My investigations under this heading fall naturally into the following divisions:—

Design of outside plant systems for long-distance communication and for subscribers' distribution.

Materials used—their suitability and durability.

Methods employed, and the incidence of the latest labour-saving devices thereon.

These matters were investigated as closely as time permitted, and numerous inspections made of different types of installations—open aerial, overhead, underground and submarine cable.

Telegraph and Interurban Telephone Lines.

The system in use in New Zealand for connecting the principal centres telegraphically and telephonically consists largely of what is known as open-aerial distribution, involving the use of pole lines and bare wire. The method employed for the prevention of "cross-talk" and of power-line inductive interference is known as the "twist" system. As already referred to, the comparatively small populations that are connected by our somewhat extensive ramifications of aerial toll wires do not yet justify the use of the more costly underground-cable systems that link the larger cities of older and more densely populated countries. Knowing that in the United Kingdom some few years ago a reversion had taken place from the "twist" to the "flat transposition" system, and that this latter method had all along been the practice in the United States, it was with much interest that the rival systems were examined. The opportunity of discussing them with experts in different countries was freely availed of.

I am now satisfied that for the New Zealand conditions, which involve frequent high-tension and extra-high-tension parallelisms of considerable magnitude, the twist system now in use is our most satisfactory solution of the problem of inductive interference, and that, as practised in New Zealand, superior advantages are obtained at no greater cost in construction or maintenance than would be possible with the less flexible and—under our conditions—less efficient transposition method. By the use of the twist system combined with what is known as "phantom" working, three first-class talking-circuits are obtained from two physical telephone channels, with a result that, in its practical operation, is not being excelled in any of the countries visited. Moreover, the twist system of erecting aerial wires, when properly installed, is practically a "permanent institution," proof against any of the fluctuations or variations in adjacent telegraph or power circuits that are continually taking place; whereas the same cannot be said of other methods, which at times call for modifications to meet changing conditions.

Subscribers' Distribution.

In relation to the distribution of telephone talking circuits from the telephone exchange to the subscriber's telephone, and the various changes involved from underground to overhead cable and to final open-aerial distribution circuits, the New Zealand system is a compromise between American and British methods. By reason of the distribution of population and the considerable amount of development in sparsely-settled areas the New Zealand conditions more closely resemble those of the United States than those of Great Britain, and it was only to be expected that our distribution system should more closely approximate to the former.

Generally speaking, the final distribution system used in the United Kingdom outside the most congested points is known as "radial distribution" from underground-cable outlets, while that of the United States is by means of aerial cable and "drop wire." The different systems have received close consideration, and afford valuable data by which we shall be able to review our methods in detail. Before a final decision can be come to on many points that arise, close studies must be made by our plant-engineering officers in order to determine to what extent changes or modifications are justified. I am, however, of the opinion that although radical changes in method cannot at this stage be made in existing installations, many of the methods observed may profitably be incorporated in new exchange systems and in extensions of the old, with resulting economies.

General.

I was somewhat impressed by the fact that certain practices which have been considered to be unsuitable in this country are being successfully used with corresponding economies elsewhere. In some cases this can be accounted for by difference in climatic conditions and the availability of local supplies of material at a correspondingly reduced cost. It is not, however, improbable that, with the wealth of detailed information generously supplied me in relation to all phases of telegraph and telephone field-engineering materials and methods, processes which have been considered unsuccessful in the past may now be introduced with every confidence of success, and that a greater degree of standardization will be possible, with resulting advantages.

Among the more important subjects coming under this heading which were investigated are the following:—

Design and reinforcement of pole structures, and methods adopted for preserving the same from decay:

Joint use of telegraph, telephone, and power poles; conditions governing same, and experience obtained therein:

Labour-saving devices used in construction and maintenance of telegraph and telephone lines (this subject has undergone considerable development, and devices are now available which are applicable, in part at least, to New Zealand conditions, and which should result in reducing the cost of works in situations where such machines can be applied):

Tools and equipment used in construction and maintenance works:

Design of toll-line systems with a view to ultimate application of radio-frequency methods for increasing the number of channels available: