THE BRITISH BROADCASTING CORPORATION

ENGINEERING DIVISION

DESIGNS DEPARTMENT

ANNUAL REPORT FOR 1954.

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Head of Designs Department.

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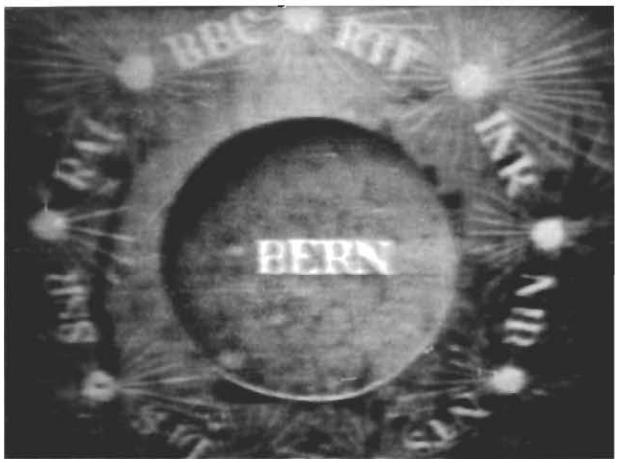

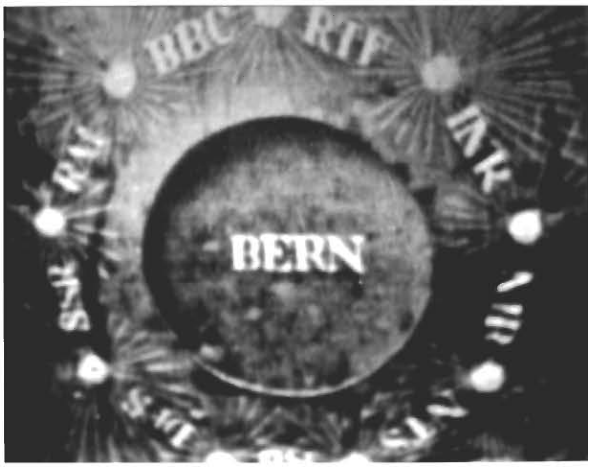

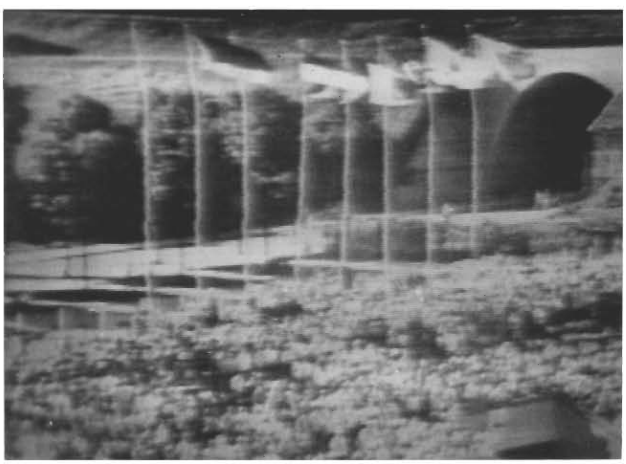

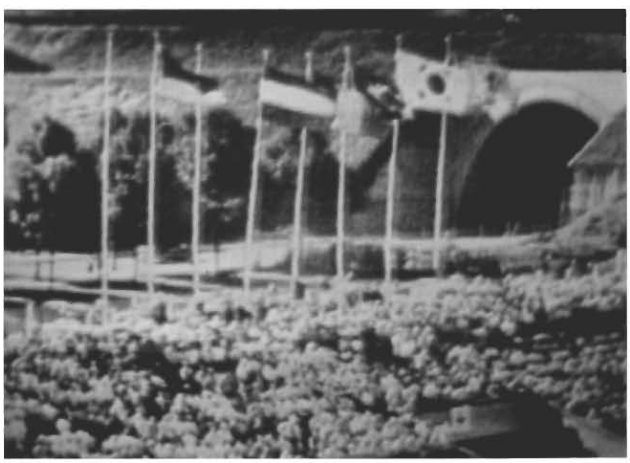

FIG. 1 PICTURES TAKEN AT SWINGATE, DIRECT FROM THE EUROPEAN NETWORK.

FIG. 2 THE SAME PICTURES AFTER CORRECTION AND CONVERSION TO THE BRITISH STANDARD.

THE WORK OF DESIGNS DEPARTMENT IN 1954

The work of the Department is reported in detail in the main body of this report, but it will be of interest to outline in an introduction some of the more interesting work carried out during the year. In selecting these examples the opportunity will be taken to show how the work of Designs Department is integrated with the wider activities of the Corporation

The first "Eurovision" transmissions were made with the aid of a standard conversion equipment which was originated by the Research Department.For further Eurovision transmission it was decided that Designs Department should take this first experimental apparatus and from it develop fully engineered equipment. During this development, a number of detailed improvements in performance have been incorporated. Many of the transmission links used across Europe are of a temporary kind and add considerably to the distortion of the picture received at the conversion point. Apparatus has therefore been designed for correcting the amplitude, phase and non-linear distortion of these circuits. This has resulted in the quality of the picture being greatly improved. Examples of the pictures received from Europe before and after correction by this apparatus are shown in Figs.1 and 2, respectively.

The Department has co-operated with the Research Department and with Marconi Co. in further extensive experiments on colour television, using equipment borrowed from the Marconi Co. for the origination of a colour television signal. A field trial has been made to transmit colour pictures over our existing network. Promising results have been obtained, but it has been found that although the existing cable links may be satisfactory for the transmission of colour pictures, the radio link from Manchester to Kirk O'Shotts will require important modification.

As a part of these tests the colour signal was also transmitted from Alexandra Palace so that the suitability of this transmitter for a more extended series of tests could be judged, and also so that observations could be made on the N.T.S.C. type of signal for monochrome reception. These tests gave promising results and it would seem that the colour picture was received with very little distortion and a high degree of compatibility was reported by a large number of observers. The Department is continuing its work in connection with colour transmission, particularly in the development of suitable measuring equipment and is also investigating the possibility of the manufacture of a limited number of colour receivers.

Where circumstances have precluded the use of centimetric links or line links for O.B. purposes, the BBC has, for a number of years, been using frequencies in the neighbourhood of 200 Mc/s. The imminent use of these frequencies for main broadcast transmitters has compelled us to find a higher frequency range on which to carry these important O.B. Services. As no commercial equipment exists for this purpose, Designs Department have started the development of an experimental 500 Mc/s transmitter, having an output power of about 15 w. The new transmitter will be frequency modulated and this should show an improvement over the earlier equipment which was amplitude modulated. Tests are now in progress and it is hoped to have the development of the prototype equipment completed by the end of the year.

