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MARK V COMMUNICATIONS SYSTEM

THE SOUND which emerges from the loudspeaker of the television receiver is only one of many sound sources generated in a television studio. For every circuit carrying programme sound destined for eventual transmission there are many other circuits distributing the same programme sound. The artistic and technical people need it, in order to keep in touch with production, together with additional speech circuits for intercommunication between the various production areas, to enable the producer to control all phases of a complex operation, and to enable his key assistants to communicate with him, with one another, and with the operators they directly control. These ancillary sound circuits are provided by a 'Communications System', of which the Marconi Mark V is the latest development, being designed basically for use with the Mark V image orthicon cameras, though fully compatible with both earlier designs and with the Mark VI and Mark VII cameras.

THE COMMUNICATIONS UNIT

The basic facilities supplied by the Communications System are to provide a distribution system for programme sound, intercommunication circuits between all concerned, and a routing of cues and standards switching facilities to cameras. At the heart of the system is the Marconi Mark V Cue and Communication Unit (Fig. 1), housed in a standard 19×7 in. frame, which can be mounted in a rack or cabinet.

Only the left-hand half of the available space in the frame is used in the basic model, and this accommodates (a) a plug-in 24-V d.c power-supply unit, (b) two plug-in talkback amplifiers, each of which is a dual unit, consisting of two identical solid-state amplifiers, electrically separate, though mounted on the same printed wiring board, and (c) a back-mounting assembly, into which the power-supply unit and amplifiers plug, and which has all the necessary plugs and sockets on its rear face for making connection to the rest of the system. In addition, within the back-mounting assembly are housed the plug-in relays and resistive networks needed for the routing and level correction of the various circuits. These relays are controlled by keys on panels normally located near to the staff in the various control rooms in the television studio complex, who make use of the intercommunication facilities provided by the system. More will be said about these panels in the description of a typical system.

The Mark V Cue and Communication Unit basically consists of four amplifiers, a power-supply unit, and relays, all occupying half a standard frame. In the remaining space can be fitted identical equipment for a second studio complex, or any combination of amplifiers and power supplies permitted by the size of the available space and a non-standard back-mounting assembly to cater for special requirements, additional to the facilities provided by the basic equipment. As no two television authorities appear to have

the same ideas, when it comes to specifying requirements for intercommunication facilities, the arrangement adopted in the Mark V Cue and Communication Unit provides for both the basic needs, common to the majority of system requirements, and space for extra amplifiers and relays to cater for the additional specialized requirements of any authority. This flexibility enables the amount of 'custom building' to be kept to a minimum.

UNIT FACILITIES

Considering only the basic system (left-hand half of frame only equipped), the following facilities are provided;

- (1) An amplifier which is always fed with the audio output from the studio ('Programme Sound', or PS).
- (2) An amplifier which is always fed from the talkback microphone of the producer ('Talkback' or TB).
- (3) An amplifier which is always fed, through a five-input resistive mixer, from the microphones in the cameramen's headsets ('Mixed Camera Talkback', or MCTB).

- (4) An amplifier which is fed either from microphones at all CCU's (for use in older systems where each camera has a CCU operator), with all microphones connected via a five-input resistive mixer, or, in modern 'hands-off' working, from the microphone of one man situated at a control position from which all five cameras can be operated ('Mixed Control Room Talkback', or MCRTB).

- (5) Five calling relays, one per camera. When not operated, communication is between the cameraman and the associated CCU operator on a one-to-one basis. When operated, each relay also connects the senior vision engineer to the cameraman. When all five relays are in use together (a system known as 'omnibus working') all mixed camera talkback and mixed control room talkback circuits are commoned together, allowing the five cameramen and the senior vision engineer to talk to one another. The calling relays are controlled by keys on the panel at the senior vision engineer's position.

