



Siemens-Schuckertwerke
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PROGRESS ON THE SHANNON

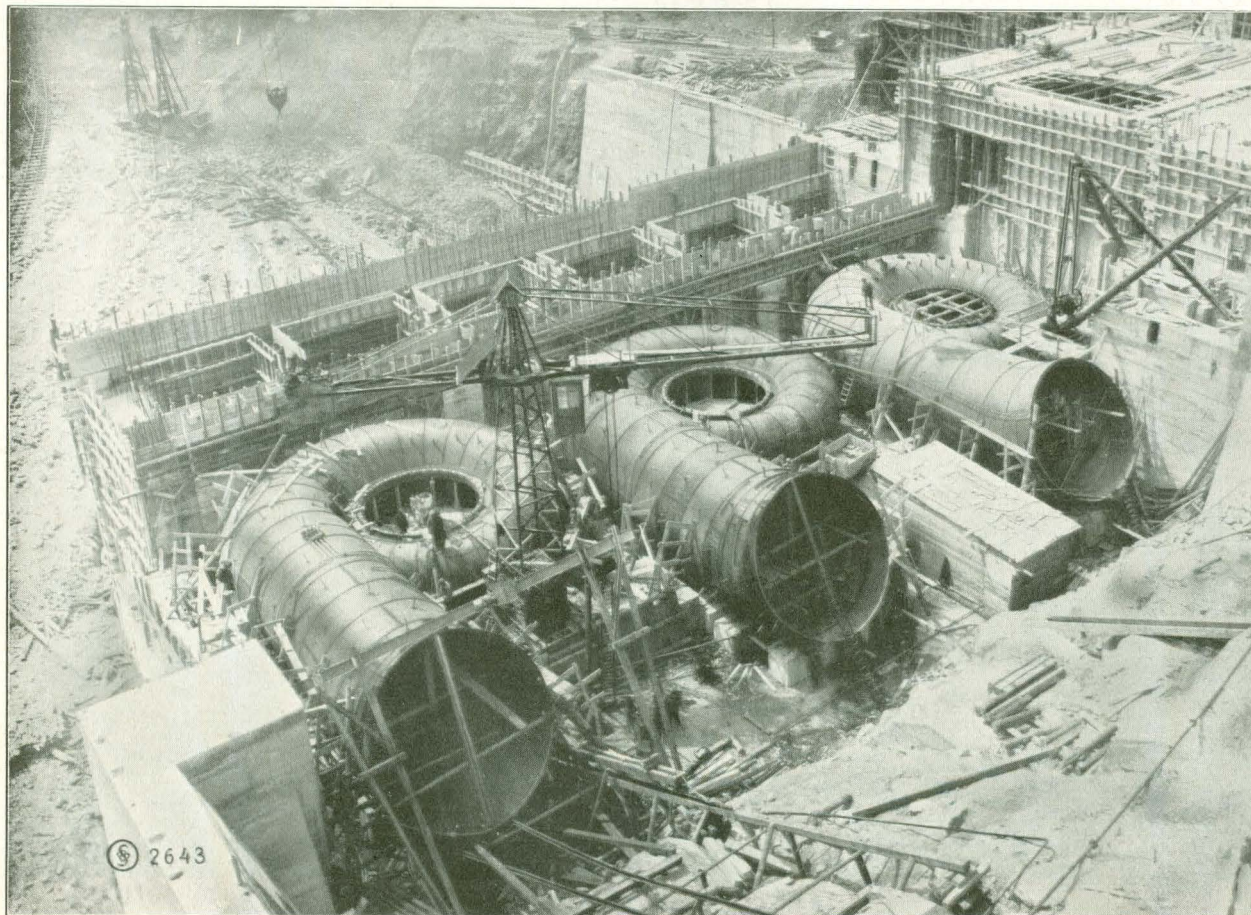
3rd YEAR

NOVEMBER 1928

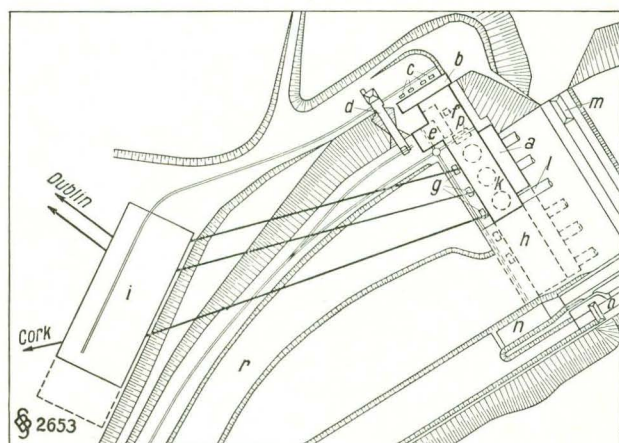
NUMBER 2

Turbines in the Power Station

In our previous pamphlet No. 10 dated July 1927, we described how the canal widens out into the head-race, where the water is dammed by the intake structure and allowed to pass as required through



Pict. 1. Spiral Casings of the first three Turbines

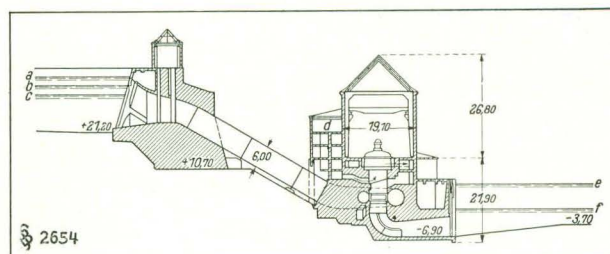


Situation at Power Station

- | | |
|------------------------------------|-----------------------------|
| a = 10 kV switch house, | i = 110 kV outdoor-station, |
| b = 38 kV switch house, | k = machine house, |
| c = 38,5 kV outdoor and exten- | l = penstock pipes, |
| guishing transformers, | m = intake sluice house, |
| d = lift on incline, | n = waste channel, |
| e = oilworkshop, | o = navigation locks, |
| f = lift, | p = unloading shaft, |
| g = 110 kV transformers, | r = tail race. |
| h = machine house, future develop- | |
| ment, | |

the six intake openings via the penstocks and then through the six turbines; which will be erected in the full development of the River Shannon (see sketches and Pictures 2 and 3).

At present in the power station we are only concerned with the partial development consisting of three units, but provision is made in the intake buildings for the total development by allowing for six intake openings.



Section trough Intake Sluice Building and Power House

- a = + 35,70 highest water level for total development,
 b = + 33,55 highest water level for partial development,
 c = + 31,20 lowest water level for partial development,
 d = 10 kV switch house,
 e = + 7,00 highest tail water level,
 f = + 0,50 lowest tail water level.

