



REPORT OF THE TELEVISION COMMITTEE


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THE TELEVISION COMMITTEE

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THE TELEVISION COMMITTEE

REPORT

The Right Hon. Sir KINGSLEY WOOD, M.P.,
His Majesty's Postmaster General.

TERMS OF REFERENCE AND PROCEEDINGS OF THE COMMITTEE

1. The appointment of the Committee was announced in the House of Commons on the 14th of May, 1934, with the following terms of reference:—

"To consider the development of Television and to advise the Postmaster General on the relative merits of the several systems and on the conditions under which any public service of Television should be provided."

2. A notification was made in the Press on the 29th of May, 1934, and again on the 11th of June, 1934, intimating that the Committee were prepared to receive evidence on the subject of Television from any interested society, firm or individual.

3. We have examined 38 witnesses—some of them on more than one occasion—representing many different interests, on the various aspects of Television. A list of witnesses who have appeared before us is set out in Appendix I. In addition, we have had the benefit of consultation with members of various Departments of the Government, who have afforded us every facility and assistance; and we have received numerous written statements regarding Television from various sources.

4. A note of the formal evidence given is presented in Appendix II (Volumes I to IV), but owing to the fact that much of this information, containing secrets of commercial value, was necessarily received in confidence and under promise of secrecy, we trust that this pledge may be maintained and that accordingly the record, while available for yourself and your responsible officers, will not be published. For similar reasons we recommend that Appendix III, containing reports on developments in the United States and Germany, and Appendix IV, containing a description of each television system we have examined in this country, should not be published. Appendix V, containing certain financial details, is also of a confidential nature (*see* paragraph 63).

(Appendix II
not printed.)

(Appendix III
not printed.)

(Appendix IV
not printed.)

Appendix V
(not printed.)

5. We have inspected, in some cases upon several occasions, all the different television systems belonging to firms who were prepared to provide demonstrations. Of the systems under development in this country, the most distinctive are those of the Baird, Cosser, Marconi-E.M.I. and Scophony Companies.

6. Further, we despatched with your approval a delegation headed by the Chairman, to investigate and report upon progress in television research in the United States, and a delegation headed by Mr. O. F. Brown, to Germany for a similar purpose. We have also been furnished with information regarding the position in certain other countries.

7. In America, our delegation visited and inspected many of the chief centres of television experimental research, as well as the plant and laboratories of the principal Broadcasting, Telephone and Telegraph Authorities. They had also the advantage of consultation in Washington with the Federal Communications Commission. To all of these Corporations and Authorities we desire to make the fullest and most sincere acknowledgment of the kindness and courtesy extended to the delegation, who were given every possible opportunity for the fullest examination of methods and plant, and the frankest interchange of opinion. A detailed report of the proceedings and conclusions of the delegation is submitted as Appendix III, A.

8. In Germany, our delegation made a similar inspection of the television experimental installations belonging to the Reichspost and also of those of several private firms in Berlin, and they had many profitable discussions with officials of the Reichspost and others regarding various aspects of Television. As in America, so also in Germany, every facility was accorded to our delegation in their investigations, for which we likewise desire to express our sincere appreciation. A report on the visit to Germany is submitted as Appendix III, B.

BASIC PRINCIPLES OF TELEVISION

9. Television may be defined as the transmission by telegraphy and reproduction in transitory visible form of images of objects in movement or at rest. The equipment utilised usually consists of combinations of optical and electrical apparatus which at the transmitting or "pick up" end of the system convert the image of the object into electric currents, and of similar combinations at the receiving end of the system which resolve the electric currents into visible forms.

10. When an object is viewed by direct vision, light reflected from the object under observation impinges on the eye and is focussed by the lens on to the retina where it stimulates nerve cells.

Each cell communicates with the brain, and the sensation of sight and the perception of any scene result from the relative stimulation applied to the brain by the cells in the retina. As the light-sensitive cells of the retina have finite dimensions, details in an object which produce an image on the retina smaller than a single cell cannot be individually perceived. The eye, therefore, really sees a large number of infinitely small objects, which in the aggregate form the image.

11. Thus all vision is of a granular structure, as is also pictorial reproduction, and, in order to transmit pictures or images over electric circuits, a suitable granular structure is adopted, the relative brilliancy of each grain or elementary area of the picture being transmitted telegraphically to the distant point, where by suitable means an equivalent brilliancy is given to a corresponding area on the receiving screen.

12. The transmission of the relative brilliancy of each grain or elementary area of the picture must be effected in some ordered sequence, and the process by which this is achieved is termed "scanning." The usual method employed is to allow light from a selected area of the subject to impinge on a device known as a photo-electric cell, which delivers an electrical output proportional to the light stimulation it receives. This electrical output, after amplification, is used to control the output of a radio transmitter by methods similar to those in use for the transmission of speech and music. The position of the selected area of the subject is varied in a definite path so that the whole of the subject is covered in a period which should be less than the time of persistence of vision. The path of selection is usually a series of horizontal or vertical parallel lines, and the process somewhat resembles the action of the human eye in reading a page of printed matter, letter by letter and line by line. A further refinement consists in making the path of selection run first along every alternate line and then, as a second process, along the lines omitted in the first process. This is known as interlaced scanning, and it appears to be successful in reducing "flicker."

13. At the receiver, the radio signal is detected and amplified by methods similar to those used for radio-telephony. The electrical signal from the receiver thus resembles the signal from the photo-electric cell or cells at the transmitter, and is used to control the brilliancy of illumination of an elementary area of the screen on which the received picture is to be displayed.

