and thence through choke coils and electrolytic arresters, provided with horn gaps placed outside, on to the line. (Fig. 23).

The 12,000-volt switches, busbars and accessories are located in the basement, and incoming feeder cables are laid in ducts beneath the basement floor, the necessary number terminating at the terminal compartment opposite each feeder switch. The heating boilers, oil tanks, storage battery, pumps and air compressor are situated in other parts of the basement. The cables feeding the switches terminate in terminal rooms with standards and bells, above which the feeders are tied together in pairs. The leads from the transformer oil switches pass up through the floor to the transformers, where the potential is stepped-up to 63,500 volts single-phase. Each feeder is equipped with three oil circuit breakers, the first connecting the power source to an auxiliary bus, the second, the auxiliary bus to the main bus, and the third, the auxiliary bus to a bank of transformers. By this arrangement a feeder, with a capacity equal to that of a transformer bank may be connected directly to a transformer bank or to the main bus. Through the medium of the auxiliary bus a transformer bank may also be connected to the main bus. This arrangement, while not complicated, offers sufficient flexibility to the circuit, since there are always two oil circuit breakers in series. The feeder switches through a water resistance. The nine 3,000-kv-a. transformers are shell type, oil-insulated, water-cooled, and designed for operation at a potential of 12,000 volts low-tension, and 110,000 volts high-tension. They are equipped with the Westinghouse condenser type of bushing. (Fig. 24).

The transformers and high-tension lines are connected to the buses by automatic three-pole oil circuit breakers, operated from the control gallery in a manner similar to the 12,000-volt oil switches. In general the oil switches are isolated by means of disconnecting switches with blades normally vertical, mounted on post insulators, supported on the walls. All 110,000-volt connections and buses consist of bare one inch seamless copper tubing installed near the roof and supported on porcelain petticoat insulators, of the built-up post type, with an over-all height of 39 inches, in turn secured to special steel structures. These buses extend the entire length of the high-tension switch room, and have a minimum clearance of 6 feet between phases and 3 feet 6 inches between a conductor and ground. The five 110,000-volt three-pole circuit breakers are electrically operated, and equipped with Westinghouse condenser type bushings. Due to the design of these switches, no concrete barriers or brick work are required, and the switches proper will automatically open by gravity, should accidents occur to their mechanism.

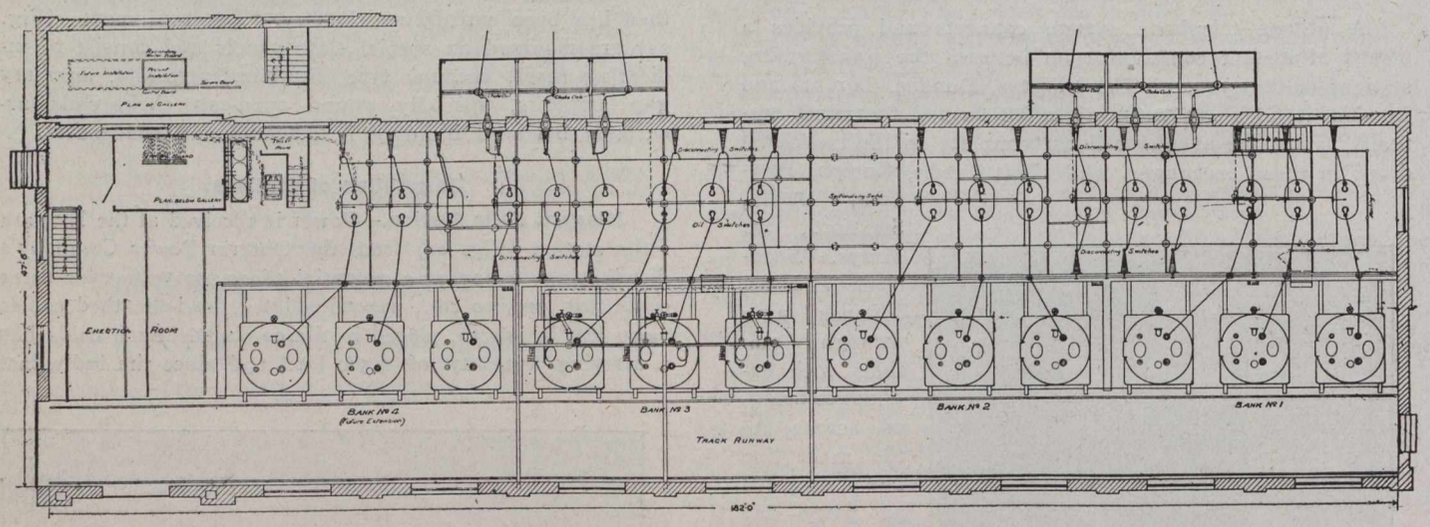

Fig. 23.—Plan View, Niagara Station.

are equipped with inverse time limit relays. The feeder switches are equipped with inverse time limit relays. Only the bus switches are non-automatic. Disconnecting switches are also supplied on both sides of the oil switches, which are electrically controlled from a switchboard located in the control room; colored lights being employed to indicate the position of the switches.

A service oil switch for controlling the transformers employed for the lighting, mechanical and other station equipment is connected to the main 12,000-volt bus.

All 12,000-volt connections, busbars and switches are enclosed in concrete cells.

The transformers and high-tension switches are located on the main floor. Transformer banks are separated from each other by a brick wall 25 feet high, and from the high-tension switches by a brick wall 15 feet in height. A track runway is provided to facilitate the removal of the transformers to the erection room for inspection or repairs. The piping subway is beneath the transformer compartments, and the oil, water and air pipes pass through the floor immediately in the rear of the transformers to the piping mains. The transformers are connected in delta on the low tension, in star on the high tension sides, and have grounded neutrals

The line outlets consist of corrugated porcelain tubes 40 inches long, supported in a horizontal position by four porcelain posts mounted to the plane of the wall in a treated wooden frame five feet square, and having the intervening space filled with plate glass.

The hoods protecting the outlet bushings from the weather are 8 feet wide and extend three feet below the level of the bushing. On leaving the porcelain the leads drop vertically to a post insulator beneath the hood from the top of which the cable is carried directly to the insulator on the arrester structure. Beneath the wall outlet and this insulator is placed a choke coil constructed of aluminum wire in the shape of a helix with porcelain separators between the adjacent turns.

Lightning protection is secured by two sets of electrolytic lightning arresters, one for each outgoing line, equipped with horn gaps and placed on special steel structures outside the building. The aluminum plates are immersed in boiler iron tanks filled with oil.

Two switchboards are installed in the control room. The main board consists of three 28-inch slate panels, each panel controlling one incoming feeder, the two connected 12,000-volt switches and one transformer bank. Two of the