Such changes in transmission frequency may also have to be applied to the experimental 'Roving Eye', described in last year's report. After extensive field trials and six months of regular broadcasting in the Television Service, this 'Roving Eye' has had

various minor modifications made to it and will now remain in regular use. As a result of this experience, consideration has been given to a second model which will have an increased range when working from a fixed site. A specially built smaller vehicle will be used and a choice will be provided between one camera and radio links or two cameras with cable links to the main network.

Designs Department has also been very active in the field of Television Recording and the associated field of reproduction of television signals is going to play as great a part in the Television Service as the recording of sound signals in the Sound Service. Work is in hand on the construction of a fully engineered recording machine using 16 mm. film. Investigations have also been carried out into the complex optical and chemical processes involved in the translation of electrical impulses on to cinematograph films and vice versa. Special equalisers have been developed for correcting defects in the system, and the various factors affecting picture quality have been evaluated. In the interests of speed, the television signal is often produced direct from the negative film but such a process entails an entirely different characteristic in the reproducing chain. Apparatus has therefore been developed so that the characteristic of the chain can be modified. This, in association with the flying-spot Mechau machines, described in last year's report, has enabled pictures to be reproduced from negative film, practically as good in standard as those from positive film. The flying-spot Mechau machines are now in service at Lime Grove and are producing pictures of excellent quality.

In the Sound Service a transition is taking place in the field of recording and reproduction of sound signals. In commercial recording the old coarse groove disks are rapidly being replaced by the longer playing fine groove disks and to make full use of these a corresponding change is taking place within the BBC. A new fine groove reproducing desk has been designed for this purpose. This new unit incorporates a number of features which are of special value in the peculiar conditions of BBC service. It is shown in Fig.3.

With such changes, there is naturally a need for the readjustment of recording standards and not only is this taking place with the international bodies concerned, but facilities are also provided for such standards to be applied within the Corporation. Extensive changes are also being made to our Sound Service transmitter system.

Work is in progress on the first part of the new F.M. transmitter scheme and the design work of special apparatus for the first six stations is nearing completion. Many of these F.M. transmitters are to be installed at Television transmitter sites and, to avoid the need for extra staff other than those required already for Television operation, these transmitters will be monitored automatically. By this means, about twenty operational staff will be saved at the first six stations. These monitoring arrangements have imposed special requirements on the lines feeding such transmitters and so the planning of the line network in conjunction with the Engineering Department of the G.P.O. has absorbed considerable effort.

Although the nearness of most of these transmitters to manned sites makes it possible to use an automatic monitor which was designed several years ago, a considerable amount of additional automatic gear is required, so that the minimum load is placed on the limited operational staff. In some cases the automatic monitoring cannot be solved in this way and therefore a new version of the apparatus is being designed. This will be used to keep a check on those stations that have no manned centre within the compass of good reception.

FIG 3 PROTOTYPE MODEL OF FINE GROOVE DISK REPLAY DESK

FIG.4 STUDIO CONTROL DESK IN STUDIO 8, BROADCASTING HOUSE.

In some areas the new F.M. stations will undoubtedly provide a signal at the old A.M. stations good enough to be used for rebroadcast purposes. This will probably make it possible to dispense with some of the lines feeding the older stations, and consequently effect a large saving in line rental. Recommendations on this subject have been issued by the department in a separate report and although various transmission conditions have yet to be verified, it is hoped that the proposed arrangement will save from £15,000 to £30,000 per annum.

The Designs Department report for 1953 described the initial development of small unit amplifiers and control desk parts which would provide the greatest flexibility in control room apparatus design, with the minimum cost and delay. Such basic parts can be stocked and then assembled into designs to meet particular operational needs. This work continues and shows extremely attractive results. One of the first new Studio Control Desks, using these basic parts, is now installed in Studio 8 in Broadcasting House (Fig.4).

Naturally one of the foremost factors in design of this kind is again the saving of operational staff. With this in view, prototype models are being made for a field trial at Manchester to enable control room traffic to be handled expeditiously by the minimum number of operators. Peak loads will be spread by providing facilities so that routing can be set up in advance and then brought into operation at the appropriate time by pressing a single button. Telephone and cueing circuits can be handled by the same arrangements.

All this apparatus which the department has designed, at one or several stages involves draughting work or the manufacture of the prototype models. This is handled by the General Services Section. Last year's report listed the work of this Section but it was largely a repetition of the work shown for the other Sections and so this year the list has been omitted. The work of the General Services Section is really that part of the department's activity which enables newly designed apparatus to pass into the broadcast service.

Details of the Work of the Various Sections in the Department

The following pages contain concise details of all the work which has been handled by the Department during the last year.

The work is grouped in accordance with the Sections into which the Department is divided, not only because this shows the responsibility of the particular Sections, but it also provides good functional classification. On the other hand, it will be appreciated that in some cases there is a certain amount of sharing between Sections, as it is only by such an arrangement that the most effective results can be obtained.

When any particular work is completed, it is usually published in a departmental report or specification, in the technical press, or in "Technical Instructions" (issued by the Engineering Training Department). Thus in most cases much fuller information is eventually available than is given here.

1. RECORDING.

Staff: 3 to 5 Engineers, 2 Laboratory Technicians.

MAGNETIC RECORDING.

No.	Job.	Work and Purpose.	State of Work.
1.01.	Leevers-Rich Tape Recorders.	A new model of the battery operated machine used on the Royal Tour was submitted and has been tested. Initially the performance was not acceptable but means of improving it were found and the equipment now appears to be generally satisfactory for mobile use, except that full-track heads are still not available. A governed motor developed by Leevers-Rich to eliminate the speed drift of this type of machine was tested. It gave reasonably good control under laboratory conditions but failed altogether in the lower temperatures encountered in outside work. A new design of mobile machine for A.C. supplies has been tested. The results have been discussed with the makers but further development is required before the machine will be suitable for BBC use. A mains unit developed by Leevers-Rich to enable the battery operated equipment to be fed from A.C. mains has been tested and found satisfactory.	Continuing.
1.02.	Midget Recorders.	Measurements have been made to determine what deterioration in performance must be accepted when the E.M.I. Midget Recorder is converted to run at 7½ ins./sec. instead of 15 ins./sec. Since the performance of these machines is somewhat variable measurements were made on six specimens. Tests have also been carried out on a midget spring-driven recorder made by Philips and a report is being prepared.	Continuing.
1.03.	Ampex Tape Recorder.	A pair of Ampex 350 Tape Recorders have been installed on a bay and have been tested. These	Continuing..

No.	Job.	Work and Purpose.	State of Work.

1.03. Ampex Tape Recorder. (Cont.)

machines, which are almost universally used for professional tape recording in the U.S.A. are cheaper and simpler than the corresponding European equipment and they have been shown to and discussed with the interested British manufacturers.

