keep abreast of the times in respect of developments, who would determine means to be applied to attain ends, and who would be able to give information to engineers outside; and conferences should take place from time to time, so that each may profit by the knowledge and experience of the other for the general well-being of the service. This staff would include commercial, traffic, and plant men, and it may, of course, be practicable to embody dual duties in the one officer if it were not found necessary or practicable to have responsible officers for each.

There would also be required local, technical, and commercial engineers to carry out works and collect and record data. It may be urged against this that it shows a tendency to load up with engineers, but it will surely be recognized that it is essential that important works involving large outlay should be well considered and thought-out before being undertaken. Engineering is slow work. Oftentimes there are no rules for guidance, and the " cut and try " method has to be adopted, which takes time with but little to show for it.

Other matters that would claim the attention of such a staff are the determination in terms of standard cable of various pieces of apparatus that are used on circuits (such as coils that have to be spoken through, induction coils, repeating-coils), leaks on circuits, the effect of condensers, and the like. In other Administrations and companies careful experiments are made, and somewhat elaborate testing methods adopted, to ascertain the speaking-value of circuits, and what the effect is of various combinations of circuits which bring into operation different apparatus, and how the apparatus affects them. This gives first-hand knowledge as to what is to be expected in certain circumstances, and enables provision to be made accordingly. Our Department is growing rapidly, and it is desirable that we should have the facilities, both of appliances and acquaintance with their use, to determine matters of the kind referred to experimentally, and not to be obliged to use apparatus that may be more or less suitable, merely because it is being or has been used elsewhere for a corresponding purpose.

Telephone service is a serious business. It cannot be treated as one subordinate in any degree to any other branch of a general service of which it may be a part. Wherever the telephone has attained any considerable development and is giving satisfaction, it will be found that these results have proceeded from the alert and watchful commercial knowledge and guidance that are continually exercised, and the technical skill and attention to detail given by engineers and officers whose sole duty it is to devise, and to give effect to the best methods applicable to the particular system being used, and to keep the apparatus operating at its highest efficiency.

From the considerations set forth it is recommended,—

(1.) That the more extended use of the telephone generally should be promoted as far as possible. The development of the telephone in centres of population in the Dominion as compared with that in many other parts of the world is low.

(2.) That the full-automatic system of giving telephone service be adopted for Auckland, Christchurch, Dunedin, and Wellington.

(3.) That the full-automatic system be adopted also for any exchanges at smaller places that may be requiring new equipment, in all cases where after a study of the conditions it may be found that the operation and economic features, and the general advantage to the public in respect of the character of the service given, would justify it.

(4.) That the Western Electric Company, London; Messrs. Siemens Bros., London, who supply the Siemens-Halske system; and the Automatic Electric Company, Chicago, who supply the Strowger system, be invited to tender for a full-automatic equipment for Wellington.

(5.) That studies be made of the four large cities to obtain some idea of what may be the expected telephone development in each, whether it is likely that it will be general throughout an area or more congested in particular parts of the area, and whether any particular parts will be specially difficult and therefore expensive to reach.

(6.) That the question of multi-office or satellite exchanges for the larger places be considered in their economic aspect as compared with giving service from, say, two or three exchanges in the area.

(7.) That, as development must to a considerable extent depend upon rates, the rate question be considered after the development study, so that, if necessary, a scale of rates may be drawn up that will promote development, be a reasonable charge for the area available, and provide reasonably for interest and depreciation of the plant and apparatus.

(8.) That suitable appliances be obtained for determining the effect upon speech of apparatus that must be introduced into telephone circuits, and for enabling the results that may be expected from combinations of circuits which introduce varied kinds and quantities of apparatus to be definitely known.

(9.) That the technical staff be increased as necessary to give effect to the foregoing, and to cope with expected developments.

Manual, Magneto, and Common-battery Telephony.

In dealing with this system it is considered that particulars of one or two exchanges will convey a good idea of general methods and procedure. Where anything calling for special remark has been noticed it will be taken up later and some comment made upon particular features such as opals, order wires, junctions, multiples, toll-working, and so on.

The first exchange visited was the main exchange in Bush Street, San Francisco. The lead cables, 400 and 600 pairs, come up from underground so as to attach to the main frame. The paper cables come in iron pipes passed through the basement-floor about 2 ft. apart. The silk- and cotton-covered lead cable, as leads to the main frame, is joined on here. The pothead is large—about 2 ft. 6 in. long and 5½ in. in diameter. Four or six 100-pair lead cables are all joined in one pothead, filled and wiped. The cables then pass out of the basement upwards and to the main frame, where they are fanned out. There are three exchanges and a toll-board in the building, but only