Mrs Goodman

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This historic picture shows the cameraman making his final preparations for televising the Coronation Procession of King George VI from Hyde Park Corner.

TWENTY FIVE YEARS OF

The Post Office has played—and continues to play—an important part in television outside broadcasting since the day in 1937 when the world's first live public television pictures were broadcast

TWENTY-FIVE years ago the BBC made world history by broadcasting on a public television service the first live outside broadcast pictures. The date was May 12, 1937, the place Hyde Park Corner and the occasion the Coronation Procession of King George VI.

The BBC's television service had been opened at Alexandra Palace on November 2, 1936, and it was obvious from the start that there was a need to venture outside the studio for programmes. To make this possible, the Post Office, early in 1936, laid a special balanced-pair cable connecting potential sources of outside broadcast programmes to Alexandra Palace. The cable was routed to provide a vision connection from Grosvenor House, Apsley House, London Pavilion, St. James's Palace, Buckingham Palace, Victoria Station, Horse Guards, the Cenotaph, St. Margaret's Church and Broadcasting House.

The balanced-pair type of cable was chosen because its configuration minimises interference with a video signal from external sources at low frequencies, against which the lead sheath of the cable provides little screening effect. The diameter of the cable, including the lead sheath, is just under one inch and repeaters, capable of equalising

and amplifying the vision signal after passing over up to eight miles of cable, were installed at Broadcasting House and Alexandra Palace.

For the first outside broadcast a 60 Mc/s radio link was set up by the BBC from Hyde Park Corner to Alexandra Palace and held in reserve in case the cable circuit failed. In the BBC's first camera the tube used (known as an Emitron, or iconoscope, pick-up tube and the best then available) was an awkward shape, which meant a bulky camera. It was also rather insensitive and required very bright illumination to give a satisfactory picture.

Each outside broadcasting unit was made up of four vehicles, each about the size of a large motor-coach. One vehicle was the mobile control room which contained the control and operation equipment of three cameras and accompanying sound facilities. The other three vehicles contained a diesel generator to provide the power supply when the local public supply was inadequate or unavailable, a vision radio-link transmitter, operating on a frequency of approximately 60 Mc/s with a peak power of 1 Kw, and an extending ladder to raise the transmitting aerial to a height of up to 80 feet.

TV OBs

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Pre-war developments

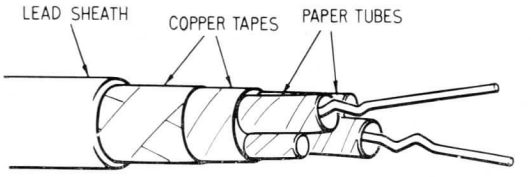
In November, 1937, cameras with the Super-Emitron, or image iconoscope pick-up tubes, were brought into service. This tube has a close family resemblance to the Emitron, but far less illumination is needed because its sensitivity is about ten times greater. From 1937 to 1939, great strides were made in improving television outside broadcast cameras and links and as a result picture quality improved, cameras and associated equipment became more portable and the outside broadcast coverage expanded to include the whole of the London area.

The BBC at first suffered severe interference with the reception of the radio-link signals at Alexandra Palace and early in 1938 a receiving station for radio links was set up at Swains Lane on Highgate Hill. The balanced-pair cable was intercepted so that vision signals received at Swains Lane could be relayed three miles to Alexandra Palace. The radio links had been chosen to operate at about 60 Mc/s because at that time this frequency was available for mobile links and gave the best chance of achieving satisfactory vision circuits from the fringe of London. The equipment was very bulky but did not need an optical path. The special balanced-pair cable provided an excellent vision circuit but the number of sources of programme within the range of its connection points—the cameras had cables which could only be extended up to 1000 feet—was very limited.

In early 1938, BBC engineers developed a technique for equalising pairs in ordinary telephone cables so that vision signals could be passed over them for limited distances. This allowed the balanced-pair cable to be exploited much more freely, because the mobile control room no longer had to be immediately adjacent to the balanced-pair connection point. The balanced-pair cable had been taken into only one telephone exchange, but, with the introduction of transmission over telephone pairs, spurs were provided into Mayfair and Gerrard exchanges.

