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EXHIBITION BROADCASTING STUDIOS

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THE exhibition broadcasting studio, although having something in common with both the permanent studio installation and outside broadcast requirements, presents many problems peculiar to itself and it is the purpose of this article to describe some of these problems and the steps taken to overcome them.

The B.B.C. has been taking part in exhibitions organised by the Radio Industry since 1924 and it is natural that many improvements have been made in the planning and constructional techniques employed during the intervening period.

At the first post-war Radiolympia, held in 1947, the B.B.C. was asked to provide a working studio with a sound and vision programme schedule to cover the ten days of the exhibition. The studio, which was constructed from canvas and wood partitions, covered an area of 100 feet by 80 feet. Semi-portable outside broadcast apparatus was used, with the addition of other ancillary equipment. Provision was made for the public to 'look in' on the studio at work from a public gallery, and two sound and eight main television programmes were staged and transmitted between October 1 and October 11. This studio was not entirely satisfactory from an operational point of view and at the Radio Exhibition of 1949 an effort was made to improve the sound-proofing by using additional canvas and wood partitioning. Little improvement was achieved, however, and both sound and vision producers demanded that a more normal studio system should be provided in the future.

A satisfactory prototype exhibition studio was evolved in 1950 for the National Radio Show organised by the Radio Industry Council and held in the B.I.F. hall at Castle Bromwich. In the following year, various improvements dictated by the experience gained there were incorporated in the studio provided for the National Radio Exhibition at Earls Court, London. Based on the Castle Bromwich prototype with certain modifications its operating characteristics approximated to the best working conditions, and the description which follows deals with this 1951 Exhibition Studio.

Before proceeding with the detailed description, however, it is necessary to give some information regarding the exhibition organisation so as to ensure that the studio and technical arrangements are seen in their proper perspective.

During the preliminary planning, representatives of the B.B.C. meet the organisers of the exhibition from the Radio Industry Council, and agreement is reached as to the general pattern of B.B.C. sound and television programme activity. Since an 'exhibition' studio, either television or sound, has much in common with a permanent studio, production facilities similar to those normally available at Broadcasting House, Lime Grove, and Alexandra Palace are required by the B.B.C. departments working in such an area. Fig. 1 shows the initial plan drawn up for the Earls Court assignment of 1951. It will be seen to include not only the studio, but also dressing rooms, scene dock, wardrobe, make-up, production offices, green-room, canteen, property store, etc., and is therefore a miniature 'Television City'.

The R.I.C. pays for the studio and ancillary areas, including erection costs, provides the revenue for all house charges such as lighting, cleaning, floor coverings, special make-up and wardrobe furniture,