14. It is essential to arrange that the area illuminated on the viewing screen at any given instant shall correspond in position with the area of which the illumination is then being determined by the scanning device. In other words, precise synchronism is necessary between the movements of the scanning device and the receiving device. Various methods have been proposed for

achieving this synchronism; it can, for instance, be accomplished by the sending of two series of special synchronising signals by the transmitter—one series to ensure the correct motion of the picture spot along each line and the second series to signal the instant of termination of one picture and the commencement of the next. As these series of signals occur respectively between successive lines of the picture and between successive pictures, their transmission need not interfere with the picture signals, and they can be sent on the same radio transmitter.

15. The relative brilliancy of each successive grain of the picture is transmitted with such rapidity that persistence of vision produces the effect at the receiving end of a complete picture, the degree of definition and steadiness of which is dependent upon the fineness of the individual grains composing the picture, *i.e.*, the number of lines used for scanning it, and the speed at which complete pictures are successively transmitted.

16. One of the difficulties which has been encountered in direct scanning is the small amount of light available to actuate the photo-electric cell obtained by reflection from objects which are being televised.

17. Accordingly, considerable experimental development has taken place upon a technique whereby the scene to be televised is first photographed on ordinary cinematograph film which, after being developed, is scanned by light transmitted through it. This system can be used to provide a method of delayed Television where direct scanning by a mechanical device would be difficult or impossible. In order to reduce the period of delay, equipment has now been produced in which the cinematograph camera is associated with the film scanner, and the film, after exposure, is immediately developed, fixed, washed and partially dried. It then passes through the scanner, and after further drying is stored for future use if required. In this way, the advances which have been made in photographic processes in the production of rapid and sensitive emulsions can be utilised to overcome the difficulties which are at present encountered due to the comparatively feeble sensitivity of photo-electric cells.

18. The direct scanning of open air scenes and studio subjects without abnormally powerful illuminating devices has also been made possible by the use of cathode rays in combination with photo-sensitive surfaces or minute photo-electric cells. For instance, in one such device which is being developed in America, Germany and this country, the image to be televised is focussed by means of lenses on to a photo-electric mosaic contained in a cathode ray tube. The cathode ray beam is directed on the surface of the mosaic and by a method of magnetic control the image is scanned repeatedly.

Electrical energy is thus drawn off from the photo-electric mosaic by the cathode ray which is proportional to the light intensity of the picture and can be transmitted to operate the distant television receiver.

19. Our observations lead us to the opinion that this system of "direct pick-up" has already attained a considerable degree of effectiveness, and we should say that satisfactory reproduction of outdoor moving scenes can now be attained by this method in conditions of light, etc., approximating to those under which satisfactory cinematograph pictures can be taken, provided that the recording apparatus can be located reasonably close to and at a moderately constant distance from the scene to be televised. We should regard it as probable that satisfactory reproduction could, even at this stage of development, be obtained of such scenes as a procession, a lawn-tennis match, or the actual finish of a horse race, though the transmission of a view of the whole course of a race, a cricket match, or a football match, would present much greater difficulty.

EXPERIMENTS IN TELEVISION

20. We are informed that the Post Office has always given facilities to qualified persons or firms who have applied for permission to conduct experiments in Television, but the licences issued have been restricted to purely research and experimental work and have given no authority for the conduct of any form of public service.

21. The view taken was that when any system of Television showed sufficient promise to justify its trial for public transmissions, the British Broadcasting Corporation should provide reasonable facilities for such a trial service on a limited scale at one or more of their broadcasting stations.

LOW DEFINITION TELEVISION

22. As far back as the autumn of 1929 the British Broadcasting Corporation gave the Baird Company facilities for experimental transmissions of Television from a broadcasting station. During the next two or three years a large number of experimental transmissions were carried out by the Baird Company independently, as well as in liaison with the British Broadcasting Corporation.

23. Improvements were gradually made in the system, and in August, 1932, the Corporation arranged with Baird Television Limited for public experimental transmissions from their London Station (Brookmans Park) of Television on a wavelength of

251 metres, and of the accompanying sound on a wavelength of 398 metres from the Midland Regional transmitter (Daventry). The Corporation agreed to provide special programme material and also staff for operating the television apparatus, which was installed in Broadcasting House by the Baird Company on a loan basis. These transmissions, the experimental nature of which was emphasised in a notice issued to the Press, have continued up to the present time, although their frequency has been reduced since 31st March, 1934, to two half-hour periods a week which are extended to three-quarters of an hour when circumstances permit.

24. In the case of these transmissions the size of the elements (elementary areas) composing the picture is such as to admit of transmission being effected in a series of thirty lines per picture and each picture is repeated $12\frac{1}{2}$ times per second (see paragraphs 12-15).

25. Any pictures built up with a structure of the order of thirty lines are, however, comparatively coarse in texture. Little detail can be given, and generally speaking the pictures are only fitted for the presentation of "close-ups"—*e.g.*, the head and shoulders of a speaker—and the quality of reproduction leaves much to be desired. Moreover, any frequency of the order of $12\frac{1}{2}$ pictures per second gives rise to a large amount of "flicker".

26. Whilst low definition Television has been the path along which the infant steps of the art have naturally tended and, while this form of Television doubtless still affords scientific interest to wireless experimenters, and may even possess some entertainment value for a limited number of others, we are satisfied that a service of this type would fail to secure the sustained interest of the public generally. We do not, therefore, favour the adoption of any low definition system of Television for a regular public service. We refer later in our report (see paragraph 34) to the question of the temporary continuance of the present low definition transmissions pending the institution of a public television service of a more satisfactory type.

HIGH DEFINITION TELEVISION

27. With a view to extending the application of Television to a wider field and thereby increasing its utility and entertainment value, much attention has been given in recent years to the problem of obtaining better definition and reduced "flicker" in the received pictures.

