REF. TD.164/2

IMAGE ORTHICON CAMERA CHANNELS

Types BD.808 & 809

TECHNICAL DESCRIPTION

The information given herein is typical of the performance that can be expected in practice but is subject to confirmation at the time of ordering.

To be read in conjunction with pamphlets ref.:
*TD.*142/2 *TD.*143/2 *TD.*144 *TD.*147/3

Marconi

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED
Head Office: Marconi House, Chelmsford · Telephone: Chelmsford 3221 *· Telegraphic Address: Expanse, Chelmsford*

CONTENTS

DATA SUMMARY

Using Image Orthicon Tubes P.807 (3 inch) and P.811 (4½ inch)

System : 405 line, 50 fields per sec. (BBC)
525 line, 60 fields per sec. (RMA)
625 line, 50 fields per sec. (CCIR)

Interlace ratio : 2 : 1

Aspect ratio : 4 : 3

Photo-cathode picture diagonal : 1.6 in. (4.06 cm)

Channel output : Composite or non-composite signal, as required, at standard level, thus (volts peak-to-peak) :

	Composite	*Non-composite*
BBC system	1	0.7
RMA system	1.4	1
CCIR system	1	0.75

Geometry : On camera, viewfinder and monitor, displacement of any part of the raster from its true position is less than 2% of the picture height.

Amplitude hum : At least 55 db below standard level at the output of the channel.

Positional hum : Not measurable in the camera. Peak-to-peak movement in the monitor less than 0.1% of picture height.

Rise time : Less than 0.2μs.

Colour response : Close to that of human eye. Satisfactory monochrome colour rendering when incident illumination used.

Sensitivity : It is difficult to quote a sensitivity in terms of foot/lamberts from the highlights for a given aperture since it depends upon the setting-up procedure. It is possible to set the tube up at the point of maximum sensitivity or, alternatively, where light is not of great importance, for the most pleasing picture. These two separate cases will correspond to different points on the transfer characteristic of the tube.

It is found possible to operate the P.807 tube on OB units, where maximum sensitivity is required, at illuminations of about 0.1 foot/lamberts highlight scene brightness at f/1.9, whereas in the studio some customers will operate at a highlight scene brightness of 20-50 foot/lamberts at f/5.6 depending upon individual preference.

Although the theoretical sensitivity of the P.811 is lower than that of the P.807, in practice the lower noise level of the P.811 allows its use at low light levels approaching those customary with the P.807.

Resolution : The P.807 has a minimum limiting resolution of 475 lines, while the P.811 has a similar resolution of better than 600 lines. Both values are taken at the centre of the picture.

Signal/Noise Ratio : P.807. Minimum 24db. P.811. Minimum 29db.

Mains supply : Mobile Channel, 193-254V 50 c/s or 91-121V 60 c/s.
Studio Channel, 206-254V 50 c/s or 101-121V 60 c/s.

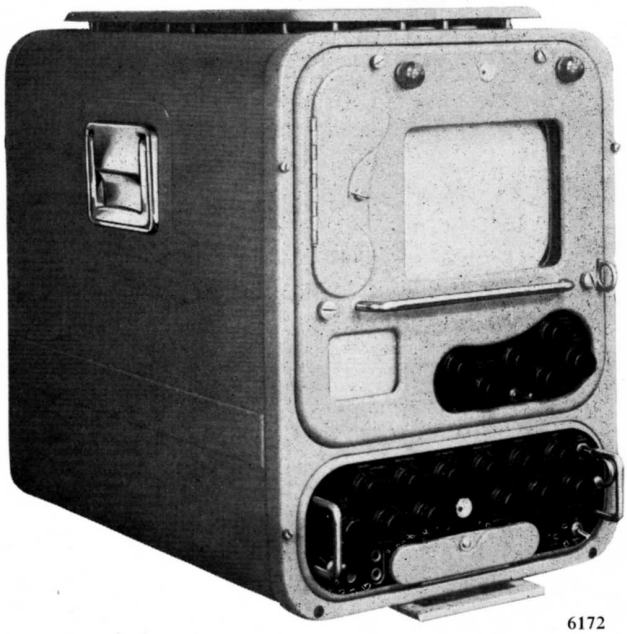
Power consumption : Approximately 1.5 kVA. for complete camera channel.

DIMENSIONS

	HEIGHT	WIDTH	DEPTH
Camera Type BD.687	17¼ in. (44 cm)	15¾ in. (40 cm)	26½ in. (67 cm)
Camera Control Chassis Type BD.626H	6 in. (15 cm)	14½ in. (37 cm)	25½ in. (65 cm)

Mobile Camera Channel *Type BD.808*

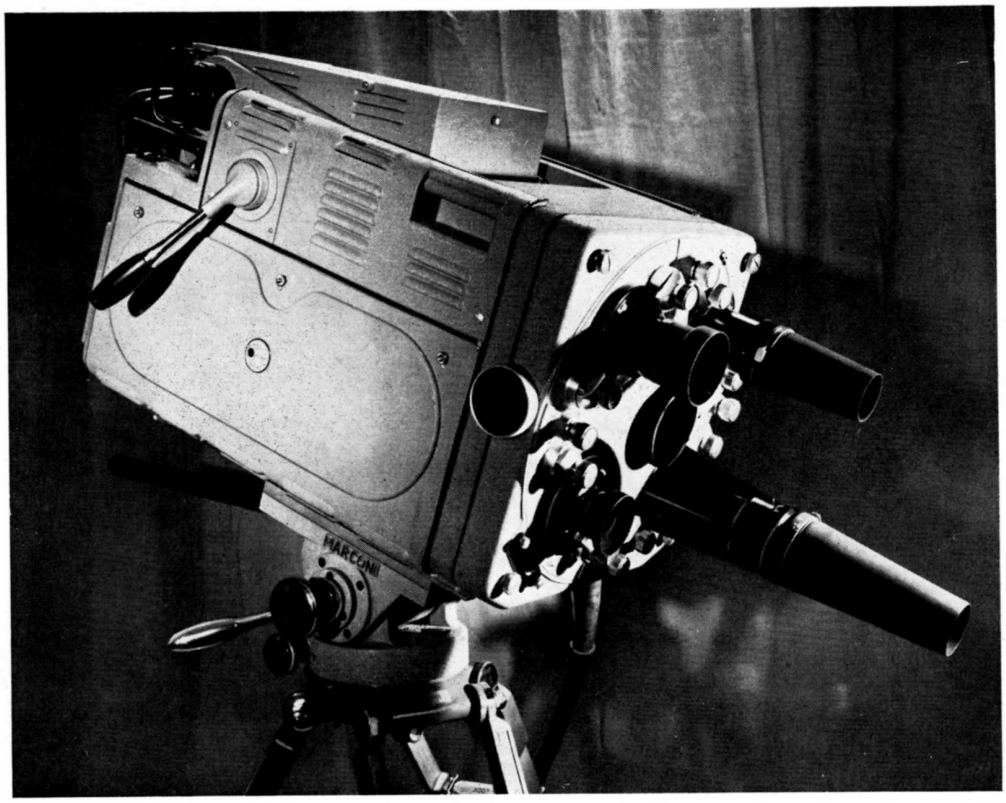
Mobile Regulated Power Supply Unit Type BD.629.



