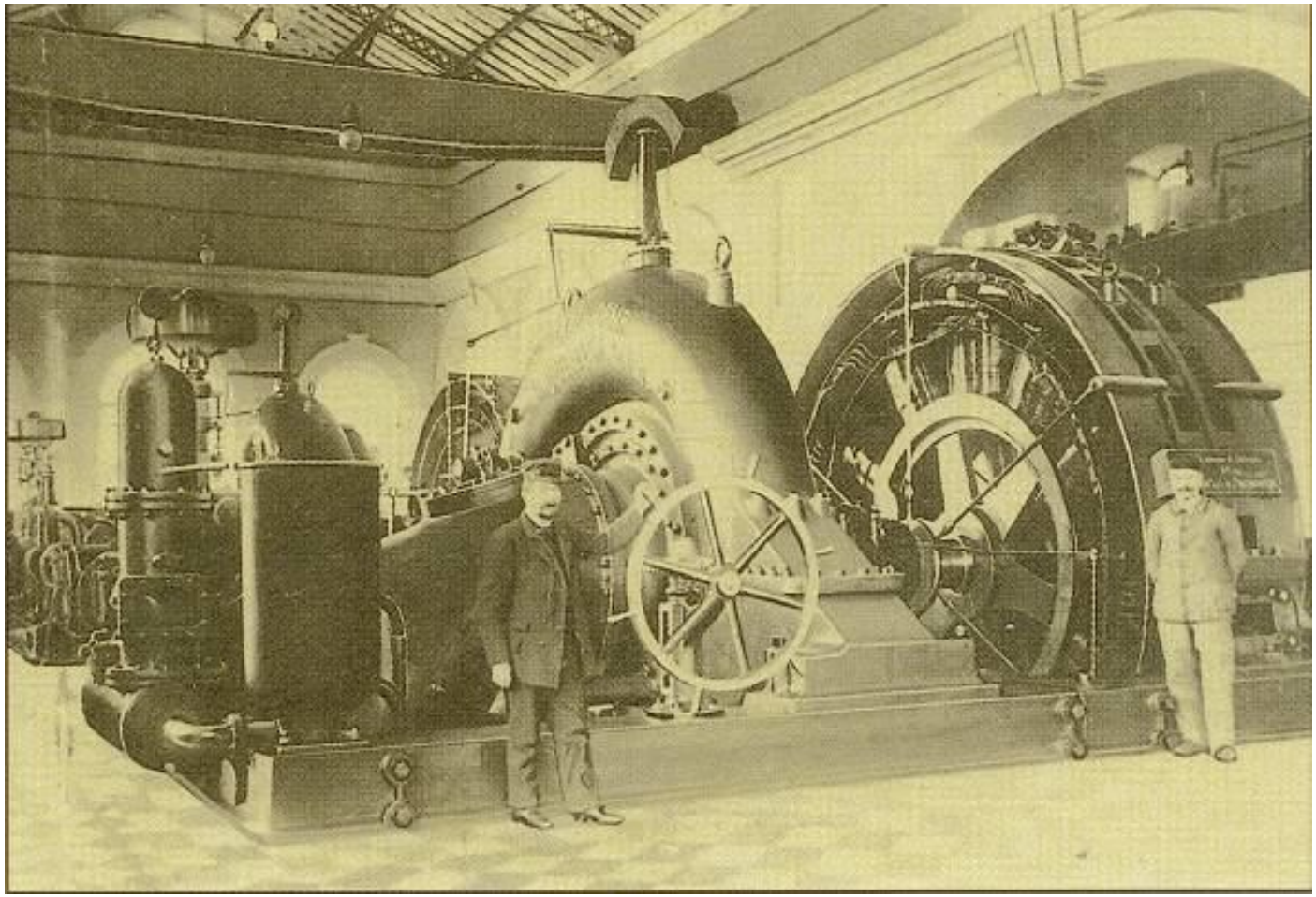
Ganz Engineering and Energetics Machinery llc.

ENTERPRISE OF STATE CORPORATION «ROSATOM»

LOW HEAD WATER TURBINES

Water Turbines since 1860



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- Turbine Department:
  - design, manufacturing and commissioning of custom-designed (under 100 MW unit power) and low series hydro generating sets and its accessories,
  - refurbishment of turbines, valves and modernise their control system.
- The Hydro Machinery Branch, successor of GANZ and later Ganz Mavag, is having more than 150 years experience producing of hydro machinery. The traditions of engineering are supported by up-to-date computer technology.
- The design and manufacturing activity in our offices and work shops is qualified and organised according to the descriptions of **EN ISO 9001:2009**.

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- The Turbine department as part of Ganz Engineering and Energetics Llc. undertakes the supply of Pelton, Francis and **Kaplan** turbines as well as all type of axial-flow hydro-power units (**bulb-, pit- and S-type**). Design and production widely conforms to the special requirements of the purchaser.
- Ganz Engineering and Energetics Llc. manufactures and supplies turbines, valves and their control system but also undertakes the supply of complete power station equipment in co-operation with other Hungarian enterprises or jointly with foreign producers or civil contractors.

Ganz Engineering and Energetics Machinery llc.