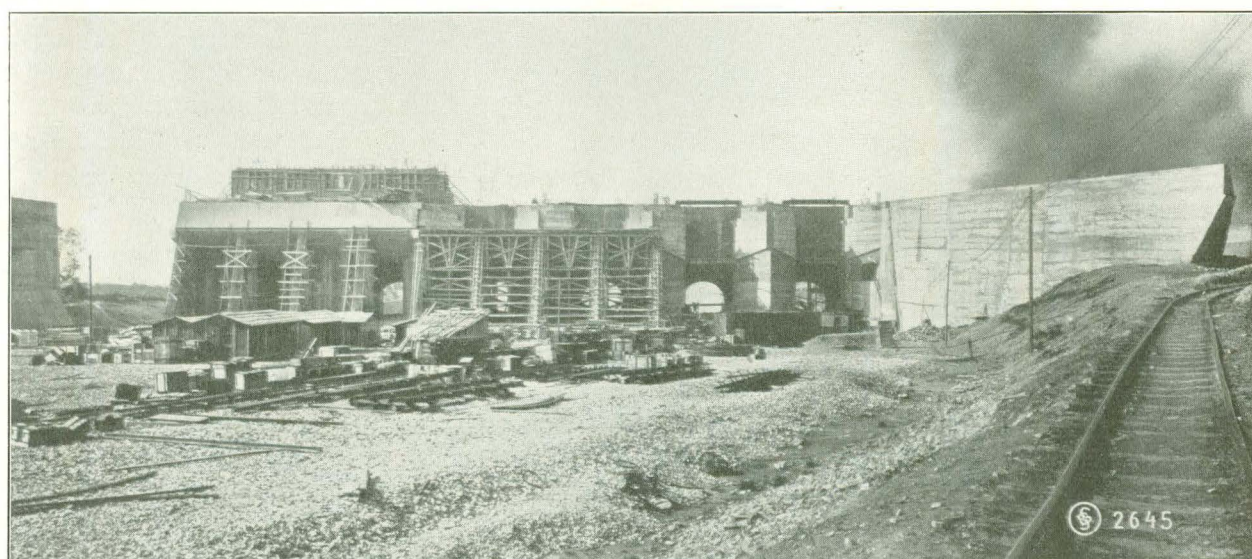
Immediately in front of the intake openings the water passes through a fine rack composed of a number of flat iron bars each 42 mm. apart.

The water, after passing through the screen, goes through the bell-mouthed openings to the penstocks (see sketches).

Behind the screen and in front of each opening is an electrically operated sluice gate, which allows the water to be shut off when necessary.

For the partial Development it will be necessary to have only the hoisting mechanism for the first three sluice gates installed, as the remaining three penstock openings will be closed by sluice gates until the full development takes place.

From the intake building the water is carried by three penstocks each 6 metres in diameter and 40metres long and constructed of high tensile strength Siemens-Martin steel. These penstocks have a slope of 31° to the horizontal (see Picture 3).



Pict. 2. Intake Sluice Building from Head Race side

At the bottom the penstocks bend to a horizontal and taper gradually from a diameter of 6 metres to 4.8 metres, at which point they connect with the spiral casings.

The spiral casing is so designed as to admit the water into the turbine rotor at all points over the periphery with the highest degree of efficiency. In fact the spiral casing may be imagined as a conical pipe tapering from 4.8 metres to zero, curved around the actual turbine and open on the inner periphery of the spiral (see Picture 1).

The spiral casings are built up of a number of tapering steel sections, rivetted together on site and varying in thickness from 18 to 11 mm according to the decreasing diameter of spiral.

The sections are securely rivetted on the inside to the speed ring for the purpose of strengthening the spiral casing and getting a streamlined flow of water to the guide mechanism of the turbine.

This speed ring consists of a solid steel casting, comprising an upper and lower disc connected together and strengthened by twelve upright struts designed so that they will be of least resistance to the water-flow (see Picture 4).

Connected to the inside flanges of the speedring,

above and below, are two further discs which house 24 moveable guide vanes, approximately 1.3 metres high, regulating the waterflow to the turbine runner inside and controlled by the oil-governor (servo motor).