The first broadcast using this form of transmission was on May 6, 1938, when an outside broadcast took place from news-film studios in Soho Square. The vision signal was relayed over about three-quarters of a mile of telephone pair in an ordinary subscribers distribution cable to Gerrard Telephone Exchange. Here, equalisation and amplification for the telephone pair was provided by the BBC, using a special repeater before connecting the balanced-pair cable to Alexandra Palace.

The summer of 1938 saw the addition of a number of extensions to the balanced-pair network,



The special balanced pair cable as used on the first television outside broadcast.

notably at Olympia, Earls Court and Fulham Telephone Exchange. An increasing number of broadcasts using telephone pair techniques was undertaken before the BBC Television Service closed on September 1, 1939. While only four broadcasts had used Post Office telephone cables from May, 1937 to September, 1938, more than 80 were made over varying lengths of telephone cable during the following 12 months.

Post-war Progress

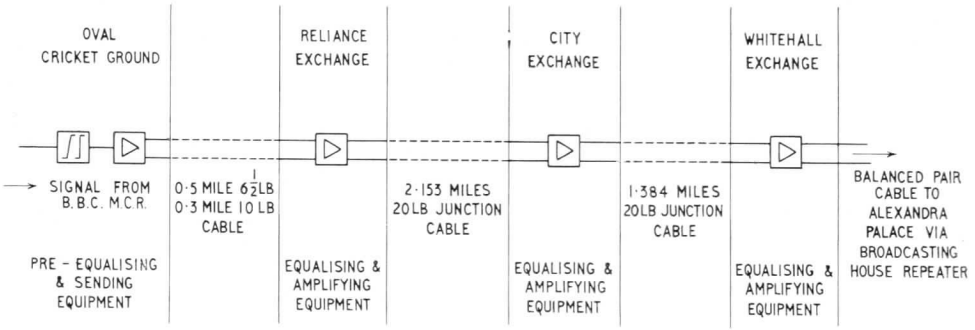
Before the BBC's Television Service was re-opened on June 7, 1946, it had been decided that the Post Office would increase the flexibility of the balanced-pair cable by providing new connection points or short spurs and repeaters for equalising and amplifying telephone pairs.

Additional outside broadcast links on new routes would be provided on coaxial cables to use new techniques of carrier transmission which were being developed. The BBC would continue to provide any temporary point-to-point radio links for television outside broadcasts and the Broadcasting House repeater equipment for the balanced pair cable, which had been destroyed by enemy action, was replaced.

When the Victory Parade was broadcast on June 8, 1946, the special balanced-pair cable had to be cut and extended to the BBC's mobile control room set opposite the saluting base in Pall Mall. The Post Office provided its first vision circuit on telephone pair for a broadcast from the Dorchester Hotel on June 21, 1946, when a telephone pair to Mayfair exchange was equalised and amplified, for connection to the balanced-pair cable. For the Test Match broadcasts from Lords in June, 1946, a length of single pair 0.375-inch coaxial cable was laid at short notice from Museum to Cunningham Telephone Exchange, with a spur from Cunningham to Lords cricket ground, so that a trial of 7 Mc/s double-sideband carrier transmission equipment could be made. The broadcast was a success and valuable experience was gained for the design of the television carrier equipment for coaxial cables.

For the Test Match from the Oval in August, 1946, the Post Office provided what was then considered an ambitious outside broadcast vision circuit. Three telephone pair sections were equalised and amplified before connection to the balanced-pair cable at Whitehall Exchange. A coaxial cable was laid later on this route, but the original method of provision on several types of telephone pair cables did much to confirm earlier tests which showed the value and capabilities of tandem connected sections of telephone pairs, each section being equipped with vision repeaters.

Post Office development of fully engineered carrier equipment for use on coaxial cables and variable equaliser-amplifiers (or repeaters) for telephone pairs proceeded steadily over the next few years. Meanwhile, the number of vision circuits provided by the Post Office on cables—including the balanced pair—in the London area gradually increased and from June, 1946, to June, 1949, the Post Office produced 140 of them. The vision circuits for the wedding of Princess Elizabeth in November, 1947, and for the silver wedding procession of King George VI and Queen Elizabeth in April, 1948, were provided mainly on the balanced-pair cable. On the former broadcast, two experimental cameras, fitted with the new cathode-potential stabilized Emitron tube were used. This tube was more sensitive than its two predecessors and although it could become unstable with bright flashes of light, it found some application in



This diagram illustrates the circuit arrangement adopted for televising the Test Match from the Oval in 1946.

outside broadcasts until the even more sensitive image-orthicon camera tube came into use in 1949.