1.04. Test Tapes. Continuing.

In conformity with a C.C.I.R. agreement, calibrated 15 ins./sec. tone tapes have been sent to a number of foreign countries and measurements have been made on the corresponding tone tapes received from them. The results of these measurements have been discussed in U.E.R. Working Party G and it has been agreed that the internationally recognised measuring procedures give a conformity that is adequate for programme interchange, though some points of detail are not yet settled.

To reduce the cost of making the comparatively large numbers of test tapes required in the BBC, an arrangement has been developed whereby complete reels are recorded at each test frequency with an automatic control keeping constant level on the tape. Test tapes are then made up by splicing together lengths recorded at the various frequencies. A stock of recorded tones for both 15 ins./sec. and 7½ ins./sec. test tapes has been prepared using Designs Department laboratory equipment. If the consumption of test tapes becomes high enough to warrant it, special equipment will be developed to enable fresh tapes to be made as a routine operation.

1.05. Bay Mounting of Tape Recorders. Continuing.

The possibility of bay mounting the only professional tape recorder available in this country, the E.M.I. BTR/2, has been investigated. It would be necessary to modify the machine substantially so that it could be used with the panel vertical but even if this were done the machine is too large to permit two being mounted at all conveniently on one bay. Unless two can be mounted in this way, no economy in space

No.	Job.	Work and Purpose	State of Work

1.05. Bay Mounting of Tape Recorders (Cont.)

could be achieved. The BBC's interest in bay mounting equipment has been made clear to manufacturers.

1.06. Tape Editing. — Continuing.

A commercial tape welder has been tested and a brief report issued. A large scale investigation into the various procedures for jointing and handling tape was begun but had to be suspended because of the pressure of other work.

1.07. Tape Duplication. — Continuing.

A comprehensive study of the various methods of duplicating magnetic tape recordings and of their application to the needs of BBC service has been completed. Since the opportunity had arisen to examine the American practice in this field the issue of a report has been delayed to take account of this.

DISK RECORDING

1.08. Fine Groove Recording. — Continuing.

A Designs specification was issued setting out the minimum modifications required to convert a Type D Recorder for microgroove work. Six months experience with a channel converted in this way has revealed a number of operational difficulties and while some may be inevitable it is certain that others can be reduced by the re-design of the head mounting to suit this type of service. Work on this has begun.

1.09. Test Disks. — Completed.

Test Disks for 33⅓ rpm. coarse groove (16" diameter), 33⅓ rpm. fine groove (12" diameter) and 78 rpm. coarse groove (12" diameter) have been made accurately to the C.C.I.R. recording characteristic and fully processed.

A 78 rpm. coarse groove (12" diameter) test disk to

No.	Job.	Work and Purpose.	State of Work.

1.09. Test Disks.(Cont.)

BBC recording characteristic has also been made and fully processed. The preparation of these test disks involved a good deal of work, particularly in checking the results of the processing operation which is wholly outside our control. This work has been described in Designs Department Report No. 1.10.(54).

1.10. Buchmann-Meyer Equipment. — Continuing..

Guidance has been given to Messrs. Decca who have been constructing two Buchmann-Meyer equipments for measuring the levels recorded on disks by means of the reflected light pattern. Both equipments are of a design developed in Research Department, one being used in Designs Department and the other for use by Decca under an arrangement with the BBC.

DISK REPRODUCTION.

1.11. Pickups. — Continuing.

Tests have been carried out and reports prepared on a revised design of Decca "Micro-Armature" pick-up and on the new Leak pickup. Tests have also been carried out on the Ferranti Ribbon pickup and a report issued. This pickup is not very suitable for general service use, but should be excellent for certain special purposes.

As a result of further work on one type of Acos crystal pickup head it appears to be practicable to adopt it in BBC service and four specimens have been installed for service trial.

1.12. Pickup Arms. — Completed.

A long arm has been designed for carrying fine groove heads on the large diameter turntables that have to be used at present in the BBC. An initial batch has been used to enable operational experience to be gained with Acos heads.

No.	Job.	Work and Purpose.	State of Work.
1.13.	Pickup Equalisers.	An equaliser to adapt the E.M.I. Type 12 pickup to the C.C.I.R. reproducing characteristic has been designed. Equalisers for adapting the Acos heads to the C.C.I.R. characteristic or to the American fine groove characteristic have also been prepared.	Completed.
1.14.	Quick-Starting of Records.	A "drop-start" unit to enable the disk on a TD/7 turntable to be brought up to speed very rapidly has been designed. After successful operational trials the manufacture of the first batch is now in hand.	Completed.
1.15.	Gramophone Motors.	Tests have been carried out, first on a prototype and later on a production model of the new Garrard Transcription Turntable. The performance was generally satisfactory and a number of modifications have been designed to adapt this commercial unit to the rather special requirements of a BBC replay desk.	Completed.
1.16.	Reproducing Characteristics.	There is now widespread international agreement on the recording and reproducing characteristics to be used for fine groove gramophone records. In the past it was sometimes necessary to modify reproducing equalisation to take account of defects in pickups and records, and listening tests have therefore been carried out with the new Acos heads and with a wide variety of fine groove records. These tests have established that the internationally agreed replay characteristic can safely be used in practical conditions in the BBC.	Completed.
1.17.	Existing Fine Groove Replay Equipment.	An investigation was carried out into complaints	Completed.

No.	Job.	Work and Purpose.	State of Work

1.17. Existing Fine Grove Replay Equipment (Cont.)

of bad reproduction from the service equipment used for replaying fine groove gramophone records. The equipment consisted of rather old coarse groove desks modified for fine groove working but, nevertheless, no case or cause of serious distortion could be found in the standard equipment. Improvements, however, were possible and a number of recommendations were made.

1.18. Replay Desk Modifications. — Completed.

In order to provide a fine groove replay channel with the best reproduction practicable, two Presto desks were entirely overhauled both electrically and mechanically and were fitted with Acos heads on BBC arms and with specially designed equalisers.

1.19. New Fine Groove Replay Desk. — Continuing.

A study of the rather complex situation arising from the virtual obsolescence of coarse groove gramophone records was made and an appraisal of the situation as it affects the BBC was prepared and issued as a draft report. On the basis of this, an entirely new design of replay desk for fine groove records has been produced to meet the special requirements developed in the BBC. This work has absorbed a large part of the Section's effort.

POWER SUPPLY.

1.20. Controlled Frequency Supplies. — Continuing.

The modifications required to enable a commercial 1 Kw. audio amplifier to serve as a power supply to to a tape recording channel have been worked out and a report issued.

A variable frequency supply unit based on a smaller commercial amplifier has also been developed as an auxiliary to the new design of replay desk.

No.	Job.	Work and Purpose.	State of Work.

STANDARDISATION.

