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THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS



The British Telephone Technical Development Committee

R. W. PALMER, M.I.E.E.,
and W. L. BRIMMER

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The function of this committee, together with the continuous co-operative effort which it represents, is important in its effect on the technical and economic efficiency of the British Post Office telephone exchange system. It also leads to a new outlook on the daily relations between supplier and consumer, far beyond the actual committee work.

Introduction.

BEFORE 1923, the telephone exchange contracts for the British Post Office were placed as the result of competitive tendering, each of the telephone manufacturers in Great Britain negotiating with the Post Office individually. This method gave rise to a fairly wide diversity in the products of the various manufacturers as there was no co-operation between the manufacturers in development, and latitude was necessary in the interpretation of the Post Office requirements to meet individual manufacturing practices. Moreover, the unsuccessful tenderers expended very considerable time and effort in vain for every contract placed.

In 1923, when the wholesale conversion of the telephone system in London to automatic working was seriously considered by the Post Office, and the step-by-step system was to be standardised, it was obvious that there would be grave disadvantages in the competitive system, so the Post Office called together the four manufacturers then in the automatic field and made an agreement with them to co-ordinate the supply of equipment at a satisfactory price level for the standard components. By 1928, a fifth manufacturer was available and a fresh agreement was drawn up for a period of five years based on the competitive quotations submitted by each of the five parties. The administration of this agreement, and those which have succeeded it, necessitated the formation of the manufacturers' Bulk Contract Committee (B.C.C.) to decide production policy and distribution of contracts, and to negotiate prices. The five firms represented are:—

Automatic Telephone & Electric Co. Ltd.,
Liverpool.

Ericsson Telephones Ltd., Beeston.

General Electric Co. Ltd., Coventry.

Siemens Bros & Co. Ltd., Woolwich.

Standard Telephones & Cables Ltd., New
Southgate.

This rational sharing of contracts and of responsibility made possible the establishment of a highly technical organisation which, under the auspices of the British Post Office, could influence telephone technical development in this country to a degree hitherto not attempted, and promote standardisation on sound practical lines. A joint technical committee was therefore formed in 1933 under the chairmanship of an Assistant Engineer-in-Chief to the Post Office, and this was named the "British Telephone Technical Development Committee" (B.T.T.D.C.). The manufacturers' complement of this committee is known as the Manufacturers' Technical Development Committee" (M.T.D.C.) which meets under the chairmanship of the Manufacturers' Secretary to exercise control on technical policy, development and technical

routine so far as the manufacturers are concerned. Devolution of work to specialist committees was also necessary to cover the detail of apparatus, circuits, equipment, etc., as the range and complexity of automatic telephony expanded.

Subscribers' telephone instruments and the many common components of telephone plant such as switchboard jacks, tag blocks and the like were also made the subject of a supply agreement in 1936, but in this case three additional manufacturers (making eight in all) were parties to the "Telephone Apparatus Agreement" (T.A.A.):—

Phoenix Telephone & Electric Works Ltd.,
London, N.W.

Plessey Co. Ltd., Ilford.

Telephone Manufacturing Co. Ltd., London, S.E.

A corresponding joint technical committee for this class of plant was formed and for convenience was linked with the B.T.T.D.C. so far as general direction is concerned.

It was recently decided to systematise the many subsidiary bodies that had been added in the course of years, and it is now possible to define the activities and responsibilities of all the various constituent bodies shown in Fig. 1.

Functions of the Main Committee.

The fundamental procedure for all major developments is to table in the first instance a Committee Paper setting out clearly the intentions of each new development, and the case is then known by that "C.P." number until the item is completed. For efficient execution of that work without overlapping of effort, the next operation is to define which manufacturer or P.O. Branch is to carry out the work, one liaison officer being named as the sole representative of the developing organisation and one as the representative of the P.O. The stage is then set for the development to proceed as a planned programme, and the quarterly meetings of the B.T.T.D.C. enable progress to be directed by means of the reports from liaison officers.