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- Ganz Engineering and Energetics Llc. undertakes the refurbishment of obsolete or damaged turbines, valves and their control system by replacement of the worn out components only as well as modernization of the equipment by replacement of complete units with updated ones.

- We are ready to work out our best technical and commercial offer to you, as well as to find the best way of the collaboration with you and your local partners to obtain the business and accomplish hydro-electric power projects.
- **http://** www.ganz-eem.com


EMT Zrt.

TANÚSÍTVÁNY

Tanúsítjuk, hogy a

Ganz Engineering és Energetikai Gépgyártó Kft.

1087 Budapest, Kőhányai út 21.

minőségirányítási rendszere megfelel az

MSZ EN ISO 9001:2009

szabvány követelményeinek, a következő alkalmazási területeken:

Vízturbinák, víz
szerelése, üzembe helyezése és karbantartása

A tanúsítvány száma: 100-3419
Dátum: 2012.01.17.
Érvényes: 2015.01.17.
EA kód: 18/28

Budaörs, 2012.01.19.

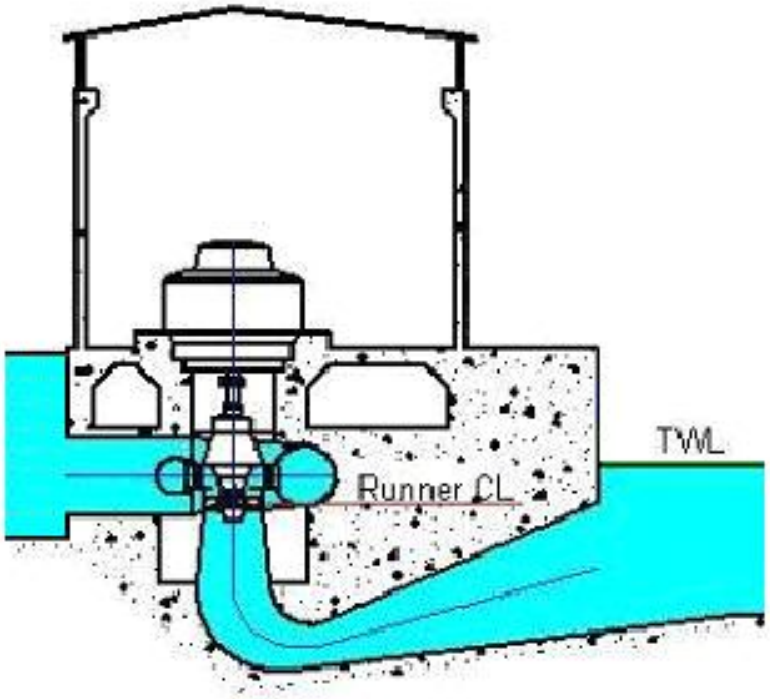
Bujtás Gyula
vezérigazgató

Engineering and R&D

Based on own research and laboratory model tests, Ganz Engineering and Energetics Machinery Llc. Produces and supplies on own design and engineering:

- water turbines
- turbine-generator machine groups
- hydropower stations

Low Head Turbines



Main features:

- **Head: 2 to 30 m**
- **Discharge: 1 to 150 m^3/s**
- **Power Output: 20 kW to 20 MW**

- **Type of turbine: KAPLAN**

General features of Kaplan Turbines

- Low head and large discharge
- Head an discharge variation:

  Double regulation for best performance, coordinated runner and guide vane adjustment
- Shaft arrangement: vertical or horizontal shaft
- Runner and shaft complete with guide and thrust bearings
- Power transmission:
  - direct coupled straight shaft
  - with speed increaser gears
  - with bevel gear: shaft is perpendicular to the pipe