6172

Camera Control Chassis Type BD.626 with Picture and Waveform Monitor Chassis Type BD.627 mounted together to form a Camera Control and Preview Monitor suitable for mobile use.

Below : *Image Orthicon Camera Type BD.687.*



6473

TECHNICAL DESCRIPTION

THE Image Orthicon Camera Channels Types BD.808 and BD.809, comprise the following major items (plus cable, lenses, friction head tripod and housings) :

Camera Type BD.687
Camera Control Chassis Type BD.626
Picture and Waveform Monitor Chassis Type BD.627
Regulated Power Supply Unit Type BD.630 for studio use *or*
Mobile Regulated Power Supply Unit Type BD.629
Focus Supply Unit Type 1881 or 2137.

The equipment forming a complete television camera channel is available in a number of editions suitable for studio or mobile use on 405-, 525-, or 625-line systems, with 50 c/s or 60 c/s mains power supplies.

The same camera is employed in both studio (Type BD.809) and mobile (Type BD.808) channels. The camera control chassis and picture and waveform monitor chassis are mounted together to form a single camera control and preview monitor unit and fitted in a studio console housing or mobile case. As the same chassis are used for both the studio and the mobile applications, maintenance personnel need only familiarise themselves with one equipment and the advantage of simple convertibility between studio and outside broadcast use is gained. The stocking of spares is also simplified.

The units of the camera channel are finished externally in light grey rivel enamel with chrome fittings. The standard interior finish is white enamel.

A synchronising generator is required to provide timing pulses for the camera channel. It is not, however, supplied normally as part of a camera channel because a single synchronising generator can provide timing pulses for a number of camera channels. Synchronising generators are described in pamphlet Ref. TD.141.

Regulated power supply units are standard items that are used in various parts of the Marconi television system as well as in the camera channel. They are described in pamphlet Ref. TD. 142/2.

The focus supply unit provides power supplies to the camera focus coils. For studio applications (Type 1881) it is built as a small panel suitable for rack mounting whilst for mobile use up to four such units are assembled in a mobile case.

The camera channel output may be either composite or non-composite.

CAMERA Type BD.687

In all aspects of construction, size and weight have been kept to a minimum consistent with rigidity and strength. The camera, therefore, is robust and built to give maximum reliability in operation, and is shower proof.

Features

(1) Extreme accessibility and the use of plug-in units gives rapid and easy servicing facilities and provides greater spares utility.
(2) The four position turret is capable of carrying any combination from 2 in. to 40 in. lenses. 80 in. and zoom lenses may also be used.
(3) Light intensity control by variable graded filter replaces conventional remote iris control methods.
(4) Viewfinder may be set at any desired angle irrespective of camera elevation.
(5) " Rehearsal " facility giving 5% pick-up tube overscan.

A special version of the camera is also available to give complete remote control.

The equipment is built in three main parts—the camera, viewfinder and lens turret, and for transport purposes these can be carried separately. Carrying cases are provided for the turret and lenses, and the camera is designed to fit on a standard shock absorber mounting. Assembly is simply carried out and quick release devices afford rapid removal of individual units.

6474

FIG. 1. *The adjustable viewfinder greatly facilitates televising at difficult angles which, as this illustration shows, is of distinct advantage for OB work.*

Camera

The camera forms the main body of the equipment and is built on to a stout framework to which side covers are fitted. All case joints have rubber seals making for quietness of removal and good waterproofing.

The image orthicon tube together with its deflection and focus coils and associated vision amplifier—which are mounted on the yoke carriage assembly—form one compartment at the left hand side (viewed from the front of the camera). The vision amplifier is built on to a plug-in chassis. The yoke carriage runs on ball bearings and may be locked in position (as may be required when zoom lenses are used or during transit). The deflection coils may be " tilted " $\pm 45^\circ$ to give tilted pictures—a useful facility in some productions.

The tube is fitted from the front of the camera by a simple plug-in process. No blower is needed in this camera since the focus coils are designed for low temperature operation and electronic temperature control of the yoke heater winding is incorporated.

The centre compartment contains the lens change driving mechanism and, as an optional feature, motorised turret rotation can be provided with control being effected from the camera control unit. This latter may be required for entirely remotely-controlled operation including pan and tilt facilities.