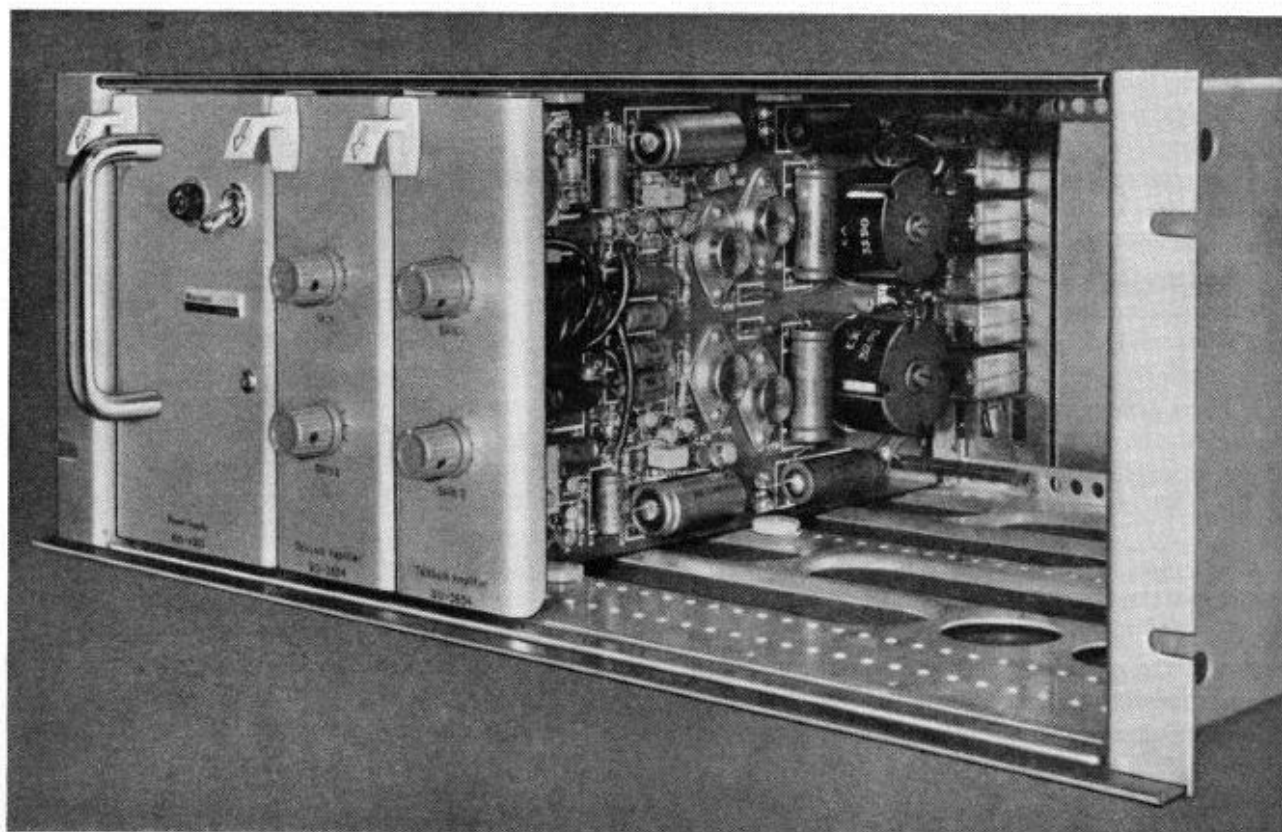


Fig. 1. Mark V Cue and Communication unit.

- (6) Three calling relays, controlled by keys at the producer's position, which enable the producer to talk to three separate people, who are not normally obtaining a full-time feed of talkback, via his talkback microphone.
- (7) A relay to connect the output of the talkback amplifier to a power amplifier feeding one or more loudspeakers in the studio. This facility, which is only available during rehearsals, allows the producer to talk to people in the studio, the loudspeaker in the control room being automatically muted to prevent 'howl round'.
- (8) A relay for use with remote control of systems switching of cameras, etc., full switching between 405-, 525- and 625-line systems, in the case of the Mark IV camera channels, but only between 525- and 625-line systems with the Mark V cameras.
- (9) A relay, which, with the Mark V cameras only, gives an 'Emergency Call Producer' facility. Each cameraman has a key which enables him to talk directly to the producer

via the programme sound loudspeaker in the production control room.

- (10) Routing of 'on air' cue circuits from vision mixer to cameras.
- (11) A supply of power for the amplifiers in the system, and for carbon microphones in any headsets so fitted.