To quote a small but typical example of a new development, the P.O. presented in the form of a "development" committee paper (C.P.187) a request for improved facilities on trunk timing, involving a new item to supersede Key No. 292. Design was allocated to firm "A" on behalf of all parties, but firm "B" followed this almost immediately with a further committee paper (C.P.190) reporting some work they were already considering for improvements to the Clock No. 44 itself to facilitate its use and readability by operators. These two committee papers were discussed and agreed in principle and the whole development was co-ordinated and allocated to firm

"A." The other firm willingly handed over all its ideas and experience to the common cause, and by inference agreed to manufacture whatever was developed by firm "A" under this B.T.T.D.C. procedure. All manufacturers were kept informed of the technical development as it proceeded, so that they could make contributions at any stage, thus ensuring that the necessary research and development work was not multiplied 5 times over by unnecessary parallel effort. When all parties had recorded their agreement to the technical features of the new design,

embarking on an actual design for inclusion in the telephone system. Similarly, any information from one or more manufacturers on developments likely to be of interest to the Post Office is submitted, an experience on overseas contracts may also give rise to an "Informative C.P." when production for the home and export markets is inter-related.

There is yet a third class of Committee Paper known as "Exploratory C.P.s" for the general guidance of future development. An example is the contribution of data and opinions on the operating efficiency of V.F. signalling systems, and there are also other important contributions such as on alternative materials and the impact of international discussion on the trend of national developments.

The whole of this C.P. procedure, including the duties and responsibilities of the liaison officer appointed for each C.P. case, is agreed jointly and defined as a "Technical Procedure" to be followed continuously, quite independently of the meetings of any committee or sub-committee.

In addition to the regular business of "C.P. developments, the agenda of the main committee naturally includes discussions of a more general nature, particularly in relation to the present problem of production. In this category is the attempt at unification of overseas practices where technical variations in specifications affect the overall production capacity of the industry. The B.T.T.D.C. has no executive authority in this field, but encouragement is being given to the standardisation of types of enamelled wire and finishes of apparatus.

Manufacturers' Technical Development Committee (M.T.D.C.).

This is the manufacturers' counterpart of the joint B.T.T.D.C. and is an important clearing house for questions of technical policy affecting the manufacturing side only, or for discussion to produce an agreement among firms prior to joint committee meeting. There are also similar counterparts of most of the joint sub-committees as indicated in Fig. 1. On the manufacturing side, there is a permanent secretary of the B.C.C. and M.T.D.C., and another for all the manufacturers' sub-committees. Although seconded from the technical staffs of individual firms they are responsible to all, and have offices and duties quite independent of any one manufacturer. They are closely linked with the Post Office, and the sub-committee secretary was for convenience provided with office accommodation on Post Office premises during the recent war.

Sub-Committees on Technical Development.

Since no single committee could handle alone the detail of so vast a subject as a complete telephone system, the devolution of a great deal of work is both deliberate and logical. Sub-committees usually meet at intervals of not less than 2-3 months, and for the purposes of this article are classified under three headings—Technical Development, Technical Details and Procedure. The first classification is intended to embrace the two which handle complete new developments within specialised fields.