On the other side, three units plug into a main chassis, which is itself hinged, and so ready access is afforded for servicing purposes. These sub-assemblies comprise the scanning generators, EHT generator and scan protection circuits ; and blanking mixer, focus modulator and vision amplifier output stages. High

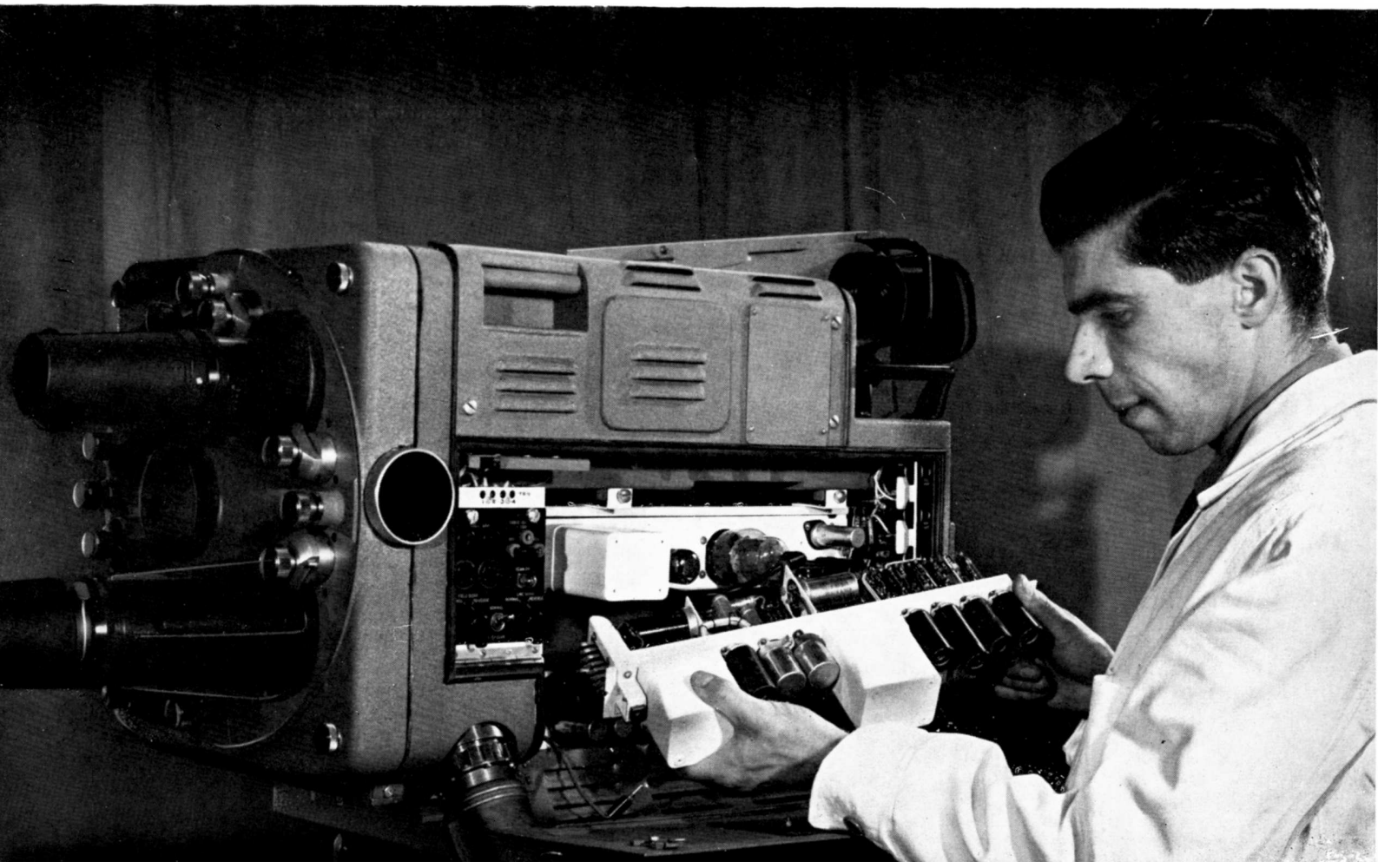
efficiency scanning systems are used and the need for linearity controls is eliminated by the careful application of negative feedback. A neon indicator shows the correct operation of the scan protection circuits. Pre-set controls, fuses, main cable plug and mains transformer are also accessible from this side of the camera.

The talk-back chassis forms the rear panel of the camera which carries jacks for connecting the cameramen's headset and microphone and two additional headsets and headphones. A microphone on/off switch and volume control are also provided. The controls on the camera are located behind a hinged door, which is open when the camera is in operation. This door carries a clip for holding a script and a small note tablet. The turret indexing handle is at the back of the camera, and the panning handle may be fitted into either side. Focusing is by means of a handle located on the camera on the operator's right hand side, operation of which brings the lever-operated focusing mechanism into action causing the yoke to travel. Cue lamps are suitably mounted on the camera. Provision is also made for fitting a panning handle on the body of the camera, which facility is of particular value when heavy lenses or zoom lenses are in use. The camera has a V block at the base and this is adjustable fore and aft to give a proper balance of weight with different lens combinations. The camera cable connector is of new design, being small in size and extremely flexible, and thereby creates less drag when panning. Two carrying handles are located in each side of the camera.

Lens Turret

Built on a sturdy light-alloy casting which actually forms the front of the camera, the turret accommodates four lenses. These are set on a 10-inch diameter circle which allows any lens combination from 2 to 40 in. to be used. The turret will mount one other lens as well as an 80 in. lens. The lenses may be speedily changed,

FIG. 2. *All the circuits of the camera are built on to plug-in sub-units whose removal and replacement is a simple matter.* 6475