Each of the four identical amplifiers mentioned above (sections 1 to 4) occupies one-half of a talkback amplifier as illustrated in Fig. 2, and can handle inputs from 30- Ω or 600- Ω sources. Alternative outputs can feed either a variable headphone load of from 200 Ω to 4.7 k Ω , shunted by up to 0.1 μ F, or provide up to 1 W of audio power into a 3- Ω loudspeaker. The gain is 96 dB \pm 2 dB between 600- Ω terminations, the noise level less than -120 dBm referred to the input; harmonic distortion less than 3%, with an input of -25 dBm and giving an output of +30 dBm into a 200- Ω load; frequency response tailored to reduce listener fatigue, with roll-offs at each end of the spectrum, as shown in Fig. 3. Experience has shown that with this type of frequency response cameramen and others wearing headsets become less tired than when an amplifier with a level

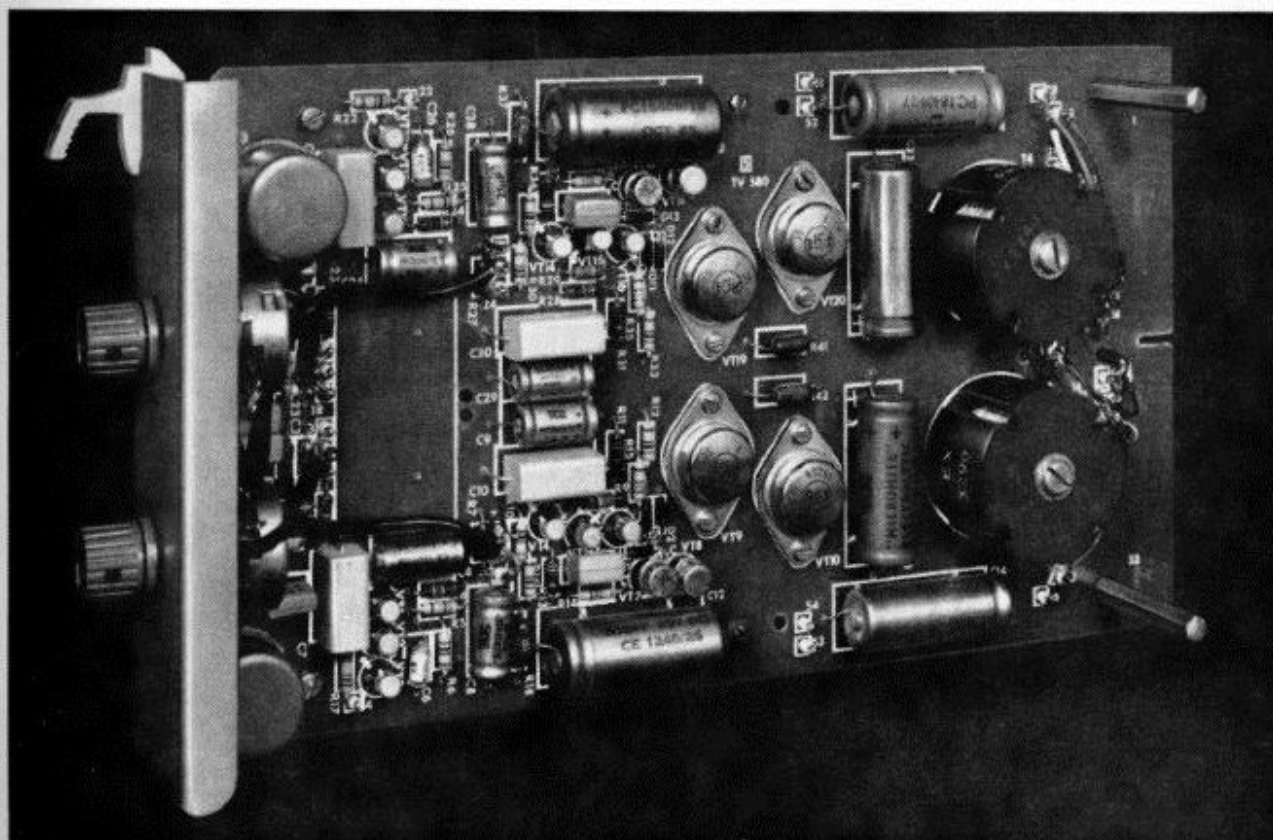


Fig. 2. Talkback amplifier.

frequency response is used. Level response can produce over-emphasis of high-frequency components when used in a system with long cable runs, due to the capacitance of the long cable. For the cameraman freedom from annoyance is especially important, as he is then less likely to push the headset off his ears, with its attendant risk of talkback being picked up by an adjacent programme microphone. A further optional refinement is a simple a.g.c circuit for restricting the output level increase when the input level rises. Any cameraman who has been on the receiving end of talkback from an excitable producer will probably appreciate this facility!

