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single runner. On the other hand, a much larger amount of concrete would be necessary for the water wheel chamber to accommodate four runners, and as the shafts would probably be over 100 ft. long, difficulties would arise in operating them successfully. It also appeared difficult to make a satisfactory design which would admit the water evenly to all four runners. The water wheel efficiency was also an important consideration in this plant where the amount of water is fixed, and it seemed evident that the vertical single wheel would have about 5 per cent. higher efficiency than the horizontal wheel.

An exhaustive study of these alternatives and the results, were so much in favor of the vertical single runner that this type was adopted.

Description of Main Units.—Each main unit consists of a single runner vertical wheel, supported on a thrust bearing carried on top of the generator. The runner is ¹⁷ ft. 7 ins. diameter (the largest yet constructed) and develops 10,800 h.p. under 30 ft. head when making 55.6 revolutions per minute. The generator was designed with a view to minimizing the labor required in making repairs. The details of the thrust bearing were designed by Mr. Kingsbury, and a year's successful operation of the bearings has proved the correctness of his work.

The shaft is a solid forging with a coupling at the lower end where it is bolted to the water-wheel runner. It is held in line by two guide bearings, one a babbited bearing immediately below the thrust bearing, and the other a lignum vitæ water lubricated bearing just above the water-wheel. The length of the shaft from the top to the coupling is 32 ft., the diameter in the lower guide bearings is 25 ins., in the upper guide bearing 24 ins., and in the hub of the generator 27 ins.

To provide support, and to guide the water in the proper direction, a cast-iron speed ring was placed just outside the movable guide vanes controlling the amount of water admitted to the wheel, and in some respects the use of this speed ring is unique in this plant. The weight of the rotating parts is carried through the bridge on top of the generator and through the generator frame itself, to cast-iron pit liners, which transmit the load through the speed ring directly to the concrete foundations of the power house. The usual design provides an arch above the runner, which carries the load to piers on each side of the draft tube, instead of distributing it as above.

The control of the water is effected by the usual type of movable vanes. The cranks and links are situated in the wheel pit, above water, so as to be easily accessible, and are operated by two trunk piston engines connected to the rotating ring at points 180° apart.

The dimensions of all the main turbines are the same, and the total weight of the revolving system is 550,000 lbs. in each unit.

A special 300-ton jack was provided for dismantling the unit and for making the fine adjustments necessary in erection, the large cranes being unsuitable for such a purpose.

The jack can be arranged so as to lift the weight from the thrust bearing, and transmit it to the foundations through the cast-iron bridge over the generator as described above. By this means the deflection of this bridge is unaltered, and minute adjustments can be made in the mechanism of the thrust bearing, as the screw of the jack can be moved through any small amount desired.

By coupling the jack to the top of the shaft the weight can be raised so as to allow the thrust bearing to be renoved. The weight can then be lowered about an inch until the rim of the generator rests on six blocks. After loosening the generator hub from the shaft, the waterwheel runner can be lowered about an inch more until it rests on a stationary base ring embedded in the concrete. The generator rotor can then be removed, the shaft can be disconnected from the runner, and the runner itself can be removed if necessary.

The arrangement proved of considerable use, particularly in view of the difficulty of making fine adjustments with the cranes.

Governor System.—The governor system was supplied by the I. P. Morris Company and operates by what is known as the open system.

The following regulation was guaranteed with the governors:---

governors.	Speed change. Load off to	Speed change. Load on from
Load change.	zero load.	zero load.
10%	2%	2%
25%	5%	5.25%
50%	11%	11.5%
100%	27%	30.5%

For supplying air to the governor accumulator tanks, two air compressors each delivering 50 cu. ft. of free air per minute were installed.

General Features and Design.—In the choice and arrangement of the auxiliary machinery facility of maintenance and operation were specially considered. All the auxiliary apparatus was therefore located on practically the same level as the main units, so as to be in sight of the men operating the main units. No machinery vital to the operation of the plant is located on lower levels or in tunnels.

FOURTH CANADIAN AND INTERNATIONAL GOOD ROADS CONGRESS—APRIL 10-14, 1917.

The prospects for the success of the Fourth Canadian and International Good Roads Congress, to be held under the auspices of the Dominion Good Roads Association in the Horticultural Building, Ottawa, from Tuesday, April 10th to 14th, inclusive, are very bright.

An interesting programme is being prepared and it is expected that papers and addresses by highway engineering experts will be presented, while road builders from all parts of Canada and the United States will be present and take part in the discussions. Profiting by the experience of the past, it is the intention to have the different lecturers and speakers simplify their deliverances as much as possible so that the layman can more readily understand what is meant.

As usual, there will be an exhibition of road machinery. Canadian and United States manufacturers of road machinery have announced their intention of placing on view a full line of their products.

The Dominion Good Roads Association, desirous of obtaining greater legal powers and of broadening its scope and increasing its usefulness, will present a bill before the adjourned session of parliament, asking for Dominion incorporation. The details of this bill, as well as the new constitution and by-laws, will be explained to the delegates, who will be asked to ratify the measures taken by the executive. The constitution will follow the general lines adopted by similar organizations in the United States, with such modifications as are suggested by local conditions.