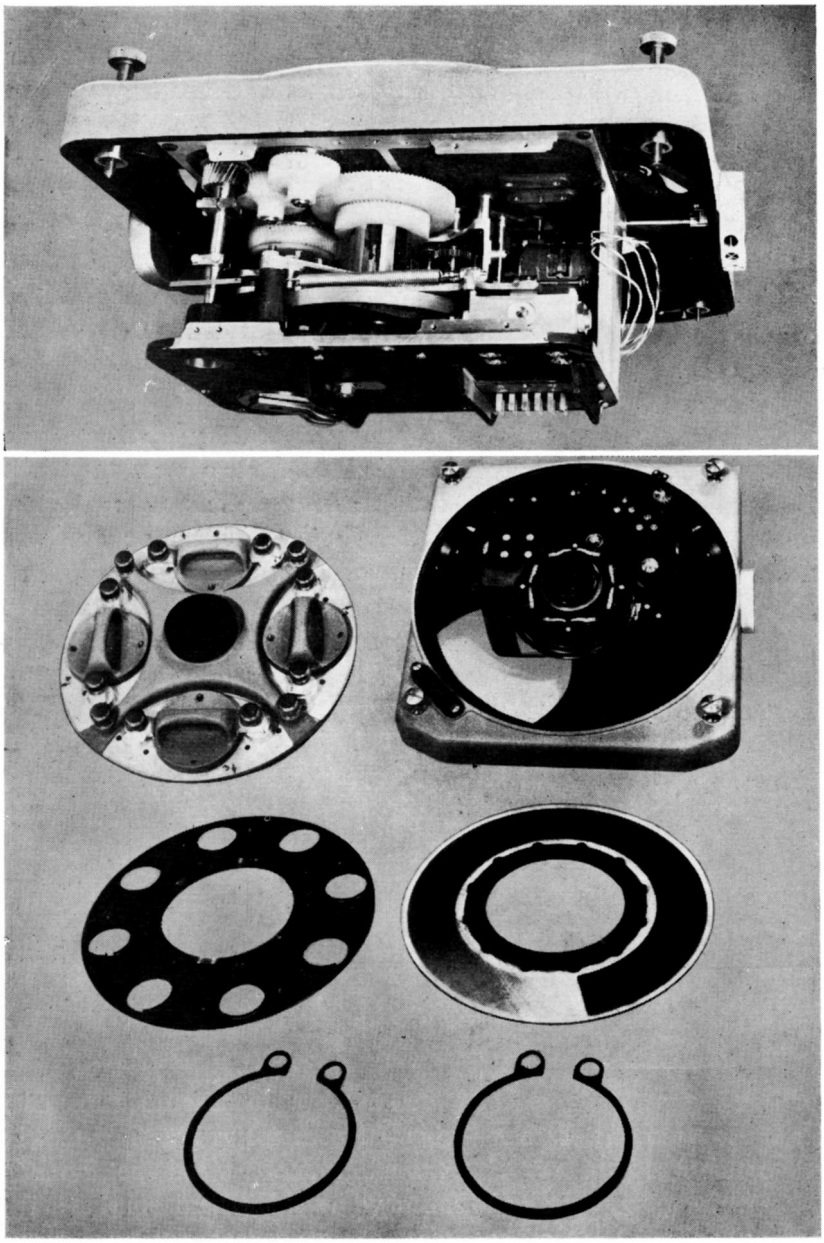


FIG. 3. *The main items of the lens turret are shown in this illustration which depicts, from top to bottom :—*

The gear box with its nylon wheels which make for quiet, smooth operation whilst being very durable and light in weight.

The main castings of magnesium alloy.

The filter wheels—one for carrying fixed filters, the other of variable density.

The retaining clips.

This lens turret is skilfully engineered and is exceedingly smooth in operation even when carrying the largest possible lens combinations.

6490

a half-turn on each of two knurled nuts being all that is necessary for their individual release. A zoom lens has a special mounting.

Turret indexing is achieved by means of a non-linear gearing mechanism so that the lens position may be changed by one revolution of the turret change handle at the rear of the camera, an action taking approximately one second. Two filter wheels are included in the turret ; one being fixed, the other variable. The fixed wheel has eight positions, four of which may be used for neutral density or colour filters, the others being left blank. It is manually operated from the front of the camera. The other filter is circularly graded having a 10 : 1 light transmission range and is remotely operated from the camera control position. This enables the iris to be set for a correct depth of focus, the amount of light depending on the filter setting. This technique marks a definite advance over conventional remote iris control.

The lens turret is held in position by means of four screws and may be quickly removed for transport or tube changing purposes. A cue lamp is fitted to the front of the turret.

Viewfinder

The top of the camera is recessed to take the viewfinder which is mounted on a counterpoise suspension, thus permitting extreme flexibility in operation and enabling the viewfinder to be set in any desired position. This facility is important in cases when the camera position needs to be close to the ground or directed

down from a parapet.

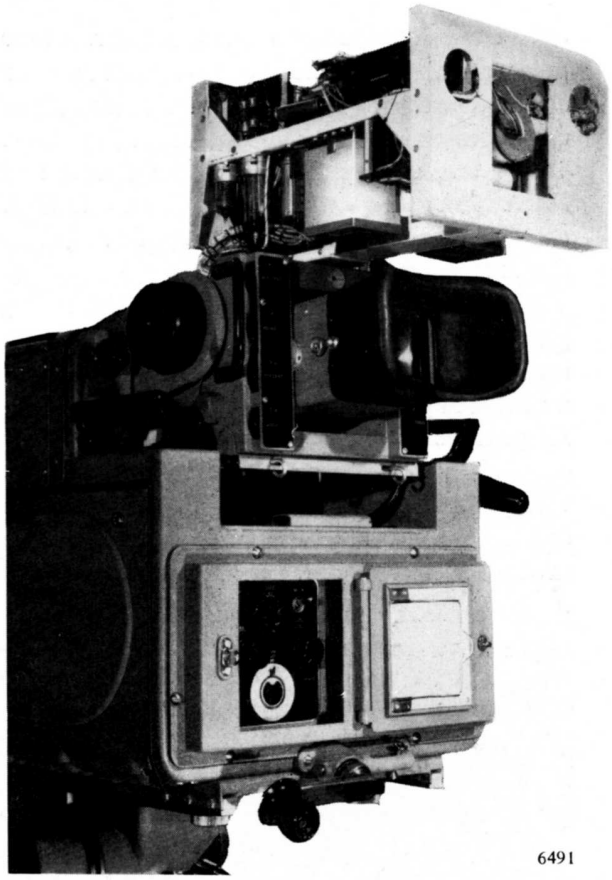
The viewfinder contains a 5-inch picture tube and associated EHT supply circuits, scanning generators and amplifier which are fitted on to a hinged frame. It is an easy matter to change a tube and this may be carried out with the viewfinder on the camera. A simple cover fits over the frame and is readily removable. A viewing hood fitted with a detachable lens having a magnification factor of two, clips on to the end of the unit. All controls are arranged around the hood, and are edge type ; no linearity control is required. Six perspex indicators are arranged along the lens edge to give cueing information to the cameraman. These indicate which lens is in use (four indicators) and whether the camera is " on-the-air " or switched to preview.

Interconnection between camera and viewfinder is made by means of two flexible plug-in leads. Extremely accessible in all respects, the viewfinder is removed from the camera by means of a quick-release device.