1.21. Considerable progress has been made in recording standardisation during the year. A new British Standard for disk recording and reproduction was prepared in draft, and after full discussion is now about to be published. An early draft of this proposed British Standard served as the basic document on which international discussion took place at the I.E.C. meeting held in Philadelphia in September and a considerable part was agreed. A document showing the inter-national agreement that was reached at this conference has also been prepared for the I.E.C. Secretariat. Continuing.

Discussions on various aspects of the standardisation of magnetic recording have also taken place at Philadelphia, and in B.S.I. meetings through the year.

At a meeting of U.E.R. Study Group G. in November the results of the interchange of C.C.I.R. Test Tapes were discussed and agreement was reached on proposed standards for films for television programme interchange.

Contact has throughout been maintained with the Services and with the manufacturers concerned.

MISCELLANEOUS.

1.22 A visit to the U.S.A. to attend a meeting of the I.E.C. in Philadelphia gave the opportunity for a brief survey of recording practices in the U.S.A. and a report was issued.

2. S.B. LINES AND COMMUNICATIONS.

Staff: 4 Engineers, 3 Laboratory Technicians.

S.B. LINES.

No.	Job.	Work and Purpose.	State of Work.
2.01.	System Design.	The plan for reorganising the S.B. network in the Northern and Scottish regions was revised and has been submitted to the Management. The scheme has now been approved and is being implemented. The line requirements of the F.M. stations have been studied, and a plan for feeding these stations by line has been issued. The possibility of using radio pick-up from the new F.M. stations has been studied and a proposal is being drawn up for submission to D.C.C.(A) showing the possibilities in this respect, together with the line-rental savings and the capital costs involved. A plan for establishing a manned switching centre at Carlisle has been drawn up and approved by the Operations and Maintenance groups concerned. The plan is being submitted to the Management for approval. A considerable amount of planning has been done in connection with deferred facilities.	Continuing.
2.02.	New Lines Acceptance.	New S.B. lines are equalised as they are handed over. Seven have been dealt with this year.	Continuing.
2.03.	Special Lines Work.	Special lines in connection with deferred facilities are tested as they become available. Twenty have been taken over this year.	Continuing.

EQUALISERS.

No.	Job.	Work and Purpose.	State of Work.
2.04.	Equalisers EV/10. ("Bode Type").	The "Bode" Type equalisers, EV/10, mentioned in the previous report, have been installed at strategic	Completed.

No.	Job.	Work and Purpose.	State of Work.
2.04.	Equalisers EV/10. (Cont.)	points in the S.B. system in order to improve the characteristics of long chains. Their performance has been analysed, with satisfactory results.	
2.05.	Variable Equalisers, EV/3/4, EV/4/3, EV/11/1.	The final specifications and technical data on these equalisers have been prepared.	Completed.
		TESTING APPARATUS.	
2.06.	Harmonic Routine Tester FHP/3A.	This instrument was redesigned as the availability of new components made a big improvement possible.	Completed.
		AUDIO FREQUENCY INDUCTANCE COILS.	
2.07.	New Types of Coil.	Two new and improved types of "Ferroxcube" coil are being studied. These new coils provide a higher Q and higher maximum inductance value than is attainable on the previous types.	Continuing.
2.08.	Production of Older Types of Coil.	About 180 Ferroxcube coils and 20 Toroid coils were designed and produced for use in filters etc. Approximately 150 coils were produced to assist S.E.L. in meeting urgent equaliser requirements.	Continuing.
		REMOTE CONTROL.	
2.09.	Short-distance System for Special Transmitters.	The design work on this system was completed, and the equipment was watched in the production stage. Complete maintenance information was supplied.	Completed.

No.	Job.	Work and Purpose.	State of Work.
2.10.	Remote Control System, Worcester and Weymouth.	The equipment manufactured for these stations had to be modified to meet changed conditions. The necessary information was issued, and additional panels were designed and watched during the manufacturing stage. Complete information for mainenance was issued.	Completed.
2.11.	Line Switching Systems.	Five line-switching systems required for the S.B. system were designed and checked prior to shipment. Operation and maintenance information was prepared.	Completed.
		MISCELLANEOUS.	
2.12.	Diesel Engine Protection.	A device, suggested by a member of P.I.D. for giving warning of the impending failure of a Diesel engine was investigated. A laboratory model was constructed and given a field trial with satisfactory results. A prototype is being designed with the object of carrying out a prolonged trial. The object of this device is to prevent the seizure of high power Diesel engines, thus avoiding costly repairs.	Continuing.
2.13.	Investigation of Earth Potentials at Difficult Locations.	Certain locations such as Holme Moss are being investigated in order to obtain information on the earth potential differences likely to be encountered on an earth/phantom circuit. The necessary testing equipment has been constructed and a trial between Manchester and Holme Moss has been completed. Preliminary findings have been issued. Further trials will be made at different sites. This work is necessary in view of the extensive use of earth/phantom circuits planned in connection with automatic transmitters.	Continuing.

No.	Job.	Work and Purpose.	State of Work.
2.14.	Quality Investigation on Long S.B. Chains.	Detailed analysis of magnetic tape recordings made at the input and output of a long S.B. chain revealed that the major defect was due to amplitude distortion at low frequencies. The effect was demonstrated to P.O. engineers, who agreed with the findings and promised to equip an experimental line with improved apparatus. In the meantime a compromise method of improving the quality by apparatus under the control of the BBC is being investigated. A preliminary field trial has given satisfactory results. This work will result in an improvement in the quality radiated by distant transmitters.	Continuing.

COMMUNICATION SERVICES.

2.15.	Teleprinter Margin Tester.	Final tests were carried out on five testers modified in accordance with the design work reported previously. The testers were returned to service and are giving satisfactory results. This work gives improved performance and facilitates maintenance on the Communication System.	Completed.
2.16.	Telegraph Break Detector.	The outstanding work on this was completed and the prototype model has been handed over to S.E.L. for operational use. The purpose of the Detector is to facilitate the maintenance of BBC carrier systems, thereby saving manpower.	Completed.
2.17.	Additional (Fourth) Telephone Channel for BBC Carrier Systems.	The design work was completed on this job, and the prototype model has been tested and put into service. The performance has been satisfactory and data is being obtained from the installed system for submission to D.C.C.(B). This scheme improves the Communications system at low annual cost.	Continuing.

No.	Job.	Work and Purpose.	State of Work.
2.18.	Telegraph Relay Testers.	Design information has been prepared for a comprehensive telegraph relay tester for Equipment Department. A prototype model is being constructed. This equipment will save testing effort on the part of Equipment Department.	Continuing.
2.19.	Electronic Telegraph Convertor.	An electronic convertor has been designed for operating a teleprinter from voice-frequency signals without the use of a telegraph relay. A prototype model has been tested and handed to S.E.L. for field trial. Information for submission to D.C.C.(B) is being prepared. This equipment will reduce maintenance effort on the communications system.	Continuing.
2.20.	Mains Unit and Switching Panel MU/52 and SP/19.	This unit is required in connection with Deferred Facilities. It provides power supplies for telegraphy and is designed for use by relatively unskilled staff. Design information has been completed, and a prototype model has been tested and handed to S.E.L. for service.	Completed.
2.21.	Shared Circuit System, Droitwich - Wood Norton.	A system was designed at S.E.L's request to improve the control and P.B.X. facilities between Droitwich and Wood Norton. This work increases the traffic that can be carried by the P.O. line, in return for a very small capital outlay.	Completed.
2.22.	Tester for Telephone Transmitters.	At the request of S.S.E.S.B. the question of providing a routine tester for telephone transmitter maintenance is being studied, since the model used hitherto is now unobtainable. Present P.O. practices	Continuing.

