering field including gas, sewer and oil installations. Very low power is entailed, approximately 210 watts at the usual AC mains voltages, 50 or 60 c/s. Average cost of a complete installation, with attachments, cables, monitor and control units, is £2,700.

Among monitors for 'The Seekers' is the little 8½-in video monitor (only 9½-in high, weighing 24 lbs), and the economical Type 2816 (separate versions for 405, 525 or 625) which uses a 14.5-in (37mm) diagonal Mullard AW 36-20 or Cathodeon C14/3A tube. However, for precision monitoring these searcher cameras can be used also with the 2788 and 2780 precision monitors built to a very high-standard specification. There is even a silent extractor fan on the rear panel to maintain a stable temperature during long periods of monitoring.

The 2788 works on 625 or 525 (switchable), and, incidentally, on the French 819-line standard. The 2780 works on 405 lines only. The 14kV high-voltage supply for the CRT is produced by an auto-transformer forming the anode load of a power which is driven by a sawtooth voltage at line frequency, derived from the blocking oscillator. The amplified high-voltage pulses produced by this auto-transformer are applied to a valve-operated voltage-doubling circuit; stabilisation of the high voltage is obtained by means of a series regulator and DC amplifier, the controlling voltage for which is derived from a resistance network including a metrosil. An extra bright picture is produced, no matter which of the three 'Seekers' is used, on a 14-in (36mm) straight-gun CRT.

technical

abstracts

Electronics

306. DUNN, S. C. The role of the critic in electronics design.

Electronics & Power, vol 11, 366-369, Nov 1965.

It is believed that informed criticism could play a large part in avoiding design errors but does not yet do so.

307. MAY, J. E. Ultrasonic travelling-wave devices for communications.

IEEE Spectrum, vol 2, no 10, 73-85, Oct 1965.

A comprehensive discussion of the latest techniques and materials in the fabrication of ultrasonic delay lines and transducers—plus a description of delay media and delay times and elastic wave interactions: diags, graphs, bibliog refs.

Acoustics

308. MORGAN, K. Assisted resonance.

Electronics & Power, vol 11, 374-377, Nov 1965.

Recent experiments at the Royal Festival Hall show that modern techniques make it possible for a concert hall to have a variable reverberation time to make it suitable for all types of concert: diag, graphs, photo.

309. ZANESCU, L. Listening room for high-quality stereo replay.

Radio & Television, no 5, 33-38, Sept 1965.

The room was designed by the Research Dept of the Rumanian Radio and Television: diags, plans, photos.

Radio propagation

310. CASSIDY, M. Communication for air-traffic services.

Proc IEE, vol 112, no 10, 1885-1893, Oct 1965.

Particular topics are the evaluation of queuing delays on aeromobile speech channels and the minimum signal/ratio required for satisfactory communication on aeronautical radio channels: diags, graphs, bibliog refs.

311. COX, K. A. The Land Mobile Radio Services.

IEEE Spectrum, vol 2, no 10, 42-43, Oct 1965.

The tremendous growth in land mobile radio has created serious congestion since less than five per cent of the suitable spectrum space (in America) has been allocated for land mobile use: diags.

312. KUHN, U. Establishment of RMS field strength above 470 Mc/s over uneven terrain. *Nachrichtentechnik*, no 5, 161-166, 1965. In German.

In mountainous terrain, deviation from the CCIR curves sometimes attain 30 db. A graph is given for establishing correction factors in dependence on terrain irregularity.

313. PEARSON, J. D. A parametric amplifier for the frequency range 400-800 Mc/s. *Radio & Electronic Engineer*, vol 30, no 4, 233-239, Oct 1965.

Considerations affecting the choice of varactor diode and pump frequency for a parametric amplifier are discussed and a description is given of a practical amplifier which has a noise figure of 1 dB: graphs, bibliog refs.

314. STARK, J. W. Simultaneous long distance tropospheric propagation measurements at 560 Mc/s and 774 Mc/s over the North Sea. *Radio & Electronic Engineer*, vol 30, no 4, 241-255, Oct 1965.

Field strengths are generally slightly higher on the higher frequency and all signals are greatly enhanced above the free-space value during anticyclonic weather: maps, diags, graphs, bibliog refs.

315. STEINKE, G. Experience with stereo recording and experimental public transmissions of broadcast programmes in the German Democratic Republic. *Radio & Television*, no 5, 26-32, Sept 1965.

Regular public experimental stereo transmissions were launched on Sept 15 1964. The pilot tone system is used, programmes being radiated by a VHF-FM transmitter operating at 99.7 Mc/s in Berlin: diags, photos, bibliog refs.