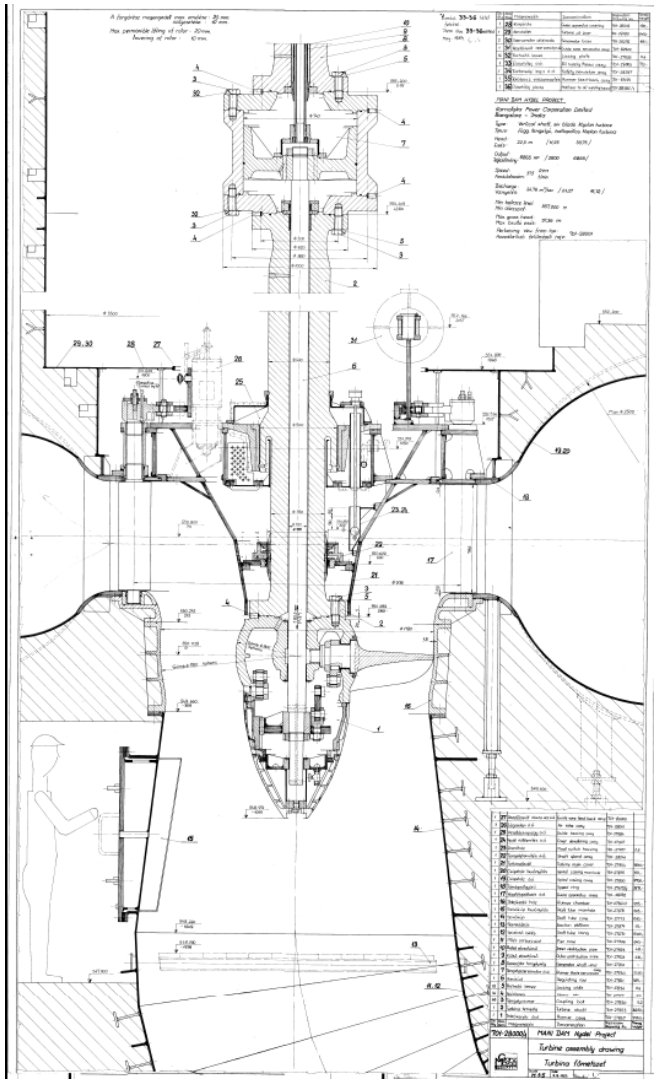
Sub-types of Kaplan Turbines

- **Full Kaplan:** **adjustable guide vanes and runner balades**
- **Propeller:** **fixed runner blades, adjustable guide vanes**
- **Arrangement of Turbines**
  - **With steel spiral casing**
  - **With concrete spiral casing or placed in pit (pit-type)**
  - **S-Type turbine**
  - **Tubular turbine**:

    - bulb

    - PIT-type - built in a concrete discharge pit

Turbine with Steel spiral case



- Vertical shaft arrangement
- At lower discharge and power output: horizontal shaft arrangement
- Higher head, up to 30 m
- Power from 200kW-20 MW

Turbine with Concrete spiral case

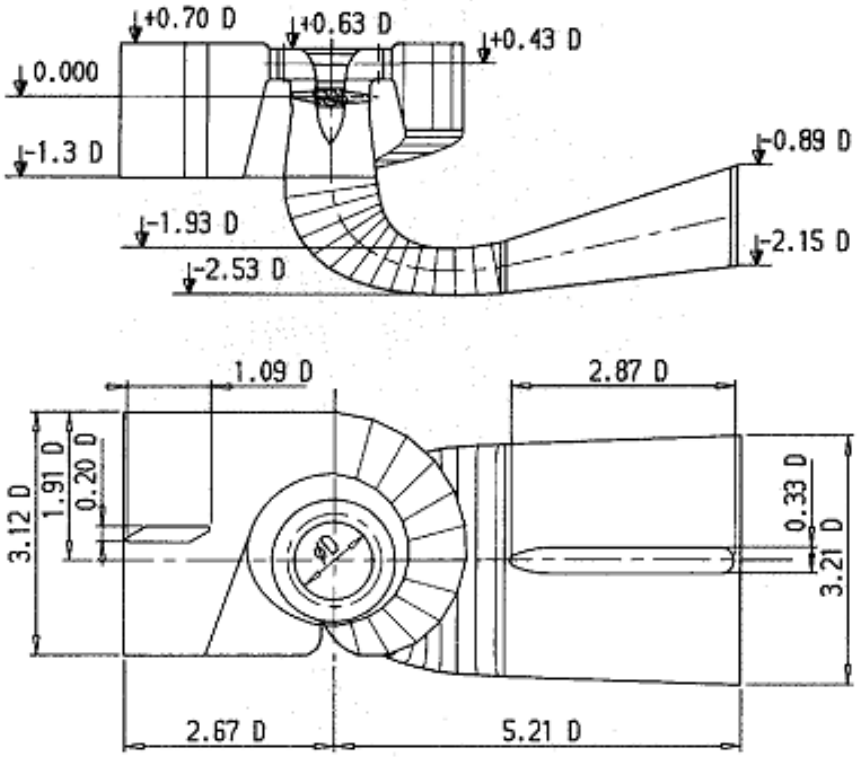
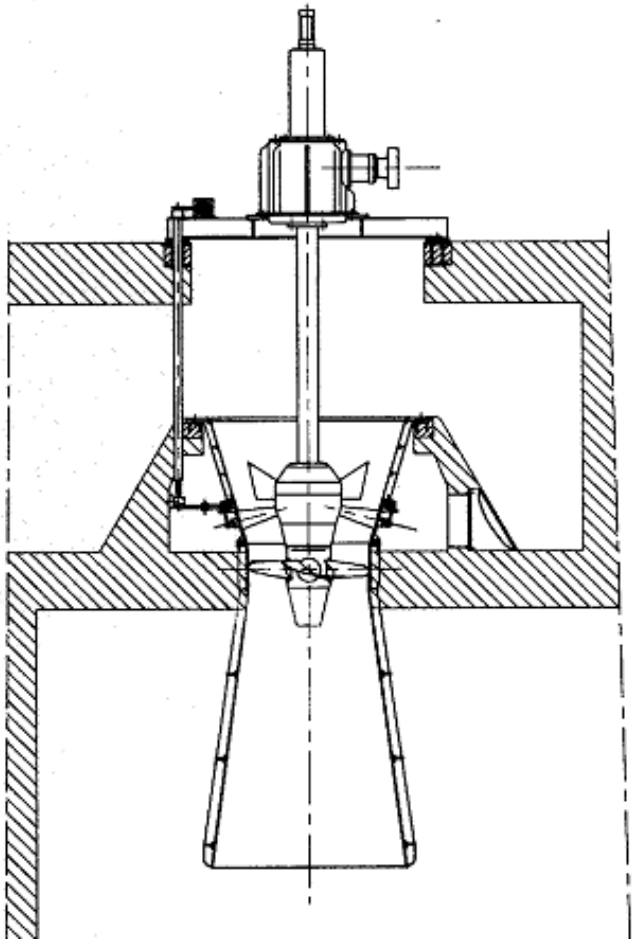


Fig. 4.
Concrete spiral case

- Vertical shaft arrangement
- Head up to 15 m
- Power up to 5 MW

Turbine in concrete pit



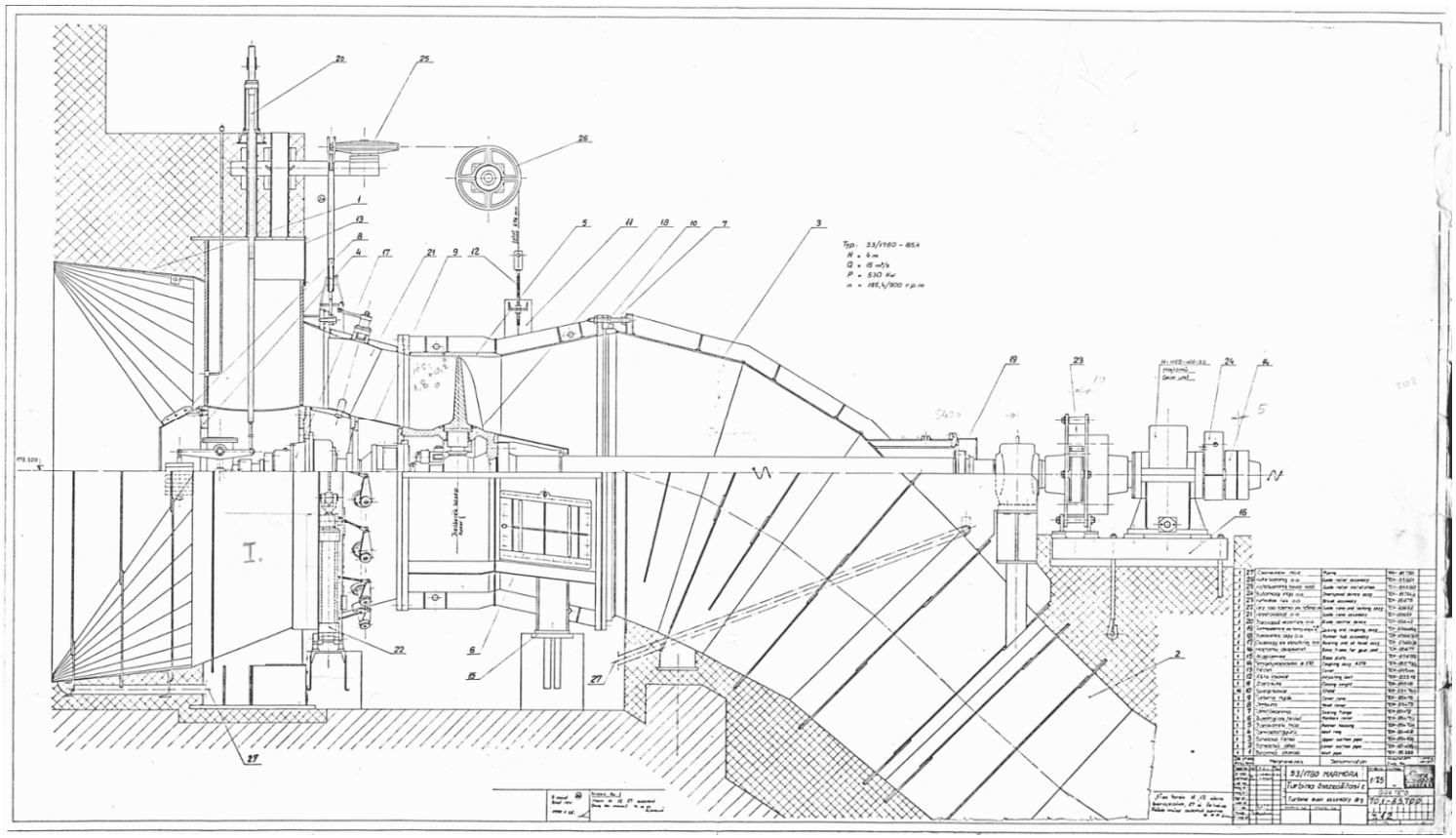
- Head up to 6 m
- Power up to 500 kW

Advantage:

- Simple, economic installation
- Generator over the head water level

S-type Turbine

- Head up to 20 m
- Discharge up to 100 m^3/s



S-type Turbine

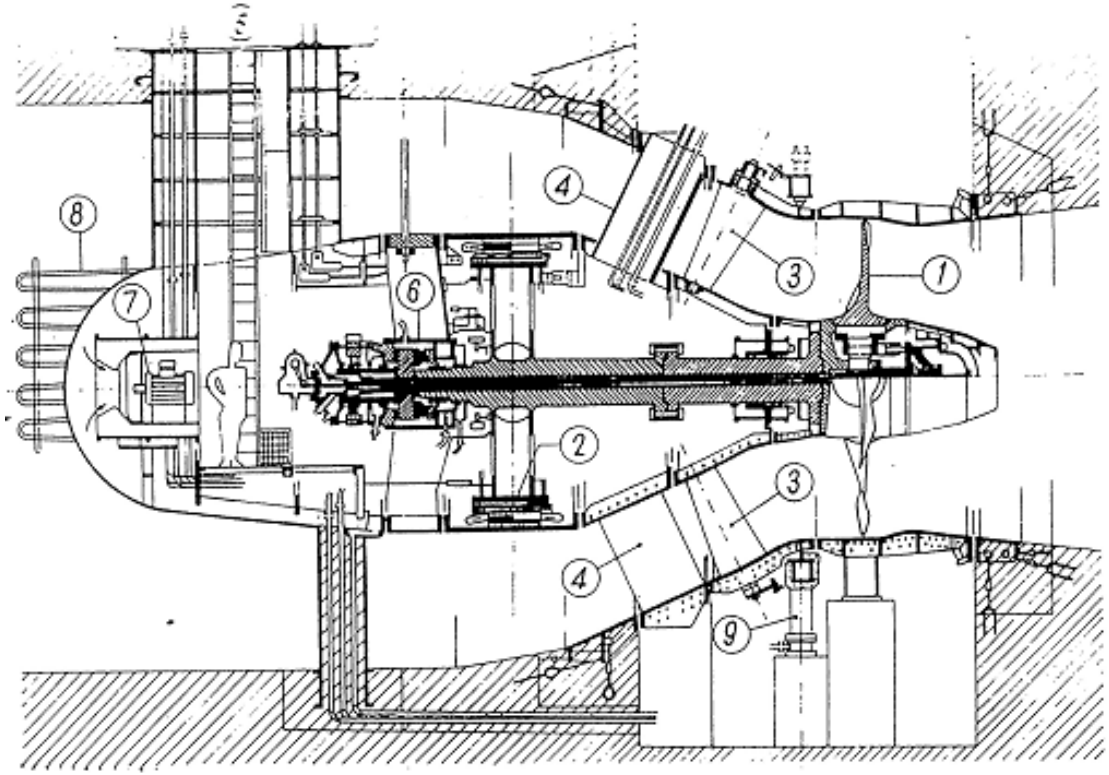
Advantage:

- Simple design
- Simple shaft sealing on the suction side
- Good suction ability
- Minor civil works
- Less maintenance

More Advantages:

- Double regulation for best performance
- Reliable speed increaser with parallel axis
- Generator on dry area

Tubular - Bulb

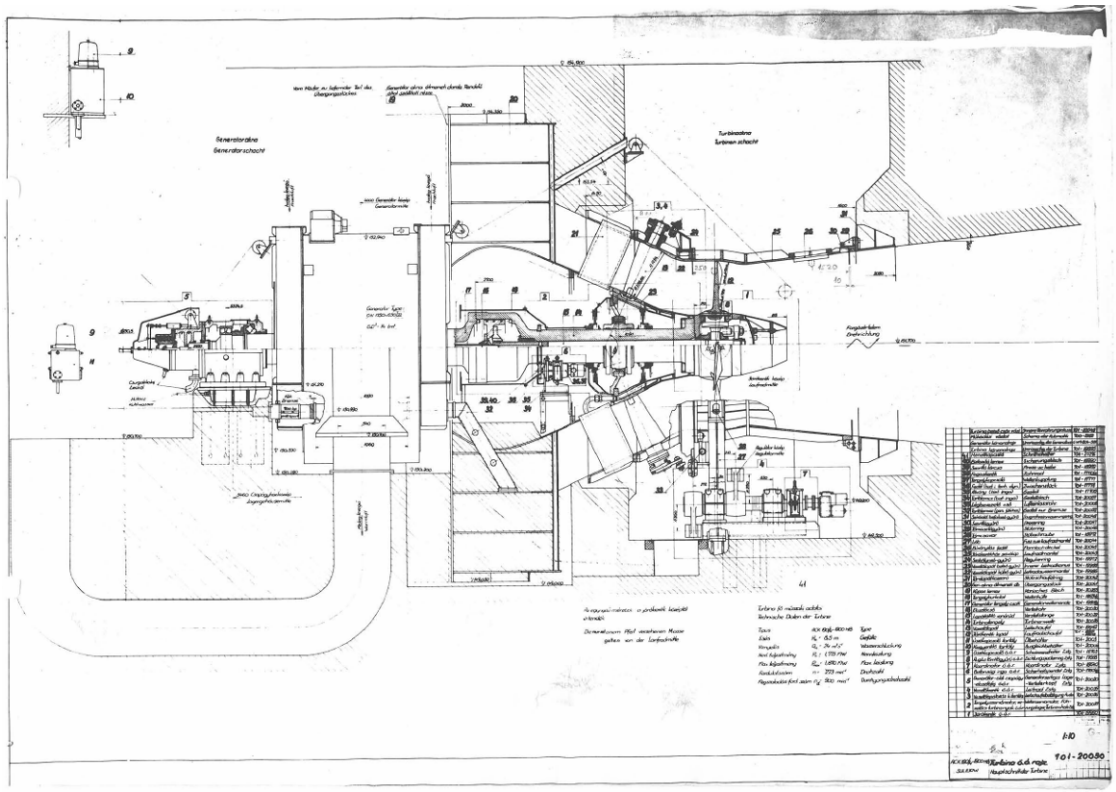


- Head up to 10 m
- Discharge up to 150 m^3/s (or more)