A simplified diagram of the set-up in a typical studio is shown in Fig. 4, and from this it can be seen that in addition to the Cue and Communication Unit, small control panels are required for the producer, the senior vision engineer, and, if more amplifiers are added to the basic system, as mentioned earlier, for the sound engineer and the lighting director. Some loudspeakers, with small power amplifiers, are also required. The production talkback panel shown in Fig. 5 provides facilities for the producer, giving him a microphone (with 'cut' key), a socket for an alternative headset, three 'calling' keys, a key to put his talkback onto the studio loudspeakers during rehearsal, and a selector key for routing programme sound plus mixed camera talkback or mixed control

room talkback to the loudspeaker in the production control room. In addition, he has controls for adjusting the relative levels of the available inputs, and a loudspeaker volume control. As an extra facility, a microphone for the programme assistant (PA) can be paralleled with the producer's microphone. A separate head-set socket can also be fitted, to give the PA feeds of programme sound, talkback and mixed camera talkback.

The senior vision engineer is provided with an engineering talkback panel illustrated in Fig. 6. This panel has a microphone, with 'cut' key, a socket for an alternative headset, five 'calling' keys for use with up to five cameras, and inputs of programme sound, talkback and mixed camera talkback, each with a level control for adjustment of relative levels. There is also a loudspeaker volume control.

At each camera control unit (CCU) there is provision for a microphone and a headset. This microphone normally feeds (via a microphone amplifier in the CCU), the headset of the cameraman at the associated camera, and also provides an input to the mixed control room talkback amplifier. However, when the senior vision engineer calls that camera, he is connected to the cameraman, the CCU operator loses his direct connection, but is reconnected via the mixed control room talkback amplifier. In a similar fashion, the cameraman's microphone in his headset