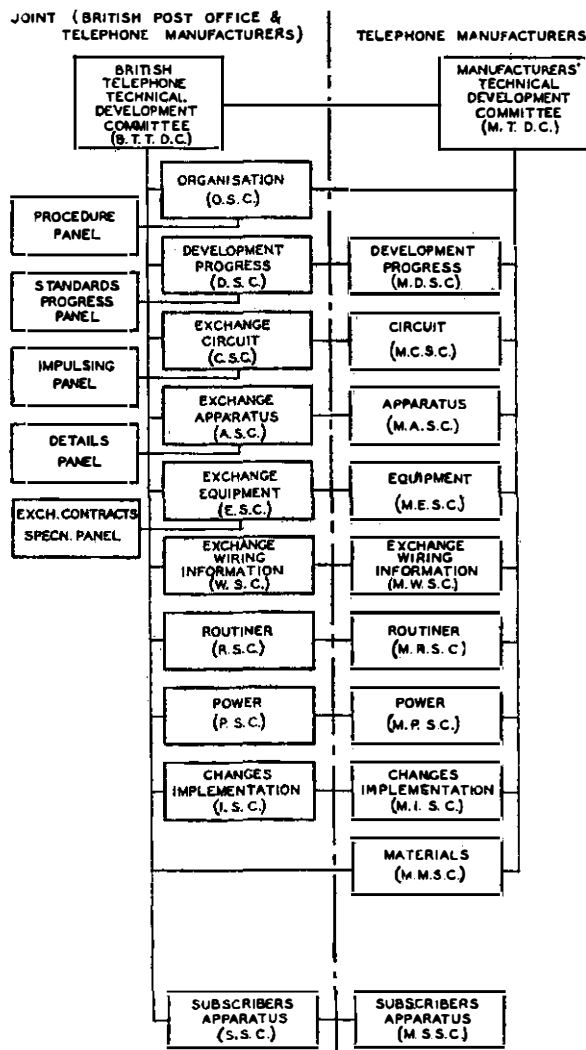


FIG. 1.—STRUCTURE OF TELEPHONE DEVELOPMENT COMMITTEES.

and a model had been approved, the main development stage was declared by the B.T.T.D.C. to be complete and arrangements were then made for the production of full manufacturing drawings with a view to manufacture by all firms as a new standard.

Apart from specific development such as this, the B.T.T.D.C. is a most valuable clearing house for technical information having a direct or indirect bearing on telephone exchange practice. For example, the Post Office may advise the manufacturers of some problem or idea which it has decided to study before

The Subscribers' Apparatus Sub-Committee (S.S.C.) has the distinction of representing the eight manufacturers under the Telephone Apparatus Agreement, and therefore is not wholly subsidiary to the B.T.T.D.C. which is representative of only five. Nevertheless, there are many standard items such as dials, fuse mountings, connection strips and the like which are purchased by the Post Office in large quantities under both the Bulk Supplies Agreement and the Telephone Apparatus Agreement, and it has been accepted that all such dual cases should be handled by this sub-committee whose primary concern is the subscriber's telephone instrument. The standardisation of P.B.X. switchboards is also very important, as Private Branch Exchanges, both manual and automatic types, are becoming more and more analogous to public exchange practice and this imposes a severe test on the flexibility and unity of the B.T.T.D.C. structure. The nature of the terms of reference make the work of this sub-committee very similar to that of the B.T.T.D.C. itself. Thus, there is a system of active and informative committee papers (S.C.P.s) to define the business in hand, together with the appointment of development contractors and liaison officers for each case.

The Routiner Sub-Committee (R.S.C.) is required to consider and reach agreement upon all questions affecting automatic routers, and the main business is again conducted on the lines of the main committee. For this purpose it operates a system of Router Committee Papers (R.C.P.s) to define the detailed design of particular routers within the requirements of the Development C.P.s of the main committee.

This overall responsibility for particular items of exchange equipment involves technical detail such as circuit design, apparatus development and exchange equipment practice, for which specialist sub-committees are also responsible, but the Router Sub-Committee observes the limits of current standard practice on exchange equipment as agreed by other bodies, and where a departure from standard practice is considered necessary, the liaison officers automatically refer the matter direct to the technical sub-committee concerned or, in the case of major policy, to the B.T.T.D.C. In fact, as many problems as possible are settled by standing procedures, and the Router Sub-Committee has referred to it only such questions as are not resolvable between its liaison officers either because of the broad nature of the question or because of a difference of opinion.

Sub-Committees on Technical Detail.

The development of new designs of plant by one party to the B.T.T.D.C. on behalf of all is accompanied by adequate opportunities for others to observe and comment on particular designs and models, but there is still a need for detailed discussion of general aspects such as circuit principles, standard apparatus components, cabling arrangements and the like. Four specialist sub-committees provide a clearing house for such discussions and they are normally more concerned with progressive changes to existing plant, or repercussions of new developments on existing equipment, than with complete new designs individually.

