extensions in hand, and provision for additional cables for future units Nos. 5 and 6 called for a large amount of detail design work for layout of cables, and details of cable cleats and supporting steelwork.

With a view to simplifying the layout as much as possible, up to nineteen conductors have been grouped in a single cable in a number of cases. The installation of lighting and auxiliary power circuits and fittings was another item which involved a large amount of detail design work. A feature of this installation is the new system of lighting for the control-room. In any control-room a high intensity of illumination is demanded, and careful planning is necessary to avoid glare and reflection from the instrument glasses. The position of this control-room demands artificial lighting twenty-four hours per day, and it was finally decided to provide a system of lay-lighting.

Penrose Substation.—The new 20,000 kVA., 11 kV. synchronous condenser for this substation is being arranged for semi-automatic operation, and is equipped with closed circuit air-circulating system and quick-response excitation. It is connected to the 22 kV. bus-bars through its own bank of transformers. The cooling water-supply for the circulating-air coolers will be recirculated through the cooling-tower for the adjacent Diesel station. A preliminary layout drawing was prepared for the synchronous condenser and equipment, and a traverser truck for handling the transformers was designed. Foundation drawings were prepared for this bank of transformers, the new 30,000 kVA., 110/22 kV. bank, and for two new oil-circuit breakers which will replace existing equipment.

Hamilton No. 1 Substation.—In connection with the transfer of the 11 kV. oil-circuit breakers from Khandallah Substation, drawings and specifications were prepared for the equipment required to complete the new switchgear installations.

Bombay Substation.—Drawings were prepared for tendering purposes for two new 3,000-kVA. banks of 50/11 kV. transformers with on-load tap-changing equipment. Foundation drawings were prepared for a 5,000 kVA. bank of 110/50 kV. transformers, six 110 kV. oil-circuit breakers, and one 50 kV. oil-circuit breaker.

Ongarue Substation.—Preliminary layout drawing of 110 kV. equipment on site was prepared.

Henderson Substation.—With the increasing load of the North Auckland area, the existing 50 kV. lines from Penrose to this substation are becoming inadequate, and additional 110 kV. lines are being considered. To provide for these lines and for the necessary 110/50 kV. transformer banks a rearrangement and partial replacement of the existing 50 kV. switchgear and steelwork is involved. A layout drawing showing this rearrangement has been prepared. Drawings and specifications were prepared for tendering purposes for the new 50 kV. switchgear and steelwork, and for two new 3,000 kVA. banks of 50/11 kV. transformers with on-load tap-changing equipment.

Maungatapere Substation.—Drawings were prepared for an additional bay of steelwork and 50 kV. switchgear to provide for the extension of the line to proposed substations in Bay of Islands Electric-power District.

Waikato Substations: General.—Drawings and specifications were prepared for switchgear cubicles for isolating and short-circuiting switchgear for the automatic on-load regulating transformers which are being installed at a number of substations.

Wiring diagrams were prepared for 11 kV. outdoor switchgear and metering-cubicles for North Auckland Substations.

Transmission-lines.

West Coast (66 kV. lines):—

(*a*) Lake Coleridge to Arahura, via Arthur's Pass and Otira. Double circuit.
(*b*) Arahura to Blackwater, via Dobson. Single circuit.

Work on above lines was continued from last year. Charts prepared for locating supports and stringing conductors. On account of late delivery of poles, several alternatives have been investigated.

Dunedin–Gore (110 kV. line).—Work continued from last year. Details of supporting structures supplied for use in the field, and deviations in the route of the line at the Clutha River crossing and the Taieri Aerodrome investigated.

Arapuni–Edgecumbe (110 kV. line).—A resumption of the work on this line, started some years ago, was made. The preliminary location of supports on route plans was completed and material ordered. Special work consists of steel towers for lake and river crossings, steel-cored aluminium conductors for a section near Tikitere Springs where sulphur fumes are injurious to copper, and short poles for about ten miles east of Rotoiti Township on account of difficult access to route of line.

Arapuni–Penrose (110 kV. line).—There is already a single-circuit wood-pole line and a double-circuit steel-tower line between Arapuni and Penrose, but the growth of load requires additional transmission-line capacity, and a second double-circuit steel-tower line is in hand. A specification and outline drawings were prepared and tenders called for the towers. Designs submitted by tenderers were analysed to ascertain their compliance with the specification, and a strength chart made for use on final location of towers on the route.

Melling–Masterton (110 kV. line).—This line has to cross over the Rimutaka Range, and on account of the rough country steel towers are to be employed between Melling and Featherston. The specification for the towers and outline drawings were prepared. Tenders were called for, and designs submitted by tenderers were analysed to see if they complied with the specification. Several matters connected with the route of the line were also investigated. Material was ordered for the wood-pole section, Masterton to Featherston.

Miscellaneous.—Drawing prepared and steelwork ordered for converting existing 66 kV. steel towers at Rangitata River to 110 kV. construction. These towers are on the line between Ashburton and Timaru, the voltage of which is to be raised in the near future. Field data also supplied in connection with restringing part of the river crossing with steel-cored aluminium.