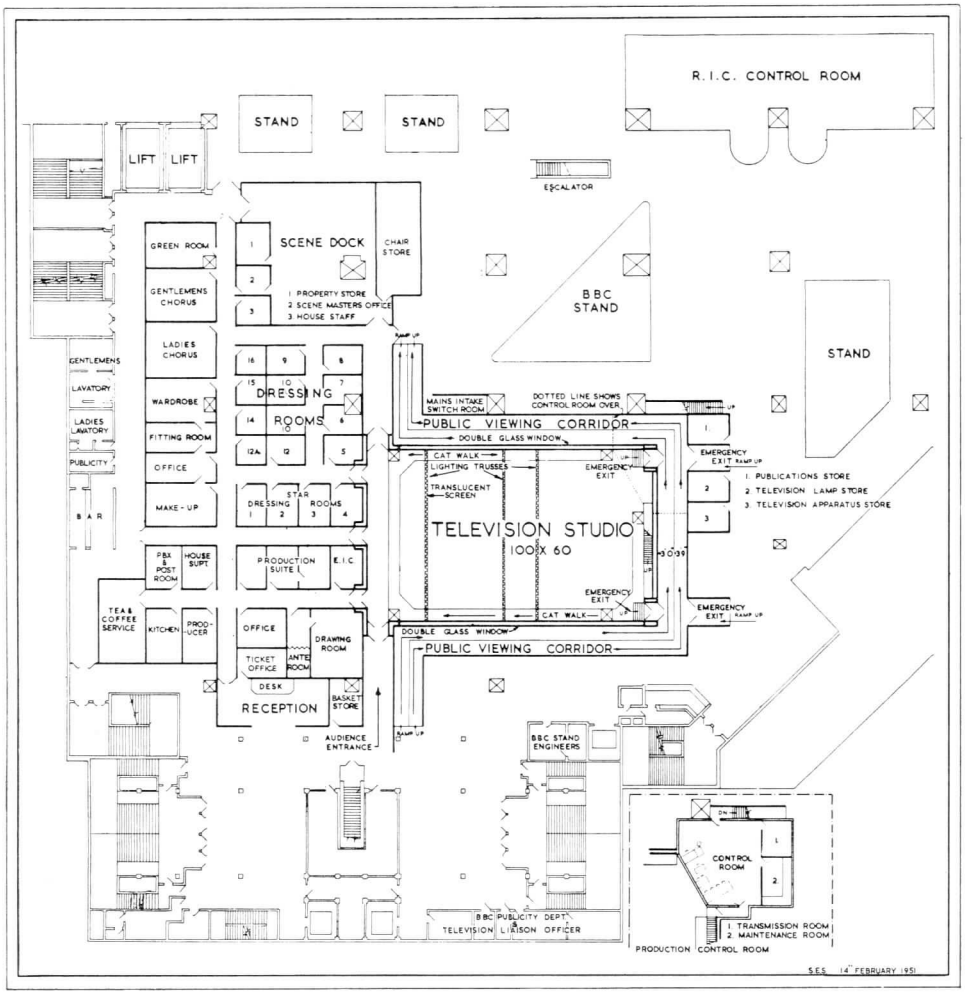

Fig. 1. Initial plan for Earls Court 1951

and some dressing room furniture. The B.B.C. pays for all programme costs including all operating staff, artists, wardrobe, make-up, scenery, apparatus, office and special furniture, technical wiring, etc.

The exhibition is run by the R.I.C., the B.B.C.'s position being that of an exhibitor. The B.B.C. pays rental for its exhibition stand, and for the lines, telephones, and services provided for it by the G.P.O.

The R.I.C. exhibition organising committee, composed of representatives from various firms in the radio and kindred industries, elects a sub-committee to control exhibition finance.

A schedule of operational requirements is prepared by the B.B.C. and, agreement having been reached between the B.B.C. and the R.I.C. to this general outline, detail planning proceeds. The specification for the studio and its associated areas prepared by the B.B.C. is put out to tender. After a comparison of the tenders, the R.I.C. Exhibition Organising Committee decides where the order is to be placed and in due course the work commences.

The essential factors in constructing the studio were as follows:

1. Operational requirements.
2. Apparatus necessary to cover (1)
3. Time factor in providing studio.
4. Acoustics of the studio.
5. Programme requirements.
6. Staffing.
7. Accommodation for public.
8. Make-up and wardrobe requirements.
9. Provision of programme and control lines.
10. Radio Industry Council's technical co-operation.

Operational Requirements

This aspect of the matter is primarily of concern to the B.B.C. but it does involve R.I.C. co-operation. In addition to the normal programmes consisting, in this particular exhibition, of Variety and Music Department sound contributions, television programmes of light entertainment, ballet, music, and such features as 'Come and Be Televised', provision had to be made to cover the opening ceremony. This included the use of television and sound equipment external to the studio itself, and had, together with the ordinary programmes and their rehearsal times, to fit into the general pattern of distribution on 'closed circuit' for the various exhibition stand holders and other R.I.C. requirements. Arrangements had also to be made for the public to 'look in' on the studio. For this purpose a raised 'viewing walk' was located on three sides of the studio to enable the public to see as much activity as possible.

Scripts, programme schedules, etc. are always produced on site and consequently office accommodation for the staff to meet these requirements had to be provided. Wardrobe and make-up facilities had to be such that casts of up to 100 strong could be dealt with at any one time. Scenery, although fed to Earls Court from Alexandra Palace during the day, must also be available locally to allow scene staff to make all night settings—the main show usually finishes at 2130 hours and the first lighting or band calls next day are often at 0800 hours—and this necessitated the provision of an adequate scene dock.

Apparatus

The main television equipment for the studio was drawn from a B.B.C. mobile control room* and was laid out in its normal van operating position to use the wiring 'harness' provided. This equipment was augmented as necessary to give operating conditions comparable with a first-class static studio. In brief outline it consisted of a three camera channel installation with associated vision control racks, one spare channel and ancillary equipment for vision mixing and previewing on three channels, plus a transmission monitor. The sound equipment consisted of a sound console with eight microphone channels mixed at low level including some group mixing. An additional sound mixer was installed to make up the twelve sound channels necessary, and to provide for extra microphone facilities, disk reproducing equipment, and mixer separation of microphones used for transmission and studio sound reinforcing. A special high-quality check loudspeaker and clock system were required, together with a comprehensive lines termination equipment, enabling sound and vision programmes to be accepted from and distributed to the nearest B.B.C. centre, as well as to the R.I.C., and to other points in the studio area.

Further studio equipment had to be provided, such as special camera dollies or cranes, microphone sound booms, 'walkie talkie' talk-back equipment, portable lighting plant, including dimmers, troughs, and tripods; also vision monitors for the conductors, make-up, production, and other departments.

A public-address system was needed in the studio as well as other facilities such as talk-back and programme feed back. Green cue lights and red transmission lamp circuits for operational use had to be available in various parts of the studio and adjacent areas. Additional equipment and

* 'Television Outside Broadcasts', by T. H Bridgewater, B.B.C. Quarterly, Vol. V, No. 3, Autumn 1950

amplifiers were necessary to enable the vision and sound programmes from the studio to be fed to the R.I.C. exhibition control room for distribution within the exhibition and to the B.B.C. transmission network for normal broadcasting purposes.