28. The degree of definition it is essential to obtain is necessarily a matter of opinion, but the evidence received and our own observations lead us to the conclusion that it should be not less than 240 lines per picture, with a minimum picture frequency of 25 per second. The standard which has been used extensively for experimental work

is 180 lines, but we should prefer the figure of 240 and we do not exclude the possible use of an even higher order of definition and a frequency of 50 pictures per second.

29. To attain such degrees of definition and picture frequency, very high modulation frequencies are required, which in practice can only be handled by radio transmitters working on ultra-short waves the effective range of which is much more restricted than the range of the medium waves used for ordinary sound broadcasting (see paragraph 47).

30. For the reception of high definition pictures the cathode ray tube is now usually employed. The cathode ray tube receiver involves no moving parts, and the picture is presented as a fluorescence at the end of the tube. A stream of electrons (particles of negative electricity) is projected along the tube, and impinges on a coating of fluorescent material at the end of the tube, the impact of the electrons on the fluorescent material causing illumination. The amount of illumination can be controlled by varying the flow of electrons, and the point of impact can be changed by deflecting the jet by means of electric or magnetic forces. The jet is modulated or controlled in amount by the received signal, and suitable electrical circuits are provided to move the point of impact in exact synchronism with the transmitter (see paragraph 14).

31. The size of the picture produced naturally depends upon the size of the cathode ray tube. At present the most usual size gives a picture of about 8 in. by 6 in., although good results have been seen with larger tubes. The apparent size can, of course, be increased by viewing the tube through a suitable fixed magnifying device, though with a corresponding loss of definition. Experimental work is proceeding with a view to the projection of pictures on a screen of much larger dimensions, but this is still in an early stage of development.

32. We are informed that the price to the public of a receiving set capable of producing a picture of about the first-mentioned size, with the accompanying sound, would probably at first be considerable, and various estimates have been given ranging from £50 to £80; but it is reasonable to assume that, if and when receivers were made on a large scale under competitive conditions, this price would be substantially reduced.

33. Most of the high definition television systems follow in broad outline the methods of transmission and reception referred to above, with some variations in technique. We are impressed with the quality of the results obtained by certain of these systems, and whilst much undoubtedly remains to be done in order to render the results satisfactory in all respects, we feel that a standard has now been reached which justifies the first steps being taken towards the early establishment of a public television service of the high definition type in this country.

34. As regards the existing low definition broadcasts, these no doubt possess, as we have said, a certain value to those interested in Television as an art, and possibly, but to a very minor extent, to those interested in it only as an entertainment. We feel that it would be undesirable to deprive these "pioneer lookers" of their present facilities until at least a proportion of them have the opportunity of receiving a high definition service. On the other hand, the maintenance of these low definition broadcasts involves not only some expense, but also possibly considerable practical difficulties. We can only, therefore, recommend—

(1) that the existing low definition broadcasts be maintained, if practicable, for the present; and

(2) that the selection of the moment for their discontinuance be left for consideration by the Advisory Committee (see paragraph 41),

with the observation that, if practicable so to maintain these broadcasts, they might reasonably be discontinued as soon as the first station of a high definition service is working.

SCOPE OF TELEVISION AND ITS RELATION TO SOUND BROADCASTING

35. In our opinion there will be little, if any, scope for television broadcasts unaccompanied by sound. Television is, however, a natural adjunct to sound broadcasting and its use will make it possible for the eye as well as the ear of the listener to be reached. Associated with sound it will greatly enhance the interest of certain of the existing types of broadcast and will also render practicable the production of other types in which interest is more dependent upon sight than upon sound.

36. We are of the opinion that there are two factors which for a number of years will tend to prevent a television service being made use of to the same extent as present day sound broadcasting—

(1) The difficulties of wireless communication on ultra-short wavelengths, particularly in hilly districts, may seriously limit the extent to which the country can be effectively covered.

(2) Some time is likely to elapse before the price of an efficient television receiver will be comparable with that of the average type of receiver now in use for sound broadcasting.

Nevertheless the time may come when a sound broadcasting service entirely unaccompanied by Television will be almost as rare as the silent cinema film is to-day. We think, however, that in general sound will always be the more important factor in broadcasting. Consequently the promotion of Television must not be allowed to prevent the continued development of sound broadcasting.

37. No doubt the evolution of Television will gradually demonstrate the possibility of its application for many purposes other than those of entertainment and illustrative information. Its uses for purposes of advertisement are obvious, were such deemed desirable. We can conceive, moreover, its potential application—as distinct from existing practice in picture transmission—to public telegraphic and telephonic services, to the transmission of lists of prices, or of facsimile signatures or documents, and to its use by the police and the forces of the Crown, or as an aid to navigation.

38. We have assumed, however, that we were intended by our terms of reference to confine our attention to the question of the introduction of a public broadcast service of Television, and we do not, therefore, make any further observations regarding its other possible applications beyond expressing the earnest hope that it will be allowed the fullest possible freedom for development consonant with the public interest.

TELEVISION OPERATING AUTHORITY

39. Holding the view which we do of the close relationship which must exist between sound and television broadcasting, we cannot do otherwise than conclude that the Authority which is responsible for the former—at present the British Broadcasting Corporation—should also be entrusted with the latter. We therefore recommend accordingly; and we have received an assurance that the Corporation is prepared fully to accept this additional responsibility and to enter whole-heartedly into the development of Television in conformity with the best interests of the licence-paying public. In discharging this task the accumulated experience of the Corporation as regards sound broadcasting cannot fail to prove of great value. Presumably a separate licence will be required from the Postmaster General specifically authorising the Corporation to undertake the broadcasting of Television.