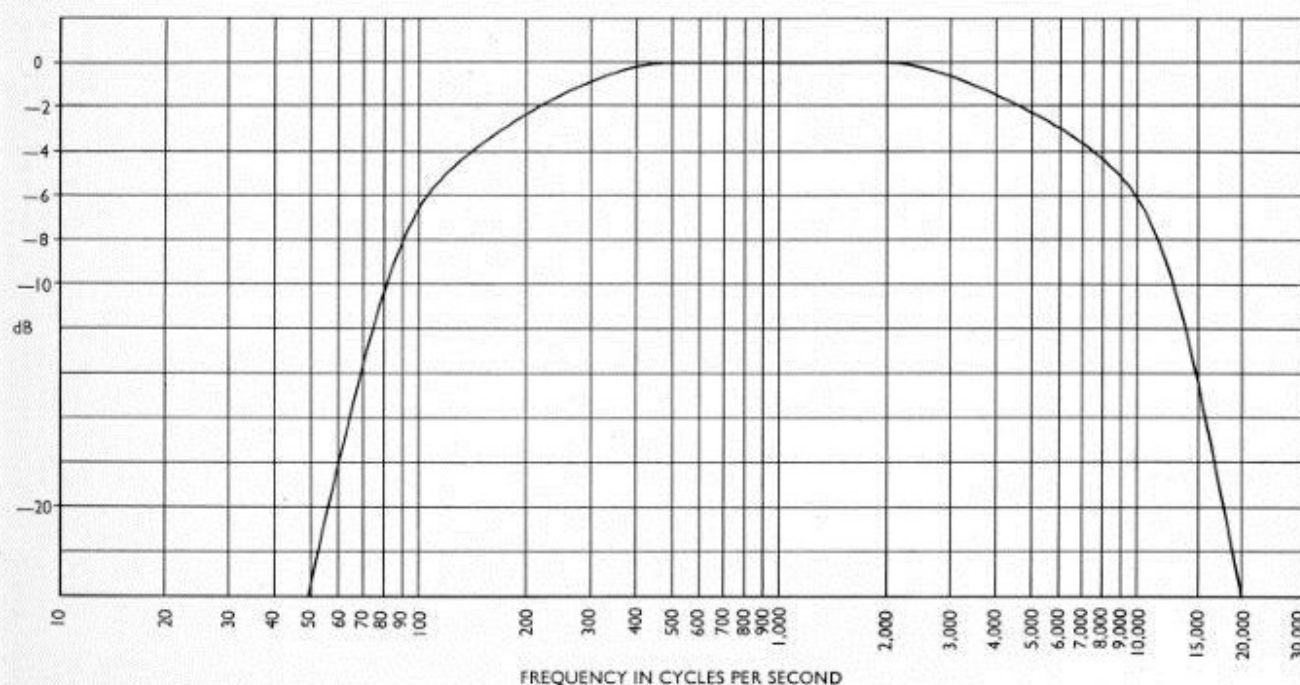


Fig. 3. Typical frequency response of talkback amplifier.

MCRTB, mixed control room TB; MCTB, mixed camera TB; CTB, camera TB; CRTB, control room TB; TB, talk back; PS, programme sound; BTB, boom TB; LTB, lighting TB.