OPERATING CHARACTERISTICS

As the image brightness on the photo-cathode is increased the signal amplitude (as observed, e.g. on a waveform monitor) at first increases in a linear manner until a point is reached at which it tends to level off. Any increase in image brightness beyond this point will not cause a greater signal output. The characteristic is similar to that of a normal receiver with good delayed AGC. It is a valuable feature of the image orthicon, since it means that the scene illumination can change by large amounts without calling for any particular attention from the control operator or the camera-man. It is generally desirable to operate the tube so that peak high-lights come at or above the " knee " of the characteristic curve. Although the signal amplitude is limited by this characteristic, white detail is preserved by electron redistribution effects.

The image orthicon tube is inherently free from variable shading effects. The slight residual shading effects are independent of picture content and can be corrected by virtually



6491

FIG. 4. *The viewfinder completely opened up showing the hinged chassis construction. In this way every component is rendered accessible and tube changing may be carried out without actually removing the viewfinder from the camera.*

preset controls.

CIRCUIT DESCRIPTION

Camera

The vision signal output from the multiplier anode of the image orthicon is applied to a wide-band amplifier. This amplifier has a response that rises with frequency to compensate for HF loss in the image orthicon load. It consists of a high peaker pentode stage followed by a triode phase splitter and a three-stage negative feedback amplifier which is coupled to a further three-stage negative feedback amplifier having a double triode cathode follower output stage. Long time constants in the interstage coupling circuits ensure good low-frequency response.

The line scanning circuit is of the driven type,

standard line driving pulses being obtained from a separate synchronising generator. These pulses are amplified and inverted by one half of a double triode and then fed to the other half of this valve which forms the sawtooth generator. Two pentode amplification stages follow and the final output pentode is transformer loaded, overall negative feedback being applied to these stages to correct linearity.

Field drive is applied to the field scanning generator. In the first stage it is amplified and inverted by a triode. This stage is followed by a sawtooth generator and a two-stage amplifier. A pentode output amplifier is transformer coupled to the field deflection coils. Negative voltage feedback, obtained from the deflection coil circuit, is amplified and applied to the sawtooth amplifier. This feedback minimises the effect on the field scanning of transformer core saturation, amplifier non linearity and the ageing of valves.

Focus modulation is applied to both line and field circuits to ensure correct focusing at target edges. Line and field scan protection circuits safeguard the image orthicon target.

Field and line drives are combined in a mixer stage to produce a blanking signal which is clipped and amplified, then fed via a cathode follower output stage to the target electrode of the image orthicon.

The 1.3 kV EHT and other positive supplies required for the camera tube are obtained by amplifying and rectifying the pulse signal that appears across the line deflection coils. The pulse is amplified by a pentode which is inductively coupled via the primary of the output

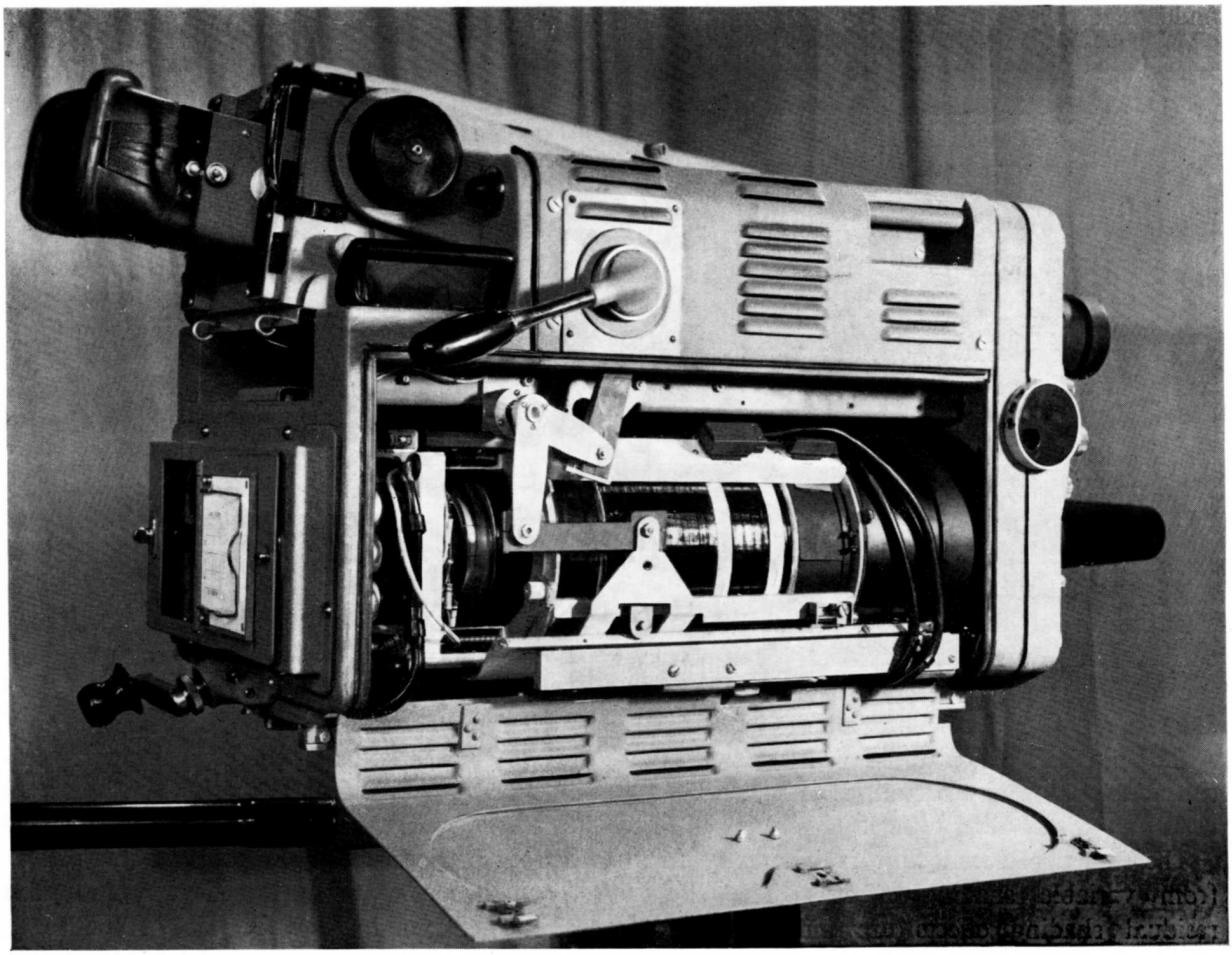


FIG. 5. *The side panels of the camera hinge open and on this side, the yoke assembly and focusing mechanism are revealed.*

6492

transformer to the metal rectifier circuit. The secondary of the transformer provides a photocathode supply at −700V.