40. We have, of course, considered the possible alternative of letting private enterprise nurture the infant service until it is seen whether it grows sufficiently lusty to deserve adoption by a public authority. This would involve the granting of licences for the transmission of sound and vision to several different firms who are pioneering in this experimental field. We should regret this course, not only because it would involve a departure from the principle of having only a single authority broadcasting a public sound service on the air, and because the subsequent process of "adoption" (which we believe would be inevitable) would be rendered costly owing to the growth of vested interests, but also because we foresee serious practical difficulties as regards the grant of licences to the existing pioneers as well as possibly to a constant succession of fresh applicants. It is therefore our considered conclusion that the

conduct of a broadcast television service should from the outset be entrusted to a single organisation, and we are satisfied that it would be in the public interest that the responsibility should be laid on the British Broadcasting Corporation.

ADVISORY COMMITTEE

41. Whilst we think that the British Broadcasting Corporation should exercise control of the actual operation of the television service to the same extent and subject to the same broad principles as in the case of sound broadcasting, we recommend that the initiation and early development of this service should be planned and guided by an Advisory Committee appointed by the Postmaster General, on which the Post Office, the Department of Scientific and Industrial Research and the British Broadcasting Corporation should be represented, together with such other members as may be considered desirable. We recommend that this Committee should be appointed forthwith, for a period of, say, five years.

42. The Committee should advise on the following:—

(a) The performance specification for the two sets of apparatus mentioned in paragraph 56, including acceptance tests, and the selection of the location of the first transmitting station.

(b) The number of stations to be built subsequently, and the choice of districts in which they should be located (*see* paragraph 57).

(c) The minimum number of programme hours to be transmitted from each station.

(d) The establishment of the essential technical data governing all television transmissions, such as the number of lines per picture, the number of pictures transmitted per second, and the nature of the synchronising signals.

(e) The potentialities of new systems.

(f) Proposals by the British Broadcasting Corporation with regard to the exact site of each station, and the general lines on which the stations should be designed.

(g) All patent difficulties of a serious nature arising from the operation of the service in relation to both transmission and reception.

(h) Any problem in connexion with the television service which may from time to time be referred to it by His Majesty's Government or the British Broadcasting Corporation.

Normally the Committee would not concern itself with detailed financial allocations, or with business negotiations between suppliers of apparatus and the British Broadcasting Corporation. It is further

considered that the Committee should not deal with the compilation of programmes, the detailed construction of stations, or their day-to-day operation, unless specifically invited to do so under sub-paragraph (h).

43. It will be clear from the foregoing that the Committee would be composed of both technical and non-technical members, and it is anticipated that a part of the Committee's work would best be carried out by a technical sub-committee.

44. Such experimental work as may be necessary for the establishment of stations and the operation of the service would be carried out by the British Broadcasting Corporation in the usual course of its functions, but this would not, of course, preclude the enlistment of the co-operation of Government Departments or other organisations in technical researches.

USE OF ULTRA-SHORT WAVES FOR TELEVISION AND THEIR EFFECTIVE RANGE

45. As previously mentioned, the transmission of high definition Television is practicable only with ultra-short waves, and a wide band of frequencies is necessary. Fortunately, there should be no difficulty, at present at all events, in assigning suitable wavelengths in the spectrum—between 3 and 10 metres—for public Television in this country, although in allocating such wavelengths regard must, of course, be paid to the claims of other services. The recent experimental work has been conducted upon wavelengths around 7 metres.

46. Technically, it is desirable that the transmitting stations should be situated at elevated points, and that the masts should be as high as practicable, consistent with any restrictions which may be deemed necessary by the Government. The mast at present in use in Berlin is about 430 feet high, and the question of employing masts of greater height is under discussion in Germany. Quality of reception varies, of course, with the location of the receiving station and the nature of its surroundings. It may be observed that reception on these ultra-short waves does not seem to be materially affected by atmospherics. The most frequent sources of interference appear at present to arise from some types of electro-therapeutic apparatus, and from the ignition systems of motor cars; but we understand that it is possible to prevent or reduce certain types of such interference by simple remedial devices.

47. Present experience both here and abroad seems to indicate that these ultra-short waves cannot be relied upon to be effective for a broadcast service much beyond what is commonly called "optical range." Generally speaking, it is at present assumed

that the area capable of being effectively covered by ultra-short wave stations of about 10 kilowatts capacity will not exceed a radius of approximately 25 miles over moderately undulating country. In more hilly districts this may be considerably reduced, and indeed in certain areas an entirely reliable service may be impracticable. It is clear, therefore, that unless and until the effective range be increased, a large number of transmitting stations would be required to provide a service covering most of the country, though we think that with 10 stations, probably at least 50 per cent. of the population could be covered from suitable locations.

PROVISION OF TELEVISION SERVICE

48. We nevertheless envisage the ultimate establishment of a general television service in this country, and in this connexion we contemplate the possibility of television broadcasts being relayed by land line or by wireless from one or more main transmitting stations to sub-stations in different parts of the country. We should observe that recent developments in cable technique render it possible for the first time to transmit, over considerable distances, frequencies such as are required for high definition Television.

49. While the establishment of such a service should be, in our opinion, the aim, we do not feel that we can advise you to proceed at once to approve the construction, at great expense, of a network of stations, intended to cover most of the country. The total number of stations required for such a purpose is as yet unknown to anyone; and the total cost is accordingly purely speculative. Moreover, Television will be a constantly developing art, and new discoveries and improvements will certainly involve continued modifications of methods—at least during its early years. A general service will only be reached step by step; but the steps should be as frequent as possible and in our opinion the first step should be taken now. *Solvitur ambulando.*

CHOICE OF SYSTEM AND PATENT DIFFICULTIES

50. We have been furnished with a great deal of information—much of it of a confidential character—concerning various systems of Television. Continuous progress is being made in the art; and even during the few months of our investigations, research has brought a number of new and important discoveries. We do not think it would be right at this early stage of development, when practical experience is small and the patent position obscure, that we should attempt to pass final judgment on the several systems of Television. A technical description of each system which we have examined in this country, indicating its distinctive features

and commenting upon its performance, is, however, submitted for your information in Appendix IV. Comments are also made in Appendix III on the systems examined in the United States and Germany.