Time Factor in Providing Studio

For economic reasons, exhibition buildings have to cater for different exhibitions in quick succession. This necessitates close timing for the erection, running, and dismantling of each one. The rental of a large building of this type running into ten acres of floor space is a costly item, and as such premises are usually let on a monthly basis, exhibition organisers have to plan their dates with care. The R.I.C. schedule allows thirteen to fourteen days for building, ten or eleven days for the exhibition itself, and six or seven days for dismantling. As the B.B.C. requires to be installing equipment and rehearsing at least four days before the opening of an exhibition, this means that only ten days are available in which to build the 'Television City'. Its design, therefore, while meeting all the operation requirements, must be such that the builders can work to this tight construction schedule. Dismantling does not usually present a problem.

Construction of Studio Area

Stages in the construction of the studio at Earls Court in 1951 are shown in the photographs—Figs. 2 and 3, pictures 1 to 12.

The area consisted essentially of three main sections:

(*a*) The studio shell and studio control room
(*b*) The public viewing walk, round three sides of the studio
(*c*) The ancillary areas, including dressing rooms, offices, scene dock, etc.

The studio area was sited in Hall 'D' of Earls Court, which is approximately sixty-five feet above the lower hall and has a floor loading of approximately 150 lbs. per square foot. Of this hall the B.B.C. was allocated just over one acre. It was agreed that the studio should have internal dimensions 90 feet long, 60 feet wide, and 24 feet high. The structure had to be self supporting and subject to all London County Council security and fire precautions for such a building.

The Studio Shell

The studio had two separate walls round the whole of its perimeter, one brick, one wooden, separated by a 6-inch air cavity. The outer walls were constructed of 3-inch hollow clay blocks rising to a height of 25 feet. These walls were supported by steel stanchions in bays of approximately 16 feet and where these stanchions did not lie directly over the existing steel members of Earls Court, steel load spreaders were used. The 6-inch air cavity was left when the inner wall, consisting of double-sided, flushed-faced partitioning (three-ply wood on 2-inch battens) was fitted. The 'ties' to the inner wood partition wall were kept to a minimum to avoid sound conduction, and, for the same reason, the two walls and their associated stanchions and spreaders were floated on a single layer of fibre-glass blanket.

The ceiling consisted of two layers, each one-inch thick, of bitumen-bonded fibre-glass, fitted over a studio valarium of taut white muslin. The external side of the fibre-glass was covered with a single layer of hardboard over its entire area. The internal studio support for the ceiling consisted of four tubular-steel box-girders (prefabricated off site) with small-mesh wire netting suitably strained between them to take the downward thrust of the ceiling. The whole ceiling area of fibre-glass was overlaid and lapped in both layers to assist sound proofing, this overlapping taking place at corners, sides, and end of the studio and at section ends of the fibre glass.

On three sides of the studio, *i.e.*, down two long and one short side, a double glazed, quarter-inch, plate-glass window