The Exchange Circuit Sub-Committee (C.S.C.) which meets three times a year, deals with circuit principles and the usage of particular apparatus items. It is therefore required to consider any problem in the design of circuits or groups of associated circuits which are of general interest or application (e.g. impulsing, cut drive, etc.), to arrive at the best solution of the problem from both the technical and the economic points of view.

Related to this basic requirement, the committee is required to consider also the electrical characteristics, performance and limitations of all apparatus used in exchange circuits, and to agree on performance limits for acceptance and maintenance testing of the equipment so composed. This requires a very detailed study and culminates in the determination of impulsing and signalling limits for all combinations of automatic equipment and particularly of new signalling systems being developed under C.P. cases. This latter work is performed by a joint Impulsing Panel.

The characteristics and performance of individual relay designs are a major factor in this work and, in fact, this committee was originally set up solely for study of this aspect. It is therefore vitally concerned with the approval of the basic design data for electromagnetic relays standardised by the P.O., and it arranges for the approval of all individual relays according to an established Technical Procedure, examining the circuit design when necessary to check the suitability of the relay proposed.

The Exchange Apparatus Sub-Committee (A.S.C.) is concerned with the physical components comprising a piece of switching equipment, and it embraces piecemeal, mechanisms, relay components, mountings and all the mechanical details involved. Electrical considerations are largely overshadowed by the mechanical and physical features in the design of apparatus, and this committee is therefore attended by specialists who are competent to discuss design for economical manufacture, choice of materials, methods of assembly and adjustment, tolerances and interchangeability, and the prevention of wear, breakage or other failure in normal use. The committee meets quarterly to resolve differences of opinion or to decide principles, and in this category have been the discussions on bank aligning gauges for 2,000-type selectors and improvements to uniselector wipers. It will be appreciated that great care is necessary before basic items of apparatus are put into mass production, and when a particular piece of plant requires discussion in great detail, a "Details Panel" is appointed to handle the particular case.

The Exchange Equipment Sub-Committee (E.S.C.) appears to have a title that is all-embracing, but, in the language of the telephone industry, the title "equipment" is restricted to racks and switchboards, and the mounting, cabling and installation of the standard selectors, etc., to constitute a telephone exchange. Thus, the design and manufacture of selectors and relay sets is outside its scope, but the way in which these items are used to build up a complete telephone exchange installation or extension is the primary concern.

The policy of extending obsolescent exchanges with

modern 2,000-type equipment is largely a product of this committee, and any queries on the interworking of old and new equipment are answered from the pool of experience represented by this co-operation of manufacturer and customer.

The detailed work on the form of exchange contract specifications, as standardised in the "draft sheets" issued to Regions by the Engineer-in-Chief's Office is also the responsibility of this sub-committee, with the assistance of an Exchange Contract Specification Panel who examine all major alterations to ensure that P.O. requirements are expressed in the simplest form consistent with clarity, avoiding unnecessary work for its translation into a production order in the contractor's works. The Panel also resolves any major difficulties of interpretation that may be raised by Regions or manufacturers in particular cases.

The approval of contractors' equivalents to P.O. standard drawings and diagrams is a matter specifically required by the Bulk Supplies Agreement, and the E.S.C. is responsible for the routine procedure by which this requirement is met.

The Power Sub-Committee (P.S.C.) deals with power supplies for telephone exchanges, and, although the manufacture of heavy electrical machinery and batteries may, in practice, be sub-let to other firms by the telephone equipment contractors, the suppliers from the P.O. point of view are those represented on the B.T.T.D.C. The items most frequently requiring discussion and agreement relate to the development of charging systems, float schemes, tone and pulse machines, etc., rather than to detailed design of generators or secondary cells.