51. The task of choosing a television system for a public service in this country is one of great difficulty. The system of transmission governs in a varying degree the type of set required for reception; and it is obviously desirable to guard against any monopolistic control of the manufacture of receiving sets. Further, whatever system or systems are adopted at the outset, it is imperative that nothing should be done to stifle progress or to prevent the adoption of future improvements from whatever source they may come. Moreover, the present patent position is difficult: the number of patents relating to Television is very large, and in regard to many of them there are conflicting views as to their importance and validity.

52. At the same time it is clear from the evidence put before us that those inventors and concerns, who have in the past devoted so much time and money to research and experiment in the development of Television, are looking—quite fairly—to recoup themselves and to gather the fruits of their labours by deriving revenue from the sale of receiving apparatus to the public, whether in sets or in parts, and whether by way of royalties paid by the manufacturers or by manufacturing themselves. It is right that this should be so, and that the growth of a new and important branch of industry, capable of providing employment for a large number of workers, should in every way be fostered and encouraged to develop freely and fully.

53. The ideal solution, if it were feasible, would be that, as a preliminary to the establishment of a public service, a Patent Pool should be formed into which all television patents should be placed, the operating authority being free to select from this Pool whatever patents it desired to use for transmission, and manufacturers being free to use any of the patents required for receiving sets on payment of a reasonable royalty to the Pool. We have seriously considered whether we should advise you to refuse to authorise the establishment of a public service of high definition Television until a comprehensive Patent Pool of this type had been formed, on terms considered satisfactory by the Advisory Committee. From evidence we have received, however, we are convinced that, under present conditions, when the relative value of the numerous television patents is so largely a matter of conjecture, the early formation of such a Pool would present extreme difficulty. The Government would have no power to compel an owner of television patents to put them into the Pool against his will; and, with the best will in the world, patent holders might find it exceedingly difficult to agree

among themselves on a fair basis for charging royalties and sharing the revenue so obtained. An attempt hastily to negotiate a Pool under these conditions would in all probability end in failure.

54. While, however, we have been compelled to abandon the idea that the formation of a comprehensive Patent Pool should be a condition precedent to the establishment of a public service, we are strongly of opinion that it is in the public interest, and in the interest of the trade itself, that such a Pool should be formed. In framing our recommendations we have kept this objective in mind; and we trust that events will shape themselves in such a way as to lead to the formation of a satisfactory Patent Pool at no distant date.

START OF SERVICE

55. We have come to the conclusion that a start could best be made with a service of high definition Television by the establishment of such a service in London. It seems probable that the London area can be covered by one transmitting station and that two systems of Television can be operated from that station. On this assumption we suggest that a start be made in such a manner as to provide an extended trial of two systems, under strictly comparable conditions, by installing them side by side at a station in London where they should be used alternately—and not simultaneously—for a public service.

56. There are two systems of high definition Television—owned by Baird Television Limited and Marconi-E.M.I. Television Company Limited respectively—which are in a relatively advanced stage of development, and have indeed been operated experimentally over wireless channels for some time past with satisfactory results. We recommend that the Baird Company be given an opportunity to supply the necessary apparatus for the operation of its system at the London station, and that the Marconi-E.M.I. Company be given a similar opportunity in respect of apparatus for the operation of its system also at that station. Besides any other conditions imposed, acceptance of offers should be subject in each case to the following conditions precedent:—

(a) The price demanded should not, in the opinion of the Advisory Committee, be unreasonable.

(b) The British Broadcasting Corporation to be indemnified against any claim for infringement of patents.

(c) The Company to undertake to grant a licence to any responsible manufacturer to use its existing patents or any patents hereafter held by it, for the manufacture of television receiving sets in this country on payment of royalty.

(d) The terms of a standard form of such licence to be agreed upon by the Company with the Radio Manufacturers' Association, or, in default of agreement, to be settled in accordance with the provisions of the Arbitration Acts, 1889 to 1934, or any statutory modification thereof, either by a single arbiter agreed upon by the Company and the Radio Manufacturers' Association, or failing such agreement, by two arbiters—each of the parties nominating one—and an umpire nominated by the Postmaster General.

(e) The Company to agree to allow the introduction into its apparatus at the station of devices other than those claimed to be covered under its own patents, in the event of such introduction being recommended by the Advisory Committee.

(f) Transmissions from both sets of apparatus should be capable of reception by the same type of receiver without complicated or expensive adjustment.

(g) The definition should not be inferior to a standard of 240 lines and 25 pictures per second.

(h) The general design of the apparatus should be such as to satisfy the Advisory Committee, and when it has been installed, tests should be given to the satisfaction of the Committee.

DEVELOPMENT OF SERVICE

57. In the light of the experience obtained with the first station, the Advisory Committee should proceed with the planning of additional stations, until a network is gradually built up. The total number of stations and the speed at which they are provided will naturally depend upon the results obtained from the earlier stations, the popularity of the service, finance and other factors. A tentative programme for the location and provision of stations should be framed by the Advisory Committee, and reviewed by them at frequent intervals.

58. Whatever system be adopted for the second or any subsequent station, we recommend that conditions be imposed similar to those set out in paragraph 56, in so far as applicable. The Advisory Committee would, of course, endeavour to secure the incorporation in each fresh station of any improvements which had come to light, and they would also naturally consider the introduction, if possible, of such improvements into existing stations. There should be no serious difficulty in doing this, so long as the changes did not materially

affect the receiving sets, or at any rate so long as the sets already in use could be adapted, without much expense, to the modified system.