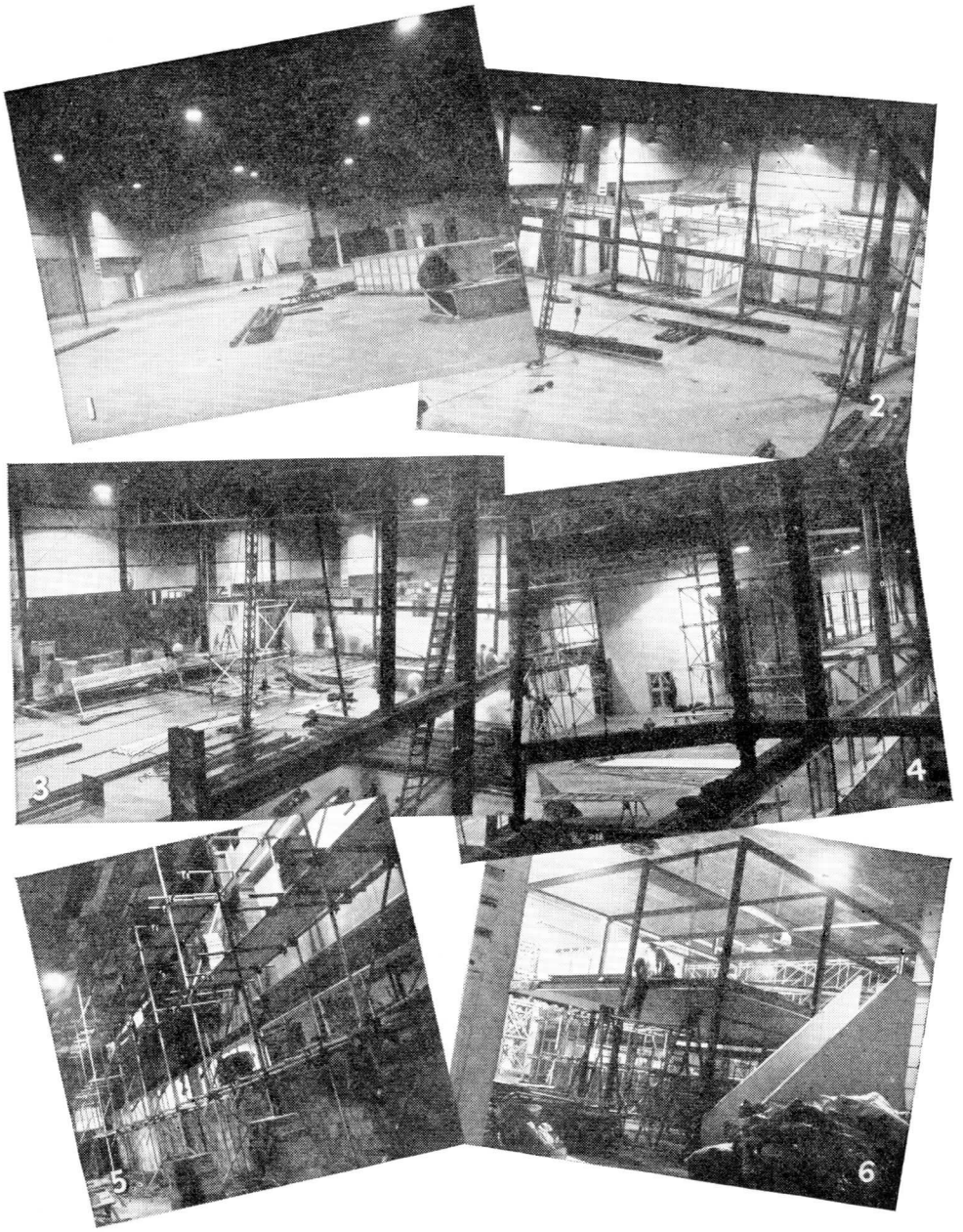

Fig. 2. Plates 1 to 6: day-to-day progress photographs

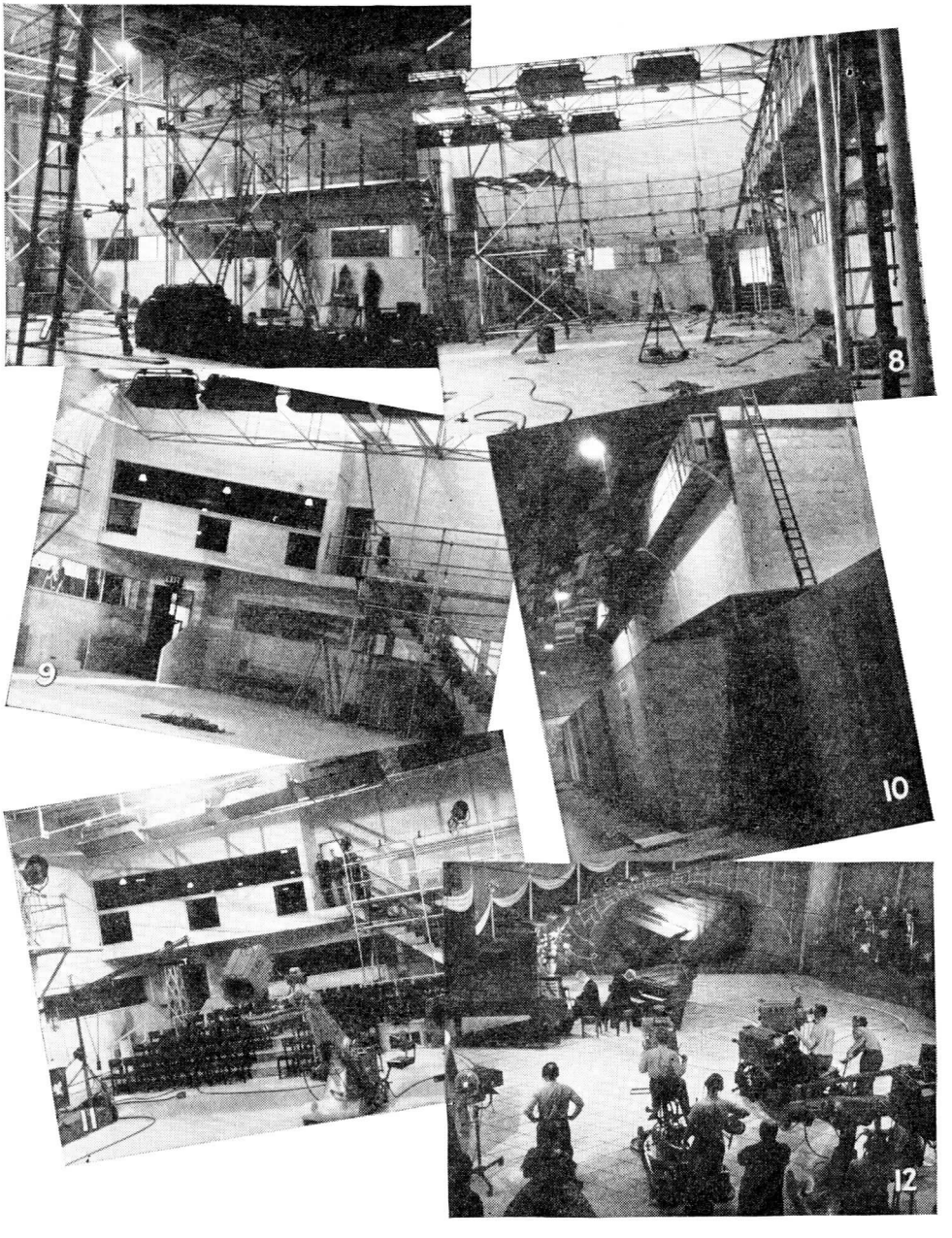

Fig. 3. Plates 7 to 12: day-to-day progress photographs

was provided for the viewing public. The continuous glazing was carried out with the minimum of stanchion obstruction. The window lintols consisted of horizontal rolled-steel joists tied in to the main steel structure. The method of fixing the glass was that usually employed for observation windows, *i.e.*, rubber insets for bedding with a supporting and sealing beading. Where glass sections or ends met, these were ground square to maintain a good fit and the edges joined with transparent fixing compound, the fronts and backs of these joints being lapped with a Cellophane tape to maintain a constant seal.

The studio floor consisted of good quality plain linoleum, laid on top of one-inch flush boarding screwed to 3-inch by 3-inch joists, at 14-inch centres. The joists were insulated from the permanent concrete floor by means of a layer of bitumen felt. Where necessary the floor stanchions and load spreaders were also packed, not only to give structure insulation, but also a level floor. Every care was taken to ensure that the floor was without ridges or gaps, and the floor boards and linoleum ran with the length of the studio to avoid the linoleum rucking under the heavy camera dollies used. One of these, of the film studio type, weighs approximately 30 hundredweights including its crew.

Studio Control Room

This was built at an angle of 45 deg. across one corner of the studio at a height of 12 feet 6 inches from floor level, the main steel frame being tied to the members used for the studio. The angled position of the control room was an operational necessity as it was desired to use either end of the studio for productions, and by adopting this layout a clear view of both ends could be obtained. The sound proofing of the area was on similar lines to that of the studio shell, except that the external walls (outside the studio) were constructed of double-faced