<u>Disadvantage:</u>

- Special, built in generator is needed
- Special shaft sealing is needed

Tubular - Pit type



Advantage:

- Generator at dry area
- Double regulation for best performance
- Reliable speed increaser with parallel axis

- Head up to 10 m
- Discharge up to 100 m^3/s

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ENTERPRISE OF STATE CORPORATION «ROSATOM»

KAPLAN TURBINES

Extract from Reference List

YEAR	OWNER	PLANT	COUNTRY	UNITS	TYPE	HEAD	OUTPUT	DISCHARGE
						(m)	(kW)	(m3/s)
1927	Superintendency of the Royal Hungarian Ports	Soroksár-Tass	Hungary	2	Propeller	2,2	330,0	17,99
1940	MAVAG, Budapest	Tiszaluc (Kesznyéten)	Hungary	2	Kaplan	13,8	2 352,0	20,44
1954	Erômű Beruházási Vállalat	Tiszalök	Hungary	3	Vert. Spiral Kaplan	4,5	4 300,0	114,60
1954	Erômű Beruházási Vállalat	Tiszapalkonya	Hungary	2	Vert. Thoma	6,5	460,0	8,49
1956	Elektrim, Warszawa	San II	Poland	2	Kaplan	22,5	4 411,0	23,51
1956	ÉDASZ, Szombathely	Kwassay	Hungary	2	Vert. Kaplan	4,6	897,0	23,39
1957	Elektrim, Warsawa	Tryszczyn	Poland	2	Vert. Kaplan	5,5	1 730,0	37,72
1957	Elektrim, Warsawa	Skawina II	Poland	1	Vert. Kaplan	7,9	1 566,0	23,77
1958		China		5	Vert. Kaplan	22,0	4 410,0	24,04
1958	Elektrim, Warsawa	Debe	Poland	4	Vert. Kaplan	5,5	5 180,0	112,95
1959	Tiszai Erômű Vállalat, Tiszapalkonya	Tiszaújváros	Hungary	1	Hor. Propeller	6,4	53,0	0,99
1960	Tiszai Erômű Vállalat, Tiszapalkonya	Oroszlány	Hungary	1	Vert. Kaplan	6,3	460,0	8,76
1960	Elektrim, Warsawa	Dabie	Poland	2	Vert. Kaplan	3,5	1 600,0	54,82
1964	Dunamenti Hôerômű Vállalat, Százhalombatta	Százhalombatta	Hungary	2	Pit type Propeller	6,0	500,0	9,99
1965	ERBE, Gyöngyös	Gyöngyös	Hungary	2	Vert. Propeller	11,3	250,0	2,65
1967	Tiszai Erômű Vállalat, Tiszapalkonya	Kisköre (1)	Hungary	4	Bulbe Kaplan	6,3	7 200,0	137,06
1967	Electrim, Warsawa	Glebinow	Poland	2	Tubular Kaplan	9,5	1 650,0	20,83
1967	Government of Maharastra, Bombay	Vir	India	2	Vert. Spiral Kaplan	17,0	4 800,0	33,86
1967	ERBE, Gyöngyös	Gyöngyös	Hungary	1	Vert. Spiral Thoma	8,3	410,0	5,92
1969	Electrim, Warsawa	Sulejow	Poland	2	Pit type Kaplan	8,5	1 770,0	24,97
1969	Mashinoimport, Moscow	Razdan	Armenia	3	Vert. Spiral Thoma	12,5	650,0	6,24
1970	ERBE, Gyöngyös	Gyöngyös	Hungary	1	Vert. Spiral Thoma	8,0	400,0	6,00
1981	Power Development Dept., Govt. of Jammu & Kashmir	Stakna (2)	India	2	Vert. Kaplan	20,0	2 200,0	13,19
1983	Karnataka Power Corporation Ltd., Bangalore	Mani Dam	India	2	Vert. Spiral Kaplan	22,5	5 050,0	26,92
1984	Electric Power Bureau	Datong	China	2	Vert. Spiral Propeller	13,0	650,0	6,00
1985	Türkie Elektric Kurumu	Trakya	Turkey	4	Hor. Spiral Propeller	19,0	430,0	2,71
1986	Türkie Elektric Kurumu	Trakya II.	Turkey	4	Hor. Spiral Propeller	19,0	430,0	2,71
1987	Public Establishments of Electricity, Damascus	Teshrin	Syria	4	Hor. Spiral Propeller	12,3	346,0	3,37

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E-mail: info@ganz-eem.com
Web: www.ganz-eem.com