59. A more difficult situation would arise if a completely new system, requiring an entirely new type of receiving set, should be evolved and should prove on trial to be definitely superior to the systems already in use. In such a case it might be necessary to adopt the improved system, in the first instance, at new stations only, and to postpone for a time its adoption at the older stations. For it is obvious that many persons would be deterred from purchasing television sets unless they had some assurance that these sets would not be rendered useless at an early date by a complete change in the transmitting system. No radical changes should, therefore, be made in the systems serving particular areas without reasonable notice being given by the British Broadcasting Corporation of the contemplated change. In the initial stages this notice should not be less than, say, two years. The Corporation would naturally consult the Advisory Committee on this point. While giving some reasonable measure of security in this direction, the aim should be to take advantage, as far as possible, of all improvements in the art of Television, and at the same time to work towards the ultimate attainment of a national standardised system of transmission.

PROGRAMMES

60. It is scarcely within our province to make detailed recommendations on the subject of television programmes. To what extent those programmes should consist of direct transmissions of studio or outdoor scenes, or televised reproductions of films, must be determined largely by experience, technical progress and public support, as well as by financial considerations. No doubt the televising of sporting and other public events will have a wide appeal, and will add considerably to the attractiveness of the service. We regard such transmissions as a desirable part of a public television service, and it is essential that the British Broadcasting Corporation should have complete freedom for the televising of such scenes, with appropriate sound accompaniment, at any time of the day.

61. With regard to the duration of television programmes, we do not consider that it will be necessary at the outset to provide programmes for many hours a day. An hour's transmission in the morning or afternoon which will give facilities for trade demonstrations and, say, two hours in the evening, will probably suffice. As regards the future, the British Broadcasting Corporation and the Advisory Committee will doubtless be guided by experience and by financial considerations.

FINANCE

62. For reasons already explained, it will be clear that at this stage no human being can estimate the cost of constructing and working a national network—nor even of such a partial system of 10 stations, as is referred to in paragraph 47—with anything resembling accuracy. Even with all the resources at our command we have been quite unable to do so, and we confine ourselves, therefore, to giving what we hope may prove to be a fairly close estimate of the cost of providing and working the London station referred to in paragraph 55 up to 31st December, 1936. We should explain that we have taken this period, firstly on the assumption that it may be possible to start the service during the latter part of 1935, and secondly because 31st December, 1936, is the date on which the British Broadcasting Corporation's present Charter is due to expire. The relevance of this point lies in the fact that, if the television service is continued and expanded on the lines contemplated, then its finance will inevitably become bound up with the question of the Corporation's finance in general. We gather that it is probable that this will come under review in connexion with the renewal of the Charter, and accordingly we confine ourselves to the consideration of Television finance for the intervening period only, observing that within that time the Advisory Committee should be able to formulate an opinion as to the development of the service.

63. We estimate that the cost of providing the London station, including all running and maintenance expenses, programme costs and amortization charges (calculated on the basis of a comparatively rapid obsolescence), for the period up to 31st December, 1936, will be £180,000. For obvious reasons we refrain from specifying here the details upon which this estimate is built, but these are available to you in the confidential section of the Report (see Appendix V). Lest, however, too hasty conclusions be drawn from this figure we add the following observations. It must not be assumed that an accurate estimate of the cost of a number of stations can be reached by the simple process of multiplication. By far the largest factor in the above figure is the programme cost. On the one hand, if the service is a success, the cost of programmes will certainly rise materially, just as the cost of sound programmes has risen. We have not budgeted during this early stage for a programme comparable in duration, variety, or quality, with existing sound programmes, although the service should be amply adequate to provide interest and entertainment for the public, as well as opportunity for daily demonstrations by retailers of sets.

On the other hand, if and when a number of stations start working, it is contemplated that one programme may be relayed simultaneously to all stations (see paragraph 48), and that only a small portion of the daily output will consist in each case of topical items of local interest. In the case, therefore, of each additional station, the amount to be added to other charges in respect of programme costs will be merely fractional.

64. We have carefully considered the question of providing the necessary funds. Roughly speaking, the means suggested to us for so doing may be classified under two heads:—

- (a) Selling time for advertisements, and
- (b) Licence revenue.

65. Advertisements may take two forms: they may be either (i) direct advertisements for which time is bought by the advertiser such as, for instance, a dress show by Messrs. Blank; or (ii) the acceptance, as a gift, of programmes provided by an advertiser and coupled with the intimation of his name, in accordance with a standard formula, such as, for instance, "This programme comes to you through the generosity of Messrs. Dot & Dash," the latter system being usually known as that of "sponsored programmes." As regards direct advertisements, this proposal has been frequently examined in past years. In relation to sound broadcasting it was discussed and rejected by the Sykes Committee on Broadcasting in 1923 (Cmd. 1951, paragraphs 40-41). We do not differ from that Committee's view and accordingly do not recommend this course. As regards "sponsored programmes," for which the Broadcasting authority neither makes nor receives payment, the Sykes Committee saw no objection to their admission; and they are now specifically allowed under the British Broadcasting Corporation's Licence, although the Corporation has, in fact, only admitted them on rare occasions. We see no reason why the provision concerning sponsored programmes in the existing Licence should not be applied also to the television service; and we think it would be legitimate, especially during the experimental period of the service, were the Corporation to take advantage of the permission to accept such programmes.

66. In attempting to provide funds from licence revenue there appear to be four possible courses:—

- (1) The raising of the fee for the general broadcast listener's licence.

(2) The issue of a special television looker's licence.

(3) The imposition of a licence upon retailers.

(4) The retention of the existing listener's licence at 10s. and the contribution from that licence revenue of the necessary funds during the experimental period.