No.	Job.	Work and Purpose.	State of Work.
2.22.	Tester for Telephone Transmitters. (Cont.)	are being examined, and it is expected that a satisfactory testing arrangement will be produced. This will facilitate the work of Operations and Maintenance Department.	Continuing.
2.23.	Miscellaneous.	A large number of problems arise out of the experience of O. and M. Department, and continuous effort is required to deal with them. Modifications to existing equipment are frequently necessary to take account of changed conditions or requirements, or to accommodate new components.	Continuing.

SPECIAL CHANNELS FOR SOUND TRANSMISSION.

2.24.	Sound Channels from T.V. link.	Considerable effort has been devoted to an attempt to use F.M. terminal equipment in order to derive a sound circuit from a television channel. It appears that there is little hope of including the F.M. channel in the T.V. spectrum without sacrificing the quality of the T.V. signal. There may be some field of use for the F.M. channel over radio links in O.B. work and this is being investigated. The object of this work has been to save rentals of music lines; the more limited field of use on O.B. links would save some line rental, but the chief advantage would lie in the operational convenience obtainable.	Continuing.
2.25.	Television Talk-back System.	This system was primarily designed to meet the requirements of Television Outside Broadcasts. It enables a two-way sound transmission to take place freely between the speaker in a Television studio and someone at a distant outside Broadcast point. With this system it will be possible to have a microphone and loudspeaker at both ends of the system so	Continuing.

No.	Job.	Work and Purpose.	State of Work.
2.25.	Television Talk-back System. (Cont.).	that both parties are free to talk to each other without the aid of telephones, headphones, or other such encumbrances. Howl back in the system is prevented by a voice operated relay. This system should simplify complex arrangements which sometimes have to be made for such broadcasts.	

3. STUDIO AND CONTROL ROOM APPARATUS.

Staff: 5 Engineers, 3 Laboratory Technicians.

DEVELOPMENT OF NEW EQUIPMENT FOR THE SOUND SERVICE.

No.	Job.	Work and Purpose.	State of Work.
3.01.	Amplifiers and Basic Technical Equipment.	The basic amplifiers are completing service trial. Miscellaneous Control Room equipment is being re-designed for 19" bays. The adoption of 19" bays together with new apparatus and techniques justify a rationalisation of the Test Apparatus for operational use. Eight such units are being dealt with at the present time.	Continuing.
3.02.	Studio Equipment.	A prototype General Purpose Studio equipment built on the unit principle has been undergoing service trial in Studio 8, Broadcasting House. Development of this for Talks and Television Studios is being considered. Flexibility and manufacturing efficiency are the aim.	Continuing.
3.03.	Control Room Operational Equipment.	The commissioning of new premises calls for up-to-date Programme routing equipment giving operational efficiency. A prototype for Regional premises is being manufactured to be installed in Manchester for service trial.	Continuing.

AUTOMATIC APPARATUS.

No.	Job.	Work and Purpose.	State of Work.
3.04.	Programme Chain Auto-Switching Equipment (Bush House).	Following the successful conclusion of the service trial, modifications to the design have been made and full manufacturing information has been prepared.	Continuing.
3.05.	Auto-time Control.	A system of maintaining ± 1 second accuracy on Master Clocks by G.T.S. control has been designed and has been adopted in the Overseas Service.	Completed.

No.	Job.	Work and Purpose.	State of Work.
3.06.	Auto-Monitoring.	A completely new design of Auto-Sequential Monitor issuing relays instead of selectors has been developed for medium and small installations and is being first used at OSE3. This will result in economy in both operation and manufacture.	Completed.
		COMPONENTS, ETC.	
3.07.	Valves.	Close check is being maintained on the performance of various valve types. Modifications of equipment are proposed before valve supply difficulties are encountered as existing types are declared obsolescent.	Continuing.
3.08.	Miscellaneous Components.	New components have been developed and a continuous watch is kept on the component market which influences, so much, our new designs.	Continuing.
3.09.	Microphones and Stands.	A close watch is kept on the market for new and improved microphones. Troubles with commercial microphone stands adopted in service have been investigated. A banquet microphone stand has been developed for Royal occasions.	Continuing.
3.10.	Loudspeakers.	Promising commercial loudspeaker units were investigated. A second-grade inexpensive monitoring loudspeaker unit has been developed.	Continuing.
3.11.	Transformer Design.	Specialised designs of audio and power transformers are constantly required. Such designs are regularly supplied to the sections in this department and other departments as required.	Continuing.
		EQUIPMENT DESIGN.	
3.12.	Trap-Valve Amplifier for O.Bs.	The prototype of this unit for use with OBA/9 equipment and to replace bulky units now used with OBA/8 has been on a successful service trial.	Completed.

No.	Job.	Work and Purpose.	State of Work.
3.13.	Variable frequency Power source.	An oscillator adjustable between 40 and 60 c.p.s. has been designed and has proved very satisfactory as a control of power supply frequency for recording purposes.	Completed.

SERVICE TO OTHER DEPARTMENTS.

3.14.	Gun-shot Generator.	An electronic device for simulating gun-shot sounds with safety, has been developed principally for the Television Service. There is some doubt as to whether it is sufficiently realistic.	Continuing.
3.15.	Noise pickup on Sound equipment.	On various occasions investigations have been carried out in co-operation with O. and M. Department to trace H.F. and hum pick-up on Sound equipment in the T.V. Service and various recommendations have been made.	Completed.
3.16.	Investigation into Talk-back Systems for Television.	The complex talk-back systems which have grown up in Television studios call for rationalisation. This, from the general point of view, has been found too complex and has, therefore, been abandoned.	Completed.
3.17.	Miscellaneous.	Design and advice on miscellaneous switching, monitoring, and loudspeaker problems have been given to O. and M. and other specialist departments.	Continuing.

MISCELLANEOUS.

3.18.	Exhibition Equipment.	The plan of work has been interrupted and modified so that Type B studio equipment could be exhibited at the 1953 Radio Exhibition.	Completed.
3.19.	Service Faults.	Analysis of service fault returns continues to give valuable information as a basis for future designs.	Continuing.