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YEAR	OWNER	PLANT	COUNTRY	UNITS	TYPE	HEAD	OUTPUT	DISCHARGE
						(m)	(kW)	(m3/s)
1988	ÉDASZ, Szombathely	Alsószölnök	Hungary	1	Pit type Propeller	3,0	52,0	2,08
1988	Sea Power AB, Göteborg		Sweden	1	Pit type Propeller	2,5	103,0	4,94
1989	Mashinoimport, Moscow	Razdan	Armenia	4	Tubular Propeller	6,2	190,0	3,68
1991	Cosolidated Hydro Ltd., Toronto	Marmora	Canada	2	S-type Kaplan	4,0	530,0	15,89
1991	Tiszai Erômű Vállalat, Tiszapalkonya	Tiszaújváros	Hungary	2	Tubular Propeller	7,0	530,0	9,08
1991	Tiszai Erômű Vállalat	Tiszalök	Hungary	3	Vert. Spiral Kaplan/ref	4,5	4 300,0	114,60
1994	Vértesi Erômű RT.	Oroszlány	Hungary	1	Vertical Kaplan/ref	4,5	418,0	11,14
1995	CanAl	Montalto Dora	Italy	1	Kaplan up-grading	10,1	1 750,0	20,78
1997	EGI-GEA	Bursa	Turkey	4	Hor. Spiral Propeller	17,4	667,0	4,43
1998	Hernádvíz Kft.	Bőcs	Hungary	1	Vert. Tube	4,3	15,0	0,50
1998	Hernádvíz Kft.	Kesznyéten (Tiszaluc)	Hungary	2	Vertical Kaplan/ref	13,8	2 300,0	20,00
2001	KDVI	Kvassay (1/2 stage)	Hungary	1	Vert. Kaplan /refb.	4,6	897,0	23,39
2002	MAPNA	SAHAND	Iran	4	Hor. Spiral Propeller	12,2	413,6	3,83
2004	KDVI	Kvassay (2/2 stage)	Hungary	1	Vert. Kaplan /refb.	4,6	897,0	23,39
2005	EGI-GEA	Zayzoon	Syria	2	Hor. Spiral Propeller	11,0	380,0	3,90
2005	EGI-GEA	Al-Nasserieh	Syria	2	Hor. Spiral Propeller	12,1	440,0	4,10
2007	EGI-GEA	Deir Ali	Syria	2	Hor. Spiral Propeller	12,0	450,0	4,17

Ref = Refurbishment
Hor = Horizontal
Vert = Vertical

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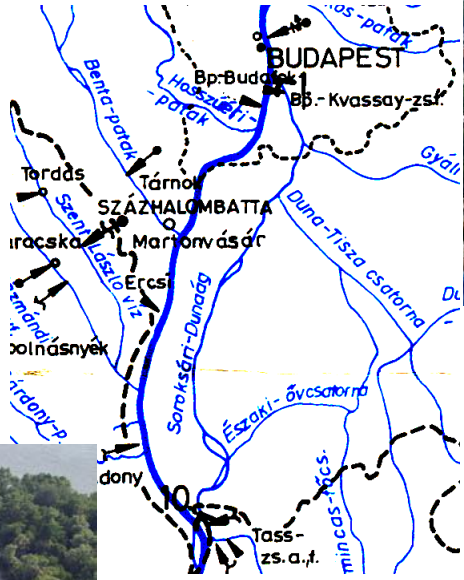
UPCOMING PROJECT

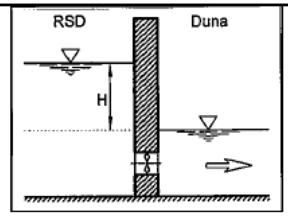
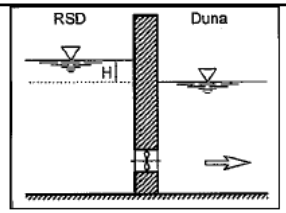
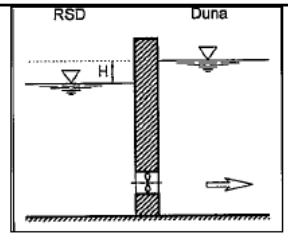
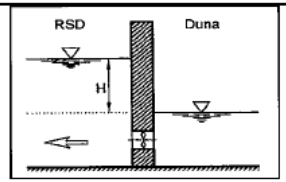
Multifunctional water regulating works at Tass



Purpose of the project:

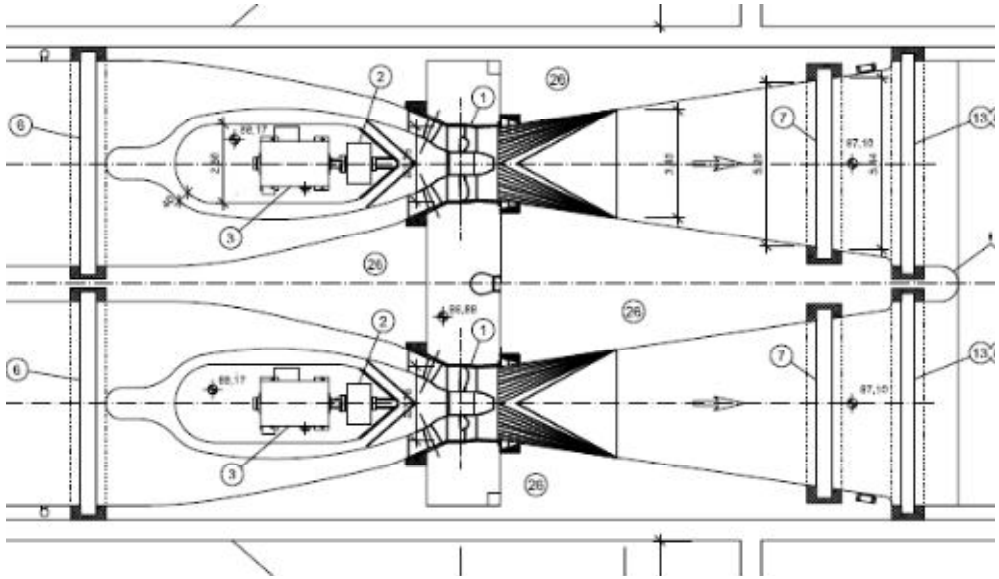
Regulating the water level and treating the water quality in the 58 km long branch of Danube river called RSD (Rackevei Soroksari Dunaag). The RSD starts at Kvassy Log and Pumping Station at Budapest and returns to the main stream at Tass.