partitioning on both sides of the air cavity, while the ceiling and floor were carried on wooden joists and packed with fibre-glass. The internal height of the area was 9 feet, and the maximum apparatus and personnel load was 5 tons. The control room shell had a mean size of 30 feet by 40 feet with two small inner rooms, 16 feet by 10 feet, and 14 feet by 10 feet, partitioned off within the area to form a transmission room and a maintenance workshop respectively. The transmission room housed the amplifiers and termination equipment associated with the distribution of programmes to the R.I.C. control room for use on the internal exhibition network, and to Alexandra Palace, for feeding to the B.B.C. television stations. The maintenance room housed all spares and provided workshop facilities. This arrangement provided a compact engineering working group. In the angled wall looking into the studio was fitted a double plate-glass observation window, 3 feet from floor level and 3 feet high by 20 feet wide. The piece of plate glass nearest the studio was supplied tinted grey to avoid light glare from the studio technical lighting. In three positions below the observation window but stretching down to floor level were panels of double plate-glass 2 feet wide armoured on the inside to give a steep vision line for 'near end' working.

Leading into this production control room were two staircases, one from the studio, for production use, fitted with a double door sound lock, and an external staircase for emergency exit and engineering traffic.

Ventilation

This was provided for both studio and control room and was arranged to give at least seven atmosphere changes per hour in both areas. It consisted of a balanced artificial inlet and extract system. The inlet was provided by tapping off two 'inlet' ports of Hall 'D's own plenum system which consists of a washed-air inlet and providing an outlet by means of a battery of 15-inch, high-speed extract fans in a long trunking with four common canvas shutes leading to the roof void. For convenience, the inlet was brought in at