Viewfinder

The electronic viewfinder comprises three main circuits, each of conventional design :

(a) A vision amplifier feeding the grid of the picture tube.

(b) A field scanning sawtooth generator and output amplifier.

(c) A line scanning sawtooth generator and output amplifier, the latter including an EHT generating circuit.

The vision amplifier employs two double triode stages each utilising single-coil high-frequency compensation in the anode circuit. In addition overall negative feedback is applied between second and fourth cathodes. These stages are AC-coupled, the DC component being restored at the output by a simple diode restorer. Adjustment is effected in the grid circuit of the first stage by means of a potentiometer to compensate for high-frequency loss when camera cable lengths of 500 ft. (152 m) or 1,000 ft. (305 m) are used.

The field scanning circuit is the directly driven type, standard field driving pulses being fed from the camera. These are amplified and inverted by one half of a double-triode amplifier, the other half of which forms the sawtooth generator. Two further double-triodes follow, the last of which has both sections in parallel and forms the output stage, being transformer-coupled to the low-impedance field deflection coils. The first two stages of the line scanning circuit are similar to those of the field circuit. The output stage uses a pentode transformer-coupled to the line deflection coils. Diode damping is employed, the amplitude of the sawtooth current wave being controlled by an adjustable inductor. The flyback pulse on the anode of the output valve is voltage tripled and rectified by metal rectifiers. Under working conditions a DC voltage of approximately 8 kV is produced which is applied directly to the final anode of the picture tube and via a potentiometer to the accelerator electrode.

CAMERA CONTROL CHASSIS
Type BD.626H

The camera control chassis contains the control and amplifier circuits necessary for the operation of the camera. It is usually associated with a Picture and Waveform Monitor Type BD.627, the two chassis being fitted into either a mobile case or a studio console, to form a camera control and preview monitor unit.

The main functions of the Camera Control Chassis are :

(a) To provide control of all the operational electrical adjustments of the camera.

(b) To receive the picture signal from the camera and to produce from it an output signal of standard characteristics. The process involves—correction of shading if necessary, amplification to standard level, equalisation of HF loss in camera cable, insertion of system blanking, clamping and adjustment of set-up and, finally, limitation of peak white to standard level.

(c) To provide cue and communication facilities with the associated camera and also from the producer, mixer, etc.

(d) To feed power and drives to the camera, viewfinder and associated monitor and to provide a junction point for circuits between the camera and associated equipment. This includes circuits for the remote control of camera focus and turret change. Provision is also made for adding a synchronising signal whilst a high impedance output makes it possible to distribute sync. to other camera channels.

(e) To feed back to the electronic viewfinder a properly adjusted picture signal.

New features incorporated in this unit include provision for the remote control of the output signal amplitude and set-up. This allows the controls for amplitude and set up of a number of camera channels to be grouped together for the use of one operator who, by previewing each channel as required and comparing it with the channel on the air, would be able to adjust the incoming channel to match the previous shot in set-up and control. One of the most difficult

operational problems in television is thereby solved.

Another new feature is the provision for mixing with the viewfinder picture the signal from another camera channel for setting up superimposition shots. Similarly, the signal from a grating generator may also be superimposed to show the camera operator what area of the raster to work in.

Power supplies for this unit are taken from the common channel regulated power supply source.

Construction

The unit consists of a flat chassis mounted by means of extensible runners upon a light cradle. At the rear of this cradle are mounted the camera cable socket, pulse and power input plugs, and picture output connector ; its upper surface is arranged to accommodate and make connection with the picture and waveform monitor chassis.

The chassis can be extended on runners from its housing for inspection or maintenance, and in this position all valves and components are directly accessible.

The wiring between the various connectors, which are stationary, and the withdrawable inner chassis, is covered with flexible rubber conduit that serves to guide and protect these cables.

All controls normally used are mounted on the front panel of the unit (see Fig. 6). The main operating controls have knobs conveniently placed in relation to the console desk surface or other support so that they can be used continuously without fatigue. The subsidiary controls are concealed beneath a small hinged cover plate. A meter is included on the front panel to indicate the position of the light control in the camera. This control can be operated remotely from the camera control chassis.

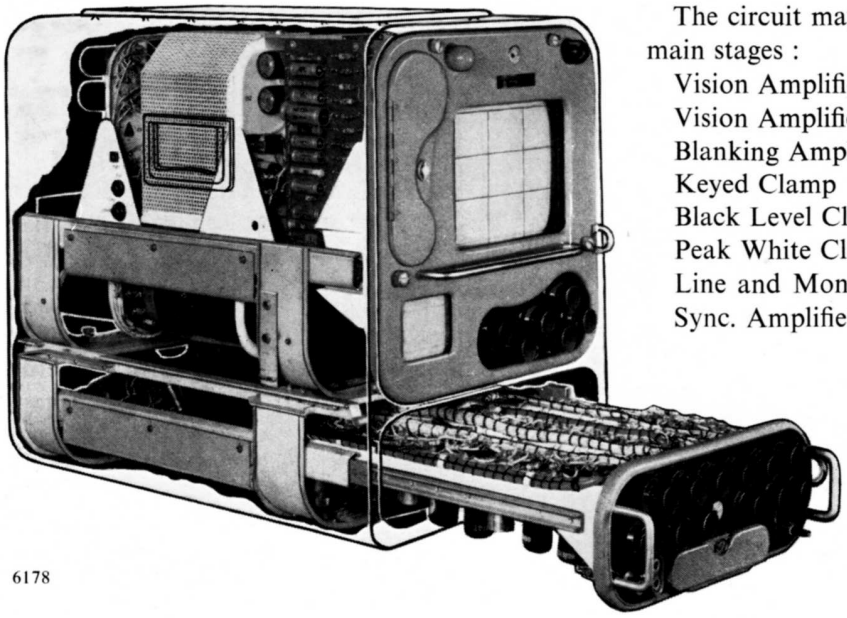
For use in studios the camera control chassis and associated picture and waveform monitor chassis are mounted together in a Studio Console Housing Type BD.650. For mobile applications they are assembled in a single Mobile Case Type BD.628. Details of cases and housings are given in pamphlet Ref. TD.143/2.