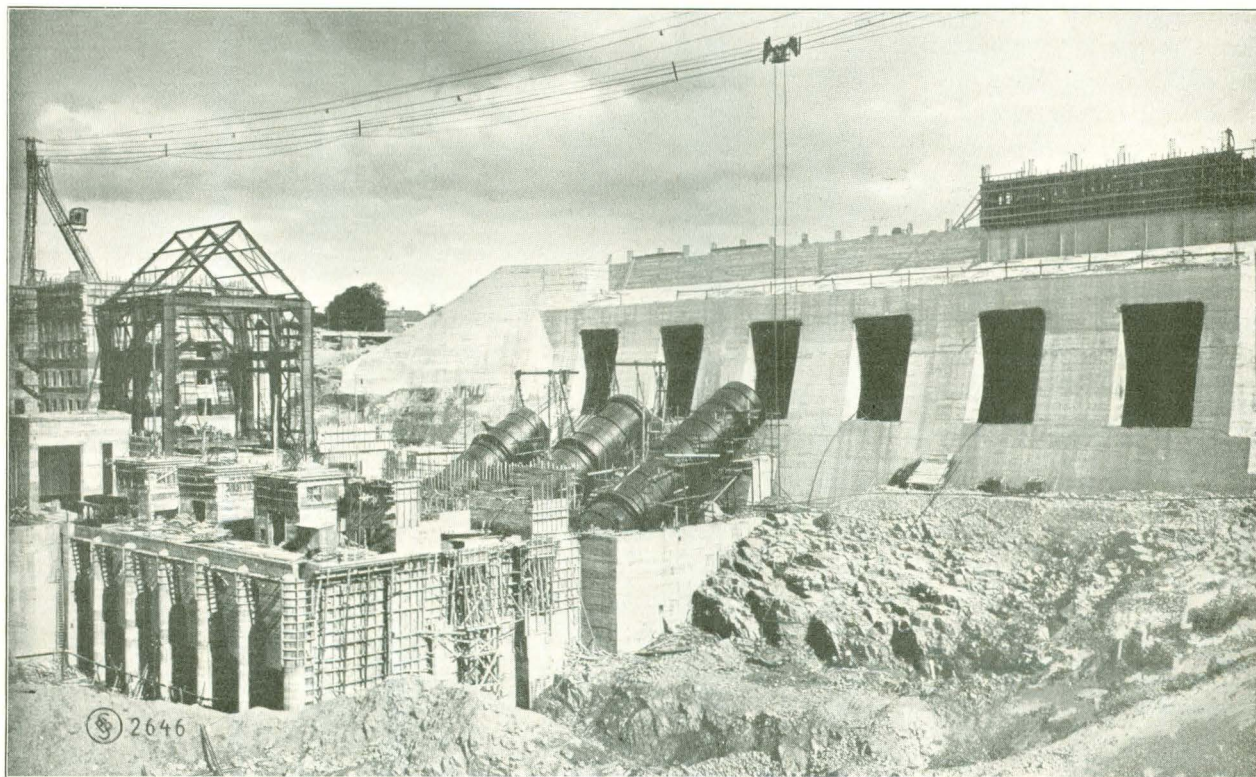
The runner wheel is bolted to the vertical shaft, which at its upper end is fixed to the rotor of the alternator.

The water enters the runner in a horizontal direction and leaves it vertically through a steel draught tube; this tube tapers in diameter from 4 to 4.8 metres over a distance of 2.5 metres. The purpose of using the steel draught tube is to ensure a good connection of the turbine with the foundations and is as well a safeguard against the higher velocity of water immediately below the runner.

