

Druckschwankungen in Turbinenzuleitungsrohren. By A. Budau. Zeitschrift des oestreichischen Ingenieur- und Architektenvereins, year 1905. A mathematical analysis of pressure variation in pipe lines.

Beitrag zur Bemessung des Inhalts von Wasserschloessern. By Konrad Pressel. Schweizerische Bauzeitung, Vol. 53, 1909. A short study of the laws governing the water fluctuations in surge tanks.

Allgemeine Theorie ueber die veraenderliche Bewegung des Wassers in Leitungen. By Lorenzo Allievi and Robert Dubs. Berlin, 1909, Julius Springer. A mathematical analysis of the hydro-mechanic problems involved in pressure conduits.

Zur Theorie des Wasserschlosses bei selbsttaetig geregelten Turbinenanlagen. By Dieter Thoma, Muenchen, 1910. R. Oldenburg. Containing an analysis of resonance phenomena.

Des effets de resonance, qui peuvent se produire pour les hautes chutes dans les coups de belier. By Comte de Sparre. La houille blanche, 1907. Investigates phenomena of resonance.

Die Kraftuebertragungsanlagen der Rurtalsperren-Gesellschaft. By Rasch and Bauwens. Zeitschrift des Vereins deutscher Ingenieure, pp. 609-611, year 1908. Gives an interesting account of resonance phenomena due to inadequate surge tank dimensions.

Unsteady water-flow in pipes. Water-ram. By I. P. Church. Cornell Civil-Engineer, year 1898.

Water hammer experiments. By M. R. Lott. Engineering Record, October, 1912.

The surge tank at San Francisquito power station No. 1, with discussions by R. D. Johnson, Roy Taylor and W. F. Durand. Engineering Record, years 1913 and 1914.

Versuche ueber Druckschwankungen in eisernen Rohrleitungen. By A. Strickler. Schweizerische Bauzeitung, Vol. 64, 1914, (Laboratory tests).

NOTE.

The article "Surge Tank Problems" will be issued at a later date in pamphlet form. A note will appear in *The Canadian Engineer* when ready for delivery.

PANAMA CANAL OPENED.

THE United States War Department steamship "Ancon" has made the passage through the Panama Canal, and transit through the waterway is now officially open to the traffic of the world. The "Ancon" made its way from its berth at Cristobal to the end of deep water channel from the Atlantic to the Gatun Locks. It went through the locks, which have a lift of 85 feet, in 70 minutes. It continued through the waterway, from deep water on the Atlantic to deep water on the Pacific side, without incident.

Vessels drawing not more than 30 feet of water and up to 10,000 tons register may now make the passage. It will be possible to put some of the big American dreadnoughts through at any time.

Facts About the Canal.

Total length of canal, 50 miles.
Salt water, channel to Gatun Locks, 7 miles.
Fresh water, Gatun Lake and Culebra Cut, 33 miles.
Fresh water, Pedro Miguel Lock to Miraflores Locks, 1½ miles.
Salt water, Miraflores Locks to Pacific, 8½ miles.
Width of channel, 300 to 1,000 feet.
Minimum depth, salt water, 40 feet.
Minimum depth, fresh water, 41½ feet.
Total angles in canal, 6000 51m.
Sharpest angle, Tabernilla, 67d 10m.
Work begun by Americans, May 4, 1904.
Number of men employed, average, 40,000.
Steam shovels employed, 101.
Locomotives employed, 307.
Drills employed, 4,572.
Railway cars employed, 4,572.
Dredges employed, 20.
Cranes, piledrivers, barges, tugs and miscellaneous machines employed, 263.
Total cost, \$375,000,000.
First vessel through Gatun Locks, Sept. 26, 1913.
Water let into Culebra Cut, Oct. 1, 1913.
Gamboa dike blown up, Oct. 10, 1913.
First vessel through Miraflores Locks, Oct. 14, 1913.

Culebra Cut.

Length, 9 miles.
Width at bottom, 300 feet.
Width at top, ¼ to ½ mile.
Deepest excavation, 495 feet.
Average depth of excavation, 120 feet.
Excavated by French, 20,419,720 cubic yards.
American excavation, estimate, 89,794,493 cu. yds.
Added excavation, account of slides, about 22,000,000 cubic yards.
Day's record for one steam shovel, 4,823 cubic yards.
Largest slide, Culebra, 10,000,000 cubic yards.

Gatun Dam.

Length, 8,000 feet.
Width of base, 2,100 feet.
Width at water level, 400 feet.
Width at top, 100 feet.
Height, 115 feet.
Volume of rock and clay, 22,100,000 cubic yards.

Gatun Lake.

Area, 164 square miles.
Height of surface above sea level, 85 feet.
Water capacity, 183,000,000,000 cubic yards.
Area of watershed, 1,320 square miles.
Minimum depth, rainy season, 47 feet.
Minimum depth, dry season, 39 feet.

Gatun Locks.

Length over all, 3,500 feet.
Width over all, 350 feet.
Volume of concrete construction, 2,043,730 cu. yds.
Width of side walls at base, 52 feet.
Width of side walls at top, 8 feet.
Width of centre walls, 60 feet.
Height of walls, 81 feet.
Dimensions of lock chambers, 1,000 x 110 feet.
Depth of water in lower lock chambers, 40 feet.
Depth of water in upper lock chambers, 41½ feet.
Length of lock gate leaves, 65 feet.
Height of lock gate leaves, 47.4 to 82 feet.
Weight of largest gate, 1,483,700 pounds.