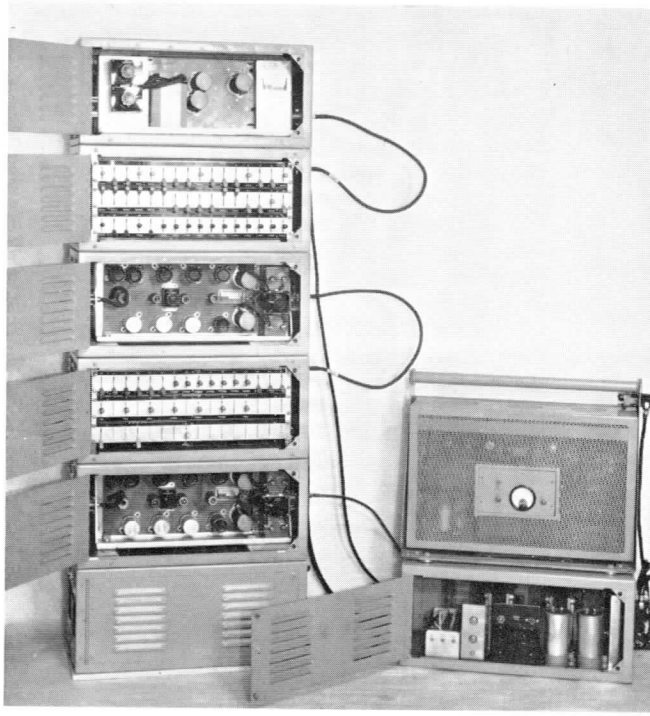
For the Olympic Games in July, 1948, a coaxial cable was laid from the Wembley Pool and Stadium to Wembley Exchange to connect with coaxial pairs through Elgar, Ladbrooke and Cunningham Telephone Exchanges to Museum. The first year in which the Boat Race broadcast involved Post Office vision cable links was 1949. The carrier equipment used on coaxial cables went through several stages of development but was finally produced in a form very similar to that adopted for main links.

On telephone pairs an unbalanced-to-balance send unit is required and repeaters are fitted at convenient points, such as exchanges, so long as the cable loss of a repeater section is not greater than about 60 db at 3 Mc/s—equivalent to about 0.75 miles of 6½ lb conductor, or 1.0 miles of 10 lb or 1.5 miles of 20 lb. Considerable improvements were made between 1948-1952, and small wheeled racks were introduced to make the repeaters more transportable. Normally up to four repeaters of this type can be connected in tandem but sometimes up to eight have been used. The method introduced by the Post Office for adjusting telephone pair repeaters depends on the visual observation of the waveform response of the vision circuit. Pulses of known shape and repetition rate are transmitted over the telephone pair and through the repeater and are then displayed on a cathode-ray oscillograph. The repeater is adjusted to give a pulse at the output whose shape is as near as possible to that of the sent pulse. When several repeaters are connected in tandem, the observation and adjustment is carried out at each repeater in turn, beginning with the one nearest the sending end. This waveform technique greatly simplifies the lining up of vision circuits.

Mobile Control Rooms

Mobile Control Rooms brought into service by the BBC after World War Two were more compact than the two used before the war, and improvements in cameras have resulted in the image-orthicon becoming the accepted type of camera tube for outside broadcasts, except where space is at a premium and the smaller vidicon tube camera is used.

There have also been post-war developments in the outside broadcast radio links. As Band I became occupied by television stations and 60



An early type of Post Office telephone pair repeater.

Mc/s links more difficult to use, radio links operating on about 200 Mc/s were brought into service by the BBC. During 1948-1950, microwave radio links, which require line-of-sight paths and operate in the band 4400-4800 Mc/s, became available and the BBC began using them.

In December, 1949, with the opening of the BBC's Television transmitter at Sutton Coldfield and the introduction of a both-way television link between London and Birmingham, the field of outside broadcasts was extended to the Midlands. In 1951 and 1952, BBC television outside broadcasts expanded to the North, Wales and the West.