No.	Job.	Work and Purpose.	State of Work.
3.20.	Tests on Commercial Equipment.	Tests are carried out from time to time on commercial sound equipment which may be suitable for either BBC or Colonial use.	Continuing.
3.21.	Visitors.	Considerable time is devoted to discussion with overseas and other visitors and demonstration of new developments.	Continuing.

4. SPECIAL SYSTEMS AND INSTRUMENTS.

Staff: 3 Engineers, 2 Laboratory Technicians.

AUTOMATIC MONITORS.

No.	Job.	Work and Purpose.	State of Work.
4.01.	Radio Automatic Monitors.	A set of equipment has been made up for a field trial at Westerglen. This has been delivered to site. It awaits testing.	Continuing.
4.02.	Line Automatic Monitors.	The original Barnstaple type of automatic monitoring equipment has been redesigned to include an additional testing level, with the object of improving its general sensitivity for use on the F.M. system. At the same time a continuous monitoring system has been developed using some of the features of the 'Minor' and the 'Major' but sending the processed signal over the line phantom. This latter system has now been developed to the exclusion of the former and information is being prepared for the Drawing Office.	Continuing.
4.03.	Transmitter Automatic Monitor.	Modifications were required on the original transmitter monitor (AMT) to reduce the dissipation of one of the valves which had a short life.	Completed.
		Another form of the 'AMT', the AMT/1B, was required for use at Londonderry where its power supplies are not derived from the transmitter.	Completed.
		A new Transmitter Automatic Monitor AMT/2, is required for F.M. transmitters. This is a development of the 'AMT' circuit but redesigned as a 19" bay mounting panel, using an improved type of relay and with internal mains rectifiers and other special facilities for F.M. transmitters. The draughting work has started.	Continuing.
4.04.	Transmission Line-up Monitor.	This equipment is designed to indicate change in equivalent of long lines, while transmitting programme. An extended field trial has been requested,	Continuing.

No.	Job.	Work and Purpose.	State of Work.
4.04.	Transmission Line-up Monitor. (Cont.)	necessitating the construction of two additional units for Droitwich. Information is with Section 8.	
		Arrangements were required for demonstrating this equipment at Radio Olympia.	Completed.

AUTOMATIC OPERATION OF TRANSMITTERS.

4.05.	F.M. Stations - General.	A considerable amount of work has been done in co-operation with the S.B. Section in devising the line arrangements to which automatic monitoring is most suitably applied.	Continuing.
		This has involved up to the present time, the planning of line and monitoring equipment for the first 30 new transmitters (10 stations) in the F.M. system but of course, bearing in mind the integration of these systems with the remaining 50 or so which have yet to be dealt with in detail.	
4.06.	Wrotham.	Equipment is required for the F.M. Station at Wrotham. Six units are being designed and manufactured.	Continuing.
		Experiments are to be carried out with Peak Choppers to determine whether it is necessary to restrict amplitude of modulation. Equipment is being installed for this purpose.	
4.07.	Barnstaple.	Modifications are required to the apparatus to try out a reduction in the restoration time after a line fault. The facility may ultimately be applied to all monitors of this type.	Continuing.
4.08.	Londonderry.	The original design for the Barnstaple system required revision for special application at Londonderry where two transmissions were to be radiated. This also involved the design of a bay mounting framework to accommodate the 'AMTs' which could not be mounted	Completed.

No.	Job.	Work and Purpose.	State of Work.

4.09. Swansea. — Completed.

A somewhat different version of the Barnstaple type of line monitor was required to monitor the line from Bristol to Swansea and give the alarm at Cardiff.

4.10. Brighton. — Continuing.

The circuit design for the Automatio Monitor on the Home programme line requires to be modified to accommodate a bay of sending-end equipment, so that Brighton can feed RBR programme to Bexhill and Folkestone and restore their transmitters after a break down on the Bartley-Brighton line.

TELEPHONIC INDICATION UNITS.

4.11. TIP/2. — Continuing.

A new Telephonic Indication Panel is required to provide a greater number of signals than produced by the original TIP/1. This is necessary for multi-transmission stations such as Londonderry and F.M. stations. The initial part of the design work is completed.

4.12. TIP/2A. — Completed.

A modified version of the TIP/2 is required for Londonderry where the equipment is accommodated in a special 'Imhof' cabinet.

R.F. EQUIPMENT.

4.13. RBR/2 Medium Wave Receiver. — Completed.

Collaboration was required with Equipment Department in connection with testing of the first units of the medium wave version of the RBR/2.

4.14. Medium wave and Long wave RBRs on 19" panels. — Continuing.

The RBR/2 required to be redesigned for 19" panels to be installed primarily at F.M. stations. The circuts will be modified at the same time to take advantage of improved types of valves, etc.

No.	Job.	Work and Purpose.	State of Work.
4.15.	F.M. Receivers.		Continuing.
		F.M. receivers are required to check programmes at attended stations which can receive the new F.M. transmissions. They will provide audio output for aural monitoring or 'comparison signals' for automatic monitor Minors.	
		A limited number of E.M.I. receivers were available but required modifying and remounting.	
		New commercial receivers in current production were sought, for later requirements. Only one suitable commeroial unit (the Dynatron) has been found and this requires modifying and remounting.	Continuing.
4.16.	F.M. Rebroadcast Receivers.		Continuing.
		F.M.Rebroadcast Receivers are required at all F.M. stations. The Dynatron mentioned in 4.15 is being investigated as a possible solution.	
4.17.	Radio Microphones.		Continuing.
		There is a long outstanding need for a small radio microphone which can be used for both Television and Sound O.Bs.	
		It is particularly necessary for Television O.Bs. so that commentators are not 'tethered' to their local base by a flexible cable.	
		Work has started on a small appliance of this kind, but has had to be temporarily suspended owing to the immediate pressure of other activities. It is hoped to complete the design as early as possible in 1955.	
4.18.	R.F. Drive Equipment.		Completed.
		Collaboration required with Equipment Department in testing modified Drive Units (COU/4) with aperiodic output circuits. A supplementary modification was decided to improve the output.	
		Drive Frequency Checking Equipment constructed by O and M Department was investigated, with reference to its approval as a standard design for operational tests. It was approved.	Completed.

No.	Job.	Work and Purpose.	State of Work.

4.19. H.F. Transformers. Continuing.

The general design for H.F. transformers for various departments continues.

BAYS AND APPARATUS MOUNTING.

4.20. Sound and Television Bays.

During the year a drive has been made towards the redesign of the bays used in the existing Control Rooms.

Work is in progress on a new design for both Sound and Television bays, the main objective being improved facilities for mounting apparatus, easier wiring inter-bay and better versatility of fixing in the Control Rooms, etc. This has proved a very controversial subject as so many interests are involved.

Sound Bays. The main principles in the design of these bays have been generally agreed inter-departmentally. The detail work will proceed when agreement has been reached on Television bays. Continuing.