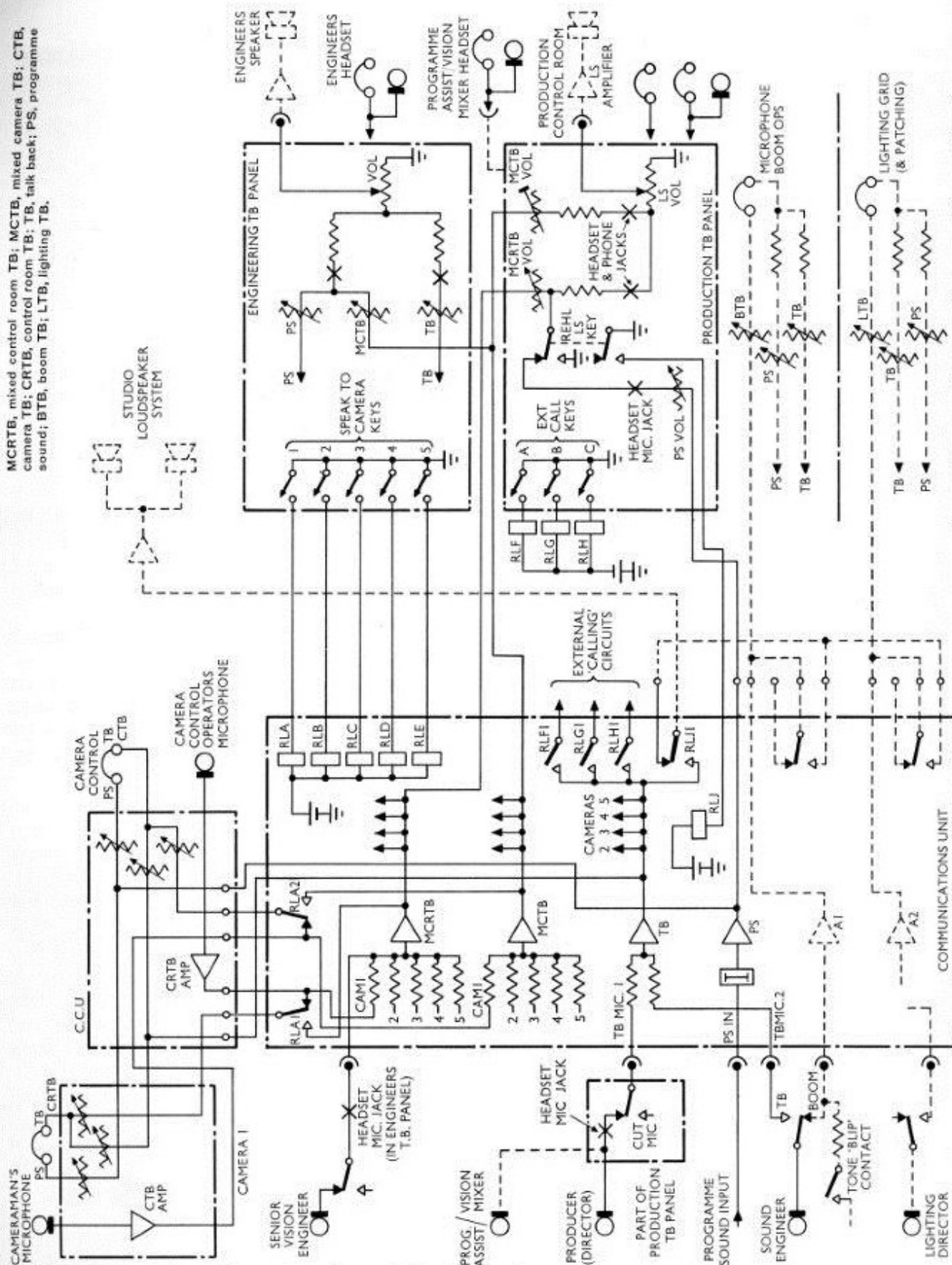


Fig. 4. Facilities diagram of Mark V Communication System (studio). Facilities shown dotted are not provided as standard but show methods of extending the standard system.

is normally connected (via a microphone amplifier in the camera) to the headset of the CCU operator. When the senior vision engineer calls the camera, the output of the cameraman's microphone amplifier is

reconnected to the CCU operator via the mixed control room talkback amplifier. This arrangement gives a direct, and private, connection between the CCU operator and the cameraman during initial setting-up of the camera channel. However when the camera is in use during a production, and the CCU is unmanned (for 'hands-off' working), the senior vision engineer is in contact with one or all cameramen as required. When 'hands-off' working is not possible, the CCU operator also receives feeds of programme sound and talkback with level controls provided for each input.

At the camera there is a socket for the cameraman's headset, 'call CCU' and 'Mic On' keys, and, with the Mark V camera only, there is an 'Emergency Call Producer' key which gives the cameraman direct access to the producer via his loudspeaker, irrespective of whether the producer has deliberately elected not to listen to mixed camera talkback. The cameraman receives feeds of programme sound, talkback and either CCU operator or mixed control room talkback. In addition, an 'On Air' cue is routed to the camera from the vision mixer whenever that camera is selected.

If required, talkback between sound engineer and producer, the sound engineer and his boom operators, and between the lighting director and the lighting grid can also be provided using an extra talkback amplifier, power-supply unit and back-mounting assembly equipped with only those relays needed to provide

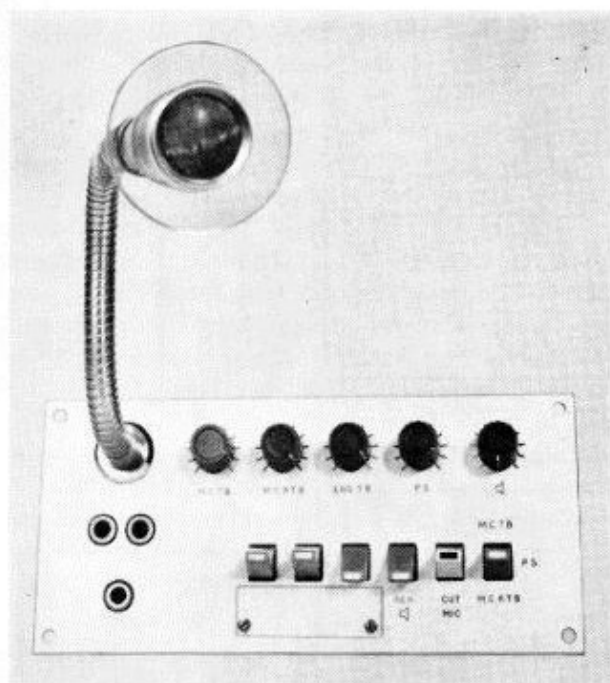


Fig. 5. Production talkback panel.