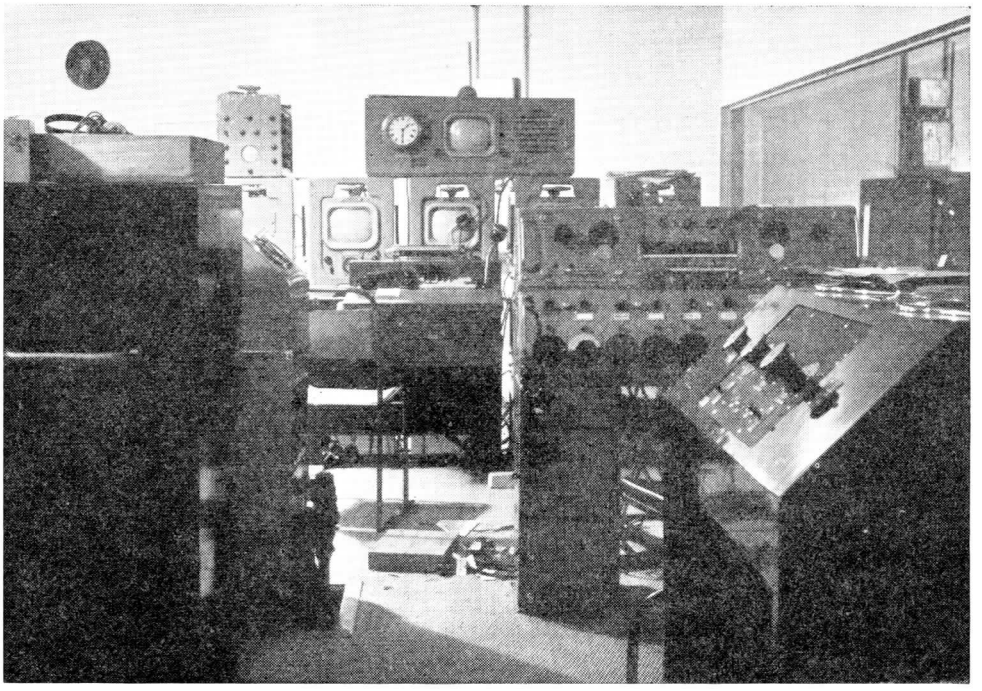

Fig. 4. A general view of the sound and vision control room at Earls Court, 1951

low level down one side of the studio and the extract fans fitted at high level on the opposite wall. The exhibition was held at the end of August and a very warm spell was experienced, but although with lighting, power, artists, and audience it was calculated that 300 kilowatts were being dissipated into the studio, it was considered that the temperature at all times was tolerable. For future occasions even better conditions will be aimed at and both sides of the studio will be provided with both inlet and extract, if funds permit. The control room received its air from the same inlet but had its own three extract fans. This scheme seemed to work fairly well, considering that during working hours the combined dissipation of light, power, and personnel approached 10 kilowatts.

Lighting and Gantry

A studio lighting gantry was provided round all sides of the studio except across the front of the control room where a lighting bar was fitted. The gantry, 12 feet 6 inches from floor level and 4 feet wide was closely boarded to allow the passage of lamp and dimmer trucks. The gantry was, in the main, cantilevered from the main studio steel stanchions with occasional 2-inch tubular steel supports, the exception to this construction being at the cyclorama end of the studio where the lighting gantry was projected 12 feet into the studio to allow for 'shooting' over backcloths and scenery sets and similar obstructions. This also formed a backstage area when the backcloths were in position. The portable 'dimmer' trucks were housed on platforms which angled out into the studio giving ample working space to the lighting control electricians. The front top rail of the gantry, at 16 feet 6 inches from studio floor level, was used for fixing all types of spots and arcs and, at the cyclorama end of the studio, it was also used for fixing backcloths, scenery

drapes, and programme identity boards where necessary.

Lighting and Power

A local substation was fitted adjacent to the studio alongside one of the many service columns in Earls Court and provided for a load of 300 kilowatts 3 phase and neutral 50 cycles and also 300 amps of D.C. The technical lighting load fed to the gantry was 250 kilowatts A.C. and 300 amps of D.C. This was used for supplying the various assortment of lighting including 15 kW arcs, 10 kW, 5 kW, and 2 kW spots together with the permanent trough lighting fixed to the box girders which served the dual purpose of supporting the roof and acting as lighting bars. The substation, which was manned continuously by duty electricians, also supplied all the other services for the whole area including power for electric irons, television monitors, canteen requirements, and general decorative lighting. Various illuminated signs and cue lights were fitted and operated from the production control room, the main item being sixteen red 'On the Air Signs' fitted internally to the studio, and externally including the public viewing walk.

Seating

This was provided on a portable basis built up on rostra on a three-deck system, each deck having 8-inch risers. The chairs and protection rails were clamped and the seating provided for an audience of 100 to 160 on television days, and 250 on sound days, the limitation on television days being to provide room for camera tracking. The seating was arranged to suit the various types of show mounted in this studio, and although at times it proved a tight fit, no seats were ever finally lost due to 'show layout'.

Exits and Entrances

These were all approved by London County Council officials and, with the artists' entrances, proved adequate, as did the scene dock entry. This layout can be seen in the original plan, Fig. 1.

Decoration

The studio was finished in a two-colour scheme which provided a good, clear artistic background. It consisted of a low, very light-pink dado which blended in with the French-beige linoleum floor covering, cream upper walls, and white muslin ceiling. This gave a light, airy, and clean appearance to the studio—a very necessary condition when the temperature reached 85 deg. F. on those hot, sultry days mentioned above.