Television Bays. A large number of experiments have been made to find the optimum arrangements of cooling and an attempt is being made to get agreement on all the other main points of the design. When these are settled the detail work can proceed. Continuing.

4.21. Apparatus mounting chassis for bays.

As during the year a decision has been made to build all new apparatus on 19" mounting plates and also new bays are in the course of design, a new standard mounting chassis has been designed to provide the maximum agreement with existing standards in other organisations and to give improved facilities when mounting BBC apparatus.

Design work has also started on a form of hinged mounting chassis which should provide better mounting space on bays with improved accessibility to particular units. Continuing.

No.	Job.	Work and Purpose.	State of Work.

MISCELLANEOUS.

4.22. Component Reliability. — Continuing.

As a background to the bay design work, detailed previously, a considerable amount of effort has been expended on investigation of component reliability. This work has been done in close co-operation with the newly appointed Standards Engineer and has assisted in ensuring that standards chosen for use in the Corporation are the best possible.

In the forefront is the problem of cooling valves in apparatus used in BBC Control Rooms. The knowledge and the technical facilities which the Section has acquired during the course of this work, is being used to assist investigations into valve life in the apparatus rooms at Lime Grove. — Continuing.

4.23. Automatic Capacity Bridge. — Continuing.

This provides automatic measurement of capacities from 10pf. to 10μf. to close limits.

The first complete model has been design and was exhibited at Radio Olympia. It has already given some useful service in the laboratories.

5. TELEVISION TRANSMISSIONS.

Staff: 6 Engineers, 3 Laboratory Technicians.
(since 20th September - 4 Laboratory Technicians.)

TELEVISION PERMANENT LINKS.

No.	Job.	Work and Purpose.	State of Work.
5.01.	Testing and acceptance of links.	The following new links have been tested and accepted:- London - Rowridge. Kirk O'Shotts - Redmoss. In addition, the following local links have been set up and tested:- Lime Grove - Shepherds Bush Empire (in both directions). Lime Grove - Television Centre (2 circuits).	Continuing.
5.02.	Broadcasting House - Museum Exchange.	Tests are being made in conjunction with the G.P.O. to determine whether video transmission can be used over existing co-axial cables. The Post Office wish to transfer the television link terminal equipment at present in Broadcasting House to Museum Exchange and to employ video transmission to and from Broadcasting House.	Continuing.
5.03.	Broadcasting House - Crystal Palace.	The initial vision link requirements to the new London television station at the Crystal Palace are for one circuit in each direction. In the future additional channels will be required for the projected second television programme and the likelihood of experimental transmissions in colour. Alternative methods of providing the circuits were investigated to determine the most economic method of obtaining them. The outcome of this investigation was to recommend that the Corporation should order two 1" co-axial cables between Broadcasting House and Crystal Palace from the G.P.O. without terminal equipment and that the latter should be developed and provided by the Corporation. It is planned to obtain eventually two vision	Continuing.

No.	Job.	Work and Purpose.	State of Work.

5.03. Broadcasting House - Crystal Palace. (Cont.).

channels on a single co-axial tube. The first stage involves the development of a complete co-axial transmission system. Work on this is progressing.

5.04. Colour Television Transmission tests. — Completed.

Co-operation with Section 8 in carrying out initial tests over the Television S.B. system using the Marconi Colour Television Equipment.

5.05. Quality rating of Television Pictures. — Continuing.

Appraisal tests have been made in co-operation with the G.P.O. to determine the acceptable limits of distortion in television pictures for our permanent links.

5.06. Simultaneous transmission of two television signals. — Completed.

An investigation was made into the feasibility of transmitting two television signals simultaneously over a single link, with a view to saving line rentals. The results of the investigation showed that this is not practicable.

TELEVISION O.B. LINKS.

5.07. Development of 500 Mc/s O.B. Link. — Completed.

Channels in Band 111 currently employed to give television O.B. link facilities will have to be given up or be severely curtailed as they are required for competitive television. Band 1V (470 - 585 Mc/s) is the next available.

In order to make transmission experiments in this band and as no suitable commercially made equipment was available, the following apparatus was developed:-

One 500 Mc/s transmitter and aerials.
A receiver for A.M. and a receiver for assessing F.M. noise.

No.	Job.	Work and Purpose.	State of Work.
5.07.	Development of 500 Mc/s O.B. link. (Cont.)		Completed.
		Field tests were carried out in the London suburban area using the above equipment to obtain information regarding the value of a U.H.F. link for conveying O.B. vision signals from the O.B. point to the main transmission link. Measurements were made using both A.M. and F.M. reception to obtain comparative information.	
		Tests were also made over the Boat Race Course between the motor vessel "Everest" and the shore, in order to compare channels in the 200, 500 and 800 Mc/s bands.	
		The results of the tests at 500 Mc/s were so encouraging that the department is now proceeding with the development of a wide band F.M. vision link. The equipment required comprises an F.M. Modulator, Transmitter and Receiver. Work on these is progressing.	Continuing.
5.08.	Injection of Television O.B. Signals into the Manchester - Kirk O'Shotts link.		Completed.
		Tests were carried out at Pontop Pike which proved the feasibility of injecting television O.B. signals into the Manchester-Kirk O'Shotts link at the intermediate frequency of the link.	
	Equipment for Injecting Television O.Bs. into the Manchester-Kirk O'Shotts links.		Continuing.
		Equipment for the purposes was ordered from the G.P.O. but about a year ago we were informed that its delivery would be delayed two or more years. As substantial line rentals will be saved when this injection gear is available, we have agreed with the G.P.O. that we should undertake its development ourselves.	
5.09.	Boat Race.		Completed.
		A special aerial filter for use on the launch "Everest" was required to enable a television receiver to operate on Alexandra Palace in the presence of the local vision, sound and R.T. transmitters on the boat. This facility provides the commentator with the picture seen by viewers.	

No.	Job.	Work and Purpose.	State of Work.

TRANSMISSION APPARATUS.

5.10. Equaliser. — Completed.

An equaliser was designed to correct flexible vision O.B. cable for Television O.B.'s.

5.11. Carrier Distribution Amplifier. — Completed.

This was designed for use at Manchester Switching Centre.

5.12. Wide-band Repeating Coils. — Completed.

A number of these transformers have been corrected for impedance and loss. They are for use with BBC Television Repeater Equipment manufactured by Equipment Department for use in the Television Service.

5.13. Low Pass Filter. — Completed.

A low pass filter with accurate phase correction has been designed which can be used to band limit noisy television links to 3 Mc/s. It is for use by Television O. and M. Department.

5.14. 200 Mc/s Receivers TV/REC/4. — Completed.

The testing, adjustment and setting up of four of these receivers has been carried out. They are in use by Television O.B's.

5.15. Equaliser Distribution Amplifier TV/DA/IC. — Completed.

The design of the Television Distribution Amplifier TV/DA/1 was modified to fulfil special requirements for Television O.B's.