Circuit Description

The camera control chassis incorporates a video amplifier in which the incoming signal from the camera is clamped, blanked, clipped and, if necessary, has synchronising signals added. The final output is at standard level, white positive. Pulse shaping circuits for the development of clamp keying and the driving pulse amplifiers necessary to feed these signals to the camera and viewfinder are also included in the camera control unit.

The circuit may be divided into the following main stages :

Vision Amplifier
Vision Amplifier and Blanking Mixer
Blanking Amplifier and Clipper
Keyed Clamp
Black Level Clipper
Peak White Clipper
Line and Monitor Output
Sync. Amplifier and Clipper



6178

FIG. 6. *Detail of the combination of a Picture and Waveform Monitor Chassis and a Camera Control Chassis into one assembly is shown in this cutaway view. The lower unit is the Camera Control Chassis*

Viewfinder Output and Mixer
Line Drive Amplifier and Clipper
Line Shading Generator
Field Drive Amplifier and Clipper
Field Shading Generator.

The peak-white clipper is designed to avoid the overloading of subsequent apparatus, particularly transmission equipment, should the camera controls be misoperated. The viewfinder output stage is provided to feed processed picture signals back to the viewfinder over a coaxial line in the camera cable.

The high-frequency response of the video amplifier is maintained by the use of video peaking coils supplemented where necessary by cathode compensation. The latter is made variable in steps to allow for variation in high frequency loss with length of camera cable.

The pulse-shaping circuits are conventional and employ double-triode valves for the most part. To avoid the need for an external negative voltage supply for the image orthicon tube beam control and other purposes, a pulse-operated bias supply is incorporated in the camera control unit. Line and field shading controls and their associated saw-tooth generators are incorporated in the unit. These are provided in order that the optimum performance may be obtained from a given image orthicon tube under varying conditions.

A transformer for the valve heater supply is mounted in the unit. Apart from the heater supply all power is taken at 250 volts positive (regulated) from the common power supply source.

PICTURE AND WAVEFORM MONITOR CHASSIS
Type BD.627

The Picture and Waveform Monitor Chassis consists of a picture display tube on which a vision signal can be technically monitored, and a waveform tube which facilitates calibration. The monitor chassis is designed for a signal input at standard level, white positive.

This unit, together with other television monitors, is fully described in pamphlet Ref. TD 147.

INTERCOMMUNICATION

The successful production of a television programme demands a full system of intercommunication between various points in the channel. The producer and the technical director must be able to give instructions and cue signals to the announcers, commentators, camera-men, and control personnel. The camera-man and the control operator on each camera channel must be able to intercommunicate. Furthermore the programme sound must be distributed to the earphones of all key personnel.

These facilities may be provided on the Marconi camera channel by one of the following units, described in pamphlet Ref. TD 145 :

Mobile Communication Unit	Type BD.649
Studio Communication Unit	Type BD.671
Mobile Single-channel Communication Unit	Type BD.632

The Type BD.632 is used with a single camera channel. Where more than one camera channel is to be used, as is generally the case, the Type BD.649 or the Type BD.671 should be specified. Each is designed to handle up to four cameras and similar units may be added in parallel.

With such a communication system the arrangement is flexible but is generally as follows :

The producer has a high-grade microphone over which he can talk to all personnel ; the technical director and two others may parallel their microphones to this circuit. The output of these microphones, which is termed " talkback ", is distributed to one earpiece of the headphones of each camera-man, each camera control operator, the technical director, studio personnel (up to four in number) near each camera, and other key staff. Each camera-man has a telephone headset one earpiece of which is fed with talkback while the other has programme sound plus speech from his control operator (control room talkback). The camera-man can speak to his control operator or to the producer by switching his microphone into circuit. A calling circuit is provided (buzzer and lamp) between camera and camera control.

All talkback and programme sound circuits are amplified and volume controls are provided at the receiving points. A sufficiently high level is available to overcome ambient noise.

CAMERA CABLE

The camera cable supplied with the image orthicon camera has been specially developed to provide reliable service. Although the cable contains three 75-ohm coaxial lines and thirty other conductors for carrying control, communication and power supply circuits, the overall diameter is only $\frac{3}{4}$ inch (1.9 cm). Polyethylene insulation is used and the cores are built up to provide a high degree of flexibility. A metal braid protects the built-up cores and is, in turn, enclosed by an outer sheath of rubber.

Failure of conventional camera cable occurs mainly at the connectors. With this type of cable, failure has been reduced to negligible proportions by moulding the connectors directly onto the cable, the material being polyethylene with a metallic outer shell.

The cable is normally supplied in lengths of 50, 100 or 200 ft. (15, 30.5 or 61 m), but can be supplied in other lengths. It is also available with bulkhead connectors suitable for fitting to a studio wall or to the connection board of a mobile unit.

CAMERA LENSES

The standard range of lenses for use in the image orthicon camera includes those shown in the following table.

TABLE I

Focal Length	Relative Aperture	Type
2 in.	f/1.9	Standard
3 in.	f/1.9	Standard
5 in.	f/3.5	Standard
8 in.	f/4.5	Standard
12 in.	f/4.5	Telephoto
17 in.	f/5.6	Telephoto
25 in.	f/5.8	Folded Telescopic
40 in.	f/9.4	Folded Telescopic
80 in.	f/10	Cassegrain Reflecting

Notes : (1) *Lenses with focal lengths from 35 mm upwards, and intermediate between, or greater than, those quoted may also be obtained.*

(2) *Lenses of greater or smaller relative aperture can be supplied.*

Lens hoods are supplied to reduce lens flare from lights outside the picture area and to improve contrast. Lens boxes are supplied for the carriage of lenses on outside broadcasts.