The Post Office initially met the BBC's requirements for outside broadcasts in the provinces by employing mobile and enthusiastic teams from London, but it was soon clear that more teams would be required as the network grew to give national coverage. So new Post Office teams were set up at Manchester and Cardiff and later at Edinburgh and Birmingham and new and more portable types of telephone pair repeaters were developed for their use. The development of cable

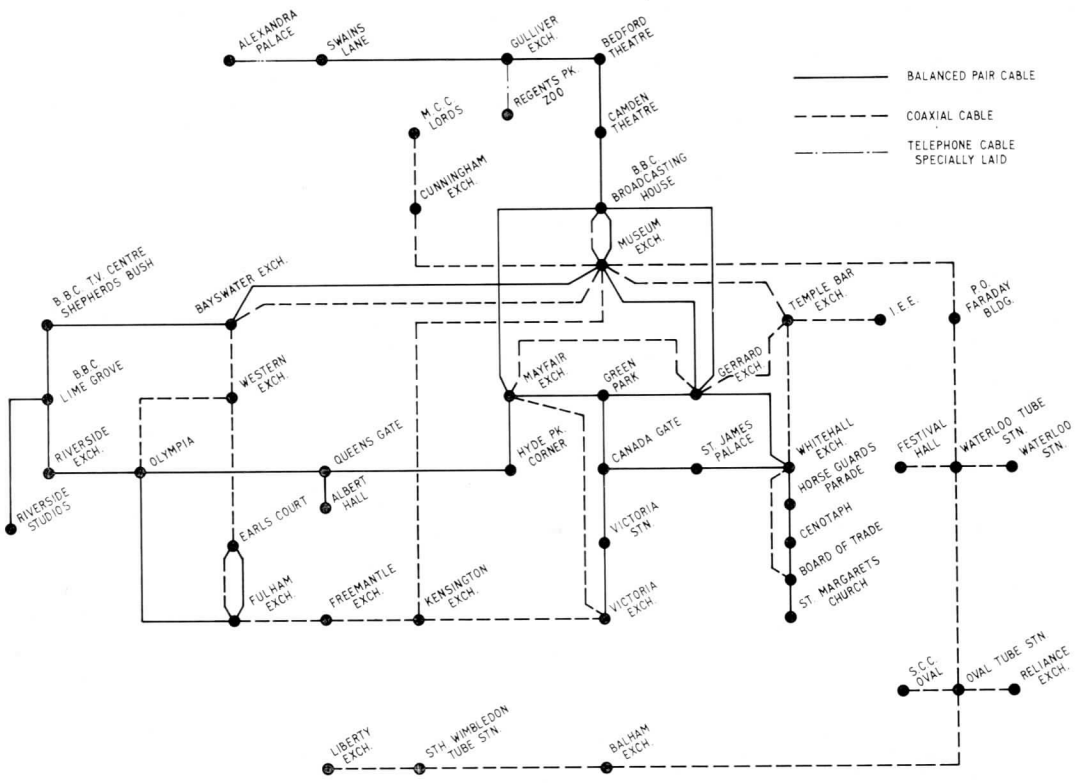
and radio injection equipments to feed an outside broadcast signal into the transmission path at any intermediate repeater station on a main link proved a valuable addition to the methods of relaying outside broadcast signals. (An article in the Autumn, 1955, issue of this Journal described the setting up and equipping of the Post Office teams.)

The outstanding BBC television coverage for the Coronation of the Queen in June, 1953 and the subsequent royal tours of Scotland and Wales gave the Post Office teams the first chance to work together on one broadcast. Since then there have been many memorable television outside broadcasts in which the Post Office has been proud to take a part. Five which will long be remembered are the opening of Independent Television, in September, 1955; the opening of Parliament (October, 1958); the General Election broadcast (October, 1959); Princess Margaret's wedding from Westminster Abbey (May, 1960); and the Duke of Kent's wedding (June, 1961).

The introduction of an Independent Television Service in 1955 led to a sudden increased demand for outside broadcast vision circuits and the number of circuits provided by the Post Office rose to over 750 in 1958, but as the ITA's programme contractors and the BBC obtained more permanent studio facilities in the provinces and video tape recording of programmes became an accepted technique, the annual rate of provision has settled to an average of about 550.

