were driven while the next span was being erected in the same manner, after which it was moved out and riveted, and so on until seven spans were on the piers and an eighth on the erection falsework.

To effect the transfer two 38-ft. by 100-ft. steel-frame barges braced together, 81 ft. apart on centres in the case of the main span, and less in that of the shore, were partly filled with water ballast, and placed under the outermost span on the piers. The water ballast was pumped out, allowing the barges to rise until the span took bearing, at the second and third panel points from each end of each truss, on wooden towers, 14 ft. high, on the decks of the barges, and were lifted clear of the piers.

The barges, with a draught of 3½ ft. and a freeboard of 4½ ft., were then towed to a point a little up-stream of the piers, and secured to an anchored scow, Fig. 1. Their tackles were then slacked, and they were carefully eased down-stream, and water ballast was readmitted to sink them until they deposited the spans on the piers, after which they were towed back to the erecting-yard for another span, and so on for eleven of the fixed spans, the remaining six being erected in the usual manner, on ordinary falsework in shallow water at the bridge site.

While each new span was being lifted from the erection piers, floated down-stream and placed in permanent position on the piers, the corresponding old span was conversely lifted from the same piers by a pair of smaller wooden barges, operated by water ballast, towed up-stream, and deposited on the erection piers at the opposite end of the island falsework. It was then rolled down a 2 per cent. grade, to the shore ends of the falsework piers, and there taken apart by a wrecking-car, and the next span brought in, and so on. The movement of the spans was so arranged as to occur during the longest intervals between regular trains, and as it occupied but a few hours for each exchange of an old for a new span, little interference with the train service was occasioned.

Solid-steel live rollers, 2½ in. in diameter, were put under the spans on the falsework piers, and the spans were moved by two four-part tackles operated by the hoisting engine on the erecting traveller. The new-span barges were stiffened by five longitudinal steel trusses; they drew 19 in. light, and were equipped with one 8-in. centrifugal pump on each, to handle the water ballast in and out. The old span barges had a draught of 15 in. light and 21 in. loaded, and were each provided with a 6-in. gate and a 6-in. centrifugal pump supplied with steam from a boiler on deck.

The new bridge was designed and erected under the direction of the engineering department of the Grand Trunk Railway System, Mr. Howard G. Kelley being the chief engineer.

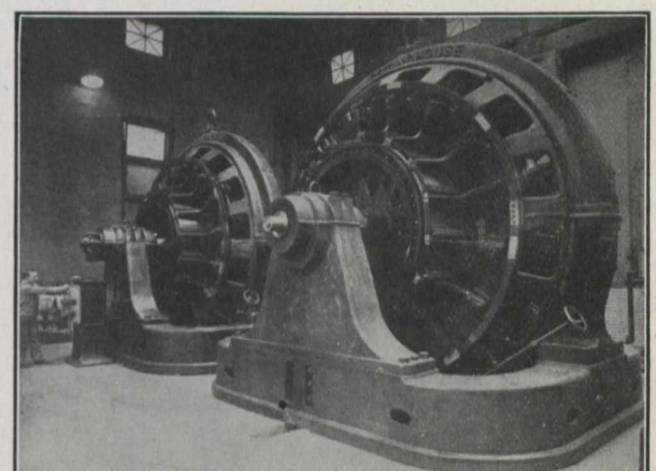
IRON ORES.

Iron ores are chiefly oxides, and native iron is almost unknown except in the meteorites occasionally picked up. Some native iron discovered by Nordenskjold at Ovifak, Greenland, in 1870, is now known to be of terrestrial origin, although it was at first supposed to be meteoric like other masses. A microscopic study of this iron has been lately made by C. Benedicks, who finds that it is really a natural steel high in sulphur and carbon, with a structure different from that of meteoric iron, and having the internal arrangement peculiar to carbon steel that has been rapidly cooled below 700 degrees C. This confirms the already preferred view that the Greenland iron—instead of coming to the surface in unoxidized condition—was reduced from the basalt by carbonaceous shale through which the molten mass was ejected.

3,000 KILOWATT ROTARY CONVERTERS.

For the economical transmission of energy as direct current either close proximity of the generator to the point of power application, or the use of alternating current for transmission is necessary. For this reason direct current for railway service is seldom generated as such in this progressive age. The tendency is to generate all energy as alternating current in large economically located stations, and to transmit it as alternating current to sub-stations located in the section where it is utilized as direct current in the railway motors. Rotary converters, because of their exceedingly high efficiency, are peculiarly adapted and are usually used in the sub-stations for converting from alternating to direct current.

It is recognized that the combined efficiency of a rotary converter and its transformers is considerably higher than that of a motor generator set of equivalent capacity and voltage. This advantage in efficiency is even more marked at light loads than at full load, and since the load factor of railway systems is usually low, the inherent fitness of the rotary converter is evident.



Two 3,000 kw. 25 Cycle Rotary Converters.

The growth of traction systems has been so rapid of late in the larger cities that it has been necessary to materially increase the outputs of the sub-stations. It was desirable, and practically necessary in some cases, to do this without increasing the sizes of the sub-stations to avoid increasing real estate investment. The Westinghouse 3,000 kw. rotary converter offers the solution to this problem in that with it maximum output can be obtained with minimum floor space.

A little over a year ago the Westinghouse Company built and installed two 3,000 kw., 25 cycle, 6 phase, 600 volt rotary converters in the sub-stations of the Interborough Rapid Transit Company, New York City, (Fig.) These two 3,000 kw. machines replaced two 1,500 kw. rotary converters. The 3,000 kw. machines occupy the same floor space as the smaller ones, but the output of the sub-station is doubled. Their success was so marked that seven more of the same type have been ordered by that company.

While some of these 3,000 kw. rotary converters are started from the direct current end, all are designed for alternating-current self starting and several will be regularly started by this method.