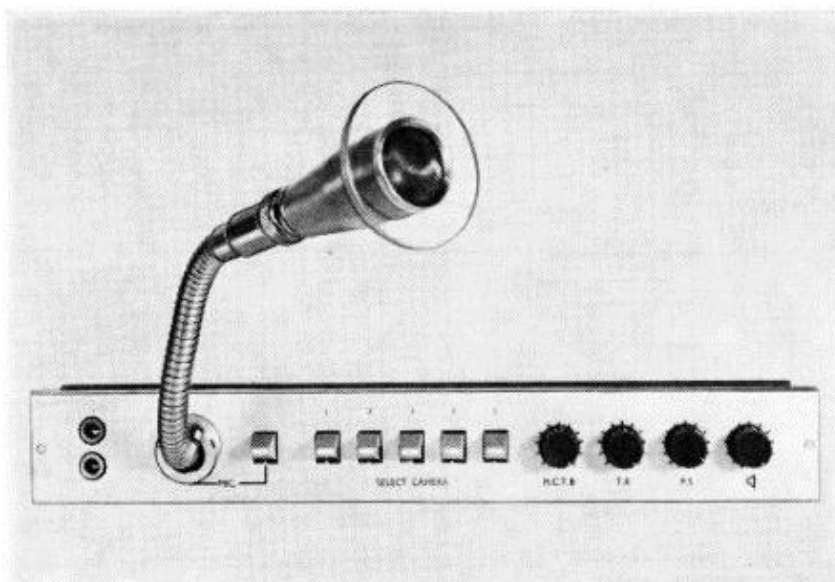


Fig. 6. Engineering talkback panel.