TABLE II

Model	Range of focal length	Relative aperture	Maximum image diameter
75/6.7 (For studio use)	3 in. to 15 in. (7.6 cm to 38.1 cm)	Max. aperture through the entire zoom range is f/6.3. f/3.0 is available from 3 in. to 6.75 in. (17.1 cm) focal length thereafter decreasing linearly to f/6.3 at 15 in.	1.6 in. (4.06 cm)
75/13.4 (For outside broadcast use)	6 in. to 30 in. (15.2 cm to 76.2 cm)	Max. aperture through the entire zoom range is f/12.5. f/6.0 is available from 6 in. to 13.5 in. (34.3 cm) focal length thereafter decreasing linearly to f/12.5 at 30 in.	2.13 in. (5.4 cm)

	LENGTH	WIDTH	HEIGHT	WEIGHT
Approximate dimensions of both models (Lens only, without cradle support).	14 in. (35.6 cm)	7 in. (17.8 cm)	$8\frac{1}{2}$ in. (21.6 cm)	30 lb (13.6 kg)

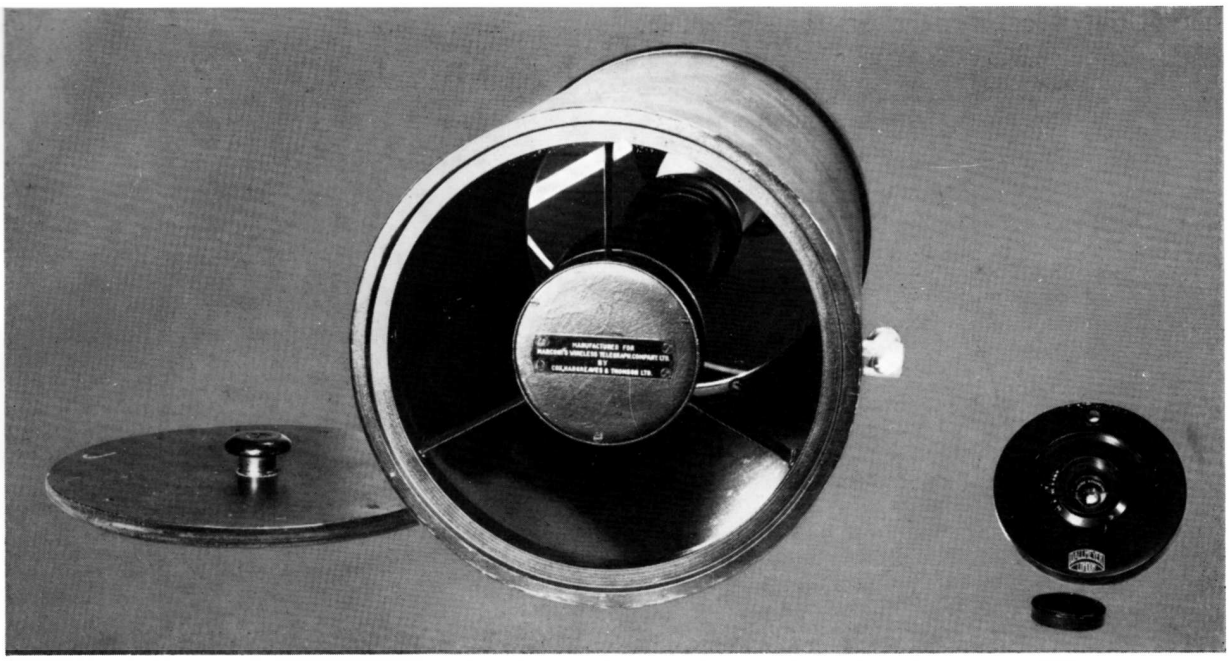


FIG. 7. *80-in. and 2-in. lenses, examples of the wide range that may be used on the Type BD.687 camera.* 6493

Zoom Lens

This is a special lens the focal length of which is continuously adjustable over a 5 : 1 range. By moving a control lever the camera operator can vary the viewing angle of the camera smoothly to produce either close-ups or distant shots while the camera itself remains stationary. This process is known as " zooming ". Once the subject is correctly focused it remains in focus through the entire zoom range. The lens may be focused on any object lying between 10 ft. 6 in. (3.2 m) of the camera and infinity. The relative aperture when once set remains constant while zooming, subject to the limitations indicated in table II.

The zoom lens has the same definition as a high quality camera lens of fixed focal length. It replaces the normal lens turret of a television camera and permits the standby camera (otherwise needed to cover lens changing on the main camera) to be dispensed with.

Two models of the zoom lens are available, as described in table II.

When the zoom lens is used with the camera both are supported on a special cradle which mounts on a standard friction head, the whole forming a well-balanced assembly.

AUXILIARY EQUIPMENT

Camera Cable Test Set Type BD.667C

To facilitate insulation and continuity tests on the camera cable a Camera Cable Test Set, Type BD.667C may be employed. Connection is made to the cable by plug and socket, and the individual cores may be switch-selected for testing purposes.

Waterproof Camera Cover

While the camera is reasonably waterproof, a cover is provided to protect it from long exposure to heavy rain.

Image Orthicon Transport Case Type BD.666

This metal case is specially designed for the carriage of a spare image orthicon tube, for example, by an outside broadcast unit. The tube is suspended in a sponge rubber mounting. The dimensions of the case are approximately 8 in. × 8 in. × 23 in. (20 cm × 20 cm × 58 cm).

Diascope Type BD.847

The Diascope is intended to be mounted on the camera turret in place of a normal taking lens so as to project an image of a test pattern or caption directly upon the photo-cathode of the tube.

Illumination is provided by a lamp fed from

the " Utility " socket on the camera. 2 in. × 2 in. slides having a 1.4 diagonal picture are used. The diascope has two main uses, as follows :—

Initial adjustment of camera—aspect ratio-etc.

" Caption " source.

Published by Marconi's Wireless Telegraph Company Limited, and printed in England 09057/300