Functions of the project

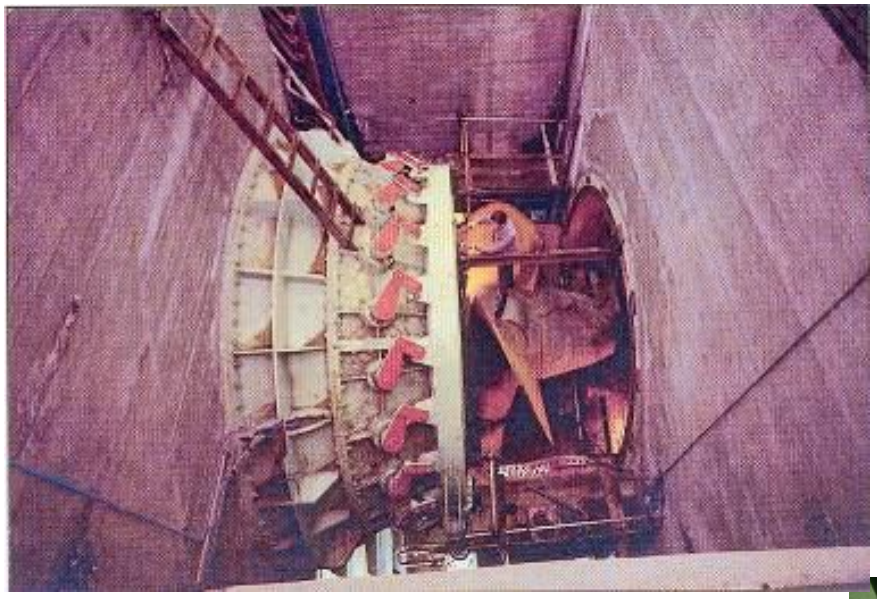
Operation	Schema	Head range (m)	Discharge range (m^3/s)
Turbine, energy production		1,2 – 5,7	20 - 50
Flood release through the hydro machines, no load operation		0 – 1,2	0 -020
Pumping to Danube		0 – 3,3	20 - 30
Pumping from Danube		maximum 5,7	15

The offered solution

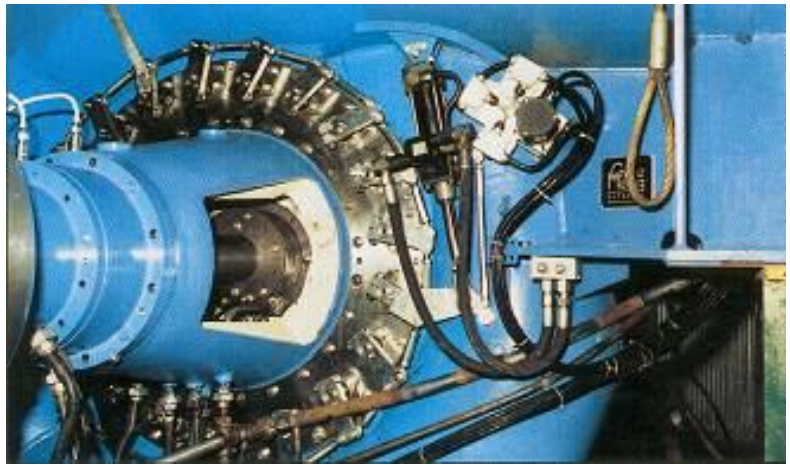
- 2 numbers of GANZ ACK-3/2350-150 Pit-type turbine/pump with speed increaser
- Control system of the project
- Connection to the national electric system
- Construction of the new dam and the power house
- Estimated investment is around 12 million Euro



Some pictures




GANZ - NEYRPIC TURBINALAP
1974 - 2004.
A KISKÖREI VÍZERŐMŰ
ENERGIATERMELŐ BLOKKJAI HÁLÓZATRA
KAPCSOLÁSÁNAK
35. ÉVFORDULÓJÁN
A TERVEZŐK, GYÁRTÓK, SZERELŐK ÉS ÜZEMELTETŐK
TISZTELETÉRE ÁLLÍTTATTA.
KISKÖRE VÁROS ÉS A TISZAVÍZ VÍZERŐMŰ
ÖNKORMÁNYZATA
KISKÖRE, 2009. OKTÓBER 08.



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