Antenna

316. DAVIES, D. E. N. A transformation between the phasing techniques required for linear and circular aerial arrays. *Proc IEE*, vol 112, no 11, 2041-2045, Nov 1965.

A technique is described for producing a deflection or continuous rotation of the directional pattern of a circular array means of the phasing system normally associated with linear arrays: diags, graphs, bibliog refs.

317. SOBIN, L. G. & MOGULSKY, E. Z. Statistical characteristics of fluctuation of remote zone field of antenna meshes. *Radiotekhnika i elektronika*, no 4, 603-609, 1965. In Russian.

Expressions for the secondary moments of fluctuation are derived. The density of the distribution of the field module is discussed.

318. STRANAK, F. Periscopic antenna with phase correction. *Slaboproudny obzor*, no 5, 279-285, 1965. In Czech.

Main attention is given to the antenna gain factor.

Television

319. ALLNATT, J. W. Subjective quality of colour-television pictures impaired by gain and delay inequalities between the luminance and chrominance channels. *Proc IEE*, vol 112, no 10, 1819-1824, October 1965.

Using a previously proposed quality-grading method, tests have been made of the effects of gain and delay inequalities between the luminance and chrominance channels of 625-line NTSC-type colour TV: diags, bibliog refs.

310. SUSLONOV, S. A. and others. Aperture and phase correcting circuits. *Tekhnika Kino i Televidenia*, no 4, 29-32, 1965. In Russian.

The Soviet PTU-2M television equipment was used for an experimental study of methods of amplitude and phase correction by means of a model of a television chain.

311. TURNER, L. W. & REDMOND, J. Experience with BBC 2. *Electronics & Power*, vol 11, 414-416, 419, Dec 1965.

Problems of the introduction of BBC 2 on 625 and how they have been overcome: map, diag.

312. WHARTON, W. Vestigial-sideband transmission at uhf. *Proc IEE*, vol 112, no 12, 2199-2207, Dec 1965.

The specification of the radiated spectrum of 625-line uhf transmissions is considered: diags, graphs, bibliog refs.

TV cameras and tubes

313. BITCH, M. I. and others. Vidicon with increased resolving power, Type LI-410. *Tekhnika Kino i Televidenia*, no 5, 52-56, 1965. In Russian.

The tube is about 220 mm long and 40 mm in diameter: diags.

314. GLAZMAN, L. F. & MAGID, I. Y. Television camera tubes with signal storage. *Tekhnika Kino i Televidenia*, no 4, 71-76, 1965. In Russian.

Literature is surveyed and various non-Russian tubes are described: diags.

315. KUZNETSOVA, G. V. New vidicon type LI-409. *Tekhnika Kino i Televidenia*, no 5, 50-51, 1965. In Russian.

Comparisons are made with the widely used LI-23: diags.

316. MAKEDONSKY, P. L. & STEPANOV, R. M. Study of efficiency of beam and secondary emission in vidicons. In Russian.

Tekhnika Kino i Televidenia, no 4, 24-28, 1965. A method of measurement is described of reloading efficiency and secondary emission factor by means of pulses in an arbitrary part of the investigated area of the vidicon target: diags.

317. MINYENKO, Y. G. Television camera tubes supplying their signals directly to cable lines. *Tekhnika Kino i Televidenia*, no 4, 19-24, 1965. In Russian.

Circuits are studied and the results of experimental checking of amplifiers used with such systems are presented.

Recording

318. AVILOV, G. V. Methods of improving magnetic tape quality. *Tekhnika Kino i Televidenia*, no 5, 72-76, 1965. In Russian.

A description is given of methods used for orienting the crystals of iron oxide in the magnetic layer is included: diags.

319. ELIASBERG, I. I. New studies of magnetic layers of magnetic tapes. *Tekhnika Kino i Televidenia*, no 5, 77-79, 1965. In Russian.

Main attention is paid to ferrites, powder alloys and metallic layers.

320. KUTAY, A. K. Problem of replacing video tape recorder equipment functions. *Tekhnika Kino i Televidenia*, no 4, 5-12, 1965. In Russian.

Results of investigation of the quality of head and discs in video tape recorders are presented.

321. MIKHNYEVITCH, A. V. Tape movement mechanism with high instantaneous stability of carrier speed. *Tekhnika Kino i Televidenia*, no 4, 40-46, 1965. In Russian.

A model of a tape movement mechanism at the VNIRT research institute is described, and the results of field tests are presented: diags.

322. VASILYEVSKY, Y. A. Establishment of some qualitative characteristics of magnetic tapes and recording equipments. *Tekhnika Kino i Televidenia*, no 5, 18-24, 1965. In Russian.

Methods and apparatus used for the checking of drop-outs of pulses and the time discrepancies in the replayed signals in multi-channel tape recording systems are treated: diags.

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.

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

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