Recent Developments

With the growth of the main television and telephony trunk networks, permanent reserve cable and protection radio channels, suitable for television transmission, have become available for



A diagram of the network of outside broadcast coaxial cables and the balanced pair cable as it is today, 25 years after the first outside broadcast.

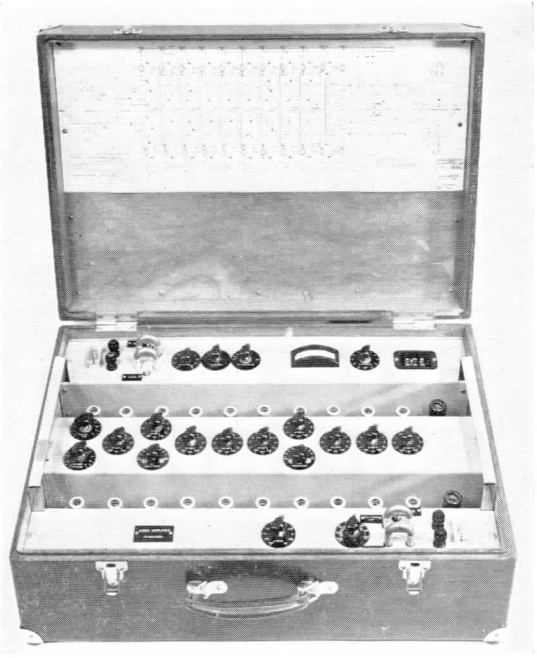
part-time television use. These channels are now being used about 100 times a year for outside broadcasts and the channel from Belfast has made possible, for the first time, regular live outside broadcasts from Northern Ireland.

Since the first BBC broadcast from Calais in August, 1950, great strides have been made in exchanging television programmes on the Eurovision Network which now links 18 television services in 14 countries. Some of the more recent outside broadcast vision circuits have been arranged for television services in other countries when the BBC and ITA have not taken the programme.

The mobile control rooms have continued to get smaller and "roving eye" cameras are now in regular use. Mobile microwave links are operated by both the BBC and ITA, using frequencies in the band 7050 to 7300 Mc/s and the Post Office has provided radio links of this type for closed circuit television.

Although the television standard for Britain is at present 405 lines, 50 fields per second, monochrome, a number of television outside broadcast vision circuits are being ordered to other standards for recording programmes for export and for exhibitions and so on. Experimental repeaters for telephone pairs have been used for the transmission of 405 line colour, 525 line monochrome and 625 line monochrome and colour signals. Transistorised repeaters capable of transmitting 405, 525 or 625 line, monochrome or colour signals are also being developed. Recent developments by the Post Office in transmitting vision signals over coaxial pairs, without modulation of the signal to a higher band of frequencies, have been applied to outside broadcast circuits and it is unlikely that any more carrier equipment will be provided for these circuits on coaxial pairs.

The tall towers (such as the 520 ft. high Museum tower) and masts which the Post Office will be using in or outside the main cities for permanent radio links with the intermediate radio relay stations, will be valuable reception points for point-to-point microwave radio links using mobile equipment. In the past, the sound circuit associated with the vision circuit has normally been provided on Post Office telephone cables, but the increased demand for music quality plant is leading to a shortage of suitable cable circuits, especially on the main routes. In future the Post Office may also often have to arrange for the associated sound circuit to be routed over a radio link.



A No. 98A amplifier which was developed by the Post Office in the early 1950s. It was more portable than the previous type of telephone pair repeaters.

Reticent About Ringing

Why is the average number of telephone calls per person in Britain lower than in most other countries?

The answer, says The Guardian, *is that the British as a race are reticent. Not only do we not like speaking in railway carriages but, compared with Americans, Canadians, Australians and most Europeans, we are reluctant to pick up the telephone, too. Only the Germans and Belgians in a list of* 12 *countries made fewer calls per person in* 1960–61 *than the average of* 90.6 *made by the British.*

The most loquacious on the telephone are the Canadians who make an average of 538.4 *calls per person a year, with the Americans close runners-up with* 520. *Although the Italians have only* 7.8 *telephones per* 100 *people (Britain has* 16.2) *the average number of calls per person is* 121.