Public Viewing Walk

This walk, part of which is shown in Fig. 5, ran round three sides of the studio and consisted of a two-tier ramp 10-feet wide divided into two lanes, the front one 3 feet, and the back one 3 feet 9 inches, from studio floor level. Each lane could comfortably accommodate three rows of persons. The studio scene could be viewed through a 3-foot high, double, plate-glass observation window, the lower glazing line of which was fixed at a height of 3 feet 6 inches from the floor of the viewing walk. Barrier rails and matting were fitted to protect the viewers and deaden noise, respectively, and, in addition, overhead loudspeakers were fitted at short intervals to enable the public to listen to rehearsals and transmissions.

Ancillary Areas

The perimeter accommodation was constructed of flush-faced partitioning with, in some cases, a soffit ceiling of white muslin. The areas are shown on the original plan and provision was made for special lighting in the entrance foyer. Hot and cold running water with complete sink units were fitted to all dressing rooms. Make-up benches with special mirror-surround lighting were provided. A scene dock, which is essential to an exhibition studio, was provided and was 18 feet high to take the long scenery flats, etc. Some general photographs give an idea of this

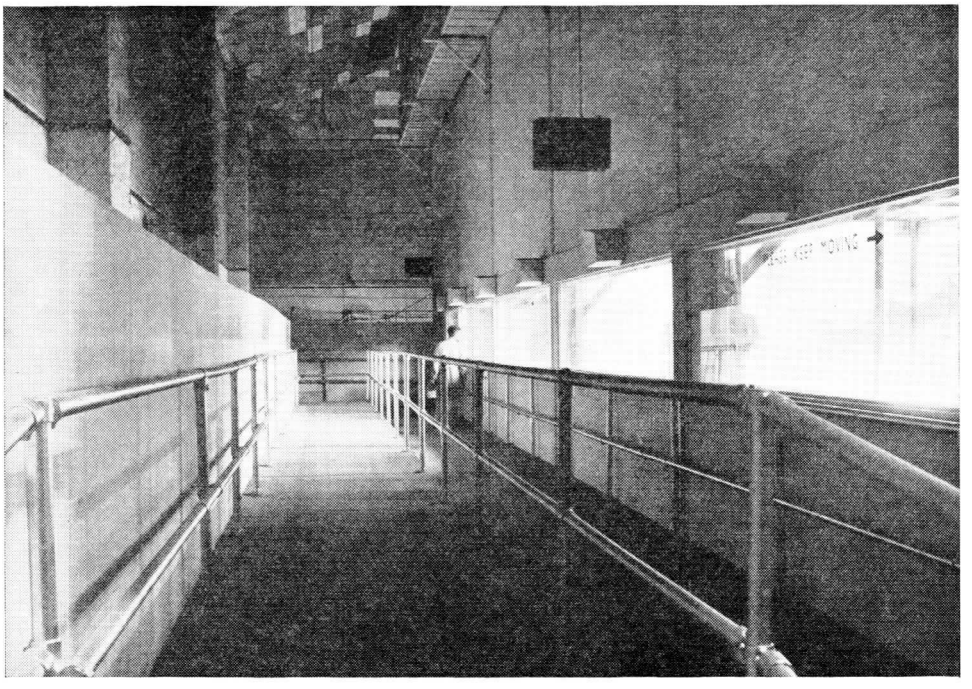

Fig. 5. Part of the public viewing walk at the Earls Court studio, 1951

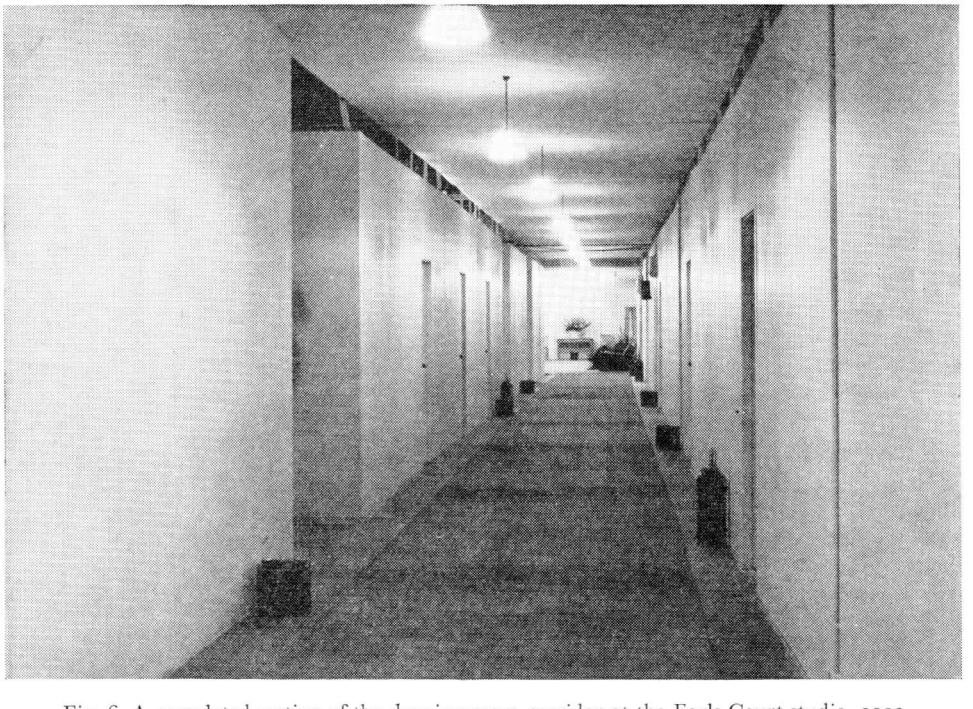

Fig. 6. A completed section of the dressing room corridor at the Earls Court studio, 1951

area in various stages of completion, and Fig. 6 shows a completed section of the dressing room corridor.