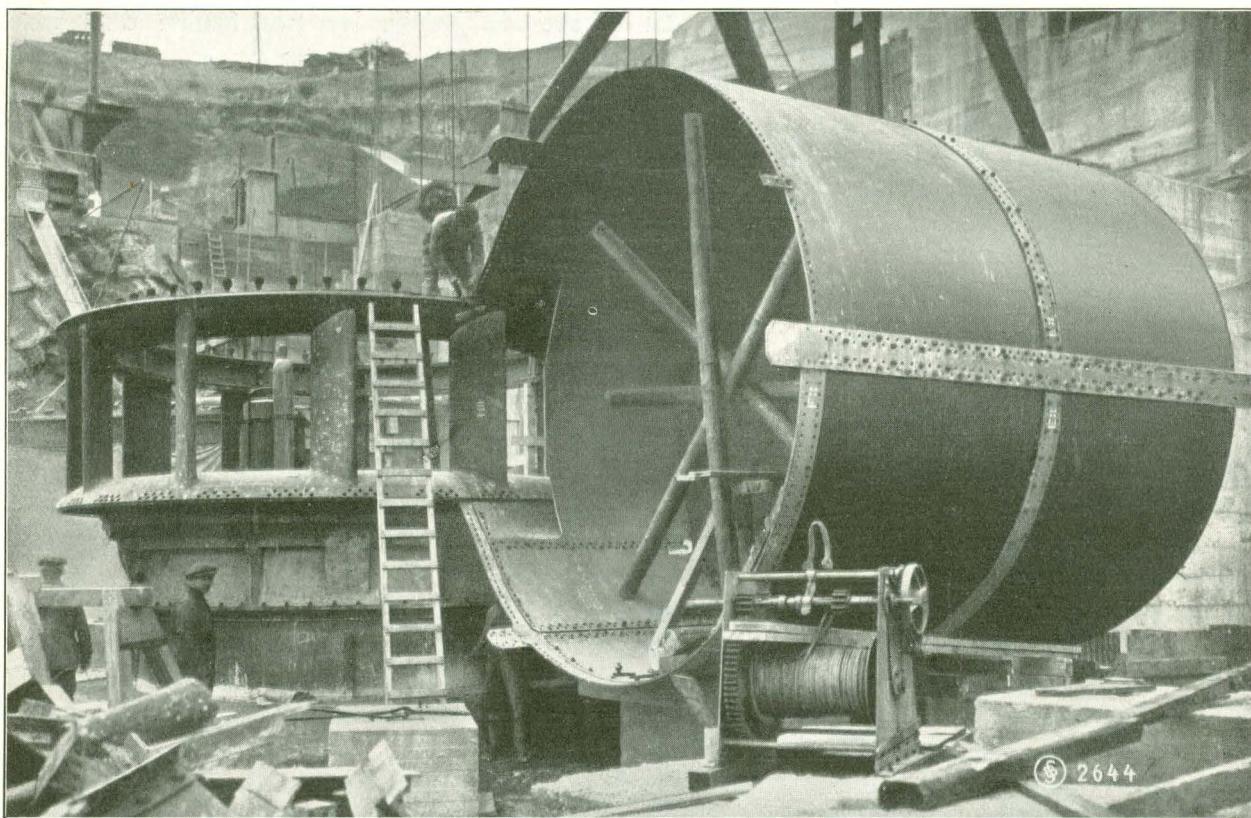
For description of the ensuing concrete draught tube see pamphlet No. 9 of June 1928.

The steel draught tube is completely concreted in and securely held in place by rivetting to several rag irons.

To facilitate inspection of the runner a watertight door is provided in the centre of the steel draught tube.



Pict. 3. Intake Sluice Building and Power House from Tail Race side



Pict. 4. Guide Mechanism and part of Spiral Casing

The spiral casings have been erected on steel shoes, securely bolted to foundation blocks, and are completely bedded in concrete and anchored by numerous rag irons.

When pouring the concrete special care was taken to avoid hollows between the spiral casing and the encasing concrete and to prevent any movement in the flowing concrete.

The number and the output of the turbines have been based on a careful economic examination of the available waterflow in the Shannon through a period of years—and the probable consumption of current in consideration of the minimum costs and high degree of efficiency for the plant.

The Francis-Spiral Turbine was chosen as the only type likely to give the best results at the output demanded, the head available and the large fluctuations of water level due to tide in the tail race.

The advantages to be derived from the turbines being in a vertical position are as follows:

1. the saving of space,
2. freedom from flooding of generators, air channels and machine floor at even the highest level in tail race,
3. the higher efficiency of draught tube.

In order to make available a draught head (that is the height from runner-outlet to water level in tail race) for the lowest water levels, the outlets of draught tubes have been deepened considerably below bed of tail race.

To avoid the entrance of air into the draught tubes, the lowest waterlevel in tail race is sufficiently above the top of draught tube outlets.

The turbines are designed for the following conditions:

Available Head	Horse Power	Rev. p. m.
28.5 metres	31000	150
33.73 „	38600	150

Further description of progress re turbines will follow.