5.16. Television Sound Receiver. — Completed.

A more sensitive Sound receiver has been designed as an alternative to the existing unit in the TV/REC/3.

5.17. Pulse Distribution Amplifier TV/PDA/1X. — Continuing.

A Distribution Amplifier, smaller and cheaper than

No.	Job.	Work and Purpose.	State of Work.
5.17.	Pulse Distribution Amplifier TV/PDA/1X. (Cont).	that in use at present, is being designed. It is intended for new installations and to replace the large number of the larger type already in use.	

INVESTIGATIONS AND TESTS ON TELEVISION APPARATUS.

5.18.	Time Equaliser.	Measurements of Loss and Delay Characteristics obtainable with G.P.O. equalisers have been made.	Completed.
5.19.	Longitudinal Stop Coil.	The performance of an S.T. and C. stop coil has been investigated.	Completed.
5.20.	Distribution of Television Signals to Offices at White City.	An investigation was made into complaints of loss of synchronization. As a consequence, modifications were made to E.M.I. equipment used for distributing signals.	Completed.
5.21.	Radio Times Mirralite Signs.	An investigation was made into complaints of interference caused by these signs.	Completed.

TELEVISION TEST APPARATUS.

5.22.	Television Test Modulator TV/TM/1.	Modifications have been made to make this unit operate on Band 111 as well as Band 1. The expermental unit is being used by Television O.B's.	Continuing.
5.23.	Television Amplitude Meter.	Experimental units have been made and installed at Lime Grove.	Continuing.

No.	Job..	Work and Purpose.	State of Work.

DEMONSTRATIONS.

5.24. European Broadcasting Union. — Completed.

Demonstrations were given to members, of the types of distortion which occurred in the European Television Exchange Programmes in June and July.

Further demonstrations of these and of the methods employed to reduce the distortions were given to the European engineers who operated these links. In particular, the flexibility of Designs Department "Bode" Equaliser (TV/EV/3) was demonstrated.

Information is being sent to the various authorities to enable them to make these units for their own use.

6. TELEVISION APPARATUS.

Staff: 5 Engineers (4 + 1 Graduate Apprentice)
5 Laboratory Technicians.

No.	Job.	Work and Purpose.	State of Work
6.01.	Inlay.	(New Work). One set of Inlay equipment is being constructed by Designs Department in co-operation with P.I.D. for installation in Studio'D'. As the result of experience, modifications were carried out to the slide mechanism on the Studio 'G' and Studio 'E' Inlay equipments to improve the performance and to adjust the speed to be more in line with operational need.	Continuing.
6.02.	Flying Spot Transparency Scanner.	The design of a Flying Spot Transparency Scanner for Television Transmitting Stations has been completed. This scanner offers facilities for originating high quality test signals from glass transparencies 2" x 2".	Completed.
6.03.	Synchronisation of Television Cameras.	The synchronising equipment used on the Coronation for locking all cameras to a central pulse generator has been modified to give flexibility to cope with various types of outside broadcasts. All the equipment is now being returned to Television O.B's.	Completed.
6.04.	Roving Eye.	The Roving Eye has been completed and put into regular television service. After six months use small modifications were carried out and it is now back in service.	Completed.
6.05.	Standards Conversion.	The display equipment for the converter now located at Swingate was designed and constructed in time for the July series of broadcasts. This equipment comprises variable equalisation and gamma correction for shaping the incoming signal to correct for dis-	Completed.

No.	Job.	Work and Purpose.	State of Work.
6.05.	Standards Conversion. (Cont.)	tortions introduced by the long links at present in use and also picture monitors for displaying the signals on 625 and 819 lines. The equipment was installed and operated during the summer under the direction of a Designs Department engineer and has now been handed over to the Television Service for regular operation.	
6.06.	Colour.	One engineer was seconded to the Marconi Wireless Telegraph Company for three months to work with the Marconi engineers on their experimental colour equipment. Work has commenced on the construction of some experimental colour monitors and coding equipment.	Continuing.
		The Department negotiated for the loan of experimental colour equipment manufactured by Messrs. Marconi, so that extensive experiments could be carried out on the television link system carrying the N.T.S.C. type of colour signal. A series of tests were carried out leading to the broad conclusion that the cable links are fairly satisfactory and can probably be put in sufficiently good order without a great deal of work but that the radio links (Manchester - Kirk O'Shotts) will require more extensive work to make them carry the colour signal. Following these tests a full-scale experiment was made of broadcasting the signal from the Alexandra Palace stand-by transmitter and a large number of observers answered questionnaires on the various aspects of the compatibility of the N.T.S.C. signal. Again, in most general terms the broad conclusion is that the N.T.S.C. signal is quite compatible. A report is to be issued.	Completed. (Except for the report.)
6.07.	Commentator's Monitor.	Design work on the commentator's monitor has started and a prototype monitor is almost complete.	Continuing.
6.08.	Transistors.	The report on the investigations mentioned last year has been issued.	Completed.

No.	Job.	Work and Purpose.	State of Work.
6.09.	Experimental O.B. Unit.	The experimental O.B. unit has been formed and work has started in preparation for television broadcasts from aeroplanes in flight.	Continuing.

7. TELEVISION RECORDING.

Staff: 3 Engineers, 3 Laboratory Technicians.

No.	Job.	Work and Purpose.	State of Work.
7.01.	16 mm. Suppressed Frame Recording.	Three channels are being built for Service use. Preliminary discussions with outside manufacturers have taken place and design of electronic units has started.	Continuing.
7.02.	Flying Spot Mechau.	Six Mechau Scanners are being built in collaboration with P.I.D. for stock. Some changes involving new design work are being made.	Continuing.
7.03.	Magnetic Sound Facilities.	Equipment is being developed to enable the prototype Flying Spot Mechau to run in synchronism with a Western Electric Film Phonograph, using 35 mm. sprocketed Magnetic Film. Similar facilities will be provided on the new machines.	Continuing.
7.04.	Negative Film Gamma Unit.	A prototype has been built and installed in the Lime Grove Flying Spot Mechau, where it is giving satisfactory results. Similar circuitry will be embodied in the new machines.	Completed.
7.05.	Microdensitometer.	A microdensitometer has been set up for measurements of test transparencies, etc., and is being built in permanent form.	Continuing.
7.06.	News and Newsreel.	An amplifier with a square law characteristic has been built and is installed at Alexandra Palace. It has been found that this characteristic improves pictures from poor films.	Completed.

No.	Job.	Work and Purpose.	State of Work.
7.07.	Picture Channel for Caption Scanner.	The picture channel for the caption scanners being produced by Section 8 has been designed.	Completed.
7.08.	Miscellaneous.	The Section's photographic facilities have been used in the preparation of test slides, etc. for other sections.	Continuing.