but only for about half or a quarter of full load, in order to ensure a good efficiency even at part load. Such types of Zoelly turbines have been built since 1908.

The characteristic feature of the Zoelly turbine has always been the design of the runner wheels and guide channels in the diaphragm, the former of which, in spite of the high factor of safety required, are enabled to give a relatively high circumferential velocity. Consequently greater latitude is permissible in regard to the number of stages and speed of the steam in each case.

Construction.—From the commencement the Zoelly turbine has always been constructed with a horizontal shaft; experience with water turbines has shown that by this method the simplest form of bearing can be used, permitting an easy inspection at all times.

In the case of turbines running at 3,600 r.p.m. a flexible shaft is used, so that the critical speed is sufficiently below the working speed; but in the case of turbines running at 1,800 r.p.m. and under, the contrary is the case, the shaft is rigid and the critical speed is above the working speed. The shaft is supported by two bearings which are lubricated by oil under pressure, and is connected by means of a rigid or flexible coupling (usually rigid) to the generator or machine to be driven. The casing is built up in two halves, the joint being horizontal, so that the rotor can easily be inspected without dismantling the bearings. An idea of the accessibility of all the important parts can be gained from the illustrations shown.

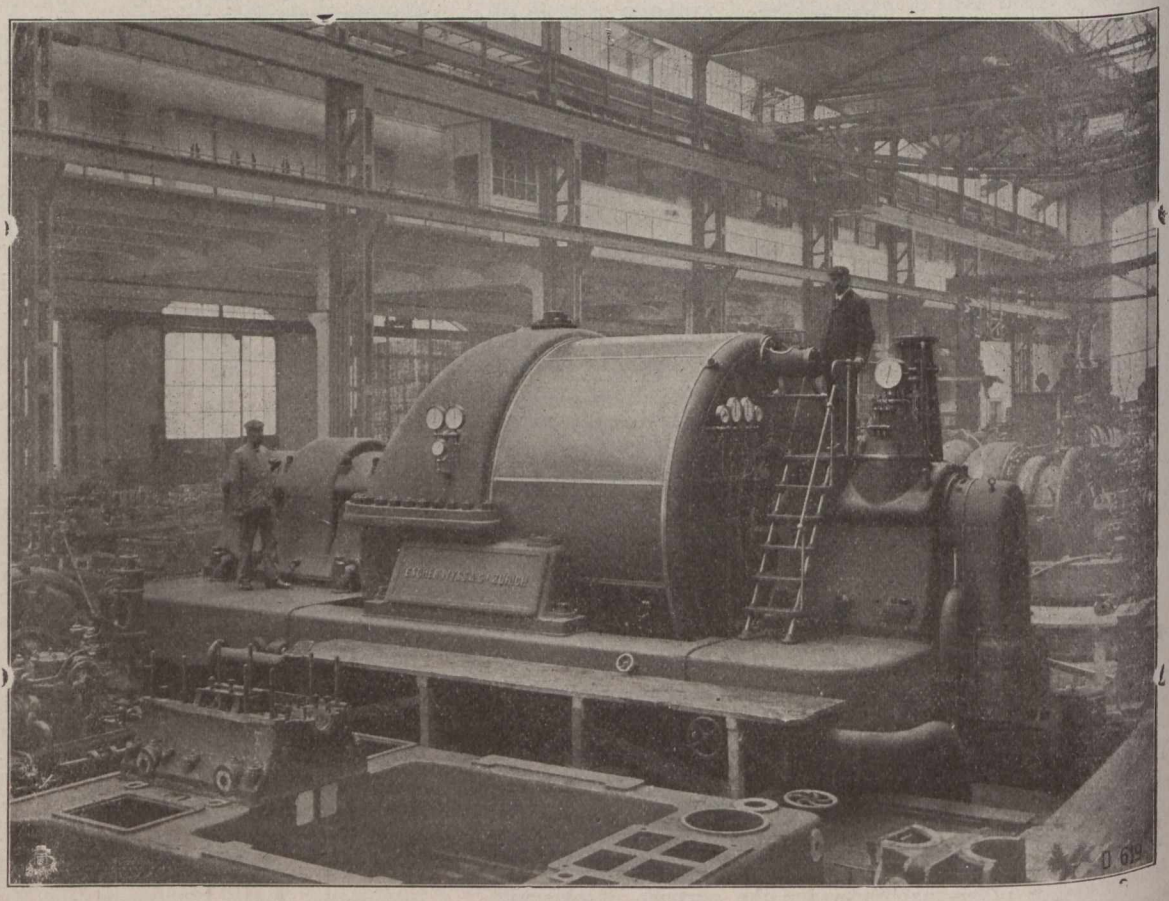

Fig. 2.—15000-kw. Escher Wyss-Zoelly Steam Turbine.

To keep the velocity of the steam low, which is possible in the simple velocity wheel, the wear in the blades, specially when working with saturated steam, is reduced to a minimum.

The impulse type allows large clearances in radial and axial direction. The axial clearances of the runner blades as well as the radial clearances are about 0.2 in. Nevertheless, the steam consumptions obtained with the Zoelly steam turbine are extremely low, particularly for the large size high-speed units.

The turbine is what can best be called a commercial machine, i.e., a machine giving with the greatest reliability best economy and least wear, with a minimum of attendance required.

The total thermodynamical efficiency obtained has been as high as 74%.

Since this turbine came on the market 11 years ago, it has done excellent work. Twenty firms are at present licensees of the Escher Wyss Company, of Zurich, who built the first machines and who have since supplied the bulk of the machines put on the market.

Up to 1913, Zoelly turbines of 3,350,000 h.p. have been supplied, of which those built by Escher Wyss and Company had a capacity of over 800,000 h.p. The largest size machine was 15,000 kw., equal to 28,000 h.p., of which two units were supplied to the Rheinisch-Westfaelisches Elektrizitaetswerk (Germany) — one in 1911 and the second as a repeat order in 1913.

A number of machines of similar size have been built for other concerns; such as, a plant of four 10,000 kw. units for the Chile Exploration Company, of New York.

The *Engineering Record* describes the recent feat accomplished in subway tunnelling in New York city thus:—"For the first time in the history of subaqueous subway construction in New York city, a radical departure from the usual methods of building the tubes in place by compressed air tunnelling methods has been made. An 8,000-ton section of four-track steel lining, 220 feet long, 26 feet wide and 24 feet deep, which had been assembled and riveted on shore, was floated out into the Harlem River and sunk into position through 60 feet of water. The enormous mass was at all times under perfect control, was handled without any surges, plunges or violent or dangerous movements, and the structure was placed in position far below the surface without the use of guides or complicated apparatus. Work was carried out strictly in accordance with a detailed schedule of time and operation, which made ample provision for all the difficult conditions under which the work was executed."