67. Of these courses, the first has the merit of certainty and simplicity. It is arguable whether an additional charge would seriously diminish the number of existing listeners, or even materially abate the normal rate of growth. It would provide a definite and substantial fund to start and maintain a television service. Moreover, if the view which we have already expressed as to the future development of Television in association with sound broadcasting be well-founded, then there is considerable logical justification for treating it as an indispensable adjunct to sound broadcasting, and accordingly laying any increased consequent charge upon the broadcast licence. We, however, see no adequate answer to the inevitable complaint from country listeners "Why should we pay an increased charge for a service which only London or some other centres can receive?"—nor even to the further complaint within such areas as are actually served, "Why should we people with restricted means pay this increased charge for a service which we cannot receive, because the necessary apparatus is at present so dear that it is only within reach of the well-off?" We do not, therefore, recommend the adoption of this course.

68. The second course, the issue of a special licence, has also considerable logical justification. It provides a means whereby those who use—and can afford the apparatus necessary to use—this service may contribute towards the cost of it. We must, however, repeat at this juncture, that we are concerned with the means necessary to start this service—to try it out and to set it on its feet—and not with its permanent financing as part of the British Broadcasting Corporation's general system. From the former point of view the proposal, however logically justifiable, has the fatal practical defect that, if the licence fee is placed high enough even to begin to cover the cost, it will strangle the growth of the infant service—while, if it is placed low enough to encourage growth, the revenue must for some time be purely derisory as a contribution towards the cost. We do not, therefore, recommend that at the start of the service there should be any extra licence, but we think that the question should be reviewed when it is seen to what extent the use of the service has taken hold, and when the costs of further extensions of it can be more accurately estimated.

69. This conclusion naturally brought us to examine the question of the imposition of a licence upon retailers of receiving sets, based upon the number of sets sold, not wholly—nor even mainly—with a view to the collection of funds, but as providing, in the absence of a special looker's licence, the next best means of keeping a tally upon the number of users, and so measuring the extent to which the service is in demand. We regard the securing of such a tally as of great importance, and it is with some regret that we feel ourselves unable to recommend the imposition of a retailer's licence on the sale of each set. Apart, however, from the administrative difficulties and the further difficulties which would inevitably arise later on when amateur constructors become sufficiently expert to construct home-made sets, the arguments which have been put before us, and which also moved the Sykes Committee (Cmd. 1951, paragraph 39), have convinced us that the adoption of such a course would be vexatious to traders and detrimental to the development of the service. We hope, however, that it may be possible to negotiate an arrangement with the trade, whereby periodical returns may be made of the total number of television sets sold in each town or district, since this would provide some measure of the growth of the demand.

70. We are therefore left with the conclusion that, during the first experimental period at least, the cost must be borne by the revenue from the existing 10s. licence fee. The determination of the allocation of this contribution as between the British Broadcasting Corporation and the Treasury naturally presents a wide field of controversy, which we should have had to survey at length were we attempting to lay down a permanent basis. Since, however, as explained above, we are dealing only with a relatively limited sum, for a very limited period, we suggest that the best course would be for a reasonable share of the amount to be borne by each of the two parties—the Corporation and the Treasury—and we think that the matter should be considered and determined in this light by the Treasury after consultation with the Postmaster General and the Corporation.

71. We may perhaps be permitted to anticipate three different types of objection which may be raised to the course proposed in the preceding paragraph. As regards any contingent contribution from the British Broadcasting Corporation, it may be argued that the new service will, at first, enure to the benefit of a limited number of people in a limited area, and that it is unfair that the general body of licence holders should have any of their payments diverted from the ordinary programmes, to the improvement of which spare cash, if any, in the British Broadcasting Corporation's coffers

should primarily be devoted. As regards a contingent Treasury contribution, it may be maintained that this is no time to cast any fresh burden upon the taxpayer in order to make an experiment of this nature. Further, it may be said that there is no hurry, and that the start of a service can well wait until the renewal of the British Broadcasting Corporation's Charter comes to be considered, when the financial question can be fully and finally settled. We respectfully submit in answer to the first contention, that, while we have already recognised its force (*see* paragraph 67) as regards any extra levy upon the general body of licence holders, there can be no denying that the existing programmes represent amazingly good value for one-third of a penny per day and that, in these circumstances, the general body of listeners may not unreasonably be asked to help, at no extra cost to themselves, in a national experiment which, if successful, will ultimately enhance programme values for a large part of their members. As regards the second objection, we feel that the development of British Television, in addition to being of evident importance from the point of view of science and entertainment, and of potential importance from the angles of national defence, commerce and communications, will also directly assist British industries. Lastly, we are quite unable to agree that there is no urgency. On the contrary, our enquiries convince us that, apart altogether from any question of scientific prestige, any delay would be most regrettable; and we feel that, if our conclusions are accepted, it is most desirable that the minimum amount of time should be lost in giving effect to our recommendations.

WIRELESS EXCHANGES (RADIO RELAYS)

72. We have considered the question, which has been raised in evidence, of the relaying of public television broadcast programmes by Wireless Exchanges. We see no reason why such a practice, if technically feasible, should not be allowed under the same conditions as are applicable in the case of sound broadcast programmes.

PRIVATE EXPERIMENTS AND RESEARCH

73. We hope that encouragement will continue to be given to all useful forms of experiment and research in Television by firms or private persons. It is true that much experimental work can be done by transmission from one room to another by wire without recourse to a radio link. In certain cases, however, the use of such a link is necessary; and we trust that the policy referred to in paragraph 20 will be maintained, and that adequate facilities for experimental work will continue to be given.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

74. Our principal conclusions and recommendations are summarised below:—

Type of Service

- (1) No low definition system of Television should be adopted for a regular public service. (Paragraph 28.)
- (2) High definition Television has reached such a standard of development as to justify the first steps being taken towards the early establishment of a public television service of this type. (Paragraph 33.)