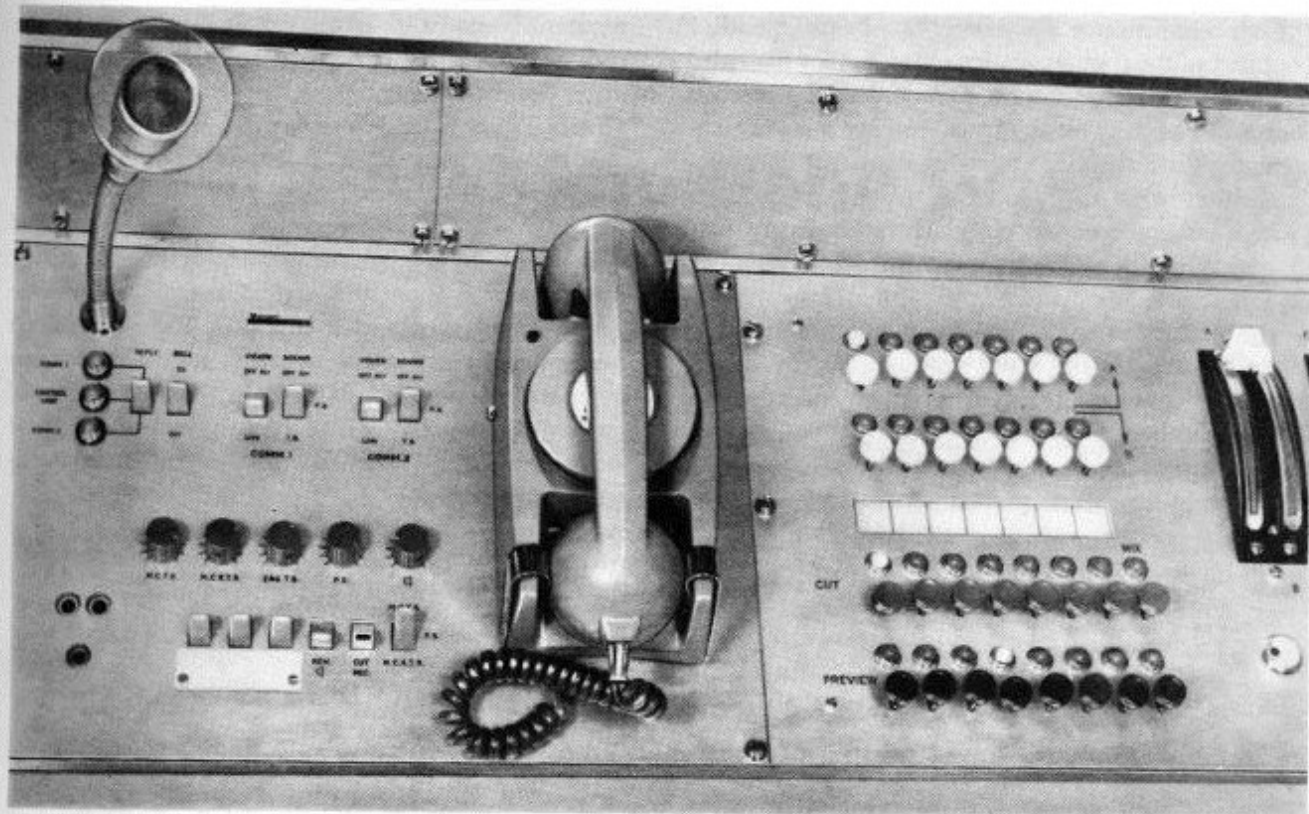


Fig. 7. Production talkback and communications panel.

the extra facilities. These extra units are housed in the right-hand half of the frame of the Cue and Communication Unit.

An outside broadcast van can be considered as a mobile control room, with the 'studio' covering a very large area, giving much longer lines of communication to cameras which can be widely dispersed. Instead of the programme microphones used in the normal studio, commentator's microphones and effects microphones are required. The need for good communication facilities between the personnel in the van and the cameramen is similar to the indoor case in the studio, but a new requirement is good communication between the producer and commentators. The small production talkback panel used in the studio is not adequate for use in an OB van, and is replaced by the production talkback and communications panel. This incorporates the studio panel, and is shown *in situ* in an OB van in Fig. 7. In addition to giving the producer all the studio facilities it has a telephone handset and ringer, with keys to enable the producer to talk to either of two commentators, or over an order wire to the studio centre to which the programme is being sent. There are also keys to route 'Off Air' or 'Line' video signals to one or two commentators, who also

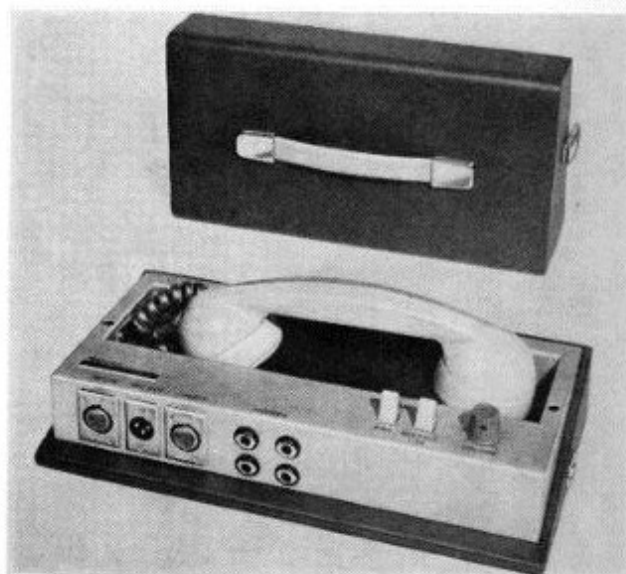


Fig. 8. Commentator's communication unit.

receive feeds of programme sound, off air sound or talkback, and a calling light and bell, which can be muted if required, to indicate an incoming telephone call.

Each commentator's position has a picture monitor (not part of the communications system) for his video input, and a commentator's communications unit, as shown in Fig. 8. This unit has a socket for the commentator's microphone, telephone handset for communication with the producer, jacks for headsets (with a volume control) on which can be heard programme sound or talkback from the producer, and two keys. The first key operates the calling lamp and bell on the production talkback and communications panel in the OB van, at the same time muting the output from the commentator's programme microphone. The second key, labelled 'Keep Mic Alive', cancels the muting imposed by the 'calling' key. This facility is for use when some person other than the com-

mentator, and who is out of pick-up range of the commentator's microphone, wishes to talk to the producer whilst the commentator is still on the air. (*There is no need for calling facilities between the producer and the commentator as the producer's talkback can be switched to the commentator's headphones.*)

The Mark V Communication System consists of equipments which are designed to fulfil all the basic intercommunication and distribution of programme sound requirements of a studio or OB van, and yet possess sufficient spare capacity to enable a more complex system to be built up with the minimum of custom manufacture to meet the demands of those users needing a system tailored to meet their particular requirements.