Problems arising in both circuit and apparatus design, and also mounting and cabling, all come under review if concerned mainly with power plant. In respect of distribution of power, tones or pulses, the line of demarcation between "power plant" and "exchange equipment" is normally the output terminal on the power switchboard, but it is only to be expected that adequate co-operation is necessary between this and other sub-committees if the power plant is to serve the many special requirements of telephone exchange switching and to follow similar standards of technical design.

Sub-Committees on Procedure.

In a separate class from the foregoing are the four sub-committees which have a controlling interest in particular phases of all other sub-committee work. They are not concerned directly with technical design but are required to co-ordinate technical development to a controlled programme or to determine organisation or general procedure from a "documentary" point of view.

The Development Progress Sub-Committee (D.S.C.) meets just before, and again just after, each meeting of the main committee, and exists mainly for routine sifting of reports on C.P. cases from which it extracts and submits the important matters requiring discussion and decision at a higher level. In its rather broad terms of reference it is required to consider technical detail only in so far as it may be affecting completion of developments by the date required and

to give directions to liaison officers for reference to the technical sub-committees as considered necessary. It is also authorised to represent the need for action direct to individual manufacturers or P.O. Branches in cases of urgency.

The D.S.C. is also required to keep under review the requirements of standard manufacturing information in relation to technical developments and it controls a Standards Progress Panel who prepare, maintain and publish lists and other documents to manufacturers and P.O. Branches to facilitate the final stages of all technical developments. This is a phase which is often overlooked, or perhaps even resented, as an unnecessary delay between the availability of a working model and its inclusion in a public telephone exchange, but experience has shown the futility of including in an exchange contract an item which may hold up execution of the whole installation because of unexpected difficulties in manufacturing details for mass production. This is not to imply that exceptions to the rule are prohibited entirely, but the expediency has to be agreed by manufacturers—or may even be initiated by manufacturers. The decision to include a new development in the Equipment Master List (denoting authority to include in exchange contracts) rests with this sub-committee, or its panel. It has been agreed that the P.O. will refrain from introducing new or changed designs for telephone exchange equipment without the agreement of the contractors who will be required to make it. This is not as magnanimous as it might seem, because an early knowledge of proposed new designs enables the manufacturer to plan his shop production with the maximum efficiency in respect of both costs and delivery programme, and also permits the advance ordering of the necessary materials and standard components.

The Changes Implementation Sub-Committee (I.S.C.) is very closely related to the D.S.C. described above, but meets every two months to deal with minor improvements and changes to existing circuits and apparatus. These changes may be quite independent of one another or inter-related to some small degree, and some may arise from the introduction of a major C.P. development and be linked with the D.S.C. and its Standards Progress Panel.

The work of the I.S.C. is in two phases, the first of which is the routine submission of proposed changes, whether originated to implement a major development, to overcome local maintenance defects or to facilitate manufacture. Each suggestion is distributed to all parties for technical examination outside committee and agreement that the change is necessary and practicable; the committee has only to see that this continuous procedure is operated on agreed lines, and to discuss items which cannot be agreed by routine methods. The technical work in committee is limited to a general appreciation of the engineering requirements and to the routing of technical problems to the Sub-Committee or Branch of the Post Office who may be concerned.

The second phase is the implementation of the agreed change, involving a decision on whether it shall be made retrospectively or not, or made a "departure"

THE MANUFACTURER.



DEVELOPMENT LABORATORY.

THE POST OFFICE.



ENGINEER-IN-CHIEF'S CIRCUIT LABORATORY.



ENGINEERING AND DRAWING OFFICE.



ENGINEER-IN-CHIEF'S OFFICE.



ASSEMBLY AND WIRING SHOP.



COMPLETED AUTOMATIC EXCHANGE IN SERVICE.