Provision of Service

Operating Authority

- (3) In view of the close relationship between sound and television broadcasting, the Authority which is responsible for the former—at present the British Broadcasting Corporation—should also be entrusted with the latter. (Paragraph 39.)

Advisory Committee

- (4) The Postmaster-General should forthwith appoint an Advisory Committee to plan and guide the initiation and early development of the television service. (Paragraph 41.)

Ultra-short Wave Transmitting Stations

- (5) Technically, it is desirable that the ultra-short wave transmitting stations should be situated at elevated points and that the masts should be as high as practicable. (Paragraph 46.)
- (6) It is probable that at least 50 per cent. of the population could be served by 10 ultra-short wave transmitting stations in suitable locations. (Paragraph 47.)

Patent Pool

- (7) It is desirable in the general interest that a comprehensive Television Patent Pool should eventually be formed. (Paragraphs 53 and 54.)

Initial Station

- (8) A start should be made by the establishment of a service in London with two television systems operating alternately from one transmitting station. (Paragraph 55.)
- (9) Baird Television, Limited, and Marconi-E.M.I. Television Company, Limited, should be given an opportunity to supply, subject to conditions, the necessary apparatus for the operation of their respective systems at the London station. (Paragraph 56.)

Subsequent Stations

(10) In the light of the experience obtained with the first station, the Advisory Committee should proceed with the planning of additional stations—incorporating any improvements which come to light in the meantime—until a network of stations is gradually built up. (Paragraphs 57 and 58.)

(11) The aim should be to take advantage, as far as possible, of all improvements in the art of Television, and at the same time to work towards the ultimate attainment of a national standardised system of transmission. (Paragraph 59.)

Finance of Service

(12) The cost of providing and maintaining the London station up to the end of 1936 will, it is estimated, be £180,000. (Paragraph 63.)

(13) Revenue should not be raised by the sale of transmitter time for direct advertisements, but the permission given in the British Broadcasting Corporation's existing Licence to accept certain types of "sponsored programmes" should be applied also to the television service. (Paragraph 65.)

(14) Revenue should not be raised by an increase in the 10s. fee for the general broadcast listener's licence. (Paragraph 67.)

(15) There should not be any separate licence for television reception at the start of the service, but the question should be reviewed later in the light of experience. (Paragraph 68.)

(16) No retailer's licence should be imposed on the sale of each television set, but arrangements should be made with the trade for the furnishing of periodical returns of the total number of such sets sold in each town or district. (Paragraph 69.)

(17) The cost of the television service—during the first experimental period at least—should be borne by the revenue from the existing 10s. licence fee. (Paragraph 70.)

75. In conclusion we desire to place on record our high appreciation of the services rendered by our Secretary, Mr. J. Varley Roberts. He has performed his duties with zeal and ability, and has been of the greatest assistance to us at every stage, both in the conduct of the Enquiry and in the compilation of our Report.

(Signed) SELSDON (*Chairman*).

JOHN CADMAN (*Vice-Chairman*).

A. S. ANGWIN.

NOEL ASHBRIDGE.

O. F. BROWN.

CHARLES D. CARPENDALE.

F. W. PHILLIPS.

J. VARLEY ROBERTS (*Secretary*).

14th January, 1935.

APPENDIX I

LIST OF WITNESSES AND ORGANISATIONS REPRESENTED

Messrs. Baird Television, Ltd.	..	{ Major A. G. Church, D.S.O., M.C. Mr. A. G. D. West, M.A., B.Sc.
Messrs. A. C. Cosser, Ltd.	.. ..	{ Mr. W. R. Bullimore. Mr. J. H. Thomas, M.I.E.E. Mr. L. H. Bedford, M.A., B.Sc.
Messrs. Electric and Musical Industries, Ltd., and Messrs. Marconi—E.M.I. Television Co., Ltd.	.. ..	{ Mr. Alfred Clark. Mr. I. Shoenberg. Mr. C. S. Agate. Mr. A. D. Blumlein. Mr. C. O. Browne. Mr. G. E. Condliffe. Mr. N. E. Davis. Mr. S. J. Preston.
Messrs. Ferranti, Ltd.	.. ..	{ Mr. V. Z. de Ferranti. Mr. A. Hall.
Messrs. General Electric Co., Ltd.	.. ..	{ Mr. C. C. Paterson, O.B.E., M.I.C.E., M.I.E.E. Mr. T. W. Heather, M.C.
Messrs. Plew Television, Ltd.	..	Dr. C. G. Lemon.
Messrs. Scophony, Ltd.	.. ..	{ Mr. S. Sagall. Mr. G. W. Walton. Mr. G. Wickeshauser.
British Broadcasting Corporation	..	Sir J. C. W. Reith, G.B.E.
Newspaper Proprietors' Association	.. ..	{ Col. the Hon. F. E. Lawson. Sir Thomas McAra, J.P. Mr. A. J. Polley. Mr. F. W. Jarvis. Mr. E. J. Kobertson.
Radio Manufacturers' Association	.. ..	{ Mr. W. W. Barnham. Mr. R. Milward Ellis.
"Popular Wireless" and "The Wireless Constructor."	.. ..	Dr. J. H. T. Roberts, F.Inst.P.
The Television Society	.. ..	{ Dr. C. Tierney, F.R.M.S. Mr. Ronald R. Poole, B.Sc. Mr. W. G. W. Mitchell, B.Sc.
		and
		Sir William Jarratt.
		Mr. W. Barrie Abbott, B.L.
		Mr. J. Guibiansky.
		Mr. A. B. Storrar.
		Mr. R. W. Hughes.