Acoustics

Acoustics in a rapidly built studio of this kind, which has to take care of programme requirements varying from an opera orchestra to ordinary opening announcements or talks, must obviously be a compromise. Another limiting factor is the material available for such a job. With the floor, walls, and ceiling constructed as indicated above much bass absorption was obtained, and it was roughly estimated from the known figures of the co-efficients of absorption of the materials used, that the studio would have a reverberation time of something a little less than one second. In practice this varied slightly with the scenery, sets, and contents of the studio, but it was generally enough to give good all-round results. Noise percolation did not become obtrusive, in fact neither the external exhibition noise nor the sound of the perambulating public was audible in the studio.

Programmes

The general and main programmes provided for this particular exhibition are given below. These were not only for transmission and the entertainment of the studio audience and the public on the viewing walk, but for the 'closed circuit' feed to the R.I.C. for exhibitors' stand sets.

Aug. 29	'First Night'	(Vision)
Aug. 30	'Happy Go Lucky'	(Sound)
Aug. 31	'Starlight'	(Vision)
Sept. 1	'Top Hat Rendezvous'	(Vision)
Sept. 3	'Opera and Ballet'	(Vision)
Sept. 4	'Come to the Opera'	(Sound)
Sept. 5	'Starlight Symphony'	(Vision)
Sept. 6	'Ballet'	(Vision)
Sept. 7	'Holiday Camp'	(Vision)

Staffing

The whole of the studio area is staffed by B.B.C. personnel and during a large show, up to 160 people may be employed. These include artists, orchestra, programme executives, production staff, engineering staff, scene and studio staff, office staff, commissionaires, make-up and wardrobe staff, telephone operators, and canteen staff.

Accommodation for the Public

Tickets for admission to the studio for rehearsals and transmissions are shared equally by the R.I.C. and the B.B.C. The R.I.C. distribute tickets to the industry, and the B.B.C. to official contacts and the public. Experience shows that demands for tickets invariably exceed the supply and a different layout was used at this year's show in August. The public viewing walk was dispensed with and the seating accommodation in the studio enlarged to seat approximately 1,000 people. Apart from enabling more people to see the programmes, this arrangement had the advantage that there was no moving public to distract the artists and producers.

Make-up and Wardrobe

A large number of costumes is shifted daily during the run of the exhibition and facilities have to be available for storing, ironing, and mending these, in fact it is necessary to provide the normal static conditions for this department. In the make-up room at least eight working positions have to be provided to avoid delay in original make-up and also 'touch-up' during the actual dress rehearsal and performance. Make-up is checked by means of vision monitors on the studio floor and in the make-up room so that any necessary 'running repairs' can be made in order to maintain good pictures.

Lines and G.P.O. Work

The B.B.C. specifies its line, telephone, and internal extension requirements to the Post Office, who install all these circuits in time for the job in hand. The lines include special circuits such as vision and sound lines, control circuits, private wires, a complete telephone installation with thirty extensions and six lines to the exchange and Broadcasting House, and

also many of the vision and sound circuits required internally for studio and 'local output' feeds.

Radio Industry Council Technical Co-operation

The R.I.C. always install a control room for local exhibition distribution of sound and vision programmes and likewise provide a small studio, with a resident announcer, to make local announcements within the confines of the exhibition. This involves close liaison between the R.I.C. technical staff and the B.B.C.

General

Mention cannot possibly be made of all the B.B.C. staff and activities concerned, but some of them are given here. A post room and facilities for cashing cheques and paying out wages are provided, also a small tea and coffee bar to supply staff with the odd cake or sandwich before going on the set. A B.B.C. receptionist on duty at the reception counter deals with any little difficulties which may arise. An efficient fire patrol and a night watchman are provided to take over when the lights are dimmed. Throughout the twenty-four hours a uniformed B.B.C. fireman is on duty to cope with any situation. Although all materials are fireproofed, nothing is left to chance when it comes to safety, and the normal fire-fighting equipment in the hall is augmented to give more than adequate facilities should they be needed. In conclusion, the authors would like to express their thanks for the co-operation and assistance they have received from the Exhibition Organising Committee of the Radio Industry Council, the contractors—in 1951 Olympia Limited—and from the many others who have been associated with these projects at various times.