dian customs duty, of $74,000 if the cast-iron pipe be purchased immediately.

"Our estimate on the cost of laying cast-iron pipe in the trench is approximately $180,000, making the total cost of the pipe laid, at to-day's price, $575,000.

"If the recommendation above set out for the adoption of reinforced concrete for this pipe be approved, we believe that the entire line can be built for about $400,000, or at a saving of $175,000."

SECRETARY KEITH'S WESTERN TRIP

(Special Correspondence)

Edmonton, Alta., August 23rd.—Fraser S. Keith, secretary of the Canadian Society of Civil Engineers, spent Wednesday, July 22nd, with the Edmonton Branch of the Society. Mr. Keith met the executive informally and discussed a number of matters of interest to the Society and especially to the western membership. Mr. Keith gave an interesting talk on the proposed new by-laws of the Society and mentioned especially the following proposed changes:—

The name of the Society.

The voting for members of council, each district to elect its representatives instead of the whole membership electing them.

The broadened objects of the Society, which has in view the establishing of closer relations with the manufacturing and business world outside of the Society, to which the engineer's work in this day and age is so closely allied.

The secretary feels, as does the branch executive, that engineers as a class, to get more general recognition, should become better known outside the profession, and should take the more active part in public affairs for which their training and experience qualifies them.

Mr. Keith's visit indicates that the society recognizes the importance of the branches to its welfare, and to its future usefulness to the engineer and to the public at large.

He left on Wednesday night for Vancouver and Victoria, via Calgary, stopping for a day at Banff, en route.

Calgary, Alta., August 21st.—Mr. Keith was the guest of the Calgary members of the Society at a luncheon at the board of trade rooms yesterday. Mr. Keith gave an inspiring address after the luncheon, on the enlarged scope of the work of the engineering society. One example of the assistance which the society has been rendering the government is the work of the Honorary Advisory Council of Scientific and Industrial Research. The appointment of the advisory council which is now permanently established, was the outgrowth of a report to the government by members of the society, and it was stated that 95 per cent. of the work of distributing the questionnaires issued by the advisory council is being done by the voluntary efforts of members of the society.

The part which members are taking in active service for their country is indicated by the extensive roll of honor which is now being prepared in the Montreal office of the society, and which will contain more than 800 names. Many of them have received decorations and 47 have made the supreme sacrifice.

W. A. Duff, chairman of the Manitoba branch of the society, was another guest at the luncheon yesterday and made a brief speech.

Local members of the society entertained Mr. Keith and Mr. Duff at the Calgary Auto Club last night.

DESIGN AND CONSTRUCTIONAL FEATURES OF TURBINE PUMPS

By A. E. L. Chorlton

(Continued from last week's issue.)

All the earlier turbine-pumps employed some form of thrust bearing, either of the collar or the ball type, to keep the impellers in correct alignment with the guide passages, and it was not until much trouble had been experienced with these that hydraulic control was ultimately adopted. Experience showed that much higher end pressures were set up than were ever anticipated, but for a period mechanical devices were persisted in, improvements being made attempting to withstand the excessive loads, and scant notice, it would appear, being taken of water-turbine practice where for many years it had been the custom to relieve axial thrust hydraulically. Fig. 19 illustrates an hydraulic balancing device in use on Francis turbines, and which, if properly proportioned, is automatic, and thus embodies all the essential points of many present turbine-pump balancers. One should bear in mind that the relation between the calculable axial thrust and the thrust realized in a water-turbine is much closer than in a centrifugal pump of the multi-stage type, the reason of this being that the disturbing factor in a high-lift pump is the leakage from stage to stage.

The well-known application of turbine-pumps to high lifts by Messrs. Sulzer at Horcajo Mines in 1898, was carried out with back-to-back impellers, and a ball thrust-bearing was provided to take the end-thrust (in one direction only), which is inseparable from this arrangement of impellers. In 1901, Professor Rateau was manufacturing pumps with end-thrust approximately eliminated hydraulically by his well-known method of shroud reduction, and provided with a balancing piston, Fig. 20. This method was not automatic, and the pressure on the piston could only be adjusted by means of a hand-operated throttle-valve. However, this was the first step, and the automatic control of the necessary pressure on the balancing

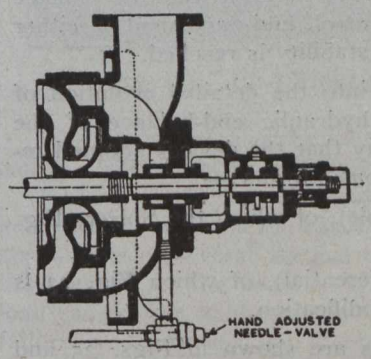

Fig. 21.—Hand Adjusted Balancer

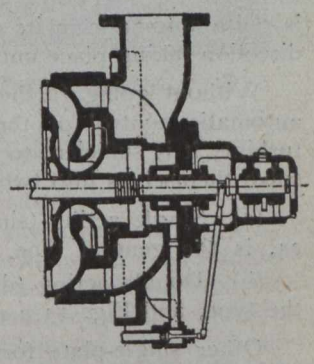

Fig. 22.—Mechanically Adjusted Balancer

device and determined by the end movement of the spindle followed as a matter of course. The development of the differential type of balancer carried out under the author's direction in 1913, extended over several years, progressing step by step from a hand-adjusted needle-valve, Fig. 21, regulated to produce the required balancing pressure, to a mechanically-operated needle-valve, Fig. 22, actuated by the axial movement of the spindle, and then through several forms of rotating throttle-valve disposed on the spindle itself and actuated by the same means. Further