TECHNICAL BRIEFS

Latest engineering developments for busy power men

10 Digests for you on:

HYDRO POWER
PUMPS
GAS TURBINES

HIGHEST HEAD AND LARGEST HYDRAULIC TURBINES BUILT IN EUROPE

Highest-head pelton turbines

Plant name	Location	Head, ft	Output, hp	Speed, rpm	Manufacturer
Reisseck	Austria	5800	31,000	750	Charmilles
Dixence	Switz.	5700	50,000	500	Charmilles
Mieville	Switz.	4750	47,800	500	Charmilles
Portillon	France	4280	55,600	500	Charmilles with Alsthom-Charmilles
Pragnieres	France	3920	100,000	428	Neyrpic
Pianto Netto	Italy	3920	14,700	600	Riva
La Bathie	France	3820	98,400	428	Neyrpic

Highest-head francis turbines

Fionnay*	Switz.	1490	63,200	750	Escher Wyss
Limberg	Austria	1430	77,700	500	Escher Wyss
Vinstra	Norway	1360	69,000	500	Kvaerner Brug
Piastrome	Italy	1320	20,140	1,000	Escher Wyss
Hol	Norway	1265	60,000	300	Kvaerner Brug
Kaprun*	Austria	1245	71,000		Escher Wyss
Bitto	Italy	1235	14,625	1,200	Escher Wyss
Roduno	Austria	1130	66,200	500	Escher Wyss

Highest-head kaplan turbines

Plant Name	Location	Head, ft	Output, hp	Speed, rpm	Manufacturer
Bort-Rhue*	France	230	31,800	375	Neyrpic
Barcis	Italy	199	13,600	500	Escher Wyss
Requejada	Spain	188	5,730	500	Escher Wyss
Rocchetta	Italy	184	5,000	500	Charmilles
Invergarry*	Scotland	177	28,000	250	English Electric
Pollaphuca	Ireland	165	25,000	300	Charmilles, with English Electric
Ligga*	Sweden	130	105,650	127	Karlstad

High-powered hydraulic turbines

Bort Les Orgues	France	336	154,000 P	187.5	Charmilles, Alsthom
Chastang	France	233	135,000 P	150	Charmilles, Alsthom
Harsprangat	Sweden	344	133,350 P	187	Karlstad
Sungari	Manchuria	276	115,500 P	175	Escher Wyss
Kilforsen	Sweden	312	112,730 P	167	Karlstad
Ligga*	Sweden	130	105,650 K	125	Karlstad
Pragnieres	France	3920	100,000 P	428	Neyrpic

* Under construction; F, francis; K, kaplan; P, pelton

Hydro Power

Modern Trends in Hydraulic Turbine Design in Europe. *By George A Bovet, Charmilles Engineering Works, Geneva, Switzerland.*

Modern trends in hydraulic-turbine design in Europe are described, especially how they differ from American practice. Even though there has been no major inventions in hydraulic turbines during the last 20 years, many outstanding units have been built in Europe for exceptionally high heads and of large sizes, as shown in the tables above. These tables are picked from extensive ones given in the paper.

The highest head pelton turbines will be in the Reisseck plant in Austria, rated 31,000 hp under a 5800-ft head. This is more than double the highest head used in the U.S. For francis type the 63,200-hp units in Fionnay plant in Switzerland will have the highest head, 1490 ft. The 230-ft head of the 31,800 Bort-Rhue kaplan units in France is more than double the highest head used on turbines of this type in this country. The Bort les Orgues in France has the largest francis turbines in Europe, 154,000 hp. Design capacity of these units is about the same as for the Grand Coulee units in this country, but the latter operates continuously loaded to 170,000 hp. *ASME paper No. 52-A-92.*

Pumps

Mechanical Pumps for High-Temperature Liquid Metals. *By Philip M Clark, Knolls Atomic Power Laboratory, General Electric Co.*

As a part of the development of nuclear power for submarine propulsion the General Electric Co designed and built a relatively large heat-transfer test system in which liquid sodium and liquid sodium-potassium were used as heat transfer media.

For this system it was necessary to develop a pump that could circulate about 400 gpm of liquid metal at temperatures up to 750 F, without leakage at the shaft. But, a small gas leakage could exist. Two identical centrifugal pumps were built and have operated successfully for several thousand hours. A description of the pump design, associated seal development and operating experience are presented in this paper.

Detailed designs of the two pumps were developed in cooperation with the Buffalo Pump Co, where the two pumps were built. Each pump is a single volute, *radial centrifugal design with a* 926 specific speed and rated 400 gpm, 126 ft head at 1750 rpm. The pumping elements are contained in a large drain tank filled with inert gas under pressure, while the supporting bearing and 20-hp, motor are above the floor plate.

Sealing the pump against leakage is one of the difficult problems that [illegible] to be solved. Different types of packing were tried, *but without complete success*, when the development was switched to rotary seals. To keep leakage down to less than 0.1 cu ft per hr both carbon and wear rings were lapped to less than three light bands and in most cases to less than one. Minute quantities of lubricant increase seal life to more than 2000 hr. *ASME paper No. 52-A-94.*

Development of Special Pumps, the Power Supply, Valves, Bearings, and Instrumentation for Liquid Metals. *By Edward F Brill, Allis-Chalmers Mfg Co.*

When planning and designing nuclear power plants the pumps or blowers for circulating coolants through the reactors to transfer heat to a power cycle or heat sink require special attention. They must circulate the coolant without failure, leakage or require maintenance for long periods. The paper discusses the several types of these pumps that have been developed and the uses of leakless pumps for high pressures and temperatures.

Among the pumps are the hermetically sealed designs of which three types have been built. They are the can [illegible]