TYPICAL SCENES IN POST OFFICE ENGINEERING DEPARTMENT AND MANUFACTURERS' WORKS.

on a temporary and optional basis without amendment of standard documents during the present production difficulties. Retrospective changes require a decision to define on which current contracts the change shall be incorporated and on which contracts the manufacture shall proceed without disturbance, leaving the change to be made after installation on site. This work has an important bearing on the manufacturers' mass production programme, because every change involves a great deal of hidden documentary work. For example, every selector must be represented in the form of a Stock List of all the sub-assemblies and standard components which it comprises, and each exchange contract must be translated by means of the Stock Lists into many "shop" orders for components. These shop orders are sent out with copies to planning executives, costing experts, shop foremen and so on, to cover all manufacturing operations from the purchase of the correct raw material to the calculation of the production costs, so the number of documents prepared for just one batch of selectors may run into hundreds. It follows that to carry even a single change of component into a current contract after this ordering machinery has been set in motion is a very serious and complex matter, and the date of implementation of changes is a matter for a balance between the operational needs of the administration and the production needs in respect of time and cost.

The Exchange Wiring Information Sub-Committee (W.S.C.) provides a discussion ground to deal with the principles of conversion of schematic circuit diagrams into standardised wiring diagrams and other wiring information for mounting and interconnection of selectors, relay sets and the like. Its function is classed as "procedure" rather than "technical detail" because it is more concerned with the preparation of documents than with physical design or with types of wire.

The "derived" documents concerned are those usually referred to as the W, U and X diagrams (e.g. ATW., ATU., etc.), which are prepared by an allocated manufacturer on behalf of all, to define relay plate wiring, shelf jack wiring and cross-connection wiring, respectively. The W.S.C. is therefore responsible for that comprehensive document known as "ATW 22000" which defines the wiring rules, nomenclature, symbols and conventions to be followed in such wiring diagrams, and this in turn must be related to the British Standard terminology and graphical symbols. The routine procedure for preparation, amendment, circulation and general approval of individual documents in this series is also defined by this committee.

The Organisation Sub-Committee (O.S.C.) is the final co-ordinating link for the whole structure. With the growth of the B.T.T.D.C. responsibilities, including the many activities which it controls outside the actual committee work, it has been necessary to devolve on to this sub-committee the definition of the procedure

and organisation applicable to all joint operations of the Post Office and manufacturers under the B.T.T.D.C. This includes the determination of the constitution and terms of reference of all committees and the publication of a loose-leaf volume of "B.T.T.D.C. Procedures" on the lines of P.C. Engineering Instructions, but with limited circulation and having the authority of both Post Office and manufacturers. The detail of production of these procedures is devolved largely on a small Procedure Panel, and the main work is that of editing and co-ordinating the drafts presented by the other specialist committees for their particular aspects of the work. The range of subject matter is illustrated by these four divisions:-

General Division, covering the history, structure and operations of the B.T.T.D.C. as a whole.

Constitution Division, which includes terms of reference and personnel of every committee and panel.

Committee Procedure Division, defining the conduct of business in committee.

Technical Procedure Division, covering joint operations outside committee.

The nature of such documents implies that they cannot be amended without the consent of all parties affected, and this includes the agreement of all sub-committees. When once settled, however, the definiteness of the obligations of all parties is of immense value in the day-to-day work of technical development and the illustrations showing typical views of a few parts of the manufacturers' and the Post Office work may serve as a reminder of the many parties concerned.

Conclusions.

It is hoped that the conclusion will have been reached from this description of the B.T.T.D.C. that organised technical development as a continuous process outside the conference room has rightly been considered more important than the committee work itself, and that the efficiency of the British telephone exchange system could not have been achieved by any other organisation.

By the removal of patronage and distrust the Post Office has been able to facilitate mass production, and the manufacturers have been able to contribute fully to the technical problems of the administration. The indirect advantages in the field of economics will be obvious, but, in addition, it has enabled manufacturers to originate many technical developments which have led to direct reductions in plant cost. Moreover, from the point of view of the engineer headquarters, in the field, or in the factory, the partnership of the B.T.T.D.C. has given freedom for the fierce technical battles which are the only true basis of technical progress.

As a final remark, it seems almost superfluous to acknowledge that this article is just another example of the anonymous co-operation of all parties concerned.